ADDENDUM NO. 3 (Rev 8/2022)
ISSUE DATE: **February 29, 2024**

RE: **TROUT LAKE RESEARCH OUTBUILDING**
UNIVERSITY OF WISCONSIN - MADISON
BOULDER JUNCTION, WISCONSIN
UW-Madison Project No. **1119-2212 /** UWSA Project No. **A-22-009**

BID OPENING FOR MEP BIDDERS: **2:00 P.M., January 31, 2024.**
BID OPENING FOR GPC BIDDERS: **2:00 P.M., *March 14*, 2024.**

FROM: **Ayres**
3433 Oakwood Hill Parkway
Eau Claire, WI54701
715-834-3161

TO: Prospective Bidders

This addendum forms a part of the Contract Documents and modifies the original Contract Documents dated **January 2, 2024,** as noted below. Acknowledge receipt of this Addendum by inserting the number and issue date of this addendum in the blank space provided on the Bid Form. Failure to do so may subject the Bidder to disqualification.

This Addendum consists of **one (1) page** and the attached documents totalling 43 pages:

- **Table of Contents GPC Bidders, pages TC-1 REBID thru TC-4 REBID**
- **GPC Invitation to Bid, page A-1(REBID)**
- **Bid Form, pages C-1(REBID) thru C-3(REBID)**
- **Table of Contents MEP Bidders, pages TC-1 REBID thru TC-4 REBID**
- **MEP Invitation to Bid, page A-1(REBID)**
- **Table of Contents Technical Section, pages TC-1 REBID thru TC-3 REBID**
- **Section 02 32 00 Geotechnical Investigation, pages 02 32 00-1 thru 23**

CHANGES TO BIDDING REQUIREMENTS:

1. Table of Contents GPC Bidders – Replace in its entirety with Table of Contents GPC Bidders, TC-1 REBID thru TC-4 REBID, attached.
2. GPC Invitation to Bid – Replace page A-1 with page A-1(REBID), attached.
3. Bid Form GPC – Replace in its entirety with C-1(REBID) through C-3(REBID), attached.
4. Table of Contents MEP Bidders - Replace in its entirety with Table of Contents MEP Bidders, TC-1 REBID thru TC-4 REBID, attached.
5. MEP Invitation to Bid – Replace page A-1 with page A-1(REBID), attached.
6. Table of Contents Technical Sections – Replace in its entirety with Table of Contents Technical Sections, TC-1 REBID thru TC-3 REBID, attached.

CHANGES TO SPECIFICATIONS:

7. *Section 02 23 00 Geotechnical Investigation* – add this section in its entirety, attached.
8. Page 32 32 42-2, line 34 – Delete sentence: "See drawings for additional detailing and reference aesthetic images." Replce with: "*Owner is open to all retaining wall systems."*

END OF ADDENDUM

Ayres
3433 Oakwood Hills Parkway
Eau Claire, WI 54701

University of Wisconsin-Madison
UWSA-Capital Planning and Budget
Madison, Wisconsin 53715

TABLE OF CONTENTS GPC BIDDERS (Rev 11/2022)
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GPC INVITATION TO BID (Rev 11/2022)
THE BOARD OF REGENTS OF THE UNIVERSITY OF WISCONSIN SYSTEM

TROUT LAKE RESEARCH OUTBUILDING
UNIVERSITY OF WISCONSIN - MADISON
BOULDER JUNCTION, WISCONSIN

UW-Madison Project No. **1119-2212 /** UWSA Project No**. A-22-009**

BID OPENING for MEP BIDDERS: 2:00 P.M., January 31, 2024.
BID OPENING for GENERAL PRIME CONTRACTOR BIDDERS: 2:00 P.M., *March* 14, 2024.

OWNER: The Board of Regents of the University of Wisconsin System on behalf of the University of Wisconsin – **Madison,** hereinafter termed the Owner.

NOTICE: All potential bidders must be certified by DOA prior to submitting bids on UW-Managed construction projects. All bids received from contractors who are not certified will be rejected. Contractor certification applications and instructions for completing the form may be obtained from the DOA Website DFD Contractor Certification page: https://doa.wi.gov/Pages/DoingBusiness/ContractorCertification.aspx .

This project is being let using a single prime bidding and contracting process. the Owner will publicly bid the applicable mechanical, electrical, plumbing, and fire protection (MEP) divisions of work **first.** Within five (5) days of the MEP bid opening, the Owner will identify a lowest, qualified, responsible, certified bidder in each applicable MEP division of work. These successful MEP bids must be included in all general prime contractor bids received. The owner will enter into a single contract with the lowest, qualified, responsible, certified general prime contractor and this general prime contractor shall enter into subcontracts with the successful MEP bidders. If a project does not include any mechanical, electrical, plumbing, or fire protection divisions of work, the Owner will bid one bid package for all work to general prime contractors.

The University of Wisconsin System Administration (UWSA) will ONLY be accepting construction bidding documents as follows:

- **PDF scanned file of all required bid documents, including bid and bid bond forms with an either original wet signatures or digital electronic signatures emailed to UWSA Bid Submissions at uwsabidsubmissions@uwsa.edu.** If submitting documents with electronic signatures, further information and requirements are in the following bullets.
- Include Project Name, Project Number, Project Location, Category of Work being bid on, Bid Date, and the Name and Address of Bidder within email submission.
- For documents that require a seal, please darken these scans for better visibility.
- For bids including a cashier's/certified check, please scan front and back of check and include with submission.
- Bidders may submit PDFs of bonds and powers of attorney containing e-signatures, e-corporate seals, and e-notaries affixed to each document in accordance with the Surety's obligations. **Telephone numbers are required for all electronic signatories** for oral verification as needed. Wisconsin law permits the use of remote online notarization if it is performed **using technology providers that have been approved by the Department of Financial Institutions (DFI)**. If a remote online notarization is used, it is the responsibility of the contractor and its Surety to ensure that the technology provider has been approved by DFI.
- Bidders may submit bid forms containing electronic signatures, but those signatures must be obtained using approved software in order to be accepted. **DocuSign software and Adobe Digital Signature software are approved for e-signatures** for submission of bids. Use of any other e-signature software will require additional verification and the bidder must obtain approval at least three (3) business days prior to submission of bids. Please contact lwoznick@uwsa.edu first regarding any proposed electronic signature software.

BID FORM – GENERAL PRIME CONTRACTOR (GPC) (Rev 11/2022)
THE BOARD OF REGENTS OF THE UNIVERSITY OF WISCONSIN SYSTEM
s.16.855 Wis. Stats.

TROUT LAKE RESEARCH OUTBUILDING
UNIVERSITY OF WISCONSIN - MADISON
BOULDER JUNCTION, WISCONSIN

UW-Madison Project No. **1119-2212 /** UWSA Project No**. A-22-009**

General Prime Contractor (GPC) Bid Opening: 2:00 P.M., March 14, 2024.

To: University of Wisconsin System Administration (UWSA)

(a joint venture)
(a corporation)
(a partnership)
We_____ (an individual)
(Cross out inapplicable)

Of_____
Street City State Zip

hereby agree to execute a contract with the Board of Regents of the University of Wisconsin System (the Owner) and a subcontract with all successful MEP Bidders identified by the Owner and listed in this bid, and to furnish satisfactory separate 100% Performance Bond and 100% Payment Bond in the amount specified no later than ten (10) days of the contract offer, and to provide all labor and material required for the construction of the project designated above, for the prices hereinafter set forth, in strict accordance with the Contract Documents prepared by **Ayres, Rita Liddell, Architect, 3433 Oakwood Hills Parkway, Eau Claire, WI, 715-831-7598,** for the Owner and dated **January 2, 2024.**

Contact Instructions:
(For use by Owner to offer contract to the successful bidders)

Contact name:_____

Title:_____

Telephone Number:_____

Email address:_____

IMPORTANT: BEFORE SUBMITTING YOUR BID, PLEASE VERIFY THAT:

1. You have been **certified by DOA as a qualified and responsible bidder** for the amount of your bid within the division(s) of work being bid.
2. You have **entered all Bid amounts in numeric characters** (Example: $9,999);
3. You have **acknowledged receipt of all addenda;**
4. You have **signed the Bid Form**
5. You have **included a valid Bid Guarantee** for not less than 10% of the value of the bid as either:
   a) a Bid Bond signed by the contractor and surety and with a Power of Attorney attached, **or**
   b) a Cashier's Check or Bank Check pursuant to Wis stats. s. 779.14(1m)(c)2.b. and 779.14(1s). A Company or Personal Check will not be accepted.

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SINGLE BASE BID - GENERAL PRIME CONTRACTOR

ALL WORK

BASE BID NO 1. ALL WORK required to fully complete the project in accordance with the Contract Documents,

for the sum of ($_____)
Enter bid amount in numeric characters only *(Example: $9,999). See Instructions to Bidders 'Article 16 Submission of Base Bids' for detailed instructions.*

Base Bid No. 1 includes the bids from the following successful MEP Subcontractors identified by UWSA for the mechanical, electrical, plumbing, and fire protection divisions of work in this project. The General Prime Contractor shall enter into subcontracts with these MEP Subcontractors:

Fire Suppression Base Bid No. 2:
Identified Subcontractor: NA

Amount: NA

Plumbing Base Bid No. 3:
Identified Subcontractor: Howard Bros. Inc.

Amount: $27, 950.00

Heating Ventilating and Air Conditioning Base Bid No. 4:
Identified Subcontractor: Wisconsin Mechanical Solutions

Amount: $55,499.00

Electrical Base Bid No. 5:
Identified Subcontractor: Newton Electric Corp

Amount: $65,316.00

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COMMENCEMENT AND COMPLETION OF CONTRACT WORK

The undersigned agrees, if awarded the contract, to enter into a subcontract with the MEP Bidders identified by the Owner.

ADDENDUM RECEIPT

We acknowledge receipt of the following Addenda:

Addendum No._____Date_____

Addendum No._____Date_____

Addendum No._____Date_____

Addendum No._____Date_____

PRIOR TO SIGNING, BIDDERS' ATTENTION IS DIRECTED TO INSTRUCTIONS TO BIDDERS TO AVOID THE POSSIBILITY OF INVALIDATING THIS BID.

BY SIGNING THIS BID FORM, THE BIDDER ATTESTS TO PERSONAL KNOWLEDGE OF THE FOLLOWING:

1. Bidder is certified by DOA as a qualified and responsible bidder for the amount of the bid submitted, within the division(s) of work being bid.

2. In accordance with Wis. Stats. 16.855 (13) and (14) and ARTICLE 21 of these Bidding Documents, Bidder agrees to enter into a subcontract with the successful MEP Subcontractors identified by the Owner.

3. Bidder has examined the drawings and specifications, carefully prepared the bid form, and has reviewed all forms in detail before submitting bid; and bidder, or the agents, officers, or employees thereof, have not, either directly or indirectly, entered into any agreement, bid rigging, bid rotation, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with this bid.

4. That all work will be performed at the Bidder's own proper cost and expense, that the Bidder will furnish all necessary materials, labor, tools, machinery, apparatus, and other means of construction in the manner provided in the applicable specifications, and at the time stated in the contract.

_____
(Firm Name)

_____
(Bidder's Printed Name)

_____
(Bidder's Title)

(Seal, if bid is by a corporation)

Date: _____ By _____
(Signature of Bidder)

[ ] Place an "X" in the box if Bidder is certified as a minority business enterprise or disabled veteran-owned business by the Wisconsin Supplier Diversity Program and wishes to be considered for the 5% bidder preference.

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MEP INVITATION TO BID (Rev 11/2022)
THE BOARD OF REGENTS OF THE UNIVERSITY OF WISCONSIN SYSTEM

TROUT LAKE RESEARCH OUTBUILDING
UNIVERSITY OF WISCONSIN - MADISON
BOULDER JUNCTION, WISCONSIN

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VOLUME 2

***

SECTION 02 32 00
GEOTECHNICAL INVESTIGATION
BASED ON DFD MASTER SPECIFICATION DATED 11/21/13

PART 1 - GENERAL

SCOPE

This section provides information resulting from subsurface investigations completed at the site as part of this project. This section may contain information applicable to ALL sitework, and other technical specification sections, as well. All Contractors are expected to review this information as part of their duties to familiarize themselves with the site.

Results of the geotechnical investigation apply only to the locations at which data was collected, at the specific time it was collected. Geotechnical conditions may differ elsewhere on the site.

Prior to making additional investigations of his own using test pits, borings, or other methods; Bidder shall first gain permission from property owner and UW Project Manager. Geotechnical investigations completed by Bidder shall comply with all applicable requirements of Division 01 through Division 33 of this project.

RELATED WORK

Applicable provisions of Division 01 govern work under this Section.

PART 2 - MATERIALS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

Professional Service Industries, Inc.
12839 30th Avenue, Chippewa Falls, WI 54729
Phone: (715) 738-2770
Fax: (715) 738-2771

February 1, 2024

Ms. Rita Liddell
Ayres Associates Inc
3433 Oakwood Hills Parkway
Eau Claire, Wisconsin 54701

SUBJECT: Geotechnical Exploration and Evaluation
Proposed Trout Lake Station Outbuilding
Boulder Junction, Wisconsin
PSI Project No. 00952183

Dear Ms. Liddell,

The geotechnical exploration and evaluation for the referenced project has been completed. An electronic copy of the report is being provided via email. Paper copies can be issued upon request. After you have had the opportunity of reading the report, please call at any time with any questions or comments you may have. Professional Service Industries, Inc. (PSI) appreciates the opportunity to be of service on this project, and looks forward to continuing as your geotechnical consultant during the design and construction phases, as well as your upcoming projects.

Sincerely,

PROFESSIONAL SERVICE INDUSTRIES, INC.

Jeffrey A. Manninen
Branch Manager

James M. Becco, P.E.
Regional Vice President

GEOTECHNICAL EXPLORATION AND EVALUATION

Proposed Trout Lake Sation Outbuilding

Boulder Junction, Wisconsin

Prepared For:

Ayres Associates Inc

3433 Oakwood Hills Parkway

Eau Claire, Wisconsin 54701

PSI Project No. 00952183

February 1, 2024

TABLE OF CONTENTS

INTRODUCTION

General

This report presents the results of the geotechnical exploration and evaluation for the proposed outbuilding that will be located in the Town of Boulder Junction, Wisconsin. The work was performed for Ayres Associates Inc, at the request of Ms. Rita Liddell.

Purpose

The purpose of this study was to evaluate the subsurface conditions at specific boring locations on the site, and to establish parameters for use by the design engineers and architects in preparing the foundation, floor slab and retaining wall designs for the proposed project.

Scope

The scope of services included a site reconnaissance, the subsurface exploration, a determination of soil characteristics by field and laboratory testing, and an evaluation of the data obtained. The scope of the field exploration program, including the number, depth and locations of the borings, was determined by PSI and the client. Estimated soil parameters for use in retaining wall evaluation are provided herein. However, no evaluation or design of the walls have been performed by PSI.

Authorization

The description of services and authorization to perform this subsurface exploration were in the form of a signed acceptance copy of PSI Proposal No. 398451, dated April 27, 2023. The general conditions for the performance of the work were referenced in the proposal. This report has been prepared on behalf of and exclusively for the use of Ayres Associates Inc. The information contained in this report may not be relied upon by any other parties without the express written consent of PSI, and acceptance by such parties of PSI's General Conditions.

SITE AND PROJECT DESCRIPTION

Site Features

The subject site is located at the UW-Trout Lake Station, at 3110 Trout Lake Station Drive, in the Town of Boulder Junction, Wisconsin. At the time of exploration, the site was occupied by several buildings, and associated parking and drive areas. The proposed development area is located to the south of the existing buildings. It consisted of a gravel parking lot, and a former wooded area that had recently been clear cut.

The topography of the site may be considered rolling to hilly, and slopes down to the east, with an elevation difference of about 7 feet indicated on the topographic map provided by Ayres Associates Inc. Elevations at the borings ranged between about EL. 1632 and EL. 1636.5.

Aerial photography from various years between 1996 and 2021 was reviewed on Google Earth. A gravel parking lot and trees appear to have occupied the site throughout the series of photos; however, several of the photos were grainy and extremely difficult to discern detail.

Project Description

Based on the information provided by the client, it is understood that the proposed project will consist of the construction of an approximate 3,600 square foot single-story structure with a loft. No basement is planned. Structural loads were not known at the time of this evaluation. For the purpose of this report, it is estimated that maximum column and wall loads will not exceed 100 kips and 10 kips per lineal foot, respectively. When structural loads are determined, PSI must be informed in order to determine if revisions to this report are necessary.

A retaining wall, that will range from about 1 to 4 feet in height, will be constructed along the northern, eastern and southern sides of the building. It is understood that the retaining wall bottom elevations will range from about EL. 1631 to EL. 1634, with footings estimated to bear at about EL. 1630 to EL. 1633. No other design details regarding the retaining wall were provided.

The finished floor slab elevation is planned to be EL 1636.6. Based on the topographic map, the existing ground surface elevations within the planned building range from about EL. 1632 to EL. 1637. Therefore, cuts of less than 1 foot and fills of up to about 4.5 feet are estimated to be necessary to establish the finished floor slab elevation. However, this will also be dependent on the subgrade preparation criteria, to be discussed in a later section.

When additional information regarding the project becomes available, and/or if any of the information discussed herein differs from current plans or changes as design progresses, PSI must be informed so that any necessary revisions to this report can be made.

EXPLORATION AND LABORATORY PROCEDURES

Scope Summary

The field data utilized in the evaluation of the subsurface materials was obtained by drilling exploratory test borings, securing soil samples by the split-spoon sampling method, and subjecting the samples to laboratory testing.

Field Exploration

Three (3) soil test borings to a depth of 16.5 feet below ground surface were performed for this project. The borings were located in the field by the drill crew utilizing conventional taping procedures referenced to existing site features. They are estimated to be accurate to within several feet. The surface elevations shown on the logs were interpolated based on the 1-foot topographic map provided by the client. They are estimated to be accurate to within about 1

foot. The approximate locations of the borings performed are shown on the Boring Location Diagram (Figure 1), which is provided in the Appendix of this report.

The soil test borings were performed with an ATV-mounted drilling rig utilizing continuous flight hollow stem augers to advance the holes. Representative samples were obtained by the Standard Penetration Test (SPT) method in general accordance with ASTM D-1586. Samples were secured at 2.5-foot intervals to a depth of 10 feet, and then at 5-foot intervals to the end of the borings. The standard penetration value (N) is defined as the number of blows of a 140-pound hammer, falling thirty (30) inches, required to advance the split-spoon sampler one (1) foot into the soil. The sampler is lowered to the bottom of the drill hole and the number of blows recorded for each of the three (3) successive increments of six (6) inches penetration. The "N" value is obtained by adding the second and third incremental numbers. The SPT provides a means of estimating the relative density of granular soils and comparative consistency of cohesive soils, thereby providing a method of evaluating the subsoil's relative strength and compressibility characteristics of the subsoils.

The SPT samples were transferred into clean glass jars immediately after retrieval, and returned to the laboratory upon completion of the field operations. Samples will be discarded unless other instructions are received. The soil samples were visually classified in general accordance with the Unified Soil Classification System (ASTM D-2488-75). After completion of the borings, the auger holes were backfilled to the ground surface with bentonite chips.

A copy of the Soil Boring Logs and Boring Location Diagram (Figure 1) are enclosed in the Appendix. The soil stratification shown on the logs represents the approximate soil conditions in the actual boring locations at the time of the exploration. The terms and symbols used on the logs are described in the General Notes found in the Appendix.

Laboratory Physical Testing

Soil samples obtained from the exploration were visually classified in the laboratory, and subjected to testing, which included moisture content determination.

The laboratory testing was performed in general accordance with the respective ASTM methods, as applicable, and the results are shown on the boring logs in the Appendix.

DESCRIPTION OF SUBSURFACE CONDITIONS

General

A description of the subsurface conditions encountered at the test boring locations is shown on the Soil Boring Logs. The lines of demarcation shown on the logs represent an approximate boundary between the various soil classifications; however, some variation is expected. It must be recognized that the soil descriptions are considered representative estimates for the specific test hole location, but that variations may occur between and beyond the sampling intervals and boring locations. Soil depths, topsoil, base course and layer thicknesses, and demarcation lines can be utilized for preconstruction planning, but should not be expected to

yield exact and final quantities. A summary of the major soil profile components is described in the following paragraphs.

Soil Conditions

The surface of the site at borings B-1 and B-2 was covered with about 6 to 8 inches of base course fill. The surface of the site at B-3 was covered with about 6 inches of clay topsoil.

The base course fill at B-2 was underlain by natural sandy clay, with trace gravel content, to a depth of about 2 feet (EL. 1633.5) below ground surface. The underlying soils at B-2, and beneath the surface materials at B-1 and B-3, consisted of natural sand, with varying amounts of silt, clay, gravel and rock fragments, to at least the termination depth of the borings (16.5 feet). These soils may be considered loose to extremely dense with standard penetration resistances of 9 blows per foot to 50 blows per 3 inches of sampler penetration.

The foregoing discussion of soil conditions on this site represents a generalized soil profile as determined at the test boring locations. A more detailed description and supporting data for each test location can be found on the individual Soil Boring Logs.

Groundwater Observations

Groundwater observations were made during the drilling operations and in the open boreholes upon completion. Groundwater was not encountered during auger advancement or upon completion of drilling.

It must be recognized that groundwater levels fluctuate with time due to variations in seasonal precipitation, lateral drainage conditions, and soil permeability characteristics. Longer term monitoring would be required to further evaluate groundwater levels on this site.

EVALUATION AND RECOMMENDATIONS

General Development Considerations

In view of the subsurface conditions encountered in the test borings, together with the structural loading criteria and development grades anticipated, conventional spread footings, along with conventional slab-on-grade construction, can be used for support of the proposed structure. Some difficulty with digging and excavation stability may be experienced on this site.

The floor slab can be supported by the existing soils following proper subgrade preparation, which must include the removal of any soft, loose, unstable or unsuitable materials. A discussion of the foundation design parameters, as well as the support conditions for the floor slab, is included in the following sections.

Site Preparation and Grading

The presence of organic topsoil, vegetation and tree roots in the subgrade can adversely affect the serviceability of structural fills, foundations, floor slabs, pavements, and other structures placed upon them. Approximately 6 inches of topsoil was present on the surface of the site at B-3. However, some variation should be anticipated. All topsoil, vegetation, trees, roots and other organic matter must be stripped from the areas of footings, floor slabs, pavements, sidewalks, and other structures.

After removing the above-mentioned items, and prior to the placement of new fill which will be placed to raise grades, the exposed subgrade must be thoroughly proofrolled to detect unstable, yielding soils. This should consist of overlapping passes in a perpendicular grid pattern, with a fully-loaded tandem-axle dump truck, or other equipment of similar size and weight suitable for the surface conditions. Proofrolling should be performed in consultation with the geotechnical engineer at the time of construction. Some difficulty with subgrade preparation may be experienced, especially in wet or cold weather, or during thawing conditions. Additionally, instability can become more severe in silty and clayey materials, which are considered to be moderately to highly moisture sensitive. It is generally recommended that earthwork be carried out during relatively warm, dry weather. Any soft, wet, or otherwise unstable zones which cannot be improved by scarification and aeration, must be removed and replaced with compacted structural fill, such as clean crushed stone, possibly in conjunction with the use of a geotextile fabric. Construction delays and difficulty with subgrade stabilization may be experienced during periods of wet and/or cool weather.

Every effort must be made to keep excavations dry. If construction proceeds during wet weather, some additional over-excavation may be necessary. If weather permits, the soil could be dried and recompacted. A crushed stone working mat, possibly in conjunction with a geotextile fabric may also be feasible to help stabilize subgrades. Site grading runoff should be directed to catch basins, so that the potential for the softening of the foundation and pavement subgrade soils is reduced.

Where site grades are raised in excess of 2 feet, the first lift of new fill must be placed so as to extend a minimum lateral distance of 5 feet beyond the planned top building pad dimension (for fills less than 5 feet in thickness), or for a distance equal to at least 1 foot laterally beyond the top pad dimension for every foot of fill thickness (for fills greater than 5 feet in depth). Subsequent lifts can then be placed on an approximate 1H:1V slope back up to the planned top perimeter dimension of the pad. Similarly, where undercutting of unsuitable soils is performed beneath foundations, floor slabs, or other structural areas, it is recommended that the removal extend laterally beyond the perimeter of the structure at least 1 foot for every foot of removal below the planned bearing depth. Proper moisture control is essential to reduce the amount of compactive effort necessary to achieve the desired densities. In addition, proper placement and compaction of new fill to raise grades is essential for proper foundation support.

When a firm and stable subgrade is established, low areas may be raised to planned grades with properly compacted structural fill. Any new fill should be a clean granular soil, such as those materials meeting the gradations outlined in Section 209 or 305 of the State of

Wisconsin Standard Specification for Highway and Structure Construction. Fill must be placed in layers of not more than nine (9) inches in thickness, at moisture contents at or near optimum, and be compacted to a minimum density of 95 percent of the maximum dry density as determined by ASTM designation D-698 (Standard Proctor). The existing sand soils with low amounts of fines can generally be used for structural fill, subject to proper moisture control and adequate compaction. However, some sorting may be required. Silt, clay, and wet granular soils are not suitable for reuse as compacted fill in trenches, or adjacent to foundation stem walls or retaining walls.

It is recommended that well-graded granular soils be utilized as backfill in new utility trenches and along side below grade walls to reduce the potential for consolidation and settlement of the fill. All fill soils must be placed and compacted under engineering controlled conditions, to provide suitable support for overlaying structures and roadways. Additional guidance can be provided at the time of construction in the selection process for grade-raising fill and trench backfill.

The selection of fill materials for various applications should be done in consultation with the soils engineer. Similarly, the evaluation of the subgrade and placement and compaction of fill for structural applications should be monitored and tested by a qualified representative of the soils engineer.

Foundation Evaluation

The proposed structure may be supported by a conventional spread foundation system, bearing on suitable naturally occurring soils or within structural fill, prepared as discussed in a previous section. Based on a planned first floor slab elevation of EL. 1636.6, interior and exterior footings are expected to bear at about EL. 1635.1 and EL. 1632.6, respectively. It is understood that the retaining wall bottom elevations will range from about EL. 1631 to EL. 1634, with footings estimated to bear at about EL. 1630 to EL. 1633. Based on the borings, it is estimated that foundations will generally bear upon natural medium dense sand soils and new structural fill used to raise grades. Conventional spread footings bearing upon suitable natural soils, or compacted structural fill, may be designed to exert a net allowable soil pressure of 3,000 psf. Some undercutting of loose, lower strength, or unstable soils may be required, on at least an isolated basis.

The suitability of the existing soils for support of the proposed foundation must be determined by testing by a qualified geotechnical engineer during construction, utilizing static cone penetrometer tests or dynamic cone penetrometer tests for cohesive and granular soils, respectively. Soft, loose or otherwise unsuitable soils may be encountered in the foundation excavation at the bearing elevations. If encountered, these soils must be densified in-place, or be removed throughout a zone extending one foot laterally for each two feet removed below the foundation, on either side of the planned footing. The over-excavated area must be backfilled with structural compacted fill. As an alternate, the excavation could extend 4 inches beyond the plan footing width to suitable bearing soil and then backfilled with lean (500 to 1,000 psi) concrete mix to planned footing grade to reduce lateral over-excavation.

All perimeter footings or footings in unheated areas must be placed at a depth of at least 4 feet (or deeper if required by local code or in accordance with customary practice) below the finished exterior grade for frost protection. All footings must be protected from the effects of frost if construction is carried out during winter months. Interior footings not subject to frost action may be placed at a shallower depth of at least 18 inches below the floor slab, provided they bear on suitable natural soils or engineered fills.

It is recommended that the footings supporting individual columns have a minimum dimension of 24 inches, and continuous footings have a minimum width of 18 inches, even if the maximum recommended allowable bearing pressure is not fully utilized. In order to minimize the effects of any slight differential movement that may occur due to variations in the character of the supporting soils and any variations in seasonal moisture contents, it is recommended that all foundations be suitably reinforced to make them as rigid as needed.

In general, the performance of the foundation system on this site is dependent on the various factors discussed herein. The excavation, preparation, and concreting of foundations should be monitored and tested by a representative of the soils engineer.

Floor Slab Subgrade Recommendations

Prior to constructing the floor slabs, and prior to the placement of any fill used to raise grades, the exposed subgrade must be prepared utilizing the proofrolling procedures described previously. It is recommended that the proofrolling be monitored by a representative of the geotechnical engineer to verify that a firm, suitable subgrade is present prior to placement of new fills, or to construction of floor slabs. In areas that exhibit soft, yielding or unstable soil conditions, the following remedial measures are recommended to provide a stable subgrade.

Localized wet, soft or unstable areas can be undercut to such depths determined necessary in the field to reach stable material, and the area backfilled with imported crushed stone, such as the 1¼-inch gradation, which is then placed and compacted as recommended in the Site Preparation section of this report. If relatively thick zones or areas of extensive yielding are observed, and they cannot be stabilized by normal discing, aeration and recompaction procedures, undercutting and replacement with crushed stone and geotextile fabric (if needed) may also be required in these areas.

The floor slab may be designed utilizing an estimated modulus of subgrade reaction of 200 pci based on the presence of a suitable and stable sand subgrade. However, this is based on common range values obtained from 1 ft. x 1 ft. plate load tests on specific soil types. Depending on how the slab load is applied, the value may need to be modified for larger areas using the following:

Modulus of Subgrade Reaction $k_s = (\frac{k}{B})$ for cohesive soil

$k_s = k\,(\frac{B+1}{2B})^2$ for cohesionless soil

where: k_s = coefficient of vertical subgrade reaction for loaded area
k = coefficient of vertical subgrade reaction for a 1x1 foot square area
B = width of area loaded, in feet

The final design and detailing should be performed by a qualified structural engineer based on the intended slab use, loading conditions and anticipated subgrade conditions.

A granular mat, which can be designed as a drainage layer, should be provided below the floor slab. This must be a minimum of six (6) inches in thickness and properly compacted. In moisture sensitive areas, a vapor retarder may be placed beneath the floor slab or base course, however, it is recommended that the architect be consulted in this regard. The proper use of a vapor retarder may not completely prevent moisture beneath or on top of slabs. If the base course contains sharp particles, a cushion layer of sand approximately 2 inches in thickness may be required to provide protection from puncture.

The floor slabs must be suitably reinforced to make them as rigid as necessary and proper joints provided at the junction of slabs and the foundation system so that a small amount of independent movement can occur without causing damage. Large floor areas must be provided with joints at frequent intervals (maximum spacing of 30 times the slab thickness, per ACI) to compensate for concrete volume changes (shrinkage). Where the slabs will be supporting live loads, such as from moving vehicles of forklifts, joints must be keyed or dowelled to permit proper load transfer. It is recommended that appropriate construction methods and curing procedures be used to minimize shrinkage and curling of the floor slabs.

Exterior/Unheated Area Slabs

Entry slabs, sidewalks, aprons, and other slabs in exterior or unheated areas are estimated to bear upon generally sandy soils. Such materials are not considered to be highly frost susceptible. However, it must be noted that slabs placed directly upon more frost susceptible soils, such as those with high silt or clay content, are subject to heaving and subsequent settlement due to freeze/thaw cycles. This can result in cracking, misalignment, and other related effects (especially at joints). If more fine-grained soils are encountered in areas beyond the borings, or are used to raise grades, it is recommended that consideration be given to limited undercutting of frost susceptible materials, where encountered, to a depth of 1 to 2 feet below the slab, and replacement with well graded, properly placed and compacted granular soils. A properly designed underdrain system connected to the municipal sewer (if permissible) or directed to on-site stormwater management areas should also be incorporated to reduce the potential effects of freeze/thaw cycles.

Retaining Walls

It is recommended that retaining walls be backfilled for a lateral distance of 3 to 4 feet with a well-graded, free-draining granular material such as crushed stone or sand and gravel. Silt

and clay soils, wet granular materials, and organic soils are not suitable for use as backfill. Proper drainage systems are recommended to be incorporated into the wall designs to ensure a fully drained condition. The selection of backfill material should be made in consultation with the geotechnical engineer. The backfill materials should be placed in lifts not exceeding 12 inches in thickness, and be compacted to at least 95 percent of the maximum dry density as determined by ASTM designation D-698. The designs must include appropriate surcharge loads. Additionally, it is cautioned that the amount of movement required to activate full passive resistance can often be excessive. Therefore, the inclusion of passive resistance in design must be carefully considered by the structural engineer. The following design parameters (Rankine) are based on the walls being backfilled to planned finished grade with well graded, free draining granular compacted fill, extending at an angle of at least 26° from vertical, away from the toe of the wall. They are based upon level backfill, and are exclusive of any surface surcharge loads, which must be considered in the design. A sample of the material planned for use in backfilling must be provided to PSI prior to construction in order to verify the design values are appropriate for the specific material.

Angle of Internal Friction of Backfill	32°
Coefficient of At-Rest Earth Pressure Behind Wall (Ko)	0.47
Coefficient of Active Earth Pressure Behind Wall (Ka)	0.31
Coefficient of Passive Earth Pressure at Toe of Wall (Kp)	3.25
Unit Weight of Backfill (Estimated)	130 pcf
Resulting Equivalent Fluid Pressure	
At-Rest Condition - Drained Condition	60 psf/ft
Active Condition - Drained Condition	40 psf/ft

Utility Construction

In general, the on-site soils can be used for support of utility lines. However, some difficulty with the stability of utility trenches should be expected due to the presence of granular soils across the site, especially in the presence of water. The use of shoring, bracing, or trench boxes will be required. Utility construction should be performed in accordance with “The Standard Specifications for Sewer and Water Line Construction” for the State of Wisconsin.

It is recommended that well graded granular soils such as those specified in Tables 37 and 39 of the Standard Specification for Sewer and Water Construction be utilized as backfill in utility trenches to reduce the potential for consolidation and settlement of the backfill. All fill soils must be properly placed and compacted under engineering controlled conditions to provide suitable support for overlaying structures and roadways. Silty and clayey soils, organic soils, and wet materials, are not recommended for use as backfill within utility trenches due to the substantial difficulty of obtaining proper compaction in confined areas.

As with all excavation work, all open cut trenches must be properly shored and braced as required by applicable federal and state OSHA codes, and as necessary to protect life and property.

CONSTRUCTION CONSIDERATIONS

Groundwater Control

Because no groundwater was encountered in the borings, no major groundwater-related difficulties are anticipated during excavation and construction of the proposed foundation systems or typical shallow depth utilities. A gravity drainage system and a filtered sump pump, may be adequate to control low volumes of perched water if encountered during shallow excavations. However, for deeper excavations and/or rising groundwater levels; or for larger volume perched zones, prolonged dewatering with a series of sump pumps may be necessary to facilitate construction.

Since the foundation materials are subject to softening when exposed to free moisture, every effort should be made to keep excavations dry. Discharge water from roof drains should be directed away from the buildings, and the site graded to direct runoff to catch basins, so that the potential for the softening of the foundation subgrade soils is reduced.

While no groundwater was encountered at the time the borings were drilled, seasonal variations in precipitation and site drainage conditions can cause groundwater to be present in the upper soils at varying times of the year, including during construction.

Excavations and Site Drainage

Sloping, shoring or bracing of the excavation sidewalls will be necessary to facilitate construction and to protect life and property. The degree of excavation instability problems is dependent upon the depth and length of time that excavations remain open, excavation bank slopes, water levels and the effectiveness of any dewatering systems. Substantial sloughing and caving may occur within granular and soft clay soils, especially when encroaching on or extending below the groundwater or perched zones. All excavation work must be performed in accordance with OSHA and local building code requirements.

All excavations must be performed with caution and utilize methods which will prevent undermining or destabilization of slopes, buildings, utilities, pavements, sidewalks or other structures. The use of a properly designed shoring and bracing, sheet piling, or underpinning system must be utilized as necessary to adequately protect buildings, utilities, pavements, and other structures. This must be performed by an experienced specialty contractor. Additionally, extreme care must be used during the installation of any bracing system, especially those using driven or vibratory methods, in order to avoid damaging existing buildings, utilities, and other structures. Consideration should be given to the performance of video and/or photographic documentation of the condition of nearby buildings, utilities, and other structures prior to installation.

Since the subgrade soils are generally sensitive to moisture, every effort should be made to provide adequate drainage across the site during construction, and to prevent ponding of runoff on the subgrade. These soils are also subject to erosion caused by runoff, and erosion control measures should be implemented where needed or required by local ordinances. Some difficulty digging may be experienced with increasing depth in some areas due to the presence of extremely dense granular soils.

It is mandated that excavations, whether they be for utility trenches, basement excavations or footing excavations, be constructed in accordance with current Occupational Safety and Health Administration (OSHA) guidelines to protect workers and others during construction. PSI recommends that these regulations be strictly enforced; otherwise, workers could be in danger and the owner(s) and the contractor(s) could be liable for substantial penalties. The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. PSI is providing this information solely as a service to our client. PSI does not assume responsibility for construction site safety or the contractor's or other parties' compliance with local, state, and federal safety or other regulations.

Seismic Design Considerations

The soils encountered in the borings are considered to meet the criteria for Site Class D in accordance with 1613.2.5.2 of the International Building Code-2018 (which directs to the simplified design procedure outlined in ASCE 7 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures).

GENERAL COMMENTS

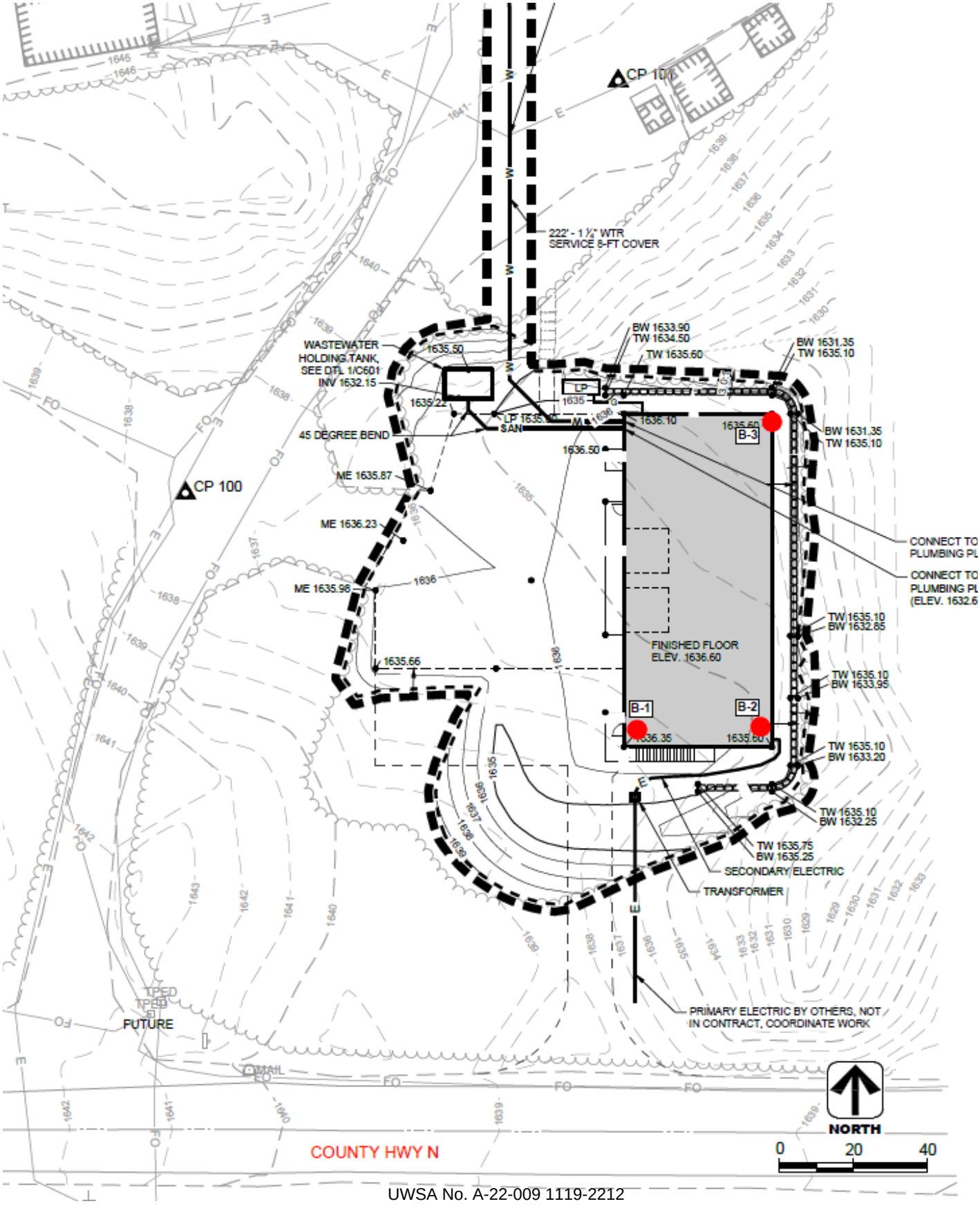
This geotechnical exploration and foundation evaluation has been prepared to aid in the evaluation of the foundation conditions on this site. The recommendations presented herein are based on the available soil information and the design information provided. Any changes in the design information or building locations should be brought to the attention of the soils engineer to determine if modifications in the recommendations are required. The final design plans and specifications should also be reviewed by the soils engineer to determine that the recommendations presented herein have been interpreted and implemented as intended.

This geotechnical study has been conducted in a manner consistent with that level of care ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. The findings, recommendations and opinions contained herein have been promulgated in accordance with generally accepted practice in the fields of foundation engineering, soils mechanics, and engineering geology. No other representations, expressed or implied, and no warranty or guarantee is included or intended in this report.

It is recommended that the earthwork and foundation operations be monitored by the soils engineer, to test and evaluate the bearing capacities, and the selection, placement and compaction of controlled fills.

APPENDIX

Appendix (in order of appearance)
Figure 1 – Boring Location Diagram
Soil Boring Logs
General Notes



UWSA No. A-22-009 1119-2212
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intertek psi	**Proposed Trout Lake Station Outbuilding** **Boulder Junction, Wisconsin**	**DATE: February 1, 2024**
		PROJECT NO: 00952183
	FIGURE 1 - BORING LOCATION DIAGRAM	**PAGE 1 OF 1**

SOIL BORING LOG: B - 1

Project: Proposed Trout Lake Station Outbuilding **Project No.:** 00952183

Location: Boulder Junction, Wisconsin **Drill Date:** January 5, 2024

DEPTH/EL. (feet)	VISUAL SOIL CLASSIFICATION GROUND SURFACE ELEVATION: 1636.5	SAMPLE NO.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	REMARKS
1 / 1635.5	0 - 6" Brown silty SAND, with gravel, trace clay, moist (BASE COURSE FILL) Brown silty SAND, trace to with gravel, trace clay, very moist	1-AU	--			12	
2 / 1634.5							
3 / 1633.5	Reddish tannish brown SAND, with silt and gravel, moist	2-SS	21			6	
4 / 1632.5							
5 / 1631.5							
6 / 1630.5	Brown SAND, with silt, clay, gravel and rock fragments, moist	3-SS	70/8"			7	
7 / 1629.5							
8 / 1628.5	Tannish brown SAND, with gravel and rock fragments, trace silt, moist	4-SS	53			5	
9 / 1627.5							
10 / 1626.5							⊥
11 / 1625.5		5-SS	20			6	
12 / 1624.5							
13 / 1623.5							
14 / 1622.5							
15 / 1621.5							
16 / 1620.5	Tannish brown SAND, with silt and gravel, trace clay, moist	6-SS	31			6	
17 / 1619.5	**END OF BORING @ 16.5± FEET**						
18 / 1618.5							
19 / 1617.5							
20 / 1616.5							

FIELD OBSERVATIONS:

Water Level $_{\text{during drilling}}$: Not Encountered ▼

Water Level $_{\text{upon completion}}$: Not Present ⌄

Caved at $_{\text{upon completion}}$: 10± feet below ground surface (EL 1626.5±) ⊥

Water Level $_{\text{delayed}}$: N/A

Caved at $_{\text{delayed}}$: N/A

ADDITIONAL COMMENTS:

Note: Lines of stratification represent an **approximate** boundary between soil types. Variations may occur between sampling intervals and/or boring locations. Transitions may also be gradual.

SOIL BORING LOG: B - 2

Project: Proposed Trout Lake Station Outbuilding **Project No.:** 00952183

Location: Boulder Junction, Wisconsin **Drill Date:** January 5, 2024

DEPTH/EL. (feet)	VISUAL SOIL CLASSIFICATION GROUND SURFACE ELEVATION: 1635.5	SAMPLE NO.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	REMARKS
1 / 1634.5	0 - 8" Brown clayey SAND, trace gravel, moist to very moist (BASE COURSE FILL)						
	Brown sandy lean CLAY, trace gravel, moist	1-AU	--			21	
2 / 1633.5							
3 / 1632.5		2-SS	14			5	
4 / 1631.5							
5 / 1630.5	Reddish tannish brown SAND, with silt, rock fragments and gravel, moist						
6 / 1629.5		3-SS	29			5	
7 / 1628.5							
8 / 1627.5		4-SS	24			4	
9 / 1626.5							
10 / 1625.5							
11 / 1624.5		5-SS	12			4	⊥
12 / 1623.5	Tan SAND, with to trace rock fragments, trace silt, damp to moist						
13 / 1622.5							
14 / 1621.5							
15 / 1620.5							
16 / 1619.5		6-SS	16			5	
17 / 1618.5	**END OF BORING @ 16.5± FEET**						
18 / 1617.5							
19 / 1616.5							
20 / 1615.5							

FIELD OBSERVATIONS:

Water Level $_{\text{during drilling}}$: Not Encountered ▼

Water Level $_{\text{upon completion}}$: Not Present ⌄

Caved at $_{\text{upon completion}}$: 11± feet below ground surface (EL 1624.5±) ⊥

Water Level $_{\text{delayed}}$: N/A

Caved at $_{\text{delayed}}$: N/A

ADDITIONAL COMMENTS:

Note: Lines of stratification represent an **approximate** boundary between soil types. Variations may occur between sampling intervals and/or boring locations. Transitions may also be gradual.

SOIL BORING LOG: B - 3

Project: Proposed Trout Lake Station Outbuilding **Project No.:** 00952183

Location: Boulder Junction, Wisconsin **Drill Date:** January 5, 2024

DEPTH/EL. (feet)	VISUAL SOIL CLASSIFICATION GROUND SURFACE ELEVATION: 1632.0	SAMPLE NO.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	REMARKS
1 / 1631.0	0 - 6" Brown sandy lean CLAY, with to trace gravel, trace root hairs, moist (TOPSOIL)						
	Brown clayey SAND, with gravel, trace silt, moist	1-AU	--			15	
2 / 1630.0							
3 / 1629.0		2-SS	9			5	
4 / 1628.0	Reddish tannish brown SAND, with silt, rock fragmetns and gravel, moist						
5 / 1627.0							
6 / 1626.0		3-SS	18			8	
7 / 1625.0							
8 / 1624.0		4-SS	50/3"			6	
9 / 1623.0							⊥
10 / 1622.0	Brown SAND, with silt, clay, gravel and rock fragments, moist						
11 / 1621.0		5-SS	26			6	
12 / 1620.0							
13 / 1619.0							
14 / 1618.0							
15 / 1617.0							
16 / 1616.0	Tannish brown SAND, trace silt, moist	6-SS	11			8	
17 / 1615.0	**END OF BORING @ 16.5± FEET**						
18 / 1614.0							
19 / 1613.0							
20 / 1612.0							

FIELD OBSERVATIONS:

Water Level $_{\text{during drilling}}$: Not Encountered ▼

Water Level $_{\text{upon completion}}$: Not Present ∨

Caved at $_{\text{upon completion}}$: 9± feet below ground surface (EL 1623±) ⊥

Water Level $_{\text{delayed}}$: N/A

Caved at $_{\text{delayed}}$: N/A

ADDITIONAL COMMENTS:

Note: Lines of stratification represent an **approximate** boundary between soil types. Variations may occur between sampling intervals and/or boring locations. Transitions may also be gradual.

GENERAL NOTES

SAMPLE IDENTIFICATION

The Unified Soil Classification System (USCS), AASHTO 1988 and ASTM designations D2487 and D-2488 are used to identify the encountered materials unless otherwise noted. Coarse-grained soils are defined as having more than 50% of their dry weight retained on a #200 sieve (0.075mm); they are described as: boulders, cobbles, gravel or sand. Fine-grained soils have less than 50% of their dry weight retained on a #200 sieve; they are defined as silts or clay depending on their Atterberg Limit attributes. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size.

DRILLING AND SAMPLING SYMBOLS

SFA: Solid Flight Auger - typically 4" diameter flights, except where noted.
HSA: Hollow Stem Auger - typically 3¼" or 4¼ I.D. openings, except where noted.
M.R.: Mud Rotary - Uses a rotary head with Bentonite or Polymer Slurry
R.C.: Diamond Bit Core Sampler
H.A.: Hand Auger
P.A.: Power Auger - Handheld motorized auger

SS: Split-Spoon - 1 3/8" I.D., 2" O.D., except where noted.
ST: Shelby Tube - 3" O.D., except where noted.
RC: Rock Core
TC: Texas Cone
BS: Bulk Sample
PM: Pressuremeter
CPT-U: Cone Penetrometer Testing with Pore-Pressure Readings

SOIL PROPERTY SYMBOLS

N: Standard "N" penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2-inch O.D. Split-Spoon.
N_{60}: A "N" penetration value corrected to an equivalent 60% hammer energy transfer efficiency (ETR)
Q_u: Unconfined compressive strength, TSF
Q_p: Pocket penetrometer value, unconfined compressive strength, TSF
w%: Moisture/water content, %
LL: Liquid Limit, %
PL: Plastic Limit, %
PI: Plasticity Index = (LL-PL),%
DD: Dry unit weight, pcf
▼,▽,⧩ Apparent groundwater level at time noted

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Relative Density	N - Blows/foot
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	50 - 80
Extremely Dense	80+

ANGULARITY OF COARSE-GRAINED PARTICLES

Description	Criteria
Angular:	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular:	Particles are similar to angular description, but have rounded edges
Subrounded:	Particles have nearly plane sides, but have well-rounded corners and edges
Rounded:	Particles have smoothly curved sides and no edges

GRAIN-SIZE TERMINOLOGY

Component	Size Range
Boulders:	Over 300 mm (>12 in.)
Cobbles:	75 mm to 300 mm (3 in. to 12 in.)
Coarse-Grained Gravel:	19 mm to 75 mm (¾ in. to 3 in.)
Fine-Grained Gravel:	4.75 mm to 19 mm (No.4 to ¾ in.)
Coarse-Grained Sand:	2 mm to 4.75 mm (No.10 to No.4)
Medium-Grained Sand:	0.42 mm to 2 mm (No.40 to No.10)
Fine-Grained Sand:	0.075 mm to 0.42 mm (No. 200 to No.40)
Silt:	0.005 mm to 0.075 mm
Clay:	<0.005 mm

PARTICLE SHAPE

Description	Criteria
Flat:	Particles with width/thickness ratio > 3
Elongated:	Particles with length/width ratio > 3
Flat & Elongated:	Particles meet criteria for both flat and elongated

RELATIVE PROPORTIONS OF FINES

Descriptive Term	% Dry Weight
Trace:	< 5%
With:	5% to 12%
Modifier:	>12%

GENERAL NOTES

(Continued)

CONSISTENCY OF FINE-GRAINED SOILS

Q_U - TSF	N - Blows/foot	Consistency
0 - 0.25	0 - 2	Very Soft
0.25 - 0.50	2 - 4	Soft
0.50 - 1.00	4 - 8	Firm (Medium Stiff)
1.00 - 2.00	8 - 15	Stiff
2.00 - 4.00	15 - 30	Very Stiff
4.00 - 8.00	30 - 50	Hard
8.00+	50+	Very Hard

MOISTURE CONDITION DESCRIPTION

Description	Criteria
Dry:	Absence of moisture, dusty, dry to the touch
Moist:	Damp but no visible water
Wet:	Visible free water, usually soil is below water table

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term	% Dry Weight
Trace:	< 15%
With:	15% to 30%
Modifier:	>30%

STRUCTURE DESCRIPTION

Description	Criteria
Stratified:	Alternating layers of varying material or color with layers at least ¼-inch (6 mm) thick
Laminated:	Alternating layers of varying material or color with layers less than ¼-inch (6 mm) thick
Fissured:	Breaks along definite planes of fracture with little resistance to fracturing
Slickensided:	Fracture planes appear polished or glossy, sometimes striated
Blocky:	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensed:	Inclusion of small pockets of different soils
Layer:	Inclusion greater than 3 inches thick (75 mm)
Seam:	Inclusion 1/8-inch to 3 inches (3 to 75 mm) thick extending through the sample
Parting:	Inclusion less than 1/8-inch (3 mm) thick

SCALE OF RELATIVE ROCK HARDNESS

Q_U - TSF	Consistency
2.5 - 10	Extremely Soft
10 - 50	Very Soft
50 - 250	Soft
250 - 525	Medium Hard
525 - 1,050	Moderately Hard
1,050 - 2,600	Hard
>2,600	Very Hard

ROCK BEDDING THICKNESSES

Description	Criteria
Very Thick Bedded	Greater than 3-foot (>1.0 m)
Thick Bedded	1-foot to 3-foot (0.3 m to 1.0 m)
Medium Bedded	4-inch to 1-foot (0.1 m to 0.3 m)
Thin Bedded	1¼-inch to 4-inch (30 mm to 100 mm)
Very Thin Bedded	½-inch to 1¼-inch (10 mm to 30 mm)
Thickly Laminated	1/8-inch to ½-inch (3 mm to 10 mm)
Thinly Laminated	1/8-inch or less "paper thin" (<3 mm)

ROCK VOIDS

Voids	Void Diameter
Pit	<6 mm (<0.25 in)
Vug	6 mm to 50 mm (0.25 in to 2 in)
Cavity	50 mm to 600 mm (2 in to 24 in)
Cave	>600 mm (>24 in)

GRAIN-SIZED TERMINOLOGY

(Typically Sedimentary Rock)

Component	Size Range
Very Coarse Grained	>4.76 mm
Coarse Grained	2.0 mm - 4.76 mm
Medium Grained	0.42 mm - 2.0 mm
Fine Grained	0.075 mm - 0.42 mm
Very Fine Grained	<0.075 mm

ROCK QUALITY DESCRIPTION

Rock Mass Description	RQD Value
Excellent	90 -100
Good	75 - 90
Fair	50 - 75
Poor	25 -50
Very Poor	Less than 25

DEGREE OF WEATHERING

Slightly Weathered: Rock generally fresh, joints stained and discoloration extends into rock up to 25 mm (1 in), open joints may contain clay, core rings under hammer impact.

Weathered: Rock mass is decomposed 50% or less, significant portions of the rock show discoloration and weathering effects, cores cannot be broken by hand or scraped by knife.

Highly Weathered: Rock mass is more than 50% decomposed, complete discoloration of rock fabric, core may be extremely broken and gives clunk sound when struck by hammer, may be shaved with a knife.