



**GEOTECHNICAL INVESTIGATION
PROPOSED ARKELL ROAD SUBDIVISION
GUELPH, ONTARIO**

for

**CRESCENT HOMES INC.
c/o MTE CONSULTANTS INC.**

PETO MacCALLUM LTD.
16 FRANKLIN STREET SOUTH
KITCHENER, ONTARIO
N2C 1R4
PHONE: (519) 893-7500
FAX: (519) 893-0654
EMAIL: kitchener@petomaccallum.com

Distribution:

1 cc: Crescent Homes Inc. (email only)
(+email - njnits@gmail.com)
18 cc: MTE Consultants Inc. (+email - jcabral@mte85.com)
1 cc: PML Kitchener

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Mr. Nitin Jain
Crescent Homes
c/o Mr. Jason Cabral, C.E.T.
MTE Consultants Inc.
520 Bingemans Centre Drive,
Kitchener, Ontario
N2B 3X9

Dear Mr. Jain

**Geotechnical Investigation
Proposed Arkell Road Subdivision
Guelph, Ontario**

Peto MacCallum Ltd. (PML) is pleased to report the results of the geotechnical investigation recently completed at the above noted project site. Authorization to proceed with this assignment was provided verbally from Mr. Nitin Jain of Crescent Homes Inc., with a signed Engineering Services Agreement to be returned.

The project involves the proposed development of a residential subdivision on the north side of Arkell Road (at Summerfield Drive), in Guelph, Ontario. It is understood that the proposed development site is currently comprised of several residential dwellings, which will be demolished as part of the project. The site is approximately 2.58 ha in size, however, the northern third of the site will not be developed. The development will include 66 town-house / apartment units, with associated parked areas as well as one roadway.

The purpose of the geotechnical investigation was to explore the subsurface soil and ground water conditions at the site. Based on the findings, we have prepared an engineering report with geotechnical recommendations pertaining to design and construction of the proposed residential subdivision. Specific considerations to be addressed in this report include:

- A description of the site and the field investigation procedure;
- A summary of the subsurface soil and ground water conditions encountered, including the presence of any topsoil, organic, fill or other anomalous features below grade;
- Log of borehole sheets, a borehole location plan drawing, and geotechnical laboratory test results;



- Foundation design options, including shallow foundation recommendations, bearing resistances, settlement projections and site class for seismic design;
- Slab-on-grade floor recommendations, including compaction requirements, perimeter and underfloor drainage requirements, and geotechnical suitability of onsite soils for re-use;
- Excavation recommendations, including safe side slopes and dewatering requirements,
- Pipe bedding, cover and backfill requirements, including material and compaction requirements, suitability of excavated soils for reuse as backfill;
- Ground water infiltration; and,
- Pavement design recommendations, including component thicknesses, compaction requirements, and drainage requirements.

The comments and recommendations provided in this report are based on the site conditions at the time of the investigation, and are for preliminary design purposes only. Any changes in plans will require review by PML to assess the applicability of the report, and may require modified recommendations, additional analysis and / or investigation. When the project design is complete, the general recommendations given in this report should be reviewed to ensure their applicability.

A limited chemical testing program of select soil samples was also completed. It should be noted that the scope of work did not include a Phase One or Phase Two Environmental Site Assessment (ESA), and the chemical testing program might not have identified all potential or actual occurrences of soil or ground water impairment at the site.

Investigation Procedure

The field work for the geotechnical investigation was completed on February 13 and March 21, 2017. Boreholes were drilled at six locations (BH1 to BH6) as shown on the appended Borehole Location Plan, Drawing 1. The field work included the installation of a total of four monitoring wells in BH2, BH3, BH4 and BH5.

The boreholes were advanced using a Diedrich D50 track mounted drillrig equipped with an automatic hammer and continuous flight hollow stem augers. The drilling equipment was supplied and operated by specialist contractors working under subcontract to PML.



Representative samples of the overburden were recovered at regular intervals throughout the depths explored. Standard penetration tests (SPT) were carried out during sampling operations of the boreholes using conventional split spoon equipment. Ground water observations were made in the boreholes during and upon completion of drilling. The boreholes were backfilled and compacted in accordance with O.Reg.903 upon completion of drilling.

The field work was supervised throughout by a member of PML's engineering staff who directed the drilling and sampling operation, prepared the stratigraphic logs, monitored ground water conditions, and processed the recovered samples.

The borehole and monitoring well locations were established in the field by Peto MacCallum Ltd. The ground surface elevations were surveyed by MTE Consultants Inc., and provided to PML on a borehole location plan.

All soil samples collected during the investigation were returned to PML's laboratory for detailed visual examination and testing. The geotechnical testing program included natural moisture content determinations on all recovered samples and two particle size distribution analyses carried out on samples of the major soil types encountered.

Summarized Site and Subsurface Conditions

The site is currently comprised of several residential dwellings, which will be demolished as part of the project. However, the northern third of the site will not be developed. The total area of the site is approximately 2.54 ha in size and relatively flat, with a gentle slope to the north, to the wetland area adjacent to the site. It is noted that the adjacent development to the east is approximately 5 m higher than the subject site.

Subsurface Conditions

Reference is made to the appended Log of Borehole sheets for details of the field work including soil descriptions, inferred stratigraphy, standard penetration test (SPT) N values, ground water observations and laboratory moisture content determinations.



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.

In general, the subsurface stratigraphy encountered at the borehole locations consists of surficial topsoil and localized fill overlying cohesionless native deposits.

Topsoil / Topsoil Fill

Between 100 and 300 mm (average thickness of 220 mm) of dark brown silt topsoil or topsoil fill was contacted from the surface in all of the boreholes. The topsoil was typically described as damp to moist, dark brown silt, trace sand with rootlets.

Fill

Below the topsoil / topsoil fill in BH1 and BH6, fill was penetrated, extending to depths of 0.46 m to 0.69 m below existing grades. The fill was variable in composition, comprising either sand and gravel or silt. Occasional rootlets were observed within the fill deposits in BH6.

Within the fill, SPT N values typically between 7 and 18 blows per 0.30 m penetration of the split spoon sampler indicate that a variable degree of compaction was used to place the fill soils. The fill soils were described as damp and moist, as demonstrated by laboratory moisture contents in the range of 5 to 20%.

Native Deposits

Native cohesionless deposits encountered below the surficial topsoil and fill were variable and generally comprised silt / sand / sand and gravel extending to the borehole termination depths. A deposit of silt till was also contacted in BH6, extending from 5.8 to 6.6 m. Generally, the encountered native cohesionless soil deposits were compact to very dense, with typical SPT N values ranging from 10 to greater than 50 blows per 0.3 m penetration of the split spoon sampler. Localized loose / very loose zones were contacted in BH1 (between 0.46 to 0.69 m), BH2



(between 0.25 to 0.69 m) and BH3 (between 0.2 to 1.4 m). Moisture contents typically ranging between 3 and 20% were indicative of variable damp to saturated conditions, with depth.

Two soil samples of the sand / sand and gravel were collected and analyzed for particle size distribution analysis, with results presented on Figure 1 and Figure 2 attached. Based on the results, the soil classification was generally consistent with those observed during the field work as included on the appended Log of Borehole sheets.

Ground Water Conditions

Ground water observations carried out during and upon completion of drilling are fully summarized on the appended Log of Borehole Sheets.

Ground water was first contacted at depths of 0.7 to 2.9 m below grade in the boreholes, corresponding to elevations of 333.4 to 331.7 (metric, geodetic), respectively.

An initial water level was also taken within the monitoring wells once installed. Ground water was measured at depths of 0.75 to 3.4 m below grade in the monitoring wells, corresponding to elevations of between 333.38 and 331.8 (metric, geodetic), respectively. Follow up ground water levels by MTE Consultants Inc., completed between March, 2017 and June, 2018 measured ground water at depths of surface level (MW4) to 3.65 m below grade (MW2), corresponding to an elevation range of between 330.38 (MW2 and MW5) to 333.99 (MW4) (metric, geodetic).

Based on the ground water observations, the ground water level appears to generally slope down from north to south, away from the wetland area.

The ground water levels at the site are subject to seasonal fluctuations and precipitation patterns.

Discussion and Recommendations

The site is an approximately 2.58 ha, rectangular shaped piece of land which is relatively flat located on the north side of Arkell Road at Summerfield Drive, Guelph, Ontario.



It is understood that the proposed development site is currently comprised of several residential dwellings, which will be demolished as part of the project. The development will include 66 town-house / apartment units, with associated parked areas as well as one roadway. However, northern third of the site will not be developed.

Once the design details for the proposed development are finalized, the recommendations in this report should be revisited to confirm that they remain applicable.

In general, the subsurface stratigraphy encountered at the borehole locations consist of surficial topsoil and localized fill overlying cohesionless native deposits.

Site Grading

As noted, the site is relatively flat with a total relief of approximately 1 m. The adjacent development to the east is approximately 5 m higher than the subject site. Consideration is being given to infilling the site.

Due to the inherent variability of the existing fill materials and the lack of consistent compactive effort utilized during fill placement, these materials are not considered suitable for support of building foundations, floor slabs, pavements, or other settlement sensitive structures. Also, the loose to very loose native materials (BH1, BH2 and BH3) are not considered suitable for the support of building foundations. In this regard, all existing fill and localized very loose / loose materials should be completely subexcavated from beneath any settlement sensitive structures (i.e., building envelopes, pavements, etc.) and replaced with well compacted, suitable engineered fill materials.

Following the stripping / removal of all surficial topsoil and any other deleterious material, and approval of the subgrade, the grades may then be raised where required. Surficial topsoil / organic thicknesses across the site were typically between 100 and 300 mm. In calculating the approximate quantity of topsoil to be stripped, we recommend that the topsoil thickness shown on the individual borehole logs be increased by 50 mm to account for variations and some stripping of the mineral soil below.



Prior to any fill placement, the subgrade surface should be proofrolled with a heavy vibratory compactor under the full time supervision of qualified geotechnical personnel. Any soft spots encountered during the proofrolling process should be subexcavated to the level of competent soils.

Fill used to raise grades should comprise either on site native inorganic cut soils or approved imported material. All engineered fill materials should be pre-approved by the geotechnical consultant prior to placement. Engineered fill material should be placed in maximum 300 mm thick lifts and compacted to at least 98% standard Proctor maximum dry density (SPMDD) below footings and 95% SPMDD below floors and pavements. Further, generic recommendations for fill subgrade preparation and engineered fill construction are provided in Appendix A.

It is noted that materials generated from grade cuts will generally consist of native cohesionless soil deposits. In general, the native on site cohesionless soils will be suitable for reuse as engineered fill, subject to geotechnical verification during construction, providing all organic, wet or saturated soils, and otherwise deleterious soils are discarded. Silty soils described as wet or saturated on the borehole logs should be dried prior to reuse.

The silty soils (i.e. silt) are frost susceptible and highly susceptible to moisture content variations, and are not well suited for engineering fill construction. Compaction to 98% SPMDD may be difficult to achieve; however, these insitu soils should be acceptable for use as engineered fill where compaction to 95% SPMDD is specified.

Foundations

For preliminary design purposes, conventional strip / spread footings founded at least 0.30 m into the competent compact to dense native deposits, or on engineered structural fill compacted to 98% SPMDD, may be designed for a net bearing resistance of 150 kPa at the serviceability limit state (SLS) and a factored bearing resistance of 225 kPa at the ultimate limit state (ULS). If very loose / loose soils are contacted at the proposed footing level, the loose soils should be subexcavated to the level of competent founding soils.



Accordingly, footings designed in accordance with the Ontario Building Code for residential housing will be satisfactory. The following table summarizes the minimum foundation depths based on the borehole findings:

LOCATION	MINIMUM FOUNDATION DEPTH (m)	CORRESPONDING ELEVATION (METRIC, GEODETIC)
BH1	1.0	333.50
BH2	1.0	334.10
BH3	1.7	332.70
BH4	0.6	333.50
BH5	0.6	334.30
BH6	0.7	333.30

Although in general, footings are anticipated to be placed on native insitu soils, where required the footings may be supported on engineered structural fill, placed in accordance with the generic recommendations for engineered fill construction provided in Appendix A. Prior to placement of engineered fill, all existing fill must be removed and the soils should be subexcavated to the level of competent native overburden soils noted in the table above. For engineered fill supporting footing loads, compaction to a minimum 98% of the materials SPMDD, should be specified as per recommendations outlined in the preceding 'Site Grading' section of this report and in Appendix B.

Footings supported on the structural fill may also be designed using the values for a net factored resistance at ULS and SLS of 225 and 150 kPa, respectively. Full time inspection of any structural fill placement by PML personnel is recommended to approve subgrade conditions, fill materials and to verify that the specified compaction levels are being achieved. Prior to concrete placement, all founding surfaces should be examined by PML personnel to check the competency of the founding surfaces.



Total settlements of footings founded on the approved engineered fill or compact to dense native overburden deposits, designed as outlined above are not expected to exceed 25 mm, with differential settlements between footings being no more than 50% of this value.

All exterior footings should be provided with a minimum 1.2 m of earth cover or the thermal insulation equivalent to provide adequate insulation against potential frost damage. A 25 mm thick layer of polystyrene insulation is thermally equivalent to 600 mm of soil cover.

Prior to concrete placement, all founding surfaces should be examined by PML personnel to check the competency of the founding surfaces.

For earthquake design, a site Class D seismic response classification may be assumed, in accordance with the 2012 Ontario Building Code.

Basement / Slab-on-Grade Floor Slabs

In general, the ground water level at the site was first contacted below depths of 0.7 to 2.9 m (Elevation 333.4 to 331.7) with follow up ground water monitoring showing ground water depths of surface level to 3.65 m below grade (Elevation 330.38 to 333.99). Basements, if any, must be located at least 1.0 m above the high ground water level. Conventional slab-on-grade construction of basement floor slabs is feasible on compact to dense native soil deposits, or on engineered structural fill compacted to 95% SPMDD.

Preparation of the floor slab subgrade should include stripping of the topsoil, and other deleterious material followed by proofrolling of the exposed subgrade with a heavy roller to ensure uniform adequate support. Excessively loose, soft or compressible materials revealed during the proofrolling operations should be subexcavated and replaced with well compacted approved material.

Fill placed under the floor slab to achieve finished subgrade levels or as foundation excavation backfill should comprise approved inorganic material having a moisture content within 3% of the optimum value, placed in maximum 200 mm thick lifts, and compacted to at least 95% of SPMDD.



A minimum 150 mm thick layer of well compacted clear stone (or equivalent) is recommended directly beneath the slab-on-grade. A polyethylene vapour barrier should be placed at the surface of the stone if a moisture sensitive finish is to be placed on the floor.

For slab-on-grade (basement less) structures, exterior grades should be maintained at least 150 mm below the finished floor slab-on-grade level and sloped to promote drainage away from the building.

Foundation Drainage and Earth Pressure Parameters

Foundation drainage measures should be taken for units with basements. Perforated drainage pipe should be laid around the outside edge of the footings, and connected to a frost free sump system. It is recommended that the drainage pipes be surrounded with a granular filter protected with filter fabric, or alternatively wrapped with filter cloth and surrounded by concrete sand.

A “free draining” granular material, or an equivalent, approved drainage board product must be provided for the basement walls, in accordance with the Ontario Building Code. The onsite native cohesionless deposits may be suitable for use as basement wall backfill. However, it should be noted that soils with high silt content (i.e. silt) are not suitable for use as basement wall backfill unless a drainage board product is provided. Backfilling should not take place until the ground floor has been constructed, in order to provide lateral support for the wall.

In conjunction with the granular material, a weeping tile system should be installed to minimize the build-up of hydrostatic pressure behind the wall. The weeping tile should be surrounded by a properly designed graded granular filter or wrapped with approved 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 sump or outlet.

The following earth pressure design parameters may be assumed for calculation of backfill materials compacted to 95% SPMDD:



PARAMETER	OPS GRANULAR B	Onsite SAND / SAND AND GRAVEL
Angle of Internal Friction (degrees)	32	30
Unit Weight (kN/m ³)	21	20
Coefficient of Active Earth Pressure (K_a)	0.30	0.33
Coefficient of Earth Pressure At Rest (K_o)	0.47	0.50
Coefficient of Passive Earth Pressure (K_p)	3.23	2.77

Note: Earth pressure coefficients assume Rankin analysis (wall friction ignored, non-sloping backfill)

It is assumed that basement floors will be more than 1.0 m above the ground water table and as such, underfloor drainage systems will not be required.

Excavation and Dewatering

It is assumed that excavations for site grading, footings and service trenches will extend through the surficial topsoil and into the native cohesionless soils, which are classified as Type 3 materials as defined in the Occupational Health and Safety Act (OHSA). Subject to inspection and providing adequate ground water control is achieved, excavations within Type 3 soils that are to be entered by workers should be inclined from the base of the excavation at one horizontal to one vertical (1H:1V) or flatter.

Ground water was first contacted at depths of 0.7 to 2.9 m below grade in the boreholes, corresponding to elevations of 333.4 to 331.7 (metric, geodetic), respectively.

An initial water level was also taken within the monitoring wells once installed. Ground water was measured at depths of 0.75 to 3.4 m below grade in the monitoring wells, corresponding to elevations of between 333.38 and 331.8 (metric, geodetic), respectively. Follow up ground water levels by MTE Consultants Inc., completed between March 2017 and June 2018 showed ground water depths of surface level to 3.65 m below grade (Elevation 330.38 to 333.99). The extent of ground water control will depend on the depth of excavation below the ground water level.



Shallow excavations extending less than 0.5 m below the ground water level can be dewatered using conventional sump pumping techniques. Deeper excavations, extending more than 0.5 m below the ground water level may require extensive ground water control measures such as keg wells or well point dewatering. The actual dewatering methods should be established at the contractor's discretion within the context of a performance specification for the project. Regardless of the dewatering method chosen, the hydraulic head and ground water inflow must be properly controlled to ensure a stable and safe excavation and to facilitate construction. The design of the dewatering system should be specified to maintain and control ground water at least 0.30 m below the excavation base level, in order to provide a stable excavation base throughout construction.

It should be noted that under the Ontario Water Resources Act, the Water Taking and Transfer Regulation 387/04, and in compliance with the Ministry of Environment and Climate Change's (MOECC) policy and Permit to Take Water (PTTW) Manual (April 2005), an application should be filed to the MOECC for the subject project construction dewatering PTTW, if the dewatering discharge is greater than 400,000 L/day, or about 4.6 L/s. If the dewatering discharge is between 50,000 L/day (or about 0.6 L/s) and 400,000 L/day (or about 4.6 L/s), dewatering activities need to be registered on the Environmental Activity and Sector Registry (EASR). Reference is made to the hydrological report by MTE Consultants Inc. for further details.

At the time of tendering, test pits should be excavated on site to allow prospective Contractors to judge the ground water conditions and to determine the appropriate control methods required closer to the time of construction. Ground water conditions are subject to seasonal variations. In this regard, a later summer construction schedule would be preferable.

Pipe Bedding and Backfilling

No bearing problems are anticipated for pipes founded in the native cohesionless soils or structural fill. On stable subgrade, a minimum 150 mm thick bedding course of Granular A material compacted to 95% SPMDD is recommended beneath the pipes. The Granular A material should extend around the pipe to at least 300 mm above the pipe obvert or as set out by Ontario Provincial Standards (OPS), or the local authority.



Backfill below pavements, floor slabs and other settlement sensitive features should be similarly compacted to 95% SPMDD. Backfill should be placed in 300 mm maximum lifts. Material that is too wet for compaction to a minimum of 95% SPMDD should be allocated for use in landscaped / non settlement sensitive locations, and compacted to at least 90% SPMDD.

The trenching and backfilling operations should be carried out in a manner which minimizes the length of trench left open yet accommodates efficient pipe laying and compaction activities.

Pavement Construction

Prior to the construction of the new pavements, surficial topsoil, fill and loose to very loose deposits should be removed. If some settlement is acceptable, the loose to very loose soils can remain in place. Based on the anticipated traffic patterns, frost susceptibility, and strength of the expected subgrade soils, the following pavement component thicknesses are considered suitable for local residential and parking lot traffic categories (no truck / heavy vehicle use).

PAVEMENT COMPONENT	THICKNESS (mm)
Asphalt	80
Granular A Base	150
Granular B Subbase	350

The flexible pavement designs provided above consider that construction will be carried out during the drier time of the year and the subgrade is stable, as determined by proofrolling inspected by PML personnel. If the subgrade is wet and unstable, additional granular subbase will be required.

The pavement materials should conform to current OPS specifications. The Granular A base and Granular B subbase courses should be placed in thin lifts and compacted to a minimum of 100% SPMDD, and asphalt should be placed to a minimum of 92% of the material's maximum relative density (MRD). Reference is made to OPS Specification 310, as revised.



During construction, testing should be conducted to confirm the gradation and compactibility characteristics of the granular base and subbase materials and the mix design properties of the asphalt.

Proofrolling procedures and the placement and compaction of all the fill and granular materials and asphalt for the pavement construction and backfilling at the site should be inspected on a continuous basis by PML technicians.

If relatively impermeable silty soils are present at a shallow depth beneath the pavement structure, pavement subdrains should be provided to prevent water accumulation on the pavement subgrade surface. The subgrade should be graded so that water is directed to the catch basin structures or to the pavement edge. Subdrains should be discharged in to the catch basins. The subdrains may consist of filter wrapped, 100 mm diameter perforated plastic pipe, set within the subbase layer at the subgrade surface.

Soil Infiltration

Soil infiltration rates for storm water management (SWM) and roof water infiltration systems were determined for the major near surface soil units and are as follows:

SOIL TYPE	ESTIMATED COEFFICIENT OF PERMEABILITY (cm/sec)	INFILTRATION RATE (mm/hr)
Sand / Sand and Gravel	1×10^{-3}	30

Any SWM ponds should be inspected by PML personnel during construction to verify the presence of a suitable subgrade. In general, the slopes of the storm water management pond should be constructed at 5H:1V or shallower and be provided with vegetation cover to minimize the potential for erosion and sloughing of the side slopes.



Limited Chemical Testing Program

As noted, a limited chemical testing program was completed on samples recovered during geotechnical investigation. PML understands that excess soil may be generated during construction, the volume of which is unknown at this time. The chemical testing program was completed to check the geoenvironmental quality of the site soils at selected sampling locations in order to provide commentary regarding on site or off site re-use and / or disposal options of potentially excess soils.

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

Chemical Testing Protocol

Representative samples collected during the geotechnical investigation were returned to our laboratory for detailed visual examination. Soil samples were submitted for chemical analysis to AGAT Laboratories Limited (AGAT), a Canadian Association for Laboratory Accreditation Inc. (CALA) accredited laboratory in Mississauga, Ontario. The chemical analyses conducted by AGAT 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.

As part of the geoenvironmental procedural protocol, all recovered soil samples were examined for visual and olfactory evidence of potential contamination. In addition, soil vapour concentrations (SVCs) were measured in the headspace of the recovered samples. The measured SVCs were typically 0 to 5 parts per million, which are not considered significant.



Five soil samples were submitted for chemical analysis for metals and inorganic parameters, and two samples were submitted for analysis for organochlorine (OC) pesticides. Selection of samples was based on visual and olfactory indications of contamination, SVCs and for general coverage. Details of the samples submitted for chemical testing are as follows:

SAMPLE ID	BOREHOLE	SAMPLE NUMBER	DEPTH (m)	SOIL TYPE	PARAMETERS TESTED
BH4 SS1	1	1	0 to 0.6	Topsoil	M&I and OC pesticides
BH5 SS1	5	1	0 to 0.6	Topsoil	M&I
BH5 SS4	5	4	2.3 to 2.7	Native	M&I
BH6 SS1	6	1	0 to 0.6	Topsoil / Fill	M&I and OC pesticides
BH6 SS3	6	3	1.5 to 2.1	Native	M&I

Site Condition Standards

The Ministry of the Environment, Conservation and Parks (MECP) has developed a set of Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act (April 15, 2011) and O.Reg. 153/04, as amended. The standards consist of nine tables (Table 1 through Table 9) that provide criteria for maximum concentrations of various contaminants. In general, the applicable Table and corresponding Site Condition Standards (SCSs) depend on the site location, land use, soil texture, bedrock depth, soil pH and source of potable water at the site.

The site is currently comprised of several residential dwellings and it is to be developed into a residential subdivision. The site is bordered by the Torrance Creek Wetland Complex to the north, which is a provincially significant wetland as identified by the Ministry of Natural Resources. Based on review of the above factors, PML selected the Generic Criteria of the O.Reg. 153/04, Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act dated April 15, 2011. In particular, the Table 1 (T1) Full Depth Background Site Condition Standards for Residential / Parkland / Institutional / Industrial / Commercial / Community (RPI/ICC) property use would likely apply to the site; however a full evaluation of applicable SCSs in accordance with Sections 41 and 43.1 of O.Reg. 153/04, as amended, was not within the scope of this assignment and further environmental work would be required to confirm this.



For off site re-use with minimal environmental restrictions, the O.Reg. 153/04, as amended, Full Depth Background Table 1 (T1) SCSs for RPI/ICC property uses were utilized. In addition, the Full Depth Generic SCSs (T2) in a Portable Ground Water Condition for ICC property use are also examined.

It is noted that a comparison to the Table 3 SCSs for full depth generic condition, Tables 4 and 5 SCSs for stratified site condition, Tables 6 and 7 SCSs for shallow bedrock condition and Table 8 and Table 9 for use within 30 m of a water body for a non-potable ground water condition were not conducted as part of this assignment. If the potential receiving site for excess soil falls within one of these categories, additional evaluation by PML will be required to confirm conformance.

Analytical Findings and Conclusions

Laboratory certificates of analysis compared to the Table 1 and 2 SCSs are included in Appendix C. The measured values and corresponding Standards (labelled as G/S for Guideline / Standard) are shown on the certificates of analysis. In the event of an exceedance of the SCSs, the level is shown in **bold** text, where applicable.

On Site Re-use

Based on the results of chemical testing, the measured concentrations of the tested parameters met the T1 RPI/ICC SCSs, with the exception of zinc in two samples (BH5 SS1 and BH6 SS3).

It is noted that there is no legal imperative to remove or treat the soil that exceeds the applicable SCSs, provided it is demonstrated that there is no off site impact or adverse effect. However, if contaminated soil is left on site, the landowner assumes liability associated with the contamination. The liability concerns could include potential scrutiny from the MECP, neighbouring property owners 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 future owners or their financiers/insurers.



Off Site Re-use

As noted, the measured concentrations of the tested parameters met the T1 RPI/ICC SCSs, with the exception of zinc in two samples (BH5 SS1 and BH6 SS3). When compared to the T2 ICC Standards, one sample (BH6 SS3) exceeded the SCS for zinc.

If the soil is to be removed from the site for off site re-use, the following conditions must be met:

- The extent of the material that exceeds the applicable SCSs is delineated;
- 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 work must be completed in accordance with local by-laws governing soil movement and/or placement at other sites;
- 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 excess soil is monitored by the environmental consultant to check the material is appropriately placed at the pre-approved site;
- The excess soil cannot be taken to a property for which a RSC is being filed as outlined in O.Reg. 153/04, as amended, unless the chemical testing program is completed in accordance with the regulation;
- The excess soil cannot be taken to a property for which a RSC has been previously filed unless the soil quality meets the SCSs contained in the RSC;
- The receiving site must be arranged and/or approved well 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 report; and



- The excavation work should be conducted in accordance with a 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. Re-use of excess excavated soil on site is also subject to acceptance for re-use by the geotechnical consultant at the time of construction based on geotechnical considerations.

If landfill disposal of excess soils is considered, PML recommends toxicity characteristic leaching procedure (TCLP) testing be completed in accordance with O. Reg. 347/558, Schedule 4, as amended.

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 MECP document Management of Excess Soil – A guideline for Best Management Practices dated January, 2014.

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 soil leaving the site.

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

Geotechnical Review and Construction Inspection and Testing

It is recommended that the design drawings be submitted to PML for general geotechnical review for compatibility with the 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 verify the specified degree of compaction is achieved uniformly throughout fill materials.

The comments and preliminary recommendations provided in this report are based on the information revealed in the boreholes. Conditions away from and between boreholes may vary. Geotechnical review during construction should be on going to confirm the subsurface conditions are substantially similar to those encountered in the boreholes, which may otherwise require modification to the original recommendations.

Closure

This assignment is subject to the Statement of Limitations that is included in Appendix B and must be read in conjunction with this report.

We trust this report has been completed within our terms of reference, and is sufficient for your immediate requirements. If you have any questions or require further information, please do not hesitate to contact our office.



Sincerely

Peto MacCallum Ltd.

A handwritten signature in black ink, appearing to read 'H. Shinwary'.

Hassen Shinwary, BASc
Project Supervisor
Geotechnical and Geoenvironmental Services



Ken Hanes, P.Eng.
Project Engineer
Geotechnical and Geoenvironmental Services



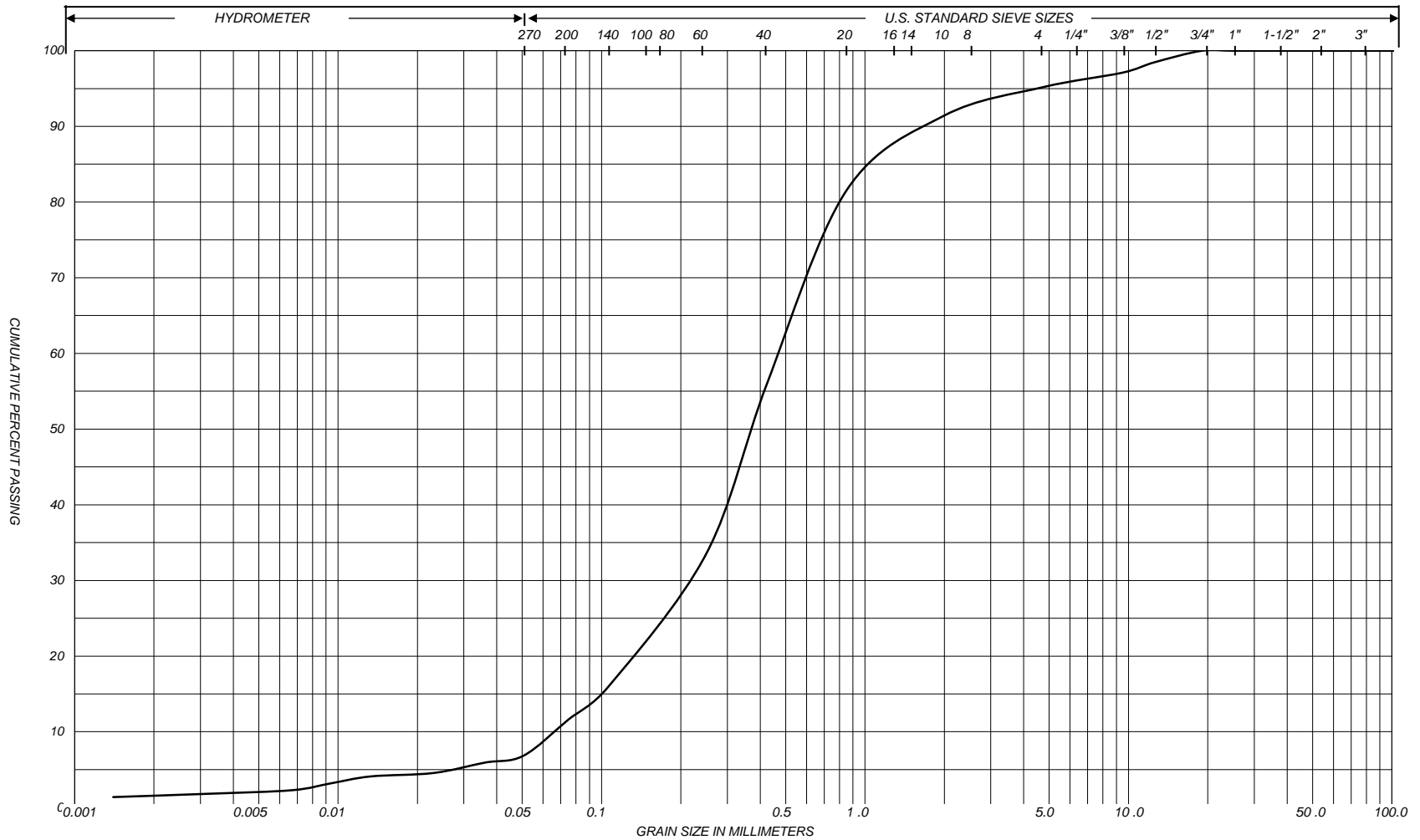
Gerry Mitchell, MEng, P.Eng.
Vice President

HS/KH:sh

Enclosures:

Figures 1 to 2 – Particle Size Distribution Charts
List of Abbreviations
Log of Boreholes 1 to 6
Drawing 1 – Borehole Location Plan
Appendix A – Engineered Fill
Appendix B – Statement of Limitations
Appendix C – AGAT Certificates of Analysis

PARTICLE SIZE DISTRIBUTION CHART

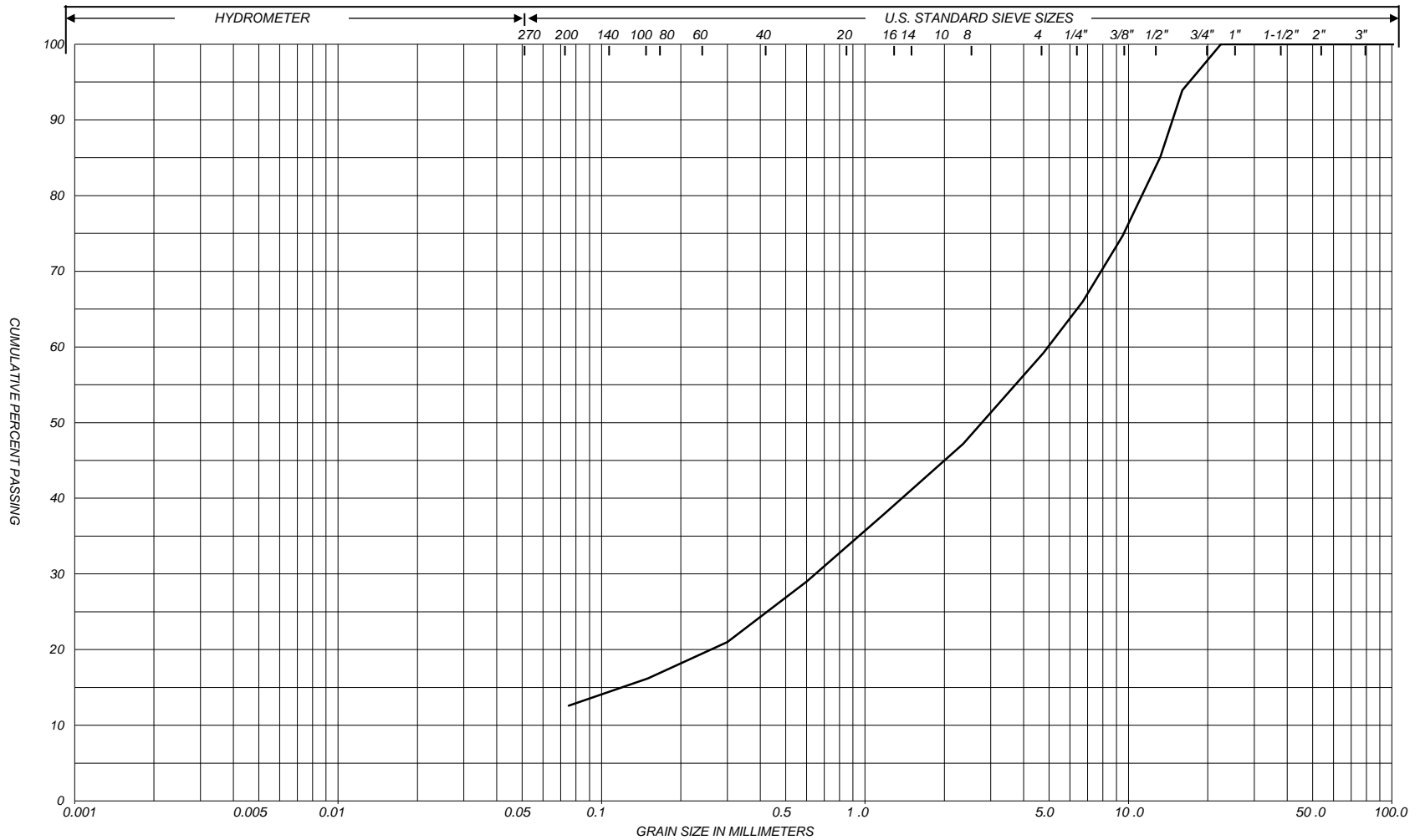


SILT & CLAY				FINE		MEDIUM		COARSE	GRAVEL			COBBLES	UNIFIED	
				SAND										
CLAY	FINE		MEDIUM	COARSE	FINE		MEDIUM		COARSE	GRAVEL			COBBLES	M.I.T.
	SILT				SAND									
CLAY		SILT			VERY FINE	FINE	MEDIUM	COARSE	GRAVEL					U.S. BUREAU
					SAND									

REMARKS Borehole 1, Sample SS6, Depth 4.5 to 5.0 m

SAND, SOME SILT, TRACE GRAVEL

PARTICLE SIZE DISTRIBUTION CHART



SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COBBLES	UNIFIED			
					SAND												
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT																
CLAY		SILT			VERY FINE	FINE	MEDIUM	COARSE	GRAVEL							U.S. BUREAU	
					SAND												

REMARKS Borehole 2, Sample SS2, Depth 0.7 to 1.2 m

SAND AND GRAVEL, SOME SILT

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		
WTPL	Wetter Than Plastic Limit			
APL	About Plastic Limit			
DTPL	Drier Than Plastic Limit			

TYPE OF SAMPLE

SS	Split Spoon	TW	Thinwall Open
WS	Washed Sample	TP	Thinwall Piston
SB	Scraper Bucket Sample	OS	Oesterberg Sample
AS	Auger Sample	FS	Foil Sample
CS	Chunk Sample	RC	Rock Core
ST	Slotted Tube Sample	USS	Undisturbed Shear Strength
PH	Sample Advanced Hydraulically	RSS	Remoulded Shear Strength
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 NO. 1

PROJECT Proposed Arkell Road Subdivision

LOCATION Arkell Road, Guelph, Ontario

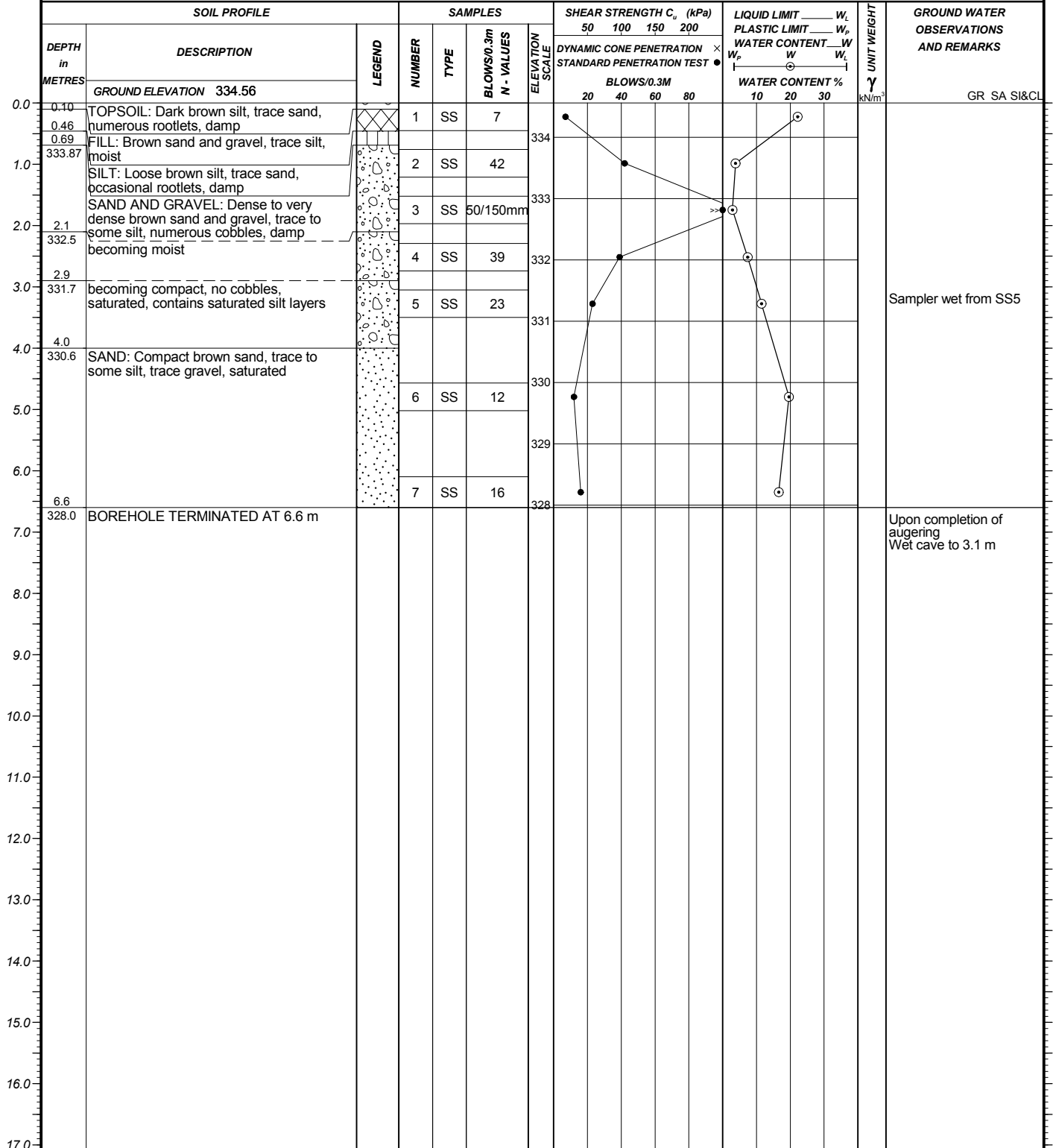
BORING METHOD Continuous Flight Hollow Stem Augers

BORING DATE: 2017 02 13

PML REF.: 17KF002

ENGINEER K. Hanes

TECHNICIAN H. Shinwary



NOTES: Headspace: SS1 0ppm, SS2 0ppm, SS3 0ppm, SS4 0ppm, SS5 0ppm, SS6 0ppm, SS7 0ppm

WATER LEVEL OBSERVED DURING / UPON COMPLETION OF DRILLING
WATER LEVEL MEASURED IN MONITORING WELL

UNDISTURBED FIELD VANE
REMOLDED FIELD VANE
LAB SHEAR TEST
POCKET PENETROMETER
POCKET TORVANE
CHECKED BY KH

LOG OF BOREHOLE NO. 2

PROJECT Proposed Arkell Road Subdivision

LOCATION Arkell Road, Guelph, Ontario

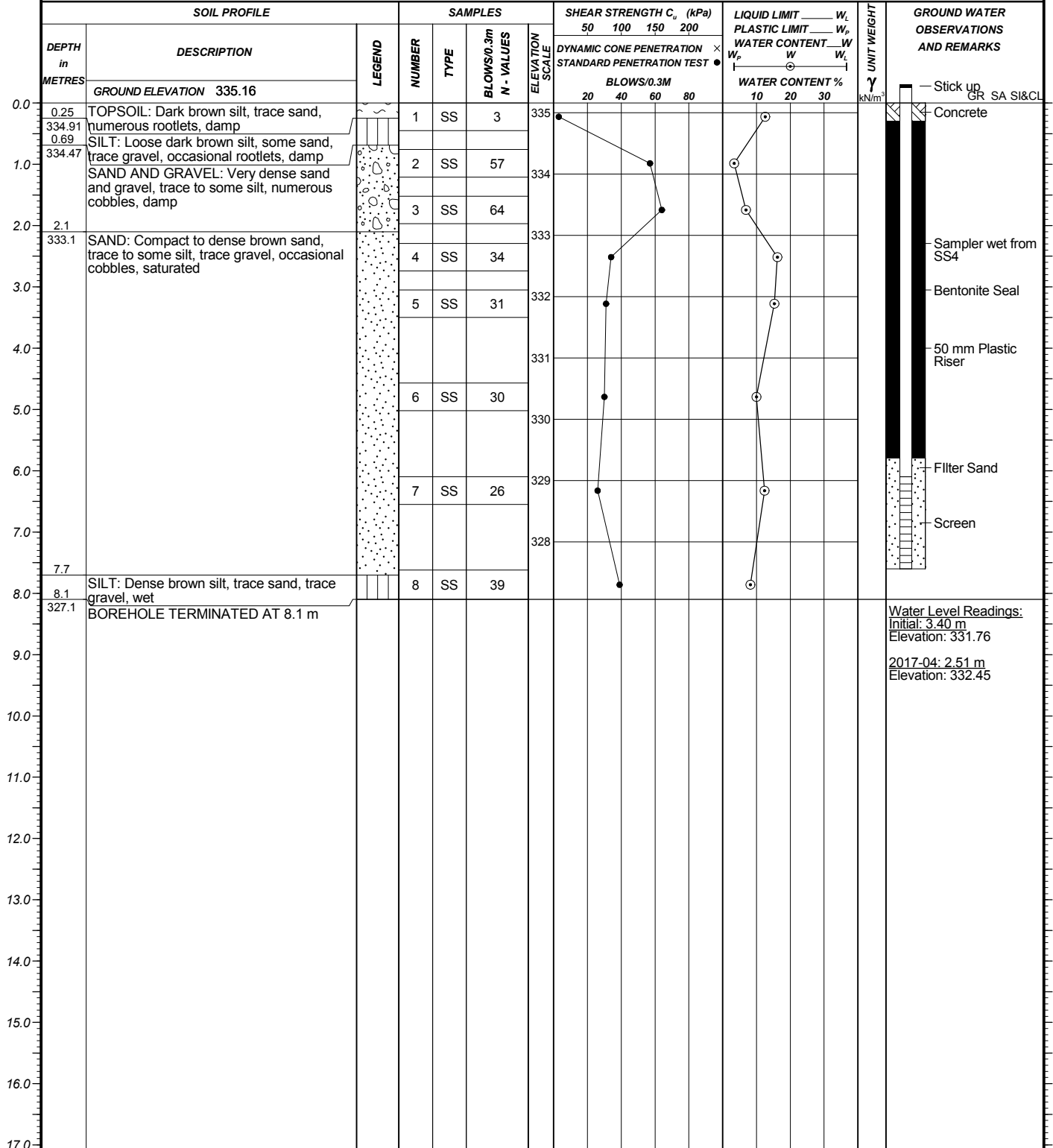
BORING METHOD Continuous Flight Hollow Stem Augers

BORING DATE: 2017 02 13

PML REF.: 17KF002

ENGINEER K. Hanes

TECHNICIAN H. Shinwary



NOTES: Headspace: SS1 0ppm, SS2 0ppm, SS3 0ppm, SS4 0ppm, SS5 5ppm, SS6 0ppm, SS7 0ppm, SS8 0ppm

WATER LEVEL OBSERVED DURING / UPON COMPLETION OF DRILLING
WATER LEVEL MEASURED IN MONITORING WELL

UNDISTURBED FIELD VANE
REMOLDED FIELD VANE
LAB SHEAR TEST
POCKET PENETROMETER
POCKET TORVANE
CHECKED BY KH

LOG OF BOREHOLE NO. 3

PROJECT Proposed Arkell Road Subdivision

LOCATION Arkell Road, Guelph, Ontario

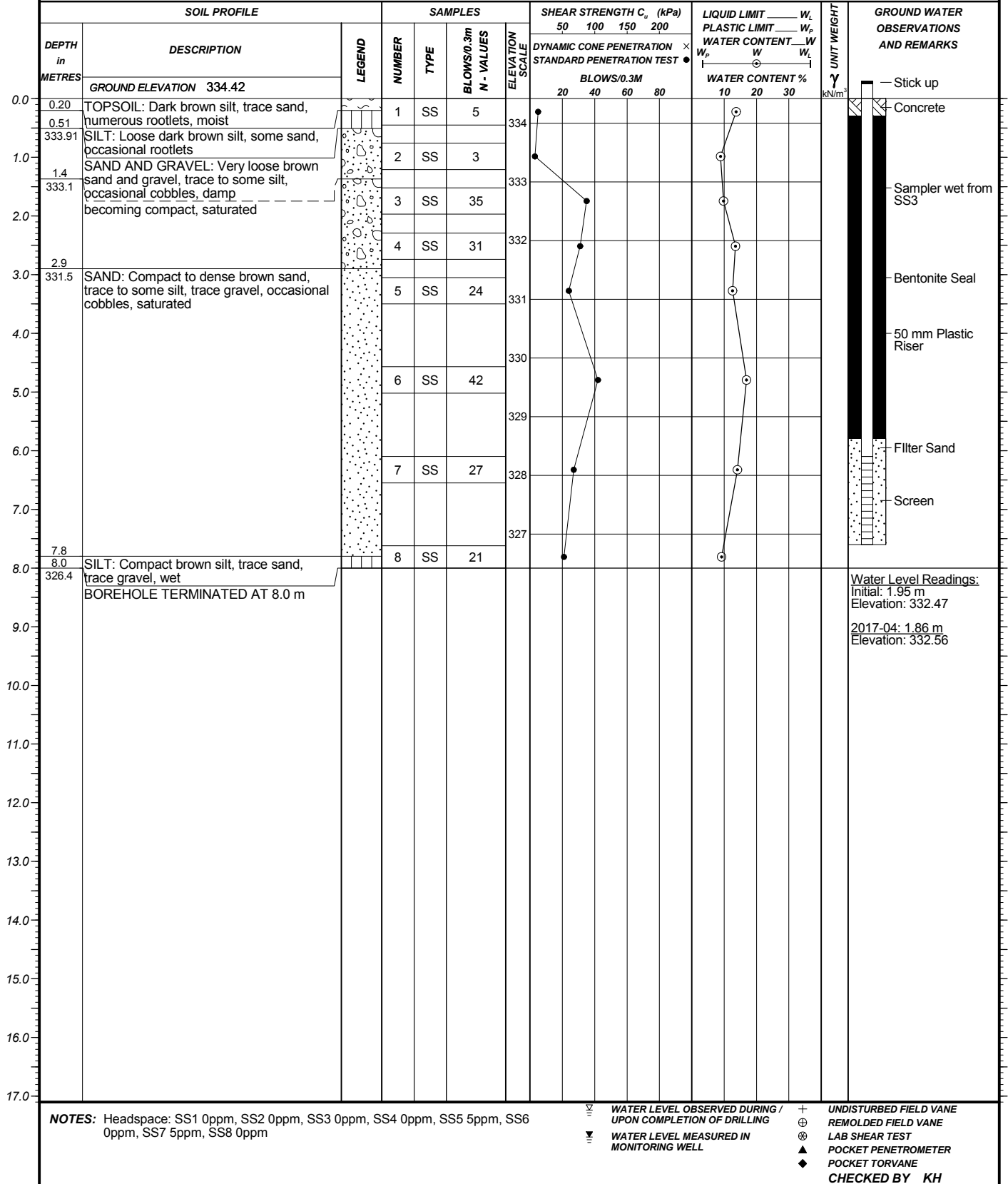
BORING METHOD Continuous Flight Hollow Stem Augers

BORING DATE: 2017 02 13

PML REF.: 17KF002

ENGINEER K. Hanes

TECHNICIAN H. Shinwary



LOG OF BOREHOLE NO. 5

PROJECT Proposed Arkell Road Subdivision

LOCATION Arkell Road, Guelph, Ontario

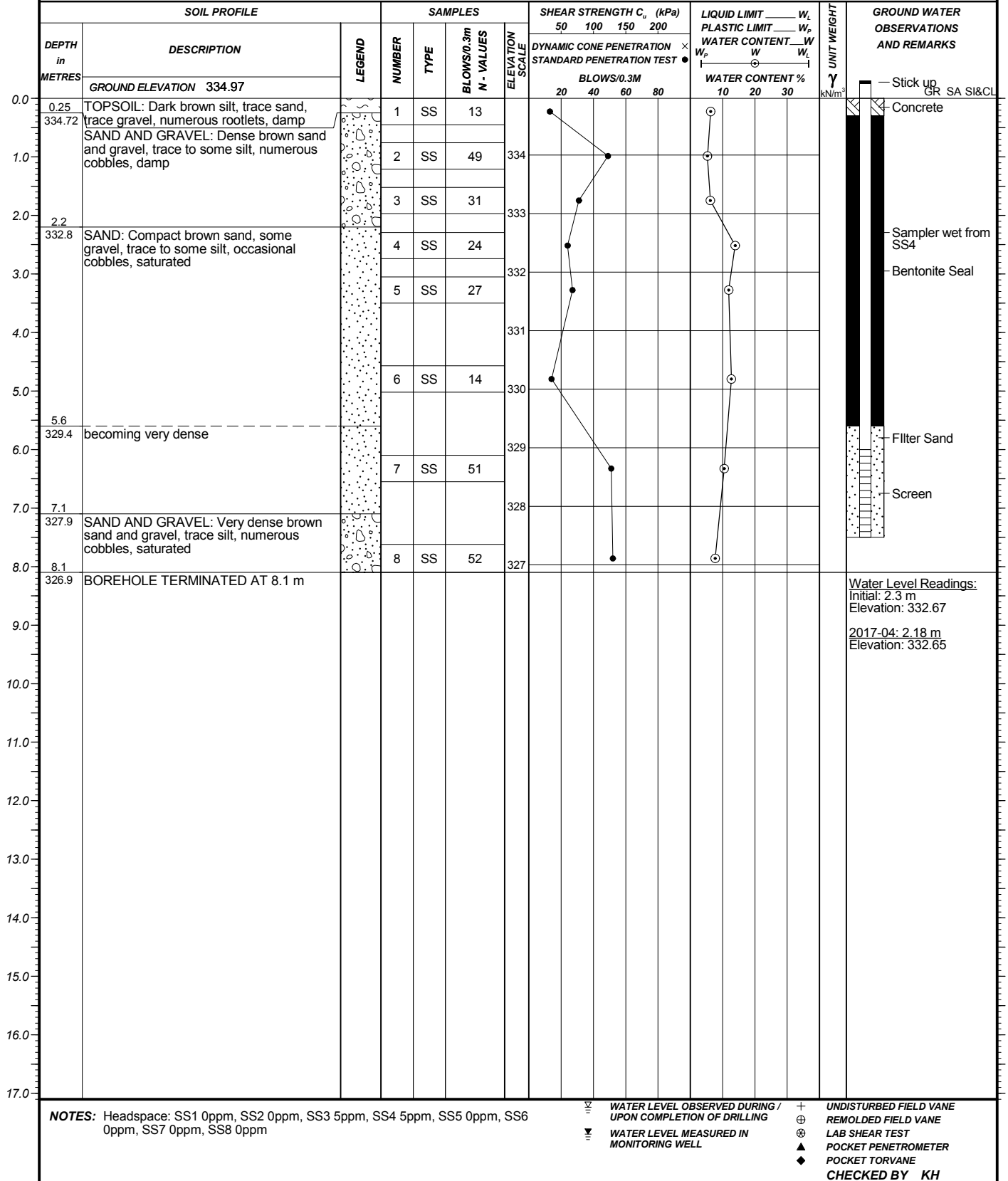
BORING METHOD Continuous Flight Hollow Stem Augers

BORING DATE: 2017 03 21

PML REF.: 17KF002

ENGINEER K. Hanes

TECHNICIAN H. Shinwary



LOG OF BOREHOLE NO. 6

PROJECT Proposed Arkell Road Subdivision

LOCATION Arkell Road, Guelph, Ontario

BORING METHOD Continuous Flight Hollow Stem Augers

BORING DATE: 2017 03 21

PML REF.: 17KF002

ENGINEER K. Hanes

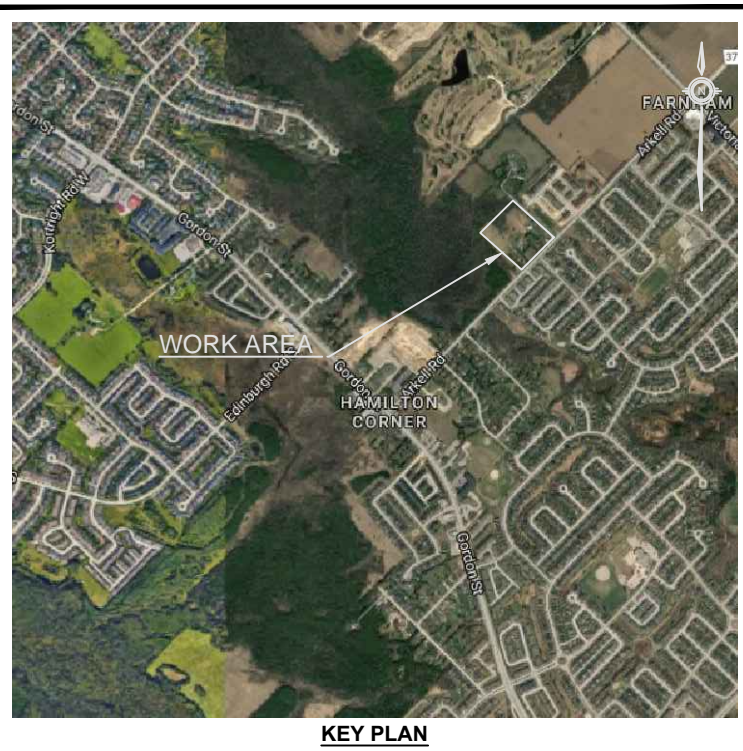
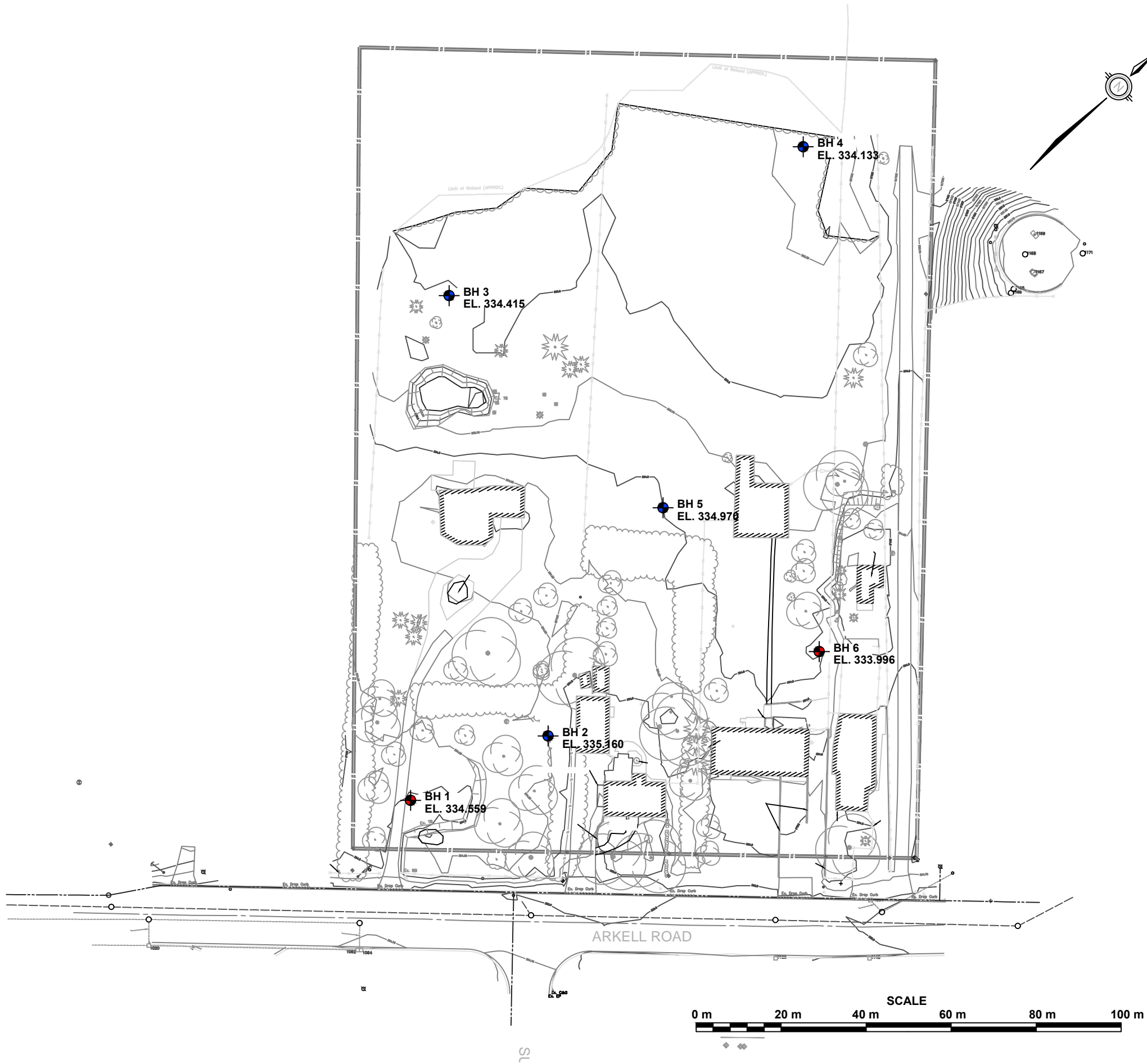
TECHNICIAN H. Shinwary

SOIL PROFILE			SAMPLES			SHEAR STRENGTH C_u (kPa)		LIQUID LIMIT W_L		UNIT WEIGHT γ	GROUND WATER OBSERVATIONS AND REMARKS
DEPTH in METRES	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS/0.3m N - VALUES	50 100 150 200	200	PLASTIC LIMIT W_p	WATER CONTENT W		
	GROUND ELEVATION 334.0										
0.0	0.20 TOPSOIL: Dark brown silt, trace sand, numerous rootlets, damp		1	SS	18						
0.41	0.69 FILL: Dark brown silt, some sand, trace gravel, occasional rootlets, damp		2	SS	45						
1.0	333.31 SAND AND GRAVEL: Dense brown sand and gravel, trace to some silt, numerous cobbles, damp		3	SS	36						
1.5	332.6 becoming moist										
2.0	331.8 becoming saturated		4	SS	12						
2.2											
3.0			5	SS	10						
4.0											
5.0			6	SS	16						
5.8											
6.0	328.2 SILT TILL: Very dense brown silt, some sand, some gravel, occasional cobbles, damp		7	SS	50/75mm						
6.6	327.4 BOREHOLE TERMINATED AT 6.6 m										
7.0											Upon completion of augering Cave to 2.0 m Free water at 1.83 m
8.0											
9.0											
10.0											
11.0											
12.0											
13.0											
14.0											
15.0											
16.0											
17.0											

NOTES: Headspace: SS1 0ppm, SS2 0ppm, SS3 0ppm, SS4 5ppm, SS5 0ppm, SS6 0ppm, SS7 0ppm

WATER LEVEL OBSERVED DURING / UPON COMPLETION OF DRILLING
WATER LEVEL MEASURED IN MONITORING WELL

+ UNDISTURBED FIELD VANE
⊕ REMOLDED FIELD VANE
⊗ LAB SHEAR TEST
▲ POCKET PENETROMETER
◆ POCKET TORVANE
CHECKED BY KH



LEGEND:

- BOREHOLE
- BOREHOLE WITH MONITORING WELL

REFERENCE:

BOREHOLE LOCATION PLAN REPRODUCED FROM DRAWING SUPPLIED BY CLIENT.

NOTE:

THE INFERRED STRATIGRAPHY REFERRED TO IN THE REPORT IS BASED ON THE DATA FROM THESE BOREHOLES SUPPLEMENTED BY GEOLOGICAL EVIDENCE. THE ACTUAL STRATIGRAPHY BETWEEN THE BOREHOLES MAY VARY.

CRESCENT HOMES

PROPOSED ARKELL ROAD SUBDIVISION
ARKELL ROAD
GUELPH, ONTARIO

BOREHOLE LOCATION PLAN

DRAWN	D. BRICE	DATE	SCALE	PML REF.	DWG. NO.
CHECKED	H. SHINWARY	OCTOBER 2018	AS SHOWN	17KF002	1
APPROVED	W. LOGHRIN				



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

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.

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.

STATEMENT OF LIMITATIONS



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 any 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.



APPENDIX C

AGAT CERTIFICATES OF ANALYSIS



O.Reg. 153/04, As Amended, Table 1 Standards (Soil)

(Residential / Parkland / Institutional / Industrial / Commercial / Community
Property Use)

CLIENT NAME: PETO MACCALLUM LIMITED
16 FRANKLIN STREET SOUTH
KITCHENER, ON N2C1R4
(519) 893-7500

ATTENTION TO: Ken Hanes

PROJECT: 17KF002

AGAT WORK ORDER: 17T199091

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

TRACE ORGANICS REVIEWED BY: Neli Popnikolova, Senior Chemist

DATE REPORTED: Apr 18, 2017

PAGES (INCLUDING COVER): 7

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.



Certificate of Analysis

AGAT WORK ORDER: 17T199091

PROJECT: 17KF002

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
<http://www.agatlabs.com>

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2017-03-23

DATE REPORTED: 2017-04-18

Parameter	Unit	SAMPLE DESCRIPTION:		BH4-SS1	BH5-SS1	BH6-SS1
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		2017-03-21	2017-03-21	2017-03-21
		G / S	RDL	8276142	8276150	8276151
Antimony	µg/g	1.3	0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	18	1	3	5	6
Barium	µg/g	220	2	15	45	48
Beryllium	µg/g	2.5	0.5	<0.5	<0.5	<0.5
Boron	µg/g	36	5	6	6	<5
Boron (Hot Water Soluble)	µg/g	NA	0.10	0.17	0.23	0.27
Cadmium	µg/g	1.2	0.5	<0.5	0.7	0.6
Chromium	µg/g	70	2	8	13	13
Cobalt	µg/g	21	0.5	1.9	4.4	4.9
Copper	µg/g	92	1	8	11	11
Lead	µg/g	120	1	40	62	53
Molybdenum	µg/g	2	0.5	0.6	0.9	0.5
Nickel	µg/g	82	1	5	10	10
Selenium	µg/g	1.5	0.4	<0.4	0.4	0.5
Silver	µg/g	0.5	0.2	<0.2	<0.2	<0.2
Thallium	µg/g	1	0.4	<0.4	<0.4	<0.4
Uranium	µg/g	2.5	0.5	0.5	0.5	0.5
Vanadium	µg/g	86	1	11	22	24
Zinc	µg/g	290	5	182	313	254
Chromium VI	µg/g	0.66	0.2	<0.2	<0.2	<0.2
Cyanide	µg/g	0.051	0.040	<0.040	<0.040	<0.040
Mercury	µg/g	0.27	0.10	<0.10	<0.10	<0.10
Electrical Conductivity	mS/cm	0.57	0.005	0.177	0.233	0.173
Sodium Adsorption Ratio	NA	2.4	NA	0.125	0.142	0.053
pH, 2:1 CaCl2 Extraction	pH Units		NA	6.74	6.90	7.07

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use

8276142-8276151 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By:

Amanjot Bhela



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 17T199091

PROJECT: 17KF002

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
<http://www.agatlabs.com>

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - OC Pesticides (Soil)

DATE RECEIVED: 2017-03-23

DATE REPORTED: 2017-04-18

		SAMPLE DESCRIPTION:		BH4-SS1	BH6-SS1
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		2017-03-21	2017-03-21
Parameter	Unit	G / S	RDL	8276142	8276151
Hexachloroethane	µg/g	0.01	0.01	<0.01	<0.01
Gamma-Hexachlorocyclohexane	µg/g	0.01	0.005	<0.005	<0.005
Heptachlor	µg/g	0.05	0.005	<0.005	<0.005
Aldrin	µg/g	0.05	0.005	<0.005	<0.005
Heptachlor Epoxide	µg/g	0.05	0.005	<0.005	<0.005
Endosulfan	µg/g	0.04	0.005	<0.005	<0.005
Chlordane	µg/g	0.05	0.007	<0.007	<0.007
DDE	µg/g	0.05	0.007	<0.007	<0.007
DDD	µg/g	0.05	0.007	<0.007	<0.007
DDT	µg/g	1.4	0.007	<0.007	<0.007
Dieldrin	µg/g	0.05	0.005	<0.005	<0.005
Endrin	µg/g	0.04	0.005	<0.005	<0.005
Methoxychlor	µg/g	0.05	0.005	<0.005	<0.005
Hexachlorobenzene	µg/g	0.01	0.005	<0.005	<0.005
Hexachlorobutadiene	µg/g	0.01	0.01	<0.01	<0.01
Moisture Content	%		0.1	33.0	6.7
Surrogate	Unit	Acceptable Limits			
TCMX	%	50-140	70	66	
Decachlorobiphenyl	%	60-130	72	88	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use

8276142-8276151 Results are based on the dry weight of the soil.

Note: DDT applies to the total of op'DDT and pp'DDT, DDD applies to the total of op'DDD and pp'DDD and DDE applies to the total of op'DDE and pp'DDE. Endosulfan applies to the total of Endosulfan I and Endosulfan II.

Chlordane applies to the total of Alpha-Chlordane and Gamma-Chlordane.

Certified By:



AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 17T199091

PROJECT: 17KF002

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
<http://www.agatlabs.com>

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
8276150	BH5-SS1	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Zinc	µg/g	290	313



Quality Assurance

CLIENT NAME: PETO MACCALLUM LIMITED

PROJECT: 17KF002

SAMPLING SITE:

AGAT WORK ORDER: 17T199091

ATTENTION TO: Ken Hanes

SAMPLED BY:

Soil Analysis															
RPT Date: Apr 18, 2017			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	8272855		3.6	3.6	NA	< 0.8	126%	70%	130%	105%	80%	120%	96%	70%	130%
Arsenic	8272855		9	7	25.0%	< 1	108%	70%	130%	105%	80%	120%	103%	70%	130%
Barium	8272855		76	75	1.3%	< 2	101%	70%	130%	98%	80%	120%	101%	70%	130%
Beryllium	8272855		<0.5	<0.5	NA	< 0.5	83%	70%	130%	105%	80%	120%	89%	70%	130%
Boron	8272855		6	6	NA	< 5	82%	70%	130%	107%	80%	120%	93%	70%	130%
Boron (Hot Water Soluble)	8272855		0.41	0.42	NA	< 0.10	112%	60%	140%	103%	70%	130%	99%	60%	140%
Cadmium	8272855		0.8	0.8	NA	< 0.5	110%	70%	130%	106%	80%	120%	105%	70%	130%
Chromium	8272855		18	18	0.0%	< 2	96%	70%	130%	114%	80%	120%	112%	70%	130%
Cobalt	8272855		5.5	5.5	0.0%	< 0.5	102%	70%	130%	110%	80%	120%	99%	70%	130%
Copper	8272855		63	62	1.6%	< 1	101%	70%	130%	117%	80%	120%	85%	70%	130%
Lead	8272855		190	197	3.6%	< 1	105%	70%	130%	101%	80%	120%	70%	70%	130%
Molybdenum	8272855		1.3	1.3	NA	< 0.5	107%	70%	130%	103%	80%	120%	105%	70%	130%
Nickel	8272855		24	25	4.1%	< 1	103%	70%	130%	112%	80%	120%	100%	70%	130%
Selenium	8272855		0.9	1.0	NA	< 0.4	128%	70%	130%	99%	80%	120%	106%	70%	130%
Silver	8272855		<0.2	<0.2	NA	< 0.2	98%	70%	130%	115%	80%	120%	110%	70%	130%
Thallium	8272855		<0.4	<0.4	NA	< 0.4	103%	70%	130%	104%	80%	120%	98%	70%	130%
Uranium	8272855		<0.5	<0.5	NA	< 0.5	98%	70%	130%	93%	80%	120%	95%	70%	130%
Vanadium	8272855		20	20	0.0%	< 1	99%	70%	130%	109%	80%	120%	109%	70%	130%
Zinc	8272855		205	199	3.0%	< 5	102%	70%	130%	117%	80%	120%	84%	70%	130%
Chromium VI	8277762		<0.2	<0.2	NA	< 0.2	93%	70%	130%	98%	80%	120%	100%	70%	130%
Cyanide	8278916		<0.040	<0.040	NA	< 0.040	102%	70%	130%	108%	80%	120%	94%	70%	130%
Mercury	8272855		0.15	0.17	NA	< 0.10	100%	70%	130%	88%	80%	120%	93%	70%	130%
Electrical Conductivity	8277893		0.376	0.369	1.9%	< 0.005	93%	90%	110%	NA			NA		
Sodium Adsorption Ratio	8276363		0.057	0.053	7.3%	NA	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	8277854		7.37	7.42	0.7%	NA	101%	80%	120%	NA			NA		

Comments: NA signifies Not Applicable.

Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By:

Amanjot Bhela



Quality Assurance

CLIENT NAME: PETO MACCALLUM LIMITED

PROJECT: 17KF002

SAMPLING SITE:

AGAT WORK ORDER: 17T199091

ATTENTION TO: Ken Hanes

SAMPLED BY:

Trace Organics Analysis

RPT Date: Apr 18, 2017

RPT Date: Apr 18, 2017			DUPLICATE			Method Blank	REFERENCE MATERIAL		METHOD BLANK SPIKE			MATRIX SPIKE			
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

O. Reg. 153(511) - OC Pesticides (Soil)

Hexachloroethane	8267227		< 0.01	< 0.01	NA	< 0.01	82%	50%	140%	96%	50%	140%	64%	50%	140%
Gamma-Hexachlorocyclohexane	8267227		< 0.005	< 0.005	NA	< 0.005	92%	50%	140%	78%	50%	140%	66%	50%	140%
Heptachlor	8267227		< 0.005	< 0.005	NA	< 0.005	80%	50%	140%	90%	50%	140%	80%	50%	140%
Aldrin	8267227		< 0.005	< 0.005	NA	< 0.005	109%	50%	140%	94%	50%	140%	68%	50%	140%
Heptachlor Epoxide	8267227		< 0.005	< 0.005	NA	< 0.005	90%	50%	140%	96%	50%	140%	82%	50%	140%
Endosulfan	8267227		< 0.005	< 0.005	NA	< 0.005	89%	50%	140%	88%	50%	140%	69%	50%	140%
Chlordane	8267227		< 0.007	< 0.007	NA	< 0.007	87%	50%	140%	91%	50%	140%	78%	50%	140%
DDE	8267227		< 0.007	< 0.007	NA	< 0.007	88%	50%	140%	98%	50%	140%	78%	50%	140%
DDD	8267227		< 0.007	< 0.007	NA	< 0.007	94%	50%	140%	94%	50%	140%	84%	50%	140%
DDT	8267227		< 0.007	< 0.007	NA	< 0.007	88%	50%	140%	87%	50%	140%	78%	50%	140%
Dieldrin	8267227		< 0.005	< 0.005	NA	< 0.005	84%	50%	140%	90%	50%	140%	80%	50%	140%
Endrin	8267227		< 0.005	< 0.005	NA	< 0.005	84%	50%	140%	76%	50%	140%	82%	50%	140%
Methoxychlor	8267227		< 0.005	< 0.005	NA	< 0.005	76%	50%	140%	82%	50%	140%	96%	50%	140%
Hexachlorobenzene	8267227		< 0.005	< 0.005	NA	< 0.005	92%	50%	140%	100%	50%	140%	92%	50%	140%
Hexachlorobutadiene	8267227		< 0.01	< 0.01	NA	< 0.01	93%	50%	140%	100%	50%	140%	68%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By:

N Popmukohof

Method Summary

CLIENT NAME: PETO MACCALLUM LIMITED

AGAT WORK ORDER: 17T199091

PROJECT: 17KF002

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A; SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010B	ICP/OES
pH, 2:1 CaCl ₂ Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Trace Organics Analysis			
Hexachloroethane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Gamma-Hexachlorocyclohexane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Heptachlor	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Aldrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Heptachlor Epoxide	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Endosulfan	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Chlordane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDE	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDD	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDT	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Dieldrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Endrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Methoxychlor	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Hexachlorobenzene	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Hexachlorobutadiene	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
TCMX	ORG-91-5112	EPA SW-846 3541,3620 & 8081	GC/ECD
Decachlorobiphenyl	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Moisture Content		MOE E3139	BALANCE

CLIENT NAME: PETO MACCALLUM LIMITED
16 FRANKLIN STREET SOUTH
KITCHENER, ON N2C1R4
(519) 893-7500

ATTENTION TO: Ken Hanes

PROJECT: 17KF002

AGAT WORK ORDER: 17W201248

SOIL ANALYSIS REVIEWED BY: Sofka Pehlyova, Senior Analyst

DATE REPORTED: Apr 10, 2017

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.



Certificate of Analysis

AGAT WORK ORDER: 17W201248

PROJECT: 17KF002

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
<http://www.agatlabs.com>

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY: H. Shinwary

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2017-03-30

DATE REPORTED: 2017-04-10

Parameter	Unit	SAMPLE DESCRIPTION:		BH5-SS4	BH6-SS3
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		2017-03-21	2017-03-21
		G / S	RDL	8288805	8288806
Antimony	µg/g	1.3	0.8	<0.8	<0.8
Arsenic	µg/g	18	1	3	4
Barium	µg/g	220	2	9	13
Beryllium	µg/g	2.5	0.5	<0.5	<0.5
Boron	µg/g	36	5	<5	<5
Boron (Hot Water Soluble)	µg/g	NA	0.10	<0.10	<0.10
Cadmium	µg/g	1.2	0.5	<0.5	0.6
Chromium	µg/g	70	2	5	8
Cobalt	µg/g	21	0.5	1.8	4.0
Copper	µg/g	92	1	8	15
Lead	µg/g	120	1	18	43
Molybdenum	µg/g	2	0.5	<0.5	0.8
Nickel	µg/g	82	1	4	8
Selenium	µg/g	1.5	0.4	<0.4	<0.4
Silver	µg/g	0.5	0.2	<0.2	<0.2
Thallium	µg/g	1	0.4	<0.4	<0.4
Uranium	µg/g	2.5	0.5	<0.5	<0.5
Vanadium	µg/g	86	1	11	19
Zinc	µg/g	290	5	180	370
Chromium VI	µg/g	0.66	0.2	<0.2	<0.2
Cyanide	µg/g	0.051	0.040	<0.040	<0.040
Mercury	µg/g	0.27	0.10	<0.10	<0.10
Electrical Conductivity	mS/cm	0.57	0.005	0.098	0.174
Sodium Adsorption Ratio	NA	2.4	NA	0.303	0.509
pH, 2:1 CaCl ₂ Extraction	pH Units		NA	7.94	8.16

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use

8288805-8288806 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl₂ extract prepared at 2:1 ratio.

Certified By:

Sofra Pehlyora



AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 17W201248

PROJECT: 17KF002

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
<http://www.agatlabs.com>

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
8288806	BH6-SS3	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Zinc	µg/g	290	370



Quality Assurance

CLIENT NAME: PETO MACCALLUM LIMITED

PROJECT: 17KF002

SAMPLING SITE:

AGAT WORK ORDER: 17W201248

ATTENTION TO: Ken Hanes

SAMPLED BY: H. Shinwary

Soil Analysis

RPT Date: Apr 10, 2017			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	8287941		<0.8	<0.8	NA	< 0.8	116%	70%	130%	100%	80%	120%	92%	70%	130%
Arsenic	8287941		4	4	NA	< 1	107%	70%	130%	98%	80%	120%	104%	70%	130%
Barium	8287941		48	47	2.6%	< 2	98%	70%	130%	96%	80%	120%	101%	70%	130%
Beryllium	8287941		<0.5	<0.5	NA	< 0.5	78%	70%	130%	108%	80%	120%	89%	70%	130%
Boron	8287941		<5	<5	NA	< 5	89%	70%	130%	108%	80%	120%	91%	70%	130%
Boron (Hot Water Soluble)	8287941		0.34	0.36	NA	< 0.10	112%	60%	140%	100%	70%	130%	101%	60%	140%
Cadmium	8287941		<0.5	<0.5	NA	< 0.5	89%	70%	130%	100%	80%	120%	103%	70%	130%
Chromium	8287941		13	13	0.0%	< 2	95%	70%	130%	106%	80%	120%	120%	70%	130%
Cobalt	8287941		6.0	6.2	3.3%	< 0.5	102%	70%	130%	108%	80%	120%	108%	70%	130%
Copper	8287941		32	33	3.1%	< 1	94%	70%	130%	110%	80%	120%	115%	70%	130%
Lead	8287941		10	10	0.0%	< 1	101%	70%	130%	101%	80%	120%	99%	70%	130%
Molybdenum	8287941		<0.5	<0.5	NA	< 0.5	101%	70%	130%	103%	80%	120%	103%	70%	130%
Nickel	8287941		13	13	0.0%	< 1	105%	70%	130%	107%	80%	120%	108%	70%	130%
Selenium	8287941		<0.4	<0.4	NA	< 0.4	107%	70%	130%	103%	80%	120%	102%	70%	130%
Silver	8287941		<0.2	<0.2	NA	< 0.2	93%	70%	130%	106%	80%	120%	105%	70%	130%
Thallium	8287941		<0.4	<0.4	NA	< 0.4	86%	70%	130%	102%	80%	120%	103%	70%	130%
Uranium	8287941		<0.5	<0.5	NA	< 0.5	90%	70%	130%	92%	80%	120%	95%	70%	130%
Vanadium	8287941		22	22	0.0%	< 1	100%	70%	130%	106%	80%	120%	124%	70%	130%
Zinc	8287941		53	49	7.8%	< 5	103%	70%	130%	118%	80%	120%	116%	70%	130%
Chromium VI	8284952		<0.2	<0.2	NA	< 0.2	92%	70%	130%	96%	80%	120%	98%	70%	130%
Cyanide	8288805	8288805	<0.040	<0.040	NA	< 0.040	102%	70%	130%	103%	80%	120%	104%	70%	130%
Mercury	8287941		<0.10	<0.10	NA	< 0.10	102%	70%	130%	95%	80%	120%	102%	70%	130%
Electrical Conductivity	8291645		0.428	0.431	0.7%	< 0.005	94%	90%	110%	NA			NA		
Sodium Adsorption Ratio	8287941		0.751	0.761	1.3%	NA	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	8285504		7.26	7.23	0.4%	NA	100%	80%	120%	NA			NA		

Comments: NA signifies Not Applicable.

Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By:

Sofia Pehlyora

Method Summary

CLIENT NAME: PETO MACCALLUM LIMITED

AGAT WORK ORDER: 17W201248

PROJECT: 17KF002

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY: H. Shinwary

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A; SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010B	ICP/OES
pH, 2:1 CaCl ₂ Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER



O.Reg. 153/04, As Amended, Table 2 Standards (Soil)

(Industrial / Commercial / Community Property Use)

CLIENT NAME: PETO MACCALLUM LIMITED
16 FRANKLIN STREET SOUTH
KITCHENER, ON N2C1R4
(519) 893-7500

ATTENTION TO: Ken Hanes

PROJECT: 17KF002

AGAT WORK ORDER: 17T199091

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

TRACE ORGANICS REVIEWED BY: Neli Popnikolova, Senior Chemist

DATE REPORTED: Apr 18, 2017

PAGES (INCLUDING COVER): 6

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.



Certificate of Analysis

AGAT WORK ORDER: 17T199091

PROJECT: 17KF002

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
<http://www.agatlabs.com>

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2017-03-23

DATE REPORTED: 2017-04-18

Parameter	Unit	SAMPLE DESCRIPTION:		BH4-SS1	BH5-SS1	BH6-SS1
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		2017-03-21	2017-03-21	2017-03-21
		G / S	RDL	8276142	8276150	8276151
Antimony	µg/g	40	0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	18	1	3	5	6
Barium	µg/g	670	2	15	45	48
Beryllium	µg/g	8	0.5	<0.5	<0.5	<0.5
Boron	µg/g	120	5	6	6	<5
Boron (Hot Water Soluble)	µg/g	2	0.10	0.17	0.23	0.27
Cadmium	µg/g	1.9	0.5	<0.5	0.7	0.6
Chromium	µg/g	160	2	8	13	13
Cobalt	µg/g	80	0.5	1.9	4.4	4.9
Copper	µg/g	230	1	8	11	11
Lead	µg/g	120	1	40	62	53
Molybdenum	µg/g	40	0.5	0.6	0.9	0.5
Nickel	µg/g	270	1	5	10	10
Selenium	µg/g	5.5	0.4	<0.4	0.4	0.5
Silver	µg/g	40	0.2	<0.2	<0.2	<0.2
Thallium	µg/g	3.3	0.4	<0.4	<0.4	<0.4
Uranium	µg/g	33	0.5	0.5	0.5	0.5
Vanadium	µg/g	86	1	11	22	24
Zinc	µg/g	340	5	182	313	254
Chromium VI	µg/g	8	0.2	<0.2	<0.2	<0.2
Cyanide	µg/g	0.051	0.040	<0.040	<0.040	<0.040
Mercury	µg/g	3.9	0.10	<0.10	<0.10	<0.10
Electrical Conductivity	mS/cm	1.4	0.005	0.177	0.233	0.173
Sodium Adsorption Ratio	NA	12	NA	0.125	0.142	0.053
pH, 2:1 CaCl2 Extraction	pH Units		NA	6.74	6.90	7.07

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON T2 S ICC CT

8276142-8276151 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By:

Amanjot Bhela



Certificate of Analysis

AGAT WORK ORDER: 17T199091

PROJECT: 17KF002

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
<http://www.agatlabs.com>

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - OC Pesticides (Soil)

DATE RECEIVED: 2017-03-23

DATE REPORTED: 2017-04-18

		SAMPLE DESCRIPTION:		BH4-SS1	BH6-SS1
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		2017-03-21	2017-03-21
Parameter	Unit	G / S	RDL	8276142	8276151
Hexachloroethane	µg/g	0.21	0.01	<0.01	<0.01
Gamma-Hexachlorocyclohexane	µg/g	0.056	0.005	<0.005	<0.005
Heptachlor	µg/g	0.19	0.005	<0.005	<0.005
Aldrin	µg/g	0.088	0.005	<0.005	<0.005
Heptachlor Epoxide	µg/g	0.05	0.005	<0.005	<0.005
Endosulfan	µg/g	0.3	0.005	<0.005	<0.005
Chlordane	µg/g	0.05	0.007	<0.007	<0.007
DDE	µg/g	0.52	0.007	<0.007	<0.007
DDD	µg/g	4.6	0.007	<0.007	<0.007
DDT	µg/g	1.4	0.007	<0.007	<0.007
Dieldrin	µg/g	0.088	0.005	<0.005	<0.005
Endrin	µg/g	0.04	0.005	<0.005	<0.005
Methoxychlor	µg/g	1.6	0.005	<0.005	<0.005
Hexachlorobenzene	µg/g	0.66	0.005	<0.005	<0.005
Hexachlorobutadiene	µg/g	0.031	0.01	<0.01	<0.01
Moisture Content	%		0.1	33.0	6.7
Surrogate	Unit	Acceptable Limits			
TCMX	%	50-140		70	66
Decachlorobiphenyl	%	60-130		72	88

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON T2 S ICC CT

8276142-8276151 Results are based on the dry weight of the soil.

Note: DDT applies to the total of op'DDT and pp'DDT, DDD applies to the total of op'DDD and pp'DDD and DDE applies to the total of op'DDE and pp'DDE. Endosulfan applies to the total of Endosulfan I and Endosulfan II.

Chlordane applies to the total of Alpha-Chlordane and Gamma-Chlordane.

Certified By:

N Popmukolof



Quality Assurance

CLIENT NAME: PETO MACCALLUM LIMITED

PROJECT: 17KF002

SAMPLING SITE:

AGAT WORK ORDER: 17T199091

ATTENTION TO: Ken Hanes

SAMPLED BY:

Soil Analysis															
RPT Date: Apr 18, 2017			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	8272855		3.6	3.6	NA	< 0.8	126%	70%	130%	105%	80%	120%	96%	70%	130%
Arsenic	8272855		9	7	25.0%	< 1	108%	70%	130%	105%	80%	120%	103%	70%	130%
Barium	8272855		76	75	1.3%	< 2	101%	70%	130%	98%	80%	120%	101%	70%	130%
Beryllium	8272855		<0.5	<0.5	NA	< 0.5	83%	70%	130%	105%	80%	120%	89%	70%	130%
Boron	8272855		6	6	NA	< 5	82%	70%	130%	107%	80%	120%	93%	70%	130%
Boron (Hot Water Soluble)	8272855		0.41	0.42	NA	< 0.10	112%	60%	140%	103%	70%	130%	99%	60%	140%
Cadmium	8272855		0.8	0.8	NA	< 0.5	110%	70%	130%	106%	80%	120%	105%	70%	130%
Chromium	8272855		18	18	0.0%	< 2	96%	70%	130%	114%	80%	120%	112%	70%	130%
Cobalt	8272855		5.5	5.5	0.0%	< 0.5	102%	70%	130%	110%	80%	120%	99%	70%	130%
Copper	8272855		63	62	1.6%	< 1	101%	70%	130%	117%	80%	120%	85%	70%	130%
Lead	8272855		190	197	3.6%	< 1	105%	70%	130%	101%	80%	120%	70%	70%	130%
Molybdenum	8272855		1.3	1.3	NA	< 0.5	107%	70%	130%	103%	80%	120%	105%	70%	130%
Nickel	8272855		24	25	4.1%	< 1	103%	70%	130%	112%	80%	120%	100%	70%	130%
Selenium	8272855		0.9	1.0	NA	< 0.4	128%	70%	130%	99%	80%	120%	106%	70%	130%
Silver	8272855		<0.2	<0.2	NA	< 0.2	98%	70%	130%	115%	80%	120%	110%	70%	130%
Thallium	8272855		<0.4	<0.4	NA	< 0.4	103%	70%	130%	104%	80%	120%	98%	70%	130%
Uranium	8272855		<0.5	<0.5	NA	< 0.5	98%	70%	130%	93%	80%	120%	95%	70%	130%
Vanadium	8272855		20	20	0.0%	< 1	99%	70%	130%	109%	80%	120%	109%	70%	130%
Zinc	8272855		205	199	3.0%	< 5	102%	70%	130%	117%	80%	120%	84%	70%	130%
Chromium VI	8277762		<0.2	<0.2	NA	< 0.2	93%	70%	130%	98%	80%	120%	100%	70%	130%
Cyanide	8278916		<0.040	<0.040	NA	< 0.040	102%	70%	130%	108%	80%	120%	94%	70%	130%
Mercury	8272855		0.15	0.17	NA	< 0.10	100%	70%	130%	88%	80%	120%	93%	70%	130%
Electrical Conductivity	8277893		0.376	0.369	1.9%	< 0.005	93%	90%	110%	NA			NA		
Sodium Adsorption Ratio	8276363		0.057	0.053	7.3%	NA	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	8277854		7.37	7.42	0.7%	NA	101%	80%	120%	NA			NA		

Comments: NA signifies Not Applicable.

Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By:

Amanjot Bhela



Quality Assurance

CLIENT NAME: PETO MACCALLUM LIMITED

PROJECT: 17KF002

SAMPLING SITE:

AGAT WORK ORDER: 17T199091

ATTENTION TO: Ken Hanes

SAMPLED BY:

Trace Organics Analysis

RPT Date: Apr 18, 2017

RPT Date: Apr 18, 2017			DUPLICATE			Method Blank	REFERENCE MATERIAL		METHOD BLANK SPIKE			MATRIX SPIKE			
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

O. Reg. 153(511) - OC Pesticides (Soil)

Hexachloroethane	8267227		< 0.01	< 0.01	NA	< 0.01	82%	50%	140%	96%	50%	140%	64%	50%	140%
Gamma-Hexachlorocyclohexane	8267227		< 0.005	< 0.005	NA	< 0.005	92%	50%	140%	78%	50%	140%	66%	50%	140%
Heptachlor	8267227		< 0.005	< 0.005	NA	< 0.005	80%	50%	140%	90%	50%	140%	80%	50%	140%
Aldrin	8267227		< 0.005	< 0.005	NA	< 0.005	109%	50%	140%	94%	50%	140%	68%	50%	140%
Heptachlor Epoxide	8267227		< 0.005	< 0.005	NA	< 0.005	90%	50%	140%	96%	50%	140%	82%	50%	140%
Endosulfan	8267227		< 0.005	< 0.005	NA	< 0.005	89%	50%	140%	88%	50%	140%	69%	50%	140%
Chlordane	8267227		< 0.007	< 0.007	NA	< 0.007	87%	50%	140%	91%	50%	140%	78%	50%	140%
DDE	8267227		< 0.007	< 0.007	NA	< 0.007	88%	50%	140%	98%	50%	140%	78%	50%	140%
DDD	8267227		< 0.007	< 0.007	NA	< 0.007	94%	50%	140%	94%	50%	140%	84%	50%	140%
DDT	8267227		< 0.007	< 0.007	NA	< 0.007	88%	50%	140%	87%	50%	140%	78%	50%	140%
Dieldrin	8267227		< 0.005	< 0.005	NA	< 0.005	84%	50%	140%	90%	50%	140%	80%	50%	140%
Endrin	8267227		< 0.005	< 0.005	NA	< 0.005	84%	50%	140%	76%	50%	140%	82%	50%	140%
Methoxychlor	8267227		< 0.005	< 0.005	NA	< 0.005	76%	50%	140%	82%	50%	140%	96%	50%	140%
Hexachlorobenzene	8267227		< 0.005	< 0.005	NA	< 0.005	92%	50%	140%	100%	50%	140%	92%	50%	140%
Hexachlorobutadiene	8267227		< 0.01	< 0.01	NA	< 0.01	93%	50%	140%	100%	50%	140%	68%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By:

N Popmukohof



Method Summary

CLIENT NAME: PETO MACCALLUM LIMITED

AGAT WORK ORDER: 17T199091

PROJECT: 17KF002

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A; SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010B	ICP/OES
pH, 2:1 CaCl ₂ Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Trace Organics Analysis			
Hexachloroethane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Gamma-Hexachlorocyclohexane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Heptachlor	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Aldrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Heptachlor Epoxide	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Endosulfan	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Chlordane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDE	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDD	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDT	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Dieldrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Endrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Methoxychlor	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Hexachlorobenzene	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Hexachlorobutadiene	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
TCMX	ORG-91-5112	EPA SW-846 3541,3620 & 8081	GC/ECD
Decachlorobiphenyl	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Moisture Content		MOE E3139	BALANCE

CLIENT NAME: PETO MACCALLUM LIMITED
16 FRANKLIN STREET SOUTH
KITCHENER, ON N2C1R4
(519) 893-7500

ATTENTION TO: Ken Hanes

PROJECT: 17KF002

AGAT WORK ORDER: 17W201248

SOIL ANALYSIS REVIEWED BY: Sofka Pehlyova, Senior Analyst

DATE REPORTED: Apr 10, 2017

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.



Certificate of Analysis

AGAT WORK ORDER: 17W201248

PROJECT: 17KF002

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
<http://www.agatlabs.com>

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY: H. Shinwary

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2017-03-30

DATE REPORTED: 2017-04-10

Parameter	Unit	SAMPLE DESCRIPTION:		BH5-SS4	BH6-SS3
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		2017-03-21	2017-03-21
		G / S	RDL	8288805	8288806
Antimony	µg/g	40	0.8	<0.8	<0.8
Arsenic	µg/g	18	1	3	4
Barium	µg/g	670	2	9	13
Beryllium	µg/g	8	0.5	<0.5	<0.5
Boron	µg/g	120	5	<5	<5
Boron (Hot Water Soluble)	µg/g	2	0.10	<0.10	<0.10
Cadmium	µg/g	1.9	0.5	<0.5	0.6
Chromium	µg/g	160	2	5	8
Cobalt	µg/g	80	0.5	1.8	4.0
Copper	µg/g	230	1	8	15
Lead	µg/g	120	1	18	43
Molybdenum	µg/g	40	0.5	<0.5	0.8
Nickel	µg/g	270	1	4	8
Selenium	µg/g	5.5	0.4	<0.4	<0.4
Silver	µg/g	40	0.2	<0.2	<0.2
Thallium	µg/g	3.3	0.4	<0.4	<0.4
Uranium	µg/g	33	0.5	<0.5	<0.5
Vanadium	µg/g	86	1	11	19
Zinc	µg/g	340	5	180	370
Chromium VI	µg/g	8	0.2	<0.2	<0.2
Cyanide	µg/g	0.051	0.040	<0.040	<0.040
Mercury	µg/g	3.9	0.10	<0.10	<0.10
Electrical Conductivity	mS/cm	1.4	0.005	0.098	0.174
Sodium Adsorption Ratio	NA	12	NA	0.303	0.509
pH, 2:1 CaCl ₂ Extraction	pH Units		NA	7.94	8.16

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON T2 S ICC CT

8288805-8288806 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl₂ extract prepared at 2:1 ratio.

Certified By:

Sofra Pehlyora



AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 17W201248

PROJECT: 17KF002

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
<http://www.agatlabs.com>

CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
8288806	BH6-SS3	ON T2 S ICC CT	O. Reg. 153(511) - Metals & Inorganics (Soil)	Zinc	µg/g	340	370



Quality Assurance

CLIENT NAME: PETO MACCALLUM LIMITED

PROJECT: 17KF002

SAMPLING SITE:

AGAT WORK ORDER: 17W201248

ATTENTION TO: Ken Hanes

SAMPLED BY: H. Shinwary

Soil Analysis

RPT Date: Apr 10, 2017			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	8287941		<0.8	<0.8	NA	< 0.8	116%	70%	130%	100%	80%	120%	92%	70%	130%
Arsenic	8287941		4	4	NA	< 1	107%	70%	130%	98%	80%	120%	104%	70%	130%
Barium	8287941		48	47	2.6%	< 2	98%	70%	130%	96%	80%	120%	101%	70%	130%
Beryllium	8287941		<0.5	<0.5	NA	< 0.5	78%	70%	130%	108%	80%	120%	89%	70%	130%
Boron	8287941		<5	<5	NA	< 5	89%	70%	130%	108%	80%	120%	91%	70%	130%
Boron (Hot Water Soluble)	8287941		0.34	0.36	NA	< 0.10	112%	60%	140%	100%	70%	130%	101%	60%	140%
Cadmium	8287941		<0.5	<0.5	NA	< 0.5	89%	70%	130%	100%	80%	120%	103%	70%	130%
Chromium	8287941		13	13	0.0%	< 2	95%	70%	130%	106%	80%	120%	120%	70%	130%
Cobalt	8287941		6.0	6.2	3.3%	< 0.5	102%	70%	130%	108%	80%	120%	108%	70%	130%
Copper	8287941		32	33	3.1%	< 1	94%	70%	130%	110%	80%	120%	115%	70%	130%
Lead	8287941		10	10	0.0%	< 1	101%	70%	130%	101%	80%	120%	99%	70%	130%
Molybdenum	8287941		<0.5	<0.5	NA	< 0.5	101%	70%	130%	103%	80%	120%	103%	70%	130%
Nickel	8287941		13	13	0.0%	< 1	105%	70%	130%	107%	80%	120%	108%	70%	130%
Selenium	8287941		<0.4	<0.4	NA	< 0.4	107%	70%	130%	103%	80%	120%	102%	70%	130%
Silver	8287941		<0.2	<0.2	NA	< 0.2	93%	70%	130%	106%	80%	120%	105%	70%	130%
Thallium	8287941		<0.4	<0.4	NA	< 0.4	86%	70%	130%	102%	80%	120%	103%	70%	130%
Uranium	8287941		<0.5	<0.5	NA	< 0.5	90%	70%	130%	92%	80%	120%	95%	70%	130%
Vanadium	8287941		22	22	0.0%	< 1	100%	70%	130%	106%	80%	120%	124%	70%	130%
Zinc	8287941		53	49	7.8%	< 5	103%	70%	130%	118%	80%	120%	116%	70%	130%
Chromium VI	8284952		<0.2	<0.2	NA	< 0.2	92%	70%	130%	96%	80%	120%	98%	70%	130%
Cyanide	8288805	8288805	<0.040	<0.040	NA	< 0.040	102%	70%	130%	103%	80%	120%	104%	70%	130%
Mercury	8287941		<0.10	<0.10	NA	< 0.10	102%	70%	130%	95%	80%	120%	102%	70%	130%
Electrical Conductivity	8291645		0.428	0.431	0.7%	< 0.005	94%	90%	110%	NA			NA		
Sodium Adsorption Ratio	8287941		0.751	0.761	1.3%	NA	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	8285504		7.26	7.23	0.4%	NA	100%	80%	120%	NA			NA		

Comments: NA signifies Not Applicable.

Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By:

Sofia Pehlyora



Method Summary

CLIENT NAME: PETO MACCALLUM LIMITED

AGAT WORK ORDER: 17W201248

PROJECT: 17KF002

ATTENTION TO: Ken Hanes

SAMPLING SITE:

SAMPLED BY: H. Shinwary

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A; SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010B	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER