GEOTECHNICAL ENGINEERING REPORT

Air National Guard
Alert GOV Parking Shelter
XGFG182006
Truax Field
Madison, Wisconsin

GESTRA Project No.: M20068-10
November 30, 2020

Prepared For:
Hanson Professional Services, Inc.
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GESTRA

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Table of Contents

1.0 INTRODUCTION 1

1.1 PROJECT INFORMATION 1

2.0 SCOPE OF WORK 2

3.0 EXPLORATION RESULTS 2

3.1 SITE CONDITIONS 2
3.2 PEDOLOGICAL INFORMATION 3
3.3 SUBSURFACE SOIL PROFILE 3
3.4 GROUNDWATER OBSERVATIONS 3
3.5 LABORATORY TEST SUMMARY 4

4.0 ANALYSIS AND RECOMMENDATIONS 4

4.1 SITE PREPARATION 4
4.2 FOUNDATION RECOMMENDATIONS 6
4.2.1 SHALLOW FOUNDATIONS 6
4.2.2 MAT FOUNDATIONS 7
4.3 FLOOR SLAB RECOMMENDATIONS 7
4.4 SEISMIC SITE CLASSIFICATION 8
4.5 PAVEMENT DESIGN 8
4.6 SOIL CORROSIVITY 9
4.7 CONSTRUCTION CONSIDERATIONS 9

5.0 EXPLORATION AND TESTING PROCEDURES 11

5.1 LAYOUT AND ELEVATION PROCEDURES 11
5.2 FIELD TESTING PROCEDURES 11
5.3 LABORATORY TESTING PROCEDURES 11

STANDARD OF CARE 12

APPENDIX I SITE LOCATION MAP, BOREHOLE LOCATION MAP, TEST BORING LOGS, GENERAL NOTES AND SOILS CLASSIFICATION

APPENDIX II LABORATORY TEST RESULTS

APPENDIX III WEB SOIL SURVEY

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1.0 INTRODUCTION

GESTRA Engineering, Inc. (GESTRA) was authorized by Hanson Professional Services, Inc. (Hanson) to complete a subsurface exploration and geotechnical engineering report for the Air National Guard (ANG) Alert GOV Parking Shelter project located at Truax Field in Madison, Wisconsin. This report presents the results from the subsurface soil exploration and describes the field exploration, laboratory test results, and provides recommendations pertaining to the design and construction of the proposed two small garage buildings and pavement.

The engineering recommendations and analysis contained within this report are based on the following project information which is a projection of GESTRA's understanding of the project. If for any reason the actual project information differs from what is reported below, GESTRA should be contacted so that we can review our recommendations in light of any new information.

1.1 PROJECT INFORMATION

The project area is located just north and west of the existing GOV Building (Building 402) and west of Building 400. The project will consist of the removal and replacement of the existing asphalt pavement, demolition of 3 small structures, and construction of two new (2) garage structures. The primary intended use of the garage structures is for parking for small trucks and snow removal equipment.

One garage structure is planned to be constructed north and one west of the GOV Building. The garage structures will be used for vehicle storage. At this time, the foundation for the garage structures are unknown, but will be either supported on shallow foundations or a mat foundation with frost walls. The garage structure located on the north side of the GOV Building will be approximately 17 feet wide by 23 feet long, and the garage structure on the west side of the GOV Building will be approximately 23 feet wide by 27 feet long. At this time the loads for the building are unknown, but it is assumed that if the structures are supported on shallow foundations the walls will be less than 7 kips per linear foot and if supported on a mat foundation will be less than 0.25 kips per square foot.

The pavement for the new drive and parking is planned to be asphalt cement concrete (ACC). It is our understanding that the pavement section will consist of 4 inches of ACC over 12 inches of aggregate.

2.0 SCOPE OF WORK

GESTRA has performed the following services for the project:

- Contacted Diggers Hotline to locate public utilities at the site.
- Staked borehole locations in the field using tape and stake methods. Elevation and coordinates of boring locations were determined by using a Geomax Zenith 35 GNSS-INS receiver and referenced to Wisconsin Carrier Registration System (WisCRS) Dane County (NAVD88). Elevation and coordinates were not obtained for boring B-8.
- Completed a total of three (3) standard penetration test (SPT) soil borings, 2 to a depth of 11 feet and 1 to a depth of 26 feet. At the completion of drilling, the spoils produced from boring B-4 during drilling were containerized in 55-gallon drums and the boreholes were abandoned per WDNR requirements. Borings performed in asphalt pavement were surface patched with cold patch asphalt and in concrete pavement with high early strength concrete.
- Performed laboratory soil testing to assign classification and engineering properties to the soils encountered. Laboratory testing included hand penetrometer, moisture and organic content, Atterberg limits, grain size analysis, modified Proctor, California Bearing Ratio (CBR) test, pH and Miller Box resistivity. GESTRA subcontracted Testing Engineers International, Inc. to perform laboratory sulfate testing.
- Prepared this geotechnical engineering report presenting the results of the field and laboratory testing as well as providing the following recommendations:
    a. Buildings: recommendations for shallow and mat foundations, allowable soil bearing capacity, estimates of settlement, floor slab recommendations, seismic site classification, site preparation/ soil correction and construction considerations.
    b. Pavement: soil parameters for the pavement design consisting of an estimated CBR value for design of asphalt pavement, and subgrade modulus of soil reaction value for design of rigid pavement.

3.0 EXPLORATION RESULTS

3.1 SITE CONDITIONS

The existing site includes of two smaller buildings on the west side and one on the north side of the existing GOV Building. The site is also comprised of asphalt pavement which provides access from the buildings to the taxiways located northwest of the project area. Based on the topographic map on the Dane County GIS website, majority of the site is relativity flat, with elevations at the boring locations varying between 857 and 859 feet.

Historical aerial photos indicate that the site was undeveloped in 1937. By 1955, the existing GOV Building was constructed and parking lots were constructed on the south and north side of the building. Since 1955, multiple improvements were made to the site, such as expanding the parking lots and construction of multiple small buildings.

3.2 PEDOLOGICAL INFORMATION

The USDA NRCS Web Soil Survey was used to research the pedologic mapping within the project limits. We have included the Web Soil Survey map in Appendix III of this report for your reference. Wacousta Silty Clay Loam was mapped within the project limits.

Wacousta series consists of very deep, very poorly drained soils formed in silty lacustrine sediments. These soils are in broad depressions and swales on till plains, moraines, and stream terraces. These soil types are considered common subgrade material, and have generally fair to poor strength characteristics.

3.3 SUBSURFACE SOIL PROFILE

The borings for the Alert GOV Parking project were completed in conjunction with other borings for multiple different projects at Truax Air Field. For the Alert GOV Parking Shelter two borings, B-4 and B-5, were performed. Boring B-8 was performed for the reconstruction of the floor slab for Building 400, but was used for this report due to its proximity to the project site. Boring B-4 was performed in the pavement located west of the GOV Building and B-5 in the drive lane near the entrance from the taxiway. The pavement structure at these boring locations consisted of 3 inches of asphalt overlying 2 ½ to 4 inches of base course material. Boring B-8 was performed in Building B400. The pavement structure at boring location B-8 consisted of 7 ½ inches of concrete over a sand with gravel layer that extended to approximately 1.5 feet below the top of slab elevation.

Fill was encountered only in boring B-8. The fill material consisted of silty sand with gravel and extended to a depth of 4.8 feet. The native soils typically consisted of very loose to medium dense sand. In boring B-5, a 1.7-foot thick organic silt layer was encountered directly below the pavement structure and in boring B-8 a 2.6-foot thick lean clay layer was encountered below the fill material. Moisture and organic content of the organic layer in boring B-5 tested was 34% and 9.2%, respectively. Moisture content of the clay layer in boring B-8 tested was 21%.

Results of the field and laboratory tests and observations are depicted on the individual boring logs included in Appendix I. Soils were grouped together based on similar observed properties. The stratification lines were estimated by the reviewing engineer based on available data and experience. The actual in-situ changes between layers may differ slightly and may be more gradual than depicted on the boring logs. Subsurface and groundwater conditions can vary between borehole locations and in areas not explored.

It is important to note that the soil observations, fill depths and topsoil thickness estimates were made in small diameter boreholes. Therefore, it should be understood that thicker or thinner deposits of the individual strata are likely to be encountered within other portions of the project. Furthermore, the estimation of a strata thickness at a particular location can differ from person to person due to a sometimes indistinct transition between the soils encountered. Additionally, it must be recognized that in the absence of foreign substances and/or debris within the soil samples obtained, it is sometimes difficult to distinguish between natural soils and clean soil fill.

3.4 GROUNDWATER OBSERVATIONS

Groundwater observations were made during drilling operations. Groundwater was observed to be around a depth of 7 feet (elevation 851 feet referenced to borings B-4 and B-5). Accurate water level readings could not be made at the completion of drilling due to collapsing soils.

Groundwater level fluctuations may occur with time and seasonal changes due to variations in precipitation, evaporation, surface water runoff and local dewatering. Perched water pockets and a higher water table may also be encountered during wet weather periods, particularly in more permeable silt and sand seams or granular fill material overlying less permeable clays. Installation and monitoring of an observation well would be required to assess true groundwater elevation.

3.5 LABORATORY TEST SUMMARY

GESTRA collected bulk samples from the auger cuttings from borings B-4, B-5 and B-8 (performed in Building 400 north of the GOV Building). The bulk samples were combined to create a composite sample to represent the generalized soil profile of the upper 5 feet of soil. Based on design pavement loads, CBR tests were performed using modified Proctor density (ASTM D1557). The details of laboratory results for the modified Proctor and CBR tests are provided in Appendix II. Following Table 3-1 summarizes the modified Proctor and CBR test results.

Table 3-1: Summarized Modified Proctor and CBR Test Results of Subgrade Materials

Sample Designation	Sample Location	Modified Proctor (ASTM D1557)		% CBR at 0.1 in penetration, 95% compaction
		Max. Dry Density (pcf)	% Optimum Moisture Content	
CBR-1	B-4 and B-8	142.0	5.9	31

Select samples of the subgrade soils were submitted for laboratory gradation testing. Table 3-2 provides a summary of the tests performed and associated USCS soil classification.

Table 3-2: Subgrade Soil Tests

Soil Sample	Sample Location	Grain Size Results (% passing)		Atterberg Limit Results (%)		Soil Type
		P4	P200	LL	PI	
CBR-1	B-4 and B-8	79.9	35.0	14	1	Silty Sand with Gravel

P4= Percent passing sieve #4; P200= Percent passing sieve #200; all the samples were non plastic; NP=not performed

4.0 ANALYSIS AND RECOMMENDATIONS

4.1 SITE PREPARATION

Site preparation should start with removal of surficial topsoil, pavement, buried organic soil (similar to that encountered in B-5), vegetation, and debris or other deleterious material, if encountered. In addition, all unused utilities should be properly rerouted, removed or abandoned. Material removed from the project site should be disposed in accordance with all applicable

federal, state, and local regulations. Soil should not be stockpiled near or adjacent to the excavations.

In the building slab on grade and pavement areas, after the initial site preparation described above, we recommend compacting the exposed material. Any areas of significant deflection during compaction may be disked, dried, and re-compacted if weather permits, or removed and replaced with engineered fill. After compaction is completed, we recommend the subgrade area should be proof rolled with a minimum 20-ton tandem axle duel wheel dump truck. A geotechnical engineer or their designated representative should be present during the proof roll in order to identify soft or unstable areas, if any, and subsequently recommend remediation procedures.

Soft areas of subgrade that deflect more than 1-inch or show permanent deformation greater than 1-inch shall be remediated. Where subgrade remediation is needed in slab on grade and pavement areas, the type of remediation and the depth needed should be determined at the time of construction based on drainage, weather and soil conditions. The following options may be considered for subgrade soil correction.

Mechanical Stabilization: Areas of subgrade remediation could be reworked to correct the moisture content and recompacted in accordance with the project specification. If the underlying soil becomes soft and unstable due to presence of water and existing soil cannot be recompacted, localized soft areas may require bridging of the unstable weak soils to facilitate construction. Bridging can be accomplished with the use of thick layers of granular engineered fill. If open-graded aggregate layers are used for subgrade replacement, we recommend a geotextile fabric be placed to prevent migration of fine soil particles into the layer.

Geogrid: Removal and replacement or mechanical stabilization can include the placement of a geogrid material with an approved granular fill. Various options of geogrid strength and related thickness of granular fill are available, but the system selected should be designed by an experienced contractor or geogrid supplier based on the site soil conditions. By using a geogrid, the soil excavation and replacement depth can be reduced.

Removal and Replacement: Removal and replacement of the soft or unstable soils can be performed and replaced with similar suitable material that exists in the other areas of the subgrade or replaced with engineered fill. The new engineered fill shall be compacted in lifts consistent with the recommendations of this report and to a density of not less than 95 percent of the maximum dry density as determined by ASTM D1557.

Site grading should direct runoff away from the planned building slab on grade and pavement areas, and should be maintained throughout construction so that the potential for softening of the subgrade soils is reduced. Equipment and working traffic should also be kept to a minimum on subgrade surfaces, especially during times of precipitation or following spring thaw. The contractor is responsible for maintaining completed earthwork areas. Consideration should be given to installing construction roads or utilizing the existing pavement for construction traffic to reduce disturbance to the subgrade soils.

As a general rule for new fill placement, the fill materials shall be constructed in lifts as established in a control strip. However, the lift thickness should not be less than 6 inches nor more than 12 inches of compacted thickness. The material in each lift shall be within ±2% of optimum moisture content before rolling to obtain the prescribed compaction. Engineered fill placed in the pavement subgrade/base course should be compacted to a minimum of 95% of the modified Proctor dry

density value. Structural soil fill should be placed a minimum of five feet beyond the edges of new pavement, and an additional foot horizontally for each vertical foot of new fill to be placed to provide adequate lateral confinement. The inorganic site soils free of any construction debris that would be removed from excavations could be reused as structural fill; however, moisture conditioning of the material may be necessary.

The information presented in this report may be used to evaluate the site conditions for construction, but the contractor is responsible for determining site preparation means and methods required to complete the project. An aggressive construction schedule or construction during seasons with limited drying time may not allow for reconditioning of the subgrade and soil correction may require removal and replacement with imported granular fill or use of geogrid with granular fill.

4.2 FOUNDATION RECOMMENDATIONS

4.2.1 SHALLOW FOUNDATIONS

The proposed buildings can be supported on a typical shallow spread/strip footing system designed for a maximum net allowable soil bearing pressure of 2,000 pounds per square foot (psf) provided the recommendations in this report are followed. Spread foundations designed for a maximum net allowable soil bearing capacity of 2,000 psf should be supported by the native sand soils with a minimum N-value of 8 blows per foot or new engineered fill placed over recommended sand soil.

Table 4-1 provides the depths at each of the test boring locations to the soil recommended for an allowable bearing capacity of 2,000 psf. Our recommendations assume the bottom of foundation will be a minimum of 2 feet above the groundwater levels encountered in our borings. If the bottom of foundation elevations is designed deeper, the recommendations should be re-evaluated and additional soil correction and/or dewatering may be required.

Table 4-1: Recommended Excavation Depths

Boring Location	Existing Surface Ground Elevation (ft)	Estimated Depth to 2,000 psf Allowable Bearing Capacity (ft)	
		Depth (ft)	Elevation (ft)
B-4	858.1	0.5	857.6
B-5	857.9	2.3	855.6

Where unsuitable soils are encountered at the foundation elevation, soil correction should consist of additional excavation to remove the unsuitable soils. If the over-excavation is being filled with engineered fill, we recommend the over-excavation be widened at a minimum 1H:1V ratio from the edge of the foundation. The over-excavation can then be filled to grade with suitable engineered fill consisting of a well graded granular material placed in lifts not exceeding 12 inches and compacted to at least 95% of the maximum dry density as determined by the modified Proctor (ASTM D1557). Alternatively, lean concrete with a minimum compressive strength of 500 psi could be used to fill the over-excavation to grade and lateral over-excavation will not be required.

The depth of excavation required to expose suitable bearing material may vary in areas not explored by GESTRA; therefore, we recommend the foundation excavations be reviewed by a geotechnical engineer or their designated representative to determine when soil suitable to support the recommended bearing capacity is observed. As stated above, if the bottom of foundation elevations is designed within 2 feet of the water levels encountered, additional soil correction and/or dewatering may be required.

The shallow foundation design should incorporate a minimum strip footing width of 18 inches and column pad width of 24 inches, even if the allowable bearing capacity has not been fully utilized. All foundations should bear a minimum of 48 inches below grade for heated structures and 60 inches for unheated structures in order to protect the structure from frost heave. We recommend that foundations also be suitably reinforced in order to compensate for the effects of minor differential movements due to subsurface soil variations.

If the recommendations as stated in this report are used in the design and construction of the proposed buildings, it is our opinion that total settlements will be less than 1 inch.

4.2.2 MAT FOUNDATIONS

It is our understanding that the garage structure could be designed to be supported on a mat foundation with frost walls. Assuming that the loading on the mat foundation will be less than 500 psf and that the load will be evenly distributed throughout the slab, the native sand soil or new engineered fill place over the recommended native soil should be suitable to support the mat foundation. If the recommendations as stated in this report are used in the design and construction of the proposed mat foundation, it is estimated that total settlement will be less than 1 inch. The mat foundation should be designed for frost protection per acceptable methods of State of Wisconsin code SPS 362.1810.

4.3 FLOOR SLAB RECOMMENDATIONS

We recommend that a subgrade reaction modulus of 200 pounds per square inch per inch of deflection (pci) be used in the design of the floor slab at grade. The modulus value was assumed based on native sand/silty sand soil or new granular fill as the subgrade soil, assumes a 1-foot plate is used to determine the modulus, and should be adjusted for the size of the foundation and confinement effect. We recommend that the floor slabs be suitably reinforced and designed to be separate from the foundation system in order to allow for separate movements. It is recommended that the structural engineer specify the floor slab thickness, reinforcing, joint details and other parameters. At a minimum, the floor slabs are recommended to be reinforced or the concrete contain an appropriate fiber mesh additive to help control shrinkage cracking.

We recommend the installation of a capillary moisture break directly below the slab. A typical capillary moisture break may consist of at least 6 inches of sand or gravel with a maximum particle size of 1-1/2 inch, containing 15-55% passing the number 4 sieve and no more than 12% passing the number 200 sieve (fines) and should follow the recommendations of ACI 302.1R-15, Chapter 6. The structural engineer, architect, or manufacturer of a floor covering should determine the need of a vapor barrier, specify the vapor barrier location and consider the concrete curing and the effects of moisture on future flooring materials or building end use. If a vapor retarder is used, we recommend it be placed in accordance with ACI 302.1 Section 3.2 and should meet the requirements of ASTM E1745. The vapor retarder should include proper sealing at penetrations,

overlap at joints, and sealing at the interface of the wall and slab and may require an adequate cushion material to prevent damage.

4.4 SEISMIC SITE CLASSIFICATION

Section 1613 of the International Building Code 2015 (IBC) was used to assign a soil site classification. Based on the native soil conditions observed and assuming these are consistent or better to a depth of 100 feet, the soil site classification **D** (stiff soil) should be used in the structural design of the proposed buildings. Based on site class D, and mapped spectral response acceleration S_s and S_1 for Madison, Wisconsin, the site coefficient F_a and F_v are 1.6 and 2.4, respectively.

4.5 PAVEMENT DESIGN

SOIL PARAMETERS FOR PAVEMENT DESIGN

From an evaluation of the subsurface conditions, FAA AC No.: 150/5320-6F, and FAA AC No.: 150/5370-10H, we recommend that the specific pavement design values outlined below be used in establishing the appropriate pavement section(s) for the project.

The parameters in Table 4-2 assume soil subgrade preparation has been performed as identified in this report and are based on Unified Soil Classification System (USCS) classification of silty sand (SM). Table 4-2 provides the recommended soil parameters for the design of the pavement section.

Table 4-2: Estimated Average Soil Parameters

Design Parameters	
USCS Soils Classification	SM
Reduced Subgrade Strength for Flexible Pavement CBR value [a], (%)	4
Frost Group Index [b]	FG-3
Frost Penetration depth [c], (Inches)	60
Maximum Dry Density [d], (pcf)	142.0
Optimum Moisture Content [d], (%)	5.9
Poisson's Ratio [e]	0.35
Revised Modulus of Subgrade Reaction Based on Frost Group Index [a] (k) (pci)	25
Elastic Modulus of Subgrade for Flexible Pavement [g] (E), (psi)	6,000

a Based on FAA AC No.: 150/5320-6F, Chapter 3. Section 3.12.18.3, Table 3-5
b Based on FAA AC No.: 150/5320-6F, Chapter 2. Section 2.7.1, Table 2-2
c Based on Hammerpedia website, Wisconsin Frost Line (https://www.hammerpedia.com/wisconsin-frost-line/)
d Based on Proctor test ran on the auger cuttings collected from upper 5 feet of borings.
e Based on FAA AC No.: 150/5320-6F, Chapter 3. Section 3.12.11, Table 3-2
f Based on FAA AC No.: 150/5320-6F, Appendix A:Soil Characteristics Pertinent to Pavement Foundations
g Estimated using empirical formula per FAA AC No.: 150/5320-6F, Chapter 2. Section 2.5.3

FAA AC No: 150/5320-6F suggests subgrade stabilization may be necessary where the elastic modulus of subgrade is less than 7,500 psi (or CBR of 5%). The above elastic modulus of subgrade value is reduced due to seasonal frost (see discussion below). If subgrade stabilization is planned,

FAA AC No: 150/5320-6F, Section 2.6.1 recommends subgrade stabilization by chemical, mechanical methods or replacement with suitable subgrade material.

DISCUSSION OF SEASONAL FROST

The airport is located in a seasonal frost area. The design of an airport pavement should address the adverse effects of seasonal frost. Per FAA AC No: 150/5320-6F, Section 3.12.15 the design of pavement can be based on either of two approaches: Frost Protection or Reduced Subgrade Strength (RSS). The estimated soil parameters in Section 4.5 are presented to be used for RSS approach.

SUBSURFACE DRAINAGE

One of the important considerations in designing a high quality and durable pavement is providing adequate drainage. Drainage design for the proposed pavement section is out of GESTRA's scope for this project. Subsurface drainage is discussed in Appendix G of FAA AC No. 150/5320-5D Airport Drainage Design dated May 13, 2013. The effectiveness of subsurface drainage will be impacted by the site groundwater.

4.6 SOIL CORROSIVITY

GESTRA completed Miller Box resistivity and pH testing on samples collected from the upper 5 feet of borings B-4 and B-8. In addition, GESTRA subcontracted Testing Engineers International, Inc. to complete sulfate testing on a sample collected from B-8. Table 4-3 provides a summary of the test results, and detailed results are included in Appendix II.

Table 4-4: Summary of Laboratory Testing (Corrosivity)

Sample Number	Soil Type	Test	Test Method	Results
B-4, SS-2	Sand	Resistivity (Miller Box)	G187	19,763 Ω*cm
B-8, SS-2	Silty Sand, FILL			12,543 Ω*cm
B-8, SS-2	Silty Sand, FILL	pH	G51	8.6
B-8, SS-1	Silty Sand, FILL	Sulfate	C1580	< 0.1 percent by mass

Based on the results from the electrical resistivity testing and Table 2-3 in the FHWA NHI-09-087, the existing onsite soils are non-corrosive.

The sulfate content determined for the sample was compared to the values in Table 19.3.1.1 of ACI 318R. Based on this table, the soil samples test are categorized as "Exposure Class S0" and injurious sulfate attack is not a concern.

4.7 CONSTRUCTION CONSIDERATIONS

The detailed means and method of excavation and construction should be decided by the contractor and approved by the project design team. Based on the specific site information, geotechnical

exploration results and requirements for the proposed structure and pavement, the following issues should be taken in consideration during construction.

Dewatering

Based on the soil boring performed, substantial water is not anticipated to be encountered during shallow excavation. If water is encountered during shallow excavation, we anticipate the appropriate number of temporary sump pits and pumps should be sufficient to remove anticipated volume of water in the excavation. The contractor should be prepared to control groundwater and surface water and prevent it from accumulating in excavations or otherwise affecting construction. If excavations are planned that will extend near the water level encountered in our borings, a formal dewatering plan should be developed before the start of construction.

Excavation Stability

Caving is a common issue for excavation side walls during construction, especially if fill material, granular soils, and/or water seepage are observed. An excavation plan should be developed and the length of excavation left open should be limited to prevent caving soil from covering the suitable bearing soils.

A temporary soil retention system may also be necessary in order to prevent caving or provide support of surrounding structures or utilities during construction. Providing recommendations or designing the retention system is out of the scope for GESTRA. The contractor must comply with the federal, state, local and updated OSHA regulations during excavation and in retention system design to ensure excavation safety and a retention system should consider the site groundwater in the design.

Occupational Safety and Health Act (OSHA) has instituted strict standards for temporary construction excavations. These standards are outlined in 29 CFR Part 1926 Subpart P. Excavations within unstable soil conditions or extending five feet or more in depth should be adequately sloped or braced according to these standards. Excavation safety is the responsibility of the contractor. Material stockpiles or heavy equipment should not be placed near the edge of the excavation slopes. The actual stable slope angle should be determined during construction and will depend upon the loading, soil, and groundwater conditions encountered.

Weather Implications

The subgrade soil or the soil at foundation level might become unstable with exposure to adverse weather such as rain, snow and freezing temperatures. The unstable areas due to weather exposure may require an additional undercut or stabilization and the representative geotechnical engineer should assist with the determination of the depth of additional undercut or stabilization procedure based on observation of the field condition.

Soil Sensitivity

Soil at the construction site will be exposed to moisture and disturbance from construction traffic, construction equipment and human factors. Due to the disturbance, soil may become sensitive with contact of water. Contractor should try to lessen the exposure the soil at the construction site may encounter to moisture and disturbances. Therefore, the foundations, floor slabs and pavements should be constructed immediately after the review of the representative geotechnical engineer.

Existing Fill

The depth and type of existing fill material varied between our borings. Excavating, handling and disposing existing fill material may have special requirements. GESTRA has not evaluated the material or groundwater with respect to environmental considerations.

5.0 EXPLORATION AND TESTING PROCEDURES

5.1 LAYOUT AND ELEVATION PROCEDURES

A total of three (3) soil borings were completed at the locations shown on the attached Borehole Location Map in Appendix I. The location of the borings were selected by Hanson and located in the field by GESTRA.

Elevation of boreholes B-4 and B-5 were obtained by GESTRA using a Geomax Zenith 35 GNSS-INS receiver. Elevations shown on the boring logs are referenced to the Wisconsin Carrier Registration System (WisCRS) Dane County (NAVD88). Coordinates and elevation were not obtained by a licensed surveyor. Elevation and coordinates were not obtained for boring B-8, since the boring was performed for a separate project and elevations were not needed as the grade inside the building will not be changing.

5.2 FIELD TESTING PROCEDURES

The boreholes were drilled using a truck mounted drill rig. The boreholes were initiated and advanced by using hollow stem augers. Samples were typically collected at 2-1/2-foot intervals to a depth of 16 feet and then at 5-foot intervals. All representative soil samples were taken in general accordance with the "Standard Method for Penetration Test and Split-Barrel Sampling of Soils" (ASTM D1586). After each sampling, a soil sample was retained and placed in a jar and recorded for type, color, consistency, and moisture, sealed and then transported to the laboratory for further review and testing, if required. The specific drilling method used including the depth, rig type, and crew chief, are included on each of the individual boring logs as it may change for each borehole.

5.3 LABORATORY TESTING PROCEDURES

After completion of drilling operations, all of the retained soil samples were transported to GESTRA's laboratory and classified by a geotechnical engineer using the Unified Soil Classification System (USCS). A chart describing the classification system used is included in Appendix I. The engineer assigned laboratory testing suited to extract important index properties of the soil layers. These tests included hand penetrometer, moisture and organic content, Atterberg limit, grain size analysis, modified Proctor, CBR, pH, resistivity using Miller box and sulfate. The methods used are presented on the individual lab forms.

STANDARD OF CARE

Our exploration was limited to evaluating subsurface soil and groundwater conditions pertaining to the proposed project. GESTRA did not perform any environmental, chemical, or hydrogeologic testing as these were not part of our work scope.

This report should be made available in its entirety to bidding contractors for information purposes. The soil borings and site sketch should not be detached from this report. Our report is not valid if used for purposes other than what is described in the report.

All OSHA regulations such as those regarding proper sloping and temporary shoring of excavations should be followed during the entire construction process.

GESTRA has presented our professional opinions in this report in the form of recommendations. Our opinions are based on our understanding of current project information and related accepted engineering practices at the time of this report. Other than this, no warranty is implied or intended.

Sincerely,

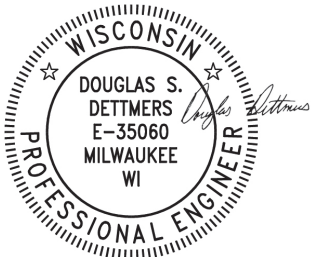
GESTRA Engineering, Inc.

Report Prepared By:

Digitally signed by Eric Jeske
Date: 2020.12.01 09:25:09 -06'00'

Eric Jeske, P.E.
Staff Engineer

Report Reviewed By:



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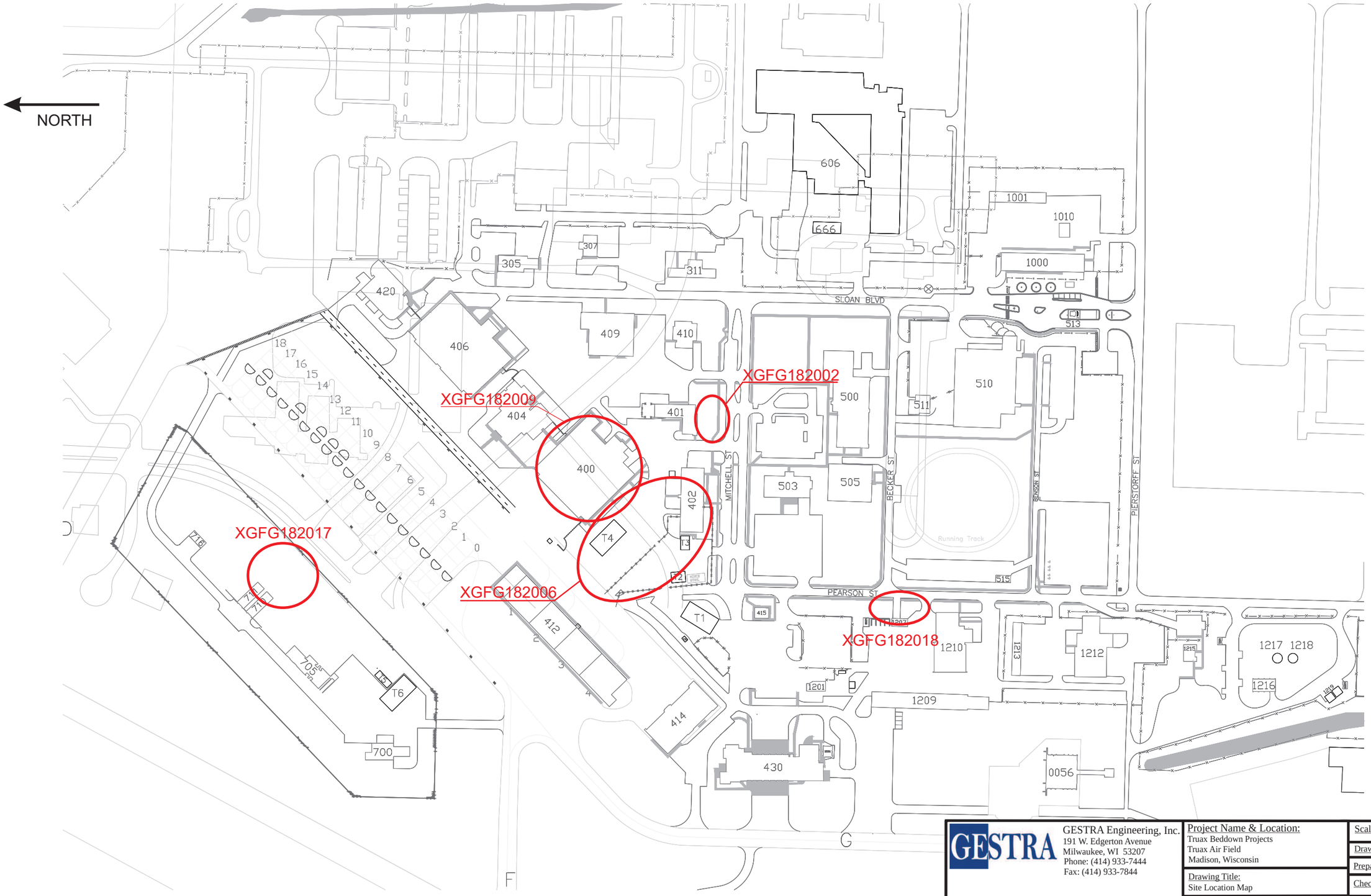
Date: 2020.12.01 09:26:14 -06'00'

Douglas Dettmers, P.E.
Senior Engineer

APPENDIX I

SITE LOCATION MAP, BOREHOLE LOCATION MAP, TEST BORING LOGS, GENERAL NOTES AND SOILS CLASSIFICATION



GESTRA

GESTRA Engineering, Inc.
191 W. Edgerton Avenue
Milwaukee, WI 53207
Phone: (414) 933-7444
Fax: (414) 933-7844

Project Name & Location:
Truax Beddown Projects
Truax Air Field
Madison, Wisconsin

Drawing Title:
Site Location Map

Project No.: M20064-10

Scale: Not to Scale

Drawing No.: 1 of 1

Prepared by: EJ

Checked by: DD

Date: October 23, 2020

Base map obtained from Dane County GIS website

= Approximate Borehole Location

GESTRA Engineering, Inc.
191 W. Edgerton Avenue
Milwaukee, WI 53207
Phone: (414) 933-7444
Fax: (414) 933-7844

Project Name & Location: Truax Beddown Projects XGFG182006 Madison, Wisconsin	Scale: 1" = 80'
	Drawing No.: 1 of 1
	Prepared by: EJ
Drawing Title: Borehole Location Map	Checked by: DD
Project No.: M20068-10	Date: October 23, 2020

SOIL BORING LOG

GESTRA Engineering Inc.
2223 Industrial Drive
Monona, WI 53713
Phone: 608-222-9406, Fax: 608-222-9408

PROJECT NAME	Truax Beddown Facility
DATE DRILLING STARTED	10/14/2020
PROJECT LOCATION	Madison, WI
DATE DRILLING ENDED	10/14/2020
PAGE NUMBER	1 of 1
BORING NUMBER	B-4
PROJECT NUMBER	M20068-10
DRILLING RIG	CME 75 (International)
BORING DRILLED BY	FIRM: Gestra CREW CHIEF: S. Gonyer
FIELD LOG	K. Turner
LAB LOG / QC	E. Jeske
NORTHING	503713
EASTING	834043
DRILLING METHOD	3¼" HSA
SURFACE ELEVATION	858.1 ft

Sample Number and Type	Sample Recovery (in)	Blow Counts	N - Value	Depth (ft)	Elevation	Soil Description and Geological Origin for Each Major Unit	USCS Classification	Graphic	Well Diagram	Unconfined Comp. Strength (Q_u or Q_p) (tsf)	Liquid Limit	Plasticity Index	Moisture Content (%)	Comments
						ASPHALT (3") 0.3 (857.8)								
						BASE COURSE (2.5") 0.5 (857.6)								
SS-2	13	5 6 6	12			SILTY SAND WITH GRAVEL, brown, moist, medium dense 3.8 (854.3)	SM							
SS-3	16	3 8 8	16	5	853.1	SAND, light gray, moist, medium dense, with gray clay seams 6.4 (851.7)	SP							
SS-4	14	2 3 4	7			SAND, light brown, wet, very loose to loose								
SS-5	11	1 1 3	4	10	848.1									
SS-6	15	2 2 2	4											
SS-7	13	4 4 5	9	15	843.1		SP							
SS-8	15	3 3 5	8	20	838.1	22.8 (835.3)								
						SAND, light brown, wet, medium dense								
SS-9	18	4 7 10	17	25	833.1	26 (832.1)	SP							
						End of Boring at 26.0 ft.								

WATER & CAVE-IN OBSERVATION DATA

WATER ENCOUNTERED DURING DRILLING (ft): 7 ft.		CAVE DEPTH AT COMPLETION (ft): NMR	WET ☐ DRY ☐
WATER LEVEL AT COMPLETION (ft): NMR		CAVE DEPTH AFTER 0 HOURS (ft): NMR	WET ☐ DRY ☐
WATER LEVEL AFTER 0 HOURS (ft): NMR		NE = Not Encountered; NMR = No Measurement Recorded	

NOTE: Stratification lines between soil types represent the approximate boundary; gradual transition between in-situ soil layers should be expected.

SOIL BORING LOG

GESTRA Engineering Inc.
2223 Industrial Drive
Monona, WI 53713
Phone: 608-222-9406, Fax: 608-222-9408

PROJECT NAME: Truax Beddown Facility	DATE DRILLING STARTED: 10/14/2020	PAGE NUMBER: 1 of 1	BORING NUMBER: B-5
PROJECT LOCATION: Madison, WI	DATE DRILLING ENDED: 10/14/2020	PROJECT NUMBER: M20068-10	DRILLING RIG: CME 75 (International)
BORING DRILLED BY: FIRM: Gestra, CREW CHIEF: S. Gonyer	FIELD LOG: K. Turner	NORTHING: 503870	DRILLING METHOD: 3¼" HSA
	LAB LOG / QC: E. Jeske	EASTING: 833976	SURFACE ELEVATION: 857.9 ft

Sample Number and Type	Sample Recovery (in)	Blow Counts	N - Value	Depth (ft)	Elevation	Soil Description and Geological Origin for Each Major Unit	USCS Classification	Graphic	Well Diagram	Unconfined Comp. Strength (Q_u or Q_p) (tsf)	Liquid Limit	Plasticity Index	Moisture Content (%)	Comments
						ASPHALT (3") 0.3 (857.6)								
SS-1	11	2 4 6	10			BASE COURSE (4") 0.6 (857.3)	OH						34	LOI = 9.2%
SS-2	12	3 5 6	11			ORGANIC SILT, black, moist 2.3 (855.6)								
						SAND, light gray, moist, medium dense, with dark clay seams 3.8 (854.1)	SP							
						SAND, gray, moist, loose, with bluish gray clay seams								
SS-3	9	2 3 5	8	5	852.9		SP							
						6.1 (851.8)								
						SAND, gray wet, very loose to loose								
SS-4	12	2 2 1	3				SP							
SS-5	13	4 5 3	8	10	847.9	11 (846.9)								
						End of Boring at 11.0 ft.								
				15	842.9									
				20	837.9									
				25	832.9									

WATER & CAVE-IN OBSERVATION DATA

WATER ENCOUNTERED DURING DRILLING (ft): 7 ft.	CAVE DEPTH AT COMPLETION (ft): NMR	WET ☐ DRY ☐
WATER LEVEL AT COMPLETION (ft): NMR	CAVE DEPTH AFTER 0 HOURS (ft): NMR	WET ☐ DRY ☐
WATER LEVEL AFTER 0 HOURS (ft): NMR	NE = Not Encountered; NMR = No Measurement Recorded	

NOTE: Stratification lines between soil types represent the approximate boundary; gradual transition between in-situ soil layers should be expected.

SOIL BORING LOG

GESTRA Engineering Inc.
2223 Industrial Drive
Monona, WI 53713
Phone: 608-222-9406, Fax: 608-222-9408

PAGE NUMBER	1 of 1
PROJECT NAME	Truax Beddown Facility
DATE DRILLING STARTED	10/14/2020
BORING NUMBER	B-8
PROJECT NUMBER	M20068-10
PROJECT LOCATION	Madison, WI
DATE DRILLING ENDED	10/14/2020
DRILLING RIG	CME 75 (International)
BORING DRILLED BY	FIRM: Gestra CREW CHIEF: S. Gonyer
FIELD LOG	K. Turner
LAB LOG / QC	E. Jeske
NORTHING	
EASTING	
DRILLING METHOD	3¼" HSA
SURFACE ELEVATION	ft

Sample Number and Type	Sample Recovery (in)	Blow Counts	N - Value	Depth (ft)	Elevation	Soil Description and Geological Origin for Each Major Unit	USCS Classification	Graphic	Well Diagram	Unconfined Comp. Strength (Q_u or Q_p) (tsf)	Liquid Limit	Plasticity Index	Moisture Content (%)	Comments
						CONCRETE (7.5") 0.6								
SS-1	6	4 12 13	25			SAND, brown, moist, trace gravel and clay seams, trace small concrete pieces, (FILL) 1.5								
SS-2	16	5 12 13	25			SILTY SAND WITH GRAVEL, brown, moist, (FILL) 4.8								
SS-3	12	2 3 5	8	5		LEAN CLAY WITH SAND, greenish gray, moist, stiff 7.4	CL			1.50			21	
SS-4	14	4 6 9	15		▽	SAND, brown, wet, medium dense	SP							
SS-5	15	3 4 6	10	10		Color change to gray at 9.5' 11								
						End of Boring at 11.0 ft.								
				15										
				20										
				25										

WATER & CAVE-IN OBSERVATION DATA

▽	WATER ENCOUNTERED DURING DRILLING (ft): 7.4 ft.		CAVE DEPTH AT COMPLETION (ft): NMR	WET ☐ DRY ☐
▼	WATER LEVEL AT COMPLETION (ft): NMR	■	CAVE DEPTH AFTER 0 HOURS (ft): NMR	WET ☐ DRY ☐
▼	WATER LEVEL AFTER 0 HOURS (ft): NMR		NE = Not Encountered; NMR = No Measurement Recorded	

NOTE: Stratification lines between soil types represent the approximate boundary; gradual transition between in-situ soil layers should be expected.

GENERAL NOTES

DRILLING AND SAMPLING SYMBOLS

SYMBOL	DEFINITION
HSA	Hollow Stem Auger
RWB	Rotary Wash Boring (Mud Drilling)
_FA	4", 6" or 10" Diameter Flight Auger
_HA	2", 4" or 6" Hand Auger
_DC	2 1/2" , 4" , 5" or 6" Steel Drive Casing
_RC	Size A, B, or N Rotary Casing
PD	Pipe Drill or Cleanout Tube
CS	Continuous Split Spoon Sampling
DM	Drill Mud
JW	Jetting Water
SS	2" O.D. Split Spoon Sample
_L	2 1/2" or 3 1/2" O.D. SB Liner Sample
ST	3" Thin Walled Tube Sample (Shelby Tube)
3TP	3" Thin Walled Tube (Pitcher Sampler)
_TO	2" or 3" Thin Walled Tube (Osterberg Sampler)
W	Wash Sample
B	Bag Sample
P	Test Pit Sample
_Q	BQ, NQ, or PQ Wireline System
_X	AX, BX, or NX Double Tube Barrel
CR	Core Recovery – Percent
NSR	No Sample Recovered, classification based on action of drilling, equipment and/or material noted in drilling fluid or on sampling bit.
NMR	No Measurement Recorded, primarily due to presence of drilling or coring fluid.
▽	Water Level Symbol

TEST SYMBOLS

SYMBOL	DEFINITION
MC	Moisture Content - % of Dry Wt. – ASTM D 2216
OC	Organic Content - % of Dry Wt. – ASTM D 2974
DD	Dry Density – Pounds Per Cubic Foot
LL, PL	Liquid and Plastic Limit – ASTM D 4318

Additional Insertions

Qu	Unconfined Comp. Strength-psf – ASTM D 2166
Qp	Penetrometer Reading – Tons/Square Foot
Ts	Torvane Reading – Tons/Square Foot
G	Specific Gravity – ASTM D 854
SL	Shrinkage Limits – ASTM D 427
OC	Organic Content – Combustion Method
SP	Swell Pressure - Tons/Square Foot
PS	Percent Swell
FS	Free Swell – Percent
pH	Hydrogen Ion Content. Meter Method
SC	Sulfate Content – Parts/ Million, same as mg/L
CC	Chloride Content - Parts/ Million, same as mg/L
C*	One Dimensional Consolidation – ASTM D 2453
Qc*	Triaxial Compression
D.S.*	Direct Shear – ASTM D 3080
K*	Coefficient of Permeability – cm/sec
D*	Dispersion test
DH*	Double Hydrometer – ASTM D 4221
MA*	Particle Size Analysis – ASTM D 422
R	Laboratory Receptivity, in ohm – cm – ASTM G 57
E*	Pressuremeter Deformation Modulus – TSF
PM*	Pressuremeter Test
VS*	Field Vane Shear – ASTM D 2573
IR*	Infiltrometer Test – ASTM D 3385
RQD	Rock Quality Designation – Percent

*See attached data sheet or graph

WATER LEVEL

Water levels shown on the boring logs are the levels measured in the borings at the time and under the conditions indicated. In sand, the indicated levels may be considered reliable ground water levels. In clay soil, it may not be possible to determine the ground water level within the normal time required for test borings, except where lenses or layers of more pervious waterbearing soil are present. Even then, an extended period of time may be necessary to reach equilibrium. Therefore, the position of the water level symbol for cohesive or mixed texture soils may not indicate the true level of the ground water table. Perched water refers to water above an impervious layer, thus impeded in reaching the water table. The available water level information is given at the bottom of the log sheet.

DESCRIPTIVE TERMINOLOGY

DENSITY TERM	"N" VALUE
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

CONSISTENCY TERM	Unconfined Compressive Strength, (tsf)	"N" VALUE
Very Soft	<0.25	0-2
Soft	0.25 - 0.49	2-4
Medium Stiff	0.5 - 0.99	4-8
Stiff	1.0 - 1.99	8-16
Very Stiff	2.0 - 3.99	16-30
Hard	4.0+	Over 30

Standard "N" Penetration: Blows per Foot of a 140 Pound Hammer Falling 30 inches on a 2 inch OD Split Barrel Sampler

Lamination	Up to 1/2" thick stratum
Layer	1/2" to 6" thick stratum
Lens	1/2" to 6" discontinuous stratum
Varved	Alternating laminations
Dry	Powdery, no noticeable water
Moist	Below saturation
Wet	Saturated, above liquid limit
Water bearing	Pervious soil below water

RELATIVE GRAVEL PROPORTIONS

CONDITION	TERM	RANGE
Coarse Grained Soils	trace of gravel	2-14%
	with gravel	15-49%
Fine Grained Soils		
15-29% + No. 200	trace of gravel	2-14%
15-29% + No. 200	with gravel	15-29%
30% + No. 200	trace of gravel	2-14%
30% + No. 200	with gravel	15-24%
30% + No. 200	gravelly	25-49%

RELATIVE SIZES

Boulder	Over 12"
Cobble	3" - 12"
Gravel	
Coarse	3/4" - 3"
Fine	#4 – 3/4"
Sand	
Coarse	#4 - #10
Medium	#10 - #40
Fine	#40- #200
Silt & Clay	- # 200, Based on Plasticity

SOILS CLASSIFICATION FOR ENGINEERING PURPOSES

ASTM Designation: D 2487 - 83

(Based on Unified Soil Classification System)

SOIL ENGINEERING

		Criteria for Assigning GroupSymbols and Group Names Using Laboratory Tests [A]		Soil Classification[B] Group Symble	Group Name
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less Less than 5% fines [C]	Cu≥ 4 and 1≤ Cc ≤3[E]	GW	Well graded gravel [F]
			Cu< 4 and/or 1> Cc >3[E]	GP	Poorly graded gravel [F]
		Gravels with Fines more than 12% fines [C]	Fines Classify as ML or MH	GM	Silty gravel [F.G.H.]
			Fines classify as CL or CH	GC	Clayey gravel [F.G.H.]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean sands Less than 5% fines [D]	Cu≥ 6 and 1≤ Cc ≤3[E]	SW	Well graded sand [I]
			Cu< 6 and/or 1> Cc >3[E]	SP	Poorly graded sand [I]
		Sands with Fines more than 12% fines [D]	Fines Classify as ML or MH	SM	Silty sand [G.H.I]
			Fines classify as CL or CH	SC	Clayey sand [G.H.I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid Limit less than 50	inorganic	PI >7 and plots on or above " A" line	CL	Lean clay [K.L.M]
			PI<4 or plots below " A " line	ML	Silt [K.L.M]
		organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OL	Organic clay [K.L.M.N] Organic Silt [K.L.M.O]
	Silts and Clays Liquid Limit 50 or more	inorganic	PI plots on or above " A " line	CH	Fat clay [K.L.M]
			PI plots below " A " line	MH	Elastic silt [K.L.M]
		Organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OH	Organic clay [K.L.M.P] Organic Silt [K.L.M.Q]
Highly organic Soils		Primarily organic matter, dark in color, and organic odor		PT	Peat
Fibric Peat > 67% Fibers		Hemic Peat 33 % - 67 % Fibers		sapric	Peat < 33% Fibers

[A] Based on the material passing the 3-in (75- mm)sieve

[B] If field sample contained cobbles or boulders, or both. add with cobbles or boulders, or both to group name

[C] Gravels with 5 to 12 % fines require dual symbols:
GW - GM well-graded gravel with silt
GW - GC well-graded gravel with clay
GP - GM poorly-graded gravel with Silt
GP - GC poorly-graded gravel with clay

[D] Sands with 5 to 12 % fines require dual symbols:
SW -SM well-graded sand with silt
SW - SC well-graded sand with clay
SP - SM poorly-graded sand with Silt
SP - SC poorly-graded sand with clay

[E] $Cu = \frac{D_{60}}{D_{10}}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name

[G] If fines classify as CL-ML, use dual symbol GC-GM. or SC-SM

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in hatched area, soil is a CL_ML silty clay
If soil contains 15 to 29% plus No. 200, add, "with sand" or " with gravel", whichever is predominent

[L] If soil contains ≥ 30% plus No.200, predominantly sand, add "sandy" to the group name

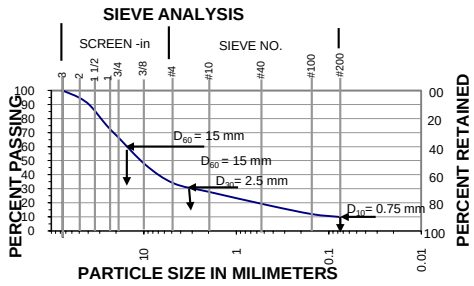
[M] If soil contains ≥ 30% plus No.200, predominantly gravel add "gravelly" to the group name

[N] PI ≥4 and plots on or above "A" Line

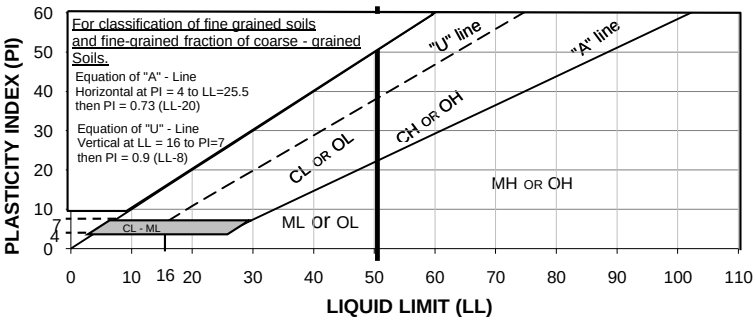
[O] PI < 4 or plots below "A" Line

[P] PI plots on or above "A" Line

[Q] PI plots below "A" Line



$Cu = \frac{D_{60}}{D_{10}} = \frac{15}{0.075} = 200$ $C_c = \frac{(D_{30})^2}{D_{60} X D_{10}} = \frac{(2.5)^2}{15X\ 0.075} = 5.6$



Geotechnical -Structural- Pavement - Construction Materials

APPENDIX II

LABORATORY TEST RESULTS

GESTRA Engineering
191 W. Edgerton Avenue
Milwaukee, WI 53207
Phone: (414) 933-7444
Fax: (414) 933-844

Laboratory Test Results of
CBR (California Bearing Ratio) of Laboratory-Compacted Soils

Project Name:	Truax Beddown Facility	Date:	Tuesday, October 27, 2020
Project Number:	M20068-10	Report To:	Hanson
Project Location:	Madison, WI		
ASTM Designation:	**D 1883**		

Sample Information

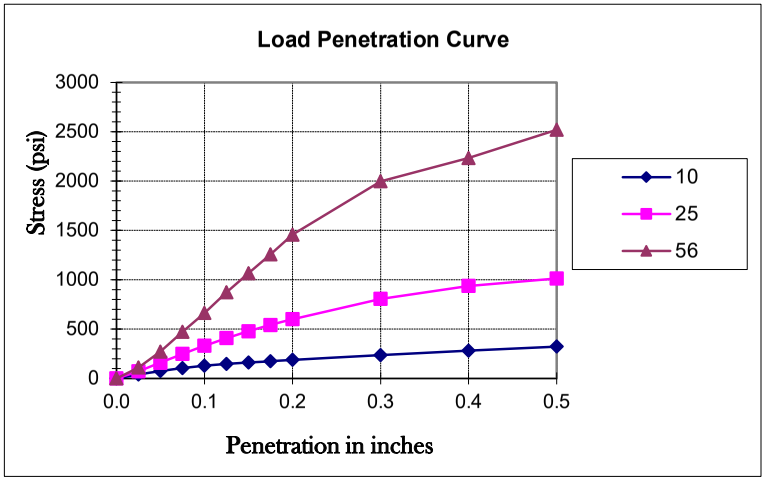
Boring number:	Combined B-4 and B-8
Description of Soil:	SILTY SAND WITH GRAVEL, brown
Strain Rate (in/min):	0.05
Method used for CBR sample preparation:	Modified
Condition of Sample:	Soaked
Surcharge Amount:	**40 lbs**
Desired percent compaction:	95%

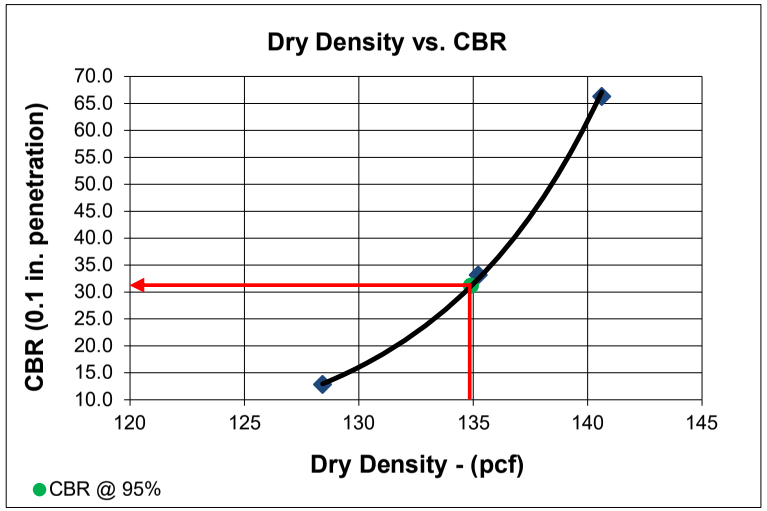
From Proctor Results

Optimum Moisture:	5.9%
Maximum Dry Density: (pcf)	142

Test Results

		Trial 1	Trial 2	Trial 3
	Number of blows / layer:	10	25	56
Moisture Content	Before Compaction	6.5	6.4	6.3
	Top 1" after soaking	10.1	9.3	7.5
	Average after soaking	9.2	8.8	7.6
	% swelling	**0.5**	**0.5**	**0.1**
Dry Density	Before soaking (pcf)	128	135	141
	After soaking (pcf)	129	135	141
	Percent Compaction	90.4%	95.2%	99.0%
CBR at 0.1 in. penetration		**12.84**	**33.14**	**66.28**
CBR at 0.2 in. penetration		**12.54**	**40.01**	**97.13**
	CBR @ 95 %:	**31**		





Performed by: T. Tran

Reviewed By: E. Jeske, PE
GESTRA Engineering, Inc.

GESTRA Engineering, Inc
2223 Industrial Drive
Monona, WI 53713
Phone: (608) 222-9406; Fax: (608) 222-9408

Laboratory Test Results of Proctor Sample

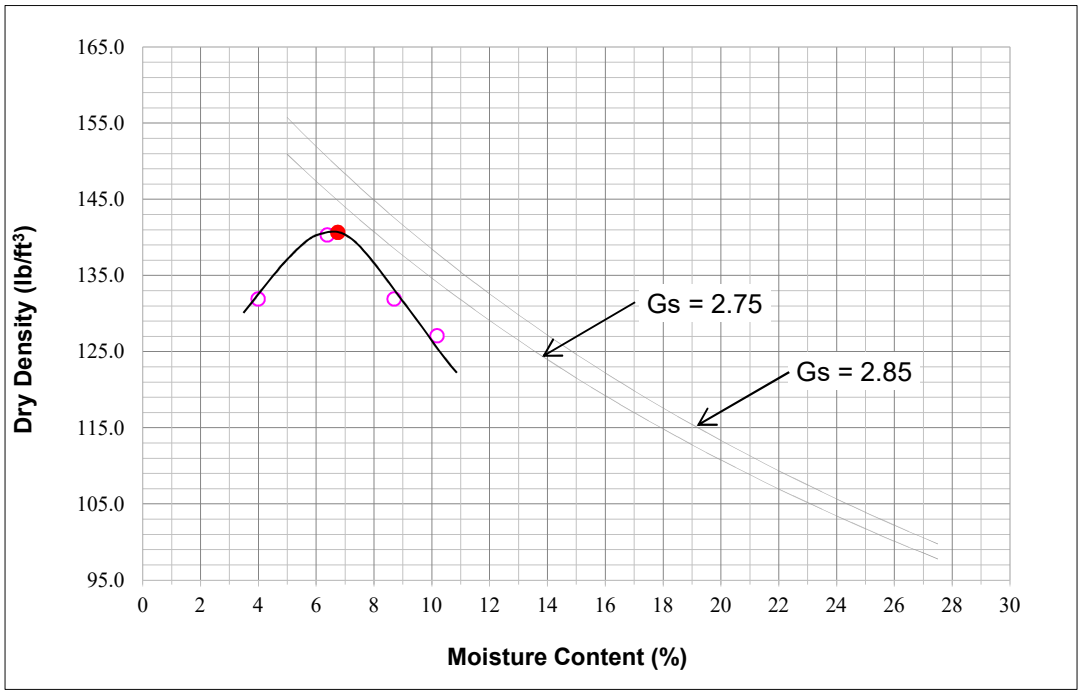
Project Name:	Truax Beddown Facility	Date:	October 24, 2020
Project Number:	M20068-10	Client:	Hanson
Projection Location:	Madison, WI		
ASTM Designation:	**D1557** Method: **B**	Rammer Type:	Manual

Sample Information

Type of Material	SILTY SAND WITH GRAVEL, brown
Sample Location	Combined B-4 and B-8
Sample Number	1
Sample Date	10/14/2020

OPTIMUM MOISTURE 6.8 **%**

UNCORRECTED			**CORRECTED**		
Maximum Density:	140.6	**lb/ft^3**	**Maximum Dry Density**	142.0	**lb/ft^3**
Oversize Gravel Content	14	**%**	**Original Gravel Content**	23	**%**
			Corrected Optimum Moisture	5.9	**%**



Notes: [1]The solid dot indicates uncorrected maximum density at test gravel content.
[2]Field density tests should be compared to the corrected maximum dry density, listed above, which uses insitu gravel content

Performed by: A.Hamberger

Reviewed By: T. Tran
GESTRA Engineering

GESTRA Engineering, Inc
2223 Industrial Drive
Monona, WI 53713
Phone: (608) 222-9406; Fax: (608) 222-9408

Laboratory Test Results of Atterberg Limits of Soil

Project Name:	Truax Beddown Facility	Date:	October 28, 2020
Project Number:	M20068-10	Client:	Hanson
Project Location:	Madison, WI		
ASTM Designation:	**D4318**		

Sample Information

Type of Sample	Bulk
Boring Number	Combined B-4 and B-8
Sample Number	1
Depth of Sample	Upper 5 feet

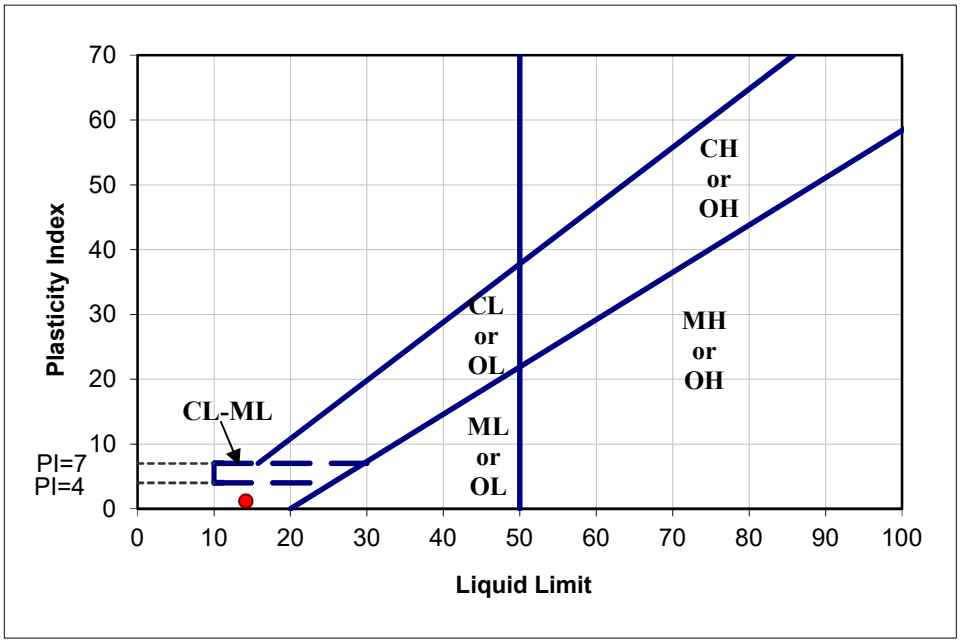
Determination of Liquid Limit

Cup Number	D24	D7	L12
Weight of Cup (g)	14.24	14.38	14.39
Weight of Wet Soil and Cup (g)	28.35	26.00	24.51
Weight of Dry Soil and Cup (g)	26.70	24.42	23.03
Moisture Content (%)	13.2	15.7	17.1
Blow Counts	28	20	15

Determination of Plastic Limit

Cup Number	L18	D8
Weight of Cup (g)	7.31	7.22
Weight of Wet Soil and Cup (g)	12.36	12.60
Weight of Dry Soil and Cup (g)	11.80	12.00
Moisture Content (%)	12.5	12.6

Compilation of Test Results



Liquid Limit	14
Plastic Limit	13
Plasticity Index	1
USCS Symbol	**ML**

Performed by: A. Hamberger

Reviewed By: E. Jeske, PE
GESTRA Engineering, Inc.

GESTRA Engineering, Inc
2223 Industrial Drive
Monona, WI 53713
Phone: (608) 222-9406, Fax (608) 222-9408

Laboratory Test Results of Mechanical Analysis of Soil or Aggregate

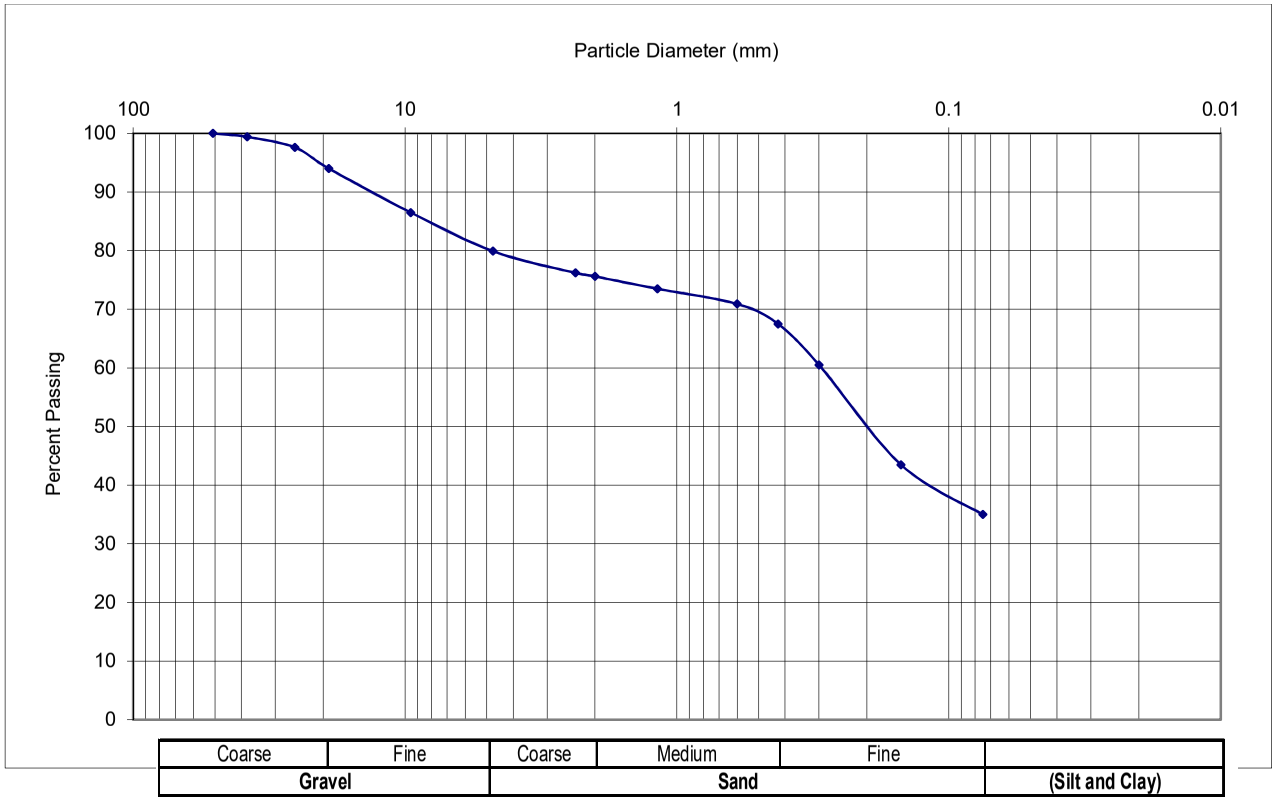
Project Name:	Truax Beddown Facility	Date:	October 29, 2020
Project Number:	M20068-10	Reported To:	Hanson
Project Location:	Madison, WI		
ASTM Designation:	**C136, D422**		

Sample Information

Type of Sample:	Bucket	Sample Number:	1
Boring Number:	Combined B-4 and B-8	Sample Depth:	Upper 5 feet

Mechanical Analysis Data

Sieve	Sieve Opening (mm)	Percent Passing (%)
2	50.8	100.0
1 1/2	38.1	99.4
1	25.4	97.6
3/4	19.05	94.0
3/8	9.525	86.5
#4	4.75	79.9
#8	2.36	76.2
#10	2	75.6
#16	1.18	73.5
#30	0.6	70.9
#40	0.425	67.5
#50	0.3	60.5
#100	0.15	43.5
#200	0.075	35.0



Remarks: Gravel 20.1 % Sand 44.9 %
Passing #200 Sieve (Silt & Clay) 35.0 %

Performed by: B. Bills

Reviewed by: E. Jeske, PE
GESTRA Engineering, Inc.

GESTRA Engineering, Inc
2223 Industrial Drive
Monona, WI 53713
Phone: (608) 222-9406; Fax: (608) 222-9408

Laboratory Test Results

Project Name:	Truax Beddown Facility	Date:	November 24, 2020
Project Number:	M20068-10	Report To:	Hanson
Project Location:	Madison, WI		

Laboratory Test Results of Resistivity of Soil (Miller Box)

ASTM Designation: G57

Boring Number	B-4	B-8
Sample Number	2	2
Moisture Content (%)		
Temperature of Sample (°F)	71.6	70.00
Temperature of Sample (°C)	22.00	21.11
Resistivty Value (Ω*cm)	17,000	11,000
Corrected Resistivty Value (Ω*cm)	19,763	12,543

Laboratory Test Results of pH of Soils

ASTM Designation: D4972-Method A "pH meter"

Boring Number	B-8
Sample Number	2
pH	8.6

Performed by: BJB

Reviewed By: E. Jeske, PE
GESTRA Engineering

PO Box 572455 / Salt Lake City UT 84157-2455 / USA
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GESTRA ENGINEERING INCORPORATED
191 WEST EDGERTON AVENUE
MILWAUKEE WI 53207-6020
USA

Analysis No.	TS-2009117
Report Date	03 November 2020
Date Sampled	26 October 2020
Date Received	30 October 2020
Where Sampled	Milwaukee, WI USA
Sampled By	Client

This is to attest that we have examined: Soil for Project Name: Truax Beddown Facility; Site Location: Madison, WI; Job Number: M20068-40

When examined to the applicable requirements of:

ASTM C 1580-15 "Standard Test Method for Water-Soluble Sulfate in Soil"

Results:

ASTM C 1580 - Sulfate (soluble)

Sample		Results		Detection Limit
		ppm (mg/kg)	%[1]	
B-8		942.	0.0942	10.
SS-1	Sand			

NOTE: [1]Percent by weight after drying.

END OF ANALYSIS

USEPA Laboratory ID UT00930

Merrill Gee P.E. – Engineer in Charge

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APPENDIX III

WEB SOIL SURVEY

Soil Map—Dane County, Wisconsin

Map Scale: 1:782 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 35 70 140 210

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Dane County, Wisconsin
Survey Area Data: Version 19, Jun 8, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 16, 2013—Aug 29, 2013

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Wa	Wacousta silty clay loam, 0 to 2 percent slopes	0.8	100.0%
Totals for Area of Interest		**0.8**	**100.0%**