Lewis Pit Expansion

Maximum Predicted Water Table Report

Project Location:
W1-2 Lot 15 Concession 9, Springwater, ON

Prepared for:
Galibier Materials Inc.
151 Whitehall Drive, Markham, ON

Prepared by:
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November 11, 2021
Revised: January 11, 2022

MTE File No.: 40318-300

Engineers, Scientists, Surveyors.

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1.0 Introduction

MTE Consultants Inc. (MTE) has been retained by Galibier Materials Inc. (Galibier) to prepare a Maximum Predicted Water Table Report to support a Category 3, Class 'A' pit above-water-table license expansion application under the Aggregate Resources Act (R.S.O., 1990) (ARA) for the property located on the southern half of W1/2 Part Lot 15, Concession 9 Springwater Township (formerly Vespra), County of Simcoe, ON (hereby referred to as the "Site"). This report will also be submitted in support of a County of Simcoe Official Plan and Zoning By-Law amendment. The Site location is illustrated on **Figure 1**.

Galibier currently owns a Category 3, Class "A" pit on the northern half of W1/2 Part Lot 15, Concession 9. This pit is known as the Lewis Pit (ARA License No. 3560) (**Figure 1**).

1.1 Objectives and Scope-of-Work

Galibier and MTE collaboratively developed a scope-of-work to present a characterization of existing hydrogeological and hydrologic conditions; an interpretation of field study results; and provide a monitoring program framework that will enable transparency and an on-going assessment of compliance with the proposed conditions of the Site Plans.

This hydrogeological investigation considers the requirements of the Aggregate Resources of Ontario: Technical Reports and Information Standards, August 2020 (Ministry of Northern Development, Mines, Natural Resources and Forestry, 2020). In accordance with the reporting standards for a Maximum Predicted Water Table Report, the principle objectives of this hydrogeological investigation are to:

- Establish the maximum water table elevation on-Site;
- Provide input into the design for an above-water-table pit, including water management and drainage; and
- Provide a monitoring program framework that will include an assessment process that will enable transparency and an on-going assessment of compliance with the Site Plan commitments.

With this understanding, the scope-of-work included:

- Reviewing available literature and publically available data sources to determine the hydrogeological, hydrologic, and climatic characteristics of the Site and surrounding area.
- Investigating the geological setting and hydraulic characteristics of the proposed licensed area, through:
    - Site Reconnaissance;
    - Construction of four overburden groundwater monitoring wells;
    - Construction of three mini-piezometers; and
    - Private Well Inventory.
- Establish background groundwater elevations.

2.0 Site Description

For the purposes of this investigation, the Study Area is defined as the Site and an area 500 m from the Site boundary. The study area, including the Site boundary, geological cross-section locations, on-Site monitoring locations, off-Site monitoring locations and Ministry of the Environment, Conservation and Parks (MECP) well record locations are illustrated on **Figure 2**. The Site has a proposed licensed area of 21.1 hectares (ha) with a proposed extraction area of 17.5 ha. Current land use on-Site consists of a woodlot and a tree farm in the southwest corner (**Figure 3**).

2.1 Adjacent Land Use

North of the existing Lewis Pit, is a Class A licensed pit (Springwater Pit ARA License No. 3567) operated by the Corporation of the Township of Springwater.

Lands north of the Springwater Pit consist of, a CP rail line, forests, rural residential dwellings, and an unevaluated wetland. Lands northeast of the Site consist of the Snow Valley Ski Resort and residential neighbourhoods along Snow Valley Road.

Lands south, west and east of the Site are primarily agricultural, forest and rural residential dwellings. Additionally, a small residential neighbourhood exists east of the Site, north of Seadon Road.

The Closed Vespra Landfill Site Number 14, which was operated by the Township of Springwater, is located directly west of the Site (**Figure 2**). Environmental monitoring for this landfill is ongoing and is currently managed by WSP Global Inc. (WSP).

2.2 Topography

Site topography generally dips from southeast to northwest (**Figure 3**). Topography peaks at approximately 314 mAMSL in the southeastern corner with a minimum elevation of approximately ~280 mAMSL occurring just south of the northwestern corner of the Site.

2.3 Surface Water and Drainage

The Site and study area are entirely within the southern portion of the Willow Creek subwatershed, one of the 11 sub-watersheds of the Nottawasaga Valley Watershed. The Willow Creek Subwatershed drainage area is approximately 307 km^2 (Lake Simcoe Region Conservation Authority, 2015).

During field reconnaissance and ongoing monitoring activities, MTE staff have observed no ponds, groundwater seeps or springs on-Site.

2.4 Existing Groundwater Users

Within the study area, groundwater users comprise agricultural and industrial uses, snow making, and domestic water supply. Residential neighbourhoods along Snow Valley Road and Seadon Road rely on municipal water supply wells for their water, while rural dwellings rely on individual private water supply wells.

MTE undertook a review of Permits to Take Water (PTTW) within the vicinity of the Site. Based on MECP mapping, seven permitted water takings were identified northeast of the Site (excluding the PTTW on the existing Lewis Pit). Three PTTW's are for municipal water supply, two PTTW's are for snow making at the Snow Valley Ski Resort and two are for agricultural purposes.

2.5 Source Water Protection

The Site is located in the Nottawasaga Valley Source Water Protection Area. Based on a review of Well Head Protection Area mapping the Site is not located within any Well Head Protection Areas.

3.0 Geology and Hydrogeology

3.1 Physiography

The Site is located on the Algonquin Bluffs at the boundary between the Simcoe Uplands and the Simcoe Lowlands (**Figure 4**). The physiography surrounding the Site is defined by drumlinized till plains overlying sand plains (Chapman & Putnam, 2007).

3.2 Quaternary Geology

Regional Quaternary geology is dominated by ice-contact tills and sand & gravel sequences deposited during successive advances and retreats of the Simcoe lobe of the Laurentide ice sheet (**Figure 5**). As such, the Quaternary sequence generally consists of sand and gravel interbedded by silts and clays.

3.3 Paleozoic Geology

The underlying bedrock is composed of Ordovician age carbonates and shales of the Simcoe Group. This can be further subdivided into five formations (from oldest to youngest): Shadow Lake Formation, Gull River Formation, Bobcaygeon Formation, Verulam Formation and the Lindsey Formation. In general, these formations dip to the southwest. The Verulam Formation underlies the Study Area and is composed of interbedded bioclastic very fine grained limestone and grey-green calcareous shale (Armstrong & Dodge, 2007).

4.0 Field Program

4.1 On-Site Monitoring Wells

Between October 21 and November 4, 2019 four monitoring wells (MW3-19, MW4-19, MW5-19 & MW7-19) and one test well (TW2-19) were constructed by Durl Hopper Ltd. on the Site (**Figure 3**).

Monitoring well locations were chosen based on the following criteria:

- Longevity – long-term monitoring (outside of the extraction area);
- Proximity to off-Site receptors; and
- For the creation of a groundwater flow map across the Site.

The objective of the drilling program was to determine the depth to the water table. Monitoring well construction was completed through the use of a mud rotary drill rig. Monitoring wells were constructed using 50 mm dia. schedule 80 PVC piping. Monitoring wells were equipped with 3.05 m length 10 slot well screens. TW2-19 was constructed using 0.2 m diameter steel casing with a 6.6 m long continuous stainless steel wire wrapped 20 slot (3.8 m) and 18 slot (2.8 m) well screen. Borehole logs can be found in **Appendix A**. Following well construction, each monitoring well was developed to ensure water levels accurately reflected the surrounding groundwater conditions.

In addition to the monitoring wells, a borehole was drilled at BH6-19 to better understand the geology of the Site (**Figure 3**). Core samples were collected at this location between Oct 25 and Nov 1, 2019 by Noll Drilling Inc. A borehole log for BH6 can be found in **Appendix A**.

Two monitoring wells installed on the existing Lewis Pit, screened in the water table aquifer (MW1D & MW2D) were also included in the monitoring network used to determine the maximum predicted water table elevation.

4.2 Wetland Mini-piezometers

On November 19, 2019 MTE installed three mini-piezometers (MP) within the unevaluated Wetland north of the Site (**Figure 2**) (Photo 1, 2 & 3 **Appendix B**). MP's were installed to measure groundwater elevations within the wetland.

Following installation, monitoring wells and mini-piezometers were geodetically surveyed for location and elevation.

4.3 Private Wells

A review of MECP well record mapping indicates that there are 14 well records (excluding those well records that correspond to wells on the Lewis Pit) within the study area (**Figure 2**). The location, MECP Well Record ID, final status and primary use of each of these wells are presented in **Table 1**. The final status of the 14 wells are categorized as follows:

- 8 water supply (7 domestic,1 livestock);
- 2 observation wells;
- 3 abandoned; and
- 1 test hole.

Additional details regarding these wells are summarized below:

- One livestock well (5712517 (which replaces 5709353), three domestic wells (5713114, 5706588 & 5706148) and one observation well (5740213) are screened within the water table aquifer;
- Three domestic wells (5711867, 5713127 & 5713596) and one observation well (7048679,) are screened in deeper confined aquifers; and
- One test hole (7259982) used for vapour monitoring.

To augment the information collected from the well records, MTE conducted a private well survey on private wells users within the study area (**Figure 2**). Completed MTE private well inspection forms and accompanying MECP Well Records (if available) can be seen in **Appendix C**.

Through the private well survey, a well record not previously mapped within the study area was identified. MECP well record 7052420 was identified to exist within the study area and be screened within the water table aquifer. Additionally, based on the results of the private well survey 5712517 was reclassified as a domestic well.

After reviewing the results of the private well survey, and based on landowner permission and well accessibility two private wells, PW2 (7052420) and PW3 (5712517) were added to the monitoring network used to determine the maximum water table elevation. Both PW2 and PW3 were geodetically surveyed for location and elevation.

4.4 Off-Site Monitoring Wells

Closed Vespra Landfill Site Number 14 - Monitoring Wells

There are several monitoring wells used for environmental monitoring at the Closed Vespra Landfill Site Number 14. Based on the depth, access, and proximity to the Site, MTE identified four groundwater wells (BH19-01, BH8-II, BH85-1 and BH85-3) that would supplement groundwater data from the Site (**Figure 2**). Borehole logs for landfill monitoring wells BH19-01, BH8-II, BH85-1 and BH85-3 can be found in **Appendix A**. Access to these monitoring wells was provided by the County of Simcoe.

Snow Valley Monitoring Wells

MTE was also granted access to a monitoring well (hereby referred to as MMW1D) owned by the Snow Valley Ski Resort. MMW1D is screened in the water table aquifer and is located northeast of the Site (**Figure 2**). The MECP well record for MMW1D (7232787) can be found in **Appendix A**.

4.5 Groundwater Monitoring

As per the reporting standards, the maximum predicted water table was determined by monitoring groundwater levels for a minimum of one year to account for seasonal variations and influences due to precipitation. Continuous groundwater monitoring of on-Site monitoring wells, select mini-piezometers (MP1 & MP3) and select landfill wells (BH19-01, BH8-II, BH85-1 & BH85-3) was accomplished using dedicated pressure transducers (data loggers). Data loggers were installed between November 12 and 28, 2019 in on-Site monitoring locations and select landfill monitoring wells. Data loggers were programmed to measure a groundwater level every hour.

In addition to data logger measurements, manual groundwater levels from on-Site monitoring wells and mini-piezometers were measured 13 times between November 2019 and June 2021[1]. Manually measured groundwater elevations are shown in **Table 2**. Groundwater elevations from on-Site monitoring wells, mini-piezometers and off-Site Landfill monitoring wells are also presented in **Hydrographs 1** through **4**.

[1] Excluding those water levels measured during a 7-day pumping test (June 22-June 29, 2020) conducted on TW2-19, the results of which are addressed under a separate cover.

5.0 Groundwater Analysis

5.1 On-Site Monitoring Wells

Groundwater elevations in on-Site monitoring wells showed very little fluctuation (< 1 m) between November 2019 and June 2021 (**Hydrograph 1** & **2**). Drawdown in Tw2-19 and MW5-19 between June 22 and June 29, 2020 is related to a pumping test undertaken on-Site; the results of which are assessed under a separate cover. Additional rapid decreases in the groundwater elevation at TW2-19 and MW5-19 are attributed to short term pumping of a test well on-Site.

5.2 Wetland Mini-piezometers

As with on-Site monitoring wells, groundwater elevations in mini-piezometers installed in the unevaluated Wetland north of the Site were observed to show very little fluctuation (**Hydrograph 3**). However, data logger and local precipitation data indicate that groundwater elevations in MP3 appear to respond to local precipitation events, which was not observed in MP1. The difference in the groundwater response in MP1 and MP3 likely results from the sediments in which the mini-piezometers are screened in. MP1 is screened in a silty sand while MP3 is screened in sand and gravel. The coarseness of the sand allows for the rapid movement of water between the surface and subsurface resulting in the groundwater's quick response to precipitation events observed at MP3.

5.3 County of Simcoe Closed Vespra Landfill Monitoring Wells

The landfill monitoring wells showed very little fluctuation between November 2019 and June 2021 (**Hydrograph 4**). MTE notes decreases in the groundwater elevation of BH85-1 on several occasions between 2020 and 2021. The decrease in the groundwater elevation in BH85-1 on September 17, 2020 is related to hydraulic testing. MTE interprets the other decreases in BH85-1 on approximately October 13, 2020 and April 6, 2021 to be related to monitoring activities conducted by WSP.

Groundwater elevations in BH19-01 were observed to respond to precipitation events, however this response was not observed in the other landfill monitoring wells. The rapid response to precipitation events observed in BH19-01 is likely as a result of BH19-01 being screened closer to the surface than BH8-II, BH85-1 or BH85-3 (**Appendix A**). In addition, there is no reported overlying till layer at BH19-01 (unlike BH85-5 and BH85-3).

5.4 Private Wells

The groundwater elevation in PW2 and PW3 were measured two times in 2020[2] (**Table 2**). Based on the measurements completed in 2020 the groundwater elevation in the vicinity of PW2 and PW3 is approximately 256 and 257 mAMSL respectively.

5.5 Snow Valley Ski Resort Monitoring Well

The groundwater elevation in MMW1D was measured five times throughout 2020 and 2021[2] (**Table 2**). Based on the measurements completed in 2020 the groundwater elevation in the vicinity of MMW1D is approximately 236 mAMSL.

[2] Excluding those water levels measured during the 7-day pumping test (June 22-June 29,2020).

6.0 Maximum Water Table Elevation

Based on a review of the data collected between November 2019 and June 2021, the date at which the maximum groundwater elevation occurred in each monitoring location varies. However, the manual measurements taken on June 22, 2020 have been selected to represent the maximum water table elevation for two reasons;

- June 22, 2020 is considered to be the most complete data set, thereby best representing the elevation of the water table in and surrounding the Site; and
- With the exception of MP3, monitoring locations were on average within 0.1 m of the maximum groundwater elevation measured (**Table 2, Hydrographs 1 & 2**).

6.1 Groundwater Flow

Groundwater flow mapping was completed for the Site using the groundwater elevation data collected from all monitors, private wells, and wetland mini-piezometers on June 22, 2020 (maximum water table elevation). Groundwater contours and flow direction have been illustrated on **Figure 6.** Groundwater flows generally north/northwest towards the Minesing Wetland beneath the Site. **Figure 6** indicates that the estimated maximum groundwater elevation on-Site ranges from approximately 256 mAMSL in the southeast corner to 251 mAMSL in the northwest corner.

6.2 Geological Cross-Sections

Hydrogeological and geological data obtained from well records on file with the MECP, borehole logs from both on and off-Site (Vespra Closed Landfill) and data from the Ontario Geological Survey (OGS) were used to construct two geological cross sections within the study area (**Figure 7A** and **Figure 7B**). Geological cross-section A-A' runs approximately northwest to southeast from the Minesing Wetland through the Site to Barrie Hill Road while geological cross Section B-B' runs approximately north to south along George Johnston Road (**Figure 2**).

The geological cross sections indicate the overburden sediments in this area consist of sand and gravel units interbedded with clay and till units. Topography generally decreases from east to west (**Figure 7A**) and south to north (**Figure 7B**). Those areas considered within the Simcoe Uplands (higher topography) are mapped by the OGS as having a layer of till between the surface and the underlying sand and gravel unit. The till layer is mapped to pinch out with decreasing topography. However, based on borehole logs from on-Site monitoring wells the presence and thickness of this till unit is not consistent across the Site. As such, underlying sand and gravel unit is considered to be an unconfined, or the water table aquifer. Cross-sections A-A' and B-B' also illustrate the maximum elevation of the water table beneath the Site.

7.0 Proposed Pit Floor

As per the Aggregate Resources Act standards, extraction of material for a Category 3, Class "A" pit above-water-table extraction is restricted to aggregate material no closer than 1.5 metres above the maximum predicted water table. As such, the pit floor elevation must be 1.5 metres above the estimated high water table. The proposed pit floor will range from approximately 257.5 mAMSL in the southeast corner to 252.5 mAMSL in the northwest corner.

8.0 Impact Assessment

As this application is for an above water table pit, MTE does not anticipate there to be any resulting drawdown in the water table aquifer. As such, nearby features will be unaffected by aggregate extraction.

9.0 Monitoring Program

MTE recommends that manual groundwater levels be collected three times per year, once in the spring, summer and fall, at on-Site monitoring well locations. Monitoring should be done on an annual basis throughout the life of the operation to monitor the water table elevation as above water table extraction occurs.

MTE recommends that the groundwater level data be retained on-file by Galibier to be made available upon request by agencies such as the Ministry of Northern Development, Mines, Natural Resources and Forestry (NDMNRF), MECP and County of Simcoe.

Monitoring wells that may be destroyed by extraction activities should be decommissioned according to the Wells Regulation (*O.Reg. 903)* and subsequently replaced at a location that will ensure the new monitoring well will remain intact to allow groundwater monitoring to continue.

10.0 Spills Contingency Plan

In accordance with the Prescribed Conditions developed to support the Aggregate Resources Act, a spills contingency plan must be developed prior to Site preparation. The plan must address:

- Secondary containment and traffic control for chemical storage and handling;
- Chemical storage security such as locks and controlled Site access;
- Required contents of spill response kits such as containment booms, drain covers, etc.;
- Spill response procedures;
- Spill reporting protocols;
- Staff training; and
- Documentation.

A Spill Contingency Plan has been developed for the existing Lewis Pit (**Appendix D**). MTE recommends that this plan be adopted for the Site. In the unlikely event of a spill, MTE recommends that the Licensee retain a Qualified Person.

11.0 Conclusions

Based on the above hydrogeological investigation, MTE offers the following conclusions:

1. The maximum water table elevation on-Site ranges from approximately 251 mAMSL on the north boundary to 256 mAMSL on the south boundary.
2. As the application is for an above water table pit groundwater will not be drawn down. As such, nearby features such as the Minesing Wetland, closed Vespra Landfill Site Number 14 and private wells in the area will be unaffected by aggregate extraction.

12.0 Recommendations

Based on the above hydrogeological investigation, MTE offers the following recommendations:

1. MTE recommends that manual water levels will be collected on a seasonal basis, three times per year, once in the spring, summer and fall, at on-Site monitoring wells.
2. MTE recommends that the annual groundwater monitoring program extend throughout the life of the operation to monitor the elevation of the water table over time.
3. MTE recommends the results of the monitoring be retained on-file by Galibier in the event this information is requested by agencies such as the NDMNRF, MECP or County of Simcoe.
4. MTE recommends monitoring wells that may be destroyed by extraction activities be decommissioned according to the Wells Regulation (O.Reg. 903) and subsequently replaced at a location that will ensure the new monitoring well will remain intact to allow groundwater monitoring to continue.
5. MTE recommends the Spill Contingency Plan for the existing Lewis Pit be adopted for the Site. In the unlikely event of a spill, MTE recommends that the Licensee retain a Qualified Person.

13.0 Limitations

Services performed by **MTE Consultants Inc.** (MTE) were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the Environmental Engineering & Consulting profession. No other warranty or representation expressed or implied as to the accuracy of the information, conclusions or recommendations is included or intended in this report.

This report was completed for the sole use of MTE and Galibier. It was completed in accordance with the Scope of Work referred to in Section 1.1. As such, this report may not deal with all issues potentially applicable to the Site and may omit issues, which are or may be of interest to the reader. MTE makes no representation that the present report has dealt with any and all of the important features, including any or all important environmental features, except as provided in the Scope of Work. All findings and conclusions presented in this report are based on Site conditions as they existed during the time period of the investigation. This report is not intended to be exhaustive in scope or to imply a risk-free facility.

Any use which a third party makes of this report, or any reliance on, or decisions to be made based upon it, are the responsibility of such third parties. MTE accepts no responsibility for liabilities incurred by or damages, if any, suffered by any third party as a result of decisions made or actions taken, based upon this report. Others with interest in the Site should undertake their own investigations and studies to determine how or if the condition affects them or their plans.

It should be recognized that the passage of time may affect the views, conclusions and recommendations (if any) provided in this report because environmental conditions of a property can change. Should additional or new information become available, MTE recommends that it be brought to our attention in order that we may re-assess the contents of this report.

Should you have any questions or concerns, please do not hesitate to contact us.

Respectfully Submitted,

MTE Consultants Inc.

2022-01-28

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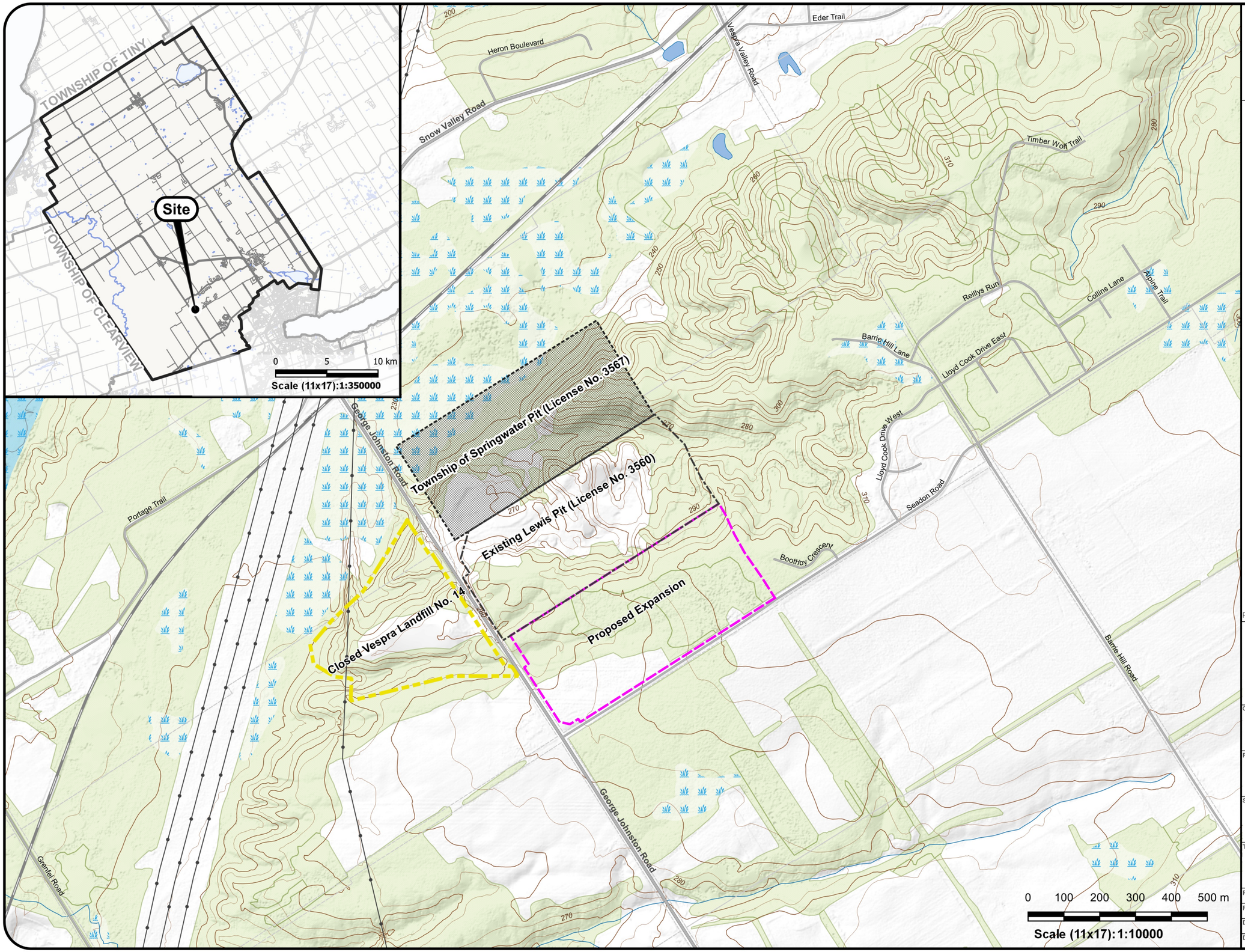
Figures



N
NORTH

N
PROJECT NORTH

Legend

Boundaries
- Lewis Pit
- Proposed Expansion
- Springwater Township Pit
- Closed Vespra Landfill No.14

Transportation
- Railway
- Roads

Misc.
- Utility Line (Hydro)

Boundaries
- Geographic Lot

Surface Water
- Surface Waterbody
- Surface Watercourse
- Minesing Wetland
- Unevaluated Wetland

Groundsurface
- Groundsurface Contour (5m Interval)

Landuse
- Wooded Area

Data Sources:

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Project CRS: NAD83 / UTM zone 17N

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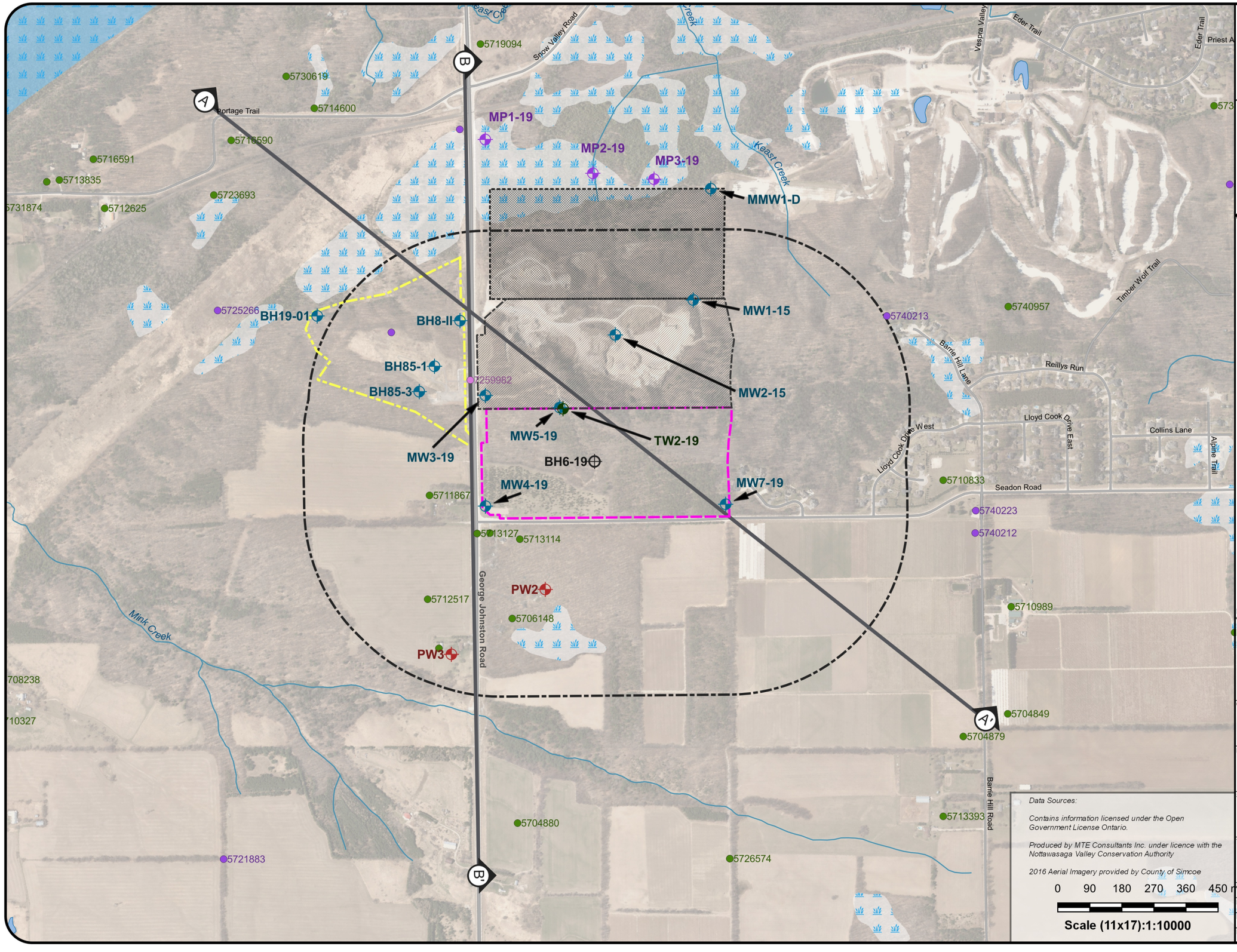
Client: Galibier Materials Inc.

Project: Lewis Pit Expansion - Maximum Predicted Water Table Report

Site: Lot 15, Concession 9, Springwater (Formerly Vespra) Township
County of Simcoe

Title: **Key Map**

Reviewed By	PAG		
Prepared By	TFC	Project No	40318-300
Drawn By	MDE	Figure No	1
Date	Nov. 2021		



NORTH

PROJECT NORTH

Legend

Boundaries
- Proposed Expansion
- Lewis Pit
- Springwater Township Pit
- Closed Vespra Landfill No. 14
- Study Area
- Geological Cross Section Location

Monitoring Locations
- Monitoring Well
- Test Well
- Minipiezometer
- Private Well
- Borehole

MECP Well Records
- Observation Wells
- Test Hole
- Water Supply

Transportation
- Railway
- Roads

Surface Water
- Surface Watercourse
- Surface Waterbody
- Minesing Wetland
- Unevaluated Wetland

Project CRS: NAD83 / UTM zone 17N

Data Sources:

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2016 Aerial Imagery provided by County of Simcoe

0 90 180 270 360 450 m

Scale (11x17):1:10000

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Client: Galibier Materials Inc.

Project: Lewis Pit Expansion - Maximum Predicted Water Table Report

Site: Lot 15, Concession 9, Springwater (Formerly Vespra) Township
County of Simcoe

Title: **Study Area Map**

Reviewed By	PAG		
Prepared By	TFC	Project No	40318-300
Drawn By	MDE	Figure No	2
Date	Nov. 2021		

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AR1.2

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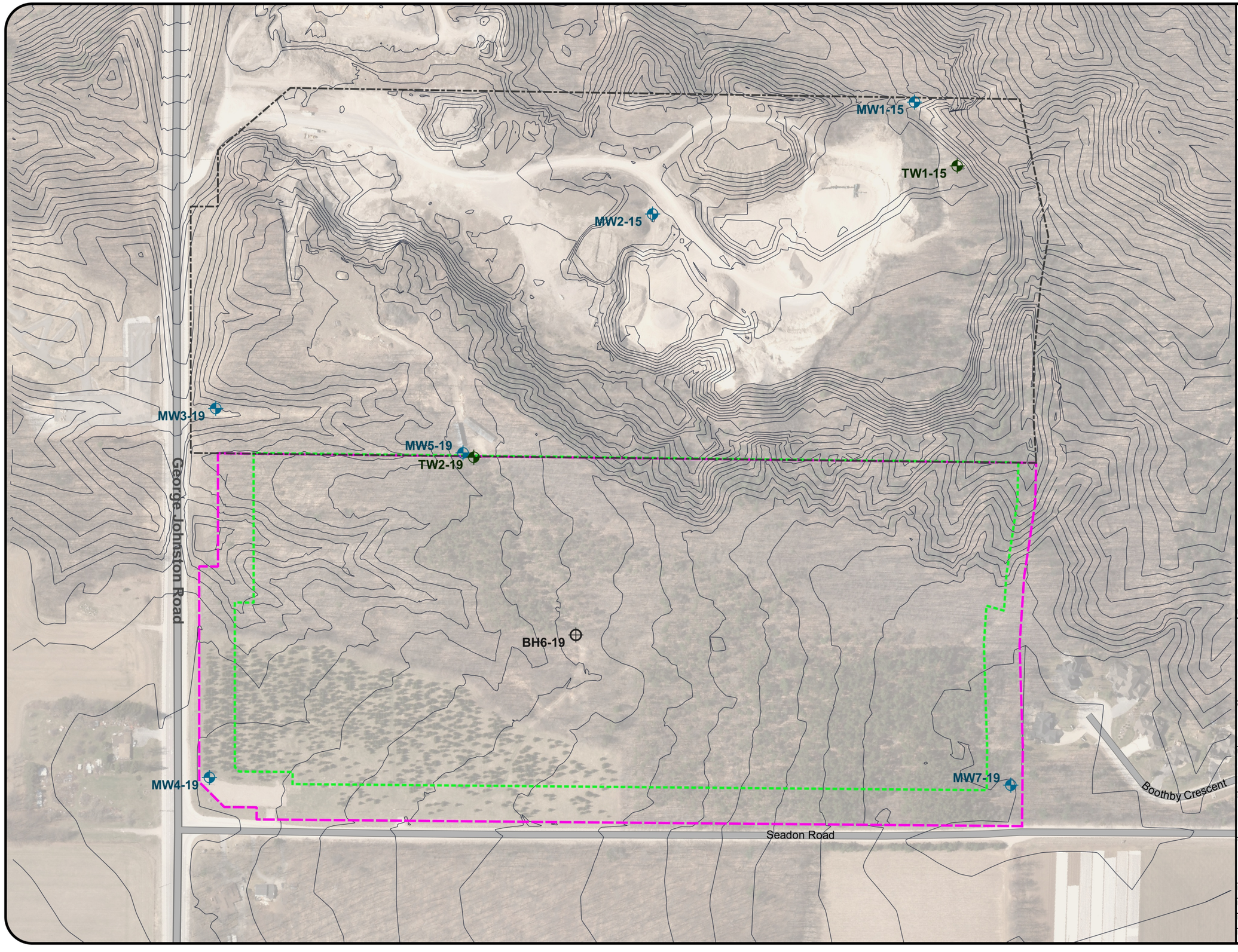

NORTH

PROJECT NORTH

Legend

Boundaries
- Lewis Pit
- Proposed Expansion
- Extraction Area

Monitoring Locations
- Monitoring Well
- Test Well
- Borehole

Groundsurface
- Groundsurface Contour (2 m Interval)

Transportation
- Roads

Data Sources:

Toopographic Information provided by J.D. Barnes Ltd.

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0 20 40 60 80 100 m

Scale (11x17): 1:3000

Project CRS: NAD83 / UTM zone 17N

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Client: Galibier Materials Inc.

Project: Lewis Pit Expansion - Maximum Predicted Water Table Report

Site: Lot 15, Concession 9, Springwater (Formerly Vespra) Township County of Simcoe

Title: **Site Map**

Reviewed By	PAG		
Prepared By	TFC	Project No	40318-300
Drawn By	MDE	Figure No	3
Date	Jan. 2022		

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AR1.3

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AR1.4

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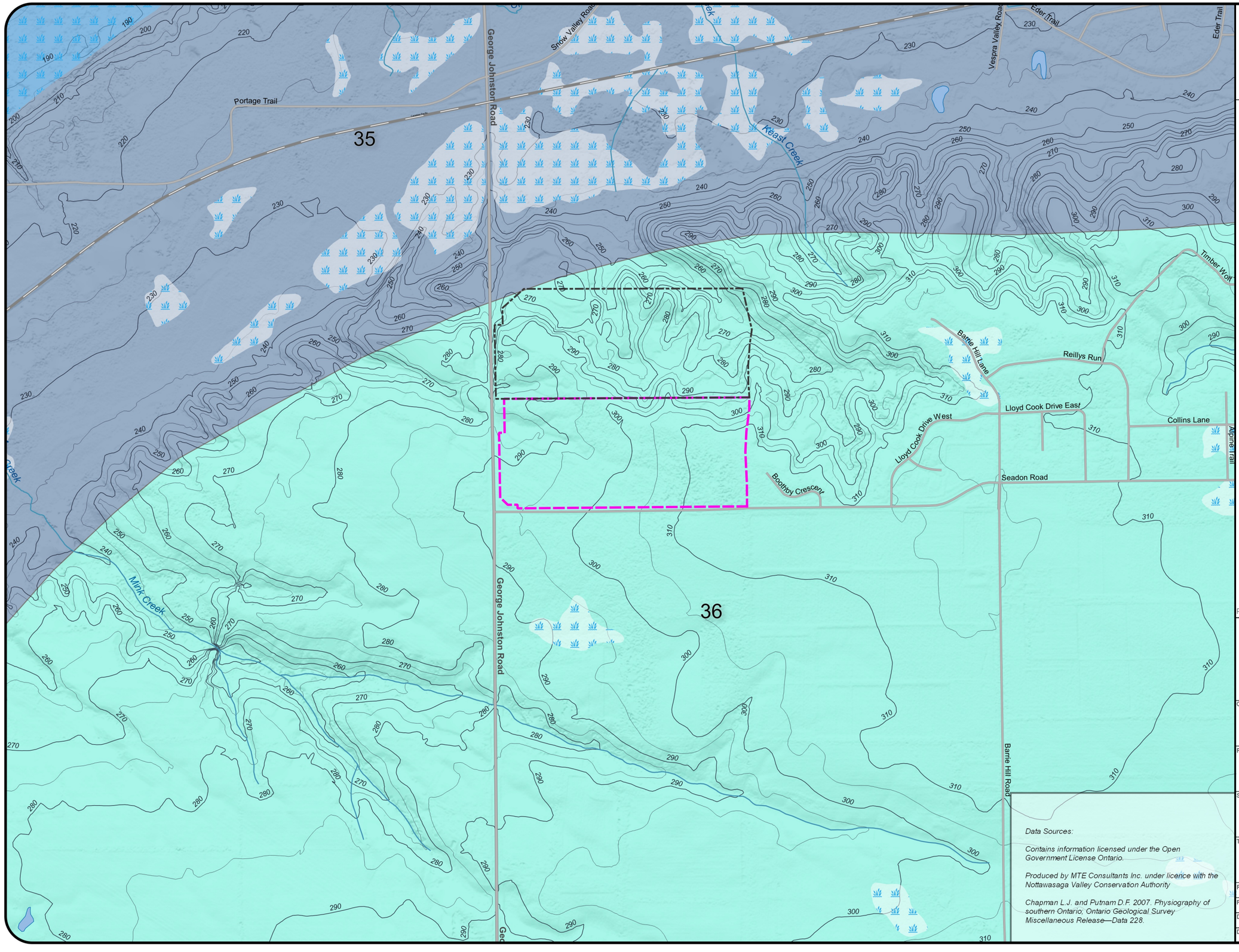

NORTH

PROJECT NORTH

Legend

Boundaries
- Lewis Pit
- Proposed Expansion

Transportation
- Railway
- Roads

Surface Water
- Surface Waterbody
- Surface Watercourse
- Minesing Wetland
- Unevaluated Wetland

Groundsurface
- Groundsurface Contour (5m Interval)

Physiographic Regions
- 35. Simcoe Lowlands
- 36. Simcoe Uplands

0 90 180 270 360 450 m

Scale (11x17): 1:10000

Project CRS: NAD83 / UTM zone 17N

Data Sources:

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Chapman L.J. and Putnam D.F. 2007. Physiography of southern Ontario; Ontario Geological Survey Miscellaneous Release—Data 228.

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Client: Galibier Materials Inc.

Project: Lewis Pit Expansion - Maximum Predicted Water Table Report

Site: Lot 15, Concession 9, Springwater (Formerly Vespra) Township
County of Simcoe

Title: **Physiographic Landforms**

Reviewed By	PAG		
Prepared By	TFC	Project No	40318-300
Drawn By	MDE	Figure No	4
Date	Nov. 2021		

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AR1.5

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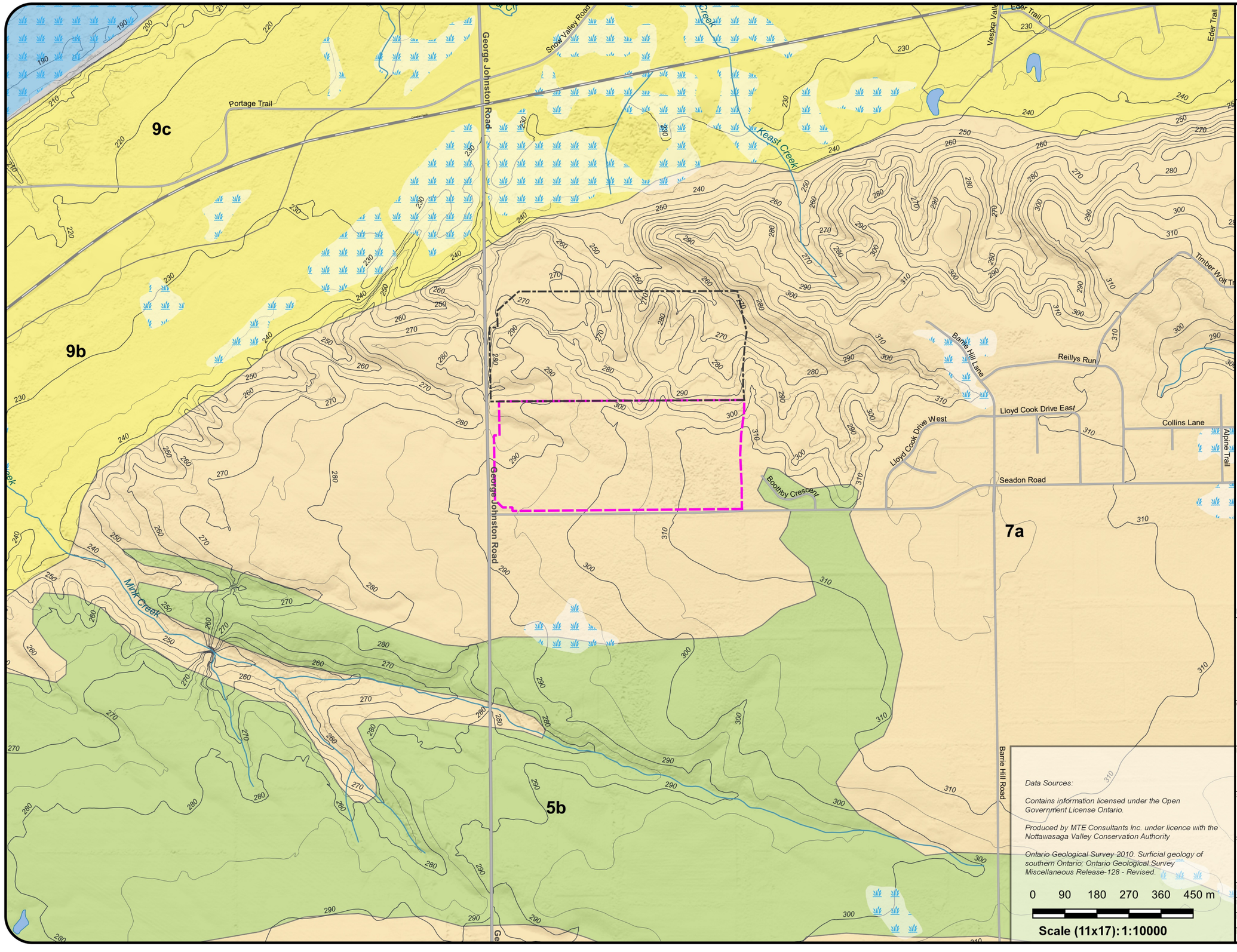

NORTH

PROJECT NORTH

Legend

Boundaries
- Lewis Pit
- Proposed Expansion

Transportation
- Railway
- Roads

Surface Water
- Surface Watercourse
- Surface Waterbody
- Minesing Wetland
- Unevaluated Wetland

Groundsurface
- Groundsurface Contour (5m Interval)

Geology

Quaternary Geology

Quaternary
- 20. Organic Deposits: peat, muck, marl
- 9. Coarse-textured glaciolacustrine deposits: sand, gravel, minor silt and clay
- 9a. Deltaic deposits
- 9b. Littoral deposits
- 7. Glaciofluvial deposits: river deposits and delta topset facies
- 7a. Sandy deposits
- 5b. Stone-poor, sandy silt to silty sand-textured till on Paleozoic terrain

Project CRS: NAD83 / UTM zone 17N

Data Sources:

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Produced by MTE Consultants Inc. under licence with the Nottawasaga Valley Conservation Authority

Ontario Geological Survey 2010. Surficial geology of southern Ontario; Ontario Geological Survey Miscellaneous Release-128 - Revised.

0 90 180 270 360 450 m

Scale (11x17): 1:10000

MTE
Engineers,Scientists, Surveyors
Ph. (519) 743-6500

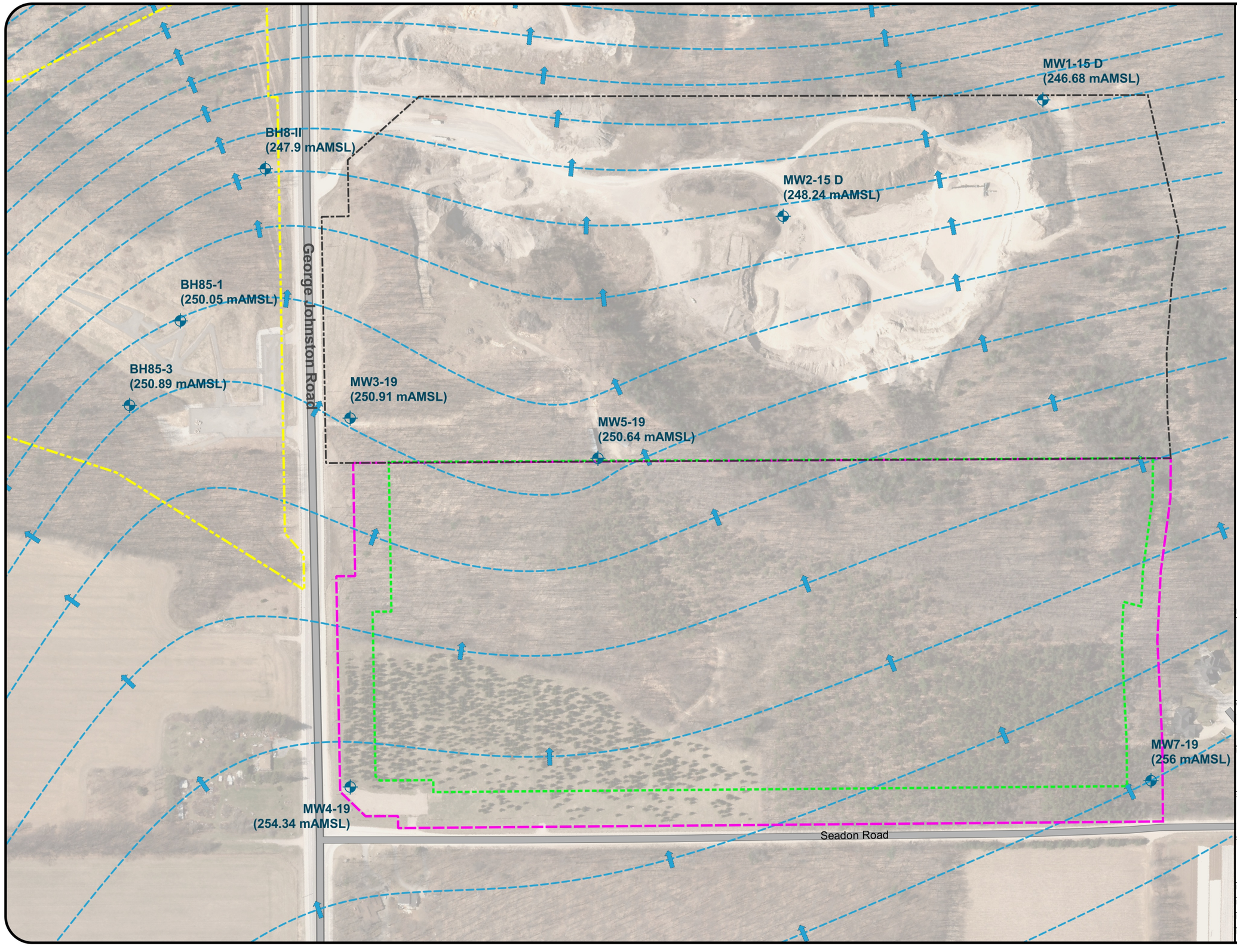
Client: Galibier Materials Inc.

Project: Lewis Pit Expansion - Maximum Predicted Water Table Report

Site: Lot 15, Concession 9, Springwater (Formerly Vespra) Township
County of Simcoe

Title: **Quaternary Geology**

Reviewed By	PAG		
Prepared By	TFC	Project No	40318-300
Drawn By	MDE	Figure No	5
Date	Nov. 2021		



NORTH

PROJECT NORTH

Legend

Boundaries
- Lewis Pit
- Proposed Expansion
- Extraction Area
- Closed Vespra Landfill No. 14

Wells
- Monitoring Well (Maximum Groundwater Elevation mAMSL)

Groundwater Flow
- Groundwater Contour (1 m Interval) and Inferred Flow Direction

Base Map

Transportation
- Roads

Data Sources:

Contains information licensed under the Open Government License Ontario.

Produced by MTE Consultants Inc. under licence with the Nottawasaga Valley Conservation Authority

2016 Aerial Imagery provided by County of Simcoe

0 20 40 60 80 100 m

Scale (11x17): 1:3000

Project CRS: NAD83 / UTM zone 17N

MTE
Engineers,Scientists, Surveyors
Ph. (519) 743-6500

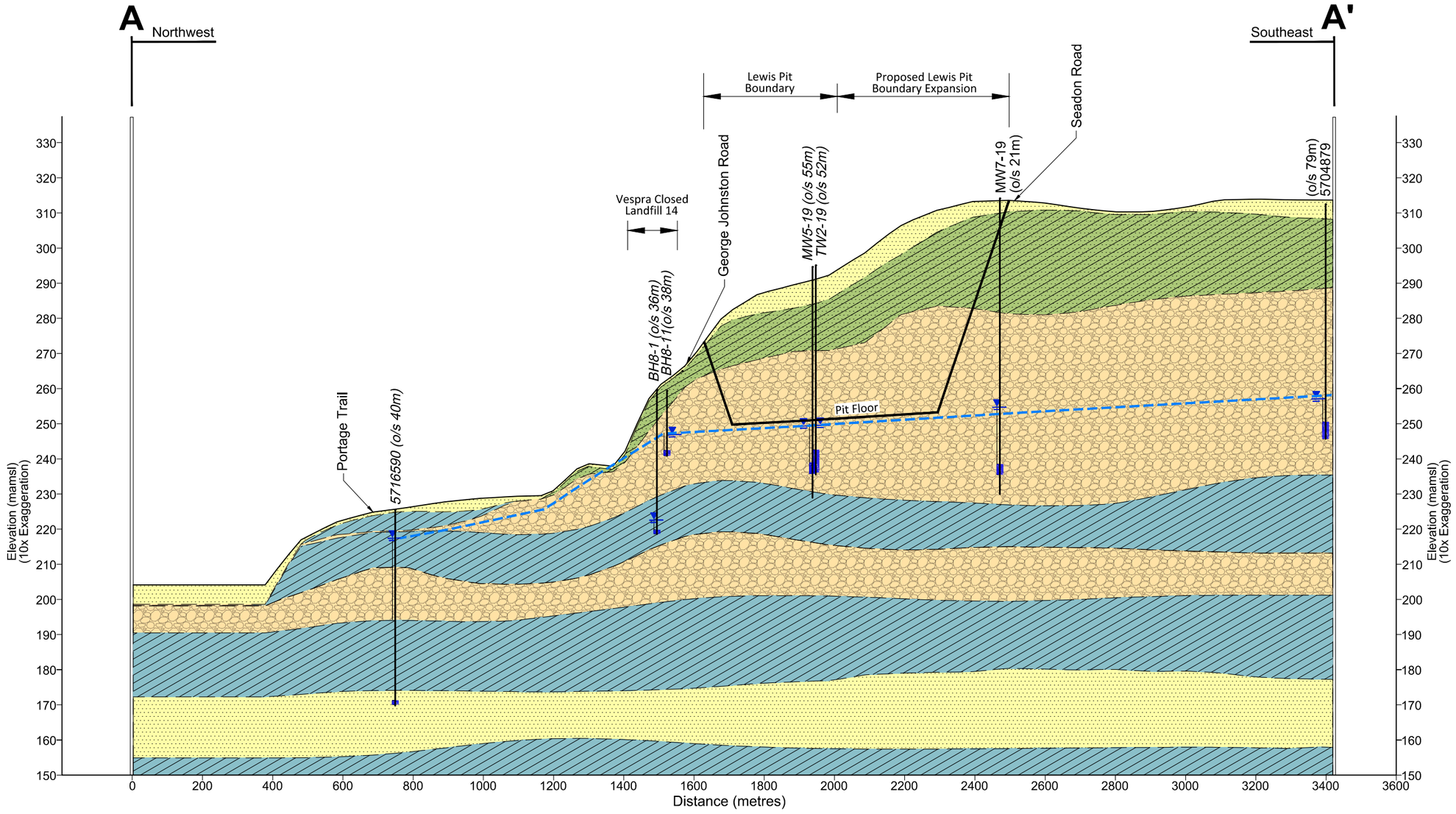
Client: Galibier Materials Inc.

Project: Lewis Pit Expansion - Maximum Predicted Water Table Report

Site: Lot 15, Concession 9, Springwater (Formerly Vespra) Township
County of Simcoe

Title: **Maximum Water Table Elevation**

Reviewed By	PAG		
Prepared By	TFC	Project No	40318-300
Drawn By	MDE	Figure No	6
Date	Jan. 2022		



NOTE:

GEOLOGICAL SEQUENCE IS BASED ON PROFESSIONAL INTERPRETATION FROM THE OVERBURDEN SEDIMENTS ENCOUNTERED DURING DRILLING, REPORTED IN MECP WELL LOGS AND OR MAPPED BY THE ONTARIO GEOLOGICAL SURVEY. ACTUAL GEOLOGICAL CONDITIONS CAN VARY BETWEEN LOCATIONS.

LEGEND

- Sand
- Silty Sand Till
- Sand & Gravel
- Silty Clay Till
- Interpreted Water Table

mamsl = metres above mean sea level

MW103 (o/s 3.7m)
- Sample Location ID & Offset Distance
- Borehole
- Water Level
- Well Screen

0 125 250 375 500 625m

Scale(11x17): 1:12500

MTE
Engineers, Scientists, Surveyors
Ph. (519) 743-6500

CLIENT
Galbier Materials Inc.

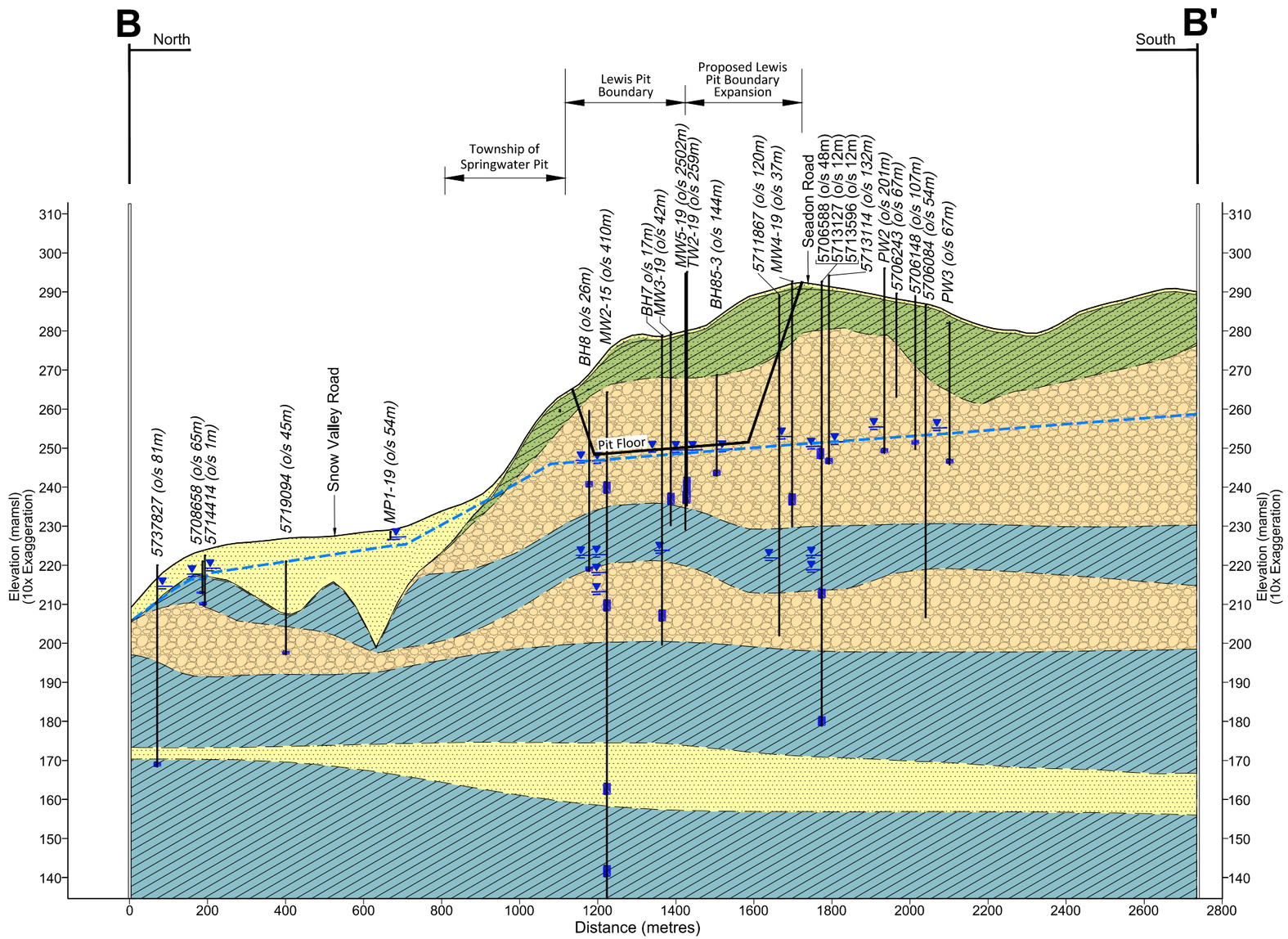
PROJECT
Lewis Pit Expansion - Maximum Water Table Report

SITE
Lot 15, Concession 9, Springwater (Formerly Vespra) Township

TITLE
Geological Cross-Section A-A'

Reviewed By	PAG		
Prepared By	TFC	Project No.	40318-300
Drawn By	EMM	Figure No.	7a
Date	November 2021		

Project: 40318-300 CAD: P:\40318\300\40318-300-XS1.DWG
Cross-Section A-A'
March 3, 2021 - 9:58 a.m. - Plotted By: SLemieux



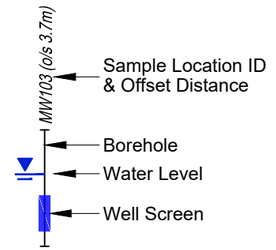
NOTE:

GEOLOGICAL SEQUENCE IS BASED ON PROFESSIONAL INTERPRETATION FROM THE OVERBURDEN SEDIMENTS ENCOUNTERED DURING DRILLING, REPORTED IN MECP WELL LOGS AND OR MAPPED BY THE ONTARIO GEOLOGICAL SURVEY. ACTUAL GEOLOGICAL CONDITIONS CAN VARY BETWEEN LOCATIONS.

LEGEND

- Sand
- Silty Sand Till
- Sand & Gravel
- Silty Clay Till
- Interpreted Water Table

mamsl = metres above mean sea level



0 125 250 375 500 625m

Scale(11x17): 1:12500

MTE
Engineers, Scientists, Surveyors
Ph. (519) 743-6500

CLIENT
Galbier Materials Inc.

PROJECT
Lewis Pit Expansion - Maximum Water Table Report

SITE
Lot 15, Concession 9, Springwater (Formerly Vespra) Township

TITLE
Geological Cross-Section B-B'

Reviewed By	PAG		
Prepared By	TFC	Project No.	40318–300
Drawn By	EMM	Figure No.	7b
Date	November 2021		

Project: 40318–300 CAD: P:\P\40318\300\40318–300–XS1.DWG
Cross–Section B–B' — Plotted By: SLemieux
March 3, 2021 — 9:56 a.m.

Tables

Table 1: MECP Well Records within the Study Area

MECP Well Record #	Date Completed	UTM Zone	Easting	Northing	Total Depth	Static Level (m)	Final Status	Primary Use
5706148	18-Jan-69	17	595794	4916353	39.3	32.6	Water Supply	Domestic
5706588	5-Aug-69	17	595614	4916523	45.7	41.8	Water Supply	Domestic
5709353	9-Sep-72	17	595664	4916173	36.6	27.4	Water Supply	Domestic
5711867	16-Sep-74	17	595414	4916523	87.2	66.8	Water Supply	Domestic
5712517	7-May-75	17	595564	4916273	37.2	25.9	Water Supply	Livestock
5713114	11-Jul-75	17	595694	4916553	48.2	42.1	Water Supply	Domestic
5713127	30-Sep-75	17	595584	4916503	81.1	69.5	Water Supply	Domestic
5713596	30-Jun-76	17	595584	4916503	113.7	78.6	Water Supply	Domestic
5740213	28-Sep-05	17	596236	4917630	62.8	55.9	Observation Wells	Municipal
7048679	17-Jul-07	17	595081	4916854	24.1	NA	Observation Wells	Monitoring
7123797	18-Mar-09	17	595227	4916985	9.1	NA	Abandoned-Other	NA
5706084	21-Dec-68	17	595764	4916303	79.9	NA	Abandoned-Supply	NA
5706243	9-Apr-69	17	595734	4916373	26.5	NA	Abandoned-Supply	NA
7259982	4-Mar-16	17	595340	4916858	9.1	NA	Test Hole	Test Hole

Table 2: Manually Measured Groundwater Elevations (mAMSL)

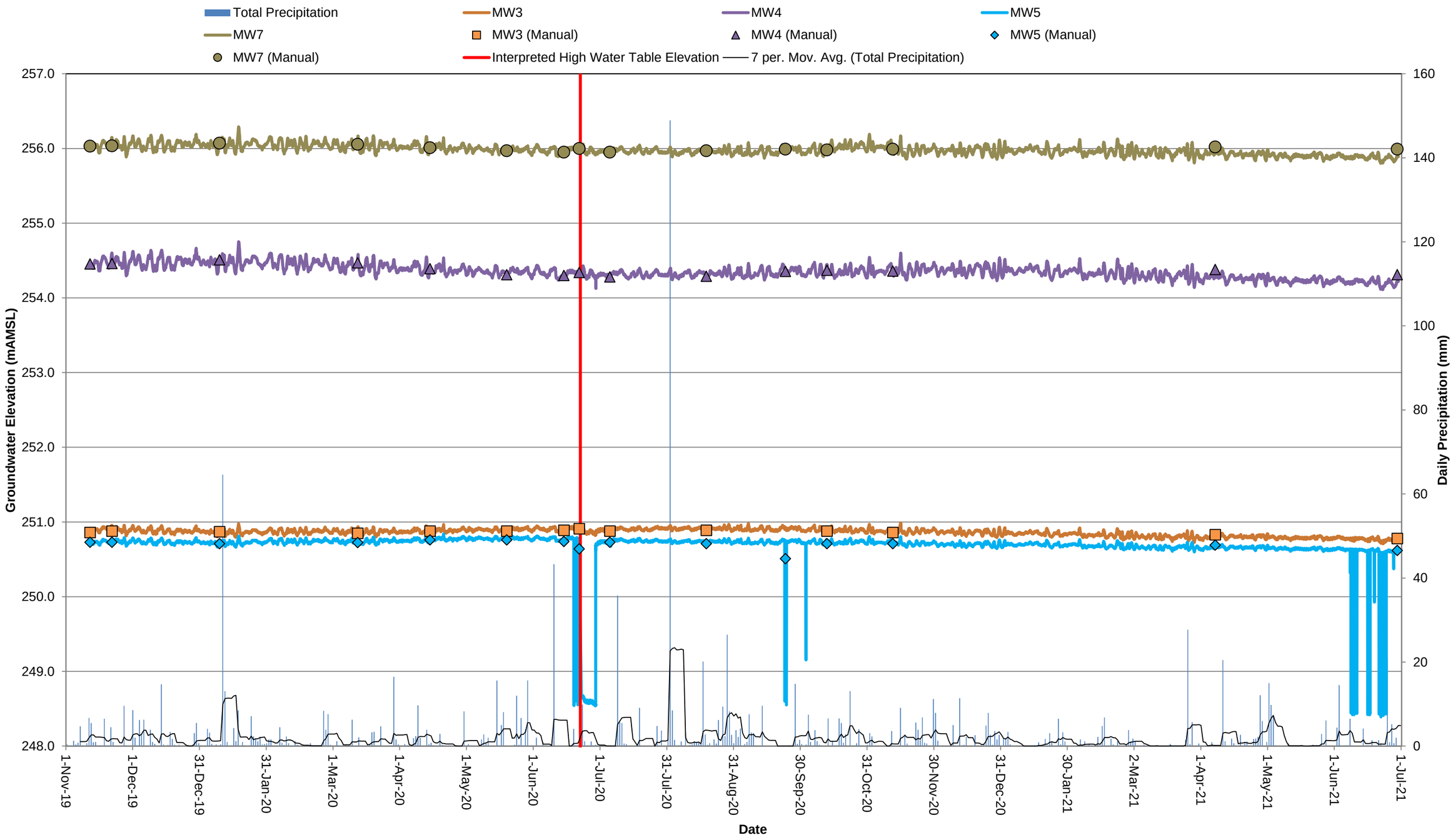
Date	MW1D-15	MW2D-15	MW3-19	MW4-19	MW5-19	MW7-19	MP1-19	MP2-19	MP3-19	BH8-II	BH85-3	BH85-1	BH19-01	PW2	PW3	MMW1-D
11/12/2019	-	-	250.86	254.46	250.73	256.03	227.43	231.07	231.65	-	-	-	-	-	-	-
11/22/2019	246.66	248.05	250.88	254.46	250.73	256.04	228.71	231.77	231.82	-	-	-	-	-	-	-
11/28/2019	-	-	-	-	-	-	-	-	-	247.69	250.82	250.04	238.05	-	-	-
1/10/2020	246.56	248.01	250.87	254.51	250.71	256.07	228.61	231.75	231.72	-	-	-	-	-	-	-
3/13/2020	246.60	248.10	250.85	254.47	250.73	256.06	228.70	231.84	232.06	-	-	-	-	-	-	-
4/15/2020	246.67	248.19	250.88	254.39	250.76	256.01	228.68	231.75	231.73	-	-	-	-	256.29	-	-
5/20/2020	246.66	248.15	250.88	254.31	250.76	255.97	228.61	231.73	231.73	247.87	250.82	250.02	238.19	-	-	-
6/15/2020	246.67	248.24	250.89	254.30	250.74	255.95	228.59	231.69	231.58	-	-	-	-	-	-	-
6/22/2020	246.68	248.24	250.91	254.34	250.64	256.00	228.64	231.74	231.59	247.90	250.89	250.05	238.17	256.24	257.05*	
7/6/2020	246.72	248.41	250.88	254.28	250.73	255.95	228.50	231.47	231.37	-	-	-	-	-	256.98	236.00
8/19/2020	246.61	248.12	250.89	254.29	250.71	255.97	228.64	231.59	231.52	-	-	-	-	-	-	-
9/16/2020	-	-	-	-	-	-	-	-	-	-	250.89	-	237.96	-	-	-
9/17/2020	-	-	-	-	-	-	-	-	-	247.76	-	249.70	-	-	-	-
9/24/2020	246.58	248.09	n/a	254.36	250.51	255.99	228.66	231.60	231.52	-	-	-	-	-	-	235.96
10/13/2020	246.56	248.06	250.88	254.37	250.71	255.98	228.69	231.76	231.74	-	-	-	-	-	-	-
11/12/2020	246.55	248.02	250.86	254.36	250.71	255.99	228.64	231.77	231.67	-	-	-	-	-	-	-
4/8/2021	246.55	248.07	250.83	254.38	250.69	256.02	228.63	231.77	231.83	-	-	-	-	-	-	235.80
6/30/2021	246.51	247.99	250.78	254.31	250.62	255.99	228.67	231.81	231.89	247.69	250.69	249.88	238.11	-	-	235.74

Notes: - = not measured, n/a = measurement error

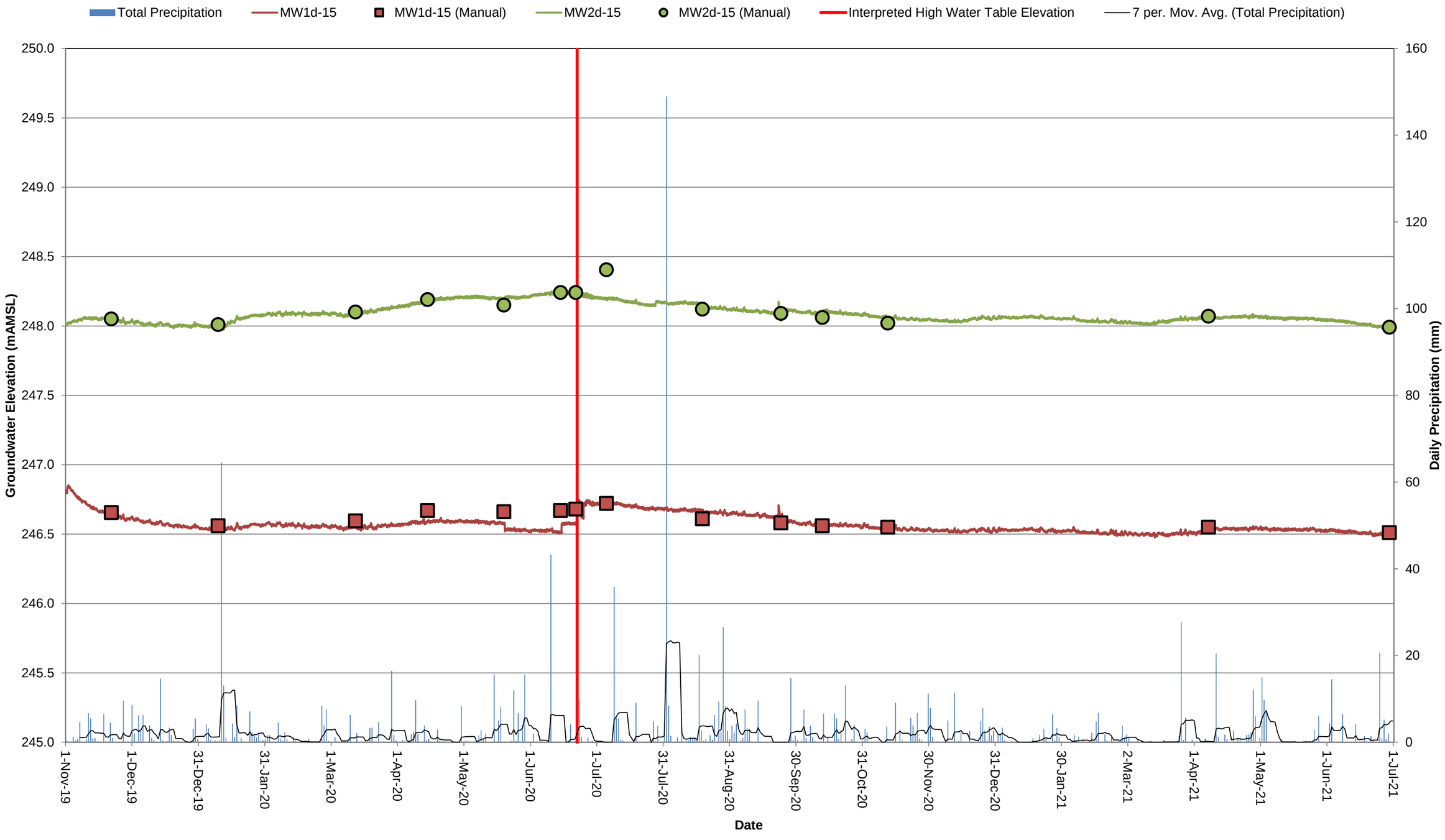
* measurement taken on June 23, 2020

Hydrographs

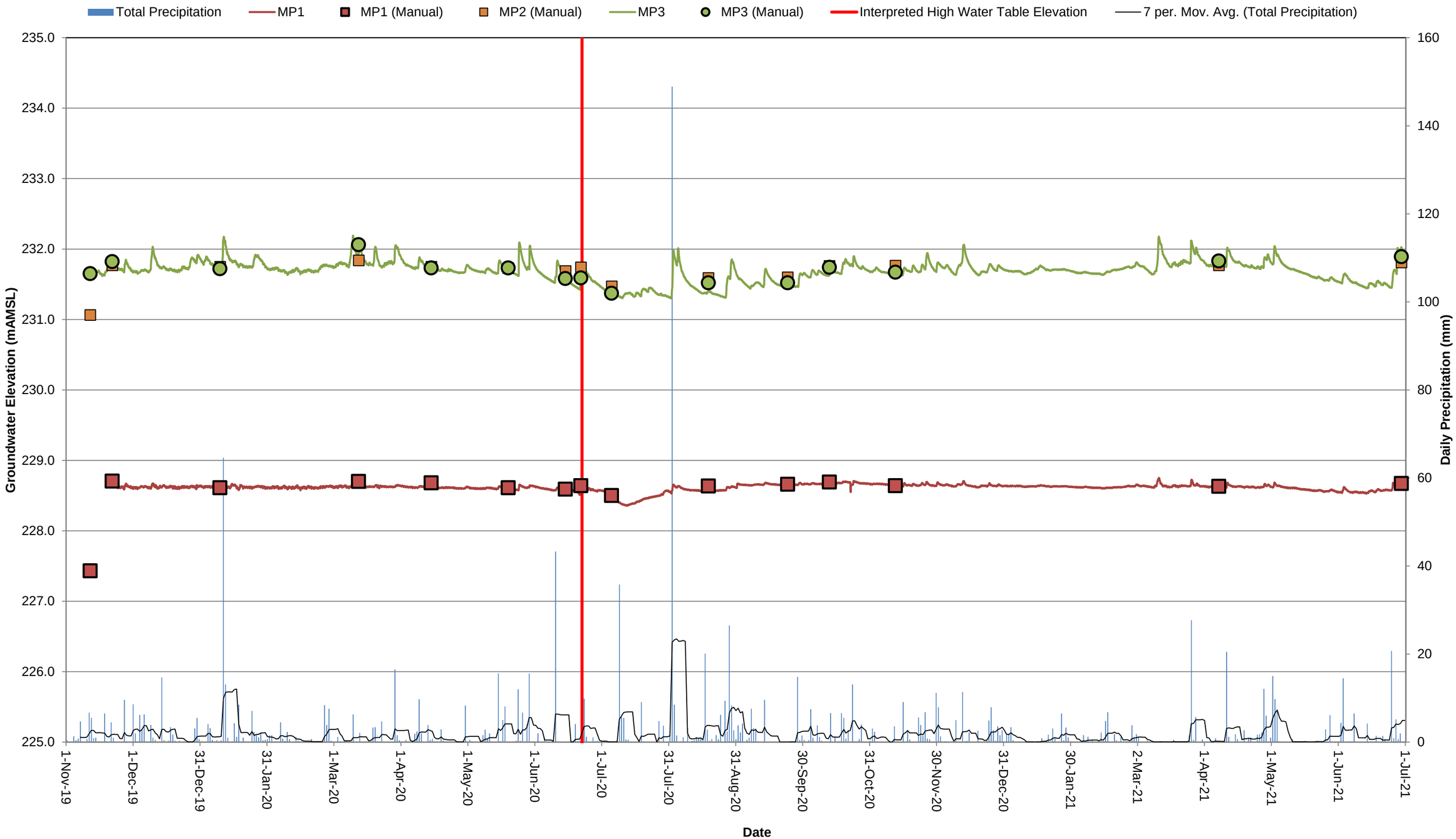
Hydrograph 1: Groundwater Elevations (mAMSL) - MW3-19, MW4-19, MW5-19 & MW7-19



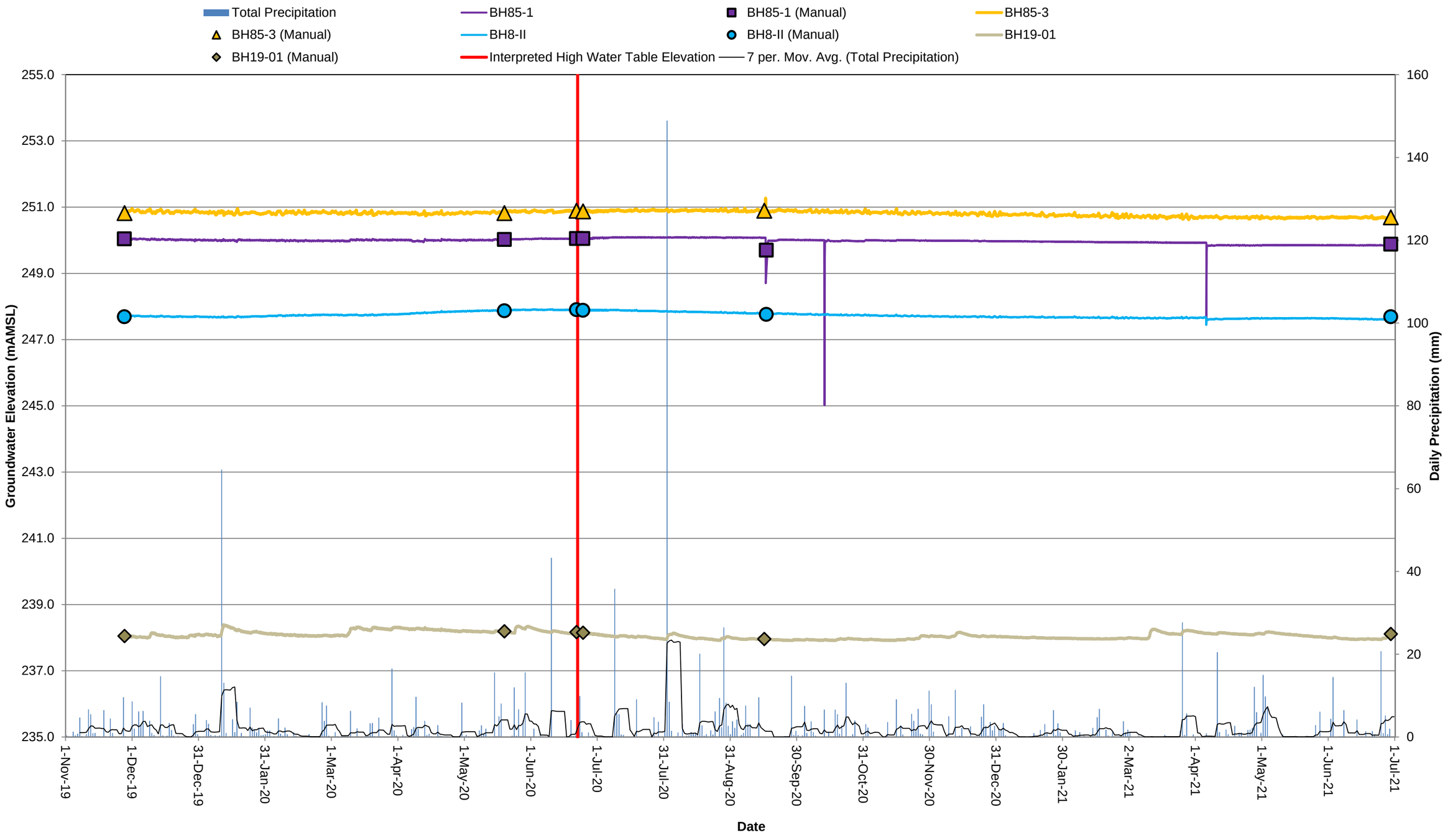
Hydrograph 2: Groundwater Elevations (mAMSL) - MW1D15 & MW2D-15



Hydrograph 3: Groundwater Elevations (mAMSL) - Mini-Piezometers - MP1, MP2 & MP3



Hydrograph 4: Groundwater Elevations (mAMSL) - County of Simcoe Closed Landfill No. 14 - Monitoring Wells



Appendix A

Borehole Logs

ID No.: MW3-19

Project Name: Galibiber Lewis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 10/25/2019

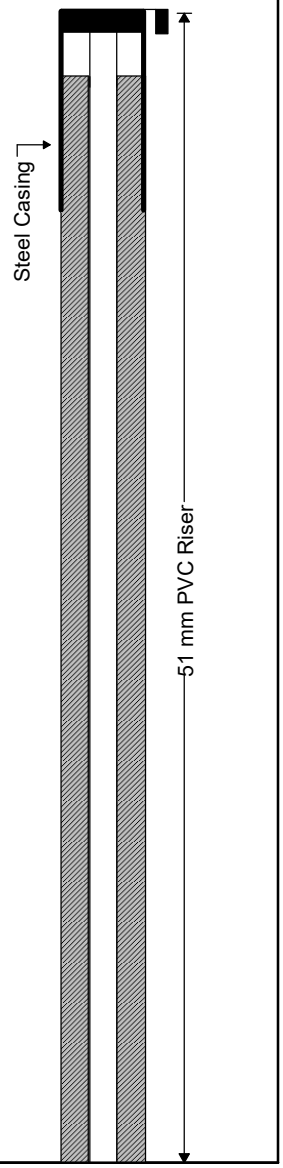
Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	
ft / m		Ground Surface	279.6						
0 / 0		**SAND AND GRAVEL**	0.0						
2 /									
4 /									
6 / 2									
8 /									
10 /									
12 / 4									
14 /									
16 /									
18 /									
20 / 6									
22 /									
24 /									
26 / 8									
28 /									
30 /									
32 / 10									
34 /									
36 /									
38 / 12									
40 /									
42 /									
44 /									
46 / 14									



Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: MW3-19

Project Name: Galibiber Lewis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 10/25/2019

Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	
48		**SAND AND GRAVEL**	264.9						
50		**SILTY SANDY GRAVEL**	14.6						
52	16								
54									
56									
58	18								
60									
62									
64									
66	20								
68			258.8						
70		**GRAVEL**	20.7						
72	22								
74									
76									
78	24								
80									
82									
84			253.7						
86	26	**SAND**	25.9						
88									
90									
92	28								
94									
96									

November 12, 2019

51 mm PVC Riser

Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: MW3-19

Project Name: Galibiber Lewis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 10/25/2019

Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	
98 30			249.1						
100		SANDY CLAY	30.5						
102									
104 32									
106									
108									
110									
112 34			245.1						
114		SAND	34.4						
116									
118 36									
120									
122									
124 38									
126									
128									
130									
132 40									
134									
136			237.8						
138 42		SAND	41.8						
140									
142									
144 44									
146			235.1						
		CLAY	44.5						

Bentonite

Sand Pack

51mm Slotted Screen

Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: MW3-19

Project Name: Galibiber Lewis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 10/25/2019

Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	Well Completion Details
148 150 46 152 154 156 48 158 160 162 164 50 166 168 170 52 172 174 176 54 178 180 182 56 184 186 188 190 58 192 194 196 60		Drilling Terminated	230.2 49.4						

Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: MW4-19

Project Name: Galibier Lewis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 10/25/2019

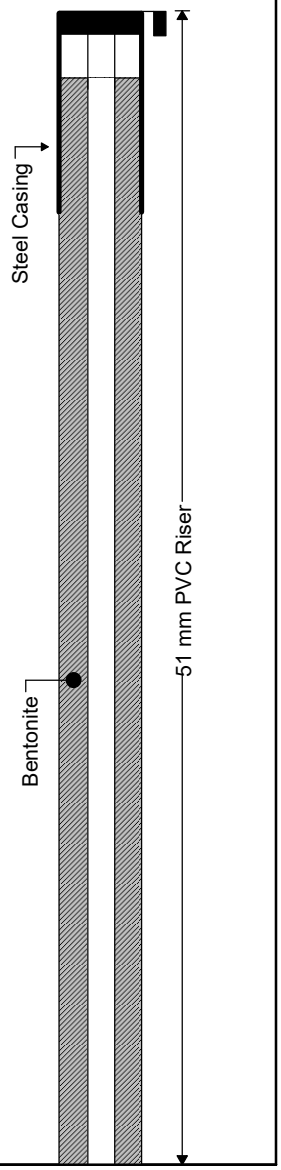
Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover:

Depth Scale	Symbol	Soil Description	Elevation (masl) / Depth (m)	Number	Type	Recovery (%)	SPT N-Value (Blows/305mm)	Moisture Content (%)	Well Completion Details
ft / m		Ground Surface	292.7						
0 / 0		**CLAY** brown clay	0.0						
6 / 2		**SAND** grey sand, other materials: silt, gravel, stones	290.5 / 2.1						
46 / 14									



Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: MW4-19

Project Name: Galibier Lewis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 10/25/2019

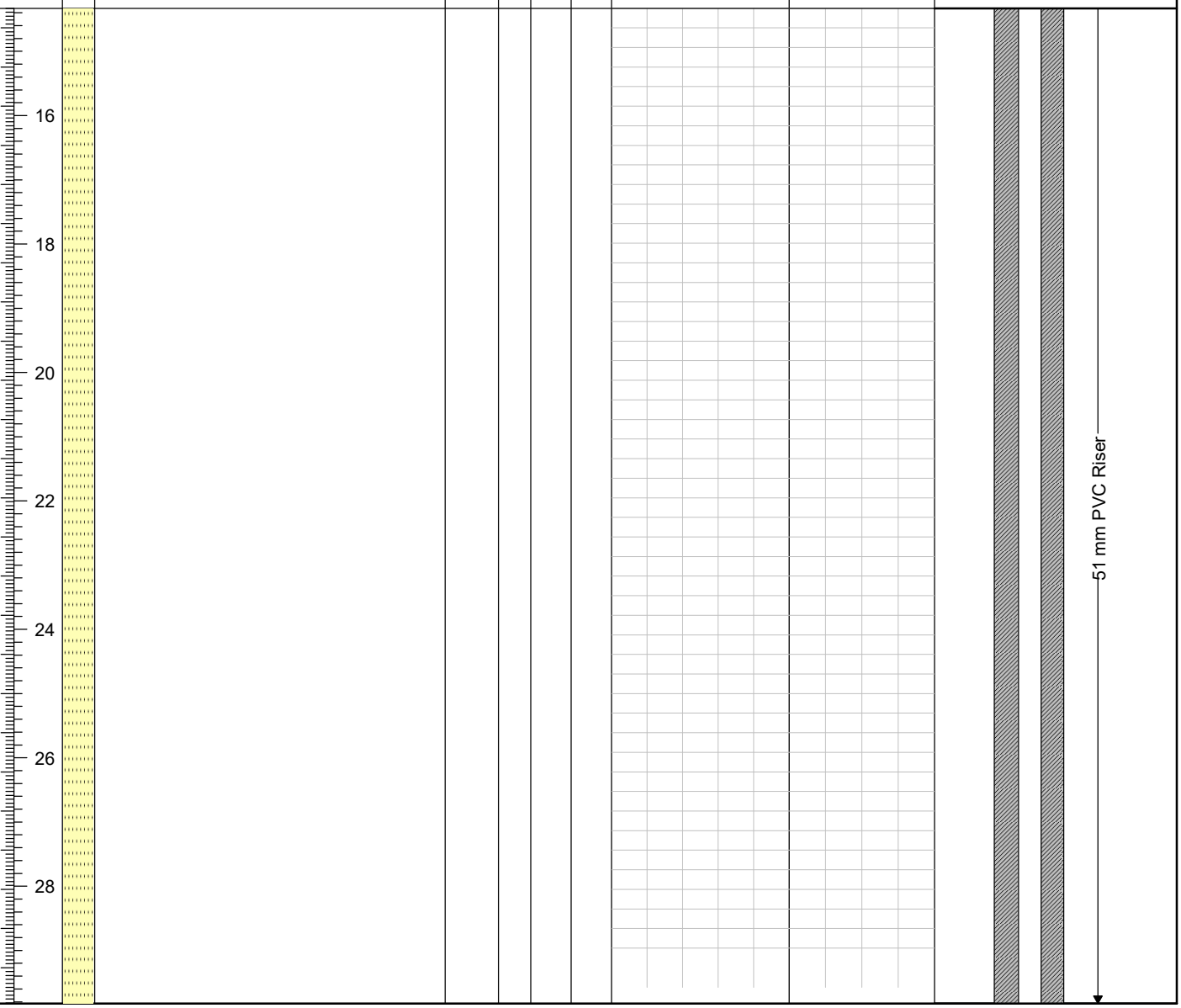
Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	



Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: MW4-19

Project Name: Galibier Lewis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 10/25/2019

Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	
98 30			261.3						
100									
102									
104 32		**GRAVEL** brown gravel, other materials: silt layers, sand	31.4						
106									
108									
110 34									
112									
114									
116									
118 36									
120			255.5						
122		**SILTY SAND** grey silty sand, other materials: white silt layers	37.2						
124 38									
126									
128									
130 40									
132									
134									
136									
138 42									
140			249.7						
142		**SAND** grey sand, other matierals: silty, silt increases towards 178'	43.0						
144 44									
146									

November 12, 2019

Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: MW4-19

Project Name: Galibier Lewis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 10/25/2019

Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	
148 150 152 154 156 158 160 162 164 166 168 170 172 174 176 178 180 182 184 186 188 190 192 194 196									
46 48 50 52 54 56 58 60									
		SAND	238.4 / 54.3						
		CLAY grey clay	235.4 / 57.3						
		SILT grey silt, other materials: sand							

Sand Pack

51mm Slotted Screen

Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: MW4-19

Project Name: Galibier Lewis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 10/25/2019

Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	Well Completion Details
198			231.7						
200		**CLAY** grey clay, other matierals: stones	61.0						
202									
62									
204									
206			229.9						
		Drilling Terminated	62.8						
208									
210									
64									
212									
214									
216									
66									
218									
220									
222									
68									
224									
226									
228									
230									
70									
232									
234									
236									
72									
238									
240									
242									
74									
244									
246									

Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: MW5-19

Project Name: Galibier Lewis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 10/21/2019

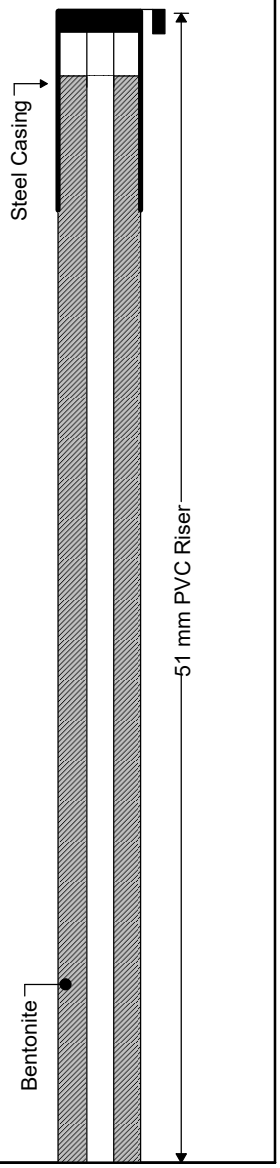
Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	
ft / m		Ground Surface	294.6						
0 / 0		**SILT** brown silt, other materials: stone	0.0						
24 / 8		**SAND** brown sand, other materials: gravel, silt, occasional stones	287.3 7.3						
46 / 14									



Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: MW5-19

Project Name: Galibier Lewis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 10/21/2019

Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	
48 50 52 16 54 56 58 18 60 62 64 66 20 68 70 72 22 74			271.8						
76 78 24 80 82 84 86 26 88 90 92 28 94 96		**GRAVEL** brown gravel, other matierals: san, silt, occasional stones/silt layers	22.9						51 mm PVC Riser

Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: MW5-19

Project Name: Galibier Lewis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 10/21/2019

Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	
98 30 100 102 104 32 106 108 110 112 34 114 116 118 36 120 122 124 38 126 128 130 40 132 134 136 138 42 140 142 144 44 146			260.5						
		SILT grey silt, other materials: stones, white/orange layers	34.1 / 259.6						
		SILT	35.1						
		SILTY SAND grey silty sand, other materials: occasional stones	251.9 / 42.7						November 12, 2019

Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: MW5-19

Project Name: Galibier Lewis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 10/21/2019

Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	
148 150 46 152 154 156 158 48 160 162 164 50 166 168 170 52 172 174 176 54 178 180 182 56 184 186 188 190 58 192 194 196 60		**SAND** grey sand, coarse layers	241.0 53.6						51mm Slotted Screen
		CLAYEY SILT grey clay silt, other materials: sand	235.5 59.1						

Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: MW5-19

Project Name: Galibier Lewis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 10/21/2019

Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	
198									
200									
202									
62 204									
206									
208									
64 210									
212									
214			229.1						
216		Drilling Terminated	65.5						
66 218									
220									
222									
68 224									
226									
228									
70 230									
232									
234									
72 236									
238									
240									
242									
74 244									
246									

Sand Pack

Bentonite

Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: BH6-19

Project Name: Galibier Lewis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 11/25/2019

Drilling Contractor: Noll Drilling Inc.

Drill Rig:

Drill Method:

Protective Cover:

Depth Scale (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Number	Type	Recovery (%)	SPT N-Value (Blows/305mm)	Moisture Content (%)	Well Completion Details
		Ground Surface	0.0						
0 / 0		**SANDY SILT TILL**	0.0			0			
4			-1.5						
6 / 2		**SANDY SILT TILL** Light grey, sandy silt TILL, few clay	1.5 -2.1						
8		**SANDY SILT TILL**	2.1 -3.0						
10		**SANDY SILT TILL** Light grey, sandy silt TILL, few clay, trace gravel	3.0 -3.7						
12 / 4		**SANDY SILT TILL**	3.7 -4.6						
16		**SANDY SILT TILL** Light grey, fine sandy silt TILL, few clay, trace gravel, trace cobbles	4.6 -5.5						
18		**SANDY SILT TILL** Light grey, fine sandy silt TILL, few clay, few cobbles, trace gravel	5.5			100			
24						100			
26 / 8			-8.8						
28		**SANDY SILT TILL** becoming for sandy	8.8			100			
32 / 10			-10.1						
34		**SANDY SILT TILL** Light grey, fine sandy silt TILL, few cobbles, trace gravel, trace clay	10.1			100			
38 / 12			-11.6						
40		**SANDY SILT** Light Grey, sandy SILT, some gravel, few cobbles	11.6			50			
42			-13.1						
44		**GRAVEL** Light grey, GRAVEL, some fine sand and silt	13.1			80			
46 / 14			-14.6						
48			14.6						
50									

Bentonite

Field Technician:

Drafted by: TFC

Reviewed by:

MTE

ID No.: BH6-19

Project Name: Galibier Lewis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 11/25/2019

Drilling Contractor: Noll Drilling Inc.

Drill Rig:

Drill Method:

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	
52 16 54 56 58		**GRAVEL** Coarse GRAVEL, some sand, some cobbles, trace silt	-17.7			90			
						60			
18 60 62		**GRAVEL**	17.7 -19.2			0			
64 20 66		**GRAVEL** Coarse GRAVEL some cobbles	19.2 -20.7			90			
68 70 72 22 74		**GRAVEL**	20.7 -23.8			50			
						70			
76 78 24 80		**GRAVEL** Coarse GRAVEL, some cobbles, trace silt	23.8 -25.3			70			
82 84 26 86		**GRAVEL** Coarse GRAVEL, some cobbles, few fine sand, trace silt	25.3			70			
88 90						15			
92 28 94		**GRAVEL**	-28.3 28.3						
96 98 30 100			-30.5 30.5						

Field Technician:

Drafted by: TFC

Reviewed by:

MTE

ID No.: MW7-19

Project Name: Galibier LEwis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 10/23/2019

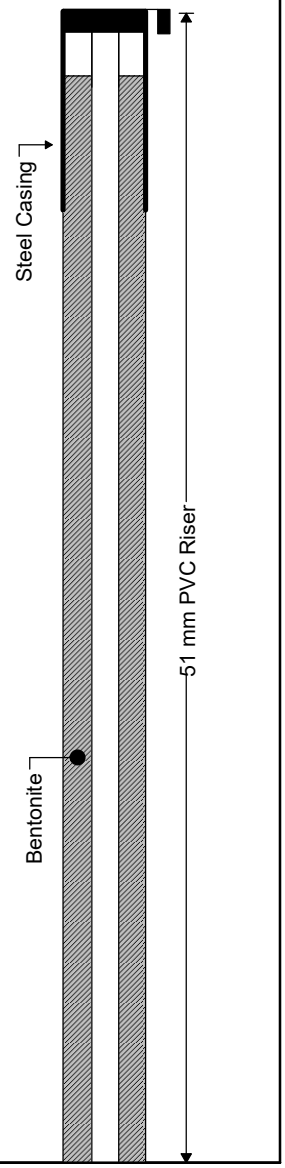
Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	Well Completion Details
ft / m		Ground Surface	314.1						
0 / 0		**SAND** grey sand, other matierals: silt layers	0.0						
2									
4 / 2									
6									
8 / 4									
10									
12 / 6									
14									
16 / 8									
18									
20 / 10									
22									
24 / 12									
26									
28 / 14									
30									
32 / 16									
34									
36 / 18									
38									
40 / 20									
42									
44 / 22									
46									



Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: MW7-19

Project Name: Galibier LEwis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 10/23/2019

Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	
48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96	16 18 20 22 24 26 28	**SAND** grey sand, other matierals: silt layers	295.8						51 mm PVC Riser
		SAND	18.3						
			291.2						
		SANDY SILT white silt, other matierals: sand/gravel	22.9						
			286.7						
		SAND AND GRAVEL grey sand & gravel, other materials: silt layers	27.4						

Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: MW7-19

Project Name: Galibier LEwis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 10/23/2019

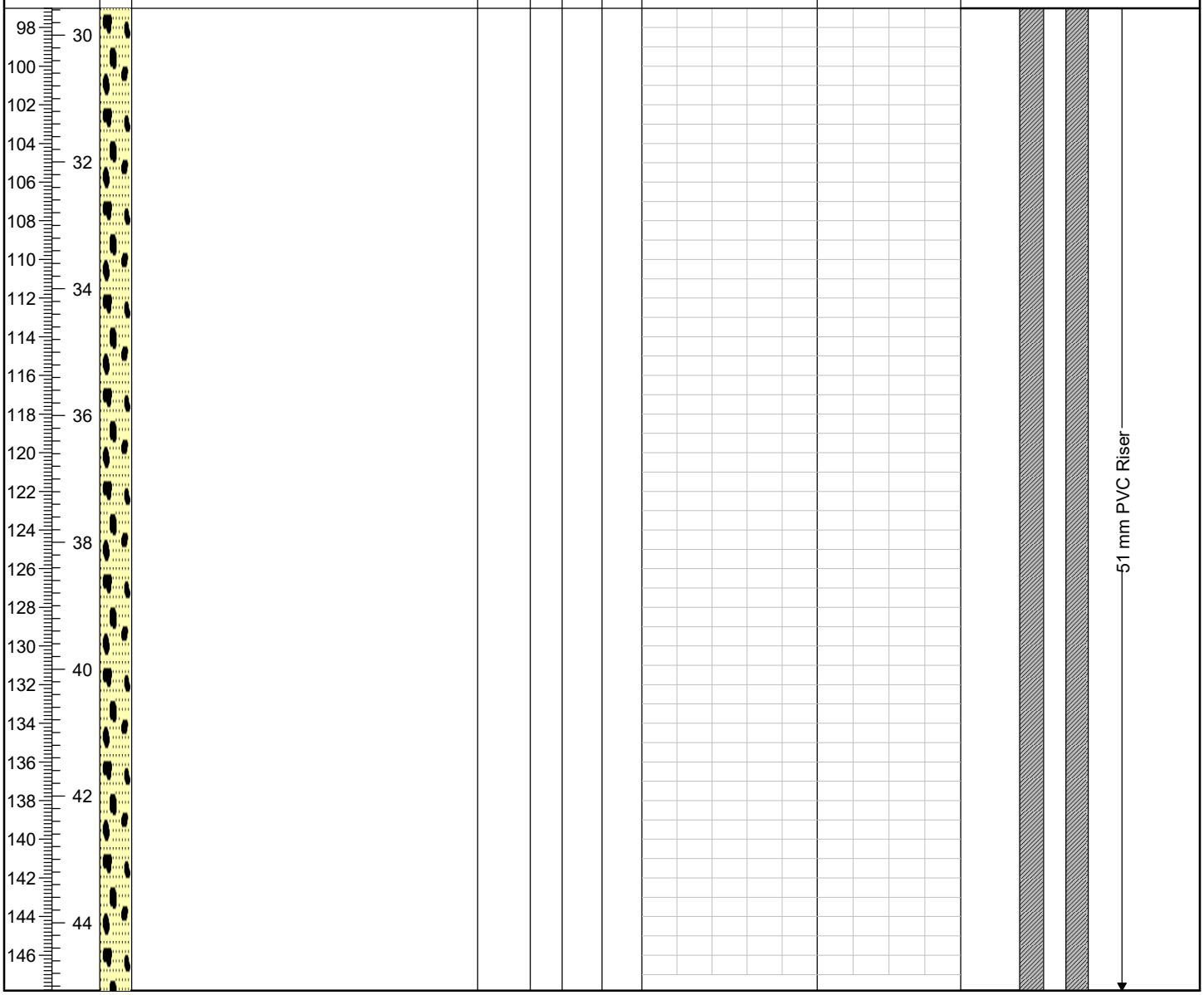
Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	



Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: MW7-19

Project Name: Galibier LEwis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 10/23/2019

Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	
148 150 152 154 156 158 160 162 164 166 168 170 172 174 176 178 180 182 184 186 188 190 192 194 196									
46 48 50 52 54 56 58 60									
			258.6						
		SILT grey silt, other materials: cobbles	55.5						
			257.4						
		SILTY SAND grey silty sand, other matierals gravel, white silt layers -loose	56.7						

November 12, 2019

Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: MW7-19

Project Name: Galibier LEwis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 10/23/2019

Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	

198
200
202
62
204
206
208
64
210
212
214
66
216
218
220
68
222
224
226
70
228
230
232
72
234
236
238
74
240
242
244
246

Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: MW7-19

Project Name: Galibier LEwis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Materials Inc.

Site Location: Springwater Township

Date Completed: 10/23/2019

Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	
248 76 250 252 254 256 78 258			235.1 78.9						Sand Pack; 51mm Slotted Screen
260 262 80 264 266 268		**CLAY**	232.4 81.7						
82 270 272 274 276 84		**SILTY SAND** white grey silty sand	230.0 84.1						
278 280 282 86 284 286 288 88 290 292 294 90 296		Drilling Terminated							

Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID Number: TW2

Project Name: Galbier Pit Expansion

Project No: 40318-300

Client: Galiber mateirals

Site Location: Springwater Township

Date Completed: 11/4/2019

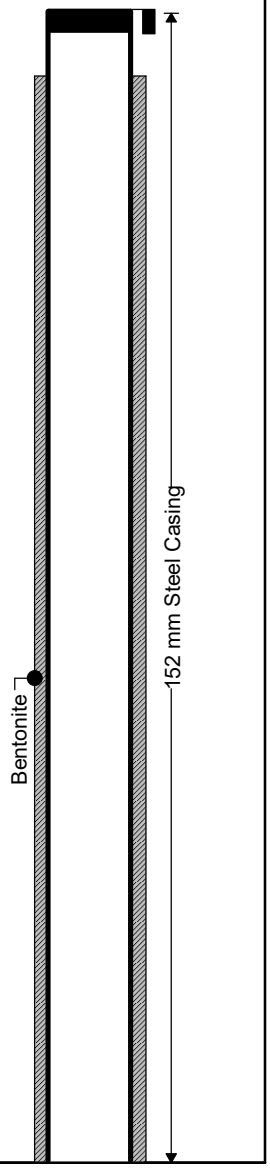
Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover: Steel Casing

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	
ft / m		Ground Surface	295.1						
0 / 0		**CLAY** brown clay, other materials stones, sand	0.0						
10 / 2			292.0						
		SANDY CLAY grey sandy clay, other materials: stones, silt	3.0						
22 / 6			288.0						
		SAND AND GRAVEL grey sand and gravel, other materials: cobbles, looser to 73'	7.0						
26 / 8									
32 / 10									
38 / 12									
46 / 14									



Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID Number: TW2

Project Name: Galbier Pit Expansion

Project No: 40318-300

Client: Galiber mateirals

Site Location: Springwater Township

Date Completed: 11/4/2019

Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover: Steel Casing

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	
48 50 52 16 54 56 58 18 60 62 64 66 20 68 70 72 22 74 76 78 24 80 82 84 26 86 88 90 92 28 94 96		**SAND** grey sand, other materials: cobbles, loose	272.8 22.3						152 mm Steel Casing

Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID Number: TW2

Project Name: Galbier Pit Expansion

Project No: 40318-300

Client: Galiber mateirals

Site Location: Springwater Township

Date Completed: 11/4/2019

Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover: Steel Casing

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	
98 30			264.9						
100		**SAND AND GRAVEL** grey stones and sand, other materials: gravel, silt	30.2						
102									
104 32									
106									
108									
110									
112 34									
114									
116									
118 36			258.8						
120		**SAND AND GRAVEL**	36.3						
122									
124 38									
126									
128									
130			255.1						
132 40		**SILTY SAND** grey silty sand, other materials: gravel	39.9						
134									
136									
138 42									
140									
142			251.5						
144 44		**SAND** grey sand, other materials: stones, silty layers	43.6						
146									

Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

ID Number: TW2

Project Name: Galbier Pit Expansion

Project No: 40318-300

Client: Galiber mateirals

Site Location: Springwater Township

Date Completed: 11/4/2019

Drilling Contractor: SD Hopper Drilling

Drill Rig:

Drill Method: Mud Rotary

Protective Cover: Steel Casing

Subsurface Profile			Sample				SPT	Moisture	
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	Well Completion Details
148									November 2, 2019
150									
46									
152									
154									
156									
48									
158									
160									
162									
164									
50									
166									
168									
170									
52									
172			242.3						
174		SAND	52.7						
176									
54									
178			240.5						
180		SAND AND GRAVEL	54.6						
182									
184									
56									
186									
188									
190									
58									
192			236.2						
194		CLAY	58.8						
196			235.3						
60		Drilling Terminated	59.7						

Sand Pack

168 mm Slot 18 Stainless Steel Screen

168 mm Slot 20 Stainless Steel Screen

Field Technician:

Drafted by: TFC

Reviewed by: PAG

MTE

Sheet: 4 of 4

ID No.: MP1-19

Project Name: Galibier Lewis Plt Expansion

MTE File No.: 40318-300

Client: Galibier Lewis Materials Inc.

Site Location: Springwater Township

Date Completed: 11/12/2019

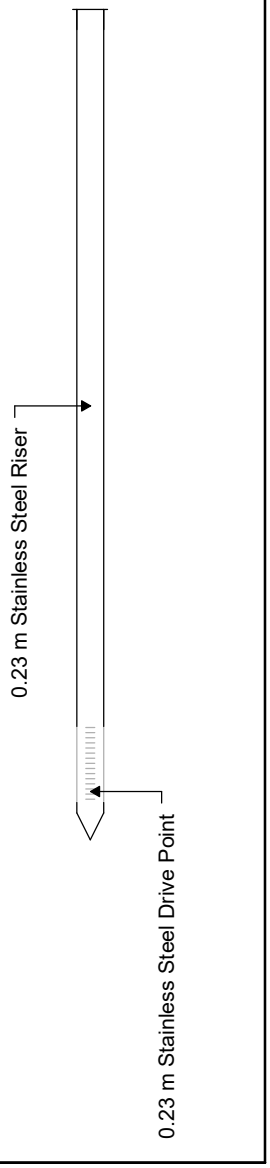
Drilling Contractor:

Drill Rig:

Drill Method:

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) / Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	
ft / m		Ground Surface	228.5						
0 / 0		**PEAT** black, organics, saturated	0.0						
			228.2						
		SANDY SILT grey/olive silt with fine sand	0.3						
2									
4									
6 / 2			226.7						
		Drilling Terminated	1.8						
8									
10									



Field Technician: TFC/JBF

Drafted by: TFC

Reviewed by: PAG

MTE

Sheet: 1 of 1

ID No.: MP2-19

Project Name: Galibier Lewis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Lewis Materials Inc.

Site Location: Springwater Township

Date Completed: 11/12/2019

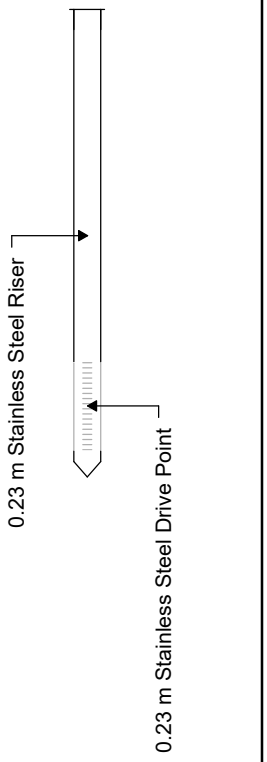
Drilling Contractor:

Drill Rig:

Drill Method:

Protective Cover:

Subsurface Profile			Sample				SPT	Moisture	
Depth Scale	Symbol	Soil Description	Elevation (masl) / Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80	Moisture Content • % • 10 20 30	Well Completion Details
ft / m		Ground Surface	231.8						
0 / 0		**PEAT** black, organics, saturated	0.0 / 231.6						
		SILTY SAND medium sand, few silt, saturated	0.2 / 231.2						
2		**SAND AND GRAVEL** medium to coarse sand with stones, saturated	0.6 / 230.8						
		Drilling Terminated	0.9						
4									
6 / 2									
8									
10									



Field Technician: TFC/JBF

Drafted by: TFC

Reviewed by: PAG

MTE

Sheet: 1 of 1

ID No.: MP3-19

Project Name: Galibier LEwis Pit Expansion

MTE File No.: 40318-300

Client: Galibier Lewis Materials Inc.

Site Location: Springwater Township

Date Completed: 11/12/2019

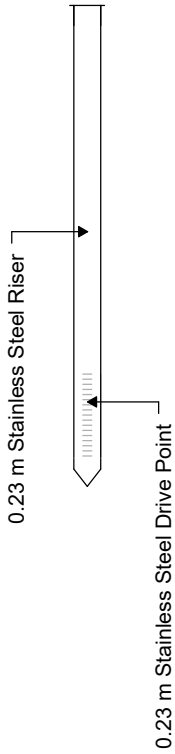
Drilling Contractor:

Drill Rig:

Drill Method:

Protective Cover:

Depth Scale (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Number	Type	Recovery (%)	SPT N-Value (Blows/305mm)	Moisture Content (%)	Well Completion Details
0 / 0		Ground Surface	232.0						
		PEAT black, organics, saturated	0.0						
		SAND fine to medium sand	231.7						
		SAND AND GRAVEL light brown/orange medium to coarse sand, few stone, few silt, saturated	0.3 / 231.4						
2		**SAND AND GRAVEL** brown medium to coarse sand few stones, trace silt, saturated	0.6 / 231.0						
		SAND AND GRAVEL dark brown medium to coarse sand few stones, trace silt, saturated	0.9 / 230.7						
4		Drilling Terminated	1.2						
6									
2									
8									
10									



Field Technician: TFC/JBF

Drafted by: TFC

Reviewed by: PAG

Sheet: 1 of 1

Appendix B

Photographic Log

Photograph No. 1
MP1 (Facing South) May 20, 2020

Photograph No. 2
TP2 (Facing South) – May 20, 2020

Photograph No. 3
MP3 (Facing North) – May 20, 2020

Appendix C

Private Well Inventories

MTE
More Than Engineering

PW2

WATER WELL SURVEY

Resident Name: [redacted]

911 Number: _____ **Road:** _____

Address: 2931 George Johnston Road

Phone Number: [redacted] **Email:** _____

Property Owner: ☑ Yes ☐ No **If No, Property Owner's Name:** _____

Previous Property Owners: No

Number of Wells on Property: 1 ☐ Don't Know

Type of Well: ☑ Drilled ☐ Dug ☐ Sand Point ☐ Other _____ ☐ Don't Know

Diameter of Well: ☐ 2 in. ☐ 4 in. ☐ 6 in. ☑ 8 in. ☐ 3 ft. ☐ Don't Know

Depth of Well: 145-150 ☑ Don't Know

Depth of Water: 40.02 m Now ☐ Don't Know

Pump Depth: _____ ☐ Don't Know

Pump Type: _____ ☐ Don't Know

Water Source: ☐ Bedrock ☐ Sand/Gravel/Overburden ☐ Don't Know

Name of Well Driller: Clearwater Drilling ☐ Don't Know

Date Installed: 2007 ☐ Don't Know

I have the MOE Water Well Record: ☐ Yes ☐ No Maybe ☐ Don't Know

MOE Water Well Record Number: AG23981 ☐ Don't Know

Type of Water Use: ☑ Domestic ☐ Farm ☐ Irrigation ☐ Industrial ☐ Other _____

Water Treatment: ☐ Softener ☐ Sand Filter ☐ Carbon Filter ☐ Fiber Filter. ☐ Aluminum Oxide
☐ UV ☐ Reverse Osmosis ☐ distillation ☐ Ion Exchange. ☐ Ozonation

Other Water Treatment: _____ ☐ Don't Know

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WATER WELL SURVEY

Condition of Well Casing: ☐ Good ☐ Buried ☐ Corroded ☐ Seized ☐ Broken ☐ Don't Know
Other: _____

Any problems with water quantity in the past? ☐ Yes ☑ No

Any problem with water quality in the past? ☑ Yes ☐ No

If yes, what type? ☐ Sulphur smell ☐ Iron Taste ☐ Brown Water ☐ Bacteria
Other: _____

Location of Septic Bed: _____

Potential Sources of Contamination: ☐ Barn ☐ Manure Pile ☐ Gas Tanks ☐ Heating Oil Tank
Other: _____

Is the well easily accessible? ☑ Yes ☐ No

Would you like to participate in a Water Monitoring Program? ☑ Yes ☐ No

Describe Well Location AT Back of house 2M away from deck Left side Looking away from house

Drawing on experience...Building on strength
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520 Bingemans Centre Drive, Kitchener, Ontario N2B 3X9 Tel: 519-743-6500 Fax: 519-743-6513 mail@mte85.com

Ontario Ministry of the Environment

Well Tag Number (Place sticker and print number below): A023981

Well Record

Regulation 903 Ontario Water Resources Act

page ___ of ___

Instructions for Completing Form

- For use in the **Province of Ontario** only. This document is a permanent **legal** document. Please retain for future reference.
- All Sections **must** be completed in full to avoid delays in processing. Further instructions and explanations are available on the back of this form.
- Questions regarding completing this application can be directed to the Water Well Management Coordinator at 416-235-6203.
- **All metre measurements shall be reported to 1/10th of a metre.**
- Please print clearly in blue or black ink only.

Ministry Use Only

MUN | CON | LOT

Well Owner's Information and Location of Well Information

First Name	Last Name	Mailing Address (Street Number/Name, RR,Lot,Concession)
ADA Custom	Homes	

County/District/Municipality	Township/City/Town/Village	Province	Postal Code	Telephone Number (include area code)
		Ontario		

Address of Well Location (County/District/Municipality)	Township	Lot	Concession
2931 George Johnston RD	Springwater		

RR#/Street Number/Name	City/Town/Village	Site/Compartment/Block/Tract etc.

GPS Reading	NAD	Zone	Easting	Northing	Unit Make/Model	Mode of Operation
	8 3	17	595629	4971647 1		☐ Undifferentiated ☑ Averaged ☐ Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

FT

General Colour	Most common material	Other Materials	General Description	Depth From	Depth To
Brown	Sand	Clay + gravel	Mixed	0	52
Brown	Sand	gravel		52	155

Hole Diameter

Depth From	Depth To	Diameter Centimetres

Water Record

Water found at ___ Metres / Kind of Water

- ___ m ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:
- ___ m ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:
- ___ m ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:

After test of well yield, water was
☐ Clear and sediment free
☐ Other, specify

Chlorinated ☐ Yes ☐ No

Construction Record

FT

Inside diam (centimetres / in)	Material	Wall thickness (centimetres / in)	Depth From	Depth To (Metres)
Casing				
6 in	☑ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	188	0	151
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
Screen				
Outside diam	☑ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	Slot No.		
6		16	151	155

No Casing or Screen

☐ Open hole

Test of Well Yield

Pumping test method

	Draw Down Time min	Draw Down Water Level (Metres / FT)	Recovery Time min	Recovery Water Level (Metres / FT)
Pump intake set at - (metres / FT) 150	Static Level	133		
Pumping rate - (litres/min) 2 in 8	1		1	
Duration of pumping ___ hrs + ___ min	2		2	
Final water level end of pumping (metres / FT) 138	3		3	
Recommended pump type. ☐ Shallow ☑ Deep	4		4	
Recommended pump depth. 148 (metres / FT)	5		5	
Recommended pump rate. 6.6 GPM (litres/min)	10		10	
If flowing give rate - (litres/min)	15		15	
	20		20	
	25		25	
If pumping discontinued, give reason.	30		30	
	40		40	
	50		50	
	60	138	60	133

Plugging and Sealing Record

☑ Annular space ☐ Abandonment

Depth set at - Metres From	Depth set at - Metres To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
0	25	Hole Plug	

Method of Construction

☐ Cable Tool ☐ Rotary (air) ☐ Diamond ☐ Digging
☑ Rotary (conventional) ☐ Air percussion ☐ Jetting ☐ Other
☐ Rotary (reverse) ☐ Boring ☐ Driving

Water Use

☑ Domestic ☐ Industrial ☐ Public Supply ☐ Other
☐ Stock ☐ Commercial ☐ Not used
☐ Irrigation ☐ Municipal ☐ Cooling & air conditioning

Final Status of Well

☑ Water Supply ☐ Recharge well ☐ Unfinished ☐ Abandoned, (Other)
☐ Observation well ☐ Abandoned, insufficient supply ☐ Dewatering
☐ Test Hole ☐ Abandoned, poor quality ☐ Replacement well

Well Contractor/Technician Information

Name of Well Contractor	Well Contractor's Licence No.
Clearwater Drilling	7074

Business Address (street name, number, city etc.): 3524 Hwy 93 Barrie Ont

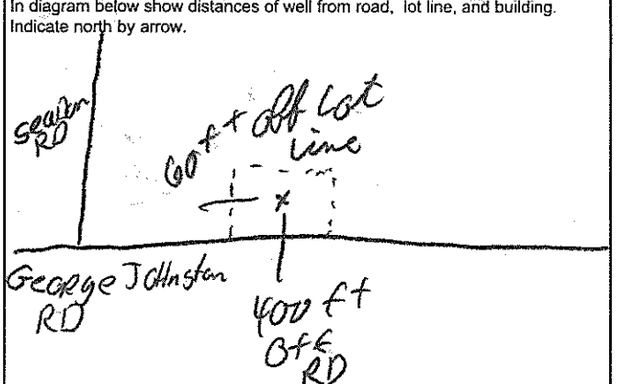
Name of Well Technician (last name, first name)	Well Technician's Licence No.
Prince Mark	2535

Signature of Technician/Contractor: X

Date Submitted: YYYY 2007 MM 7 DD 20

Location of Well

In diagram below show distances of well from road, lot line, and building. Indicate north by arrow.



Audit No. Z 24563

Date Well Completed: YYYY 2007 MM 7 DD 20

Was the well owner's information package delivered? ☐ Yes ☐ No

Date Delivered: YYYY 2007 MM 7 DD 20

Ministry Use Only

Data Source	Contractor
Date Received: YYYY 2007 MM NOV 15 DD	Date of Inspection YYYY MM DD
Remarks	Well Record Number

0506E (09/03) Contractor's Copy ☐ Ministry's Copy ☐ Well Owner's Copy ☐ *Cette formule est disponible en français*

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PW3

WATER WELL SURVEY

Resident Name: [redacted]

911 Number: _____ **Road:** _____

Address: 2nd de George Johnson Road

Phone Number: [redacted] **Email:** _____

Property Owner: ☑ Yes ☐ No **If No, Property Owner's Name:** _____

Previous Property Owners: _____

Number of Wells on Property: 1 ☐ Don't Know

Type of Well: ☑ Drilled ☐ Dug ☐ Sand Point ☐ Other _____ ☐ Don't Know

Diameter of Well: ☐ 2 in. ☐ 4 in. ☑ 6 in. ☐ 8 in. ☐ 3 ft. ☐ Don't Know

Depth of Well: 187' ☐ Don't Know

Depth of Water: _____ ☐ Don't Know

Pump Depth: _____ ☐ Don't Know

Pump Type: _____ ☐ Don't Know

Water Source: ☐ Bedrock ☐ Sand/Gravel/Overburden ☐ Don't Know

Name of Well Driller: George Buer ☐ Don't Know

Date Installed: Sept 1972 ☐ Don't Know

I have the MOE Water Well Record: ☐ Yes ☑ No ☐ Don't Know

MOE Water Well Record Number: _____ ☐ Don't Know

Type of Water Use: ☑ Domestic ☐ Farm ☐ Irrigation ☐ Industrial ☐ Other _____

Water Treatment: ☐ Softener ☐ Sand Filter ☐ Carbon Filter ☐ Fiber Filter. ☐ Aluminum Oxide
☐ UV ☐ Reverse Osmosis ☐ distillation ☐ Ion Exchange. ☐ Ozonation

Other Water Treatment: _____ ☐ Don't Know

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WATER WELL SURVEY

Condition of Well Casing: ☐ Good ☐ Buried ☐ Corroded ☐ Seized ☐ Broken ☐ Don't Know
Other: _____

Any problems with water quantity in the past? ☐ Yes ☑ No

Any problem with water quality in the past? ☐ Yes ☑ No

If yes, what type? ☐ Sulphur smell ☐ Iron Taste ☐ Brown Water ☐ Bacteria
Other: _____

Location of Septic Bed: Right behind the house.

Potential Sources of Contamination: ☐ Barn ☐ Manure Pile ☐ Gas Tanks ☐ Heating Oil Tank
Other: _____

Is the well easily accessible? ☑ Yes ☐ No Need Allen keys.

Would you like to participate in a Water Monitoring Program? ☑ Yes ☐ No

Describe Well Location _____

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The Ontario Water Resources Commission Act

WATER WELL RECORD

Water management in Ontario

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 | 5709353 | MUNICIP. 57016 | CON. C QW | 10

COUNTY OR DISTRICT: Simcoe | TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE: Vespra | CON., BLOCK, TRACT, SURVEY, ETC.: Con 10 | LOT: 016

OWNER (SURNAME FIRST): [redacted] | ADDRESS: Scott 26th Barrie | DATE COMPLETED: DAY 09 MO [illegible] YR 78

RC. 4 | ELEVATION 0925 | RC. 5 | BASIN CODE 22

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH – FEET FROM	DEPTH – FEET TO
	Brown	Clay Loam		0	41
	Clay	Stone		4	95
	Hard	Sand	Streaks of Clay	95	110
	Course	Sand and	Water	110	[illegible]

31 | 0046 0502 | 0025 0512 | 0110 1405 | 0120 10

32

41 WATER RECORD

WATER FOUND AT – FEET	KIND OF WATER
0115 10-13	1 ☒ FRESH 3 ☐ SULPHUR 14; 2 ☐ SALTY 4 ☐ MINERAL
15-18 0120	1 ☒ FRESH 3 ☐ SULPHUR 19; 2 ☐ SALTY 4 ☐ MINERAL
20-23	1 ☐ FRESH 3 ☐ SULPHUR 24; 2 ☐ SALTY 4 ☐ MINERAL
25-28	1 ☐ FRESH 3 ☐ SULPHUR 29; 2 ☐ SALTY 4 ☐ MINERAL
30-33	1 ☐ FRESH 3 ☐ SULPHUR 34; 2 ☐ SALTY 4 ☐ MINERAL 80

51 CASING & OPEN HOLE RECORD

INSIDE DIAM. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH – FEET FROM	DEPTH – FEET TO
10-11 4"	1 ☒ STEEL 12; 2 ☐ GALVANIZED; 3 ☐ CONCRETE; 4 ☐ OPEN HOLE	188	0	15 0115
17-18	1 ☐ STEEL 19; 2 ☐ GALVANIZED; 3 ☐ CONCRETE; 4 ☐ OPEN HOLE			20-23
24-25	1 ☐ STEEL 26; 2 ☐ GALVANIZED; 3 ☐ CONCRETE; 4 ☐ OPEN HOLE			27-30

SCREEN

SIZE(S) OF OPENING (SLOT NO.) 31-33	DIAMETER 34-38	LENGTH 39-40
010	04.000 INCHES	04 FEET
MATERIAL AND TYPE: 55	DEPTH TO TOP OF SCREEN 41-44: 0115 FEET	80

61 PLUGGING & SEALING RECORD

DEPTH SET AT – FEET FROM	DEPTH SET AT – FEET TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)
10-13	14-17	
18-21	22-25	
26-29	30-33 80	

71 PUMPING TEST

PUMPING TEST METHOD 10: 1 ☐ PUMP 2 ☒ BAILER

PUMPING RATE 11-14: 0010 GPM | DURATION OF PUMPING 15-16 HOURS 01 17-18 MINS. 00

STATIC LEVEL 19-21	WATER LEVEL END OF PUMPING 22-24	WATER LEVELS DURING 25: 1 ☒ PUMPING 2 ☐ RECOVERY	15 MINUTES 26-28	30 MINUTES 29-31	45 MINUTES 32-34	60 MINUTES 35-37
090 FEET	092 FEET		FEET	FEET	092 FEET	FEET

IF FLOWING, GIVE RATE 38-41: GPM.

PUMP INTAKE SET AT: 112 FEET

WATER AT END OF TEST 42: ☒ 1 CLEAR 2 ☐ CLOUDY

RECOMMENDED PUMP TYPE: ☐ SHALLOW ☒ DEEP

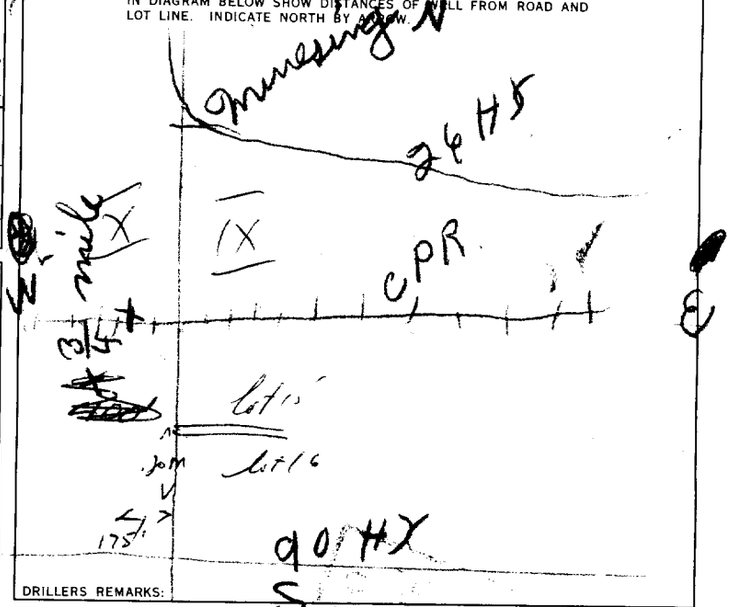
RECOMMENDED PUMP SETTING 43-45: 110 FEET

RECOMMENDED PUMPING RATE 46-49: 0006 GPM.

50-53: 005.0 GPM./FT. SPECIFIC CAPACITY

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS:

FINAL STATUS OF WELL 54

1 ☒ WATER SUPPLY; 2 ☐ OBSERVATION WELL; 3 ☐ TEST HOLE; 4 ☐ RECHARGE WELL; 5 ☐ ABANDONED, INSUFFICIENT SUPPLY; 6 ☐ ABANDONED, POOR QUALITY; 7 ☐ UNFINISHED

WATER USE 55-56: 01

1 ☒ DOMESTIC; 2 ☐ STOCK; 3 ☐ IRRIGATION; 4 ☐ INDUSTRIAL; ☐ OTHER; 5 ☐ COMMERCIAL; 6 ☐ MUNICIPAL; 7 ☐ PUBLIC SUPPLY; 8 ☐ COOLING OR AIR CONDITIONING; 9 ☐ NOT USED

METHOD OF DRILLING 57

1 ☒ CABLE TOOL; 2 ☐ ROTARY (CONVENTIONAL); 3 ☐ ROTARY (REVERSE); 4 ☐ ROTARY (AIR); 5 ☐ AIR PERCUSSION; 6 ☐ BORING; 7 ☐ DIAMOND; 8 ☐ JETTING; 9 ☐ DRIVING

CONTRACTOR

NAME OF WELL CONTRACTOR: Ale Cameron | LICENCE NUMBER: 1510

ADDRESS

NAME OF DRILLER OR BORER | LICENCE NUMBER: 1510

SIGNATURE OF CONTRACTOR: Ale Cameron | SUBMISSION DATE DAY 9 MO Sept YR 78

OFFICE USE ONLY

DATA SOURCE 58: 1 | CONTRACTOR 59-62: 1510 | DATE RECEIVED 02 01 79 63-68 | 80

DATE OF INSPECTION | INSPECTOR

REMARKS: P WI

OWRC COPY

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PW4

WATER WELL SURVEY

Resident Name: [redacted]

911 Number: _____ **Road:** _____

Address: 2361 Snow Valley Rd

_____

Phone Number: [redacted] **Email:** [redacted]

Property Owner: ☑ Yes ☐ No **If No, Property Owner's Name:** _____

Previous Property Owners: _____

Number of Wells on Property: 1 ☐ Don't Know

Type of Well: ☑ Drilled ☐ Dug ☐ Sand Point ☐ Other _____ ☐ Don't Know

Diameter of Well: ☐ 2 in. ☐ 4 in. ☐ 6 in. ☑ 8 in. ☐ 3 ft. ☐ Don't Know

Depth of Well: 185' 8 gal/MIN 226.65M measured. ☐ Don't Know

Depth of Water: 9.23 M. ☐ Don't Know

Pump Depth: _____ ☐ Don't Know

Pump Type: 1/2 horsepower ☐ Don't Know

Water Source: ☐ Bedrock ☐ Sand/Gravel/Overburden ☐ Don't Know

Name of Well Driller: ? ☐ Don't Know

Date Installed: 2003 ☐ Don't Know

I have the MOE Water Well Record: ☐ Yes ☑ No ☐ Don't Know

MOE Water Well Record Number: _____ ☐ Don't Know

Type of Water Use: ☑ Domestic ☐ Farm ☐ Irrigation ☐ Industrial ☐ Other _____

Water Treatment: ☑ Softener ☐ Sand Filter ☐ Carbon Filter ☐ Fiber Filter. ☐ Aluminum Oxide
☐ UV ☐ Reverse Osmosis ☐ distillation ☐ Ion Exchange. ☐ Ozonation

Other Water Treatment: Iron Filter ☐ Don't Know

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WATER WELL SURVEY

Condition of Well Casing: ☐ Good ☐ Buried ☐ Corroded ☐ Seized ☐ Broken ☐ Don't Know
Other: _____

Any problems with water quantity in the past? ☐ Yes ☑ No

Any problem with water quality in the past? ☐ Yes ☐ No OK

If yes, what type? ☑ Sulphur smell ☑ Iron Taste ☐ Brown Water ☑ Bacteria
Other: _____

Location of Septic Bed: _____

Potential Sources of Contamination: ☐ Barn ☐ Manure Pile ☐ Gas Tanks ☐ Heating Oil Tank
Other: _____

Is the well easily accessible? ☑ Yes ☐ No

Would you like to participate in a Water Monitoring Program? ☑ Yes ☐ No

Describe Well Location _____

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PW7

WATER WELL SURVEY

Resident Name: [redacted]

911 Number: _____ **Road:** _____

Address: 2878 George Johnston Rd RR2 Barrie

Phone Number: [redacted] **Email:** [redacted]

Property Owner: ☑ Yes ☐ No **If No, Property Owner's Name:** _____

Previous Property Owners: 30+ Living Here 1979

Number of Wells on Property: 1 ☐ Don't Know

Type of Well: ☐ Drilled ☑ Dug ☐ Sand Point ☐ Other _____ ☐ Don't Know

Diameter of Well: ☐ 2 in. ☐ 4 in. ☐ 6 in. ☐ 8 in. ☐ 3 ft. ☐ Don't Know

Depth of Well: 96 ft. ☐ Don't Know

Depth of Water: _____ ☐ Don't Know

Pump Depth: 5 ☐ Don't Know

Pump Type: _____ ☐ Don't Know

Water Source: ☐ Bedrock ☐ Sand/Gravel/Overburden ☐ Don't Know

Name of Well Driller: _____ ☐ Don't Know

Date Installed: _____ ☑ Don't Know

I have the MOE Water Well Record: ☐ Yes ☑ No ☐ Don't Know

MOE Water Well Record Number: _____ ☐ Don't Know

Type of Water Use: ☑ Domestic ☐ Farm ☐ Irrigation ☐ Industrial ☐ Other _____

Water Treatment: ☐ Softener ☐ Sand Filter ☐ Carbon Filter ☐ Fiber Filter. ☐ Aluminum Oxide
☐ UV ☐ Reverse Osmosis ☐ distillation ☐ Ion Exchange. ☐ Ozonation

Other Water Treatment: _____ ☐ Don't Know

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WATER WELL SURVEY

Condition of Well Casing: ☐ Good ☐ Buried ☐ Corroded ☐ Seized ☐ Broken ☐ Don't Know
Other: _____

Any problems with water quantity in the past? ☐ Yes ☑ No

Any problem with water quality in the past? ☑ Yes ☐ No

If yes, what type? ☐ Sulphur smell ☐ Iron Taste ☐ Brown Water ☐ Bacteria
Other: _____

Location of Septic Bed: Out Back

Potential Sources of Contamination: ☐ Barn ☐ Manure Pile ☐ Gas Tanks ☐ Heating Oil Tank
Other: _____

Is the well easily accessible? ☐ Yes ☑ No 2 ft underground.

Would you like to participate in a Water Monitoring Program? ☑ Yes ☐ No

Describe Well Location New Pump put in
Left of Front Door Under Seahorse statue

DL 93 did repair - put in Galvenized Piping.
Well Company. - Pulled Pump.
Hammers. Well Drilling.

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PW8

WATER WELL SURVEY

Resident Name: [redacted]

911 Number: _____ **Road:** _____

Address: 2957 George Johnston Rd

Phone Number: [redacted] **Email:** _____

Property Owner: ☑ Yes ☐ No **If No, Property Owner's Name:** _____

Previous Property Owners: _____

Number of Wells on Property: 1 ☐ Don't Know

Type of Well: ☑ Drilled ☐ Dug ☐ Sand Point ☐ Other _____ ☐ Don't Know

Diameter of Well: ☐ 2 in. ☐ 4 in. ☑ 6 in. ☐ 8 in. ☑ 3 ft. ☐ Don't Know

Depth of Well: 127' ☐ Don't Know

Depth of Water: _____ ☑ Don't Know

Pump Depth: _____ ☑ Don't Know

Pump Type: _____ ☐ Don't Know

Water Source: ☐ Bedrock ☐ Sand/Gravel/Overburden ☐ Don't Know

Name of Well Driller: _____ ☑ Don't Know

Date Installed: 1969 - 1970 ☐ Don't Know

I have the MOE Water Well Record: ☐ Yes ☑ No ☐ Don't Know

MOE Water Well Record Number: _____ ☐ Don't Know

Type of Water Use: ☑ Domestic ☐ Farm ☐ Irrigation ☐ Industrial ☐ Other _____

Water Treatment: ☐ Softener ☐ Sand Filter ☐ Carbon Filter ☐ Fiber Filter. ☐ Aluminum Oxide
☐ UV ☐ Reverse Osmosis ☐ distillation ☐ Ion Exchange. ☐ Ozonation

Other Water Treatment: _____ ☐ Don't Know

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WATER WELL SURVEY

Condition of Well Casing: ☐ Good ☐ Buried ☐ Corroded ☐ Seized ☐ Broken ☐ Don't Know
Other: _____

Any problems with water quantity in the past? ☐ Yes ☑ No

Any problem with water quality in the past? ☐ Yes ☑ No

If yes, what type? ☐ Sulphur smell ☐ Iron Taste ☐ Brown Water ☐ Bacteria
Other: _____

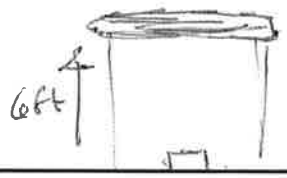
Location of Septic Bed: Out Back

Potential Sources of Contamination: ☐ Barn ☐ Manure Pile ☐ Gas Tanks ☐ Heating Oil Tank
Other: _____

Is the well easily accessible? ☐ Yes ☒ No Large Concrete Cap Very Heavy. Can't Down From Here

Would you like to participate in a Water Monitoring Program? ☑ Yes ☐ No

Describe Well Location _____



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Appendix D

Curricula Vitae

Peter is a Vice President and Senior Hydrogeologist for MTE. He has more than 30 years of experience on various types of projects ranging from international to domestic assignments, including groundwater, surface water, soil and contaminant investigations, to the exploration / development and protection of municipal groundwater and surface water supplies. He has been responsible for the design, construction, supervision and testing of municipal wells and assessing the impacts of various contaminants on groundwater and surface water resources. He is experienced with scoping, managing and reporting on large-scale groundwater developments, site assessment and contamination investigations. Peter has also completed risk communication training to assist in the transfer of sensitive and detailed technical knowledge to audiences including clients, peers, legal counsel and the general public including lay persons.

Peter A. Gray, P.Geo., QP_{ESA}

Title: Vice President, Environmental
Senior Hydrogeologist
Licensed Well Contractor #C-7302
Instructor, Continuing Education, Fleming College

Professional Experience

Education

Bachelor of Science (Honours, Co-op), Earth Sciences | University of Waterloo | 1987

Professional Designations

Professional Geoscientist (P.Geo.) | Association of Professional Geoscientists of Ontario

Qualified Person for Environmental Site Assessment (QP_{ESA})| O. Reg. 153/04 | Ministry of the Environment

Licensed Well Contractor | Ministry of the Environment, Conservation and Parks

Tenure with MTE

Since 1995

Professional Development

Advanced Wilderness First Aid | Stonehearth Open Learning Opportunities (SOLO)

Training for Property Entry per Section 88 of Clean Water Act | Ministry of the Environment

Assessment Report Technical Training-Drinking Water Source Protection | Ministry of the Environment

Memberships

Ontario Ground Water Association

Ontario Stone, Sand and Gravel Association

Canadian Council of Professional Geoscientists (CCPG)

National Ground Water Association

Association of Groundwater Scientists and Engineers

American Association of Petroleum Geologists (AAPG), Division of Environmental Geosciences

International Association of Hydrogeologists

Peter is one of the founding directors and is the volunteer president of the Children's Water Education Council (CWEC). This is a registered, non-profit charitable organization that in 1994 initiated the first Children's Groundwater Festival, since which more than 850,000 children have become educated about a wide variety of water-based issues and concepts. Each year, water festivals will be held in upwards of 30 communities across Ontario, educating more than 60,000 children annually. Peter has worked across Canada and the United States, and has also assessed groundwater and surface water resources in Malawi, Bangladesh and Southeast Asia. He was the co-team leader in 2005 for a Canadian-led team conducting Community Based Environmental Assessments for the Southeast Asia Tsunami Response Team on behalf of World Vision Canada and the Canadian International Development Agency (CIDA) in the countries of Indonesia, Sri Lanka, Thailand and India.

Community Involvement

Rotary Club of Kitchener | Environment Committee Chair | 2010-Present

Coldwater Canada | Youth Leadership Development, Advisory Council | 2011-Present

Children's Water Education Council | Past President | 2001-2016

University of Waterloo | Environmental Studies Faculty | Dean's Council | 2002-2010

University of Waterloo | Earth Sciences Museum | Board of Directors | 2006-Present

Grand River Conservation Authority | Water Forum Committee | 2000-2010

University of Waterloo | Environmental Studies Faculty | Advisory Council | 2000-2010

Waterloo Wellington Children's Groundwater Festival | Co-Founder / Honorary Chair | 1996-Present

Work History

Vice President, Senior Hydrogeologist | MTE Consultants | 2007-Present

Managing Partner, Senior Hydrogeologist | Frontline Environmental Management | 1995-2007 (Acquired by MTE Consultants)

President, Senior Hydrogeologist | Wavefront Environmental Technologies | 2000-2002

Senior Hydrogeologist, Manager-Kitchener Office | ADAMAS Environmental | 1995

Hydrogeologist; Project Manager, Co-Manager-Cambridge Office | Dames & Moore | 1992-1995

Project Geologist / Hydrogeologist | Trow Dames & Moore | 1987-1992

Senior Geological Assistant | Ontario Geological Survey | Quaternary Division | 1986

Geologist | Petro-Canada | International Exploration Division | 1986

Hydrogeological Assistant | Ontario Ministry of the Environment | Technical Support Section | 1985

Field Geologist | Ontario Geological Survey | Quaternary Division | 1984

Awards

Ontario Volunteer Service Award, 25 Years | Ministry of Heritage, Sport, Tourism and Culture Industries | 2020

Paul Harris Fellow | The Rotary Foundation of Rotary International | 2019

Award of Merit | Association of Professional Geoscientists of Ontario (APGO) | 2018

15-Year Service Ontario Volunteer Award | For Waterloo-Wellington Science & Engineering Fair | Ontario Ministry of Citizenship and Immigration, Ontario Volunteer Awards | 2018

Latornell Leadership Award | Latornell Conservation Symposium | 2016

Nominee | Volunteer of the Year | Cambridge Chamber of Commerce | 2015

June Callwood Outstanding Achievement Award for Volunteerism in Ontario | Ontario Ministry of Citizenship, Immigration and International Trade | 2015

20-Year Service Ontario Volunteer Award | For Waterloo Wellington Children's Groundwater Festival Chair | Ontario Ministry of Citizenship, Immigration and International Trade, Ontario Volunteer Service Awards | 2015

Volunteer Impact Award, Shining Stars: Planning Action Award | Volunteer Action Centre of Kitchener-Waterloo and Area | 2013

Heritage Community Recognition Award for Lifetime Achievement | Ontario Heritage Trust | 2012

American Association of Petroleum Geologists (AAPG): Division of Environmental Geosciences Public Outreach Award | Houston, TX | 2011

15-Year Service Ontario Volunteer Award | For Waterloo Wellington Children's Groundwater Festival Chair | Ontario Ministry of Citizenship and Immigration, Ontario Volunteer Awards | 2011

Faculty of Science, Alumni Award of Honour | University of Waterloo 50th Anniversary Awards | 2007

25th Anniversary Provincial Award | For "Just Add Water", Children's Water Education Council (CWEC) President | Ontario Trillium Foundation | 2007

10-Year Service Ontario Volunteer Award | For Waterloo Wellington Children's Groundwater Festival Chair | Ontario Ministry of Citizenship and Immigration, Ontario Volunteer Awards | 2006

2005 Environmental Education Award | For "Just Add Water", a combined Ontario Water Works Association (OWWA) / Children's Water Education Council (CWEC) program sponsored by The Ontario Trillium Foundation, CWEC President | AWWA /OWWA | 2005

Community Recognition Program -Environmental Sector | For Outstanding Contribution to the Community as Chair of the Waterloo Wellington Children's Groundwater Festival | Ontario Heritage Foundation | 2005

Michael R. Follett Community Leader Award Nominee | Greater Kitchener Waterloo Chamber of Commerce Business Excellence Awards | 2005

Grand River Watershed Conservation Award | Waterloo Wellington Children's Groundwater Festival, Chair | Grand River Conservation Authority | 2004

The Outstanding Achievement Award for Voluntarism in Ontario | Waterloo Wellington Children's Groundwater Festival, Chair | Ministry of Culture and Tourism | 2002

Environmental Education Award | Waterloo Wellington Children's Groundwater Festival, Chair | Regional Municipality of Waterloo | 1999

Environmental Sustainability Award in Education | For Waterloo Wellington Children's Groundwater Festival, Chair | Waterloo Region Chamber of Commerce | 1999

Award for Education | For Children's Groundwater Institute, Director | Financial Post | 1996

Ministry of Environment, Conservation and Parks (MECP) Risk Assessments
Various locations, Ontario
Role: Senior Hydrogeologist
2005-Present

Peter has been a member of MECP Vendor of Record (VOR) Review teams assisting in the review of Pre-Submission Forms and Risk Assessments submitted to the MECP Standards Development Branch to identify regulatory compliance under O. Reg. 153/04. Peter is a member of the core review team for hydrogeology and soil sciences under continuous VOR agreements.

Environmental Investigations Phase I / One and II / Two Environmental Site Assessment
Various locations, Ontario
Role: Senior Hydrogeologist
1995-Present

Since 1995 Peter has served in the capacity of Senior Hydrogeologist for Frontline / MTE. He has undertaken, internally reviewed and peer reviewed hundreds of Phase I / One and II / Two ESAs, along with Remedial Action Plans, Environmental Compliance Audits and Environmental Site Restoration Plans. Peter has served as QPESA for a number of Ontario Ministry of Environment, Conservation and Parks (MECP) orders issued to clients, and has served as QPESA as a Vendor Of Record with the current MOE Consulting Services for Expert Multi-Disciplinary Scientific Reviews of Brownfield Sites.

Canadian General Tower Vinyl Manufacturing Facility, Cambridge
Environmental Investigations & Remediation
Role: Senior Hydrogeologist
1994-Present

Peter is responsible for the review and reporting on data collection, data analysis, environmental characterization, statistical and computer modelling, and report preparation, presentations at public meetings and coordination of regulatory approvals. Additional services includes drilling supervision, packer testing, design and monitoring well installation in dolostone bedrock formations and overburden environments, geologic core logging, review / analysis of packer test results, geophysical log / borehole video log response to assist in interpretation of bedrock geologic / hydrogeological environment. Further, design, construction and testing of groundwater control / free-product contamination recovery wells and municipal production wells, design, coordination and supervision of pumping tests, supervision of staff / sub-contractor adherence to health and safety protocols.

City of Kitchener
Bramm Street Works Yard
Environmental Investigations & Remediation
Role: Senior Hydrogeologist
2005-2010

Peter was the Senior Hydrogeologist for a comprehensive Phase II ESA for an investigation of past land uses of the property as a landfill. The workplan included the installation of 11 boreholes and 15 monitoring wells to investigate potential areas of concern and to develop a remedial action plan. Contaminates of concern included PAHs, petroleum hydrocarbons, VOCs, lead, arsenic, sodium adsorption ratio, electrical conductivity, and antimony in cinders, ash, native soil and groundwater. The remediation plan identified volumes of impacted soil and recommended a scoped Site-Specific Risk Assessment and partial intrusive remediation of the site in designated areas of environmental impacts.

City of Kitchener
Joseph & Gaukel Streets, Former Coal Gasification Plant
Environmental Remediation
Role: Senior Hydrogeologist
2007-2011

Peter was the Senior Hydrogeologist during the $29-million coal tar remediation as part of a municipal road reconstruction project. The site is the location of a historic coal gasification plant and resulted in extensive coal tar impacts to soil and groundwater. He was responsible for the completion of Phase I and II Environmental Site Assessments, remediation and Risk Assessment.

City of Hamilton
Hamilton Police Services Storage Building
Environmental Investigations
Role: Senor Hydrogeologist
2015-2018

MTE was retained by the City to provide a Supplemental Phase II ESA and a Designated Substance and Hazardous Material Assessment of the Hamilton Police Services Storage Building. This involved a review of previous environmental site assessment and remediation reports, conducting additional soil and groundwater sampling and managing the completion of a geotechnical investigation. Peter oversaw the construction dewatering assessment and analysis completed for the site.

Region of Waterloo
Maple Grove Road & Fountain Street, Cambridge
Groundwater Resource Evaluation
Role: Project Hydrogeologist
2010-2015

Peter evaluated the groundwater resources for a Class C Environmental Assessment for a water supply system. The objective of this project was to determine the maximum sustained pumping rate at a newly constructed 305-mm water well and existing production well sites designed by MTE. A number of monitoring wells were installed throughout the study area to determine the most suitable location for a new test production well. To aid in the prediction of the long-term effects of pumping MTE used the predictive FEFLOW model. The model also provided an understanding of the existing geological setting and hydrogeological properties of the study area. MTE completed a long-term pumping test (40 days) at a rate of 80 L/sec from two production wells to assess the potential for groundwater interference with existing groundwater users. Water levels from 40 private domestic water supplies and surface water features were monitored using electronic pressure transducers along with the collection and assessment of surface water flow data from a nearby creek and precipitation data. Groundwater quality and quantity were assessed using water samples obtained during the pumping test to monitor the impacts on local surface water courses.

City of Kitchener
Battler Snow Storage Facility
Hydrogeological Investigation
Role: Senior Hydrogeologist
2013-2018

Peter was the Project Hydrogeologist for a new snow storage facility in the City of Kitchener. During the site selection process the hydrogeological conditions were assessed, including evaluating the site in the local and regional hydrogeological framework, along with considering proposed risks to groundwater and surface water quality as a result of chloride impacts from melting snow. During development, Pete is providing oversight for the hydrogeological study and groundwater monitoring program.

Region of Waterloo
St. Agatha Municipal Wells
Groundwater Assessment
Role: Project Manager & Hydrogeologist
2008-2011

Peter served as Project Manager and Project Hydrogeologist for a groundwater exploration program to assess the potential to develop a new municipal groundwater supply to service, and potentially replace the existing nitrate impacted municipal wells in the Hamlet of St. Agatha. The project included the drilling and construction of monitoring wells, executing private property access agreements, and drilling, construction, design and hydraulic testing of one test production well.

Municipality of North Huron
Wingham & Blyth
Hydrogeological Study
Role: Hydrogeologist
2003-2005

MTE was retained to conduct a hydrogeological study for the determination of Groundwater Under the Direct Influence of Surface Water (GUDI). This project included coordination of field activities, selection of water quality testing methods, isotopic analysis, bacteriological analysis, review of pumping test results and determination of the influence of surface water on groundwater resources. Specific project tasks included hydrogeological setting assessment, conducting a door-to-door survey to identify water quality concerns and to establish monitoring points for use during pumping tests, installation of piezometers, well inspections, pumping tests, and water quality sampling, data compilation and interpretation, groundwater modelling, and hydrogeological reporting for the determination of the need for filtration for the municipal wells.

Municipality of South Huron
Exeter
Groundwater Management Study
Role: Hydrogeologist
2003-2006

MTE conducted a Groundwater Management Study under the Ontario Government's "Provincial Water Protection Fund" program. The study focused on Exeter's existing groundwater supplies and covered an area of approximately 140 square kilometres in southern Huron County. MTE also assisted in completing a GUDI assessment of the water supplies and undertook the hydrogeological component of a Class EA Study for Long-Term Water Supply.

Region of Waterloo
River Well Assessment, Kitchener
Role: Project Manager & Hydrogeologist
1998-2000

Peter served as Project Manager and Project Hydrogeologist, in association with EarthFx, to assess the hydrogeology of the River Wells, a series of nine wells located along the Grand River east of Kitchener (including the Forwell, Pompeii and Woolner well fields). The assignment included the construction and calibration of a 3D groundwater flow model, with both forward and backward in time particle tracking to understand the flow regime in which the wells were constructed. The project also included a study of potential adverse impacts to the wells from gravel extraction activities and future land use plans.

Region of Waterloo
Peaking Wells K90 - K93
Well Oversight & Testing
Role: Hydrogeologist
1990-1993

Peter served as Project Hydrogeologist for a groundwater development project that included the test drilling, design, construction oversight, hydraulic testing and permitting for municipal wells K90, K91, K92 and K93. The intention of the wells was to assist in meeting peak water supply demands for the Region.

Region of Waterloo
Guidelines for Privately Serviced Developments
Hydrogeological Consulting
Role: Hydrogeologist
1992

Peter served on a team of consultants that drafted the terms of reference for hydrogeological studies to be undertaken for proposed rural developments on private services. The investigations, which have been updated over time, included assessing water supply demands from a quality and quantity perspective, as well as waste water requirements, including sewage disposal systems.

Region of Waterloo
Well Interference Complaints
Role: Hydrogeologist
1989-1993

Peter investigated well interference complaints on behalf of the Region through the Well Interference Complaint Committee. These complaints had been registered by rural landowners across the Region, alleging that their private water supply had been affected by the pumping of a nearby municipal well. The investigations included meeting with the landowners, collection and review of background data, well inspection, summary report preparation and presentation of findings and recommendations to the Committee.

City of Cornwall
Landfill Assessments
Role: Senior Hydrogeologist
2010-2014

Peter was the Senior Hydrogeologist for various Landfill Assessments for both open and closed landfills in Cornwall.

Ferma Aggregates
Carden Quarry, Kirkfield
Hydrogeological Investigation
Role: Senior Hydrogeologist
2011-Present

This project involved an exploration well installation (cored holes) for the purpose of aggregate quality testing. The results of the cored holes were used in a geological evaluation for the purpose of assessing bedrock quality and quantity at the quarry. This project also included groundwater level and quality monitoring to comply with the aggregate license and the Environmental Compliance Approval needed to discharge water back into the natural environment. Annual compliance reports are submitted to the Ministry of Natural Resources and Ministry of Environment to demonstrate the impact of the quarry on surface and groundwater resources.

Severn Aggregates
Cumberland Quarry
Hydrogeological Investigation
Role: Senior Hydrogeologist
2007-Present

MTE conducted a regional-scale groundwater assessment in support of an application for a quarry below the water table. This project included a drainage basin analysis for the purpose of identifying groundwater and surface water interactions. This analysis involved the assessment of baseflow condition of onsite creeks, and completion of water budget calculations. Groundwater levels and quality monitoring as well as hydrological monitoring (stream flow) is being done to track long-term fluctuation over time. This information is being inputted into a database used for the development of a numerical groundwater model using FEFLOW 6.0. The purpose of the model will be to assess the potential impacts of the quarry on surface water and groundwater resources and their uses as the quarry develops.

Fowler Construction Company
Fleming Quarry, Washago
Surface & Groundwater Studies
Role: Senior Hydrogeologist
2010-2015

This project required the completion of a Hydrogeological Investigation to support an application for a quarry below the water table. This project included drilling and installation of eight onsite bedrock water wells and two wetland monitoring stations. Peter was responsible for overseeing the technical reports that were required for the assessment of potential impacts to surface water and groundwater resources from quarrying activities as required to obtain a Permit to Take Water and a Certificate of Approval for quarry dewatering.

Harold Sutherland Construction
Keppel Quarry
Hydrogeological Investigation
Role: Senior Hydrogeologist
2006-2019

Level 1 and Level 2 Hydrogeological Investigations were completed to support an application for a quarry expansion and assessed the risk to groundwater and surface water resources. First Nations consultation began during the Stage 1 investigation, and continued through the Stage 2 investigation up to and including the Ontario Municipal Board and Environmental Review Tribunal hearings. An Adaptive Management Plan was also developed allowing for strategic decision-making so that potential impacts to the natural environment could assessed and mitigated prior to any adverse impact. Before the plan was developed, MTE's Hydrogeological Investigation was peer reviewed by several Hydrogeologist at the Ministry of Natural Resources, MOE, and the Niagara Escarpment Commission.

First Nations Consultation
Role: Qualified Professional
1995-Present

Peter has extensive experience working with First Nations through the Duty to Consult – Constitution Act, 1982, as it relates to work performed on various gravel pit and bedrock quarry sites that Peter has been involved as a QP across Ontario. Peter has attended and provided expert witness testimony at the Ontario Environment Review Tribunal on matters concerning First Nations consultation, and has worked for individual bands on a project by project basis, including the Chippewa's of the Thames, Ojibwe Nation near London, ON, the Dokis Nation, near Lake Nipissing, ON, and the Cree Nation near Mistissini, QC.

Community Based Environmental Assessments on Rehabilitation Projects, Southeast Asia
Role: Co-Team Leader
2004-2006

Peter was the Co-Team Leader for Community-Based Environmental Assessment Reports for Indonesia, Thailand, Sri-Lanka – CIDA and non-CIDA, and India – CIDA and non-CIDA funded projects, on behalf of World Vision Canada / CIDA SE Asia Tsunami Response Team, following the December 26, 2004 Southeast Asia Tsunami.

Canadian International Development Agency
Save the Buriganga Program, Bangladesh
Role: Project Director
2000-2003

Peter was the Project Director for the "Save the Buriganga Program;" a river clean-up project sponsored by the Canadian International Development Agency (CIDA), in association with the Ministry of Environment and Forest; and Department of Environment, Government of the People's Republic of Bangladesh.

Vinyl Manufacturing Facility, Toledo, Ohio
Contaminant Hydrogeological Assessment
Role: Project Manager
1995-1997

Peter was the Project Manager for a stormwater and surface water assessment at a vinyl manufacturing facility.

Groundwater Supply Development Zomba, Malawi
Role: Senior Hydrogeologist
1995-1996

Peter was the Senior Hydrogeologist for the development of a groundwater supply for the Naming'azi Farm Training Centre, an elementary school and a youth hostel and local villages located near the City of Zomba, Malawi in Southeast Africa. This work was completed through the Presbyterian World Service and Development (PWS&D) in association with the Church of Central Africa Presbyterian (CCAP).

Publications & Presentations

Gray, P.A. (2020). Bon Park Podcast. April, 2020

Gray, P.A. (2020). "Estimating the Yield of a Domestic Well", Ground Water Canada Magazine. April, 2020.

Bingeman, A.L., **P.A. Gray,** F. Abu-Hijleh, K. Wallace. (2018). "The Effect of Close-Proximity Blasting on Groundwater Quality and Impacts on a Communal Drinking Water Systems. A Cast Study". Presented at the National Groundwater Association (NGWA) Groundwater Week, Groundwater Summit Conference. December 3, 2018. Las Vegas, NV.

Gray, P.A. (2016). "Navigating Permits to Take Water (PTTWs)", Presented at the Ontario Stone, Sand and Gravel Association, Environmental Workshop. November 22, 2016. Mississauga, ON.

Gray, P.A., (2016). "Water Education Beyond the Classroom, 20 Years Later", Presented at the Canadian Ground Water Conference and Expo 2016. June 10, 2016. Niagara Falls, ON.

Gray, P.A. (2015). "Navigating Permits to Take Water (PTTWs)", Presented at the Ontario Stone, Sand and Gravel Association, Environmental Workshop. November 25, 2015. Mississauga, ON.

Gray, P.A. and J. Flanagan (2015). " A fine balance. Progressive rehabilitation helps make water balance naturally through vegetated areas", Avenues Magazine. Volume 5, Issue 2. November, 2015.

Gray, P.A. and M. Bradley (2015). "Leadership in action: The Children's Groundwater Festival successfully promotes environmental leadership by educating our youth", Avenues Magazine. Volume 5, Issue 1. February, 2015.

Gray, P.A. (2014). "Navigating Permits to Take Water (PTTWs)", Presented at the Ontario Stone, Sand and Gravel Association, Environmental Workshop. November 4, 2014. Mississauga, ON.

Gray, P.A. (2014). "Working with Water from Africa to Asia to Waterloo Region", Presented for the Haysville Sunshine Retirees Club. June 19, 2014. Haysville, ON

Gray, P.A. (2014). "Water Education Beyond the Classroom – 20 Years Later", Environmental Science and Engineering Magazine. January-February Issue, 2014.

Gray, P.A. (2013). "Working with Water From Africa to Asia", SAWA – Stratford Area World Aid Water Project-Dukam, Ethiopia. November 7, 2013. Stratford, ON.

Gray, P.A. (2011). "Just Add Water" – Soupfest: World Water Day, Children's Water Education Council. March 22, 2011. Kitchener, ON.

Gray, P.A. (2010). "Just Add Water" – Soupfest: World Water Day, Children's Water Education Council. March 22, 2010. Kitchener, ON.

Gray, P.A. (2009). Community Based Environmental Assessments Where Hazards / Catastrophes / Society Come Together. Case Study: SE Asia Tsunami Response – Indonesia, Sri Lanka, Thailand, India; May-July 2005. Presented at the International Association of Hydrogeologists / Hydrogeology Division of Canada Geotechnical Society. March 2, 2009. Kitchener, ON.

Reid, S. and **P.A. Gray** (2008). Water Education: Beyond the Classroom. Presented at the Ontario Society for Environmental Education (OSEE) Summer Conference. May 8, 2008. Oshawa, ON.

Lizhong, W., L. Fang, K. Hipel and **P.A. Gray** (2008). Subsurface Contaminant Remediation and Cost/Benefit Sharing to Redevelop a Naphtha Contaminated Brownfield. Proceedings of Water Down Under 2008, incorporating the 31st Hydrology and Water Resources Symposium and the 4th International Conference on Water Resources and Environment Research. April 14 to 17, 2008. Adelaide, Australia. pp. 2423-2433.

Gray, P.A. (2008). Uncertainty and Conflict in a Disaster Zone: Case Study: SE Asia Tsunami Response, Environmental Policy and Planning Course. February 7, 2008. McMaster University, Hamilton, ON.

Reid, S. and **P.A. Gray** (2007). Beyond the Classroom: An Overview of the Water Education in Ontario, Day 1, Environmental Education and Communications. A.D. Latornell Conservation Symposium: Your Watersheds, Our Great Lakes. November 14, 2007. Alliston, ON.

Yousefi, S., K. Hipel, K.T. Hegazy, J.A. Witmer and **P.A. Gray** (2007). Negotiation Characteristics in Brownfield Redevelopment Projects. Presented at 2007 IEEE International Conference on Systems, Man and Cybernetics. October 2007. Montreal, QC.

Yousefi, S., K. Hipel, K.T. Hegazy, J.A. Witmer and **P.A. Gray** (2007). Cooperative Brownfield Redevelopment for an Educational Institution. Presented at Brownfields Redevelopment Negotiation and Strategy Workshop, Wilfrid Laurier University. June 23, 2007. Waterloo, ON.

Yousefi, S., K. Hipel, K.T. Hegazy, J.A. Witmer and **P.A. Gray** (2007). Cooperative Brownfield Redevelopment for an Educational Institution. Presented at 4th International Conference in Group Decision and Negotiation (GDN). March, 2007. Montreal, QC.

Gray, P.A. (2006). Water Festivals to Field Programs. Presented at 7th Annual Water Forum, Grand River Conservation Authority. September, 2006.

Gray, P.A. (2006): The World's Thirst for Water, presented at International Projects and Issues Conference, Rotary International, Cameron Heights Collegiate Institute. May 25, 2006. Kitchener, ON.

Gray, P.A. (2006). The World's Thirst For Water. Presented at World Vision 30-Hour Famine. April 29, 2006. Cambridge, ON.

Gray, P.A. and J. Johnson (2006). Rotary International Minds Conference… a think tank for youth. Great Lakes: Climate Change – Are Water Levels in the Great Lakes Rising or Falling, University of Waterloo, Waterloo, Ontario, April 13, 2006.

Gray, P.A. (2006). The Dec 26/04 Tsunami meets the Water Table, Banda Aceh, Sumatra Island, Indonesia, What on Earth, A Canadian Newsletter for the Earth Sciences, Volume 4, Number 1, University of Waterloo, March 2006.

Gray P.A. and S. Reid (2005). Water Education, Beyond the Classroom. Presented at the Ontario Water Works Association Annual Conference. May 8, 2005.

Gray, P.A. (2005) Rotary International Minds Conference… A think tank for youth. Great Lakes: Planning for Competing Interests, University of Waterloo. April 10, 2005. Waterloo, ON.

Gray P.A., T.A. Bonin and M.F. Ahmed (2004) Dhaka's Waterways: Save the Buriganga River Program. Presented to 39th Central Canadian Symposium on Water Quality Research, Drinking Water Session. February 9, 10, 2004. Burlington, ON.

Gray, P.A. (2004). Rotary International Minds Conference… A Think Tank for Youth. A Civic Youth Conference on Water, Wilfrid Laurier University. April 16, 2004. Waterloo, ON.

Gray, P.A., E. Hodgins and B. Veale (2004). Planning for Water Conservation and Use in Waterloo Region, Chapter 17, Towards a Grand Sense of Place. Writings on the changing environments, land-uses, landscapes, lifestyles and planning of a Canadian Heritage River. pp. 225-240, 2004.

Gray, P.A. and D. Schultz (2003). Water Management Building Blocks, Breakthroughs and Opportunities. Environmental Science and Engineering Magazine. November 2003.

Gray, P.A. (2003). 3rd Annual Grand River Watershed Water Forum, Building Blocks, Breakthroughs & Opportunities, Afternoon Session Moderator, September 12, 2003. Cambridge, ON.

Gray, P.A. and T. Bonin (2003). Dhaka's Waterways, Save the Buriganga Program. Presented to St. Lawrence River Institute of Environmental Science: Large River Ecosystems - Under Stress Conference. May 13-15, 2003. Cornwall, ON.

Fedy, R., **P. Gray,** R. Barnes and J. Witmer (2003). Ralgreen Restoration Project, A Brownfield Cleanup Project in a Residential Neighbourhood. Presented to 38th Central Canadian Symposium on Water Quality Research. February 10-11, 2003. Burlington, ON.

Gray, P.A. and S. Reid (2002). Children's Water Education Council, Water Festivals and Grade 8 Programming. Presented at and published in proceedings of 2002 Groundwater Foundation Fall Conference, "Groundwater: the Forgotten Element of Watershed Protection". November 2002. Eugene, OR.

Gray, P.A. and S. Reid (2002). A Practical Approach to Educating Children About Water. Presented on behalf of the Children's Water Education Council at the Managing Shared Waters International Conference. June 2002. Hamilton, ON.

Gray, P.A., B. Davidson, A. MacDonald (2001). Pressure Pulse Technology (PPT): A Revolutionary Fluid Flow Technology for Porous Media. Presented at 2001 An Earth Odyssey, 54th Canadian Geotechnical Conference, 2nd Joint IAH and CGS Groundwater Conference. September 16-19, 2001. Calgary, AB.

Bajc, A.F., White, T.N. and **Gray, P.A.** (2001). Quaternary geology of the Northwest Bay area. Ontario Geological Survey, Map 2572, scale 1:50,000.

Bajc, A.F., and **Gray, P.A.** (2001). Quaternary geology of the Rainy River area; Ontario Geological Survey, Map 2570, scale 1:50,000

Gray, P. A. (2001). Source Zone Removal Using Pressure Pulse Technology. Presented at the 2001 Groundwater Foundation Fall Conference and Groundwater Guardian Designation Conference on Today's Technology Protecting Tomorrow's Groundwater. November 14-16, 2001. Pittsburgh, PA.

Gray, P.A., E. Hodgins and B. Veale (2001). Water, water everywhere? Understanding and protecting our nation's most valuable resource. Environments 29(1): 39-66. Theme Issue: Urban Environmental Planning, Management and Decision Making.

Gray, P.A. (2000). The Importance and Sensitivity of Our Water Resources; presented at the Western Ontario Water Works Conference, Windsor, Ontario, October 4, 2000.

Gray, P.A. and A. MacDonald (2000). Dramatic LNAPL Recovery using Pressure Pulse Technology (PPT) at a Manufacturing Facility in Ontario. Environmental Science and Engineering Magazine, November-December, 2000.

Gray, P.A. (2000). Measuring Water Quality Management Performance Conference, Session 2 Chair, Water Performance Issues. Presented by Federated Press. October 30-31, 2000. Toronto, ON.

Gray, P.A. (2000). Water Quality Issues and Challenges. Presented to and paper at the Federated Press, Measuring Water Quality Management Performance Conference. October 30-31, 2001, Toronto, ON.

Gray, P.A. (2000). Water, Water Everywhere? Workshop Series. Presentation and paper on Urban Living and Environmental Change, The Urban Environmental Project – Workshop Series, Session II. Presented by the Heritage Resource Center, Interdisciplinary Research Fund, Dean of Environmental Studies and the School of Planning at the University of Waterloo in conjunction with the Rotary Club of Kitchener; January 20, 2000.

Gray, P.A. and T.A. Bonin (1999). 3-D Visualization of Groundwater Flow from an Industrial Property Towards Canada's Newest Heritage River. Presented at 22nd Biennial Ground Water Conference "Interconnected Water Supply in California". September 20-21, 1999.

Gray, P.A. (1997) The Role of Quaternary Geology in Computer Modeling of Groundwater Flow. Presented at the Quaternary Discussion Group, University of Waterloo. November, 1997.

Gray, P.A. (1995) Groundwater Resources – An Overview. Presented at the Spring (May 1995) and Fall (October 1995) Workshops, Groundwater Development and Well Design, Operation and Maintenance, Western Ontario Waterworks Conference and Ontario Waterworks Association, a section of AWWA, Toronto (May 1995), Stratford (October 1995), ON.

Gray, P.A. (1994). Wellhead Protection – An Overview. Presented at the CanWell '94 Convention, Technical Session C: Aquifer Protection. April 1994. Vancouver, B.C.

Gray, P.A. (1994) Groundwater Education in Ontario – Consultants and Contractors Make It Happen. Presented at CanWell '94 Convention, Technical Session C: Management Issues. April 1994. Vancouver, B.C.

Gray, P.A. (1993). Groundwater Education in Ontario – Consultants and Contractors Make It Happen. Presented at the Second American Ground Water Trust National Workshop on Ground Water Education, NGWA Convention. November 1993. Kansas City, MO.

Gray, P.A. (1991). Proper Protection and Placement of Domestic Wells. Parent-Child Guide Book.

Bajc, A.F., White, T.N. and **Gray, P.A.** (1990). Quaternary geology, Northwest Bay area. Ontario Geological Survey, Preliminary Map P.3138, scale 1:50,000.

Bajc, A.F. and **Gray, P.A.** (1987) Quaternary Geology of the Rainy River Area, District of Rainy River. Ontario Geological Survey, Map P. 3065; Geological Series – Preliminary Map; Scale 1:50,000. Geology 1986.

Jay's project management expertise includes planning, budget preparation and tracking, coordination of staff and sub-contractors, and communication with residents and reviewing agencies. He has completed Level 1 and Level 2 Hydrogeological Investigations for aggregate resource applications, Permit to Take Water (PTTW) applications, Certificate of Approval (C of A) applications, Environmental Compliance Approval (ECA) and reporting for compliance with PTTW, C of A, ECA and extraction licenses. Jay has detailed knowledge of site characterization and hydrogeological modelling, as well as field experience in sampling techniques including groundwater, surface water, soil and sediment sampling. He also has a broad understanding of aggregate quarrying and effluent, as well as water management. His fieldwork experience incorporates hollow stem and solid stem augering, geoprobe, continuous core sampling, air-rotary drilling, monitoring well installation, and soil sampling. He also has detailed knowledge of provincial guidelines and regulations in particular the Aggregate Resources Act, Ontario Water Resources Act and Environmental Protection Act.

Jay Flanagan, B.E.S., B.Ed.

Title: Manager, Aggregate Resources

Professional Experience

Education

Environmental Engineering Applications Post Graduate Diploma | Conestoga College | 2003

Bachelor of Education | Western University | 2001

Bachelor of Environmental Studies | University of Waterloo | 1997

Certificate | Environmental Assessment | University of Waterloo | 1997

Professional Designations

Certified Well Technician (O. Reg. 903) | Ministry of Environment (MOE) | 2007

Tenure with MTE

Since 2003

Professional Development

40-Hour Contaminated Site Health and Safety Training Course

Project Management Bootcamp | PSMJ Resources, Inc.

Hazardous Waste Operations and Emergency Response (HAZWOPER) | Ontario Health and Safety Association (OHSA) Standard (29CFR 1910.120 Certified)

Standard First Aid & CPR / AED Certification

WHIMIS

Work History

Project Manager | MTE Consultants | 2003-Present

Aecon Construction and Materials
Oliver Pit
Hydrogeological Investigation
Role: Project Manager

This Hydrogeological Investigation was completed to support an application for a Permit To Take Water (PTTW) for a proposed wash plant. The annual groundwater monitoring and compliance reporting was completed as per the PTTW and extraction license. Jay was responsible for the implementation of a monitoring program that included annual reporting on water levels and water quality for a gravel pit in the Township of North Dumfries. The annual reporting considered the effects of the gravel pit on groundwater and surface water resources by reviewing data from seven monitoring wells, two surface water staff gauges in a provincially significant wetland, and two private wells.

Aecon Construction and Materials
Marmora Mine
Preliminary Dewatering Impact Assessment
Role: Project Manager

This assessment was completed to investigate the feasibility of dewatering an open pit mine so that it can be used for a pumped storage hydro power project to be operated by Northland Power Inc. The mine has been filling with water (i.e. precipitation, runoff, and groundwater) since 1978 when extraction ceased. The mine is currently a lake and approximately 90 per cent of the water would need to be discharged into a nearby Provincially Significant Wetland (PSW). As part of this investigation, the quality and quantity of the water in the mine was determined, baseline habitats studies were completed, and the risk of flooding as well as the ability of the PSW to assimilate the water assessed. The information collected was used to make recommendations for managing the water so that a final dewatering strategy could be developed. Jay was responsible for coordinating and completing the field work, report writing, and making a formal presentation to the stakeholders regarding the preliminary findings of the study. The surface water and ecological components of this study are ongoing.

Aecon Construction and Materials
Mountain Lake Quarry, Mississauga Landing
Surface Water Study
Role: Project Manager

MTE was retained to complete a surface water assessment in support of a Permit to Take Water (PTTW) for a wash plant. The assessment was requested to determine the potential impact on the natural environment related to taking water from a nearby body of water known as Mountain Lake. The water was needed for aggregate washing purposes. The scope of work for the surface water study included mapping the drainage area for Mountain Lake in combination with designing a field program to collect background data on the flows from Mountain Lake. The drainage area mapping was used to complete water balance calculations to estimate the average annual inputs into Mountain Lake, while the field program involved establishing continuous flow monitoring stations at a culvert which drains from Mountain Lake. MTE completed discrete flow monitoring at the culvert and will create a rating table for which continuous flow data can be generated. The flow data will help assess any future impacts of the proposed water taking from Mountain Lake. The surface water study is ongoing.

Bot Construction Group
Sebright Quarry
Surface and Groundwater Studies
Role: Project Manager

This project included groundwater monitoring of 28 onsite bedrock wells and 16 offsite private water supply wells. Jay was responsible for ensuring completion of technical reports to assess the potential impacts to surface water and groundwater resources from quarrying activities as required to obtain a Permit to Take Water and a Certificate of Approval for quarry dewatering.

Durham Stone and Paving
Feversham Pit
Groundwater Study
Role: Project Manager

This project required the completion of a Hydrogeological Investigation to support an application for a pit that is above the water table as well as a Hydrogeological Investigation to support an application for a Permit to Take Water for a wash plant. This project included installation of eight onsite water wells. Jay was responsible for ensuring completion of technical reports to assess the potential impacts to groundwater resources from pit activities as required to obtain a Permit To Take Water and an aggregate license under the Aggregate Resources Act.

Ferma Aggregates
Carden Quarry, Ferma
Hydrogeological Investigation
Role: Project Manager

This project involved an exploration well installation (cored holes) for the purpose of aggregate quality testing. The results of the cored holes were used in a geological evaluation for the purpose of assessing bedrock quality and quantity at the quarry. This project also included groundwater level and quality monitoring to comply with the aggregate license and the Environmental Compliance Approval needed to discharge water back into the natural environment. Annual compliance reports are submitted to the Ministry of Natural Resources and Ministry of the Environment to demonstrate the impact of the quarry on surface and groundwater resources.

Fowler Construction Company
Fleming Quarry, Washago
Surface & Groundwater Studies
Role: Project Manager

This project required the completion of a Hydrogeological Investigation to support an application for a quarry below the water table. This project included drilling and installation of eight onsite bedrock water wells and two wetland monitoring stations. Jay was responsible for ensuring completion of technical reports to assess the potential impacts to surface water and groundwater resources from quarrying activities as required to obtain a Permit To Take Water and a Certificate of Approval for quarry dewatering.

Fowler Construction Company
Rosewarne Quarry, Bracebridge
Permit To Take Water (PTTW) &
Annual Groundwater Monitoring
Role: Project Manager

This project involves a reapplication for a PTTW, annual reporting on groundwater and surface water monitoring for the PTTW, and monitoring compliance with a Certificate of Approval.

G.W. Clarke Drainage Contractors
Bokor Pit, Cedar Springs
Groundwater Impact Assessment
Role: Project Manager

This Level 1 and Level 2 Hydrogeological Investigation was to support a new below-water-table gravel pit application. This project included ongoing groundwater water monitoring of six onsite groundwater monitoring wells for the purpose of monitoring impacts to groundwater resources. Annual compliance reports are submitted to the Ministry of Natural Resources that report on the changes to the groundwater flow regime as the pit expands.

Greenwood Construction
East and West Pits, Orangeville
Surface and Groundwater Studies
Role: Project Manager

This project required the completion of a Hydrogeological Investigation to support an application for a Class A Gravel Pit that is above the water table. This project was a preliminary Hydrogeological Investigation for the purpose of determining the final extraction elevation to the established groundwater table. It included drilling and installation of water wells for the purpose of mapping groundwater levels across the site. Jay was responsible for ensuring completion of technical reports to assess the potential impacts to surface water and groundwater resources from quarrying activities as required to obtain an aggregate license under the Aggregate Resources Act.

Greenwood Construction
Greenwood Ready-Mix Plant, Elora
Hydrogeology Study
Role: Project Manager

This project required the completion of a Hydrogeological Investigation to support a development permit needed for the construction of a ready-mix plant. The elevation of the established groundwater table was determined as wells as the groundwater connection of the site to a nearby wetland. The information was used to help design a stormwater retention pond to manage overland runoff. This project included drilling and installation of monitoring wells for the purpose of mapping groundwater levels across the site as well as piezometers in the nearby wetland to establish the groundwater connection. Jay was responsible for ensuring the completion of technical reports to assess the potential impacts to surface water and groundwater resources from the development of the ready-mix plant.

Greenway Environmental Management
Inland Pit, Arkona
Hydrogeological Investigation
Role: Project Manager

This Level 1 and Level 2 Hydrogeological Investigation was to support a gravel pit expansion. The annual groundwater monitoring and compliance reporting was per Permit to Take Water.

Sarjent Company
Waverley Pits
Groundwater Impact Assessment
Role: Project Manager

This Level 1 and Level 2 Hydrogeological Investigation was to support a new below-water-table gravel pit application. This project included ongoing groundwater water monitoring of nine onsite groundwater monitoring wells and seven offsite private water supply wells.

Harold Sutherland Construction
Keppel Quarry
Hydrogeological Investigation
Role: Project Manager

This Level 1 and Level 2 Hydrogeological Investigation was in support of an application for a quarry expansion. This investigation was done to assess the risk to groundwater and surface water resources as a result of a quarry expansion. From this investigation, management plans were development called an Adaptive Management Plan that will allow for strategic decision making with respect to quarry operations so that potential impacts to the natural environment can be fully assessed and mitigated prior to any adverse impact. Before the Adaptive Management Plan was developed the results of the Hydrogeological Investigation was peer reviewed by several professional hydrogeologists including those at the Ministry of Natural Resources, Ministry of the Environment, and the Niagara Escarpment Commission.

Severn Aggregates Ltd.
Cumberland Quarry
Hydrogeological Investigation
Role: Project Manager

MTE conducted a regional-scale groundwater assessment (Level 1 and Level 2 hydrogeological investigation) in support of an application for a quarry below the water table. This project includes a drainage basin analysis for the purpose of identifying groundwater and surface water interactions. The drainage basin analysis involves the assessment of baseflow condition of onsite creeks, as well as the completion of water budget calculations. Groundwater levels and quality monitoring as well as hydrological monitoring (stream flow) is being done on the site to track long-term fluctuation over time. This information is being inputted into a database used for the development of a numerical groundwater model using FEFLOW 6.0. The purpose of the numerical model will be to assess the potential impacts of the quarry on surface water and groundwater resources and their uses as the quarry develops.

Jim Brown & Sons Trucking
Brown Pit, Orangeville
Surface and Groundwater Studies
Role: Project Manager

This project involved the completion of Hydrogeological and Hydrological Assessments in support of an application for a gravel pit below the water table. This project includes drainage basin analysis for the purpose of identifying groundwater and surface water interactions as well as water budget calculations to determine the impact of the proposed pit on a nearby wetland. Groundwater test wells were installed on the site so that groundwater levels could be tracked over time.

Limehouse Clay Products
Limehouse Quarry, Georgetown
Level 1 & Level 2 Hydrogeological Investigation
Role: Project Manager

This project has involved groundwater and surface water analysis and groundwater levels since 2004. Recent work involved application for quarry deepening. Work assessing risk to up-gradient wells and designing a monitoring and mitigation plan to handle any potential environmental risk was included in the application.

St. Marys Cement
Tikal Pit, Puslinch
Groundwater Monitoring
Role: Project Manager

This project involved a groundwater and surface water monitoring plan for a below-water-table gravel pit. Jay was responsible for the implementation of comprehensive groundwater monitoring plan to assess potential impacts on groundwater and surface water resources from a below-water-table gravel pit. His duties involved coordinating with field staff to collect weekly groundwater and surface water level measurements and annual groundwater and surface water samples; review and comparison of the weekly monitoring data to threshold limits established as part of the contingency plan for the gravel pit; and, annual reporting to the Township, Conservation Authority, and Ministry of Natural Resources.

St. Marys Cement
Woods-Gray Pit, Orangeville
Groundwater Monitoring
Role: Project Manager

This Hydrogeological Investigation was completed to support an application for a Permit to Take Water (PTTW) for a proposed wash plant. The annual groundwater monitoring and compliance reporting was completed as per the PTTW. Jay was responsible for the implementation of a groundwater monitoring program that included bi-annual reporting on water levels for a gravel pit in the Township of East Garafraxa. The annual reporting considered the effects of the gravel pit on groundwater and surface water resources by reviewing data from 10 monitoring wells, and two surface water staff gauges in nearby private groundwater sourced ponds.

McCann Redi-Mix
Bell Pit, St. Marys
Groundwater and Surface Water Impact Assessment
Role: Project Manager

This Level 1 and Level 2 Hydrogeological Investigation was to support an expansion to an existing below-water-table gravel pit application. This project included ongoing groundwater water monitoring of three onsite groundwater monitoring wells for the purpose of monitoring impacts to groundwater and surface water resources (Flat Creek). Annual compliance reports are submitted to the Ministry of Natural Resources reporting on the changes to the groundwater flow regime as the pit expands.

Carson Reid Homes
Elora Meadows
Hydrogeological Investigation
Role: Project Manager

This project involved an impact assessment of a groundwater collection system on groundwater and surface water resources. The system was designed to protect the basements of residential dwellings from flood risks associated with high water table conditions. It also included annual monitoring and compliance reporting as per the Permit to Take Water related to dewatering activities for the installation of a culvert crossing.

Reid's Heritage Homes
Aberfoyle Meadows, Guelph
Hydrogeological Investigation
Role: Project Manager

This site required a comprehensive groundwater resource evaluation, with an assessment of sustainable supply. A communal supply well was drilled into bedrock (Amabel Formation) to provide water for 59 residential units. A backup well was drilled nearby. For the long-term pumping test, 24 data loggers were installed in every creek, pond, observation well and accessible private well in the area. Pumping was conducted at 1,180 L per minute to stress the aquifer to calculate the hydraulic parameters. Nestlès' bottled-water facility is located less than 500 m to the west, so mutual interference was readily observed. With interpretation of the data, and predictions of the regional water supply, a Permit to Take Water was obtained from the Ministry of the Environment to adequately supply the development. An ongoing comprehensive monitoring program assures that all of the conditions are satisfied.

Robertson Rural
Industrial & Commercial
Development, Guelph
Hydrogeological Investigation
Role: Project Manager

This project involved an impact assessment of a development on the bedrock aquifer and Clythe Creek. This local-scale groundwater assessment included a contaminant attenuation capacity for septic systems proposed for an industrial and commercial development. Jay was the Project Manager responsible for overseeing the completion of several well tests on private wells surrounding the site to assess the sustainability of the aquifer as a water supply. He also collected and assessed water quality results obtained from various private wells to ensure the aquifer had adequate water quality. Jay's tasks included the supervision of nitrate loading calculations for the septic systems, the completion of hydrogeological monitoring and analysis (groundwater levels, stream flow measurements, and precipitation volumes), and the preparation of a hydrogeological report that summarized and interpreted the findings and included geological cross-sections and groundwater flow maps.

Property Severance, Maryhill
Hydrogeological Study and
Environmental Impact Study
Role: Project Manager

The hydrogeological component of this study included a local-scale groundwater assessment that involved nitrate loading calculations for the septic systems proposed for property, groundwater flow mapping and preparation of geological cross-sections to identify underlying aquifers. Jay was the Project Manager responsible for overseeing the installation of monitoring wells for the purpose of mapping the established water table and the collection of groundwater quality samples. The environmental impact component of this study involved investigating the significance and ecological sensitivity of a environmental core feature, designated by the Region of Waterloo, adjacent to the site. For this component, Jay was responsible for overseeing the field work and meetings with the Grand River Conservation Authority.

Fraser has eight years of field experience in sampling techniques including groundwater, surface water, soil and sediment sampling as well as knowledge of site characterization and hydrogeological modelling. Fraser is also familiar with provincial guidelines and regulations, in particular the Ontario Water Resources Act and Environmental Protection Act.

Fraser Cummings, M.Sc., P.Geo.

Title: Manager, Hydrogeological Services

Professional Experience

Education

Masters of Science, Earth Science | University of Waterloo | 2014

Bachelor of Science (Honours), Earth Science, Environmental Specialization | University of Waterloo | 2012

Professional Designations

Professional Geoscientist (P.Geo.) | Professional Geoscientists of Ontario (PGO)

Tenure with MTE

Since 2014

Professional Development

CPR and Emergency First Aid Certified

WHMIS

Work History

Manager, Hydrogeological Services; Manager, Environmental Practices; Hydrogeologist; Environmental Scientist | MTE Consultants | 2014-Present

Educational Tutor | Webster Educational Services | 2012-2014

City of Kitchener
Battler Road Snow Storage Facility
Hydrogeological Assessment
Role: Environmental Scientist

Fraser provided hydrogeological services for a new snow storage facility. During the site selection process the hydrogeological conditions were assessed, including evaluating the site in the local and regional hydrogeological framework, along with considering proposed risks to groundwater and surface water quality as a result of chloride impacts from melting snow.

City of Guelph
Former Guelph Coal Gasification Plant
Environmental Investigations
Role: Environmental Scientist

MTE was retained by the City to complete a Phase I and II ESA, and a Geophysical Survey of the City's former coal gasification plant. The Phase II ESA involved installing multiple well nests into soil and bedrock to characterize the nature and extent of impacts. Fraser provided onsite hydrogeology services and analysis for this assignment.

City of Waterloo
RIM Park Recreational Facility
Structural & Geotechnical Assessment
Role: Environmental Scientist

Since construction in 2001, this 30,000-m^2 (320,000-ft^2) recreational facility has experienced issues suspected to be related to the groundwater, such as heaving floors, cracking of non-structural members, and water seepage into interior spaces. As a result the City engaged the services of MTE to undertake and manage subconsultants to complete a structural and geotechnical analysis of the facility. The complex includes three ice rinks, a figure skating facility, an indoor field house and gymnasium. As a member of the project team, Fraser provided onsite hydrogeology services and analysis for this assignment.

Carson Reid Homes
Elora Meadows
Hydrogeological Investigation
Role: Environmental Scientist

This project involved an impact assessment of a groundwater collection system on groundwater and surface water resources. The system was designed to protect the basements of residential dwellings from flood risks associated with high water table conditions. It also included annual monitoring and compliance reporting as per the Permit to Take Water related to dewatering activities for the installation of a culvert crossing. As the Environmental Scientist on the project, Fraser conducts monitoring activities on an ongoing basis.

Chicopee Ski and Summer Resort, Kitchener
Snow Making Investigation
Role: Environmental Scientist

This project involved an investigation to examine Chicopee's water supply and evaluate their options for expanding snow production. Fraser was involved with the drilling of a hole to assess soil conditions, collection of soil samples and equipping the hole with a permanent monitoring well to preform hydraulic testing. Long-term pumping tests are currently being conducted to evaluate aquifer conditions.

Galibier Materials
Galibier Lewis Pit, Vespra
Hydrogeological investigation
Role: Environmental Scientist

This project required the completion of a Hydrogeological Investigation to support an application for a Permit to Take Water for a wash plant. This project included drilling and installation of eight onsite monitoring wells and one pumping well. Fraser was responsible for overseeing onsite drilling, a seven-day pumping test and writing the technical report required for the assessment of potential impacts to surface water and groundwater resources from pumping activities as required to obtain a Permit to Take Water.

Ferma Aggregates
Carden Quarry, Kirkfield
Surface & Groundwater Monitoring
Role: Environmental Scientist

This project includes the monitoring of groundwater levels, surface water flow and surface water quality monitoring to comply with the aggregate license and the Environmental Compliance Approval needed to discharge water back into the natural environment.

Fowler Construction Company
Rosewarne Quarry , Washago
Surface & Groundwater Monitoring
Role: Environmental Scientist

This project includes the monitoring of groundwater levels, surface water flow and surface water quality monitoring to comply with the Permit to Take Water needed to discharge water back into the natural environment. Annual compliance reports are submitted to the Ministry to demonstrate the impact of the quarry on surface and groundwater resources.

Harold Sutherland Construction
Keppel Quarry
Hydrogeological Investigation
Role: Environmental Scientist

Fraser was responsible for managing water level data an ensuring that the quarry operator follows the Adaptive Management Plan developed for strategic decision making with respect to quarry operations so that potential impacts to the natural environment can be fully assessed and mitigated prior to any adverse impact.

Aecon Construction and Materials
Oliver Pit
Hydrogeological Investigation
Role: Environmental Scientist

This Hydrogeological Investigation was completed to support an application for a Permit To Take Water (PTTW) for a proposed wash plant. The annual groundwater monitoring and compliance reporting was completed as per the PTTW and extraction license. MTE implemented a monitoring program that included annual reporting on water levels and water quality for the gravel pit. Fraser collected data for the annual report which considered the effects of the gravel pit on groundwater and surface water resources. He assisted with fieldwork which involved seven monitoring wells, two surface water staff gauges in a provincially significant wetland, and two private wells.

Conn Pit, Gibraltar
Hydrogeological Investigation
Role: Environmental Scientist

This project required the completion of a Hydrogeological Investigation to support an application for a pit below the water table. This project included drilling and installation of six onsite monitoring wells and. Fraser was responsible for overseeing the onsite drilling and writing the technical report that was required for the assessment of potential impacts to surface water and groundwater resources from pit activities.

Aecon Construction and Materials
Marmora Mine
Preliminary Dewatering Impact Assessment
Role: Environmental Scientist

This assessment was completed to investigate the feasibility of dewatering an open pit mine so that it can be used for a pumped storage hydro power project. The mine has been filling with water (i.e. precipitation, runoff, and groundwater) since 1978 when extraction ceased. The mine is currently a lake and approximately 90 per cent of the water would need to be discharged into a nearby Provincially Significant Wetland (PSW). As part of this investigation, the quality and quantity of the water in the mine was determined, baseline habitats studies were completed, and the risk of flooding as well as the ability of the PSW to assimilate the water assessed. The information collected was used to make recommendations for managing the water so that a final dewatering strategy could be developed.