



**GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
61 ALFRED STREET WEST
THORNBURY, ONTARIO**

for

CAREY HOMES INC.



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Report: 1

Mr. Ryan Carey
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Dear Mr. Carey

**Geotechnical Investigation
Proposed Residential Development
61 Alfred Street West
Thornbury, Ontario**

Peto MacCallum Ltd. (PML) is pleased to present the results of the geotechnical investigation recently completed at the above noted project site. Authorization for the work described in this report was provided by Mr. G. Cooper of C.F. Crozier & Associates Inc., on behalf of the Client, in the email dated May 28, 2019.

A residential development is proposed for the 1.3 ha parcel of land located at 61 Alfred Street West in Thornbury. The proposed concept plan includes five detached homes, four semi-detached units and six townhomes all fronting on a single paved cul-de-sac. All homes are slated to have full-depth basements. The subdivision will be fully serviced with the new road accessible from Victoria Street. The proposed site configuration is shown on Drawing 1, appended.

The purpose of this investigation was to assess the subsurface conditions at the site, and based on this information, provide comments and geotechnical engineering recommendations for building foundations with basements, site servicing, and pavement design.

A limited chemical testing program also was carried out to check the geoenvironmental quality of a limited number of soil samples retrieved from the boreholes in order to provide comments regarding on-site reuse and/or off-site disposal/reuse of excess excavated soil. The chemical testing program was expanded to include corrosion and sulphate.

The comments and recommendations provided in this report are based on the site conditions at the time of the investigation, and are applicable only to the proposed works as addressed in the report. Any changes in the proposed plans will require review by PML to re-assess the validity of the report, and may require modified recommendations, additional investigation and/or analysis.



INVESTIGATION PROCEDURES

The field work for this investigation was conducted on June 28, 2019, and consisted of Boreholes 1 to 3 advanced to 6.6 m depth across the site. Borehole locations are shown on Drawing 1, appended.

PML laid out the boreholes in the field. The ground surface elevation at the borehole locations was obtained with a Sokkia SHC5000 Global Navigation Satellite System (GNSS). Vertical and horizontal accuracy of this unit are 0.1 m and 0.5 m, respectively. Co-ordination for clearances of underground utilities was provided by PML. The boreholes were drilled cognizant of the underground utilities.

The boreholes were advanced using continuous flight solid stem augers, powered by a rubber tire mounted CME-75 drill rig, equipped with an automatic hammer, supplied and operated by a specialist drilling contractor, working under the full-time supervision of a member of PML's engineering staff.

At the surface of the boreholes, the topsoil thicknesses encountered were measured in hand excavated divots.

Representative samples of the overburden were recovered at frequent depth intervals for identification purposes using a conventional split spoon sampler. Standard penetration tests were carried out simultaneously with the sampling operations to assess the strength characteristics of the substrata. The ground water conditions in the boreholes were assessed during drilling by visual examination of the soil samples, the sampler, and drill rods as the samples were retrieved, and measurement of water in the open boreholes upon completion, if any.

Monitoring wells comprising 50 mm diameter pipe with 1.5 m long screens, filter sand, bentonite seal and above grade protective covers were installed in all three boreholes to permit ground water level monitoring. Water levels in the monitoring wells were measured about one week after installation. A program comprising monthly water level measurements for a year is currently in progress and results will be provided when complete. It should be noted that the wells become



the property of the Owner and will have to be decommissioned by the Owner. PML would be pleased to assist in this regard.

All recovered samples were returned to our laboratory for detailed examination and moisture content determinations. Grain size analyses and Atterberg Limits testing was carried out on three samples of the major soil unit. The results are provided on Figures 1 and 2, appended.

Two soil samples from the boreholes were submitted to an external laboratory for chemical testing to assess the need for corrosion protection and concrete resistance to sulphate attack. Three soil samples were submitted for chemical testing to check geoenvironmental quality of the soil.

Geoenvironmental procedural protocols and analytical testing results are presented and discussed later in the report

SUMMARIZED SUBSURFACE CONDITIONS

Reference is made to the appended Log of Borehole sheets for details of the subsurface conditions, including soil classifications, inferred stratigraphy, Standard Penetration test N Values (N Values, blows per 300 mm penetration of the split spoon sampler), monitoring well installation details, ground water observations and the results of laboratory moisture content determinations and Atterberg Limits tests.

Due to the soil sampling procedures and the limited size of samples, the depth/elevation demarcations on the borehole logs must be viewed as “transitional” zones, and cannot be construed as exact geologic boundaries between layers. PML should be retained to assist in defining the geological boundaries in the field during construction, if required.

Topsoil was encountered over deposits of sandy silt and clayey silt. A local sand layer was encountered in one borehole. A description of the distribution of the subsurface conditions encountered is provided below.



Soil

Topsoil was present at the surface of all boreholes, being 150 to 200 mm thick.

Below the topsoil in Borehole 3, a local sand layer was noted carrying to 0.7 m depth (elevation 197.85). The material had an N Value of 7 indicating loose conditions. The layer was wet with a water content of 18%.

An upper sandy silt layer was encountered below the topsoil in Borehole 1, and the sand layer in Borehole 3, extending to 2.1 and 1.4 m depth (elevation 196.1 to 197.2), respectively. The sandy silt was loose to compact (N Values of 4 to 18) and was moist to very moist with water contents of 15 to 24%.

Beneath the topsoil in Borehole 2 and upper sandy silt in Boreholes 1 and 3, a major clayey silt unit was encountered extending to 4.0 to 5.5 m depth (elevation 192.7 to 194.6). Three samples of the material were submitted for grain size analysis and the results are presented on Figure 1, appended. Atterberg Limits tests (Figure 2) show the material has a plastic limit of 16% and a liquid limit of 22 to 23%. The unit was typically stiff to very stiff based on N Values of 11 to 28, locally firm in the upper portion of Borehole 2 (N Value of 4). Water contents were typically between 15 and 19% (locally as high as 29%), being typically about the plastic limit.

A lower sandy silt layer was revealed in all boreholes beneath the clayey silt unit, carrying to the 6.6 m depth of excavation in all boreholes. The layer was loose to compact (N Values of 6 to 19) and was wet with a water content of 16 to 26%.



Ground Water

The first water strike (ground water first encountered during drilling), the ground water levels measured in the boreholes upon completion of augering, and measured in the wells on July 8, 2019 are summarized in the table below, on a borehole by borehole basis.

BOREHOLE	FIRST STRIKE DURING DRILLING DEPTH (m) / ELEVATION	UPON COMPLETION OF AUGERING DEPTH (m) / ELEVATION	WATER LEVEL IN WELLS JULY 8, 2019 DEPTH (m) / ELEVATION
1	1.5 / 196.7	4.6 / 193.6	1.3 / 196.9
2	No Water	No Water to 6.6 / 191.9	1.5 / 197.0
3	1.5 / 197.1	No Water to 6.6 / 192.0	3.1 / 195.5

Based on the water level readings, there is a local perched ground water table above the clayey silt, some 1.3 to 1.5 m below existing grade near elevation 197.0. The ground water table resides within the lower sandy silt layer below the clayey silt and is under slight artesian pressure.

Ground water levels will fluctuate seasonally, and in response to variations in precipitation.

GEOTECHNICAL ENGINEERING CONSIDERATIONS

General

A residential development is proposed for the 1.3 ha parcel of land located at 61 Alfred Street West in Thornbury. The proposed concept plan includes five detached homes, four semi-detached units and six townhomes all fronting on a single paved cul-de-sac. All homes are slated to have full-depth basements. The subdivision will be fully serviced with the new road accessible from Victoria Street.

Site Grading and Engineered Fill

The grading for the site has not been finalized, however considering the surrounding area is already developed, it is understood the initial concept is to raise grades about 1.0 to 1.5 m. Basements are assumed to be about 2.5 to 3.0 m deep and will be achieved by excavating 1.0 to



1.5 m below existing grade and implementing the 1.0 to 1.5 m grade raise. It is initially recommended that basement floors be established at elevation 197.5 or higher, to avoid ground water issues. Further ground water monitoring is programmed and this recommendation will be reviewed when the additional data has been gathered.

In general, the site soils are compact/stiff below 0.7 to 1.0 m depth across the site. As such, it is recommended that existing topsoil and upper firm/loose soil be removed and replaced with engineered fill as required. Basement footings and floor slabs can then be founded on compact/stiff native soils or on engineered fill.

Reference is made to Appendix A for guidelines for engineered fill construction. The following general highlights are provided:

- Strip existing topsoil, loose/firm upper soils and other deleterious materials down to about 0.7 to 1.0 m depth, subject to geotechnical review during construction. The excavated soil should be segregated and stockpiled for reuse or disposal based on geotechnical review;
- Proofroll exposed subgrade using a heavy roller to targeted 100% Standard Proctor maximum dry density, under geotechnical review. It is noted that the subgrade soils, will be easily disturbed and can become unstable, if wet in-situ or allowed to become wet. The contractor shall adopt methods and equipment accordingly;
- Following geotechnical review and approval of the subgrade, spread approved material in maximum 200 mm thick lifts and uniformly compacted to 100% Standard Proctor maximum dry density in building areas and 95% Standard Proctor maximum dry density in pavement areas. If wet subgrade conditions are present the use of Granular B Type II may be required for the first lift or two of engineered fill;
- Organics, topsoil, oversized (over 150 mm) or otherwise deleterious material is not suitable for reuse as engineered fill. The upper native soils had relatively higher moisture contents and as such are generally considered to be too wet and unsuitable for reuse as engineered fill unless allowed to dry out (which will require time). Further, where grades are to be raised, imported material will be required. Imported material should comprise OPSS Select Subgrade Material (SSM) or OPSS Granular B Type I. Other sources of imported material should be reviewed by our office to ensure suitability;



- The engineered fill pad must extend at least 1 m beyond the structure to be supported, then outwards and downwards at no steeper than 45° to the horizontal to meet the underlying approved native subgrade. In this regard, strict survey control and detailed documentation of the lateral and vertical extent of the engineered fill limits should be carried out to ensure that the engineered fill pad fully incorporates the structure to be supported;
- Engineered fill construction must be carried out under full time field review by PML, to approve sub-excavation and subgrade preparation, backfill materials, placement and compaction procedures, and to verify that the specified compaction standards are achieved throughout.

Foundations

Based on the discussion above, basement floor slabs should be set at elevation 197.5 or higher and therefore underlying footings at about elevation 197.0. At this elevation footings will be supported on compact/stiff native soil, or locally engineered fill, constructed as discussed above. Footings supported on the compact/stiff native soil, or engineered fill, can be designed for a net geotechnical bearing resistance at Serviceability Limit State (SLS) of 125 kPa, and a factored net bearing resistance at Ultimate Limit State (ULS) of 190 kPa.

The geotechnical bearing resistance at SLS is based on 25 mm of settlement in the bearing stratum with differential settlement not exceeding 75% of the value.

Footings subject to frost action should be provided with a minimum 1.2 m of earth cover or equivalent insulation.

Prior to placement of structural concrete, all founding surfaces should be reviewed by PML to verify the design bearing capacity is available, or to reassess the design parameters based on the actual conditions revealed in the excavation.

It is noted that if the subgrade soils are wet in-situ or allowed to become wet due to weather they will become easily disturbed under construction or pedestrian traffic. If the footing subgrade is disturbed it will have to be sub-excavated. As such, the contractor should adopt construction methodology and equipment to suit. Concrete skim coats may be required in some areas.



Seismic Design

Based on the soil profile (N Values) revealed in the boreholes, Site Classification D is applicable for Seismic Site Response as set out in Table 4.1.8.4.A of the Ontario Building Code (2012). Based on the type and relative density of the soil cover at the site there is a low potential for liquefaction of soils to occur.

Basement Walls and Floor Slabs

At the time of this report, grading plans had not been provided. It is recommended that basements be established a minimum 0.5 m above the high ground water level, currently the recommended lowest floor slab is set at elevation 197.0. In this regard, a year-long ground water level monitoring program has been undertaken and will be reported on upon its completion in June 2020.

Full-depth basements are proposed for all houses. Basement perimeter walls must be designed to resist the unbalanced horizontal earth pressure imposed by the backfill adjacent to the walls.

The lateral earth pressure, P , may be computed using the following equation and assuming a triangular pressure distribution:

$$P = K (\gamma h + q) + C_p$$

Where

- P = lateral pressure at depth h (m) below ground surface (kPa)
- K = lateral earth pressure coefficient of compacted granular backfill = 0.5
- h = depth below grade (m) at which lateral pressure is calculated
- γ = unit weight of compacted granular backfill = 21.0 kN/m³
- q = surcharge loads (kPa)
- C_p = compaction pressure

The above equation assumes that drainage measures will be incorporated to prevent the buildup of hydrostatic pressure. In this regard, foundation wall backfill should comprise free draining granular material conforming to OPSS Granular B. Alternatively, a proprietary drainage board product can be utilized with on-site soils as backfill. A weeping tile system should be installed to prevent the build-up of hydrostatic pressure behind the wall. The weeping tiles should be



protected by a properly designed granular filter or geotextile to prevent migration of fines into the system. The drainage pipe should be placed on a positive grade and lead to a frost-free outlet.

Basement wall backfill should be placed in thin lifts compacted to a minimum 95% Standard Proctor maximum dry density. Over compaction close to the walls should be avoided as this could generate excessive pressure on the walls.

Basement floor slab construction is feasible on compact/stiff native soils or locally engineered fill. In general, a minimum 200 mm thick base layer of crushed stone (nominal 19 mm size) is recommended directly under the slab. A polyethylene sheet vapour barrier should be incorporated under the ground floor slab if a vapour sensitive floor finish is planned.

Exterior grades should be established to promote surface drainage away from the buildings.

Reference is made to the appended Figure 3 for general recommendations regarding drainage and backfill requirements for basement walls and floor slabs

Site Servicing

Design details were not finalized at the time of this report. For purposes of this report, inverts are assumed to be as much as 3.0 m below existing grades.

Trench Excavation and Ground Water Control

Trench excavation and ground water control are described later in the report under Excavation and Ground Water Control.

Pipe Bedding

Native stiff clayey silt or loose to compact sandy silt is generally expected within the upper 3 m soil stratum which is considered satisfactory for pipe support.



Where existing fill or other deleterious material is encountered at the design invert level, such material should be sub-excavated and replaced with an increased thickness of bedding material, subject to geotechnical field review and approval.

Standard Granular A bedding, in accordance with OPSS, compacted to 95% Standard Proctor maximum dry density should be satisfactory. For flexible pipes, bedding and cover material should comprise OPSS Granular A. For rigid pipes, the bedding material should comprise OPSS Granular A and cover material may comprise select native soil free of oversized material.

Trench Backfill

Backfill in trenches should comprise select inorganic soil and be placed in maximum 200 mm thick loose lifts compacted to at least 95% Standard Proctor maximum dry density to minimize post construction settlement in the backfill. Topsoil, organic, excessively wet, frozen oversized (greater than 200 mm), or otherwise deleterious material should not be incorporated as trench backfill. The moisture content of the trench backfill should be within 2% of the optimum moisture content in order to achieve the specified compaction and be close to optimum moisture content in the upper 1 m to prevent subgrade instability issues. Ideally the backfill should comprise excavated site soil, in order to minimize differential frost heave.

The excavated soil will comprise sand, sandy silt, and the upper portion of the clayey silt layer. The native soil should generally be acceptable for reuse subject to moisture content review removal of organics and geotechnical review during construction. A sheeps foot compactor should be utilized to compact the clayey silt material.

Earthworks operations should be inspected by PML to verify subgrade preparation, backfill materials, placement and compaction efforts and ensure the specified degree of compaction is achieved throughout.

Excavation and Ground Water Control

Based on the water levels to date, it is anticipated that excavation for houses with basements will extend down as much as 1.0 to 1.5 m below existing grade. Excavation for site servicing is



anticipated to 3 m below existing grade. Excavation will encounter sand, sandy silt, and clayey silt.

Subject to the ground water control as discussed below, the site soils encountered at the site should be considered as Type 3 soil requiring excavation sidewalls to be constructed at no steeper than one horizontal to one vertical (1H:1V) from the base of the excavation in accordance with the Occupational Health and Safety Act.

The ground water table was generally encountered below the anticipated excavation depths during the assignment except for localized perched water. As well, soils exhibit generally low percolation rates (clayey silt). Accordingly, it is expected that nuisance ground water seepage should be managed using conventional sump pumping techniques. If excavation is carried out deeper, or into the underlying sandy silt, a higher degree of ground water control will be required, and there may be a potential for blow out at the base of the excavation.

Water taking in Ontario is governed by the Ontario Water Resources Act (OWRA) and the Water Takings and Transfer Regulation O. Reg. 387/04. Section 34 of the OWRA requires anyone taking more than 50,000 L/d to notify the Ministry of the Environment, Conservation and Parks (MECP). This requirement applies to all withdrawals, whether for consumption, temporary construction dewatering, or permanent drainage improvements. Where it is assessed that more than 50,000 L/d but less than 400,000 L/d of ground water taking is required, the Owner can register online via the Environmental Activity and Sector Registry (EASR) system. Where it is assessed that more than 400,000 L/d of ground water taking is required then a Category 3 Permit-To-Take-Water (PTTW) is required.

Based on the conditions revealed in the boreholes and anticipated excavation depths noted above, a PTTW or registry on the EASR is not anticipated as the excavation will generally be above the ground water table. Deeper excavation may require a PTTW or registry on the EASR.

It is cautioned that boreholes were drilled during the dry time of the year and as such, seasonal ground water levels may be higher than those currently measured to date. In this regard, this report should be reviewed upon completion of the year-long ground water level monitoring period, in June 2020.



Pavement Design and Construction

Grading has not yet been established. However, a 1.0 to 1.5 m grade raise is proposed. Currently, it is anticipated that the pavement subgrade will comprise near surface soil which predominantly comprises moderately to highly frost susceptible sandy silt and clayey silt. The following pavement structure thicknesses are recommended and should be reviewed when grading/subgrade soils are determined:

MATERIAL	THICKNESS (mm)
Asphalt Surface Course HL 3	40
Asphalt Binder Course HL 4	40
Granular A Base Course	150
Granular B Subbase Course	450
Total Thickness	690

In general, it is recommended that following rough grading to the subgrade level, subgrade preparation should include proofrolling and compacting the exposed subgrade with a heavy compactor to minimum 95% Standard Proctor maximum dry density under geotechnical review. Any unstable zones identified during this process should be sub-excavated and replaced with compacted select site material at a suitable moisture content placed in 200 mm thick lifts and compacted to minimum 95% Standard Proctor maximum dry density, subject to geotechnical field review.

The pavement design considering that construction will be carried out during the dry time of the year and that the subgrade is relatively dry and is stable, as determined by proofrolling operations described above. It is noted the sandy silt/clayey silt soils may become easily disturbed and unstable if wet due to perched water, or if allowed to become wet due to wet weather. If the pavement subgrade is wet, remediation may include increasing the thickness/depth of the subbase, the use of Granular B Type II and/or the use of geogrid reinforcement, subject to geotechnical review during construction.

Imported material for the granular base and subbase should conform to OPSS gradation specifications for Granular A and Granular B, and should be compacted to



100% Standard Proctor maximum dry density. Asphalt should be compacted in accordance with OPSS 310.

For the pavement to function properly, it is essential that provisions be made for water to drain out of and not collect in the base material. The incorporation of subdrains is recommended in conjunction with crowning of the final subgrade to promote drainage towards the pavement edge. Subdrains should be installed at least 300 mm below the subgrade level. Refer to OPSS 216. Series for details regarding pipe, filter fabric or filter sock, bedding and cover material. Maintenance hole/catchbasins should be backfilled with free draining Granular B. The above measures will help drain the pavement structure as well as alleviate the problems of differential frost movement between the catchbasins and pavement.

Concrete Resistance and Corrosion Protection

Reference is made to the Certificates of Analyses in Appendix B, for the chemical test results of sulphate, chloride, and corrosion parameters on two soil samples from the subject site.

In accordance with Canadian Standard Association, CSA-A23.1-04, Table 3, the test results indicate a negligible potential degree of sulphate attack on buried concrete. Accordingly, the use of normal Portland cement is indicated.

Generally, a chlorine concentration value in excess of 250 ppm (0.25%) leads to corrosive environment for buried metals or reinforced steel. The chloride content of 33 µg/g and 34 µg/g (0.0034% and 0.0033%) is below the levels noted above. The potential for corrosive environment due to chlorine is assessed to be low.



Assessment of the corrosion potential test results in accordance with the American Water Works Association, ANSI/AWWA C105/A21.5-99 is provided below:

	BOREHOLE 1	BOREHOLE 3
Sample	Sample 3	Sample 2
Depth (m)	1.5 to 2.1	0.8 to 1.4
Material	Sandy Silt	Sandy Silt
Resistivity (ohm-cm)	7,980 (0)	8,050 (0)
pH	7.75 (0)	7.75 (0)
Redox Potential (mV)	162 (0)	173 (0)
Sulphide	Trace (2)	Trace (2)
Moisture	Poor Drainage (2)	Poor Drainage (2)
Total Points	4	4

Note: Point values indicated by () are based on Table A.1 from ANSI/AWWA C105/A21.5-99. A total of ten points or more indicates the soil is corrosive to ductile iron pipe and protective measures are required.

Based on the above, protective measures are not indicated for ductile iron.

Geotechnical Review and Construction Inspection and Testing

It is recommended that the final design drawings be submitted to PML for geotechnical review for compatibility with site conditions and recommendations of this report.

Earthworks operations should be carried out under the supervision of PML to approve subgrade preparation, backfill materials, placement and compaction procedures and check the specified degree of compaction is achieved throughout.

Prior to placement of structural concrete, all founding surfaces must be inspected by PML to verify the design bearing capacity is available, or to reassess the design parameters based on the actual conditions.

The comments and recommendations provided in the report are based on information revealed in the boreholes. Conditions away from and between boreholes may vary. Geotechnical review during construction should be ongoing to confirm the subsurface conditions are substantially



similar to those encountered in the boreholes, which may otherwise require modification to the original recommendations.

GEOENVIRONMENTAL CONSIDERATIONS

General

A limited chemical testing program was carried out to check the geoenvironmental quality of the soil at selected sampling locations in order to provide comments regarding on site reuse or off-site disposal options for excess excavated soil.

A Phase One Environmental Site Assessment (ESA) was not within the scope of work for this assignment. Accordingly, soil impairment that has not been identified by the limited chemical testing program may exist at the site. The limited chemical testing program does not constitute an Environmental Site Assessment as defined under the Environmental Protection Act and O. Reg. 153/04, as amended.

Chemical Testing Protocols

As part of the geoenvironmental procedural protocol, all recovered soil samples were field examined for visual and olfactory evidence of potential contamination. It is noted that none of the samples displayed visual or olfactory evidence of contamination.

After field examination, selected geoenvironmental soil samples were placed in laboratory air tight glass containers and stored in an insulated cooler for transportation to our laboratory for detailed visual examination.

Soil samples were submitted for chemical analysis to a Canadian Association for Laboratory Accreditation Inc. (CALA) accredited laboratory. The chemical analyses conducted were in accordance with the O. Reg. 153/04, as amended Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act dated March 9, 2004, amended as of July 1, 2011.



For general environmental quality characterization, soil samples were tested for the following analyte groups:

- Metals and Inorganics;
- Petroleum Hydrocarbons (F1 to F4 fractions).

The following soil samples were submitted for testing:

Borehole 1 SS 2, (sandy silt – 0.8 to 1.4 m); Borehole 3 SS 3, (clayey silt – 1.5 to 2.1 m).
Borehole 2 SS 2, (clayey silt – 0.8 to 1.4 m);

Site Condition Standards

In general, the applicable environmental quality guidelines depend on the site location, land use, soil texture and source of potable water at the site. In this regard, we selected the Generic Criteria of the O. Reg. 153/04, as amended, Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act dated April 15, 2011.

The site is not considered a sensitive site based on Sections 41 and 43 of O.Reg. 153/04, as amended, and review of readily available information.

Further, the site was reviewed against the County of Grey's Intake Protection Zones (Map 2, June 2013) and other maps for watercourses and private wells as part of the protocol to determine the applicable Site Condition Standards (SCSs) for the site. In this regard, the site is within 300 m of a private water well based on the MECP well records website. The site is not within 30 m of a water body, nor is it within an Intake Protection Zone.

Based on the above reviews, the criteria of Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition for Residential/Parkland/Institutional (RPI) land use, Table 2 RPI SCSs, are considered applicable to the site.



Analytical Findings and Conclusions

The Certificates of Analyses for Chemical Testing are included in Appendix B.

On-Site Reuse

In summary, the concentration of the tested parameters in the submitted soil samples from the boreholes were either not detected (below the method detection limit) or were within Table 2 RPI SCSs.

The soil associated with the boreholes meets the applicable SCSs and can remain on-site for reuse, subject to geotechnical requirements.

It should be noted that there is no legal imperative to remove or treat soil that exceeds the applicable SCSs, provided it is demonstrated that there is no off-site impact or adverse effect. If contaminated soil is left on-site, the land Owner assumes liability associated with the site contamination and potential off-site contamination. The liability concerns could include potential scrutiny from the MECP and the public, potential for decreased value of the land, and issues during potential divesting of the property due to environmental liability concerns on the part of the future Owners or their financiers/insurers.

It should be noted that the soil conditions between and beyond the sampled locations may differ from those encountered during this assignment. PML should be contacted if impacted soil conditions become apparent during future development to further assess and appropriately handle the materials, if any, and evaluate whether modifications to the conclusions documented in this report are necessary.

This assessment is subject to the Statement of Limitations that is included with this report (Appendix C) which must be read in conjunction with the report.



Off-Site Reuse/Disposal

O.Reg. 153/04, as amended has nine tables outlining SCSs (Tables 1 to 9) for evaluating Environmental Soil Characteristics. These tables are further divided based on land use. The chemical testing results from this project were compared to the various SCSs to evaluate where the excess soil can be transported. Our assessment was limited to Tables 1 to 3, the most common SCSs. If a potential receiving site has SCSs other than Tables 1 to 3, then PML should be consulted to ensure that the results meet the applicable SCSs of the proposed receiving site.

Based on the results of the limited chemical testing, if excess excavated soil associated with the boreholes is to be taken off-site, then the SCSs for the receiving site should comply with any one of the following O.Reg. 153/04, as amended, criteria;

- Table 1 (any land use);
- Table 2 (any land use);
- Table 3 (any land use).

Alternatively, excess excavated soil can be transported to a landfill site, however, additional testing for Toxicity Characteristic Leaching Procedure (TCLP) will be required, in accordance with Ontario Regulation 347, Schedule 4, as amended to Ontario Regulation 558/00, dated March 2001.



When transporting excavated site soil to another site the following are recommended:

- The work must be completed in accordance with local by-laws governing soil movement and/or placement at other sites;
- All analytical results and environmental assessment reports must be fully disclosed to the receiving site owners/authorities and they have agreed to receive the material;
- The applicable SCSs for the receiving site have been determined, as confirmed by the environmental consultant and the SCSs are consistent with the chemical quality of the soil originating at the source site;
- Transportation and placement of the surplus soil is monitored by the environmental consultant to check the material is appropriately placed at the pre-approved site;
- The receiving site must be arranged and/or approved in advance of excavation in order to avoid delays during construction. As well, it is noted the chemical testing requirements for various receiving sites is site-specific and additional testing may be required, beyond that provided in this limited sampling and testing report;
- The excavation work should be conducted in accordance with a written Soil Management Plan prepared by a qualified professional to ensure that all surplus excavated material is tested and managed appropriately, and that imported fill material is of suitable quality and meets the SCSs applicable to the site. Reuse of surplus excavated soil on site is also subject to acceptance for reuse by the geotechnical consultant at the time of construction based on geotechnical considerations;
- Additional sampling and chemical testing should be carried out during construction to verify the chemical quality of the excess soil to assess the appropriate management/disposal options for the actual soil leaving the site;
- It is recommended that transportation of fill material from the Source Site (s) to the Receiving Site (s) be carried out in accordance with the MOECC document *Management of Excess Soil – A Guide for Best Management Practices* dated January 2014.

This assessment is subject to the Statement of Limitations that is included with this report (Appendix C) which must be read in conjunction with the report.

CLOSURE

We trust this report is complete within our terms of reference, and the information presented is sufficient for your present purposes. If you have any questions, or when we may be of further assistance, please do not hesitate to call our office.

Sincerely

Peto MacCallum Ltd.



Richard Blair, P.Eng.
Project Engineer, Geotechnical Services



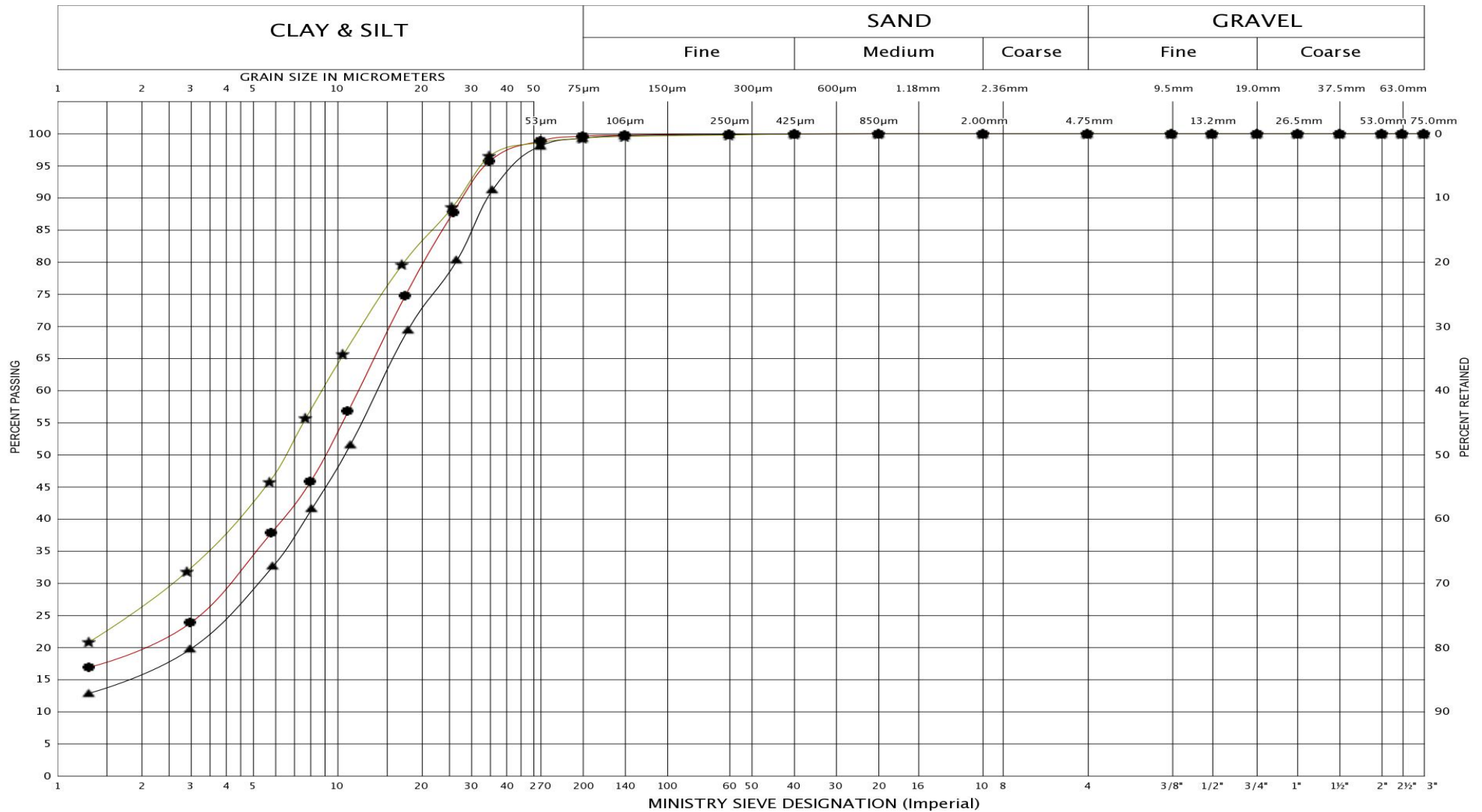
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Associate
Manager, Geotechnical and Geoenvironmental Services

RB/GRW:jlb/tc

Enclosures:

Figures 1 and 2 – Grain Size Distribution and Atterberg Limits Test Results
Figure 3 – General Recommendations Regarding Drainage and Backfill Requirements for Basement Wall & Floor Slab Construction
List of Abbreviations
Log of Borehole Nos. 1 to 3
Drawing 1 - Borehole Location Plan
Appendix A – Engineered Fill
Appendix B – Certificates of Analyses for Chemical Testing
Appendix C – Statement of Limitations

UNIFIED SOIL CLASSIFICATION SYSTEM



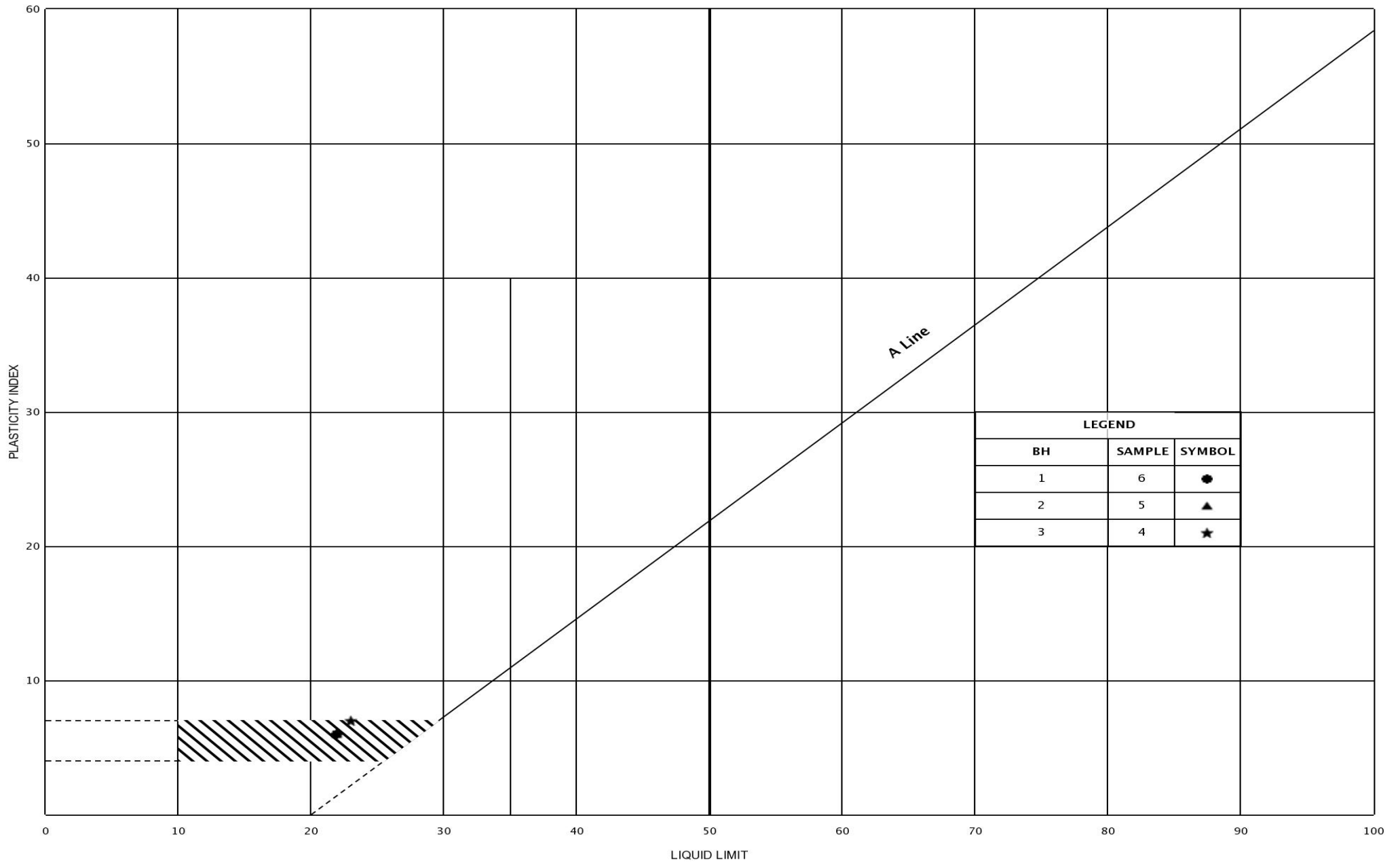
LEGEND	BH	1	2	3
	SAMPLE	6	5	4
	SYMBOL	●	▲	★

GRAIN SIZE DISTRIBUTION

CLAYEY SILT, Trace Sand

FIG No.: 1

Project No.: 19CF010



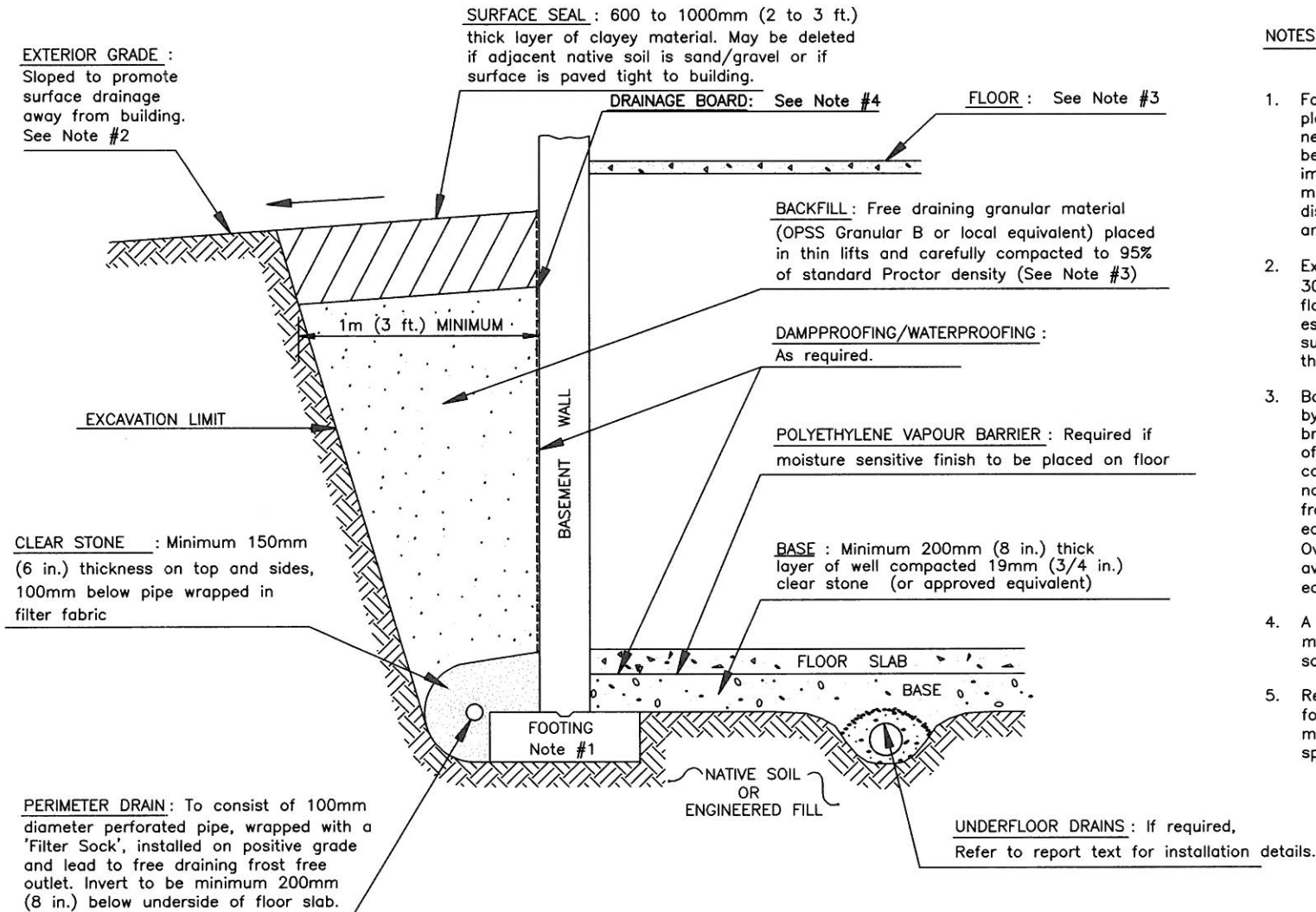
ATTERBERG LIMITS TEST RESULTS

Clayey Silt, Trace Sand

FIG No.: 2

HWY.:

Proj No. 19CF010



NOTES

1. Footing may be constructed by placement of structural concrete neat against natural soil. Drain to be installed in a similar manner immediately above footing maintaining 200mm (8 in.) distance between top of drain and underside of floor slab.
2. Exterior grade to be minimum 300mm (12 in.) below interior floor slab, or other means established to prevent entry of surface water into building through building openings.
3. Basement wall to be supported by floor system or interior bracing prior to commencement of backfill placement. Heavy construction equipment should not be permitted within a distance from the foundation wall equivalent to half the wall height. Overcompaction of backfill to be avoided as excessive lateral earth pressure may result.
4. A proprietary drainage board product may be used with compacted native soil as backfill against the wall.
5. Refer to text for details regarding founding levels, competent bearing material and construction details specific to particular site.

STANDARD DRAWING

GENERAL RECOMMENDATIONS REGARDING DRAINAGE AND BACKFILL REQUIREMENTS FOR BASEMENT WALL AND FLOOR SLAB CONSTRUCTION



Peto MacCallum Ltd.
CONSULTING ENGINEERS

DRAWN:	N/A	DATE	SCALE	JOB NO.	FIGURE NO.
CHECKED:	GW	AUG. 2019	N.T.S.	19CF010	3
APPROVED:	GW				

LIST OF ABBREVIATIONS



PENETRATION RESISTANCE

Standard Penetration Resistance N: - The number of blows required to advance a standard split spoon sampler 0.3 m into the subsoil. Driven by means of a 63.5 kg hammer falling freely a distance of 0.76 m.

Dynamic Penetration Resistance: - The number of blows required to advance a 51 mm, 60 degree cone, fitted to the end of drill rods, 0.3 m into the subsoil. The driving energy being 475 J per blow.

DESCRIPTION OF SOIL

The consistency of cohesive soils and the relative density or denseness of cohesionless soils are described in the following terms:

<u>CONSISTENCY</u>	<u>N (blows/0.3 m)</u>	<u>c (kPa)</u>	<u>DENSENESS</u>	<u>N (blows/0.3 m)</u>
Very Soft	0 - 2	0 - 12	Very Loose	0 - 4
Soft	2 - 4	12 - 25	Loose	4 - 10
Firm	4 - 8	25 - 50	Compact	10 - 30
Stiff	8 - 15	50 - 100	Dense	30 - 50
Very Stiff	15 - 30	100 - 200	Very Dense	> 50
Hard	> 30	> 200		
WTLL	Wetter Than Liquid Limit			
WTPL	Wetter Than Plastic Limit			
APL	About Plastic Limit			
DTPL	Drier Than Plastic Limit			

TYPE OF SAMPLE

SS	Split Spoon	ST	Slotted Tube Sample
WS	Washed Sample	TW	Thinwall Open
SB	Scraper Bucket Sample	TP	Thinwall Piston
AS	Auger Sample	OS	Oesterberg Sample
CS	Chunk Sample	FS	Foil Sample
GS	Grab Sample	RC	Rock Core
	PH	Sample Advanced Hydraulically	
	PM	Sample Advanced Manually	

SOIL TESTS

Qu	Unconfined Compression	LV	Laboratory Vane
Q	Undrained Triaxial	FV	Field Vane
Qcu	Consolidated Undrained Triaxial	C	Consolidation
Qd	Drained Triaxial		

LOG OF BOREHOLE/MONITORING WELL NO. 1

1 of 1

177 542755E 4934190N

PROJECT Proposed Residential Development

LOCATION 61 Alfred Street, Thornbury, Ontario

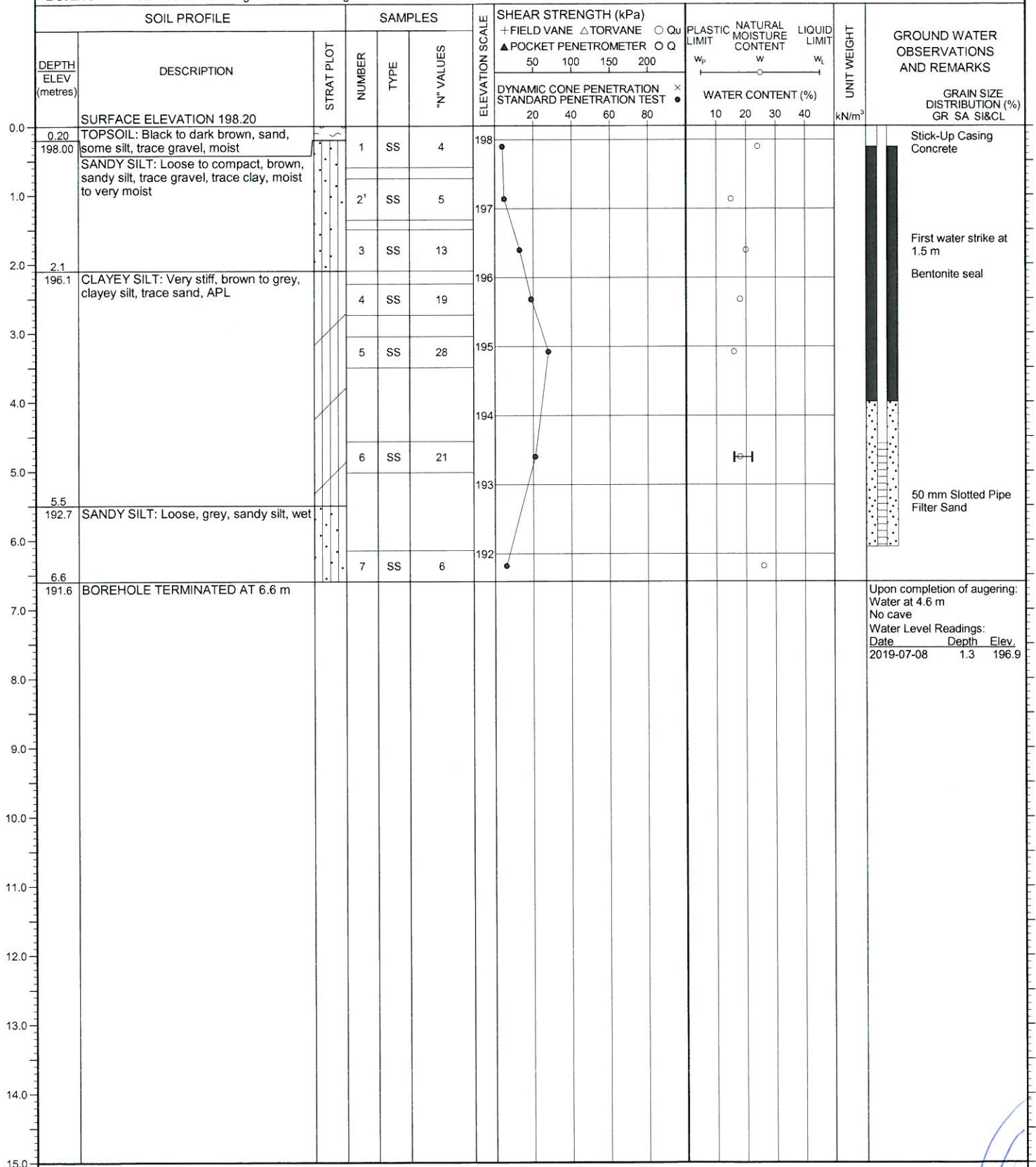
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE June 28, 2019

PML REF. 19CF010

ENGINEER GW

TECHNICIAN AT



NOTES 1 - Soil sample submitted for chemical testing.

LOG OF BOREHOLE/MONITORING WELL NO. 2

1 of 1

17T 542776E 4934119N

PROJECT Proposed Residential Development

LOCATION 61 Alfred Street, Thornbury, Ontario

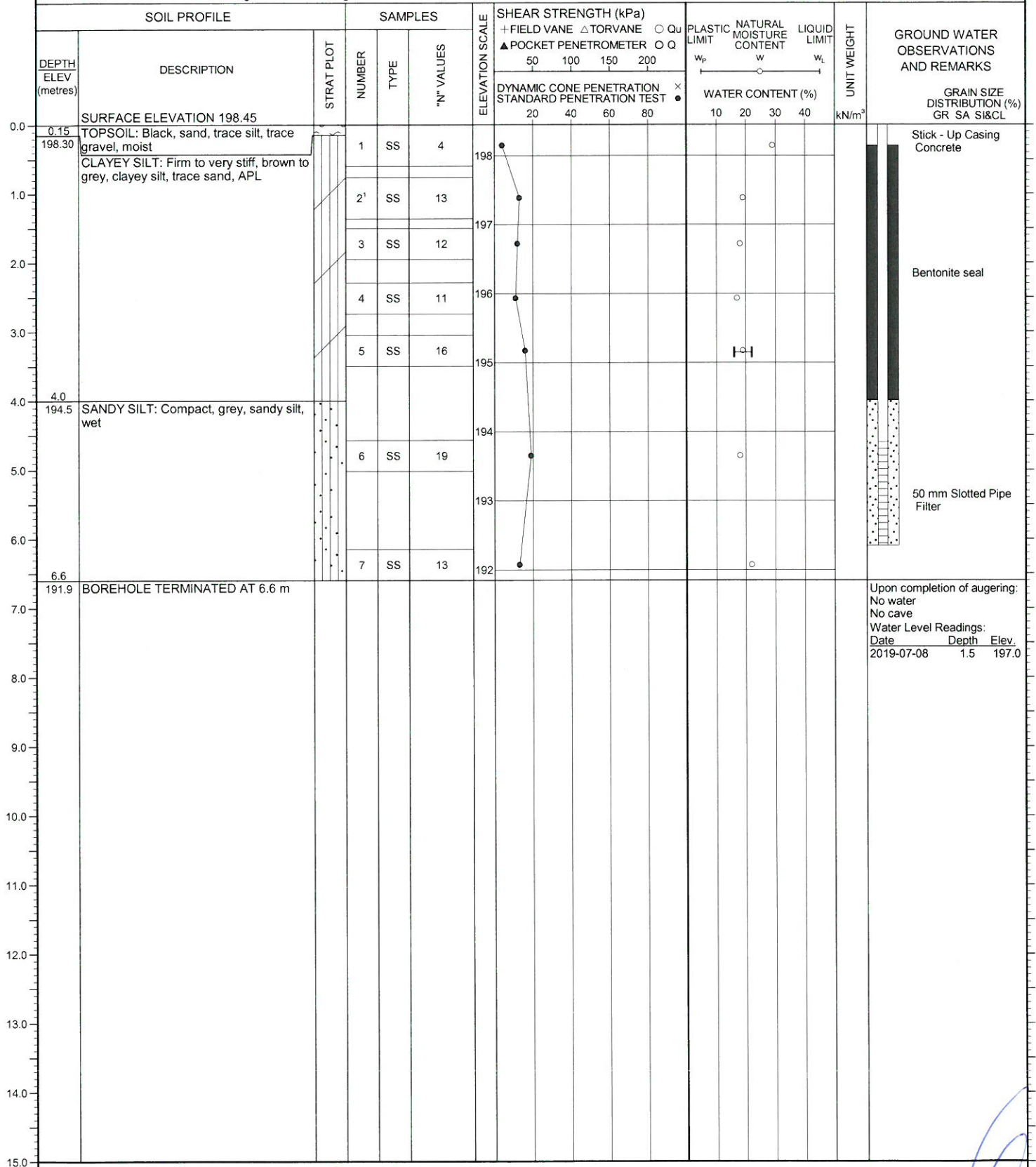
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE June 28, 2019

PML REF. 19CF010

ENGINEER GW

TECHNICIAN AT



NOTES 1 - Soil sample submitted for chemical testing.

Upon completion of augering:
No water
No cave
Water Level Readings:
Date 2019-07-08 Depth 1.5 Elev. 197.0

LOG OF BOREHOLE/MONITORING WELL NO. 3

1 of 1

17T 542715E 4934135N

PROJECT Proposed Residential Development

LOCATION 61 Alfred Street, Thornbury, Ontario

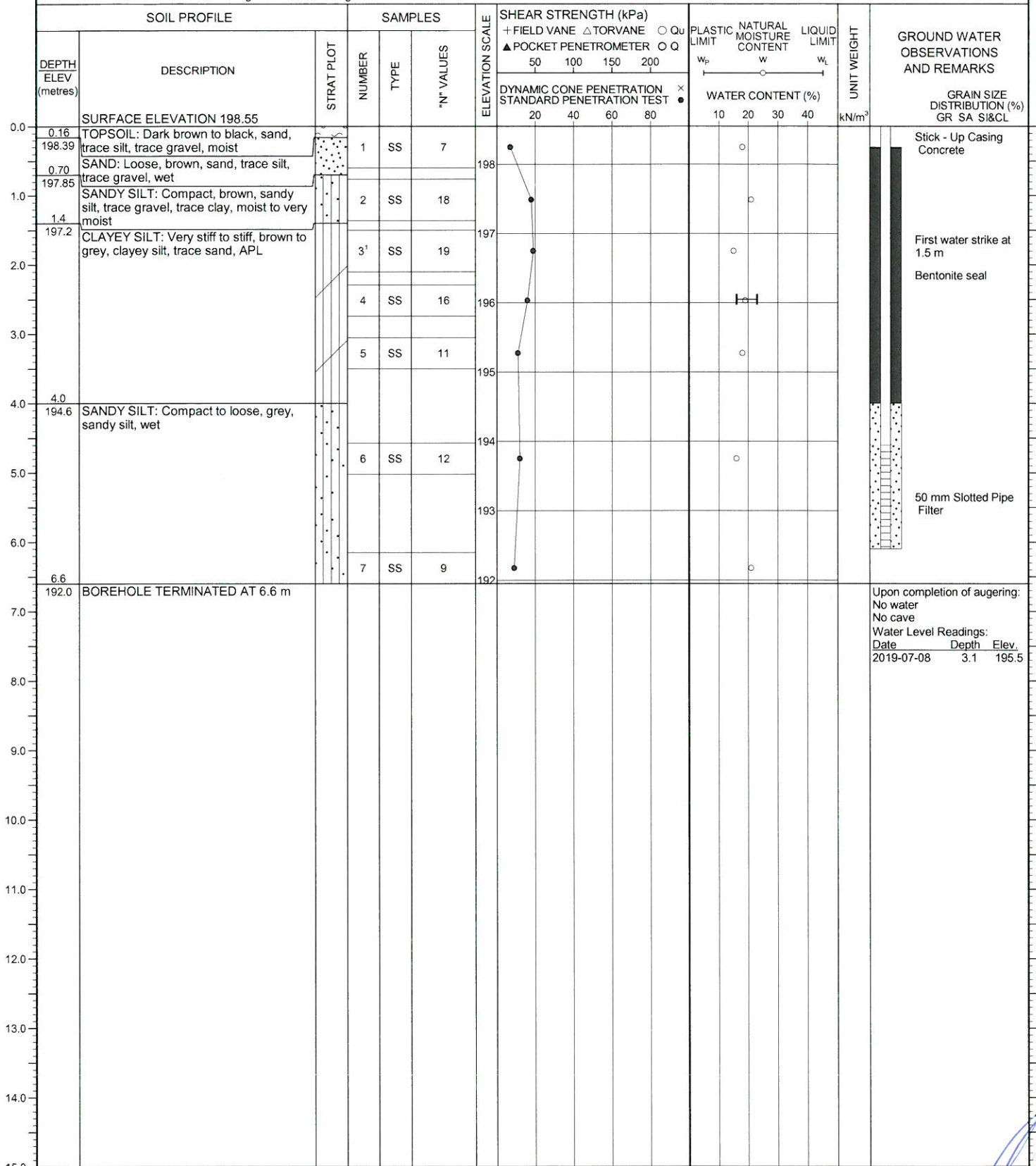
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE June 28, 2019

PML REF. 19CF010

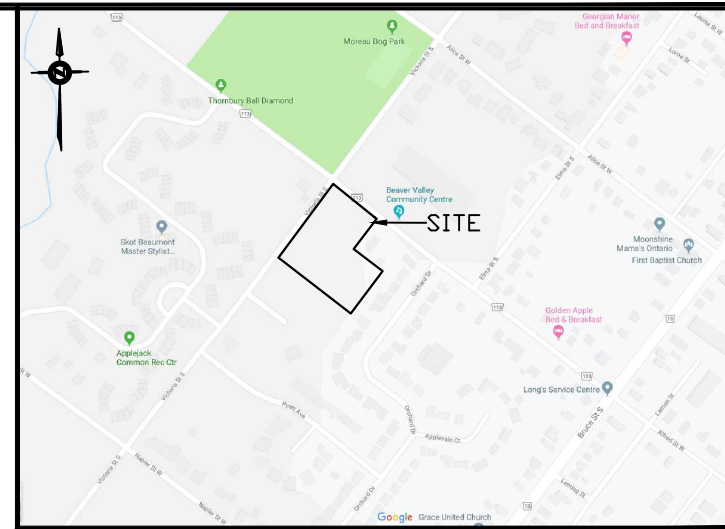
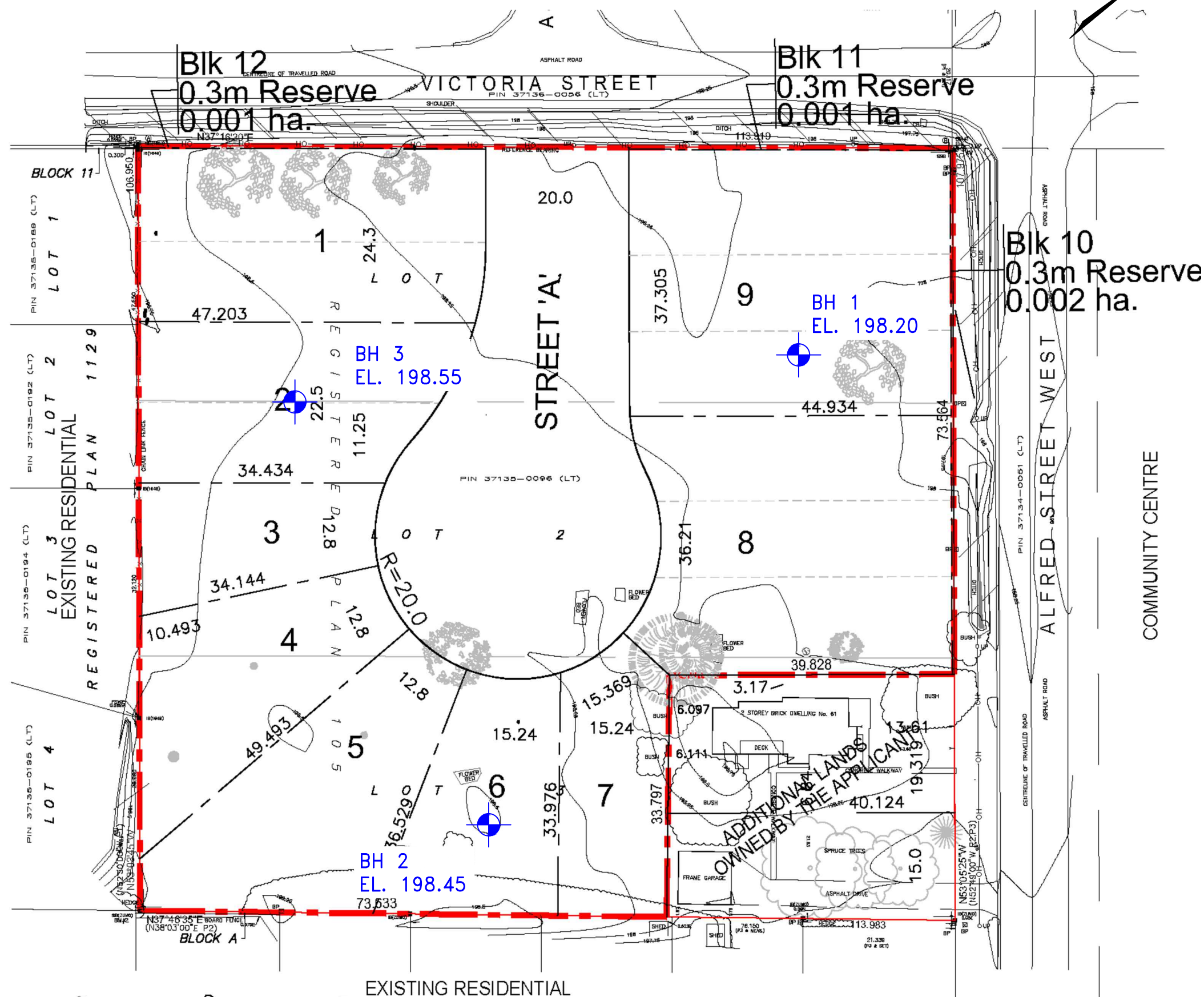
ENGINEER GW

TECHNICIAN AT



NOTES 1 - Soil sample submitted for chemical testing.

Upon completion of augering:
No water
No cave
Water Level Readings:
Date Depth Elev.
2019-07-08 3.1 195.5



KEY PLAN
THORNBURY, ONTARIO

LEGEND:

--- SITE LIMITS

+ **BH 1** BOREHOLE 1 (WITH MONITORING WELL)
EL. 198.20 SURFACE ELEVATION

REFERENCE:
BASE PLAN PROVIDED BY CLIENT.

0m 10 20 30 40 50

SCALE

BOREHOLE LOCATION PLAN

PROPOSED RESIDENTIAL DEVELOPMENT
61 ALFRED STREET
THORNBURY, ONTARIO

PML Peto MacCallum Ltd.
CONSULTING ENGINEERS

DRAWN	RB	DATE	SCALE	PML REF.	DRAWING NO.
CHECKED	RB	AUG. 2019	AS SHOWN	19CF010	1
APPROVED	GW				



APPENDIX A

Engineered Fill

The information presented in this appendix is intended for general guidance only. Site specific conditions and prevailing weather may require modification of compaction standards, backfill type or procedures. Each site must be discussed, and procedures agreed with Peto MacCallum Ltd. prior to the start of the earthworks and must be subject to ongoing review during construction. This appendix is not intended to apply to embankments. Steeply sloping ravine residential lots require special consideration.

For fill to be classified as engineered fill suitable for supporting structural loads, a number of conditions must be satisfied, including but not necessarily limited to the following:

1. Purpose

The site specific purpose of the engineered fill must be recognized. In advance of construction, all parties should discuss the project and its requirements and agree on an appropriate set of standards and procedures.

2. Minimum Extent

The engineered fill envelope must extend beyond the footprint of the structure to be supported. The minimum extent of the envelope should be defined from a geotechnical perspective by:

- at founding level, extend a minimum 1.0 m beyond the outer edge of the foundations, greater if adequate layout has not yet been completed as noted below; and
- extend downward and outward at a slope no greater than 45° to meet the subgrade

All fill within the envelope established above must meet the requirements of engineered fill in order to support the structure safely. Other considerations such as survey control, or construction methods may require an envelope that is larger, as noted in the following sections.

Once the minimum envelope has been established, structures must not be moved or extended without consultation with Peto MacCallum Ltd. Similarly, Peto MacCallum Ltd. should be consulted prior to any excavation within the minimum envelope.

3. Survey Control

Accurate survey control is essential to the success of an engineered fill project. The boundaries of the engineered fill must be laid out by a surveyor in consultation with engineering staff from Peto MacCallum Ltd. Careful consideration of the maximum building envelope is required.

During construction it is necessary to have a qualified surveyor provide total station control on the three dimensional extent of filling.

4. Subsurface Preparation

Prior to placement of fill, the subgrade must be prepared to the satisfaction of Peto MacCallum Ltd. All deleterious material must be removed and in some cases, excavation of native mineral soils may be required.

Particular attention must be paid to wet subgrades and possible additional measures required to achieve sufficient compaction. Where fill is placed against a slope, benching may be necessary and natural drainage paths must not be blocked.

5. Suitable Fill Materials

All material to be used as fill must be approved by Peto MacCallum Ltd. Such approval will be influenced by many factors and must be site and project specific. External fill sources must be sampled, tested and approved prior to material being hauled to site.

6. Test Section

In advance of the start of construction of the engineered fill pad, the Contractor should conduct a test section. The compaction criterion will be assessed in consultation with Peto MacCallum Ltd. for the various fill material types using different lift thicknesses and number of passes for the compaction equipment proposed by the Contractor.

Additional test sections may be required throughout the course of the project to reflect changes in fill sources, natural moisture content of the material and weather conditions.

The Contractor should be particularly aware of changes in the moisture content of fill material. Site review by Peto MacCallum Ltd. is required to ensure the desired lift thickness is maintained and that each lift is systematically compacted, tested and approved before a subsequent lift is commenced.

7. Inspection and Testing

Uniform, thorough compaction is crucial to the performance of the engineered fill and the supported structure. Hence, all subgrade preparation, filling and compacting must be carried out under the full time inspection by Peto MacCallum Ltd.

All founding surfaces for all buildings and residential dwellings or any part thereof (including but not limited to footings and floor slabs) on structural fill or native soils must be inspected and approved by PML engineering personnel prior to placement of the base/subbase granular material and/or concrete. The purpose of the inspection is to ensure the subgrade soils are capable of supporting the building/house foundation and floor slab loads and to confirm the building/house envelope does not extend beyond the limits of any structural fill pads.

8. Protection of Fill

Fill is generally more susceptible to the effects of weather than natural soil. Fill placed and approved to the level at which structural support is required must be protected from excessive wetting, drying, erosion or freezing. Where adequate protection has not been provided, it may be necessary to provide deeper footings or to strip and recompact some of the fill.

9. Construction Delay Time Considerations

The integrity of the fill pad can deteriorate due to the harsh effects of our Canadian weather. Hence, particular care must be taken if the fill pad is constructed over a long time period.

It is necessary therefore, that all fill sources are tested to ensure the material compactability prior to the soil arriving at site. When there has been a lengthy delay between construction periods of the fill pad, it is necessary to conduct subgrade proof rolling, test pits or boreholes to verify the adequacy of the exposed subgrade to accept new fill material.

When the fill pad will be constructed over a lengthy period of time, a field survey should be completed at the end of each construction season to verify the areal extent and the level at which the compacted fill has been brought up to, tested and approved.

In the following spring, subexcavation may be necessary if the fill pad has been softened attributable to ponded surface water or freeze/thaw cycles.

A new survey is required at the beginning of the next construction season to verify that random dumping and/or spreading of fill has not been carried out at the site.

10. Approved Fill Pad Surveillance

It should be appreciated that once the fill pad has been brought to final grade and documented by field survey, there must be ongoing surveillance to ensure that the integrity of the fill pad is not threatened.

Grading operations adjacent to fill pads can often take place several months or years after completion of the fill pad.

It is imperative that all site management and supervision staff, the staff of Contractors and earthwork operators be fully aware of the boundaries of all approved engineered fill pads.

Excavation into an approved engineered fill pad should never be contemplated without the full knowledge, approval and documentation by the geotechnical consultant.

If the fill pad is knowingly built several years in advance of ultimate construction, the areal limits of the fill pad should be substantially overbuilt laterally to allow for changes in possible structure location and elevation and other earthwork operations and competing interests on the site. The overbuilt distance required is project and/or site specified.

Iron bars should be placed at the corner/intermediate points of the fill pad as a permanent record of the approved limits of the work for record keeping purposes.

11. Unusual Working Conditions

Construction of fill pads may at times take place at night and/or during periods of freezing weather conditions because of the requirements of the project schedule. It should be appreciated therefore, that both situations present more difficult working conditions. The Owner, Contractor, Design Consultant and Geotechnical Engineer must be willing to work together to revise site construction procedures, enhance field testing and surveillance, and incorporate design modifications as necessary to suit site conditions.

When working at night there must be sufficient artificial light to properly illuminate the fill pad and borrow areas.

Placement of material to form an engineered fill pad during winter and freezing temperatures has its own special conditions that must be addressed. It is imperative that each day prior to placement of new fill, the exposed subgrade must be inspected and any overnight snow or frozen material removed. Particular attention should be given to the borrow source inspection to ensure only nonfrozen fill is brought to the site.

The Contractor must continually assess the work program and have the necessary spreading and compacting equipment to ensure that densification of the fill material takes place in a minimum amount of time. Changes may be required to the spreading methods, lift thickness, and compaction techniques to ensure the desired compaction is achieved uniformly throughout each fill lift.

The Contractor should adequately protect the subgrade at the end of each shift to minimize frost penetration overnight. Since water cannot be added to the fill material to facilitate compaction, it is imperative that densification of the fill be achieved by additional compaction effort and an appropriate reduced lift thickness. Once the fill pad has been completed, it must be properly protected from freezing temperatures and ponding of water during the spring thaw period.

If the pad is unusually thick or if the fill thickness varies dramatically across the width or length of the fill pad, Peto MacCallum Ltd. should be consulted for additional recommendations. In this case, alternative special provisions may be recommended, such as providing a surcharge preload for a limited time or increase the degree of compaction of the fill.



APPENDIX B

Certificates of Analyses for Chemical Testing

C.O.C.: G75893

REPORT No. B19-19577

Report To:

Peto MacCallum Ltd

19 Churchill Drive,

Barrie ON L4N 8Z5

Attention: Geoff White

Caduceon Environmental Laboratories

112 Commerce Park Drive

Barrie ON L4N 8W8

Tel: 705-252-5743

Fax: 705-252-5746

DATE RECEIVED: 02-Jul-19

JOB/PROJECT NO.:

DATE REPORTED: 09-Jul-19

P.O. NUMBER: 19CF010

SAMPLE MATRIX: Soil

WATERWORKS NO.

			Client I.D.	BH 1 SS 3	BH 3 SS 2		
			Sample I.D.	B19-19577-1	B19-19577-2		
			Date Collected	28-Jun-19	28-Jun-19		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
pH @25°C	pH Units		MOEE3530	05-Jul-19/R	7.75	7.75	
Resistivity	ohms-cm	1	MOEE3530	05-Jul-19/R	7980	8050	
REDOX potential	mV		In-House	08-Jul-19/R	162	173	
Chloride	µg/g	5	SM4110C	09-Jul-19/O	34	33	
Sulphate	µg/g	10	SM4110C	09-Jul-19/O	10	10	
Sulfide	µg/g	0.1	In-House	09-Jul-19	< 0.1 ¹	< 0.1 ¹	

¹ Subcontracted to Testmark Labs



Christine Burke
Lab Manager

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

TESTING REQUIREMENTS

REPORT NUMBER (Lab Use)

- ☒ O.Reg 153 Table 1 ☐ Medium/Fine ☐ Coarse ☐ MISA Guidelines
☐ Surface Soil ☐ Sub Surface Soil (O.Reg 153) ☐ O.Reg 558 Leachate Analysis
☐ Yes ☐ No Record of Site Condition (O.Reg 153) Disposal Site: _____
☐ Provincial Water Quality Objectives ☐ Landfill Monitoring
☐ Sewer Use By-Law: _____ ☐ Other: _____

19577
819-19573.8r

Are any samples to be submitted intended for Human Consumption under any Drinking Water Regulations? ☐ Yes ☒ No (If yes, submit all Drinking Water Samples on a Drinking Water Chain of Custody)

Indicate Laboratory Samples are submitted to: ☐ Kingston ☐ Ottawa ☐ Richmond Hill ☐ Windsor ☒ Barrie ☐ London

Organization: Pete MacCallum Ltd.
 Contact: Geoff White
 Tel: 705-734-3900

Address and Invoicing Address (if different)
All PML invoices to
barrie@petomacallum.com

Fax: 705-734-9911

Quote No.: _____ Project Name: 19CF010

Email: rblair@petomacallum.com

P.O. No.: _____ Additional Info: _____

ANALYSES REQUESTED (Print Test in Boxes)

Mt 1
pH (FI to FI)
Corrosivity Package
Sulphate

Suspected Highly Contaminated

TURNAROUND SERVICE
REQUESTED (see back page)

- ☐ Platinum 200% Surcharge**
☐ Gold 100% Surcharge
☐ Silver 50% Surcharge
☐ Bronze 25% Surcharge
☒ Standard 5-7 days

☐ Specific Date: _____

* Sample Matrix Legend: WW=Waste Water, SW=Surface Water, GW=Groundwater, LS=Liquid Sludge, SS=Solid Sludge, S=Soil, Sed=Sediment, PC=Paint Chips, F=Filter, Oil = Oil

Lab No.	Sample Identification	S.P.L.	Sample Matrix *	Date Collected (yy-mm-dd)	Time Collected	Indicate Test For Each Sample By Using A Check Mark In The Box Provided												Field pH	Field Temp.	# Bottles Sample	Field Filtered (Y/N)
	BH 1 SS2		S	19-06-28		✓	✓														
	BH 2 SS2		S	"		✓	✓														
	BH 3 SS3		S	"		✓	✓														
①	BH 1 SS3		S	19-06-28				✓	✓												
②	BH 3 SS2		S	"				✓	✓												

SAMPLE SUBMISSION INFORMATION

SHIPPING INFORMATION

REPORTING / INVOICING

SAMPLE RECEIVING INFORMATION (LABORATORY USE ONLY)

Print: <u>A. Turner</u>	Submitted by: <u>R. Blair</u>	Client's Courier <input type="checkbox"/>	Invoice <input type="checkbox"/>	Report by Fax <input type="checkbox"/>	Received By (print): <u>S. Paul</u>	Signature: <u>[Signature]</u>
Sign: <u>[Signature]</u>	Date (yy-mm-dd): <u>2019-06-28</u>	Caduceon's Courier <input type="checkbox"/>	# of Pieces: <u>1</u>	Report by Email <input checked="" type="checkbox"/>	Date Received (yy-mm-dd): <u>19/07/02</u>	Time Received: <u>15:30</u>
	Date (yy-mm-dd): <u>2019-07-02</u>	Drop Off <input checked="" type="checkbox"/>		Invoice by Email <input checked="" type="checkbox"/>	Laboratory Prepared Bottles: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
		Caduceon (Pick-up) <input type="checkbox"/>		Invoice by Mail <input type="checkbox"/>	Sample Temperature °C: <u>13.2</u>	Labeled by: <u>SS</u>

Comments: Peecup & trials - RH

room jar -> testmark

Page 1 of 1
G 75893

C.O.C.: G75893

REPORT No. B19-19573 (i)

Rev. 1

Report To:

Peto MacCallum Ltd

19 Churchill Drive,
Barrie ON L4N 8Z5

Attention: Geoff White

Caduceon Environmental Laboratories

112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 02-Jul-19

JOB/PROJECT NO.:

DATE REPORTED: 19-Jul-19

SAMPLE MATRIX: Soil

P.O. NUMBER: 19CF010

WATERWORKS NO.

Parameter	Qty	Site Analyzed	Analyst Initials	Date Analyzed	Lab Method	Reference Method
Cyanide	3	Kingston	TK	09-Jul-19	A-CN s K	in house
Conductivity	3	Richmond Hill	ABL	05-Jul-19	A-COND-02 s RH	MOEE3530
pH	3	Richmond Hill	ABL	05-Jul-19	A-pH-02 (rh)	MOEE3530
Chromium (VI)	3	Holly Lane	LMG	05-Jul-19	D-CRVI-02 (o)	EPA7196A
Mercury	3	Holly Lane	PBK	08-Jul-19	D-HG-01 (o)	EPA 7471A
Sodium Adsorption Ratio	3	Holly Lane	TPR	08-Jul-19	D-ICP-01 SAR (o)	SM 3120
Metals - ICP-OES	3	Holly Lane	TPR	08-Jul-19	D-ICP-02 (o)	EPA 6010
Metals - ICP-MS	3	Holly Lane	TPR	08-Jul-19	D-ICPMS-01 (o)	EPA 6020

µg/g = micrograms per gram (parts per million) and is equal to mg/Kg

F1 C6-C10 hydrocarbons in µg/g, (F1-btex if requested)

F2 C10-C16 hydrocarbons in µg/g, (F2-naph if requested)

F3 C16-C34 hydrocarbons in µg/g, (F3-pah if requested)

F4 C34-C50 hydrocarbons in µg/g

This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.

Any deviations from the method are noted and reported for any particular sample.

nC6 and nC10 response factor is within 30% of response factor for toluene:

nC10, nC16 and nC34 response factors within 10% of each other:

C50 response factors within 70% of nC10+nC16+nC34 average:

Linearity is within 15%:

All results expressed on a dry weight basis.

Unless otherwise noted all chromatograms returned to baseline by the retention time of nC50.

Unless otherwise noted all extraction, analysis, QC requirements and limits for holding time were met.

If analyzed for F4 and F4G they are not to be summed but the greater of the two numbers are to be used in application to the CWS PHC

QC will be made available upon request.

O. Reg. 153 - Soil, Ground Water and Sediment Standards
Tbl. 2 - RPI Soil - Table 2 - Res./Parkland/Institutional Soil Std



Christine Burke
Lab Manager

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston, W-Windsor, O-Ottawa, R-Richmond Hill, B-Barrie

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C.O.C.: G75893

REPORT No. B19-19573 (i)

Rev. 1

Report To:

Peto MacCallum Ltd

19 Churchill Drive,

Barrie ON L4N 8Z5

Attention: Geoff White

Caduceon Environmental Laboratories

112 Commerce Park Drive

Barrie ON L4N 8W8

Tel: 705-252-5743

Fax: 705-252-5746

DATE RECEIVED: 02-Jul-19

JOB/PROJECT NO.:

DATE REPORTED: 19-Jul-19

P.O. NUMBER: 19CF010

SAMPLE MATRIX: Soil

WATERWORKS NO.

			Client I.D. Sample I.D. Date Collected	BH 1 SS 2 B19-19573-1 28-Jun-19	BH 2 SS 2 B19-19573-2 28-Jun-19	BH 3 SS 3 B19-19573-3 28-Jun-19	O. Reg. 153 Tbl. 2 - RPI Soil	
Parameter	Units	R.L.						
pH @25°C	pH Units			7.68	7.77	7.66		
Conductivity @25°C	mS/cm	0.07		0.11	0.11	0.13	0.7	
Cyanide (Free)	µg/g	0.05		< 0.05	< 0.05	< 0.05	0.051	
Sodium Adsorption Ratio	units			0.0850	0.0966	0.117	5	
Antimony	µg/g	0.5		< 0.5	< 0.5	< 0.5	7.5	
Arsenic	µg/g	0.5		3.4	3.1	2.7	18	
Barium	µg/g	1		20	23	25	390	
Beryllium	µg/g	0.2		0.3	0.4	0.6	4	
Boron	µg/g	0.5		4.9	6.8	9.3	120	
Cadmium	µg/g	0.5		< 0.5	< 0.5	< 0.5	1.2	
Chromium	µg/g	1		11	12	14	160	
Chromium (VI)	µg/g	0.2		< 0.2	< 0.2	< 0.2	8	
Cobalt	µg/g	1		5	6	8	22	
Copper	µg/g	1		14	14	15	140	
Lead	µg/g	5		5	< 5	< 5	120	
Mercury	µg/g	0.005		0.016	0.006	0.008	0.27	
Molybdenum	µg/g	1		< 1	< 1	< 1	6.9	
Nickel	µg/g	1		11	13	16	100	
Selenium	µg/g	0.5		< 0.5	< 0.5	< 0.5	2.4	
Silver	µg/g	0.2		< 0.2	< 0.2	< 0.2	20	
Thallium	µg/g	0.1		< 0.1	< 0.1	< 0.1	1	
Uranium	µg/g	0.1		0.4	0.4	0.4	23	
Vanadium	µg/g	1		15	19	18	86	
Zinc	µg/g	3		23	25	31	340	

1 Revised report to change guidelines as per client request.

O. Reg. 153 - Soil, Ground Water and Sediment Standards

Tbl. 2 - RPI Soil - Table 2 - Res./Parkland/Institutional Soil Std



Christine Burke
Lab Manager

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

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C.O.C.: G75893

REPORT No. B19-19573 (i)

Rev. 1

Report To:

Peto MacCallum Ltd

19 Churchill Drive,

Barrie ON L4N 8Z5

Attention: Geoff White

Caduceon Environmental Laboratories

112 Commerce Park Drive

Barrie ON L4N 8W8

Tel: 705-252-5743

Fax: 705-252-5746

DATE RECEIVED: 02-Jul-19

JOB/PROJECT NO.:

DATE REPORTED: 19-Jul-19

P.O. NUMBER: 19CF010

SAMPLE MATRIX: Soil

WATERWORKS NO.

Summary of Exceedances

O. Reg. 153 - Soil, Ground Water and Sediment Standards
Tbl. 2 - RPI Soil - Table 2 - Res./Parkland/Institutional Soil Std



R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an *

Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Christine Burke
Lab Manager

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

C.O.C.: G75893

REPORT No. B19-19573 (ii)

Rev. 1

Report To:

Peto MacCallum Ltd

19 Churchill Drive,

Barrie ON L4N 8Z5

Attention: Geoff White

Caduceon Environmental Laboratories

112 Commerce Park Drive

Barrie ON L4N 8W8

Tel: 705-252-5743

Fax: 705-252-5746

DATE RECEIVED: 02-Jul-19

JOB/PROJECT NO.:

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SAMPLE MATRIX: Soil

P.O. NUMBER: 19CF010

WATERWORKS NO.

Parameter	Qty	Site Analyzed	Analyst Initials	Date Analyzed	Lab Method	Reference Method
% Moisture	3	Richmond Hill	FAL	08-Jul-19	A-% moisture RH	
PHC(F2-F4)	3	Kingston	KPR	04-Jul-19	C-PHC-S-001 (k)	CWS Tier 1
PHC(F1)	3	Richmond Hill	FAL	04-Jul-19	C-VPHS-01 (rh)	CWS Tier 1

µg/g = micrograms per gram (parts per million) and is equal to mg/Kg

F1 C6-C10 hydrocarbons in µg/g, (F1-btex if requested)

F2 C10-C16 hydrocarbons in µg/g, (F2-naph if requested)

F3 C16-C34 hydrocarbons in µg/g, (F3-pah if requested)

F4 C34-C50 hydrocarbons in µg/g

This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.

Any deviations from the method are noted and reported for any particular sample.

nC6 and nC10 response factor is within 30% of response factor for toluene:

nC10, nC16 and nC34 response factors within 10% of each other:

C50 response factors within 70% of nC10+nC16+nC34 average:

Linearity is within 15%:

All results expressed on a dry weight basis.

Unless otherwise noted all chromatograms returned to baseline by the retention time of nC50.

Unless otherwise noted all extraction, analysis, QC requirements and limits for holding time were met. If analyzed for F4 and F4G they are not to be summed but the greater of the two numbers are to be used in application to the CWS PHC QC will be made available upon request.

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SAMPLE MATRIX: Soil

WATERWORKS NO.

			Client I.D. Sample I.D. Date Collected	BH 1 SS 2 B19-19573-1 28-Jun-19	BH 2 SS 2 B19-19573-2 28-Jun-19	BH 3 SS 3 B19-19573-3 28-Jun-19	O. Reg. 153 Tbl. 2 - RPI Soil	
Parameter	Units	R.L.						
PHC F1 (C6-C10)	µg/g	10	< 10	< 10	< 10		55	
PHC F2 (>C10-C16)	µg/g	5	< 5	< 5	< 5		98	
PHC F3 (>C16-C34)	µg/g	10	< 10	< 10	< 10		300	
PHC F4 (>C34-C50)	µg/g	10	< 10	< 10	< 10		2800	
% moisture	%		13.5	13.2	15.2			

1. Revised report to change guidelines as per client request.

O. Reg. 153 - Soil, Ground Water and Sediment Standards
Tbl. 2 - RPI Soil - Table 2 - Res./Parkland/Institutional Soil Std



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Lab Manager

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Christine Burke
Lab Manager

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Are any samples to be submitted intended for Human Consumption under any Drinking Water Regulations? ☐ Yes ☒ No (If yes, submit all Drinking Water Samples on a Drinking Water Chain of Custody)

Indicate Laboratory Samples are submitted to: ☐ Kingston ☐ Ottawa ☐ Richmond Hill ☐ Windsor ☒ Barrie ☐ London

Organization: Pete MacCallum Ltd.	Address and Invoicing Address (if different)	
Contact: Geoff White	All PML invoices to barrie@petomacallum.com	
Tel: 705-734-3900		
Fax: 705-734-9911	Quote No.:	Project Name: 19CF010
Email: rblair@petomacallum.com	P.O. No.:	Additional Info:

ANALYSES REQUESTED (Print Test in Boxes)

TURNAROUND SERVICE
REQUESTED (see back page)

<input type="checkbox"/>	Platinum	200% Surcharge**
<input type="checkbox"/>	Gold	100% Surcharge
<input type="checkbox"/>	Silver	50% Surcharge
<input type="checkbox"/>	Bronze	25% Surcharge
<input checked="" type="checkbox"/>	Standard	5-7 days

☐ Specific Date: _____

* Sample Matrix Legend: WW=Waste Water, SW=Surface Water, GW=Groundwater, LS=Liquid Sludge, SS=Solid Sludge, S=Soil, Sed=Sediment, PC=Paint Chips, F=Filter, Oil = Oil

[illegible]

SAMPLE SUBMISSION INFORMATION			SHIPPING INFORMATION		REPORTING / INVOICING	SAMPLE RECEIVING INFORMATION (LABORATORY USE ONLY)	
	Sampled by:	Submitted by:	Client's Courier <input type="checkbox"/>	Invoice <input type="checkbox"/>	Report by Fax <input type="checkbox"/>	Received By (print): SPH	Signature: [Signature]
Print:	A. Turner	R. Blair	Caduceon's Courier <input type="checkbox"/>	<input type="checkbox"/>	Report by Email <input checked="" type="checkbox"/>	Date Received (yy-mm-dd): 9/07/02	Time Received: 15:30
Sign:	[Signature]	[Signature]	Drop Off <input checked="" type="checkbox"/>	# of Pieces	Invoice by Email <input checked="" type="checkbox"/>	Laboratory Prepared Bottles: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
	2019-06-28	2019-07-02	Caduceon (Pick-up) <input type="checkbox"/>	1	Invoice by Mail <input type="checkbox"/>	Sample Temperature °C: 13.2	Labeled by: ES
	Date (yy-mm-dd)/Time:	Date (yy-mm-dd)/Time:					

Comments:
pee amp & vials - DK
jar - DO
jar - DK

Page 1 of 1
G 75893



APPENDIX C

Statement of Limitations

STATEMENT OF LIMITATIONS



STATEMENT OF LIMITATIONS

This report is prepared for and made available for the sole use of the client named. Peto MacCallum Ltd. (PML) hereby disclaims any liability or responsibility to any person or entity, other than those for whom this report is specifically issued, for any loss, damage, expenses, or penalties that may arise or result from the use of any information or recommendations contained in this report. The contents of this report may not be used or relied upon by any other person without the express written consent and authorization of PML.

This report shall not be relied upon for any purpose other than as agreed with the client named without the written consent of PML. It shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. A portion of this report may not be used as a separate entity: that is to say the report is to be read in its entirety at all times.

The report is based solely on the scope of services which are specifically referred to in this report. No physical or intrusive testing has been performed, except as specifically referenced in this report. This report is not a certification of compliance with past or present regulations, codes, guidelines and policies.

The scope of services carried out by PML is based on details of the proposed development and land use to address certain issues, purposes and objectives with respect to the specific site as identified by the client. Services not expressly set forth in writing are expressly excluded from the services provided by PML. In other words, PML has not performed any observations, investigations, study analysis, engineering evaluation or testing that is not specifically listed in the scope of services in this report. PML assumes no responsibility or duty to the client for any such services and shall not be liable for failing to discover any condition, whose discovery would require the performance of services not specifically referred to in this report.

STATEMENT OF LIMITATIONS



STATEMENT OF LIMITATIONS (continued)

The findings and comments made by PML in this report are based on the conditions observed at the time of PML's site reconnaissance. No assurances can be made and no assurances are given with respect to any potential changes in site conditions following the time of completion of PML's field work. Furthermore, regulations, codes and guidelines may change at any time subsequent to the date of this report and these changes may effect the validity of the findings and recommendations given in this report.

The results and conclusions with respect to site conditions are therefore in no way intended to be taken as a guarantee or representation, expressed or implied, that the site is free from any contaminants from past or current land use activities or that the conditions in all areas of the site and beneath or within structures are the same as those areas specifically sampled.

Any investigation, examination, measurements or sampling explorations at a particular location may not be representative of conditions between sampled locations. Soil, ground water, surface water, or building material conditions between and beyond the sampled locations may differ from those encountered at the sampling locations and conditions may become apparent during construction which could not be detected or anticipated at the time of the intrusive sampling investigation.

Budget estimates contained in this report are to be viewed as an engineering estimate of probable costs and provided solely for the purposes of assisting the client in its budgeting process. It is understood and agreed that PML will not in any way be held liable as a result of any budget figures provided by it.

The Client expressly waives its right to withhold PML's fees, either in whole or in part, or to make any claim or commence an action or bring any other proceedings, whether in contract, tort, or otherwise against PML in anyway connected with advice or information given by PML relating to the cost estimate or Environmental Remediation/Cleanup and Restoration or Soil and Ground Water Management Plan Cost Estimate.