Infrastructure Engineering Solutions

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GEOTECHNICAL & ENVIRONMENTAL DATA REPORT

LAKE OKONOKA AND SOUTH SHORE
HABITAT RESTORATION
BELLE ISLE, DETROIT, MICHIGAN

Client:
Friends of the Detroit River

Prepared for:

SMITHGROUPJJR

SmithGroupJJR
201 Depot St., Second Floor
Ann Arbor, MI 48104

2015005A
September 17, 2015

Somat Engineering, INCORPORATED

Somat Engineering, INCORPORATED

September 17, 2015
2015005A

Mr. Paul Evanoff
SmithGroupJJR
201 Depot St., Second Floor
Ann Arbor, MI 48104

RE: Geotechnical Data Report
Lake Okonoka and South Shore Habitat Restoration
Belle Isle, Detroit, Michigan

Dear Mr. Evanoff:

We have completed the geotechnical investigation for the Lake Okonoka and South Shore habitat restoration located on Belle Isle in Detroit, Michigan. This report presents the results of our understanding of the project, a description of our field investigation, the results of the field and laboratory tests, the logs of test borings, our interpretation of subsoil and groundwater conditions.

The soil samples collected during our field investigation will be retained in our laboratory for 60 days from the date of this final report, at which time these samples will be discarded unless otherwise directed by you.

It was a pleasure working with you on this project. If you have any questions regarding this report, please do not hesitate to contact us.

Sincerely,
Somat Engineering, Inc.

Jonathan D. Zaremski, P.E.
Project Manager

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LAKE OKONOKA AND SOUTH SHORE HABITAT RESTORATION
BELLE ISLE, DETROIT, MICHIGAN

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GEOTECHNICAL & ENVIRONMENTAL DATA REPORT
LAKE OKONOKA AND SOUTH SHORE HABITAT RESTORATION
BELLE ISLE, DETROIT, MICHIGAN

1.0 INTRODUCTION

1.1 GENERAL

Upon authorization from SmithGroupJJR (SGJJR) of Ann Arbor, Michigan, Somat Engineering, Inc. (Somat) has conducted a geotechnical investigation for the Lake Okonoka and South Shore habitat restoration, located on Belle Isle in Detroit, Michigan. The geotechnical investigation was performed in general accordance with Somat Proposal No. P1140453, dated January 13, 2015.

The following sections of this report will provide our understanding of the project, a description of our field investigation, the results of the field and laboratory tests, the logs of test borings, our interpretation of subsoil and groundwater conditions.

1.2 PROJECT INFORMATION

The project consists of the rehabilitation of the habitats at two sites: Lake Okonoka and the South Shore at Belle Isle. The two sites are located on the south side at the east end of the island. The main purpose of the project is to restore the natural habitats on the island and increase fish and wildlife populations.

As we understand, the Lake Okonoka project will include establishing hydraulic connections between Blue Heron Lagoon and Lake Okonoka and between the south side of Lake Okonoka to the Detroit River. The project will also include excavation of lake sediment to improve lake hydrologic functions. We understand the sediment is proposed to be placed on the adjacent lawn areas around the lake. The volume of dredging is estimated at 4,000 cubic yards or less. The South Shoreline project is located west and directly downstream from the South Fishing Pier and includes habitat modifications.

A geotechnical investigation was performed to aid in the proposed rehabilitation design. The investigation included sediment sampling and environmental testing in Lake Okonoka;

geotechnical soils borings around Lake Okonoka; and sediment probes (without sampling) at the South Shore.

1.3 SITE CONDITIONS

Lake Okonoka and the South Shoreline are both located at the east end of Belle Isle along the southern shore. Lake Okonoka is generally bounded by Woodside Drive, The Strand Street, and Lakeside Drive. The lake covers an area of approximately 24 acres with several small islands throughout.

The South Shoreline is located on the southeast side of Belle Isle, downstream of the existing South Fishing Pier. The proposed area of restoration along the shoreline is approximately 2,500 feet, extending west from the west side of the South Fishing Pier.

2.0 SUBSURFACE INVESTIGATION

2.1 LAKE OKONOKA FIELD EXPLORATION

The field exploration program for the Lake Okonoka habitat restoration project consisted of performing soil borings on the shore in the area surrounding Lake Okonoka and performing sediment cores at various locations within the lake.

In total, four (4) soil borings were performed around the perimeter of Lake Okonoka, each extending to a depth of 15 feet below existing grade. The borings were designed as B-01 to B-04. Six (6) sediment cores were performed within the lake, each extending to a depth ranging between 3 and 5 feet below the surface of the water in the lake. The sediment cores were designed as C-01 to C-06. Four (4) sediment probes were performed at the South Shore, designated as P-01 to P-04.

The locations of the soil borings, sediment cores and sediment probes were selected by Somat and approved by SGJJR. The final locations were staked by Somat, taking into consideration the locations of the utilities (underground and overhead). The final locations were also adjusted for access of the sediment core sampling equipment; which required a water depth of 1.5 feet or less and sediment probe equipment which required 10 feet of water or less. Approximate coordinates were determined in the field by a hand-held GPS device. Ground surface elevations were not available at the time of writing this geotechnical data report. A location diagram is presented in Appendix A showing the locations of the soil borings, sediment cores and sediment probes. The logs of soil borings, sediment cores and sediment probes are included in Appendix B.

2.1.1 Fieldwork Operations

The soil borings and sediment cores were performed on May 13 and May 14, 2015. The sediment probes were performed on June 11, 2015. The soil borings were drilled using 2¼-inch diameter hollow stem augers. Upon completion, all the borings were backfilled with soil cuttings. One (1) duplicate soil boring sample was obtained as part of the project QAQC procedure.

The sediment cores were performed with an Argo rig using drive core sampling equipment. The cores were collected in clear, cellulose acetate butyrate (CAB) liners. It should be noted that no standard penetration blow count data is available from these samples to indicate the apparent density of granular materials or consistency of cohesive soils. All soil information provided by the sediment cores is qualitative. Where standing water was present, the depth of water was determined by use of weighted tape. One (1) duplicate sediment sample was obtained as part of the project QAQC procedure. Photographs of the sediment cores are included in Appendix E.

The sediment probes were performed with a steel rod. The depth of water was determined by use of weighted tape. The thickness of the soft sediment was recorded at each location. A visual observation of the material was made by the field engineer when possible.

2.1.2 Standard Penetration Test (SPT)

Soil samples collected from the soil borings during the drilling portion of the subsoil exploration were labeled with the soil boring designation and a unique sample number. Soil boring samples were obtained by Standard Penetration Tests in general accordance with ASTM D-1586 procedures, whereby a conventional 2-inch O.D. split-spoon sampler is driven into the soil with a 140 pound hammer repeatedly dropped through a free-fall distance of 30 inches. The sampler is generally driven three successive 6-inch increments, with the blows for each 6-inch increment being recorded. The number of blows required to advance the sampler through 12 inches after an initial penetration of 6 inches, is termed the Standard Penetration Test resistance (N-value) and is presented graphically on the individual Logs of Test Borings. As added information, the number of blows for each 6-inch increment are also presented on the soil boring logs.

2.1.3 Sampling

Soil samples from the borings were recovered using split-spoon sampling procedures in general accordance with ASTM Standard D-1586 ("Standard Method for Penetration Tests and Split Barrel Sampling of Soils"). The samples were obtained at a regular interval of 2½ feet to a depth of 10 feet below grade and at an interval of 5 feet thereafter to the exploration depth of the borings. The samples were sealed in glass jars in the field to protect the soil and maintain the soil's natural moisture content. All soil samples obtained from the soil borings were transported to Somat's laboratory for further analysis and testing.

Sediment samples were obtained by driving a metal probe with a 4-inch diameter CAB liner. The core was driven into the sediment until refusal. The sediment is collected inside the liner, and is extracted with the drive core sampling equipment. The soil in the CAB liner is visually observed and classified, and the depth of the sediment is recorded. Selected sediment samples were collected for chemical analyses, which included testing for 12 metals, PCBs, and PNAs. The samples were sent to Quantum Laboratories, Inc. in Wixom, Michigan for chemical analyses under chain-of-custody protocol.

The soil samples (other than the ones sent to the chemical lab and those noted above) will be retained in our lab for a period of 90 days from the date of the final report and will then be disposed of unless directed otherwise.

2.1.4 Groundwater Level Observation Procedures

Whenever possible, groundwater level observations were made during the drilling operations and immediately after completion of drilling, and are shown on the individual Logs of Test Borings.

During drilling, the depth at which free water was observed, where drill cuttings became saturated or where saturated samples were collected, was indicated as the groundwater level during drilling. In granular, pervious soils, the indicated water levels are considered relatively reliable when solid or hollow-stem augers are used for drilling. However, in cohesive soils, groundwater observations are not necessarily indicative of the static water table due to the low permeability rates of the soils, and due to the sealing off of natural paths of groundwater flow during drilling operations.

It should be noted that seasonal variations and recent rainfall conditions may influence the level of the groundwater table and significantly. Groundwater observation wells are generally used if precise groundwater table information is needed, however the installation of wells was not deemed critical for this preliminary design stage of this project. For the purposes of this investigation and the scope of the project, our experience with the soil and groundwater conditions in this area should provide for reasonable approximation of the groundwater level.

2.2 GEOTECHNICAL LABORATORY TESTING

All soil samples were classified in general accordance with the Unified Soil Classification System. Representative soil samples were subjected to laboratory tests consisting of moisture content determinations, Torvane tests, hand penetrometer and Loss on Ignition (LOI) tests. Results are included on the respective logs of test borings in Appendix B. All laboratory tests were performed in general accordance with applicable ASTM procedures.

In the hand penetrometer test, the shear strength of a cohesive soil sample is estimated by measuring the resistance of the sample to the penetration of a small, calibrated spring-loaded cylinder. The maximum capacity of the penetrometer is 4.5 tons per square foot.

In the Torvane test, the shear strength of a cohesive soil sample is estimated by measuring the resistance of the sample in shear when twisting a small, calibrated spring-loaded vane pressed into the sample.

Standard Test Methods for Loss on Ignition (LOI) of Solid Combustion Residues were performed according to ASTM D7348 on soil samples suspected to contain organics. The soil sample is super-heated as a means to burn off all present organic matter and the percentage of organic matter is then calculated.

2.3 CHEMICAL TESTING

Soil samples were sent to Quantum Laboratories, Inc. in Wixom, Michigan for specific chemical analyses under chain-of-custody protocol. Each sediment sample was tested for the following chemical tests.

Parameter	Method
METALS	
Arsenic	SM6020
Barium	SM6020
Cadmium	SM6020
Chromium	SM6020
Copper	SM6020
Lead	SM6020
Manganese	SM6020
Mercury	SM7471
Nickel	SM6020
Selenium	SM6020
Silver	SM6020
Zinc	SM6020
PCBs	SM8082
PNAs	SM8270

The sediment samples sent for chemical testing were generally selected from the top portion of the sediment core; from the upper 6 to 26 inches. A total of seven (7) samples were sent to a chemical lab for testing, including each of the six sediment samples and one (1) duplicate. The results of the testing are included in Appendix C. A summary table of the samples depths and identification numbers is also presented below:

Sediment Core Sample	Sample Depth (ft)	Sample ID
C-01	0 to 0.9	S-2015005-JTC-006
C-02	0 to 0.5	S-2015005-JTC-005
C-03	0 to 1	S-2015005-JTC-007
C-04	0 to 2.1	S-2015005-JTC-001
C-04A	0 to 2.1 (Duplicate Sample)	S-2015005-JTC-002
C-05	0 to 0.5	S-2015005-JTC-004
C-06	0 to 0.6	S-2015005-JTC-003

2.4 LIMITATIONS

The scope of our services for the soil borings did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater or air, on, below or around this site. This investigation was strictly geotechnical and did not include any environmental investigation other than the chemical testing performed on the sediment samples as referenced above.

3.0 SUBSURFACE CONDITIONS

3.1 SOIL STRATIFICATION

Soil conditions encountered at the soil boring locations have been evaluated and are presented in the form of Logs of Test Borings. The Logs of Test Borings presented in Appendix B include approximate soil stratification with detailed soil descriptions and selected physical properties for each stratum encountered in the soil borings and sediment cores. In addition to the observed subsoil stratigraphy, the soil boring logs present information relating to sample data, Standard Penetration Test results, groundwater level conditions observed in the boring, personnel involved, and other pertinent data. For information, and to aid in understanding the data as presented on the boring logs, General Notes defining nomenclature used in soil descriptions are presented immediately following the Logs of Test Borings in Appendix B. It should be noted that the Logs of Test Borings included with this report have been prepared on the basis of laboratory classifications as well as field observations and logs of the soils encountered.

3.1.1 Lake Okonoka Soil Borings

A generalized description of the soils encountered in soil borings SB-01 through SB-04 is provided below, beginning at the existing ground surface and proceeding downward:

Stratum 1: Topsoil.
Topsoil was encountered at the surface of all four soil borings. The thickness of the topsoil ranged between 2 and 4 inches.

Stratum 2: Fill.
Fill soils consisting of silty clay, clayey sand, or a mixture of these soils were encountered below the surface material in soil borings SB-02 and SB-03. The fill soils extended to a depth of 3 feet below existing grade. The consistency of the cohesive fill soils was stiff.

Stratum 3: Peat.
Peat was encountered below the fill material in soil boring SB-02. The peat extended to a depth of 5.5 feet below existing grade. An LOI test determined the organic content was 12% at a depth of 5 feet below existing grade.

Stratum 4: Clay.
Native soils consisting of silty clay was encountered in all four soil borings and extended to the termination depth of the soil borings at 15 feet below existing grade. The consistency of the cohesive fill soils ranged from hard to soft. LOI tests determined the organic content as summarized below:

Soil Boring	Sample Depth	Organic Content
SB-01	2.5	5.8%
SB-02	7.5	2.7%
SB-02	10	2.3%
SB-03	4.5	3.0%
SB-04	2.5	7.0%

A loose sand layer was encountered within the clay stratum in soil boring SB-03 from a depth of 4.5 to 8.5 feet below existing grade. An LOI tests and duplicate sample determined the organic content was 3.9% and 6.9% at the sample depth of 5 feet.

3.1.2 Lake Okonoka Sediment Cores

A generalized description of the soils encountered in sediment cores C-01 through C-06 is provided below, beginning at the existing water level surface and proceeding downward:

Stratum 1: Water.
Water was encountered to a depth ranging between 0.8 and 1.6 feet.

Stratum 2: Sediment - Clayey Silt/Silty Fine Sand/Sand
Clayey silt, silty sand or sand materials were encountered at the surface of the sediment cores, except C-02. The material extended to depths ranging from 1.8 to 3.7 feet below the water level surface (thickness of 4.8 to 25.2 inches). The material included trace to some gravel, organics, and frequent roots and root mats.

Stratum 3: Silty/Sandy Clay (Possible fill).
Silty clay and/or sandy clay was encountered at the surface of C-02 and below Stratum 1 in the remaining borings. The clay extended to the termination depth of the drive core at depths of 3 to 4.9 feet below the water surface. The clay included trace to some roots, root mats, organics, sand and gravel. In C-02 frequent red brick fragments were observed above depth 1.2 feet below water level. In C-06 the silty clay encountered frequent sand seams and pockets. This material is possible fill material.

3.1.3 South Shore Sediment Probes

A generalized description of the soils encountered in sediment probes P-01 to P-04 is provided below, beginning at the existing water level surface and proceeding downward:

Stratum 1: Water.
Water was encountered to a depth ranging between 6.2 and 8.3 feet.

Stratum 2: Soft Sediment
The soft sediment thickness ranged from 4 to 48 inches as determined by the probe.

Stratum 3: Clayey Silt/Silty sand /Silty clay
Clayey silt and silty sand was observed below the soft sediment as reported by the engineer. These materials were overlying silty clay. No samples were obtained. The probes terminated at depths of 18 to 48 inches below the river bottom.

3.2 GROUNDWATER LEVEL OBSERVATIONS

During the drilling process, groundwater was encountered during drilling and/or upon completion of drilling in the soil borings and ranged generally between 3.5 and 4.0 feet in depth below existing grades.

It should be noted that the elevation of the perched or natural groundwater table is likely to vary throughout the year depending on the amount of precipitation, runoff, evaporation and percolation in the area, as well as on the water level of surface water bodies in the vicinity affecting the groundwater flow pattern.

3.3 SUMMARY OF CHEMICAL ANALYSIS ON SEDIMENT SAMPLES

The laboratory analytical reports are included in Appendix C. A summary of the chemical results is presented in Appendix D for reference.

Six of the seven samples reported metals higher than the Michigan statewide default background levels. Some of the samples exceeded the background levels for Arsenic, Barium, Selenium and Zinc. However, not all samples exceeding the statewide default values exceed the regional background levels-criteria study published by MDEQ in 2005 for southeast Michigan, Erie-Huron Lobe. The regional levels are also included for reference. The values exceeding the default statewide background levels are reported in bold.

4.0 GENERAL QUALIFICATIONS

This report and the attached Logs of Test Borings are instruments of service, which have been prepared in accordance with generally accepted soil and foundation engineering practices.

The contents of this report have been prepared in order to aid in the evaluation of expected subsoil properties to assist the engineer in the design of this project. Since the information obtained from test borings is specific to the exact test boring locations, soil and water information could be different from those occurring at other locations of the site. This report does not reflect variations that may occur between the borings. The nature and extent of these variations may not become evident until the time of construction.

We expect that the Logs of Test Borings included in this report will assist you in designing the proposed structures. If you have any questions regarding this report, please contact us.

APPENDIX A

SOIL BORING AND SEDIMENT PROBE/CORE LOCATION DIAGRAM

SEDIMENT PROBES (P-1 TO P-4) SOIL BORINGS (SB-1 TO SB-4) SEDIMENT SAMPLES (C-1 TO C-6)

Applicant:	Project:	Project Location:	Soil boring location	Sheet Title:	Sheet:
Somat Engineering, Inc. 660 Woodward Ave, suite 2430 Detroit, Michigan 48226	Belle Isle Lake Okonoka & South Shoreline Habitat Restoration	Belle Isle City of Detroit, Wayne County, MI	diagram adapted from GoogleEarth	Location Diagram, Overall Plan	1 of 5 Date Prepared: 6-30-2015

APPLICANT: SOMAT ENGINEERING, INC. 660 WOODWARD AVE, SUITE 2430 DETROIT, MICHIGAN 48226	PROJECT: BELLE ISLE LAKE OKONOKA & SOUTH SHORELINE HABITAT RESTORATION	PROJECT LOCATION: BELLE ISLE CITY OF DETROIT, WAYNE COUNTY, MI	SOIL BORING LOCATION DIAGRAM ADAPTED FROM GOOGLEEARTH	SHEET TITLE: LOCAITON DIAGRAM SOUTH SHORELINE SEDIMENT PROBES	SHEET: 2 OF 5 DATE PREPARED: 6-30-2015

▲ SEDIMENT PROBES (P-1 TO P-4)

SOIL BORINGS (SB-1 TO SB-2)   SEDIMENT SAMPLES (C-1 TO C-3)

Applicant:	Project:	Project Location:	Soil boring location	Sheet Title:	Sheet:
Somat Engineering, Inc. 660 Woodward Ave, suite 2430 Detroit, Michigan 48226	Belle Isle Lake Okonoka & South Shoreline Habitat Restoration	Belle Isle City of Detroit, Wayne County, MI	diagram adapted from GoogleEarth	Locaiton Diagram Soil Borings & Sediment Samples	3 of 5 Date Prepared: 6-30-2015

SOIL BORING (SB-3)   SEDIMENT SAMPLES (C-3 TO C-5)

Applicant: Somat Engineering, Inc. 660 Woodward Ave, suite 2430 Detroit, Michigan 48226	Project: Belle Isle Lake Okonoka & South Shoreline Habitat Restoration	Project Location: Belle Isle City of Detroit, Wayne County, MI	Soil boring location diagram adapted from GoogleEarth	Sheet Title: Locaiton Diagram Soil Borings & Sediment Samples	Sheet: 4 of 5 Date Prepared: 6-30-2015

SOIL BORING (SB-4) SEDIMENT SAMPLES (C-5 TO C-6)

APPLICANT: SOMAT ENGINEERING, INC. 660 WOODWARD AVE, SUITE 2430 DETROIT, MICHIGAN 48226	PROJECT: BELLE ISLE LAKE OKONOKA & SOUTH SHORELINE HABITAT RESTORATION	PROJECT LOCATION: BELLE ISLE CITY OF DETROIT, WAYNE COUNTY, MI	SOIL BORING LOCATION DIAGRAM ADAPTED FROM GOOGLEEARTH	SHEET TITLE: LOCAITON DIAGRAM SOIL BORINGS & SEDIMENT SAMPLES	SHEET: 5 OF 5 DATE PREPARED: 6-30-2015

APPENDIX B

LOGS OF TEST BORINGS AND SEDIMENT CORES AND GENERAL NOTES

PROJECT NO. 2015005A **DATE** 5/13/2015 **LOG OF SEDIMENT CORE C-01**

ELEVATION ft	LOG OF SOIL PROFILE	Depth	DEPTH (ft)	SAMPLE TYPE	SAMPLE RECOVERY (inches)	PID READING (PPM)	SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS (Sample ID at sample depth)
	Water Surface Elevation		0				
	Water	1.2					
	SEDIMENT - CLAYEY SILT with root mat and organics, gray (ML)	2.1		CT1			S-2015005-051315-JTC-006 composite sample obatined for top 10-inches of core.
	SILTY CLAY with roots and organics, gray (CL) (Possible fill)	2.6					
	SILTY CLAY, trace sand, mottled gray and brown (CL) (Possible fill)	3.3					
	SILTY CLAY, trace sand and gravel, gray and brown (CL) (Possible fill)	4.0					
	End of Core at 3.95 ft.		5				
			10				

BORING COORDINATES

Notes:
CT= Acetate Core Tube

Remarks:
GPS Coordinates: Latitude 42.33991°, Longitude -82.9683°

Engineer on Rig: J. Cunningham
Sampling Method: Vibracore
Date Started: 05-13-15
Date Completed: 05-13-15
Checked By: CJW

Somat Engineering

Lake Okonoka and South Shore Habitat Restoration
Belle Isle, Detroit, Michigan

PROJECT NO. 2015005A **DATE** 5/13/2015 **LOG OF SEDIMENT CORE C-02**

ELEVATION ft	LOG OF SOIL PROFILE	Depth	DEPTH (ft)	SAMPLE TYPE	SAMPLE RECOVERY (inches)	PID READING (PPM)	SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS (Sample ID at sample depth)
	Water Surface Elevation		0				
	Water	0.8					
	FILL - SILTY CLAY with root mat and organics, frequent red brick and cobble fragments, brown (CL)	1.2		CT1			S-2015005-051315-JTC-005 composite sample obatined for top 6-inches of core.
	SILTY CLAY with roots and organics, gray (CL) (Possible fill)	1.6					
	Field Engineer reported 2-inch sand seam, gray (Possible fill)	1.8					
	SILTY CLAY trace sand and gravel, brown and gray (CL) (Possible fill)	2.8					
	SILTY CLAY trace gravel, brown and gray (CL) (Possible fill)	3.1					
	End of Core at 3.1 ft.		5				
			10				

BORING COORDINATES

Notes:
CT= Acetate Core Tube

Remarks:
GPS Coordinates: Latitude 42.3404°, Longitude -82.9661°

Engineer on Rig: J. Cunningham
Sampling Method: Vibracore
Date Started: 05-13-15
Date Completed: 05-13-15
Checked By: CJW

Somat Engineering

Lake Okonoka and South Shore Habitat Restoration
Belle Isle, Detroit, Michigan

PROJECT NO. 2015005A **DATE** 5/13/2015 **LOG OF SEDIMENT CORE C-03**

ELEVATION ft	LOG OF SOIL PROFILE	Depth	DEPTH (ft)	SAMPLE TYPE	SAMPLE RECOVERY (inches)	PID READING (PPM)	SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS (Sample ID at sample depth)
	Water Surface Elevation		0				
	Water	0.8					
	SEDIMENT - SILTY FINE SAND, some root mats and organics, frequent cobbles (SM)	1.3		CT1			S-2015005-051315-JTC-007 composite sample obatined for top 12-inches of core.
	SEDIMENT - FINE TO MEDIUM SAND, frequent sandy clay pockets, brown (SP)	1.8					
	SILTY CLAY, trace sand and gravel, brown and gray (CL) (Possible fill)	3.0					
	End of Core at 3 ft.		5				
			10				

BORING COORDINATES

Notes:
CT= Acetate Core Tube

Remarks:
GPS Coordinates: Latitude 42.3401°, Longitude -82.9648°

Engineer on Rig: J. Cunningham
Sampling Method: Vibracore
Date Started: 05-13-15
Date Completed: 05-13-15
Checked By: CJW

Somat Engineering

Lake Okonoka and South Shore Habitat Restoration
Belle Isle, Detroit, Michigan

PROJECT NO. 2015005A **DATE** 5/13/2015 **LOG OF SEDIMENT CORE C-04**

LOG OF SOIL PROFILE				FIELD DATA			
ELEVATION ft	Description	Depth	DEPTH (ft)	SAMPLE TYPE	SAMPLE RECOVERY (inches)	PID READING (PPM)	SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS (Sample ID at sample depth)
	Water Surface Elevation		0				
	Water	1.6					
	SILTY SAND SEDIMENT, trace leaves and root mats	1.9		CT1			S-2015005-051315-JTC-001 and S-2015005-051315-JTC-002 composite sample obatined for top 26-inches of core.
	SEDIMENT-SILTY SAND, trace root mat and organics, brown (SM)	3.2					
	SEDIMENT - FINE TO MEDIUM SAND AND GRAVEL, gray	3.7					
	Heavy ORGANIC ROOT MAT, trace sand	4.0					
	SILTY CLAY, gray (CL) (Possible fill)	4.9	5				
	End of Core at 4.9 ft.		10				

BORING COORDINATES

Engineer on Rig: J. Cunningham
Sampling Method: Vibracore
Date Started: 05-13-15
Date Completed: 05-13-15
Checked By: CJW

Notes:
CT= Acetate Core Tube

Remarks:
GPS Coordinates: Latitude 42.34065°, Longitude -82.96107°. Duplicate sample collected.

Somat Engineering

Lake Okonoka and South Shore Habitat Restoration
Belle Isle, Detroit, Michigan

PROJECT NO. 2015005A **DATE** 5/13/2015 **LOG OF SEDIMENT CORE C-05**

ELEVATION ft	LOG OF SOIL PROFILE	Depth	DEPTH (ft)	SAMPLE TYPE	SAMPLE RECOVERY (inches)	PID READING (PPM)	SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS (Sample ID at sample depth)
	Water Surface Elevation		0				
	Water	0.9					
	SEDIMENT - SILTY SAND, trace to some clay and root mats, gravel and tree branches (SM)	1.3		CT1			S-2015005-051315-JTC-004 composite sample obatined for top 7-inches of core.
	SILTY CLAY, trace gravel and roots, dark gray (CL) (Possible fill)	2.0					
	SILTY CLAY, trace gravel, dark gray (CL) (Possible fill)	2.9					
	SILTY CLAY, trace to some gravel, trace cobbles, brown and gray (CL) (Possible fill)	3.7					
	End of Core at 3.7 ft.		5				
			10				

BORING COORDINATES

Notes:
CT= Acetate Core Tube

Remarks:
GPS Coordinates: Latitude 42.3417°, Longitude -82.9621°

Engineer on Rig: J. Cunningham
Sampling Method: Vibracore
Date Started: 05-13-15
Date Completed: 05-13-15
Checked By: CJW

Somat Engineering

Lake Okonoka and South Shore Habitat Restoration
Belle Isle, Detroit, Michigan

PROJECT NO. 2015005A **DATE** 5/13/2015 **LOG OF SEDIMENT CORE C-06**

ELEVATION ft	LOG OF SOIL PROFILE	Depth	DEPTH (ft)	SAMPLE TYPE	SAMPLE RECOVERY (inches)	PID READING (PPM)	SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS (Sample ID at sample depth)
	Water Surface Elevation		0				
	Water	1.6					
	SEDIMENT - SILTY SAND mixed with gravel, leaves and coarse sand, dark gray (SM)	2.2		CT1			S-2015005-051315-JTC-003 composite sample obatined for top 6-inches of core.
	SANDY CLAY with gravel and organics, dark gray (CL) (Possible fill)	2.7					
	SILTY CLAY, trace sand pockets, tree branches and gravel, mottled brown and gray (CL) (Possible fill)	3.5					
	SILTY CLAY, frequent sand pockets and sand seams, mottled brown and gray (CL) (Possible fill)	3.7					
	End of Core at 3.7 ft.		5				
			10				

BORING COORDINATES

Notes:
CT= Acetate Core Tube

Remarks:
GPS Coordinates: Latitude 42.3434°, Longitude -82.961°

Engineer on Rig: J. Cunningham
Sampling Method: Vibracore
Date Started: 05-13-15
Date Completed: 05-13-15
Checked By: CJW

Somat Engineering

Lake Okonoka and South Shore Habitat Restoration
Belle Isle, Detroit, Michigan

PROJECT NO. 2015005A DATE 6/18/2015 LOG OF SEDIMENT CORE P-01

ELEVATION ft		LOG OF SOIL PROFILE	Depth	DEPTH (ft)	SAMPLE TYPE	SAMPLE RECOVERY (inches)	PID READING (PPM)	SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS (Sample ID at sample depth)
		Water Surface Elevation		0				
		Water depth reported 6.2 ft	6.2	5				
		Field engineer reported 18-inches of soft sediment	7.7					
		Field engineer observed dark gray sandy silt and clayey silt, with some organics below soft sediment. End of Core at 7.7 ft.		10 15 20				

LOG OF GEOTECHNICAL SEDIMENT CORE BELLE ISLE LAKE OKONAKA AND SOUTH SHORELINE.GPJ SOMAT.GDT 9/16/15

BORING COORDINATES

Notes:
CT= Acetate Core Tube

Remarks:
Sediment probe. GPS Coordinates: Latitude 42.33868°, Longitude -82.96541°

Engineer on Rig: J. Cunningham
Sampling Method: n/a
Date Started: 06-18-15
Date Completed: 06-18-15
Checked By: CJW

Somat Engineering

Lake Okonoka and South Shore Habitat Restoration
Belle Isle, Detroit, Michigan

PROJECT NO. 2015005A **DATE** 6/18/2015 **LOG OF SEDIMENT CORE P-02**

ELEVATION ft	LOG OF SOIL PROFILE		Depth	DEPTH (ft)	SAMPLE TYPE	SAMPLE RECOVERY (inches)	PID READING (PPM)	SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS (Sample ID at sample depth)
		Water Surface Elevation		0				
		Water depth reported 7.6 ft	7.6	5				
		Field engineer reported 45-inches of soft sediment	11.4	10				
		Field engineer observed dark gray sandy silt and clayey silt below soft sediment. Gravelly clay observed at bottom of probe (45-inches below river bottom). End of Core at 11.4 ft.		15 20				

BORING COORDINATES

Notes:
CT= Acetate Core Tube

Remarks:
Sediment probe. GPS Coordinates: Latitude 42.33811°, Longitude -82.96806°

Engineer on Rig: J. Cunningham
Sampling Method: n/a
Date Started: 06-18-15
Date Completed: 06-18-15
Checked By: CJW

Somat Engineering

Lake Okonoka and South Shore Habitat Restoration
Belle Isle, Detroit, Michigan

PROJECT NO. 2015005A **DATE** 6/18/2015 **LOG OF SEDIMENT CORE P-03**

ELEVATION ft	LOG OF SOIL PROFILE		Depth	DEPTH (ft)	SAMPLE TYPE	SAMPLE RECOVERY (inches)	PID READING (PPM)	SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS (Sample ID at sample depth)
		Water Surface Elevation		0				
		Water depth reported 8.3 ft	8.3	5				
		Field engineer reported 48-inches of soft sediment.	12.3	10				
		Field engineer observed dark gray sandy silt and clayey silt below soft sediment. Silty clay observed at bottom of probe from about 46 to 48 inches below river bottom. End of Core at 12.3 ft.		15				
				20				

BORING COORDINATES

Notes:
CT= Acetate Core Tube

Remarks:
Sediment probe. GPS Coordinates: Latitude 42.33786°, Longitude -82.97053°

Engineer on Rig: J. Cunningham
Sampling Method: n/a
Date Started: 06-18-15
Date Completed: 06-18-15
Checked By: CJW

Somat Engineering

Lake Okonoka and South Shore Habitat Restoration
Belle Isle, Detroit, Michigan

PROJECT NO. 2015005A **DATE** 6/18/2015 **LOG OF SEDIMENT CORE P-04**

ELEVATION ft	LOG OF SOIL PROFILE		Depth	DEPTH (ft)	SAMPLE TYPE	SAMPLE RECOVERY (inches)	PID READING (PPM)	SAMPLE SUBMITTED FOR CHEMICAL ANALYSIS (Sample ID at sample depth)
		Water Surface Elevation		0				
		Water depth reported 7.1 ft	7.1	5				
		Field engineer reported 4-inches of soft sediment	7.4					
		Field engineer observed dark gray silty sand with some sand and gravel below soft sediment. End of Core at 7.4 ft.		10				
				15				
				20				

BORING COORDINATES

Notes:
CT= Acetate Core Tube

Remarks:
Sediment probe. GPS Coordinates:
Latitude 42.33755°, Longitude -82.9728°

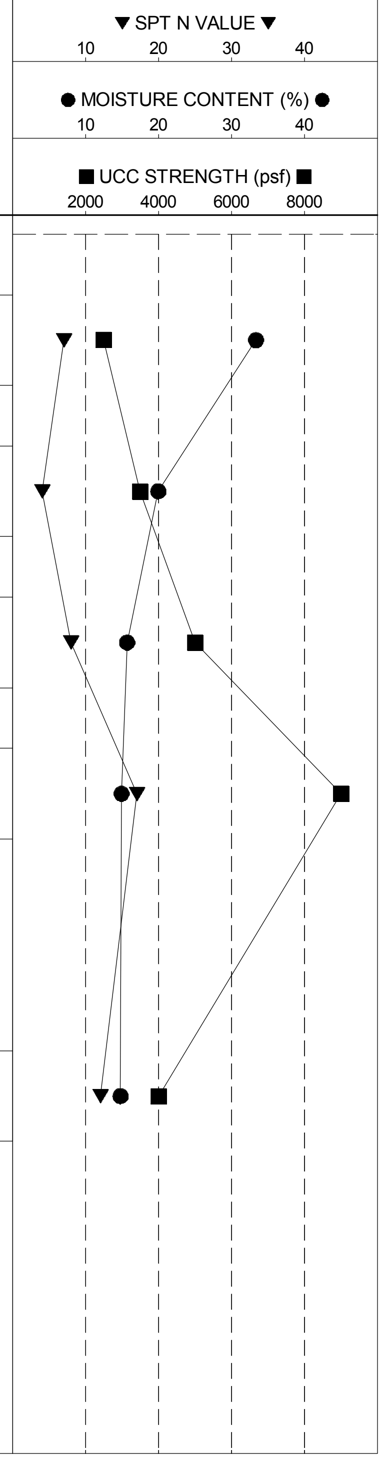
Engineer on Rig: J. Cunningham
Sampling Method: n/a
Date Started: 06-18-15
Date Completed: 06-18-15
Checked By: CJW

Somat Engineering

Lake Okonoka and South Shore Habitat Restoration
Belle Isle, Detroit, Michigan

PROJECT NO. 2015005A **DATE** 5/14/2015 **LOG OF TEST BORING SB-01**

Soil Profile	Layer Depth	Sample No.	No. of Blows for 6-inch Drive	N Value	Sample Tip Depth (ft)	Unconfined Comp Strength (psf)	Moisture Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Passing #200
Ground Surface Elevation											
2 inches of TOPSOIL	0.2										
Stiff SILTY CLAY, trace sand and gravel, trace to some organics above 2.5 ft, mottled brown and gray (CL) (Organic Content at 2.5 ft = 5.8%)	4.5	SS1	2-3-4	7	2.5	2500*	33.3				
		SS2	1-2-2	4	5.0	3500*	19.9				
Very stiff to hard SILTY CLAY, trace to some sand, trace gravel, brown with seams of gray (CL)	13.0	SS3	2-3-5	8	7.5	5000*	15.7				
		SS4	5-7-10	17	10.0	9000+*	14.9				
Very stiff SILTY CLAY, trace to some sand, trace gravel, brown (CL)	15.0	SS5	4-5-7	12	15.0	4000*	14.8				
End of Boring at 15 ft.											



BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 3.5 feet
Upon Completion: 4 feet

Remarks:
GPS Coordinates: Latitude 42.3401°, Longitude -82.9687°

Drilling Company: Strata Drilling
Drill Rig: CME
Engineer on Rig: C. Schroeder
Drilling Method: HSA
Hammer Type: Automatic
Backfilled With: Cuttings
Date Started: 05-14-15
Date Completed: 05-14-15
Checked By: ALOG
Torvane
* Pocket Penetrometer
<> Disturbed Sample

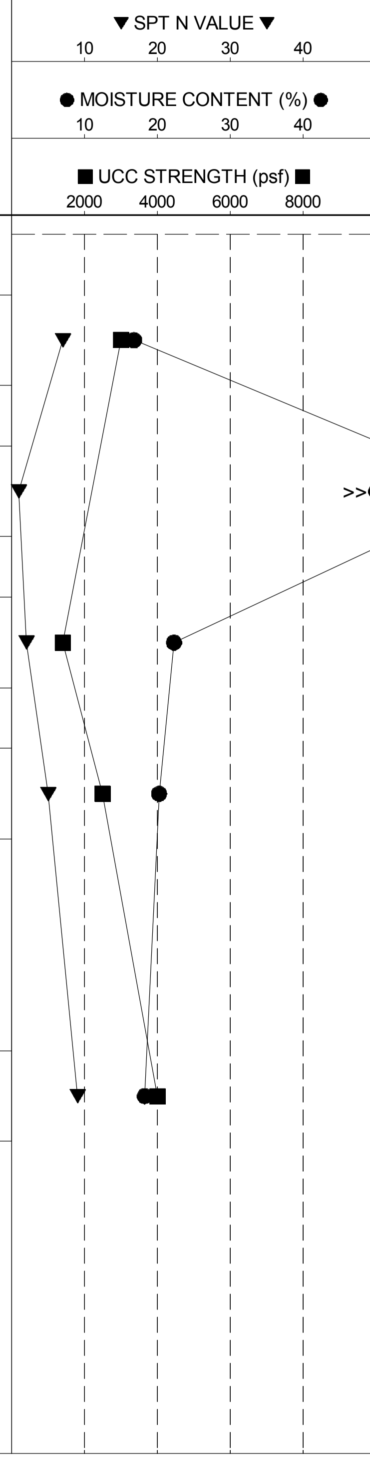
Somat Engineering

Lake Okonoka and South Shore Habitat Restoration
Belle Isle, Detroit, Michigan

PROJECT NO. 2015005A **BORING NO.** SB-01 **PAGE 1 of 1**

PROJECT NO. 2015005A **DATE** 5/14/2015 **LOG OF TEST BORING SB-02**

ELEVATION ft	LOG OF SOIL PROFILE	Depth	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT	PLASTICITY INDEX	% PASSING #200
	Ground Surface Elevation		0										
	4 inches of TOPSOIL	0.3											
	FILL - Stiff silty clay, trace to some sand, trace gravel, brick pieces and topsoil, brown (CL)	3.0		SS1	2-3-4	7	2.5	3000*	16.8				
	PEAT, trace sand, black (Pt) (Organic Content at 5.0 ft = 12.0%	5.5	5	SS2	1-0-1	1	5.0		66.7				
	Medium to stiff SILTY CLAY, trace sand, gravel and roots/vegetation, occasional marl pockets, light gray (CL) (Organic Content at 7.5 ft = 2.7%) (Organic Content at 10 ft = 2.3%)	14.0		SS3	0-0-2	2	7.5	1400#	22.3				
			10	SS4	0-2-3	5	10.0	2500#	20.2				
	Very stiff SILTY CLAY, trace to some sand, trace gravel, gray (CL)	15.0	15	SS5	3-4-5	9	15.0	4000*	18.3				
	End of Boring at 15 ft.		20										



BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 3.5 feet
Upon Completion: 4 feet

Remarks:
GPS Coordinates: Latitude 42.3398°, Longitude -82.9655°. Cave-in reported at 4 ft.

Drilling Company: Strata Drilling
Drill Rig: CME
Engineer on Rig: C. Schroeder
Drilling Method: HSA
Hammer Type: Automatic
Backfilled With: Cuttings
Date Started: 05-14-15
Date Completed: 05-14-15
Checked By: ALOG
Torvane
* Pocket Penetrometer
<> Disturbed Sample

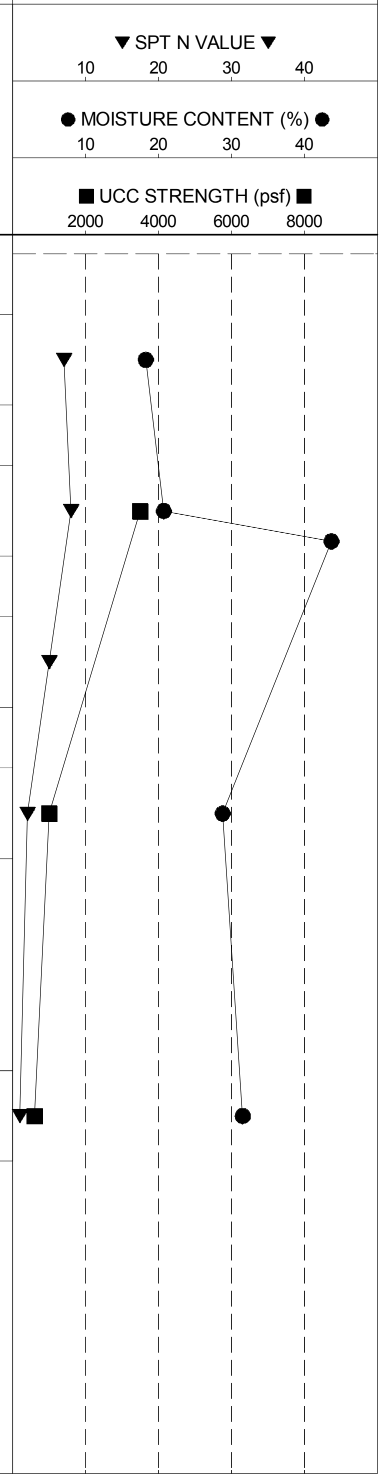
Somat Engineering

Lake Okonoka and South Shore Habitat Restoration
Belle Isle, Detroit, Michigan

PROJECT NO. 2015005A **BORING NO.** SB-02 **PAGE 1 of 1**

PROJECT NO. 2015005A **DATE** 5/14/2015 **LOG OF TEST BORING SB-03**

ELEVATION ft	LOG OF SOIL PROFILE	Depth	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT	PLASTICITY INDEX	% PASSING #200
	Ground Surface Elevation												
	3 inches of TOPSOIL	0.3	0										
	FILL - Mixed silty clay and clayey fine sand, trace gravel, roots and topsoil, brown/drark brown (CL)	3.0		SS1	3-3-4	7	2.5	<>	18.2				
	Stiff SILTY CLAY, trace to some sand, trace gravel and organics, dark brown (CL) (Organic Content at 4.5 ft = 3.0%)	4.5		SS2	3-4-4	8	5.0	3500*	20.7 43.7				
	Loose FINE SAND, trace to some organics, trace silt and gravel, occasional peat seams, black, moist (SP) (Organic Content = 3.9% and 6.9%)	5.5	5										
	Loose FINE TO MEDIUM SAND, trace to some silt, trace gravel, gray, wet (SP/SM)	8.5		SS3	1-2-3	5	7.5						
	SILTY CLAY, trace to some sand, trace gravel, trace roots/vegetation above 10 ft., gray (CL)		10	SS4	1-1-1	2	10.0	1000#	28.8				
		15.0	15	SS5	0-0-1	1	15.0	600#	31.5				
	End of Boring at 15 ft.		20										



BORING COORDINATES

GROUNDWATER READINGS
First Encountered: none
Upon Completion: none

Remarks:
GPS Coordinates: Latitude 42.3399°, Longitude -82.9622°. Cave-in reported at 3.5 ft. Duplicate sample collected at depth of 5 feet below existing grade.

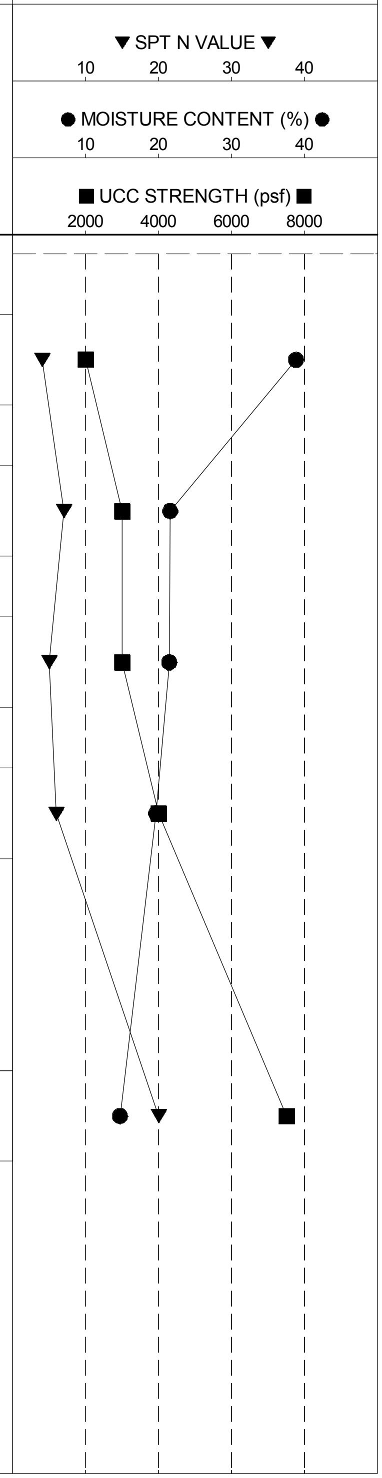
Drilling Company: Strata Drilling
Drill Rig: CME
Engineer on Rig: C. Schroeder
Drilling Method: HSA
Hammer Type: Automatic
Backfilled With: Cuttings
Date Started: 05-14-15
Date Completed: 05-14-15
Checked By: ALOG
Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Lake Okonoka and South Shore Habitat Restoration
Belle Isle, Detroit, Michigan

PROJECT NO. 2015005A **DATE** 5/14/2015 **LOG OF TEST BORING SB-04**

ELEVATION ft	LOG OF SOIL PROFILE	Depth	DEPTH (ft)	SAMPLE NO.	NO. OF BLOWS FOR 6-inch DRIVE	N VALUE	SAMPLE TIP DEPTH (ft)	UNCONFINED COMP STRENGTH (psf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	LIQUID LIMIT	PLASTICITY INDEX	% PASSING #200
	Ground Surface Elevation		0										
	3 inches of TOPSOIL	0.3											
	Stiff SILTY CLAY, trace to some organics, trace sand, gravel and roots, dark brown (CL) (Organic Content at 2.5 ft = 7.0%)	4.0		SS1	1-1-3	4	2.5	2000*	38.8				
	Stiff to very stiff SILTY CLAY, trace to some sand, trace gravel, trace roots above 5 ft., mottled brown and gray (CL)	14.0	5	SS2	3-4-3	7	5.0	3000*	21.6				
				SS3	3-2-3	5	7.5	3000*	21.4				
			10	SS4	3-3-3	6	10.0	4000*	19.6				
	Very stiff SILTY CLAY, trace to some sand, trace gravel, brown (CL)	15.0	15	SS5	4-9-11	20	15.0	7500*	14.7				
	End of Boring at 15 ft.		20										



BORING COORDINATES

GROUNDWATER READINGS
First Encountered: 3.5 feet
Upon Completion: 4 feet

Remarks:
GPS Coordinates: Latitude 42.3446°, Longitude -82.9608°

Drilling Company: Strata Drilling
Drill Rig: CME
Engineer on Rig: C. Schroeder
Drilling Method: HSA
Hammer Type: Automatic
Backfilled With: Cuttings
Date Started: 05-14-15
Date Completed: 05-14-15
Checked By: ALOG
Torvane
* Pocket Penetrometer
<> Disturbed Sample

Somat Engineering

Lake Okonoka and South Shore Habitat Restoration
Belle Isle, Detroit, Michigan

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon – 1 3/8" I.D., 2" O.D. (standard)
S :	Split Spoon – non-standard size, as noted
ST:	Thin-Walled Tube – 3" O.D., (unless otherwise noted)
LS:	Liner Sample
PA:	Power Auger
HA:	Hand Auger
AU:	Auger Sample
BS:	Bulk Sample
HS:	Hollow Stem Auger
DP:	Direct Push
PS:	Piston Sample
PT:	Pitcher Sample
WS:	Wash Sample
RC:	Rock Core with diamond bit, NX size, (unless otherwise noted)
RB:	Rock Bit/Roller Bit
WR:	Wash Rotary
NR:	No Recovery
VS:	Vane Shear Test

Standard Penetration Test Resistance, N-Value: Sum of 2nd and 3rd 6-inch increments, in blows per foot of a 140-pound hammer falling 30 inches and driving an 18-inch long, 2-inch OD split spoon.

WATER LEVEL MEASUREMENT:
Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. In pervious soils, the indicated levels may reflect the location of a groundwater table. In low permeability soils (clays and silts), the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION:
Soil classification is based on the Unified Soil Classification (USC) System and ASTM Standards D-2487 and D-2488. Coarse-grained soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: gravel or sand. Fine-grained soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays, if they are plastic, and silts, if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their apparent in-place density and fine-grained soils on the basis of their apparent in-place density (silty soils) or consistency (clayey soils).

SECONDARY SOIL CONSTITUENT

Percentage Range	Primary Constituent	
	Sand & Gravel	**Clay & Silt**
≤ 5%	Trace	Trace
>5% → ≤12%	Trace to Some	Trace to Some
>12% → ≤25%	Secondary Constituent	Some
>25% → <50%	Secondary Constituent	Secondary Constituent

COARSE-GRAINED SOILS

N-Value	Apparent Density
0 – 4	Very Loose
5 – 9	Loose
10 – 29	Medium Dense
30 – 49	Dense
50 – 80	Very Dense
>80	Extremely Dense

FINE-GRAINED SOILS

Unconfined Compressive Strength Qu, psf	Consistency
< 500	Very Soft
500 - <1000	Soft
1000 - <2000	Medium
2000 - <4000	Stiff
4000 - <8000	Very Stiff
≥ 8000	Hard

DEFINITIONS OF STRUCTURAL AND DEPOSITIONAL FEATURES

Term	Definition
Parting	≤ 1/16 inch (1.6 mm) thick
Seam	> 1/16 inch (1.6 mm) → ½ inch (12.7 mm) thick
Layer	> ½ inch (12.7 mm) to ≤ 12 inches (305 mm) thick
Pocket	Small, erratic deposits of limited lateral extent
Lens	Lenticular deposit
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay
Varved	Alternating partings or seams (1 mm – 12 mm) of silt and/or clay and sometimes fine sand
Stratified	Alternating layers of varying material or color with layers ≥ 6 mm thick
Laminated	Alternating layers of varying material or color with layers < 6 mm thick
Fissured	Contains shears or separations along planes of weakness
Slickensided	Shear planes appear polished or glossy, sometimes striated
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Homogeneous	Same color and appearance throughout
Occasional	One or less per foot (305 mm) of thickness
Frequent	More than one per foot (305 mm) of thickness
Interbedded	Applied to strata of soil lying between or alternating with other strata of a different nature

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Size Range
Boulders	≥ 12" (300 mm)
Cobbles	< 12" - 3" (300 mm – 75 mm)
Gravel - Coarse	< 3" - ¾" (75 mm – 19 mm)
Gravel – Fine	< ¾" - #4 (19 mm – 4.75 mm)
Sand – Coarse	< #4 - #10 (4.75 mm – 2 mm)
Sand – Medium	< #10 - #40 (2 mm - 0.425 mm)
Sand – Fine	< #40 - #200 (0.425 mm -0 .074 mm)
Silt	< 0.074 mm - 0.005 mm
Clay	<0 .005 mm

APPENDIX C

CHEMICAL LABORATORY REPORTS AND SUMMARY TABLE

QUANTUM LABORATORIES, INC.
28221 Beck Road • Suite A-11
Wixom, Michigan 48393
248-348-TEST or 248-348-8378
Fax: 248-348-7029

Quantum Laboratories, Inc.

ANALYTICAL REPORT

For:	Somat Engineering, Inc. 6660 Woodward Ave. Ste. 2430 Detroit MI 48226	**Report Number:**	**8457**
		Report Date:	May 23, 2015
		Project Name:	-
		Project Number:	2015005-A
		Page:	1 of 18
Attn:	Mr. Jason Cunningham	313-963-2721	Fax: 313-963-2736

Sample Description

Seven (7) samples reported to be Soil and identified as “2015005-A”, 5/13/15, Grab and:

1. S-2015005-051315-JTC-001
2. S-2015005-051315-JTC-002
3. S-2015005-051315-JTC-003
4. S-2015005-051315-JTC-004
5. S-2015005-051315-JTC-005
6. S-2015005-051315-JTC-006
7. S-2015005-051315-JTC-007

Analysis Requested

Chemical Analysis per SW-846 (SW) for:

1. Polynuclear Aromatic Hydrocarbons (PNA), Method 8270C
2. Polychlorinated Biphenyls (PCB), Method 8082
3. Metals:
   a) Arsenic, Method 7010
   b) Barium, Method 7010
   c) Cadmium, Method 7010
   d) Chromium, Method 7010
   e) Copper, Method 7010
   f) Lead, Method 7010
   g) Manganese, Method 7010
   h) Mercury, Method 7470A
   i) Nickel, Method 7010
   J) Selenium, Method 7010
   k) Silver, Method 7010
   l) Zinc, Method 7010

Analytical Results

Sample Description:	S-2015005-051315-JTC-001, 5/13/15					
Laboratory ID:	8457-1	Reporting Limit	Units of Measure	Date of Analysis	Analyst	Data Qualifiers
PNAs						
Acenaphthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Acenaphthylene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(a)anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(b)fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(k)fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(g,h,i)perylene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(a)pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Chrysene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Dibenz(a,h)anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Fluorene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Indeno(1,2,3-cd)pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
2-Methylnaphthalene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Naphthalene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Phenanthrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Surrogate Standards						
Nitrobenzene-d5	58.8%	-	% Recovery	05/19/15	BD	
2-Fluorobiphenyl	71.5%	-	% Recovery	05/19/15	BD	
Terphenyl-d14	70.7%	-	% Recovery	05/19/15	BD	
PCBs						
Aroclor 1016	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1221	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1232	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1242	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1248	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1254	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1260	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Polychlorinated biphenyls (Total)	Not Detected	700	µg/Kg, dry wt.	05/14/15	DS	
Surrogate Standards						
Tetrachloro-m-xylene	83.2%	-	% Recovery	05/14/15	DS	
Decachlorobiphenyl	100%	-	% Recovery	05/14/15	DS	
continued						

Quantum Laboratories, Inc.

Sample Description:	S-2015005-051315-JTC-001, 5/13/15					
Laboratory ID:	8457-1	Reporting Limit	Units of Measure	Date of Analysis	Analyst	Data Qualifiers
Metals						
Arsenic	3040	100	µg/Kg, dry wt.	05/22/15	DS	
Barium	69200	1000	µg/Kg, dry wt.	05/20/15	MT	
Cadmium	Not Detected	200	µg/Kg, dry wt.	05/18/15	MT	
Chromium	6130	2000	µg/Kg, dry wt.	05/18/15	MT	
Copper	8580	1000	µg/Kg, dry wt.	05/20/15	MT	
Lead	20300	1000	µg/Kg, dry wt.	05/18/15	MT	
Manganese	43700	1000	µg/Kg, dry wt.	05/22/15	DS	
Mercury	Not Detected	50	µg/Kg, dry wt.	05/14/15	DS	
Nickel	6830	1000	µg/Kg, dry wt.	05/20/15	MT	
Selenium	Not Detected	200	µg/Kg, dry wt.	05/23/15	DS	
Silver	Not Detected	100	µg/Kg, dry wt.	05/22/15	DS	
Zinc	21800	1000	µg/Kg, dry wt.	05/20/15	MT	
Analysis Information						
Dry Weight Solids	61.6%	-	% by weight	05/14/15	DS	
PCB Extraction	Completed	-	-	05/14/15	BD	
PNA Extraction	Completed	-	-	05/19/15	BD	
Mercury Digestion	Completed	-	-	05/14/15	DS	
Metals Digestion	Completed	-	-	05/18/15	MT	

Quantum Laboratories, Inc.

Sample Description:	S-2015005-051315-JTC-002, 5/13/15					
Laboratory ID:	8457-2	Reporting Limit	Units of Measure	Date of Analysis	Analyst	Data Qualifiers
PNAs						
Acenaphthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Acenaphthylene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(a)anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(b)fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(k)fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(g,h,i)perylene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(a)pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Chrysene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Dibenz(a,h)anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Fluorene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Indeno(1,2,3-cd)pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
2-Methylnaphthalene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Naphthalene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Phenanthrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Surrogate Standards						
Nitrobenzene-d5	66.4%	-	% Recovery	05/19/15	BD	
2-Fluorobiphenyl	79.3%	-	% Recovery	05/19/15	BD	
Terphenyl-d14	83.2%	-	% Recovery	05/19/15	BD	
PCBs						
Aroclor 1016	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1221	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1232	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1242	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1248	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1254	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1260	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Polychlorinated biphenyls (Total)	Not Detected	700	µg/Kg, dry wt.	05/14/15	DS	
Surrogate Standards						
Tetrachloro-m-xylene	79.8%	-	% Recovery	05/14/15	DS	
Decachlorobiphenyl	106%	-	% Recovery	05/14/15	DS	
continued						

Sample Description:	S-2015005-051315-JTC-002, 5/13/15					
Laboratory ID:	8457-2	Reporting Limit	Units of Measure	Date of Analysis	Analyst	Data Qualifiers
Metals						
Arsenic	3610	100	µg/Kg, dry wt.	05/22/15	DS	
Barium	93100	1000	µg/Kg, dry wt.	05/20/15	MT	
Cadmium	Not Detected	200	µg/Kg, dry wt.	05/18/15	MT	
Chromium	5550	2000	µg/Kg, dry wt.	05/18/15	MT	
Copper	9690	1000	µg/Kg, dry wt.	05/20/15	MT	
Lead	12500	1000	µg/Kg, dry wt.	05/18/15	MT	
Manganese	36700	1000	µg/Kg, dry wt.	05/22/15	DS	
Mercury	Not Detected	50	µg/Kg, dry wt.	05/14/15	DS	
Nickel	6770	1000	µg/Kg, dry wt.	05/20/15	MT	
Selenium	Not Detected	200	µg/Kg, dry wt.	05/23/15	DS	
Silver	Not Detected	100	µg/Kg, dry wt.	05/22/15	DS	
Zinc	20800	1000	µg/Kg, dry wt.	05/20/15	MT	
Analysis Information						
Dry Weight Solids	54.9%	-	% by weight	05/14/15	DS	
PCB Extraction	Completed	-	-	05/14/15	BD	
PNA Extraction	Completed	-	-	05/19/15	BD	
Mercury Digestion	Completed	-	-	05/14/15	DS	
Metals Digestion	Completed	-	-	05/18/15	MT	

Sample Description:	S-2015005-051315-JTC-003, 5/13/15					
Laboratory ID:	8457-3	Reporting Limit	Units of Measure	Date of Analysis	Analyst	Data Qualifiers
PNAs						
Acenaphthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Acenaphthylene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(a)anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(b)fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(k)fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(g,h,i)perylene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(a)pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Chrysene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Dibenz(a,h)anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Fluorene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Indeno(1,2,3-cd)pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
2-Methylnaphthalene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Naphthalene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Phenanthrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Surrogate Standards						
Nitrobenzene-d5	47.6%	-	% Recovery	05/19/15	BD	
2-Fluorobiphenyl	63.8%	-	% Recovery	05/19/15	BD	
Terphenyl-d14	83.2%	-	% Recovery	05/19/15	BD	
PCBs						
Aroclor 1016	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1221	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1232	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1242	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1248	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1254	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1260	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Polychlorinated biphenyls (Total)	Not Detected	700	µg/Kg, dry wt.	05/14/15	DS	
Surrogate Standards						
Tetrachloro-m-xylene	91.2%	-	% Recovery	05/14/15	DS	
Decachlorobiphenyl	112%	-	% Recovery	05/14/15	DS	
continued						

Sample Description:	S-2015005-051315-JTC-003, 5/13/15					
Laboratory ID:	8457-3	Reporting Limit	Units of Measure	Date of Analysis	Analyst	Data Qualifiers
Metals						
Arsenic	4660	100	µg/Kg, dry wt.	05/22/15	DS	
Barium	206000	1000	µg/Kg, dry wt.	05/20/15	MT	
Cadmium	211	200	µg/Kg, dry wt.	05/18/15	MT	
Chromium	11500	2000	µg/Kg, dry wt.	05/18/15	MT	
Copper	15000	1000	µg/Kg, dry wt.	05/20/15	MT	
Lead	32800	1000	µg/Kg, dry wt.	05/18/15	MT	
Manganese	156000	1000	µg/Kg, dry wt.	05/22/15	DS	
Mercury	Not Detected	50	µg/Kg, dry wt.	05/14/15	DS	
Nickel	12700	1000	µg/Kg, dry wt.	05/20/15	MT	
Selenium	Not Detected	200	µg/Kg, dry wt.	05/23/15	DS	
Silver	Not Detected	100	µg/Kg, dry wt.	05/22/15	DS	
Zinc	55000	1000	µg/Kg, dry wt.	05/20/15	MT	
Analysis Information						
Dry Weight Solids	76.1%	-	% by weight	05/14/15	DS	
PCB Extraction	Completed	-	-	05/14/15	BD	
PNA Extraction	Completed	-	-	05/19/15	BD	
Mercury Digestion	Completed	-	-	05/14/15	DS	
Metals Digestion	Completed	-	-	05/18/15	MT	

Data Qualifiers:
I Internal standard results outside acceptance limits
S QC spike recovery outside of acceptance limits
R RPD outside of acceptance limits
E Reporting limit is elevated
D Result is from a dilution
J Result should be considered estimated
M Matrix interference observed
X Result by SIM Mode analysis
C See Case Narrative

Quantum Laboratories, Inc.

Sample Description:	S-2015005-051315-JTC-004, 5/13/15					
Laboratory ID:	8457-4	Reporting Limit	Units of Measure	Date of Analysis	Analyst	Data Qualifiers
PNAs						
Acenaphthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Acenaphthylene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(a)anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(b)fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(k)fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(g,h,i)perylene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(a)pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Chrysene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Dibenz(a,h)anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Fluorene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Indeno(1,2,3-cd)pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
2-Methylnaphthalene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Naphthalene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Phenanthrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Surrogate Standards						
Nitrobenzene-d5	67.9%	-	% Recovery	05/19/15	BD	
2-Fluorobiphenyl	82.4%	-	% Recovery	05/19/15	BD	
Terphenyl-d14	82.7%	-	% Recovery	05/19/15	BD	
PCBs						
Aroclor 1016	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1221	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1232	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1242	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1248	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1254	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1260	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Polychlorinated biphenyls (Total)	Not Detected	700	µg/Kg, dry wt.	05/14/15	DS	
Surrogate Standards						
Tetrachloro-m-xylene	74.0%	-	% Recovery	05/14/15	DS	
Decachlorobiphenyl	89.1%	-	% Recovery	05/14/15	DS	
continued						

Sample Description:	S-2015005-051315-JTC-004, 5/13/15					
Laboratory ID:	8457-4	Reporting Limit	Units of Measure	Date of Analysis	Analyst	Data Qualifiers
Metals						
Arsenic	6190	100	μg/Kg, dry wt.	05/22/15	DS	
Barium	160000	1000	μg/Kg, dry wt.	05/20/15	MT	
Cadmium	Not Detected	200	μg/Kg, dry wt.	05/18/15	MT	
Chromium	14300	2000	μg/Kg, dry wt.	05/18/15	MT	
Copper	26500	1000	μg/Kg, dry wt.	05/20/15	MT	
Lead	9650	1000	μg/Kg, dry wt.	05/18/15	MT	
Manganese	97700	1000	μg/Kg, dry wt.	05/22/15	DS	
Mercury	Not Detected	50	μg/Kg, dry wt.	05/14/15	DS	
Nickel	15400	1000	μg/Kg, dry wt.	05/20/15	MT	
Selenium	1450	200	μg/Kg, dry wt.	05/23/15	DS	
Silver	Not Detected	100	μg/Kg, dry wt.	05/22/15	DS	
Zinc	47200	1000	μg/Kg, dry wt.	05/20/15	MT	
Analysis Information						
Dry Weight Solids	56.4%	-	% by weight	05/14/15	DS	
PCB Extraction	Completed	-	-	05/14/15	BD	
PNA Extraction	Completed	-	-	05/19/15	BD	
Mercury Digestion	Completed	-	-	05/14/15	DS	
Metals Digestion	Completed	-	-	05/18/15	MT	

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Sample Description:	S-2015005-051315-JTC-005, 5/13/15					
Laboratory ID:	8457-5	Reporting Limit	Units of Measure	Date of Analysis	Analyst	Data Qualifiers
PNAs						
Acenaphthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Acenaphthylene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(a)anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(b)fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(k)fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(g,h,i)perylene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(a)pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Chrysene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Dibenz(a,h)anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Fluorene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Indeno(1,2,3-cd)pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
2-Methylnaphthalene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Naphthalene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Phenanthrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Surrogate Standards						
Nitrobenzene-d5	67.3%	-	% Recovery	05/19/15	BD	
2-Fluorobiphenyl	82.3%	-	% Recovery	05/19/15	BD	
Terphenyl-d14	88.4%	-	% Recovery	05/19/15	BD	
PCBs						
Aroclor 1016	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1221	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1232	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1242	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1248	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1254	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1260	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Polychlorinated biphenyls (Total)	Not Detected	700	µg/Kg, dry wt.	05/14/15	DS	
Surrogate Standards						
Tetrachloro-m-xylene	73.7%	-	% Recovery	05/14/15	DS	
Decachlorobiphenyl	92.0%	-	% Recovery	05/14/15	DS	
continued						

Data Qualifiers:
I Internal standard results outside acceptance limits
S QC spike recovery outside of acceptance limits
R RPD outside of acceptance limits
E Reporting limit is elevated
D Result is from a dilution
J Result should be considered estimated
M Matrix interference observed
X Result by SIM Mode analysis
C See Case Narrative

Sample Description:	S-2015005-051315-JTC-005, 5/13/15					
Laboratory ID:	8457-5	Reporting Limit	Units of Measure	Date of Analysis	Analyst	Data Qualifiers
Metals						
Arsenic	4630	100	µg/Kg, dry wt.	05/22/15	DS	
Barium	253000	1000	µg/Kg, dry wt.	05/20/15	MT	
Cadmium	Not Detected	200	µg/Kg, dry wt.	05/18/15	MT	
Chromium	9330	2000	µg/Kg, dry wt.	05/18/15	MT	
Copper	11400	1000	µg/Kg, dry wt.	05/20/15	MT	
Lead	9800	1000	µg/Kg, dry wt.	05/18/15	MT	
Manganese	250000	1000	µg/Kg, dry wt.	05/22/15	DS	
Mercury	Not Detected	50	µg/Kg, dry wt.	05/14/15	DS	
Nickel	11600	1000	µg/Kg, dry wt.	05/20/15	MT	
Selenium	1130	200	µg/Kg, dry wt.	05/23/15	DS	
Silver	Not Detected	100	µg/Kg, dry wt.	05/22/15	DS	
Zinc	39400	1000	µg/Kg, dry wt.	05/20/15	MT	
Analysis Information						
Dry Weight Solids	74.8%	-	% by weight	05/14/15	DS	
PCB Extraction	Completed	-	-	05/14/15	BD	
PNA Extraction	Completed	-	-	05/19/15	BD	
Mercury Digestion	Completed	-	-	05/14/15	DS	
Metals Digestion	Completed	-	-	05/18/15	MT	

Quantum Laboratories, Inc.

Sample Description:	S-2015005-051315-JTC-006, 5/13/15					
Laboratory ID:	8457-6	Reporting Limit	Units of Measure	Date of Analysis	Analyst	Data Qualifiers
PNAs						
Acenaphthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Acenaphthylene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(a)anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(b)fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(k)fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(g,h,i)perylene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(a)pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Chrysene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Dibenz(a,h)anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Fluorene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Indeno(1,2,3-cd)pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
2-Methylnaphthalene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Naphthalene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Phenanthrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Surrogate Standards						
Nitrobenzene-d5	65.6%	-	% Recovery	05/19/15	BD	
2-Fluorobiphenyl	79.0%	-	% Recovery	05/19/15	BD	
Terphenyl-d14	83.3%	-	% Recovery	05/19/15	BD	
PCBs						
Aroclor 1016	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1221	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1232	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1242	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1248	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1254	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1260	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Polychlorinated biphenyls (Total)	Not Detected	700	µg/Kg, dry wt.	05/14/15	DS	
Surrogate Standards						
Tetrachloro-m-xylene	85.8%	-	% Recovery	05/14/15	DS	
Decachlorobiphenyl	106%	-	% Recovery	05/14/15	DS	
continued						

Data Qualifiers:

I Internal standard results outside acceptance limits	E Reporting limit is elevated	M Matrix interference observed
S QC spike recovery outside of acceptance limits	D Result is from a dilution	X Result by SIM Mode analysis
R RPD outside of acceptance limits	J Result should be considered estimated	C See Case Narrative

Sample Description:	S-2015005-051315-JTC-006, 5/13/15					
Laboratory ID:	8457-6	Reporting Limit	Units of Measure	Date of Analysis	Analyst	Data Qualifiers
Metals						
Arsenic	5750	100	µg/Kg, dry wt.	05/22/15	DS	
Barium	37200	1000	µg/Kg, dry wt.	05/20/15	MT	
Cadmium	210	200	µg/Kg, dry wt.	05/18/15	MT	
Chromium	16600	2000	µg/Kg, dry wt.	05/18/15	MT	
Copper	24500	1000	µg/Kg, dry wt.	05/22/15	DS	
Lead	11900	1000	µg/Kg, dry wt.	05/18/15	MT	
Manganese	102000	1000	µg/Kg, dry wt.	05/22/15	DS	
Mercury	Not Detected	50	µg/Kg, dry wt.	05/14/15	DS	
Nickel	14800	1000	µg/Kg, dry wt.	05/20/15	MT	
Selenium	654	200	µg/Kg, dry wt.	05/23/15	DS	
Silver	Not Detected	100	µg/Kg, dry wt.	05/22/15	DS	
Zinc	52800	1000	µg/Kg, dry wt.	05/20/15	MT	
Analysis Information						
Dry Weight Solids	58.8%	-	% by weight	05/14/15	DS	
PCB Extraction	Completed	-	-	05/14/15	BD	
PNA Extraction	Completed	-	-	05/19/15	BD	
Mercury Digestion	Completed	-	-	05/14/15	DS	
Metals Digestion	Completed	-	-	05/18/15	MT	

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Sample Description:	S-2015005-051315-JTC-007, 5/13/15					
Laboratory ID:	8457-7	Reporting Limit	Units of Measure	Date of Analysis	Analyst	Data Qualifiers
PNAs						
Acenaphthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Acenaphthylene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(a)anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(b)fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(k)fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(g,h,i)perylene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Benzo(a)pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Chrysene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Dibenz(a,h)anthracene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Fluoranthene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Fluorene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Indeno(1,2,3-cd)pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
2-Methylnaphthalene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Naphthalene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Phenanthrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Pyrene	Not Detected	330	µg/Kg, dry wt.	05/19/15	BD	
Surrogate Standards						
Nitrobenzene-d5	62.4%	-	% Recovery	05/19/15	BD	
2-Fluorobiphenyl	78.3%	-	% Recovery	05/19/15	BD	
Terphenyl-d14	79.3%	-	% Recovery	05/19/15	BD	
PCBs						
Aroclor 1016	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1221	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1232	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1242	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1248	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1254	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Aroclor 1260	Not Detected	100	µg/Kg, dry wt.	05/14/15	DS	
Polychlorinated biphenyls (Total)	Not Detected	700	µg/Kg, dry wt.	05/14/15	DS	
Surrogate Standards						
Tetrachloro-m-xylene	87.7%	-	% Recovery	05/14/15	DS	
Decachlorobiphenyl	114%	-	% Recovery	05/14/15	DS	
continued						

Sample Description:	S-2015005-051315-JTC-007, 5/13/15					
Laboratory ID:	8457-7	Reporting Limit	Units of Measure	Date of Analysis	Analyst	Data Qualifiers
Metals						
Arsenic	3630	100	µg/Kg, dry wt.	05/22/15	DS	
Barium	215000	1000	µg/Kg, dry wt.	05/20/15	MT	
Cadmium	213	200	µg/Kg, dry wt.	05/18/15	MT	
Chromium	12100	2000	µg/Kg, dry wt.	05/18/15	MT	
Copper	10700	1000	µg/Kg, dry wt.	05/20/15	MT	
Lead	12700	1000	µg/Kg, dry wt.	05/18/15	MT	
Manganese	336000	1000	µg/Kg, dry wt.	05/22/15	DS	
Mercury	Not Detected	50	µg/Kg, dry wt.	05/14/15	DS	
Nickel	12200	1000	µg/Kg, dry wt.	05/20/15	MT	
Selenium	820	200	µg/Kg, dry wt.	05/23/15	DS	
Silver	Not Detected	100	µg/Kg, dry wt.	05/22/15	DS	
Zinc	45800	1000	µg/Kg, dry wt.	05/20/15	MT	
Analysis Information						
Dry Weight Solids	77.3%	-	% by weight	05/14/15	DS	
PCB Extraction	Completed	-	-	05/14/15	BD	
PNA Extraction	Completed	-	-	05/19/15	BD	
Mercury Digestion	Completed	-	-	05/14/15	DS	
Metals Digestion	Completed	-	-	05/18/15	MT	

Quality Control

PNA Matrix Spike Data

Spiked Sample: 8457-4	Matrix: Soil		Units: ppm in extract					
Parameter	Sample Result	Spike Added	MS Result	MSD Result	MS % Rec.	MSD % Rec.	RPD	Data Qualifiers
Acenaphthene	0.0	20	18	19	90	95	5.4	
Phenanthrene	0.0	20	20	21	100	105	4.9	
Fluoranthene	0.0	20	22	23	110	115	4.4	
Pyrene	0.0	20	18	18	90	90	0.0	
Chrysene	0.0	20	20	21	100	105	4.9	

PCB Matrix Spike Data

Spiked Sample: 8457-4	Matrix: Soil		Units: ppm in extract					
Parameter	Sample Result	Spike Added	MS Result	MSD Result	MS % Rec.	MSD % Rec.	RPD	Data Qualifiers
Aroclor 1260	0.000	0.200	0.225	0.230	113	115	2.2	

Metals Matrix Spike Data

Spiked Sample: 8457-7 (8446-10 for Mercury)					Matrix: Soil		Units: ppb in solution	
Parameter	Sample Result	Spike Added	MS Result	MSD Result	MS % Rec.	MSD % Rec.	RPD	Data Qualifiers
Arsenic	1.1	12.5	11.9	15.5	86	115	26.5	R, M, C
Barium	215	100	235	225	20	9	4.6	
Cadmium	1.1	1.3	2.2	2.2	81	85	2.2	
Chromium	90.2	10	73.6	75.9	NC	NC	3.1	C
Copper	132	25	61.5	63.0	NC	NC	2.5	C
Lead	65.3	25	93.3	94.7	112	118	1.6	
Manganese	20.9	25	38.3	46.8	70	104	20.0	R, M, C
Mercury	0.0	5.0	5.8	6.0	116	120	3.8	
Nickel	139	25	128	137	NC	NC	6.8	C
Selenium	7.9	25	4.6	4.5	-	-	2.9	S, M, C
Silver	1.4	5.0	4.9	5.0	71	72	0.8	
Zinc	147	500	472	497	65	70	5.2	

Case Narrative

Matrix spike percent recoveries for Chromium, Copper, and Nickel were not calculated because the sample results were greater than four times the spike amounts added.

The matrix spike (MS) and/or matrix spike duplicate (MSD) percent recoveries for Selenium were outside of control limits due to sample matrix interference.

The matrix spike (MS) / matrix spike duplicate (MSD) relative percent difference (RPD) values for Arsenic and Manganese were outside of control limits due to sample matrix interference.

All method protocols and quality control requirements were satisfied for all samples.

Notes

(1) Quality Control Limits available upon request.

(2) Results are applicable only to the sample tested.

(3) All samples will be discarded after 30 days unless the laboratory receives other instructions.

(4) Chain of Custody document attached.

QUANTUM LABORATORIES, INC.

David W. Starr
Analytical Chemistry Manager

Somat Engineering, INCORPORATED
6660 Woodward Avenue Suite 2430, Detroit, MI 48226

CHAIN OF CUSTODY RECORD

SHIPPED TO (Laboratory Name): Quantum Lab. 8457

REFERENCE NUMBER: 2015005 A

REPORT TO: Jason Cunningham
Email (or fax): jcunningham@somateng.com Phone: 313-350-7929

Sampler's Signature: Printed Name:

Seq No.	Date	Time	Sample ID	Sample Type	No. OF CONTAINERS	12 metals**	PCBs	PNAs	Comments: (eg., additional sample description, HOT sample notation, methanol preservation wts.)
1	5-13-15		S-2015005A-051315-JTC-001	S	1	X	X	X	
2			S-2015005-051315-JTC-002	S	1	X	X	X	** 12 metals
3			S-2015005-051315-JTC-003	S	1	X	X	X	- arsenic
4			S-2015005-051315-JTC-004	S	1	X	X	X	- barium
5			S-2015005-051315-JTC-005	S	1	X	X	X	- cadmium
6			S-2015005-051315-JTC-006	S	1	X	X	X	- chromium
7			S-2015005-051315-JTC-007	S	1	X	X	X	- copper
									- lead
									- manganese
									- mercury
									- nickel
									- selenium
									- silver
									- zinc

Total number of containers:

Relinquished by:	Date/Time	Received by:	Date/Time
1. Jodi Mills	Date: 5-14 Time: 8:00	1. [signature]	Date: Time:
2. [signature]	Date: 5-14 Time: 9:00	2. [signature]	Date: Time:
3.	Date: Time:	3.	Date: Time:

RECEIVED FOR LABORATORY BY:
DATE: TIME:

METHOD OF SHIPMENT:
AIR BILL NO:

FOR LAB USE ONLY:
Temp of Samples: _____ °C On Wet Ice?: _____
Comments:

TURNAROUND DESIRED:
Standard ☐ **Rush:** Next BD ☐ 2nd BD ☐ 3rd BD ☐

SAMPLE TEAM:

White * Fully Executed Copy Pink * Shipper Copy
Yellow * Receiving Laboratory Copy

Infrastructure Engineering Solutions

APPENDIX D

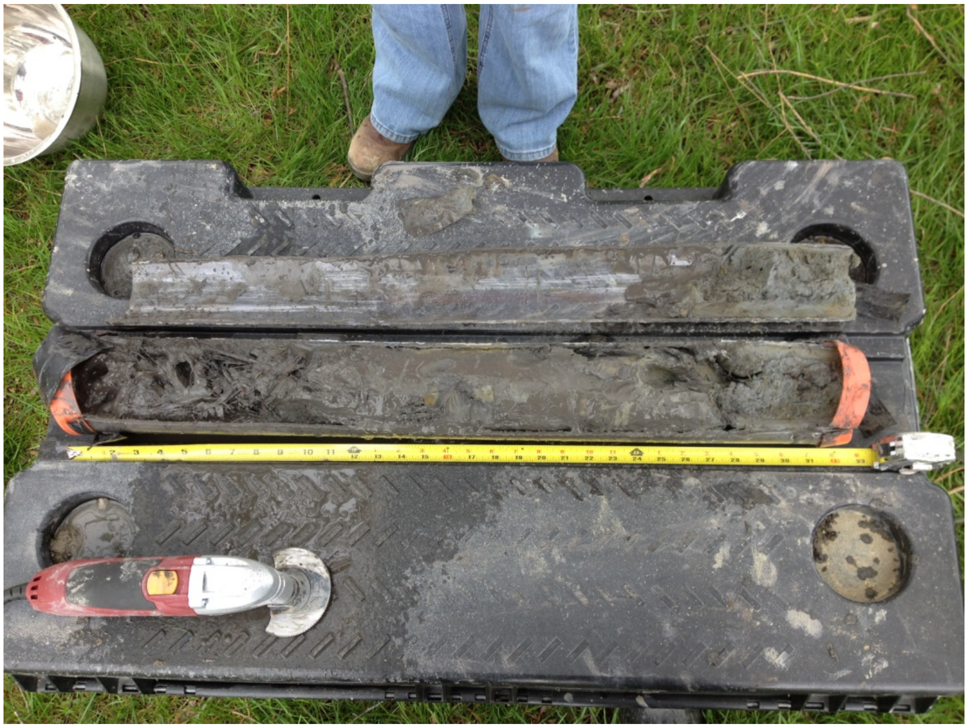
CHEMICAL LABORATORY RESULTS SUMMARY TABLE

Parameters* *(Refer to detailed laboratory report for method reference data)*	Chemical Abstract Service Number	Statewide Default Background Levels	Calculated Regional Background Level- Sand-Erie-Huron Lobe	Calculated Regional Background Level- Clay-Erie-Huron Lobe	Lab ID	8457-1	8457-2	8457-3	8457-4	8457-5	8457-6	8457-7
					Sample ID & Core No.	JTC-001 C-4	JTC-002 C-4A	JTC-003 C-6	JTC-004 C-5	JTC-005 C-2	JTC-006 C-1	JTC-007 C-3
					Collection Date	5/13/15	5/13/15	5/13/15	5/13/15	5/13/15	5/13/15	5/13/15
Metals, ug/Kg												
Arsenic	7440-38-2	5,800	19,600	22,700		3,040	3,610	4,660	**6,190***	4,630	5,750	3,630
Barium (B)	7440-39-3	75,000	220,000	220,000		69,200	**93,100***	**206,000***	**160,000***	**253,000***	37,200	**215,000***
Cadmium (B)	7440-43-9	1,200	NA	NA		<200	<200	211	<200	<200	210	213
Chromium, Total	7440-47-3	18,000 (total)	20,280	55,000		6,130	5,550	11,500	14,300	9,330	16,600	12,100
Copper (B)	7440-50-8	32,000	29,670	48,090		8,580	9,690	15,000	26,500	11,400	24,500	10,700
Lead (B)	7439-92-1	21,000	25,240	30,330		20,300	12,500	32,800	9,650	9,800	11,900	12,700
Manganese (B)	7439-96-5	4.4E+5	NA	NA		43,700	36,700	156,000	97,700	250,000	102,000	336,000
Mercury, Total	7439-97-6	130	NA	NA		<50	<50	<50	<50	<50	<50	<50
Nickel (B)	7440-02-0	20,000	NA	NA		6,830	6,770	12,700	15,400	11,600	14,800	12,200
Selenium (B)	7782-49-2	410	NA	NA		<200	<200	<200	**1,450***	**1,130***	**654***	**820***
Silver (B)	7440-22-4	1,000	NA	NA		<100	<100	<100	<100	<100	<100	<100
Zinc (B)	7440-66-6	47,000	65,800	75,000		21,800	20,800	**55,000***	**47,200***	39,400	**52,800***	45,800
Semivolatiles, PNAs, ug/Kg												
Acenaphthene	83-32-9	NA	NA	NA		<330	<330	<330	<330	<330	<330	<330
Acenaphthylene	208-96-8	NA	NA	NA		<330	<330	<330	<330	<330	<330	<330
Anthracene	120-12-7	NA	NA	NA		<330	<330	<330	<330	<330	<330	<330
Benzo(a)anthracene (Q)	56-55-3	NA	NA	NA		<330	<330	<330	<330	<330	<330	<330
Benzo(b)fluoranthene (Q)	205-99-2	NA	NA	NA		<330	<330	<330	<330	<330	<330	<330
Benzo(k)fluoranthene (Q)	207-08-9	NA	NA	NA		<330	<330	<330	<330	<330	<330	<330
Benzo(g,h,i)perylene	191-24-2	NA	NA	NA		<330	<330	<330	<330	<330	<330	<330
Benzo(a)pyrene (Q)	50-32-8	NA	NA	NA		<330	<330	<330	<330	<330	<330	<330
Chrysene (Q)	218-01-9	NA	NA	NA		<330	<330	<330	<330	<330	<330	<330
Dibenzo(a,h)anthracene (Q)	53-70-3	NA	NA	NA		<330	<330	<330	<330	<330	<330	<330
Fluoranthene	206-44-0	NA	NA	NA		<330	<330	<330	<330	<330	<330	<330
Fluorene	86-73-7	NA	NA	NA		<330	<330	<330	<330	<330	<330	<330
Indeno(1,2,3-cd)pyrene (Q)	193-39-5	NA	NA	NA		<330	<330	<330	<330	<330	<330	<330
2-Methylnaphthalene	91-57-6	NA	NA	NA		<330	<330	<330	<330	<330	<330	<330
Naphthalene	91-20-3	NA	NA	NA		<330	<330	<330	<330	<330	<330	<330
Phenanthrene	85-01-8	NA	NA	NA		<330	<330	<330	<330	<330	<330	<330
Pyrene	129-00-0	NA	NA	NA		<330	<330	<330	<330	<330	<330	<330
PCBs, ug/Kg												
PCB, Aroclor 1016	12674-11-2					<100	<100	<100	<100	<100	<100	<100
PCB, Aroclor 1221	11104-28-2					<100	<100	<100	<100	<100	<100	<100
PCB, Aroclor 1232	11141-16-5					<100	<100	<100	<100	<100	<100	<100
PCB, Aroclor 1242	53469-21-9					<100	<100	<100	<100	<100	<100	<100
PCB, Aroclor 1248	12672-29-6					<100	<100	<100	<100	<100	<100	<100
PCB, Aroclor 1254	11097-69-1					<100	<100	<100	<100	<100	<100	<100
PCB, Aroclor 1260	11096-82-5					<100	<100	<100	<100	<100	<100	<100
Total PCBs	1336-36-3	NA	NLL	NLL		<700	<700	<700	<700	<700	<700	<700

***BOLD values exceed statewide default background levels**

APPENDIX E

PHOTOGRAPHS OF SEDIMENT CORES



Sediment Core C-01

Sediment Core C-02

Sediment Core C-03

Sediment Core C-4 Top

Sediment Core C-4 Bottom

Sediment Core C-05

Sediment Core C-06

APPENDIX F

IMPORTANT INFORMATION ABOUT YOUR REPORT

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
THE BEST PEOPLE ON EARTH

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