ATTACHMENT 3

RESPONSE TO MOECC COMMENTS
RE: LEVEL 1 AND LEVEL 2 HYDROGEOLOGICAL INVESTIGATION REPORT, PROPOSED FREYMOND QUARRY

April 3, 2018
MTE File No.: C33886-100

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Dear Mr. Guo:

Response to MOECC Comments
Re: Level 1 and Level 2 Hydrogeological Investigation Report,
Proposed Freymond Quarry

This letter aims to respond to the questions raised by the MOECC throughout the review process regarding the Level 1 and Level 2 Hydrogeological Investigation Report for the Freymond Quarry. This letter will also address if a Permit to Take Water (PTTW) is required to manage groundwater discharging into the Site at rates higher than 50,000 L/day (35 L/min). For reference purposes the Site as well as on-Site and off-Site monitoring locations are shown on **Figure 1**.

1.0 CHRONOLOGY OF EVENTS

The following is a chronology summarizing the events that have taken place related to the MOECC review of the Level 1 and Level 2 Hydrological Investigation Report for the proposed Freymond Quarry.

December 1, 2016
On December 1, 2016 MTE on behalf of Freymond Lumber Ltd. submitted a Level 1 and Level 2 Hydrological Investigation Report for a proposed Category 2, Class A Quarry Below Water.

May 3, 2017
MTE received comments from Mr. Guo, a hydrogeologist with the MOECC, regarding the Level 1 and Level 2 Hydrogeological Investigation Report for the Freymond Quarry on May 3, 2017 related to the requirement for a Permit to Take Water (PTTW) and the zone of influence calculations. MTE obtained clarification on these comments with a follow up telephone conversation which occurred on May 10, 2017.

May 24, 2017
On May 24, 2017 MTE responded to Mr. Guo's comments in which the amount of water actively draining from the quarry face post extraction was examined and calculated using five different, and widely accepted analytical models: Darcy's Law (1856), Theis (1935), Powers (2007), and two analytical models derived by S.S. Papadopulos & Associates, Inc. (2013). These methods all showed good agreement with each other. The zone of influence was found to be approximately 500 m from the quarry face extending predominantly in the west and southwest directions. In addition the amount of water draining into the quarry from a single fracture via gravity drainage was estimated using Darcy's Law (1856). The estimated drainage rate was found to coincide with the flows estimated by the analytical models above. Based on the calculations being less than 50,000 L/day MTE maintained that a PTTW would not be required, in relation to the 50,000 L/day threshold.

June 12, 2017
On June 12, 2017 MTE received a response from Mr. Guo related to the letter sent by MTE dated May 24, 2017. Following Mr. Guo's response on June 12, 2017 MTE proposed a Site meeting at the Freymond proposed quarry with the MOECC. Representatives from Freymond Lumber (Site Owner) and Fowler Construction (Proposed Operator) were also invited to attend the Site meeting.

October 2, 2017
On October 2, 2017 representatives from MTE, Fowler Construction and Freymond Lumber met on-Site to discuss comments the MOECC had on the Level 1 and Level 2 Hydrological Investigation Report submitted by MTE. The meeting concluded with the agreement that MTE would outline a work plan that would address comments raised by the MOECC.

October 6, 2017
On October 6, 2017, MTE sent the MOECC a work plan which outlined a proposed short term (72 hour) pumping test on MW7 along with a monitoring plan and the construction of an additional open borehole (MW8) at the northwest corner of the Site.

October 17, 2017
MTE submitted a Category 2 PTTW application for a short term pumping test to be performed on MW7.

October 25, 2017
On October 25, 2017 MTE received a response from Mr. Guo related to the work plan submitted by MTE on October 6, 2017.

November 6, 2017
MTE revised the previously submitted PTTW application to include a short term (24 hr) pumping test on MW7 and on the newly constructed open borehole MW8.

November 21, 2017
The MOECC issued PTTW No. 1205-ASYT3W (**Attachment 1)** for the short term pumping tests on MW7 and MW8.

December 4, 2017
MTE undertook a 24 hour pumping test on MW7 beginning at a rate of 50 L/min, which was maintained for the first 450 minutes. The pumping rate was observed to drop to 40 L/min 750 minutes into the test (**Table 1**). The pumping rate continued to decline and at the end of the test the rate was measured to be 30 L/min.

December 11, 2017
MTE undertook a 24 hour pumping test on MW8 at 50 L/min. MW8 was unable to sustain a sufficient yield (>35 L/min) and the test ended after approximately 285 minutes. The pumping rate was noted to be approximately 11L/min prior to the pump being shut off (**Table 2**).

2.0 CONCEPTUAL MODEL

The following is a description of MTE's conceptual groundwater flow model, which is important when interpreting the results of the pumping test discussed in **Section 3.0**. Since the geology of the Site is composed of crystalline Precambrian rocks these rocks become the host of infiltrated groundwater. As such, an analytical zone-of-influence calculation was used by MTE to describe the potential impacts to groundwater resources from quarry operations. The conceptual model used by MTE to describe how groundwater will enter the quarry at the conclusion of quarrying is outlined below:

- The predominant '*aquifer*' in the study area is identified as metasedimentary Precambrian bedrock. Groundwater flows through secondary porosity features, including fractures and joints in the bedrock.
- Post extraction, the final shape of the proposed quarry can be approximated as a rectangle in plan and a wedge in cross section oriented in a west-east direction, with the western end representing the high part of the wedge.
- A common approach for assessing the drainage (dewatering) effects of quarries is to model the quarry as a circular well with an effective area equivalent to the Site. Groundwater entering into the well (quarry) will occur through a gravity driven seepage process.
- Since the final shape of the quarry can be approximated as a wedge (as described above), flow into the quarry is approximately half that calculated for a circular well that theoretically receives water uniformly around its full circumference from radial flow. Therefore, the wedge will predominantly receive flow from its upgradient faces throughout the excavation.
- The proposed final floor elevation at the outlet will be at approximately 333 mAMSL.

- The maximum observed groundwater elevation on-Site was ~376 mAMSL.
- To ensure the eastward drainage from the face to the SWM facility, the elevation of the quarry floor varies from an elevation of 340 mAMSL at the western edge to 333 mAMSL at the outlet (eastern edge). For the purposes of the drainage calculations, MTE has extrapolated a quarry floor elevation of 333 mAMSL across the entire Site to represent a worst-case scenario. As such, the entire quarry face will be dewatered via gravity, resulting in a maximum drawdown of approximately 43 m (376 – 333 mAMSL) at the westward/leading or up-gradient edge within the Site.
- Since quarry dewatering is a passive gravity driven process and no wells will be used to dewater the quarry, groundwater within the proposed quarry, and ultimately beyond it cannot theoretically be drawn down below the quarry floor.
- Following quarry operations, the rehabilitated quarry will continue to exert an influence on the Precambrian bedrock until such time that the groundwater elevation at the quarry face equals the elevation of the quarry floor and the groundwater system enters into equilibrium.

3.0 PUMPING TEST RESULTS

Responding to comments received by the MOECC, MTE endeavored to conduct a 24 hour pumping test on MW7 and MW8 as seen on **Figure 1**. The purpose of this pumping test was to determine aquifer properties, evaluate the sustainable yield of each well, and identify any impacts related to pumping.

A previous short term (2 hour) pumping test of MW7 was conducted on September 22, 2016. This pumping test indicated that MW7 was able to sustain a yield of 52L/min over 2 hours with a sustained drawdown trend. Based on drawdown data observed in this test MTE interpreted a water bearing fracture at an elevation of approximately 345 mAMSL. Data collected from this pumping test indicated that the specific capacity of MW7 at 52 L/min was 1.8 L/min/m. Based on this information, MTE applied for a PTTW for a pumping rate of 52L/min.

MW7 Pumping Test

The pumping test on MW7 commenced on December 4, 2017 at 09:30 am at 50L/min and continued until December 5, 2017 at 09:52 am (~24.5 hours). The pumping test was done in compliance with temporary PTTW No. 1205-ASYT3W. MW7 was pumped using a 3 inch Grundfos 1 horse power 15 gpm pump installed and provided by Joe Legge and Son's Drilling. The pump was set at approximately 26 m due to the construction of the well. MTE and Freymond staff collected manual measurements from on-Site wells and measured the flow rate periodically throughout the duration of the pumping test. Pumping rates were estimated and recorded by MTE and Freymond staff from an in-line flow meter (**Photo 1 – Attachment 2**). At 750 minutes the pumping rate

notably decreased to 40 L/min, air was also noted to be coming out of the discharge pipe. The pumping rate continued to slowly decrease for the remainder of the test, decreasing to approximately 30 L/min by the end of the test (**Table 1**). Water pumped during the test was discharged through a solid pipe directed approximately 50 m away from MW7 where it was then allowed to follow the natural topography and infiltrate down gradient. This was done to reduce any potential artificial recharge effects.

MW8 Pumping Test

The pumping test on MW8 commenced on December 11, 2017 at 09:17 am at 50L/min and continued until December 11, 2017 at 02:02 pm (~4.8 hours). The pumping test was stopped at 02:02 pm as MW8 was incapable of sustaining a consistent yield of > 15 L/min. The pumping test was done in compliance with temporary PTTW No. 1205-ASYT3W. MW8 was pumped using a 3 inch Grundfos 1 horse power 15 gpm pump installed and provided by Joe Legge and Son's Drilling. MTE also collected manual measurements from on-Site wells and measured the flow rate periodically throughout the duration of the pumping test. Pumping rates were recorded by MTE from an in-line flow meter (**Photo 1 – Attachment 2**). At approximately 99 minutes the pumping rate declined to approximately 28 L/min. The pumping rate continued to decrease for the remainder of the test, decreasing to < 15L/min by tests end. Water pumped during the test was discharged through a solid pipe directed 30 m away from MW8 where it was then allowed to follow the natural topography and infiltrate down gradient. This was done to reduce any potential artificial recharge effects.

3.1 Monitoring Locations

Prior to, during, and post pumping at MW7 and MW8, water levels were measured at 16 monitoring locations which are outlined below and can be seen on **Figure 1.**

- One (0.1 m diameter) pumping well – MW7;
- One (0.2 m diameter) pumping well – MW8;
- Six monitoring (0.03 m diameter PVC) well nests - MW1s, MW1d, MW2s, MW2d, MW3s, MW3d, MW4s, MW4d, MW5s, MW5d, MW6s and MW6d; and
- Two private wells – PW2 and PW13.

The insert below indicates the device used to monitor water levels at each monitoring location. To eliminate variations introduced by barometric pressure fluctuations when using data loggers, a barometric pressure logger was used. Manual groundwater level and elevation data for wells monitored during the pumping test can be seen in **Tables 3 & 4**.

METHOD USED FOR MEASURING WATER LEVELS

Well	Location	Device used
Pumping well	MW7 & MW8	Electric WL Tape and data logger
Monitoring wells	MW1s, MW2s, MW2d, MW3s, MW3d, MW5s, MW6s and MW6d	Electric WL Tape and data logger
	MW1d, MW5d	Electric WL Tape
	MW4s, MW4d	Data Logger
Private wells	PW13	Electric WL Tape and data logger
	PW2	Data Logger

Data loggers were installed in select on-Site and private wells and programmed to collect background water level measurements between 1 minute and 5 minute intervals with the exception of MW4s and MW4d. Due to the slow recovery data loggers in MW4s and MW4d were not able to be reprogrammed and recorded a water level every 8 hours. Water levels in the pumping wells were recorded every 30 seconds during pumping and either 1 minute or 5 minute intervals during non-pumping.

At MW4, the pressure in the fractures has risen to a level above the ground surface. In an effort to measure static conditions (i.e. when the pressure has been relieved or reached equilibrium with the atmosphere), a manometer[1] was added to these wells **(Photo 2 – Attachment 2)**. Unfortunately due to temperatures being below zero during the pumping tests, water within the manometers froze and as such is no longer an accurate measurement of the natural water level during the winter season.

During pumping, water levels were measured in off-Site private wells to identify potential off-Site impacts if any. Prior to start-up, water levels from off-Site private wells were collected to establish background conditions. Data loggers were installed in PW2 and PW13 and were programmed to take a reading every 1 minute in PW2 and every 5 minutes in PW13.

Upon inspection of PW2, MTE was informed by the homeowner that the well is a flowing artesian well and that the well has been sealed in a way to control the flow of water. Water from the well enters into the house through a pipe that leads to a pressure tank (**Photo 3 – Attachment 2**). As such, traditional methods of measuring water levels from this well could not be employed. Instead of measuring a water level directly, MTE had installed an in-line pipe with a data logger that was installed between the pipe coming from the well and going to the pressure tank **(Photo 4 – Attachment 2)**, in an attempt to measure changing pressure conditions during the testing period.

[1] A manometer is an instrument that uses a column of liquid to measure pressure, although the term is currently often used to mean any pressure measuring instrument.

Groundwater level data for all monitoring locations with the exception of PW2 (between December 1 and December 20 2017) are illustrated on **Hydrograph 1**. Total pressure data for PW2 was compared to groundwater elevations from select on-Site wells is presented on **Hydrograph 2**. MTE considers a response to pumping to be a measurable amount of drawdown and recovery that corresponds to the beginning and end of the pumping test.

3.2 MW7 24 hour Pumping Test Results - Analysis and Interpretation

This section describes the analyses and interpretation of water level data related to the 24 hour constant rate pumping test performed on MW7. Based on these analyses, hydrogeological coefficients were calculated and are described herein. With the exception of MW3d all on-Site and off-Site monitoring locations showed no response to pumping of MW7 (**Hydrograph 1**).

3.2.1 Drawdown vs. Time

Observed drawdown versus log time for MW7 and MW3d are presented on **Hydrograph 3**. The drawdown trend observed at MW7 (**Hydrograph 3**) is comparable to the trend observed in MW3d. Approximately 375 minutes into the test the drawdown in MW7 stabilized around 25 m while the pumping rate remained close to 50 L/min. The pumping rate was observed to drop to 40 L/min 750 minutes into the test despite the valve controlling flow being fully open. Freymond staff also noted air coming out of the discharge hose at 750 minutes. Following 750 minutes the pumping rate generally decreased for the remainder of the pumping test with the pumping rate prior to shutting off the pump noted to be approximately 30L/min (**Table 1**). MTE interprets the sudden stabilization of the drawdown within MW7 is related to the depth the pump was set at (as evidenced by the presence of air in the discharge water, with the pump braking suction), additionally the decrease in pumping rate is interpreted to be correlated to the rate at which water is entering the well from the formation.

In order to better analyze the water level data related to the pumping of MW7, a derivative plot of drawdown vs. time was created in AquiferTest©. A derivative plot or a plot of the derivative of the drawdown vs time has been proven useful in the interpretation of well-test data as they accentuate small variations in the data (Renard, Glenz, & Mejias, 2009). The derivative plot is then compared/matched qualitatively to characteristic diagnostic plots. The use of derivative plots further aids in the selection of a conceptual model. The derivative plot for MW7 closely matches that of a double porosity system. The double porosity theory initially developed by Barenblatt et al. (1960) describes a fractured rock system as consisting of two different media; the fractures and the matrix block each having their own properties (Kruseman & Ridder, 1990). The double porosity theory is consistent with our conceptual model (fractured bedrock system) discussed in **Section 2.0**.

Double porosity analysis was used to analyze MW7 drawdown data related to the 24 hour pumping test. For MW3d three methods were used when analyzing the drawdown data these included; Theis, Copper Jacob and Theis recovery. Analysis results are summarized in **Table 5**. Transmissivity (T) values ranged from 0.4 m^2/day to 0.8 m^2/day, while Storativity (S) values calculated from drawdown data observed in MW3d were found to range from 9.3 x 10^{-6} to 1.3 x 10^{-5} or 1.1 x 10^{-5} on average which is on the low side of the typical range for confined aquifers (5 x 10^{-3} – 5 x 10^{-5}) (Freeze & Cherry, 1979). Hydraulic conductivity values were in close agreement ranging from 1.5 x 10^{-7} m/s to 2.9 x 10^{-7} m/s. AquiferTest© data sheets are provided in **Attachment 3**.

3.2.2 Recovery vs. Time

Recovery data from MW7 and MW3d was analyzed using Theis Recovery analysis in AquiferTest© software. Analytical results are summarized in **Table 5**. MTE interprets the coefficients related to this time to describe the system as a whole (fractures & bulk media). Transmissivity results calculated from analysis of the recovery vs. time data (i.e. 0.6 m^2/day to 0.7 m^2/day) correlate well to Transmissivity results calculated from the time-drawdown data. Recovery derived hydraulic conductivity values are summarized in **Table 5** and ranged from 2.2 x 10^{-7} m/s to 2.8 x 10^{-7} m/s. AquiferTest© data sheets are provided in **Attachment 3**.

3.3 Analysis and Interpretation of MW8 Pumping Test Results

This section describes the analyses and interpretation of water level data related to the 24 hour constant rate pumping test performed on MW8. Based on these analyses, hydrogeological coefficients were calculated and are described herein. No response to pumping of MW8 was observed in any on-Site or off-Site monitoring locations (**Hydrograph 2**).

3.3.1 Drawdown vs. Time

Observed drawdown versus log time for MW8 is presented on **Hydrograph 4**. At approximately 99 minutes the pumping rate decreased from the initial pumping rate of ~51 L/min to 27 L/min. This drop in pumping rate was coupled with a small stabilization in the drawdown in MW8 from 95 to 144 minutes prior to water levels decreasing significantly again (**Hydrograph 4**). The pumping rate decreased again at 119 min to 23 L/min and again at 271 minutes to 11L/min (**Table 2**). Water levels in MW8 were observed to decrease throughout this time with the exception of a small increase between 215 and 237 minutes. The decrease in pumping rate is interpreted to be a function of the rate at which water is entering the well from the formation.

In order to better analyze the water level data related to the pumping of MW8, a derivative plot of drawdown vs. time was created in AquiferTest©. As with MW7, the derivative plot for MW8 closely matches that of a double porosity system.

Double porosity analysis was used to evaluate MW8 drawdown data related to the pumping test. Double porosity analysis results are summarized in **Table 6**. Transmissivity (T) was calculated to be 0.5 m^2/day and hydraulic conductivity was found to be 2.4 x 10^{-7} m/s. AquiferTest© data sheets are provided in **Attachment 3**.

3.3.2 Recovery vs. Time

Recovery data from MW8 was analyzed using Theis Recovery analysis in AquiferTest© software. Analytical results are summarized in **Table 6**. MTE interprets the coefficients related to this time to be related to the system as a whole (fractures & bulk media). Transmissivity from the analysis of the recovery vs. time data was calculated to be 3.2 m^2/day with hydraulic conductivity being 1.6 x 10^{-6} m/s. AquiferTest© data sheets are provided in **Attachment 3**.

4.0 DISCUSSION

Results from the pumping tests conducted on MW7 and MW8 indicated that neither well was capable of sustaining a pumping rate greater than 35 L/min (~50,000 L/day) for a prolonged period of time as pumping rates in both wells decreased throughout their perspective pumping tests. Only one monitoring location (MW3d) was observed to respond to pumping at MW7 and no monitoring locations were observed to respond to pumping at MW8. Lack of response to pumping at MW8 in on-Site monitoring wells may indicate that the fracture that intersects MW7 is more laterally extensive then the fracture that intersects MW8. Additionally based on water level data a fracture does not hydraulically connect MW7 to MW8. Water level and pressure data indicated that PW2 and PW13 (closest off-Site receptors) were not affected by pumping at MW8 or MW7.

Based on pumping test drawdown data MTE was able to calculate aquifer characteristics such as transmissivity, storativity and hydraulic conductivity. The geometric mean of the hydraulic conductivity values calculated from the pumping tests at both MW7 and MW8 was 3.6 x 10^{-7} m/s (**Table 7**). Single well response tests from MW7 previously indicated a hydraulic conductivity of approximately 4.7 x 10^{-6} m/s (**Table 7**). The hydraulic conductivity value calculated from the single well response test is likely related to the hydraulic conductivity of the fracture that intersects MW7 and not the bulk media.

When calculating the theoretical zone of influence in the 2016 Level 1 Level 2 Hydrogeological Investigation, MTE took the geometric mean from all the previously conducted hydraulic conductivity tests including the hydraulic conductivity value of 4.7 x 10^{-6} m/s. Since the hydraulic conductivity values calculated using the pumping test data are within the range of that used to calculate the geometric mean, MTE considers the calculations completed in the 2016 Level 1 Level 2 Hydrogeological Investigation to be representative of the Site.

5.0 SUMMARY AND CONCLUSIONS

A summary of results from the pumping tests at MW7 and MW8 are presented below:

1. MW7 could not support a pumping rate of > 35L/min for 24 hours.
2. MW3d was the only monitoring location to respond to pumping at MW7.
3. MW8 could not support a pumping rate of > 35L/min for more than 100 minutes.
4. No monitoring locations responded to pumping at MW8.
5. Derivative plot analysis indicated that both MW7 and MW8 are in a double porosity system composed of higher hydraulic conductivity fractures within a low conductivity bulk media.
6. The hydraulic conductivity geometric mean from analysis of pumping test data at MW7 and MW8 was 3.6×10^{-7} m/s.
7. Water level data and pressure data from PW2 and PW13 did not show a response to pumping at either MW7 or MW8.
8. Based on water level data from on-Site monitoring locations, specifically MW7 and MW8 (open boreholes), fractures occurring on-Site are discontinuous and are of limited lateral extent.
9. These findings support the conceptual and analytical models presented for the Site in MTE's 2016 Level 1 and Level 2 Hydrological Investigation Report.

The MOECC inquired as to the extent of fractures that the quarry may intersect and as to whether these fractures are connected to private water supplies. The pumping tests conducted on MW7 and MW8 indicate that fractures are random and discontinuous across the Site and of limited aerial extent. In addition, pumping at MW8 which is located at the northwest corner of the Site did not affect the two closest off-Site receptors to the Site.

Based on the results of the pumping tests neither MW7 nor MW8 was capable of sustaining a pumping rate greater than 35L/min (~ 50,000 L/day). MTE maintains that a Permit to Take Water will not be required to manage groundwater discharging into the quarry at a rate higher than 50,000 L/day. Further, we maintain that the potential impact of the quarry post extraction has been appropriately assessed by MTE utilizing the analytical methods described in the 2016 Level 1 Level 2 Hydrogeological Investigation Report, and supporting documentation provided to the MOECC by MTE in our correspondence with the MOECC documented herein.

Should you have any questions, please do not hesitate to contact the undersigned.

Yours truly,

MTE CONSULTANTS INC.

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6.0 REFERENCES

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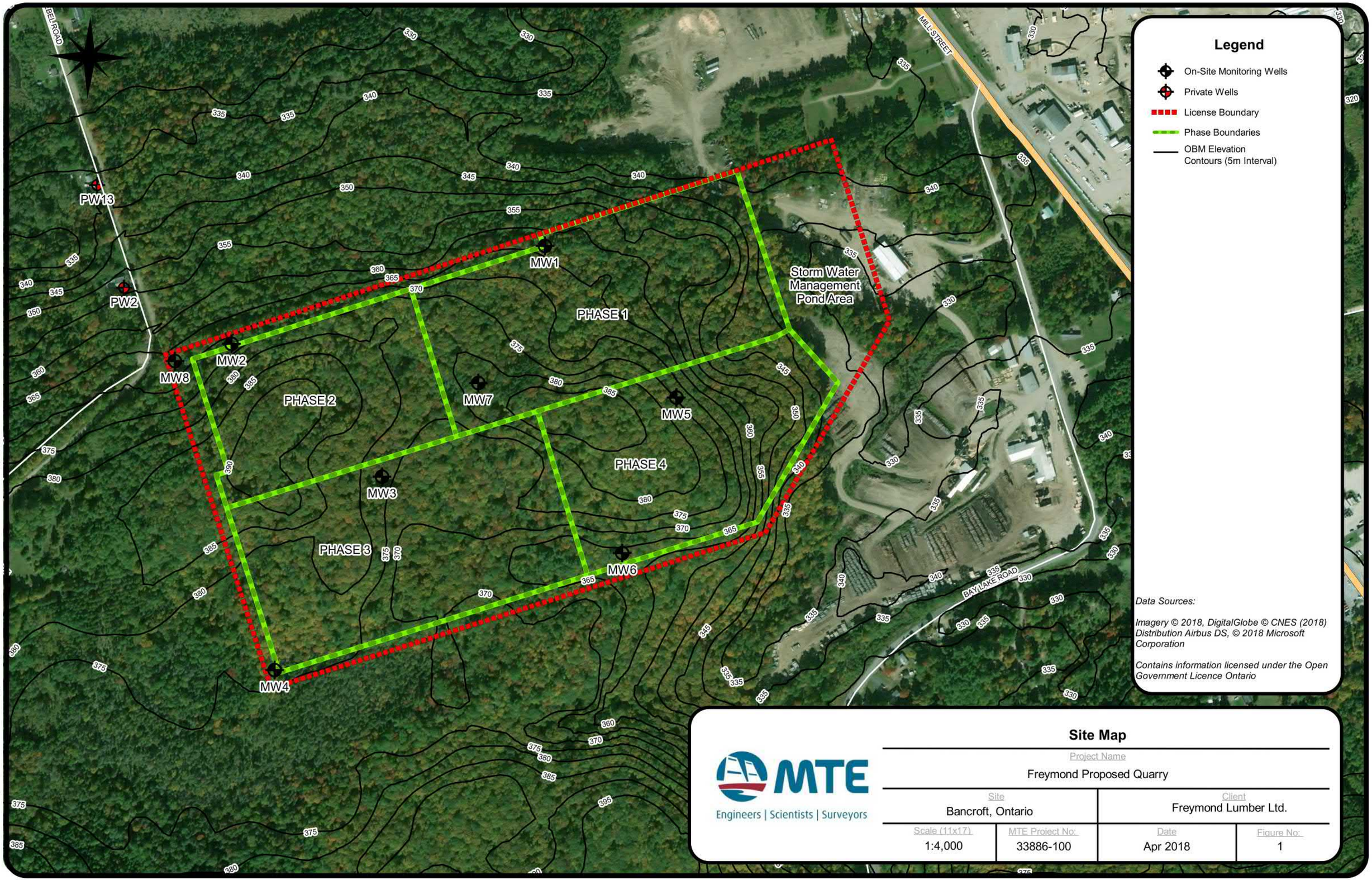
FIGURES



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Site Map

April 03, 2018 - 09:14 - Plotted By: fcummings

TABLES

Table 1: MW7 Pumping Rates

Time Since Pumping Began (min)	Pumping Rate L/min
25	50.46
30	51.15
35	50.93
40	49.88
45	51.28
50	51.33
55	51.15
60	50.13
70	49.02
80	51.55
90	49.83
100	51.86
120	50.63
165	51.55
200	50.38
360	51.68
420	48.47
450	48.43
750	40.00
855	34.60
1188	33.15
1240	37.27
1440*	30.00

* Pumping Rate estimated using a 20L pail.

Table 2: MW8 Pumping Rates

Time Since Pumping Began (min)	Pumping Rate L/min	Pumping Rate m^3/min
83	51.06	0.051
99	27.63	0.028
119	23.36	0.023
271*	11.43	0.011

* Pumping Rate estimated using a 20L pail.

Table 3: Groundwater Levels (mBTOC)
Manual Measurements

Date	MW1s	MW1d	MW2s	MW2d	MW3s	MW3d	MW4s	MW4d	MW5s	MW5d	MW6s	MW6d	MW7	MW8	PW13
1-Dec-17	1.62	20.86	9.72	16.77	0.16	2.79	0.72	-0.21	13.66	*	1.38	2.81	9.56	3.58	-
4-Dec-17	1.60	20.85	9.69	16.74	0.18	3.60	0.65	-0.13	13.66	*	1.39	2.87	24.19	3.50	5.20
4-Dec-17	1.61	20.85	9.70	16.74	0.19	4.53	0.65	-0.12	13.67	*	1.39	2.87	-	3.50	5.43
6-Dec-17	1.61	20.85	9.57	16.73	**	6.32	***	***	13.66	*	1.37	2.78	12.73	3.01	-
11-Dec-17	1.62	20.85	9.50	16.73	**	3.37	***	***	13.68	*	1.31	2.77	10.70	23.16	-
20-Dec-17	1.58	20.84	9.32	16.70	**	3.38	***	***	13.67	*	1.39	2.90	10.71	3.37	4.80

Notes: ** = well was dry at time of measurement*

*** = well was flowing at time of measurement*

**** = well was frozen at time of measurement*

- = well was not measured

negative numbers indicate a water level higher than the base of the manometer

Table 4: Groundwater Elevations (mAMSL)
Manual Measurements

Date	MW1s	MW1d	MW2s	MW2d	MW3s	MW3d	MW4s	MW4d	MW5s	MW5d	MW6s	MW6d	MW7	MW8	PW 13
TOC Elevation (mAMSL)	**360.59**	**361.64**	**368.07**	**368.56**	**376.69**	**376.17**	**371.21**	**372.12**	**370.33**	**369.79**	**364.75**	**364.32**	**383.06**	**366.50**	**337.74**
1-Dec-17	358.97	340.79	358.35	351.79	376.53	373.38	370.49	372.33	356.67	*	363.38	361.52	373.50	362.93	-
4-Dec-17	358.99	340.80	358.38	351.82	376.51	372.57	370.56	372.25	356.67	*	363.36	361.46	358.87	363.00	332.54
4-Dec-17	358.98	340.79	358.37	351.82	376.50	371.64	370.56	372.24	356.66	*	363.36	361.46	-	363.00	332.31
6-Dec-17	358.98	340.80	358.50	351.83	**	369.85	***	***	356.67	*	363.38	361.55	370.33	363.49	-
11-Dec-17	358.97	340.79	358.57	351.83	**	372.80	***	***	356.66	*	363.44	361.55	372.36	343.34	-
20-Dec-17	359.01	340.80	358.75	351.86	**	372.79	***	***	356.66	*	363.36	361.42	372.35	363.13	332.94

Notes: mAMSL = metres above mean sea level

** = well was dry at time of measurement*

*** = well was flowing at time of measurement*

**** = well was frozen at time of measurement*

- = well was not measured

TOC Elevation was resurveyed by MTE November 2017

Table 5: Summary of Aquifer Coefficients

Well	Method	Transmissivity (m^2/day)	Hydraulic Conductivity (m/s)	Storage Coefficient
MW3d	Theis	0.38	1.46E-07	1.25E-05
MW3d	Cooper Jacob	0.76	2.91E-07	9.29E-06
MW3d	Theis Recovery	0.56	2.16E-07	-
Average		0.57	2.18E-07	1.09E-05
MW7	Double Porosity	0.48	1.84E-07	-
MW7	Theis Recovery	0.74	2.84E-07	-
Average		0.61	2.34E-07	-

Table 6: Summary of Aquifer Coefficients

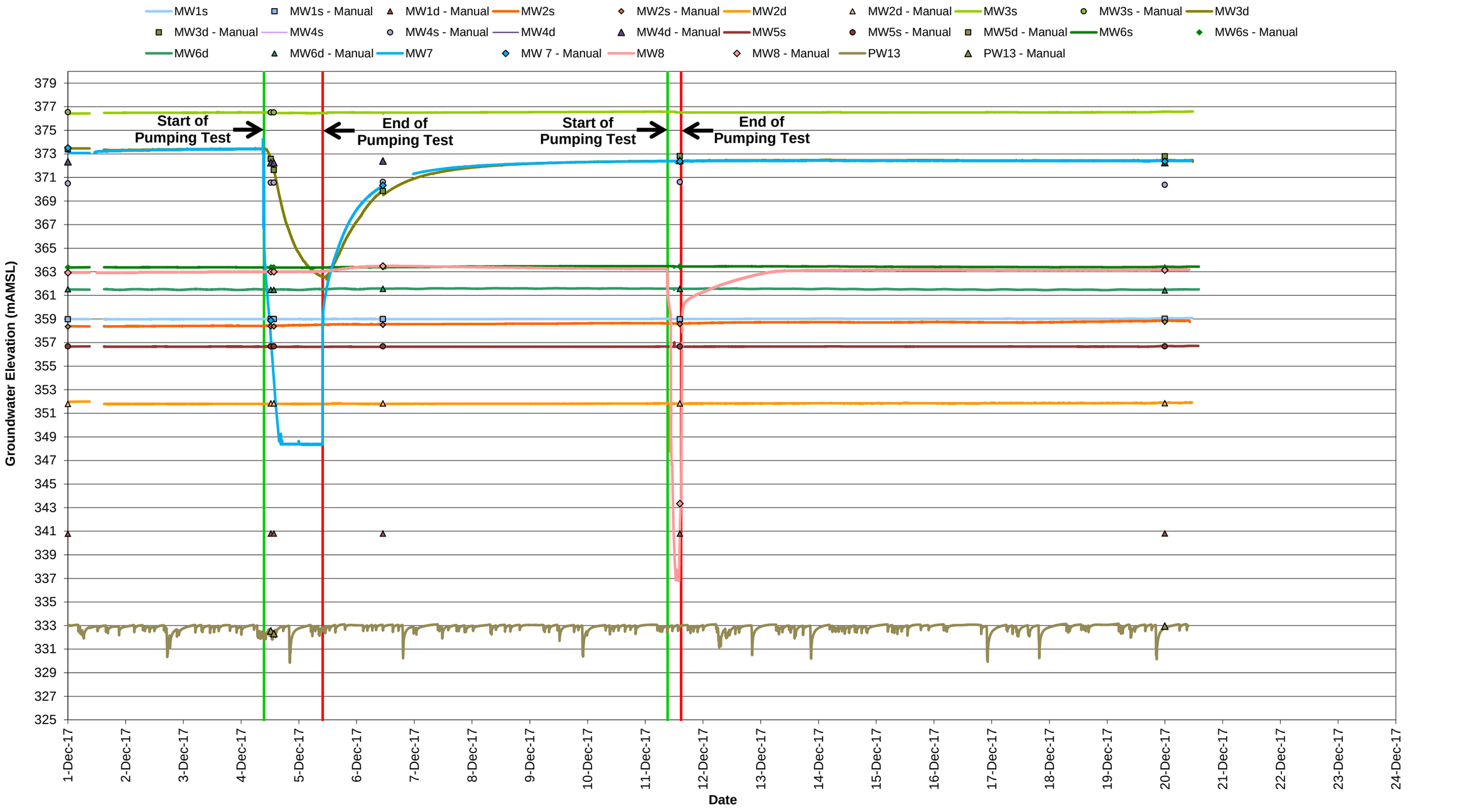
Well	Method	Trasmissivity (m^2/day)	Hydrualic Conductivity (m/s)
MW8	Double Porsity	0.50	2.41E-07
MW8	Theis Recovery	3.20	1.55E-06
Average		1.85	8.96E-07

Table 7: Hydraulic Conductivity (m/s) Summary

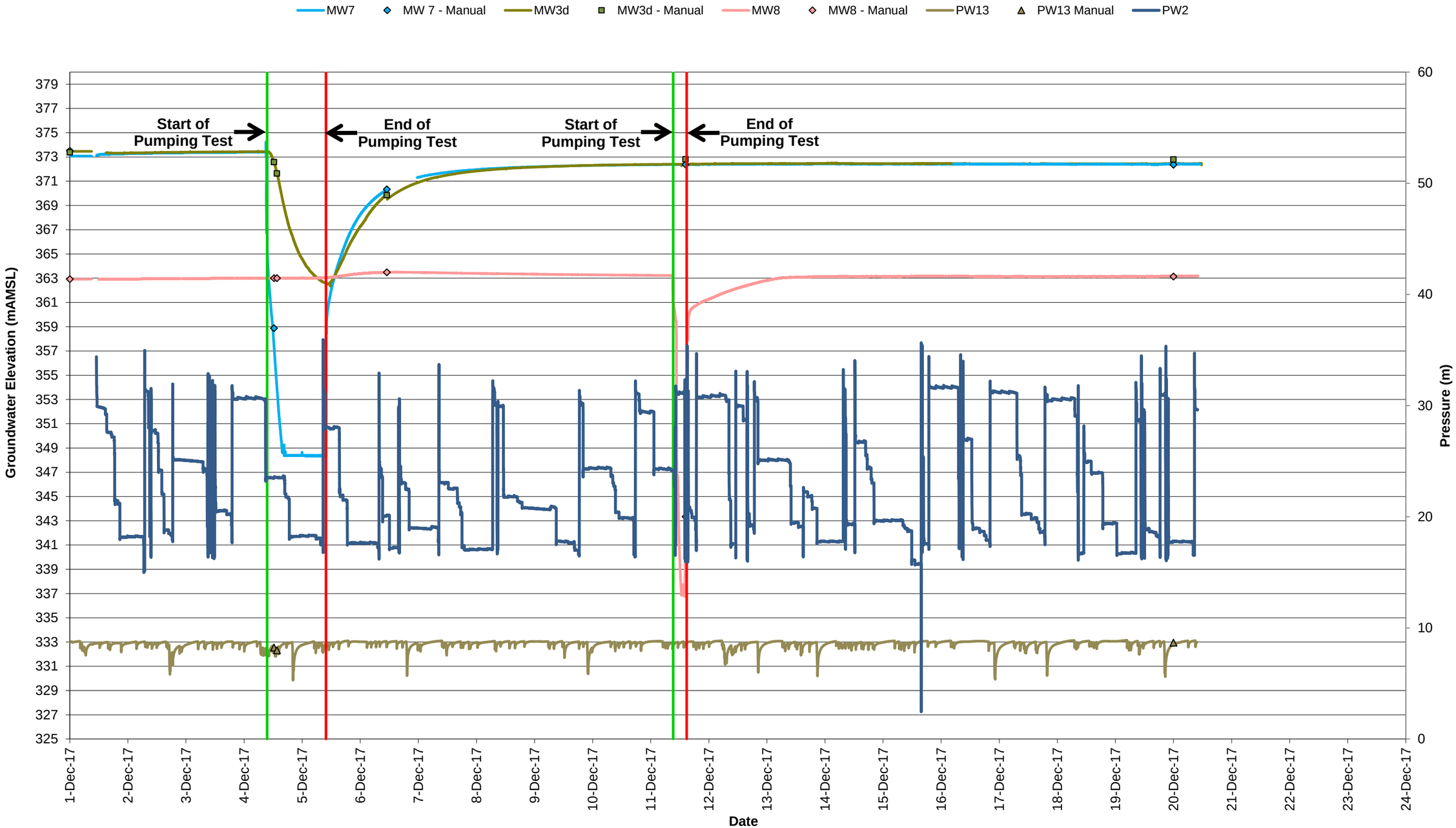
Location	Hydraulic Conductivity (m/s)
Shallow Bedrock Wells	
MW1s	6.97E-11
MW2s	2.41E-10
MW4s	5.61E-11
MW6s	1.07E-08
Geomean	3.17E-10
Deeper Bedrock Wells	
MW2d	6.36E-11
MW4d	6.34E-11
Geomean	6.35E-11
Deeper Bedrock Wells	
MW7 Falling	6.54E-06
MW7 Rising	3.35E-06
Geomean	4.68E-06
Pumping Test Results - MW7	
MW3d	2.18E-07
MW7	2.34E-07
Pumping Test Results - MW8	
MW8	8.96E-07
Geomean (Pumping Tests)	3.57E-07
Geomean (All)	9.21E-09

HYDROGRAPHS

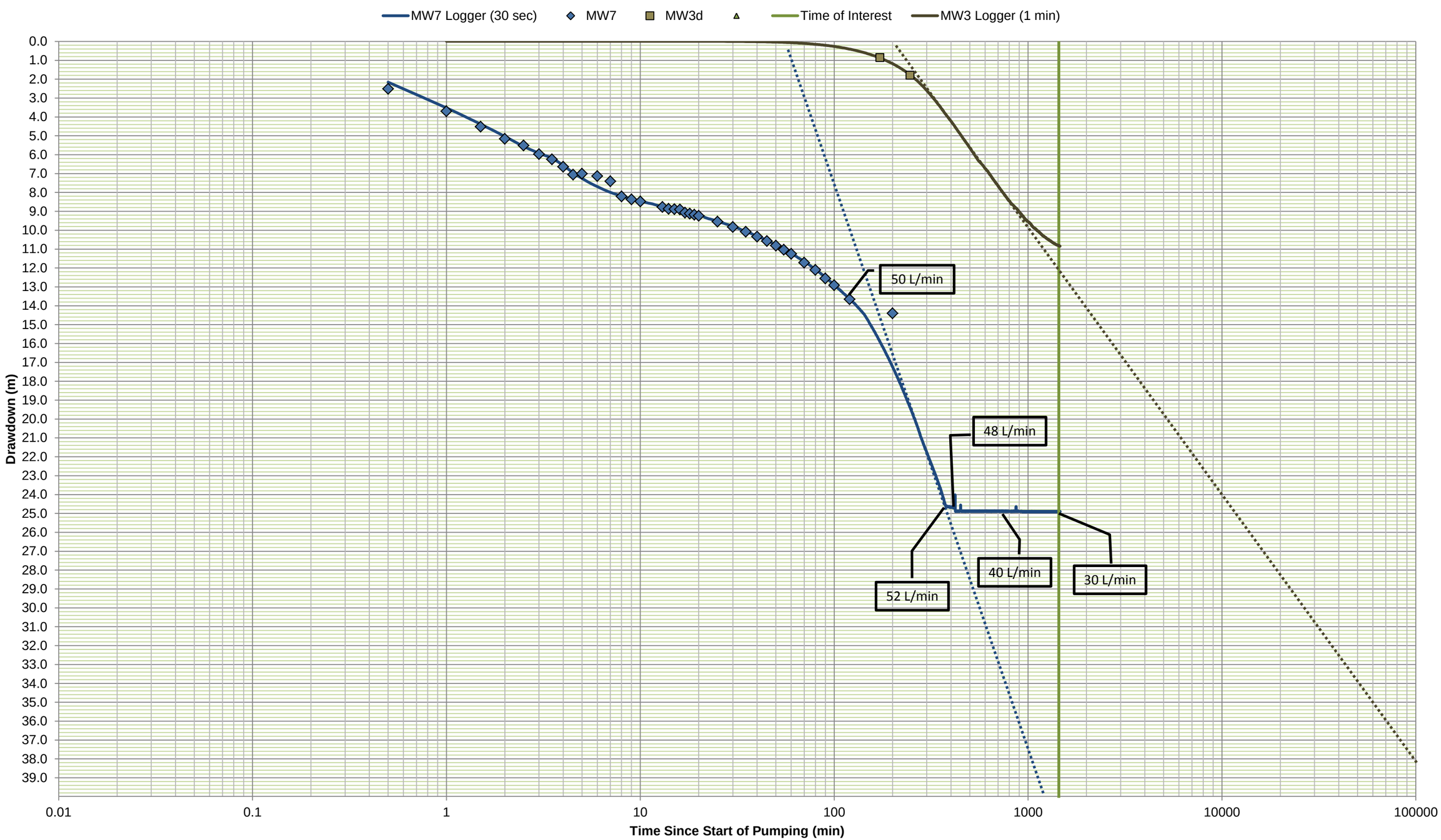
Hydrograph 1: Groundwater Elevations (mAMSL) - Proposed Freymond Quarry



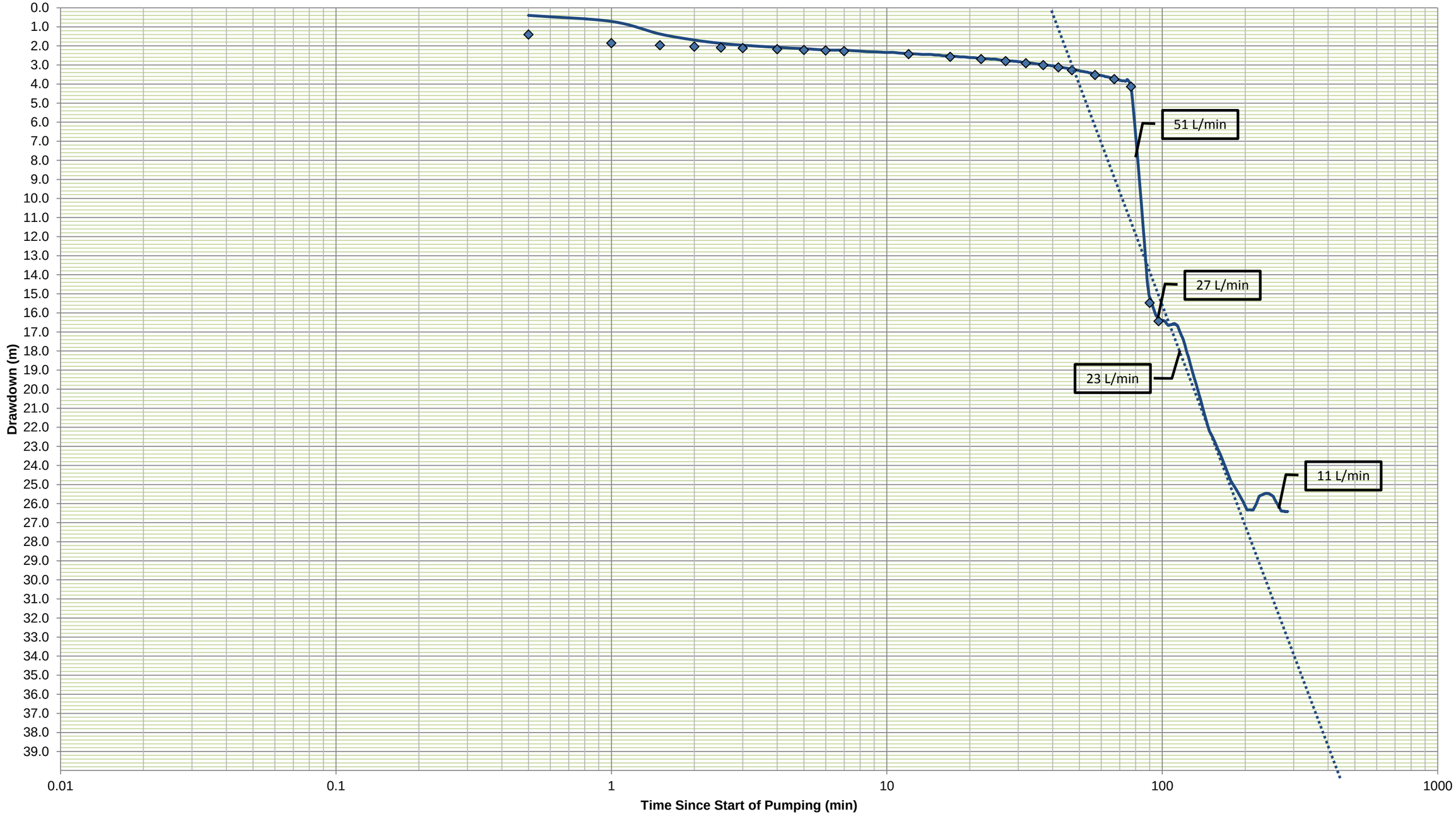
Hydrograph 2: Groundwater Elevations (mAMSL) & PW2 Total Pressure - Proposed Freymond Quarry



Hydrograph 3: Drawdown vs. Time - MW7



Hydrograph 4: Drawdown vs. Time - MW8



ATTACHMENT 1

PTTW NO. 1205-ASYT3W

Ontario

Ministry of the Environment and Climate Change
Ministère de l'Environnement et de l'Action en matière de changement climatique

PERMIT TO TAKE WATER
Ground Water
NUMBER 1205-ASYT3W

Pursuant to Section 34.1 of the Ontario Water Resources Act, R.S.O. 1990 this Permit To Take Water is hereby issued to:

Freymond Lumber Limited
2287 Bay Lake Rd
Bancroft, Ontario, K0L 1C0
Canada

For the water taking from: Well MW 7 and Well MW 8

Located at: Lot 52, Concession West of Hastings Road, Geographic Township of Faraday Bancroft, County of Hastings

For the purposes of this Permit, and the terms and conditions specified below, the following definitions apply:

DEFINITIONS

(a) "Director" means any person appointed in writing as a Director pursuant to section 5 of the OWRA for the purposes of section 34.1, OWRA.

(b) "Provincial Officer" means any person designated in writing by the Minister as a Provincial Officer pursuant to section 5 of the OWRA.

(c) "Ministry" means Ontario Ministry of the Environment and Climate Change.

(d) "District Office" means the Belleville District Office.

(e) "Permit" means this Permit to Take Water No. 1205-ASYT3W including its Schedules, if any, issued in accordance with Section 34.1 of the OWRA.

(f) "Permit Holder" means Freymond Lumber Limited.

(g) "OWRA " means the *Ontario Water Resources Act*, R.S.O. 1990, c. O. 40, as amended.

You are hereby notified that this Permit is issued subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. Compliance with Permit

1.1 Except where modified by this Permit, the water taking shall be in accordance with the application for this Permit To Take Water, dated October 16, 2017 and signed by Lou Freymond, and all Schedules included in this Permit.

1.2 The Permit Holder shall ensure that any person authorized by the Permit Holder to take water under this Permit is provided with a copy of this Permit and shall take all reasonable measures to ensure that any such person complies with the conditions of this Permit.

1.3 Any person authorized by the Permit Holder to take water under this Permit shall comply with the conditions of this Permit.

1.4 This Permit is not transferable to another person.

1.5 This Permit provides the Permit Holder with permission to take water in accordance with the conditions of this Permit, up to the date of the expiry of this Permit. This Permit does not constitute a legal right, vested or otherwise, to a water allocation, and the issuance of this Permit does not guarantee that, upon its expiry, it will be renewed.

1.6 The Permit Holder shall keep this Permit available at all times at or near the site of the taking, and shall produce this Permit immediately for inspection by a Provincial Officer upon his or her request.

1.7 The Permit Holder shall report any changes of address to the Director within thirty days of any such change. The Permit Holder shall report any change of ownership of the property for which this Permit is issued within thirty days of any such change. A change in ownership in the property shall cause this Permit to be cancelled.

2. General Conditions and Interpretation

2.1 Inspections

The Permit Holder must forthwith, upon presentation of credentials, permit a Provincial Officer to carry out any and all inspections authorized by the OWRA, the *Environmental Protection Act* , R.S.O. 1990, the *Pesticides Act* , R.S.O. 1990, or the *Safe Drinking Water Act,* S. O. 2002.

2.2 Other Approvals

The issuance of, and compliance with this Permit, does not:

(a) relieve the Permit Holder or any other person from any obligation to comply with any other applicable legal requirements, including the provisions of the *Ontario Water Resources Act* , and the *Environmental Protection Act* , and any regulations made thereunder; or

(b) limit in any way any authority of the Ministry, a Director, or a Provincial Officer, including the authority to require certain steps be taken or to require the Permit Holder to furnish any further information related to this Permit.

2.3 Information

The receipt of any information by the Ministry, the failure of the Ministry to take any action or require any person to take any action in relation to the information, or the failure of a Provincial Officer to prosecute any person in relation to the information, shall not be construed as:

(a) an approval, waiver or justification by the Ministry of any act or omission of any person that contravenes this Permit or other legal requirement; or

(b) acceptance by the Ministry of the information's completeness or accuracy.

2.4 Rights of Action

The issuance of, and compliance with this Permit shall not be construed as precluding or limiting any legal claims or rights of action that any person, including the Crown in right of Ontario or any agency thereof, has or may have against the Permit Holder, its officers, employees, agents, and contractors.

2.5 Severability

The requirements of this Permit are severable. If any requirements of this Permit, or the application of any requirements of this Permit to any circumstance, is held invalid or unenforceable, the application of such requirements to other circumstances and the remainder of this Permit shall not be affected thereby.

2.6 Conflicts

Where there is a conflict between a provision of any submitted document referred to in this Permit, including its Schedules, and the conditions of this Permit, the conditions in this Permit shall take precedence.

3. Water Takings Authorized by This Permit

3.1 **Expiry**

This Permit expires on **December 31, 2017**. No water shall be taken under authority of this Permit after the expiry date.

3.2 Amounts of Taking Permitted

The Permit Holder shall only take water from the source, during the periods and at the rates and amounts of taking specified in Table A. Water takings are authorized only for the purposes specified in Table A.

Table A

	Source Name / Description:	Source: Type:	Taking Specific Purpose:	Taking Major Category:	Max. Taken per Minute (litres):	Max. Num. of Hrs Taken per Day:	Max. Taken per Day (litres):	Max. Num. of Days Taken per Year:	Zone/ Easting/ Northing:
1	MW 7	Well Drilled	Pumping Test	Miscellaneous	52	24	74,880	3	18 276117 4991610
2	MW 8	Well Drilled	Pumping Test	Miscellaneous	52	24	74,880	3	18 275714 4991619
						Total Taking:	149,760		

3.3 Purpose of Pumping Test

Water taken by the Permit Holder shall be used solely for the purpose of pumping tests in order to assess hydrogeological conditions.

4. Monitoring

4.1 Monitoring of Water Takings

The Permit Holder shall maintain a record of all water takings. This record shall include the dates and times of water takings, and the total measured amounts of water taken per day for each day that water is taken under the authorization of this Permit. A separate record shall be maintained for each source. The Permit Holder shall keep all required records up to date and available at or near the site of the taking and shall produce the records immediately for inspection by a Provincial Officer upon his or her request.

4.2 Type of Water Taking Measurement

The total amounts of water taken shall be measured using a calibrated flow meter and totalizer.

5. Impacts of the Water Taking

5.1 Notification

The Permit Holder shall immediately notify the local District Office of any complaint arising from the taking of water authorized under this Permit and shall report any action which has been taken or is proposed with regard to such complaint. The Permit Holder shall immediately notify the local District Office if the taking of water is observed to have any significant impact on the surrounding waters. After hours, calls shall be directed to the Ministry's Spills Action Centre at 1-800-268-6060.

5.2 For Groundwater Takings

If the taking of water is observed to cause any negative impact to other water supplies obtained from any adequate sources that were in use prior to initial issuance of a Permit for this water taking, the Permit Holder shall take such action necessary to make available to those affected, a supply of water equivalent in quantity and quality to their normal takings, or shall compensate such persons for their reasonable costs of so doing, or shall reduce the rate and amount of taking to prevent or alleviate the observed negative impact. Pending permanent restoration of the affected supplies, the Permit Holder shall provide, to those affected, temporary water supplies adequate to meet their normal requirements, or shall compensate such persons for their reasonable costs of doing so.

If permanent interference is caused by the water taking, the Permit Holder shall restore the water supplies of those permanently affected.

5.3 Water Interference Contingency Plan

Prior to commencing the pumping test, the Permit Holder shall develop a contingency plan to compensate other water users in the event that this water taking negatively impacts the area's water supply. The Permit Holder shall implement this contingency plan upon the validation of any water interference complaint and this plan shall remain in effect until the affected water supply recovers to a sustainable quality and quantity that may be considered usable for the normal use of the water.

5.4 Area of Study

The Permit Holder shall contact all well owners within 500 metres of the test well(s) prior to commencing the pumping test and seek written permission to access the well(s).

5.5 Required Pumping Test Results

Where written permission sought under Condition 5.4 has been obtained, the Permit Holder shall measure and record static water levels prior to the pumping test, pumping water levels at an appropriate frequency to allow for the calculation of aquifer conductivity and storativity values and water levels during the recovery period in the well(s) until 95% recovery occurs or for a period of time equal to the duration of the pumping test, whichever is less.

5.6 Notification of the Director

The Permit Holder must immediately report to the Director all interference and surface water discharge problems associated with the pumping test.

5.7 Prevention of Damage To Structures

The Permit Holder shall take all measures necessary to prevent damage to buildings, structures, roads and/or railway lines that may be impacted by this taking.

5.8 Discharge of Water Taken

The discharge of water shall be controlled in such a way as to avoid erosion and sedimentation in the receiving stream.

5.9 The Permit Holder shall ensure that any water discharged to the natural environment does not result in scouring, erosion or physical alteration of stream channels or banks and that there is no flooding in the receiving area or water body, downstream water bodies, ditches or properties caused or worsened by this discharge.

5.10 Any discharge to the land surface shall use a multi-barrier approach to control erosion and run-off and the discharge shall be to a well vegetated area to promote infiltration prior to re-entering the watercourse.

5.11 The Permit Holder shall not discharge turbid water to any watercourse. Turbid water shall be defined as any discharge water or diverted water with a maximum increase of 8 NTUs above the receiving stream's background levels.

5.12 Siltation control measures shall be installed at the discharge site(s) and shall be sufficient to control the volumes. Continuous care shall be taken to properly maintain the siltation control devices.

6. Director May Amend Permit

The Director may amend this Permit by letter requiring the Permit Holder to suspend or reduce the taking to an amount or threshold specified by the Director in the letter. The suspension or reduction in taking shall be effective immediately and may be revoked at any time upon notification by the Director. This condition does not affect your right to appeal the suspension or reduction in taking to the Environmental Review Tribunal under the *Ontario Water Resources Act* , Section 100 (4).

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is included to ensure that the conditions in this Permit are complied with and can be enforced.

2. Condition 2 is included to clarify the legal interpretation of aspects of this Permit.

3. Conditions 3 through 6 are included to protect the quality of the natural environment so as to safeguard the ecosystem and human health and foster efficient use and conservation of waters. These conditions allow for the beneficial use of waters while ensuring the fair sharing, conservation and sustainable use of the waters of Ontario. The conditions also specify the water takings that are authorized by this Permit and the scope of this Permit.

*In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, you may by written notice served upon me, the Environmental Review Tribunal and the Environmental Commissioner, **Environmental Bill of Rights**, R.S.O. 1993, Chapter 28, within 15 days after receipt of this Notice, require a hearing by the Tribunal. The Environmental Commissioner will place notice of your appeal on the Environmental Registry. Section 101 of the Ontario Water Resources Act, as amended provides that the Notice requiring a hearing shall state:*

1. The portions of the Permit or each term or condition in the Permit in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

In addition to these legal requirements, the Notice should also include:

a. The name of the appellant;
b. The address of the appellant;
c. The Permit to Take Water number;
d. The date of the Permit to Take Water;
e. The name of the Director;
f. The municipality within which the works are located;

This notice must be served upon:

The Secretary
Environmental Review Tribunal
655 Bay Street, 15th Floor
Toronto ON
M5G 1E5
Fax: (416) 326-5370
Email:
ERTTribunalsecretary@ontario.ca

AND

The Environmental Commissioner
1075 Bay Street
6th Floor, Suite 605
Toronto, Ontario M5S 2W5

AND

The Director, Section 34.1,
Ministry of the Environment and Climate Change
1259 Gardiners Rd, PO Box 22032
Kingston, ON
K7P 3J6

Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal:

by Telephone at	by Fax at	by e-mail at
(416) 212-6349	(416) 326-5370	www.ert.gov.on.ca
Toll Free 1(866) 448-2248	Toll Free 1(844) 213-3474	

*This instrument is subject to Section 38 of the **Environmental Bill of Rights** that allows residents of Ontario to seek leave to appeal the decision on this instrument. Residents of Ontario may seek to appeal for 15 days from the date this decision is placed on the Environmental Registry. By accessing the Environmental Registry, you can determine when the leave to appeal period ends.*

Dated at Kingston this 17th day of November, 2017.

Greg Faaren
Director, Section 34.1
Ontario Water Resources Act , R.S.O. 1990

Schedule A

This Schedule “A” forms part of Permit To Take Water 1205-ASYT3W, dated November 17, 2017.

ATTACHMENT 2

PHOTOGRAPHIC LOG

Photographic Log
Proposed Freymond Quarry, Township of Faraday, County of Hastings, ON

Photograph No. 1 In-line Flow Meter used for pumping tests at MW7 & MW8

Photograph No. 2 – Manometers - MW4 - Oct-9-14

Photograph No. 3 – PW2

Photograph No. 4 – PW2 In-Line pipe in which a data logger was installed

ATTACHMENT 3

AQUIFER TEST DATA SHEETS

MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener Ontario

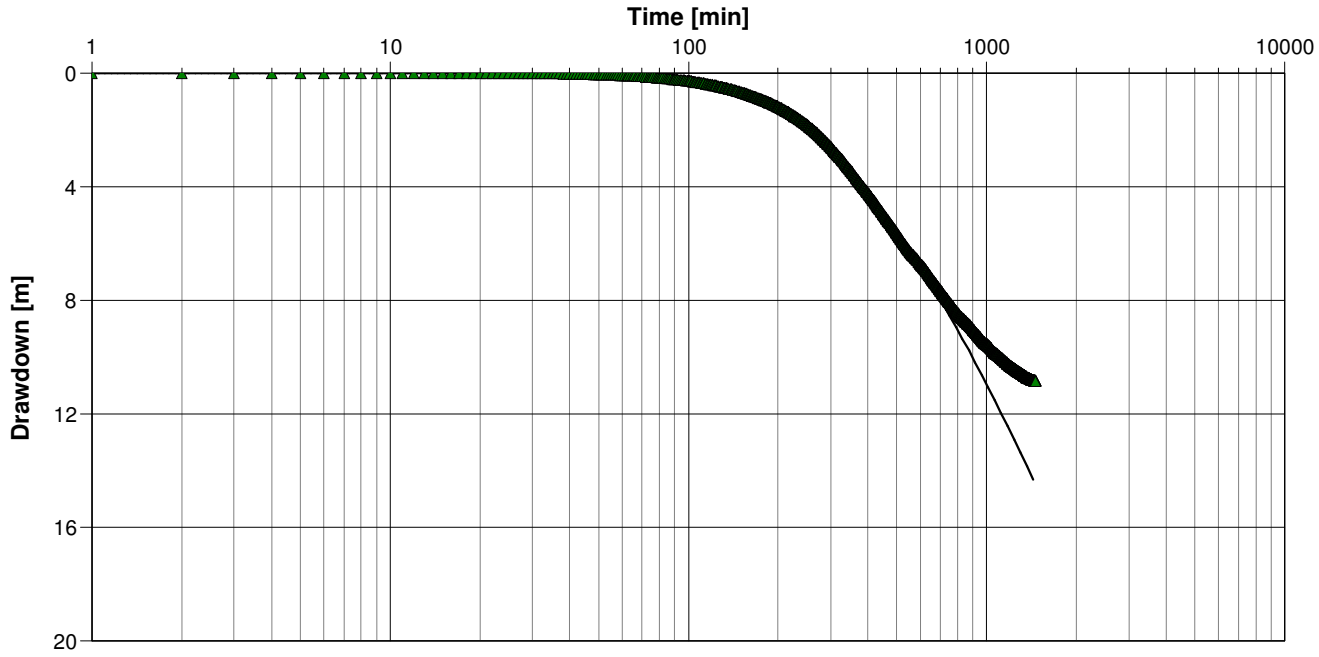
Pumping Test Analysis Report

Project: Freymond Quarry

Number: 33886-100

Client: Freymond Lumber

Location: Bancroft	Pumping Test: Pumping Test Dec 4	Pumping Well: MW7
Test Conducted by: MDE		Test Date: 12/4/2017
Analysis Performed by: TFC	Theis	Analysis Date: 12/7/2017
Aquifer Thickness: 30.22 m	Discharge: variable, average rate 0.039715 [m³/min]	



Calculation using Theis

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Storage coefficient	Radial Distance to PW [m]	
MW3d	3.81×10^{-1}	1.26×10^{-2}	1.25×10^{-5}	158.31	

MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener Ontario

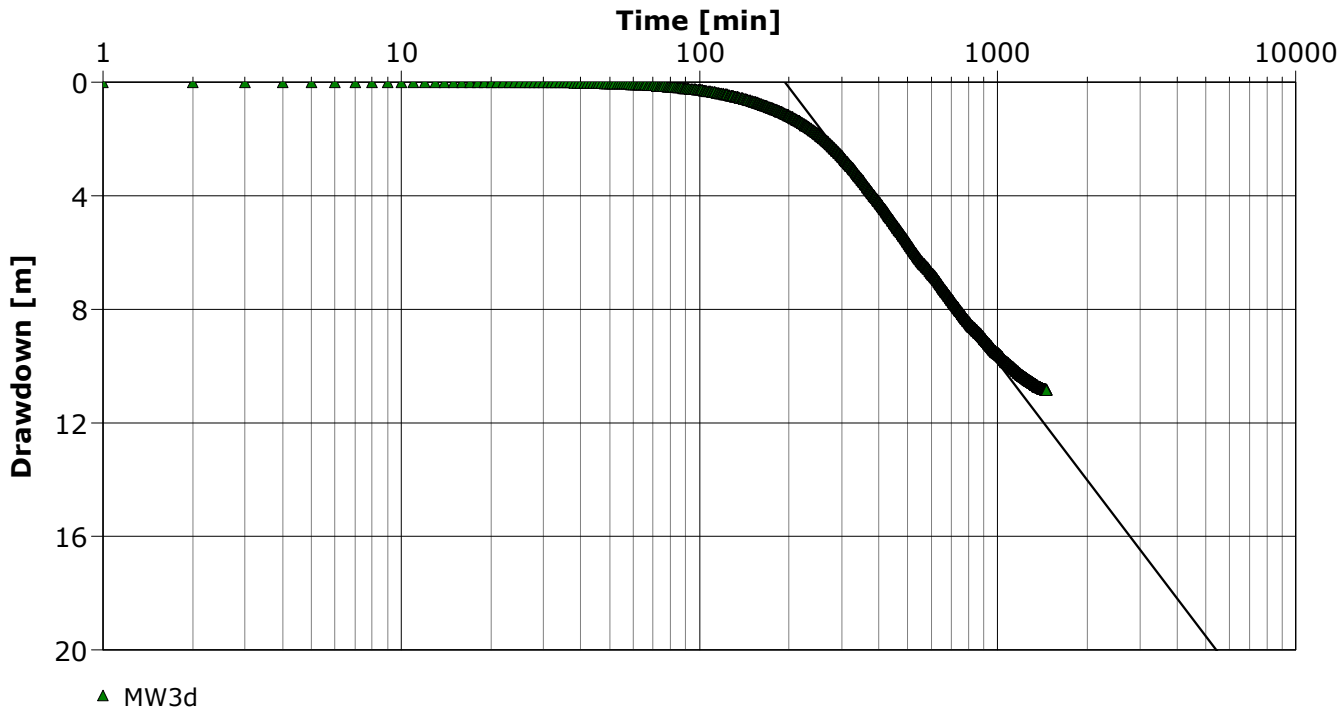
Pumping Test Analysis Report

Project: Freymond Quarry

Number: 33886-100

Client: Freymond Lumber

Location: Bancroft	Pumping Test: Pumping Test Dec 4	Pumping Well: MW7
Test Conducted by: MDE		Test Date: 12/4/2017
Analysis Performed by: TFC	Cooper Jacob	Analysis Date: 12/7/2017
Aquifer Thickness: 30.22 m	Discharge: variable, average rate 0.039715 [m³/min]	



Calculation using COOPER & JACOB

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Storage coefficient	Radial Distance to PW [m]	
MW3d	7.57×10^{-1}	2.51×10^{-2}	9.14×10^{-6}	158.31	

MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener Ontario

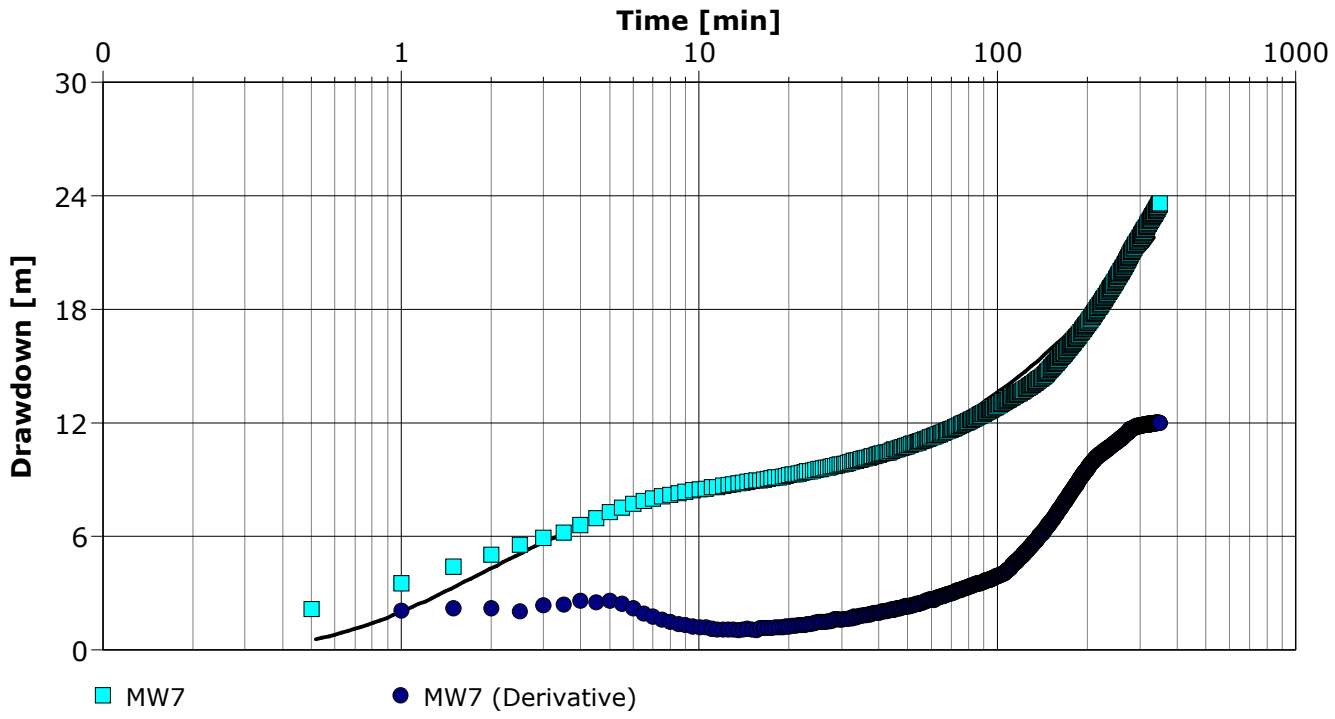
Pumping Test Analysis Report

Project: Freymond Quarry

Number: 33886-100

Client: Freymond Lumber

Location: Bancroft	Pumping Test: Pumping Test Dec 4	Pumping Well: MW7
Test Conducted by: MDE		Test Date: 12/4/2017
Analysis Performed by: MDE & TFC	Double Porsity	Analysis Date: 12/7/2017
Aquifer Thickness: 30.22 m	Discharge: variable, average rate 0.039715 [m³/min]	



Calculation using Double Porosity

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Storage coefficient	Sigma	Lambda	Radial Distance to PW [m]
MW7	4.79×10^{-1}	1.59×10^{-2}	1.18×10^{-1}	2.15×10^{1}	1.00×10^{0}	0.1

MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener Ontario

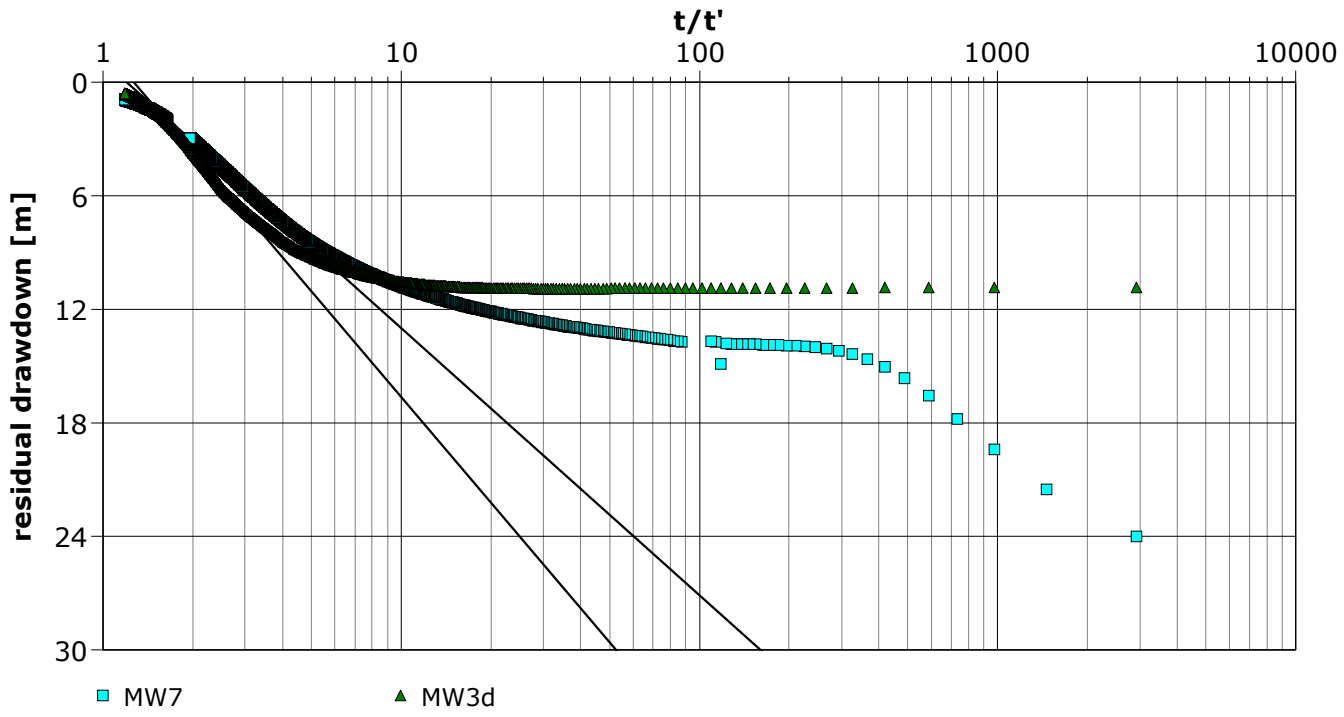
Pumping Test Analysis Report

Project: Freymond Quarry

Number: 33886-100

Client: Freymond Lumber

Location: Bancroft	Pumping Test: Pumping Test Dec 4	Pumping Well: MW7
Test Conducted by: MDE		Test Date: 12/4/2017
Analysis Performed by: MDE & TFC	Theis Recovery	Analysis Date: 1/9/2018
Aquifer Thickness: 30.22 m	Discharge: variable, average rate 0.039715 [m³/min]	



Calculation using THEIS & JACOB

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Radial Distance to PW [m]	
MW7	7.41×10^{-1}	2.45×10^{-2}	0.1	
MW3d	5.64×10^{-1}	1.87×10^{-2}	158.31	
Average	6.53×10^{-1}	2.16×10^{-2}		

MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener Ontario

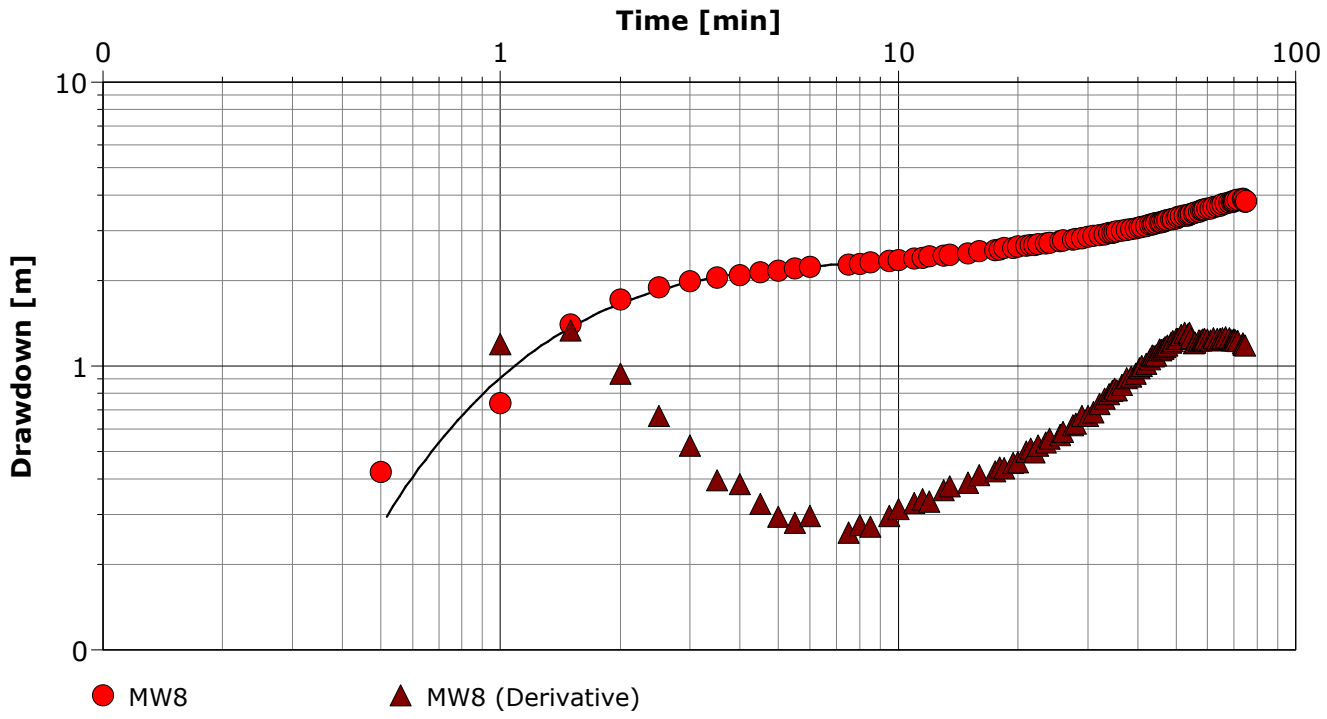
Pumping Test Analysis Report

Project: Freymond Quarry

Number: 33886-100

Client: Freymond Lumber

Location: Bancroft	Pumping Test: Pumping Test Dec 11	Pumping Well: MW8
Test Conducted by: TFC		Test Date: 12/11/2017
Analysis Performed by: TFC & MDE	Double Porosity	Analysis Date: 1/9/2018
Aquifer Thickness: 23.86 m	Discharge: variable, average rate 0.02346 [m³/min]	



Calculation using Double Porosity

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Storage coefficient	Sigma	Lambda	Radial Distance to PW [m]
MW8	4.97×10^{-1}	2.08×10^{-2}	5.39×10^{-2}	5.47×10^{1}	2.41×10^{0}	0.15

MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener Ontario

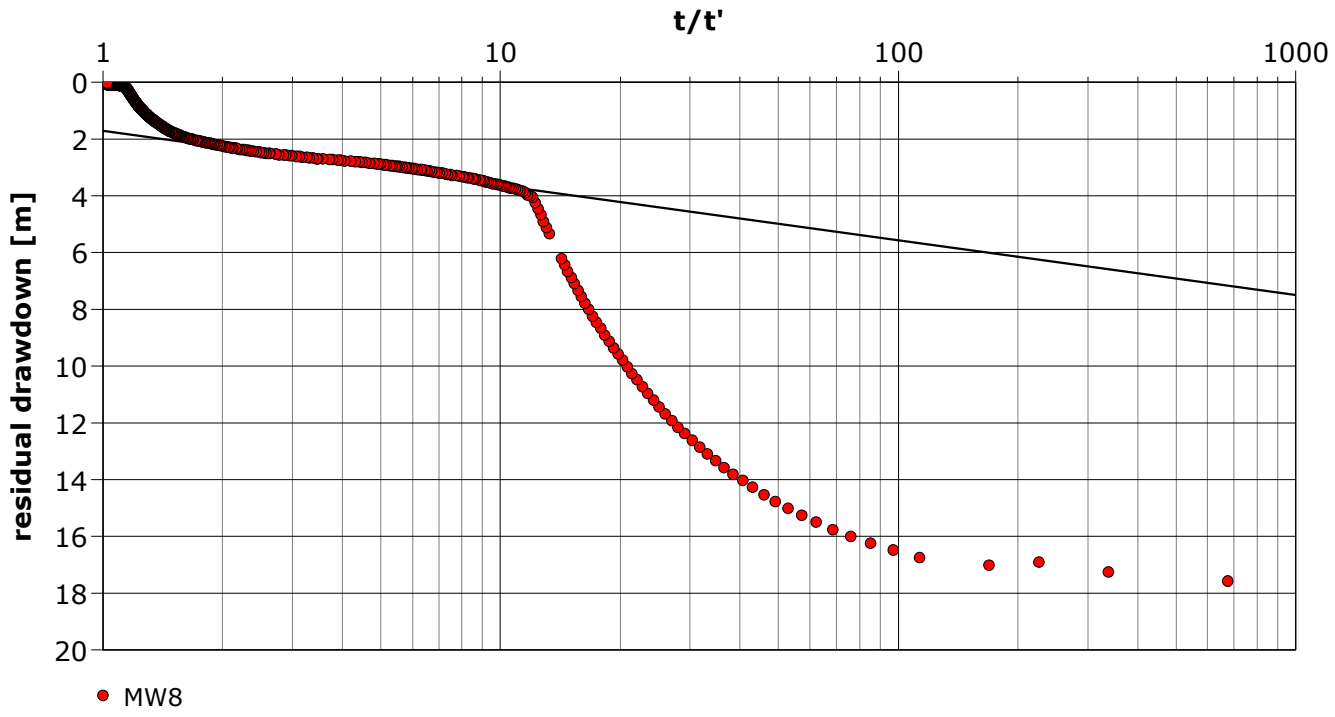
Pumping Test Analysis Report

Project: Freymond Quarry

Number: 33886-100

Client: Freymond Lumber

Location: Bancroft	Pumping Test: Pumping Test Dec 11	Pumping Well: MW8
Test Conducted by: TFC		Test Date: 12/11/2017
Analysis Performed by: TFC	Theis Recovery	Analysis Date: 11/3/2017
Aquifer Thickness: 23.86 m	Discharge: variable, average rate 0.02346 [m³/min]	



Calculation using THEIS & JACOB

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Radial Distance to PW [m]	
MW8	3.20×10^{0}	1.34×10^{-1}	0.15	

ATTACHMENT 4

SOUTH STREAM ANALYSIS

TECHNICAL MEMORANDUM

TO:	Lou Freymond	**MTE FILE NO.:**	33886-100
COMPANY:	Freymond Lumber Ltd.	**DATE:**	April 25, 2018
		FROM:	PAG/TFC
		PROJECT NAME:	Freymond Quarry

RE: PROPOSED FREYMOND QUARRY – SOUTH STREAM ANALYSIS

Introduction

The Greer Galloway Group Inc. hereby referred to as "Greer Galloway" was retained by the County of Hastings to carry out a peer review of MTE's Level 1 and Level 2 Hydrogeological Investigation for the proposed Freymond Quarry. This technical memo is intended to provide additional information related to comments received from Greer Galloway regarding the South Stream.

The proposed Freymond Quarry is located on Lot 51 and 52, Concession WHR in the Township of Faraday, County of Hastings (hereby referred to as the "Site") (see **Figure 1** of MTE's Level 1 and Level 2 Hydrogeological Investigation).

A review of the nearby surface water features for the Level 1 and Level 2 Hydrogeological Investigation based on OBM (Ontario Base Mapping) identified two unnamed streams north and south of the Site, hereby referred to as the North and South Stream (see **Figure 2** of MTE's Level 1 and Level 2 Hydrogeological Investigation).

Field Studies

During the fall of 2017, MTE set out to better characterize the South Stream based on comments received from Greer Galloway. This characterization involved:

- Field verifying and surveying the location of the stream; and
- Establishing surface water stations (SW's) and measuring flow.

Field reconnaissance of the South Stream indicated that OBM mapping did not accurately map the location of the South Stream west of SW5.

Survey data indicated that the headwaters of the South Stream originate west of Phase 3 (**Figure 1**). From SW1 the South Stream flows northeast and then east roughly along the licensed boundary. Approximately 35 m southwest of the Phase 3/Phase 4 boundary, the South Stream is joined by a tributary whose headwaters originate in Phase 3. The South Stream then flows east between the licensed and extraction boundary for approximately 185 m before flowing south towards SW5.

Field reconnaissance also revealed a small branch that has headwaters west of SW3 and flows slightly past SW4 before disappearing. This branch appears to correlate to the location of the OBM mapped South Stream. A small unconnected branch was also noted to occur south of SW3 which flows from south to north.

In 2015, MTE established three flow stations (SW1, SW2 and SW8) and conducted preliminary flow measurements on two occasions (9/10/15 & 18/11/15) (**Table 1**). Flows were taken at SW1, SW2 and SW8 under the assumption that these locations fell along the OBM mapped South Stream, which was shown on the OBM as off-Site. Flows taken in the fall of 2015 at SW1 and SW2 were similar and ranged between 0.7 and 2.1 L/s. A small increase in flow between SW2 and SW8 was noted to occur on both occasions in fall 2015. Higher flows at SW1 and SW2 appear to correlate to higher flows downstream at SW8.

In the fall of 2017, MTE initially focused on determining if the stretch of the South Stream between SW5 and SW7 (**Figure 1**) was recharging water into an underlying aquifer. This was completed by measuring flows at SW5, SW6 and SW7. The location of SW5 was chosen as it is upstream of the Freymond Lumber yard. SW6 and SW7 were chosen as SW6 is upstream of the proposed outlet for the SWM facility while SW7 is downstream of the proposed outlet.

Flow Analysis

Flow analysis was conducted to better understand how flow along the South Stream varied between 2015 and 2017. In the fall of 2015, flows measured at SW1 and SW2 were 0.7 to 0.8 L/s, respectively. In contrast, flows measured in the fall of 2017, were 14.7 and 20.0 L/s (**Table 1**). This difference in flow between 2015 and 2017 demonstrates the large natural range in flow conditions in the South Stream at these two stations. MTE understands Freymond staff have also witnessed no flow in the South Stream historically.

Flows measured on November 21, 2017 indicated that despite an increase occurring between SW1 and SW2, flows decreased between SW2 and SW5. Quaternary geology mapping shows a deposit of glaciofluvial outwash and deltaic deposits (sand) in this area (**Figure 2**) and the presence of this sand deposit was confirmed in the field while measuring flows. This flow decrease between SW2 and SW5 is likely related to losses to the underlying sand deposit.

Flow data collected from SW5 and SW6 in the fall of 2017 showed an increase in flow (**Table 1**) indicating that this portion of the South stream may not be recharging water into the underlying sand deposit. Downstream of SW6, a small decrease in flow was measured at SW7 (on November 21 and 28) but MTE staff noted that the braided nature of the stream prohibited capturing 100% of the flow at this location.

Flows measured between SW3 and SW4 on November 21, 2017 showed a slight increase (**Table 1**), but downstream of SW4 the flow disappeared. This lack of flow between SW4 and SW5 is related to losses to the underlying sand deposits downstream of SW4.

Catchment Area Assessment

In order to better predict the effect that the quarry may have on the South Stream, MTE assessed the catchment area of the South Stream to Bay Lake Road (SW8). The catchment area was mapped using contours obtained from Ontario Base Maps (OBM) and can be seen in **Figure 3**. Using this catchment area MTE completed a macro drainage analysis to assess the potential impact on the South Stream due to quarry activities. This analysis assumed there were no inputs to the South Stream from the Storm Water Management (SWM) Facility (SW7). A summary of the catchment assessment is presented in **Table 2**. For an explanation of how runoff values were calculated, please see MTE's Level 1 and Level 2 Hydrogeological Investigation Appendix F Macro Drainage Analysis.

Based on the Macro drainage analysis following quarry activities, flow in the South Stream upstream of the SWM Facility outlet is conservatively estimated to decrease by 22% (3.76 L/s). The phased extraction approach as well as the time it takes to fully extract each phase (Phase 1 ≥ 13 years, Phase 2 ≥ 14 years, Phase 3 ≥ 17 years, Phase 4 ≥ 6 years) will result in a gradual reduction in flow to the South Stream upstream of the SWM Facility. As indicated in the Appendix F of MTE's 2016 Level 1 and Level 2 Hydrogeological Investigation, downstream of the SWM Facility outlet flows in the South Stream will increase as a result of flow input from the SWM Facility by approximately 8% compared to pre-quarry conditions.

In addition to the above, MTE has assessed the catchment area of SW1 to better understand the groundwater contribution to the headwaters of the South Stream. The catchment area was mapped using contours obtained from Ontario Base Maps (OBM) and can be seen in **Figure 4**. A summary of the catchment assessment is presented in **Table 3**.

This assessment indicated that the catchment area contributing runoff to SW1 is 62.6 ha with 3.7 ha of that total area located within the licensed area. Using this area and the runoff value, the pre-extraction average annual runoff volume to SW1 was calculated to be 313,887 m^3/year or 10.0 L/s, which is comparable to the flow measured at SW1 on November 21, 2017 (14.65 L/s).

Average annual post-extraction runoff to SW1 was calculated to be 295,363 m^3/year or 9.4 L/s which equates to a 6% loss in runoff. The flow calculated by the catchment

assessment showed good agreement with the on-Site measured flow, indicating that flow at SW1 is maintained primarily by overland runoff.

Impact Assessment

Downstream Impacts

Based on the setbacks as indicated on the Operational Site Plans (**Attachment 1**) the main branch of the South Stream will remain intact throughout and post extraction (**Figure 1**). Following the extraction of Phase 3, any flow originating within Phase 3 will no longer contribute to the main branch of the South Stream and instead will be directed toward the SWM Facility and will ultimately flow back into the South Stream. Water originating at the headwaters of SW1 will continue to flow downstream to SW5.

Upstream Impacts

To better assess impacts to the South Stream in the west portion of the proposed quarry, MTE created an additional cross section (C-C') (**Figure 5**) which runs approximately northwest to southeast through the west portion of the Site (**Figure 1)**. Cross section C-C' shows the elevation and depth of two domestic wells (PW2 and PW13), four on-Site wells (MW8, MW2, MW3 and MW4) and the South Stream at SW1 as well as the groundwater elevations taken from on-Site monitoring wells on December 1, 2017.

Cross section C-C' indicates that the groundwater elevation in MW4s (370.5 mAMSL) is above the elevation of the stream bed (368.0 mAMSL). MTE did not observe any groundwater springs at MW4 despite artesian conditions present in both MW4s and MW4d. This lack of groundwater springs indicates that fractures at depth do not intersect the ground surface at this location. Therefore, artesian conditions in the vicinity of MW4 do not directly correlate to the South Stream being supported by groundwater discharge. Further, the discussion in the Catchment Area Assessment above, along with the surface water flow measurements, supports the interpretation that the south stream is supported primarily by overland flow.

SUMMARY

A summary of results from the South Stream analysis are presented below:

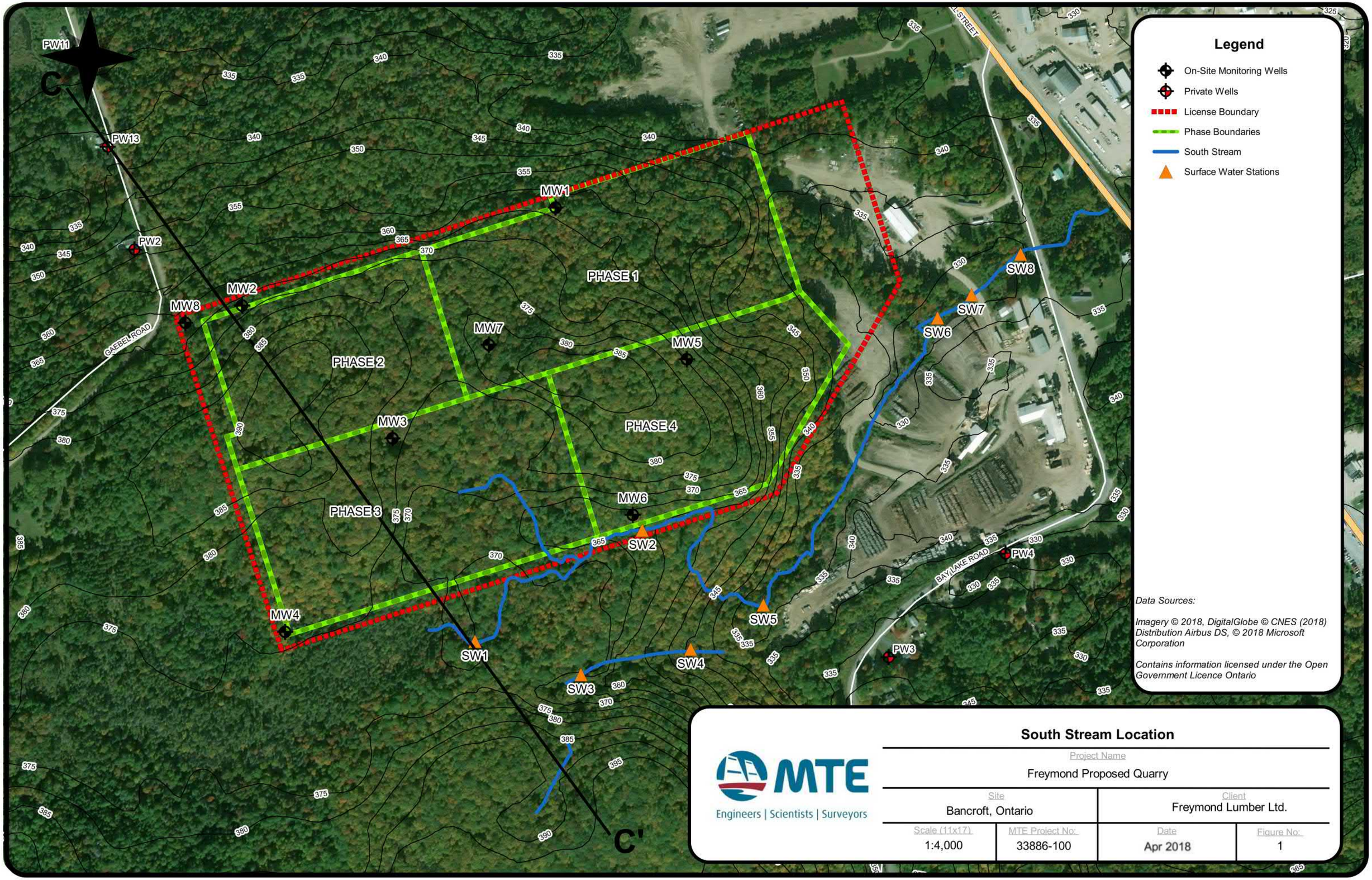
- Characterization of the South Stream by MTE in the fall of 2017 indicated that the location of the South Stream was incorrectly mapped by the OBM;
- Flows measured at SW1 and SW2 in 2015 and 2017 indicate a large range in natural flow conditions;
- Flows between SW4 and SW5 appear to be recharging the underlying Quaternary deposits (sand);
- Flows between SW2 and SW5 may also be recharging into the underlying Quaternary deposits (sand) prior to SW5;
- Based on the Macro drainage analysis following quarry activities, flow in the South Stream upstream of the SWM Facility outlet is conservatively estimated to decrease by 22% (3.76 L/s), but downstream of the SWM Facility outlet flows will increase by approximately 8% compared to pre-quarry conditions;
- The phased approach to extraction will ensure changes in flow to the South Stream are gradual over the course approximately 50 years.
- The average annual flow calculated using the catchment area for SW1 showed good agreement with the on-Site measured flow taken on Nov 21, 2017 indicating that flow in the South Stream is primarily maintained by overland runoff; and
- The main branch of the South Stream will remain intact post extraction and will continue to supply flow.

REFERENCES

Barnett, P. J., 1985: *Quaternary Geology of the Bancroft Area;* Ontario Geological Survey, Map 2500, Quaternary Geology Series, scale 1:50 000, Geology 1978, 1979.

Ministry of the Environment. (2003). *Stormwater Management Planning and Design Manual.* Ministry of the Environment.

Thornthwaite, C.W. and Mather, J.R., 1957: Instructions and tables for computing the potential evapotranspiration and the water balance; Publications in Climatology, 10. Laboratory of Climatology, Drexel Institute of Technology, Centerton, New Jersey.



Legend

- On-Site Monitoring Wells
- Private Wells
- License Boundary
- Phase Boundaries
- South Stream
- Surface Water Stations

Data Sources:

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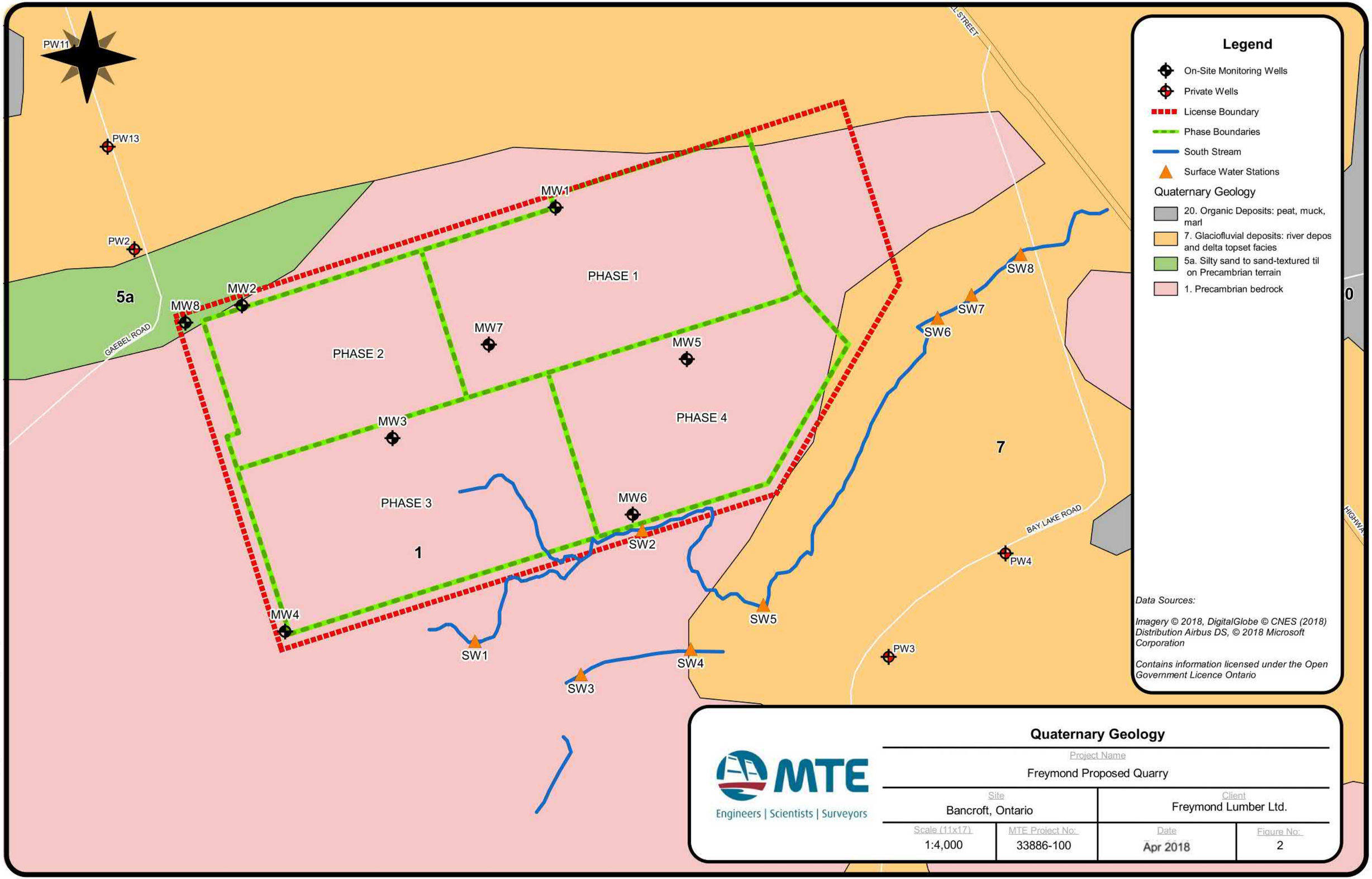
MTE
Engineers | Scientists | Surveyors

South Stream Location

Project Name			
Freymond Proposed Quarry			
Site: Bancroft, Ontario		Client: Freymond Lumber Ltd.	
Scale (11x17): 1:4,000	MTE Project No: 33886-100	Date: Apr 2018	Figure No: 1

Project No: 33866-100 Q:/33866/Maps/33866-100 Freymond Quarry.qgs

February 22, 2018 - 15:35 - Plotted By: fcummings



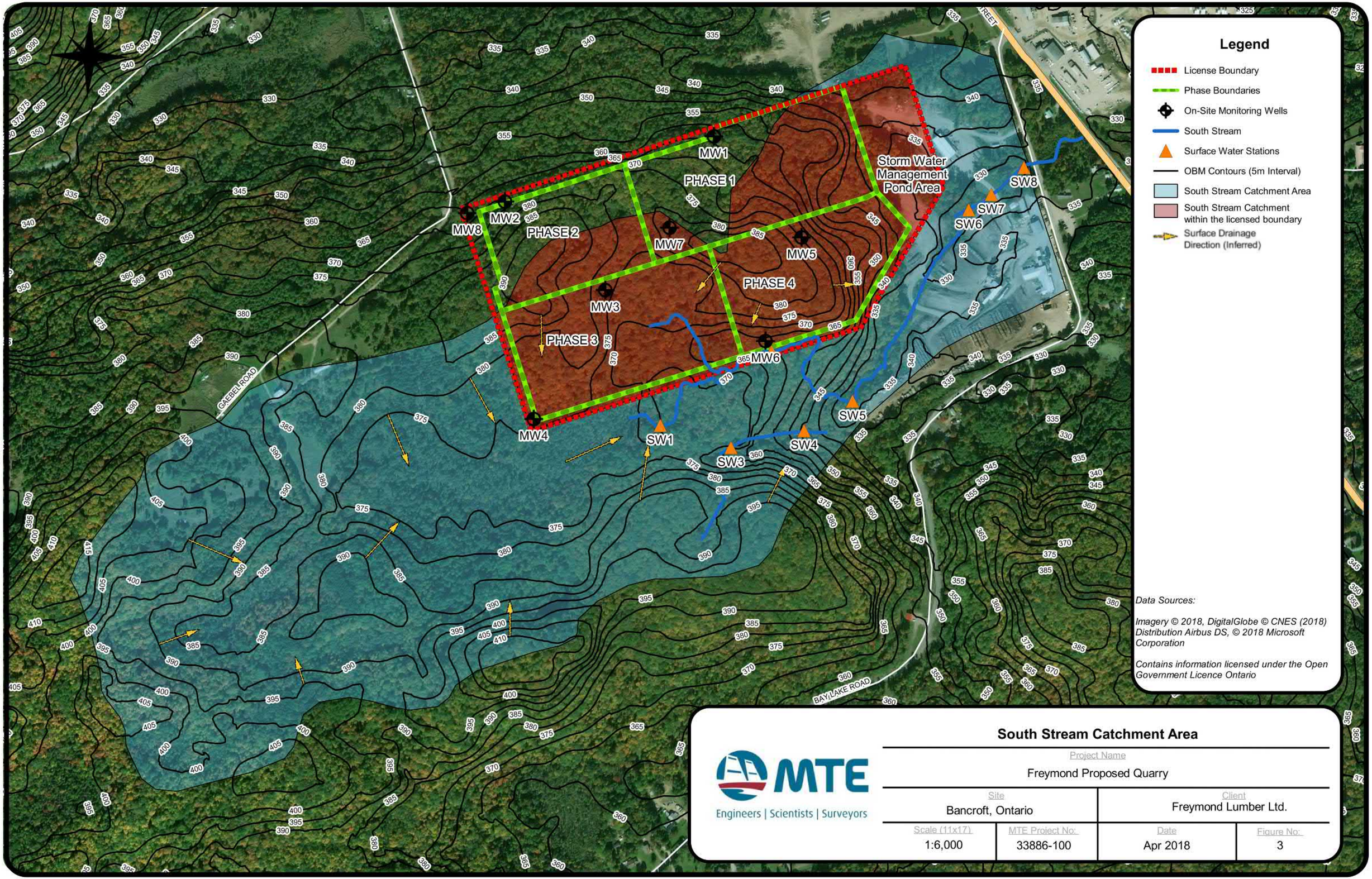
Project No: 33886-100 Q:/33886/Maps/33886-100 Freymond Quarry.qgs

February 16, 2018 - 11:39 - Plotted By: fcummings

MTE
Engineers | Scientists | Surveyors

Quaternary Geology

Project Name			
Freymond Proposed Quarry			
Site: Bancroft, Ontario		Client: Freymond Lumber Ltd.	
Scale (11x17): 1:4,000	MTE Project No: 33886-100	Date: Apr 2018	Figure No: 2



Legend

- License Boundary
- Phase Boundaries
- On-Site Monitoring Wells
- South Stream
- Surface Water Stations
- OBM Contours (5m Interval)
- South Stream Catchment Area
- South Stream Catchment within the licensed boundary
- Surface Drainage Direction (Inferred)

Data Sources:

Imagery © 2018, DigitalGlobe © CNES (2018) Distribution Airbus DS, © 2018 Microsoft Corporation

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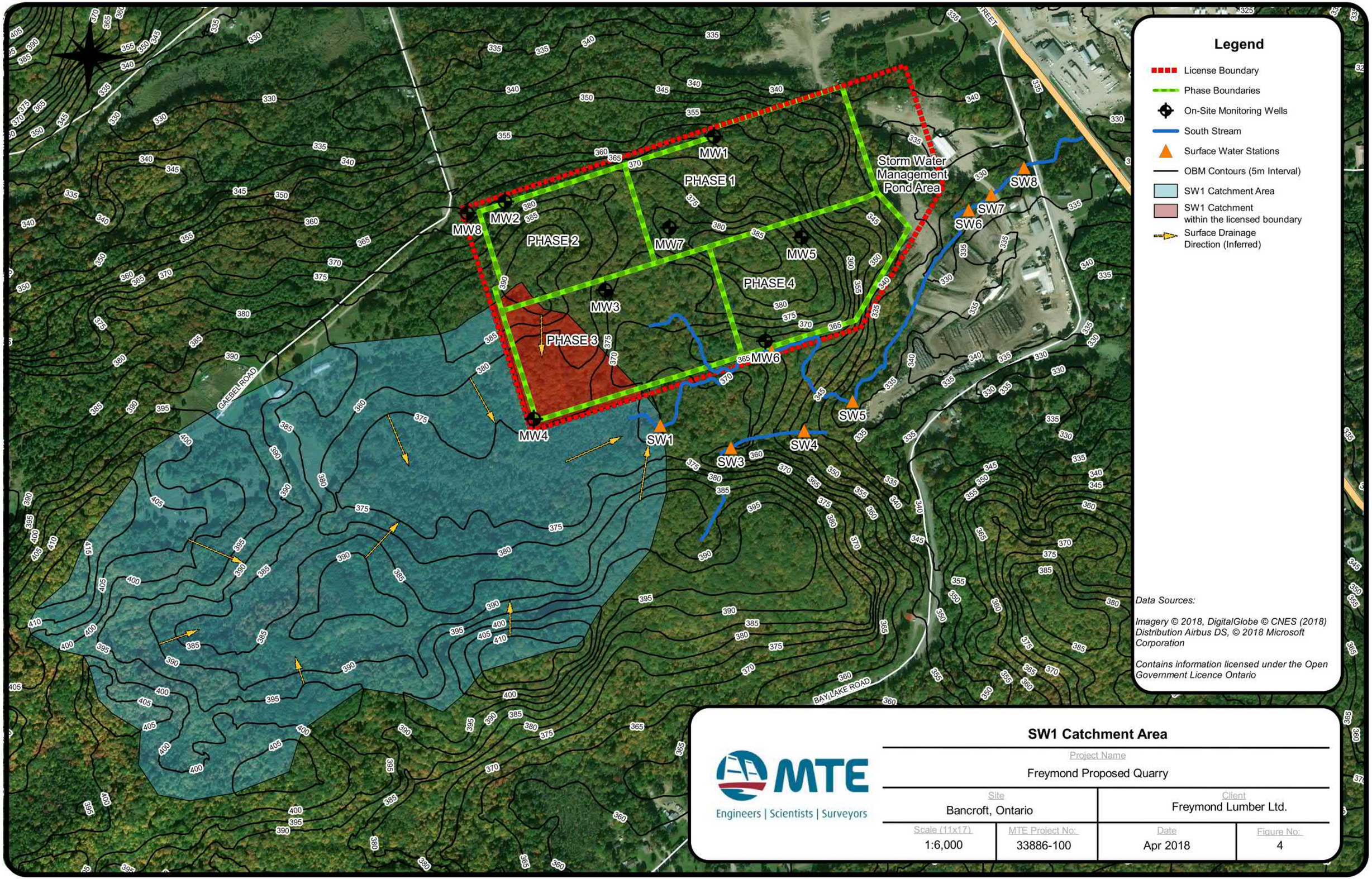
South Stream Catchment Area

Project Name			
Freymond Proposed Quarry			
Site: Bancroft, Ontario		Client: Freymond Lumber Ltd.	
Scale (11x17): 1:6,000	MTE Project No: 33886-100	Date: Apr 2018	Figure No: 3



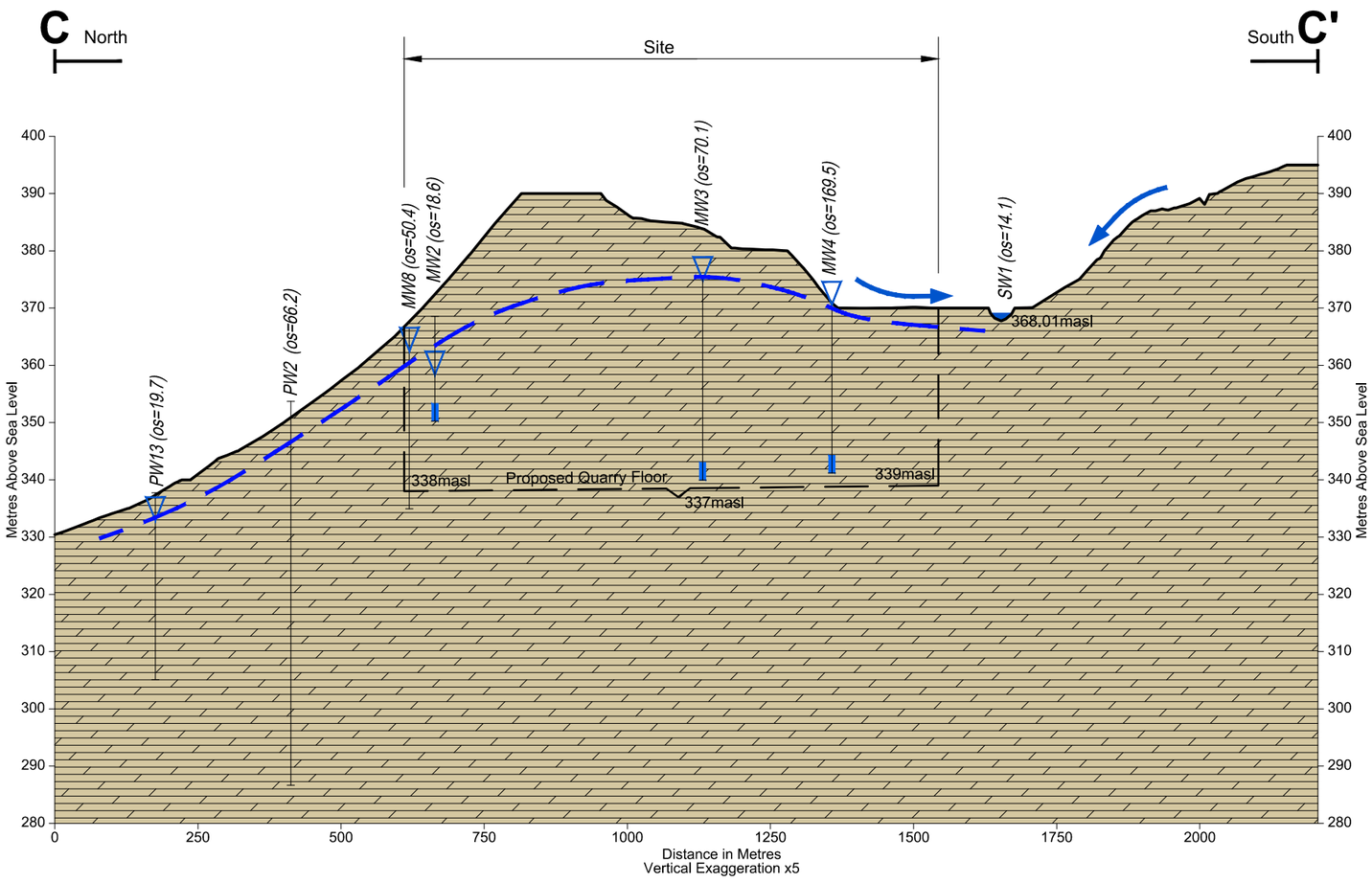
Project No: 33866-100 Q:\33866\Maps\33866-100 Freymond Quarry.qgs

April 09, 2018 - 20:34 - Plotted By: fcummings

Engineers | Scientists | Surveyors

SW1 Catchment Area

Project Name			
Freymond Proposed Quarry			
Site: Bancroft, Ontario		Client: Freymond Lumber Ltd.	
Scale (11x17): 1:6,000	MTE Project No: 33886-100	Date: Apr 2018	Figure No: 4



LEGEND

- Glaciofluvial Outwash - Sand and Gravel
- Metasedimentary Rock
- Interpreted Water Table Surface
- Static Water Level
- Water Found
- Overland Flow
- 2920756 (os=27m) — MOECC Well Identification No. and offset (m)
- Private Well
- Well Screen

Engineers | Scientists | Surveyors

GEOLOGICAL CROSS-SECTION C-C'

Project Name			
Freymond Proposed Quarry			
Site		Client	
Bancroft, Ontario		Freymond Lumber Limited	
Scale (11x17)	MTE Project No.	Date	Figure No.
1:5000	33886-100	April 2018	5

Table 1: Surface Water Station Flow (L/s)

Date	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
	Flow (L/s)							
9-Oct-15	**0.74**	**0.82**	NA	NA	NA	NA	NA	**2.67**
18-Nov-15	**2.13**	**1.87**	NA	NA	NA	NA	NA	**4.34**
11-Oct-17	NA	NA	NA	NA	**4.94**	**5.13**	**5.96**	NA
13-Nov-17	NA	NA	NA	NA	**6.40**	NA	NA	NA
21-Nov-17	**14.65**	**20.00**	**0.32**	**1.01**	**9.51**	**11.85**	**8.10**	NA
28-Nov-17	NA	NA	NA	NA	**8.33**	**10.20**	**6.76**	NA

Notes:

NA = Flow Data was not taken.

Table 2: South Stream Macro Drainage Analysis

Freymond Quarry

Town of Bancroft, Hastings County

Project: 33886-100
Date: April 9, 2018
By: TFC

Hydrologic Cycle Component Values

Land-use/Soil Type	Hydrologic Components (mm/year)		
	Evapotranspiration	Runoff	Infiltration
Mature Forests Fine Sandy Loam (Type B)	544	503	26
Mature Forests Silt Loam (Type C)	546	501	26
Mature Forests Precambrian Bedrock (Type D)	545	502	26
Lakes / Ponds / Small Reservoirs	700	374	0
Exposed Quarry Floor	209	821	43
Overburden - Urban Lawn / Glaciofluvial outwash, gravelly sand (Type B)	521	524	28
Rehabilitated Land- Shrub / Glaciofluvial outwash, gravelly sand (Type B)	535	511	27
Overburden - Urban Lawn / Precambrian Bedrock Type D	521	524	28
Rehabilitated Land- Shrub / Precambrian Bedrock (Type D)	539	507	27

South Catchment Area:

Land Use / Soil Type	Pre-Extraction (103 & 104)			Phase 1 (203 & 204)			Phase 2 (303 & 304)			Phase 3 (403 & 404)			Phase 4 (503 & 504)		
	Area Draining to South Creek (ha)	Runoff (mm/yr)	Volume to Stream (m^3/year)	Area Draining to South Creek (ha)	Runoff (mm/yr)	Volume to Stream (m^3/year)	Area Draining to South Creek (ha)	Runoff (mm/yr)	Volume to Stream (m^3/year)	Area Draining to South Creek (ha)	Runoff (mm/yr)	Volume to Stream (m^3/year)	Area Draining to South Creek (ha)	Runoff (mm/yr)	Volume to Stream (m^3/year)
Undisturbed Area															
Mature Forest / Glaciofluvial outwash, gravelly sand (Type B)	15.40	503	77,423	14.83	503	74,558	14.83	503	74,558	14.83	503	74,558	12.90	503	64,855
Mature Forest / Precambrian Bedrock (Type D)	93.70	502	470,193	87.11	502	437,124	82.46	502	413,790	73.79	502	370,283	72.57	502	364,161
Total	*109.10*		**547,616**	*101.94*		**511,681**	*97.29*		**488,347**	*88.62*		**444,841**	*85.47*		**429,016**
Net Loss of Surface Runoff (Pre-Extraction vs Post)			**0**			**35,935**			**59,269**			**102,775**			**118,600**
% Net Loss of Surface Runoff			**0.0%**			**6.6%**			**10.8%**			**18.8%**			**21.7%**
Disturbed Area															
Overburden - Urban Lawn / Glaciofluvial outwash, gravelly sand (Type B)	0.00	521	0	0.00	521	0	0.00	521	0	0.00	521	0	1.93	521	10,055
Rehabilitated Land- Shrub / Glaciofluvial outwash, gravelly sand (Type B)	0.00	535	0	0.00	535	0	0.00	535	0	0.00	535	0	0.00	535	0
Overburden - Urban Lawn / Precambrian Bedrock Type D	0.00	521	0	5.09	521	26,519	8.23	521	42,878	7.53	521	39,231	6.12	521	31,885
Rehabilitated Land- Shrub / Precambrian Bedrock (Type D)	0.00	539	0	0.00	539	0	4.29	539	23,123	9.84	539	53,038	21.46	539	115,669
Mature Forest / Bog & Swamp Deposits (Type C)	0.00	501	0	0.00	501	0	0.00	501	0	0.00	501	0	0.00	501	0
Exposed Quarry Floor	0.00	821	0	4.75	821	38,988	5.17	821	42,435	8.99	821	73,790	0.00	821	0
Quarry Pond	0.00	374	0	0.96	374	3,586	0.96	374	3,586	0.96	374	3,586	0.96	374	3,586
Total	*0.00*		**0**	*10.80*		**69,093**	*18.65*		**112,022**	*27.32*		**169,644**	*30.47*		**161,196**
South Stream Catchment Area to Assessment Node															
Total	*109.10*		**547,616**	*112.74*		**580,774**	*115.94*		**600,370**	*115.94*		**614,485**	*115.94*		**590,211**
Net Gain of Surface Runoff (m^3)			**0**			**33,158**			**52,754**			**66,869**			**42,595**
% Net Gain of Surface Runoff			**0.0%**			**6.1%**			**9.6%**			**12.2%**			**7.8%**

Assumptions:

1) Precambrian bedrock is assumed to act like Soil Type D (Clay) to provide high runoff
2) Bog cover is considered "mature forest"
3) Bog is Type C soil (some infiltration)
4) No major depression storage
6) Overburden cover is considered "urban lawn"
7) Rehabilitated land is considered "shrub"
8) Lake evaporation obtained from Government of Canada "Mean Lake Evaporation" map:
(http://open.canada.ca/data/en/dataset/67de4f04-855d-5d23-bb4a-2a270d1488d0)
9) Surplus water to stream is Precipitation minus Evapotranspiration (assuming infiltration becomes stream interflow)

Table 3: SW1 Macro Drainage Analysis

Freymond Quarry

Town of Bancroft, Hastings County

Project: 33886-100
Date: April 9, 2018
By: TFC

Hydrologic Cycle Component Values

Land-use/Soil Type	Hydrologic Components (mm/year)		
	Evapotranspiration	Runoff	Infiltration
Mature Forests Precambrian Bedrock (Type D)	545	502	26

SW1 Catchment Area:

Land Use / Soil Type	Pre-Extraction			Post-Extraction		
	Area Draining to SW1 (ha)	Runoff (mm/yr)	Volume to Stream (m^3/year)	Area Draining to SW1 (ha)	Runoff (mm/yr)	Volume to Stream (m^3/year)
Mature Forest / Precambrian Bedrock (Type D) off-Site	58.86	502	295,363	58.86	502	295,363
Mature Forest / Precambrian Bedrock (Type D) on-Site	3.69	502	18,524	0.00	0	0
Total	*62.55*		**313,887**	*58.86*		**295,363**
	Total Pre-Development (m^3)		**313,887**	**Total Post-Development (m^3)**		**295,363**
				Net Loss of Surface Runoff (m^3)		**18,524**
				% Net Loss of Surface Runoff		**5.9%**

Assumptions:

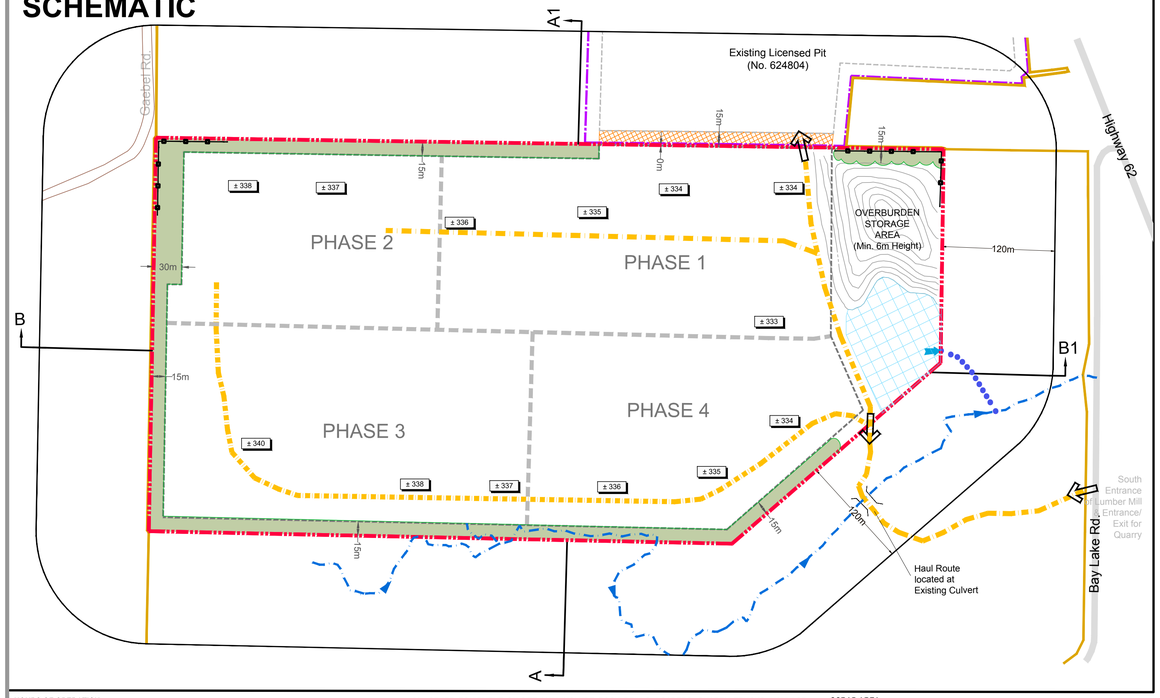
1) Precambrian bedrock is assumed to act like Soil Type D (Clay) to provide high runoff
2) No major depression storage
3) Surplus water to stream is Precipitation minus Evapotranspiration (assuming infiltration becomes stream interflow)

ATTACHMENT 1

OPERATIONAL PLAN

Operation Plan

SCHEMATIC



HOURS OF OPERATION

1. SITE PREPARATION, REHABILITATION, EXTRACTION, DRILLING AND PROCESSING IS PERMITTED FROM 7:00AM TO 5:30PM (MONDAY TO FRIDAY).
2. SHIPPING IS PERMITTED FROM 6:00AM TO 7:00PM (MONDAY TO FRIDAY) AND ON SATURDAYS FROM 7:00AM TO 12:00PM.
3. BLASTING IS PERMITTED FROM 8:00AM TO 5:30PM (MONDAY TO FRIDAY) PROVIDED IT IS DAYLIGHT.
4. THERE WILL BE NO OPERATIONS ON SUNDAYS AND STATUTORY HOLIDAYS AS DEFINED IN ACCORDANCE WITH THE EMPLOYMENT STANDARDS ACT.

MAXIMUM ANNUAL TONNAGE LIMIT

5. THE MAXIMUM AMOUNT OF MATERIAL THAT MAY BE SHIPPED FROM THIS LICENCE IN ANY CALENDAR YEAR SHALL BE 300,000 TONNES.

SEQUENCE OF EXTRACTION / EXTRACTION SETBACKS

6. THE AREA TO BE EXTRACTED IS 27.5HA (68.0AC).
7. EXTRACTION SETBACKS ARE SHOWN AND LABELLED ON THE OPERATION SCHEMATIC (SEE SITE PLAN OVERRIDES 1.2.25 (SEC. 5.10) THIS PAGE).
8. EXTRACTION OF THE SITE IS PROPOSED IN FOUR PHASES AND WILL OCCUR SEQUENTIALLY TO MINIMIZE THE DISTURBED AREAS. SEE CONCEPTUAL PHASING SCHEMATICS.
9. EXTRACTION WILL COMMENCE IN THE NORTH-EASTERN PORTION OF THE SITE (PHASE 1) AND WILL PROCEED WEST TO THE NORTH-WESTERN PORTION OF THE SITE (PHASE 2).
10. EXTRACTION WILL THEN PROCEED SOUTH TO THE SOUTH-WESTERN PORTION OF THE SITE (PHASE 3) PRIOR TO PROCEEDING EAST TO THE SOUTH-EASTERN PORTION OF THE SITE (PHASE 4).
11. EXISTING VEGETATION WITHIN THE SETBACKS WILL BE MAINTAINED EXCEPT WHERE REQUIRED FOR OVERBURDEN STORAGE IN THE NORTHEAST CORNER OF THE SITE, CONSTRUCTION OF THE STORMWATER MANAGEMENT POND, AND THE INTERNAL HAUL ROAD. SEE OPERATIONS SCHEMATIC FOR THE LOCATION OF THESE ACTIVITIES.

BENCH HEIGHTS / MAXIMUM DEPTH OF EXTRACTION

12. EXTRACTION WILL TAKE PLACE IN ONE OR TWO BENCHES. THE MAXIMUM BENCH HEIGHT WILL NOT EXCEED MINISTRY OF LABOUR REQUIREMENTS.
13. WHERE A SECOND BENCH IS REQUIRED APPROXIMATELY A 5 M LEDGE WILL REMAIN. SEE QUARRY FACE DETAIL PAGE 3 OF 3.
14. THE MAXIMUM DEPTH OF EXTRACTION IS +/-333 M.A.S.L. AS INDICATED BY PROPOSED SPOT ELEVATIONS AS SHOWN ON THE OPERATION SCHEMATIC.

INTERNAL HAUL ROUTES AND ENTRANCE / EXIT

15. THE MAIN INTERNAL HAUL ROUTES ARE APPROXIMATELY SHOWN ON THE OPERATION SCHEMATIC AND MAY BE DEVELOPED DURING SITE PREPARATION. THE NORTHERN INTERNAL HAUL ROUTE IS TO TRANSFER AGGREGATE FROM THE PROCESSING AREA TO THE ENTRANCE / EXIT AND WILL BE LOCATED ON THE QUARRY FLOOR. THE SOUTHERN INTERNAL HAUL ROUTE IS FOR THE PURPOSE OF SITE PREPARATION AND WILL OCCUR AT GRADE.
16. THERE WILL BE ADDITIONAL INTERNAL HAUL ROUTES ON THE QUARRY FLOOR WITHIN EACH PHASE TO ACCESS THE ACTIVE EXTRACTION AREAS AND THE PROCESSING PLANT.
17. ENTRANCE/EXITS ARE SHOWN ON THE OPERATION SCHEMATIC. AGGREGATE WILL BE TRANSFERRED FROM THE LICENSED AREA TO THE FREYMOND LUMBER YARD FOR SHIPPING.
18. AGGREGATE RESOURCES FROM THE CLASS B LICENSE LOCATED TO THE NORTH MAY ALSO BE TRANSFERRED THROUGH THE LICENSED AREA TO THE FREYMOND LUMBER YARD FOR SHIPPING.

BUILDING / STRUCTURES

19. OTHER THAN THE PROCESSING PLANT NO BUILDINGS ARE TO BE ERECTED ON-SITE.

PROCESSING PLANT / OTHER ON-SITE EQUIPMENT

20. A PROCESSING PLANT IS PERMITTED WITHIN PHASES 1 AND 2 (INCLUDES PRIMARY, SECONDARY AND TERTIARY CRUSHING AND SCREENING UNITS WITH AN ASSOCIATED DIESEL GENERATOR). WITHIN PHASE 1, PROCESSING IS PERMITTED WITHIN THE EXTRACTION LIMIT. WITHIN PHASE 2, PROCESSING IS PERMITTED WITHIN THE EXTRACTION LIMIT EXCEPT WITHIN 90 M OF THE WESTERN LICENSE BOUNDARY. THERE WILL BE NO PROCESSING IN PHASES 3 AND 4.
21. THE PROCESSING PLANT SHALL IMPLEMENT THE MITIGATION MEASURES OUTLINED IN SECTION 7.0.3 OF THE NOISE STUDY (SOURCE: HUGH WILLIAMSON ASSOCIATES INC., DECEMBER 15, 2016) TO ENSURE MOECC NOISE LIMITS ARE MET FOR SURROUNDING RESIDENTS.
22. THE OVERBURDEN STORAGE AREA IN THE NORTHEAST CORNER OF THE SITE SHALL BE BUILT DURING SITE PREPARATION OF PHASE 1 TO A MINIMUM HEIGHT OF 6 METRES AND BE MAINTAINED FOR THE DURATION OF OPERATIONS TO SERVE AS A NOISE BARRIER FOR THE SENSITIVE RECEPTORS TO THE EAST. WHEN EXTRACTING PHASE 4, THE BENCH HEIGHT TO THE EAST IS TO BE MAINTAINED AT A MINIMUM HEIGHT OF 6 METRES TO SERVE AS A NOISE BARRIER TO THE SENSITIVE RECEPTORS TO THE EAST. IF REQUIRED, OVERBURDEN OR A NOISE BARRIER MAY BE UTILIZED TO ACHIEVE REQUIRED HEIGHTS. EXAMPLES OF SUITABLE NOISE BARRIERS ARE OUTLINED IN SECTION 7.0.6 D) OF THE NOISE STUDY (SOURCE: HUGH WILLIAMSON ASSOCIATES INC., DECEMBER 15, 2016).
23. OTHER EQUIPMENT ON-SITE MAY INCLUDE ROCK DRILLS, LOADERS, QUARRY TRUCKS, HAULAGE TRUCKS, AND EQUIPMENT FOR SITE PREPARATION AND REHABILITATION INCLUDING BUT NOT LIMITED TO EXCAVATORS, HYDRAULIC SHOVELS AND DOZERS.
24. EQUIPMENT USED FOR SITE PREPARATION AND REHABILITATION SHALL COMPLY WITH MOECC PUBLICATION NPC-115.
25. THE ROCK DRILLS SHALL IMPLEMENT THE MITIGATION MEASURES OUTLINED IN SECTION 7.0.1 AND 7.0.2 OF THE NOISE STUDY (SOURCE: HUGH WILLIAMSON ASSOCIATES INC., DECEMBER 15, 2016) TO ENSURE MOECC LIMITS ARE MET FOR SURROUNDING RESIDENTS.
26. TECHNICAL ADVANCEMENTS IN EXTRACTION METHODS, PROCESSING EQUIPMENT, DRILLS, QUARRY TRUCKS, LOADERS AND OTHER EQUIPMENT MAY ALLOW FOR ALTERNATIVE MITIGATION APPROACHES TO BE IMPLEMENTED SUBJECT TO THE LICENSEE CONFIRMING THAT MOECC NOISE LIMITS ARE MET FOR SURROUNDING RESIDENTS.
27. IF AN OPERATIONAL CHANGE IS CONSIDERED THAT HAS A POTENTIAL TO INCREASE NOISE LEVELS, THEN THIS CHANGE SHALL BE ASSESSED BY A QUALIFIED ACOUSTICAL CONSULTANT AND NOISE MITIGATION MEASURES SHALL BE REVIEWED, AND ALTERED IF NECESSARY, TO ENSURE THAT MOECC SOUND LEVEL LIMITS ARE MET FOR SURROUNDING RESIDENTS.

BLASTING

28. THE LICENSEE SHALL MONITOR ALL BLASTS FOR GROUND VIBRATIONS AND OVERPRESSURE AT THE CLOSEST PRIVATELY OWNED RESIDENTS TO ENSURE COMPLIANCE WITH CURRENT PROVINCIAL VIBRATION AND OVERPRESSURE STANDARDS. A MINIMUM OF ONE MONITOR SHALL BE INSTALLED IN FRONT OF THE BLAST AND ONE INSTALLED BEHIND THE BLAST.
29. AN ATTENUATION STUDY SHALL BE UNDERTAKEN BY AN INDEPENDENT BLASTING CONSULTANT DURING THE FIRST 12 MONTHS OF OPERATION TO ASSIST IN DEVELOPING FUTURE BLAST DESIGNS.
30. THE EXTRACTION FACE SHALL BE ORIENTATED SO THE DIRECTION OF THE OVERPRESSURE PROPAGATION IS AWAY FROM STRUCTURES AS MUCH AS POSSIBLE.
31. BLAST DESIGNS SHALL BE CONTINUALLY REVIEWED AND MODIFIED AS REQUIRED TO ENSURE COMPLIANCE WITH CURRENT PROVINCIAL STANDARDS.

AGGREGATE STOCKPILES / RECYCLED AGGREGATE

32. AGGREGATE STOCKPILES AND RECYCLABLE ASPHALT MAY OCCUR WITHIN THE EXTRACTION AREA LOCATED ON THE QUARRY FLOOR (SEE SITE PLAN OVERRIDES 1.2.25 (SEC. 5.13) THIS PAGE).
33. RECYCLABLE ASPHALT MATERIALS WILL NOT BE STOCKPILED WITHIN 30 M OF ANY WATER BODY OR MAN-MADE POND OR WITHIN 2 M OF THE GROUNDWATER WATER TABLE ON THE QUARRY FLOOR.
34. ONCE THE AGGREGATE ON SITE HAS BEEN DEPLETED THERE WILL BE NO FURTHER IMPORTATION OF RECYCLABLE MATERIALS PERMITTED AND RECYCLING OPERATIONS WILL CEASE PRIOR TO FINAL REHABILITATION.

STORAGE OF TOPSOIL AND SUBSOIL

35. WITHIN THE LIMIT OF EXTRACTION, THE SITE WILL BE STRIPPED OF TOPSOIL AND SUBSOIL.
36. THE INITIAL TOPSOIL AND SUBSOIL STRIPPED IN PHASE 1, THE STORMWATER MANAGEMENT POND AND CONSTRUCTION OF THE INTERNAL HAUL ROAD MAY BE TRANSPORTED PERMANENTLY TO THE NORTHEAST CORNER OF THE SITE AS SHOWN ON THE OPERATIONS SCHEMATIC AND PLANTED WITH RED PINE AND MAINTAINED TO CONTROL EROSION. THIS OVERBURDEN AREA SHALL BE A MINIMUM HEIGHT OF 6 M AND NOT BE LOCATED WITHIN 15 M OF THE ADJACENT CEMETERY. (SEE SITE PLAN OVERRIDES 1.2.25 (SEC. 5.13) THIS PAGE).
37. THE REMAINING TOPSOIL AND SUBSOIL MAY BE STORED ANYWHERE WITHIN THE LIMIT OF EXTRACTION AND WILL BE USED IN REHABILITATION.
38. NO IMPORTATION OF FILL IS PERMITTED ON-SITE.

TIMBER RESOURCES

39. TIMBER RESOURCES WILL BE SALVAGED FOR USE IN THE FREYMOND LUMBER OPERATION. STUMPS AND BRUSH CLEARED DURING SITE PREPARATION MAY BE BURNED (SUBJECT TO NECESSARY LOCAL APPROVAL), MULCHED OR USED IN THE PROGRESSIVE REHABILITATION OF THIS SITE.

FENCING

40. THE SITE WILL BE FENCED WITH A 1.2 METRE PAIGE WIRE FENCE IN THE NORTH-EASTERN CORNER ADJACENT TO THE CEMETERY AND IN THE NORTH-WESTERN CORNER ADJACENT TO GAEBEL ROAD.
41. THE REMAINDER OF THE LICENSED BOUNDARY WILL BE DELINEATED BY MARKER POSTS.
42. FENCING AND MARKER POSTS WILL BE INSTALLED PRIOR TO THE COMMENCEMENT OF OPERATIONS (SEE SITE PLAN OVERRIDES 1.2.25 (SEC. 5.1 AND 5.2) THIS PAGE).

SCRAP AREA

43. TEMPORARY SCRAP STORAGE MAY BE LOCATED IN THE PROCESSING AREA AND SHALL BE REMOVED ON AN ON-GOING BASIS.

FUEL STORAGE

44. THERE WILL BE NO FUEL STORAGE LOCATED ON-SITE. EQUIPMENT WILL BE FUELLED BY FUEL TRUCKS OR AT THE ADJACENT FREYMOND LUMBER YARD.

ON-SITE WATER RESOURCES

45. THE EXISTING WATER TABLE ELEVATION ON THIS PROPERTY RANGES FROM +/-352 M.A.S.L. TO +/-376 M.A.S.L.
46. THE LICENSEE SHALL DESIGN A STORMWATER MANAGEMENT POND AND OBTAIN AN MOECC ENVIRONMENTAL COMPLIANCE APPROVAL FOR PERIODIC DISCHARGE OF WATER. MONITORING OF THE STORMWATER MANAGEMENT FACILITY SHALL BE COMPLETED IN ACCORDANCE WITH MOECC APPROVALS.
47. WITHIN THE ACTIVE EXTRACTION AREAS AND REHABILITATED PORTIONS OF THE QUARRY SURFACE AND GROUNDWATER WILL BE DIVERTED TO THE STORMWATER MANAGEMENT POND. THERE WILL BE NO ACTIVE PUMPING OF WATER OFF-SITE.
48. THE LICENSEE SHALL COMPLETE THE ON-SITE GROUNDWATER MONITORING PROGRAM AS OUTLINED IN SECTION 7.5 OF THE WATER RESOURCES REPORT (SOURCE: MTE CONSULTANTS INC., DECEMBER 1, 2016). THE RESULTS OF THE MONITORING PROGRAM SHALL BE PRESENTED IN AN ANNUAL WATER MONITORING REPORT SUBMITTED TO MNRF AND MOECC BY MARCH 31ST OF EACH CALENDAR YEAR.

OFF-SITE PRIVATE WATER WELLS

49. THE LICENSEE SHALL COMPLETE THE PRIVATE WELL MONITORING PROGRAM AS OUTLINED IN SECTION 7.5 OF THE WATER RESOURCES REPORT (SOURCE: MTE CONSULTANTS INC., DECEMBER 1, 2016). THE RESULTS OF THE MONITORING PROGRAM SHALL BE PRESENTED IN ANNUAL WATER MONITORING REPORT SUBMITTED TO MNRF AND MOECC BY MARCH 31ST OF EACH CALENDAR YEAR.
50. ALTHOUGH NO WELL IMPACTS ARE PREDICTED, IN THE EVENT OF A WELL COMPLAINT FROM SURROUNDING RESIDENTS THE LICENSEE SHALL IMPLEMENT THE WELL INTERFERENCE COMPLAINT RESPONSE PROCEDURE AS OUTLINED IN SECTION 7.1 OF THE WATER RESOURCES REPORT (SOURCE: MTE CONSULTANTS INC., DECEMBER 1, 2016). TO ENSURE THAT ANY WELL IMPACTED BY THE QUARRY IS REPLACED OR RESTORED AT THE EXPENSE OF THE LICENSEE.

SPILLS CONTINGENCY PLAN

51. A SPILLS CONTINGENCY PROGRAM WILL BE DEVELOPED PRIOR TO SITE PREPARATION AND AVAILABLE ON-SITE.

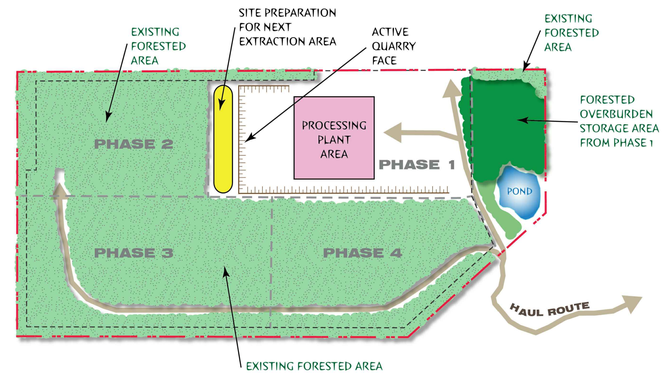
TREE REMOVAL

52. VEGETATION CLEARING SHALL BE CONDUCTED IN STAGES AND THE AREA CLEARED SHOULD BE MINIMIZED TO ONLY CLEAR THE AREA REQUIRED FOR FUTURE EXTRACTION NEEDS.
53. NO REMOVAL OF VEGETATION OR CLEARING OF LAND SHALL OCCUR FROM APRIL 1 TO JULY 31.

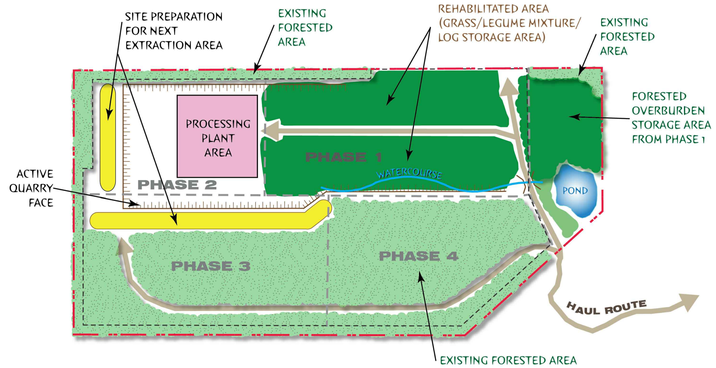
ARCHAEOLOGY

54. IN THE EVENT THAT DEEPLY BURIED ARCHAEOLOGICAL MATERIAL IS FOUND WHILE WORKING ON SITE, ALTERATION OF THAT AREA SHALL BE TEMPORARILY SUSPENDED AND THE MINISTRY OF TOURISM, CULTURE AND SPORT SHALL BE NOTIFIED IMMEDIATELY.
55. IN THE EVENT THAT HUMAN REMAINS ARE ENCOUNTERED WHILE WORKING ON SITE, ALTERATION OF THAT AREA SHALL BE TEMPORARILY SUSPENDED AND THE POLICE AND THE REGISTRAR OF CEMETERIES AT THE MINISTRY OF CONSUMER SERVICES MUST BE NOTIFIED IMMEDIATELY.

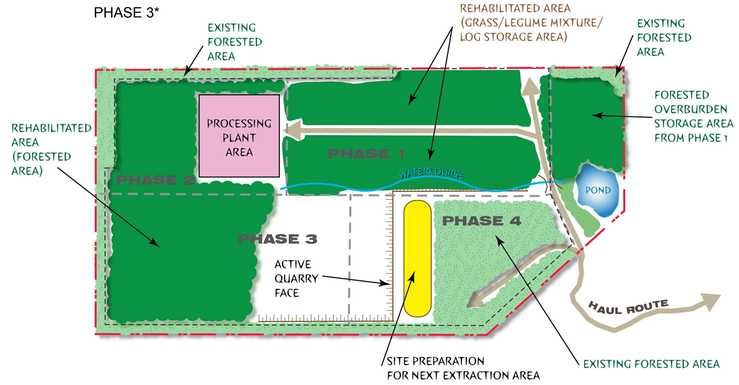
CONCEPTUAL PHASING PLAN
PHASE 1*



PHASE 2*



PHASE 3*



** THE CONCEPTUAL PHASING PLAN IS AN APPROXIMATE REPRESENTATION OF THE PROPOSED SEQUENCE OF OPERATIONS AND IS NOT TO SCALE.*

THE ESTIMATED RESERVE LOCATED WITHIN THE EXTRACTION LIMIT IS APPROXIMATELY 15,000,000 TONNES.
THE FOLLOWING TIMELINES REPRESENT THE DURATION OF EACH PHASE ASSUMING THE MAXIMUM LIMIT OF 300,000 TONNES IS EXTRACTED EACH YEAR:

- PHASE 1: 13 YEARS OF EXTRACTION
- PHASE 2: STARTS YEAR 14 OR LATER
- PHASE 3: STARTS YEAR 27 OR LATER
- PHASE 4: STARTS YEAR 44 OR LATER

VARIATIONS FROM OPERATIONAL STANDARDS

OPERATIONAL STANDARD	VARIATION
5.1	THE SITE WILL BE FENCED ONLY IN THE NORTH-EASTERN CORNER ADJACENT TO THE CEMETERY AND IN THE NORTH-WESTERN CORNER ADJACENT TO GAEBEL ROAD. SEE OPERATION SCHEMATIC FOR LOCATION. THE REMAINDER OF THE LICENCED BOUNDARY WILL BE DELINEATED BY MARKER POSTS.
5.2	A GATE WILL NOT BE REQUIRED AT THE ENTRANCE/EXIT BETWEEN LICENCE NO. 624804 AND THIS SITE.
5.10	EXCAVATION SETBACK ADJACENT TO LICENCE NO. 624804 WILL BE REDUCED TO 0M.
5.13	WITHIN PHASES 1 AND 2, AGGREGATE, TOPSOIL, OVERBURDEN AND RECYCLED AGGREGATE MAY BE LOCATED WITHIN THE LIMIT OF EXTRACTION. WITHIN PHASES 1 AND 2, PROCESSING IS PERMITTED WITHIN THE LIMIT OF EXTRACTION EXCEPT ALONG THE WESTERN LICENCE BOUNDARY WHERE A 90M SETBACK SHALL BE MAINTAINED. TO THE EAST OF PHASE 1, OVERBURDEN AND TOPSOIL MAY BE PLACED WITHIN THE LICENCE BOUNDARY, EXCEPT WITHIN 15 M OF THE CEMETERY. WITHIN PHASES 3 AND 4, AGGREGATE, TOPSOIL AND OVERBURDEN MAY BE PERMITTED WITHIN THE LIMIT OF EXTRACTION.
5.19.2	PORTIONS OF THE QUARRY FACE MAY REMAIN VERTICAL. SEE REHABILITATION PLAN AND QUARRY FACE DETAIL ON PAGE 3 OF 3.

DECEMBER 2016 VERSION OF SITE PLANS UPDATED APRIL 2018 TO SHOW UPDATED LOCATION OF SOUTH STREAM

Legal Description

PART OF LOTS 51 & 52
CONCESSION W.H.R.
TOWNSHIP OF FARAD
COUNTY OF HASTING

Legend

- Proposed Licensed Boundary
- Proposed Limit of Extraction
- Existing Licence Boundary
- Existing Limit of Extraction
- Boundary of Lands Owned by Applicant
- 120m from Licensed Boundary
- 1.2m Fencing
- Phase Boundary
- A A — Cross-Section
- Entrance/Exit
- Existing Watercourse
- Surface Water Discharge Point
- Connection from Stormwater Management Pond to Existing Watercourse (Drainage Feature or Pipe)
- Paved Road
- ± 333 — Proposed Quarry Floor Elevation (m.a.m.s.l.)
- Approximate Location of Internal Haul Route
- Approximate Location of Stormwater Management Pond
- Existing Vegetation to remain
- Area Subject to Separate ARA Site Plan Amendment to Reduce Setback from 15m to 0m

Site Plan Amendments

No.	Date	Description	By

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE
113 COLLIER STEET BARRIE, ON, L4M 1H2 | P: 705 728 0045 F: 705 728 2010 | WWW.MHBCPLAN.COM

MNRF Approval Stamp

Stamp

BRIAN ZEMAN — PLANNERS URBANISTES — MCIP MIOJ

north

Project

FREYMOND AGGREGATES

FREYMOND LUMBER LTD.
RR#1, 2287 Bay Lake Road
Bancroft, Ontario K0L 1C0

MNRF Licence Reference No.

Pre-approval review:
First Submission to MNRF, December 19, 2016

Plan Scale **1:3000**

Metres
0 25 50 100 150

Drawn By L.H. | File No. **1515B**
Checked By B.Z. | Date April 25, 2018

File Name

OPERATION PLAN

Drawing No.

2 OF 3