WILLS

PARTNERS IN ENGINEERING, PLANNING & ENVIRONMENTAL SERVICES

October 7, 2021

Via Email: s.lennox@hotmail.com

3060 Concession Road 7
Pickering, Ontario
L1Y 1C4

**Attention: Stephen Lennox**

Dear Mr. Lennox:

**Re: Additional Services Request #1 - Hydrogeological Study**
**Pigeon Lake Commercial Cabins**
**16 Fire Route 94A, Point Pleasant**
**Municipality of Trent Lakes, County of Peterborough**
**D.M. Wills Project No. 20-85099**

## 1.0 Introduction

D.M. Wills Associates Limited (Wills) was retained by Stephen Lennox (Client) to complete a Hydrogeological Study (Study) in support of a Zoning By-law Amendment (ZBA) application for the property located at 16 Fire Route 94A, Point Pleasant in the Municipality of Trent Lakes, County of Peterborough (Subject Property). A Subject Property Plan showing the approximate property boundary is included as **Figure 1**.

Wills' Study has been prepared to address the capacity of the Subject Property to support a private on-site sewage disposal system (sewage system) with anticipated daily flows in excess of 4,500 L/day, on the basis of Ontario Regulation (O. Reg.) 545/06, Schedule 1, item 25. The anticipated post-development daily flows are expected to be 8,500 L/day, as shown on Brad Clark's sewage system design sketch, provided by the Client and included as **Appendix A**.

On the basis of the MOE *Design Guidelines for Sewage Works* (2008) (MOE Design Guideline), MECP consultation guidance, and the MECP *Lakeshore Capacity Assessment Handbook – Protecting Water Quality in Inland Lakes on Ontario's Precambrian Shield – Consultation Draft* (2007)[LCA], the subsurface soil, bedrock, groundwater, and surface water quality on and directly adjacent to the Subject Property were evaluated to assess potential environmental impacts resulting from the proposed sewage system.

Professional Engineers Ontario
ASSOCIATION OF CONSULTING ENGINEERING COMPANIES ONTARIO
PGO
Health and Safety Excellence program Member wsib 2020


**Legend**

Subject Property

**Subject Property Plan**

Hydrogeological Study
Pigeon Lake Commercial Cabins


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D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, Ontario
Canada K9J 0B9

P. 705.742.2297
F. 705.749.9944
E. wills@dmwills.com


| | |
|---|---|
| Drawn By IM | Scale See scale bar |
| Checked | Date Sept 2021 |
| | |
| Project No. 20-85099 | Drawing File No. Figure 1 |

## 2.0 Scope of Work

Wills' approved Scope of Work to complete the Study included the following:

- Prior to initiating the field investigation, public and private utility service locates were obtained and reviewed by Wills. Additionally, a Site Specific Health and Safety Plan (HASP), and Field Investigation Plan was prepared to ensure a safe, coordinated, and efficient field work program.
- Six (6) test pits were excavated on the Subject Property under the direct supervision of Wills staff within the vicinity of the proposed sewage system. *Four (4) test pits were originally proposed, however, In view of the encountered shallow bedrock conditions, two (2) additional test pits were excavated to confirm the underlying bedrock profile as a change in the approved Scope of Work*.
- Groundwater was not encountered above the bedrock-soil interface, and thus, proposed monitor wells were not installed and groundwater samples were not collected*, as a change in the approved Scope of Work*.
- Two (2) soil samples were submitted to a Canadian Certified Independent Laboratory (CCIL) for analysis of Particle Size Distribution.
- Two (2) soils samples were submitted to a Canadian Association for Laboratory Accreditation (CALA) accredited laboratory (SGS Canada Inc.) for analysis of calcium content in lieu of submitting groundwater samples*, as a change in the approved Scope of Work*.
- The findings of the field investigation were summarized in this Hydrogeological Study Report that includes:
    - A summary of the subsurface soil, bedrock, and groundwater conditions observed during the field investigation, and soil testing results.
    - A Surface Water Impact Assessment that considers the discharge of sewage effluent to Pigeon Lake. *Wills investigative findings concluded that surface water should be considered the receiving body for sewage effluent generated on the Subject Property, and thus, a Reasonable Use Assessment (MOE Procedure B-7-1, Determination of Contaminant Limits and Attenuation Zones) was deemed inappropriate for evaluating the Subject Property's capacity to support the proposed sewage system, as a change in the approved Scope of Work.*

## 3.0 Field Investigation

Wills retained Steenburgh Sand & Gravel to excavate six (6) test pits at locations selected by Wills on the Subject Property on July 20, 2021. The test pits were excavated within and directly adjacent to the proposed sewage system footprint, and were designated as TP21-01 through TP21-06. All six (6) test pits were terminated on bedrock at depths ranging from approximately 0.25 to 0.75 metres below grade (mbg). Groundwater was not encountered in any of the test pits above the bedrock-soil interface, and monitor wells were not installed. Test pit locations are shown on **Figure 2.** A photographic log of the field investigation has been included as **Appendix B**.


**Legend**

- Subject Property
- Subsurface Investigation Area
- Test Pit

**Subsurface Investigation Plan**

Hydrogeological Study
Pigeon Lake Commercial Cabins

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, Ontario
Canada K9J 0B9

P. 705.742.2297
F. 705.749.9944
E. wills@dmwills.com

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| Drawn By IM | Scale See scale bar |
| Checked | Date July 2021 |
| Project No. 20-85099 | Drawing File No. Figure 2 |

## 3.1 Soil Profile Summary

The Subject Property is located in the Physiographic Region of the Dummer Moraines (*The Physiography of Southern Ontario, Chapman and Putnam, 1984*), which is characterized by drumlinized till plains. Ontario Geological Survey (OGS) mapping suggests that local physiography includes shallow till and rock ridges.

The subsurface conditions encountered on the Subject Property align with the OGS depositional model. The results of Wills' field investigation indicate that the overburden is generally consistent across the Subject Property, with slight variations in gravel, sand, silt, and clay content. Generally, the subsurface profile consists of silty sand topsoil underlain by a thin, discontinuous layer of sand, and a basal layer of silty sand till overlying shallow bedrock. The Subject Property encompasses a small peninsula that extends south into Pigeon Lake, and can be described as a narrow bedrock ridge with discontinuous glacial drift. **Table 1** summarizes the individual soil units encountered during the subsurface investigation.

**Table 1 - Stratigraphic Summary**

| Test Pit ID: | TP21-01 | | TP21-02 | | | TP21-03 | | TP21-04 | | TP21-05 | | TP21-06 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Units:** | **Topsoil** | **Till** | **Topsoil** | **Sand** | **Till** | **Topsoil** | **Till** | **Topsoil** | **Till** | **Topsoil** | **Till** | **Topsoil** | **Sand** | **Till** |
| **Depth Range:** | 0 – 0.15 mbg | 0.15 – 0.25 mbg | 0 – 0.15 mbg | 0.15 – 0.25 mbg | 0.25 – 0.45 mbg | 0 – 0.10 mbg | 0.10 – 0.35 mbg | 0 – 0.30 mbg | 0.30 – 0.70 mbg | 0 – 0.25 mbg | 0.25 – 0.75 mbg | 0 – 0.25 mbg | 0.25 – 0.35 mbg | 0.35 – 0.70 mbg |
| **Description:** | Dark brown silty sand, trace clay, trace gravel, rootlets. | Medium brown silty sand, trace clay, trace gravel, occasional cobble. | Dark brown silty sand, trace clay, trace gravel, rootlets. | Light brown sand, trace silt, some gravel, occasional cobble. | Medium brown silty sand, trace clay, trace gravel, occasional cobble. | Dark brown silty sand, trace clay, trace gravel, rootlets. | Medium brown silty sand, trace clay, trace gravel, occasional cobble. | Dark brown silty sand, trace clay, some gravel, rootlets. | Medium brown sand and gravel, some silt trace clay, occasional cobble and boulder. | Dark brown silty sand, trace clay, trace gravel, rootlets. | Medium brown silty sand, some cobble, trace gravel, trace clay, occasional boulder. | Dark brown silty sand, trace clay, trace gravel, rootlets. | Light brown sand, trace gravel, moist. | Medium brown sand and silt, trace clay, trace gravel, occasional cobble. |
| **Moisture:** | Moist | Moist | Moist | Moist | Moist | Moist | Moist | Moist | Moist | Moist | Moist | Moist | Moist | Moist |
| **Sample ID:** | GS1 | GS2 | GS1 | GS2 | GS3 | GS1 | GS2 | GS1 | GS2 | GS1 | GS2 | GS1 | GS2 | GS3 |
| **Comments:** | Refusal on bedrock at 0.25 mbg | | Refusal on bedrock at 0.45 mbg | | | Refusal on bedrock at 0.35 mbg | | Refusal on bedrock at 0.70 mbg | | Refusal on bedrock at 0.75 mbg | | Refusal on bedrock at 0.70 mbg | | |

Two (2) representative soil samples were collected from the test pits and submitted to WSP Canada Inc. (WSP) for analysis of Particle Size Distribution, including sieve and hydrometer tests. A summary of the physical testing results are provided in **Table 2**, on the basis of the Unified Soil Classification System (USCS). Certificates of Analysis for the physical soil testing results are included as **Appendix C.**

**Table 2 - Summary of Particle Size Distribution, Till Material**

| Test Pit ID | Sample No. | Gravel (3 in. to No.4 Sieve) (%) | Sand (No.4 to No.200 Sieve) (%) | Silt and Clay (Passing No.200 Sieve) (%) |
|---|---|---|---|---|
| TP21-02 | GS3 | 5 | 52 | 37 – Silt<br>6 - Clay |
| TP21-04 | GS2 | 35 | 41 | 21 – Silt<br>4 - Clay |

### 3.1.1 Permeability and Percolation Time

Soil percolation rates were estimated on the basis of physical soil characteristics determined through laboratory testing, and were compared to the Ministry of Municipal Affairs and Housing, Building and Development Branch (MMAH) Supplementary Standard SB-6 – Percolation Time and Soil Descriptions Table 2 values (Ontario Building Code, 2012) (Table 2 OBC).

Based on the laboratory results, the encountered till material on the Subject Property generally falls within the SM soil envelope (silty sands, sand-silt mixtures), as per the USCS. On the basis of Table 2 OBC, SM soils generally have a T-Time ranging from 8-20 minutes per centimetre (min/cm), which is equivalent to approximately 30-75 millimetres per hour (mm/hr). Based on Table 2 OBC, these soils are described as having a medium to low permeability.

## 3.2 Bedrock

Shallow bedrock was encountered in all six (6) test pits at depths ranging from 0.25 mbg in TP21-01 to 0.75 mbg in TP21-05. Although detailed bedrock classification was beyond the scope of Wills' Study, OGS mapping (2007) indicates that the local bedrock geology includes mafic to felsic metavolcanic rocks belonging to the Grenville Supergroup and Flinton Group.

Minor irregularities (undulations) of the bedrock surface were observed on a local scale, and bedrock outcrops were noted in between the test pit locations. In general, the bedrock surface generally follows the topography of the Subject Property, with decreasing elevations towards the shoreline of Pigeon Lake where exposed bedrock was observed. A topographic map prepared by Donevan Fleischmann Petrick, (June 12, 2020) is included in **Appendix D**, which is expected to mimic the expression of the underlying bedrock profile**.**

### 3.3 Groundwater

Groundwater was not encountered during the field investigation. All test pits were dry following completion and no evidence of groundwater (e.g. soil mottling or groundwater seepage) was observed in any of the test pits above the bedrock-soil interface.

## 4.0 Sewage Effluent Discharge to Surface Water

Wills determined that surface water (Pigeon Lake) should be considered as the receiving environment for any sewage effluent generated on the Subject Property. This determination was made on the basis of the following observations:

- Shallow bedrock was encountered within and adjacent to the proposed sewage system footprint at depths ranging from surface to approximately 0.75 mbg. Furthermore, the bedrock profile slopes towards Pigeon Lake on all three (3) sides of the peninsula. Based on the Drainage Area Plan included in Wills' Functional Servicing Review (2021), it is expected that sewage effluent generated on the Subject Property will generally flow south-east from the proposed leaching bed towards Pigeon Lake.
- Groundwater was not encountered above the bedrock-soil interfaces and is not expected to interact with sewage effluent or surface water infiltration. Sewage effluent and infiltrating surface water is expected to remain above the tight and impervious Pre-Cambrian bedrock, and migrate laterally across the bedrock surface before discharging into Pigeon Lake.

When surface water is the receiving environment for sewage effluent, the appropriate water quality criteria are found in the Provincial Water Quality Objectives (PWQO). The MOEE document titled *Water Management: Policies, Guidelines, Provincial Water Quality Objectives* (1994) outlines the goals of surface water quality management, and includes the following two (2) Policies:

- Policy 1 - Areas with Water Quality Better than the Objective – surface water quality shall be maintained at or above the PWQO.
- Policy 2 – Areas with Water Quality Not Meeting the Objectives – Surface water shall not be further degraded and all practical measures shall be taken to upgrade the water quality to the PWQO.

The MOE Design Guideline provides the following considerations for effluent discharge to surface water:

- In Section 22.5.5 Critical Contaminants, the guideline states that critical contaminants for surface water include phosphorus and ammonia. For the purpose of this Study, phosphorus has been considered as the indicator parameter for potential surface water impacts.
- Section 22.5.11 states that in the case of sewage systems located on the Precambrian Shield, phosphorus discharge to surface water should be evaluated by the LCA.

In addition to the above guideline, Wills consulted the MECP to clarify the application of the LCA with respect to effluent discharge to surface water, and mitigation measures required to support the application process. Based on Wills' MECP consultation, and information provided in the LCA, the following criteria and considerations were determined for assessing the Subject Property's capacity to support the proposed sewage system.

- Overburden soils found on the Canadian Shield have been categorized as having high acidity.
- Soils with less than 2% calcium (deemed acidic soils) have extremely high retention rates for phosphorus.
- Information provided by the MECP suggests that acidic soils have a 90% plus retention rate for phosphorus.
- Sewage system effluent must be kept above the high water table.
- The Subject Property must demonstrate deep overburden soils (two [2] to three [3] meter thickness).
- The MECP assumes a standard loading 10 mg/L phosphorus in sewage effluent, and does not consider daily flow rates for evaluating surface water impacts.

- The sewage system setbacks (i.e. from receiving waterbodies) outlined in the OBC must be respected in order for the above-mentioned phosphorus retention rate to be considered applicable.
- The receiving water body must hold a Policy 1 designation for water quality.

At the time of writing this report, Wills' understands that the MECP is in the process of developing a formal framework/guideline for assessing sewage effluent discharge into surface water, which is expected to capture the considerations mentioned above.

### 4.1 Background Pigeon Lake Water Quality

Pigeon Lake is under the jurisdiction of the Kawartha Region Conservation Authority (KRCA), and undergoes water quality monitoring on a consistent basis to assess potential degradation. As mentioned in **Section 4.0**, phosphorus is considered a critical contaminant for sewage effluent discharge into surface water, and has a respective PWQO of 20 µg/L (for lakes).

Based on KRCA's *Pigeon Lake Watershed Characterization Report* (2018), the Total Phosphorus (TP) concentration in Pigeon Lake averages between 14-19 µg/L. Pigeon Lake is considered Mesotrophic with fair water quality on the basis of the measured TP concentrations and additional nutrient parameters. Furthermore, historical TP concentrations measured in Pigeon Lake are typically just below the PWQO. For the purpose of Wills' Study, Pigeon Lake can be classified as a Policy 1 waterbody with water quality better than the PWQO, as such surface water quality shall be maintained at or above the PWQO.

It should be noted that there are time periods, notably in the summer months, where Pigeon Lake has had phosphorus levels that exceed the PWQO, and there is a history of algae blooms in the southern portion of the lake several kilometres from the Subject Property. Phosphorus levels in the northern portion of the lake, including the waters surrounding the Subject Property, are generally on the lower end of the average TP concentrations measured in Pigeon Lake.

## 5.0 Surface Water Impact Assessment

A Surface Water Impact Assessment (Impact Assessment) was conducted on the basis of Wills' investigative findings, MECP consultation, and relevant MECP guidance documents to determine the Subject Property's capacity to support the proposed sewage system. **Table 3** provides a summary of the evaluation criteria, site specific conditions, and respective results in

context of the anticipated phosphorus loading resulting from the proposed sewage system.

**Table 3 – Surface Water Impact Assessment – Phosphorus**

| Evaluation Criteria (*Source*) | Subject Property Conditions | Result |
|---|---|---|
| Acidic Soils with < 2% Calcium<br>(*MECP Consultation*) | Soil samples TP21-02 GS3 and TP21-03 GS2 were submitted to SGS Canada Inc. (SGS) for analysis of calcium content. | TP21-03 GS2 – 0.47% calcium<br>TP21-02 GS3 – 0.68 % calcium<br>The Subject Property soils are considered acidic with the ability to retain at least 90% of effluent phosphorus.<br>The Certificate of Analysis from SGS is included as **Appendix E**. |
| Sewage system effluent must be kept above the high water table<br>(*MECP Consultation*) | Groundwater was not encountered above the bedrock-soil interface during Wills' investigation. | Sewage effluent is not expected to interact with the high water table before discharging into Pigeon Lake. |
| The MECP assumes 10 mg/L phosphorus concentration in sewage system effluent.<br>(*MECP Consultation*) | Effluent from the proposed septic system should be assumed to contain 10 mg/L of phosphorus. | Assuming 90% phosphorus retention rate is achieved through the acidic soils, pre-treatment of phosphorus and septic system design would require phosphorus removal of 0.98 mg/L to reach the PWQO of 0.02 mg/L at the discharge point into Pigeon Lake. |
| Deep overburden<br>(*MECP Consultation and LCA*) | Shallow soils (< 1.0 m thick) were encountered on the Subject Property within the proposed leaching bed footprint. | The MECP and the LCA recommend that the engineered design of the sewage system must include a raised bed design where shallow soils are encountered. A soil thickness between two (2) to three (3) m (below the infiltration trenches) is required to avoid soil saturation and to ensure adequate phosphorus retention. |

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| Evaluation Criteria (*Source*) | Subject Property Conditions | Result |
|---|---|---|
| Proper sewage system setbacks from receiving waterbody.<br>As per OBC and MECP requirements, septic system setbacks from waterbodies are:<br>15 m for an historical development (*OBC and MECP*)<br>30 m for a new development (*MECP*) | As per the design sketch provided to Wills by Brad Clark (**Appendix A**), the proposed sewage system setbacks will maintain an approximate 18 m setback from Pigeon Lake. | The Subject Property is considered an historical development. The proposed sewage system setbacks satisfy the OBC and MECP requirements. |
| Receiving Waterbody Policy designation as per the document *Water management: policies, guidelines, provincial water quality objectives* (1994) | Based on water quality monitoring conducted by the KRCA, the annual phosphorus concentrations in Pigeon Lake range between 14-19 µg/L. This range is below the PWQO of 20 µg/L. | Pigeon Lake is classified as Mesotrophic with fair water quality within KRCAs *Pigeon Lake Watershed Characterization Report* (2018), which for the purposes of this report could classify Pigeon Lake as falling into the Policy 1 framework for surface water quality management. |

## 6.0 Conclusions and Recommendations

Based on Wills' Study, the following conclusions and recommendations are provided:

- Six (6) test pits were excavated within and directly adjacent to the proposed sewage system footprint on the Subject Property, on July 20, 2021.
- The encountered subsurface profile included silty sand topsoil underlain by a discontinuous layer of sand, and a basal layer of silty sand till overlying shallow bedrock.
- Pre-Cambrian bedrock was encountered at all six (6) test pit locations and ranged in depth from 0.25 mbg in TP21-01 and 0.75 mbg in TP21-05. Areas of exposed bedrock were present within the investigated area, and local bedrock irregularities are attributed to the regional bedrock fabric.
- Topography on the Subject Property is likely controlled by the underlying bedrock profile, which generally slopes away from the topographic high the in center of the peninsula towards Pigeon Lake on all three (3) sides.
- A review of the physical soil characteristics and comparison against Table 2 OBC suggests a conservative percolation time (T-Time) of 20 min/cm for the native till material. These soils are described as having medium to low permeability.
- Two (2) soil samples were submitted to SGS for analysis of calcium content. Calcium content ranged from 0.47% in sample TP21-03 GS2 to 0.68% in TP21-02 GS3, and the submitted soils are considered to be acidic based on MECP guidance.
- Groundwater was not encountered in any of the test pits above the soil-bedrock interface, and effluent generated from the proposed sewage system is not expected to interact with groundwater.
- In view of the shallow bedrock conditions and local topography, surface water (Pigeon Lake) is considered as the receiving environment for any sewage effluent generated on the Subject Property.
- Evaluating the capacity of the Subject Property to support an on-site sewage system using the MOE's *Reasonable Use Assessment* was considered inappropriate in view of the anticipated discharge of sewage effluent to surface water. Wills consulted the MECP to develop an assessment framework for discharge to surface water,

which considers phosphorus as the primary contaminant of concern.

- On the basis of MECP consultation, relevant MECP guidance documents, and medium to low permeability rates and acidic soil conditions encountered on the Subject Property, Wills determined that phosphorus retention of 90% is possible if the sewage system is engineered with advanced pre-treatment and a raised bed design that ensures two (2) to three (3) meters (m) of separation between the absorption trenches and underlying bedrock.
- Shallow bedrock conditions are expected to require a raised leaching bed design, and the leaching bed fill should be comprised of acidic soils (< 2% calcium) to ensure adequate phosphorus retention.
- The MECP assumes 10 mg/L of phosphorus concentration for sewage system effluent, and does not consider daily design flows for Surface Water Impact Assessments.
- Assuming 90% phosphorus retention is achieved through the leaching bed fill design (acidic soils) and underlying overburden, the proposed sewage system design should consider a pre-treatment mechanism to remove 0.98 mg/L of phosphorus to satisfy the PWQO of 0.02 mg/L at the discharge point into Pigeon Lake.
- The PWQO does not specify nitrate concentration limits, however, effluent pre-treatment should ensure that effluent nitrate concentrations do not exceed the Canadian Council of Ministers of the Environment water quality guidelines for the Protection of Aquatic Life of 13 µg/L at the discharge point (Pigeon Lake shoreline).
- A vegetative buffer surrounding the perimeter of the Subject Property is recommended as a best management practice, as outlined in the LCA.
- The proposed sewage system is located approximately 18 m from the Pigeon Lake shoreline, which satisfies both the 15 m minimum setback from lakes provided in the OBC, and the MECP setback guideline for historical developments.
- On the basis of MECP consultation, Wills recommends conducting post-development surface water quality monitoring of Pigeon Lake surrounding the Subject Property to assess any potential impacts the sewage system may be having on receiving water body.
- Estimated daily flows for the proposed sewage system are expected to be less than 10,000 L/day (8,500 L/day), and thus, the sewage system is not considered a Large Subsurface Sewage Disposal System and will not require MECP approval.

- It is Wills professional opinion that this Study supports the Client's Zoning By-law application for the Subject Property, provided that the proposed sewage system design considers the MECP and LCA design requirements provided in this report.

We trust that the information contained in and attached to this report meets your needs at this time. The following Statement of Limitations should be read carefully and is an integral part of this report. Do not hesitate to contact the undersigned if you have any questions or concerns.

Respectfully submitted,

Prepared by: _____
Lynsey Tuters, C. Tech
Environmental Technician

Reviewed by: _____
Ian Ames, M.Sc., P.Geo.
Environmental Monitoring and Management Lead

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## Statement of Limitations

This report is intended solely for Mr. Steven Lennox (Client) in support of a Zoning By-law Amendment application for the property located at 16 Fire Route 94A, Point Pleasant (Subject Property) in the Municipality of Trent Lakes (Municipality), County of Peterborough (County), and is prohibited for use by others without D.M. Wills Associates Limited's (Wills) prior written consent. This report is considered Wills' professional work product and shall remain the sole property of Wills. Any unauthorized reuse, redistribution of or reliance on this report shall be at the Client and recipient's sole risk, without liability to Wills. The Client shall defend, indemnify and hold Wills harmless from any liability arising from or related to the Client's unauthorized distribution of the report. No portion of this report may be used as a separate entity; it is to be read in its entirety and shall include supporting drawings and appendices.

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

The recommendations and comments made in this report are based on Wills' investigations and resulting understanding of the Project, as defined at the time of the assignment. Wills should be retained to review our recommendations when the final or any modified design drawings and specifications are complete. Without this review, Wills shall not be liable for any misunderstanding of our recommendations or their application and adaptation.

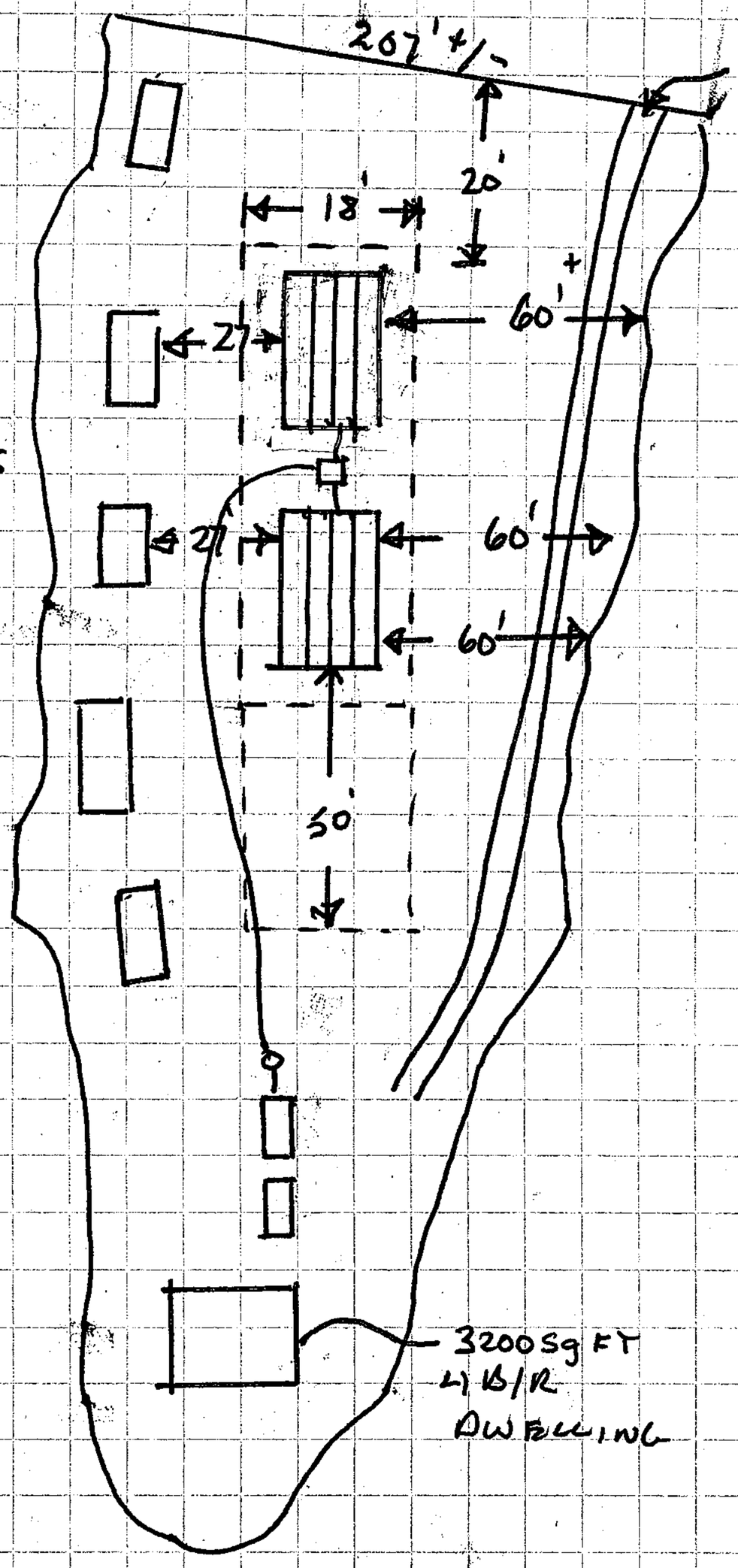
Soil, bedrock, and groundwater conditions between and beyond the testing locations may differ both horizontally and vertically from those encountered at those locations. Should any conditions at the Subject Property be encountered which differ from those found at the testing locations, Wills must be notified immediately in order to permit a reassessment of our recommendations. If different conditions are identified, no matter how minor, the recommendations in this report shall be considered invalid until sufficient review and written assessment of said conditions by Wills is completed.

# Appendix A

## Sewage System Design Sketch

LENNOX

16 FIRE ROUTE 94A.




5 x 2 BEDROOM COTTAGES

1100 L/DAY EACH

= 5500 L

1 NEW 4 BEDROOM 4

BATHROOM 3200 SQ FT

DWELLING

= 3000 L/DAY

TOTAL 8500 L/DAY

2 x 18' x 26'

6 RUNS 23' @ 3' CENTRES

F.D. = 18' x 26'

= 468 SQ FT

= 43.47 SQ M

17' PIPE TO PIPE

BETWEEN BEDS

50' MANTLE

RE ROD AT ALL

POINTS FOR

ORIENTATION

WATERLOO ANAEROBIC

DIGESTER

WATERLOO BULK FILLED

SUGGEST PLACING

SEWAGE PUMPS X2

1 TO SERVICE 3 COTTAGES

1 TO SERVICE 2 COTTAGES

TO TANK @ MAIN

DWELLING

- PUMP TO BEDS

AFTER BULK FILLED

# Appendix B

## Photographic Log

| **Client Name:** | **Site Location:** |
|---|---|
| Pigeon Lake Commercial Cabins | 16 Fire Route 94A, Point Pleasant, Ontario |

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|---|
| **Photograph No.:** 1 |
| **Date:**<br>July 20, 2021 |
| **Direction**:<br>South |
| **Description:**<br>Excavator at TP21-01. |


| |
|---|
| **Photograph No.:** 2 |
| **Date:**<br>July 20, 2021 |
| **Direction**:<br>Northwest |
| **Description:**<br>Encountered bedrock in TP21-02 at 0.45 metres below grade (mbg). |


D.M. Wills Associates Limited
150 Jameson Drive, Peterborough, Ontario, Canada K9J 0B9
**P**. 705.742.2297 **F**. 705.748.9944 **E**. wills@dmwills.com

| |
|---|
| **Photograph No.:** 3 |
| **Date:**<br><br>July 20, 2021 |
| **Direction**:<br>Northwest |
| **Description:**<br>Soil profile in TP21-03. Silty sand topsoil overlying silty sand till. Refusal on bedrock at 0.35 mbg. |


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|---|
| **Photograph No.:** 4 |
| **Date:**<br><br>July 20, 2021 |
| **Direction**:<br>East |
| **Description:**<br>Completed TP21-04. Silty sand topsoil overlying silty sand till. Refusal on bedrock at 0.70 mbg. |

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|---|
| **Photograph No.:** 5 |
| **Date:**<br><br>July 20, 2021 |
| **Direction**:<br>North |
| **Description:**<br>TP21-05 upon completion. Silty sand topsoil overlying silty sand till. Refusal on bedrock at 0.75 mbg. |

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| **Photograph No.:** 6 |
| **Date:**<br><br>July 20, 2021 |
| **Direction**:<br>North |
| **Description:**<br>Sand layer between 0.25 – 0.35 mbg in TP21-06. |

D.M. Wills Associates Limited
150 Jameson Drive, Peterborough, Ontario, Canada K9J 0B9
**P**. 705.742.2297 **F**. 705.748.9944 **E**. wills@dmwills.com

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|---|
| **Photograph No.:** 7 |
| **Date:**<br><br>July 20, 2021 |
| **Direction**:<br>Northwest |
| **Description:**<br>Bedrock at surface |

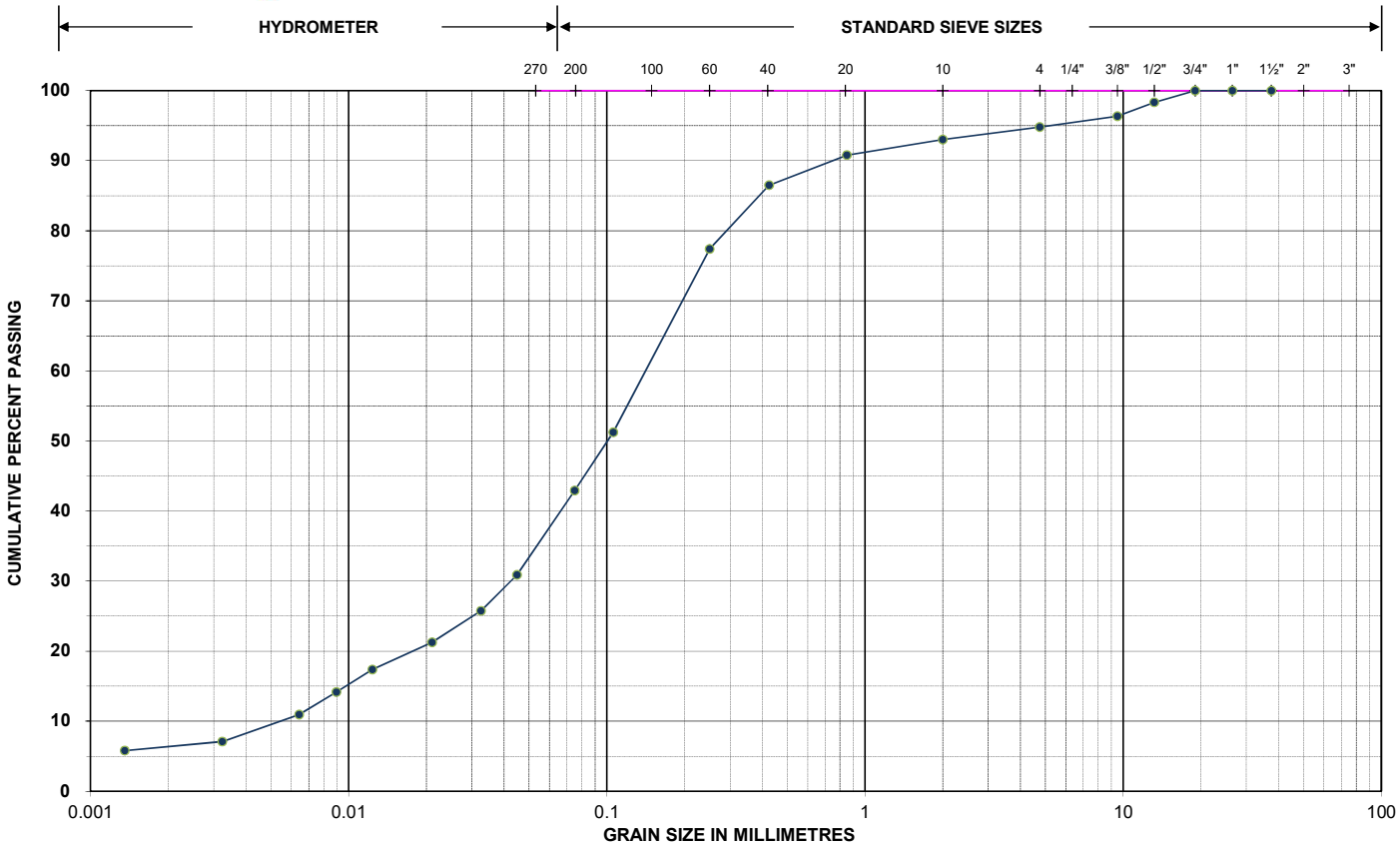
| |
|---|
| **Photograph No.:** 8 |
| **Date:**<br><br>July 20, 2021 |
| **Direction**:<br>Northwest |
| **Description:**<br>Pigeon Lake – taken from edge of Subject Property |

| |
|---|
| **Photograph No.:** 9 |
| **Date:**<br><br>July 20, 2021 |
| **Direction**:<br>East |
| **Description:**<br>Pigeon Lake – taken from edge of Subject Property |

# Appendix C

## Certificates of Analysis – Particle Size Distribution

# PARTICLE SIZE DISTRIBUTION LS702/ASTM D422




*Unified Classification System*

| SILT AND CLAY | SAND | GRAVEL |
|---|---|---|

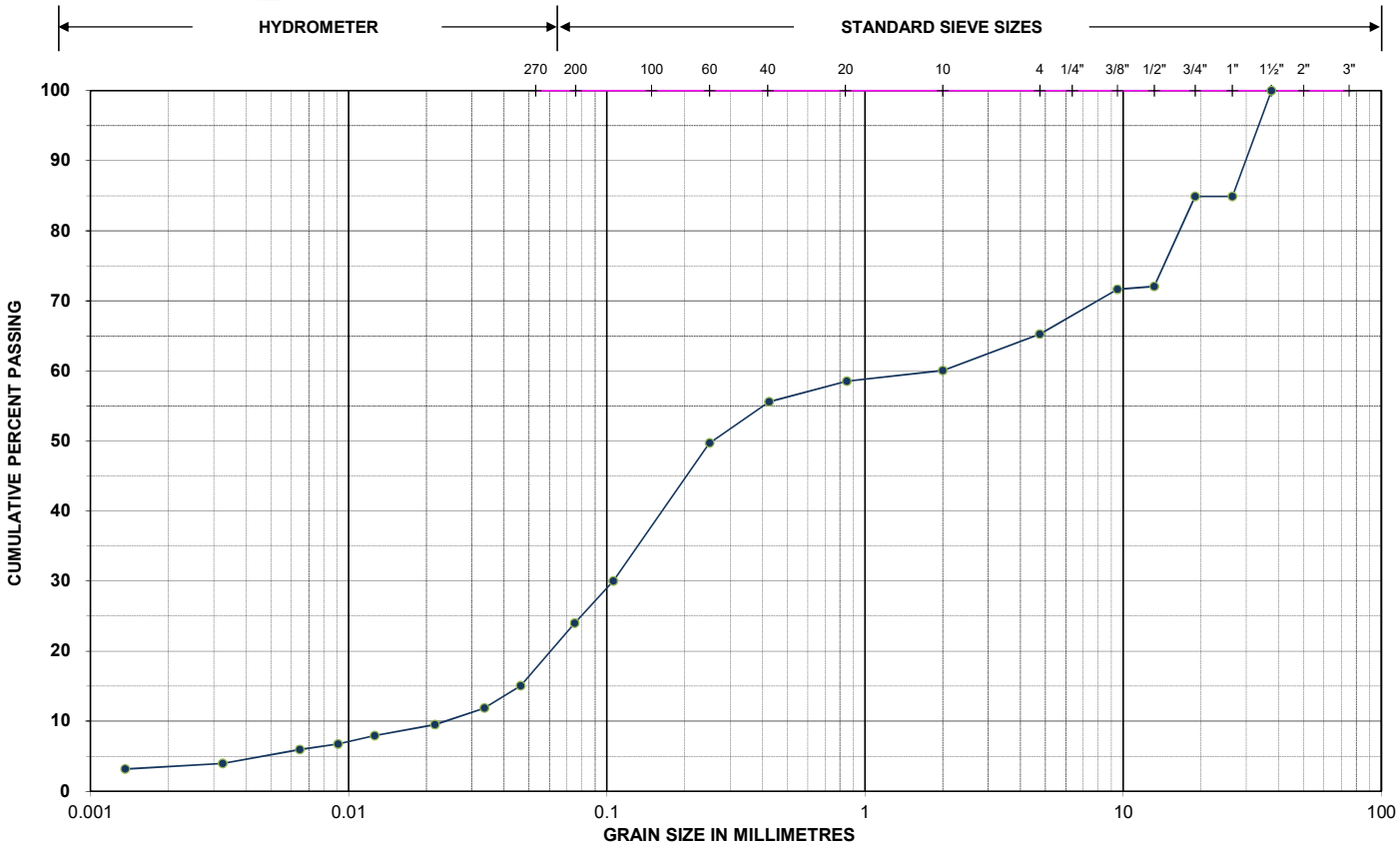
**Project Name:** DM Wills - Pigeon Lake Commercial Cabins **Project No.:** 201-07253-00 (85099)

**Location ID.:** TP21-02 **Sample No./Depth:** GS3 / 3.7m

| Sieve Size | % Passing Coarse | Sieve Size | % Passing Fine | Hydrometer (mm) | % Passing |
|---|---|---|---|---|---|
| **37.5 mm** | 100.0 | **2.00 mm** | 93.0 | **0.045** | 30.9 |
| **26.5 mm** | 100.0 | **0.850 mm** | 90.8 | **0.021** | 21.2 |
| **19.0 mm** | 100.0 | **0.425 mm** | 86.5 | **0.009** | 14.2 |
| **13.2 mm** | 98.3 | **0.250 mm** | 77.4 | **0.003** | 7.1 |
| **9.50 mm** | 96.3 | **0.106 mm** | 51.2 | **0.001** | 5.8 |
| **4.75 mm** | 94.8 | **0.075 mm** | 42.9 | | |

Note: More information is available upon request. Tested by: LEK Reviewed by: Hoorlon Date: 29-Jul-21

# PARTICLE SIZE DISTRIBUTION LS702/ASTM D422




*Unified Classification System*

| SILT AND CLAY | SAND | GRAVEL |
|---|---|---|

**Project Name:** DM Wills - Pigeon Lake Commercial Cabins **Project No.:** 201-07253-00 (85099)

**Location ID.:** TP21-04 **Sample No./Depth:** GS2 / 4.6m

| Sieve Size | % Passing Coarse | Sieve Size | % Passing Fine | Hydrometer (mm) | % Passing |
|---|---|---|---|---|---|
| **37.5 mm** | 100.0 | **2.00 mm** | 60.1 | **0.046** | 15.1 |
| **26.5 mm** | 84.9 | **0.850 mm** | 58.5 | **0.022** | 9.5 |
| **19.0 mm** | 84.9 | **0.425 mm** | 55.6 | **0.009** | 6.7 |
| **13.2 mm** | 72.1 | **0.250 mm** | 49.7 | **0.003** | 4.0 |
| **9.50 mm** | 71.6 | **0.106 mm** | 30.0 | **0.001** | 3.2 |
| **4.75 mm** | 65.2 | **0.075 mm** | 24.0 | | |

Note: More information is available upon request. Tested by: LEK Reviewed by: Date: 29-Jul-21

# Appendix D

## Topographic Map

PLAN OF TOPOGRAPHIC DETAIL OF

# 16 FIRE ROUTE 94A, PIGEON LAKE

COUNTY OF PETERBOROUGH

Scale 1:200

5 0 5 10 METRES

## METRIC

DISTANCES AND ELEVATIONS SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

## ELEVATION NOTE

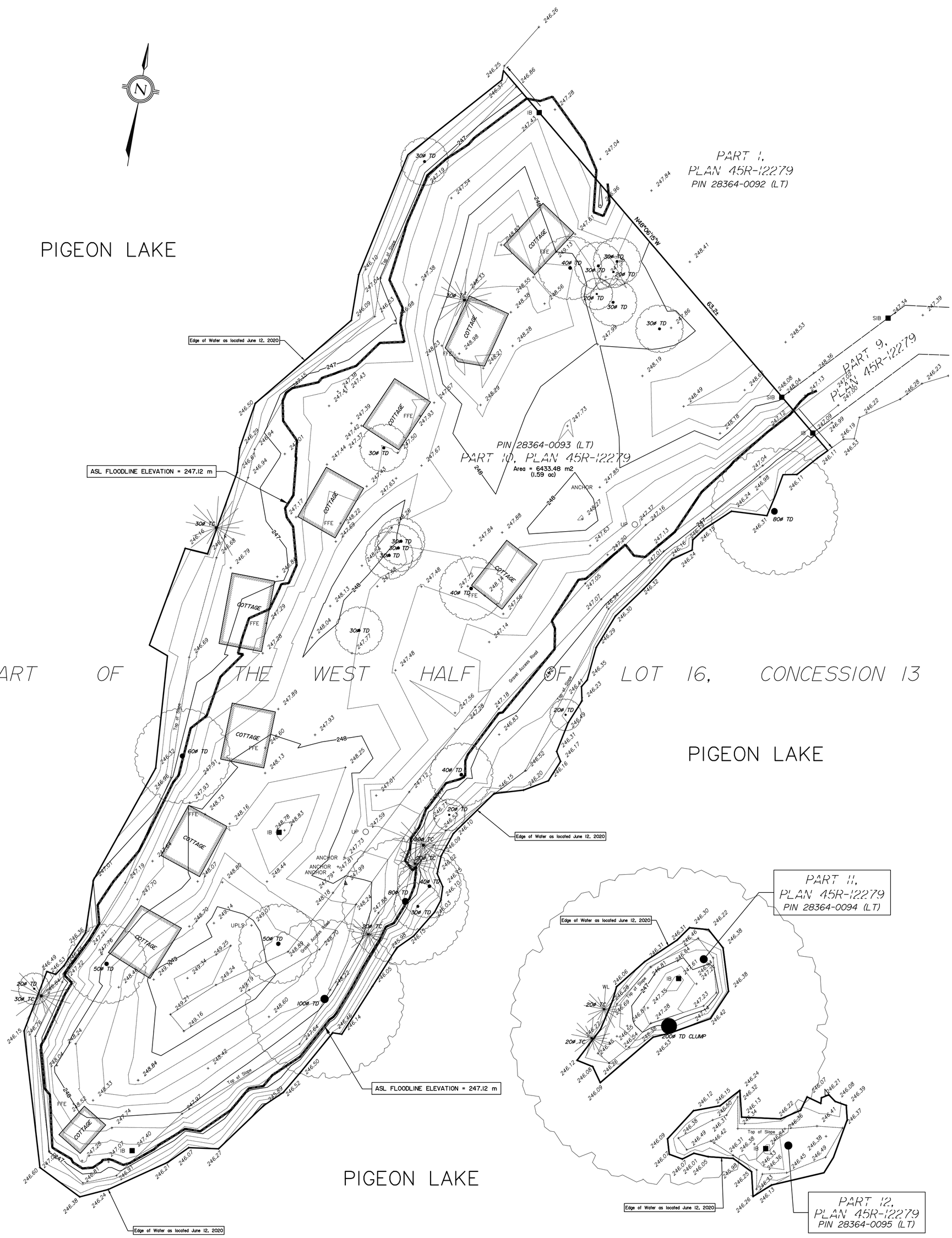
ELEVATIONS ARE GEODETIC, DERIVED BY RTK GPS OBSERVATIONS USING THE TOPNET REAL-TIME NETWORK SERVICE AND REFERRED TO CGVD28-1978 USING THE NRCAN HTv2.0 GEOID SEPARATION MODEL.

## LEGEND

| | |
|---|---|
| BOL | DENOTES BOLLARD |
| BP | DENOTES BELL POLE |
| BPED | DENOTES BELL PEDESTAL |
| BCAB | DENOTES BELL CABINET |
| BUGV | DENOTES BELL UNDERGROUND VAULT |
| CAHW | DENOTES CABLE HANDWELL |
| CB | DENOTES CATCHBASIN |
| CT | DENOTES CONIFEROUS TREE |
| DS | DENOTES DOWN SPOUT |
| DT | DENOTES DECIDUOUS TREE |
| EBOX | DENOTES ELECTRICAL BOX |
| EMH | DENOTES ELECTRICAL MANHOLE |
| HYD | DENOTES FIRE HYDRANT |
| GP | DENOTES GUY POLE |
| GV | DENOTES GAS VALVE |
| GW | DENOTES GUY WIRE |
| HM | DENOTES HYDRO METER |
| HP | DENOTES HYDRO POLE |
| HW | DENOTES HANDWELL |
| ICV | DENOTES IRRIGATION CONTROL VALVE |
| LS | DENOTES LIGHT STANDARD |
| MH | DENOTES MANHOLE |
| MW | DENOTES MONITORING WELL |
| TLS | DENOTES TRAFFIC LIGHT STANDARD |
| TL | DENOTES TRAFFIC LIGHT |
| UGV | DENOTES UNDERGROUND VAULT |
| WV | DENOTES WATER VALVE |

## LAKE ELEVATION

MEAN LAKE ELEVATION = 246.18 m.




| | | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| 0 | JULY 10, 2020 | FIRST DRAFT | AWS |
| REV | DATE | DESCRIPTION | BY |

CLIENT: 11923811 CANADA INC.



## SURVEYOR'S CERTIFICATE

I CERTIFY THAT

1. THE SURVEY WAS COMPLETED ON JUNE 12, 2020.

JULY 10, 2020

FRED PETRICH B.Sc.
ONTARIO LAND SURVEYOR

DFP SURVEYORS
DONEVAN FLEISCHMANN PETRICH LTD.
ONTARIO LAND SURVEYORS
SUITE 1, 1101 BOUNDARY ROAD
OSHAWA ON, L1J 8P8
PH - (905) 725-4795 1-888-743-2222
FAX - (905) 725-9957

| | | | |
|---|---|---|---|
| DRAWN BY: AWS | CHECKED BY: AK | SHEET SIZE: 24" X 24" | JOB No: 2020-054 |
| SCALE: 1:300 |  | | |

E:\DFP Jobs\2020-054_Lot-16_Conc.13_Harvey_Steve-Lennox Topo_Grading-Plan\20-054 TOPO.dwg

# Appendix E

## Certificates of Analysis - Calcium Content

# FINAL REPORT

## CA15288-SEP21 R

**85099**

Prepared for

D.M. Wills -Peterborough

# FINAL REPORT

CA15288-SEP21 R

## First Page

| CLIENT DETAILS | | LABORATORY DETAILS | |
|---|---|---|---|
| Client | D.M. Wills -Peterborough | Project Specialist | Brad Moore Hon. B.Sc |
| | | Laboratory | SGS Canada Inc. |
| Address | 150 Jameson Drive<br>Peterborough, ON<br>K9J 0B9. Canada | Address | 185 Concession St., Lakefield ON, K0L 2H0 |
| Contact | Lynsey Tuters | Telephone | 705-652-2143 |
| Telephone | 289-385-6230 | Facsimile | 705-652-6365 |
| Facsimile | 705-741-3568 | Email | brad.moore@sgs.com |
| Email | ltuters@dmwills.com | SGS Reference | CA15288-SEP21 |
| Project | 85099 | Received | 09/14/2021 |
| Order Number | | Approved | 09/16/2021 |
| Samples | Soil (2) | Report Number | CA15288-SEP21 R |
| | | Date Reported | 09/16/2021 |

COMMENTS

Temperature of Sample upon Receipt: 20 degrees C
Cooling Agent Present:No
Custody Seal Present:Yes

Chain of Custody Number:NA

SIGNATORIES

Brad Moore Hon. B.Sc

TABLE OF CONTENTS

# FINAL REPORT

CA15288-SEP21 R

**Client:** D.M. Wills -Peterborough
**Project:** 85099
**Project Manager:** Lynsey Tuters
**Samplers:** Lynsey Tuters

PACKAGE: **- Metals and Inorganics** (SOIL)

| | | |
|---|---|---|
| **Sample Number** | 5 | 6 |
| **Sample Name** | TP21-02GS3 | TP21-03GS2 |
| **Sample Matrix** | Soil | Soil |
| **Sample Date** | 20/07/2021 | 20/07/2021 |

| Parameter | Units | RL | | Result | Result |
|---|---|---|---|---|---|
| **Metals and Inorganics** | | | | | |
| Calcium | µg/g | 3 | | 6800 | 4700 |
| Calcium | % | 0.0003 | | 0.68 | 0.47 |

## QC SUMMARY

### Metals in Soil - Aqua-regia/ICP-MS

Method: EPA 3050/EPA 200.8 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-005

| Parameter | QC batch Reference | Units | RL | Method Blank | Duplicate | | LCS/Spike Blank | | | Matrix Spike / Ref. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | RPD | AC (%) | Spike Recovery (%) | Recovery Limits (%) | | Spike Recovery (%) | Recovery Limits (%) | |
| | | | | | | | | Low | High | | Low | High |
| Calcium | EMS0088-SEP21 | % | 0.0003 | <3 | 4 | 20 | 100 | 70 | 130 | 85 | 70 | 130 |

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

**Multielement Scan Qualifier**: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

**Duplicate Qualifier**: for duplicates 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.

**Matrix Spike Qualifier**: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

## LEGEND

### FOOTNOTES

| | |
|---|---|
| **NSS** | Insufficient sample for analysis. |
| **RL** | Reporting Limit. |
| ↑ | Reporting limit raised. |
| ↓ | Reporting limit lowered. |
| **NA** | The sample was not analysed for this analyte |
| **ND** | Non Detect |

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.



-- End of Analytical Report --

# SGS

## Request for Laboratory Services and CHAIN OF CUSTODY

No:

Page 1 of 1

SGS Environmental Services - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Toll Free: 877-747-7658 Fax: 705-652-6365
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361 Web: www.ca.sgs.com

**Laboratory Information Section - Lab use only**

Received By: Mike Dancey
Received Date (mm/dd/yyyy): SEP 14 2021 (mm\dd\yy)
Received Time: 11:40
Received By (signature):
Custody Seal Present: ☒
Custody Seal Intact: ☒
Cooling Agent Present: ☐ NC
Temperature Upon Receipt (°C): 20x2
LAB LIMS #: CA-15288 Sep21

### REPORT INFORMATION

Company: D-N Wills
Contact: Lynsey Tuters
Address: 150 Jameson Dr.
Phone: 705-742-2297
Fax:
Email: ltuters@dnwills.com

### INVOICE INFORMATION

☑ (same as Report Information)
Company:
Contact:
Address:
Phone:
Email: accounts@dnwills.com

### PROJECT INFORMATION

Quotation #: P.O. #:
Project #: 85099 Site Location/ID:

### TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days) TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 3pm or on weekends : TAT begins the next business day

**RUSH TAT (Additional Charges May Apply)** ☐ 1 Day ☐ 2 Days ☐ 3-4 Days

**PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION**

Specify Due Date: Rush Confirmation ID:

### REGULATIONS

**Regulation 153 (2011):**
☐ Table 1 ☐ Res/Park Soil Texture: ☐ Coarse
☐ Table 2 ☐ Ind/Com ☐ Medium
☐ Table 3 ☐ Agri/Other ☐ Fine
☐ Table ____

**Other Regulations:**
☐ Reg 347/558 (3 Day min TAT)
☐ PWQO ☐ MMER
☐ CCME ☐ Other:
☐ MISA

**Sewer By-Law:**
☐ Sanitary
☐ Storm
Municipality:

DRINKING WATER SAMPLES (POTABLE WATER FOR HUMAN CONSUMPTION) MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

**RECORD OF SITE CONDITION (RSC)** ☐ YES ☐ NO

### ANALYSIS REQUESTED

| | SAMPLE IDENTIFICATION | DATE SAMPLED | TIME SAMPLED | # OF BOTTLES | MATRIX | PHC F1-F4 BTEX | O.Reg153 Metals (ICP & hydride metals) | ☐Hg ☐B-HWS ☐Cr(VI) | O.Reg 153 VOCs | Calcium (e/s) | | | | | | | | COMMENTS: Field Filtered (F) Preserved (P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | TP21-02GS3 | July 20, 2021 | - | 1 | Soil | | | | | ✓ | | | | | | | | |
| 2 | TP21-03GS2 | July 20, 2021 | - | 1 | Soil | | | | | ✓ | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | |

Observations/Comments/Special Instructions

| | | | | |
|---|---|---|---|---|
| **Sampled By (NAME):** ~~M. Dancey~~ L. Tuters | **Signature:** L Tuters | Date: 09/14/21 (mm/dd/yy) | Pink Copy - Client |
| **Relinquished by (NAME):** L. Tuters | **Signature:** L Tuters | Date: 09/14/21 (mm/dd/yy) | Yellow & White Copy - SGS |

Revision #: 1.0
Date of Issue: 01 June, 2014