Shiprock First Responders Substation Facility

Highway 491, Shiprock, NM 87420
Dyron Murphy Architects Project No. 2023.16

ADDENDUM No. 2

March 7, 2024

This addendum forms part of the Contract Documents and modifies the Bid Documents dated, January 28, 2019, as noted below. All Bidders must acknowledge receipt of this Addendum. Failure to do so may subject the Bidder to disqualification.

BIDDERS QUESTIONS AND ANSWERS:

(Please note that some questions may be paraphrased or edited to ensure clarity of responses to inquiries received)

ADDITIONS/MODIFICATIONS TO THE BID DOCUMENTS AS FOLLOWS:

CONTRACT DOCUMENTS

1. Modify the following document, "*Invitation To Bid*" – the date for bid submittals is changed from March 14, 2024 to March 21, 2024 at 2:00pm MDST at the office of the Architect.

2. Included herein is a copy of the *Geotechnical Testing Report*, dated May 25, 2018, 43pp.

SPECIFICATIONS:

1. Per Part 3.0 –of the "*Instructions To Bidders*", the following Request for Substitution is acceptable, as long as it meets or exceeds the criteria spelled out in the project specifications:
    a. Section 07 5400 – "*Thermoplastic Membrane Roofing*" – Part 2 Products, Subpart 2.01 (A), Manufacturers – include Holcim – Elevate UltraPly TPO Membrane.
    b. Section 10 2800 – "*Toilet, Bath and Laundry Accessories*" - Part 2 Products, Subpart 2.01 (B), Manufacturers – include Saniflow Corporation - Machflow model hand dryers.

2. Add the following Specification 07 7600 – "*Roof Pavers and Pedestal System*", 5pp.

3. Clarification on Specification 10 2240 – "*Vertically Folding Operating Walls*", Part 2 Products, Subpart 2.02 A(1) and A(2) – Components: Modify to show fabric finish on panel as full height, delete marker board finish requirement. The product color will be selected by Architect during the product submittal process.

4. Modify Specification Section 10 2600 – "*Wall and Door Protection*", Part 2 Products, Subpart 2.02 A(2) – Corner Guards: Change BASIS OF DESIGN Construction Specialties, Inc. product "Acrovyn FS-10", PVC & Aluminum Retainer component in lieu of "wood corner guard and stainless steel insert".

5. Modify Specification Section 10 2600 – "*Wall and Door Protection*", Part 2 Products, Subpart 2.02 B(2) – Crash Rails: Change BASIS OF DESIGN Construction Specialties, Inc.

product "Acrovyn FR-225", PVC component in lieu of "wood crash rail and stainless steel insert".

6. Modify Specification Section 10 2600 – "*Wall and Door Protection*", Part 3 Execution, Subpart 3.02 B: Change to read as: "Position corner guard 4 inches above finished floor to 48 inches high".

7. Modify Specification Section 10 4400 – "*Fire Protection Specialties*", Part 2 Products, Subpart 2.03 C(2): Change to read as: "Trim: Rolled Edge with 2 inch wide face".

DRAWINGS:

INTERIOR DESIGN

1. SHEET ID101 – Clarification: Corner guards indicated on this sheet are identified as 37 total in quantity. Contractor/Supplier to verify actual quantity.

2. SHEET ID602 –MATERIAL SCHEDULE, Revise product manufacturer identified under GC-1 from Fry Reglet to Construction Specialties, Inc. Additionally, Detail A1 shall be changed according to product manufacturer's standard material and installation detail.

3. SHEET ID602 –MATERIAL SCHEDULE, Product identified as GC-1: Modify "Locations" to read as: "All interior wall corners as identified on the Finish Plan". Additionally, for the same product under Comments, change to read as: "Continuous aluminum retainer, finish to maximum 48 inches above finish floor".

By:
Dyron Murphy, Principal Architect
Dyron Murphy Architects, P.C

Attachments: Geotechnical Testing Report, 43pp.
Specification Section 07 7600 – "*Roof Pavers and Pedestal System*", 5pp.

END OF ADDENDUM No. 2

GEOTECHNICAL ENGINEERING REPORT
NAVAJO NATION
PROPOSED INCIDENT COMMAND CENTER
SHIPROCK, NEW MEXICO

Submitted To:

Dyron V. Murphy, RA
Dyron Murphy Architects, P.C.
4505 Montbel Place, N.E.
Albuquerque, New Mexico 87107

Submitted By:

GEOMAT Inc.
915 Malta Avenue
Farmington, New Mexico 87401

May 25, 2018
GEOMAT Project 182-3000

GEOMAT INC.
915 Malta Avenue ◆ Farmington, NM 87401 ◆ Tel (505) 327-7928 ◆ Fax (505) 326-5721

May 25, 2018

Dyron V. Murphy, RA
Dyron Murphy Architects, P.C.
4505 Montbel Place, N.E.
Albuquerque, New Mexico 87107

RE: Geotechnical Engineering Report
Proposed Incident Command Center
Shiprock, New Mexico
GEOMAT Project No. 182-3000

GEOMAT Inc. (GEOMAT) has completed the geotechnical engineering exploration for the proposed Incident Command Center to be located in Shiprock, New Mexico. This study was performed in general accordance with our Proposal No. 182-02-29, dated February 26, 2018.

The results of our engineering study, including the geotechnical recommendations, site plan, boring records, and laboratory test results are attached. Based on the geotechnical engineering analyses, subsurface exploration and laboratory test results, the proposed building could be supported on shallow spread footings bearing on engineered fill. Slab on grade floors may be utilized for the interior floor systems. 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.

Donald R. Baldwin
Geologist

MATTHEW J. CRAMER
NEW MEXICO
18710
5/25/18
PROFESSIONAL ENGINEER

Matthew J. Cramer, P.E.
Vice President

Copies to: Addressee (1)

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GEOTECHNICAL ENGINEERING REPORT
NAVAJO NATION
PROPOSED INCIDENT COMMAND CENTER
SHIPROCK, NEW MEXICO
GEOMAT PROJECT NO. 182-3000

INTRODUCTION

This report contains the results of our geotechnical engineering exploration for the proposed Incident Command Center to be located in Shiprock, New Mexico, 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
- parking lot pavement design
- 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 the proposed Shiprock Incident Command Center will be a two-story structure with a total footprint of approximately 18,900 square feet. Of that total area, the ground floor will be approximately 13,000 square feet. We anticipate the building will be of CMU and structural steel construction, and will be supported on conventional spread footings with a concrete slab-on-grade floor system. Based on our experience with similar structures, we estimate the maximum structural loads will be approximately 100 kips for columns and 5 KLF for walls. We also understand the project will include an associated parking area/drive lane for both standard and heavy vehicles. We anticipate that up to two fire trucks and two ambulances may occupy the parking area at any given time. No basements or other below-grade structures are planned, and no significant cuts or fills are expected to be necessary to achieve the planned finished grades.

SITE EXPLORATION

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

Field Exploration:

Subsurface conditions at the site were explored on May 7, 2018, by drilling seven exploratory borings at the approximate locations shown on the Site Plan in Appendix A. Borings B-1 through B-5 were drilled to depths of approximately 15 to 20 feet below existing ground surface within the footprint of the proposed building. Borings B-6 and B-7 were drilled to depths of approximately five feet in the proposed parking areas.

The borings were advanced using a CME-45 truck-mounted drill rig with continuous-flight, 4.5-inch O.D. solid-stem auger. The borings were continuously monitored by a geologist 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 California 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 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.

In addition to the borings, soil percolation testing was performed at the approximate location shown on the Site Plan in Appendix A. The falling-head percolation test, designated PT-1, was performed in general accordance with the State of New Mexico Environmental Improvement Division Percolation Test for Individual Lots. We understand the results of our percolation test will be used by others to as an aid in designing a possible retention pond.

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 site of the proposed Incident Command Center is located on the west side of U.S. Highway 491, approximately one-half mile south of the intersection of U.S. Highways 491 South and 64 West. The existing NOYD facility is located on the neighboring lot to the north of the site. Residential housing units occupy the area to the south. The ground surface across the site appeared to be relatively level. Portions of the site were not vegetated, and other areas were vegetated by a sparse growth of grasses and weeds at the time of our exploration. The following photograph depicts the site at the time of our exploration.

View to the Northwest
Existing NOYD Building in Background

SUBSURFACE CONDITIONS

Soil Conditions:

As presented on the Boring Logs in Appendix A, in borings B-1 through B-4, we generally encountered silty clay and/or lean clay soils from the ground surface to depths extending to approximately 14 feet. In borings B-5 through B-7, the clayey soils extended to the total depths explored (16 feet in B-5, and 5 feet in B-6 and B-7). The clayey soils were generally stiff to very stiff, and dry to slightly damp. When moistened, the plasticity of these soils varied from nil to slightly plastic.

Below the silty clay/lean clay soils in B-1, B-2, and B-4, we encountered silty sand soils extending to depths of approximately 18 to 19 feet, and to the total depth explored (16 feet) in B-3. The silty sand soils were medium dense and slightly damp to damp.

Below the silty sand soils in B-1, B-2, and B-4, we encountered gravel with sand and cobbles to the total depths explored. The gravelly soils were generally dense and slightly damp. Borings B-1 and B-2 were terminated short of their planned depths of 25 feet due to auger refusal on cobbles.

Groundwater Conditions:

Groundwater was not encountered in any of the borings to the depths explored. 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 samples tested indicate the silty clay/lean clay soils have fines contents (silt- and/or clay-sized particles passing the U.S. No. 200 sieve) ranging from approximately 81 to 88 percent. Plasticity indices of samples tested ranged from 6 to 13. In-place dry densities of the silty clay/lean clay soils ranged from approximately 87 to 103 pounds per cubic foot (pcf), with natural moisture contents between about 4 and 7 percent.

Laboratory consolidation/expansion testing was performed on undisturbed ring samples of the subgrade soils beneath the proposed building. Results of these tests indicate that the silty clay/lean clay soils undergo slight to moderate compression when subjected to anticipated foundation stresses at the existing moisture contents. When subjected to increased moisture conditions at these stresses, they undergo significant additional compression. Based on the results of these tests, the silty clay/lean clay soils were characterized as highly compressible and potentially susceptible to hydro-collapse.

Results of all laboratory tests are presented in Appendix B.

OPINIONS AND RECOMMENDATIONS

Geotechnical Considerations:

The site is considered suitable for the proposed building and parking areas based on the geotechnical conditions encountered and tested for this report. However, the existing silty clay/lean clay soils are moisture-reactive and could undergo significant compression if they were to experience an increase in their existing moisture content. To reduce the potential for settlement, and provide more uniform and higher allowable bearing pressures, the footings and floor slab should bear on engineered fill.

Even with the removal and replacement of the existing moisture-reactive soils, some movement of the underlying native soils is possible if they become moistened. Greater depths of removal and replacement of the existing soils would further reduce the potential for moisture-induced soil movements. However, the depth of removal recommended herein should provide a reasonable reduction of the potential for soil movements, unless there is a large-scale increase in the moisture content of the soils. Therefore, proper drainage around the structure and locating the retention basin away from the structure are of paramount importance to prevent the soils below the engineered fill from becoming wet.

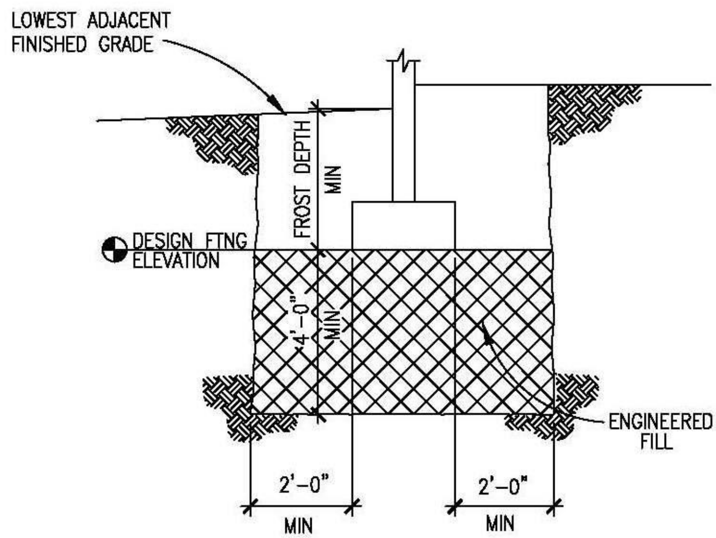
If there are any significant deviations from the assumed floor elevations, structure locations and/or loads noted at the beginning of this report, the opinions and recommendations of this report should be reviewed and confirmed/modified as necessary to reflect the final planned design conditions.

Foundations:

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 shallow spread footings bearing on engineered fill. The engineered fill should be provided for a depth below the footing of at least the width of wall footings and one-half the width of column footings, but not less than four (4.0) feet for either case. The engineered fill should extend at least two (2.0) feet beyond the edges of the footings. If the entire building area is excavated for the engineered fill placement, the engineered fill should extend at least five (5.0) feet beyond the perimeter of the building.

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 soils from undergoing significant moisture changes.

A generalized depiction of a shallow spread footing supported on engineered fill is shown in the following illustration.



The recommended design bearing capacities and footing depths are presented in the following table.

Footing Depth[1] (ft)	Allowable Bearing Pressure (psf)	Bearing Soil
2.5[2]	**2,500**	**Engineered Fill**
3.0	**3,000**	**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.

Total and differential settlements resulting from the assumed structural loads are estimated to be on the order of ½ 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 structures.

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

- Foundations are constructed as recommended, and
- Essentially no changes occur in water contents 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 soil conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required.

Site Classification:

Based on the subsurface conditions encountered in the borings, we estimate that Site Class D is appropriate for the site according to Table 20.3-1 of the ASCE 7-10 Standard in accordance with the 2015 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.

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.

Floor Slab Design and Construction:

The floor slabs should be placed on a minimum of two (2.0) feet of compacted soil (including the base course). On-site or imported soils with low expansive potentials 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 250 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 on-site soils obtained from boring B-6 was tested to evaluate the potential for the on-site soils to corrode buried metal and/or concrete. The sample was tested for pH, electrical resistivity, and 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**	**Resistivity (ohm-cm)**	**Sulfates (%)**	**Chlorides (%)**
6450	B-6	0 - 5	7.96	251	1.83	0.014

Corrosion of Concrete:

The soluble sulfate content of the sample tested was 1.83 percent by weight, which is characterized as severe sulfate exposure (Class S2) according to American Concrete Institute Building Code 318, Table 4.3.1. For this level of sulfate exposure, ACI 318 recommends the use of Type V cement (or Type II cement with the addition of Class F fly ash) and a maximum water-cementitious material ratio of 0.45. Calcium chloride admixture is not permitted in concrete subjected to severe sulfate exposure conditions. Additionally, it recommends the use of concrete with a minimum 28-day compressive strength of 4,500 psi. All concrete should be designed, mixed, placed, finished, and cured in accordance with the guidelines presented by the Portland Cement Association (PCA) and the American Concrete Institute (ACI).

Corrosion of Metals:

Corrosion of buried ferrous metals can occur when electrical current flows from the metal into the soil. As the resistivity of the soil decreases, the flow of electrical current increases, increasing the potential for corrosion. A commonly accepted correlation between soil resistivity and corrosion of ferrous metals is shown in the following table.

Resistivity (ohm-cm)	Corrosivity
0 to 1,000	Severely Corrosive
1,000 to 2,000	Corrosive
2,000 to 10,000	Moderately Corrosive
>10,000	Mildly Corrosive

The samples tested each had a resistivity of 251 ohm-cm. Based on these laboratory results and the table above, the on-site soils would be characterized as severely corrosive toward ferrous metals. The potential for corrosion should be taken into account during the design process.

Pavement Design and Construction:

We are presenting options for both flexible (asphalt) and rigid (concrete) pavement sections. A separate option is provided for areas subjected only to light vehicle parking. 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).

The recommended pavement sections are presented in the tables below.

Recommended Pavement Sections for Drive Lanes and Parking Areas Subjected to Fire Trucks and Ambulances			
Option	**Hot Mix Asphalt** (inches)	**Aggregate Base Course** (inches)	**Portland Cement Concrete** (inches)
Asphalt	4.0	10.0	--
Concrete	--	--	6.0

Recommended Pavement Sections for Light Vehicle Parking Areas			
Option	**Hot Mix Asphalt** (inches)	**Aggregate Base Course** (inches)	**Portland Cement Concrete** (inches)
Asphalt	3.0	8.0	--
Concrete	--	--	4.5

Recommended Heavy Duty Pavement Section	
Portland Cement Concrete (inches)	**Aggregate Base Course** (inches)
6.0	4.0

*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 conform to Section 303 of the NMDOT specifications for Type I Base Course.

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 NMDOT specifications. The hot-mix paving should be placed and compacted in accordance with NMDOT specifications. HMA should be either an SP-III or SP-IV mix complying with the requirements of section 416, Minor Paving of the 2014 NMDOT Specifications. HMA lift thicknesses should comply with the following:

HMA Lift Thicknesses		
HMA Type	**Minimum Thickness** (inches)	**Maximum Thickness** (inches)
SP-III	2.5	3.5
SP-IV	1.5	3.0

Concrete Pavements:

Concrete should be placed directly on the prepared subgrade. Reinforcing steel is not required or recommended for rigid pavement sections. Concrete used for pavement sections should have a minimum 28-day compressive strength of 4,000 pounds per square inch (psi). 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*".

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.

Percolation Test Results:

One soil percolation test, PT-1, was performed on the eastern portion of the site to provide information for the design of a retention pond. The percolation test was performed using the falling head method in a borehole that was approximately eight inches in diameter and approximately five feet below existing ground surface. The sides and bottom of the borehole were scarified and any remaining loose soil was removed from the borehole. A layer of clean gravel was placed in the bottom of the borehole to help reduce disturbance of the native soil surface during introduction of water into the borehole. The soils were allowed to presoak overnight prior to testing.

After the presoaking, the water level was adjusted to approximately 6 inches above the bottom of the borehole and test trials were performed to establish a stabilized percolation rate. Each test trial was performed by measuring and recording the vertical drop in the water level at 30 minute intervals. This process was repeated until a stabilized percolation rate was indicated. The test results are presented in the table below:

STABILIZED PERCOLATION TEST RESULTS

Test Number	Test Depth[1] (Feet)	Pre-Soak Date	Test Date	Percolation Rate (Minutes Per Inch)
PT-1	5	5/7/2018	5/8/2018	**7**

[1]Approximate depth measured to bottom of test hole from adjacent existing grade

These rates should be expected to become slower after construction as the pond(s) "silt in". Periodic maintenance should be utilized to maintain the design percolation rates for the ponds. Note percolation rates will differ if final grades vary from the existing grades and the depth at which the percolation test was performed at the time of our field test.

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 area. 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 near optimum moisture content, and compacted to at least 95% of standard proctor (ASTM D698).

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. Soils should be removed to provide at least a two (2.0) foot thickness of compacted soil and base course below the floor slab.

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. The existing site soils are clayey and are not suitable for use as structural fill. Imported soils with low expansive potentials could be used as fill material for the following:

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

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

3. Imported soils to be used in structural fills should conform to the following:

Gradation	**Percent finer by weight (ASTM C136)**
3"	100
No. 4 Sieve	50-100
No. 200 Sieve	50 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. Aggregate base should conform to Type I Base Course as specified in Section 303 of the 2014 New Mexico Department of Transportation (NMDOT) *"Standard Specifications for Road and Bridge Construction."*

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 meeting the following gradation should be placed adjacent to walls which retain earth:

Sieve Size	Percent Finer by Weight
1 inch	100
3/4 inch	85 - 100
No. 4	45 - 95
No. 200	5 max

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 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

Not to Scale

SITE PLAN	PROJECT
Boring Locations (approximate)	Proposed Incident Command Center Shiprock, New Mexico
GEOMAT Project No. 182-3000 Date of Exploration: April 9, 2018	

GEOMAT INC.

GEOMAT INC.

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

Borehole B-1

Project Name:	Proposed Incident Command Center	Date Drilled:	5/7/2018
Project Number:	182-3000	Latitude:	Not Determined
Client:	Dyron Murphy Architects	Longitude:	Not Determined
Site Location:	Shiprock, New Mexico	Elevation:	Not Determined
Rig Type:	CME-55	Boring Location:	See Site Plan
Drilling Method:	7.25" O.D. Hollow Stem Auger	Groundwater Depth:	None Encountered
Sampling Method:	Ring and Split spoon samples	Logged By:	DB
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
							CL-ML		1	Silty CLAY, brown to gray, very stiff, dry to slightly damp
									2	contains white calcareous veins
	88	6		8-10-12	SS 18				3	
									4	pocket penetrometer > 5 tsf
96.3			4.7	10-17	R 12				5–6	trace gravel
									7–9	
				9-9-10	SS 18				10–11	stiff
									12–14	
				10-9-13	SS 18		SM		14–19	Silty SAND with trace gravel, brown, fine-grained, medium dense, slightly damp
				31-35-30	SS 18		GP		19–21½	GRAVEL with sand and cobbles, brown to gray, fine- to coarse-grained, dense, slightly damp
									22–25	Boring terminated at 21½ feet due to auger refusal on cobbles Total Depth 21½ feet

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

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Borehole B-2

Project Name: Proposed Incident Command Center
Project Number: 182-3000
Client: Dyron Murphy Architects
Site Location: Shiprock, New Mexico
Rig Type: CME-55
Drilling Method: 7.25" O.D. Hollow Stem Auger
Sampling Method: Ring and Split spoon samples
Hammer Weight: 140 lbs
Hammer Fall: 30 inches

Date Drilled: 5/7/2018
Latitude: Not Determined
Longitude: Not Determined
Elevation: Not Determined
Boring Location: See Site Plan
Groundwater Depth: None Encountered
Logged By: DB
Remarks: None

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 (%)							
							CL-ML		0–14	Silty CLAY, tan to gray, stiff, slightly damp, trace white calcareous veins
87.2			6.6	10-11	R 12				3	pocket penetrometer > 5 tsf
				6-6-6	SS 18				5	pocket penetrometer = 2.7 tsf
102.8			4.0	10-18	R 12				10	pocket penetrometer = 4.2 tsf
				9-10-15	SS 18		SM		14–19	Silty SAND, brown, fine-grained, medium dense, slightly damp, no appreciable cementation
				28-24-50/6"	SS 18		GP		19–21½	GRAVEL with sand and occasional cobbles, brown to gray, fine- to coarse-grained, dense, slightly damp
									21½	Boring terminated at 21½ feet due to auger refusal on cobbles Total Depth 21½ feet

Depth scale (ft): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25

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

GEOMAT INC.

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Borehole B-3

Project Name:	Proposed Incident Command Center	Date Drilled:	5/7/2018
Project Number:	182-3000	Latitude:	Not Determined
Client:	Dyron Murphy Architects	Longitude:	Not Determined
Site Location:	Shiprock, New Mexico	Elevation:	Not Determined
Rig Type:	CME-55	Boring Location:	See Site Plan
Drilling Method:	7.25" O.D. Hollow Stem Auger	Groundwater Depth:	None Encountered
Sampling Method:	Ring and Split spoon samples	Logged By:	DB
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
							CL-ML		0–4	Silty CLAY, brown to gray, stiff, dry to damp
93.6			4.5	6-12	R 12				3	pocket penetrometer > 5 tsf
				6-7-8	SS 18		SM		4–6	Silty SAND, brown, fine-grained, medium dense, slightly damp
				5-5-7	SS 18		CL		6–14	Lean CLAY, brown to gray, firm to stiff, slightly damp
				6-6-6	SS 18		SM		14–16½	Silty SAND, tan to brown, fine-grained, medium dense, slightly damp, no appreciable cementation contains layers/lenses of clay
									16½	Total Depth 16½ feet

Depth scale (ft): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25

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

GEOMAT INC.
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Borehole B-4

- Project Name: Proposed Incident Command Center
- Project Number: 182-3000
- Client: Dyron Murphy Architects
- Site Location: Shiprock, New Mexico
- Rig Type: CME-55
- Drilling Method: 7.25" O.D. Hollow Stem Auger
- Sampling Method: Ring and Split spoon samples
- Hammer Weight: 140 lbs
- Hammer Fall: 30 inches
- Date Drilled: 5/7/2018
- Latitude: Not Determined
- Longitude: Not Determined
- Elevation: Not Determined
- Boring Location: See Site Plan
- Groundwater Depth: None Encountered
- Logged By: DB
- Remarks: None

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 (%)							
							CL-ML		0–1	Silty CLAY, brown to gray, stiff, dry to slightly damp
				6-6-7	SS 18				2.5–4	
93.0			6.7	8-14	R 12				5–6	pocket penetrometer > 5 tsf
				4-2-3	SS 18				10–11.5	firm, slightly damp pocket penetrometer = 3.8 tsf
							SM		14	Silty SAND with trace gravel, brown, medium dense, damp
				8-19	R 12				15–16	contains white calcareous veins
							GP		18	GRAVEL with sand and cobbles, brown to gray, fine- to coarse-grained, dense, slightly damp
				27-17-14	SS 18				20–21.5	
									21.5	Total Depth 21½ feet

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

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Borehole B-5

Project Name:	Proposed Incident Command Center	Date Drilled:	5/7/2018
Project Number:	182-3000	Latitude:	Not Determined
Client:	Dyron Murphy Architects	Longitude:	Not Determined
Site Location:	Shiprock, New Mexico	Elevation:	Not Determined
Rig Type:	CME-55	Boring Location:	See Site Plan
Drilling Method:	7.25" O.D. Hollow Stem Auger	Groundwater Depth:	None Encountered
Sampling Method:	Ring and Split spoon samples	Logged By:	DB
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
							CL		0–1	Lean CLAY, brown to gray, stiff, dry to slightly damp
	88	13		5-6-8	SS 18				2.5	
100.4			5.1	13-11	R 12				5	pocket penetrometer > 5 tsf
				11-14-15	SS 18				10	very stiff
				4-5-6	SS 18				15	stiff
									16½	Total Depth 16½ feet

Depth scale (ft): 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

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

GEOMAT INC.
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Borehole B-6

Project Name:	Proposed Incident Command Center	Date Drilled:	5/7/2018
Project Number:	182-3000	Latitude:	Not Determined
Client:	Dyron Murphy Architects	Longitude:	Not Determined
Site Location:	Shiprock, New Mexico	Elevation:	Not Determined
Rig Type:	CME-55	Boring Location:	See Site Plan
Drilling Method:	7.25" O.D. Hollow Stem Auger	Groundwater Depth:	None Encountered
Sampling Method:	Bulk sample from auger cuttings	Logged By:	DB
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
					A		CL		1–5	Lean CLAY with sand, brown to gray, dry to slightly damp
									5–25	Total Depth 5 feet

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

GEOMAT INC.
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Borehole B-7

Project Name:	Proposed Incident Command Center	Date Drilled:	5/7/2018
Project Number:	182-3000	Latitude:	Not Determined
Client:	Dyron Murphy Architects	Longitude:	Not Determined
Site Location:	Shiprock, New Mexico	Elevation:	Not Determined
Rig Type:	CME-55	Boring Location:	See Site Plan
Drilling Method:	7.25" O.D. Hollow Stem Auger	Groundwater Depth:	None Encountered
Sampling Method:	Bulk sample from auger cuttings	Logged By:	DB
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
	81	8			A		CL		0–5	Lean CLAY with sand, brown to gray, dry to slightly damp
									5–25	Total Depth 5 feet

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

GEOMAT 182-3000.GPJ GEOMAT.GDT 5/23/18

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.

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.

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

Appendix B

LAB NO.	BORING NO.	SAMPLE DEPTH (ft)	ASTM D698		MOISTURE CONT. (%)	DENSITY		ATTERBERG LIMITS			SWELL (%)	CONSOL TEST	% PASS #200 SIEVE	SOIL CLASSIFICATION *ASTM D2487 **ASTM D2488
			Density	Moisture		WET (pcf)	DRY (pcf)	LL	PL	PI				
6434	B-1	2.5	--	--	--	--	--	26	20	6	--	--	88	Silty **CLAY** (CL-ML)*
6435	B-1	5	--	--	4.7	100.8	96.3	--	--	--	--	--	--	Silty **CLAY** (CL-ML)**
6436	B-2	2.5	--	--	6.6	93.0	87.2	--	--	--	--	Attached	--	Silty **CLAY** (CL-ML)**
6437	B-2	10	--	--	4.0	107.0	102.8	--	--	--	--	--	--	Silty **CLAY** (CL-ML)**
6438	B-3	2.5	--	--	4.5	97.9	93.6	--	--	--	--	--	--	Silty **CLAY** (CL-ML)**
6439	B-4	5	--	--	6.7	99.2	93.0	--	--	--	--	Attached	--	Silty **CLAY** (CL-ML)**
6440	B-5	2.5	--	--	--	--	--	28	15	13	--	--	88	Lean **CLAY** (CL)*
6441	B-5	5	--	--	5.1	151.6	100.4	--	--	--	--	Attached	--	Lean **CLAY** (CL)**
6442	B-7	2.5	--	--	--	--	--	26	18	8	--	--	81	Lean **CLAY** w/ sand (CL)*

*ASTM D2487 = Laboratory Classification
**ASTM D2488 = Visual-Manual Classification

GEOMAT INC.

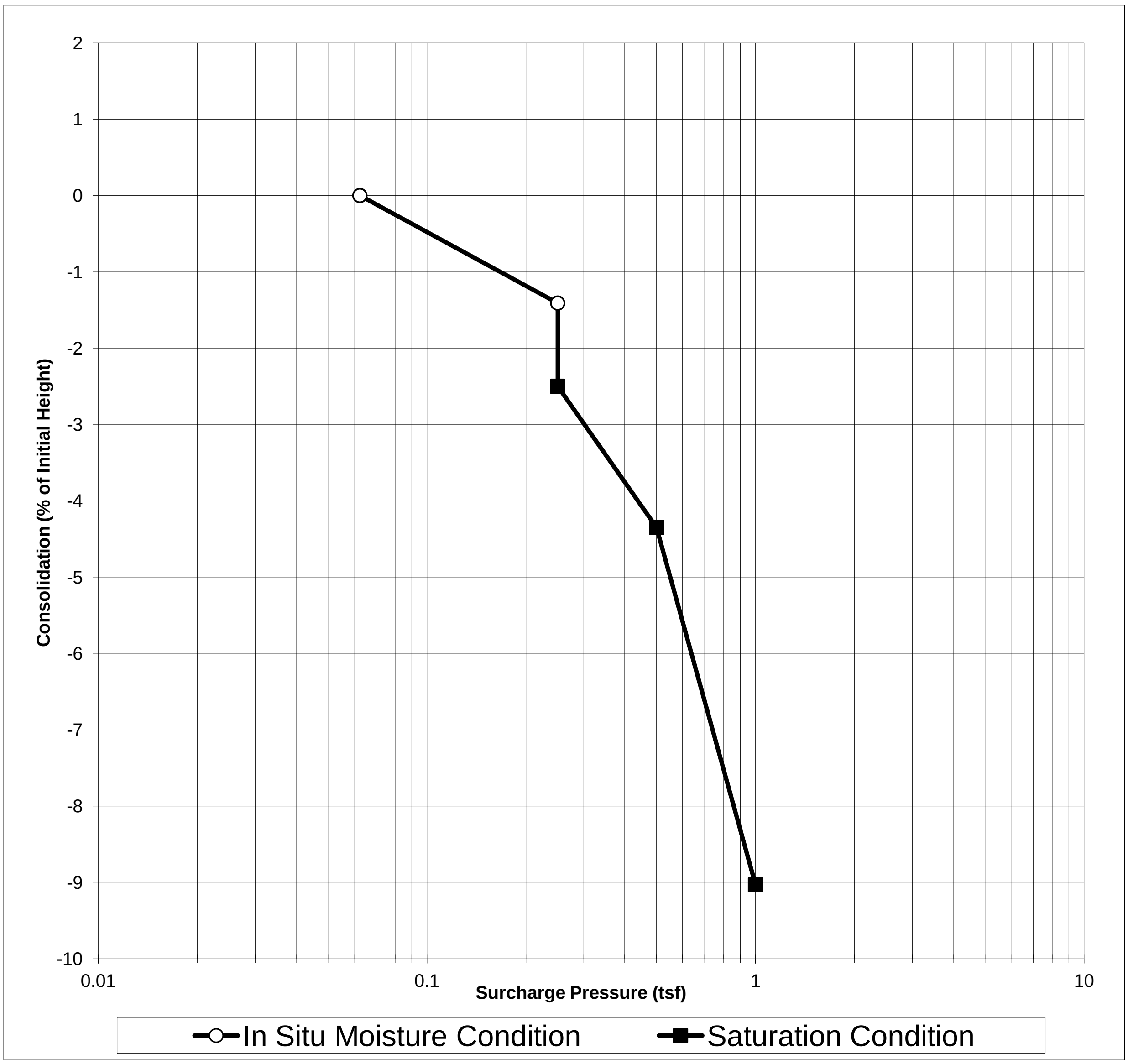
SUMMARY OF SOIL TESTS

Project	Proposed Incident Command Center
Job No.	182-3000
Location	Shiprock, New Mexico
Date of Exploration	5/7/2018

PROJECT:	Shiprock Incident Command Center	**JOB NO:**	182-3000
CLIENT:	Dyron Murphy Architects, P.C.	**WORK ORDER NO:**	NA
MATERIAL:	Silty CLAY (CL-ML)	**LAB NO:**	6436
SAMPLE SOURCE:	B-2 @ 2.5'	**DATE SAMPLED:**	5/7/2018
SAMPLE PREP.:	In Situ	**SAMPLED BY:**	DB

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS (ASTM D2435)

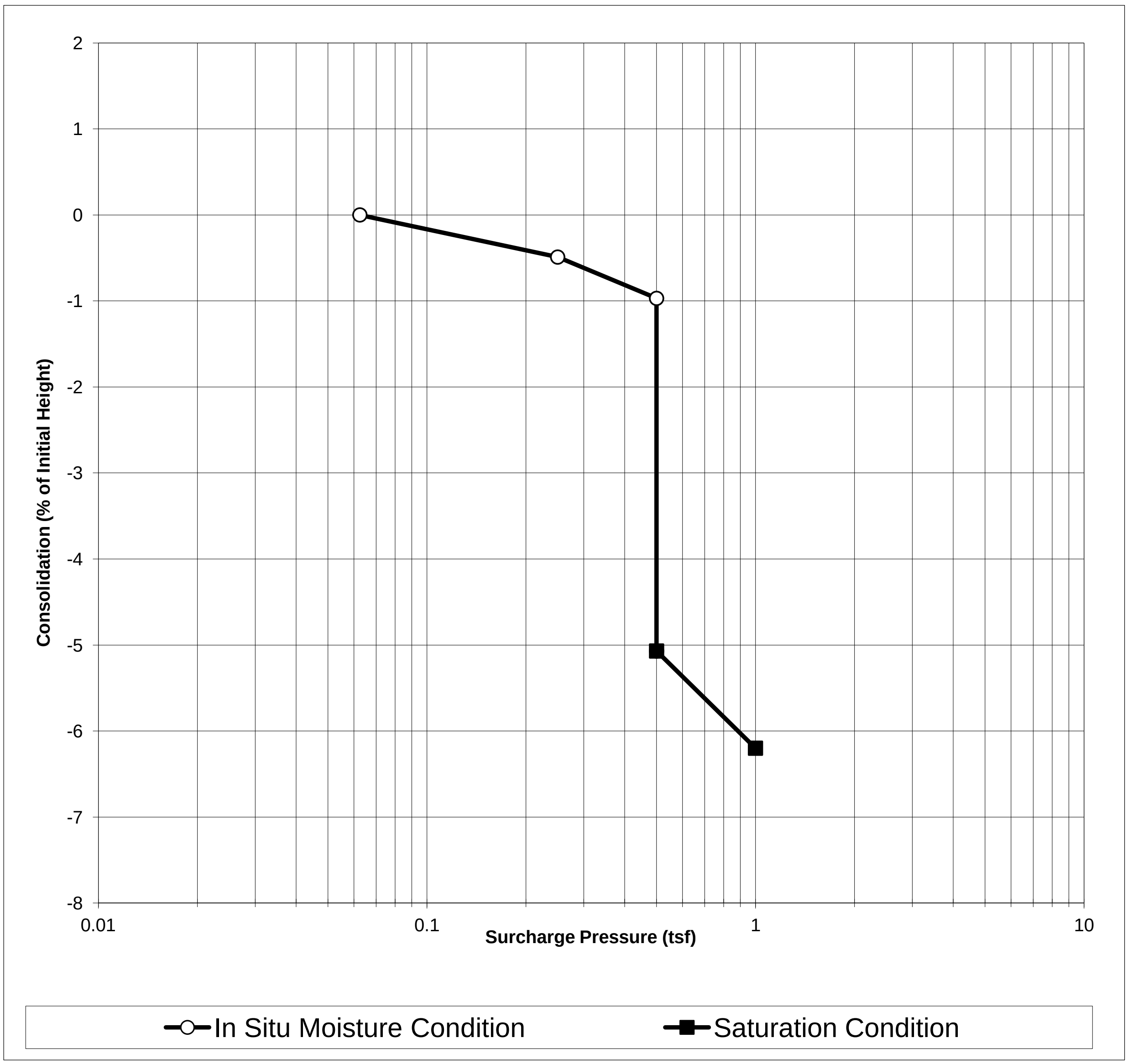
INITIAL VOLUME (cu.in)	4.60	FINAL VOLUME (cu.in)	4.19
INITIAL MOISTURE CONTENT	6.6%	FINAL MOISTURE CONTENT	28.2%
INITIAL DRY DENSITY(pcf)	87.2	FINAL DRY DENSITY(pcf)	95.4
INITIAL DEGREE OF SATURATION	16%	FINAL DEGREE OF SATURATION	79%
INITIAL VOID RATIO	0.91	FINAL VOID RATIO	0.73
ESTIMATED SPECIFIC GRAVITY	2.651	SATURATED AT	0.25 tsf



PROJECT:	Shiprock Incident Command Center	**JOB NO:**	182-3000
CLIENT:	Dyron Murphy Architects, P.C.	**WORK ORDER NO:**	NA
MATERIAL:	Silty CLAY (CL-ML)	**LAB NO:**	6439
SAMPLE SOURCE:	B-4 @ 5'	**DATE SAMPLED:**	5/7/2018
SAMPLE PREP.:	In Situ	**SAMPLED BY:**	DB

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS (ASTM D2435)

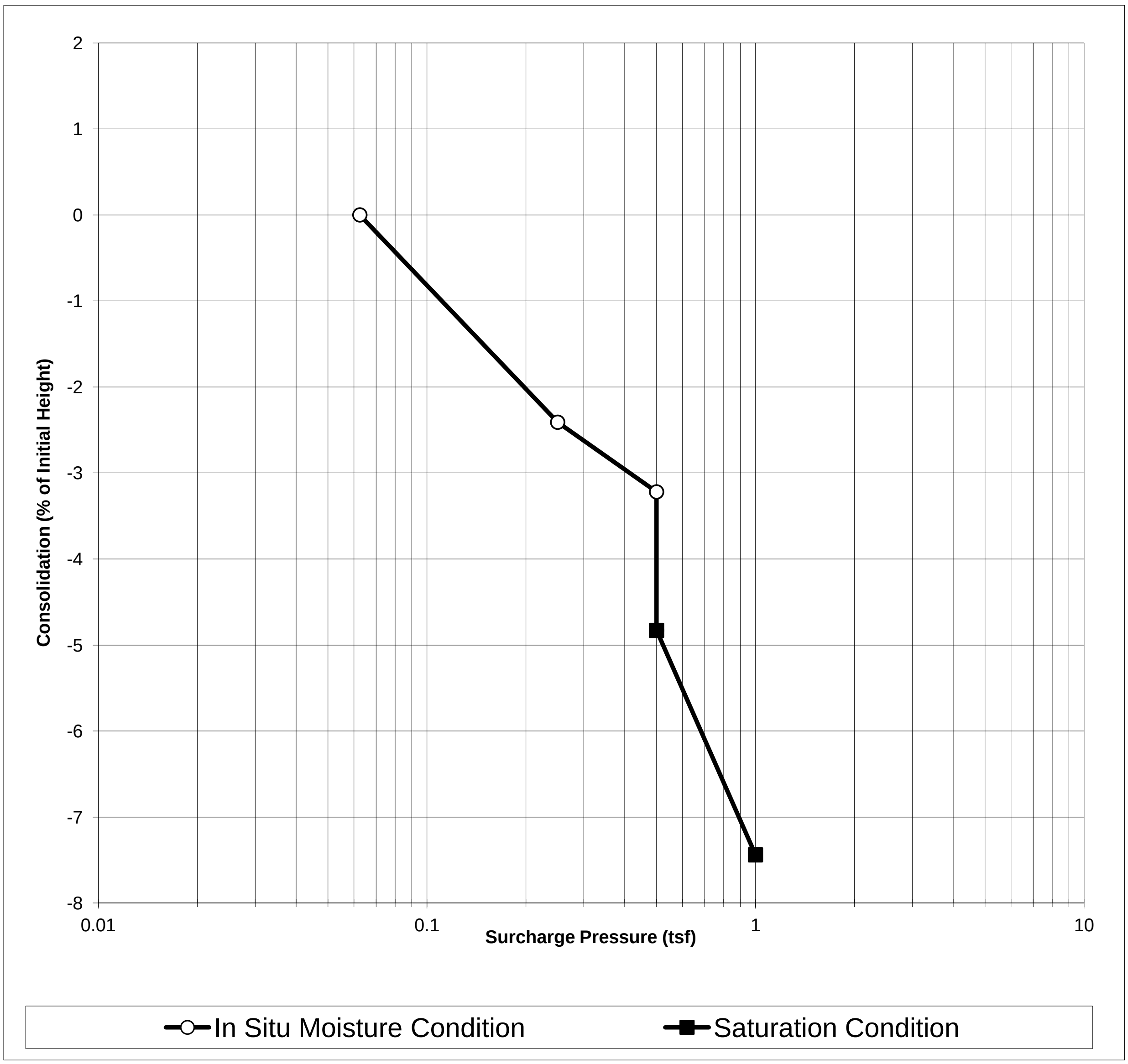
INITIAL VOLUME (cu.in)	4.60	FINAL VOLUME (cu.in)	4.32
INITIAL MOISTURE CONTENT	6.7%	FINAL MOISTURE CONTENT	24.8%
INITIAL DRY DENSITY(pcf)	93.0	FINAL DRY DENSITY(pcf)	98.7
INITIAL DEGREE OF SATURATION	18%	FINAL DEGREE OF SATURATION	74%
INITIAL VOID RATIO	0.79	FINAL VOID RATIO	0.68
ESTIMATED SPECIFIC GRAVITY	2.651	SATURATED AT	0.5 tsf



PROJECT:	Shiprock Incident Command Center	**JOB NO:**	182-3000
CLIENT:	Dyron Murphy Architects, P.C.	**WORK ORDER NO:**	NA
MATERIAL:	Silty CLAY (CL-ML)	**LAB NO:**	6441
SAMPLE SOURCE:	B-5 @ 5'	**DATE SAMPLED:**	5/7/2018
SAMPLE PREP.:	In Situ	**SAMPLED BY:**	DB

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF SOILS (ASTM D2435)

INITIAL VOLUME (cu.in)	4.60	FINAL VOLUME (cu.in)	4.26
INITIAL MOISTURE CONTENT	5.1%	FINAL MOISTURE CONTENT	19.6%
INITIAL DRY DENSITY(pcf)	100.4	FINAL DRY DENSITY(pcf)	108.0
INITIAL DEGREE OF SATURATION	16%	FINAL DEGREE OF SATURATION	70%
INITIAL VOID RATIO	0.65	FINAL VOID RATIO	0.53
ESTIMATED SPECIFIC GRAVITY	2.651	SATURATED AT	0.5 tsf



LABORATORY TESTING PROCEDURES

Consolidation Tests: One-dimensional consolidation tests are performed using "Floating-ring" type consolidometers. The test samples are approximately 2.5 inches in diameter and 1.0 inch high and are usually obtained from test borings using the dynamically-driven ring samplers. Test procedures are generally as outlined in ASTM D2435. Loads are applied in several increments to the upper surface of the test specimen and the resulting deformations are recorded at selected time intervals for each increment. Samples are normally loaded in the in-situ moisture conditions to loads which approximate the stresses which will be experienced by the soils after the project is completed. Samples are usually then submerged to determine the effect of increased moisture contents on the soils. Each load increment is applied until compression/expansion of the sample is essentially complete (normally movements of less than 0.0003 inches/hour). Porous stones are placed on the top and bottom surfaces of the samples to facilitate introduction of the moisture.

Expansion Tests: Tests are performed on either undisturbed or recompacted samples to evaluate the expansive potential of the soils. The test samples are approximately 2.5 inches in diameter and 1.0 inch high. Recompacted samples are typically remolded to densities and moisture contents that will simulate field compaction conditions. Surcharge loads normally simulate those which will be experienced by the soils in the field. Surcharge loads are maintained until the expansion is essentially complete.

Atterberg Limits/Maximum Density/Optimum Moisture Tests: These tests are performed in accordance with the prescribed ASTM test procedures.

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, clients can benefit from a lowered exposure to the subsurface problems 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 below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs 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. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project 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.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- 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, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been 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 your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

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

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment 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 from project start to project finish, so the individual can provide 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 not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed 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 full-time 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 on hand quickly 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 observation.

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 informational 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, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. 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. 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 Not 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 relate any 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 yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

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, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled 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 not 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 not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

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e-mail: info@geoprofessional.org www.geoprofessional.org

SECTION 07 7600 - ROOF PAVERS AND PEDESTAL SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. Section includes concrete roof pavers and pedestal system as shown and specified. Work includes providing and installing an effective drainage between the pavers and the system below.

1.02 RELATED REQUIREMENTS

A. Section 01 6000 - Product Requirements.

B. Section 07 2500- Weather Barrier

C. Section 07 5400 -Thermoplastic Membrane Roofing

D. Section 07 6200 - Sheet Metal Flashing and Trim

1.03 REFERENCE STANDARDS

A. ASTM D 1238-04 - Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.

B. ASTM D 792-00 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

C. ASTM D 638-03 - Standard Test Method for Tensile Properties of Plastics.

D. ASTM D 256-06 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.

E. ASTM D 648-06 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.

1.04 SUBMITTALS

A. Submit manufacturer’s product data. Include construction details, material descriptions, profiles and finishes of system components.

B. Submit shop drawings. Include design plans, details, dimensions and attachments to other work.

C. Submit manufacturer's color charts showing the full range of Standard colors available for concrete pavers and aluminum planter cubes.

D. Submit Installer Certificate, signed by installer, certifying compliance with project qualification requirements.

E. Manufacturers warranties.

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications
   1. All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten (10) years experience.

B. Installer’s Qualifications:
   1. The deck support system installer must have a minimum of two (2) years proven construction experience, be capable of estimating and building from blueprint plans and details, determine elevations, and properly handle materials. All Work must comply with the installation application procedures for deck support work specified herein.

C. Performance Requirements: The contractor assumes the responsibility for and must take into consideration the structural capability and adequacy of the structure to carry the dead and live load weight(s) involved, and that the density of any insulation is satisfactory to resist crushing and damaging the waterproofing membrane.

D. Mock-Up: Provide mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship is approved by Architect.

1.06 DELIVERY STORAGE AND HANDLING

A. Deliver and store system components with labels intact and legible.

B. Inspect all delivered materials to insure they are undamaged and in good condition.

C. Store and dispose of solvent-based materials such as construction adhesive, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 PROJECT CONDITIONS

A. There are no pedestal installation temperature restriction guidelines other than the practical considerations of working in any unsafe condition or inclement weather.

B. Deck supports specified are to be for used with pedestrian traffic only.

C. Pedestrian decks must be restrained by perimeter blocking or walls on all sides. Lateral movement greater than one tab width is unacceptable and will be rejected.

D. Installation or anticipated installation of additional items on top of the deck, (such as planters, concrete benches, sculptures, hot tubs, grills, or industrial equipment) must be supported directly by additional pedestals that are in addition to the main deck paver/tile pedestal system. Special consideration must be also given when installing equipment that vibrates. Total weights must be calculated and dispersed evenly over the number of pedestals needed to carry the expected weight. To avoid point loading, the use of planters or architectural features with ‘feet’ is not allowed. Failure to adequately support the additional weight of any such features or items may cause significant damage to the deck, underlying structure, or waterproofing system.

E. All decks shall be designed to not exceed the design capacity of the pedestal.

F. The substrate immediately below the pedestals shall provide positive drainage.

G. In the case of decks over roofing substrates, roof systems must meet local building code and be in accordance with the NRCA recommended good construction practices. Only roofing manufacturer approved systems shall be used.

1.08 WARRANTY

A. Submit manufacturer's and installer's written warranty agreeing to repair or replace roof paver system work which fails in materials or work-manship within three (3) year of the date of delivery.

B. Submit manufacturer’s and installer’s written warranty outlining terms, conditions, and limitations of their limited warranty against manufacturing defect for a period of 3 years of the pedestal system.

C. The contractor shall warrant that his work will remain free from defects of labor and materials used in conjunction with this work in accordance with the General Conditions for this project for a minimum of three years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hanover Architectural Products: www.hanoverpavers.com tel:(717) 637.7045

B. Westile an Old Castle Company: www.westile.com tel:(800 433.8453

C. Envirospec, Inc./Pave-El: www.envirospecinc.com tel: (716) 689.8548

2.02 CONCRETE ROOF PAVERS AND PEDESTAL SYSTEM

A. Furnish and install a complete adjustable deck support system with a maximum cavity height as noted on drawings. Provide effective drainage between the pavers and planter cubes, and the system below.

2.03 MATERIALS

A. Pedestals
   1. Provide components as required per manufacturer for proper function of system including required adjustment and leveling of pavers: top cap, bottom cap, top and bottom shims, spacers, buffer pads and pedestal joist plate.

B. Concrete Pavers
   1. Dimensions: 23 1/2" x 23 1/2" x 2"
   2. Absorption: less than 5%.
   3. Density: 155 lbs/cu ft.
   4. Compressive Strength: 8,500 psi at 28 days
   5. Flexural Strength: 1,100 psi
   6. Weight: 25 lbs/sf

7. Color: Integrally colored. Pattern and colors as shown on drawings from manufacturer's standard colors.
8. Finish: Tudor
9. High density, hydraulically pressed concrete units manufactured with 1/8" tolerance and produced by subjecting the concrete mix to a minimum pressure of 1,000 pounds per square inch over the entire surface area.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify all elevations, required pedestal heights and deck dimensions before commencing work.

3.02 PREPARATION

A. Establish accurate lines, levels and visual pattern.

B. The substrate surface that will receive the deck supports must be well compacted (on grade) and structurally capable of carrying the dead and live loads anticipated.

C. The substrate must be clean and free of projections and debris that could impair the performance of the pedestals or the total deck system.

D. Installation requirements vary for each individual project site. Deck materials used, pattern, grid layout, starting point, and finished elevation should be shown on plan view shop drawings which have been prepared and approved by the designer, installing contractor and/or owner.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. If required, place a Floating Insulation Base (FIB) board or Floating Foundation Base (FFB) in the location on the grid of each pedestal.

C. Always maintain adequate thread engagement.

D. Slope Compensation: A base leveler disk should be used to level the pedestal base. Place one to four disks under the pedestal base to compensate for up to 1 inch per foot of slope. Compensate for slope by placing the disks' thickest edge (located on the edge by a small finger tab) at the down slope side of the deck support, one disk compensates for 1/4 inch per foot of slope. Using two to four disks, rotate one in relation to the other to create a level deck support.

3.04 FIELD QUALITY CONTROL

A. Inspect often during installation to assure that grid spacer lines are being maintained in a straight and consistent pattern and that deck panels or pavers are level and not rocking.

B. Unless otherwise specified in writing to allow for expansion, inspect to assure that all paver spacing between tiles and at perimeter containment does not exceed a tab width. Particular attention should be made to assure that all pedestrian entry or access points to the deck are level and that the deck surface tiles are not randomly raised or uneven creating a tripping or safety hazard.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION