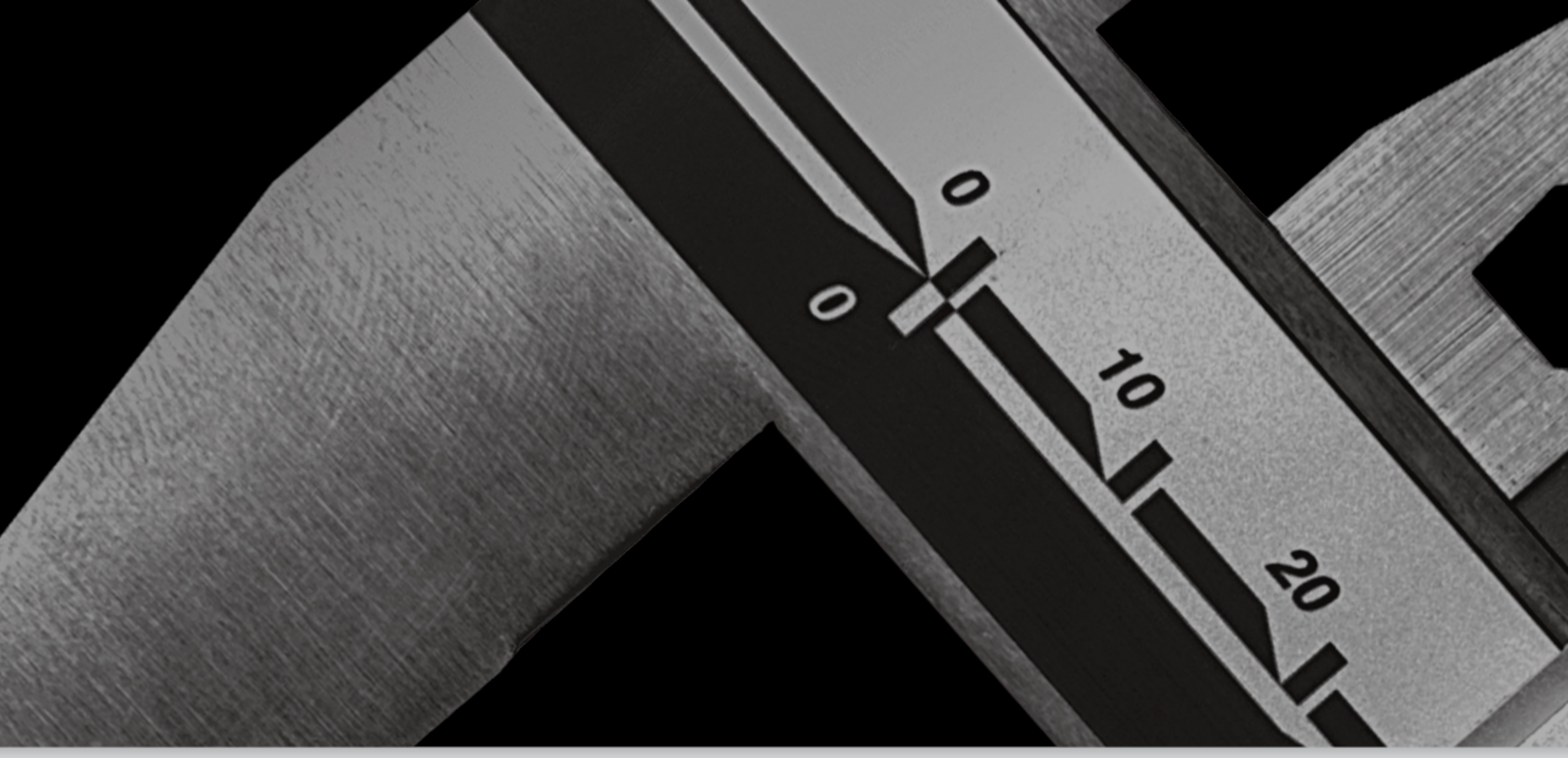

REPORT: T021335-A1

Argue Construction Ltd.
Geotechnical Investigation Report
New APEX Truck Terminal
1599 St. Laurent Blvd.
Ottawa, ON

October 9, 2014

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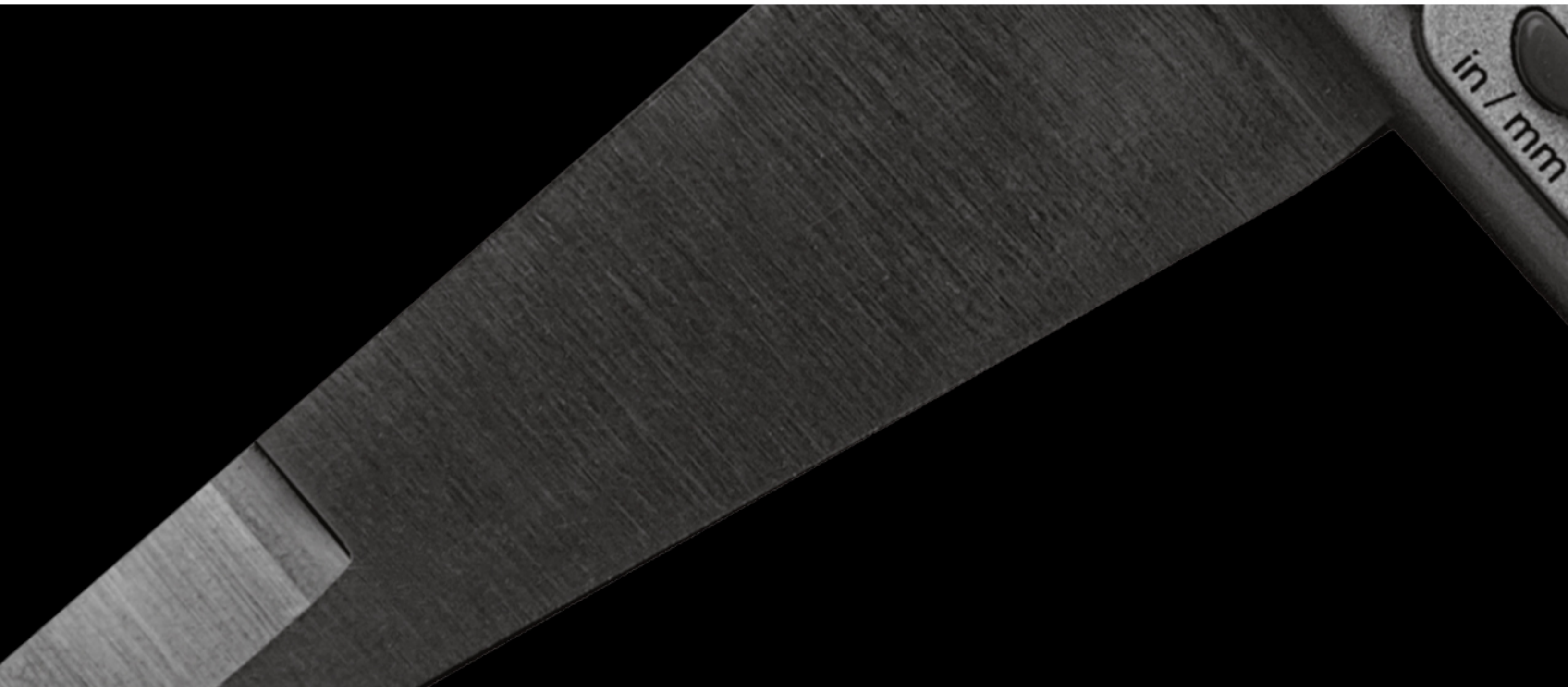

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Project No.: T021335-A1

Ottawa, October 9, 2013

Mr. Keith Riley
Argue Construction Ltd.
105-A Willowlea Road
Carp, ON
K0A 1L0

Subject: Geotechnical Investigation Report
T021335-A1
New APEX Truck Terminal
1599 St. Laurent Blvd.,
Ottawa, Ontario

Dear Riley:

It is with pleasure that we provide you with our Geotechnical Investigation report T021335-A1, regarding the construction of the new APEX Truck Terminal located at 1599 St. Laurent Boulevard in Ottawa, Ontario.

We thank you for having retained Inspec-Sol for technical and professional services and we hope to have the privilege of serving you again in the future.

The Inspec-Sol team is committed to exceeding the expectations of its clients.

Do not hesitate to contact us for any further information.

Best regards.

INSPEC-SOL INC.

Joseph B. Bennett, P. Eng.
Vice-President

SD/nc

INSPEC-SOL
ENGINEERING SOLUTIONS

Argue Construction Ltd.

Geotechnical Investigation
New APEX Truck Terminal
1599 St. Laurent Blvd.
Ottawa, Ontario

Date : **October 9, 2014** Our Ref. : **T021335-A1**

INSPEC•SOL
ENGINEERING SOLUTIONS

Mr. Keith Riley
Argue Construction Ltd.
105-A Willowlea Road
Carp, ON
K0A 1L0

Geotechnical Investigation
New APEX Truck Terminal
1599 St. Laurent Blvd.
Ottawa, Ontario

Ref.: T021335-A1
October 9, 2014

Prepared by :

Shan Dunstan, P.Eng.
Project Manager

Approved by:

Joseph B. Bennett, P. Eng.
Vice-President

REGISTERED PROFESSIONAL ENGINEER
October 9, 2014
T021335-A1
J. B. BENNETT
PROVINCE OF ONTARIO

Distribution: **Client –** Mr. Keith Riley
Copy by email: (keith@argueconsturction.ca)

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1.0 INTRODUCTION

Inspec-Sol Inc. (**Inspec-Sol**) was retained by Mr. Keith Riley of Argue Construction Ltd. to prepare an updated geotechnical investigation report for the construction and design of the new APEX Truck Terminal located at 1599 St. Laurent Boulevard in the City of Ottawa, Ontario.

Fondex Ontario Ltd., which was a wholly owned company of **Inspec-Sol**, had previously prepared a Geotechnical Investigation for this Site, *Ref No: F2711*, dated November 2004. However the Ontario Building Code revisions in 2006 and now 2012 make the technical recommendations of that report obsolete. The purpose of the current report is to use the soils data collected in 2004 and complete new engineering analysis and present new recommendations based upon the new analyses.

This report has been prepared with the understanding that the design will be as described in *Section 2.0* and will be carried out in accordance with OBC-2012 and applicable ASTM standards. Any changes to the project described herein will require that **Inspec-Sol** be retained to assess the impact of the changes on the recommendations provided herein.

The present scope of work for **Inspec-Sol** consisted of the following activities:

- **Reporting:** Prepare a Geotechnical Report based on the previous Fondex soils data, summarizing the findings of those fieldwork programs, and present new recommendations for the design and construction of the structure.

2.0 SITE AND PROJECT DESCRIPTION

The proposed APEX Truck Terminal (Project) is located at 1599 St. Laurent Boulevard (Site) in the City of Ottawa. The lot is a trapezoidal shape, currently vacant lot with vegetation cover. The Site is bounded to the north and east by industrial and commercial structures. It is bounded to the west by a similar undeveloped lot. It is bounded to the south by the CN rail tracks.

The proposed warehouse and office building will consist of a single storey industrial structure, which is rectangular in shape. No basement level is planned for the proposed structure. It is understood that the building will be surrounded by asphalt parking. Proposed and existing site servicing plans were not provided at the time of submitting this report.

Inspec-Sol has not been informed of any special floor loading requirements (i.e. rack loading or other specific floor design requirements). Therefore for the purposes of this report our recommendations are based upon floor loading of less than 24 kPa and no heavy racking or heavy process machinery. We understand that significant grade raises (i.e. >0.6m) are not envisioned for the Site.

The location of the Site is shown on the *Site Location Map* attached as, *Dwg. No.: T021335-A1-1*, at the end of this report.

3.0 FIELD INVESTIGATION

3.1 Historical Test Pit Fieldwork (Fondex-2004)

The historical test pit fieldwork component of this Geotechnical Investigation, performed by Fondex in 2004, consisted of the advancement of total of six (6) test pits.

Test pits TP2-04 through TP6-04 were excavated down to the bedrock at depths varying from approximately 3.9 m down to approximately 4.5 m below the existing surface grade. Test pit TP1-04 was terminated on a large slab of concrete located at a depth of approximately 1.6 m below the existing surface grade. Test pits were backfilled on completion.

The excavation of test pits was performed on November 1, 2004 using an excavator or rubber tired backhoe. The work was carried out under the supervision of Fondex Field Staff.

The location of the test pits is shown in the *Borehole and Test Pit Location Plan* attached as *Dwg No.: T021335-A1-2*, at the end of this report. A graphical representation of each borehole location presented on the *Test Pit Logs*, attached as *Enclosure Nos: 1 to 6* at the end of this report. *Notes on Boreholes and Test Pit Logs* are provided as *Appendix A*, at the end of this report to assist in the interpretation of the information.

The test pits were related to an arbitrary temporary bench mark which is described as the “top of spindle of the hydrant located at the south end of Triole Street”. This benchmark was given an arbitrary elevation of 100.00 m, non geodetic (NG). The benchmark is for information purposes only, and is to be used only within the context of this report. Test Pit elevations were related to this bench mark using a laser level by Fondex field staff.

3.2 Historical Borehole Fieldwork (CRA-2004)

The historical borehole fieldwork component of this Geotechnical Investigation, performed by Conestoga-Rovers & Associates (CRA) in 2004, consisted of the advancement of total of six (6) boreholes.

Boreholes MW01-04, MW02-04, MW03-04, and MW04-04 were advanced to depths of approximately 4.4 m, 3.6 m, 4.4 m, and 4.4 m, respectively, below the existing surface grade and were terminated within the native till. Boreholes MW05-04, and MW06-04 were advance to practical auger refusal at approximate depths of 4.3 m and 4.9 m, respectively below the existing surface grade. Boreholes were outfitted with monitoring wells screened at varying levels.

Boreholes were undertaken on November 1, 2004 using a specialized truck mounted drill rig adapted for soil sampling, under the supervision of CRA field staff. Boreholes were advanced into the overburden using hollow-stem continuous-flight auger equipment. Standard Penetration Tests (SPTs – ASTM D1586) were performed at regular intervals using a 50 mm diameter split-spoon sampler and a 63.5 kg hammer free falling from a distance of 760 mm, to collect soil samples. The number of drops required to drive the sampler 0.3 m is recorded on the borehole logs as “N” value.

The location of the boreholes and test pits is shown in the *Borehole and Test Pit Location Plan* attached as *Dwg No.: T021335-A1-2*, at the end of this report. A graphical representation of each borehole location presented on the *Borehole Logs*, attached as *Enclosure Nos: 7 through 12* at the end of this report. *Notes on Boreholes and Test Pit Logs* are provided as *Appendix A*, at the end of this report to assist in the interpretation of the information.

The boreholes were related to an arbitrary temporary bench mark which is described as the “top of spindle of the hydrant located at the south end of Triole Street”. This benchmark was given an arbitrary elevation of 100.00 m, non geodetic (NG). The benchmark is for information purposes only, and is to be used only within the context of this report. Borehole elevations were related to this bench mark using a laser level by CRA field staff.

4.0 SUBSURFACE CONDITIONS

In general, soils encountered at the test pit and borehole locations consisted of fill soils, with a buried topsoil or organic layer, followed by native sandy silts, underlain by a native shaley till. The bedrock at the Site was found to be shale.

General descriptions of the subsurface conditions found within the test locations are summarized in the following sections, with a graphical representation of each borehole location presented on the *Test Pit and Borehole Logs*, attached as *Enclosure Nos: 1 to 12* at the end of this report. *Notes on Boreholes and Test Pit Logs* are provided as *Appendix B*, at the end of this report to assist in the interpretation of the information. The soil conditions presented in this report reflect the results of the twelve (12) test locations only conditions and may vary in other areas, especially in previously excavated and backfilled areas such as this Site.

4.1 Fill Soils

In all test locations, fill soils were encountered. The upper levels of the fill, near the surface were described as a sand and gravel fill. Traces of bricks and wood were also noted within the upper fills. The deeper fills were described as a heterogeneous mixture of sands, silts and clays. It had some gravel sizes, cobbles, concrete rubble, and clay bricks. It was loose to compact in relative density, brown to grey in colour, and was recovered in a moist condition. The fill soils were found to be deepest in location MW05-04 at approximately 3.8 m below the existing grade. The fill soils were found to be shallowest in location MW06-04 at approximately 0.6 m below the existing surface grade.

In location TP1-04, a concrete slab was encountered at a depth of approximately 1.6 m below the existing surface grade. Additional probes around this test pit found that the concrete slab at least 6 m long or wide in each direction. TP1-04 was terminated on the surface of the concrete slab.

4.2 Sandy Silt / Silty Sand

In all test locations with the exception of TP1-04, the fill soils were found to be underlain by a native sandy silt or silty sand. This layer was identified as native based on the defining topsoil layers noted in locations TP2-04, TP3-04, TP5-04, TP6-04, MW01-04, and MW-03-04. The native soil was described as a sandy silt or a silty sand. It was loose to compact in relative density, grey with brownish mottling, and was recovered in a wet condition. The silty sand to sandy silt was found to be the thickest in location MW05-04 extending to approximately 4.0 m below the existing grade. The native sandy silt or silty sand was found to be thinnest in location MW06-04 extending to approximately 2.1 m below the existing surface grade.

4.3 Shale Till

In all test locations with the exception of TP1-04, the native sandy silt or silty sand was found to be underlain by a native shale till sand. The native shale till was described as a silt with some clay, some sand, and some gravel. Occasional cobble sized rock fragments were noted. It was compact to dense in relative compaction, dark grey in colour, and was recovered in a wet condition. In eastern Ontario, deposits such as this which exhibit the full spectrum of grain sizes and directly overly bedrock are often referred to as a Glacial Till. The shale till was found to extend deepest in location MW06-04 extending to approximately 4.9 m below the existing surface grade. It was found to be the shallowest in location TP3-04 at approximately 3.5 m below the existing surface grade.

4.4 Bedrock

The bedrock at this Site was identified as shale bedrock of the Billings or Carlsbad formations. Bedrock was observed in test pits TP2-04 through TP6-04. Practical refusal to auger advancement was encountered on assumed bedrock in boreholes MW05-04 and MW06-04. Bedrock was found to be shallowest in location TP3-04 at approximately 3.5 m below the existing surface grade. It was found to be deepest in location MW16-04, at approximately 4.9 m below the existing surface grade. As coring of the bedrock was not part of the scope of work, **Inspec-Sol** is not able to comment on the quality of the bedrock.

5.0 GROUNDWATER

As part of the historical CRA-2004 fieldwork, six (6) monitoring wells were installed across the Site. The water levels were recorded on November 2, 2014. Based on the historical Fondex-2004 fieldwork, comments were made on where the soils became wet with depth.

The following summary of the observations of water levels at the time of sampling are presented to assist Designers and Contractors:

TABLE 1: Groundwater Observations

Sample Location	Groundwater Level in Monitoring Well * **	Additional Observations based on Sample Appearance **
TP1-04		No comments provided
TP2-04		Becoming wet at 1.6 m
TP3-04		Becoming wet at 1.3 m
TP4-04		Becoming wet at 3.0 m
TP5-04		Becoming wet at 1.3 m
TP6-04		Becoming wet at 2.2 m
MW01-04	2.6 m	Becoming wet at 2.2 m
MW02-04	1.3 m	Becoming wet at 1.5 m
MW03-04	2.6 m	Becoming wet at 1.5 m
MW04-04	3.3 m	Becoming wet at 2.3 m
MW05-04	1.6 m	Becoming wet at 2.3 m
MW05-04	2.1 m	Becoming wet at 1.8 m

* As measured by CRA on November 2, 2004.
** Below the existing grade.

It should be noted that groundwater levels are subject to seasonal fluctuations and in response to precipitation and snowmelt events, and are anticipated to be at their highest during the thaw in early spring.

6.0 DISCUSSION AND RECOMMENDATIONS

The recommendations contained within this report are based on **Inspec-Sol**'s understanding of the proposed development, which is outlined as follows:

- The proposed building will consist of a one (1) storey slab-on-grade construction;
- There are no (0) basements or crawl spaces;
- The floor slab is of a lightly loaded commercial type with no heavy racking or process machinery; **Inspec-Sol** is assuming floor loadings of less than

24kPa. If designers have higher loads then **Inspec-Sol** should be informed to review the recommendations for the floor slab design.

- There are no (0) significant grade raises planned for this Site (i.e. grade raises in excess of 0.6 m).

If any of these assumptions are incorrect or these facts change through the design or construction phases, **Inspec-Sol** must be retained to assess the impact on our recommendations.

Based on our understanding of the proposed structure, the subsurface conditions encountered in the boreholes, and assuming them to be representative of the subsurface conditions across the Site, the following recommendations are provided. The most important geotechnical considerations for the design of the proposed building are the following:

- **Depth of Foundations:** Pad and strip footings must be founded on native undisturbed silty sand or sandy silt. The existing fills are not a suitable founding soil. Based on the sample locations, the fill in the building location appears to extend down to approximately 1.7 m below the existing surface grade. Therefore, **Inspec-Sol** recommends that footings be founded at approximately 2.0 m deep;
- **Minimization of Soil Disturbance:** The sandy silt / silty sand soils on Site are subject to softening if exposed to standing water for any extended period of time. Excavations need to be free of water during concrete placement. Footing excavations in the silty sand / sandy silt should be performed with a smooth-edged ditching bucket to ensure that the footing subgrade is undisturbed. It is recommended that Contractors employ a lean mix concrete mud slab on the approved subgrade.
- **Removal of Fill Soils and Buried Topsoil from Beneath the Floor Slab**: It is important to note that there are existing fill soils and buried Topsoil. Designers and Contractors will need to be aware of this issue, as it will mean increased quantities earthwork and soil handling. All fill and buried Topsoil soils should be removed from beneath the building footprint and replaced with Engineered Fill.

6.1 Site Preparation

Site preparation within the footprint of the building will require the stripping of all fill soils and buried Topsoil to expose a native undisturbed silty sand or sandy silt subgrade. The exposed surface should be examined by geotechnical personnel to assess the competency. Any identified local anomalies or soft spots should be subsequently excavated, replaced with suitable fill, and compacted. All fill underlying footings or floor slabs should be considered as Engineered Fill and treated in accordance to the comments in *Section 6.5.1.*

Fill materials are not suitable for bearing of any foundation elements or floor slabs. Excavations for footings should extend to expose a native undisturbed silty sand or sandy silt subgrade surface. Subgrades should be free of fill, roots, and any organics. All footing subgrades should be inspected by a Geotechnical Engineer or a qualified technologist working under the supervision of a Geotechnical Engineer.

The native soils at this site are subject to strength loss upon disturbance, especially when these soils are subjected to elevated moisture content. Disturbed soils will not be suitable and will need to be removed. Specifications should make some allowance for this issue, but Contractors will need to use construction practices, methods, and equipment that minimize the risk of disturbance. All final subgrade excavations should be performed with a smooth-edged ditching bucket to leave a relatively even subgrade.

Inspec-Sol recommends that all footing bearing surfaces, once inspected, be immediately covered with a lean mix concrete mud slab. This will serve to protect the soils from disturbance, and provide a clean level working mat upon which to place reinforcing steel.

The Site should be graded in the early stages of construction to provide for control of surface water, directing it away from excavations. A ditching and pumping system may be necessary in order to collect any surface runoff or groundwater accumulation.

6.2 Excavation and Dewatering

All footings will need to rely on native undisturbed silty sand / sandy silt or on Engineered Fill. Therefore, it is expected that excavations for the building will extend to approximately 2.0 m below the existing ground surface.

All excavations should be completed and maintained in accordance with the current Occupational Health and Safety Act (OHSA), Regulations for Construction. The following recommendations for excavations should be considered to be a supplement to, and not a replacement of the OHSA requirements.

Based on the results of the investigation, the heterogeneous fill soils that will be encountered during excavation, and which range from approximately 0.6 m down to approximately 3.5 m would be considered as a “Type 3 Soil”, as defined by the OHSA Regulations for Construction. However if they become wet or muddy from surface water or because they are below the water table, they will become a “Type 4 Soil”, as defined by the OHSA Regulations for Construction.

Based on the results of the investigation, the native silty sand / sandy silt that will be encountered during excavation, and which range from approximately 2.1 m to approximately 3.0 m would be considered as a “Type 3 Soil”, as defined by the OHSA Regulations for Construction. However if they become wet or muddy from surface water or because they are below the water table, they will become a “Type 4 Soil”, as defined by the OHSA Regulations for Construction.

Surface water and groundwater infiltration is expected to enter into the anticipated excavations. Water quantities will depend on seasonal conditions, depth of excavations, and the duration that excavations are left open. The scope of work did not include hydraulic testing and analysis to confirm quantities. Conventional construction dewatering techniques should be expected during construction, such as pumping from sumps and or ditches. Contractors will need to use techniques and methods to minimize disturbance to soils.

The groundwater inflow into the excavations (groundwater and precipitation and runoff) should be included in construction management. It is noted that as per the Water Taking and Transfer Regulation (O.Reg. 387/04), a regulation under the Ontario Water Resources Act. Section 34, anyone taking water more than 50,000 Litres per day needs to apply for Permit to Take Water (PTTW).

This issue will need to be reviewed and may need additional investigative program prior to construction. PTTW applications into the MOE will take a minimum of 3 months for review, or longer. The time for investigation and PTTW Permit preparation must also be factored into the schedule.

6.3 Foundations

Inspec-Sol understands that the proposed foundation for the single storey building is to consist of pad and strip footings.

Fill materials are not suitable for bearing of any foundation elements. Based on the test locations TP2-04, TP3-04, TP4-04, TP5-04, TP6-04, and MW02-04, the fill soils were found to extend to a depth ranging from approximately 1.3 m down to approximately 1.7 m. Furthermore a buried topsoil layer was found below this, which will also not be suitable. Therefore, it is recommended that the footings be founded at a depth of approximately 1.8m or on the native undisturbed silty sand / sandy silt, whichever is deeper. In deeper areas it may be practical to sub-excavate unsuitable soils to reach competent subgrade and then backfill with Engineered Fill placed directly on the undisturbed silty sand / sandy silt.

For footings set on native undisturbed silty sand / sandy silt, or Engineered Fill, the recommended bearing pressure would be 125 kPa under factored (geotechnical resistance factor, Φ=0.5) Ultimate Limit State (ULS) conditions, and 100 kPa under Serviceability Limit State (SLS) conditions. This is based on a maximum footing width of 2.0 m for strip footings, and a maximum of 4.0 m x 4.0 m for pad footings. For foundation elements placed on native silty sand / sandy silt, we estimate that total and differential settlements will not exceed 25mm and 19mm, respectively under the SLS loading condition of 100 kPa. Larger footing sizes, shallower footings, and significant grade raises (>0.6 m) will require a specific settlement estimate, and may decrease the available bearing pressures.

Designers and Contractors must ensure that the Engineered Fill used to raise the grade below the footings and above the sandy silt / silty sand, has the lateral extent of Engineered Fill beneath foundations extend laterally a distance equivalent to 1.5 D from any edge of the foundation, where D is depth of the Engineered Fill below the footings. Specific comments for Engineered Fill are presented in *Section 6.5.1.* The silty sand / sandy silt surface below the Engineered Fill should similarly be prepared as if it was a footing base, and reviewed by the Engineer prior to placement of the Engineered Fill, as outlined above.

Footings at varying levels and/or constructed adjacent to utility trenches, sump pits or similar should be constructed such that footings be set at a level below an imaginary line constructed 10H:7V from the base of the lower excavation. Step footings should be designed with benching no steeper than 2H:1V along their length.

Footing excavations in the silty sand / sandy silt should be performed with a smooth-edged ditching bucket to ensure that the footing subgrade is undisturbed. It is recommended that Contractors employ a lean mix concrete mud slab on the approved subgrade.

It is recommended that **Inspec-Sol** be retained to complete a review for compliance with our recommendations and during construction to verify suitability of subgrade materials.

6.3.1 Seismic Site Classification

In accordance with OBC-2012, buildings and their structural elements must be designed to resist a minimum earthquake force. Based upon the results of the CRA-2004 drilling program, we recommend that structures be designed to Site Class 'D', with respect to Table 4.1.8.4.A of the OBC-2012. In addition to the above, it should be noted that no soil deposit with a thickness of 3.0 m or more, was found within the borehole locations which would be considered as "soft soils" as defined in Table 4.1.8.4.A of OBC-2012. In order to be considered as "soft soils" all of the following criteria must be satisfied:

- Plastic Index: Ip > 20%;
- Moisture Content: w ≥ 40%; and
- Undrained Shear: Strength Su < 25 kPa.

6.3.2 Frost Protection

All exterior footings exposed to freezing temperatures that are associated with a heated building should be provided with at least 1.5 m of earth cover or its equivalent in insulation, in order to provide adequate protection against detrimental frost action. This cover depth should be increased to 1.8 m for unheated or "stand-alone" structures such as entrance canopies, outbuildings, or light posts.

The soils encountered in the boreholes are considered to be frost-susceptible. Should construction take place during winter, the exposed subgrades to support foundations must be protected by Contractors against freezing.

6.4 Permanent Drainage

Under floor and perimeter drains are not considered necessary for a structure with no basement and a floor slab set at a minimum of 0.3 m above finished exterior grades. If the floor slab is set level with exterior grades, then a perimeter drainage system around the proposed building is recommended. The drain should be connected to a frost-free outlet for year round drainage.

6.5 Building Backfill

The placement and compaction of the materials that will support floor slabs, footings, or pavement must be treated as Engineered Fill.

6.5.1 Engineered Fill

The fill operations for Engineered Fill placement must satisfy the following criteria.

- Engineered Fill must be placed under the continuous supervision of the Geotechnical Engineer, or a qualified technician working under the supervision of the Geotechnical Engineer. Prior to placing any Engineered Fill, all unsuitable fill materials must be removed, and the subgrade proof rolled, and approved. Any deficient areas should be repaired;
- Prior to the placement of Engineered Fill, the source or borrow areas for the Engineered Fill must be evaluated for its suitability. Samples of proposed fill material must be provided to the Geotechnical Engineer and tested in the geotechnical laboratory for Standard Proctor Maximum Dry Density (SPMDD) and grain size, prior to approval of the material for use as Engineered Fill. The Engineered Fill must consist of environmentally suitable soils (as per industry standard procedures of federal or provincial guidelines/regulations), free of organics and other deleterious material (building debris such as wood, bricks, metal, and the like), compactable, and of suitable moisture content so that it is within -2% to +0.5% of the Optimum Moisture as determined by the Standard Proctor test. Imported granular soils meeting the requirements of Granular ‘A’, Granular ‘B’ Type I or Type II Ontario Provincial Standard Specification (OPSS) 1010 criteria would be suitable;

- The Engineered Fill must be placed in maximum loose lift thicknesses of 0.2 m. Each lift of Engineered Fill must be compacted with a heavy roller to 100% SPMDD;
- Field density tests must be taken by a qualified technician working under the supervision of the Geotechnical Engineer, on each lift of Engineered Fill. Any Engineered Fill, which is tested and found to not meet the specifications, shall be either removed or reworked and retested; and
- The lateral extent of Engineered Fill beneath foundations should be equivalent to 1.5 D from any edge of the foundation, where D is depth of the Engineered Fill below the footings.

6.5.2 Exterior Foundation Wall Backfill

The backfill placed against exterior foundation walls should be free draining granular materials meeting the grading requirements of OPSS 1010 for Granular ‘B’ Type I or II specifications with maximum nominal size for both materials of less than 75 mm. In landscaped areas the upper 0.3 m below landscape details should be a low permeable soil to reduce surface water infiltration. Exterior foundation wall backfill should be placed and compacted as outlined below.

- Free-draining granular backfill should be used for the foundation wall;
- Backfill should not be placed in a frozen condition, or place on a frozen subgrade;
- Backfill should be placed and compacted in uniform lift thickness compatible with the selected construction equipment, but not thicker than 0.2 m. Backfill should be placed uniformly on both sides of the foundation walls to avoid build-up of unbalanced lateral pressures;
- At exterior flush door openings the underside of sidewalks should be insulated, or the sidewalk should be placed on frost walls to prevent heaving. Granular backfill should be used and extended laterally beneath the entire area of the entrance slab. The entrance slab should slope away from the building;

- For backfill that would underlie paved areas, sidewalks or exterior slabs-on-grade, each lift should be uniformly compacted to at least 98% of its SPMDD;
- For backfill on the building exterior that would underlie landscaped areas, each lift should be uniformly compacted to at least 95% of its SPMDD;
- In areas on the building exterior where an asphalt or concrete pavement will not be present adjacent to the foundation wall, the upper 0.3 m of the exterior foundation wall backfill should be a low permeable soil to reduce surface water infiltration; and
- Exterior grades should be sloped away from the foundation wall, and roof drainage downspouts should be placed so that water flows away from the foundation wall.

6.6 Floor Slabs

Conventional slab-on-grade construction is considered suitable for the proposed building. We are assuming that the building will have light floor loadings only, i.e. considered to be less than 24 kPa. Higher loading requirements such as racking or process machinery will require additional consultation and analysis.

A layer consisting of OPSS 110 Granular ‘A’, Type II, at least 200 mm thick should be placed to support the slab-on-grade. This layer should be compacted to 100% of its SPMDD and placed on approved subgrade surfaces.

If floor coverings are to be used, a vapour barrier and a capillary moisture barrier is recommended to be incorporated beneath the slab. The capillary barrier can be obtained by using a Clear Stone layer beneath the slab. The vapour barrier may use heavy duty polythene plastic sheeting.

Floor toppings are impacted by curing and moisture conditions of the concrete which are in turn impacted by the presence/absence of vapour barriers. Floor finish manufacturer’s specifications and requirements should be consulted and procedures outlined in the specifications should be followed.

The slabs should not be tied into the foundation walls. The placement of construction and control joints in the concrete should be in accordance with generally accepted practice.

6.7 Underground Services

6.7.1 Bedding and Cover

The following are recommendations for service trench bedding and cover materials:

- Bedding for buried utilities should be OPSS Granular ‘A’ or ‘B’ Type II as applicable, and placed in accordance with City of Ottawa specifications;
- Use of 19 mm Clear Stone is not recommended for use as bedding. The voids in the stone may result in a low gradient water flow and infiltration of fines from the surrounding soils and cover materials, causing settlement and loss of support to pipes and structures;
- The cover material should be a sand material or Granular ‘A’ and the dimensions should comply with City of Ottawa standards;
- The bedding material and cover materials should be compacted as per City of Ottawa standards and to at least 95% of its SPMDD; and
- Compaction equipment should be used in such a way that the utility pipes are not damaged during construction.

6.7.2 Service Trench Backfill

Backfill above the cover for buried utilities should be in accordance with the following recommendations:

- For service trenches under landscaped areas, the backfill should be placed and compacted in uniform thickness compatible with the selected compaction equipment and not thicker than 200 mm. Each lift should be compacted to a minimum of 95% SPMDD;
- The backfill placed in the upper 300 mm below a pavement or sidewalk subgrade elevation should be compacted to a minimum of 100% SPMDD;

- To reduce the potential for differential settlement and frost heave, the selected backfill materials should reasonably match the existing soil profile within the frost penetration zone (1.8 m below finished grade) except that fill with organic matter should not be re-used in trenches. Alternatively, if imported backfill, including granular materials are used, then the excavation side slopes should have frost tapers as per OPSD 800 series which essentially indicates that there should be a backslope of 10:1 (H:V) from the bedding grade to the finished grade;
- If the native excavated soils are used as backfill, this material should be protected from moisture increases during construction. The native excavated soils should be assessed and approved by a Geotechnical Engineer prior to re-use; and
- Excavated soils that are too wet (i.e. greater than 5% above the optimum moisture content based upon a Standard Proctor Test) will become problematic to compact and may not perform properly during construction period. If such conditions occur, the options include drying of the soils; compacting and leaving the area untraveled for a period of time; importation of more suitable material; or a combination of above and the use of geotextiles at the base and possibly additional layers within the pavement structure's granular base courses. The appropriate measures will need to be discussed during construction period and be such to achieve adequate performance from the pavement structure.

6.8 Parking and Driveway Pavements

Roadways, driveways, and parking areas are expected to be constructed over the existing fill soils, provided they are proof-rolled, inspected, and approved by geotechnical personnel. In order to prepare the site for the pavement area, it is necessary that the area be stripped of any existing cover materials such as surficial topsoil and associated root-mat, or other deleterious materials deemed unsuitable by geotechnical personnel to expose a suitable subgrade. The exposed subgrade should be proof rolled in the presence of a Geotechnical Engineer. Any areas where "soft spots", rutting, local anomalies, or appreciable deflection are noted should be excavated and replaced with suitable fill, and use of geotextiles may be warranted for strength improvement. The fill should be compacted to at least 100% of its SPMDD.

The pavement sections described in Table 2 below are recommended for areas subjected to both typical parking use and heavy traffic (i.e. driven lanes). Pavement materials and workmanship should conform to the appropriate OPSS.

Table 2: Recommended Minimum Pavement Sections

Pavement Layer	Light Duty (Parking Stalls)	Heavy Duty (Driven Lanes)
HL3 Asphalt Surface*	50 mm	50 mm
HL8 Asphalt Binder	N/R	50 mm
Granular A Basecourse	100 mm	150 mm
Granular B Type II Subbase	300 mm	450 mm

*HL1 in truck turning areas.

Drainage of all pavement layers is important. The subgrade surface and each layer of the pavement section should be provided with a suitable cross fall (approximately 2%) to prevent water from ponding on the pavement surface and beneath the pavement layers. Surface runoff should be directed to storm sewers, or allowed to flow into ditches.

Sufficient field-testing should be carried out during construction to assess compaction of each lift of the pavement layers. This should be accompanied by laboratory testing of the granular and asphalt materials. All granular base course materials should be compacted to 100% of its SPMDD. Asphalt materials should be compacted to a minimum of 92.0% of the Marshall Maximum Relative Density as per OPSS 310, Table 10.

Annual or regular maintenance will be required to achieve maximum life expectancy. Generally, the asphalt pavement maintenance will involve crack sealing and repair of local distress.

It should be noted that the pavement sections described within this report represent end-use conditions only, which includes light vehicular traffic and occasional garbage or service trucks. It may be necessary that these sections be temporarily over-built during the construction phase to withstand larger construction loadings such as loaded dump trucks or concrete trucks.

6.9 Construction Field Review

The recommendations provided in this report are based on an adequate level of construction monitoring being conducted during construction phase of the proposed building. **Inspec-Sol** requests to be retained to review the drawings and specifications, once complete, to verify that the recommendations within this report have been adhered to, and to look for other geotechnical problems. Due to the nature of the proposed development, an adequate level of construction monitoring is considered to be as follows:

- Prior to construction of footings, the exposed foundation subgrade should be examined by a Geotechnical Engineer or a qualified technician acting under the supervision of a Geotechnical Engineer, to assess whether the subgrade conditions correspond to those encountered in the boreholes, and the recommendations provided in this report have been implemented;
- A qualified technician acting under the supervision of a Geotechnical Engineer should monitor placement of Engineered Fill underlying footings and floor slabs;
- Backfilling operations should be conducted in the presence of a qualified technician to ensure that proper material is employed and specified compaction is achieved; and
- Placement of concrete should be periodically tested to ensure that job specifications are being achieved.

7.0 LIMITATION OF THE INVESTIGATION

This report is intended solely for Argue Construction Ltd. or other party explicitly identified in this report, and is prohibited for use by others without **Inspec-Sol**’s prior written consent. This report is considered **Inspec-Sol**’s professional work product and shall remain the sole property of **Inspec-Sol**. Any unauthorized reuse, redistribution of or reliance on the report shall be at the Client and recipient’s sole risk, without liability to **Inspec-Sol**. Client shall defend, indemnify and hold **Inspec-Sol** harmless from any liability arising from or related to Client’s unauthorized distribution of the report. No portion of this report may be used as a separate entity; it is to be read in its entirety and shall include all supporting drawings and appendices.

The recommendations made in this report are in accordance with our present understanding of the project, the current site use, ground surface elevations and conditions, and are based on the work scope approved by the Client and described in the report. The services were performed in a manner consistent with that level of care and skill ordinarily exercised by members of Geotechnical Engineering professions currently practicing under similar conditions in the same locality. No other representations, and no warranties or representations of any kind, either expressed or implied, are made. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

All details of design and construction are rarely known at the time of completion of a geotechnical study. The recommendations and comments made in the study report are based on our subsurface investigation and resulting understanding of the project, as defined at the time of the study. We should be retained to review our recommendations when the drawings and specifications are complete. Without this review, **Inspec-Sol** will not be liable for any misunderstanding of our recommendations or their application and adaptation into the final design.

By issuing this report, **Inspec-Sol** is the Geotechnical Engineer of record. It is recommended that **Inspec-Sol** be retained during construction of all foundations and during earthwork operations to confirm the conditions of the subsoil are actually similar to those observed during our study. The intent of this requirement is to verify that conditions encountered during construction are consistent with the findings in the report and that inherent knowledge developed as part of our study is correctly carried forward to the construction phases.

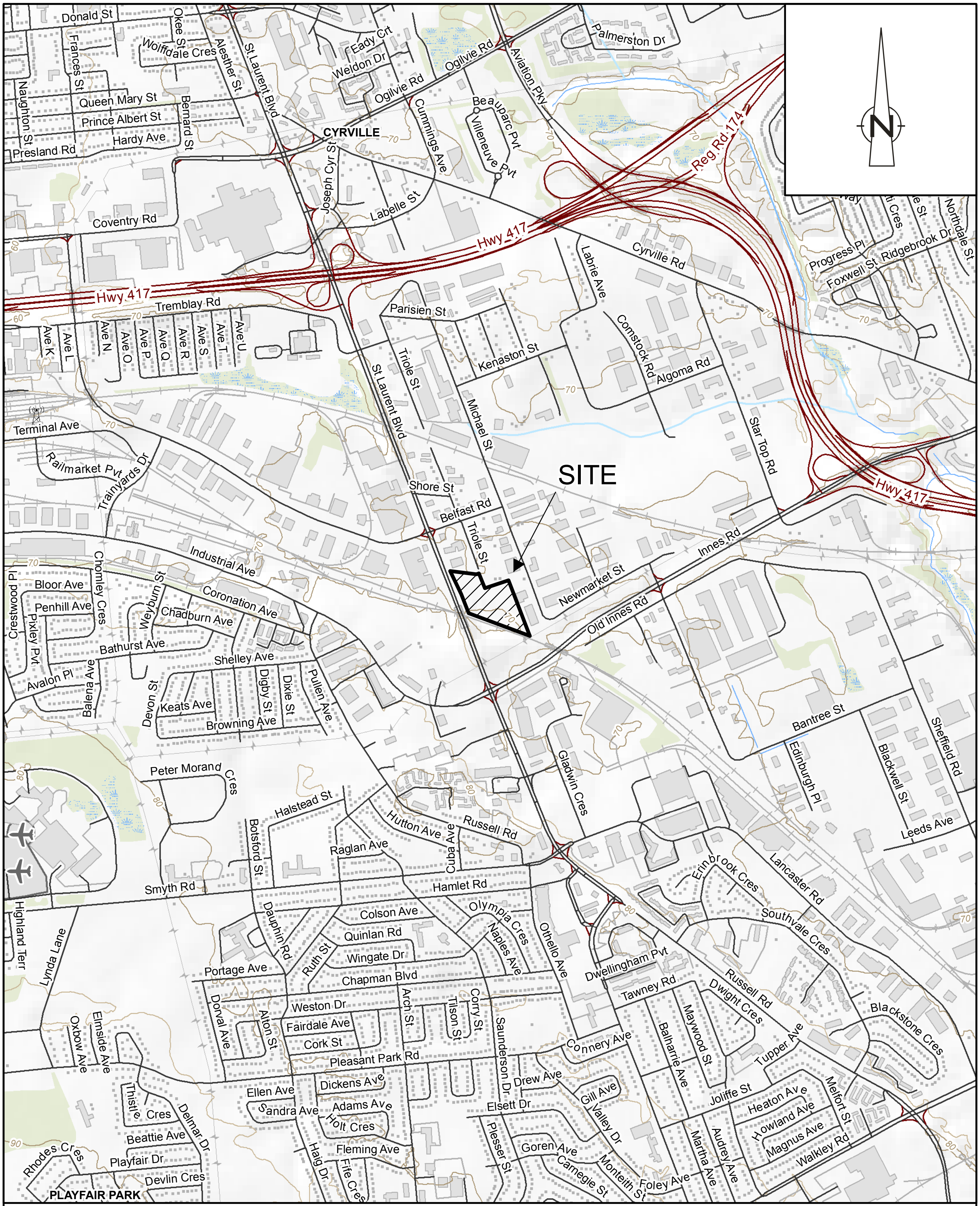
It is important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments included in this report are based on the results obtained at the six (6) borehole and six (6) test pit locations only. The subsurface conditions confirmed at these test locations may vary at other locations. Soil and groundwater conditions between and beyond the twelve (12) test locations may differ both horizontally and vertically from those encountered at the test locations and conditions may become apparent during construction, which could not be detected or anticipated at the time of our investigation. Should any conditions at the site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations.

If changed conditions are identified during construction, no matter how minor, the recommendations in this report shall be considered invalid until sufficient review and written assessment of said conditions by **Inspec-Sol** is completed.

SD/nc

Drawings

- T021335-A1-1 Site Location Plan
- T021335-A1-2 Borehole and Test Pit Location Plan



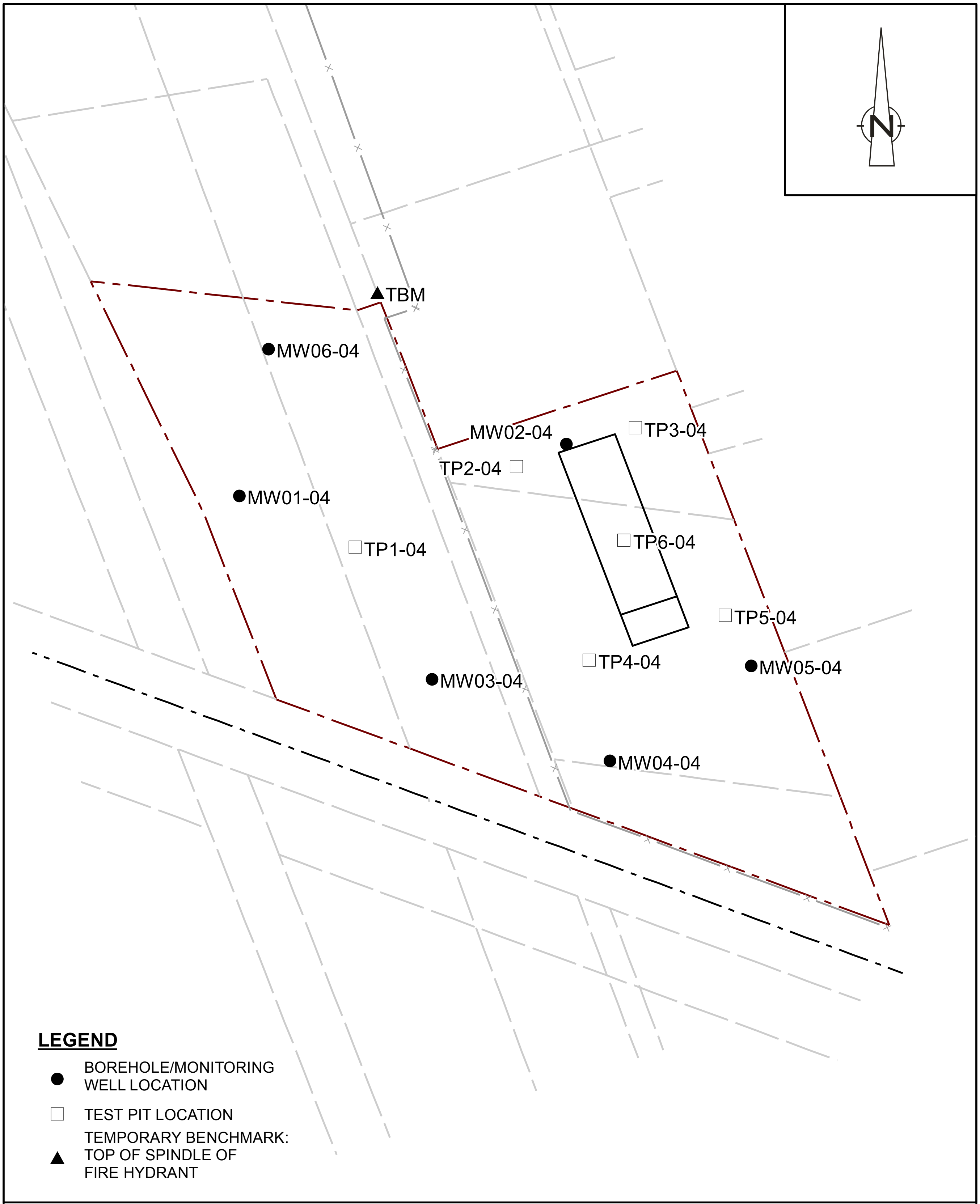
Source: MNR NRVIS, 2013. Produced by CRA under licence from Ontario Ministry of Natural Resources, © Queen's Printer 2014;
Coordinate System: NAD 1983 UTM Zone 18N

SITE LOCATION MAP

GEOTECHNICAL INVESTIGATION
NEW APEX TRUCK TERMINAL
ARGUE CONSTRUCTION LTD.
Dwg. No. T021335-A1-1

INSPEC·SOL

T021335-A1(001)GIS-OT001 October 08, 2014



LEGEND

●	BOREHOLE/MONITORING WELL LOCATION
☐	TEST PIT LOCATION
▲	TEMPORARY BENCHMARK: TOP OF SPINDLE OF FIRE HYDRANT

Source: FONDEX Dwg No. F2711-2;
Coordinate System: NAD 1983 UTM Zone 18N

BOREHOLE LOCATION PLAN

GEOTECHNICAL INVESTIGATION
NEW APEX TRUCK TERMINAL
ARGUE CONSTRUCTION LTD.
Dwg. No. T021335-A1-2

INSPEC-SOL

T021335-A1(001)GIS-OT002 October 08, 2014

Enclosures

Test Pit Logs (Fondex-2004)	TP1-04 through TP6-04
Borehole Logs (CRA-2004)	MW01-04 through MW06-04

REFERENCE No.: F2711

ENCLOSURE No.:

FONDEX

TEST PIT No.: TP1-04

ELEVATION: 99.56 m

TEST PIT LOG

Page: 1 of 1

CLIENT: W.A. Redekopp

PROJECT: Geotechnical Survey/Phase II Environmental Site Assessment

LOCATION: 1599 St. Laurent Boulevard, Ottawa, Ontario

DESCRIBED BY: M.Soliman

CHECKED BY:

DATE (START): January 11, 2004

DATE (FINISH):

LEGEND

GSE	Grab Sample (environmental)
GS	Grab Sample (Geotechnical)
CHEM	Chemical Analysis
▼	Water Level
○	Water content (%)
⊢⊣	Atterberg limits (%)
☐ Cu	Shear Strength based on Lab Vane
S	Sensitivity Value of Soil
▲	Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				SCALE FOR TEST RESULTS
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Test Type	Organic Vapour ppm or %LEL		50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
metres	99.56		GROUND SURFACE			ppm		
		▨	SAND AND GRAVEL FILL, trace clay, moist					
		▨	CLAY AND SAND FILL, large concrete blocks, burned wood, and construction waste, loose to compact, brown, moist					
0.5		▨						
1.0		▨						
1.5		▨						
			Test pit ended on large concrete slab.					
2.0								
2.5								
3.0								
3.5								
4.0								
4.5								

NOTES:

1. Test pit dry upon completion.

BOREHOLE LOG F2711-00(01-NOV-04-BM)BH-OT001.GPJ INSPEC_SOL.GDT 11/12/04

REFERENCE No.: F2711

ENCLOSURE No.:

FONDEX

TEST PIT No.: TP2-04

ELEVATION: 99.36 m

TEST PIT LOG

Page: 1 of 1

CLIENT: W.A. Redekopp

PROJECT: Geotechnical Survey/Phase II Environmental Site Assessment

LOCATION: 1599 St. Laurent Boulevard, Ottawa, Ontario

DESCRIBED BY: M.Soliman

CHECKED BY:

DATE (START): January 11, 2004

DATE (FINISH):

LEGEND

GSE	Grab Sample (environmental)
GS	Grab Sample (Geotechnical)
CHEM	Chemical Analysis
▼	Water Level
○	Water content (%)
├─┤	Atterberg limits (%)
□ Cu	Shear Strength based on Lab Vane
S	Sensitivity Value of Soil
▲	Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Test Type	Organic Vapour ppm or %LEL		
metres	99.36		GROUND SURFACE			ppm		
			SAND AND CLAY FILL, some gravel, some stone fragments and concrete blocks, compact, brown, very moist					
			TOPSOIL					
			SANDY SILT, loose to compact, grey, wet					
			SILTY CLAY TILL, stiff, dark grey, wet					
			Excavation refused on shale bedrock.					

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

NOTES:
1. Water tabled estimated from sample appearance at 1.6m depth.

REFERENCE No.: F2711

ENCLOSURE No.:

FONDEX

TEST PIT No.: TP3-04

ELEVATION: 99.38 m

TEST PIT LOG

Page: 1 of 1

CLIENT: W.A. Redekopp

PROJECT: Geotechnical Survey/Phase II Environmental Site Assessment

LOCATION: 1599 St. Laurent Boulevard, Ottawa, Ontario

DESCRIBED BY: M.Soliman

CHECKED BY:

DATE (START): January 11, 2004

DATE (FINISH):

LEGEND

GSE	Grab Sample (environmental)
GS	Grab Sample (Geotechnical)
CHEM	Chemical Analysis
▼	Water Level
○	Water content (%)
⊢⊣	Atterberg limits (%)
□ Cu	Shear Strength based on Lab Vane
S	Sensitivity Value of Soil
▲	Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Test Type	Organic Vapour ppm or %LEL		SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
metres	99.38		GROUND SURFACE			ppm		
		▩	SILTY SAND FILL, some gravel and shale fragments, some construction waste, compact, brown, very moist					
0.5								
1.0		⁘	TOPSOIL					
		▨	SANDY SILT, loose, grey, very moist					
1.5			becoming wet					
2.0								
		▨	SILTY CLAY TILL, stiff, dark grey, wet					
2.5								
3.0								
3.5			Excavation refused on shale bedrock.					
4.0								
4.5								

NOTES:

1. Water tabled estimated from sample appearance at 1.5m depth.

BOREHOLE LOG F2711-00(01-NOV-04-BM)BH-OT001.GPJ INSPEC_SOL.GDT 11/12/04

REFERENCE No.: F2711 ENCLOSURE No.:

TEST PIT No.: TP4-04

ELEVATION: 99.46 m

TEST PIT LOG

Page: 1 of 1

CLIENT: W.A. Redekopp

PROJECT: Geotechnical Survey/Phase II Environmental Site Assessment

LOCATION: 1599 St. Laurent Boulevard, Ottawa, Ontario

DESCRIBED BY: M.Soliman CHECKED BY:

DATE (START): January 11, 2004 DATE (FINISH):

LEGEND

GSE	Grab Sample (environmental)
GS	Grab Sample (Geotechnical)
CHEM	Chemical Analysis
▼	Water Level
○	Water content (%)
├─┤	Atterberg limits (%)
☐ Cu	Shear Strength based on Lab Vane
S	Sensitivity Value of Soil
▲	Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Test Type	Organic Vapour ppm or %LEL		SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
metres	99.46		GROUND SURFACE			ppm		
			SAND AND GRAVEL FILL, compact, grey, moist					
			SAND FILL, fine to medium, compact, brown, moist					
0.5			SILTY CLAY FILL, some stone fragments, large boulder, firm, grey, very moist					
1.0								
1.5			SAND FILL, medium to coarse, compact, brown, moist					
			SANDY SILT, loose to compact, brown, very moist					
2.0								
2.5								
3.0			SANDY SILT TILL, compact, grey, wet					
3.5								
4.0								
4.5			Excavation refused on shale bedrock.					

NOTES:

1. Water tabled estimated from sample appearance at 3.0m depth.

BOREHOLE LOG F2711-00(01-NOV-04-BM)BH-OT001.GPJ INSPEC_SOL.GDT 11/12/04

REFERENCE No.: F2711

ENCLOSURE No.:

FONDEX

TEST PIT No.: TP5-04

ELEVATION: 99.04 m

TEST PIT LOG

Page: 1 of 1

CLIENT: W.A. Redekopp

PROJECT: Geotechnical Survey/Phase II Environmental Site Assessment

LOCATION: 1599 St. Laurent Boulevard, Ottawa, Ontario

DESCRIBED BY: M.Soliman

CHECKED BY:

DATE (START): January 11, 2004

DATE (FINISH):

LEGEND

GSE	Grab Sample (environmental)
GS	Grab Sample (Geotechnical)
CHEM	Chemical Analysis
▼	Water Level
○	Water content (%)
├─┤	Atterberg limits (%)
☐ Cu	Shear Strength based on Lab Vane
S	Sensitivity Value of Soil
▲	Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA			
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Test Type	Organic Vapour ppm or %LEL	SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
metres	99.04		GROUND SURFACE			ppm	
0.5			SAND AND GRAVEL FILL, some boulders, trace clay, compact, grey, moist				
1.0 1.5			SILTY CLAY FILL, gravel sizes, loose to compact, organic material at 1.10m.				
			TOPSOIL				
2.0 2.5			SANDY SILT, loose to compact, grey, wet				
3.0 3.5			SILT TILL, compact, grey, wet				
4.0 4.5			Excavation refused on shale bedrock.				

NOTES:

1. Water tabled estimated from sample appearance at 1.9m depth.

BOREHOLE LOG F2711-00(01-NOV-04-BM)BH-OT001.GPJ INSPEC_SOL.GDT 11/12/04

REFERENCE No.: F2711 ENCLOSURE No.:

FONDEX

TEST PIT No.: TP6-04

ELEVATION: 99.11 m

TEST PIT LOG

Page: 1 of 1

CLIENT: W.A. Redekopp

PROJECT: Geotechnical Survey/Phase II Environmental Site Assessment

LOCATION: 1599 St. Laurent Boulevard, Ottawa, Ontario

DESCRIBED BY: M.Soliman CHECKED BY:

DATE (START): January 11, 2004 DATE (FINISH):

LEGEND

GSE	Grab Sample (environmental)
GS	Grab Sample (Geotechnical)
CHEM	Chemical Analysis
▼	Water Level
○	Water content (%)
⊢⊣	Atterberg limits (%)
☐ Cu	Shear Strength based on Lab Vane
S	Sensitivity Value of Soil
▲	Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Test Type	Organic Vapour ppm or %LEL		SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
metres	99.11		GROUND SURFACE			ppm		
		▨	SANDY GRAVEL FILL, compact, brown, moist					
0.5		▨	SAND FILL, medium to coarse, loose to compact, brown, moist					
1.0 1.5		▨	SILTY SAND FILL, gravel sizes, some stone fragments, with brick and wood pieces, loose to compact, grey, moist					
		░	TOPSOIL					
2.0 2.5		▥	SANDY SILT, compact, grey, wet					
3.0 3.5 4.0		▧	SILT TILL, dense, dark grey, wet					
4.5			Excavation refused on shale bedrock.					

NOTES:
1. Water tabled estimated from sample appearance at 1.9m depth.

REFERENCE No.: F2711

ENCLOSURE No.:

FONDEX

BOREHOLE No.: MW01-04

ELEVATION: 99.58 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: W.A. Redekopp

PROJECT: Phase II Environmental Site Assessment

LOCATION: 1599 St-Laurent Boulevard, Ottawa, Ontario

DESCRIBED BY: I.Leclerc-Morin

CHECKED BY:

DATE (START): November 1, 2004

DATE (FINISH):

LEGEND

- ☒ SS Split Spoon
- ▨ ST Shelby Tube
- ▯ RC Rock Core
- ▼ Water Level
- ○ Water content (%)
- ⊢⊣ Atterberg limits (%)
- ● N Penetration Index based on Split Spoon sample
- • N Penetration Index based on Dynamic Cone sample
- △ Cu Shear Strength based on Field Vane
- □ Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- ▲ Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA					SCALE FOR TEST RESULTS
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD	50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
metres	99.58		GROUND SURFACE			%	ppm	N	
			SAND AND GRAVEL FILL, trace wood fragments, brown, moist	☒	SS-1		2.3		
	99.27		FILL, concrete pieces, cobbles, very hard, grey, dry			33		50+	●
0.5				☒	SS-2		2.0		
1.0									
1.5				☒	SS-3	12	2.2	50+	●
2.0									
	97.45		SAND AND GRAVEL FILL, with wood fragments, beige, wet						
	97.29		TOPSOIL, with sand and gravel, brown, wet						
	97.14		SILTY SAND, trace shells and roots, fine, loose, dark grey, wet		SS-4	67	1.9	4	●
▼2.5									
3.0				☒	SS-5		2	12	●
			- becoming greenish-grey with rust-coloured spots at 3.05m depth - becoming grey to brown at 3.20m depth						
3.5				☒	SS-6		1.6	6	●
	95.77		SILTY CLAY TILL, with sand and gravel, grey to brown, wet						
4.0				☒	SS-7		1.5	8	●
	95.16		End of Borehole						
4.5									
5.0									
5.5									

NOTES:
1. Monitoring well installed in borehole.
2. Water table measure at 2.56m after one day.

BOREHOLE LOG F2711-00(01-NOV-04-BM)BH-OT002.GPJ INSPEC_SOL.GDT 11/11/04

REFERENCE No.: F2711 ENCLOSURE No.:

FONDEX

BOREHOLE No.: MW02-04

ELEVATION: 99.51 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: W.A. Redekopp

PROJECT: Phase II Environmental Site Assessment

LOCATION: 1599 St-Laurent Boulevard, Ottawa, Ontario

DESCRIBED BY: I.Leclerc-Morin CHECKED BY:

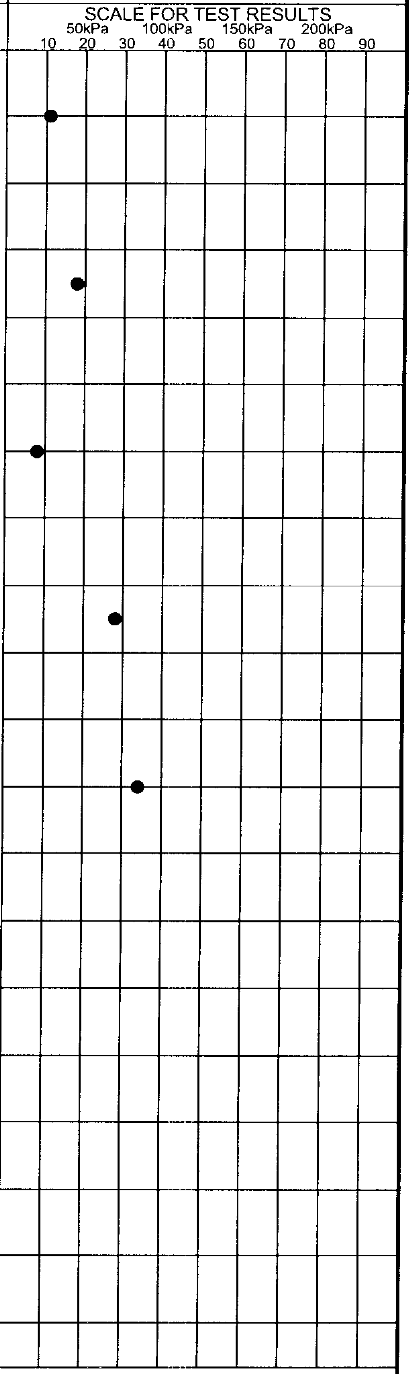
DATE (START): November 1, 2004 DATE (FINISH):

LEGEND

☒ SS	Split Spoon
▨ ST	Shelby Tube
▯ RC	Rock Core
▼	Water Level
○	Water content (%)
├─┤	Atterberg limits (%)
● N	Penetration Index based on Split Spoon sample
• N	Penetration Index based on Dynamic Cone sample
△ Cu	Shear Strength based on Field Vane
□ Cu	Shear Strength based on Lab Vane
S	Sensitivity Value of Soil
▲	Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
metres	99.51		GROUND SURFACE			%	ppm	N
			SAND AND GRAVEL FILL, with cobbles, medium, brown to grey, moist	☒	SS-1	67	11.2	11
			- increasing silt content, presence of bricks at 0.76m	☒	SS-2	71	12.3	18
▼								
1.5	97.99		SILTY SAND, fine, loose, mottled grey and brown, wet	☒	SS-3	79	7.5	8
	97.22		SAND, SILT, AND GRAVEL TILL, compact to firm, grey, wet	☒	SS-4	58	15.4	28
				☒	SS-5	92	12.8	34
3.5	96.00		BEDROCK					
	95.85		End of Borehole					

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5



NOTES:
1. Monitoring well installed in borehole.
2. Water table measure at 1.32m after one day.

BOREHOLE LOG F2711-00(01-NOV-04-BM)BH-OT002.GPJ INSPEC_SOL.GDT 11/11/04

REFERENCE No.: F2711 ENCLOSURE No.:

FONDEX

BOREHOLE No.: MW03-04
ELEVATION: 99.53 m

BOREHOLE LOG

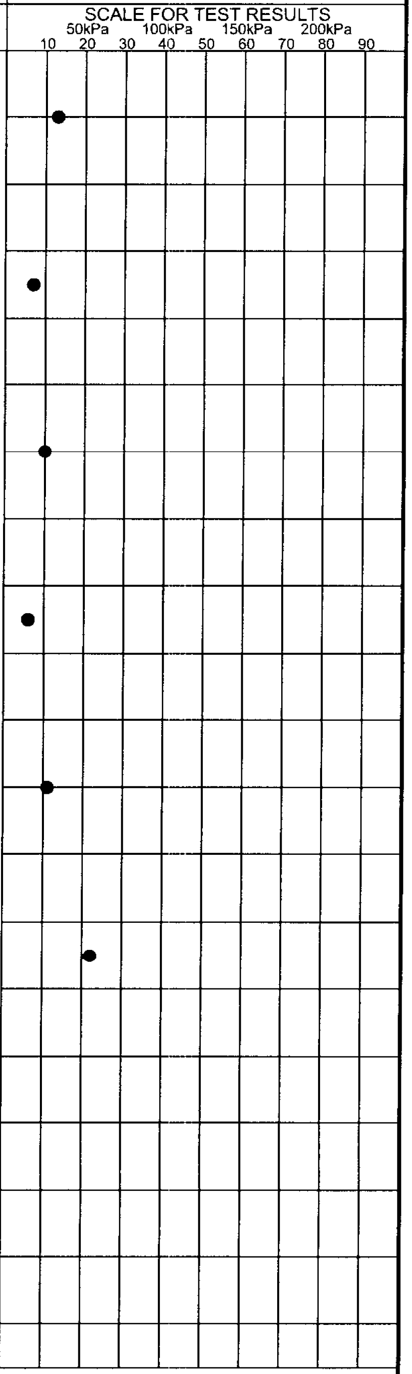
Page: 1 of 1

CLIENT: W.A. Redekopp
PROJECT: Phase II Environmental Site Assessment
LOCATION: 1599 St-Laurent Boulevard, Ottawa, Ontario
DESCRIBED BY: I.Leclerc-Morin CHECKED BY:
DATE (START): November 1, 2004 DATE (FINISH):

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
◧	RC	Rock Core
▼		Water Level
○		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
☐	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
metres	99.53		GROUND SURFACE			%	ppm	N
			SAND AND GRAVEL FILL, compact, brown, moist					
				☒	SS-1	46	8.6	13
0.5								
			- increasing silt content at 0.76m depth					
1.0				☒	SS-2	37	1.6	7
1.5								
			- becoming moist to wet, with cobbles at 1.52m depth					
				☒	SS-3	21	5.8	10
2.0								
	97.40		SAND AND SILT, with roots, firm, dark grey, wet					
	97.14		SILTY SAND, trace roots, mica particles, loose to compact, grey with brown spots, wet					
▼2.5				☒	SS-4	71	2.0	6
3.0								
			- with cobbles at 3.05m depth					
				☒	SS-5	17	1.0	11
3.5								
	95.72		SAND, SILT, AND GRAVEL TILL, with cobbles, compact, brownish grey, wet					
4.0				☒	SS-6	21	1.2	22
	95.11		End of Borehole					
4.5								
5.0								
5.5								



NOTES:
1. Monitoring well installed in borehole.
2. Water table measure at 2.59m after one day.

REFERENCE No.: F2711

ENCLOSURE No.:

FONDEX

BOREHOLE No.: MW04-04

ELEVATION: 99.52 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: W.A. Redekopp

PROJECT: Phase II Environmental Site Assessment

LOCATION: 1599 St-Laurent Boulevard, Ottawa, Ontario

DESCRIBED BY: I.Leclerc-Morin

CHECKED BY:

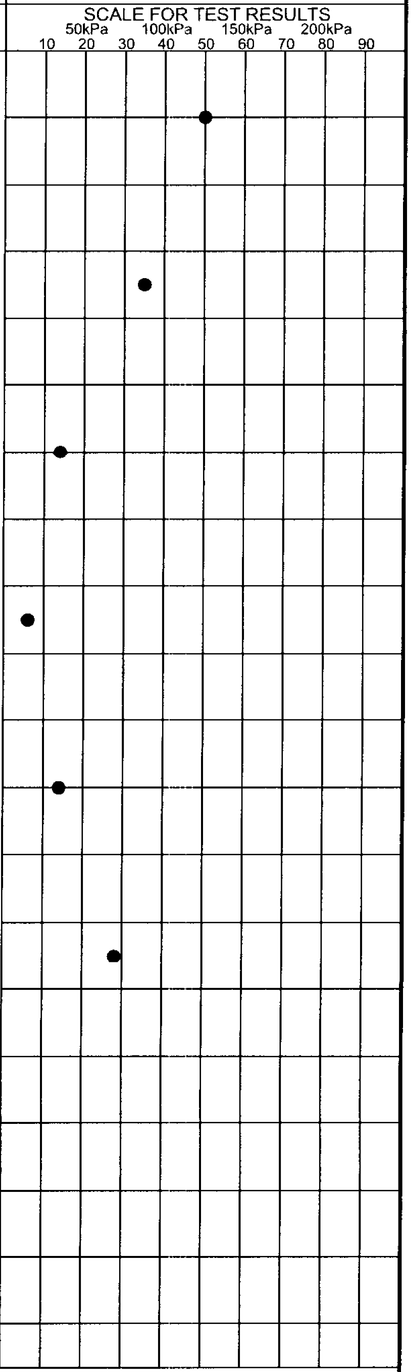
DATE (START): November 1, 2004

DATE (FINISH):

LEGEND

☒ SS	Split Spoon
▨ ST	Shelby Tube
▯ RC	Rock Core
▼	Water Level
○	Water content (%)
⊢⊣	Atterberg limits (%)
● N	Penetration Index based on Split Spoon sample
• N	Penetration Index based on Dynamic Cone sample
△ Cu	Shear Strength based on Field Vane
□ Cu	Shear Strength based on Lab Vane
S	Sensitivity Value of Soil
▲	Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
metres	99.52		GROUND SURFACE			%	ppm	N
0.5			SAND AND GRAVEL FILL, with silt and cobbles, trace brick, brownish-grey, moist - concrete piece at 0.30m depth	☒	SS-1	50	0.9	50+
1.0			- increasing silt and cobble content at 0.76m depth - concrete piece at 1.02m depth	☒ ☒	SS-2 SS-3	75	0.8 0.5	35
1.5 2.0	98.00		SILTY SAND FILL, trace gravel and wood pieces, fine, compact, dark grey with reddish- brown, and black spots, moist	☒	SS-4	79	0.8	14
2.5 3.0	97.23		SILTY SAND, fine, loose, mottled grey and reddish brown, wet - with cobbles at 3.05m depth	☒	SS-5	92	0.3	6
▼ 3.5 4.0	96.40		SILT, SAND, AND GRAVEL TILL, compact, dark grey, wet	☒ ☒	SS-6 SS-7	62 54	0.1 0.6	14 28
	95.25		BEDROCK, dark grey, dry					
4.5 5.0 5.5	95.10		End of Borehole					



NOTES:
1. Monitoring well installed in borehole.
2. Water table measure at 3.30m after one day.

REFERENCE No.: F2711

ENCLOSURE No.:

FONDEX

BOREHOLE No.: MW05-05

ELEVATION: 99.34 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: W.A. Redekopp

PROJECT: Phase II Environmental Site Assessment

LOCATION: 1599 St-Laurent Boulevard, Ottawa, Ontario

DESCRIBED BY: I.Leclerc-Morin

CHECKED BY:

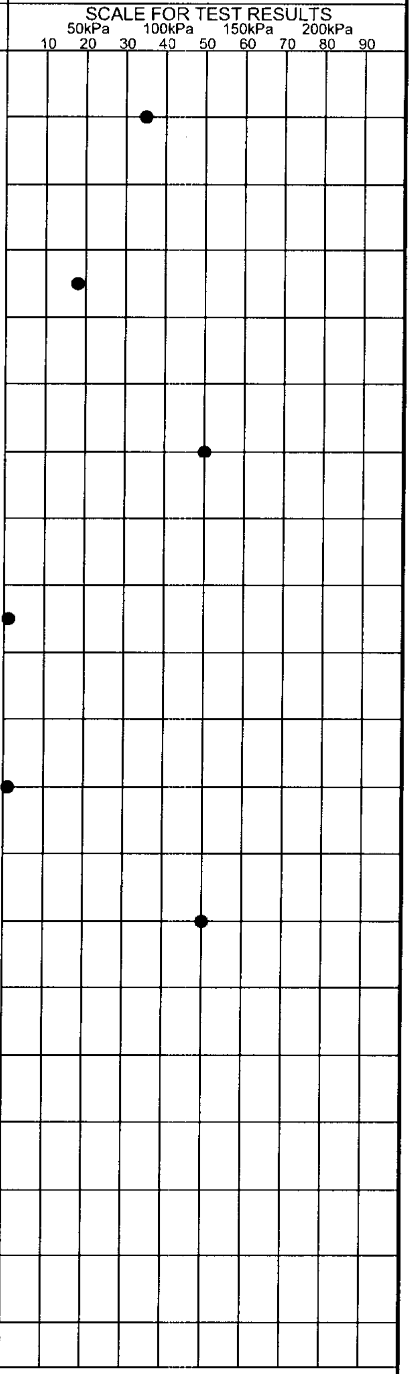
DATE (START): November 1, 2004

DATE (FINISH):

LEGEND

☒ SS	Split Spoon
▨ ST	Shelby Tube
▯ RC	Rock Core
▼	Water Level
○	Water content (%)
⊢⊣	Atterberg limits (%)
● N	Penetration Index based on Split Spoon sample
• N	Penetration Index based on Dynamic Cone sample
△ Cu	Shear Strength based on Field Vane
□ Cu	Shear Strength based on Lab Vane
S	Sensitivity Value of Soil
▲	Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
metres	99.34		GROUND SURFACE			%	ppm	N
		▨	SAND AND GRAVEL FILL, with silt and roots, brown, moist	☒	SS-1	67	4.0	35
0.5		▨	- boulder, brittle, light grey at 0.30m depth	☒	SS-2		4.2	
1.0		▨	- becoming brown to beige, trace wood fragments, very moist to wet at 0.76m depth	☒	SS-3		5.3	18
▼ 1.5 2.0	97.82	▨	GRANULAR FILL, stone dust, sand and cobbles, beige, slightly moist	☒	SS-4	75	3.9	50+
2.5	97.05	▨	CLAY FILL, with trace coarse gravel, light grey with dark brown liquid spots, very soft, wet, strong septic, odour	☒	SS-5	58	6.5	1
3.0 3.5		▨	- fibre and paper found at 2.74m depth	☒	SS-6	100	6.2	1
4.0	95.53	▨	SAND, SILT, AND GRAVEL TILL, very dense, dark grey, wet, septic odour	☒	SS-7		5.9	50+
	95.33	▨	BEDROCK					
4.5 5.0 5.5	95.07		End of Borehole					



NOTES:
1. Monitoring well installed in borehole.
2. Water table measure at 1.60m after one day.

BOREHOLE LOG F2711-00(01-NOV-04-BM)BH-OT002.GPJ INSPEC_SOL.GDT 11/11/04

REFERENCE No.: F2711

ENCLOSURE No.:

BOREHOLE No.: MW06-04

ELEVATION: 99.19 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: W.A. Redekopp

PROJECT: Phase II Environmental Site Assessment

LOCATION: 1599 St-Laurent Boulevard, Ottawa, Ontario

DESCRIBED BY: I.Leclerc-Morin

CHECKED BY:

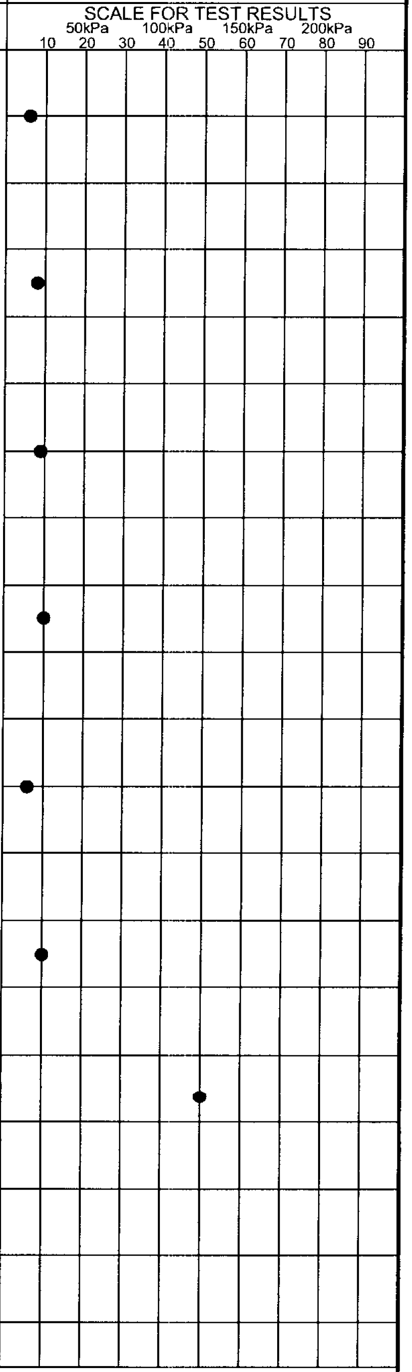
DATE (START): November 1, 2004

DATE (FINISH):

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▯	RC	Rock Core
▼		Water Level
○		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
	S	Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
metres	99.19		GROUND SURFACE			%	ppm	N
		▩	SAND AND GRAVEL FILL, with topsoil, loose, brown, moist	☒	SS-1	75	3.5	6
0.5	98.66	▤	SILTY SAND, fine, loose to compact, brown to grey with reddish spots, moist					
1.0				☒	SS-2	75	2.6	8
1.5			- trace mica-like minerals at 1.52m depth					
			- becoming loose, wet at 1.83m depth	☒	SS-3	92	3.0	9
2.0 ▼								
			- some cobbles at 2.29m depth					
2.5				☒	SS-4	83	6.5	10
3.0	96.14	▨	SILT, SAND, AND GRAVEL TILL, with cobbles, loose to very dense, grey, wet					
				☒	SS-5	67	3.2	6
3.5								
			- with cobbles at 3.81m depth					
4.0				☒	SS-6	50	0.8	10
4.5				☒	SS-7	21	0.7	50+
5.0	94.24		End of Borehole					
5.5								



NOTES:
1. Monitoring well installed in borehole.
2. Water table measure at 2.13m after one day.

BOREHOLE LOG F2711-00(01-NOV-04-BM)BH-OT002.GPJ INSPEC_SOL.GDT 11/11/04

Appendix A

- Notes on Borehole and Test Pit Logs

INSPEC•SOL

NOTES ON BOREHOLE AND TEST PIT REPORTS

SOIL DESCRIPTION:

Each subsoil stratum is described using the following terminology. The relative density of granular soils is determined by the standard penetration index ("N" value), while the consistency of clayey soils is measured by the value of the undrained shear strength (Cu).

CLASSIFICATION (UNIFIED SYSTEM)

Clay	< 0,002mm		
Silt	0,002 to 0,075mm		
Sand	0,075 to 4,75mm	fine	0,075 to 0,425mm
		medium	0,425mm to 2,0mm
		coarse	2,0 to 4,75mm
Gravel	4,75 to 75mm	fine	4,75mm to 19mm
		coarse	19 to 75mm
Cobbles	75 to 300mm		
Boulders	> 300mm		

TERMINOLOGY

"traces"	1 - 10%
"some"	10 - 20%
adjective (silty, sandy)	20 - 35%
"and"	35 - 50%

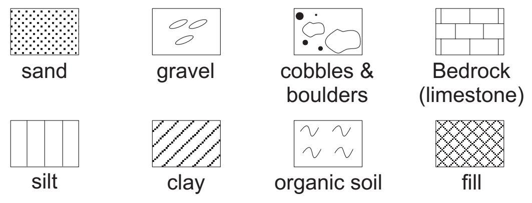
RELATIVE DENSITY OF GRANULAR SOILS	STANDARD PENETRATION INDEX "N" VALUE (BLOWS/ft - 300mm)
Very loose	0 - 4
Loose	4 - 10
Compact	10 - 30
Dense	30 - 50
Very dense	> 50

CONSISTANCY OF COHESIVE SOILS	UNDRAINED SHEAR STRENGTH (Cu)	
	(P.S.F.)	(kPa)
Very soft	< 250	< 12
Soft	250 - 500	12 - 25
Firm	500 - 1000	25 - 50
Stiff	1000 - 2000	50 - 100
Very stiff	2000 - 4000	100 - 200
Hard	> 4000	> 200

ROCK QUALITY DESIGNATION

"RQD" (%) VALUE	QUALITATIVE
< 25	very poor
25 - 50	poor
50 - 75	fair
75 - 90	good
> 90	excellent

STRATIGRAPHIC LEGEND



SAMPLES:

TYPE AND NUMBER

The type of sample recovered is shown on the log by the abbreviation listed hereafter. The numbering of samples is sequential for each type of sample.

SS: Split spoon
SSE, GSE, AGE: Environmental sampling
ST: Shelby tube
PS: Piston sample (Osterberg)
AG: Auger
RC: Rock core
GS: Grab sample

RECOVERY

The recovery, shown as a percentage, is the ratio of length of the sample obtained to the distance the sampler was driven/pushed into the soil.

RQD

The "Rock Quality Designation" or "RQD" value, expressed as a percentage, is the ratio of the total length of all core fragments of 4 inches (10cm) or more to the total length of the run.

IN-SITU TESTS:

N: Standard penetration index
R: Refusal to penetration
N_C: Dynamic cone penetration index
Cu: Undrained shear strength
Pr: Pressuremeter
k: Permeability
ABS: Absorption (Packer test)

LABORATORY TESTS:

I_p: Plasticity index
W_l: Liquid limit
W_p: Plastic limit
H: Hydrometer analysis
GSA: Grain size analysis
A: Atterberg limits
w: Water content
γ: Unit weight
C: Consolidation
CS: Swedish fall cone
CHEM: Chemical analysis
O.V.: Organic vapor

Appendix B

- Site Classification for Seismic Site Response

Seismic Site Classification (Cohesionless)

Site Classification for Seismic Site Response Calculations (Commentary J)

Depth		**Soil**	**Layer Thickness** ***t***	**Corrected N-Value** N_{60}	t/N_{60}	
From	**To**					
(m)	**(m)**		**(m)**	**( )**		
2.0	4.0		2.0	6	0.3333	(1)
4.0	4.3		0.3	16	0.0188	
4.3	32.0	BEDROCK	27.7	100	0.2770	(2)
		TOTAL =	**30.0**	Sum t/N_{60} =	**0.6291**	

NOTES:

(1) Footing depth estimated at 2.0 m based on fill depth observed in test pits.

(2) The N-Value of bedrock is conservatively taken as 100.

The average standard penetration resistance is calculated using the following formula:

(as per OBC 2006 Table 4.1.8.4.A.):

$$\text{Avg}(N_{60}) = \frac{\text{Total Thickness of all Layers}}{\sum \dfrac{\text{Layer Thickness } (t)}{\text{Layer Corrected N-Value } (N_{60})}}$$

$$\text{Avg(N60)} = \frac{30.0}{0.6291}$$

Avg(N60) = 47.7

Average Standard Penetration Resistance for the Site is between 15 and 50.

∴ Seismic Site Class = 'D' based on average standard penetration resistance.