Memo

To: Northfield Township Board

From: Howard Fink

Date: 7/7/2016

Re: Van Curler Soil and Environmental Analysis

Dear Township Board,

Attached is the summary report from G2 on the Soil and Environmental Analysis performed on the Van Curler Property. There does not seem to be any issues present that would prevent us from purchasing the property. Jacob Rushlow will be present to give a presentation on the results.

Respectfully Submitted,

Howard Fink, Township Manager

CONSULTING
GROUP

Report of Preliminary Geotechnical Investigation

Proposed Lake Access Parcels
Main Street and Barker Road
Northfield Township, Michigan
48189

Latitude 42.424873° N
Longitude 83.765250° W

Prepared for:

OHM Advisors
c/o Northfield Township
34000 Plymouth Road
Livonia, MI 48150

G2 Project No. 163137
June 30, 2016

g2consultinggroup.com

Headquarters 1866 Woodslee St Troy, MI 48083 P 248.680.0400 F 248.680.9745
Ann Arbor 1595 Eisenhower Pl Ann Arbor, MI 48108 P 734.390.9330 F 734.390.9331
Chicagoland 1186 Heather Dr Lake Zurich, IL 60047 P 847.353.8740 F 847.353.8742

CONSULTING
GROUP

June 30, 2016

Mr. Jacob A. Rushlow, PE
Project Manager
c/o Northfield Township
34000 Plymouth Road
Livonia, MI 48150

Re: Report of Preliminary Geotechnical Investigation
Proposed Lake Access Parcels
Main Street and Barker Road
Northfield Township, Washtenaw County, Michigan
G2 Project No. 163137

Dear Mr. Rushlow:

We have completed the preliminary geotechnical investigation for the proposed lake access development in Northfield Township, Michigan. This report presents the results of our observations and analyses and our preliminary recommendations for earthwork operations, foundation design, slab-on-grade design, pavement design, and construction considerations as they relate to the geotechnical conditions on site.

We appreciate the opportunity to be of service to OHM and Northfield Township and look forward to discussing the recommendations presented. In the meantime, if you have any questions regarding our report or any other matter pertaining to the project, please contact us.

Sincerely,

G2 Consulting Group, LLC

Matt M. Hambright, P.E.
Project Engineer

Jason B. Stoops, P.E.
Project Manager

MMH/JBS/cjb

Enclosures:

EXECUTIVE SUMMARY

We understand the proposed project consists of a public lake access development to Whitmore Lake, in Northfield Township, Michigan. Site features, structure types, structure locations, and site details were not available at the time of this report. Once these details become available, additional soil borings will be necessary to provide geotechnical design recommendations. We anticipate multiple structures with associated site utilities and pavements may be constructed. When finished grades and actual building load conditions become available, G2 Consulting Group, LLC (G2) should be notified so we can re-evaluate the recommendations provided herein.

Approximately 2 to 14 inches of clayey topsoil are present at the boring locations. A layer of granular fill material consisting sand or clayey sand underlies the topsoil within borings B-03, B-04, B-11 and B-13 and extends to depths of 3 to 5-1/2 feet. Native soils, typically consisting of alternating layers of sand, clayey sand, silty clay or sandy clay, underlie the topsoil and/or fill material and generally extends to the explored depth of 20 feet. However, a layer of organic peat and clayey silt was encountered within borings B-03 and B-04, and at its maximum thickness extended from 5-1/2 to 17 feet deep.

During drilling operations, groundwater was encountered at depths ranging from 4 to 16 feet below the ground surface. Upon completion of drilling operations, groundwater was encountered at depths ranging from 7-1/2 to 16 feet below the ground surface. A collapse of the boreholes was observed within most of the borings at depths of 9 to 16 feet upon removal of the augers.

The subgrade soils will consist of silty clay, sandy clay and clayey sand. Therefore, we recommend site grading operations be performed during the drier summer months. In addition, consideration should be given to not expose the native cohesive soils to prolonged periods of precipitation to prevent the subgrade from becoming unstable.

The organic material (peat and organic silt) encountered within borings B-03 and B-04 is not suitable for support of shallow foundations. Any structures proposed in this area would require the organic soils to be completely removed within the influence of the footings/floor slabs so that the footings will either be supported on suitable native soils or engineered fill. Alternatively, deep foundations that extend through the organic material and bear within the stiff to very stiff native silty clay may be used. The remaining boring locations encountered near-surface soils consisting of stiff to very stiff clay or loose to medium compact sand, which are suitable for support of conventional shallow foundations.

Based on the encountered subsurface conditions and anticipated structural loads, we recommend the proposed buildings be supported on conventional shallow spread and/or strip footings. We recommend preliminary net allowable soil bearing capacities of 2,000 to 3,000 pounds per square foot be used for design of foundations bearing on the stiff to very stiff native clay, loose to medium compact sand, or engineered fill. We recommend a qualified geotechnical technician be on site during construction to observe the foundation excavations, measure the bearing depth, and confirm the adequacy of the bearing soils.

This summary is not to be considered separate from the entire text of this report with all the conclusions and qualifications mentioned herein. Details of our analysis and recommendations are discussed in the following sections and in the Appendix of this report.

PROJECT DESCRIPTION

We understand the proposed project consists of a lake access development along North Main Street, north of the Barker Road intersection, in Northfield Township, Michigan. The development is intended to provide public lake access to Whitmore Lake. Site features, structure types, structure locations, and site details were not available at the time of this report. Once these become available, additional soil borings will be necessary in order to provide final geotechnical design recommendations. We anticipate multiple structures with associated site utilities and pavements may be constructed. The finished floor elevation and the structural loading conditions were also not available at the time of this report. For the purposes of this report, we have assumed the maximum column loads will range from 50 to 150 kips, and the maximum wall loads will range from 2 to 4 kips per linear foot. When finished grades and actual building load conditions become available, G2 Consulting Group, LLC (G2) should be notified so we can re-evaluate the recommendations provided herein.

SCOPE OF SERVICES

The field operations, laboratory testing, and engineering report preparation were performed under the direction and supervision of a licensed professional engineer. Our services were performed according to generally accepted standards and procedures in the practice of geotechnical engineering. Our scope of services for this project was as follows:

1. G2 drilled a total of thirteen (13) soil borings, throughout the entire proposed site. All borings were drilled to a depth of 20 feet.

2. We performed laboratory testing on representative samples obtained from the soil borings. Laboratory testing included visual engineering classification, moisture content, dry density, unconfined compressive strength, organic matter content, and Atterberg limits.

3. We prepared this engineering report. Our report includes preliminary recommendations regarding the foundation type suitable for the soil conditions encountered, allowable bearing capacities of the anticipated bearing soil layers, estimated settlements, site preparation, floor slab design, pavement design parameters, and construction considerations related to site preparation and foundation construction.

FIELD OPERATIONS

At the time of this report a site layout was not available. G2 should be provided this information once it becomes available so that our recommendations may be reevaluated and additional borings may be drilled as necessary to evaluate the soil conditions in areas critical to the proposed structures.

G2 Consulting selected the number, depth, and location of the soil borings. The soil boring locations were staked by a representative of G2 prior to the drilling operations through the use of handheld mobile technology and conventional taping methods. The approximate soil boring locations are shown on the Soil Boring Location Plan, Plate No. 1. Ground surface elevations were approximated from Google Earth.

The soil borings were drilled using an all-terrain vehicle (ATV) drill rig. Continuous flight, 2-1/4-inch, inside diameter, hollow-stem augers were used to advance the boreholes to the explored depths. Within each soil boring, soil samples were obtained at intervals of 2-1/2 feet within the upper 10 feet and at intervals of 5 feet below that depth. These samples were obtained by the Standard Penetration Test method (ASTM D 1586), which involves driving a 2-inch diameter split-spoon sampler into the soil with a 140-pound weight falling 30 inches. The sampler is generally driven three successive 6-inch increments with the number of blows for each increment recorded. The number of blows required to advance the sampler the last 12 inches is termed the Standard Penetration Resistance (N). Blow counts for each 6-inch increment and the resulting N-values are presented on the individual soil boring logs.

Please note that borings B-03, B-04, B-10, and B-12 were performed using proper environmental sampling protocol. The soil boring equipment was decontaminated prior to and between each use. The sampling tools were also sequentially rinsed with a phosphate free detergent/water wash, clean water rinse, and deionized water final rinse. Disposable latex gloves were donned by field personnel between each sampling interval to reduce the potential for cross contamination

The soil samples were placed in sealed containers in the field and brought to our laboratory for testing and classification. During field operations, a G2 engineer and member of the drilling crew maintained logs of the encountered subsurface conditions, including changes in stratigraphy and observed groundwater levels. The final boring logs are based on the field logs supplemented by laboratory soil classification and test results. After completion of drilling operations, the boreholes were backfilled with auger cuttings.

LABORATORY TESTING

Representative soil samples were subjected to laboratory testing to determine soil parameters pertinent to foundation design and site preparation. An experienced geotechnical engineer classified the samples in general conformance with the Unified Soil Classification System.

Laboratory testing included natural moisture content, dry density, Atterberg limits, organic matter content, and unconfined compressive strength in accordance with the following test methods:

- ASTM D2216: Standard Test Method for Laboratory Determination of Moisture Content
- ASTM D4318: Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D2974: Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
- ASTM D2166: Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

Additionally, unconfined compressive strengths were determined using a spring-loaded hand penetrometer. The hand penetrometer estimates the unconfined compressive strength to a maximum of 4-1/2 tons per square foot (tsf) by measuring the resistance of the soil sample to the penetration of a calibrated spring-loaded cylinder.

The results of the moisture content, dry density, and unconfined compressive test are indicated on the soil boring logs at the depths the samples were obtained. The Unconfined Compressive Strength Test and Atterberg limits are graphically presented in the appendix of this report as Figure No. 14 and 15, respectively. We will hold the soil samples for 60 days from the date of this report. If you would like us to retain the samples beyond this date, or you would like the samples, please let us know.

SITE DESCRIPTION

The proposed site is generally located west of the intersection between North Main Street and Barker Road in Northfield Township, Michigan. The area is bounded by North Main Street to the east, Barker Road to the south, the rail line to the west and US-23 to the north. The surrounding properties consist of both residential and commercial. Whitmore Lake is located east of the property, across North Main Street. The proposed development area currently consists of seven parcels varying in size from 0.2 to 17.76 acres, covering a total area of approximately 23.1 acres.

Portions of the site are open and vacant, while other portions are covered with heavy brush and trees. The majority of the heavily wooded areas are located along the north and west of the site, with a slightly less-dense area located to the south. No topographical survey was available at the time of this report; however, based on aerial photographs, it appears the ground surface ranges from approximately elevation 899 to 910 feet.

SOIL CONDITIONS

Approximately 2 to 14 inches of clayey topsoil are present at the boring locations. A layer of granular fill material consisting sand or clayey sand underlies the topsoil within borings B-03, B-04, B-11 and B-13 and extends to depths of 3 to 5-1/2 feet. Native soils, typically consisting of alternating layers of sand, clayey sand, silty clay or sandy clay, underlies the topsoil and/or fill material and generally extends to the explored depth of 20 feet. However, a layer of organic peat and clayey silt was encountered within borings B-03 and B-04, and at its maximum thickness extended from 5-1/2 to 17 feet deep.

The organic peat and clayey silt present in borings B-03 and B-04 extends from 5-1/2 to 17 feet deep. The fibrous peat is very loose in compactness with SPT N-values of 4 blows per foot (bpf) and an organic matter content of 83 percent. The clayey silty is very soft to soft in consistency with a natural moisture content between 19 and 29 percent and unconfined compressive strengths between 200 and 1,000 psf. The upper 3 to 13 feet of clayey sand is generally loose to medium compact with Standard Penetration Test (SPT) N-values ranging between 5 and 22 bpf. The upper 3 to 13 feet of sandy clay and silty clay are medium to very stiff in consistency with a natural moisture contents between 9 and 22 percent and unconfined compressive strengths typically between 1,800 and 7,000 pounds per square foot (psf). The deeper granular material, generally consisting of sand and clayey sand, encountered from 13 feet to the explored depth of 20 feet is typically medium compact to very compact with SPT N-values between 11 and 67 bpf; however, a layer of very loose sand with a SPT N-value of 4 bpf was encountered from 18 to 20 feet deep within B-09. The deeper cohesive material, generally consisting of sandy clay and silty clay, encountered from 7 feet to the explored depth of 20 feet is typically stiff to hard in consistency with a natural moisture content between 8 and 16 percent and unconfined compressive strengths typically between 3,000 and 9,000 psf.

The stratification depths shown on the soil boring logs represent the soil conditions at the boring locations. Variations may occur between borings. Additionally, the stratigraphic lines represent the approximate boundaries between soil types. The transition may be more gradual than what is shown. We have prepared the boring logs on the basis of laboratory classification and testing, as well as field logs of the soils encountered.

The Soil Boring Location Plan, Plate No. 1, and the Soil Boring Logs, Figure Nos. 1 through 13, are presented in the Appendix. The soil profiles described above are generalized descriptions of the conditions encountered at the boring locations. General Notes Terminology defining the nomenclature used on the boring logs and elsewhere in this report is presented on Figure No. 16.

GROUNDWATER CONDITIONS

During drilling operations, groundwater was encountered at depths ranging from 4 to 16 feet below the ground surface. Upon completion of drilling operations, groundwater was encountered at depths ranging from 7-1/2 to 16 feet below the ground surface. A collapse of the boreholes was observed within most of the borings at depths of 9 to 16 feet upon removal of the augers.

Fluctuations in perched and long-term groundwater levels should be anticipated due to seasonal variations and following periods of prolonged precipitation. It should be noted that groundwater observations made during drilling operations in predominantly cohesive soils are not necessarily indicative of the static groundwater level. This is due to the low permeability of such soils and the tendency of drilling operations to seal off the natural paths of groundwater flow.

SITE PREPARATION

At the time of this report, site layout and final grading plans were not available. G2 should be provided this information once it becomes available so that our recommendations may be reevaluated and revised as necessary.

We anticipate earthwork operations will consist of removing the existing topsoil and vegetation from within the footprint of any proposed structures and pavement areas, balancing the site, proof-rolling the exposed subgrade, placing and compacting engineered fill to achieve finished grades, excavating for utilities and foundations, and preparing the site for floor slab support. We recommend all earthwork operations be performed in accordance with comprehensive specifications and be properly monitored in the field by qualified personnel under the direction of a licensed engineer.

Very loose organic peat and very soft to soft clayey silt were encountered within borings B-03 and B-04, and at its maximum thickness extended from depths of 5-1/2 to 17 feet. This material is not suitable for support of shallow foundations. Any structures proposed in this area would require this material to be completely removed within the influence of the footings/floor slabs so that the footings will either be supported on suitable native soils or engineered fill. Alternatively, deep foundations that extend through the organic material and bear within the stiff to very stiff native silty clay may be used.

We anticipate the subgrade soils will consist of cohesive material, or granular material containing a large fraction of cohesive material. Therefore, we recommend site grading operations be performed during the drier summer months. In addition, consideration should be given to not expose the native cohesive soils to prolonged periods of precipitation to prevent the subgrade from becoming unstable.

Once the existing topsoil and vegetation is completely removed, and any necessary undercuts are complete, and prior to placement of engineered fill, the exposed subgrade should be thoroughly proof-rolled with a heavy rubber-tired vehicle, such as a loaded dump truck, and visually evaluated for instability and/or unsuitable conditions. Any unstable or unsuitable areas noted should be removed and replaced with engineered fill. The same proof-rolling operations should be performed within the pavement areas once the proposed subgrade soils are exposed.

Engineered fill should be free of organic matter, frozen soil, clods, or other harmful material. We anticipate the on-site soils free of organic material may be used as engineered fill. However, the upper native cohesive soils have moisture contents ranging from 15 to 25 percent which is above the anticipated optimum moisture content. Therefore, moisture conditioning of the on-site silty clay or sandy clay soil will be required. We recommend disking and drying the clay in the summer months. Moisture conditioning of the on-site clay cannot be performed in the wet seasons or winter. If earthwork is performed in the wet seasons or winter months, stabilization will be required to place the silty clay in an engineered manner.

Engineered fill should be placed in uniform horizontal layers, not more than 9 inches in loose thickness. The engineered fill should be compacted to achieve a density of at least 95 percent of the maximum dry density as determined by the Modified Proctor compaction test (ASTM D 1557). All engineered fill material should be placed and compacted at approximately the optimum moisture content. Frozen material should not be used as fill, nor should fill be placed on a frozen subgrade.

FOUNDATION RECOMMENDATIONS

A preliminary site plan was not available at the time of this report. G2 should be provided this information once it becomes available so that our recommendations may be reevaluated and revised as necessary. For the purposes of this evaluations, we have assumed the finished floor elevation will be near the existing grade.

The organic material encountered within borings B-03 and B-04 is not suitable for support of shallow foundations. Any structures proposed in this area would require this material to be completely removed within the influence of the footings/floor slabs so that the footings will either be supported on suitable native soils or engineered fill. Alternatively, deep foundations that extend through the organic material and bear within the stiff to very stiff native silty clay may be used. The remaining boring locations encountered near-surface soils consisting of stiff to very stiff clay or loose to medium compact sand, which are suitable for support of conventional shallow foundations.

Based on the encountered subsurface conditions and anticipated structural loads, we recommend the proposed buildings be supported on conventional shallow spread and/or strip footings. We recommend preliminary net allowable soil bearing capacities of 2,000 to 3,000 pounds per square foot be used for design of foundations bearing on the stiff to very stiff native clay, loose to medium compact sand, or engineered fill. We recommend a qualified geotechnical technician be on site during construction to observe the foundation excavations, measure the bearing depth, and confirm the adequacy of the bearing soils.

Exterior footings must bear at a minimum depth of 3-1/2 feet for protection against frost heave. Interior footings can bear at shallower depths provided suitable bearing soils are present and they are protected from frost during construction operations. Continuous wall or strip footings should be at least 12 inches in width and isolated spread footings should be at least 30 inches in their least dimension. To achieve a change in the level of a strip footing, the footing should be gradually stepped at a grade no steeper than two units horizontal to one unit vertical. We recommend all strip footings be suitably reinforced to minimize the effects of differential settlements associated with local variations in subsoil conditions.

If the recommendations outlined in this report are adhered to, total and differential settlements for the completed structures should be within 1 inch and 1/2 inch, respectively. We expect settlements of these magnitudes are within tolerable limits for the types of structures proposed.

FLOOR SLAB RECOMMENDATIONS

We anticipate the subgrade soils will consist of stiff to very stiff clay, or loose to medium compact sand. These soils are suitable for floor slab support provided they pass the proof-rolling operations and the recommendations in the Site Preparation section of the report are adhered to. A preliminary modulus of subgrade reaction value (k) of 100 to 120 pounds per cubic inch (pci) may be used in design of floor slabs supported on the stiff to very stiff clay, loose to medium compact sand or engineered fill.

However, within the area of borings B-03 and B-04, organic peat and marl is present. The soils are generally not suitable for support of floor slabs, especially if existing grades are raised in this are surcharging the organic, compressible soils. If the organic soils are left in place, we anticipate a structurally supported floor slab would be required.

We recommend at least 4 inches of clean coarse sand or pea gravel be placed between the subgrade and the bottom of the floor slab for use as a capillary break to reduce moisture transmission through the concrete floors and to reduce the potential for concrete curling. If moisture sensitive floor coverings are planned or if greater protection against vapor transmission is desired, a vapor barrier consisting of 10-mil plastic sheeting, or equivalent, may be placed atop the sand layer beneath the floor slab. We recommend all concrete floor slabs be suitably reinforced and separated from the foundation system to allow for independent movement.

PAVEMENT RECOMMENDATIONS

At the time of this investigation, a proposed grading plan was not available; however, we anticipate the pavement grades will be at or near the existing grades. Based on the soil borings performed throughout the property, the anticipated subgrade soils are expected to consist of predominantly sandy clay or clayey sand. Cohesive soils are considered poor for direct support of pavement structures, have poor drainage characteristics, are susceptible to frost heave, and may become unstable under repeated loading typical of pavement construction operations. We recommend an effective roadbed soil resilient modulus of 9,375 pounds per square inch (psi) for use in design of bituminous and concrete pavements supported on the native silty clay. Once parking lot and access drive locations have been determined, as well as anticipated traffic frequency and loading conditions, specific pavement section designs can be performed for the development.

Large front-loading refuse trucks can impose significant concentrated wheel loads within trash dumpster pick-up areas. This type of loading can result in rutting of asphalt pavements and ultimately in failure. Therefore, we recommend reinforced concrete pavement, at least 8 inches in thickness, be used in these areas.

Proper drainage is considered to be an important consideration for pavement design. We recommend "stub" or "finger" drains be provided around catch basins and other low parts of the site to minimize the accumulation of water above and within any frost susceptible subgrade soils. Consideration should also be given to providing subdrains around the perimeter of any parking areas, since they can become a source of water infiltration into the pavement. Such subdrains could be connected to nearby catch basins. The pavement and subgrade should be properly sloped to promote effective surface and sub surface drainage and prevent water ponding. If any undercuts are performed during pavement construction where unstable areas are noted, we recommend these areas be connected with finger drains to catch basins as well.

Regular timely maintenance should be performed on the pavement to reduce the potential deterioration associated with moisture infiltration through surface cracks. The owner should be prepared to seal the cracks with a hot-applied elastic crack filler as soon as possible after cracking develops and as often as necessary to block the passage of water to the subgrade soils. We recommend that crack sealing be performed on a yearly basis for pavements that are in good and fair condition to extend the life of the pavements.

CONSTRUCTION CONSIDERATIONS

We anticipate utility excavations will extend to depths of 5 to 7 feet below finished grades and foundation excavations will extend a minimum of 3-1/2 feet below finished grades. We anticipate the contractor will be able to excavate foundations neat within the native silty clay. However, the contractor should come prepared to over-excavate and form foundations placed within the sandy clay material if any caving and/or sloughing of the soils occurs while excavating. The sides of the spread and/or strip footing foundations should be constructed straight and vertical to reduce the risk of frozen soil adhering to the concrete and raising the foundations.

In general, we do not anticipate significant accumulation of groundwater within the construction excavations at the depths anticipated for this project. We anticipate the contractor will be able to control any ground water seepage or surface run off with properly constructed sumps. The contractor should be prepared to construct proper sumps if surface run-off water or groundwater seepage is encountered. However, if deeper excavations are required (e.g. if basements are proposed for the structure), additional dewatering techniques may be necessary, such as a well point system.

Where excavations extend deeper than 5 feet and sufficient space is available, we recommend maximum slopes of 2 horizontal units to 1 vertical unit (2H:1V) for sloped excavations within the upper loose granular material, 1-1/2H:1V within the medium compact granular soils and medium clay soils, and 1H:1V within the stiff to very stiff clay soils. All excavations should be safely sheeted, shored, sloped, or braced in accordance with MI-OSHA requirements. If material is stored or equipment is operated near an excavation, stronger shoring must be used to resist the extra pressure due to the superimposed loads.

SUPPLEMENTAL GEOTECHNICAL INVESTIGATION

At the time of this investigation, a proposed site plan was not available and the proposed structure had not been finalized. Once the site layout, building loading conditions, and building location have been established, G2 should be notified in order to review the recommendations provided within this report. At that time, G2 will determine the scope of work for a supplemental geotechnical investigation in order to provide adequate final geotechnical design recommendations.

GENERAL COMMENTS

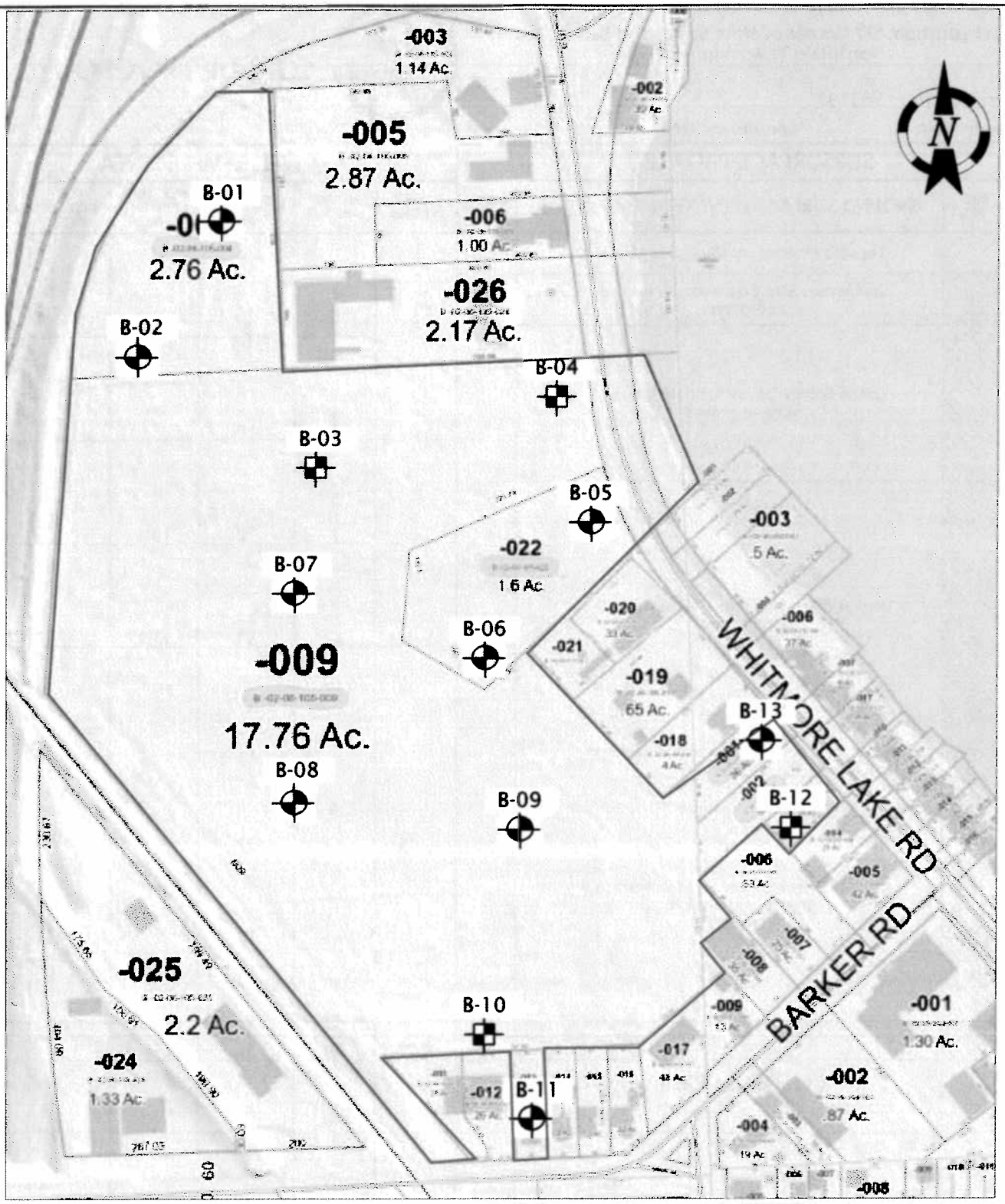
We have formulated the evaluations and recommendations presented in this report relative to site preparation and foundations on the basis of data provided to us relating to the location, type, and grade for the proposed site. Any significant change in this data should be brought to our attention for review and evaluation with respect to the prevailing subsurface conditions.

The scope of the present investigation was limited to evaluation of subsurface conditions for the support of the building foundations and other related aspects of the development. If changes occur in the design, location, or concept of the project, the conclusions and recommendations contained in this report are not valid unless G2 Consulting Group, LLC reviews the changes. G2 Consulting Group, LLC will then confirm the recommendations presented herein or make changes in writing.

We have based the analyses and recommendations submitted in this report upon the data from soil borings performed at the approximate locations shown on the Soil Boring Location Plan, Plate No. 1. This report does not reflect variations that may occur between the actual boring locations and the actual structure locations. The nature and extent of any such variations may not become clear until the time of construction. If significant variations then become evident, it may be necessary for us to re-evaluate our report recommendations.

Soil conditions at the site could vary from those generalized on the basis of soil borings made at specific locations. It is, therefore, recommended that G2 be retained to provide soil engineering services during the site preparation, excavation, and foundation construction phases of the proposed project. This is to observe compliance with the design concepts, specifications, and recommendations. Also, this allows design changes to be made in the event that subsurface conditions differ from those anticipated prior to the start of construction.

APPENDIX



Legend

- Soil borings drilled by Strata Drilling, Inc., June 9, 2016 to June 10, 2016
- Environmental testing locations drilled by Strata Drilling, Inc., June 9, 2016 to June 10, 2016
- Approximate Property Boundary

Soil Boring and Environmental Sampling Location Plan

Northfield Township Proposed Lake Access
Whitmore Lake Road and Barker Road
Northfield Township, Michigan

2G CONSULTING GROUP

Project No. 163137	
Drawn by: MMH	
Date: 06-24-16	Plate No. 1
Scale: NTS	

Project Name: Proposed Lake Access Parcels

Project Location: NW Corner of Main Street and Barker Road
Northfield Township, Michigan

G2 Project No. 163137

Latitude: N/A Longitude: N/A

Soil Boring No. B-01

G2 CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 907.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Brown Silty Clay (12 inches) 1.0							
		Stiff Brown Silty Clay with trace sand and gravel 2.3		S-01	2 3 2	5	18.7		4000*
902.0		Loose Brown Clayey Sand with trace silt and gravel	5	S-02	3 4 6	10			
		6.0		S-03	3 5 7	12	13.8		5000*
897.0		Very Stiff Brown Sandy Clay with trace silt and gravel	10	S-04	7 22 32	54	11.7		5000*
		12.5							
892.0			15	S-05	9 15 17	32			
		Compact Gray Clayey Sand with trace silt and gravel, and occasional clay layers							
887.0		20.0	20	S-06	14 17 20	37			
		End of Boring @ 20 ft							
882.0			25						

Total Depth: 20 ft
Drilling Date: June 10, 2016
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Drilling Method:
2-1/4 inch inside diameter hollow-stem auger

Water Level Observation:
13-1/2 feet during and upon completion of drilling operations

Notes:
Borehole offset 30 feet south
Borehole collapsed at 14 ft after auger removal
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Figure No. 1

SOIL / PAVEMENT BORING 163137.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 6/24/16

Project Name: Proposed Lake Access Parcels

Project Location: NW Corner of Main Street and Barker Road
Northfield Township, Michigan

G2 Project No. 163137

Latitude: N/A Longitude: N/A

Soil Boring No. B-02

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 906.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Brown Silty Clay (9 inches) 0.8							
		Brown Silty Clay with trace sand and gravel 1.5		S-01	3 3 3	6			
901.0			5	S-02	2 4 7	11			
		Loose to Medium Compact Brown Clayey Sand with trace silt and gravel		S-03	4 6 7	13			
896.0			10	S-04	6 9 12	21			
		13.0							
891.0		Compact Brown Sand with little gravel and trace silt	15	S-05	13 19 23	42			
		17.0							
886.0		Compact Gray Clayey Sand with trace silt and gravel 20.0	20	S-06	11 20 24	44			
		End of Boring @ 20 ft							
881.0			25						

Total Depth: 20 ft
Drilling Date: June 10, 2016
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Water Level Observation:
12-1/2 feet during and upon completion of drilling

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Drilling Method:
2-1/4 inch inside diameter hollow-stem auger

Figure No. 2

SOIL / PAVEMENT BORING 163137.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 6/24/16

Project Name: Proposed Lake Access Parcels

Project Location: NW Corner of Main Street and Barker Road
Northfield Township, Michigan

G2 Project No. 163137

Latitude: N/A Longitude: N/A

Soil Boring No. B-03

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 899.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Brown Clayey Sand (12 inches) 1.0							
		Fill: Medium Compact Brown Clayey Sand with little gravel and trace silt		S-01	5 5 7	12			
894.0			5	S-02	3 12 10	22			
		5.5							
		Very Loose Dark Brown Fibrous Peat (Organic Matter Content = 83%)		S-03	2 2 2	4			
889.0			10	S-04	2 2 2	4			
		12.0							
		Very Soft Gray Clayey Silt with trace organics (Organic Matter Content = 1.4%)							
884.0			15	S-05	WoH/18"	---	29.3		200**
		17.0							
		Very Stiff Gray Silty Clay with trace sand and gravel							
879.0		20.0	20	S-06	3 4 5	9	16.0		4220
		End of Boring @ 20 ft							
874.0			25						

Total Depth: 20 ft
Drilling Date: June 9, 2016
Inspector:
Contractor: Strata Drilling, Inc.
Driller: D. Watkins

Drilling Method:
2-1/4 inch inside diameter hollow-stem auger

Water Level Observation:
Dry during and upon completion of drilling

Notes:
Borehole offset 30 feet west and 100 feet south
Borehole collapsed at 15 ft after auger removal
* Calibrated Hand Penetrometer
** Torvane

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Figure No. 3

SOIL / PAVEMENT BORING 163137.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 6/24/16

Project Name: Proposed Lake Access Parcels

Project Location: NW Corner of Main Street and Barker Road
Northfield Township, Michigan

G2 Project No. 163137

Latitude: N/A Longitude: N/A

Soil Boring No. B-04

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 901.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Brown Sandy Clay (11 inches) 0.9							
		Fill: Brown Sandy Clay 1.8							
		Buried Topsoil: Brown Silty Sand with trace gravel 3.0		S-01	3 3 4	7			
896.0		Loose Gray Clayey Sand with trace silt and gravel	5	S-02	4 3 2	5			
		6.0		S-03	4 3 5	8	18.7		1000*
		Soft Gray Clayey Silt with little organics 8.0							
891.0			10	S-04	5 7 11	18	13.0		7000*
886.0		Stiff to Very Stiff Gray Silty Clay with trace sand and gravel	15	S-05	5 6 7	13	14.2		4000*
881.0		20.0	20	S-06	3 5 6	11	15.3		3000*
876.0		End of Boring @ 20 ft	25						

Total Depth: 20 ft
Drilling Date: June 9, 2016
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Drilling Method:
2-1/4 inch inside diameter hollow-stem auger

Water Level Observation:
4 feet during drilling operations; 13 feet upon completion

Notes:
Borehole collapsed at 15-1/2 ft after auger removal
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Figure No. 4

SOIL / PAVEMENT BORING 163137.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 6/24/16

Project Name: Proposed Lake Access Parcels

Project Location: NW Corner of Main Street and Barker Road
Northfield Township, Michigan

G2 Project No. 163137

Latitude: N/A Longitude: N/A

Soil Boring No. B-05

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 902.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Dark Brown Clayey Sand (14 inches) 1.2							
		Loose Dark Brown Clayey Sand with trace silt and gravel 3.0		S-01	3 4 4	8			
897.0		Medium Brown and Gray Mottled Silty Clay with trace sand and gravel	5	S-02	3 3 5	8	21.9		1820
		7.0		S-03	8 14 17	31	11.2		9000*
892.0		Hard Brown and Gray Mottled Silty Clay with trace sand and gravel	10	S-04	7 13 17	30	11.2		9000*
		12.0							
887.0			15	S-05	3 5 7	12	10.9		5000*
		Very Stiff Gray Silty Clay with trace sand and gravel							
882.0		20.0	20	S-06	6 9 11	20	8.0		7000*
		End of Boring @ 20 ft							
877.0			25						

Total Depth: 20 ft
Drilling Date: June 10, 2016
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Drilling Method:
2-1/4 inch inside diameter hollow-stem auger

Water Level Observation:
Dry during and upon completion of drilling

Notes:
Borehole collapsed at 14 ft after auger removal
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Figure No. 5

SOIL / PAVEMENT BORING 163137.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 6/24/16

Project Name: Proposed Lake Access Parcels

Project Location: NW Corner of Main Street and Barker Road
Northfield Township, Michigan

G2 Project No. 163137

Latitude: N/A Longitude: N/A

Soil Boring No. B-06

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 908.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Brown Silty Clay (11 inches)							
		0.9		S-01	2 3 3	6	20.1		5000*
903.0			5	S-02	4 7 11	18	12.3		8000*
		Very Stiff to Hard Brown Silty Clay with trace sand and gravel		S-03	5 8 13	21	13.7		9000*
898.0			10	S-04	5 10 12	22	10.8		5000*
		12.0							
893.0		Very Stiff Gray Silty Clay with trace sand, gravel and occasional sand seams	15	S-05	3 4 6	10	14.8		4000*
		16.0							
888.0		Medium Compact Gray Sand with trace silt and gravel, and occasional gravel layers	20	S-06	5 9 9	18			
		20.0							
883.0		End of Boring @ 20 ft	25						

Total Depth: 20 ft
Drilling Date: June 10, 2016
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Drilling Method:
2-1/4 inch inside diameter hollow-stem auger

Water Level Observation:
14 feet during drilling operations; 14-1/2 feet upon completion

Notes:
Borehole collapsed at 15-1/2 ft after auger removal
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Figure No. 6

SOIL / PAVEMENT BORING 163137.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 6/24/16

Project Name: Proposed Lake Access Parcels

Project Location: NW Corner of Main Street and Barker Road
Northfield Township, Michigan

G2 Project No. 163137

Latitude: N/A Longitude: N/A

Soil Boring No. B-07

CONSULTING GROUP

ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 907.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Brown Clayey Sand (9 inches) 0.8							
				S-01	3 3 3	6			
902.0		Loose to Medium Compact Brown Clayey Sand with trace silt and gravel	5	S-02	4 4 5	9			
				S-03	4 9 13	22			
		8.0 Brown Sand and Gravel 9.0							
897.0		Medium Compact Brown Sand with trace silt and gravel	10	S-04	7 9 16	25			
		13.0							
892.0		Very Compact Gray Clayey Sand with trace silt and gravel	15	S-05	12 27 40	67			
		18.0							
887.0		Hard Gray Silty Clay with trace sand and gravel, and occasional sand layers 20.0	20	S-06	11 24 18	42	10.7		9000*
882.0		End of Boring @ 20 ft	25						

Total Depth: 20 ft
Drilling Date: June 10, 2016
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Drilling Method:
2-1/4 inch inside diameter hollow-stem auger

Water Level Observation:
16 feet during drilling operations; 14 feet upon completion

Notes:
Borehole collapsed at 16 ft after auger removal
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Figure No. 7

SOIL / PAVEMENT BORING 163137.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 6/24/16

Project Name: Proposed Lake Access Parcels

Project Location: NW Corner of Main Street and Barker Road
Northfield Township, Michigan

G2 Project No. 163137

Latitude: N/A Longitude: N/A

Soil Boring No. B-08

G2 CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 907.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Brown Sandy Clay (10 inches) 0.8							
		Very Stiff Brown Sandy Clay with trace silt and gravel		S-01	3 3 3	6	15.0		7000*
902.0			5	S-02	3 3 4	7	12.3		5000*
		6.0							
		Medium Compact Brown Clayey Sand with some gravel and trace silt		S-03	7 7 9	16			
		8.0							
		Brown Sand and Gravel							
		9.5		S-04	7 15 19	34			
897.0		Compact Brown Sand with trace silt and gravel	10						
		12.5							
				S-05	11 34 50	84			
892.0			15						
		Very Compact Gray Clayey Sand with trace silt and gravel, and occasional gravel layers (Finer than No. 200 = 49%)							
				S-06	16 20 31	51			
887.0		20.0	20						
		End of Boring @ 20 ft							
882.0			25						

Total Depth: 20 ft
Drilling Date: June 10, 2016
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Drilling Method:
2-1/4 inch inside diameter hollow-stem auger

Water Level Observation:
16 feet during and upon completion of drilling

Notes:
Borehole offset 15 feet east of tree line
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Figure No. 8

SOIL / PAVEMENT BORING 163137.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 6/24/16

Project Name: Proposed Lake Access Parcels

Project Location: NW Corner of Main Street and Barker Road
Northfield Township, Michigan

G2 Project No. 163137

Latitude: N/A Longitude: N/A

Soil Boring No. B-09

G2 CONSULTING GROUP

SUBSURFACE PROFILE

GROUND SURFACE ELEVATION: 910.0 ft ±

ELEV. (ft)	Description	Depth (ft)
	Topsoil: Brown Sandy Clay (8 inches)	0.7
905.0	Very Stiff Brown Sandy Clay with trace silt and gravel	5
		6.5
900.0	Loose to Medium Compact Brown Silty Sand with trace gravel	10
		12.5
895.0	Compact Brown Silty Sand with trace gravel	15
		16.0
	Gray Sandy Clay	
		18.0
890.0	Very Loose Gray Sand with trace silt and gravel	20
		20.0
885.0	End of Boring @ 20 ft	25

SOIL SAMPLE DATA

SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
S-01	3 2 3	5	13.7		5000*
S-02	3 4 6	10	13.3		4000*
S-03	3 4 6	10			
S-04	4 6 7	13			
S-05	9 20 23	43			
S-06	1 2 2	4			

Total Depth: 20 ft
Drilling Date: June 10, 2016
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Drilling Method:
2-1/4 inch inside diameter hollow-stem auger

Water Level Observation:
6-1/2 feet during drilling operations; 7-1/2 feet upon completion

Notes:
Borehole collapsed at 9 ft after auger removal
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Figure No. 9

SOIL / PAVEMENT BORING 163137.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 6/24/16

Project Name: Proposed Lake Access Parcels

Project Location: NW Corner of Main Street and Barker Road
Northfield Township, Michigan

G2 Project No. 163137

Latitude: N/A Longitude: N/A

Soil Boring No. B-10

G2 CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 910.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Brown Sandy Clay (14 inches)							
		1.2							
		Very Stiff Brown Sandy Clay with trace silt and gravel (Finer than No. 200 = 54%)		S-01	4 4 3	7	14.6		5000*
		3.0							
905.0		Loose Brown Clayey Sand with trace gravel and silt (Finer than No. 200 = 22%)	5	S-02	2 2 3	5			
		6.0		S-03	3 3 3	6			
900.0		Stiff to Very Stiff Brown Sandy Clay with trace silt and gravel (No Recovery at 7-1/2 feet)	10	S-04	4 10 12	22	9.4		4000*
		12.0 ▼							
895.0		Compact Brown Silty Sand with trace gravel and clay	15	S-05	10 20 13	33			
		18.0							
890.0		Compact Brown Silty Sand	20	S-06	11 20 20	40			
		20.0 End of Boring @ 20 ft							
885.0			25						

Total Depth: 20 ft
Drilling Date: June 9, 2016
Inspector:
Contractor: Strata Drilling, Inc.
Driller: D. Watkins

Drilling Method:
2-1/4 inch inside diameter hollow-stem auger

Water Level Observation:
12 feet during and upon completion of drilling

Notes:
Borehole collapsed at 12 ft after auger removal
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Figure No. 10

SOIL / PAVEMENT BORING 163137.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 6/24/16

Project Name: Proposed Lake Access Parcels

Project Location: NW Corner of Main Street and Barker Road
Northfield Township, Michigan

G2 Project No. 163137

Latitude: N/A Longitude: N/A

Soil Boring No. B-11

CONSULTING GROUP

ELEV. (ft)	PROFILE	GROUND SURFACE ELEVATION: 909.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Brown Sand (2 inches) 0.2							
		Fill: Medium Compact Brown Sand with some gravel and brick and trace roots		S-01	5 9 12	21			
		3.0							
904.0		Very Stiff Brown Silty Clay with some sand, trace gravel and roots	5	S-02	3 5 6	11	12.3		5000*
				S-03	4 6 7	13	11.7		5000*
		8.0							
899.0		Loose Brown Clayey Sand with trace silt and gravel (Finer than No. 200 = 42%)	10	S-04	4 4 6	10			
		11.0							
894.0		Medium Compact Brown Sand with trace silt and gravel	15	S-05	6 13 16	29			
889.0		20.0	20	S-06	4 9 13	22			
		End of Boring @ 20 ft							
884.0			25						

Total Depth: 20 ft
Drilling Date: June 10, 2016
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Drilling Method:
2-1/4 inch inside diameter hollow-stem auger

Water Level Observation:
15 feet during and upon completion of drilling

Notes:
Borehole collapsed at 15 ft after auger removal
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Figure No. 11

SOIL / PAVEMENT BORING 163137.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 6/24/16

Project Name: Proposed Lake Access Parcels

Project Location: NW Corner of Main Street and Barker Road
Northfield Township, Michigan

G2 Project No. 163137

Latitude: N/A Longitude: N/A

Soil Boring No. B-12

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 910.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Brown Sandy Clay (14 inches)							
		1.2		S-01	3 4 3	7	11.6		5160
905.0		Very Stiff Brown Sandy Clay with trace silt and gravel	5	S-02	5 5 7	12	9.9		5000*
		5.5		S-03	7 6 7	13			
		Medium Compact Brown Silty Sand with trace clay and gravel							
		8.0		S-04	6 7 9	16	9.4		9000*
900.0		Hard Brown Sandy Clay with trace silt and gravel	10						
		12.0		S-05	14 15 15	30	8.8		9000*
895.0		Hard Dark Gray Sandy Clay with trace silt and gravel	15						
		16.0		S-06	5 4 7	11			
890.0		Medium Compact Brown Sand with trace silt and gravel	20						
		20.0							
885.0		End of Boring @ 20 ft	25						

Total Depth: 20 ft
Drilling Date: June 9, 2016
Inspector:
Contractor: Strata Drilling, Inc.
Driller: B. Sienkiewicz

Drilling Method:
2-1/4 inch inside diameter hollow-stem auger

Water Level Observation:
16 feet during drilling operations; 15-1/2 feet upon completion

Notes:
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Figure No. 12

SOIL / PAVEMENT BORING 163137.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 6/24/16

Project Name: Proposed Lake Access Parcels

Project Location: NW Corner of Main Street and Barker Road
Northfield Township, Michigan

G2 Project No. 163137

Latitude: N/A Longitude: N/A

Soil Boring No. B-13

G2 CONSULTING GROUP

ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 909.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Brown Silty Sand (12 inches) 1.0							
		Fill: Brown Silty Sand with trace brick and roots 3.0		S-01	10 50/5"	---			
904.0		Loose to Medium Compact Brown Clayey Sand with trace silt and gravel	5	S-02	3 2 5	7			
				S-03	5 6 6	12			
899.0		9.0	10	S-04	8 9 10	19	9.6		7000*
		Very Stiff Brown Sandy Clay with trace silt and gravel 13.0							
894.0		Hard Dark Brown Silty Clay with trace gravel, sand, and cobble	15	S-05	8 9 12	21	8.6		9000*
		16.0							
889.0		Hard Dark Brown Silty Clay with trace sand and gravel and occasional sand seams 20.0	20	S-06	5 6 8	14	10.2		9000*
884.0		End of Boring @ 20 ft	25						

Total Depth: 20 ft
Drilling Date: June 9, 2016
Inspector:
Contractor: Strata Drilling, Inc.
Driller: D. Watkins

Drilling Method:
2-1/4 inch inside diameter hollow-stem auger

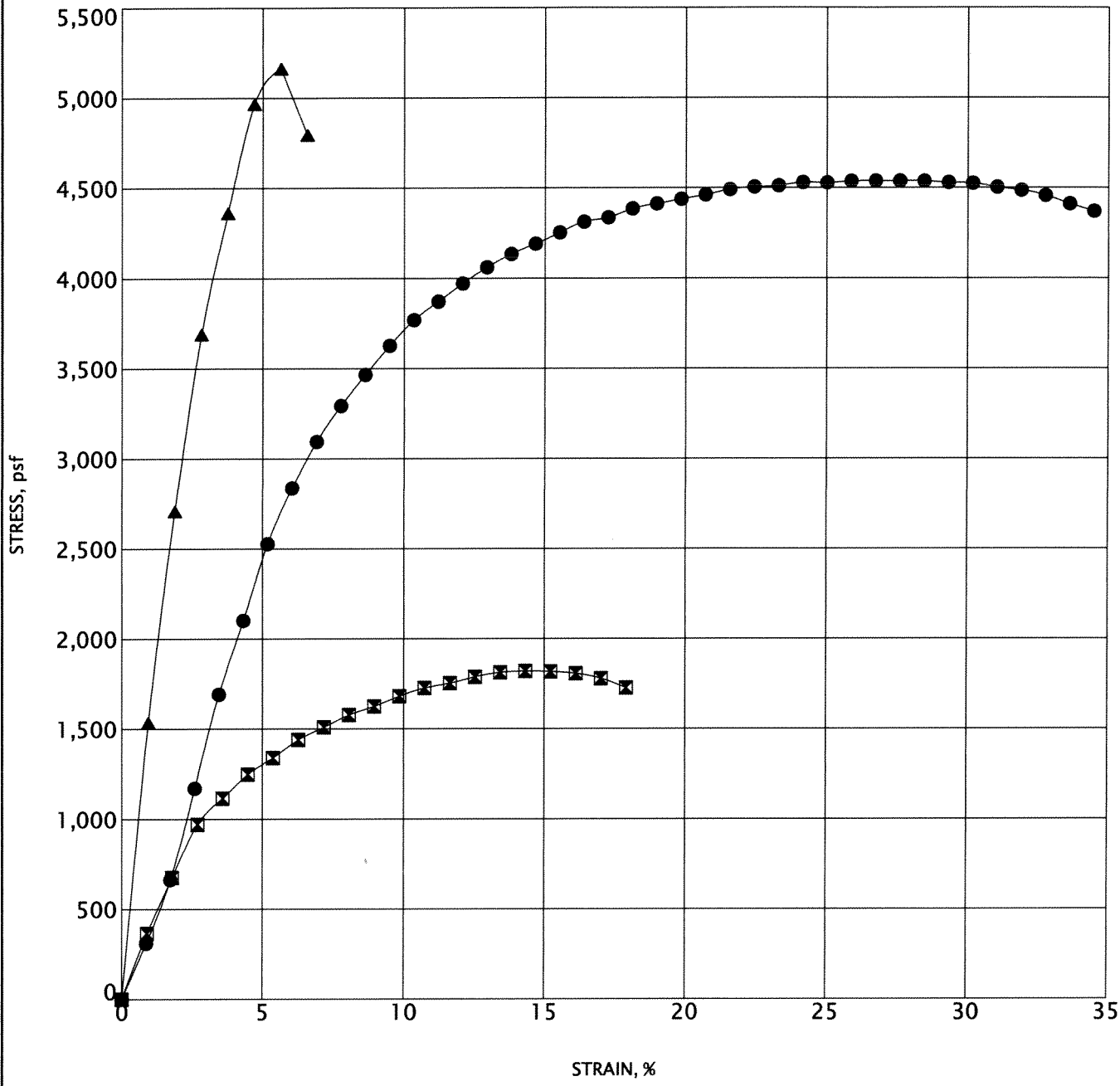
Water Level Observation:
9 feet during drilling operations; 11-1/2 feet upon completion

Notes:
Borehole collapsed at 15-1/2 ft after auger removal
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Borehole backfilled with auger cuttings

Figure No. 13

SOIL / PAVEMENT BORING 163137.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 6/24/16



Specimen		Classification	MC%	γ_d	UC
● B-03	S-06	Gray Silty Clay	16		4220
⊠ B-05	S-02	Brown and Gray Mottled Silty Clay	22		1820
▲ B-12	S-01	Brown Sandy Clay	12		5160

CONSULTING GROUP

UNCONFINED COMPRESSIVE STRENGTH TEST

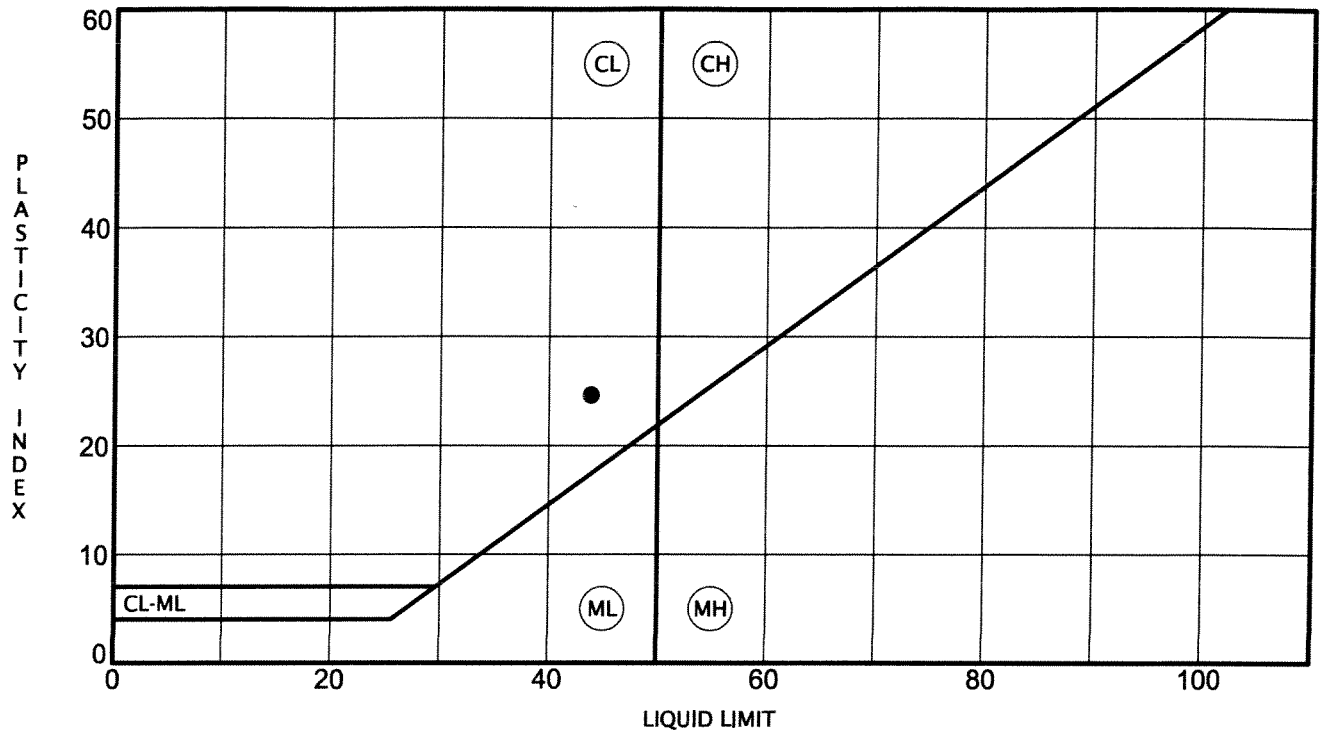
Project Name: Proposed Lake Access Parcels

Project Location: NW Corner of Main Street and Barker Road
Northfield Township, Michigan

G2 Project No.: 163137

Figure No. 14

US_UNCONFINED 163137.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 6/24/16



	Specimen Identification		LL	PL	PI	Fines	M %	Classification
●	B-06	S-01	44	19	25		20	Brown Silty Clay

ATTERBERG LIMITS RESULTS

CONSULTING GROUP

Project Name: Proposed Lake Access Parcels

Project Location: NW Corner of Main Street and Barker Road
Northfield Township, Michigan

G2 Project No.: 163137

Figure No. 15

US_ATTERBERG_LIMITS 163137.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 6/24/16

CONSULTING GROUP

GENERAL NOTES TERMINOLOGY

Unless otherwise noted, all terms herein refer to the Standard Definitions presented in ASTM 653.

PARTICLE SIZE

Boulders		- greater than 12 inches
Cobbles		- 3 inches to 12 inches
Gravel	- Coarse	- 3/4 inches to 3 inches
	- Fine	- No. 4 to 3/4 inches
Sand	- Coarse	- No. 10 to No. 4
	- Medium	- No. 40 to No. 10
	- Fine	- No. 200 to No. 40
Silt		- 0.005mm to 0.074mm
Clay		- Less than 0.005mm

CLASSIFICATION

The major soil constituent is the principal noun, i.e. clay, silt, sand, gravel. The second major soil constituent and other minor constituents are reported as follows:

Second Major Constituent (percent by weight)	Minor Constituent (percent by weight)
Trace - 1 to 12%	Trace - 1 to 12%
Adjective - 12 to 35%	Little - 12 to 23%
And - over 35%	Some - 23 to 33%

COHESIVE SOILS

If clay content is sufficient so that clay dominates soil properties, clay becomes the principal noun with the other major soil constituent as modifier, i.e. sandy clay. Other minor soil constituents may be included in accordance with the classification breakdown for cohesionless soils, i.e. silty clay, trace sand, little gravel.

Consistency	Unconfined Compressive Strength (psf)	Approximate Range of (N)
Very Soft	Below 500	0 - 2
Soft	500 - 1,000	3 - 4
Medium	1,000 - 2,000	5 - 8
Stiff	2,000 - 4,000	9 - 15
Very Stiff	4,000 - 8,000	16 - 30
Hard	8,000 - 16,000	31 - 50
Very Hard	Over 16,000	Over 50

Consistency of cohesive soils is based upon an evaluation of the observed resistance to deformation under load and not upon the Standard Penetration Resistance (N).

COHESIONLESS SOILS

Density Classification	Relative Density %	Approximate Range of (N)
Very Loose	0 - 15	0 - 4
Loose	16 - 35	5 - 10
Medium Compact	36 - 65	11 - 30
Compact	66 - 85	31 - 50
Very Compact	86 - 100	Over 50

Relative Density of cohesionless soils is based upon the evaluation of the Standard Penetration Resistance (N), modified as required for depth effects, sampling effects, etc.

SAMPLE DESIGNATIONS

AS - Auger Sample – Cuttings directly from auger flight
BS - Bottle or Bag Samples
S - Split Spoon Sample - ASTM D 1586
LS - Liner Sample with liner insert 3 inches in length
ST - Shelby Tube sample - 3 inch diameter unless otherwise noted
PS - Piston Sample - 3 inch diameter unless otherwise noted
RC - Rock Core - NX core unless otherwise noted

STANDARD PENETRATION TEST (ASTM D 1586) - A 2.0 inch outside- diameter, 1- 3/8 inch inside- diameter split barrel sampler is driven into undisturbed soil by means of a 140- pound weight falling freely through a vertical distance of 30 inches. The sampler is normally driven three successive 6- inch increments. The total number of blows required for the final 12 inches of penetration is the Standard Penetration Resistance (N).