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July 6, 2009

Mr. Willard Moeri
Hazel Mackin Community Library
107 East Maple Street
Roberts, Wisconsin 54023

**SUBJECT: Subsurface Exploration and Foundation Evaluation
Proposed Hazel Mackin Community Library
Roberts, Wisconsin
MES Project No. 4-93049**

Dear Mr. Moeri,

The subsurface exploration and foundation evaluation for the above referenced project has been completed. One (1) copy of the report is included herein, and two (2) copies have been forwarded to Ms. Cori Prokopowicz of Building With Architects.

After you have had the opportunity of reading the report, please call at any time with any questions or comments you may have. Midwest Engineering Services, Inc. (MES) 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,

MIDWEST ENGINEERING SERVICES, INC.

Ryan M. Levenson
Project Manager

Jeffrey A. Manninen
Branch Manager

James M. Becco, P.E.
Region Manager

SUBSURFACE EXPLORATION AND FOUNDATION EVALUATION

Proposed Hazel Mackin Community Library

Roberts, Wisconsin

Prepared For:

Hazel Mackin Community Library

107 East Maple Street

Roberts, Wisconsin 54023

July 6, 2009

MES Project No. 4-93049

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INTRODUCTION

General

This report presents the results of the subsurface exploration and evaluation for the proposed library, in Roberts, Wisconsin. The work was performed for the Hazel Mackin Community Library, at the request of Ms. Cori Prokopowicz of Building With Architects.

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 and floor slab designs for the 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 and analysis of the data obtained. The scope of the field exploration program, including the number, depth and approximate locations of the borings, was determined by Building With Architects.

Authorization

The description of services and authorization to perform this subsurface exploration and analysis were in the form of a signed copy of MES Proposal No. 4-9078, dated June 15, 2009. 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 the Hazel Mackin Community Library. The information contained in this report may not be relied upon by any other parties without the express written consent of MES, and acceptance by such parties of MES' General Conditions.

SITE AND PROJECT DESCRIPTION

Site Features

The subject site is located at the northeast corner of the intersection of West Warren Street and West Boulevard, in the Village of Roberts, Wisconsin. At the time of the exploration, the site was a vacant lot, covered with grass. Scattered trees and shrubs are located along the property boundaries, and a gravel driveway was present on the eastern property boundary. The topography of the general area is relatively flat. The project site is also relatively flat, with a maximum elevation difference of less than 1 foot measured between the boring locations. At the time of the exploration, the surface of the site was firm, and the drill rig did not experience difficulty in moving around.

Project Description

From the information provided by the client, it is understood that the proposed project will consist of a single-story structure and associated paved parking areas. No basement is planned. Structural loads were not known at the time of this analysis, but they are expected to be moderate in magnitude.

The finished first floor elevation was not known at the time of report preparation. Based on the existing grades of the project site in relation to adjacent roadways and developments, a finished first floor elevation of EL 99 was estimated for use in this evaluation.

The ground surface elevations at the borings performed in the planned building range from approximately EL 99.7 to EL 100.1. Therefore, on the basis of the estimated first floor elevation, only minor grading anticipated. However, this will also be dependent on the actual selected finished floor elevation, and upon the subgrade preparation criteria, to be discussed in a later section.

EXPLORATION AND LABORATORY PROCEDURES

Scope Summary

The field data utilized in the evaluation and analysis 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 borings to a depth of about 21.5 feet (B-1 through B-3); and one (1) soil boring to a depth of about 11.5 feet were performed for this project. The number and approximate locations of the borings were provided by the client. The borings were located in the field by the drill crew utilizing conventional taping procedures referenced to existing site features and apparent property lines. They are considered accurate to within a few feet. The elevations indicated on the test boring logs were determined by the MES drill crew, using conventional surveying techniques relative to an on-site benchmark, and are considered accurate to within about 1 foot. The benchmark utilized was the top nut of the fire hydrant located on the north side of West Warren Street, approximately 45 feet east of West Boulevard. The benchmark was assigned a temporary reference elevation of EL 100 for the purpose of this study.

The soil test borings were performed with a truck-mounted rotary 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 procedures at 2.5 foot intervals to 10 feet, and then at 5 foot intervals thereafter to the end of the borings. The SPT provides a means of determining the relative density of granular soils

and comparative consistency of cohesive soils, thereby providing a method of evaluating the relative strength and compressibility characteristics of the subsoils.

The SPT soil 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. All soil samples were visually classified by a soils engineer 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.

Selected cohesive soil samples were tested in unconfined compression with a calibrated hand penetrometer to aid in evaluating the soil strength characteristics. The values of strength tests performed on soil samples obtained by the Standard Penetration Test Method (SPT) are considered approximate, recognizing that the SPT method provides a representative but somewhat disturbed soil sample.

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 approximate boundaries between the various soil classifications. It must be recognized that the soil descriptions are considered representative for the specific test hole location, but that variations may occur between and beyond the sampling intervals and boring locations. Soil depths, topsoil and layer thicknesses, and demarcation lines utilized for preconstruction planning 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 the borings was covered with about 2 to 7 inches of topsoil. The topsoil was generally underlain by fine-grained silt and clay soils to depths of about 13 inches to 5 feet (EL 95.1 to EL 99.0). These soils were generally in a medium dense/stiff condition.

The underlying soils generally consisted of granular strata comprised of sand with variable clay, silt and gravel content to at least the termination depth of B-4 (11.5 feet/EL 88.2), and to depths of about 16 to 20 feet (EL 80.1 to EL 83.7) at the remaining borings. These soils may be considered medium dense to dense, with standard penetration resistances between 7 and 22 blows per foot, and natural moisture contents ranging from 2 to 7 percent.

At borings B-1 through B-3, the sand soils were underlain by dense to very dense sandstone to at least the termination depth of the borings.

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 drilling operations and in the open boreholes upon completion. No water was encountered in any of the boreholes while drilling.

On the basis of the field observations and the soils relative moisture contents, the free water level is judged to be below the depth of the borings at the time of the exploration. 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 better evaluate groundwater levels on this site.

EVALUATION AND RECOMMENDATIONS

General

In view of the subsurface conditions encountered in the test borings, together with the structural loading criteria and development grades anticipated, spread and continuous wall footings, along with slab-on-grade construction are recommended for the support of the structure.

A discussion of the building foundation design parameters, as well as the support conditions for the floor slab is included in later sections.

Site Preparation and Grading

The presence of organic topsoil and vegetation in the subgrade can adversely affect the serviceability of structural fills, foundations, floor slabs, pavements, and other structures placed upon them. Approximately 2 to 7 inches of topsoil was present on the surface of the site at the borings. 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 the removal of topsoil and other unsuitable bearing materials, and prior to the placement of new fill which will be placed to raise grades, the subgrade must be thoroughly proofrolled to detect unstable, yielding soils, which must be removed or improved by appropriate preparation and compaction techniques. Unstable soils may be encountered, at least on an isolated basis. Scarification, drying and recompaction of wet soils or removal and replacement with suitable fill are two (2) methods which can be considered, but this must be determined by the soils engineer at the time of construction. Low areas may then be raised to the planned grades with suitable properly compacted fill.

Portions of the exposed subgrade are expected to consist of silt and clay soils. Such soils are considered highly moisture sensitive and subject to softening. Therefore, equipment and worker traffic must be kept to a minimum on subgrade bearing surfaces, especially during times of precipitation or following spring thaw. Some difficulty with subgrade preparation can be expected in wet or cold weather conditions. Removal of unsuitable portions of the near surface soils and replacement with structural fill may be required, especially if earthwork is not carried out during periods of relatively warm, dry weather, which provide more favorable conditions for drying of these soils. Any soft 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. Lime and fly ash modification are two additional remedial measures which can be considered. However, this must only be performed at the direction and under the supervision of the geotechnical engineer. A proper mix design must be performed prior to the performance of any modification. Substantial construction delays and difficulty with subgrade stabilization may be experienced, especially 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 overexcavation 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 the removal of unsuitable bearing material is performed beneath proposed footings, the excavation must extend laterally beyond the perimeter of the foundation for a distance at least equal to the thickness of the fill below the footing bottom. This general guideline also applies to instances where a raised structural fill pad is constructed to achieve a bearing elevation

greater than existing grades. The influence zone of footing stresses can be represented as an imaginary 45° line extending downward and outward from the footing bottom. All fill placed within this zone after cutting to firm soil must be properly engineered, from the bottom of the cut, up to the floor slab subgrade elevation.

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. Proper moisture control is essential to reduce the amount of compactive effort necessary to achieve the desired densities.

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". If fine-grained soils, such as those with high silt or clay content are used, they should generally be placed over large open areas, where conditions are more favorable for the proper placement and compaction of such materials. It must be recognized that high silt or clay content materials are difficult to compact when placed at moisture contents beyond a few percent of the optimum moisture content. 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. The on-site soils present beneath the topsoil on the upper levels of the site have high amounts of fines (clay and silt) and are considered suitable for use as new fill to raise grades, generally over large areas. However, moisture conditioning may be required. The underlying sand soils are generally considered suitable for use as structural fill, subject to proper moisture control. 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.

Proper moisture control is essential to reduce the amount of compactive effort necessary to achieve the desired densities. This is especially true of clayey soils, where scarification and aeration may be required to achieve near-optimum moisture levels prior to compaction. A sheepsfoot roller is generally required for compaction of clayey soils, whereas a vibratory smooth drum roller is preferred for granular material. Small hand-operated compactors should be used in confined areas; granular fills are generally more readily compacted to the required densities in such applications.

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 System Analysis

The proposed structure may be supported by a conventional spread foundation system. Based upon the borings and an estimated finished floor slab elevation (EL 99), the soils at the approximate footing bearing elevations (EL 97 and EL 94.5 for interior and exterior footings, respectively) are estimated to consist of natural medium dense to dense granular soils and stiff cohesive soils. Spread and continuous wall footings bearing upon suitable natural soils, or upon compacted structural fill, may be designed for a net allowable soil pressure of 3,000 psf.

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 materials not disclosed by the borings, may be encountered in the foundation excavations at the bearing elevation. If unsuitable existing soil is present, it must 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 1000 psi) concrete mix to planned footing grade to reduce lateral over-excavation.

All perimeter wall footings must be placed at a depth of at least 4 feet 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 eighteen (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 continuous footings 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 or pavements, and prior to the placement of any fill used to raise grades, the exposed subgrade must be prepared utilizing the proofrolling procedures described previously. In areas that exhibit soft, yielding or unstable soil conditions, which may become extensive, the following remedial measures are recommended to provide a stable subgrade. It must be recognized that the high silt and clay content soils are highly sensitive to increases in moisture and construction disturbance. It will therefore be necessary to maintain these materials in a relatively dry condition to allow for proper fill placement and subgrade preparation. It is recommended that the proofrolling operations be monitored by a representative of the geotechnical engineer to ensure that a firm, suitable subgrade is present prior to placement of new fills, or to construction of floor slabs and pavements.

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 specified in Section 305 of the WisDOT Standard Specifications, 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 slabs may be designed utilizing an estimated modulus of subgrade reaction of 150 pci based on the presence of silt and clay soils, prepared as discussed in this report. 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 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 should 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 slab will be supporting live loads, such as from moving forklifts or vehicles, 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 may bear upon silt or clay soils. Such materials are moderately to highly frost susceptible and poorly drained. Slabs placed directly upon such soils 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). It is recommended that consideration be given to limited undercutting of the frost susceptible materials 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.

Utility Construction

In general, the on-site soils can be used for support of utility lines. Some difficulty with the stability of utility trenches should be expected due to the presence of granular soils, 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 should be properly placed and compacted under engineering controlled conditions to provide suitable support for overlaying structures and roadways. Silty and clayey soils are not recommended for use as backfill within utility trenches due to the substantial difficulty of obtaining proper compaction in confined areas. Sandstone was encountered within the borings at depths of about 16 to 20 feet (EL 80.1 to EL 83.7). Based upon the estimated finished floor elevation, it is generally expected that typical utility excavations will remain above the sandstone encountered within the borings.

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 boreholes during the exploration, no major groundwater-related difficulties during excavation and construction of the proposed foundation system is anticipated. A gravity drainage system and filtered sump pumps or other conventional dewatering procedures, should be adequate to control perched water if encountered.

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 building, and the site graded to direct runoff to catch basins, so that the potential for the softening of the foundation and pavement 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.

Excavations and Site Drainage

Sloping, shoring or bracing of the excavation sidewalls will be necessary. Trenching in granular soils may be difficult due to the instability of vertical slopes, and will therefore require a flattening of trench sides, or some other means of protection, to facilitate construction and to protect life and property. Some sloughing and caving should be expected within unprotected excavations. 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. All excavation work must be performed in accordance with OSHA and local building code requirements.

Dense sandstone was encountered in the borings at depths of about 16 to 20 feet (EL 80.1 to EL 83.7). Based upon the estimated finished floor elevation, it is generally expected that excavations will remain above these depths. However, should deeper than typical excavations be required or contemplated, additional exploration must be performed to better evaluate the depths and excavatability of the sandstone.

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.

Seismic Design Considerations

On-site natural soils generally consist of stiff cohesive soils and medium dense to dense granular soils, underlain by sandstone. The on-site natural soils are considered to meet the criteria for Site Class C in accordance with Table 1615.1.1 of the International Building Code-2006.

GENERAL COMMENTS

This geotechnical exploration and foundation analysis 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

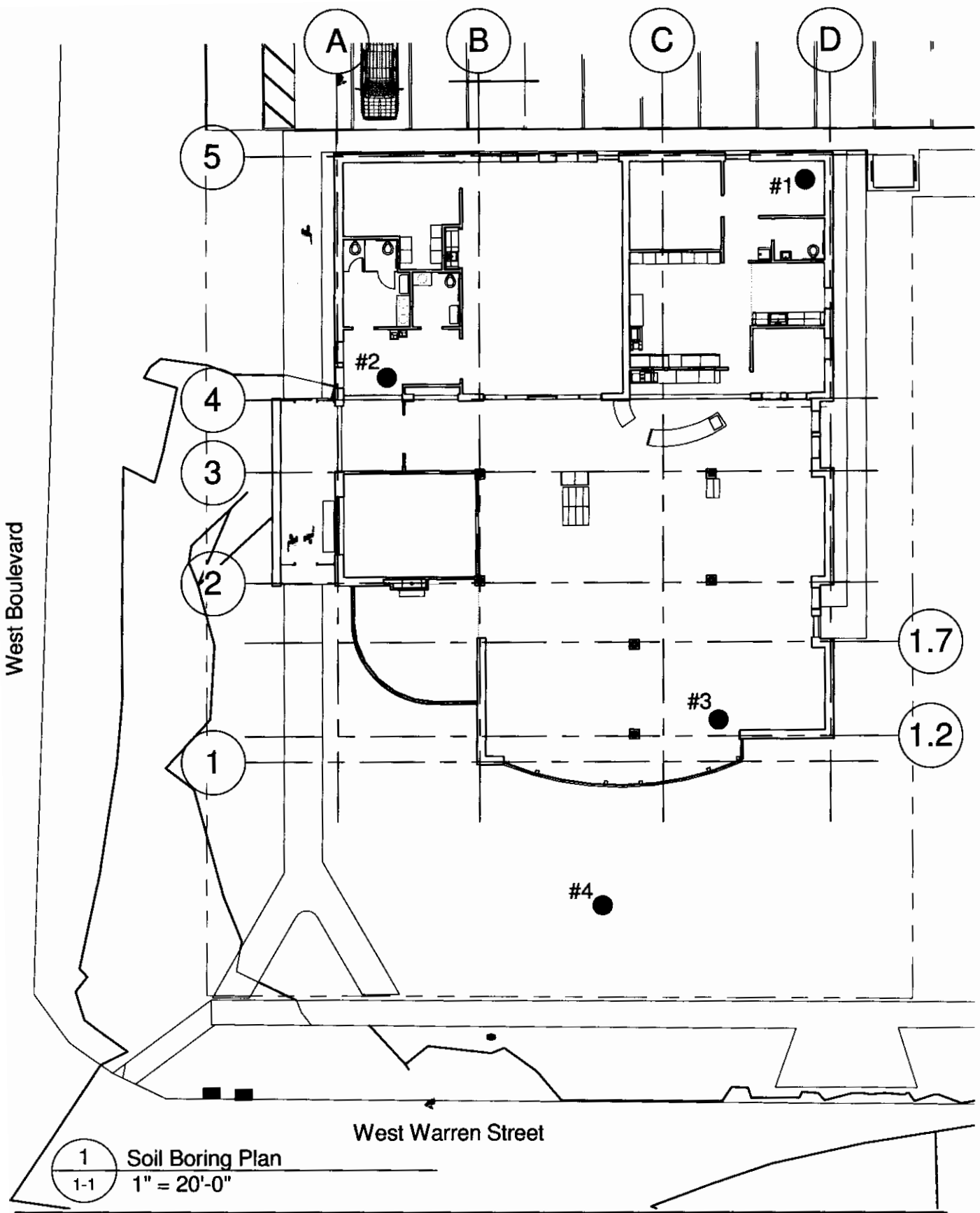
plans and specifications should also be reviewed by the soils engineer to determine that the recommendations presented herein have been interpreted and implemented as intended.

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



**Figure 1 - Boring Location Diagram
Proposed Hazel Mackin Community Library
Roberts, Wisconsin
MES Project No. 4-93049**

Project: Proposed Hazel Mackin Community Library
Location: Roberts, Wisconsin

Project No.: 4-93049
Drill Date: June 22, 2009
Drilled by: Joe Black

DEPTH/EL. (feet)	VISUAL SOIL CLASSIFICATION	SAMPLE NO.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	REMARKS
	GROUND SURFACE ELEVATION: 100.1						
1 99.1	0-2": TOPSOIL	1-AU					
2 98.1	2-12": Light brown SAND, with gravel, little silt, damp						
3 97.1	12-30": Dark brown SILT, little clay, trace sand and root hairs, damp	2-SS	6	1.5		14	
4 96.1	Light brown silty CLAY, trace sand, damp						
5 95.1							
6 94.1	Light orangish brown SAND, little clay, trace gravel, damp	3-SS	16			4	
7 93.1							
8 92.1	Light brown SAND, little gravel, trace silt, damp	4-SS	17			6	
9 91.1							
10 90.1							
11 89.1		5-SS	8			3	
12 88.1							
13 87.1	Brown SAND, with gravel, trace silt, damp						
14 86.1							
15 85.1							
16 84.1		6-SS	21			4	
17 83.1	Light brown SAND, little gravel, trace silt, damp						
18 82.1							
19 81.1							
20 80.1							
21 79.1	Yellow SANDSTONE	7-SS	50/2"			2	
22 78.1							
23 77.1							
24 76.1							
25 75.1							
26 74.1							
27 73.1							
28 72.1							
29 71.1							
30 70.1							
31 69.1							
32 68.1							
33 67.1							
34 66.1							
35 65.1							
36 64.1							
37 63.1							
38 62.1							
39 61.1							
40 60.1							
41 59.1							
42 58.1							
WATER LEVEL OBSERVATIONS: During drilling: None Observed Upon completion: None Observed Depth/Delay: NA Caved at: 11.3± feet (EL 88.8±)		ADDITIONAL COMMENTS: -No groundwater encountered while drilling or upon completion.					

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. Dashed lines are indicative of potentially erratic or unknown transitions, such as fill-to-natural soil zone transitions.



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SOIL BORING LOG: B - 2

Page 1 of 1

Project: Proposed Hazel Mackin Community Library
Location: Roberts, Wisconsin

Project No.: 4-93049
Drill Date: June 22, 2009
Drilled by: Joe Black

DEPTH/EL. (feet)	VISUAL SOIL CLASSIFICATION	SAMPLE NO.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	REMARKS	
GROUND SURFACE ELEVATION: 99.7								
1	98.7	0-6": TOPSOIL						
2	97.7	1-AU						
3	96.7	Dark brown SILT, little clay, trace sand and root hairs, damp						
4	95.7	2-SS	10	1.75		7		
5	94.7	Light brown silty CLAY, trace sand, damp						
6	93.7	3-SS	20			7		
7	92.7	Light orangish brown SAND, little clay, trace gravel, damp						
8	91.7	4-SS	18			2		
9	90.7	Light brown SAND, trace to little gravel, trace silt, damp						
10	89.7	5-SS	9			5		
11	88.7	Light brown SAND, trace to little gravel, trace silt, damp						
12	87.7	6-SS	35			-		
13	86.7	Tan to yellow SANDSTONE						
14	85.7	7-SS	50/5.5"			-		
15	84.7	END OF BORING @ 21.5± FEET						
16	83.7							
17	82.7							
18	81.7							
19	80.7							
20	79.7							
21	78.7							
22	77.7							
23	76.7							
24	75.7							
25	74.7							
26	73.7							
27	72.7							
28	71.7							
29	70.7							
30	69.7							
31	68.7							
32	67.7							
33	66.7							
34	65.7							
35	64.7							
36	63.7							
37	62.7							
38	61.7							
39	60.7							
40	59.7							
41	58.7							
42	57.7							
WATER LEVEL OBSERVATIONS:			ADDITIONAL COMMENTS:					
During drilling: None Observed			-No groundwater encountered while drilling or upon completion.					
Upon completion: None Observed								
Depth/Delay: NA								
Caved at: 17.8± feet (EL 79.9±)								

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. Dashed lines are indicative of potentially erratic or unknown transitions, such as fill-to-natural soil zone transitions.



midwest engineering services, inc.

SOIL BORING LOG: B - 3

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Project: Proposed Hazel Mackin Community Library
Location: Roberts, Wisconsin

Project No.: 4-93049
Drill Date: June 22, 2009
Drilled by: Joe Black

DEPTH/EL. (feet)	VISUAL SOIL CLASSIFICATION	SAMPLE NO.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	REMARKS	
GROUND SURFACE ELEVATION: 100.1								
1	99.1	0-7": TOPSOIL						
2	98.1	7-13": Dark brown SILT, little clay, trace sand and root hairs, damp						
3	97.1							
4	96.1	2-SS	13			4		
5	95.1	Light oranglish brown SAND, trace clay and gravel, damp						
6	94.1	3-SS	7			6		
7	93.1							
8	92.1	4-SS	19			7		
9	91.1							
10	90.1	5-SS	12			6		
11	89.1							
12	88.1	Light brown SAND, trace to little gravel, trace silt, damp						
13	87.1							
14	86.1							
15	85.1	6-SS	12			3		
16	84.1							
17	83.1							
18	82.1							
19	81.1	Orange SANDSTONE						
20	80.1	7-SS	50/4"			-		
21	79.1	END OF BORING @ 21.5± FEET						
22	78.1							
23	77.1							
24	76.1							
25	75.1							
26	74.1							
27	73.1							
28	72.1							
29	71.1							
30	70.1							
31	69.1							
32	68.1							
33	67.1							
34	66.1							
35	65.1							
36	64.1							
37	63.1							
38	62.1							
39	61.1							
40	60.1							
41	59.1							
42	58.1							
WATER LEVEL OBSERVATIONS:		ADDITIONAL COMMENTS:						
During drilling: None Observed		-No groundwater encountered while drilling or upon completion.						
Upon completion: None Observed								
Depth/Delay: NA								
Caved at: 16.2± feet (EL 83.9±)								

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. Dashed lines are indicative of potentially erratic or unknown transitions, such as fill-to-natural soil zone transitions.

Project: Proposed Hazel Mackin Community Library
Location: Roberts, Wisconsin

Project No.: 4-93049
Drill Date: June 22, 2009
Drilled by: Joe Black

DEPTH/EL. (feet)	VISUAL SOIL CLASSIFICATION	SAMPLE NO.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	REMARKS
	GROUND SURFACE ELEVATION: 99.7						
1	98.7	0-6" TOPSOIL					
2	97.7	1-AU					
3	96.7	Dark brown SILT, little clay, trace sand and root hairs, damp					
4	95.7	2-SS	7			6	
5	94.7	Orangish brown clayey SAND, damp					
6	93.7	3-SS	13			5	
7	92.7	Orangish brown SAND, little clay, trace gravel, damp					
8	91.7	4-SS	22			3	
9	90.7	Light brown SAND, little to with gravel, trace silt, damp					
10	89.7	5-SS	10			5	
11	88.7	END OF BORING @ 11.5± FEET					
12	87.7						
13	86.7						
14	85.7						
15	84.7						
16	83.7						
17	82.7						
18	81.7						
19	80.7						
20	79.7						
21	78.7						
22	77.7						
23	76.7						
24	75.7						
25	74.7						
26	73.7						
27	72.7						
28	71.7						
29	70.7						
30	69.7						
31	68.7						
32	67.7						
33	66.7						
34	65.7						
35	64.7						
36	63.7						
37	62.7						
38	61.7						
39	60.7						
40	59.7						
41	58.7						
42	57.7						

WATER LEVEL OBSERVATIONS:
 During drilling: None Observed
 Upon completion: None Observed
 Depth/Delay: NA
 Caved at: 6± feet (EL 93.7±)

ADDITIONAL COMMENTS:
 -No groundwater encountered while drilling or upon completion.

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. Dashed lines are indicative of potentially erratic or unknown transitions, such as fill-to-natural soil zone transitions.

GENERAL NOTES

SAMPLE IDENTIFICATION

Visual soil classifications are made in general accordance with the Unified Soil Classification System on the basis of textural and particle size categorization, and various soil behavior characteristics. Visual classifications should be substantiated by appropriate laboratory testing when a more exact soil identification is required to satisfy specific project applications criteria.

PARTICLE SIZE±			
Boulders:	8 inches	Coarse Sand:	2 to 4 mm
Cobbles:	3 to 8 inches	Medium Sand:	0.42 to 2 mm
Gravel:	5 mm to 3 inches	Fine Sand:	0.074 to 0.42 mm
		Silt:	0.005 to 0.074 mm
		Clay:	<0.005 mm

DRILLING & SAMPLING SYMBOLS

SS:	Split-spoon, 2" O.D. by 1 3/8" I.D.	RB:	Roller Bit
ST:	Shelby Tube, 2" O.D. or 3" O.D., as noted in text	WS:	Wash Sample
AU:	Auger Sample	BS:	Bag Sample
DB:	Diamond Bit	HA:	Hand Auger
CB:	Carbide Bit		

SOIL PROPERTY SYMBOLS

N:	Standard penetration count, indicating number of blows of a 140 lb. hammer with a 30 inch drop, required to advance a split-spoon sampler one foot.		
Qu:	Unconfined compressive strength, tons per square foot (tsf)		
Qp:	Calibrated hand penetrometer resistance, tsf		
MC:	Moisture content, %		
LL:	Liquid Limit	PL:	Plastic Limit
		PI:	Plasticity Index
Dd:	Dry Density, pounds per cubic foot (pcf)		
PID:	Photoionization Detector (Hnu meter) volatile vapor level, ppm		

SOIL RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

NON-COHESIVE SOILS		COHESIVE SOILS		
Classifier	N-Value Range	Classifier	Qu Range (tsf)	N-Value Range
very loose	0-3	very soft	0-0.25	0-2
loose	3-7	soft	0.25-0.5	2-5
medium dense	7-15	medium stiff	0.5-1.0	5-10
dense	15-38	stiff	1.0-2.0	10-14
very dense	38+	very stiff	2.0-4.0	14-32
		hard	4.0+	32+

GROUNDWATER



: Approximate Groundwater level at time noted on soil boring log, measured in open borehole unless otherwise noted. Groundwater levels often vary with time, and are affected by soil permeability characteristics, weather conditions, & lateral drainage conditions.