CTI and Associates, Inc.
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July 12, 2012

Ms. Amy Kuras, Landscape Architect
City of Ann Arbor Parks and Recreation Services
301 E. Huron Street
Ann Arbor, Michigan 48104

RE: Geotechnical Investigation Addendum No. 1
Proposed Tennis Courts – Windemere Park
Ann Arbor, Michigan
CTI Project No. 3122040016

Dear Ms. Kuras:

As requested, CTI and Associates, Inc. (CTI) has completed a geotechnical evaluation for the proposed tennis courts to be constructed within the eastern portion of Windemere Park in Ann Arbor, Michigan. That report was dated May 11, 2012. On June 11, 2012, Ms. Amy Kuras, Landscape Architect with City of Ann Arbor Parks and Recreation Services requested that additional soil borings be performed in the western portion of Windemere Park, within the existing tennis court area. The additional services were performed in general accordance with the scope of services outlined in CTI Proposal No. 112PR02040-086 dated June 13, 2012 as authorized by City of Ann Arbor on June 15, 2012.

In general, the additional soil borings revealed random fill and organic soils to depths as great as 11 feet. These soils are extremely poor for the support of the proposed tennis courts without costly improvement. Given the expected costs of the proposed tennis courts, CTI estimates that total replacement or similar improvement of these soils will result in a ten-fold or greater increase in construction cost. Partial improvement of the soils at a reduced cost may be possible, but will significantly increase the risk of pavement distress, differential settlement, post deflection, and other signs of poor subgrade performance. Accordingly, CTI recommends construction of the tennis courts at an alternate site. The following sections detail the findings of the additional borings.

SITE AND PROJECT DESCRIPTION

The proposed development area is located in the western portion of Windemere Park. Windemere Park is located on the north side of Windemere Drive, between Charter Place and Markbarry Drive in Ann Arbor, Michigan.

CTI was informed on June 11, 2012 that the existing tennis courts may be reconstructed instead of developing a new tennis court area in the eastern portion of the park. The existing tennis courts have undergone some pavement distress with both horizontal and vertical displacement cracks, depressed areas, and both fence and net post foundations that have experienced lateral and vertical movement.

Soil boring logs performed within Windemere Park by ISC on April 12, 2011 were provided to CTI for reference. The test borings reveal poor soil and subsurface drainage conditions in the vicinity of the existing courts.

Based on the provided information, CTI understands that the proposed project will include the reconstruction of the tennis courts in the western portion of Windemere Park. We further understand that a pavement section consisting of 3 inches of asphalt over 6 inches of aggregate base material is desired. We anticipate that the footprint of the proposed courts will be approximately 108 feet wide by 120 feet long. We further anticipate that the courts will be surrounded by an approximately 10-foot high chain link fence.

INVESTIGATION PROCEDURES

Our field investigation consisted of drilling four test borings within the existing tennis court area, designated as B-6 through B-9. CTI had proposed to perform the borings to a depth of 10 feet below the existing site grades. However, due to the soil conditions encountered, Boring B-8 was extended to a depth of 17½ feet, and Borings B-7 and B-9 were performed to depths of 5 and 7½ feet, respectively. The boring locations were selected by CTI and City of Ann Arbor Parks and Recreation Services personnel. The borings were marked in the field by CTI personnel.

The approximate boring locations – both our original borings (B-1 through B-5) and the additional borings (B-6 through B-9) are shown on the Boring Location Plan included with this report. The estimated locations of borings SB-1 through SB-5, performed by ISC, are presented on the Boring Location Plan for reference.

The drilling operations were performed by Stearns Drilling personnel under the direction of CTI on June 21, 2012 utilizing a rotary head drilling rig. The soil borings were advanced using continuous flight hollow-stem augers with an inside diameter of 3¼ inches. Soil samples were obtained at intervals of 2½ feet to the explored depths of the borings. The soil samples were obtained by the Standard Penetration Test Method (ASTM D-1586), whereby a 2-inch outside diameter split-barrel sampler is driven into the soil with a 140-pound weight falling freely through a distance of 30 inches. The sampler is generally driven three successive 6-inch increments, with the number of blows for each increment being recorded. The number of blows required to advance the sampler the last 12 inches is termed the Standard Penetration Resistance, N. The soil samples obtained with the split-barrel sampler were sealed in glass jar containers and transported to our laboratory for further classification and testing. After completion of the drilling operations, the borehole was backfilled with excavated soil (i.e., auger cuttings).

The laboratory testing program determined the general soil classification and physical properties of recovered samples. All laboratory testing was performed in general accordance with applicable ASTM test method standards. The laboratory testing program consisted of visually classifying each collected soil sample in general accordance with the Unified Soil Classification System (USCS), and natural moisture content and loss-on-ignition (organic content) testing of selected samples. The unconfined compressive strength of selected cohesive samples was also estimated based on the resistance to a calibrated spring-loaded hand penetrometer. The results of all laboratory tests are indicated on the boring logs at the depths from which the samples were obtained.

Soil and groundwater conditions observed in the test borings have been evaluated and are presented on the boring logs included in the Appendix. To aid in understanding the data presented on the boring logs, "General Notes for Soil Classification," describing nomenclature used in soil descriptions, are also included in the Appendix. The soil descriptions reported on the test boring logs are based upon field logs prepared by experienced drillers with modifications made based on the results of laboratory testing and engineering review.

SUBSURFACE CONDITIONS

Soil Conditions

A pavement section consisting of approximately 6 inches of asphalt with 6 inches of gravel fill was encountered at the boring locations. Below the pavement section, clay fill containing varying amounts of organics was encountered within Borings B-6, B-8 and B-9 to depths of 5 to 7 feet below the existing pavement surface. Loss-on-Ignition testing indicated that the clay fill materials encountered within B-2, B-4 and B-5 had an organic content ranging from 2.3 percent to 3.7 percent.

The fill material encountered within B-8 was underlain by clayey peat to a depth of about 11 feet. Loss-on-Ignition testing indicated that the peat encountered within B-8 had an organic content of 73.0 percent.

Below the pavement section encountered at the location of B-7, below the fill encountered within B-6 and B-9, and below the clayey peat encountered within B-8, inorganic clay was encountered to the final explored depths of the borings. The clay encountered within B-7 was classified in the laboratory as "possible fill." In the absence of organics or foreign debris, it is difficult to distinguish between natural soils and clean fill soil within a relatively small diameter boring.
Typically, brown and gray clay was encountered to a depth of about 8 feet. Below a depth of 8 feet, the encountered clay was gray. Standard Penetration Test (SPT) resistances (N-values) within the inorganic brown and gray clay soils ranged from 4 to 7 blows per foot. The unconfined compressive strength of the tested brown and gray clay samples ranged from 2,000 pounds per square foot (psf) to 3,500 psf, indicating medium stiff to stiff consistencies.

N-values ranging from 2 to 5 blows per foot were recorded within the inorganic gray clay. The unconfined compressive strength of the tested gray clay samples ranged from less than 500 psf to 1,500 psf, indicating very soft to medium stiff consistencies.

The moisture contents of representative clay samples ranged from approximately 14 to 30 percent. The clay samples generally appeared to be in a moist condition when examined in the laboratory.

The stratification depths shown on the soil boring logs represent the soil conditions at the specific boring locations. Variations in the soil conditions may occur between and/or beyond the boring locations.

Groundwater Conditions

The drillers looked for indications of groundwater seepage both during and after drilling. Water was encountered during drilling within B-8 at a depth of about 16 feet. Collapse of the test borings upon removal of the augers precluded measurement of the groundwater level upon completion of the drilling operations. The remaining test borings were reported as dry both during and after drilling.

The short-term groundwater level observations from the borings are not necessarily indicative of the static, long-term groundwater conditions. The groundwater within cohesive soil deposits (clays) is typically confined within discontinuous sand or silt seams interbedded within the clay soil. Drilling operations in these soils have a tendency to seal off the paths of groundwater flow due to the slurry created during drilling. Seams of water-bearing sand or silt are possible at various depths and locations within the native clay soils. Groundwater seepage through the clays soils at this site will depend highly on the frequency of sand seams present within the soil.

Due to the inherent low permeability of the native clay soils, a long time would be required for the water level in an open borehole to stabilize with the long-term, hydrostatic groundwater level. It would be necessary to install and monitor a series of observation wells (piezometers) over an extended period of time to accurately determine the position of the long-term hydrostatic groundwater level in these soil conditions. The installation of groundwater monitoring wells was beyond the scope of our services for this project.

Normally, if a boring is drilled in cohesive soils, groundwater may not reach a static level immediately after drilling. The groundwater may rise or fall to a static level if the boring is left open for an extended period of time, possibly several days. The depth at which the soil color changes from brown to gray is often an indication of the long-term piezometric level. This color change generally results from the lack of oxidation in the soil below the zone of saturation. Based on the results of the test borings, the long-term piezometric level at this site appears to be at or below a depth of about 8 to 11 feet below the existing grades.

The groundwater conditions discussed herein and indicated on the soil boring logs represent those encountered at the time of the field investigation. The groundwater levels, including perched groundwater accumulations, should be expected to fluctuate seasonally, based on variations in precipitation, evaporation, surface run-off and other factors not evident at the time of our investigation.

The above soil and groundwater conditions represent a generalized summary of the subsurface conditions and material characteristics. The individual Test Boring Logs and Test Boring Location Plan should be reviewed for specific information and details relating to specific areas of the site.

RECOMMENDATIONS

As noted previously, approximately 5 to 7 feet of uncontrolled fill was encountered in three of the four borings performed. The boring performed in the center of the tennis court (B-8) revealed that a 4-foot thick layer of clayey peat is present below the uncontrolled fill material. A review of ISC's SB-2 shows that the soils in the southeast corner of the tennis court area consist of approximately 7 feet of fill, underlain by organic soils to a depth of almost 8 feet. These soils are not suitable to support the tennis courts and their appurtenant foundations. To ensure adequate performance of the constructed tennis courts, these soils would need to be completely excavated and replaced with inorganic, engineered fill. CTI anticipates that this solution would be cost-prohibitive. Therefore, a better solution is to construct the tennis courts on an alternative site and use the existing tennis court area for park features that are insensitive to differential settlement.

If the City elects to pursue the construction of the tennis courts on this site, it is possible to do so by applying partial subgrade improvement at reduced costs as follows. However, this approach has greater risk of poor performance in the future. Following the removal of the existing tennis court pavement section, net posts and fence, the resulting subgrade soils should be thoroughly proofrolled. The subgrade improvement and pavement recommendations contained in our original report should be applied, including the recommended drainage improvements. However, at this location, the aggregate base thickness should be increased to 12 inches. We further recommend that the existing berm be removed from the perimeter of the tennis court area to improve surface drainage.

The existing fill and organic soils are not considered suitable for support of the proposed fence post or net post foundations. The proposed fence posts and net posts can be supported on pier footings bearing on the medium stiff to stiff inorganic clay encountered below the uncontrolled fill and organic soils at this site. However, depending on the existing subgrade soils at the fence post and net post locations, some lateral instability may occur even if the foundations are extended to significant depths. Foundations placed on the medium stiff to stiff inorganic clay soils can be designed for a maximum net allowable soil bearing pressure of 1,500 psf.

We recommend that where the foundations extend through near-surface fill, a minimum embedment depth of 1 foot into the native medium stiff to stiff clay be achieved. It should be noted that at the location of B-8, the net post foundations should be extended through the very soft to soft clay encountered below the peat, to bear at a minimum depth of about 17 feet. Where foundation elements extend through the geogrid reinforcement, the geogrid should be cut to allow foundation excavation. Alternatively, the foundation elements could be constructed prior to the installation of the geogrid.

It is anticipated that the fence post and net post foundations will be excavated with an auger and have a minimum diameter of 6 inches. Due to the soils encountered, we recommend a full length temporary steel casing be used during foundation to prevent the fill, organic soils or very soft native clays from sloughing or squeezing into the excavation. CTI should be notified if a smaller diameter is used so that these

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recommendations can be adjusted.

Alternatively, the net posts may be able to be fitted with a 3-foot by 3-foot steel plate base and embedded in the pavement aggregate base (above the geogrid). This should help the lateral stability of the posts, but will not completely remove the risk of vertical and horizontal movement.

GENERAL COMMENTS

The evaluations and recommendations discussed in this report are based on the provided design drawings and the soil conditions encountered in the test borings performed at the approximate locations indicated on the attached Boring Location Plan and on the date indicated on the boring logs.

This letter should be considered as an addendum to our original report (CTI Project No. 3122040016, dated May 11, 2012). All evaluations, recommendations and conclusions presented in the original geotechnical report are still in effect except where they are specifically modified herein.

We appreciate the opportunity to provide continued service to you on this project. If you have any questions or require additional information, please contact our office.

Sincerely,

CTI and ASSOCIATES, INC.

Theresa M. Marsik, P.E.
Senior Project Engineer

Kevin Foye, Ph.D., P.E.
Project Engineer

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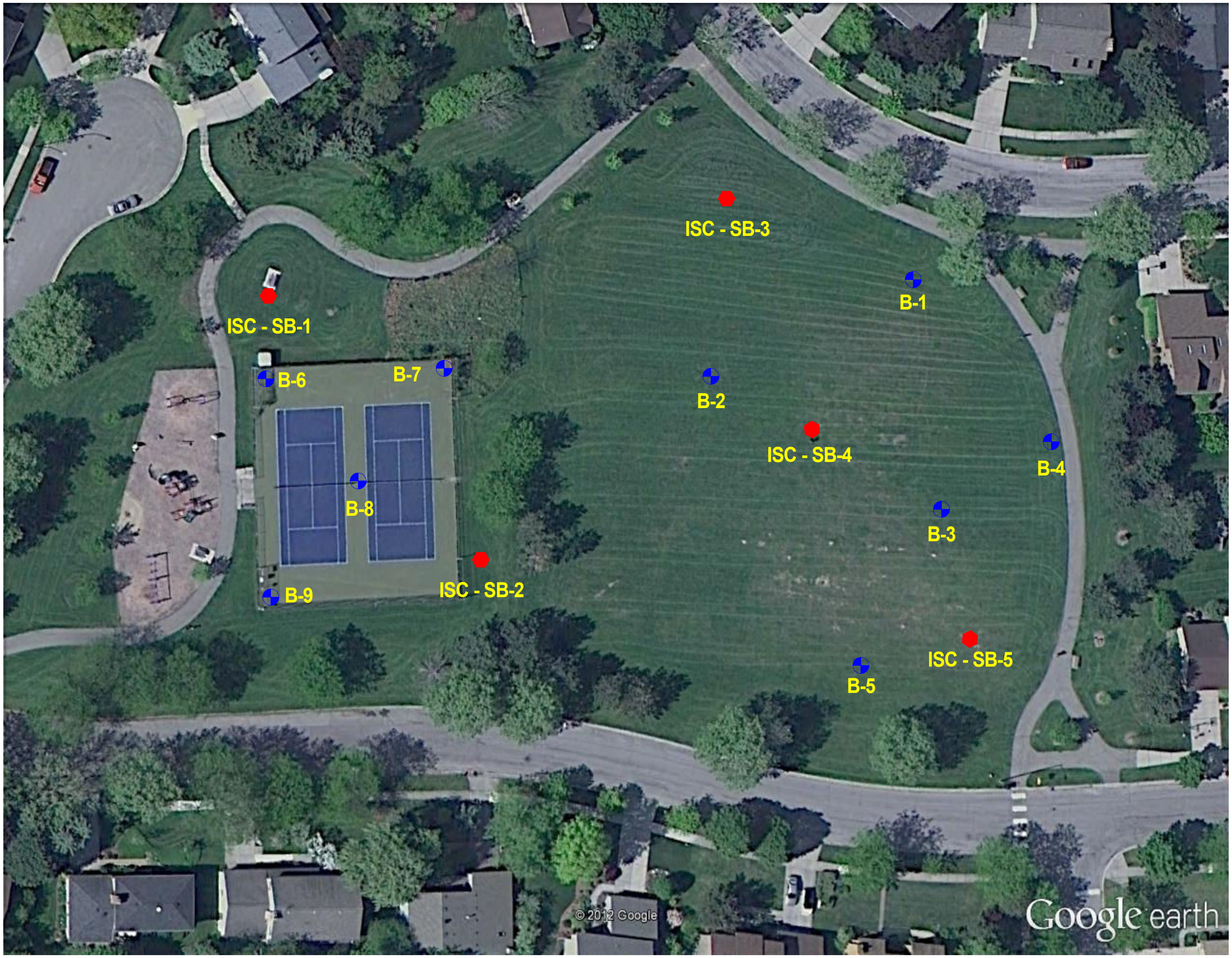

NOTE: IMAGE REPRODUCED FROM GOOGLE EARTH.

LEGEND:

- APPROXIMATE CTI BORING LOCATION
- ESTIMATED ISC BORING LOCATION

SCALE:	As Shown
PROJECT NUMBER:	3122040016 Add
FILE NAME:	BORINGPLAN.CAD
DATE:	6-29-12

BORING LOCATION PLAN

PROPOSED TENNIS COURTS -
WINDEMERE PARK
ANN ARBOR, MICHIGAN

PLATE:
I

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BORING NUMBER B-6

PAGE 1 OF 1

CLIENT City of Ann Arbor - Parks and Recreation Services

PROJECT NAME Proposed Tennis Courts - Windemere Park

PROJECT NUMBER 3122040016

PROJECT LOCATION Ann Arbor, Michigan

DATE STARTED 6/21/12 **COMPLETED** 6/21/12

GROUND ELEVATION N/A

DRILLING CONTRACTOR Stearns Drilling

GROUND WATER LEVELS:

DRILLING METHOD 4-1/4 inch Hollow Stem Auger

DURING DRILLING None

LOGGED BY J. Huntoon **CHECKED BY** T. Marsik

AFTER DRILLING None

NOTES Boring backfilled with auger cuttings and patched with cold patch

COLLAPSE DEPTH ---

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf) UNC. STRENGTH (psf)	NATURAL MOISTURE CONTENT (%)
0	6 inches of ASPHALT					
	6 inches of dark brown moist sandy GRAVEL - (FILL)					
	Brown and dark gray variegated moist CLAY with silt and traces of gravel, sand and organics - (FILL)	SS 1	100	2-3-5 (8)		
	Gray moist CLAY with silt and traces of sand and organics - (FILL) Organic Content = 3.7%	SS 2	100	1-1-1 (2)		
5						22
	Brown and gray variegated moist stiff CLAY with silt and trace of sand - (CL)	SS 3	100	2-2-3 (5)	1.25	
	Gray moist medium stiff CLAY with silt and trace of sand - (CL)	SS 4	100	2-3-2 (5)	0.75	
10						30

▲ SPT N VALUE ▲ (5, 10, 15, 20); PL — MC — LL (5, 10, 15, 20); ☐ FINES CONTENT (%) ☐ (20, 40, 60, 80)

Bottom of borehole at 10.0 feet.

BORING NUMBER B-7

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CLIENT City of Ann Arbor - Parks and Recreation Services

PROJECT NAME Proposed Tennis Courts - Windemere Park

PROJECT NUMBER 3122040016

PROJECT LOCATION Ann Arbor, Michigan

DATE STARTED 6/21/12 **COMPLETED** 6/21/12

GROUND ELEVATION N/A

DRILLING CONTRACTOR Stearns Drilling

GROUND WATER LEVELS:

DRILLING METHOD 4-1/4 inch Hollow Stem Auger

DURING DRILLING None

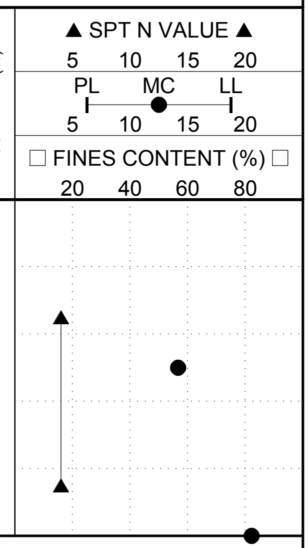
LOGGED BY J. Huntoon **CHECKED BY** T. Marsik

AFTER DRILLING None

NOTES Boring backfilled with auger cuttings and patched with cold patch

COLLAPSE DEPTH ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf) UNC. STRENGTH (psf)	NATURAL MOISTURE CONTENT (%)
0		6 inches of ASPHALT					
		6 inches of dark brown moist sandy GRAVEL - (FILL)					
		Brown and gray variegated moist stiff to medium stiff CLAY with silt, traces of gravel and sand and occasional sand partings - (CL/Possible FILL)	SS 1	100	2-2-2 (4)	1.75	14
5			SS 2	100	2-2-2 (4)	1.0	21



Bottom of borehole at 5.0 feet.

BORING NUMBER B-8

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CLIENT City of Ann Arbor - Parks and Recreation Services
PROJECT NAME Proposed Tennis Courts - Windemere Park
PROJECT NUMBER 3122040016
PROJECT LOCATION Ann Arbor, Michigan
DATE STARTED 6/21/12 **COMPLETED** 6/21/12
GROUND ELEVATION N/A
DRILLING CONTRACTOR Stearns Drilling
GROUND WATER LEVELS:
DRILLING METHOD 4-1/4 inch Hollow Stem Auger
DURING DRILLING 16'
LOGGED BY J. Huntoon **CHECKED BY** T. Marsik
AFTER DRILLING 14'
NOTES Boring backfilled with auger cuttings and patched with cold patch
COLLAPSE DEPTH 15'

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf) UNC. STRENGTH (psf)	NATURAL MOISTURE CONTENT (%)
0	6 inches of ASPHALT					
	6 inches of dark brown moist sandy GRAVEL - (FILL)					
	Brown, dark brown and dark gray variegated moist CLAY with silt and traces of gravel, sand and organics - (FILL)	SS 1	100	1-1-1 (2)		
		SS 2	100	1-2-1 (3)		
5						20
		SS 3	100	1-1-1 (2)		
	Dark brown moist very soft clayey PEAT - (PT)					
		SS 4	100	0-1-1 (2)		
10	Organic Content = 73.0%					389
	Gray moist very soft CLAY with silt, traces of gravel and sand and occasional sand partings - (CL)	SS 5	100	1-1-1 (2)	0.25	23
		SS 6	100	0-1-1 (2)	<0.25	
15						17
	Gray moist medium stiff CLAY with silt, traces of gravel and sand and occasional wet sand seams - (CL)	SS 7	100	2-2-3 (5)	0.75	19

▲ SPT N VALUE ▲ 5 10 15 20
PL MC LL 5 10 15 20
☐ FINES CONTENT (%) ☐ 20 40 60 80

Bottom of borehole at 17.5 feet.

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BORING NUMBER B-9

CLIENT City of Ann Arbor - Parks and Recreation Services

PROJECT NAME Proposed Tennis Courts - Windemere Park

PROJECT NUMBER 3122040016

PROJECT LOCATION Ann Arbor, Michigan

DATE STARTED 6/21/12 **COMPLETED** 6/21/12

GROUND ELEVATION N/A

DRILLING CONTRACTOR Stearns Drilling

GROUND WATER LEVELS:

DRILLING METHOD 4-1/4 inch Hollow Stem Auger

DURING DRILLING None

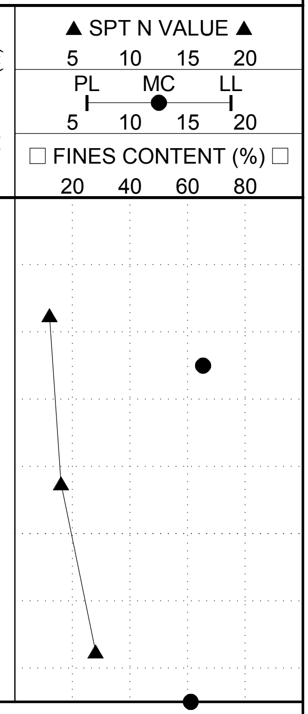
LOGGED BY J. Huntoon **CHECKED BY** T. Marsik

AFTER DRILLING None

NOTES Boring backfilled with auger cuttings and patched with cold patch

COLLAPSE DEPTH ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf) UNC. STRENGTH (psf)	NATURAL MOISTURE CONTENT (%)
0		6 inches of ASPHALT					
		6 inches of dark brown moist sandy GRAVEL - (FILL)					
		Brown and gray variegated moist CLAY with silt, traces of gravel and sand and occasional topsoil seams - (FILL) Organic Content = 2.3%	SS 1	100	2-2-1 (3)		16
			SS 2	100	3-2-2 (4)		
5		Brown and gray variegated moist stiff CLAY with silt and traces of gravel and sand - (CL)					
			SS 3	100	3-3-4 (7)	1.75	15



Bottom of borehole at 7.5 feet.

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SUMMARY OF LABORATORY RESULTS

CLIENT City of Ann Arbor - Parks and Recreation Services
PROJECT NAME Proposed Tennis Courts - Windemere Park
PROJECT NUMBER 3122040016
PROJECT LOCATION Ann Arbor, Michigan

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Unc. Strength (tsf)	Loss-on-Ignition (%)
B-6	5.0							22			3.7
B-6	7.5									1.25	
B-6	10.0							30		0.75	
B-7	2.5							14		1.75	
B-7	5.0							21		1.0	
B-8	5.0							20			
B-8	10.0							389			73.0
B-8	12.5							23		0.25	
B-8	15.0							17		<0.25	
B-8	17.5							19		0.75	
B-9	2.5							16			2.3
B-9	7.5							15		1.75	

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LOG OF TEST BORING

PROJECT: Windemere Park	
LOCATION: Ann Arbor, Michigan	
PROJECT NO. : 11340	BORING NO. : SB-1
DATE : 4/14/11	PAGE : 1 of 1

Elev. (ft)	SOIL DESCRIPTION	Depth
	Ground Surface	0.0'
↑ FILL	Stiff dark brown sandy CLAY TOPSOIL (grass)	0.9'
FILL	Stiff brown silty clayey SAND ▽	2.2'
FILL	Soft WET (2.2'-2.6')	2.6'
FILL	Medium brown sandy CLAY trace gravel ▼	4.1'
FILL	▽	4.5'
FILL	Loose WET (4.5'-5.1') brown clayey medium SAND with some organics and pockets of brown silty clay	5.1'
FILL ↓	Stiff dark brown sandy CLAY some organics	6.4'
	Stiff black sandy CLAY some peat	7.6'
	▽ Medium mottled dark brown and gray silty CLAY	8.1'
	Soft mottled dark brown and gray silty CLAY with WET thin seams of gray silty medium sand	8.9'
	Stiff mottled brown & gray silty CLAY	9.6'
	Very stiff mottled brown & gray silty CLAY	11.0'
	Hard mottled brown & gray silty CLAY ▽	16.5'
	Hard gray silty sandy CLAY trace gravel with WET thin seams of gray medium sand	22.0'
	Medium Compact WET gray med.SAND trace gravel	23.7'
	Hard gray silty CLAY trace gravel	25.0'
	END OF BORING - 25.0'	

Depth (ft)	Sample Type	Blows/ 6-Inches	SPT* (N)	Moisture Content (%)	Dry Density (pcf)	Shear Strength ** (psf)
1						
		3				3800
2		2				3800
	S-1	1	3			<1000
3						
4		3				2000
		3				
5	S-2	5	8			
6						
		3				3000
7		3				2100
	S-3	2	5			1800
8						
9		2				1100
		3				3000
10	S-4	4	7			6100
11						
12						
13						
14		8				
		11				>9000
15	S-5	15	26			
16						
17						
18						
19		6				
		8				7900
20	S-6	11	19			
21						
22						
23						
24		8				
		10				8500
25	S-7	12	22			

LEGEND	SAMPLE TYPE
Topsoil	S-Split spoon sample
Sand	LS- Liner sample
Clay	AS-Auger sample
Silt	BS-Bulk sample
Gravel	ST-Shelby tube
Concrete	C-Core

DRILLING INFORMATION

METHOD: 4" solid-stem augers

CO. / REP: G. Groenwood, P.E.

BACKFILL: Soil

REMARKS

*Standard Penetration Test (N) : Driving 2" OD Sampler 18" with 140# Hammer Falling 30", Count made at 6" Intervals.

** Shear Strength Determined by Pocket Penetrometer

FILL to 6.4'

GROUNDWATER

During: 2.2', 4.5', 8.1' & 16.5' ▽ | **0.5 Hrs After Completion: 4.1'** ▼

LOG OF TEST BORING

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PROJECT: Windemere Park	
LOCATION: Ann Arbor, Michigan	
PROJECT NO. : 1291	BORING NO. : SB-2
DATE : 4/14/11	PAGE : 1 of 1

Elev. (ft)	SOIL DESCRIPTION	Depth to base (ft)
	Ground Surface	0.0'
FILL	Loose dark brown silty clayey medium SAND TOPSOIL (grass)	0.5'
FILL	Stiff mottled light and dark brown sandy CLAY	1.9'
FILL	▽ Stiff mottled brown and gray silty sandy CLAY	3.0'
FILL	Stiff mottled brown and gray silty sandy CLAY with WET thin seams of brown silty medium sand	4.4'
FILL	▼ (5.2') Medium mottled brown and gray silty sandy CLAY	6.9
	▽ Soft mottled dark brown sandy CLAY TOPSOIL	7.8'
	Stiff to V. Stiff mottled dark & light gray silty CLAY with WET thin seams of dark gray silty clayey sand	9.4'
	V.stiff to hard mottled brown&gray silty sandy CLAY trace gravel	16.5'
	Hard gray & brown layers of silty sandy CLAY trace gravel	25.0'
	END OF BORING - 25.0'	

Depth (ft)	Sample Type	Blows/ 6-Inches	SPT* (N)	Moisture Content (%)	Dry Density (pcf)	Shear Strength ** (psf)
1		2				2500
2		3				2800
	S-1	2	5			
3						
4		2				2800
		2				
5	S-2	2	4			2000
6		2				
7		2				
	S-3	1	3			1000
8						
9		2				2400
		3				
10	S-4	5	8			5200
11						
12						
13						
14		7				6400
		10				9000+
15	S-5	13	23			
16						
17						
18						
19		6				
		8				9000+
20	S-6	10	18			
21						
22						
23						
24		6				
		9				9000+
25	S-7	13	21			

LEGEND	SAMPLE TYPE
Topsoil	S-Split spoon sample
Sand	LS- Liner sample
Clay	AS-Auger sample
Silt	BS-Bulk sample
Gravel	ST-Shelby tube
Concrete	C-Core

DRILLING INFORMATION

METHOD: 4" solid-stem augers

CO. / REP: G. Groenwood, P.E.

BACKFILL: Soil

REMARKS

*Standard Penetration Test (N) : Driving 2" OD Sampler 18" with 140# Hammer Falling 30", Count made at 6" Intervals.

** Shear Strength Determined by Pocket Penetrometer

FILL: to 6.9'

GROUNDWATER

During: 3.0' and 7.8' ▽ | 0.5 Hrs After Completion: 5.2' ▼

CTI and Associates, Inc.

GENERAL NOTES FOR SOIL CLASSIFICATION

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STANDARD PENETRATION TEST: Driving a 2" outside diameter, 1-3/8" inside diameter sampler a distance of 18 inches into undisturbed soil with a 140 pound hammer free falling a distance of 30 inches. The sampler is driven three successive 6-inch increments. The number of blows required for the last 12 inches of penetration is termed the Standard Penetration Resistance (N).

GROUNDWATER: Observations are made at the times indicated on logs. Porosity of soil strata, weather conditions and site topography may cause changes in the water levels.

SOIL CLASSIFICATION PROCEDURE: Classification on the logs is generally made by visual inspection. For fine-grained soils (silt, clay and combinations thereof), the classification is primarily based upon plasticity. For coarse-grained soils (sand and gravel), the classification is based upon particle size distribution. Minor soil constituents are reported as "trace" (0-5%), "some" (5-12%) and "with" (15-29%). Where the minor constituents are in excess of 29%, an adjective is used preceding the major constituent name (i.e. for sands containing 35% silt, the soil is classified as silty sand).

PARTICLE SIZE DISTRIBUTION

Boulders	-	Greater than 12 inches average diameter
Cobbles	-	3 inches to 12 inches
Gravel –		
Coarse	-	¾ inches to 3 inches
Fine	-	No. 4 (4.75mm) to ¾ inches
Sand –		
Coarse	-	No. 10 (2.00mm) to No. 4 (4.75mm)
Medium	-	No. 40 (0.425mm) to No. 10 (2.00mm)
Fine	-	No. 200 (0.075mm) to No. 40 (0.425mm)
Silt and Clay	-	Less than 0.075mm, Classification based upon plasticity. Generally silt particles size ranges from 0.005mm to 0.075mm and clay particle size is less than 0.005mm.

CONSISTENCY OF FINE GRAINED SOILS IN TERMS OF UNCONFINED COMPRESSIVE STRENGTH AND N-VALUES

Consistency	Unconfined Compressive Strength (Tons per square foot)	Approximate range of N
Very Soft	Less than 0.25	0 - 2
Soft	0.25 to 0.5	3 - 4
Medium Stiff	0.5 to 1.0	5 - 8
Stiff	1.0 to 2.0	9 - 15
Very Stiff	2.0 to 4.0	16 - 30
Hard	over 4.0	over 31

RELATIVE DENSITY OF COARSE GRAINED SOILS ACCORDING TO N-VALUES

Density Classification	Relative Density, %	Approximate Range of N
Very Loose	0 – 15	0 – 4
Loose	16 – 35	5 – 10
Medium Dense	36 - 65	11 - 30
Dense	66 - 85	31 – 50
Very Dense	86 – 100	over 50

Relative density of cohesionless soils is based upon an evaluation of the Standard Penetration Resistance (N), modified as required for overburden pressure.