Carden Quarry

Hydrogeological Assessment Report

Project Location:

Lot 6-10, Concession 9, Township of Carden
Kawartha Lakes, ON

Prepared for:

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1.0 INTRODUCTION

MTE Consultants Inc. (MTE) was retained by Ferma Aggregates Inc. (Ferma) to assess the water supply potential and the hydraulic properties of the underlying bedrock at the Ferma-Carden Quarry. This information will be used to demonstrate that the quarry can extract below 255 masl in Phase 1, expand into remaining phases, and mitigate potential impacts to existing groundwater users by accessing a safe and reliable water supply from a separate deeper bedrock aquifer.

The Ferma-Carden Quarry is located on Lot 6-10, Concession 9, former geographic Township of Carden, City of Kawartha Lakes, ON (hereby referred to as the "Site"). Additionally, Ferma owns W ½ Lot 6 & 7 Concession 10 as well as Lot 8, Concession 10. **Figure 1** illustrates the Site location and the additional lands owned by Ferma.

This report is organized into the following sections:

- Section 1: Introduction – Provides background information, project scope and objectives;
- Section 2: Regional Bedrock Geology – Recaps the geological conditions of the Site by describing the Bobcaygeon Formation, the underlying Gull River Formation with its Green Marker Beds, and the deeper underlying Shadow Lake Formation/Precambrian contact zone;
- Section 3: Gull River Formation Green Marker Beds – Summarizes available information used to determine the elevation of the Green Marker Beds on a regional scale as well as a site-specific scale;
- Section 4: Hydraulic Testing Program – Presents the results of hydraulic testing completed on-Site for each bedrock zone;
- Section 5: Water Chemistry Assessment – Presents the results of groundwater sampling and analysis for each bedrock zone;
- Section 6: Discussion – General discussion of the physical and chemical properties of the bedrock formations and the implications for the Ferma-Carden Quarry;
- Section 7: Conclusions – Lists conclusions resulting from this assessment; and
- Section 8: Recommendations – Lists recommendations resulting from this assessment.

1.1 Objectives and Scope

The principle objectives of this assessment are to:

1. Establish a baseline understanding of the hydraulic condition (physical and chemical properties) of the different bedrock zones (Formations) with respect to water quality and quantity;
2. Provide information showing that the quarry can extract below 255 masl in Phase 1, and then into the remaining phases, provided potential impacts to existing groundwater users are mitigated as proposed; and
3. Demonstrate that a potable water supply of comparable water quality and quantity to what residents are currently utilizing is available at depths below 255 masl, which can be used to mitigate impacts to water supply wells permanently affected by quarry dewatering.

1.2 ARA Site Plan

The Ferma-Carden Quarry is licensed to extract bedrock under ARA License Number 108268 as a Category 2, Class A, Quarry Below Water. The approved ARA Site Plans are found in **Appendix A.** Based on the approved ARA Site Plan, the maximum depth of extraction for Phase 1 is 231 masl with a sump elevation of 228 masl. However, Dewatering Condition 1 states that:

> *The Permit to Take Water applies to dewatering the first lift of Phase 1, North Part, Ferma-Carden Quarry which is defined as limestone excavation limited to a depth elevation of 255.0 masl over the east half of lots 8 and 9, Concession IX, Carden Township. Subsequent lifts or Phases or greater pumping volumes will require a new Permit to Take Water.*

This condition limits the quarry floor to an elevation of 255 masl in Phase 1 until such time that a Permit to Take Water (PTTW) is issued for dewatering at deeper depths and subsequent phases. This condition was added to the Site Plan by the Ministry of the Environment Conservation and Parks (MECP) to mitigate potential impacts to nearby domestic well users (Trow Consulting Engineers Ltd., 2002).

To further protect domestic well users from potential impacts from dewatering the quarry, Condition 4A (Trigger Mechanism and Contingency Measures – Domestic Wells) states that:

> *The Operator will maintain a potable water supply source to surrounding wells adversely affected by dewatering operations. Contingency measures include, but not limited to, the use of holding tanks, the construction of a new wells(s) with the upper bedrock aquifer at a locations(s) unaffected by quarry dewatering and the delivery of water from the new wells(s) by pressurized pipe system to each affected residence. Dewatering mechanisms will be shut down failing the resolution of water supply problems caused by quarry dewatering.*

As previously mentioned, this report will provide information demonstrating that an alternative reliable potable water supply of comparable water quality and quantity is available at depths deeper than 255 masl, such that the quarry can provide affected residences a viable new well(s) in the event they are permanently affected by quarry dewatering.

2.0 REGIONAL BEDROCK GEOLOGY

The following is a description of the general bedrock geology of the Lake Simcoe Region as reported by the Geological Survey of Canada (GSC) and Ontario Geological Survey (OGS).

There are four bedrock units present in the Lake Simcoe Area. These include three sedimentary bedrock formations: the Bobcaygeon, the Gull River, and the Shadow Lake Formations, and one underlying metamorphic Precambrian gneiss. **Table 1** provides a general description of the lithology of these units as reported by the GSC.

Table 1: Regional Bedrock Lithology

System	Group	Formation		Lithology
ORDOVICAN	Simcoe	Bobcaygeon	Upper Member	Calcarenites and sublithographic limestone
			Middle Member	Sublithographic limestone
			Lower Member	Argillaceous limestone and calcarenite
		Gull River	Upper Member	Lithographic semicrystalline limestone

System	Group	Formation		Lithology
			Middle Member	Lithographic limestone
			Lower Member	Dolomitic limestone and lithographic limestone
CAMBRIAN	Basal	Shadow Lake		Red and green shale, arkose
PRECAMBRIAN				

2.1 Bobcaygeon Formation

The Bobcaygeon Formation is divided into three members. Essentially the lower member consists of grey, fine-grained limestone, but encloses calcarenite in its uppermost few feet. The middle member consists of sublithographic limestone. The upper member alternates between sublithographic and medium calcarenite limestone, but also includes some brown lithographic limestone and bluish fine-grained limestone in minor thicknesses. Shaley partings (up to 2 mm thick) have been observed in this formation. Shaley partings are commonly styolitic and occasionally undulating.

Contact

The lower contact of the Bobcaygeon Formation is defined where the typical grey-brown, fine- and medium-grained argillaceous limestone with shaley beds overlies the more finely grained dolomitic limestone of the Gull River Formation. This contact in many places is marked by a transitional boundary. The OGS defines this contact as the Moore Hill beds which are a dark brown fossiliferous limestone (Armstrong, 2000)

2.2 Gull River Formation

The Gull River Formation is divided into three members. The lower member consists of fine-grained limestone, lithographic limestone, and fine-grained dolomitic limestone. The middle member is composed almost entirely of lithographic limestone; the upper member lithographic, sublithographic, and semi-crystaline limestone.

Contact

The lower contact of the Gull River Formation is defined where the limestone and dolomitic limestone overlie the red and green shales of the Shadow Lake Formation. The upper contact is defined as the top of the highest development of lithographic limestone and argillaceous limestone of the Bobcaygeon Formation. On gross lithology, the Gull River Formation is a lithographic dolomitic limestone; and the Bobcaygeon Formation is a grey, fine-grained, argillaceous limestone.

The upper contact of the lower member of this Formation is marked in places by a green grey sandy dolostone horizon which is known as the “upper green marker bed”. A similar horizon near the bottom of the lower member is referred to as the “lower green marker bed”.

The contact between the Gull River Formation and the underlying Shadow Lake Formation is gradational from carbonate to sandstone and shale. It is convenient to define this contact as the uppermost extent of the gradation because of the deleterious effects of the sandstone and shale content on the potential aggregate quality of the Gull River Formation (Armstrong, 2000).

2.3 Shadow Lake Formation

The Shadow Lake Formation consists of greenish grey, coarse-grained, calcareous arkose overlain by several feet of red and green arenaceous shales. The shales are locally calcareous and commonly contain frosted, rounded to angular quartz grains that are as much as 1.25 cm long. The formation also includes some transitional red mottled green shale. Where the Cambrian formations are present, the Shadow Lake Formation may include reworked Cambrian sediments, such as purplish sandstone and shale. In well cuttings the formation appears to be more arkosic and sandy (with greenish and reddish shale fragments) than it actually is, because the softer shale is washed away by the drilling mud.

Contact

The upper contact of the Shadow Lake Formation is defined where the main shale section of the Shadow Lake Formation is overlain by the limestone sequence of the Simcoe Group. The lower member of the Gull River Formation consists of grey and brown, fine- and medium-grained limestone and dolomitic limestone, and grey and brown, dense, sublithographioc to lithographic limestone (Armstrong, 2000).

3.0 GULL RIVER FORMATION GREEN MARKER BEDS

Over the past 30 years several studies have been undertaken to characterize the lithology of the Carden Plain, and in particular the presence and elevations of the “Green Marker Beds” located in the Gull River Formation. The Green Marker Beds have been of particular interest as they reportedly represent a regionally extensive aquifer that although being relatively thin (1-3 m) represents a significant transmissive layer (Golder Associates, 2012). In an effort to document the presence of the Green Marker Beds in the vicinity of, and beneath the Site, MTE has reviewed a number of pertinent documents, including:

- Cumulative Impacts Assessment for Groundwater Takings in the Carden Plain Area (Golder Associates, 2012);
- R.W. Tomlinson Ltd. – Brechin Quarry borehole and borehole geophysical logs (Golder Associates, 2009);
- Hydrotechnical Report Ferma – Carden Quarry for Ferma Crushed Stone Inc. (Oliver, Mangione, McCalla & Associates Ltd., 1995);
- Well records on file with the MECP for boreholes drilled in 2006;
- Two borehole core logs, logged by MTE in 2011; and
- On-Site geophysical logs completed in 2018.

3.1 Regional Scale Model – Golder, 2016

In 2012, Golder developed a regional scale groundwater model to assess the cumulative impacts of pumping from the various quarries within the Carden Plain. MTE specifically reviewed the regionally modelled surface of the Upper Green Marker Bed (UGMB) as presented in the Addendum report to the Cumulative Impacts Assessment for Groundwater Takings in the Carden Plain Area (Golder Associates Ltd., 2016). This report showed the UGMB from approximately 235 to 245 mAMSL across the Site (**Appendix B**). This regional scale model is useful in roughly predicting the elevations of the GMBs, but lacks local scale data to calibrate the findings and is therefore only useful in a general sense.

3.2 Green Marker Bed Identification - Golder, 2009

To further understand the geology and hydrogeology of the Carden Plain, and to place the Ferma Quarry in the regional context, MTE made a Freedom of Information (FOI) submission (ref: A-2018-05968) to the MECP for information related to hydrogeology and geophysics for the R.W. Tomlinson – Brechin Quarry, located approximately 11 km to the southwest of the Site.

The FOI request returned borehole and geophysical logs from monitoring wells installed at the Brechin Quarry (**Appendix C**). Each location was geophysically logged for natural gamma and conductivity.

A review of the borehole and geophysical logs from the R.W. Tomlinson Brechin Quarry showed that the locations of the UGMB and Lower Green Marker Bed (LGMB) could be identified based on geophysical logs. Specifically, it was found that increased gamma values within the Gull River Formation correlated well with the location of both the UGMB and LGMB. These results were then compared with visual observations of the core to confirm the correlation between increased gamma values and the presence of the Green Marker Beds.

The borehole logs presented in **Appendix C** indicate that the UGMB ranges in thickness from 0.1 to 0.3 m while the LGMB thickness was observed to range from 0.4 to 1.4 m in thickness. The UGMB was found to occur approximately 3.4 to 3.9 m below the Bobcaygeon and Gull River Formation contact while the LGMB occurred generally 8.0 m below the UGMB.

3.3 On-Site Borehole Logs - Oliver, Mangione, McCalla, 1993 – 1995, MECP Well Logs, 2006 & MTE 2011

In 1993, a bedrock core from BH4 was logged by Oliver Mangione McCalla & Associates Ltd. (**Appendix D**) located 224 m south of the Phase 1 at the Site (Oliver, Mangione, McCalla & Associates Ltd., 1995). The log provided by Oliver Mangione McCalla & Associates noted a greenish grey to dark greenish grey silty to sandy dolostone layer at approximately 27.8 metres below ground surface, or approximately 239.8 mAMSL. This layer is interpreted by MTE to be the UGMB. According to the borehole log the UGMB had an approximate thickness of 0.7 m. Another greenish grey to dark greenish grey silty to sandy dolostone layer (interpreted by MTE to be the LGMB) was noted to occur at 231.3 mAMSL and based on the borehole log is approximately 3.0 m thick.

In 2006, six multi-level monitoring wells were installed on-Site (WA, WB, WF, WG, WH & WI), as shown on **Figure 2**. Well logs on file with MECP for these boreholes are provided in **Appendix E**. The presence of green limestone was noted at various depths, which MTE interprets to be the approximate depths of the Green Marker Beds. The UGMB was found to generally dip from northeast to southwest across the Site, occurring at an elevation of approximately 244.3 mAMSL in the north to 233.2 mAMSL in the south. The LGMB was only discreetly observed in three boreholes (WA, WB & WI) and occurred at an approximate elevation of 233.0 to 234.0 mAMSL.

In 2011, MTE retained Marathon Drilling to conduct borehole coring at two locations: BH1-11, located 47 m north of Phase 1, and BH2-11, located 176 m southwest of Phase 1, as identified on **Figure 2**, to assess the rock quality for use as aggregate products. MTE has recently re-examined the borehole and photographic logs for the presence of the Green Marker Beds. Borehole logs and photographic logs for BH1-11 and BH2-11 can be seen in **Appendix F**. Based on the borehole logs from on-Site monitoring wells, MTE interprets the UGMB to occur at approximately 243.0 mAMSL (Photograph 1.1) in BH1-11 and 237.8 mAMSL (**Appendix F**: Photograph 2.1) in BH2-11. The LGMB was interpreted to occur at an approximate elevation of 230.4 mAMSL (Photograph 1.2) in BH1-11 and 225.4 mAMSL (Photograph 2.2) in BH2-11.

3.4 On-Site Geophysical Logs - MTE, 2018

In 2018, MTE retained Lotowater Technical Services to conduct geophysical logging on two deep, open boreholes (W22 & MW4) on-Site. Based on the information obtained from the Golder Report (i.e. increased gamma readings correlated to the Green Marker Beds), MTE reassessed the previously published logs for W22, located approximately one kilometer south of Phase 1 and MW4, located 1.2 km east of Phase 1. Based on this reassessment, the UGMB is estimated to be located at an elevation of approximately 238.5 mAMSL in W22 and 247.0 mAMSL in MW4, (**Figure 3 and 4**). The LGMB was estimated to be located at approximately 231.5 mAMSL in W22 and 239.0 mAMSL in MW4.

3.5 On-Site Elevations of the Green Marker Beds

In order to interpret and present the information discussed above, MTE prepared two cross sections across the Site at the locations shown on **Figure 2.** The cross-sections show the interpreted elevations for the UGMB and LGMB (**Figures 5 and 6**).

4.0 HYDRAULIC TESTING PROGRAM

4.1 March 2022 Hydraulic Testing

Hydraulic testing undertaken in March 2022 was completed by W.D. Hopper and Sons Ltd. (Hopper) to assess the hydraulic properties of the underlying bedrock, particularly the Gull River Formation Green Marker Beds at the Ferma-Carden Quarry. The hydraulic testing program was completed in accordance with Environmental Activity and Sector Registration (EASR) No. R-011-7169340455 and the Pumping Test Design Report completed by MTE dated March 10, 2022 (**Appendix G**).

The objective of the hydraulic testing program was to document the hydraulic properties of each of the bedrock formations including the Bobcaygeon Formation, the Gull River Formation Upper and Lower Green Marker Beds, and the Shadow Lake Formation / Precambrian contact zone.

In order to determine the hydraulic properties of the underlying bedrock zones, hydraulic testing was undertaken at MW3 and MW4. The details of these locations are described below.

Monitoring well MW3 is a 0.15 m dia, 20 m deep open borehole extending from 6 to 20 m below grade and was designed to represent a typical domestic well in the area, the majority of which are completed in the Bobcaygeon Formation (see Well Tag No.: A238596 in **Appendix E**).

MW4 is completed as a 0.20m dia, 40.8 m deep open borehole extending from 3 m to 40.8 m below ground level. This well was designed to extend from the Bobcaygeon Formation to the Pre-Cambrian bedrock contact (see Well Tag No.: A238597 in **Appendix E**).

The following section describes the results of the hydraulic testing program.

4.2 Bobcaygeon Formation (Zone 1)

In order to assess the hydraulic conductivity of the Bobcaygeon Formation (Zone 1) monitoring well MW3 was pumped at a constant rate of 130 L/min for a period of 60 min on March 17, 2022.

Water levels were recorded in MW3 during the pumping and recovery periods using a datalogger (see **Hydrograph 1**). Based on the analysis of the recovery data, the hydraulic conductivity (K) of Zone 1 as measured in MW3 was 2.2×10^{-6} m/s, with a transmissivity (T) of 3.9×10^{-5} m^2 /day and a storativity of 6.0×10^{-2}.

In order to document the water quality of the Zone 1, water samples were collected from the water discharged from MW3 after approximately 30 min of pumping and analyzed for general water quality parameters. Water quality results are further discussed in **Section 6.0**.

4.3 Upper Gull River Formation (Zone 2)

In order to assess the hydraulic characteristics of the Gull River Formation at the MW4 location, the geophysical logs for MW4 were reviewed (**Figure 4**). Based on a review of the geophysical logs MTE identified the presence of the Upper Green Marker Bed within Zone 2.

As part of this program, and in order to assess the hydraulic properties of the Upper Gull River Formation including the UGMB (Zone 2), on March 16, 2022 inflatable straddle packers were placed in the open MW4 borehole at depths of 21.6 m bgl and 32.9 m bgl with a submersible pump and datalogger installed in between. The straddle packers were designed to effectively isolate Zone 2 by sealing off the underlying Lower Gull River (including the Lower Green Marker Bed), Shadow Lake Formation and Precambrian contact zone from the overlying Bobcaygeon Formation, while allowing Zone 2 to be pumped separately. The placement of the packers are illustrated on **Figure 7** and the temporary well modifications and pumping was completed by Hopper, licensed well technicians.

To assess the productivity of Zone 2, an initial pumping rate of 40 L/min was chosen. After 1-2 minutes of pumping, this pumping rate was not able to be sustained. Through trial and error, a constant pumping rate of 8 L/min was achievable while maintaining the pumping level at a safe level above the pump intake to avoid cavitation and allow for suitable cooling while pumping. The results of these pumping activities are shown on **Hydrograph 2**.

Based on an analysis of the recovery data from the pumping activities, the Hydraulic Conductivity (K) and Transmissivity (T) and Storativity (S) of Zone 2 at the MW4 location was determined to be 6.7×10^{-7} m/s, 6.5×10^{-5} m^2 /day and 6.8×10^{-3} respectively.

In order to document the water quality of the Zone 2, water samples were collected on March 16, 2022 from the water discharged from the pumped isolated zone after approximately 40 min of pumping and analyzed for general water quality parameters. Water quality results are further discussed in **Section 6.0**.

4.4 Lower Gull River Formation / Shadow Lake Formation / Precambrian Contact Zone (Zone 3)

In order to assess the hydraulic characteristics of the Lower Gull River Formation / Shadow Lake Formation / Precambrian Contact zone at the MW4 location, the geophysical logs for MW4 were reviewed (**Figure 4**). Based on a review of the geophysical logs MTE identified the presence of the LGMB within Zone 3.

As part of this program, and in order to assess the hydraulic properties of the Lower Gull River Formation including the LGMB / Shadow Lake Formation / Precambrian Contact zone (Zone 3), on March 14, 2022 an inflatable packer was placed in the open MW4 borehole at a depth of 32.9 m bgl with a submersible pump and datalogger placed below. The packer was designed to effectively isolate Zone 3 by sealing off the overlying Zones 1 & 2, while allowing Zone 3 to be pumped separately. The placement of the packers are illustrated on **Figure 8** and the temporary well modifications and pumping was completed by Hopper licensed well technicians. Once the packer was in place water levels in the overlying open borehole representing Zones 1 & 2 and the isolated Zone 3 were monitored prior to pumping. Based on the manual measurements taken prior to pumping test in Zone 3, the vertical water level separation between Zones 1 & 2 and Zone 3 was in the order of 1 m higher, indicative of a downward vertical hydraulic gradient.

The hydraulic testing plan was to conduct a short term variable rate step test in order to assess the specific capacity and yield of Zone 3, while allowing for an assessment of the optimal rate for a longer term constant rate test. Based on the documented pumping rate on the Water Well Record for MW4 (ie. 300 gpm, see **Appendix E**), this zone was anticipated to have a high production capability.

4.4.1 Variable Rate Step Test

On March 14, 2022, the Zone 3 portion of MW4 was pumped at rates of approximately 190 L/min, 380 L/min and 570 L/min sequentially for periods of 30 minutes, separated by 30 minute periods of recovery.

Based on the results of the pumping, the specific capacity of each pumping rate was 826 L/min/m, 655 L/min/m and 532 L/min/m respectively.

With an additional 34 m of available drawdown after the end of pumping of the third step, along with the high specific capacity values measured, this pumping confirmed that Zone 3 is a highly productive water producing zone at this location. Water levels in the pumped zone were measured on a continual basis using dataloggers and are shown on **Hydrograph 3**.

4.4.2 Constant Rate Pumping Test

Based on the results of the variable rate step test, on March 15, 2022, Zone 3 at MW4 was pumped at a constant rate of 570 L/min for a period of 8 hrs in order to document the results of sustained pumping at a relatively high yield and enable the collection of water samples for chemical analysis. The hydrograph displaying the water levels collected during this test are shown on **Hydrograph 4**.

Based on an analysis of the recovery data from the pumping activities, Hydraulic Conductivity (K), Transmissivity (T) and Storativity (S) of the Lower Gull River / Shadow Lake / Precambrian Contact zone at the MW4 location were determined to be 4.8×10^{-5} m/s, 3.1×10^{-4} m^2 /day and 7.7×10^{-6} respectively.

In order to document the water quality of Zone 3, water samples were collected on March 15, 2022 from the water discharged from the pumped isolated zone after 70 minutes and 450 minutes of pumping and analyzed for general water quality parameters. Water quality results are further discussed below in **Section 5.0**.

5.0 MULTI-LEVEL WELL INSTALLATION

5.1 W22

Per Condition 4.4 of PTTW 238-BBLKNE on November 30, 2021 W22 was completed as a multi-level well by Hopper. W22 was completed as two discreetly screened monitoring wells referred to as W22a and W22b. W22a and W22b were constructed using 0.04 m diameter schedule 40 PVC piping equipped with a 3 m length No. 10 slot well screen. Borehole logs indicating the screened elevations of W22a and W22b can be found in **Appendix H**. W22b was completed within the Gull River Formation between the Upper and Lower Green Marker Beds while W22b was completed across the contact between the Bobcageon and Gull River Formations above the Upper Green Marker Bed.

Following well development both W22a and W22b had a data logger installed to allow for groundwater levels within these wells to be tracked continually on an hourly basis. Manual water level measurements and continuous data logger data can be seen on **Hydrograph 5**. A review of the water level data indicates that water levels in W22b follow a similar trend to other

monitoring wells completed other on-Site monitoring wells. However, groundwater levels in W22a appear to still be recovering since the well was developed in December 2021. The lack of recovery to static conditions within W22a indicates an area of low hydraulic conductivity within the Upper Gull River Formation.

5.2 MW4

Per Condition 4.4 of PTTW 238-BBLKNE on January 18th, 2024, MW4 was completed as a multi-level well by Hopper. MW4 was completed as two discreetly screened monitoring wells referred to as TW4-24 and MW4a. TW4-24 was constructed using 0.14 m diameter steel casing with a 6.1 m long continuous stainless steel wire wrapped 100 slot well screen. MW4a-24 was constructed using 0.03 m schedule 40 PVC piping equipped with a 1.5 m length No. 10 slot well screen. Borehole logs and an As-Constructed drawing indicating the screened elevations of MW4a-23 and TW4-24 can be found in **Appendix H**. Well screen intervals were based on geophysical data and hydraulic testing data collected in 2022.

MW4 was left an open borehole between 34.1 mbgs and 41.5 mbgs, this depth relates to Zone 3. Zone 3 was hydraulically isolated using a combination of shale traps and bentonite pellets up to a depth of 23.7 mbgs where a 0.5 m layer of #2 gravel was placed. Between 23.3 mbgs and the surface MW4 was left as an open borehole which corresponds to the Bobcageon Formation (Zone 1). Photos taken during the installation of TW4-24 and MW4a can be seen in **Appendix I**.

Following the installation of TW4a-24 On January 18, 2024 a well yield test was completed on January 19, 2024. The well yield test was also used to verify the water quantity, quality and that TW4-24 (Zone 3) had been hydraulically isolated from MW4a-24 (Zone 1). The well yield test took place over approximately 66 minutes. TW4-24 was pumped at 113 L/min for approximately 20 minutes before increasing to 416 L/min for the remainder of the test. A water quality sample from the discharge water was collected to compare to previous obtained water quality results. Water levels from TW4-24, MW4a-24 and MW3 during the well yield test can be seen on **Hydograph 6**. As can be observed on **Hydrograph 6** groundwater levels in both MW4a-24 and nearby MW3 were not impacted as a result of pumping from TW4-24 thereby verifying that TW4-24 had successfully been hydraulically isolated from those wells completed in Zone 1.

6.0 WATER CHEMISTRY ASSESSMENT

6.1 Results – ODWS Compliance

The following section presents the results of groundwater sampling and analysis collected from the underlying bedrock zones as defined in **Section 4**. The water quality results are compared to each other and the Ontario Drinking Water Standards. A summary of the water quality results from the different zones has been presented in **Table 2**.

6.1.1 Bobcaygeon Formation (Zone 1)

The groundwater sample collected from Zone 1 was within the chemical standards for the ODWS. MTE noted an aesthetic exceedance for iron in the sample obtained from Zone 1, however iron is not considered a health concern.

6.1.2 Upper Gull River Formation (Zone 2)

The groundwater sample collected from Zone 2 was within the chemical standards for the ODWS with the exception of a minor exceedance for lead (0.014 mg/L vs. 0.01 mg/L). MTE also noted an aesthetic exceedance for iron and manganese in the sample obtained from Zone 2, however both iron and manganese are not considered a health concern.

6.1.3 Lower Gull River / Shadow Lake / Precambrian Contact Zone (Zone 3)

The groundwater samples collected from Zone 3 during the 2022 Hydraulic Testing and during the well yield test in 2024 were within the chemical and health standards for the ODWS. MTE notes the water quality results of the 2024 groundwater samples were comparable to the 2022 samples.

Exceedances of aesthetic guidelines for colour, hardness, and turbidity were noted in samples collected from bedrock Zones 1, 2 & 3, however aesthetic guidelines and are not health related.

Additionally, no hydrocarbons were detected in samples collected from Zone 1, 2 or 3.

6.2 Geochemical analysis

This section compares the results of the geochemical analysis of the groundwater samples to determine similarities/differences between the geochemical signatures of the three bedrock zones that were pumped.

Geochemical analysis of the groundwater samples from each of the respective bedrock zones (i.e. Zone 1, Zone 2 and Zone 3) was undertaken to determine similarities between the geochemical signature of the different bedrock zones. For visualization purposes the geochemical results of the major ionic species (Na^+, K^+, Ca^{2+}, Mg^{2+}, Cl^-, CO_3^{2-} + HCO_3^-, and SO_4^{2-}) have been plotted on a trilinear diagram (Piper, 1944) as percent composition of each cation or anion (**Figure 9**). For the purposes of this report CO_3^{2-} + HCO_3^- has been plotted as measured alkalinity. As shown on **Figure 9** groundwater samples from each of the three respective zones plot in a very similar location on the trilinear plot, which indicates comparable water quality between bedrock zones.

7.0 DISCUSSION

7.1 2022 Hydraulic Testing Compared to Historical Data

In addition to the results of the hydraulic testing presented herein, MTE also reviewed hydraulic conductivities (K) from previous reports for the Ferma-Carden Quarry, as well as other quarries within the Carden Plain. The following sections compare the K-values presented herein to the those calculated from historical on-Site testing, as well as from the Golder, 2012 report, with the purpose of corroborating the reported hydraulic conductivities for Zone 1, 2 and 3 presented above.

7.1.1 Bobcaygeon Formation (Zone 1)

In a report prepared by MTE under separate cover titled “Ferma Aggregates Inc. – Carden Quarry Zone of Influence Assessment Category 3 PTTW Application Lot 6-10, Concession 9, Carden Township, City of Kawartha Lakes, ON”, dated January 5, 2018, MTE estimated the hydraulic properties of the Bobcaygeon Formation, in which the Ferma-Carden Quarry is being extracted. Based on a review of this report, the Hydraulic Conductivity (K) and Transmissivity (T) of the Bobcaygeon Formation at the active quarry location were reported as 3.0×10^{-5} m/s and 39 m^2 /day respectively.

The Golder Associates 2012 Report summarized hydraulic conductivity data from 12 quarries within the Carden Plain, reporting the geometric mean hydraulic conductivity of the Bobcaygeon Formation was 5.3×10^{-8} m/s.

Further, on-Site testing conducting previously (1995) indicates the hydraulic conductivity within the Middle Bobcaygeon generally ranged from 10^{-5} m/s to 10^{-7} m/s with one notable outlier of 10^{-9} m/s (Oliver, Mangione, McCalla & Associates Ltd., 1995).

The Table below summarizes the hydraulic conductivity values of the Bobcaygeon Formation based on on-Site testing and the 2012 Golder Report.

Source	Hydraulic Conductivity
Ferma-Carden Quarry (Oliver, Mangione, McCalla & Associates Ltd., 1995)	10^{-5} m/s to 10^{-7} m/s
Quarries analyzed as part of the 2012 Golder Report	5.3×10^{-8} m/s
Ferma-Carden Quarry (MTE Consultants Inc., 2018)	3.0×10^{-5} m/s
Ferma-Carden Quarry Pumping Test, MTE Consultants Inc., 2022	2.2×10^{-6} m/s

It is MTE's opinion that the hydraulic conductivity values calculated based on MTE's work in 2018 and the 2022 data from the pumping test on MW3 are the most reliable / representative of the K of the Bobcaygeon Formation in this area of the Carden Plain, as it is based on Site specific testing and in general agreement with previously published on-Site data. Golder's estimate of the K in the Bobcaygeon Formation appears to be several orders of magnitude lower than reported above, which is indicative of the spatial variability of K within this Formation. Based on the above, MTE classifies Zone 1 as a relatively low producing aquifer zone.

7.1.2 Gull River Formation (Zone 2)

The Golder Associates 2012 Report indicated the geometric mean hydraulic conductivity of the Upper Gull River Formation (including the UGMB) was 1.6×10^{-6} m/s.

On-Site testing conducting previously (1995) indicates the hydraulic conductivity within the Lower Bobcaygeon/Upper Gull River (including the UGMB) ranged from 4.0×10^{-6} m/s to 1.0×10^{-8} m/s (Oliver, Mangione, McCalla & Associates Ltd., 1995).

The Table below summarizes the hydraulic conductivity values of the Upper Gull River Formation (including the UGMB) based on on-Site testing and the 2012 Golder Report.

Source	Hydraulic Conductivity
Ferma-Carden Quarry (Oliver, Mangione, McCalla & Associates Ltd., 1995)	4.0×10^{-6} m/s to 1.0×10^{-8} m/s
Quarries analyzed as part of the 2012 Golder Report	1.6×10^{-6} m/s
Ferma-Carden Quarry Pumping Test, MTE Consultants Inc., 2022	6.7×10^{-7} m/s

MTE notes that the 2012 Golder Report identifies and models the Upper Gull River Formation as an aquitard. This interpretation agrees with MTE's testing and is further supported by the lack of water level recovery to static conditions noted in W22a (**Hydrograph 5**).

The 1995 Hydrotechnical Report by Oliver, Mangione, McCalla & Associates Ltd. indicates beneath the Bobcaygeon Formation is an approximatly 10 m thick lower permeable section which MTE is interpretting to be the Upper Gull River Formation. The hydraulic conductivity value calculated based on the data from the pumping test at MW4 on Zone 2 is in agreement with previously presented data, as such Zone 2 (including the UGMB) is considered an aquitard.

7.1.3 Lower Gull River Formation / Shadow Lake Formation / Precambrian Contact Zone (Zone 3)

The Golder Associates 2012 Report indicated the geometric mean hydraulic conductivity of the "Green Bed" within the Gull River Formation, the Lower Gull River Formation (including the LGMB) and the Shadow Lake Formation ranged from 1.1 x 10^{-6} m/s to 2.8 x 10^{-7} m/s. However, MTE notes that the "Green Bed" within the Gull River Formation was reported to have a maximum hydraulic conductivity of 2.8 x 10^{-4} m/s (Golder Associates, 2012). Additionally, a hydraulic conductivity of the Shadow Lake Formation / Precambrian contact is not provided specifically, while a range of 9.2 x 10^{-7} m/s to 9.0 x 10^{-11} m/s is provided. On-Site testing conducted previously (1995) indicates the hydraulic conductivity within the Gull River/Shadow Lake ranged from 7.0 x 10^{-5} m/s to 1.0 x 10^{-8} m/s (Oliver, Mangione, McCalla & Associates Ltd., 1995).

The table below summarizes the hydraulic conductivity values of the area pertaining to Lower Gull River Formation (including the LGMB) down to the Precambrian based on on-Site testing and the 2012 Golder Report.

Source	Hydraulic Conductivity
Ferma-Carden Quarry (Oliver, Mangione, McCalla & Associates Ltd., 1995)	7.0 x 10^{-5} m/s to 1.0 x 10^{-8} m/s
Quarries analyzed as part of the 2012 Golder Report	1.1 x 10^{-6} m/s to 2.8 x 10^{-7} m/s
Ferma-Carden Quarry Pumping Test, MTE Consultants Inc., 2022	4.8 x 10^{-5} m/s

MTE notes that the 2012 Golder Report identifies and models both the "Green Bed" (within the Gull River Formation) and the Shadow Lake Formation /Precambrian contact as an aquifer. Additionally, the 1995 Hydrotechnical Report by Oliver, Mangione, McCalla & Associates Ltd. also identifies the Lower Gull River Formation to the Precambrian basement as an aquifer. As such, the hydraulic conductivity value calculated by MTE based on the data from the 2022 pumping test at MW4 on Zone 3 is in agreement with previously presented data and therefore Zone 3 is considered a relatively highly producing aquifer.

7.2 Water Source Potential Assessment

7.2.1 Water Quantity

The Bobcaygeon Formation (Zone 1) is the primary aquifer in the vicinity of the Site in which domestic wells obtain their water and the Ferma-Carden Quarry extracts high grade carbonate aggregate materials. Previous reports completed on-Site have indicated that as the quarry expands and the extraction area approaches its limits that nearby domestic wells may be impacted. As such, in addition to assessing the hydraulic properties of the underlying bedrock zones MTE also assessed the potential water supply capabilities of the various bedrock zones beneath the Site.

As discussed above, hydraulic testing indicates that the hydraulic conductivity of Zone 2 (which contains the Upper Green Marker Bed) was 6.7 x 10^{-7} m/s, additionally Zone 2 was found to have limited sustainable yield (8 L/min). As such, Zone 2 is not viewed as a viable alternative water source, should nearby residential domestic wells be impacted by quarry extraction.

Anecdotal evidence from the water well record prepared at the time of construction of MW4 (**Appendix E**) indicated that a high producing fracture was encountered in the Lower Gull River Formation. Results from the Zone 3 pumping test that took place in 2022 and the well yield test

on TW4-24 which took place in 2024 confirmed the viability of this zone as a potential future water source. As a result, this aquifer zone (Zone 3) can be considered as a viable alternative aquifer in which to supply water to domestic wells that may experience well interference issues related to the dewatering of the Ferma-Carden Quarry.

7.2.2 Water Quality

As shown on **Figure 9** groundwater samples from each of the three respective bedrock zones plot in a very similar location on the trilinear plot. These results are interpreted to indicate a downward movement of groundwater from Zone 1 to Zone 2 and finally Zone 3 whereby water quality is similar. As such, in the event a nearby resident's domestic well requires replacement due to quarry dewatering, the water quality of a well installed within Zone 3 will have comparable water quality to domestic wells currently completed in Zone 1.

8.0 ROLE OF THE GREEN MARKER BEDS

8.1 Upper Green Marker Bed

Pumping test data from Zone 2 (which contains the UGMB) indicated that this zone had limited water supply potential (8 L/min). These results were found to agree with previous conclusions from 2012 Golder Report categorizing the Upper Gull River Formation as an aquitard. As such, it is MTE's opinion that the UGMB is not considered to be a highly transmissive zone on-Site and would provide low quantities of water, should it be extracted.

Although the water quality within Zone 2 was found to be comparable to Zone 1 (Bobcageon Formation) the limited transmissivity within this zone does not make it a good candidate as an alternative water source.

8.2 Lower Green Marker Bed

Based on hydraulic testing undertaken in 2022 and well yield testing in 2024, Zone 3 is considered to be an alternative water supply with comparable water quality to the Bobcageon Formation. With the LGMB contained within this aquifer zone, this zone would provide significant quantities of water, should quarrying activities be expanded into it.

Maximum Depth of Extraction

As indicated in **Section 1.2** the current maximum extraction depth of Phase 1 is 255 masl. This limit was established in an effort to mitigate potential negative impacts to nearby domestic wells as a result of quarry dewatering. However based on on-Site testing in the event nearby water supply wells are impacted as a result of dewatering, a new supply well could be drilled into Zone 3 to supply the affected resident. As such, in order to protect the potential future water source of Zone 3, MTE recommends the future quarry floor maintain a separation of 10 m above the Lower Green Marker Bed, as shown on **Figure 5 & 6**. Domestic wells completed within Zone 3 or below are not anticipated to be negatively impacted as the depth of the quarry will remain 10 m above the LGMB.

Based on MTE's interpretation of the data presented herein, which combined on-Site current and historical testing as well as a review of hydraulic data from 12 different quarries within the Carden Plain, it is MTE's opinion that extraction should be allowed to occur down to a depth of 10 m above the LGMB while still maintaining the integrity of the underlying water source (Zone 3).

9.0 CONCLUSIONS

Based on the work conducted for the Scope of Work as outlined in Section 1.0, MTE offers the following conclusions:

- The hydraulic conductivity (K) of Zone 1 as measured in MW3 was 2.2 x 10^{-6} m/s, with a transmissivity (T) of 3.9 x 10^{-5} m^2 /day and a storativity of 6.0 x 10^{-2}.Zone 1 is interpreted to be a low producing aquifer.
- The hydraulic conductivity (K) and Transmissivity (T) and Storativity (S) of Zone 2 (including the UGMB) at the MW4 location was determined to be 6.7 x 10^{-7} m/s, 6.5 x 10^{-5} m^2 /day and 6.8 x 10^{-3} respectively. Zone 2 is interpreted to be an aquitard zone.
- The hydraulic conductivity (K), Transmissivity (T) and Storativity (S) of Zone 3, including the Lower Gull River Formation (including the UGMB) / Shadow Lake Formation / Precambrian Contact zone at the MW4 location was determined to be 4.8 x 10^{-5} m/s, 3.1 x 10^{-4} m^2 /day and 7.7 x 10^{-6}, respectively. Zone 3 is interpreted to be a relatively high producing aquifer.
- The hydraulic characteristics of the three bedrock zones are in agreement with previous hydraulic testing that was undertaken on-Site.
- Most nearby domestic wells are completed in the Bobcaygeon (Zone 1).
- Those domestic wells completed within the Lower Gull River Formation, Shadow Lake Formation or underlying Precambrian are not anticipated to be negatively impacted as the depth of the quarry will be 10 m above the LGMB.
- Based on hydraulic testing Zone 3 was found to be a water bearing aquifer zone that can produce sufficient quantities of good quality water for household domestic requirements.
- Zone 3 was found to have comparable water quality to that of Zone 1.
- Zone 3 can be used as a future water source to mitigate the impacts of quarry dewatering.
- To maintain the integrity of Zone 3, MTE's opinion is that the quarry floor can be lowered down to a maximum depth of 10 m above the LGMB.

10.0 RECOMMENDATIONS

Based on the results of the hydraulic and water quality testing described herein, MTE offers the following recommendations:

- Ferma Aggregates Inc. apply for a Site Plan Amendment to increase the depth of extraction to 10 m above the LGMB;
- Prior to expansion into additional phases, Ferma Aggregates conducts sufficient geological and hydraulic testing and analysis to confirm the depth elevation of the LGMB at each phase; and
- On-going monitoring continue as per PTTW 238-BBLKNE.

11.0 LIMITATIONS

Services provided by **MTE Consultants Inc**. (MTE) were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the Geological 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 their client. It was completed in accordance with the scope of work identified in the introduction of the text. 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. All findings and conclusions presented in this report are based on Site conditions, as they existed during the time period of the investigation.

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.

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.

We trust this meets your current requirements. If you have any questions or comments, please do not hesitate to contact the undersigned directly at (519) 743-6500.

All of which is respectfully submitted,

MTE Consultants Inc.

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M:\36123\200\Reports\Hydrogeological Assessment Report\36123-200_2024-06-03_rpt_Hydro_G_Assessment.docx

12.0 REFERENCES

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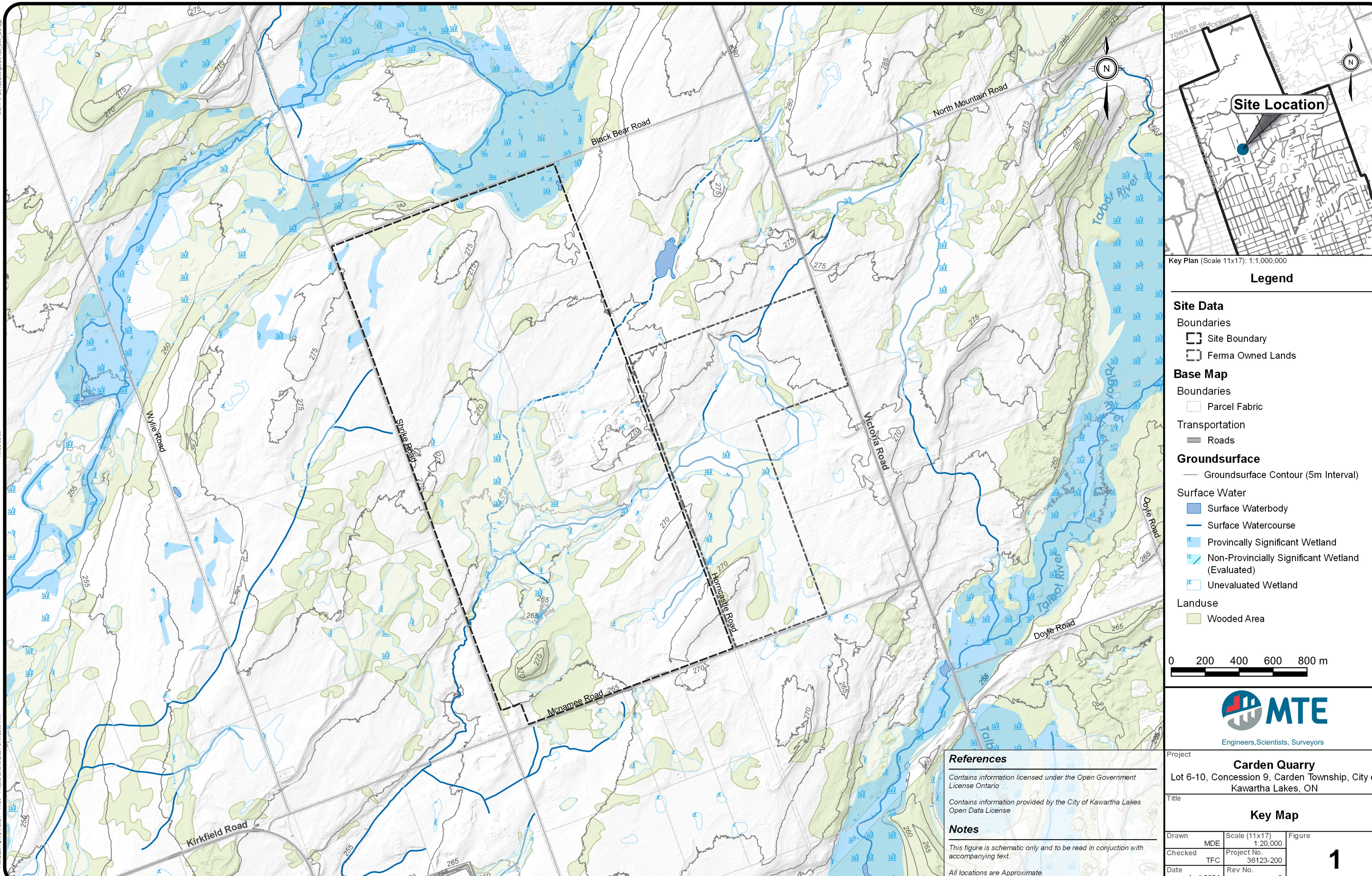
Oliver, Mangione, McCalla & Associates Ltd. (1995). *Hydrotechnical Report Ferma - Carden Quarry.* Orillia.

Trow Consulting Engineers Ltd. (2002). *Hydrotechnical Report Update Ferma Aggregates Inc. Carden Quarry.* Barrie.

Figures



Key Plan (Scale 11x17): 1:1,000,000

Legend

Site Data

Boundaries

- Site Boundary
- Ferma Owned Lands

Base Map

Boundaries

- Parcel Fabric

Transportation

- Roads

Groundsurface

- Groundsurface Contour (5m Interval)

Surface Water

- Surface Waterbody
- Surface Watercourse
- Provincally Significant Wetland
- Non-Provincially Significant Wetland (Evaluated)
- Unevaluated Wetland

Landuse

- Wooded Area

0 200 400 600 800 m

References

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Notes

This figure is schematic only and to be read in conjuction with accompanying text.

All locations are Approximate

MTE

Engineers,Scientists, Surveyors

Project

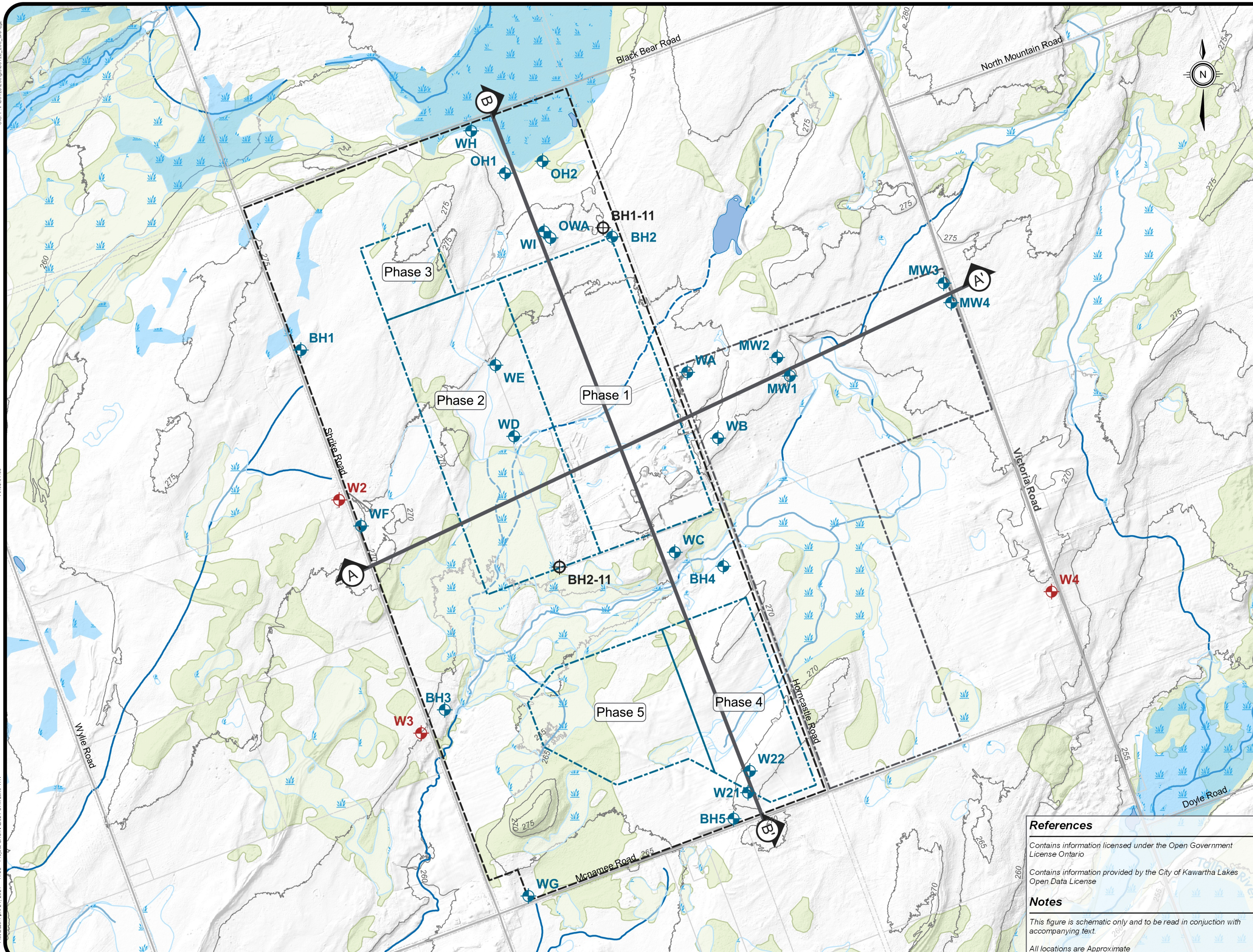
Carden Quarry

Lot 6-10, Concession 9, Carden Township, City of Kawartha Lakes, ON

Title

Key Map

Drawn	Scale (11x17)	Figure
MDE	1:20,000	1
Checked	Project No.	
TFC	36123-200	
Date	Rev No.	
April 2024	0	



Legend

Site Data

Boundaries
- Site Boundary
- Phase Boundaries
- Ferma Owned Lands
- Geological Cross Section Location

Monitoring Locations
- Monitoring Well
- Private Well
- Borehole

Base Map

Boundaries
- Parcel Fabric

Transportation
- Street

Surface Water
- Surface Waterbody
- Surface Watercourse
- Provincially Significant Wetland
- Non-Provincially Significant Wetland (Evaluated)
- Unevaluated Wetland

Groundsurface
- Groundsurface Contour (5m Interval)

Landuse
- Wooded Area

0 100 200 300 400 m

MTE

Engineers,Scientists, Surveyors

References

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Notes

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All locations are Approximate

Project: **Carden Quarry**
Lot 6-10, Concession 9, Carden Township, City of Kawartha Lakes, ON

Title: **Site Map**

Drawn	Scale (11x17)	Figure
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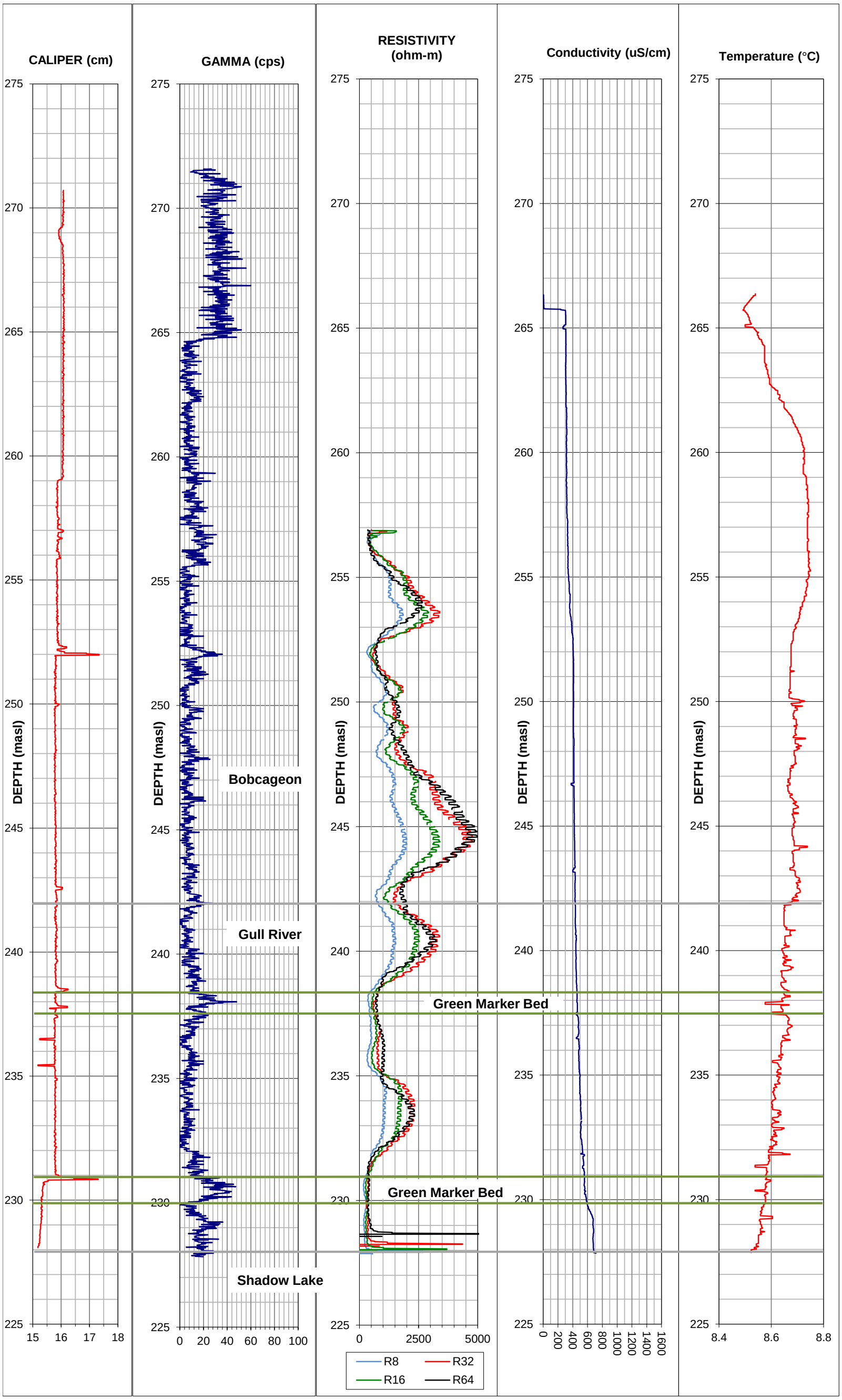
Checked TFC	Project No. 36123-200	
Date April 2024	Rev No. 0	

Figure 3: Borehole Geophysical Log of W22

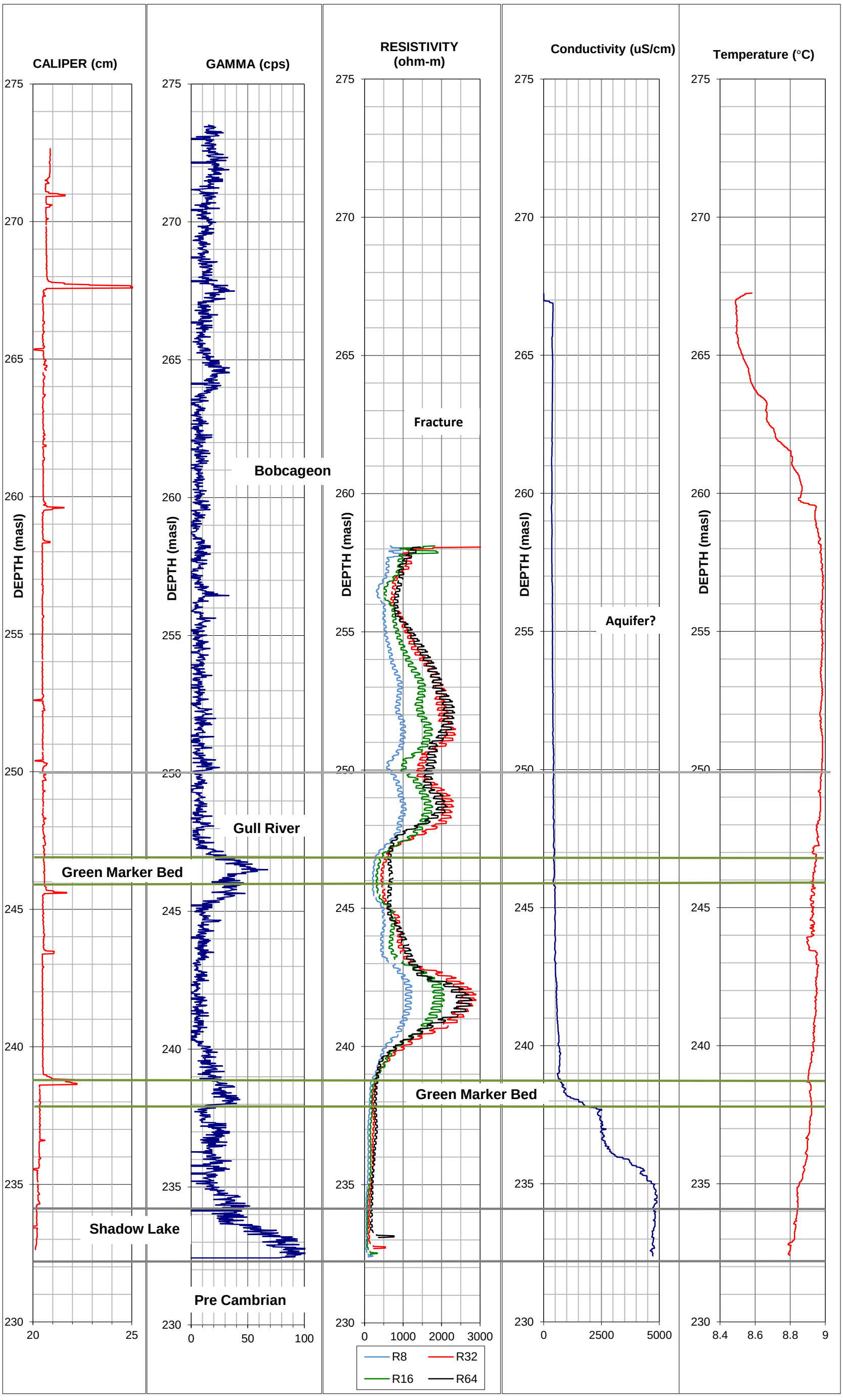


Notes:

Reference Point: TOC

Date Logged: 2018/06/28

Figure 4: Borehole Geophysical Log of MW4



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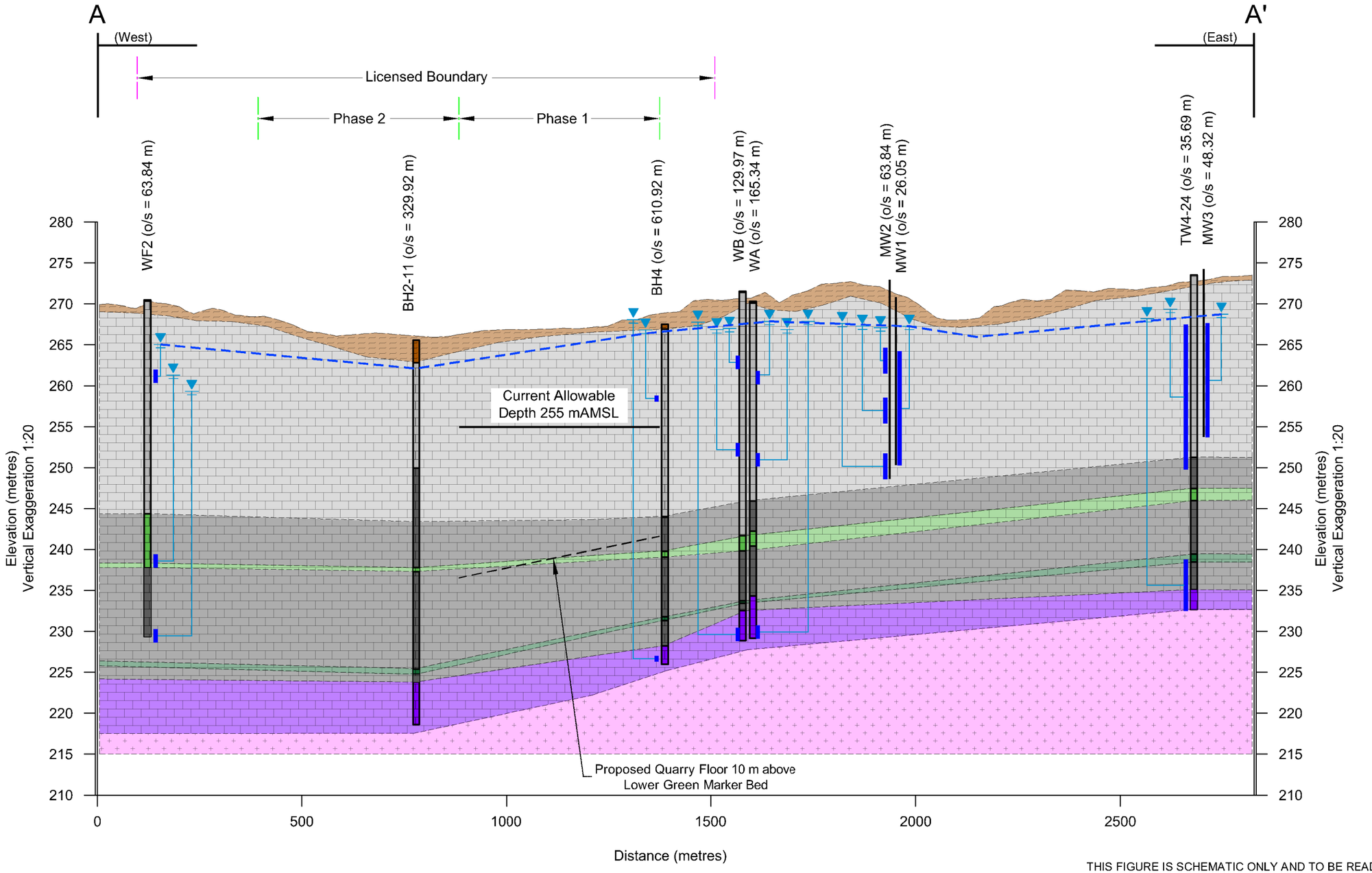
Date Logged: 2018/06/29



LEGEND

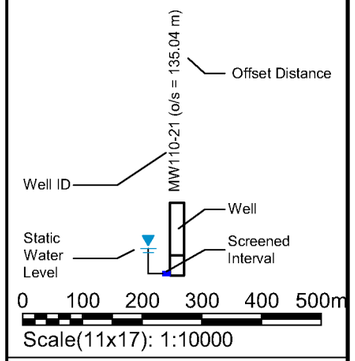
Interpreted Water Table

HYDROSTRATIGRAPHIC LEGEND

- Overburden
- Bobcaygeon Formation
- Gull River Formation
- Upper Green Marker Bed
- Lower Green Marker Bed
- Shadow Lake Formation
- Precambrian

BOREHOLE LEGEND

- Overburden
- Bobcaygeon Formation
- Gull River Formation
- Upper Green Marker Bed
- Lower Green Marker Bed
- Shadow Lake Formation
- Precambrian



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WIDTH OF BOREHOLES FOR ILLUSTRATION PURPOSES ONLY AND DO NOT CORRESPOND TO ACTUAL SPATIAL EXTENT.

THE SIMPLIFIED LITHOLOGY PRESENTED HEREIN IS BASED O PROFESSIONAL INTERPRETATION FROM ROCK CORE LOGS AND MECP WELL RECORDS. ACTUAL LITHOLOGY CONDITIONS MAY VARY BETWEEN AND BEYOND LOCATIONS.

ALL LOCATIONS ARE APPROXIMATE.

MTE
Engineers, Scientists, Surveyors
Ph. (905) 639-2552

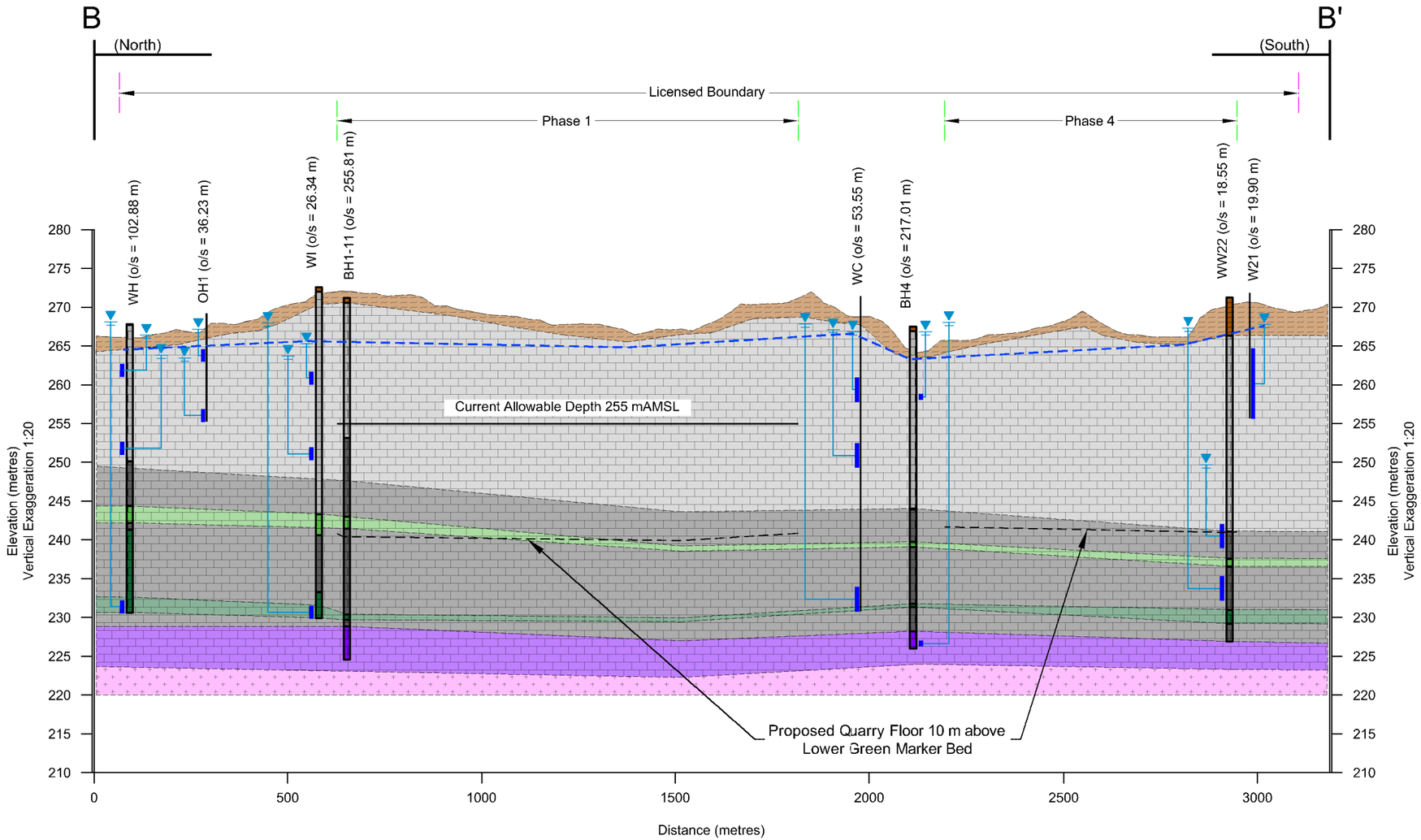
CLIENT: Ferma Aggregates Inc.

PROJECT: Firma-Carden Quarry

SITE: Lot 6-10, Concession 9, Geographic Township of Carden

TITLE: Geological Cross-Section A-A'

Reviewed By	PAG		
Prepared By	TFC	Project No.	36123-200
Drawn By	SGL	Figure No.	5
Date	April 2024		



LEGEND

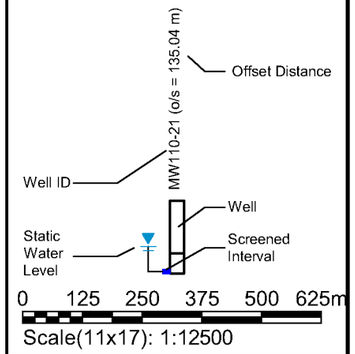
Interpreted Water Table

HYDROSTRATIGRAPHIC LEGEND

- Overburden
- Bobcaygeon Formation
- Gull River Formation
- Upper Green Marker Bed
- Lower Green Marker Bed
- Shadow Lake Formation
- Precambrian

BOREHOLE LEGEND

- Overburden
- Bobcaygeon Formation
- Gull River Formation
- Upper Green Marker Bed
- Lower Green Marker Bed
- Shadow Lake Formation
- Precambrian



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ALL LOCATIONS ARE APPROXIMATE.

MTE
Engineers, Scientists, Surveyors
Ph. (905) 639-2552

CLIENT
Ferma Aggregates Inc.

PROJECT
Firma-Carden Quarry

SITE
Lot 6-10, Concession 9,
Geographic Township of Carden

TITLE
Geological Cross-Section B-B'

Reviewed By	PAG		
Prepared By	TFC	Project No.	36123-200
Drawn By	SGL	Figure No.	6
Date	April 2024		

Figure 7 – Packer Location - Hydraulic Testing - Zone 2

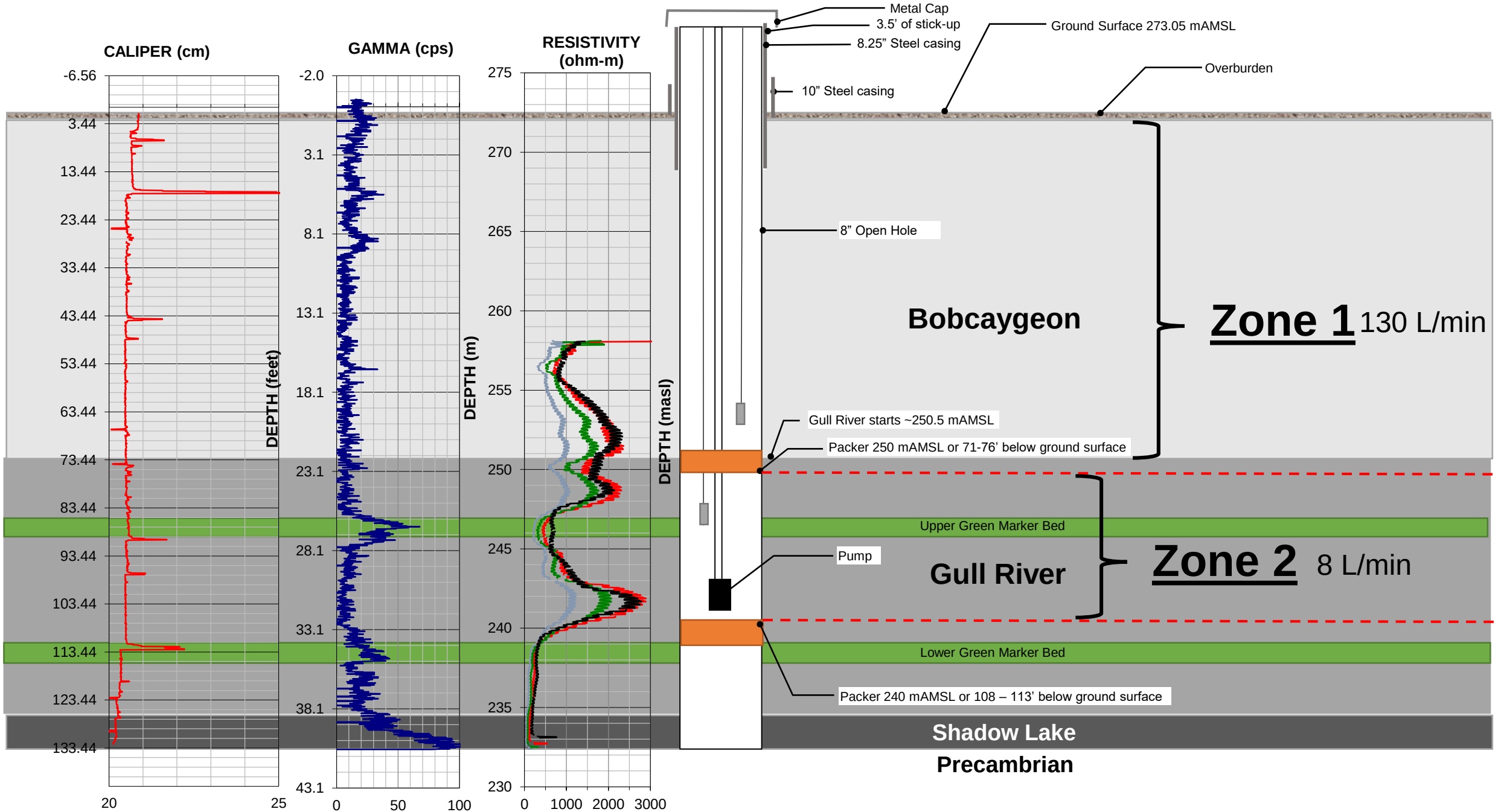
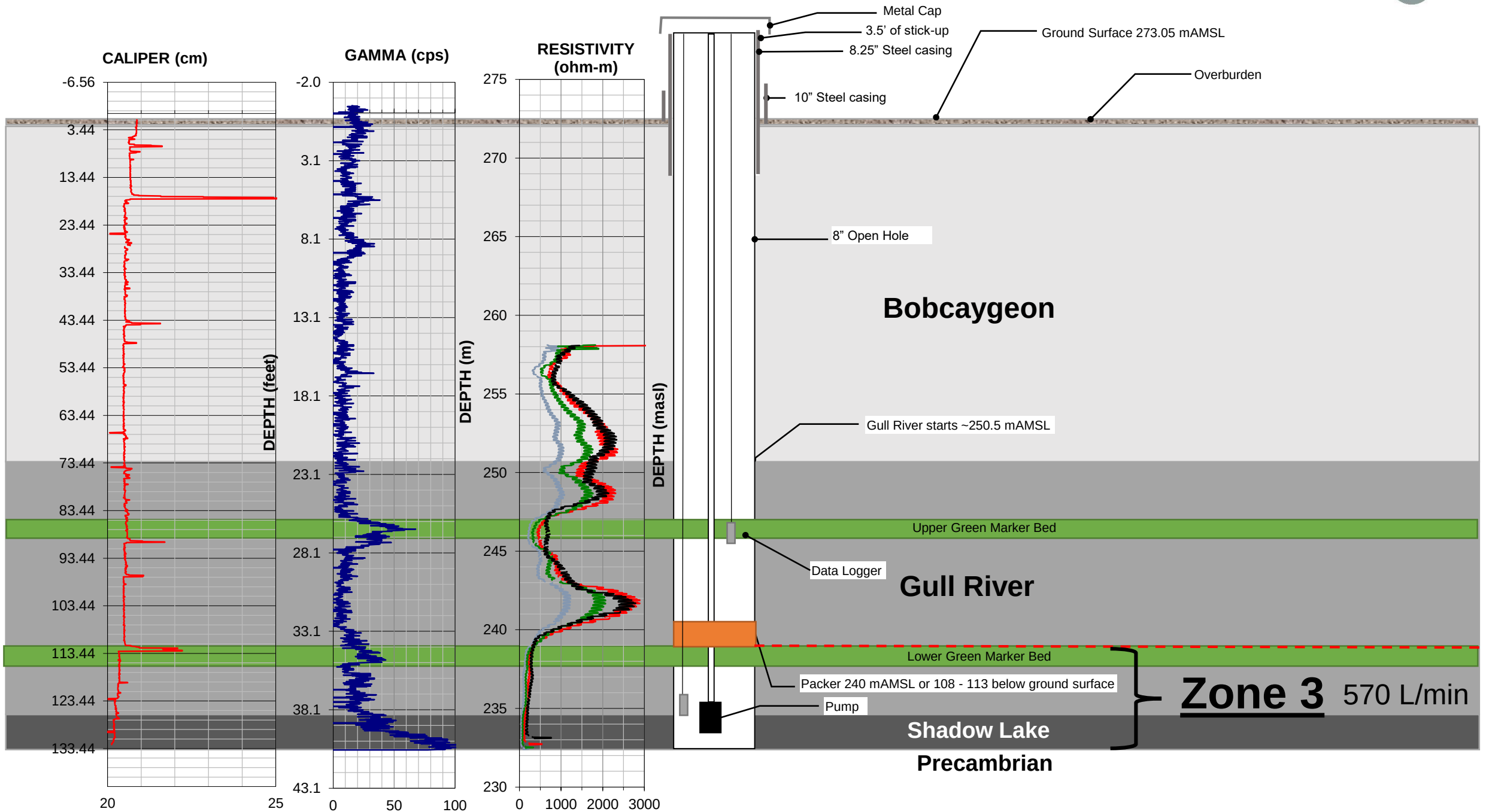
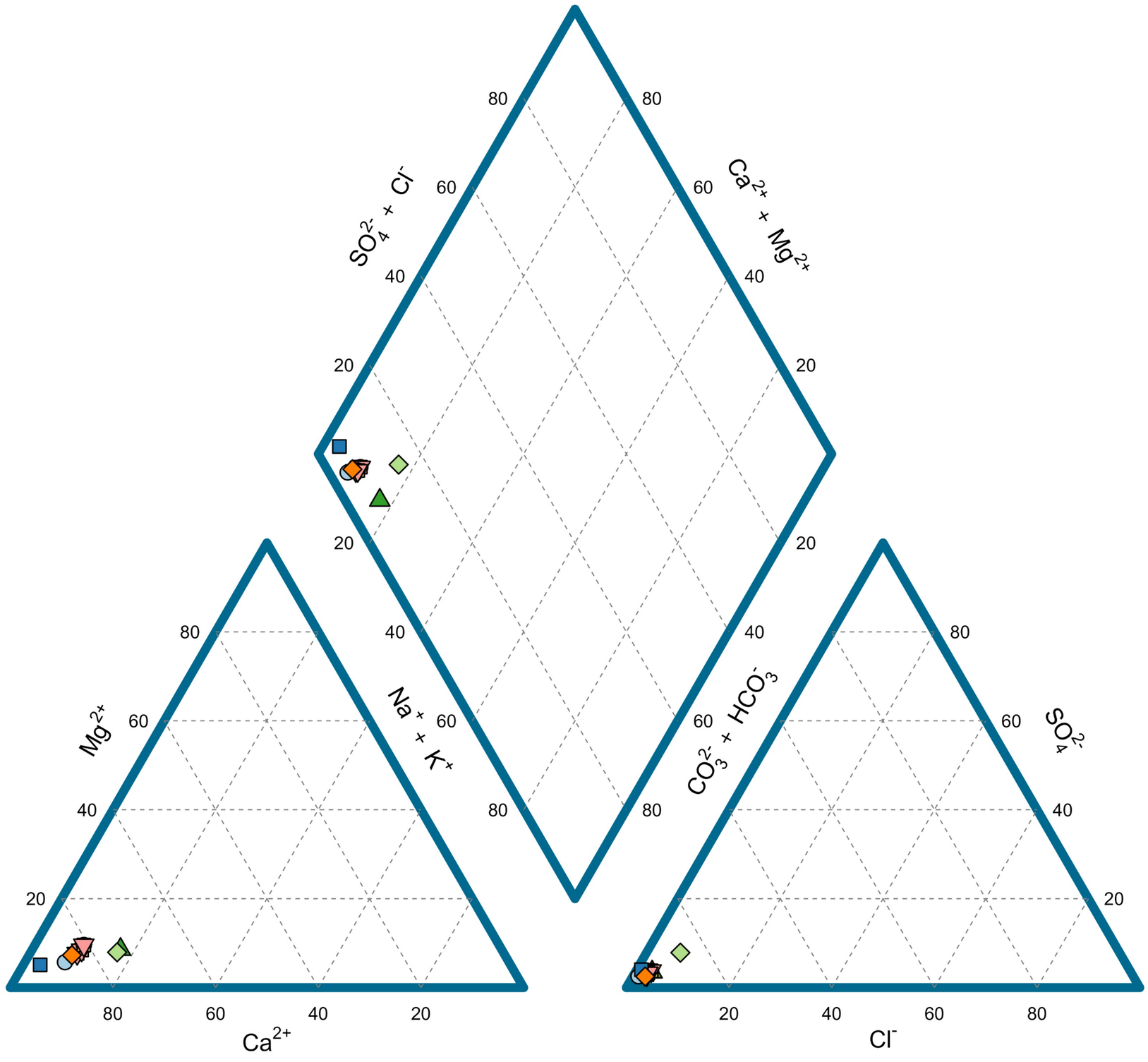


Figure 8 – Packer Location - Hydraulic Testing - Zone 3





Legend

- W2 - 2017-10-24 9:55
- W3 - 2017-10-14 9:55
- W4 - 2018-07-25 9:50
- Zone 1 - 2022-03-17 11:40
- Zone 2 - 2022-03-16 16:00
- Zone 3 - 2022-03-15 10:40
- Zone 3 - 2022-03-15 17:00
- Zone 3 - 2024-01-19 12:30

MTE
Engineers,Scientists, Surveyors

Project
Carden Quarry
Lot 6-10, Concession 9, Carden Township, City of Kawartha Lakes, ON

Title
Water Quality Assessment - Piper Plot

Drawn MDE	Scale (11x17)	Figure **9**
Checked TFC	Project No. 36123-200	
Date April 2024	Rev No. 0	

Tables

Table 2: Groundwater Quality Summary

Parameter	Units	Reporting Detection Limit	ODWS	MW4 Zone 3 Start 3/15/2022	MW4 Zone 3 End 3/15/2022	MW4 Zone 2 3/16/2022	MW3 3/17/2022	MW4 Zone 3 1/19/2024
Alkalinity	mg/L	1	30/500	234	237	228	249	252
Ammonia	mg/L	0.01	-	0.091	0.098	0.089	0.238	0.0916
Chloride	mg/L	0.5	250	6.29	7.47	6.15	8.75	6.42
Fluoride	mg/L	0.02	1.5	0.102	0.119	0.111	0.187	0.1
Nitrate	mg/L	0.02	10	<0.02	<0.02	<0.02	<0.02	<0.02
Nitrite	mg/L	0.01	1	<0.01	<0.01	<0.01	<0.01	<0.01
Orthophosphate	mg/L	0.003/0.001	-	<0.003	<0.003	<0.003	<0.003	<0.001
Sulfate	mg/L	0.3	500	7.18	9.59	7.95	9.35	6.63
Benzene	ug/L	0.5	1	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	ug/L	0.5	140/2.4	<0.5	<0.5	<0.5	<0.5	<0.5
Toluene	ug/L	0.5	60/24	0.67	<0.5	11.3	2.18	<0.5
Total Xylenes	ug/L	0.5	90/300	<0.5	<0.5	<0.5	<0.5	<0.5
o-Xylene	ug/L	0.3	-	<0.3	<0.3	<0.3	<0.3	<0.3
p+m-Xylene	ug/L	0.4	-	<0.4	<0.4	<0.4	<0.4	<0.4
Aluminum-Total	mg/L	0.005/0.05	0.1	<0.005	<0.005	3.76	0.0325	0.0057
Antimony-Total	mg/L	0.0001/0.001	0.006	<0.0001	<0.0001	<0.001	<0.0001	<0.0001
Arsenic-Total	mg/L	0.0001/0.001	0.01	<0.0001	0.00017	0.0033	0.00013	<0.0001
Barium-Total	mg/L	0.0001/0.001	1	0.016	0.0148	0.0243	0.0112	0.0184
Beryllium-Total	mg/L	2E-05/0.001	-	<0.0001	<0.0001	<0.001	<0.0001	<2E-05
Bismuth-Total	mg/L	5E-05/0.0005	-	<5E-05	<5E-05	<0.0005	<5E-05	<5E-05
Boron-Total	mg/L	0.01/0.1	5	0.091	0.102	<0.1	0.208	0.102
Cadmium-Total	mg/L	5E-06/5E-05	0.005	<5E-06	<5E-06	<5E-05	<5E-06	<5E-06
Calcium-Total	mg/L	0.05/0.5	-	79.1	79.7	85.2	76	81.9
Cesium-Total	mg/L	1E-05/0.0001	-	<1E-05	<1E-05	0.00054	3.80E-05	<1E-05
Chromium-Total	mg/L	0.0005/0.005	0.05	<0.0005	<0.0005	0.007	<0.0005	<0.0005
Cobalt-Total	mg/L	0.0001/0.001	-	<0.0001	<0.0001	0.0031	<0.0001	<0.0001
Copper-Total	mg/L	0.0005/0.005	1	<0.0005	<0.0005	0.0971	<0.0005	<0.0005
Iron-Total	mg/L	0.01/0.1	0.3	0.208	0.283	**4.05**	**0.512**	0.137
Lead-Total	mg/L	5E-05/0.0005	0.01	<5E-05	<5E-05	**0.0143**	9.30E-05	<5E-05
Lithium-Total	mg/L	0.001/0.01	-	0.0061	0.0064	<0.01	0.0166	0.007
Magnesium-Total	mg/L	0.005/0.05	-	7.33	8.24	10.1	8.79	7.08
Manganese-Total	mg/L	0.0005/0.005	0.05	0.0425	0.043	**0.13**	0.0426	0.0432
Molybdenum-Total	mg/L	5E-05/0.0005	-	0.000168	0.000311	<0.0005	0.000102	0.000078
Nickel-Total	mg/L	0.0005/0.005	-	<0.0005	<0.0005	0.009	<0.0005	<0.0005
Phosphorus-Total	mg/L	0.05/0.5	-	<0.05	<0.05	<0.5	<0.05	<0.05
Potassium-Total	mg/L	0.05/0.5	-	1.21	1.38	2.04	2.2	1.15
Rubidium-Total	mg/L	0.0002/0.002	-	0.00124	0.00151	0.0057	0.00203	0.00127
Selenium-Total	mg/L	5E-05/0.0005	0.05	<5E-05	<5E-05	<0.0005	<5E-05	<5E-05
Silicon-Total	mg/L	0.1/1	-	1.9	2.13	6.6	1.75	1.71
Silver-Total	mg/L	1E-05/0.0005	-	<5E-05	<5E-05	<0.0005	<5E-05	<1E-05
Sodium-Total	mg/L	0.05/0.5	20/200	7.53	8.04	8.01	15.4	6.98
Strontium-Total	mg/L	0.001/0.01	-	0.524	0.709	0.501	0.675	0.395
Sulfur-Total	mg/L	0.5/5	-	2.58	3.39	<5	3.03	2.84
Tellurium-Total	mg/L	0.0002/0.002	-	<0.0002	<0.0002	<0.002	<0.0002	<0.0002
Thallium-Total	mg/L	1E-05/0.0001	-	<1E-05	<1E-05	<0.0001	<1E-05	<1E-05
Thorium-Total	mg/L	0.0001/0.001	-	<0.0001	<0.0001	<0.001	<0.0001	<0.0001
Tin-Total	mg/L	0.0001/0.001	-	<0.0001	<0.0001	<0.001	<0.0001	<0.0001
Titanium-Total	mg/L	0.0009/0.0003/0.003	-	<0.0003	<0.0003	0.0521	<0.0009	<0.0003
Tungsten-Total	mg/L	0.0001/0.001	-	<0.0001	<0.0001	<0.001	<0.0001	<0.0001
Uranium-Total	mg/L	1E-05/0.0001	0.02	4.10E-05	4.60E-05	0.0006	5.40E-05	4.10E-05
Vanadium-Total	mg/L	0.0005/0.005	-	<0.0005	<0.0005	<0.005	<0.0005	<0.0005
Zinc-Total	mg/L	0.003/0.03	5	0.0067	0.0087	0.354	0.0276	0.0041
Zirconium-Total	mg/L	0.0002/0.002	-	<0.0002	<0.0002	<0.002	<0.0002	<0.0002
F1 (C6-C10)	ug/L	25	-	<25	<25	<25	<25	<25
F1 (C6-C10) - BTEX	ug/L	25	-	<25	<25	<25	<25	<25
F2 (C10-C16 Hydrocarbons)	ug/L	100	-	<100	<100	<100	<100	<100
F3 (C16-C34 Hydrocarbons)	ug/L	250	-	<250	<250	<250	<250	<250
F4 (C34-C50 Hydrocarbons)	ug/L	250	-	<250	<250	<250	<250	<250
Total Hydrocarbons (C6-C50)	ug/L	370	-	<370	<370	<370	<370	<370
Colour	CU	2	5	**12**	**16.1**	**29.2**	4.6	**10.7**
Electrical Conductivity	umhos/cm	1	-	458	473	436	496	473
Hardness	mg/L	0.5/1.3	80/100	***228***	***233***	***254***	***226***	***234***
Total Dissolved Solids	mg/L	20	500	249	267	285	284	259
Turbidity	NTU	0.1	5	1.18	2.57	**70.7**	**7.15**	0.5
pH	pH units	0.1	6.5/8.5	7.89	7.91	7.93	7.94	8.23

*Reporting Detection Limit (RDL) may have been altered based on the RDL at the time of analyis.

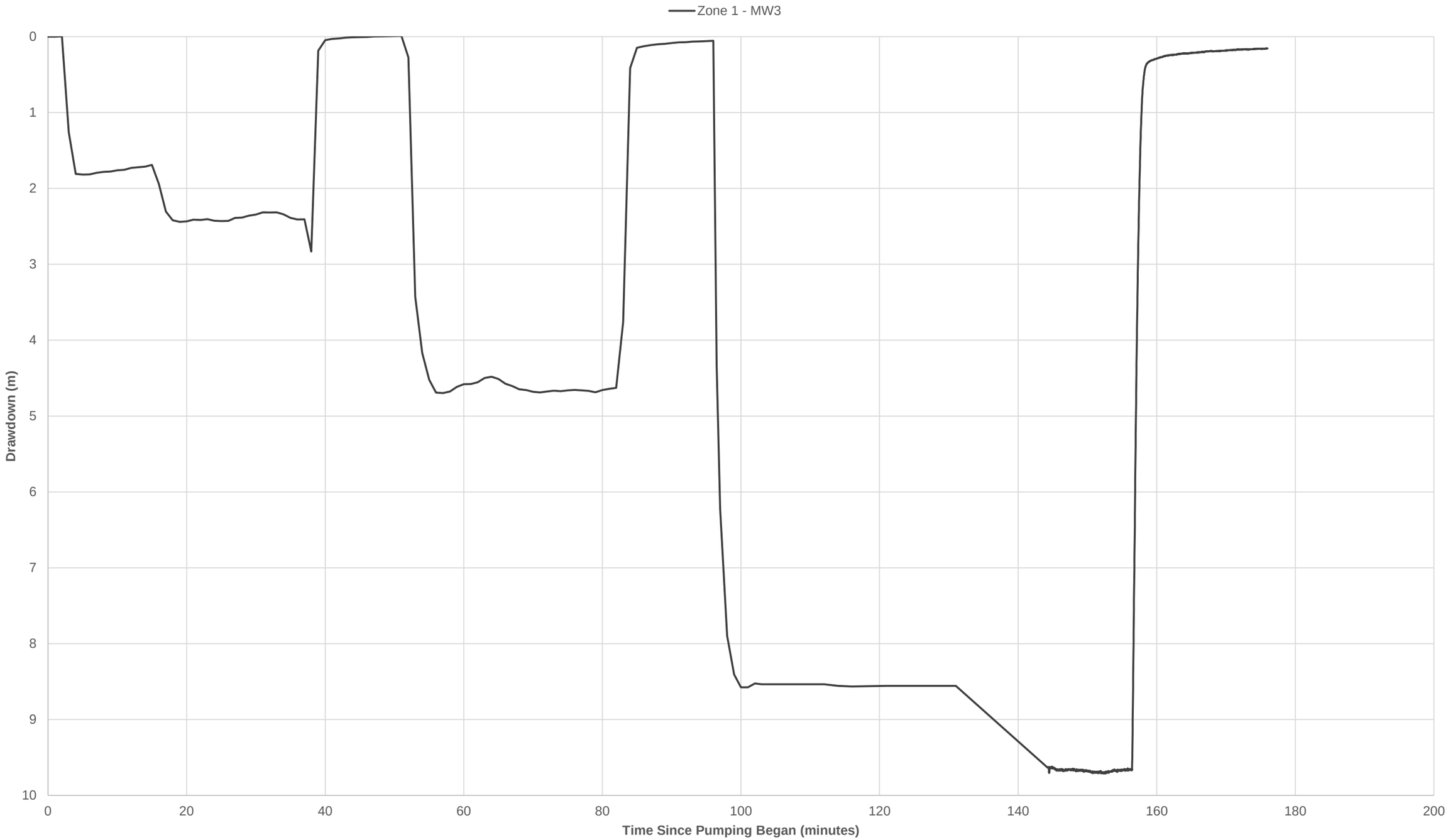
0.00 **=** Result did not fall within range of suggested operational guidelines

0.00 = Result exceeded ODWS Aesthetic Objective

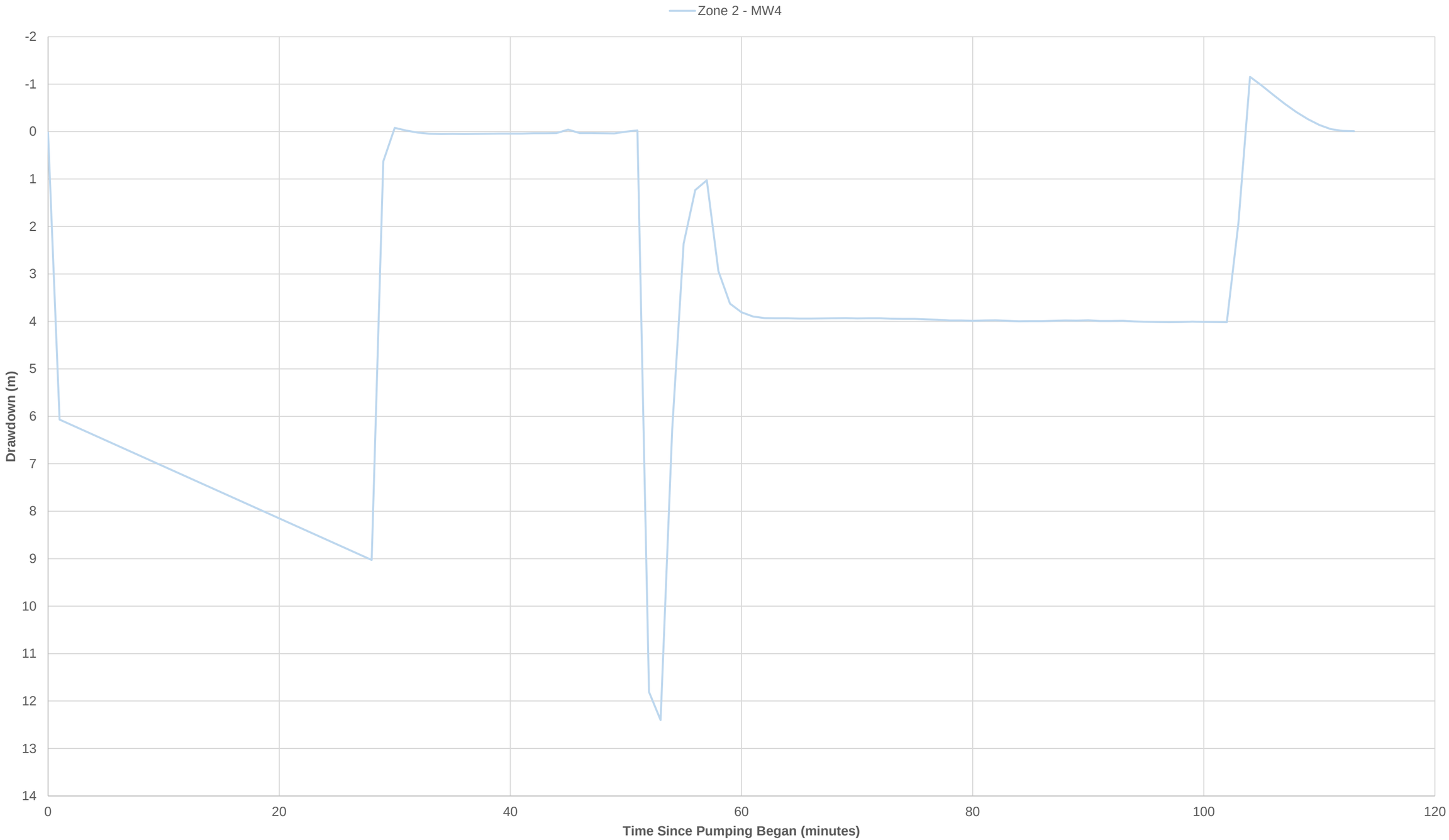
0.00 = Result exceeded ODWS Health Objective

Hydrographs

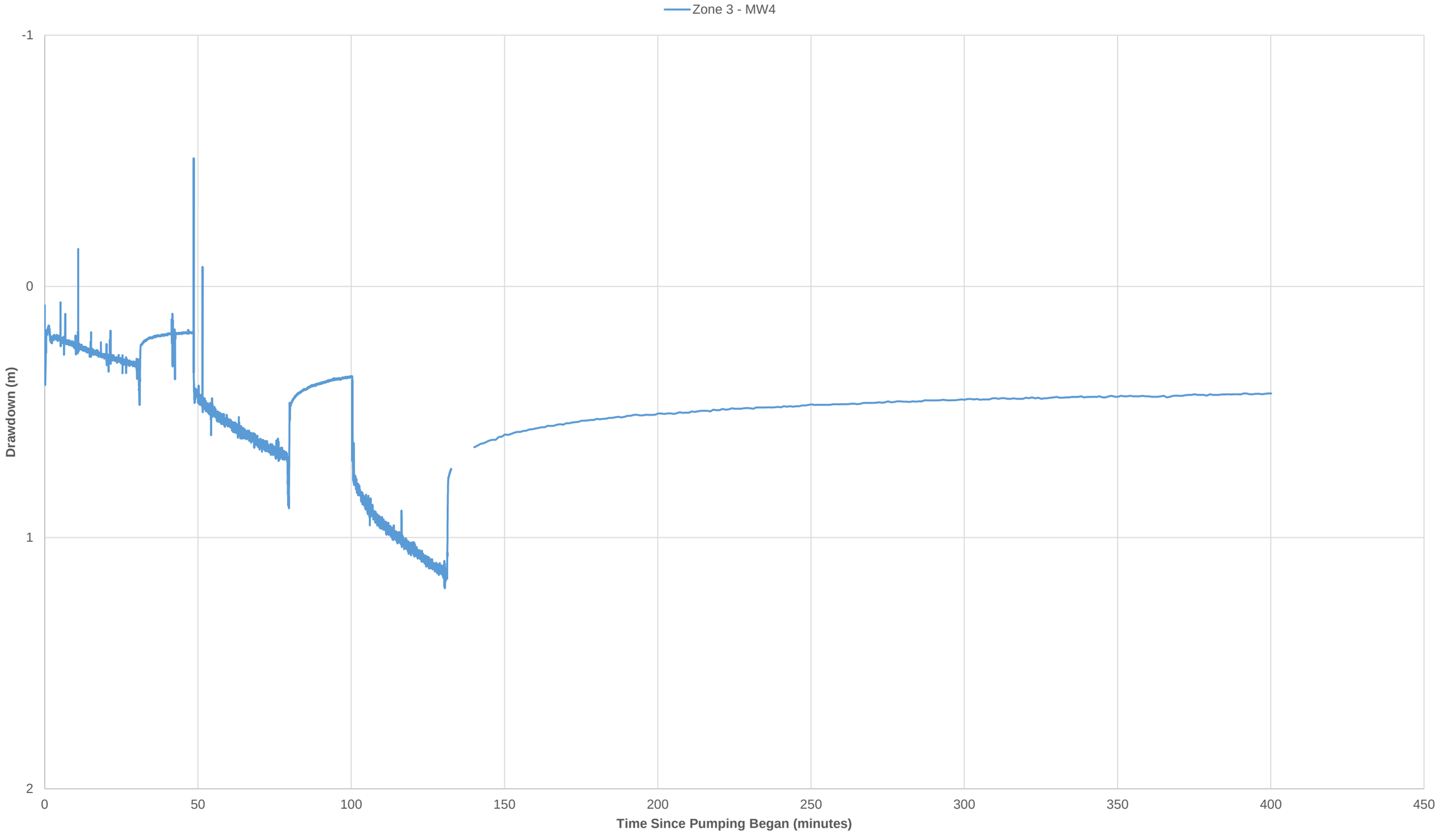
Hydrograph 1: Zone 1 Pumping Test



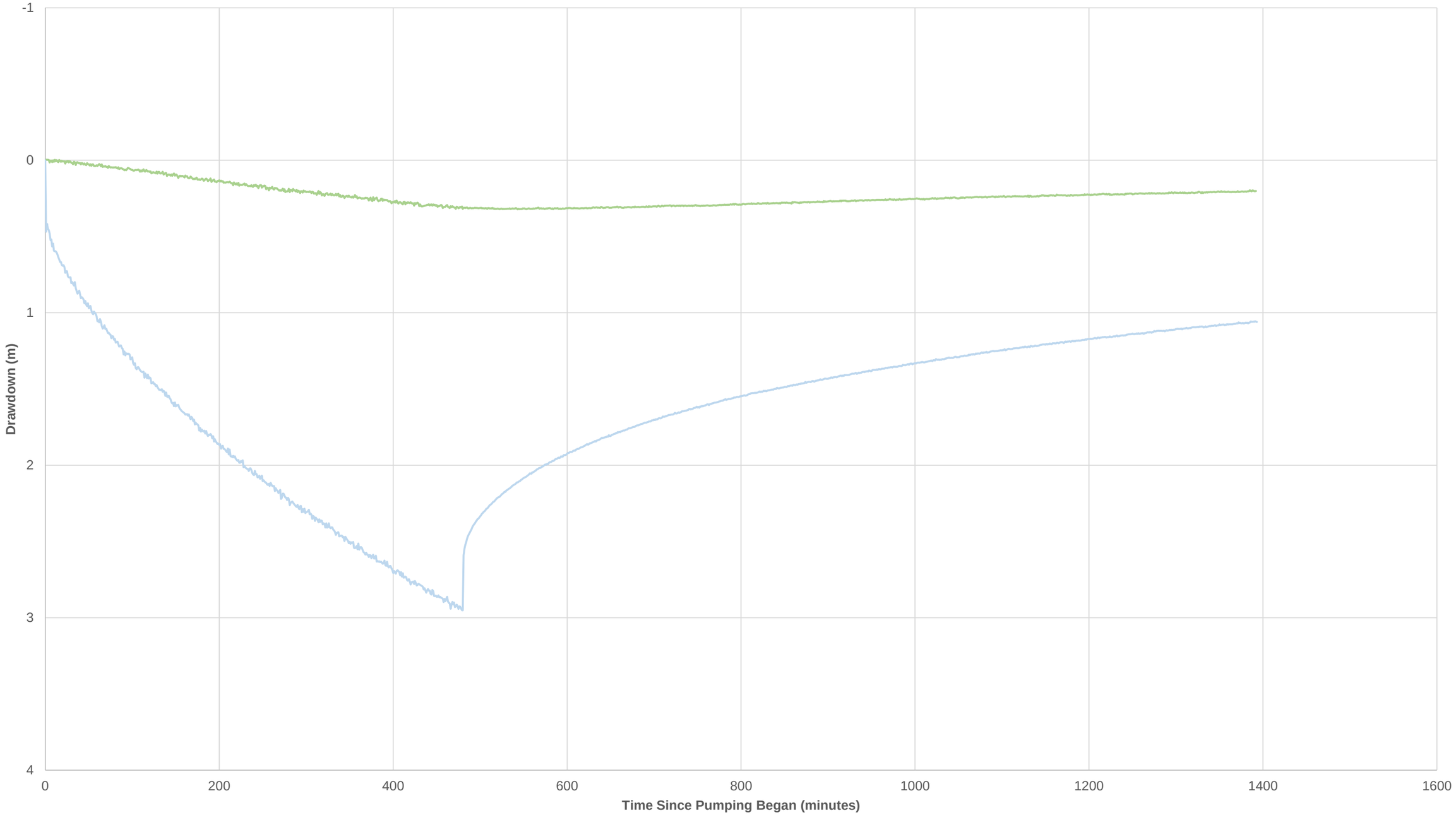
Hydrograph 2: Zone 2 Pumping Test



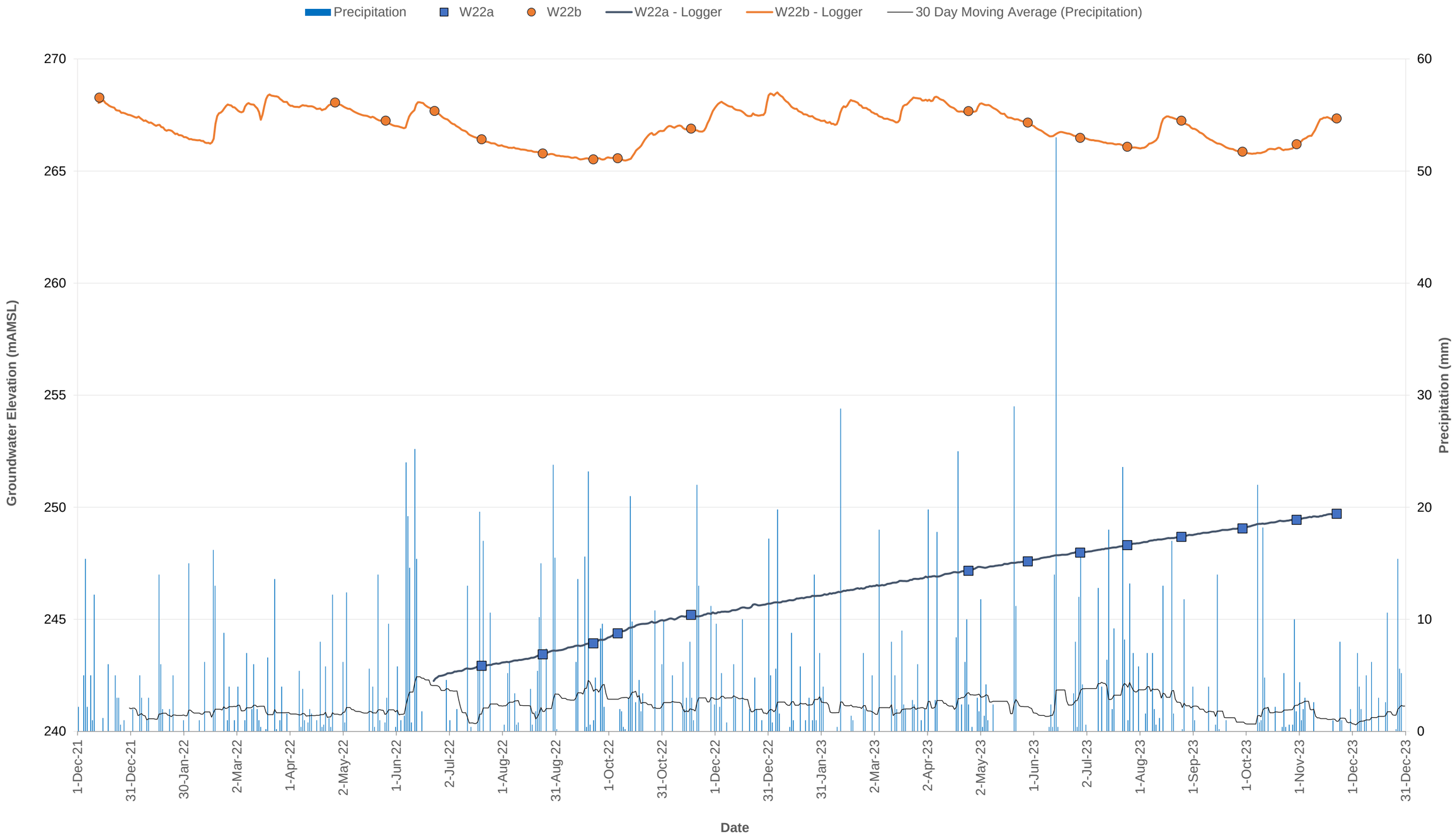
Hydrograph 3: Zone 3 Step Test



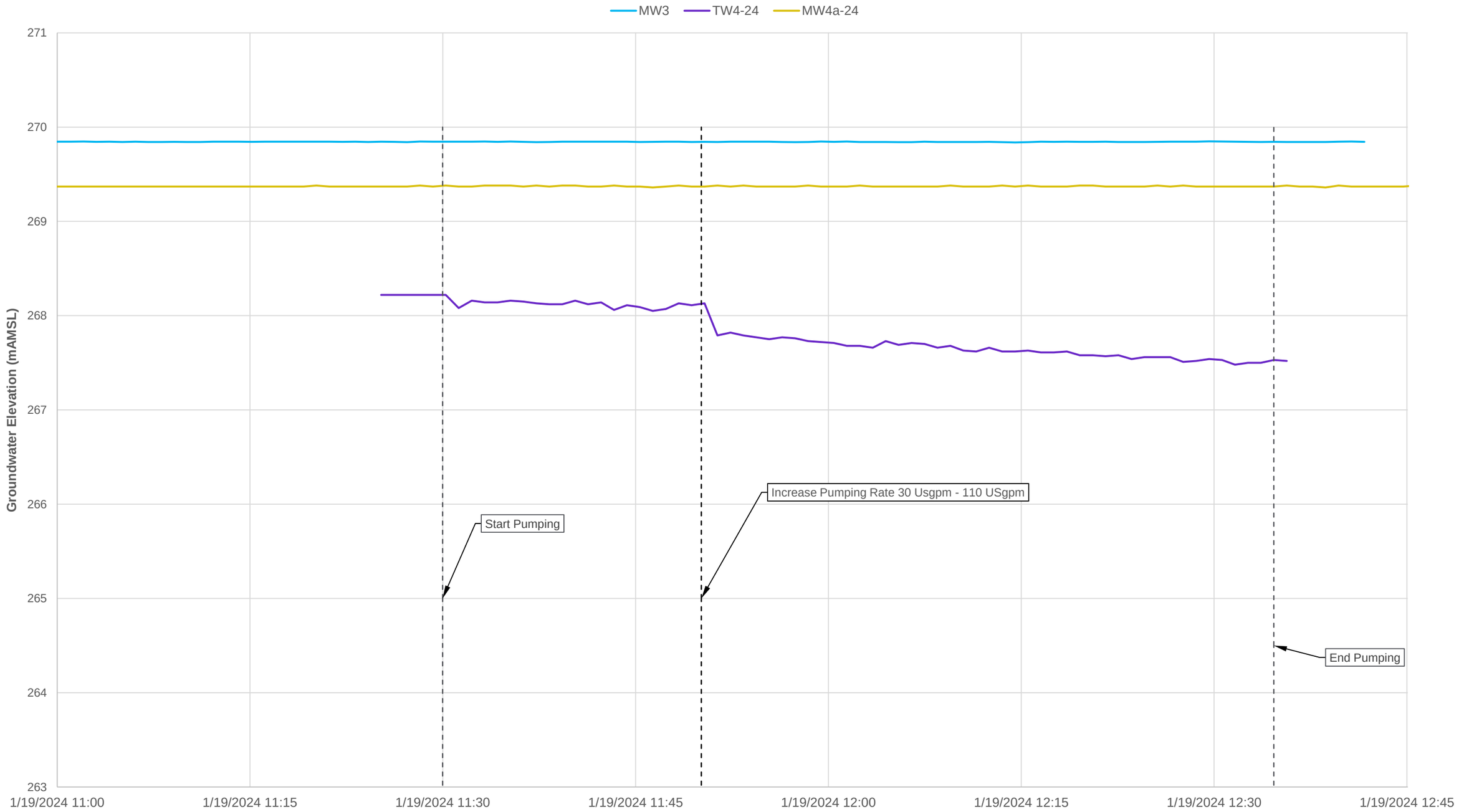
Hydrograph 4: Zone 3 Pumping Test



Hydrograph 5: Groundwater Elevations (masl) - W22a & W22b

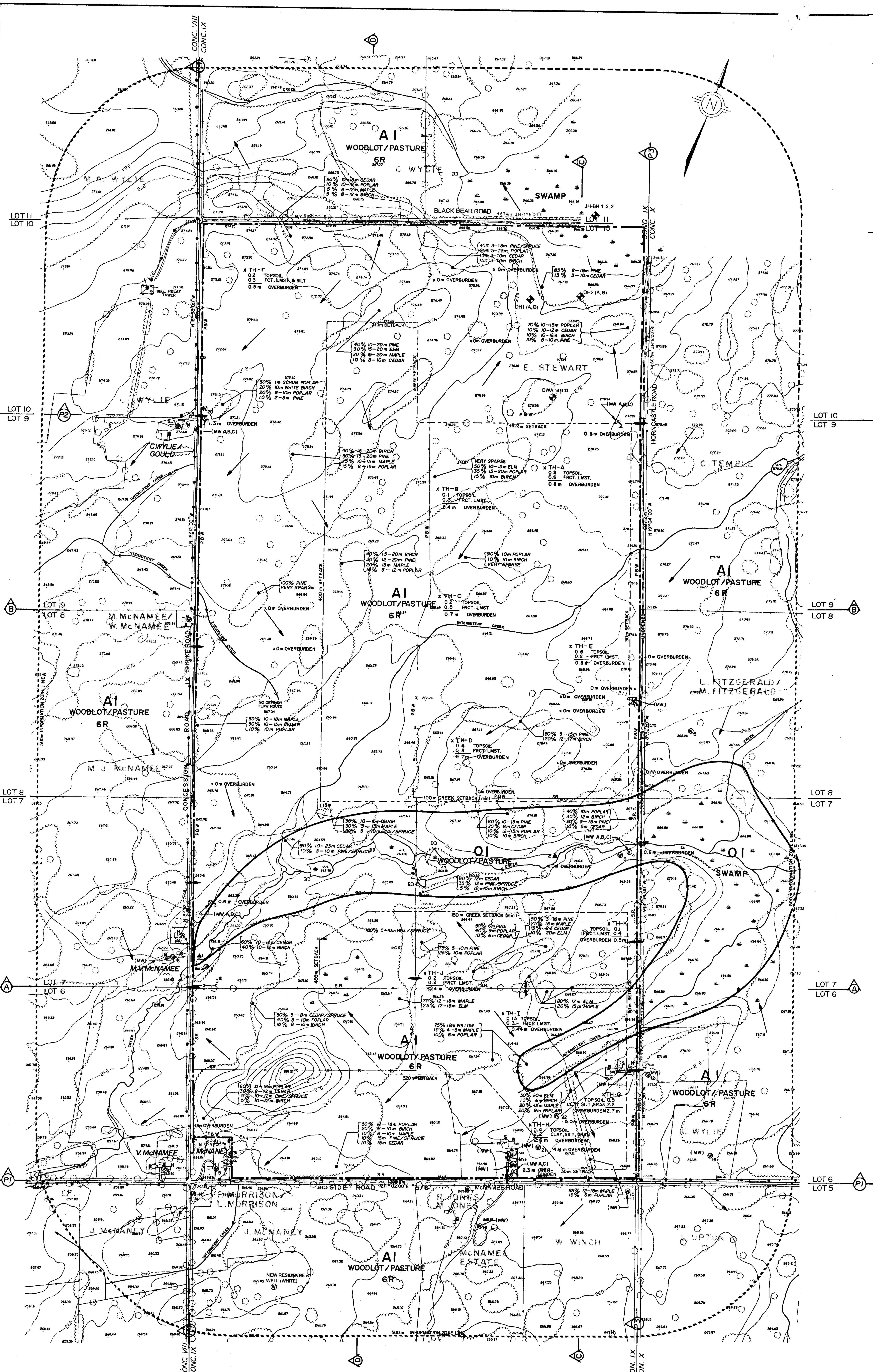


Hydrograph 6: Well Yield Test TW4-24



Appendix A

Ferma-Carden Quarry Site Plans



REFERENCE MATERIAL

1) AERIAL PHOTOGRAPH:	MNR, MAY 1987, PHOTO SCALE 1:16,000
2) GROUND CONTROL:	HORIZONTAL AND VERTICAL DATUM OF BASE MAPPING OBTAINED FROM MINISTRY OF NATURAL RESOURCES BASE MAPS PRODUCED BY SURVEYS AND MAPPING AND REMOTE SENSING, PUBLISHED 1991.
3) BASE MAPPING:	PREPARED BY THE BASE MAPPING CO. LTD., FEB. 1993. 90% OF WELL DEFINED FEATURES, WITH THE EXCEPTION OF FEATURES UNAVOIDABLY DISPLACED BY SYMBOLIZATION OR FEATURES OBSCURED BY VEGETATION WOULD HAVE A RELATIVE ACCURACY OF ±1 METRE. 90% OF THE WELL DEFINED FEATURES WOULD HAVE A ABSOLUTE ACCURACY EQUIVALENT TO OR LESS THAN THE MINISTRY OF NATURAL RESOURCES BASE MAPS.
4) METES & BOUNDS:	PLAN OF SURVEY BY H. F. GRANDER O.L.S., MAY 23, 1991, PLAN 57R-6487, DEPOSITED JUNE 10, 1991
5) ZONING:	THE CORPORATION OF THE TOWNSHIP OF CARDEN ZONING BY-LAW 79-2
6) BENCH MARK:	GEODETIC SURVEY OF CANADA #1581, ELEVATION 258.358 (m.a.s.l.), VICTORIA ROAD
7) WELL DATA:	MINISTRY OF ENVIRONMENT WELL RECORDS AND FIELD SURVEY
8) BOREHOLE DATA:	FIELD SURVEY
9) KEY MAP:	ENERGY MINES AND RESOURCES, MAPS 31D/10 & 31D/11
10) DRILLING:	BOREHOLES BY ATCOST SOIL DRILLING LTD., TEST WELL (WELL NOS. 21 & 22) BY CARL BALDWIN WELL DRILLING LTD. OWA, OH1, OH2 BY HERB LANG WELL DRILLING LTD.
11) LITHOLOGY:	BH1 - TERRAPROBE LIMITED (DEC. 1993), BH4 - SOIL AND AGGREGATES SECTION, MINISTRY OF TRANSPORTATION (SEPT. 1993)

WELL SUMMARY

WELL NO.	MOEE NO.	TYPE	USE	ELEVATIONS (masl/m) GROUND	WELL DEPTH	STATIC LEVEL/DEPTH BELOW GROUND	WATER FOUND	COMMENTS	
1		DRILLED	DOMESTIC	273.9		271.9/2.0		WELL PIT & SEAL	
2	64-5891	DRILLED	DOMESTIC	271.0	10.3	267.0/4.0	266.1	WELL PIT & SEAL	
3	64-5890	DRILLED	DOMESTIC	265.5	14.3	263.5/2.0	255.4	WELL PIT & SEAL	
4		DRILLED	DOMESTIC	264.3	10.0	260.1/4.2		WELL PIT & SEAL	
5	64-5096	DRILLED	DOMESTIC	265.1	8.0	261.1/4.0	257.5	WELL PIT & SEAL	
6	64-3691	DRILLED	DOMESTIC	264.4	8.0	261.4/3.0	256.6	WELL PIT & SEAL	
7		DRILLED	NONE	265.5				HAND PUMP	
8		DUG	NONE	270.0	5.8	267.7/2.3		HAND PUMP	MW
9		DRILLED	DOMESTIC	269.8	12.8	265.6/4.2		OPEN CASING	MW
10		DRILLED	NONE	268.3	5.2	267.2/1.1		HAND PUMP	MW
11		DUG	NONE	271.9	6.6	268.6/3.3		HAND PUMP	MW
12		DUG	NONE	272.0	5.0	268.9/3.1		HAND PUMP	MW
13		DRILLED	OBSTRUCTED					WIND PUMP	
14		DRILLED	NONE	268.7	1.6	268.3/0.4		WIND PUMP	MW
15		DRILLED	OBSTRUCTED					WIND PUMP	MW
16		DRILLED	OBSTRUCTED	266.1		265.8/0.3		WIND PUMP	
17		DRILLED	OBSTRUCTED					OPEN CASING	
18		DUG	CATTLE	264.2	1.7	262.9/1.3		SOMETIMES DRY	MW
19		DRILLED	NONE	269.6	9.1	265.6/4.0		OPEN CASING	MW
20		DRILLED	OBSTRUCTED					OPEN CASING	
21		DRILLED	TESTING	270.9	15.2	266.5/4.4	DRY	POOR SUPPLY	MW
22		DRILLED	TESTING	271.1	42.7	266.2/4.9	251.6	GOOD SUPPLY	MW

NOTE: WELLS 1, 2, 3, 4, 5, AND 6 ARE INACCESSIBLE FOR MONITORING PURPOSES, STATIC WATER LEVELS ARE BASED ON MOE RECORDS AND DISCUSSIONS WITH USERS. ALL REMAINING LEVELS ARE AVERAGE RECORDED MEASUREMENTS BY FIELD SURVEY FOR THE PERIOD OF JUNE 1993 TO NOVEMBER 2002 (EXCEPT FOR WELL 18, MEASUREMENTS TO MAY 1996). GROUND ELEVATIONS WERE SURVEYED AND MAY NOT NECESSARILY CORRESPOND TO THAT SHOWN ON TOPOGRAPHIC MAPPING. MW - MONITORING WELL.

BOREHOLE/PIEZOMETER SUMMARY

BOREHOLE	GROUND ELEV. (masl)	PIEZOMETER	DEPTH (m)	WATER LEVEL (masl/m below ground)	LOG (material & depth - m)	MONITOR
1	273.2	A	12.2	270.2/3	OB 1.4, LMST TO 44.5,	BH1A
		B	24.2	265.6/7.6	CIRCUL. MAINTAINED	BH1B
		C	44.5	265.3/7.9		BH1C
2	271.3	A	9.2	OBSTRUCTED	OB 0.3, FCT LMST 24.1,	BH2A
		B	24.3	266.6/4.7	LMST 42.8, GNT TO 44.5	BH2B
		C	41.5	266.7/4.6	CIRCUL. LOST THROUGHOUT	BH2C
3	264.6	A	13.1	262.7/1.9	OB 0.6, FCT LMST 4.9,	BH3A
		B	29.0	260.3/4.3	LMST 41.0, GNT TO 41.5,	BH3B
		C	41.5	260.6/4.0	CIRCUL. LOST @ 4.5, 9.1, & 39.6	BH3C
4	267.4	A	9.3	266.5/0.9	OB 0.6, FCT LMST 26.3,	BH4A
		B	24.3	266.5/0.9	LMST 41.1, GNT TO 41.5	BH4B
		C	41.5	266.5/0.9		BH4C
5	269.6	A	13.0	265.8/3.8	OB 2.3, LMST 33.6,	BH5A
		B	27.4	PLUGGED	BRN LMST 37.3, LMST 44.2,	
		C	44.5	262.1/7.5	GNT TO 44.5, CIRCUL. MAINTAINED	BH5C

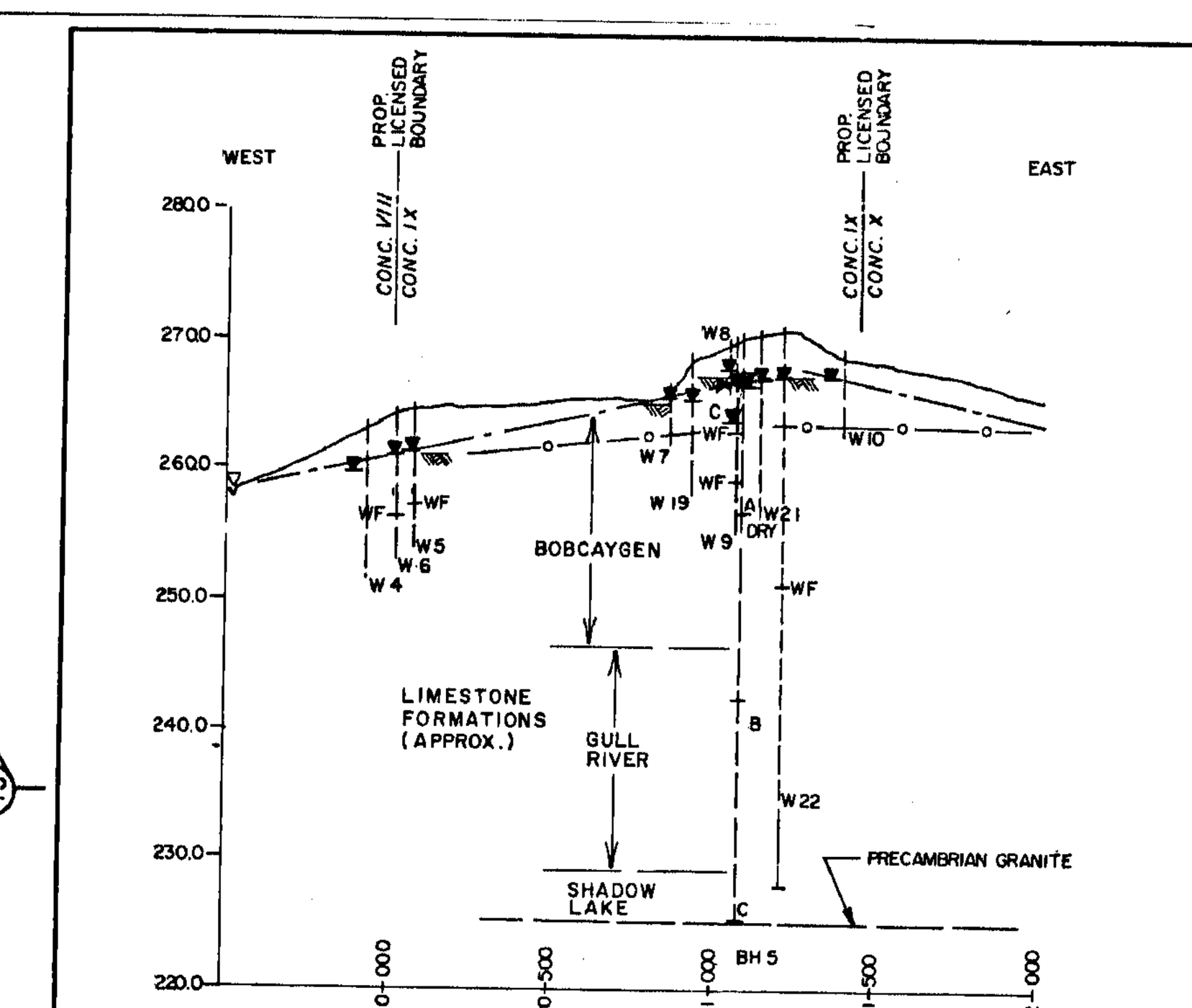
ABBREVIATIONS: OB - OVERBURDEN, LMST - GREY LIMESTONE WITH INTERBEDS OF SHALE, BRN LMST - BROWN LIMESTONE, CLCT - CALCITE, SHL - SHALE, GNT - GRANITE, FCT - FRACTURED, CIRCUL. - CIRCULATION OF DRILLING FLUID

NOTE: BOREHOLES CONSTRUCTED MARCH/APRIL 1993, PIEZOMETERS DEVELOPED MAY 1993, STATIC WATER LEVELS ARE BASED ON AVERAGE RECORDED MEASUREMENTS BY FIELD SURVEY FOR THE PERIOD OF JUNE 1993 TO NOVEMBER 2002. GROUND ELEVATIONS ARE SURVEYED ELEVATIONS, AND MAY NOT NECESSARILY CORRESPOND TO THAT SHOWN ON THE TOPOGRAPHIC MAPPING.

OBSERVATION WELLS

WELL	GROUND ELEV. (masl)	PIEZOMETER	DEPTH (m)	STATIC WATER LEVEL/DEPTH BELOW GROUND (masl/m)
OH1	268.3	A	5.1	266.6/1.7
		B	12.1	263 /4.6
OH2	267.2	A	3.1	266.3/0.9
		B	10.2	263.9/3.3
OWA	272.6	OWA	18.29	263.9/8.7
JH-BH-1 (02-1-I)	266.7		6.2	266.1/0.6
JH-BH-2 (02-1-III)	266.7		3.2	266.2/0.5
JH-BH-3 (03-1-II)	266.7		5.6	266.3/0.4

NOTE: OBSERVATION WELLS CONSTRUCTED JUNE 7, 2002, JH SERIES ON JUNE 25, 2002. WATER LEVELS ARE BASED ON AVERAGE RECORDED MEASUREMENTS BY FIELD SURVEY FOR THE PERIOD JUNE 17 TO NOVEMBER 5, 2002.

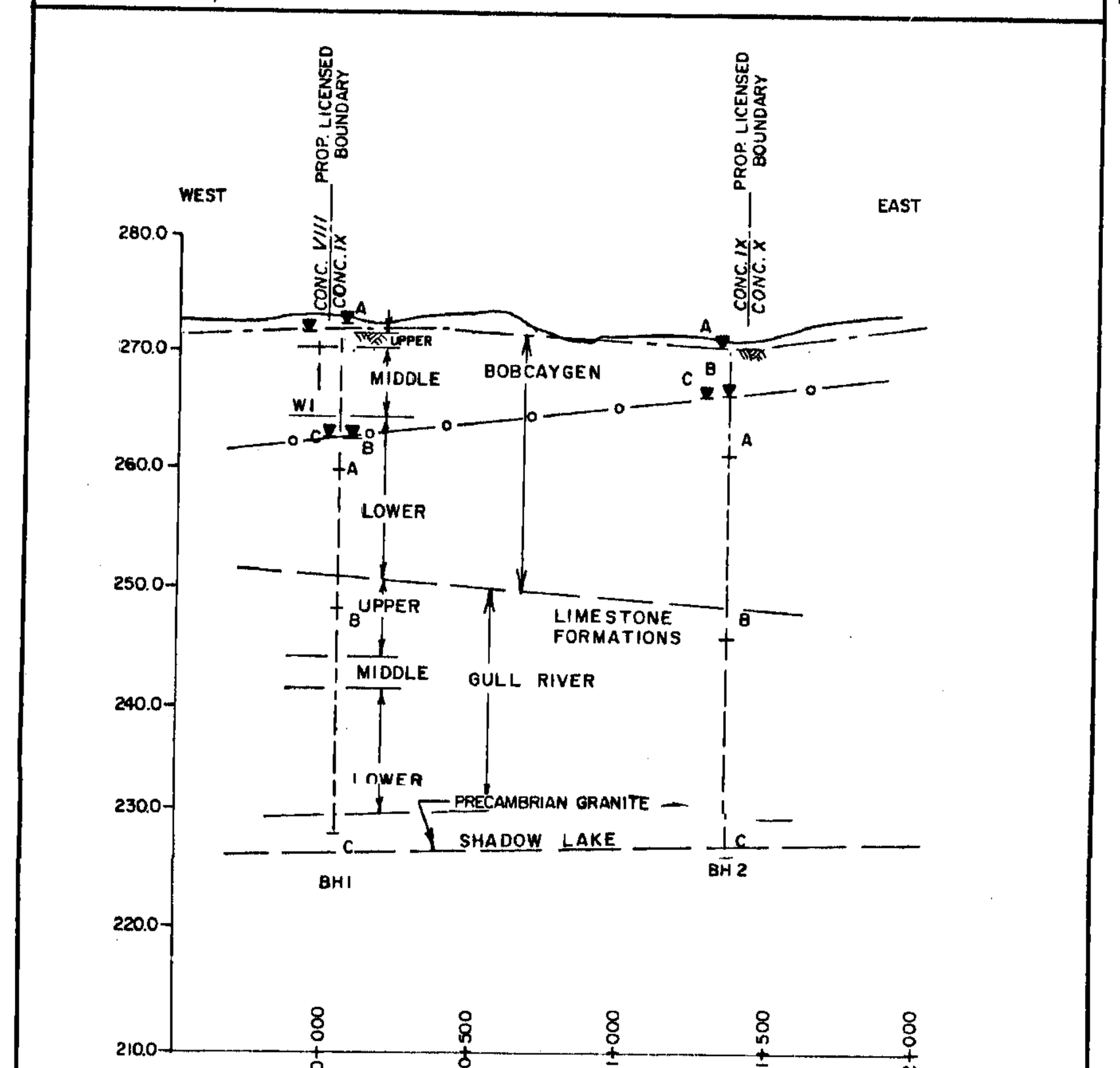


P1 PROFILE-LINE BETWEEN LOTS 5 & 6
SCALE 1:5000 HORIZ. 1:750 VERT.

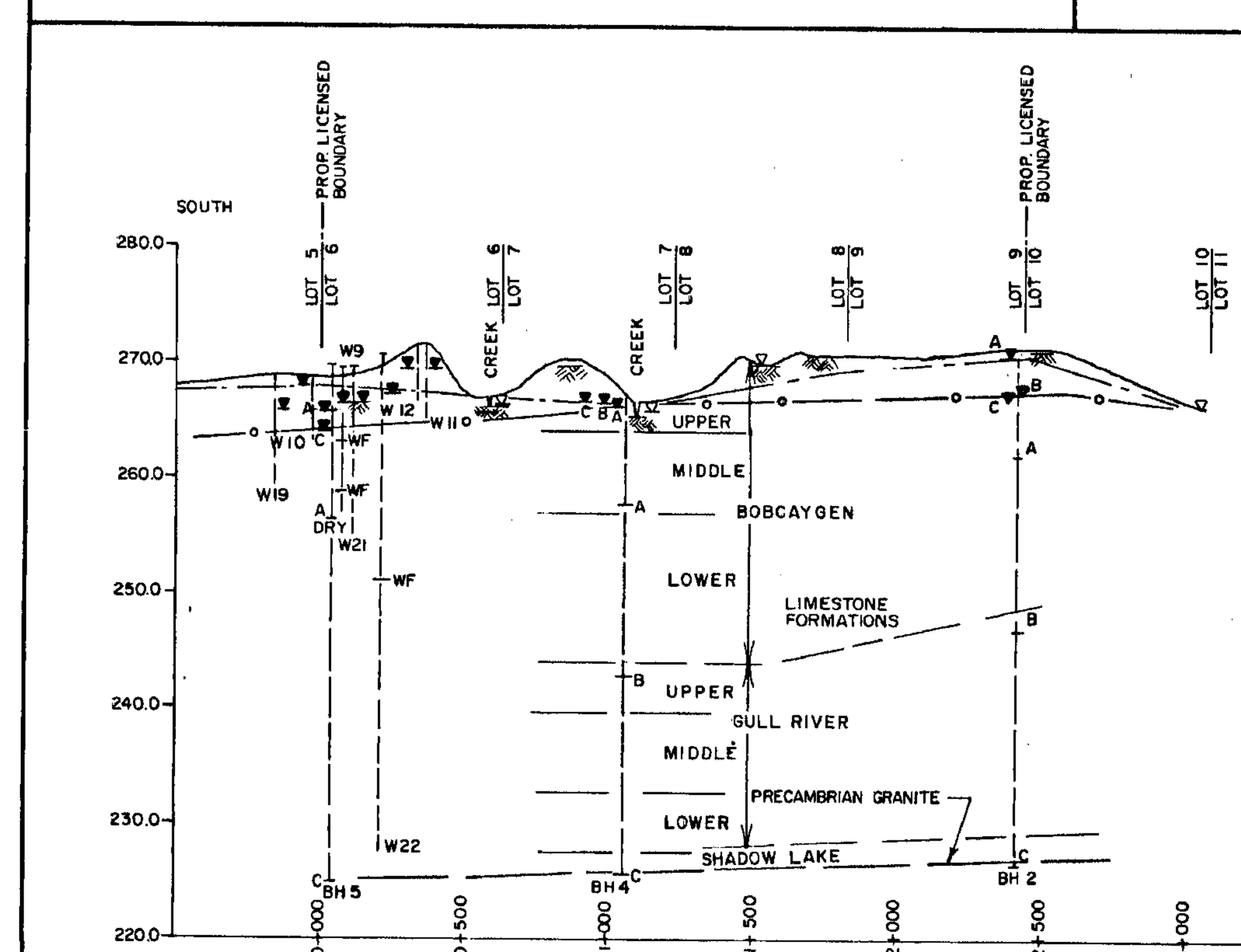
LEGEND FOR PROFILES

- TOP OF LIMESTONE
- STATIC WATER LEVEL
- WATER TABLE UPPER BEDROCK
- POTENTIOMETRIC SURFACE LOWER BEDROCK
- W2 — WELL NUMBER
- BH3 — BOREHOLE NUMBER
- B — PIEZOMETER NUMBER & STATIC WATER LEVEL
- SURFACE WATER LEVEL
- B — BASE OF PIEZOMETER
- WF — WATER FOUND
- APPROXIMATE DIVISION BETWEEN GEOLOGIC ZONES
- UPPER, MIDDLE, LOWER — MEMBERS OF GEOLOGIC FORMATIONS

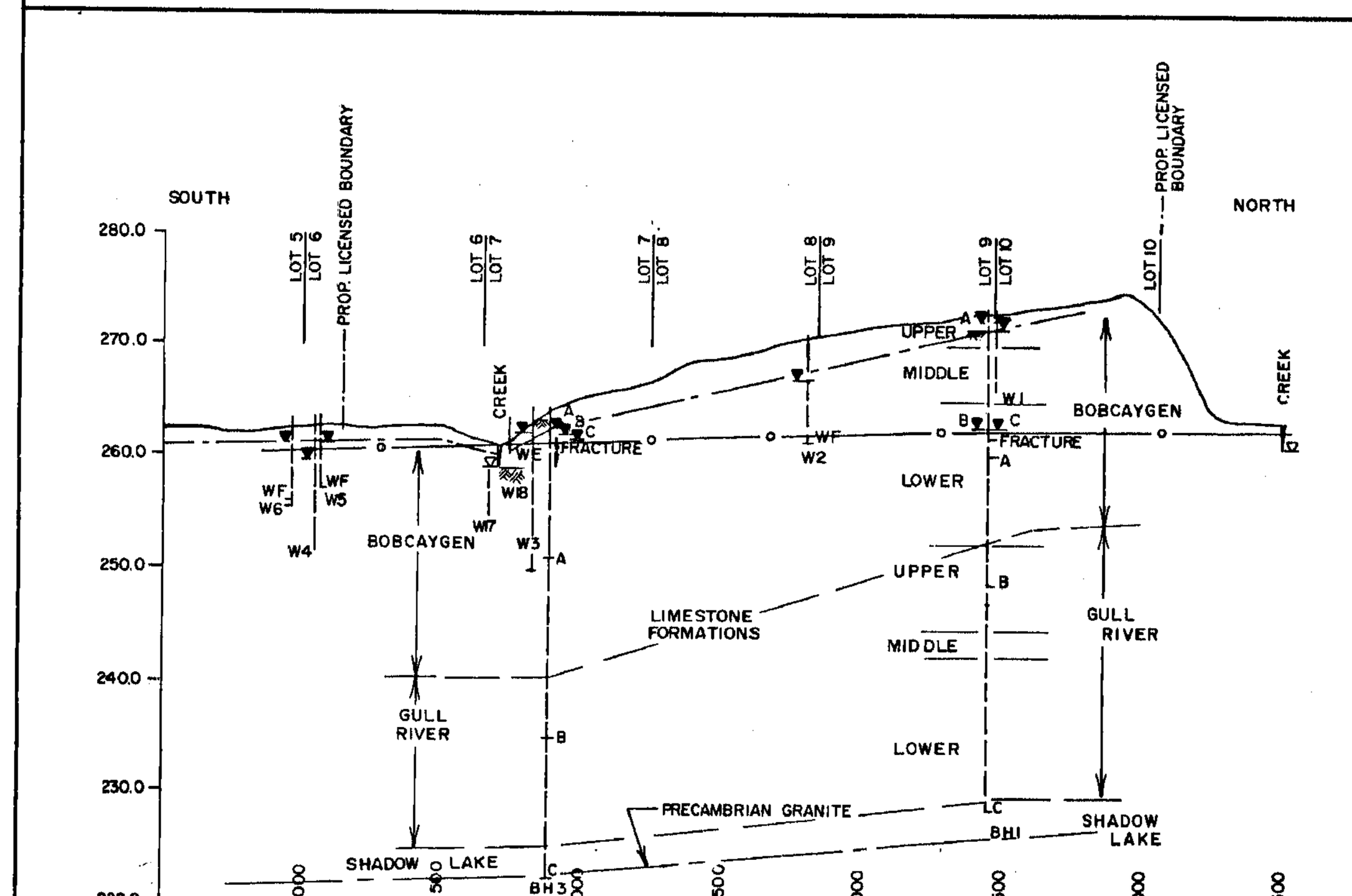
NOTES: 1. LIMESTONE GEOLOGIC PROFILES COMPILED FROM LABORATORY ANALYSIS OF CORE SAMPLES FROM BOREHOLES NUMBERS 1 & 4.
2. ACTUAL GEOLOGIC AND HYDROGEOLOGIC CONDITIONS MAY VARY FROM THAT INTERPRETED BETWEEN POINTS OF MEASUREMENT.



P2 PROFILE-LINE BETWEEN LOTS 9 & 10
SCALE 1:5000 HORIZ. 1:750 VERT.



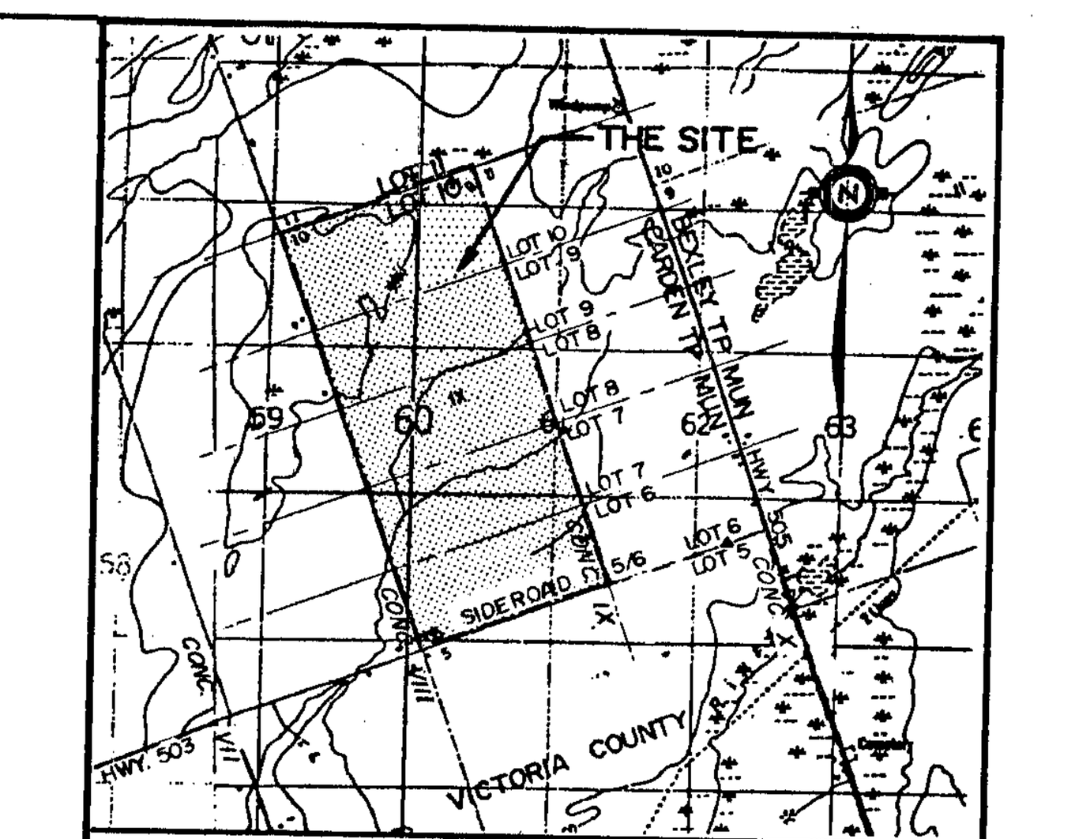
P3 PROFILE - LINE BETWEEN CONCESSIONS IX & X
SCALE 1:5000 HORIZ. 1:750 VERT.



P4 PROFILE - LINE BETWEEN CONCESSIONS VIII & IX
SCALE 1:5000 HORIZ. 1:750 VERT.

MINISTRY OF NATURAL RESOURCES
PLANS APPROVED UNDER THE AGGREGATE RESOURCES ACT
AGGREGATE RESOURCES OFFICER
DATE April 28/03

103268



KEY MAP 1000 0 1000 2000 SCALE 1:50000

NOTES

1. LICENSED AREA 427.2 ha.
2. AREA OF EXTRACTION — SOUTH PART - 58.3 ha; NORTH PART - 127.9 ha; TOTAL 186.2 ha
3. AREA TO BE REHABILITATED — S. PART - 71.5 ha; N. PART - 163.0 ha; TOTAL 234.5 ha
4. THE WATER TABLE ELEVATION RANGES BETWEEN 260 AND 272, AND BETWEEN 0m AND 4 m BELOW THE GROUND SURFACE.
5. THIS PLAN WAS PREPARED USING PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHS.
6. LOT, CONCESSION AND BOUNDARY LINES ON THIS PLAN ARE APPROXIMATE.
7. THIS IS NOT A LEGAL SURVEY DRAWINGS IN ACCORDANCE WITH THE PROVINCE OF ONTARIO SURVEYORS ACT 1987.

LEGEND

268.20	EXISTING ELEVATION
270	2.0m CONTOUR INTERVAL
	TREES / BUSH
CREEK	DRAINAGE COURSE & FLOW DIRECTIONS
	GENERAL SURFACE DRAINAGE DIRECTION
BD	BEAVER DAM
	SWAMP
W/L 270.10	POND AND WATER LEVEL
1	WELL LOCATION AND NUMBER
1	SURFACE WATER MONITORING POINT
H B S G C (5m x 7m, 20x15, 15x7, 4x5, 5x6)	BUILDINGS (HOUSE-BARN-SHED-GARAGE-COTTAGE) DIMENSIONS
C.WYLIE/W.GOULD	OWNER/ TENANT
P&W 1.2m S.R.	FENCE TYPE & HEIGHT (P & W-POST & WIRE) (S.R.-SPLIT RAIL)
	GATE
	ASSUMED ROAD
	UNASSUMED ROAD
	TRAIL
	ENTRANCE / EXIT
	LOT/CONCESSION LINE
	ZONE BOUNDARY
AI OI	ZONING (AI-RURAL GENERAL) (OI-OPEN SPACE)
PASTURE/WOODLOT	LAND USE
6R	AGRICULTURAL LAND CLASSIFICATION
N19°04'20"W 900.0m	BOUNDARY OF AREA TO BE LICENSED METES AND BOUNDS
	LIMIT OF PROPOSED EXTRACTION
30m SETBACK	PROPOSED SETBACK DISTANCE
	500m INFORMATION AREA LIMIT LINE
A	CROSS SECTION/PROFILE NUMBER & LOCATION
2	BOREHOLE NUMBER AND LOCATION
70% 10-15m POPULAR	AVERAGE TREE SPECIES % COVERAGE & HEIGHT
	HYDRO/TELEPHONE POLES
	OBSERVATION WELL
(MW)	MONITORING WELL
A,B,C	PIEZOMETER

THIS SITE PLAN IS PREPARED FOR SUBMISSION TO THE MINISTRY OF NATURAL RESOURCES IN CONJUNCTION WITH AN APPLICATION FOR A CLASS A LICENCE UNDER THE AGGREGATE RESOURCES ACT AND REGULATIONS.

FERMA AGGREGATES INC.
2666 RENA ROAD
MISSISSAUGA, ONTARIO
L4T 3C8
Telephone: (905) 677-9241 Fax: (905) 677-9817

SIGNATURE OF LICENSEE — DATE 04/28/03

AMENDMENTS	DATE APPROVED
SITE PLANS APPROVED BY MINISTRY OF NATURAL RESOURCES SIGNATURE DATE	

REGISTERED PROFESSIONAL ENGINEER — J. S. GOURLEY — PROVINCE OF ONTARIO — Apr 28/03

THESE PLANS WERE DESIGNED TO ENSURE COMPLETE PRACTICALITY DURING THE OPERATIONS, PROGRESSIVE REHABILITATION AND FINAL REHABILITATION OF THE LICENSED PROPERTY

Trow Associates Inc.
Parent Company of
OLIVER MANGIONE McCALLA & ASSOCIATES LIMITED
561 BRYNE DRIVE UNIT D
BARRIE, ONTARIO L4N 9Y3
Tel: (705) 734-6222
Fax: (705) 734-6224

92-8977

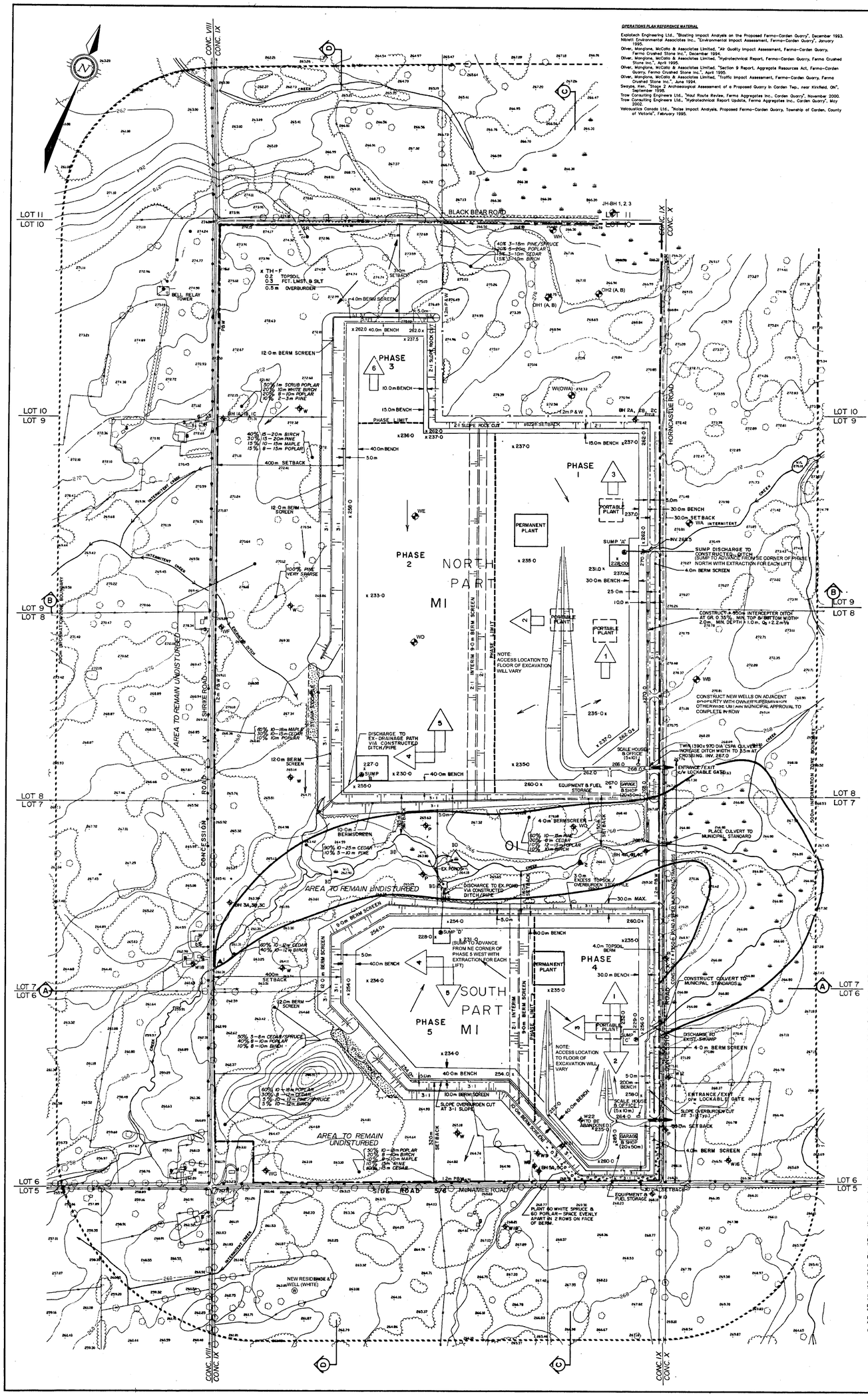
FERMA-CARDEN QUARRY

LOTS 6,7,8,9,& 10
CONCESSION IX
TOWNSHIP OF CARDEN
CITY OF KAWARTHA LAKES

EXISTING FEATURES

PAGE 1 OF 5				
PHOTO SCALE 1:16000	ROLL No. 87-4426	PHOTO Nos. 188 - 190	LINE No. 3	PHOTO DATE MAY 1987
MAP SCALE AS SHOWN	CONTOUR INTERVAL 2.0 m	DATE OF SITE PLAN DECEMBER 2002		

100 0 100 200 300 400m
1:5000



OPERATIONS PLAN REFERENCE MATERIAL

Explotech Engineering Ltd., "Blasting Impact Analysis on the Proposed Ferma–Carden Quarry", December 1993.
Niblett Environmental Associates Inc., "Environmental Impact Assessment, Ferma–Carden Quarry", January 1995.
Oliver, Mangione, McCalla & Associates Limited, "Air Quality Impact Assessment, Ferma–Carden Quarry, Ferma Crushed Stone Inc.", December 1994.
Oliver, Mangione, McCalla & Associates Limited, "Hydrotechnical Report, Ferma–Carden Quarry, Ferma Crushed Stone Inc.", April 1995.
Oliver, Mangione, McCalla & Associates Limited, "Section 9 Report, Aggregate Resources Act, Ferma–Carden Quarry, Ferma Crushed Stone Inc.", April 1995.
Oliver, Mangione, McCalla & Associates Limited, "Traffic Impact Assessment, Ferma–Carden Quarry, Ferma Crushed Stone Inc.", June 1994.
Swayze, Ken, "Stage 2 Archaeological Assessment of a Proposed Quarry in Carden Twp., near Kirkfield, ON", September 1998.
Trow Consulting Engineers Ltd., "Haul Route Review, Ferma Aggregates Inc., Carden Quarry", November 2000.
Trow Consulting Engineers Ltd., "Hydrotechnical Report Update, Ferma Aggregates Inc., Carden Quarry", May 2002.
Valcoustics Canada Ltd., "Noise Impact Analysis, Proposed Ferma–Carden Quarry, Township of Carden, County of Victoria", February 1995.

SITE PLAN CONDITIONS

LOGGERHEAD SHRIKE

Condition 1 - Quarry Development and Operations

i) The Licensee shall establish a 400 metre loggerhead shrike setback zone from an existing or future loggerhead shrike nest (occupied or unoccupied) within or adjacent to the Licensed property. That portion of the setback zone location falling within the Licensed area shall be demarcated by brightly painted and securely anchored 1.2 metre high metal 'T' bars placed 400 metres from the nest at 15 to 30 metre intervals. No activities shall occur within the shrike setback zone unless otherwise approved by MNR, or within five maximum consecutive years of the abandonment of a nesting site.
ii) No blasting shall be undertaken between April 30th (subject to commencement of nesting activity) and July 15th. Should fledglings remain in nest by July 15th then the commencement of blasting shall be delayed until the birds have left the nest. Should the monitoring program demonstrate that no nesting is occurring in early June, then blasting may commence after June 15th for that year.
iii) The portable Crushing Plant is to be located behind the working face. The working face is to advance towards any nesting location setback from the furthest point of the extraction limit.
iv) Hydraulic drills with dust bags shall be used for all drilling.
v) Stripping and clearing of all Phases shall not commence until the nesting period has expired.

Condition 2 - Shrike Monitoring

i) The Licensee shall conduct annual monitoring of shrike nesting on the whole of the Licensed property and within a 400 metre radius outside of the Licensed boundary subject to the neighbouring landowner's permission. Any new nesting locations are to be reported to MNR immediately. The final written monitoring report with the findings shall be submitted to the Ministry of Natural Resources by September 30, following the preceding spring monitoring period.
ii) The Licensee shall assess annual productivity of nesting loggerhead shrikes by monitoring nest site(s), number of eggs, number of young hatched, number of young fledglings and success of fledglings, and date abandoned.
iii) Shrike monitoring shall be carried out on behalf of the Licensee by the Eastern Loggerhead Shrike Recovery Team or other organization approved by MNR, and the Terms of Reference for monitoring and reporting approved by MNR.
iv) The Licensee shall restrict access within the Licensed property within the shrike setback zone except for researchers, and those individuals undertaking the monitoring on behalf of the Licensee, from April 15th to July 30th.

ARCHAEOLOGY

Condition 1
In the event that buried cultural remains are encountered during excavation activities anywhere on the property, the Archaeology and Heritage Planning Unit of the Ministry of Culture, Tourism and Recreation and/or the Cemeteries Branch of Consumer and Commercial Relations shall be contacted immediately.

Condition 2
A Stage 2 Archaeological Assessment shall be undertaken on any subsequent Phase(s) of the quarry development and a Letter of Clearance obtained from the Ministry of Citizenship, Culture, and Recreation prior to the advancement of any quarry activities into the subsequent Phase(s) of development.

NOISE

Condition 1 - Rock Drill Specifications
The rock drill will be an Ingersoll Rand DM 30 or acoustical equivalent having a maximum south emission level not exceeding 85.3 dBA at 15 metres distance.

Condition 2 - Permanent Plant
Building design for housing noisy pieces of equipment within the permanent processing plant are to be reviewed and approved by a qualified acoustical engineer to ensure compliance with applicable noise guidelines prior to construction.

Condition 3 - Implementation
Prior to the commencement of quarrying, all noise control measures must be fully implemented for that particular quarrying location.

Condition 4 - Other
The working face is to advance towards the north or south in an overall westerly direction depending on loggerhead shrike nesting location(s).

Until adequate room is available to accommodate a permanent plant on the floor of the final lift, portable processing facilities are to be located within 30 to 50 m of the westerly working face with interim 9.0 m berms constructed to provide additional sound attenuation.

Perimeter 10.0 m to 12.0 m berm screens are to be constructed upon removal of the 9.0 m interim berms and employment of the permanent plant.

Aggregate material loading for off–site delivery is to occur in plant area and is to take advantage of screening from stockpiles and buildings

BLASTING

Condition 1 - Notification
All residents within 500 metres of the boundaries of the licensed area must be given adequate notice prior to blasting.

Condition 2 - Monitoring
All blasts must be monitored.

Condition 3 - Peak Pressure
Blasts shall not exceed the peak pressure level limit for concussion of 128 dB and the peak particle velocity for vibration of 1.25 cm/s.

Condition 4 - Records
The information outlined in the above Conditions 1, 2, and 3 for Blasting must be kept by the operator and made available to the Ministries of the Environment and Natural Resources upon request.

Condition 5 - Other
A pre–blast survey shall be conducted on surrounding residences and buildings.

Non electric detonating devices shall be used in vicinity of Bell relay tower (northwest quadrant).

SPILLS

A Spill Control Plan following the guidelines established by the Aggregate Producers Association of Ontario will be prepared prior to commencement of quarry operations.

WASTE DISPOSAL

Stumps, branches, brush, roots etc. must be transported and disposed of in accordance with Ministry of Environment Regulations, or reused as product".

DEWATERING

Condition 1 - Water Taking
The Permit to Take Water applies to dewatering the first lift of Phase 1, North Part, Ferma–Carden Quarry which is defined as a limestone excavation limited to a depth elevation of 255.0 masl over the east half of Lots 8 and 9, Concession IX, Carden Township. Subsequent lifts or Phases, or greater pumping volumes, will require a new Permit to Take Water.

Condition 2A - Monitoring Wells
Monitoring wells containing tri–level piezometers at the following locations are to be constructed one year prior to commencing dewatering: WA (mid north part of east limit of Phase 1), WB (mid south part of east limit of Phase 1), WC (mid south limit of Phase 1), WD (mid south part of west limit of Phase 1), WE (mid north part of west limit of Phase 1), WF (opposite side of road from domestic well W2), WG (southwest corner of site), WH (mid north limit of E1/2 Lot 10, Con. 9), and WI (50 metres north of Phase 1 north limit). Subject to the property owner's consent, monitoring wells WA and WB are to be located 50 to 100 metres west of Horncastle Road. Shallow overburden, upper and lower bedrock aquifer piezometers are to have base elevations at approximately 260 – 264 masl, 250 – 255 masl and 230 masl, respectively.

Each tri–level monitoring well will have three 50 mm diameter piezometers each having a 1.0 metre long slotted screen section located within the water bearing zone of respective aquifers. The annulus surrounding the screens and casings are to be backfilled with silica sand with upper and lower aquifers isolated by a 3.0 metre thick bentonite seal placed using a tremie pipe or by pumping. Surface protection is also required per Regulation 901. In addition to the above, well BH2A will be replaced one year prior to dewatering.

With permission of the landowner, the Operator will monitor water levels in supply wells and dug–outs within a 500 metre circumference of the Licence boundary. Monitoring will also be carried out at those wells and dug–outs falling within a 500 to 1,500 metre circumference of the Licence Boundary subject to the request of the landowner.

Condition 2B - Groundwater and Dug-Out Water Level Measurements
On a monthly basis commencing one year prior to dewatering, static water levels are to be recorded within the above monitors, all domestic wells, dug–outs and at existing monitoring locations which include: BH 1A, 1B, 1C; BH 2B, 2C; BH 3A, 3B, 3C; BH 4A, 4B, 4C; BH 5A, 5C; W8; W9; W11; W21; W22; OWA; OH1A, 1B; OH2A, 2B; and, boreholes JH–BH1 (BH02–1–i), JH–BH2 (BH02–1–iii) and JH–BH3 (BH02–1–ii). All piezometers or monitoring wells destroyed by quarry operations are to be replaced. Monitoring wells proposed in Condition 2A will be subject to the same frequency of monitoring.

In addition, twice monthly measurements of static water levels during March, April, August, September and October shall be measured at: OWA; WI; BH 2A, OH1A, 1B; OH2A, 2B; and, boreholes JH–BH1 (BH02–1–i), JH–BH2 (BH02–1–iii) and JH–BH3 (BH02–1–ii).

Condition 2C - Water Quality Monitoring - Domestic Wells
Water quality monitoring will be carried out on a quarterly basis one year prior to dewatering in order to establish baseline conditions one year prior to dewatering and then bi–annually thereafter. The monitoring results shall be provided to the property owner and the City of Kawartha Lakes.

Condition 3 - Monitoring and Reporting
Within 90 days following the first anniversary and annually thereafter of commencing dewatering activities, the Operator will submit a report to the Ministries of Environment and Natural Resources, and the Liaison Committee, summarizing for the previous year: static water level and water quality observations; daily pumping rates; water budget calculations; the extent of drawdown; anticipated pumping rates and corresponding drawdown within the next operating year; well logs of constructed wells; a sketch showing well locations, extent of excavation and equipotential contours of the upper and lower aquifer; water supply complaints received and steps taken to resolve same; recommended changes to monitoring frequency, monitoring locations and triggering criteria; contingency measures implemented; and, any out of the ordinary observations made.

Condition 4A - Trigger Mechanism and Contingency Measures - Domestic Wells
A drop in minimum static level at BH1A by 2.0 metres (to approximately 270 masl), and a corresponding drop of greater than 2.0 metres in static water level at proposed observation wells WD and/or WE, shall initiate contingency measures for water supply at domestic well W1 upon confirmation that W1 supply is inadequate. Similarly, a drop in minimum static water level at proposed monitoring well WF of 2.0 metres (to approximately 265 masl), and a corresponding drop in static level at proposed monitoring well WD and/or WE of greater than 2.0 metres, shall initiate contingency measures for water supply at domestic well W2 upon confirmation that W2 supply is inadequate.

The Operator will maintain a potable water supply source to surrounding wells adversely affected by dewatering operations. Contingency measures include, but are not limited to, the use of holding tanks, the construction of a new well(s) within the upper bedrock aquifer at a locations(s) unaffected by quarry dewatering and the delivery of water from the new well(s) by pressurized piped system to each affected residence. Dewatering mechanisms will be shut down failing the resolution of water supply problems caused by quarry dewatering.

Condition 4B - Trigger Mechanism and Contingency Measures - N.E. Wetland
A drop below the minimum monthly baseline static water level of 0.25 metres within the unconfined overburden aquifer measured at wetland piezometers OH1A, OH2A, JH–BH1, JH–BH2 and JH–BH3 and a corresponding drop of a greater amount at intermediate monitoring well locations, consistently in March, April, May; or August, September and October, shall initiate a detailed investigation as to the cause of the observed decline.

A drop below the minimum monthly baseline static water level of 0.5 metres within the unconfined overburden aquifer measured at wetland piezometers OH1A, OH2A, JH–BH1, JH–BH2 and JH–BH3 and a corresponding drop of a greater amount at intermediate monitoring wells, consistently in March, April, May; or August, September and October shall initiate the implementation of contingency measures to restore the observed decline in water levels.

The contingency measures to be implemented will vary depending on the cause of the observed decline and may include, but are not limited to, one or more of the following: 1) Diversion of dewatering activities to the northeast with re–introduction of same into the unconfined overburden aquifer or upper bedrock aquifer via re–injection wells, exfiltration trenches, or directly by ditching, whichever is most appropriate; 2) Grouting (sealing) fissures that are causing excessive draining: and, 3) Termination of active dewatering attributed to the cause of observed drawdown.

Condition 5 - Monitoring Wells, Trigger Mechanism and Contingency Measures - Cattle Water Supply
Cattle in range rely on several sources of water supply including dug–outs and wetland areas which surround the area to be Licensed.

The supply of surface and groundwater recharge to the various sources of livestock water supply may be vulnerable as a result of quarry dewatering activities.

Upon quarry extraction occurring within 1,000 metres of an adjacent source of livestock water supply, the Operator will undertake the following:
i) Establish, in consultation with the owner of the subject source of water supply, the location of new monitoring wells nearby the water source and at intermediate locations between the source and quarry activities if not already in place; and,
ii) Provide emergency contacts and details of temporary sources of water supply should the source be adversely affected by quarry dewatering.

Each monitoring well will consist of bi–level monitors completed in the upper bedrock aquifer and unconfined aquifer, if encountered.

Monthly measurements of static water levels at the above locations, shall occur commencing with establishing monitoring wells.

A drop below the minimum monthly baseline static water level of 0.25 metres measured at the water source monitoring well, and a corresponding drop of greater amount measured at the intermediate monitoring well, consistently over a one month period during the June to October period shall initiate a detailed investigation as to the cause of the observed decline.

A drop below the minimum monthly baseline static water level of 0.5 metres within the aquifer supporting the livestock water supply measured at the water source monitoring well, and a corresponding drop of greater amount measured at the intermediate monitoring well, consistently over a 12 month period shall initiate the implementation of contingency measures to restore the observed decline in water levels.

The contingency measures to be implemented will vary depending on the cause of the observed decline and may include, but are not limited to, one or more of the following: 1) Diversion of dewatering activities to the affected water source through re–introduction of same into the aquifer(s) via re–injection wells, exfiltration trenches, or by overland ditching or piping, whichever is most appropriate; 2) Grouting (sealing) fissures that are causing excessive draining of the aquifer supporting the water source; and, 3) Termination of active dewatering attributed to the cause of observed drawdown.

Condition 6 - Complaint Resolution
Should a complaint by an affected landowner with respect to [illegible] water in a well or cattle dugout remain unresolved by the Operator, the complaint [illegible] arbitration at the cost of the Operator. (If the Operator [illegible] until such time the complaint or dispute is suspension.) Interim potable water supply and storage will be provided by the Operator for loss of domestic water source, and similarly a water supply and storage suitable for livestock [illegible] by the Operator until such time the complaint or dispute is resolved.

Condition 7 - Other
i) 72 hour detention of the 25 mm rainfall event shall be provided.
ii) Mobile fuel and chemical storage facilities are to be employed and located adjacent to the garage/shop area of respective parts. Storage units are to be located on concrete pads curbed to contain an equivalent volume of stored substance.
iii) Temporary erosion control measures such as rock check dams and siltation control fencing shall be constructed during stripping and berm construction and maintained until berms are stabilized with plantings.
iv) *The refueling and maintenance of haulage vehicles is to occur off–site except in emergency situations.*
v) Restoration of water supply per the Permit to Take Water applies to both surface and groundwater supplies.

DUST

i) Permanent plant location must be pre–approved by MNR.
ii) Dust suppression measures are to be employed during crushing, screening, conveying, and stockpiling to maintain a moisture content (1.5%).
iii) McNamee Rd. and Horncastle Rd surfaces are to be treated asphalt or surface treated within the first year of operations commencing, subject to the Haul Route Agreement with the local Municipality.
iv) 1 l/m2 of water to be applied every 8 hours during dry weather on all travelled surfaces not treated with asphalt or surface treatment. A Permit to Take Water is required for amounts in excess of 50,000 L/day.
i) First 200 m of internal haul road will be surface treated should off–site dust levels become a nuisance downwind of any site access points.

HAUL ROUTE

Subject to a Haul Route Agreements with the City of Kawartha Lakes and the County of Simcoe.

SITE PLAN REDLINE REVISIONS

Revisions to the circulated Site Plans include:
i) Establishing a 310 metre buffer strip (or excavation setback) from the north Licence limit within the W1/2 Lot 10, Concession 9 (reducing Phase 3 from 29 ha to 10 ha).
ii) Adding 42.7 ha located within the E1/2 Lot 10, Concession 9 to the Licence for shrike habitat and wetland buffer area, for a total Licence area of approximately 427.2 ha.

SITE PLAN CONDITION CONFLICTS

All those Conditions shown on the circulated Site Plans that are in conflict with the proposed amended Conditions shall be deleted.

LIAISON COMMITTEE

The Licensee shall give notice to the City of Kawartha Lakes and all residents, businesses and organizations within 1,500 metres of the quarry property, together with all residents along the haul route within the City of Kawartha Lakes, of their opportunity to be members of the Citizens Liaison Committee. The Committee shall be composed of a Municipal representative and any and all persons receiving such notice who wish to be members of the Committee. The first meeting of the Citizens Liaison Committee shall be organized by the Licensee and shall take place within six months of the issuance of the quarry license and prior to commencement of site operations. The Citizens Liaison Committee shall develop its own rules and procedures, and meet as often as it sees fit however; in the event that the Citizens Liaison Committee has not met for a period of twelve (12) months, the Licensee shall be responsible for organizing and hosting a meeting. The Committee shall be encouraged to keep minutes of its meetings and to submit such minutes annually to the Licensee and the Municipality. The Licensee, upon reasonable notice, shall make available to the Committee a representative of the Licensee knowledgeable about current site operations and authorized to make decisions for each meeting of the Committee. The Licensee shall also provide the Committee with a contact person and phone numbers so that the Committee may contact the Licensee in the event of a complaint or emergency. At the request of the Chairperson of the Citizens Liaison Committee the Licensee shall, upon 48 hours notice, allow a representative or representatives of the Committee access to the quarry to inspect the quarry and quarry operations. The Committee shall have access to any and all studies, reports and other documents submitted by the Licensee to the Ministry of Natural Resources, Ministry of Environment and any other government oversight body, with respect to the quarry and quarry operations.

OTHER APPROVALS

Permanent and Portable Plants, Air (Blasting, Noise & Dust) – Environmental Protection Act
Sump and Sump Discharge, Wash Plant, Amendments to Permit to Take Water, Injection Wells – Water Resources Act
Stream Diversions And Crossings with over 1.5 km2 drainage area – Lakes And Rivers Improvement Act
Official Plan Amendment And Rezoning (Prior To Licensing), Building Permits – City of Kawartha Lakes
Fuel Storage – Technical Standards and Safety Act
Discharge to surface water and stream work – Fisheries Act

OPERATING DETAILS

TONNAGE:
Initial extraction rate = ±250,000 tonnes/year, maximum extraction rate = 1,000,000 tonnes per year.

WATER TABLE:
Mining will occur below the existing water table.

SEQUENCE:
Phasing sequence is described schematically on the progressive rehabilitation and final rehabilitation plan. The sequence and limits of extraction may alter subject to material quality, market demand, dewatering impacts, loggerhead shrike nesting location(s), and various regulatory requirements.

1) Construct access road to Phase 1.
2) Within one year of commencing operations, erect and/or reinstate perimeter 1.2 m high post and wire fence around entire site, and construct entrance gate to north part. Existing access gates to south part to remain until operations relocate to the south part. Block off cattle access to the water course within three years of commencing operations.
3) Construct a ±950 m interceptor ditch (to occur in stages as mining advances north), at 0.35% grade having a minimum width of 2.0 m and depth of 1.0 m and outlet to swamp area. Install temporary siltation control measures, and stabilize disturbed areas outside of areas to be extracted with topsoil and seed.
4) Commencing in the north part – Phase 1, clear overburden and construct 9.0 m interim berm, 4.0 m east perimeter berm and south limit (north part) berm from east perimeter berm to interim berm, and stabilize with plantings.
5) Construct monitoring wells around perimeter of north part, and initiate monthly monitoring of groundwater levels and stream flows at all monitoring locations per Site Plan Conditions. Prepare for, and undertake, annual dewatering assessments and water quality monitoring requirements.
6) Conduct pre–blast survey of all surrounding structures within 500 m of license boundary, establish blast monitoring points, and monitor for first year of operation and adjust explosive charge per period as necessary to meet recommended blast vibration and overpressure. Contact the Ministry of Environment and Energy 24 hours prior to blasting.
7) Establish 5.0 m x 10 m scale house/office and install scales in southeast corner of Phase 1.
8) Erect 20 m x 50 m garage/shop and fuel storage facilities in southeast corner of Phase 1 when facilities are deemed necessary and subsequent to Phase 1 stripping and berm construction.
9) Phase 1, Stage 1 – initiate first sinking cut at sump "A" and proceed with extraction in a southerly direction. Construct temporary sump on floor of initial lift and install pumping system and outlet to constructed interceptor ditch to approved extraction depth elevation. Lower and move sump "A" dewatering system as mining proceeds and establish permanent sump as per recommended dimensions when final elevations are reached. Maintain bench width around perimeter of extraction.
10) Upon completing extraction in Stage 3, remove overburden from Phase 2 and 9.0 m interim berm screen. Establish 10 m to 12 m perimeter berm screens along the southerly and westerly limit of extraction within Phase 2 and stabilize with plantings. Construct all groundwater monitoring wells required for Phase 2 Clearance.
11) Phase 2, Stage 4 – extract first sinking cut working in a westerly direction and construct temporary sump at sump location "B". Install temporary sediment controls, construct and stabilize permanent sump outlet and install pumping system. Initiate subsequent lifts, and upon reaching final elevation, establish permanent sump per recommended dimensions.
12) Phase 2, Stage 5 – upon extracting Stage 4, extract the remainder of Phase 2 working towards the north and west.
13) Upon completing extraction in Stage 5, remove overburden from Phase 3 and establish 4.0 m and 12 m perimeter berm screens along remainder of the north part and stabilize with plantings.
14) Phase 3, Stage 6 – commence extraction working north.
15) Upon extracting Phase 3, complete final slopes around perimeter of extracted area by relocating berm and overburden material stockpiles to perimeter benches and stabilize with topsoil and hydroseed. Establish permanent drainage outfall adjacent to sump "B" and stabilize banks. All disturbed areas outside of areas to be flooded are to be reinstated with topsoil and hydroseed.
16) Remove all plant, machinery, stump stockpile, equipment, scrap, fuel storage facilities, and undertake a general site clean–up of any potential sources of contamination. Remove pump systems from the north part and allow to flood after slopes have stabilized. Final flood/lake elevation = ±264.5.
17) Construct main access gate to south part and close up all other remaining access points. Remove all remaining structures not required for mining activities.
18) Construct outfall ditch from sump "C". Install temporary siltation control measures, and stabilize disturbed areas outside of areas to be extracted with topsoil and seed.
19) Commencing in south part – Phase 4, clear overburden and construct 9.0 m interim berm, and 4.0 m and 10.0 m perimeter berm screens adjacent to road allowances; and stabilize with planting. Stockpile excess overburden along north perimeter of south part and similarly stabilize.
20) Construct groundwater monitoring wells required for Phase 4 Clearance around perimeter of south part, and continue monthly monitoring of groundwater levels and stream flows at all monitoring locations. Continue to undertake annual dewatering assessments and water quality monitoring requirements.
21) Conduct pre–blast survey of all new structures within 500 m of licensed boundary, establish blast monitoring points and monitor for first year of operation and adjust explosive charge per period as necessary to meet recommended blast vibration and overpressure.
22) Establish 5.0 m x 10 m scale house/office and install scales in southeast corner of Phase 4.
23) Erect 20 m x 50 m garage/shop and fuel storage facilities in southeast corner of Phase 4 when facilities are deemed necessary and subsequent to Phase 4 stripping and berm construction.
24) Phase 4, Stage 1 – Initiate first 10 m sinking cut at sump "C" and proceed with extraction in a northerly direction. Construct temporary sump on floor of first lift and install pumping system and outlet to constructed outfall. Initiate subsequent lifts (may occur in multiple lifts) when space permits to approved extraction depth elevation. Lower dewatering system as mining proceeds and establish permanent sump as per recommended dimensions when final elevations are reached. Maintain bench width around perimeter of extraction.
25) Phase 4, Stage 2 – upon extraction of Stage 1 proceed from sump "C" in a southerly direction.
26) Phase 4, Stage 3 – upon extraction of Stage 2 proceed south/north working in an overall direction towards the west limit of Phase 4.
27) Establish permanent plant within Phase 4 during extraction of Stage 3, 300 m from east licence boundary when space permits.
28) Upon completing extraction in Stage 3, remove overburden from Phase 5 and 9.0 m interim berm screen. Establish 10 m to 12 m perimeter berm screens along the southerly and westerly limit of extraction, and 3.0 m to 9.0 m transition berm along the northerly limit of extraction within Phase 5 and stabilize with plantings.
29) Phase 5, Stage 4 – extract first 10 m lift working in a westerly direction and construct temporary sump at sump location "D". Install temporary sediment controls, construct and stabilize permanent sump outlet and install pumping system. Initiate subsequent lifts, and upon reaching final elevation, establish permanent sump per recommended dimensions.
30) Phase 5, Stage 5 – upon extracting Stage 4, extract the remainder of Phase 5 working towards the south and west.
31) Upon extracting Phase 5, complete final slopes around perimeter of extract area by relocating berm and overburden/unmarketable material stockpiles to perimeter benches and stabilize with topsoil and hydroseed. Establish permanent drainage outfall adjacent to sump "D" and stabilize banks. All disturbed areas outside of areas to be flooded are to be reinstated with topsoil and hydroseed.
32) Remove all plant, machinery, stump stockpile, equipment, scrap, fuel storage facilities, and undertake a general site clean–up of any potential sources of contamination. Remove pump systems from the north part and allow to flood after slopes have stabilized. Final flood/lake elevation = ±264.0.

GENERAL NOTES

STRIPPING:
Topsoil is to be conserved by stripping, temporarily stockpiling, and stockpiled permanently by redistributing on top of berm screens constructed of stripped overburden material.

FINAL SLOPES:
Final slopes are to be established by relocating perimeter berm material and sloping at 3:1 (2:1 minimum) from original ground to the perimeter bench and stabilizing. Topsoil reserves stockpiled on berm screens must be stripped, temporarily stockpiled, then reapplied to final slopes and prepared for hydroseeding with crownvetch. Undesirable aggregate material is to be stockpiled on perimeter benches and utilized to progressively establish final perimeter slopes.

PORTABLE PLANT:
Portable processing plant to be located onto the floor of initial lift when sufficient space is available and similarly to the floor of lower lift when space permits. Maintain portable plant in a position of 30 to 50 m from west working face while in use.

STOCKPILES:
Aggregate stockpiles are to be located in vicinity of the processing plant and are to be limited to 15 m high above original surrounding grade elevation. Stockpiles are to be relocated onto the floor of respective lifts when space permits. Overburden and topsoil are to be stockpiled at berm locations.

SUMPS:
Sump size requirements (depth x length x width in metres): A = 3 x 64 x 60; B = 3 x 100 x 90; C = 3 x 50 x 45; D = 3 x 60 x 45. Pump intakes to be within sub–sumps two metres deep below the base of each sump.

PLANTINGS:
The face of perimeter berm screens within 100 m of side road 5/6 (McNamee Rd) and Concession Road IX (Shrike Rd) are to be planted with two staggered rows spaced 4.0 m apart consisting of one row of 0.5 m high white spruce and one row of 1.5 m high poplar planted 4.0 m on–centre, respectively. Disturbed areas, and overburden/topsoil berm screens are to be stabilized with 50 to 75 mm of topsoil and hydroseed consisting of grass mixtures. All existing vegetable screens and plantings are to be maintained and replaced as required. Final perimeter slopes are to be hydroseeded with a compatible mixture of crownvetch.

SCRAP:
All scrap material is to be removed from site.

EQUIPMENT:
Rock drill (Ingersoll Rand DM8 with down the hole hammer)
Front end loader (Caterpillar 988B or Michigan 275)
Portable primary crusher (Cedarapids 30 x 42 or equal)
Portable secondary crusher (Cedarapids 800 or equal)
Portable screening plant (Cedarapids 5 x 16, 3 deck or equal)
Portable conveyors
Mist sprayers for dust suppression
Processing equipment power supply (V12 GM Diesel & generator)
Stripping (Cat 235 plus tandem/triaxel dump trucks)
Scale (soft truck semi portable)
Permanent plant (to be determined)
Water tank truck for dust suppression

OPERATING HOURS:
No operations will occur on Sundays or legal holidays (Also, see Loggerhead Shrike Guidelines).

Drilling Monday to Friday, 7:00 to 17:00
Blasting Monday to Friday, at 13:00 on the hour (or at an alternate time as necessary to minimize disturbance).
Processing Monday to Friday, 6:00 to 19:00; and Saturday, 6:00 to 12:00
Off Site Haulage As per processing, excluding periods of half load restrictions.

OTHER LAND USES:
Open space and agricultural (cattle range). The south part will remain as grazing land/swamp/forest until extraction within the north part is completed.

KEY MAP 1000 0 1000 2000 SCALE 1:50000

NOTES

1. LICENSED AREA – 427.2 ha
2. AREA OF EXTRACTION SOUTH PART – 58.3 ha; NORTH PART – 127.9 ha; TOTAL 186.2 ha
3. AREA TO BE REHABILITATED S. PART – 71.5 ha; N. PART – 163.0 ha; TOTAL 234.5 ha
4. THE WATER TABLE ELEVATION RANGES BETWEEN 260 AND 272, AND BETWEEN 0 m AND 5 m BELOW THE GROUND SURFACE AS RECORDED BY FIELD SURVEY.
5. THIS PLAN WAS PREPARED USING PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHS.
6. LOT, CONCESSION AND BOUNDARY LINES ON THIS PLAN ARE APPROXIMATE.
7. THIS IS NOT A LEGAL SURVEY DRAWING IN ACCORDANCE WITH THE PROVINCE OF ONTARIO SURVEYORS ACT 1987.

▲2	STREAM FLOW MONITORING POINT
3:1	TOP OF SLOPE ANGLE OF SLOPE (HORIZ. TO VERT.) BOTTOM OF SLOPE
268.20	EXISTING ELEVATION
270	2.0m CONTOUR INTERVAL
	TREES / BUSH
CREEK	DRAINAGE COURSE & FLOW DIRECTIONS
←	GENERAL SURFACE DRAINAGE DIRECTION
BD	BEAVER DAM
	SWAMP
W/L 270.10	POND AND WATER LEVEL
● ●	HYDRO / TELEPHONE POLES
H 5mx7m, B 20x15, S 15x7, G 4x5, C 5x6	BUILDINGS (HOUSE–BARN–SHED–GARAGE–COTTAGE) DIMENSIONS
W12/BH 5A	MONITORING WELL/PIEZOMETER LOCATION & NUMBER
P&W 1.2m S.R.	FENCE TYPE & HEIGHT (P & W-POST & WIRE) (S.R.-SPLIT RAIL)
	GATE
	ASSUMED ROAD/INTERNAL ROAD
	UNASSUMED ROAD
	TRAIL
◀▶	ENTRANCE / EXIT
	LOT/CONCESSION LINE
	ZONE BOUNDARY FOR OI
AI OI MI	ZONING (AI - RURAL GENERAL) (OI - OPEN SPACE) (MI-INDUSTRIAL EXTRACTIVE)
●	PUMP(S) LOCATION
	BOUNDARY OF LICENSED AREA
30m SETBACK	EXTRACTION LIMIT & SETBACK DISTANCE
	OBSERVATION WELL
232.0	FINAL ELEVATION
	500m INFORMATION AREA LIMIT LINE
A	CROSS SECTION/PROFILE NUMBER & LOCATION
	PHASE LIMIT
2	DIRECTION OF EXTRACTION & SEQUENCE
▨	STUMP STOCK PILE AREA
70% 10–15m POPLAR	AVERAGE TREE SPECIES % COVERAGE & HEIGHT
W/P	LOCATION OF POSSIBLE FUTURE MONITORING WELLS (W) OR PIEZOMETERS (P)

THIS SITE PLAN IS PREPARED FOR SUBMISSION TO THE MINISTRY OF NATURAL RESOURCES IN CONJUNCTION WITH AN APPLICATION FOR A CLASS A LICENCE UNDER THE AGGREGATE RESOURCES ACT AND REGULATIONS.

FERMA AGGREGATES INC.
2666 RENA ROAD
MISSISSAUGA, ONTARIO
L4T 3C8
Telephone:(905)677-9241 Fax:(905)677-9817

04/28/03
SIGNATURE OF LICENSEE DATE

AMENDMENTS	DATE APPROVED
SITE PLANS APPROVED BY MINISTRY OF NATURAL RESOURCES SIGNATURE DATE	

J. S. GOURLEY
Apr 25/03

THESE PLANS WERE DESIGNED TO ENSURE COMPLETE PRACTICALITY DURING THE OPERATIONS, PROGRESSIVE REHABILITATION AND FINAL REHABILITATION OF THE LICENSED PROPERTY

Trow Associates Inc.
Parent Company of
OLIVER MANGIONE McCALLA
& ASSOCIATES LIMITED

561 BRYNE DRIVE UNIT D
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MINISTRY OF NATURAL RESOURCES
93-8977
PLANS APPROVED
UNDER THE AGGREGATE RESOURCES ACT
AGGREGATE RESOURCES OFFICER
DATE April 28/03

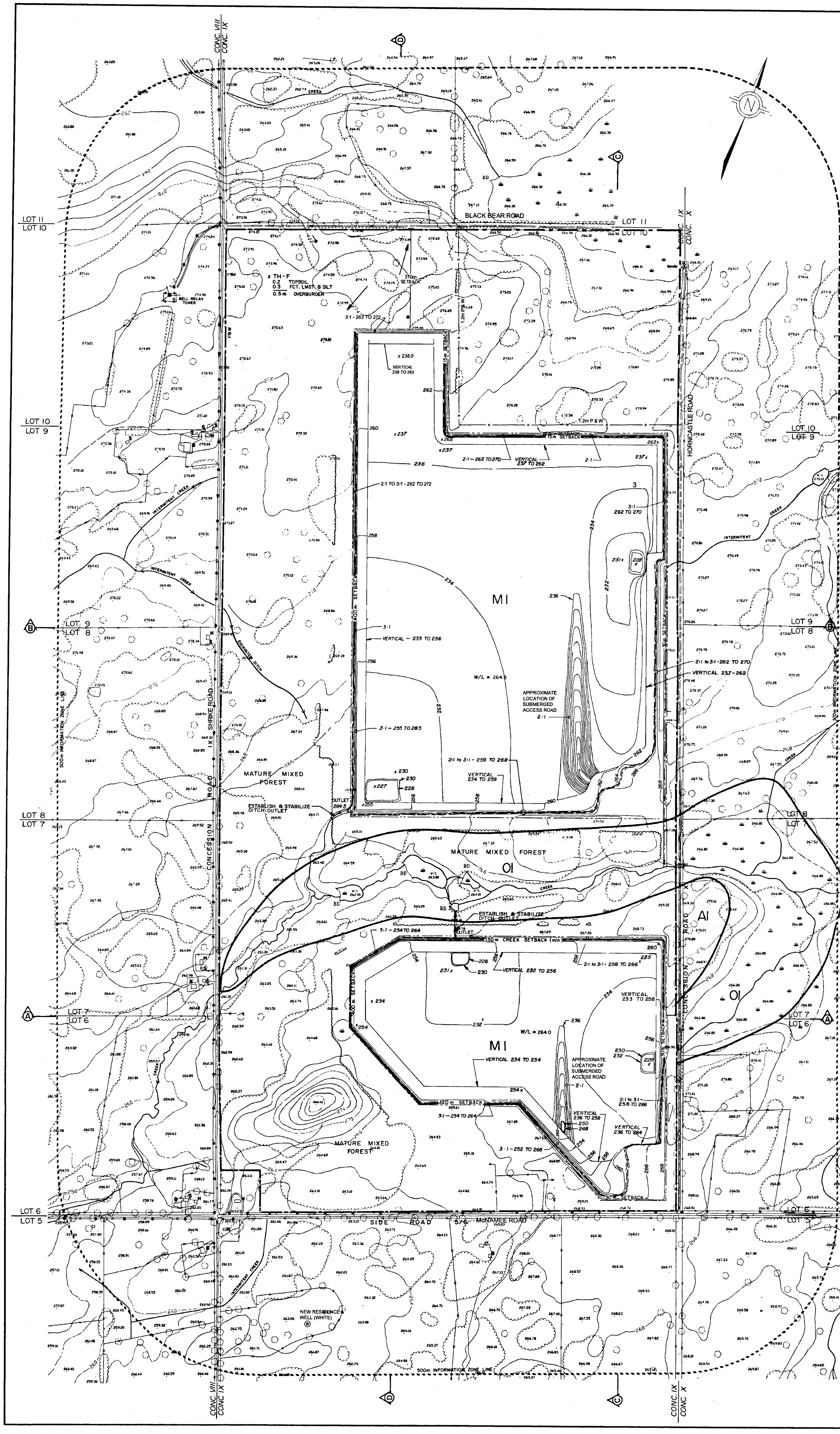
FERMA-CARDEN QUARRY

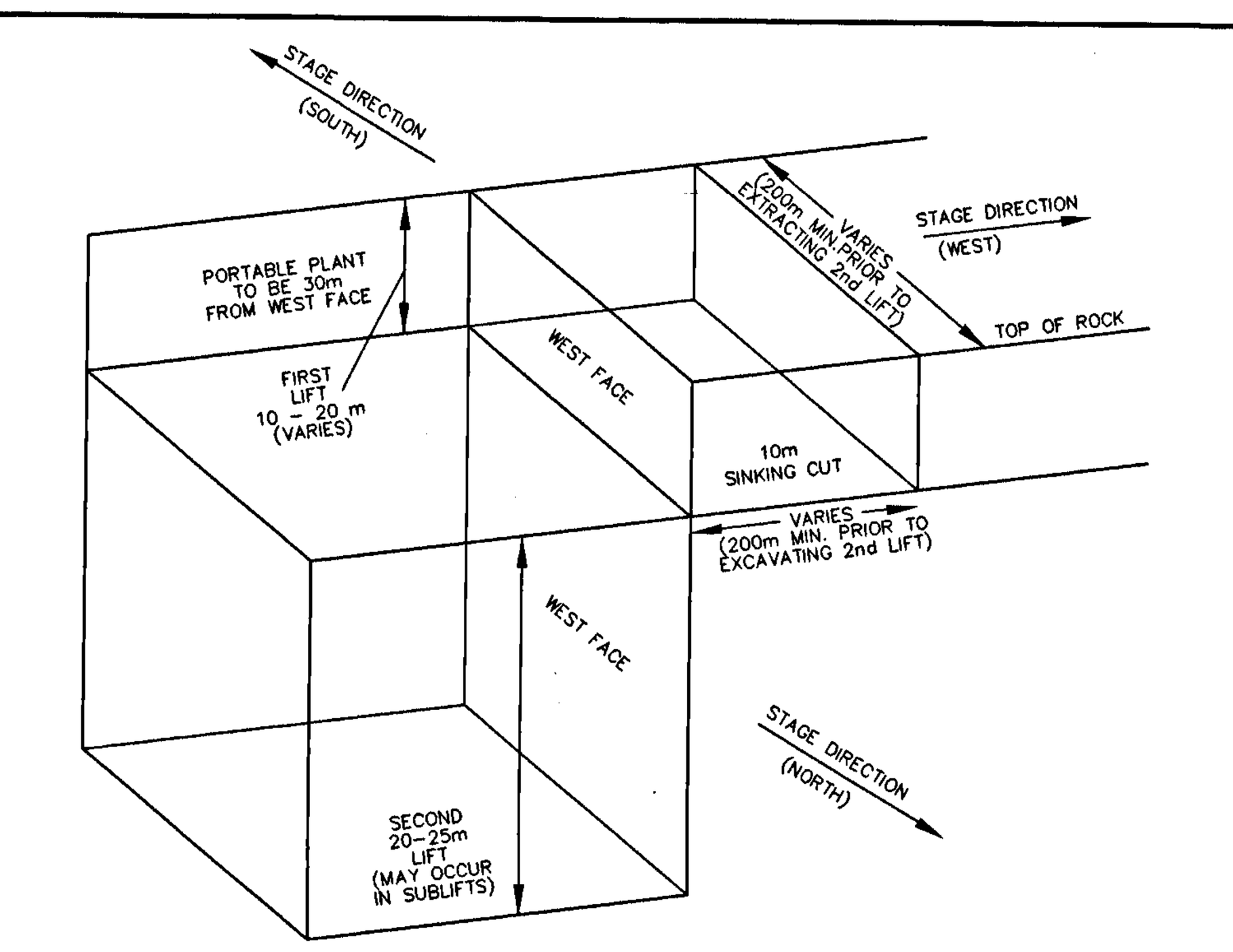
LOTS 6,7,8,9,& 10
CONCESSION IX
TOWNSHIP OF CARDEN
CITY OF KAWARTHA LAKES

OPERATIONAL PLAN

PAGE 2 OF 5				
PHOTO SCALE 1:16000	ROLL No. 87–4426	PHOTO Nos. 188 – 190	LINE No. 3	PHOTO DATE MAY 1987
MAP SCALE AS SHOWN	CONTOUR INTERVAL 2.0 m	DATE OF SITE PLAN APRIL 2003		

100 0 100 200 300 400m
1:5000





TYPICAL EXTRACTION PATTERN RELATIVE TO WEST DIRECTION

REFERENCE MATERIAL

OLIVER, MANGIONE, MCCALLA & ASSOCIATES LIMITED, "HYDROTECHNICAL REPORT", APRIL 1995.

FINAL REHABILITATION

1) FINAL SLOPES ARE TO BE ESTABLISHED BY RELOCATING PERIMETER BERM MATERIAL OR UNMARKETABLE MATERIAL AND SLOPING AT 3:1 (2:1 MINIMUM) FROM ORIGINAL GROUND TO THE PERIMETER BENCH AND STABILIZING. TOPSOIL RESERVES STOCKPILED ON BERM SCREENS MUST BE STRIPPED, TEMPORARILY STOCKPILED, THEN REAPPLIED TO FINAL SLOPES AND PREPARED FOR HYDROSEEDING WITH A MIXTURE OF CROWMVETCH. UNDESIRABLE AGGREGATE MATERIAL IS TO BE UTILIZED TO PROGRESSIVELY ESTABLISH FINAL PERIMETER SLOPES.

2) REMOVE ALL PLANT, MACHINERY, STUMP STOCKPILE, EQUIPMENT, SCRAP, FUEL STORAGE FACILITIES, AND UNDERTAKE A GENERAL SITE CLEAN-UP OF ANY SOURCE OF POTENTIAL CONTAMINATION. REMOVE PUMP SYSTEMS AND ALLOW TO FLOOD AFTER PERIMETER SLOPES HAVE STABILIZED.

3) FINAL NORTH PART LAKE ELEVATION = ±264.5 WITH OUTLET AT SOUTHWEST CORNER OF LAKE. FINAL SOUTH PART LAKE ELEVATION = ±264.0 WITH OUTLET AT NORTH SIDE NEAR WEST END OF LAKE. ESTIMATED FINAL WATER LEVELS ARE BASED ON TOPOGRAPHIC INTERPOLATION OF CONTROLLING ELEVATIONS.

4) INTERCEPTOR DITCH ON EAST LIMIT OF NORTH PART TO REMAIN TO AVOID THE POSSIBILITY OF LAKE CONTAMINATION BY SURFACE RUNOFF FROM UPSTREAM AGRICULTURAL LANDS.

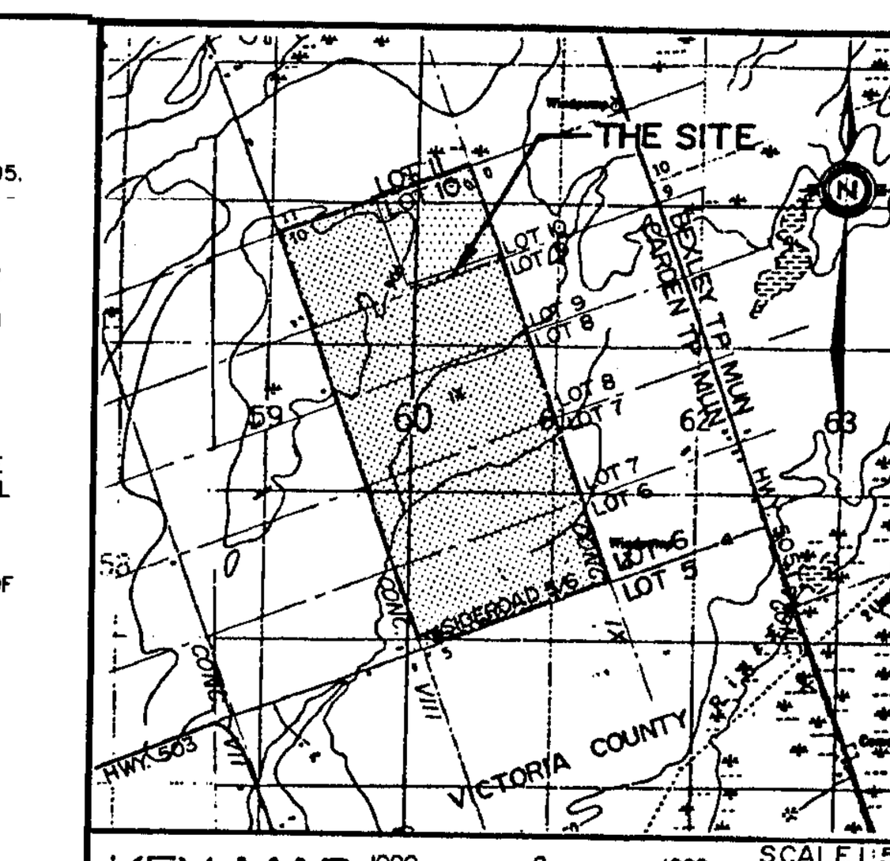
5) UPON SITE FINAL REHABILITATION, THE APPLICABLE PROPOSED LAND USE DESIGNATION UNDER THE PRESENT OFFICIAL PLAN WOULD BE SHORELINE. APPLICABLE ZONING CATEGORIES WOULD INCLUDE: C3 – COMMERCIAL RECREATION, OR C4 – COMMERCIAL CAMPGROUND, OR RR2 – RURAL RESIDENTIAL TYPE TWO.

MINISTRY OF NATURAL RESOURCES

PLANS APPROVED
UNDER THE AGGREGATE RESOURCES ACT

AGGREGATE RESOURCES OFFICER

DATE April/28/03

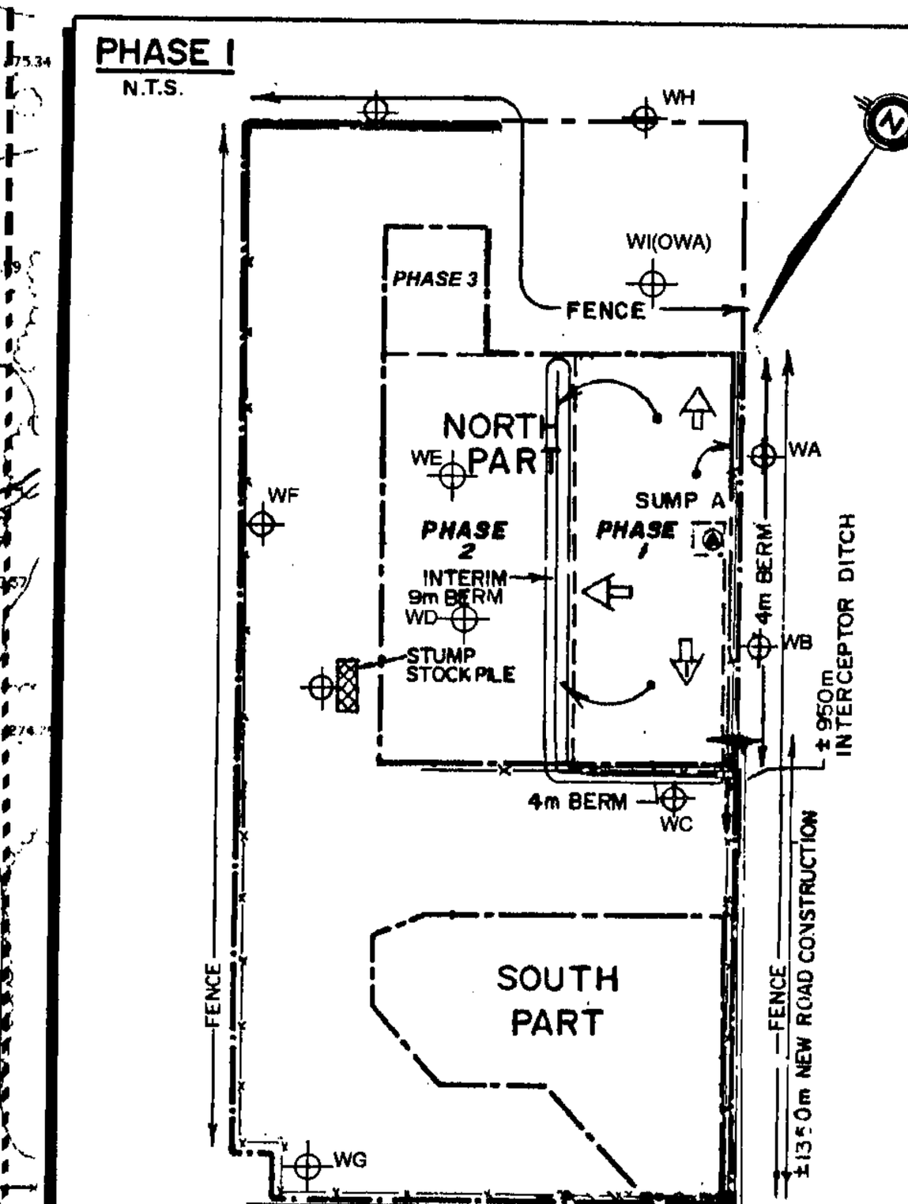


KEY MAP 1000 0 1000 2000 SCALE 1:50000

NOTES

1. LICENSED AREA – 427.2 ha
2. AREA OF EXTRACTION — SOUTH PART – 58.3 ha; NORTH PART – 127.9 ha; TOTAL 186.2 ha
3. AREA TO BE REHABILITATED — S. PART – 71.5 ha; N. PART – 163.0 ha; TOTAL 234.5 ha
4. THE WATER TABLE ELEVATION RANGES BETWEEN 258.0 AND 273.0, AND BETWEEN 0.0 m AND 14 m BELOW THE GROUND SURFACE AS RECORDED BY FIELD SURVEY.
5. THIS PLAN WAS PREPARED USING PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHS.
6. LOT, CONCESSION AND BOUNDARY LINES ON THIS PLAN ARE APPROXIMATE.
7. THIS IS NOT A LEGAL SURVEY DRAWING IN ACCORDANCE WITH THE PROVINCE OF ONTARIO SURVEYORS ACT 1987.

PHASE 1
N.T.S.

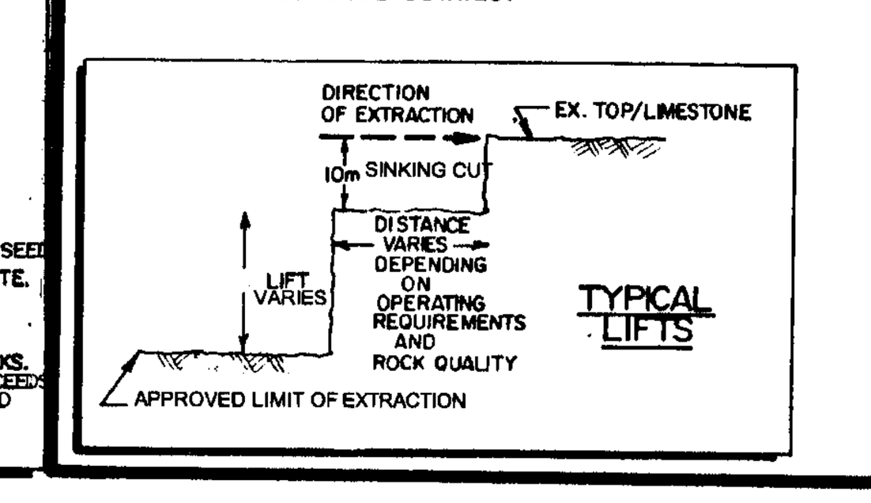


- IMPROVE SIDEROAD 5/6 TO HWYS 502 & 505
- INSTALL ADDITIONAL MONITORING WELLS AS REQUIRED
- CONSTRUCT INTERCEPTOR DITCH
- STRIP PHASE 1 & CONSTRUCT INTERIM & PERIMETER BERM & STABILIZE WITH SEED
- REINSTATE/ERECT PERIMETER 1.2 m POST & WIRE FENCING & ERECT ENTRANCE GATE.
- CONSTRUCT ±1350m OF MUNICIPAL ROAD & IMPROVEMENTS TO SIDEROAD 5/6
- ESTABLISH SCALE HOUSE & OFFICE.
- EXTRACT PH. 1 – STAGE 1 & CONSTRUCT SUMP A, AND INSTALL DEWATERING WORKS.
- ESTABLISH FINAL SLOPES ON PERIMETER BENCH AS EXTRACTION PROCEEDS USING UNMARKETABLE AGGREGATE, STABILIZE WITH TOPSOIL & HYDROSEED
- EXTRACT STAGES 2 THEN 3
- STAGES TO OCCUR IN SEQUENTIAL LIFTS

LEGEND

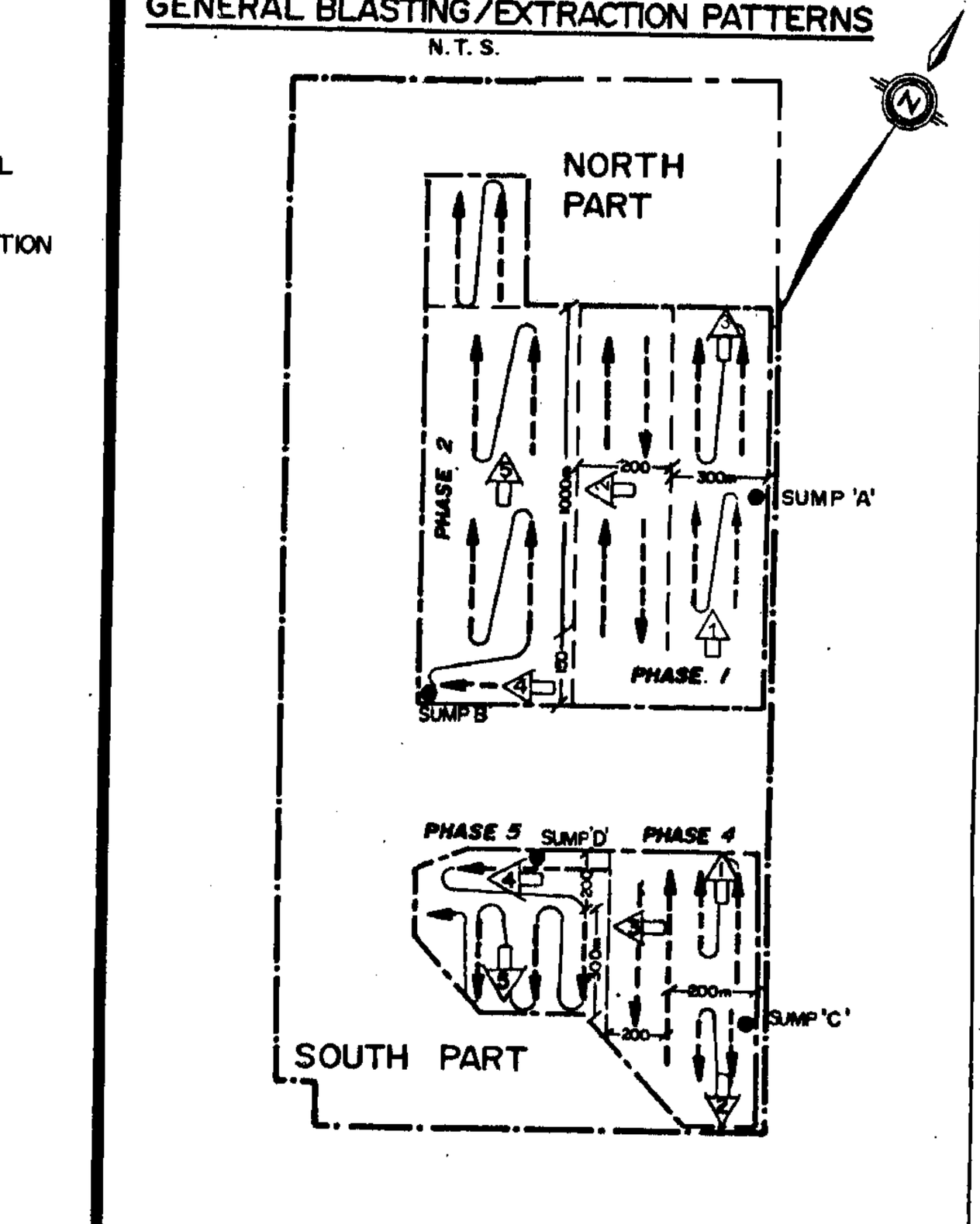
- PROPOSED MONITORING WELL
- STAGE & DIRECTION OF EXTRACTION
- PHASE LIMIT
- TREES
- FENCE
- BERMS
- DITCH / DRAINAGE OUTLET
- PUMP(S)
- SLOPE
- ENTRANCE / EXIT
- OVERBURDEN RELOCATION

NOTE: REFER TO OPERATIONAL PLAN FOR PHASE SEQUENCE DETAILS.



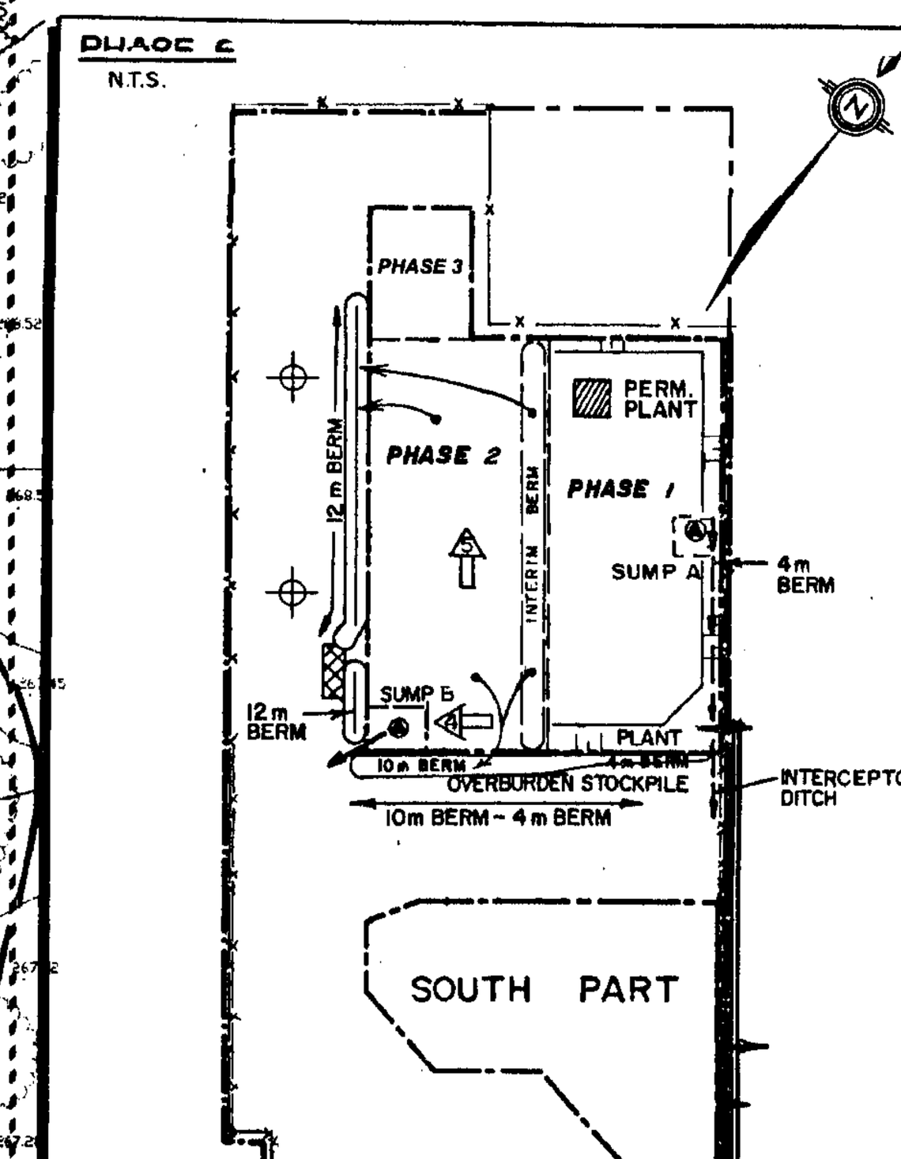
TYPICAL LIFTS

GENERAL BLASTING/EXTRACTION PATTERNS
N.T.S.



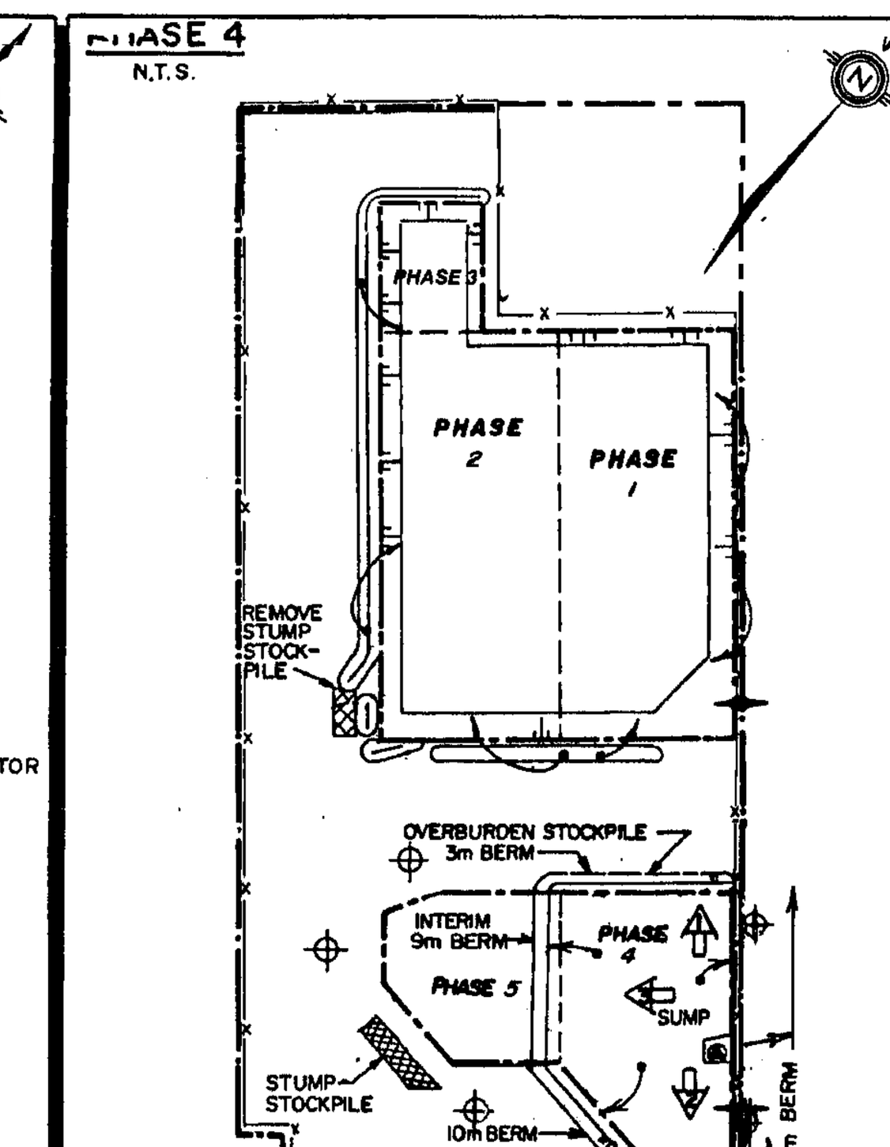
- PROPOSED BLASTING/EXTRACTION PATTERNS ARE BASED ON DRAINAGE & NOISE ATTENUATION REQUIREMENTS.
- PORTABLE PLANT TO BE WITHIN 30-50m OF WEST FACE
- GENERAL PATTERN IS NORTH / SOUTH WITH OVERALL PROGRESSION TOWARDS THE WEST.

PHASE 2
N.T.S.



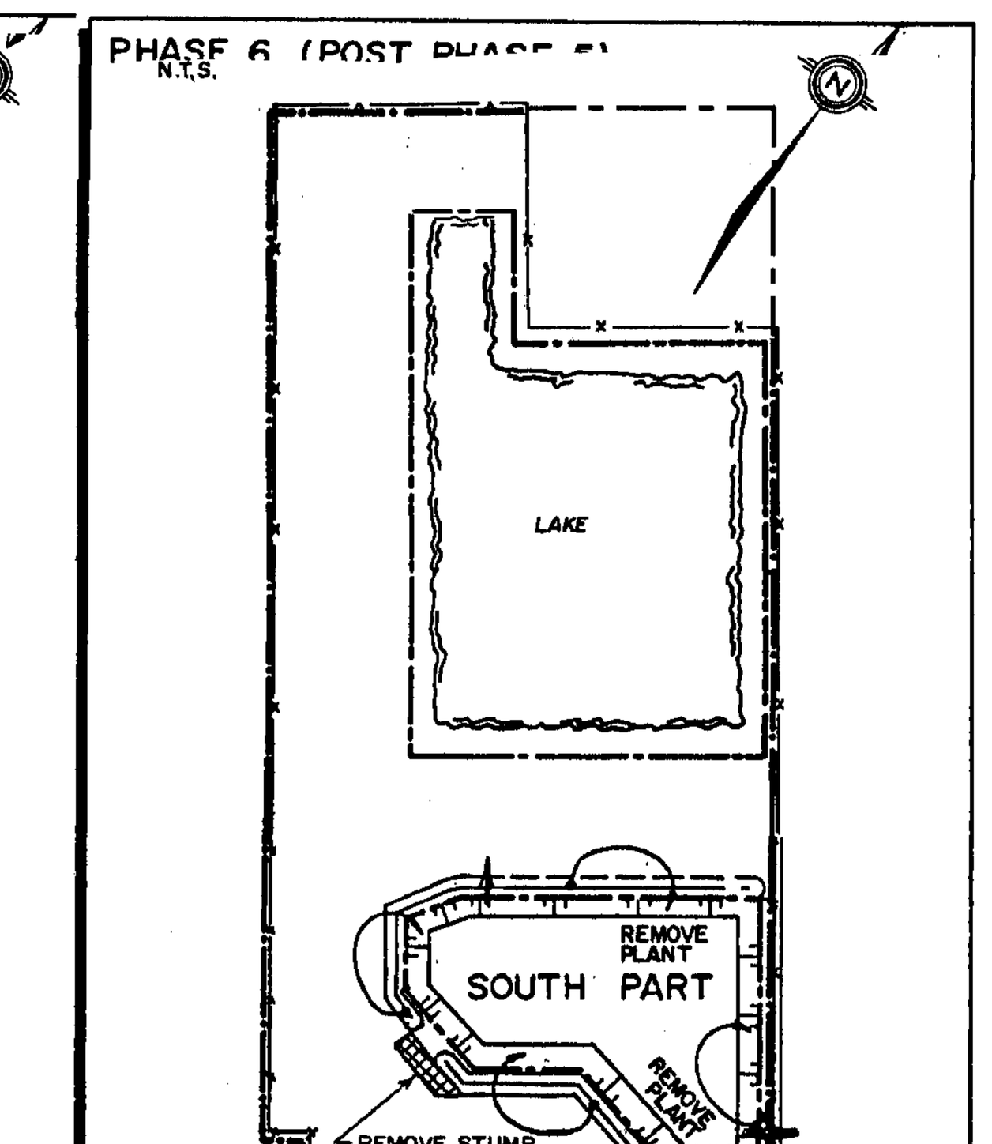
- ERECT PERMANENT IN PHASE 1 PLANT SHOULD PRODUCTION WARRENT
- PROGRESSIVELY STRIP PHASE 2, REMOVE INTERIM BERM & CONSTRUCT PERIMETER BERMS
- PLANT PERIMETER BERMS
- EXTRACT PHASE 2 - STAGE 4 & CONSTRUCT SUMP B & OUTLET DITCH, INSTALL DEWATERING WORKS
- EXTRACT PHASE 2 - STAGE 5. • STAGES TO OCCUR IN SEQUENTIAL LIFTS
- INSTALL ADDITIONAL MONITORING WELLS AS REQUIRED
- ESTABLISH FINAL SLOPES ON PERIMETER BENCH AS EXTRACTION PROCEEDS USING UNMARKETABLE AGGREGATE, STABILIZE WITH TOPSOIL & HYDROSEED

PHASE 4
N.T.S.



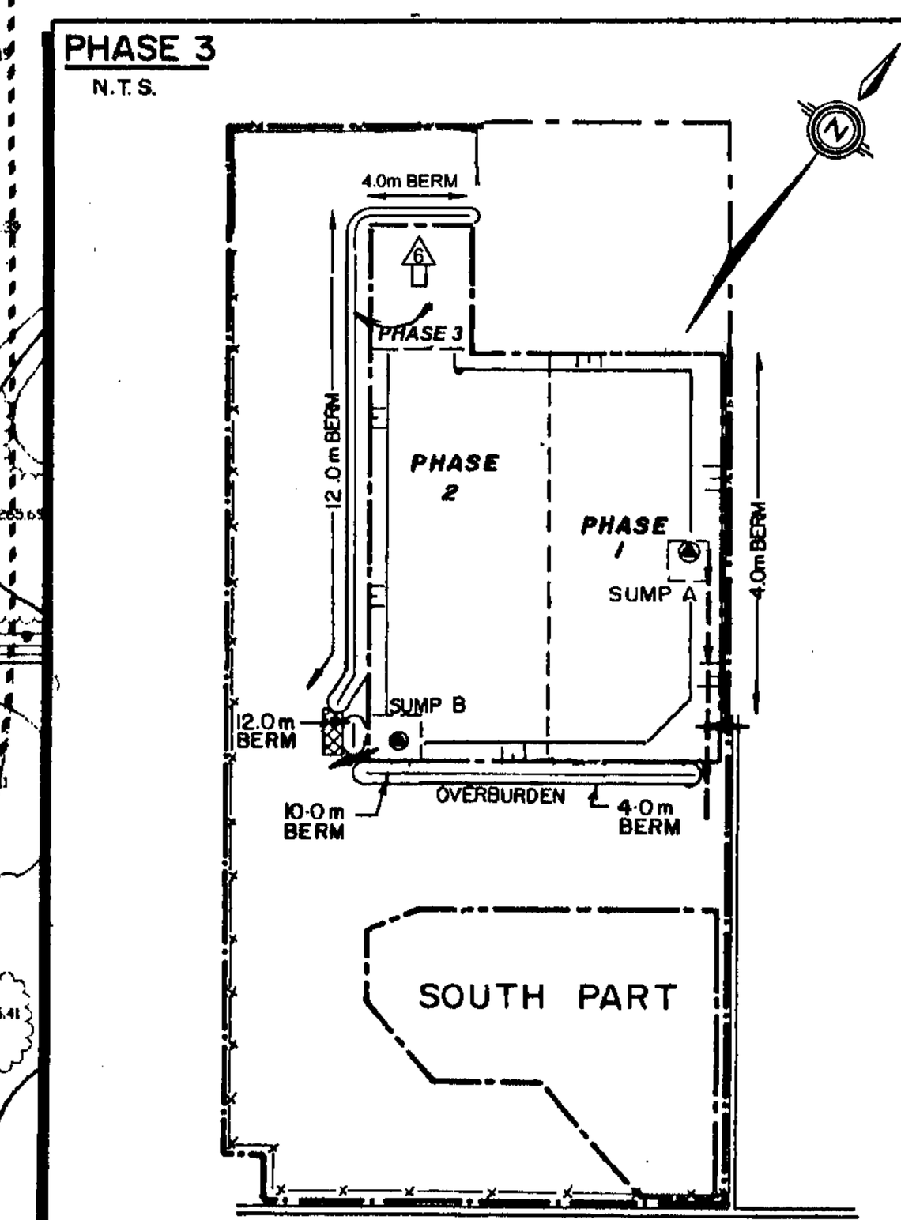
- INSTALL ADDITIONAL MONITORING WELLS AS REQUIRED
- MOVE SCALE HOUSE, OFFICE TO S. PART & REMOVE PERMANENT PLANT
- PROGRESSIVELY STRIP PHASE 4, CONSTRUCT INTERIM & PERIMETER BERM, PLANT TREES & STABILIZE WITH TOPSOIL & SEED
- EXTRACT PHASE 4 - STAGE 1, CONSTRUCT SUMP C & INSTALL DEWATERING WORKS.
- CONCURRENTLY COMPLETE FINAL SLOPES AROUND PERIMETER OF N. PART
- EXTRACT PHASE 4 - STAGE 2. • STAGES TO OCCUR IN SEQUENTIAL LIFTS

PHASE 6 (POST PHASE 5)
N.T.S.



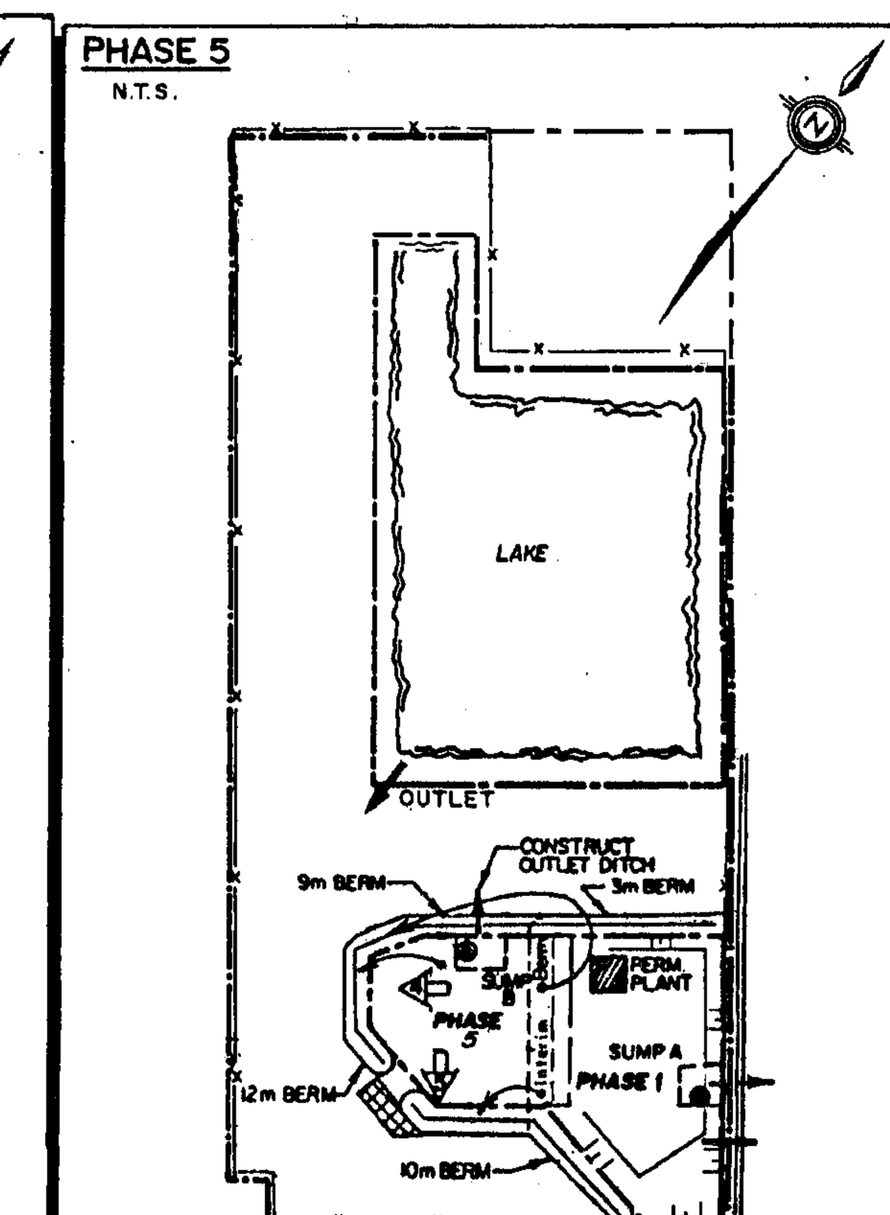
- COMPLETE EXTRACTION OF SOUTH PART - STAGE 5
- REMOVE SCALEHOUSE, OFFICE, PLANT & STUMP STOCKPILE
- COMPLETE FINAL SLOPES AROUND PERIMETER OF SOUTHERN PART

PHASE 3
N.T.S.



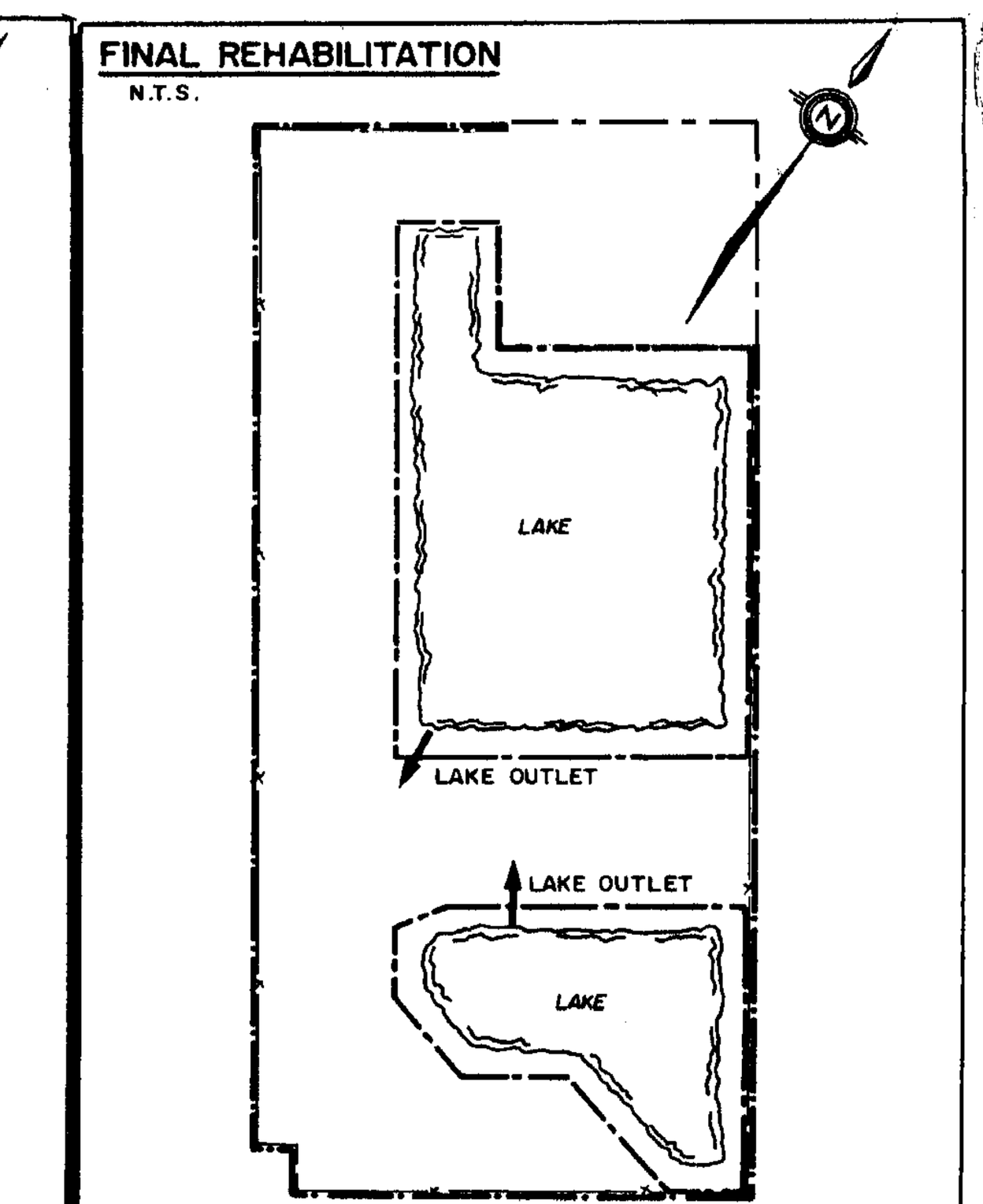
- STRIP PHASE 3 & CONSTRUCT REMAINING PERIMETER BERM SCREEN & STABILIZE
- PLANT TREES ON PERIMETER BERM
- EXTRACT PHASE 3-STAGE 6. STAGES TO OCCUR IN SEQUENTIAL LIFTS
- ESTABLISH FINAL SLOPES ON PERIMETER BENCH AS EXTRACTION PROCEEDS USING UNMARKETABLE AGGREGATE, STABILIZE WITH TOPSOIL & HYDROSEED

PHASE 5
N.T.S.



- ERECT PERMANENT PLANT SHOULD PRODUCTION WARRENT
- REMOVE INTERIM BERM & STRIP PHASE 5
- CONSTRUCT REMAINING PERIMETER BERMS & PLANT
- EXTRACT PHASE 5 - STAGE 4 & CONSTRUCT SUMP D & OUTLET DITCH, INSTALL DEWATERING WORKS
- EXTRACT PHASE 5 - STAGE 5.
- STAGES TO OCCUR IN SEQUENTIAL LIFTS
- ESTABLISH FINAL SLOPES ON PERIMETER BENCH AS EXTRACTION PROCEEDS USING UNMARKETABLE AGGREGATE, STABILIZE WITH TOPSOIL & HYDROSEED
- INSTALL ADDITIONAL MONITORING WELLS AS REQUIRED

FINAL REHABILITATION
N.T.S.



- PROPOSED POST REHABILITATION DEVELOPMENT PLAN TO BE APPROVED BY MUNICIPALITY PRIOR TO REZONING FROM INDUSTRIAL EXTRACTIVE TO COMMERCIAL / RECREATIONAL OR RURAL RESIDENTIAL.
- ALL WELLS NO LONGER USE ARE TO BE REMOVED

LEGEND

Symbol	Description
x 228	FINAL ELEVATION
268.20	EXISTING ELEVATION
270	2.0m CONTOUR INTERVAL
	TREES / BUSH
CREEK	DRAINAGE COURSE & FLOW DIRECTIONS
	GENERAL SURFACE DRAINAGE DIRECTION
BD	BEAVER DAM
	SWAMP
W/L 270.10	POND AND WATER LEVEL
	HYDRO / TELEPHONE POLES
W/L	WATER LEVEL
H 5m x 7m, B 20 x 15, S 15 x 7, G 4 x 5, C 5 x 6	BUILDINGS (HOUSE-BARN-SHED-GARAGE-COTTAGE) DIMENSIONS
P&W, 1.2m, S.R.	FENCE TYPE & HEIGHT (P & W - POST & WIRE) (S.R. - SPLIT RAIL)
	GATE
	ASSUMED ROAD
	UNASSUMED ROAD
	TRAIL
	ENTRANCE / EXIT
	LOT / CONCESSION LINE
	ZONE BOUNDARY FOR OI
AI OI MI	ZONING (AI - RURAL GENERAL) (OI - OPEN SPACE) (MI - INDUSTRIAL EXTRACTIVE)
	AGRICULTURAL LAND CLASSIFICATION
	BOUNDARY OF LICENSED AREA
30m SETBACK	EXTRACTION LIMIT & SETBACK DISTANCE
30m SETBACK	PROPOSED SETBACK DISTANCE
	500m INFORMATION AREA LIMIT LINE
A	CROSS SECTION / PROFILE NUMBER & LOCATION
	WELL
	WATER LINE
3:1	ANGLE OF SLOPE (VERT. TO HORIZ.)
N.T.S.	NOT TO SCALE

THIS SITE PLAN IS PREPARED FOR SUBMISSION TO THE MINISTRY OF NATURAL RESOURCES IN CONJUNCTION WITH AN APPLICATION FOR A CLASS A LICENCE UNDER THE AGGREGATE RESOURCES ACT AND REGULATIONS.

FERMA AGGREGATES INC.
2666 RENA ROAD
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Telephone: (905)677-9241 Fax: (905) 677-9817

SIGNATURE OF LICENSEE — DATE 04/28/03

AMENDMENTS	DATE APPROVED
SITE PLANS APPROVED BY MINISTRY OF NATURAL RESOURCES SIGNATURE DATE	

REGISTERED PROFESSIONAL ENGINEER — J. S. GOURLEY — PROVINCE OF ONTARIO — Apr 28/03

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92-8977

FERMA-CARDEN QUARRY

LOTS 6,7,8,9, & 10
CONCESSION IX
TOWNSHIP OF CARDEN
CITY OF KAWARTHA LAKES

PROGRESSIVE REHABILITATION & FINAL REHABILITATION

PAGE 3 OF 5

PHOTO SCALE	ROLL No.	PHOTO Nos.	LINE No.	PHOTO DATE
1:16000	87-4426	188 – 190	3	MAY 1987

MAP SCALE	CONTOUR INTERVAL	DATE OF SITE PLAN
AS SHOWN	2.0 m	DECEMBER 2002

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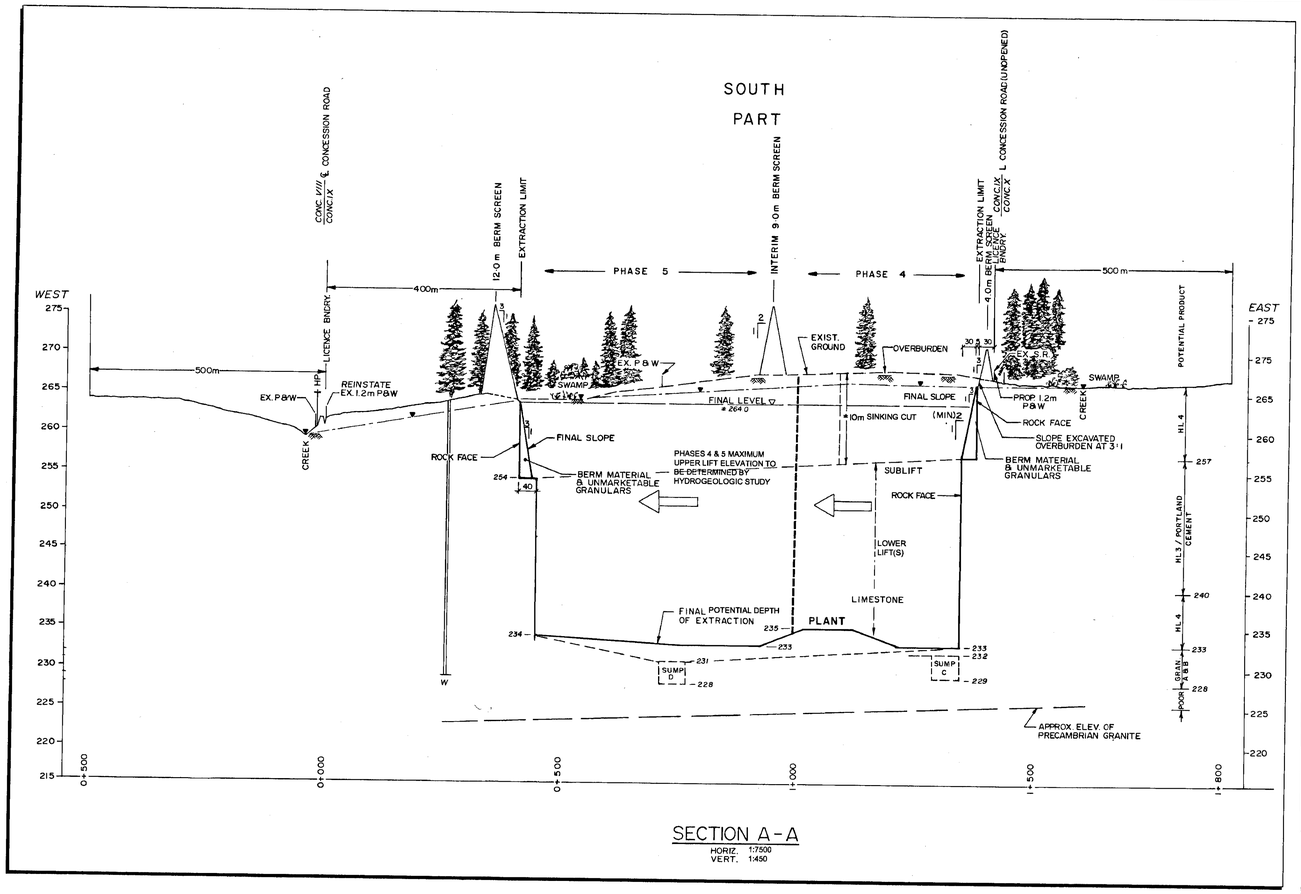
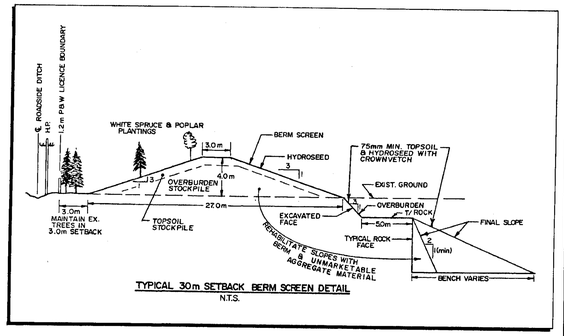
1:5000



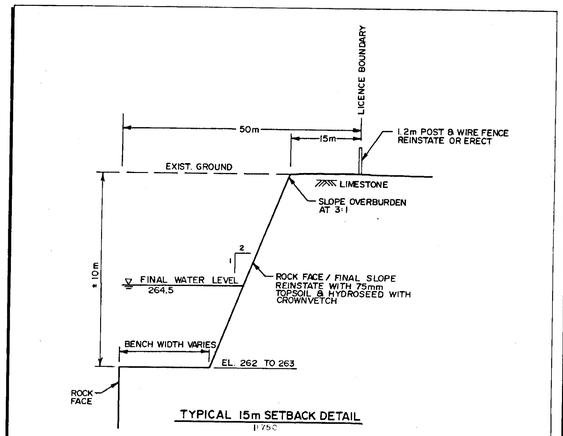
SECTION A-A

HORIZ. 1:7500
VERT. 1:450



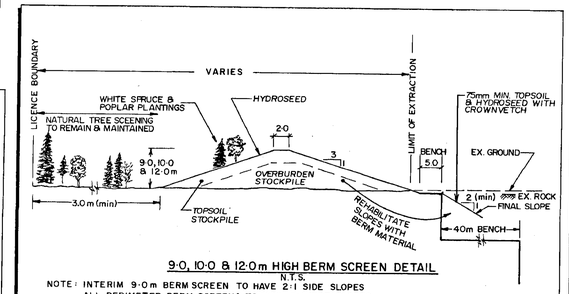
TYPICAL 30m SETBACK BERM SCREEN DETAIL

N.T.S.



TYPICAL 15m SETBACK DETAIL

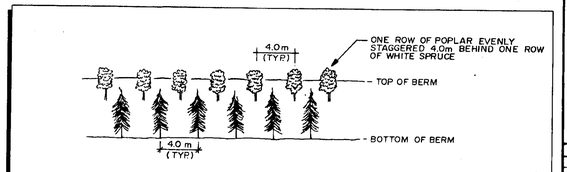
N.T.S.



9.0, 10.0 & 12.0m HIGH BERM SCREEN DETAIL

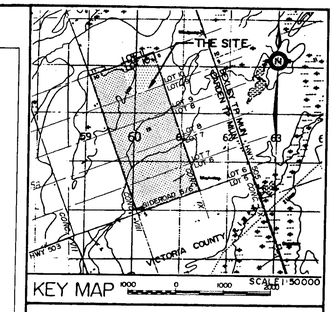
N.T.S.

NOTE: INTERIM 9.0m BERM SCREEN TO HAVE 2:1 SIDE SLOPES
ALL PERIMETER BERM SCREENS TO HAVE 3:1 SIDE SLOPES



TYPICAL PERIMETER BERM SCREEN TREE PLANTING SEPARATION

N.T.S.



KEY MAP 1000 0 1000 SCALE 1:50000

NOTES

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5. THIS PLAN WAS PREPARED USING PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHS.
6. LOT, CONCESSION AND BOUNDARY LINES ON THIS PLAN ARE APPROXIMATE.
7. THIS IS NOT A LEGAL SURVEY DRAWINGS IN ACCORDANCE WITH THE PROVINCE OF ONTARIO SURVEYORS ACT 1987.

LEGEND FOR CROSS SECTIONS

P	BI-LEVEL PIEZOMETER
▼	WATER TABLE
P&W	POST & WIRE FENCE
S.R.	SPLIT RAIL FENCE
	TOP OF LIMESTONE
▽	FINAL SURFACE WATER LEVEL
2 / 1	3 TO 1 HORIZ. TO VERT. SLOPE
BH 7	BORE HOLE LOCATION & NUMBER
A	PIEZOMETER LOCATION & LEVEL
W2	WELL LOCATION & NUMBER
	GENERAL DIRECTION OF EXTRACTION
	PHASE BOUNDARY
W	150 DIA. MONITORING WELL
HL 4	MATERIAL SUITABLE FOR ASPHALT BASE COURSE MIX
HL 3	MATERIAL SUITABLE FOR ASPHALT TOP COURSE MIX
PORTLAND CEMENT	MATERIAL SUITABLE FOR PORTLAND CEMENT CONCRETE
GRAN. 'A' & 'B'	MATERIAL SUITABLE FOR ROAD BASE CONSTRUCTION
N.T.S.	NOT TO SCALE
	WORKING FACE / LIFT

THIS SITE PLAN IS PREPARED FOR SUBMISSION TO THE MINISTRY OF NATURAL RESOURCES IN CONJUNCTION WITH AN APPLICATION FOR A CLASS A LICENCE UNDER THE AGGREGATE RESOURCES ACT AND REGULATIONS.

FERMA AGGREGATES INC.
2666 RENA ROAD
MISSISSAUGA, ONTARIO
L4T 3C8
Telephone (905)677-9241 Fax (905)677-9817

SIGNATURE OF LICENSEE — DATE 04/28/03

AMENDMENTS	DATE APPROVED

SITE PLANS APPROVED BY MINISTRY OF NATURAL RESOURCES

SIGNATURE — DATE

J. S. GOURLEY — PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO — 2003

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MINISTRY OF NATURAL RESOURCES
PLANS APPROVED UNDER THE AGGREGATE RESOURCES ACT
AGGREGATE RESOURCES OFFICER
DATE April 28/03

Trow Associates Inc.
Parent Company of
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Tel: (705) 734-8222
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92-8977

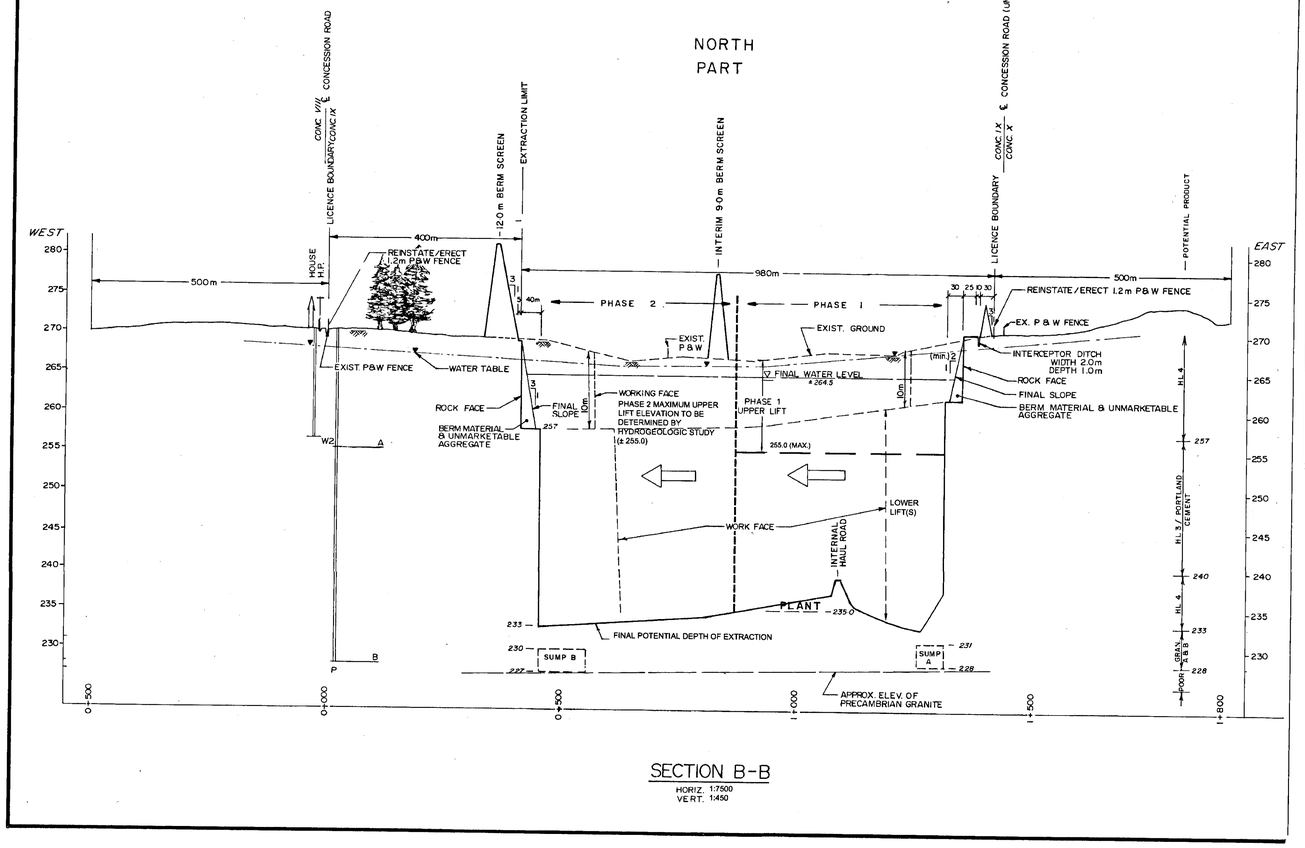
FERMA-CARDEN QUARRY

LOTS 6, 7, 8, 9, & 10
CONCESSION IX
TOWNSHIP OF CARDEN
CITY OF KAWARTHA LAKES

BERM DETAILS & CROSS-SECTIONS A & B

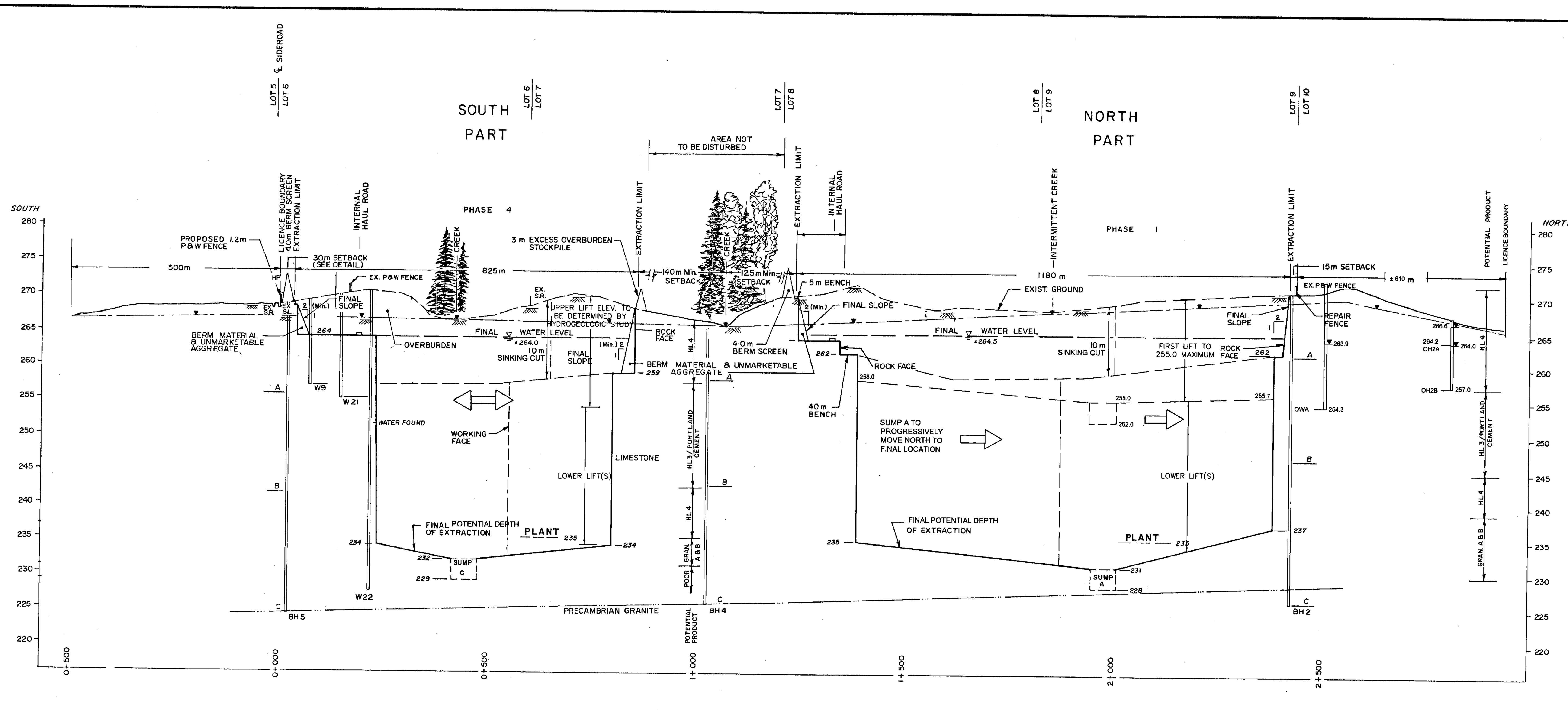
PAGE 4 OF 5				
PHOTO SCALE 1:16000	ROLL No 87-4426	PHOTO Nos 188 – 190	LINE No. 3	PHOTO DATE MAY 1987
MAP SCALE AS SHOWN	CONTOUR INTERVAL 2.0m	DATE OF SITE PLAN DECEMBER 2002		

100 0 100 200 300 400m
1:5000



SECTION B-B

HORIZ. 1:7500
VERT. 1:450



SECTION C - C

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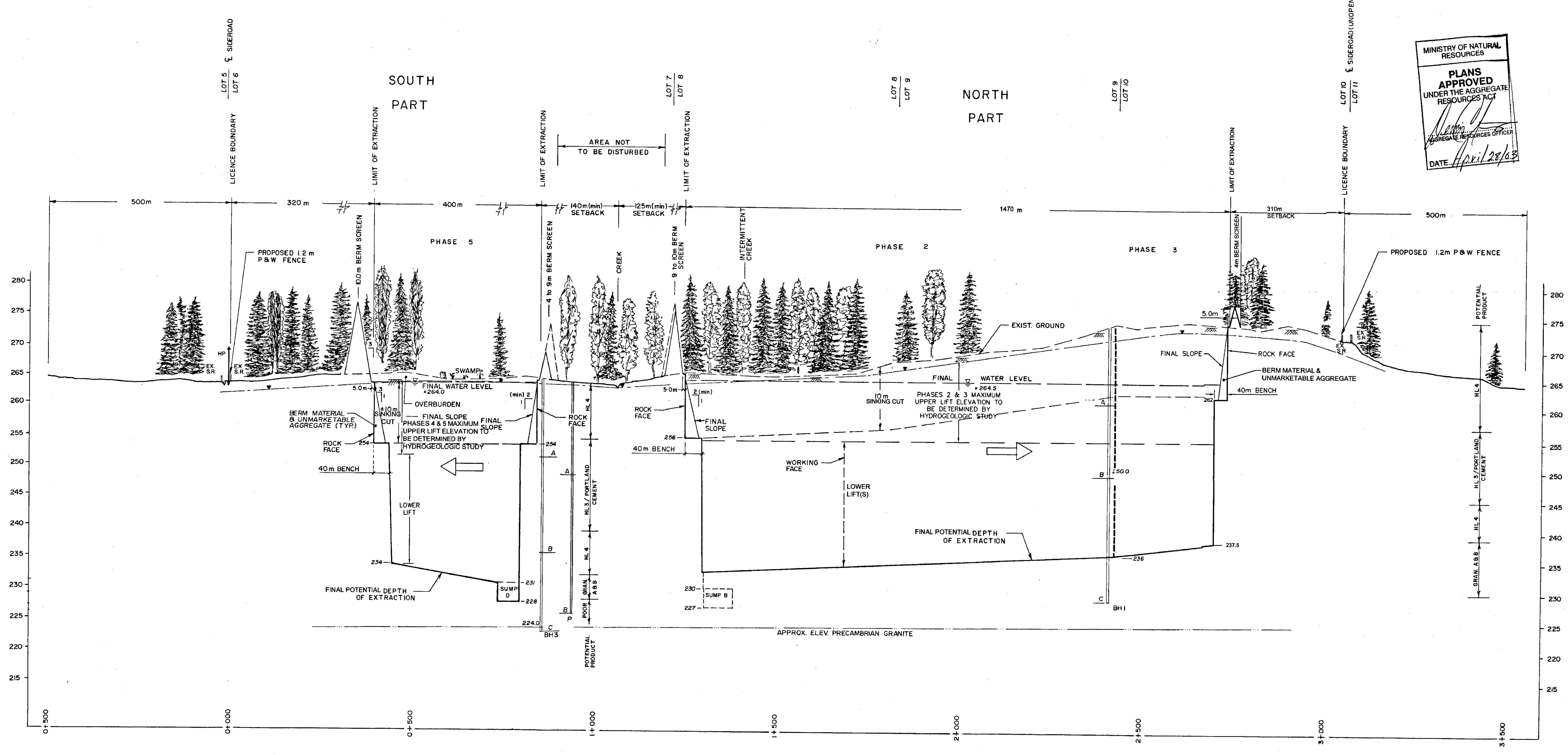
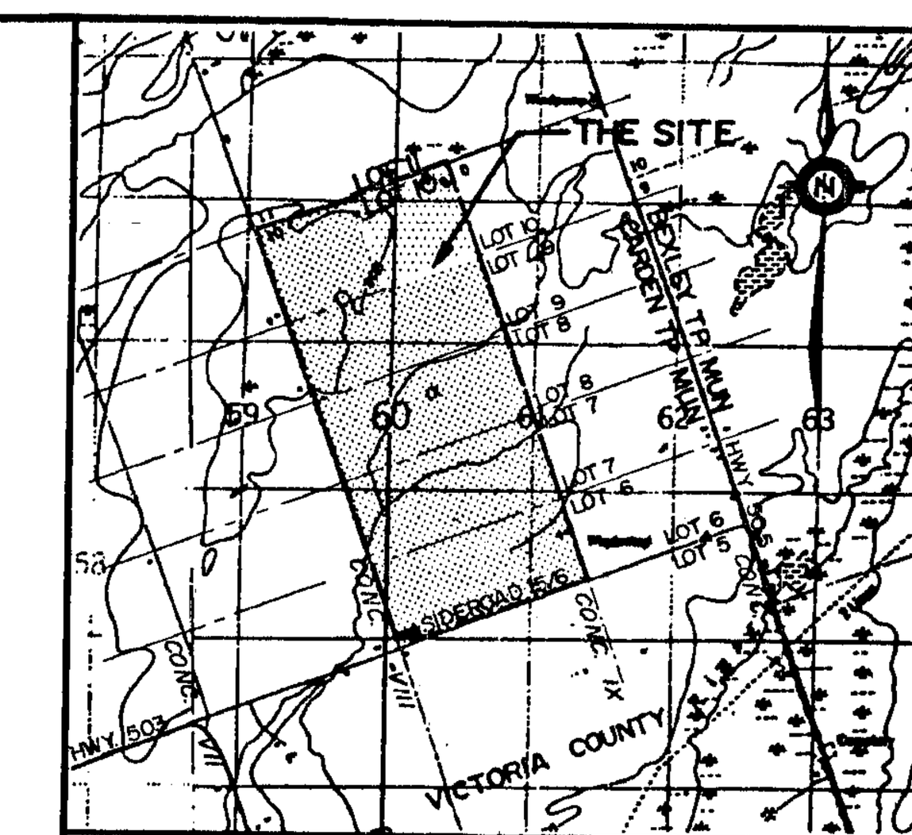
VERT. 1:450



SECTION D - D

HORIZ. 1:7500
VERT. 1:450

MINISTRY OF NATURAL RESOURCES
PLANS APPROVED UNDER THE AGGREGATE RESOURCES ACT
AGGREGATE RESOURCES OFFICER
DATE April 28/03



KEY MAP 1000 0 1000 2000 SCALE 1:50000

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LEGEND FOR CROSS SECTIONS

P	BI-LEVEL PIEZOMETER
▼	WATER TABLE
P&W	POST & WIRE FENCE
S.R	SPLIT RAIL FENCE
	TOP OF LIMESTONE
	FINAL SURFACE WATER LEVEL
	3 TO 1 HORIZ. TO VERT. SLOPE
BH 7	BORE HOLE LOCATION & NUMBER
A	PIEZOMETER LOCATION & LEVEL
W2	WELL LOCATION & NUMBER
⇨	GENERAL DIRECTION OF EXTRACTION
— - —	PHASE BOUNDARY
W	150mm DIA. MONITORING WELL
HL4	MATERIAL SUITABLE FOR ASPHALT BASE COURSE MIX
HL3	MATERIAL SUITABLE FOR ASPHALT TOP COURSE MIX
PORTLAND CEMENT	MATERIAL SUITABLE FOR PORTLAND CEMENT CONCRETE
GRAN.'A' & 'B'	MATERIAL SUITABLE FOR ROAD BASE CONSTRUCTION
— — —	WORKING FACE / LIFT

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MISSISSAUGA, ONTARIO
L4T 3C8
Telephone:(905)677-9241 Fax:(905)677-9817

SIGNATURE OF LICENSEE 04/28/03 DATE

AMENDMENTS	DATE APPROVED
SITE PLANS APPROVED BY MINISTRY OF NATURAL RESOURCES SIGNATURE DATE	

REGISTERED PROFESSIONAL ENGINEER J. S. GOURLEY PROVINCE OF ONTARIO 04/28/03

THESE PLANS WERE DESIGNED TO ENSURE COMPLETE PRACTICALITY DURING THE OPERATIONS, PROGRESSIVE REHABILITATION AND FINAL REHABILITATION OF THE LICENSED PROPERTY

Trow Associates Inc.
Parent Company of
OLIVER MANGIONE McCALLA & ASSOCIATES LIMITED
561 BRYNE DRIVE UNIT D
BARRIE, ONTARIO L4N 9Y3
Tel: (705) 734-6222
Fax: (705) 734-6224

92 – 8977

FERMA-CARDEN QUARRY

LOTS 6,7,8,9,& 10
CONCESSION IX
TOWNSHIP OF CARDEN
CITY OF KAWARTHA LAKES

CROSS-SECTIONS C & D

PAGE 5 OF 5

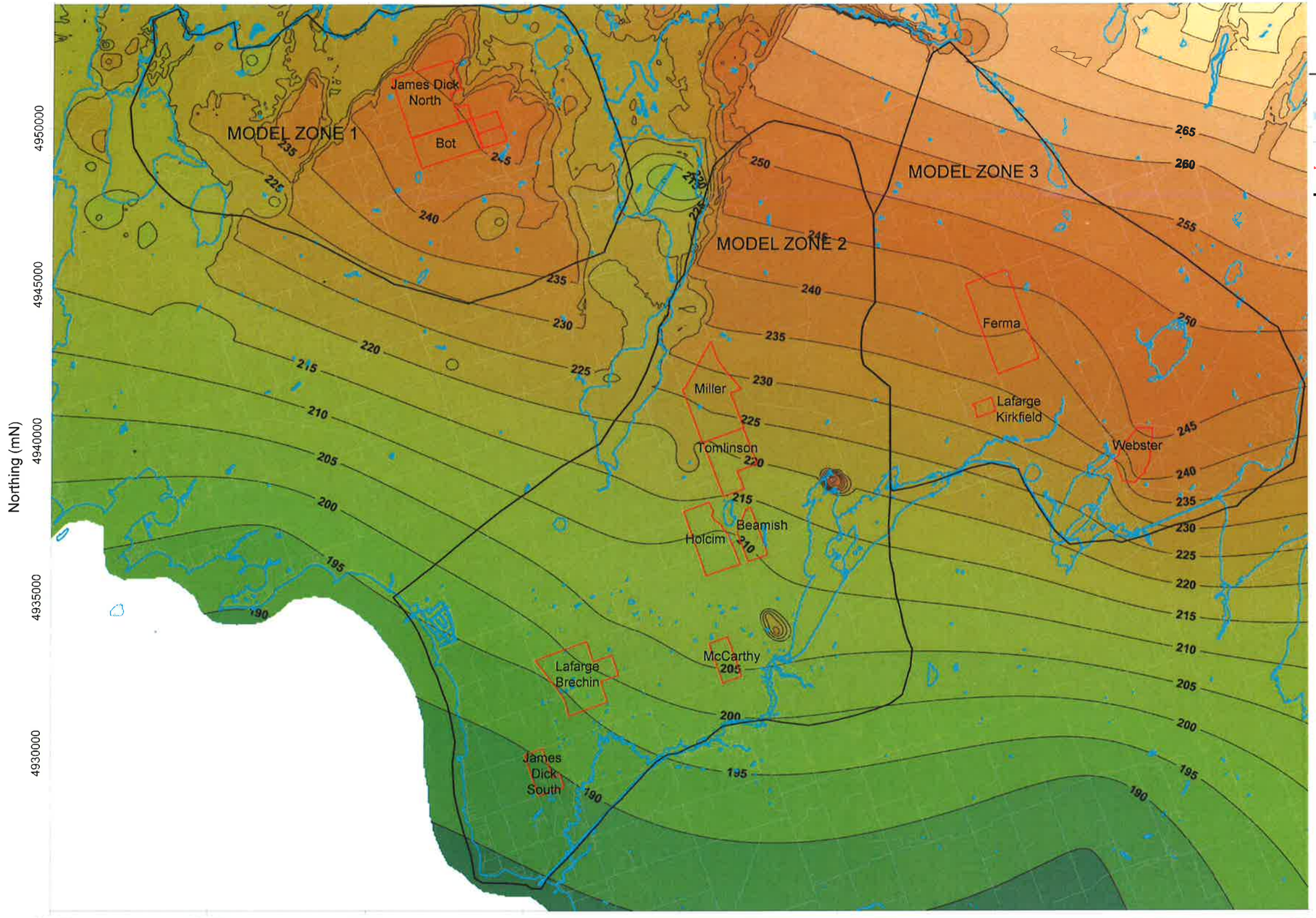
PHOTO SCALE	ROLL No.	PHOTO Nos	LINE No.	PHOTO DATE
1:16000	87-4426	188 – 190	3	MAY 1987

MAP SCALE	CONTOUR INTERVAL	DATE OF SITE PLAN
AS SHOWN	2.0 m	DECEMBER 2002

100 0 100 200 300 400m
1:5000

Appendix B

Figure 6 – Golder Associates Ltd., 2016 – Cumulative Impacts Assessment for Groundwater Takings in the Carden Plain Area – Addendum Report



LEGEND

- Roads
- Waterbodies
- Watercourses
- Quarry License Boundaries
- Extents of Groundwater Flow Model Domain Zones

Top of Gull River Formation Green Beds Elevation (mASL)

300 295 290 285 280 275 270 265 260 255 250 245 240 235 230 225 220 215 210 205 200 195 190 185 180 175 170 165

CLIENT
Ontario Stone, Sand & Gravel Association

CONSULTANT
Golder Associates

YYYY-MM-DD	2016/2/3
PREPARED	NFB
DESIGN	NFB
REVIEW	KAM
APPROVED	KAM

PROJECT
Carden Plain Cumulative Impact Assessment Addendum Report

TITLE
Elevation of Top of Gull River Formation Green Beds

PROJECT No	Phase	Rev.	FIGURE
1407839	4000	0	6

Appendix C

R.W. Tomlinson Ltd. – Golder Associates, 2009 – Brechin Quarry Borehole and Borehole Geophysical Logs

October 2009

APPLICATION FOR A CATEGORY 3 PERMIT TO TAKE WATER, R.W. TOMLINSON LIMITED BRECHIN QUARRY, CITY OF KAWARTHA LAKES, ONTARIO

Submitted to:
Permit to take Water Director
Ontario Ministry of the Environment
Environmental Assessment and Approvals Branch
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L

Report Number: 04-1120-800-3

Distribution:

1 copy - Ontario Ministry of the Environment
1 copy - R.W. Tomlinson Limited
2 copies - Golder Associates Ltd.

Golder Associates

LIST OF ABBREVIATIONS

The abbreviations commonly employed on Records of Boreholes, on figures and in the text of the report are as follows:

I. SAMPLE TYPE

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO	Drive open
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

II. PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:
The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) drive open Sampler for a distance of 300 mm (12 in.)

Dynamic Penetration Resistance; N_d:
The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) to drive Uncased a 50 mm (2 in.) diameter, 60^0 cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH:	Sampler advanced by hydraulic pressure
PM:	Sampler advanced by manual pressure
WH:	Sampler advanced by static weight of hammer
WR:	Sampler advanced by weight of sampler and rod

Peizo-Cone Penetration Test (CPT):
An electronic cone penetrometer with a 60^0 conical tip and a projected end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded Electronically at 25 mm penetration intervals.

III. SOIL DESCRIPTION

(a) Cohesionless Soils

Density Index (Relative Density)	N Blows/300 mm Or Blows/ft.
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

(b) Cohesive Soils

Consistency	$C_{u2}S_u$ Kpa	Psf
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1,000
Stiff	50 to 100	1,000 to 2,000
Very stiff	100 to 200	2,000 to 4,000
Hard	Over 200	Over 4,000

IV. SOIL TESTS

w	water content
w_p	plastic limited
w_l	liquid limit
C	consolidaiton (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, G_s)
DS	direct shear test
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	modified Proctor compaction test
SPC	standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V	field vane test (LV-laboratory vane test)
γ	unit weight

Note:
1. Tests which are anisotropically consolidated prior shear are shown as CAD, CAU.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	= 3.1416
ln x, natural logarithm of x	
$\log_{10}$ x or log x, logarithm of x to base 10	
g	Acceleration due to gravity
t	time
F	factor of safety
V	volume
W	weight

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma'$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
ν	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma$"-u)
σ'_{vo}	initial effective overburden stress
$\sigma_1\sigma_2\sigma_3$	principal stresses (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1+\sigma_2+\sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight*)
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma'=\gamma-\gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s/\rho_w$) formerly (G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is ρ. Unit weight symbol is γ where $\gamma=\rho g$(i.e. mass density x acceleration due to gravity)

(a) Index Properties (cont'd.)

w	water content
w_l	liquid limit
w_p	plastic limit
I_p	plasticity Index=(w_l-w_p)
w_s	shrinkage limit
I_L	liquidity index=$(w-w_p)/I_p$
I_c	consistency index=$(w_l-w)/I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index-$(e_{max}-e)/(e_{max}-e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (overconsolidated range)
C_s	swelling index
C_a	coefficient of secondary consolidation
m_v	coefficient of volume change
c_v	coefficient of consolidation
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation pressure
OCR	Overconsolidation ratio=σ'_p/σ'_{vo}

(d) Shear Strength

$\tau_p\tau_r$	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction=tan δ
c'	effective cohesion
c_u, S_u	undrained shear strength (ϕ=0 analysis)
p	mean total stress $(\sigma_1+\sigma_3)/2$
p'	mean effective stress $(\sigma'_1+\sigma'_3)/2$
q	$(\sigma_1-\sigma_3)/2$ or $(\sigma'_1-\sigma_3)/2$
q_u	compressive strength $(\sigma_1-\sigma_3)$
S_t	sensitivity

Notes: 1. $\tau=c'\sigma'\tan\phi'$

2. Shear strength=(Compressive strength)/2

LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATHERING STATE

Fresh: no visible sign of weathering

Faintly Weathered: weathering limited to the surface of major discontinuities.

Slightly weathered: penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material.

Moderately weathered: weathering extends throughout the rock mass but the rock material is not friable

Highly weathered: weathering extends throughout rock mass and the rock material is partly friable.

Completely weathered: rock is wholly decomposed and in a friable condition but the rock texture and structure are preserved.

BEDDING THICKNESS

Description	Bedding Plane Spacing
Very thickly bedded	>2 m
Thickly bedded	0.6 m to 2m
Medium bedded	0.2 m to 0.6 m
Thinly bedded	60 mm to 0.2 m
Very thinly bedded	20 mm to 60 mm
Laminated	6 mm to 20 mm
Thinly laminated	<6 mm

JOINT OR FOLIATION SPACING

Description	Spacing
Very wide	>3 m
Wide	1 – 3 m
Moderately close	0.3 – 1 m
Close	50 – 300 mm
Very close	<50 mm

GRAIN SIZE

Term	Size*
Very Coarse Grained	>60 mm
Coarse Grained	2 – 60 mm
Medium Grained	60 microns - 2mm
Fine Grained	2 – 60 microns
Very Fine Grained	<2 microns

Note: *Grains >60 microns diameter are visible to the naked eye.

O:\ Templates\Rock Description Terminology

CORE CONDITION

Total Core Recovery

The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run.

Solid Core Recovery (SCR)

The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.

Rock Quality Designation (RQD)

The percentage of solid drill core, greater than 100 mm length, recovered at full diameter, measured relative to the length of the total core run. RQD varies from 0% for completely broken core 100% for core in solid sticks.

DISCONTINUITY DATA

Fracture Index

A count of the number of discontinuities (physical separations) in the rock core, including both naturally occurring fractures and mechanically induced breaks caused by drilling.

Dip with Respect to (W.R.T.) Core Axis

The angle of the discontinuity relative to the axis (length) of the core. In a vertical borehole a discontinuity with a 90^0 angle is horizontal.

Description and Notes

An abbreviated description of the discontinuities, whether naturally occurring separations such as fractures, bedding planes and foliation planes or mechanically induced features caused by drilling such as ground or shattered core and mechanically separated bedding or foliation surfaces. Additional information concerning the nature information concerning the nature of fracture surfaces and infillings are also noted.

Abbreviations

B –	Bedding	Ca-	Calcite
FO-	Foliation/Schistosity	P-	Polished
CL -	Cleavage	S-	Slickensided
SH -	Shear Plane/Zone	SM-	Smooth
VN-	Vein	R-	Ridged/Rough
F -	Fault	ST-	Stepped
CO-	Contact	PL-	Planar
J -	Joint	FL-	Flexured
FR-	Fracture	UE-	Uneven
MF -	Mechanical	W-	Wavy
A-	Angular	C-	Curved
BP-	Bedding Plane	H-	Hackly
BL-	Blast Induced	SL-	Sludge Coated
ll	Parallel To	TCA-	To Core Axis
	Perpendicular To	STR-	Stress Induced

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-1

SHEET 1 OF 12

LOCATION: N 4939121.7 ;E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH / % RETURN / COLOUR	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		GROUND SURFACE		249.65												MW-1
0		Topsoil		0.00 / 249.55												
		Verulam Formation 0.1 m to 15.0 m Fresh, faintly to moderately weathered on bedding partings, tan grey to medium grey, very fine to fine grained, thinly bedded, micritic, nodular, argillaceous limestone. Sequence contains dark grey to black shaly bedding partings, circular 2 mm to 6 mm burrow casts and occasional thinly to medium bedded, brownish grey, fine to medium crystalline, fossiliferous (crinoids, corals, pelecypods) calcarenite beds and minor, very thin, lithoclastic calcarenite beds associated with rip up clasts. Rock core is weathered and broken up from 0.1 m to 1.3 m with iron oxide staining on joint and bedding surfaces extending to 0.2 m depth. Broken weathered core occurs again at 3.40 m to 3.50 m.		0.10	1										
1					2											
2					3											Bentonite Seal
3					4											
4					5											
5		*CONTINUED NEXT PAGE*														

DEPTH SCALE
1 : 25

LOGGED: MK
CHECKED: KAI

Golder Associates

000024

MISS_ROCK 041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-1

SHEET 2 OF 12

LOCATION: N 4939121.7 ;E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —														
5		Verulam Formation 0.1 m to 15.0 m Fresh, faintly to moderately weathered on bedding partings, tan grey to medium grey, very fine to fine grained, thinly bedded, micritic, nodular, argillaceous limestone. Sequence contains dark grey to black shaly bedding partings, circular 2 mm to 6 mm burrow casts and occasional thinly to medium bedded, brownish grey, fine to medium crystalline, fossiliferous (crinoids, corals, pelecypods) calcarenite beds and minor, very thin, lithoclastic calcarenite beds associated with rip up clasts. Rock core is weathered and broken up from 0.1 m to 1.3 m with iron oxide staining on joint and bedding surfaces extending to 0.2 m depth. Broken weathered core occurs again at 3.40 m to 3.50 m.			5										MW-1
6					6											Bentonite Seal
7					7											
8					8											
9																
10		*CONTINUED NEXT PAGE*														

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KAM

000025

MISS_ROCK 04112080O-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-1

SHEET 3 OF 12

LOCATION: N 4939121.7 ;E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR & % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —															MW-1
10		Verulam Formation 0.1 m to 15.0 m Fresh, faintly to moderately weathered on bedding partings, tan grey to medium grey, very fine to fine grained, thinly bedded, micritic, nodular, argillaceous limestone. Sequence contains dark grey to black shaly bedding partings, circular 2 mm to 6 mm burrow casts and occasional thinly to medium bedded, brownish grey, fine to medium crystalline, fossiliferous (crinoids, corals, pelecypods) calcarenite beds and minor, very thin, lithoclastic calcarenite beds associated with rip up clasts. Rock core is weathered and broken up from 0.1 m to 1.3 m with iron oxide staining on joint and bedding surfaces extending to 0.2 m depth. Broken weathered core occurs again at 3.40 m to 3.50 m.			8											
11																	
12					9												Bentonite Seal
13					10												
14																	
15		CONTINUED NEXT PAGE		234.65	11												

DEPTH SCALE
1 : 25

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LOGGED: MK

CHECKED: KA

000026

MISS_ROCK 04112080O-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-1

SHEET 4 OF 12

LOCATION: N 4939121.7 ;E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —														MW-1
15		Bobcaygeon Formation 15.0 m to 28.35 m Sharp contact with Verulam Formation. Fresh, medium brownish grey to medium grey, fine grained micritic to medium grained crystalline calcarenitic, thinly to thickly bedded, interbedded argillaceous limestone to calcarenitic limestone with argillaceous shaly bedding partings. From 15.00 m to 16.60 m: Fresh medium brown, medium grained crystalline, faintly petroliferous, medium to thickly bedded calcarenite limestone. From 16.60 m to 18.36 m: Fresh medium brownish grey, fine to medium grained, thinly to medium bedded, nodular, argillaceous, micritic to calcarenitic limestone. From 18.36 m to 19.90 m: Fresh, medium brownish grey, fine grained, thinly bedded, nodular, argillaceous, micritic limestone with numerous dark grey to black argillaceous to shaly bedding partings up to 1 cm thick. From 19.90 m to 24.95 m: Fresh, light to medium brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone with argillaceous shaly partings interbedded with occasional brownish grey, fine to medium grained, crystalline thin to medium beds of fossiliferous, bioclastic (crinoid, coral) calcarenitic limestone and very thin lithoclastic limestone beds. First fossiliferous calcarenite bed occurs between 24.70 m and 24.95 m. Distinctive coral fossil inclusion at 23.40 m in calcarenite bed between 23.30 m and 23.50 m. From 24.95 m to 28.35 m: Fresh, light grey to creamy light grey, very fine grained, thinly to medium bedded lithographic limestone with disseminated medium grained calcite crystals and occasional minor pyrite grains interbedded with light brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone. First nodular, micritic limestone bed occurs between 27.85 m and 27.93 m. Light grey, plastic clay parting 2 mm thick at 26.83 m.		15.00	11										Bentonite Seal
16					12											
17																
18					13											
19					14											
20		CONTINUED NEXT PAGE														

DEPTH SCALE
1 : 25

LOGGED: MK
CHECKED: KAM

Golder Associates

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-1

SHEET 5 OF 12

LOCATION: N 4939121.7 ;E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (min/m)	FLUSH	COLOUR OF RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —															MW-1
20		Bobcaygeon Formation 15.0 m to 28.35 m Sharp contact with Verulam Formation. Fresh, medium brownish grey to medium grey, fine grained micritic to medium grained crystalline calcarenitic, thinly to thickly bedded, interbedded argillaceous limestone to calcarenitic limestone with argillaceous shaly bedding partings. From 15.00 m to 16.60 m: Fresh medium brown, medium grained crystalline, faintly petroliferous, medium to thickly bedded calcarenite limestone. From 16.60 m to 18.36 m: Fresh medium brownish grey, fine to medium grained, thinly to medium bedded, nodular, argillaceous, micritic to calcarenitic limestone. From 18.36 m to 19.90 m: Fresh, medium brownish grey, fine grained, thinly bedded, nodular, argillaceous, micritic limestone with numerous dark grey to black argillaceous to shaly bedding partings up to 1 cm thick. From 19.90 m to 24.95 m: Fresh, light to medium brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone with argillaceous shaly partings interbedded with occasional brownish grey, fine to medium grained, crystalline thin to medium beds of fossiliferous, bioclastic (crinoid, coral) calcarenitic limestone and very thin lithoclastic limestone beds. First fossiliferous calcarenite bed occurs between 24.70 m and 24.95 m. Distinctive coral fossil inclusion at 23.40 m in calcarenite bed between 23.30 m and 23.50 m. From 24.95 m to 28.35 m: Fresh, light grey to creamy light grey, very fine grained, thinly to medium bedded lithographic limestone with disseminated medium grained calcite crystals and occasional minor pyrite grains interbedded with light brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone. First nodular, micritic limestone bed occurs between 27.85 m and 27.93 m. Light grey, plastic clay parting 2 mm thick at 26.83 m.			14												
21					15												
22					16												Bentonite Seal
23																	
24					17												
25		CONTINUED NEXT PAGE			18												

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KA

000028

MISS_ROCK 041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-1

SHEET 6 OF 12

LOCATION: N 4939121.7 ;E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE CL-CLEAVAGE SH-SHEAR VN-VEIN

F-FAULT J-JOINT P-POLISHED S-SLICKENSIDED

SM-SMOOTH R-ROUGH ST-STEPPED PL-PLANAR

FL-FLEXURED UE-UNEVEN W-WAVY C-CURVED

BC-BROKEN CORE MB-MECH. BREAK B-BEDDING

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
25		— CONTINUED FROM PREVIOUS PAGE —															
		Bobcaygeon Formation 15.0 m to 28.35 m (Continued - see previous page for detailed description)			18												
26																	
					19												Bentonite Seal
27																	
28				221.30 28.35	20												
		Gull River Formation 28.35 m to 45.10m Unit 4 28.35 m to 31.60 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, lithographic limestone with occasional disseminated medium grained calcite crystals, a stylolite (29.70 m), mottled textured beds (29.70 m to 30.00 m and 31.20 m to 31.40 m), laminar beds and argillaceous bedding partings.															Sand
29																	
					21												
30		CONTINUED NEXT PAGE															

MISS_ROCK 04112080O-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

DEPTH SCALE 1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-1

SHEET 7 OF 12

LOCATION: N 4939121.7 ;E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —															MW-1
30		Gull River Formation 28.35 m to 45.10m Unit 4 28.35 m to 31.60 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, lithographic limestone with occasional disseminated medium grained calcite crystals, a stylolite (29.70 m), mottled textured beds (29.70 m to 30.00 m and 31.20 m to 31.40 m), laminar beds and argillaceous bedding partings.			21											
31		Unit 3 31.60 m to 35.55 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings and mottled textured bed (33.26 m to 34.43 m). Open, 1 cm thick shaly bedding parting at top of unit. Distinct, light greenish grey, fine grained, siliceous dolostone beds at 32.27 m to 32.37 m and 34.87 m to 34.97 m with lithoclastic bed from 34.97 m to 35.00 m.			22											Monitoring well constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen.
32		Unit 2 35.55 m to 38.88 m Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional stylolite (36.75 m), mottled textured beds (35.55 m to 35.60 m, 36.75 m to 37.06 m and 38.10 m to 38.68 m) and argillaceous bedding partings.														
33		Unit 1 38.88 m to 45.10 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals argillaceous bedding partings, a stylolite (42.64 m), mottled textured bed (40.34 m to 41.50 m) and thin, laminar textured beds. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone beds occur at 38.92 m to 40.34 m and 43.54 m to 43.62 m. Reddish brown, thin shaly dolostone beds at 43.62 m to 43.68 m and 44.35 m to 44.37 m. Silty to sandy lithoclastic dolostone at 44.37 m to 44.76 m.			23											
34		Base bed marked by buff brown dolostone from 44.76 m to 45.10 m. Top of Unit 1 marked by open argillaceous bedding partings between 38.88 m and 38.94 m. Distinct white, soft marl layers occur at 39.85 m to 39.92 m and at 41.83 m to 41.86 m overlying weathered black shale from 41.86 m to 41.88 m.			24											
35		CONTINUED NEXT PAGE														

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KA

000030

MISS_ROCK 04112080-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-1

SHEET 8 OF 12

LOCATION: N 4939121.7 ;E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —														
35		Gull River Formation 28.35 m to 45.10m Unit 4 28.35 m to 31.60 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, lithographic limestone with occasional disseminated medium grained calcite crystals, a stylolite (29.70 m), mottled textured beds (29.70 m to 30.00 m and 31.20 m to 31.40 m), laminar beds and argillaceous bedding partings.			24											MW-1
36		Unit 3 31.60 m to 35.55 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings and mottled textured bed (33.28 m to 34.43 m). Open, 1 cm thick shaly bedding parting at top of unit. Distinct, light greenish grey, fine grained, siliceous dolostone beds at 32.27 m to 32.37 m and 34.87 m to 34.97 m with lithoclastic bed from 34.97 m to 35.00 m.			25											
37		Unit 2 35.55 m to 38.88 m Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional stylolite (36.75 m), mottled textured beds (35.55 m to 35.60 m, 36.75 m to 37.06 m and 38.10 m to 38.68 m) and argillaceous bedding partings.														
		Unit 1 38.88 m to 45.10 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals argillaceous bedding partings, a stylolite (42.64 m), mottled textured bed (40.34 m to 41.50 m) and thin, laminar textured beds. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone beds occur at 38.92 m to 40.34 m and 43.54 m to 43.62 m. Reddish brown, thin shaly dolostone beds at 43.62 m to 43.68 m and 44.35 m to 44.37 m. Silty to sandy lithoclastic dolostone at 44.37 m to 44.76 m.			26											Bentonite Seal
38																
39		Base bed marked by buff brown dolostone from 44.76 m to 45.10 m. Top of Unit 1 marked by open argillaceous bedding partings between 38.88 m and 38.94 m. Distinct white, soft marl layers occur at 39.85 m to 39.92 m and at 41.83 m to 41.86 m overlying weathered black shale from 41.86 m to 41.88 m.			27											
40		CONTINUED NEXT PAGE														

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KAM

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-1

SHEET 9 OF 12

LOCATION: N 4939121.7 ;E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR, % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —															MW-1
40		Gull River Formation 28.35 m to 45.10m Unit 4 28.35 m to 31.60 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, lithographic limestone with occasional disseminated medium grained calcite crystals, a stylolite (29.70 m), mottled textured beds (29.70 m to 30.00 m and 31.20 m to 31.40 m), laminar beds and argillaceous bedding partings.			27											
41		Unit 3 31.60 m to 35.55 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings and mottled textured bed (33.28 m to 34.43 m). Open, 1 cm thick shaly bedding parting at top of unit. Distinct, light greenish grey, fine grained, siliceous dolostone beds at 32.27 m to 32.37 m and 34.87 m to 34.97 m with lithoclastic bed from 34.97 m to 35.00 m.			28											
42		Unit 2 35.55 m to 38.88 m Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional stylolite (36.75 m), mottled textured beds (35.55 m to 35.80 m, 36.75 m to 37.06 m and 38.10 m to 38.68 m) and argillaceous bedding partings.			29											Bentonite Seal
43		Unit 1 38.88 m to 45.10 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals argillaceous bedding partings, a stylolite (42.64 m), mottled textured bed (40.34 m to 41.50 m) and thin, laminar textured beds. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone beds occur at 38.92 m to 40.34 m and 43.54 m to 43.62 m. Reddish brown, thin shaly dolostone beds at 43.62 m to 43.68 m and 44.35 m to 44.37 m. Silty to sandy lithoclastic dolostone at 44.37 m to 44.76 m. Base bed marked by buff brown dolostone from 44.76 m to 45.10 m. Top of Unit 1 marked by open argillaceous bedding partings between 38.88 m and 38.94 m. Distinct white, soft marl layers occur at 39.85 m to 39.92 m and at 41.83 m to 41.86 m overlying weathered black shale from 41.86 m to 41.88 m.			30											
44																	
45		CONTINUED NEXT PAGE			31												

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KAN

000032

MISS_ROCK 041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-1

SHEET 10 OF 12

LOCATION: N 4939121.7 ;E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH / % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —														
45				204.55												
		Shadow Lake Formation 45.10 m to 53.51 m		45.10												
		From 45.10 m to 47.70 m: Fresh, light to dark greenish grey, fine to medium grained, faintly to moderately porous, thinly to medium bedded, quartz sandstone with siltstone partings. Greenish grey shaly siltstone beds at 45.10 m to 45.23 m and 45.42 m to 45.46 m. Red shale bed between 46.75 m and 46.80 m.			31											
46		From 47.70 m to 48.90 m: Fresh, dark greenish grey, slake susceptible shale and shaly siltstone. Transitional lower contact.														
		From 48.90 m to 51.25 m: Fresh, dark reddish brown, slake susceptible shale with green shale at 50.65 m to 50.80 m. Transitional lower contact.														
47		From 51.25 to 53.51 m: Fresh, dark reddish brown, fine to coarse grained, faintly porous, medium bedded sandstone comprised of angular clasts of feldspar crystals and quartz with traces of disseminated pyrite below 51.50 m. With basal light grey silty quartz sandstone bed from 53.30 m to 53.51 m.			32											Bentonite Seal
48																
					33											
49																
					34											
50		CONTINUED NEXT PAGE														

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KAM

MISS_ROCK 04112080O-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-1

SHEET 11 OF 12

LOCATION: N 4939121.7 ;E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
50		*--- CONTINUED FROM PREVIOUS PAGE ---*															MW-1
		Shadow Lake Formation 45.10 m to 53.51 m From 45.10 m to 47.70 m: Fresh, light to dark greenish grey, fine to medium grained, faintly to moderately porous, thinly to medium bedded, quartz sandstone with siltstone partings. Greenish grey shaly siltstone beds at 45.10 m to 45.23 m and 45.42 m to 45.46 m. Red shale bed between 46.75 m and 46.80 m.			34											
51		From 47.70 m to 48.90 m: Fresh, dark greenish grey, slake susceptible shale and shaly siltstone. Transitional lower contact. From 48.90 m to 51.25 m: Fresh, dark reddish brown, slake susceptible shale with green shale at 50.65 m to 50.80 m. Transitional lower contact. From 51.25 to 53.51 m: Fresh, dark reddish brown, fine to coarse grained, faintly porous, medium bedded sandstone comprised of angular clasts of feldspar crystals and quartz with traces of disseminated pyrite below 51.50 m. With basal light grey silty quartz sandstone bed from 53.30 m to 53.51 m.			35											
52																	Bentonite Seal
53					36												
		Precambrian Basement 53.51 m to 59.93 m From 53.51 m to 53.76 m: Completely weathered, dark brown, micaceous, gneissic regolith.		196.14 53.51													
54		From 53.76 m to 54.80 m: Highly weathered, dark reddish brown, chlorite-feldspar-amphibole-gneiss. From 54.80 m to 56.25 m: Faintly to moderately weathered, dark grey, medium grained, strongly foliated, feldspar - amphibole gneiss. From 56.25 m to 56.55 m: Highly weathered gneiss. From 56.55 m to 59.93 m: Fresh, dark grey diorite gneiss. Last open weathered fracture at 57.10 m.			37											
55		*CONTINUED NEXT PAGE*															

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KAI

000034

MISS_ROCK 041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-1

SHEET 12 OF 12

LOCATION: N 4939121.7 ;E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH COLOUR, % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —														MW-1
55		Precambrian Basement 53.51 m to 59.93 m From 53.51 m to 53.76 m: Completely weathered, dark brown, micaceous, gneissic regolith. From 53.76 m to 54.80 m: Highly weathered, dark reddish brown, chlorite-feldspar-amphibole-gneiss. From 54.80 m to 56.25 m: Faintly to moderately weathered, dark grey, medium grained, strongly foliated, feldspar - amphibole gneiss. From 56.25 m to 56.55 m: Highly weathered gneiss. From 56.55 m to 59.93 m: Fresh, dark grey diorite gneiss. Last open weathered fracture at 57.10 m.			37										
56					38											
57					39											Bentonite Seal
58																
59					40											
60		END OF DRILLHOLE		189.72 59.93												

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

000035

MISS_ROCK 04112080O-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-2

SHEET 1 OF 8

LOCATION: N 4939749.9 ;E 651897.5

DRILLING DATE: Sep. 16, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (cm/min)	FLUSH	COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		GROUND SURFACE		246.87													MW-2
0		Topsoil		0.00													(B) (A)
		Verulam Formation 0.05 m to 9.00 m Fresh, faintly to moderately weathered on bedding partings, tan grey to medium grey, very fine to fine grained, thinly bedded, micritic, nodular, argillaceous limestone. Sequence contains dark grey to black shaly bedding partings, circular 2 mm to 6 mm burrow casts and occasional thinly to medium bedded, brownish grey, fine to medium crystalline, fossiliferous (crinoids, corals, pelecypods) calcarenite beds and minor, very thin, lithoclastic calcarenite beds associated with rip up clasts.		0.05	1												▽ (B)
1					2												
					3												
2					4												
3																	
4					5												
5		CONTINUED NEXT PAGE															

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK

CHECKED: KA

000036

MISS_ROCK 041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-2

SHEET 2 OF 8

LOCATION: N 4939749.9 ;E 651897.5

DRILLING DATE: Sep. 16, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —														MW-2 (B) (A)
5		Verulam Formation 0.05 m to 9.00 m Fresh, faintly to moderately weathered on bedding partings, tan grey to medium grey, very fine to fine grained, thinly bedded, micritic, nodular, argillaceous limestone. Sequence contains dark grey to black shaly bedding partings, circular 2 mm to 6 mm burrow casts and occasional thinly to medium bedded, brownish grey, fine to medium crystalline, fossiliferous (crinoids, corals, pelecypods) calcarenite beds and minor, very thin, lithoclastic calcarenite beds associated with rip up clasts.			6										
6																
7					7											
8					8											
9		Bobcaygeon Formation 9.00 m to 21.95 m (See next page for detailed description)		237.87 9.00	9											
10		CONTINUED NEXT PAGE														

MISS_ROCK 041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KAM

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-2

SHEET 3 OF 8

LOCATION: N 4939749.9 ;E 651897.5

DRILLING DATE: Sep. 16, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SUCKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH / % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —														MW-2
10		**Bobcaygeon Formation** **9.00 m to 21.95 m** Sharp contact with Verulam Formation. Fresh, medium brownish grey to medium grey, fine grained micritic to medium grained crystalline calcarenitic, thinly to thickly bedded, interbedded argillaceous limestone to calcarenitic limestone with argillaceous shaly bedding partings. From 9.00 m to 10.50 m: Fresh medium brown, medium grained crystalline, faintly petroliferous, medium to thickly bedded calcarenite limestone. From 10.50 m to 12.15 m: Fresh, medium brownish grey, fine to medium grained, thinly to medium bedded, nodular, argillaceous, micritic to calcarenitic limestone. From 12.15 m to 13.73 m: Fresh, medium brownish grey, fine grained, thinly bedded, nodular, argillaceous, micritic limestone with numerous dark grey to black argillaceous to shaly bedding partings up to 1 cm thick. From 13.73 m to 20.22 m: Fresh, light to medium brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone with argillaceous shaly partings interbedded with occasional brownish grey, fine to medium grained crystalline, thin to medium beds of fossiliferous, bioclastic (crinoid, coral) calcarenitic limestone and very thin lithoclastic limestone beds. First calcarenite bed occurs between 17.10 m and 17.50 m with distinctive coral fossil inclusion at 17.35 m. From 20.22 m to 21.95 m: Fresh, light grey to creamy light grey, very fine grained, thinly to medium bedded, lithographic limestone with disseminated medium grained calcite crystals and occasional minor pyrite grains interbedded with light brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone. Weathered shaly parting at 20.70 m with laminar argillaceous partings between 21.10 m and 21.20 m and black shale parting at 21.86 m to 21.89 m.			9									(B) (A)
11																Bentonite Seal
					10											
12																
13					11											
14																
15		*CONTINUED NEXT PAGE*			12											

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KA

000038

MISS_ROCK 041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-2

SHEET 4 OF 8

LOCATION: N 4939749.9 ;E 651897.5

DRILLING DATE: Sep. 16, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH / % RETURN / COLOUR	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —														MW-2
																(B) (A)
15		Bobcaygeon Formation 9.00 m to 21.95 m Sharp contact with Verulam Formation. Fresh, medium brownish grey to medium grey, fine grained micritic to medium grained crystalline calcarenitic, thinly to thickly bedded, interbedded argillaceous limestone to calcarenitic limestone with argillaceous shaly bedding partings. From 9.00 m to 10.50 m: Fresh medium brown, medium grained crystalline, faintly petroliferous, medium to thickly bedded calcarenite limestone. From 10.50 m to 12.15 m: Fresh, medium brownish grey, fine to medium grained, thinly to medium bedded, nodular, argillaceous, micritic to calcarenitic limestone. From 12.15 m to 13.73 m: Fresh, medium brownish grey, fine grained, thinly bedded, nodular, argillaceous, micritic limestone with numerous dark grey to black argillaceous to shaly bedding partings up to 1 cm thick. From 13.73 m to 20.22 m: Fresh, light to medium brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone with argillaceous shaly partings interbedded with occasional brownish grey, fine to medium grained crystalline, thin to medium beds of fossiliferous, bioclastic (crinoid, coral) calcarenitic limestone and very thin lithoclastic limestone beds. First calcarenite bed occurs between 17.10 m and 17.50 m with distinctive coral fossil inclusion at 17.35 m. From 20.22 m to 21.95 m: Fresh, light grey to creamy light grey, very fine grained, thinly to medium bedded, lithographic limestone with disseminated medium grained calcite crystals and occasional minor pyrite grains interbedded with light brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone. Weathered shaly parting at 20.70 m with laminar argillaceous partings between 21.10 m and 21.20 m and black shale parting at 21.86 m to 21.89 m.			12										Bentonite Seal
16																
17					13											
18					14											
19					15											
20		CONTINUED NEXT PAGE														

DEPTH SCALE
1 : 25

LOGGED: MK
CHECKED: KAM

Golder Associates

000039

MISS_ROCK 04112080O-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-2

SHEET 5 OF 8

LOCATION: N 4939749.9 ;E 651897.5

DRILLING DATE: Sep. 16, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	COLOUR & RETURN FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —														MW-2
20		Bobcaygeon Formation 9.00 m to 21.95 m (Continued - see previous page for detailed description)			15											(B) (A)
21					16											Bentonite Seal
22		Gull River Formation 21.95 m to 35.50 m (See next page for detailed description)		224.92 21.95												
23					17											
24					18											
25		CONTINUED NEXT PAGE			19											Sand

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK

CHECKED: KA

000040

MISS_ROCK_041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-2

SHEET 6 OF 8

LOCATION: N 4939749.9 ;E 651897.5

DRILLING DATE: Sep. 16, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —														MW-2
25		Gull River Formation 21.95 m to 35.50 m Unit 4 21.95 m to 25.35 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, stylolitic, lithographic limestone from 21.95 m to 24.40 m with occasional disseminated medium grained calcite crystals with bluish mottled textured bed at top of sequence. Laminar bedded, argillaceous limestone from 24.40 m to 25.35 m.			19										(B) (A) Sand
26		Unit 3 25.35 m to 28.88 m Fresh, light grey to light tan brown, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings with mottled textured beds from 25.66 m to 26.40 m and 26.85 m to 28.40 m. Open, 1 cm thick shaly bedding parting at top of unit from 25.35 m to 25.40 m. Distinct, light greenish grey, fine grained, siliceous dolostone beds at top and bottom of unit from 25.35 m to 25.60 m and 28.55 m to 28.82 m with reddish brown dolostone bed from 28.82 m to 28.88 m.													
27		Unit 2 28.88 m to 34.70 m Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional mottled textured beds (30.50 m to 30.80 m, 31.70 m to 32.37 m and 33.80 m to 34.45 m) and argillaceous to shaly bedding parting from 32.73 m to 32.80 m and 33.45 m to 33.55 m with 1 cm thick soft mud seam at 33.55 m.			20										A and B wells constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen.
28		Unit 1 34.70 m to 35.50 m Fresh, light grey, fine grained, thinly to thickly bedded, mottled textured, dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals and argillaceous bedding partings. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone bed at 33.70 m to 34.07 m.			21										
29																
30		CONTINUED NEXT PAGE			22											

HYDRAULIC CONDUCTIVITY K, cm/sec: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KAM

MISS_ROCK 04112080O-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-2

SHEET 7 OF 8

LOCATION: N 4939749.9 ;E 651897.5

DRILLING DATE: Sep. 16, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (min/m)	COLOUR % RETURN FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —														MW-2
30		Gull River Formation 21.95 m to 35.50 m Unit 4 21.95 m to 25.35 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, stylolitic, lithographic limestone from 21.95 m to 24.40 m with occasional disseminated medium grained calcite crystals with bluish mottled textured bed at top of sequence. Laminar bedded, argillaceous limestone from 24.40 m to 25.35 m.			22											(B) (A)
31		Unit 3 25.35 m to 28.88 m Fresh, light grey to light tan brown, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings with mottled textured beds from 25.66 m to 26.40 m and 26.85 m to 28.40 m. Open, 1 cm thick shaly bedding parting at top of unit from 25.35 m to 25.40 m. Distinct, light greenish grey, fine grained, siliceous dolostone beds at top and bottom of unit from 25.35 m to 25.60 m and 28.55 m to 28.82 m with reddish brown dolostone bed from 28.82 m to 28.88 m.			23											
32		Unit 2 28.88 m to 34.70 m Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional mottled textured beds (30.50 m to 30.80 m, 31.70 m to 32.37 m and 33.80 m to 34.45 m) and argillaceous to shaly bedding parting from 32.73 m to 32.80 m and 33.45 m to 33.55 m with 1 cm thick soft mud seam at 33.55 m.														Bentonite Seal
33		Unit 1 34.70 m to 35.50 m Fresh, light grey, fine grained, thinly to thickly bedded, mottled textured, dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals and argillaceous bedding partings. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone bed at 33.70 m to 34.07 m.			24											
34																
35		CONTINUED NEXT PAGE			25											

DEPTH SCALE 1 : 25

Golder Associates

LOGGED: MK

CHECKED: KA

000042

MISS_ROCK 04112080O-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-2

SHEET 8 OF 8

LOCATION: N 4939749.9 ;E 651897.5

DRILLING DATE: Sep. 16, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —															MW-2 (B) (A)
35					25												Bentonite Seal
				211.37													
		END OF DRILLHOLE		35.50													
36																	
37																	
38																	
39																	
40																	

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KAM

000043

MISS_ROCK_041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-3

SHEET 1 OF 12

LOCATION: N 4938298.2 ;E 651523.4

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		GROUND SURFACE		247.79													MW-3 (B) (A) (B)
0		Topsoil		0.00													
		Verulam Formation 0.06 m to 16.30 m		0.06													
		Fresh, faintly to moderately weathered on bedding partings, tan grey to medium grey, very fine to fine grained, thinly bedded, micritic, nodular argillaceous limestone. Sequence contains dark grey to black shaly bedding partings, circular 2 mm to 6 mm burrow casts and occasional thinly to medium bedded, brownish grey, fine to medium crystalline, fossiliferous (crinoids, corals, pelycepods) calcarenite beds and minor, very thin, lithoclastic calcarenite beds associated with rip up clasts. Numerous shaly partings from 3.69 m to 4.86 m and 13.92 m to 15.04 m			1												
1																	
					2												
2																	
					3												
3																	
					4												
4																	
5		CONTINUED NEXT PAGE															

MISS_ROCK 041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK

CHECKED: KA

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-3

SHEET 2 OF 12

LOCATION: N 4938298.2 ;E 651523.4

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —															MW-3 (B) (A)
5		Verulam Formation 0.06 m to 16.30 m Fresh, faintly to moderately weathered on bedding partings, tan grey to medium grey, very fine to fine grained, thinly bedded, micritic, nodular argillaceous limestone. Sequence contains dark grey to black shaly bedding partings, circular 2 mm to 6 mm burrow casts and occasional thinly to medium bedded, brownish grey, fine to medium crystalline, fossiliferous (crinoids, corals, pelycepods) calcarenite beds and minor, very thin, lithoclastic calcarenite beds associated with rip up clasts. Numerous shaly partings from 3.69 m to 4.86 m and 13.92 m to 15.04 m			5												Bentonite Seal
6					5												
7					6												
8					7												
9					8												
10		*CONTINUED NEXT PAGE*															

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KAM

MISS_ROCK 041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-3

SHEET 3 OF 12

LOCATION: N 4938298.2 ;E 651523.4

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
10		— CONTINUED FROM PREVIOUS PAGE —															MW-3
		Verulam Formation 0.06 m to 16.30 m Fresh, faintly to moderately weathered on bedding partings, tan grey to medium grey, very fine to fine grained, thinly bedded, micritic, nodular argillaceous limestone. Sequence contains dark grey to black shaly bedding partings, circular 2 mm to 6 mm burrow casts and occasional thinly to medium bedded, brownish grey, fine to medium crystalline, fossiliferous (crinoids, corals, pelycepods) calcarenite beds and minor, very thin, lithoclastic calcarenite beds associated with rip up clasts. Numerous shaly partings from 3.69 m to 4.86 m and 13.92 m to 15.04 m			8												(B) (A)
11																	Bentonite Seal ▽ (A)
					9												
12																	
13																	
					10												
14																	
					11												
15		CONTINUED NEXT PAGE															

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

000046

MISS_ROCK 041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-3

SHEET 4 OF 12

LOCATION: N 4938298.2 ;E 651523.4

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —															MW-3
15		Verulam Formation 0.06 m to 16.30 m Fresh, faintly to moderately weathered on bedding partings, tan grey to medium grey, very fine to fine grained, thinly bedded, micritic, nodular argillaceous limestone. Sequence contains dark grey to black shaly bedding partings, circular 2 mm to 6 mm burrow casts and occasional thinly to medium bedded, brownish grey, fine to medium crystalline, fossiliferous (crinoids, corals, pelycepods) calcarenite beds and minor, very thin, lithoclastic calcarenite beds associated with rip up clasts. Numerous shaly partings from 3.69 m to 4.86 m and 13.92 m to 15.04 m			11												(B) (A)
16				231.49 16.30													Bentonite Seal
17		Bobcaygeon Formation 16.30 m to 29.26 m Sharp contact with Verulam Formation. Fresh, medium brownish grey to medium grey, fine grained micritic to medium grained crystalline calcarenitic, thinly to thickly bedded, interbedded argillaceous limestone to calcarenitic limestone with argillaceous shaly bedding partings. From 16.30 m to 17.55 m: Fresh medium brown, medium grained, crystalline, faintly petroliferous, medium to thickly bedded calcarenite limestone.			12												
18		From 17.55 m to 20.10 m: Fresh, medium brownish grey, fine to medium grained, thinly to medium bedded, nodular, argillaceous, micritic to calcarenitic limestone. From 20.10 m to 21.10 m: Fresh, medium brownish grey, fine grained, thinly bedded, nodular, argillaceous, micritic limestone with numerous dark grey to black argillaceous to shaly bedding partings up to 1 cm thick.			13												
19		From 21.10 m to 27.25 m: Fresh, light to medium brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone with argillaceous shaly partings interbedded with occasional brownish grey, fine to medium grained, crystalline, thin to medium beds of fossiliferous, bioclastic (crinoid, coral) calcarenitic limestone and very thin lithoclastic limestone beds. First calcarenite bed occurs between 23.50 m and 23.90 m with shaly limestone bed at 23.47 m to 23.50 m. From 27.25 m to 29.26 m: Fresh, light grey to creamy light grey, very fine grained, thinly to medium bedded, lithographic limestone with disseminated medium grained calcite crystals interbedded with light brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone. First nodular, micritic limestone bed occurs between 29.05 m and 29.26 m.			14												
20		*CONTINUED NEXT PAGE*															

HYDRAULIC CONDUCTIVITY K, cm/sec: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

DIAMETRAL POINT LOAD INDEX (MPa): 2 4 6

DEPTH SCALE
1 : 25

LOGGED: MK

CHECKED: KAM

Golder Associates

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-3

SHEET 5 OF 12

LOCATION: N 4938298.2 ;E 651523.4

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH / % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —														MW-3 (B) (A)
20		Bobcaygeon Formation 16.30 m to 29.26 m Sharp contact with Verulam Formation. Fresh, medium brownish grey to medium grey, fine grained micritic to medium grained crystalline calcarenitic, thinly to thickly bedded, interbedded argillaceous limestone to calcarenitic limestone with argillaceous shaly bedding partings. From 16.30 m to 17.55 m: Fresh medium brown, medium grained, crystalline, faintly petroliferous, medium to thickly bedded calcarenite limestone.			14										
21		From 17.55 m to 20.10 m: Fresh, medium brownish grey, fine to medium grained, thinly to medium bedded, nodular, argillaceous, micritic to calcarenitic limestone. From 20.10 m to 21.10 m: Fresh, medium brownish grey, fine grained, thinly bedded, nodular, argillaceous, micritic limestone with numerous dark grey to black argillaceous to shaly bedding partings up to 1 cm thick.			15										Bentonite Seal
22		From 21.10 m to 27.25 m: Fresh, light to medium brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone with argillaceous shaly partings interbedded with occasional brownish grey, fine to medium grained, crystalline, thin to medium beds of fossiliferous, bioclastic (crinoid, coral) calcarenitic limestone and very thin lithoclastic limestone beds. First calcarenite bed occurs between 23.50 m and 23.90 m with shaly limestone bed at 23.47 m to 23.50 m.			16										
23		From 27.25 m to 29.26 m: Fresh, light grey to creamy light grey, very fine grained, thinly to medium bedded, lithographic limestone with disseminated medium grained calcite crystals interbedded with light brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone. First nodular, micritic limestone bed occurs between 29.05 m and 29.26 m.													
24					17										
25		CONTINUED NEXT PAGE			18										

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAI

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-3

SHEET 6 OF 12

LOCATION: N 4938298.2 ;E 651523.4

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (cm/min)	COLOUR % RETURN	FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —															MW-3 (B) (A)
25		Bobcaygeon Formation 16.30 m to 29.26 m Sharp contact with Verulam Formation. Fresh, medium brownish grey to medium grey, fine grained micritic to medium grained crystalline calcarenitic, thinly to thickly bedded, interbedded argillaceous limestone to calcarenitic limestone with argillaceous shaly bedding partings. From 16.30 m to 17.55 m: Fresh medium brown, medium grained, crystalline, faintly petroliferous, medium to thickly bedded calcarenite limestone. From 17.55 m to 20.10 m: Fresh, medium brownish grey, fine to medium grained, thinly to medium bedded, nodular, argillaceous, micritic to calcarenitic limestone. From 20.10 m to 21.10 m: Fresh, medium brownish grey, fine grained, thinly bedded, nodular, argillaceous, micritic limestone with numerous dark grey to black argillaceous to shaly bedding partings up to 1 cm thick. From 21.10 m to 27.25 m: Fresh, light to medium brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone with argillaceous shaly partings interbedded with occasional brownish grey, fine to medium grained, crystalline, thin to medium beds of fossiliferous, bioclastic (crinoid, coral) calcarenitic limestone and very thin lithoclastic limestone beds. First calcarenite bed occurs between 23.50 m and 23.90 m with shaly limestone bed at 23.47 m to 23.50 m. From 27.25 m to 29.26 m: Fresh, light grey to creamy light grey, very fine grained, thinly to medium bedded, lithographic limestone with disseminated medium grained calcite crystals interbedded with light brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone. First nodular, micritic limestone bed occurs between 29.05 m and 29.26 m.			18											Bentonite Seal
26																	
27					19												
28																	
29				218.53 29.26	20												
		Gull River Formation 29.26 m to 46.20 m (See next page for detailed description)			21												
30		CONTINUED NEXT PAGE															

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KAM

000049

MISS_ROCK 041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-3

SHEET 7 OF 12

LOCATION: N 4938298.2 ;E 651523.4

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —															MW-3
30		Gull River Formation 29.26 m to 46.20 m Unit 4 29.26 m to 32.62 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, lithographic limestone with occasional disseminated medium grained calcite crystals, occasional stylolites, and mottled textured bed at top of unit between 29.26 m and 29.34 m with black argillaceous bedding parting at 31.26 m.			21											(B) (A)
31		Unit 3 32.62 m to 36.25 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings and mottled textured beds (32.80 m to 33.39 m, 33.56 m to 34.24 m and 34.50 m to 36.10 m). Open, 3 cm thick shaly bedding parting at top of unit. Distinct, light greenish grey, fine grained, siliceous dolostone beds at 32.65 m to 32.80 m and 36.10 m to 36.25 m with green lithoclastic bed from 33.39 m to 33.56 m and argillaceous laminar textured dolomitic limestone from 34.24 m to 34.50 m.			22											Bentonite Seal
32		Unit 2 36.25 m to 40.12 m Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional stylolite, mottled textured beds (37.90 m to 38.25 m and 39.03 m to 39.80 m) and argillaceous bedding partings. Stumped bedding structure at top 10 cm of unit.														
33		Unit 1 40.12 m to 46.20 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals and argillaceous to black shaly bedding partings, mottled textured bed (41.66 m to 42.50 m) and thin, laminar textured beds. Top of Unit 1 marked by shale parting from 40.12 m to 40.13 m. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone beds occur at 40.95 m to 41.46 m and 45.25 m to 45.50 m. Top of upper green bed marked by shaly limestone from 40.85 m to 40.95 m. Distinct white, soft marl layer occur at base of upper green bed at 41.46 m. Reddish brown, thin shaly dolostone bed at 45.50 m to 45.52 m.			23											
34					24											
35		CONTINUED NEXT PAGE														

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KAM

000050

MISS_ROCK 041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-3

SHEET 8 OF 12

LOCATION: N 4938298.2 ;E 651523.4

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —															MW-3 (B) (A)
35		Gull River Formation 29.26 m to 46.20 m Unit 4 29.26 m to 32.62 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, lithographic limestone with occasional disseminated medium grained calcite crystals, occasional stylolites, and mottled textured bed at top of unit between 29.26 m and 29.34 m with black argillaceous bedding parting at 31.26 m.			24											
36		Unit 3 32.62 m to 36.25 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings and mottled textured beds (32.80 m to 33.39 m, 33.56 m to 34.24 m and 34.50 m to 36.10 m). Open, 3 cm thick shaly bedding parting at top of unit. Distinct, light greenish grey, fine grained, siliceous dolostone beds at 32.65 m to 32.80 m and 36.10 m to 36.25 m with green lithoclastic bed from 33.39 m to 33.56 m and argillaceous laminar textured dolomitic limestone from 34.24 m to 34.50 m.			25											Bentonite Seal
37		Unit 2 36.25 m to 40.12 m Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional stylolite, mottled textured beds (37.90 m to 38.25 m and 39.03 m to 39.80 m) and argillaceous bedding partings. Slumped bedding structure at top 10 cm of unit.			26											
38		Unit 1 40.12 m to 46.20 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals and argillaceous to black shaly bedding partings, mottled textured bed (41.66 m to 42.50 m) and thin, laminar textured beds. Top of Unit 1 marked by shale parting from 40.12 m to 40.13 m. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone beds occur at 40.95 m to 41.46 m and 45.25 m to 45.50 m. Top of upper green bed marked by shaly limestone from 40.85 m to 40.95 m. Distinct white, soft marl layer occur at base of upper green bed at 41.46 m. Reddish brown, thin shaly dolostone bed at 45.50 m to 45.52 m.			27											
39																	
40		CONTINUED NEXT PAGE															

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KAM

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-3

SHEET 9 OF 12

LOCATION: N 4938298.2 ;E 651523.4

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH / COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY, K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —														MW-3
40		Gull River Formation 29.26 m to 46.20 m Unit 4 29.26 m to 32.62 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, lithographic limestone with occasional disseminated medium grained calcite crystals, occasional stylolites, and mottled textured bed at top of unit between 29.26 m and 29.34 m with black argillaceous bedding parting at 31.26 m.			27											(B) Bentonite Seal (A)
41		Unit 3 32.62 m to 36.25 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings and mottled textured beds (32.80 m to 33.39 m, 33.56 m to 34.24 m and 34.50 m to 36.10 m). Open, 3 cm thick shaly bedding parting at top of unit. Distinct, light greenish grey, fine grained, siliceous dolostone beds at 32.65 m to 32.80 m and 36.10 m to 36.25 m with green lithoclastic bed from 33.39 m to 33.56 m and argillaceous laminar textured dolomitic limestone from 34.24 m to 34.50 m.			28											Sand
42		Unit 2 36.25 m to 40.12 m Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional stylolite, mottled textured beds (37.90 m to 38.25 m and 39.03 m to 39.80 m) and argillaceous bedding partings. Slumped bedding structure at top 10 cm of unit.			29											
43		Unit 1 40.12 m to 46.20 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals and argillaceous to black shaly bedding partings, mottled textured bed (41.66 m to 42.50 m) and thin, laminar textured beds. Top of Unit 1 marked by shale parting from 40.12 m to 40.13 m. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone beds occur at 40.95 m to 41.46 m and 45.25 m to 45.50 m. Top of upper green bed marked by shaly limestone from 40.85 m to 40.95 m. Distinct white, soft marl layer occur at base of upper green bed at 41.46 m. Reddish brown, thin shaly dolostone bed at 45.50 m to 45.52 m.			30											A well constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen.
44					31											
45		CONTINUED NEXT PAGE														

DEPTH SCALE 1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAI

000052

MISS_ROCK 04112080O-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-3

SHEET 10 OF 12

LOCATION: N 4938298.2 ;E 651523.4

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —															MW-3 (B) (A)
45		Gull River Formation 29.26 m to 46.20 m (Continued - See previous page for detailed description)			31												
				201.59													
46		Shadow Lake Formation 46.20 m to 54.90 m From 46.20 m to 49.68 m: Fresh, light to dark greenish grey, fine to medium grained, faintly to moderately porous, thinly to medium bedded, quartz sandstone with siltstone partings. Greenish grey sandy siltstone beds with green shale lithoclasts at 46.20 m to 46.70 mm. Transitional lower contact. From 49.68 m to 52.52 m: Fresh, medium to dark greenish grey, slake susceptible shale and shaly siltstone with dark reddish brown shale between 51.75 m and 51.98 m and interbedded dark reddish brown and green shale to 52.25 m. Transitional lower contact. From 52.25 m to 54.90 m: Fresh, light green to dark reddish brown, fine to coarse grained, faintly porous, thinly to medium bedded sandstone comprised of angular clasts of feldspar crystals and quartz. Sharp basal contact.		46.20	32											A well constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen.
47																	
48					33												Bentonite Seal
49																	
50		*CONTINUED NEXT PAGE*			34												

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KAM

000053

MISS_ROCK 04112080O-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4938298.2 ;E 651523.4

INCLINATION: -90° AZIMUTH: —

RECORD OF BOREHOLE: MW-3

DRILLING DATE: Sep. 27, 2004

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

SHEET 11 OF 12

DATUM: GEODETIC

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH / COLOUR / % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —														MW-3
50		Shadow Lake Formation 46.20 m to 54.90 m From 46.20 m to 49.68 m: Fresh, light to dark greenish grey, fine to medium grained, faintly to moderately porous, thinly to medium bedded, quartz sandstone with siltstone partings. Greenish grey sandy siltstone beds with green shale lithoclasts at 46.20 m to 46.70 mm. Transitional lower contact. From 49.68 m to 52.52 m: Fresh, medium to dark greenish grey, slake susceptible shale and shaly siltstone with dark reddish brown shale between 51.75 m and 51.98 m and interbedded dark reddish brown and green shale to 52.25 m. Transitional lower contact. From 52.25 m to 54.90 m: Fresh, light green to dark reddish brown, fine to coarse grained, faintly porous, thinly to medium bedded sandstone comprised of angular clasts of feldspar crystals and quartz. Sharp basal contact.			34										(B) (A)
51					35											
52																Bentonite Seal
53					36											
54					37											
55		CONTINUED NEXT PAGE		192.89 54.90												

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK

CHECKED: KA

000054

MISS_ROCK 041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-3

SHEET 12 OF 12

LOCATION: N 4938298.2 ;E 651523.4

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	COLOUR & % RETURN	FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —															MW-3
55		Precambrian Basement 54.90 m to 58.41 m From 54.90 m to 55.70 m: Highly weathered, fractured, dark reddish brown, chlorite-feldspar-amphibole-gneiss. From 55.70 m to 57.20 m: Faintly to moderately weathered, dark grey, medium grained, strongly foliated, quartz-feldspar-amphibole gneiss with moderately to highly weathered sections between 55.90 m and 56.10 m, 56.50 m and 56.70 m, and 57.00 m and 57.20 m. From 57.20 m to 58.41 m: Fresh, dark grey, foliated, quartz-feldspar-amphibole gneiss.			37											(B) (A)
56					38												Bentonite Seal
57					39												
58				189.38													
		END OF DRILLHOLE		58.41													
59																	
60																	

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KAM

000055

MISS_ROCK 04112080O-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-4

SHEET 1 OF 8

LOCATION: N 4939830.4 ;E 650784.6

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR & % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		GROUND SURFACE		237.41													MW-4
0		Topsoil		0.00													(B) (A)
				237.31													
		Overburden		0.10													
					1												
1																	
					2												
2																	
3																	
				234.06													
		Bobcaygeon Formation 3.35 m to 15.48 m (See next page for detailed description)		3.35	3												
4					4												
					5												
5		*CONTINUED NEXT PAGE*															

(B) ▽

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KA

000056

MISS_ROCK 041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-4

SHEET 2 OF 8

LOCATION: N 4939830.4 ;E 650784.6

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K_s cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —														MW-4 (B) (A)
5		Bobcaygeon Formation 3.35 m to 15.48 m Fresh, medium brownish grey to medium grey, fine grained micritic to medium grained crystalline calcarenitic, thinly to thickly bedded, interbedded argillaceous limestone to calcarenitic limestone with argillaceous shaly bedding partings. From 3.35 m to 4.70 m: Fresh, medium brown, medium grained crystalline, faintly petroliferous, medium to thickly bedded calcarenite limestone.			5 6										
6		From 4.70 m to 6.74 m: Fresh, medium brownish grey, fine to medium grained, thinly to medium bedded, nodular, argillaceous, micritic to calcarenitic limestone. From 6.74 m to 7.68 m: Fresh, medium brownish grey, fine grained, thinly bedded, nodular, argillaceous, micritic limestone with numerous dark grey to black argillaceous to shaly bedding partings up to 1 cm thick.													
7		From 7.68 m to 12.65 m: Fresh, light to medium brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone with argillaceous shaly partings interbedded with occasional brownish grey, fine to medium grained, crystalline thinly to medium beds of fossiliferous, bioclastic (crinoid, coral) calcarenitic limestone. Very thin, lithoclastic limestone bed from 9.30 m to 9.40 m. Coral or stromatoporoid fossil layer at 11.25 m to 11.30 m.			7										
8		From 12.65 m to 15.48 m: Fresh, light grey to creamy light grey, very fine grained, thinly to medium bedded, lithographic limestone with disseminated medium grained calcite crystals interbedded with light brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone. Soft, light grey shale parting between 14.25 m and 14.30 m. Transitional lower contact.			8										
9					9										
10		CONTINUED NEXT PAGE													

DEPTH SCALE
1 : 25

LOGGED: MK
CHECKED: KAM

Golder Associates

000057

MISS_ROCK 041120900-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4939830.4 ;E 650784.6

INCLINATION: -90° AZIMUTH: —

RECORD OF BOREHOLE: MW-4

SHEET 3 OF 8

DRILLING DATE: Sep. 27, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH / % RETURN	COLOUR	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K_s cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —															MW-4
10		Bobcaygeon Formation 3.35 m to 15.48 m Fresh, medium brownish grey to medium grey, fine grained micritic to medium grained crystalline calcarenitic, thinly to thickly bedded, interbedded argillaceous limestone to calcarenitic limestone with argillaceous shaly bedding partings. From 3.35 m to 4.70 m: Fresh, medium brown, medium grained crystalline, faintly petroliferous, medium to thickly bedded calcarenite limestone. From 4.70 m to 6.74 m: Fresh, medium brownish grey, fine to medium grained, thinly to medium bedded, nodular, argillaceous, micritic to calcarenitic limestone. From 6.74 m to 7.68 m: Fresh, medium brownish grey, fine grained, thinly bedded, nodular, argillaceous, micritic limestone with numerous dark grey to black argillaceous to shaly bedding partings up to 1 cm thick. From 7.68 m to 12.65 m: Fresh, light to medium brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone with argillaceous shaly partings interbedded with occasional brownish grey, fine to medium grained, crystalline thinly to medium beds of fossiliferous, bioclastic (crinoid, coral) calcarenitic limestone. Very thin, lithoclastic limestone bed from 9.30 m to 9.40 m. Coral or stromatoporoid fossil layer at 11.25 m to 11.30 m. From 12.65 m to 15.48 m: Fresh, light grey to creamy light grey, very fine grained, thinly to medium bedded, lithographic limestone with disseminated medium grained calcite crystals interbedded with light brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone. Soft, light grey shale parting between 14.25 m and 14.30 m. Transitional lower contact.			9											(B) (A)
11					10												
12					11												
13					12												
14																	
15		CONTINUED NEXT PAGE															

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KA

000058

MISS_ROCK 041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-4

SHEET 4 OF 8

LOCATION: N 4939830.4 ;E 650784.6

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —															MW-4 (B) (A)
15					12												
				221.93													
		Gull River Formation 15.48 m to 32.32 m		15.48													
		Unit 4 15.48 m to 19.10 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, lithographic limestone with occasional disseminated medium grained calcite crystals, mottled textured beds, laminar beds and argillaceous bedding partings. From 15.70 m to 15.72 m, slaking shale parting.															
16		Unit 3 19.10 m to 23.10 m: Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings and mottled textured beds (19.82 m to 20.30 m and 21.00 m to 22.25 m). Shaly argillaceous limestone bedding parting at top of unit from 19.10 m to 19.15 m. Distinct, light greenish grey, fine grained, siliceous dolostone bed at 19.15 m to 19.37 m. Soft, white marl layer between 19.78 m and 19.82 m at depth where drillers reported cavity. Sharp contact with Unit 2.			13												
17		Unit 2 23.10 m to 27.08 m: Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional stylolite, mottled textured beds (24.30 m to 24.65 m and 25.75 m to 26.08 m) and argillaceous bedding partings. Sharp contact with Unit 1.															
		Unit 1 27.08 m to 32.32 m: Fresh, light grey to light tan grey, fine grained, thinly to thickly bedded dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals, argillaceous bedding partings, mottled textured beds (27.73 m to 28.57 m and 28.80 m to 29.25 m) and thin, laminar textured beds. Dark grey, slaking shale from 27.08 m to 27.13 m. Silty to sandy lithoclastic dolostone at 27.13 m to 27.27 m. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone bed occurs at 27.27 m to 27.73 m. Weathered shale parting at 29.25 m. Reddish brown, thin shaly dolostone beds at 30.40 m to 30.45 m with disseminated pyrite and 31.75 m to 37.80 m.			14												
18																	
19					15												
20		CONTINUED NEXT PAGE															

DEPTH SCALE 1 : 25

LOGGED: MK

CHECKED: KAM

Golder Associates

000059

MISS_ROCK 04112080O-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-4

SHEET 5 OF 8

LOCATION: N 4939830.4 ;E 650784.6

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (min/m)	FLUSH / % RETURN / COLOUR	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —														MW-4
20		Gull River Formation 15.48 m to 32.32 m Unit 4 15.48 m to 19.10 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, lithographic limestone with occasional disseminated medium grained calcite crystals, mottled textured beds, laminar beds and argillaceous bedding partings. From 15.70 m to 15.72 m, slaking shale parting.			15											(B) (A)
21		Unit 3 19.10 m to 23.10 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings and mottled textured beds (19.82 m to 20.30 m and 21.00 m to 22.25 m). Shaly argillaceous limestone bedding parting at top of unit from 19.10 m to 19.15 m. Distinct, light greenish grey, fine grained, siliceous dolostone bed at 19.15 m to 19.37 m. Soft, white marl layer between 19.78 m and 19.82 m at depth where drillers reported cavity. Sharp contact with Unit 2.			16											
22		Unit 2 23.10 m to 27.08 m Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional stylolite, mottled textured beds (24.30 m to 24.65 m and 25.75 m to 26.08 m) and argillaceous bedding partings. Sharp contact with Unit 1.			17											
23		Unit 1 27.08 m to 32.32 m Fresh, light grey to light tan grey, fine grained, thinly to thickly bedded dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals, argillaceous bedding partings, mottled textured beds (27.73 m to 28.57 m and 28.80 m to 29.25 m) and thin, laminar textured beds. Dark grey, slaking shale from 27.08 m to 27.13 m. Silty to sandy lithoclastic dolostone at 27.13 m to 27.27 m. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone bed occurs at 27.27 m to 27.73 m. Weathered shale parting at 29.25 m. Reddish brown, thin shaly dolostone beds at 30.40 m to 30.45 m with disseminated pyrite and 31.75 m to 37.80 m.			18											
24																
25		CONTINUED NEXT PAGE			19											

HYDRAULIC CONDUCTIVITY K, cm/sec: 10^{-4} 10^{-5} 10^{-6} 10^{-7} 10^{-8}

DIAMETRAL POINT LOAD INDEX (MPa): 2 4 6

MISS_ROCK 041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

DEPTH SCALE 1:25

Golder Associates

LOGGED: MK

CHECKED: KA

000060

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-4

SHEET 6 OF 8

LOCATION: N 4939830.4 ;E 650784.6

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR & RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —															MW-4 (B) (A)
25		Gull River Formation 15.48 m to 32.32 m Unit 4 15.48 m to 19.10 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, lithographic limestone with occasional disseminated medium grained calcite crystals, mottled textured beds, laminar beds and argillaceous bedding partings. From 15.70 m to 15.72 m, slaking shale parting. Unit 3 19.10 m to 23.10 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings and mottled textured beds (19.82 m to 20.30 m and 21.00 m to 22.25 m). Shaly argillaceous limestone bedding parting at top of unit from 19.10 m to 19.15 m. Distinct, light greenish grey, fine grained, siliceous dolostone bed at 19.15 m to 19.37 m. Soft, white marl layer between 19.78 m and 19.82 m at depth where drillers reported cavity. Sharp contact with Unit 2. Unit 2 23.10 m to 27.08 m Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional stylolite, mottled textured beds (24.30 m to 24.65 m and 25.75 m to 26.08 m) and argillaceous bedding partings. Sharp contact with Unit 1. Unit 1 27.08 m to 32.32 m Fresh, light grey to light tan grey, fine grained, thinly to thickly bedded dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals, argillaceous bedding partings, mottled textured beds (27.73 m to 28.57 m and 28.80 m to 29.25 m) and thin, laminar textured beds. Dark grey, slaking shale from 27.08 m to 27.13 m. Silty to sandy lithoclastic dolostone at 27.13 m to 27.27 m. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone bed occurs at 27.27 m to 27.73 m. Weathered shale parting at 29.25 m. Reddish brown, thin shaly dolostone beds at 30.40 m to 30.45 m with disseminated pyrite and 31.75 m to 37.80 m.			19											
26																	
27					20												
28																	
29					21												
30		CONTINUED NEXT PAGE			22												

DEPTH SCALE 1 : 25

LOGGED: MK

CHECKED: KAM

Golder Associates

000061

MISS_ROCK 04112080-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4939830.4 ;E 650784.6

INCLINATION: -90° AZIMUTH: —

RECORD OF BOREHOLE: MW-4

SHEET 7 OF 8

DRILLING DATE: Sep. 27, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

FR/FX-FRACTURE F-FAULT SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (cm/min)	FLUSH	COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —															MW-4
30		Gull River Formation 15.48 m to 32.32 m (See previous page for detailed description)			22												(B) (A)
31					23												
32				205.09 32.32													
		Shadow Lake Formation 32.32 m to 35.53 m From 32.32 m to 35.15 m: Fresh, light to dark greenish grey, fine grained, thinly interbedded, siltstone, shale and minor sandstone. From 35.15 m to 35.53 m: Fresh, dark greenish grey, slake susceptible shale.			24												
33																	
34					25												
35		CONTINUED NEXT PAGE															

MISS_ROCK 041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

000062

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-4

SHEET 8 OF 8

LOCATION: N 4939830.4 ;E 650784.6

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

FR/FX-FRACTURE F-FAULT- SM-SMOOTH FL-FLEXURED BC-BROKEN CORE
CL-CLEAVAGE J-JOINT R-ROUGH UE-UNEVEN MB-MECH. BREAK
SH-SHEAR P-POLISHED ST-STEPPED W-WAVY B-BEDDING
VN-VEIN S-SLICKENSIDED PL-PLANAR C-CURVED

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR & % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		— CONTINUED FROM PREVIOUS PAGE —															MW-4 (B) (A)
35		Shadow Lake Formation 32.32 m to 35.53 m From 32.32 m to 35.15 m: Fresh, light to dark greenish grey, fine grained, thinly interbedded, siltstone, shale and minor sandstone. From 35.15 m to 35.53 m: Fresh, dark greenish grey, slake susceptible shale. END OF DRILLHOLE		201.88 35.53	25												
36																	
37																	
38																	
39																	
40																	

HYDRAULIC CONDUCTIVITY K, cm/sec: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

DIAMETRAL POINT LOAD INDEX (MPa): 2 4 6

MISS_ROCK 041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/8/06 JDR

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

APPENDIX A.2

RECORD OF GEOPHYSICAL LOGS

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-1

SHEET 1 OF 12

LOCATION: N 4939121.7 ;E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-1
		GROUND SURFACE		249.65			
0		Topsoil		0.00 249.55			
		Verulam Formation 0.1 m to 15.0 m Fresh, faintly to moderately weathered on bedding partings, tan grey to medium grey, very fine to fine grained, thinly bedded, micritic, nodular, argillaceous limestone. Sequence contains dark grey to black shaly bedding partings, circular 2 mm to 6 mm burrow casts and occasional thinly to medium bedded, brownish grey, fine to medium crystalline, fossiliferous (crinoids, corals, pelecypods) calcarenite beds and minor, very thin, lithoclastic calcarenite beds associated with rip up clasts. Rock core is weathered and broken up from 0.1 m to 1.3 m with iron oxide staining on joint and bedding surfaces extending to 0.2 m depth. Broken weathered core occurs again at 3.40 m to 3.50 m.		0.10			
1							
2							Bentonite Seal
3							
4							
5		*CONTINUED NEXT PAGE*					

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KAM

000065

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4939121.7 ;E 651592.4

GEOPHYSICAL LOG OF: MW-1

DRILLING DATE: Aug. 11-12, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-1
5		*— CONTINUED FROM PREVIOUS PAGE —*					
		Verulam Formation 0.1 m to 15.0 m Fresh, faintly to moderately weathered on bedding partings, tan grey to medium grey, very fine to fine grained, thinly bedded, micritic, nodular, argillaceous limestone. Sequence contains dark grey to black shaly bedding partings, circular 2 mm to 6 mm burrow casts and occasional thinly to medium bedded, brownish grey, fine to medium crystalline, fossiliferous (crinoids, corals, pelecypods) calcarenite beds and minor, very thin, lithoclastic calcarenite beds associated with rip up clasts. Rock core is weathered and broken up from 0.1 m to 1.3 m with iron oxide staining on joint and bedding surfaces extending to 0.2 m depth. Broken weathered core occurs again at 3.40 m to 3.50 m.					
6							
7							Bentonite Seal
8							
9							
10		*CONTINUED NEXT PAGE*					

DEPTH SCALE
1 : 25

LOGGED: MK

CHECKED: KAM

Golder Associates

000066

BAR_GEOPHYSICAL 041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-1

SHEET 3 OF 12

LOCATION: N 4939121.7 ;E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-1
10		*— CONTINUED FROM PREVIOUS PAGE —*					
		Verulam Formation 0.1 m to 15.0 m Fresh, faintly to moderately weathered on bedding partings, tan grey to medium grey, very fine to fine grained, thinly bedded, micritic, nodular, argillaceous limestone. Sequence contains dark grey to black shaly bedding partings, circular 2 mm to 6 mm burrow casts and occasional thinly to medium bedded, brownish grey, fine to medium crystalline, fossiliferous (crinoids, corals, pelecypods) calcarenite beds and minor, very thin, lithoclastic calcarenite beds associated with rip up clasts. Rock core is weathered and broken up from 0.1 m to 1.3 m with iron oxide staining on joint and bedding surfaces extending to 0.2 m depth. Broken weathered core occurs again at 3.40 m to 3.50 m.					
11							
12							Bentonite Seal
13							
14							
15		*CONTINUED NEXT PAGE*		234.65			

DEPTH SCALE
1 : 25

LOGGED: MK

CHECKED: KAN

Golder Associates

000067

BAR_GEOPHYSICAL 041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4939121.7 ;E 651592.4

GEOPHYSICAL LOG OF: MW-1

DRILLING DATE: Aug. 11-12, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION
		— CONTINUED FROM PREVIOUS PAGE —					MW-1
15		Bobcaygeon Formation 15.0 m to 28.35 m Sharp contact with Verulam Formation. Fresh, medium brownish grey to medium grey, fine grained micritic to medium grained crystalline calcarenitic, thinly to thickly bedded, interbedded argillaceous limestone to calcarenitic limestone with argillaceous shaly bedding partings. From 15.00 m to 16.60 m: Fresh medium brown, medium grained crystalline, faintly petroliferous, medium to thickly bedded calcarenite limestone. From 16.60 m to 18.36 m: Fresh medium brownish grey, fine to medium grained, thinly to medium bedded, nodular, argillaceous, micritic to calcarenitic limestone. From 18.36 m to 19.90 m: Fresh, medium brownish grey, fine grained, thinly bedded, nodular, argillaceous, micritic limestone with numerous dark grey to black argillaceous to shaly bedding partings up to 1 cm thick. From 19.90 m to 24.95 m: Fresh, light to medium brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone with argillaceous shaly partings interbedded with occasional brownish grey, fine to medium grained, crystalline thin to medium beds of fossiliferous, bioclastic (crinoid, coral) calcarenitic limestone and very thin lithoclastic limestone beds. First fossiliferous calcarenite bed occurs between 24.70 m and 24.95 m. Distinctive coral fossil inclusion at 23.40 m in calcarenite bed between 23.30 m and 23.50 m. From 24.95 m to 28.35 m: Fresh, light grey to creamy light grey, very fine grained, thinly to medium bedded lithographic limestone with disseminated medium grained calcite crystals and occasional minor pyrite grains interbedded with light brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone. First nodular, micritic limestone bed occurs between 27.85 m and 27.93 m. Light grey, plastic clay parting 2 mm thick at 26.83 m.		15.00			Bentonite Seal
16							
17							
18							
19							
20		CONTINUED NEXT PAGE					

DEPTH SCALE

1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-1

SHEET 5 OF 12

LOCATION: N 4939121.7 ;E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-1
20		*— CONTINUED FROM PREVIOUS PAGE —*					
		Bobcaygeon Formation 15.0 m to 28.35 m Sharp contact with Verulam Formation. Fresh, medium brownish grey to medium grey, fine grained micritic to medium grained crystalline calcarenitic, thinly to thickly bedded, interbedded argillaceous limestone to calcarenitic limestone with argillaceous shaly bedding partings. From 15.00 m to 16.60 m: Fresh medium brown, medium grained crystalline, faintly petroliferous, medium to thickly bedded calcarenite limestone. From 16.60 m to 18.36 m: Fresh medium brownish grey, fine to medium grained, thinly to medium bedded, nodular, argillaceous, micritic to calcarenitic limestone. From 18.36 m to 19.90 m: Fresh, medium brownish grey, fine grained, thinly bedded, nodular, argillaceous, micritic limestone with numerous dark grey to black argillaceous to shaly bedding partings up to 1 cm thick. From 19.90 m to 24.95 m: Fresh, light to medium brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone with argillaceous shaly partings interbedded with occasional brownish grey, fine to medium grained, crystalline thin to medium beds of fossiliferous, bioclastic (crinoid, coral) calcarenitic limestone and very thin lithoclastic limestone beds. First fossiliferous calcarenite bed occurs between 24.70 m and 24.95 m. Distinctive coral fossil inclusion at 23.40 m in calcarenite bed between 23.30 m and 23.50 m. From 24.95 m to 28.35 m: Fresh, light grey to creamy light grey, very fine grained, thinly to medium bedded lithographic limestone with disseminated medium grained calcite crystals and occasional minor pyrite grains interbedded with light brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone. First nodular, micritic limestone bed occurs between 27.85 m and 27.93 m. Light grey, plastic clay parting 2 mm thick at 26.83 m.					Bentonite Seal
21							
22							
23							
24							
25		*CONTINUED NEXT PAGE*					

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAN

000069

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4939121.7 ;E 651592.4

GEOPHYSICAL LOG OF: MW-1

DRILLING DATE: Aug. 11-12, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-1
25		— CONTINUED FROM PREVIOUS PAGE —					
		Bobcaygeon Formation 15.0 m to 28.35 m (Continued - see previous page for detailed description)					
26							
							Bentonite Seal
27							
28				221.30 28.35			
		Gull River Formation 28.35 m to 45.10m Unit 4 28.35 m to 31.60 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, lithographic limestone with occasional disseminated medium grained calcite crystals, a stylolite (29.70 m), mottled textured beds (29.70 m to 30.00 m and 31.20 m to 31.40 m), laminar beds and argillaceous bedding partings.					
29							Sand
30		CONTINUED NEXT PAGE					

DEPTH SCALE

1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAI

000070

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-1

SHEET 7 OF 12

LOCATION: N 4939121.7 ;E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-1
30		*— CONTINUED FROM PREVIOUS PAGE —*					
		Gull River Formation 28.35 m to 45.10m Unit 4 28.35 m to 31.60 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, lithographic limestone with occasional disseminated medium grained calcite crystals, a stylolite (29.70 m), mottled textured beds (29.70 m to 30.00 m and 31.20 m to 31.40 m), laminar beds and argillaceous bedding partings. Unit 3 31.60 m to 35.55 m					
31		Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings and mottled textured bed (33.28 m to 34.43 m). Open, 1 cm thick shaly bedding parting at top of unit. Distinct, light greenish grey, fine grained, siliceous dolostone beds at 32.27 m to 32.37 m and 34.87 m to 34.97 m with lithoclastic bed from 34.97 m to 35.00 m. Unit 2 35.55 m to 38.88 m					Monitoring well constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen.
32		Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional stylolite (36.75 m), mottled textured beds (35.55 m to 35.60 m, 36.75 m to 37.06 m and 38.10 m to 38.68 m) and argillaceous bedding partings. Unit 1 38.88 m to 45.10 m					
33		Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals argillaceous bedding partings, a stylolite (42.64 m), mottled textured bed (40.34 m to 41.50 m) and thin, laminar textured beds. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone beds occur at 38.92 m to 40.34 m and 43.54 m to 43.62 m. Reddish brown, thin shaly dolostone beds at 43.62 m to 43.68 m and 44.35 m to 44.37 m. Silty to sandy lithoclastic dolostone at 44.37 m to 44.76 m. Base bed marked by buff brown dolostone from 44.76 m to 45.10 m. Top of Unit 1 marked by open argillaceous bedding partings between 38.88 m and 38.94 m. Distinct white, soft marl layers occur at 39.85 m to 39.92 m and at 41.83 m to 41.86 m overlying weathered black shale from 41.86 m to 41.88 m.					
34							
35		*CONTINUED NEXT PAGE*					

DEPTH SCALE
1 : 25

LOGGED: MK

CHECKED: KAN

Golder Associates

000071

BAR_GEOPHYSICAL 041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4939121.7 ;E 651592.4

GEOPHYSICAL LOG OF: MW-1

DRILLING DATE: Aug. 11-12, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION
		— CONTINUED FROM PREVIOUS PAGE —					MW-1
35		Gull River Formation 28.35 m to 45.10m Unit 4 28.35 m to 31.60 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, lithographic limestone with occasional disseminated medium grained calcite crystals, a stylolite (29.70 m), mottled textured beds (29.70 m to 30.00 m and 31.20 m to 31.40 m), laminar beds and argillaceous bedding partings.					
36		Unit 3 31.60 m to 35.55 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings and mottled textured bed (33.28 m to 34.43 m). Open, 1 cm thick shaly bedding parting at top of unit. Distinct, light greenish grey, fine grained, siliceous dolostone beds at 32.27 m to 32.37 m and 34.87 m to 34.97 m with lithoclastic bed from 34.97 m to 35.00 m.					
37		Unit 2 35.55 m to 38.88 m Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional stylolite (36.75 m), mottled textured beds (35.55 m to 35.60 m, 36.75 m to 37.06 m and 38.10 m to 38.68 m) and argillaceous bedding partings.					
38		Unit 1 38.88 m to 45.10 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals argillaceous bedding partings, a stylolite (42.64 m), mottled textured bed (40.34 m to 41.50 m) and thin, laminar textured beds. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone beds occur at 38.92 m to 40.34 m and 43.54 m to 43.62 m. Reddish brown, thin shaly dolostone beds at 43.62 m to 43.68 m and 44.35 m to 44.37 m. Silty to sandy lithoclastic dolostone at 44.37 m to 44.76 m.					Bentonite Seal
39		Base bed marked by buff brown dolostone from 44.76 m to 45.10 m. Top of Unit 1 marked by open argillaceous bedding partings between 38.88 m and 38.94 m. Distinct white, soft marl layers occur at 39.85 m to 39.92 m and at 41.83 m to 41.86 m overlying weathered black shale from 41.86 m to 41.88 m.					
40		CONTINUED NEXT PAGE					

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-1

SHEET 9 OF 12

LOCATION: N 4939121.7 ;E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100 / CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-1
40		*— CONTINUED FROM PREVIOUS PAGE —*				
		Gull River Formation 28.35 m to 45.10m Unit 4 28.35 m to 31.60 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, lithographic limestone with occasional disseminated medium grained calcite crystals, a stylolite (29.70 m), mottled textured beds (29.70 m to 30.00 m and 31.20 m to 31.40 m), laminar beds and argillaceous bedding partings. Unit 3 31.60 m to 35.55 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings and mottled textured bed (33.28 m to 34.43 m). Open, 1 cm thick shaly bedding parting at top of unit. Distinct, light greenish grey, fine grained, siliceous dolostone beds at 32.27 m to 32.37 m and 34.87 m to 34.97 m with lithoclastic bed from 34.97 m to 35.00 m. Unit 2 35.55 m to 38.88 m Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional stylolite (36.75 m), mottled textured beds (35.55 m to 35.60 m, 36.75 m to 37.06 m and 38.10 m to 38.68 m) and argillaceous bedding partings. Unit 1 38.88 m to 45.10 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals argillaceous bedding partings, a stylolite (42.64 m), mottled textured bed (40.34 m to 41.50 m) and thin, laminar textured beds. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone beds occur at 38.92 m to 40.34 m and 43.54 m to 43.62 m. Reddish brown, thin shaly dolostone beds at 43.62 m to 43.68 m and 44.35 m to 44.37 m. Silty to sandy lithoclastic dolostone at 44.37 m to 44.76 m. Base bed marked by buff brown dolostone from 44.76 m to 45.10 m. Top of Unit 1 marked by open argillaceous bedding partings between 38.88 m and 38.94 m. Distinct white, soft marl layers occur at 39.85 m to 39.92 m and at 41.83 m to 41.86 m overlying weathered black shale from 41.86 m to 41.88 m.				Bentonite Seal
41						
42						
43						
44						
45		*CONTINUED NEXT PAGE*				

DEPTH SCALE
1 : 25

LOGGED: MK
CHECKED: KAN

Golder Associates

BAR_GEOPHYSICAL_04112080O-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4939121.7 ;E 651592.4

GEOPHYSICAL LOG OF: MW-1

DRILLING DATE: Aug. 11-12, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-1
45		*— CONTINUED FROM PREVIOUS PAGE —*					
		Shadow Lake Formation 45.10 m to 53.51 m From 45.10 m to 47.70 m: Fresh, light to dark greenish grey, fine to medium grained, faintly to moderately porous, thinly to medium bedded, quartz sandstone with siltstone partings. Greenish grey shaly siltstone beds at 45.10 m to 45.23 m and 45.42 m to 45.46 m. Red shale bed between 46.75 m and 46.80 m.		204.55 45.10			
46		From 47.70 m to 48.90 m: Fresh, dark greenish grey, slake susceptible shale and shaly siltstone. Transitional lower contact.					
		From 48.90 m to 51.25 m: Fresh, dark reddish brown, slake susceptible shale with green shale at 50.65 m to 50.80 m. Transitional lower contact.					
47		From 51.25 to 53.51 m: Fresh, dark reddish brown, fine to coarse grained, faintly porous, medium bedded sandstone comprised of angular clasts of feldspar crystals and quartz with traces of disseminated pyrite below 51.50 m. With basal light grey silty quartz sandstone bed from 53.30 m to 53.51 m.					Bentonite Seal
48							
49							
50		*CONTINUED NEXT PAGE*					

DEPTH SCALE

1 : 25

Golder Associates

LOGGED: MK

CHECKED: KA

000074

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-1

SHEET 11 OF 12

LOCATION: N 4939121.7 ;E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100 / CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-1
50		*— CONTINUED FROM PREVIOUS PAGE —*				
		Shadow Lake Formation 45.10 m to 53.51 m From 45.10 m to 47.70 m: Fresh, light to dark greenish grey, fine to medium grained, faintly to moderately porous, thinly to medium bedded, quartz sandstone with siltstone partings. Greenish grey shaly siltstone beds at 45.10 m to 45.23 m and 45.42 m to 45.46 m. Red shale bed between 46.75 m and 46.80 m. From 47.70 m to 48.90 m: Fresh, dark greenish grey, slake susceptible shale and shaly siltstone. Transitional lower contact. From 48.90 m to 51.25 m: Fresh, dark reddish brown, slake susceptible shale with green shale at 50.65 m to 50.80 m. Transitional lower contact. From 51.25 to 53.51 m: Fresh, dark reddish brown, fine to coarse grained, faintly porous, medium bedded sandstone comprised of angular clasts of feldspar crystals and quartz with traces of disseminated pyrite below 51.50 m. With basal light grey silty quartz sandstone bed from 53.30 m to 53.51 m.				
51						
52						Bentonite Seal
53				196.14 53.51		
		Precambrian Basement 53.51 m to 59.93 m From 53.51 m to 53.76 m: Completely weathered, dark brown, micaceous, gneissic regolith. From 53.76 m to 54.80 m: Highly weathered, dark reddish brown, chlorite-feldspar-amphibole-gneiss. From 54.80 m to 56.25 m: Faintly to moderately weathered, dark grey, medium grained, strongly foliated, feldspar - amphibole gneiss. From 56.25 m to 56.55 m: Highly weathered gneiss. From 56.55 m to 59.93 m: Fresh, dark grey diorite gneiss. Last open weathered fracture at 57.10 m.				
54						
55		*CONTINUED NEXT PAGE*				

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

000075

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4939121.7 ;E 651592.4

GEOPHYSICAL LOG OF: MW-1

DRILLING DATE: Aug. 11-12, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)
55		*--- CONTINUED FROM PREVIOUS PAGE ---*		
		Precambrian Basement 53.51 m to 59.93 m From 53.51 m to 53.76 m: Completely weathered, dark brown, micaceous, gneissic regolith. From 53.76 m to 54.80 m: Highly weathered, dark reddish brown, chlorite-feldspar-amphibole-gneiss. From 54.80 m to 56.25 m: Faintly to moderately weathered, dark grey, medium grained, strongly foliated, feldspar - amphibole gneiss. From 56.25 m to 56.55 m: Highly weathered gneiss. From 56.55 m to 59.93 m: Fresh, dark grey diorite gneiss. Last open weathered fracture at 57.10 m.		
56				
57				
58				
59				
60		END OF DRILLHOLE		189.72 59.93

GEOPHYSICAL RECORD

GAMMA (cps): 25 50 75 100

CONDUCTIVITY (mS/m): 40 80 120 160

PIEZOMETER OR STANDPIPE INSTALLATION

MW-1

Bentonite Seal

DEPTH SCALE

1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAI

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-2

SHEET 1 OF 8

LOCATION: N 4939749.9 ;E 651897.5

DRILLING DATE: Sep. 16, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)
		GROUND SURFACE		248.87
0		Topsoil		0.00
		Verulam Formation 0.05 m to 9.00 m Fresh, faintly to moderately weathered on bedding partings, tan grey to medium grey, very fine to fine grained, thinly bedded, micritic, nodular, argillaceous limestone. Sequence contains dark grey to black shaly bedding partings, circular 2 mm to 6 mm burrow casts and occasional thinly to medium bedded, brownish grey, fine to medium crystalline, fossiliferous (crinoids, corals, pelecypods) calcarenite beds and minor, very thin, lithoclastic calcarenite beds associated with rip up clasts.		0.05
1				
2				
3				
4				
5		CONTINUED NEXT PAGE		

GEOPHYSICAL RECORD

GAMMA (cps): 25 50 75 100

CONDUCTIVITY (mS/m): 40 80 120 160

PIEZOMETER OR STANDPIPE INSTALLATION

MW-2

(B) (A)

Bentonite Seal

Bentonite Seal

Sand

DEPTH SCALE

1 : 25

LOGGED: MK

CHECKED: KAN

Golder Associates

000077

BAR_GEOPHYSICAL_04112080O-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4939749.9 ;E 651897.5

GEOPHYSICAL LOG OF: MW-2

DRILLING DATE: Sep. 16, 2004
DRILL RIG: Longeyear 38
DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-2
5		*— CONTINUED FROM PREVIOUS PAGE —*					(B) (A)
		Verulam Formation 0.05 m to 9.00 m Fresh, faintly to moderately weathered on bedding partings, tan grey to medium grey, very fine to fine grained, thinly bedded, micritic, nodular, argillaceous limestone. Sequence contains dark grey to black shaly bedding partings, circular 2 mm to 6 mm burrow casts and occasional thinly to medium bedded, brownish grey, fine to medium crystalline, fossiliferous (crinoids, corals, pelecypods) calcarenite beds and minor, very thin, lithoclastic calcarenite beds associated with rip up clasts.					Sand
6							
7							Bentonite Seal
8							
9				237.87 9.00			
		Bobcaygeon Formation 9.00 m to 21.95 m (See next page for detailed description)					
10		*CONTINUED NEXT PAGE*					

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KAM

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-2

LOCATION: N 4939749.9 ;E 651897.5

DRILLING DATE: Sep. 16, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-2 (B) (A)
		— CONTINUED FROM PREVIOUS PAGE —					
10		Bobcaygeon Formation 9.00 m to 21.95 m Sharp contact with Verulam Formation. Fresh, medium brownish grey to medium grey, fine grained micritic to medium grained crystalline calcarenitic, thinly to thickly bedded, interbedded argillaceous limestone to calcarenitic limestone with argillaceous shaly bedding partings. From 9.00 m to 10.50 m: Fresh medium brown, medium grained crystalline, faintly petroliferous, medium to thickly bedded calcarenite limestone. From 10.50 m to 12.15 m: Fresh, medium brownish grey, fine to medium grained, thinly to medium bedded, nodular, argillaceous, micritic to calcarenitic limestone. From 12.15 m to 13.73 m: Fresh, medium brownish grey, fine grained, thinly bedded, nodular, argillaceous, micritic limestone with numerous dark grey to black argillaceous to shaly bedding partings up to 1 cm thick. From 13.73 m to 20.22 m: Fresh, light to medium brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone with argillaceous shaly partings interbedded with occasional brownish grey, fine to medium grained crystalline, thin to medium beds of fossiliferous, bioclastic (crinoid, coral) calcarenitic limestone and very thin lithoclastic limestone beds. First calcarenite bed occurs between 17.10 m and 17.50 m with distinctive coral fossil inclusion at 17.35 m. From 20.22 m to 21.95 m: Fresh, light grey to creamy light grey, very fine grained, thinly to medium bedded, lithographic limestone with disseminated medium grained calcite crystals and occasional minor pyrite grains interbedded with light brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone. Weathered shaly parting at 20.70 m with laminar argillaceous partings between 21.10 m and 21.20 m and black shale parting at 21.86 m to 21.89 m.					Bentonite Seal
11							
12							
13							
14							
15		*CONTINUED NEXT PAGE*					

DEPTH SCALE

1 : 25

LOGGED: MK

CHECKED: KAN

PROJECT: 04-1120-800

LOCATION: N 4939749.9 ;E 651897.5

GEOPHYSICAL LOG OF: MW-2

DRILLING DATE: Sep. 16, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-2 (B) (A)
15		*— CONTINUED FROM PREVIOUS PAGE —*					
		Bobcaygeon Formation 9.00 m to 21.95 m Sharp contact with Verulam Formation. Fresh, medium brownish grey to medium grey, fine grained micritic to medium grained crystalline calcarenitic, thinly to thickly bedded, interbedded argillaceous limestone to calcarenitic limestone with argillaceous shaly bedding partings. From 9.00 m to 10.50 m: Fresh medium brown, medium grained crystalline, faintly petroliferous, medium to thickly bedded calcarenite limestone. From 10.50 m to 12.15 m: Fresh, medium brownish grey, fine to medium grained, thinly to medium bedded, nodular, argillaceous, micritic to calcarenitic limestone. From 12.15 m to 13.73 m: Fresh, medium brownish grey, fine grained, thinly bedded, nodular, argillaceous, micritic limestone with numerous dark grey to black argillaceous to shaly bedding partings up to 1 cm thick. From 13.73 m to 20.22 m: Fresh, light to medium brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone with argillaceous shaly partings interbedded with occasional brownish grey, fine to medium grained crystalline, thin to medium beds of fossiliferous, bioclastic (crinoid, coral) calcarenitic limestone and very thin lithoclastic limestone beds. First calcarenite bed occurs between 17.10 m and 17.50 m with distinctive coral fossil inclusion at 17.35 m. From 20.22 m to 21.95 m: Fresh, light grey to creamy light grey, very fine grained, thinly to medium bedded, lithographic limestone with disseminated medium grained calcite crystals and occasional minor pyrite grains interbedded with light brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone. Weathered shaly parting at 20.70 m with laminar argillaceous partings between 21.10 m and 21.20 m and black shale parting at 21.86 m to 21.89 m.					Bentonite Seal
16							
17							
18							
19							
20		*CONTINUED NEXT PAGE*					

DEPTH SCALE

1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAN

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-2

SHEET 5 OF 8

LOCATION: N 4939749.9 ;E 651897.5

DRILLING DATE: Sep. 16, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-2 (B) (A)
20		*— CONTINUED FROM PREVIOUS PAGE —*					
		Bobcaygeon Formation 9.00 m to 21.95 m (Continued - see previous page for detailed description)					
21							
				224.92 21.95			
22		Gull River Formation 21.95 m to 35.50 m (See next page for detailed description)					Bentonite Seal
23							
24							Sand
25		*CONTINUED NEXT PAGE*					

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

000081

BAR_GEOPHYSICAL 041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4939749.9 ;E 651897.5

GEOPHYSICAL LOG OF: MW-2

DRILLING DATE: Sep. 16, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-2 (B) (A)
25		*--- CONTINUED FROM PREVIOUS PAGE ---*					
		Gull River Formation 21.95 m to 35.50 m Unit 4 21.95 m to 25.35 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, stylolitic, lithographic limestone from 21.95 m to 24.40 m with occasional disseminated medium grained calcite crystals with bluish mottled textured bed at top of sequence. Laminar bedded, argillaceous limestone from 24.40 m to 25.35 m.					Sand
26		Unit 3 25.35 m to 28.88 m Fresh, light grey to light tan brown, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings with mottled textured beds from 25.66 m to 26.40 m and 26.85 m to 28.40 m. Open, 1 cm thick shaly bedding parting at top of unit from 25.35 m to 25.40 m. Distinct, light greenish grey, fine grained, siliceous dolostone beds at top and bottom of unit from 25.35 m to 25.60 m and 28.55 m to 28.82 m with reddish brown dolostone bed from 28.82 m to 28.88 m.					
27		Unit 2 28.88 m to 34.70 m Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional mottled textured beds (30.50 m to 30.80 m, 31.70 m to 32.37 m and 33.80 m to 34.45 m) and argillaceous to shaly bedding parting from 32.73 m to 32.80 m and 33.45 m to 33.55 m with 1 cm thick soft mud seam at 33.55 m.					A and B wells constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen.
28		Unit 1 34.70 m to 35.50 m Fresh, light grey, fine grained, thinly to thickly bedded, mottled textured, dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals and argillaceous bedding partings. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone bed at 33.70 m to 34.07 m.					
29							
30		*CONTINUED NEXT PAGE*					

DEPTH SCALE

1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAN

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-2

SHEET 7 OF 8

LOCATION: N 4939749.9 ;E 651897.5

DRILLING DATE: Sep. 16, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 60 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-2 (B) (A)
		— CONTINUED FROM PREVIOUS PAGE —					
30		Gull River Formation 21.95 m to 35.50 m Unit 4 21.95 m to 25.35 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, stylolitic, lithographic limestone from 21.95 m to 24.40 m with occasional disseminated medium grained calcite crystals with bluish mottled textured bed at top of sequence. Laminar bedded, argillaceous limestone from 24.40 m to 25.35 m.					
31		Unit 3 25.35 m to 28.88 m Fresh, light grey to light tan brown, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings with mottled textured beds from 25.66 m to 26.40 m and 26.85 m to 28.40 m. Open, 1 cm thick shaly bedding parting at top of unit from 25.35 m to 25.40 m. Distinct, light greenish grey, fine grained, siliceous dolostone beds at top and bottom of unit from 25.35 m to 25.60 m and 28.55 m to 28.82 m with reddish brown dolostone bed from 28.82 m to 28.88 m.					
32		Unit 2 28.88 m to 34.70 m Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional mottled textured beds (30.50 m to 30.80 m, 31.70 m to 32.37 m and 33.80 m to 34.45 m) and argillaceous to shaly bedding parting from 32.73 m to 32.80 m and 33.45 m to 33.55 m with 1 cm thick soft mud seam at 33.55 m.					Bentonite Seal
		Unit 1 34.70 m to 35.50 m Fresh, light grey, fine grained, thinly to thickly bedded, mottled textured, dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals and argillaceous bedding partings. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone bed at 33.70 m to 34.07 m.					
33							
34							
35		*CONTINUED NEXT PAGE*					

DEPTH SCALE
1 : 25

LOGGED: MK

CHECKED: KAM

Golder Associates

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4939749.9 ;E 651897.5

GEOPHYSICAL LOG OF: MW-2

DRILLING DATE: Sep. 16, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-2 (B) (A)
35		--- CONTINUED FROM PREVIOUS PAGE ---					Bentonite Seal
		END OF DRILLHOLE		211.37 35.50			
36							
37							
38							
39							
40							

DEPTH SCALE

1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-3

SHEET 1 OF 12

LOCATION: N 4938298.2 ;E 651523.4

DRILLING DATE: Sep. 27, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-3
		GROUND SURFACE		247.79			(B) (A)
0		Topsoil		0.00			
		Vernlam Formation 0.06 m to 16.30 m Fresh, faintly to moderately weathered on bedding partings, tan grey to medium grey, very fine to fine grained, thinly bedded, micritic, nodular argillaceous limestone. Sequence contains dark grey to black shaly bedding partings, circular 2 mm to 6 mm burrow casts and occasional thinly to medium bedded, brownish grey, fine to medium crystalline, fossiliferous (crinoids, corals, pelycepods) calcarenite beds and minor, very thin, lithoclastic calcarenite beds associated with rip up clasts. Numerous shaly partings from 3.69 m to 4.88 m and 13.92 m to 15.04 m		0.06			Sand B well constructed with 25mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen. Bentonite Seal
1							
2							
3							
4							
5		CONTINUED NEXT PAGE					

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

PROJECT: 04-1120-800

LOCATION: N 4938298.2 ;E 651523.4

GEOPHYSICAL LOG OF: MW-3

DRILLING DATE: Sep. 27, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-3 (B) (A)
5		*— CONTINUED FROM PREVIOUS PAGE —*					
		Verulam Formation 0.06 m to 16.30 m Fresh, faintly to moderately weathered on bedding partings, tan grey to medium grey, very fine to fine grained, thinly bedded, micritic, nodular argillaceous limestone. Sequence contains dark grey to black shaly bedding partings, circular 2 mm to 6 mm burrow casts and occasional thinly to medium bedded, brownish grey, fine to medium crystalline, fossiliferous (crinoids, corals, pelycepods) calcarenite beds and minor, very thin, lithoclastic calcarenite beds associated with rip up clasts. Numerous shaly partings from 3.69 m to 4.86 m and 13.92 m to 15.04 m					
6							
7							Bentonite Seal
8							
9							
10		*CONTINUED NEXT PAGE*					

DEPTH SCALE

1:25

Golder Associates

LOGGED: MK

CHECKED: KAM

000086

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-3

SHEET 3 OF 12

LOCATION: N 4938298.2 ;E 651523.4

DRILLING DATE: Sep. 27, 2004
DRILL RIG: Longeyear 38
DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-3
		— CONTINUED FROM PREVIOUS PAGE —					(B) (A)
10		Verulam Formation 0.06 m to 16.30 m Fresh, faintly to moderately weathered on bedding partings, tan grey to medium grey, very fine to fine grained, thinly bedded, micritic, nodular argillaceous limestone. Sequence contains dark grey to black shaly bedding partings, circular 2 mm to 6 mm burrow casts and occasional thinly to medium bedded, brownish grey, fine to medium crystalline, fossiliferous (crinoids, corals, pelycepods) calcarenite beds and minor, very thin, lithoclastic calcarenite beds associated with rip up clasts. Numerous shaly partings from 3.69 m to 4.86 m and 13.92 m to 15.04 m					
11							
12							Bentonite Seal
13							
14							
15		*CONTINUED NEXT PAGE*					

DEPTH SCALE
1 : 25

LOGGED: MK
CHECKED: KAM

Golder Associates

000087

BAR_GEOPHYSICAL_04112080O-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4938298.2 ;E 651523.4

GEOPHYSICAL LOG OF: MW-3

DRILLING DATE: Sep. 27, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-3 (B) (A)
15		— CONTINUED FROM PREVIOUS PAGE —					
		Verulam Formation 0.06 m to 16.30 m Fresh, faintly to moderately weathered on bedding partings, tan grey to medium grey, very fine to fine grained, thinly bedded, micritic, nodular argillaceous limestone. Sequence contains dark grey to black shaly bedding partings, circular 2 mm to 6 mm burrow casts and occasional thinly to medium bedded, brownish grey, fine to medium crystalline, fossiliferous (crinoids, corals, pelycepods) calcarenite beds and minor, very thin, lithoclastic calcarenite beds associated with rip up clasts. Numerous shaly partings from 3.69 m to 4.86 m and 13.92 m to 15.04 m					
16				231.49 16.30			
		Bobcaygeon Formation 16.30 m to 29.26 m Sharp contact with Verulam Formation. Fresh, medium brownish grey to medium grey, fine grained micritic to medium grained crystalline calcarenitic, thinly to thickly bedded, interbedded argillaceous limestone to calcarenitic limestone with argillaceous shaly bedding partings. From 16.30 m to 17.55 m: Fresh medium brown, medium grained, crystalline, faintly petroliferous, medium to thickly bedded calcarenite limestone. From 17.55 m to 20.10 m: Fresh, medium brownish grey, fine to medium grained, thinly to medium bedded, nodular, argillaceous, micritic to calcarenitic limestone. From 20.10 m to 21.10 m: Fresh, medium brownish grey, fine grained, thinly bedded, nodular, argillaceous, micritic limestone with numerous dark grey to black argillaceous to shaly bedding partings up to 1 cm thick. From 21.10 m to 27.25 m: Fresh, light to medium brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone with argillaceous shaly partings interbedded with occasional brownish grey, fine to medium grained, crystalline, thin to medium beds of fossiliferous, bioclastic (crinoid, coral) calcarenitic limestone and very thin lithoclastic limestone beds. First calcarenite bed occurs between 23.50 m and 23.90 m with shaly limestone bed at 23.47 m to 23.50 m. From 27.25 m to 29.26 m: Fresh, light grey to creamy light grey, very fine grained, thinly to medium bedded, lithographic limestone with disseminated medium grained calcite crystals interbedded with light brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone. First nodular, micritic limestone bed occurs between 29.05 m and 29.26 m.					Bentonite Seal
17							
18							
19							
20		CONTINUED NEXT PAGE					

BAR_GEOPHYSICAL_04112080O-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

DEPTH SCALE

1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-3

SHEET 5 OF 12

LOCATION: N 4938298.2 ;E 651523.4

DRILLING DATE: Sep. 27, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-3 (B) (A)
20		*— CONTINUED FROM PREVIOUS PAGE —*					
		Bobcaygeon Formation 16.30 m to 29.26 m Sharp contact with Verulam Formation. Fresh, medium brownish grey to medium grey, fine grained micritic to medium grained crystalline calcarenitic, thinly to thickly bedded, interbedded argillaceous limestone to calcarenitic limestone with argillaceous shaly bedding partings. From 16.30 m to 17.55 m: Fresh medium brown, medium grained, crystalline, faintly petroliferous, medium to thickly bedded calcarenite limestone. From 17.55 m to 20.10 m: Fresh, medium brownish grey, fine to medium grained, thinly to medium bedded, nodular, argillaceous, micritic to calcarenitic limestone. From 20.10 m to 21.10 m: Fresh, medium brownish grey, fine grained, thinly bedded, nodular, argillaceous, micritic limestone with numerous dark grey to black argillaceous to shaly bedding partings up to 1 cm thick. From 21.10 m to 27.25 m: Fresh, light to medium brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone with argillaceous shaly partings interbedded with occasional brownish grey, fine to medium grained, crystalline, thin to medium beds of fossiliferous, bioclastic (crinoid, coral) calcarenitic limestone and very thin lithoclastic limestone beds. First calcarenite bed occurs between 23.50 m and 23.90 m with shaly limestone bed at 23.47 m to 23.50 m. From 27.25 m to 29.26 m: Fresh, light grey to creamy light grey, very fine grained, thinly to medium bedded, lithographic limestone with disseminated medium grained calcite crystals interbedded with light brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone. First nodular, micritic limestone bed occurs between 29.05 m and 29.26 m.					Bentonite Seal
21							
22							
23							
24							
25		*CONTINUED NEXT PAGE*					

DEPTH SCALE
1 : 25

LOGGED: MK

CHECKED: KAN

Golder Associates

000089

BAR_GEOPHYSICAL_04112080O-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4938298.2 ;E 651523.4

GEOPHYSICAL LOG OF: MW-3

DRILLING DATE: Sep. 27, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-3 (B) (A)
25		*— CONTINUED FROM PREVIOUS PAGE —*					
		Bobcaygeon Formation 16.30 m to 29.26 m Sharp contact with Verulam Formation. Fresh, medium brownish grey to medium grey, fine grained micritic to medium grained crystalline calcarenitic, thinly to thickly bedded, interbedded argillaceous limestone to calcarenitic limestone with argillaceous shaly bedding partings. From 16.30 m to 17.55 m: Fresh medium brown, medium grained, crystalline, faintly petroliferous, medium to thickly bedded calcarenite limestone.					
26		From 17.55 m to 20.10 m: Fresh, medium brownish grey, fine to medium grained, thinly to medium bedded, nodular, argillaceous, micritic to calcarenitic limestone. From 20.10 m to 21.10 m: Fresh, medium brownish grey, fine grained, thinly bedded, nodular, argillaceous, micritic limestone with numerous dark grey to black argillaceous to shaly bedding partings up to 1 cm thick.					
27		From 21.10 m to 27.25 m: Fresh, light to medium brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone with argillaceous shaly partings interbedded with occasional brownish grey, fine to medium grained, crystalline, thin to medium beds of fossiliferous, bioclastic (crinoid, coral) calcarenitic limestone and very thin lithoclastic limestone beds. First calcarenite bed occurs between 23.50 m and 23.90 m with shaly limestone bed at 23.47 m to 23.50 m.					Bentonite Seal
28		From 27.25 m to 29.26 m: Fresh, light grey to creamy light grey, very fine grained, thinly to medium bedded, lithographic limestone with disseminated medium grained calcite crystals interbedded with light brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone. First nodular, micritic limestone bed occurs between 29.05 m and 29.26 m.					
29		Gull River Formation 29.26 m to 46.20 m (See next page for detailed description)		218.53 29.26			
30		*CONTINUED NEXT PAGE*					

DEPTH SCALE

1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-3

SHEET 7 OF 12

LOCATION: N 4938298.2 ;E 651523.4

DRILLING DATE: Sep. 27, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-3 (B) (A)
		— CONTINUED FROM PREVIOUS PAGE —					
30		Gull River Formation 29.26 m to 46.20 m Unit 4 29.26 m to 32.62 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, lithographic limestone with occasional disseminated medium grained calcite crystals, occasional stylolites, and mottled textured bed at top of unit between 29.26 m and 29.34 m with black argillaceous bedding parting at 31.26 m.					
31		Unit 3 32.62 m to 36.25 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings and mottled textured beds (32.80 m to 33.39 m, 33.56 m to 34.24 m and 34.50 m to 36.10 m). Open, 3 cm thick shaly bedding parting at top of unit. Distinct, light greenish grey, fine grained, siliceous dolostone beds at 32.65 m to 32.80 m and 36.10 m to 36.25 m with green lithoclastic bed from 33.39 m to 33.56 m and argillaceous laminar textured dolomitic limestone from 34.24 m to 34.50 m.					
32		Unit 2 36.25 m to 40.12 m Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional stylolite, mottled textured beds (37.90 m to 38.25 m and 39.03 m to 39.80 m) and argillaceous bedding partings. Slumped bedding structure at top 10 cm of unit.					Bentonite Seal
33		Unit 1 40.12 m to 46.20 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals and argillaceous to black shaly bedding partings, mottled textured bed (41.66 m to 42.50 m) and thin, laminar textured beds. Top of Unit 1 marked by shale parting from 40.12 m to 40.13 m. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone beds occur at 40.95 m to 41.46 m and 45.25 m to 45.50 m. Top of upper green bed marked by shaly limestone from 40.85 m to 40.95 m. Distinct white, soft marl layer occur at base of upper green bed at 41.46 m. Reddish brown, thin shaly dolostone bed at 45.50 m to 45.52 m.					
34							
35		*CONTINUED NEXT PAGE*					

DEPTH SCALE
1 : 25

LOGGED: MK
CHECKED: KAM

Golder Associates

000091

BAR_GEOPHYSICAL 041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4938298.2 ;E 651523.4

GEOPHYSICAL LOG OF: MW-3

DRILLING DATE: Sep. 27, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-3 (B) (A)
35		*— CONTINUED FROM PREVIOUS PAGE —*					
		Gull River Formation 29.26 m to 46.20 m Unit 4 29.26 m to 32.62 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, lithographic limestone with occasional disseminated medium grained calcite crystals, occasional stylolites, and mottled textured bed at top of unit between 29.26 m and 29.34 m with black argillaceous bedding parting at 31.26 m.					
36		Unit 3 32.62 m to 36.25 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings and mottled textured beds (32.80 m to 33.39 m, 33.56 m to 34.24 m and 34.50 m to 36.10 m). Open, 3 cm thick shaly bedding parting at top of unit. Distinct, light greenish grey, fine grained, siliceous dolostone beds at 32.65 m to 32.80 m and 36.10 m to 36.25 m with green lithoclastic bed from 33.39 m to 33.56 m and argillaceous laminar textured dolomitic limestone from 34.24 m to 34.50 m.					
37		Unit 2 36.25 m to 40.12 m Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional stylolite, mottled textured beds (37.90 m to 38.25 m and 39.03 m to 39.80 m) and argillaceous bedding partings. Slumped bedding structure at top 10 cm of unit.					Bentonite Seal
		Unit 1 40.12 m to 46.20 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals and argillaceous to black shaly bedding partings, mottled textured bed (41.66 m to 42.50 m) and thin, laminar textured beds. Top of Unit 1 marked by shale parting from 40.12 m to 40.13 m. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone beds occur at 40.95 m to 41.46 m and 45.25 m to 45.50 m. Top of upper green bed marked by shaly limestone from 40.85 m to 40.95 m. Distinct white, soft marl layer occur at base of upper green bed at 41.46 m. Reddish brown, thin shaly dolostone bed at 45.50 m to 45.52 m.					
38							
39							
40		*CONTINUED NEXT PAGE*					

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

DEPTH SCALE

1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-3

SHEET 9 OF 12

LOCATION: N 4938298.2 ;E 651523.4

DRILLING DATE: Sep. 27, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-3 (B) (A)
		— CONTINUED FROM PREVIOUS PAGE —					
40		Gull River Formation 29.26 m to 46.20 m Unit 4 29.26 m to 32.62 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, lithographic limestone with occasional disseminated medium grained calcite crystals, occasional stylolites, and mottled textured bed at top of unit between 29.26 m and 29.34 m with black argillaceous bedding parting at 31.26 m.					Bentonite Seal
41		Unit 3 32.62 m to 36.25 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings and mottled textured beds (32.80 m to 33.39 m, 33.56 m to 34.24 m and 34.50 m to 36.10 m). Open, 3 cm thick shaly bedding parting at top of unit. Distinct, light greenish grey, fine grained, siliceous dolostone beds at 32.65 m to 32.80 m and 36.10 m to 36.25 m with green lithoclastic bed from 33.39 m to 33.56 m and argillaceous laminar textured dolomitic limestone from 34.24 m to 34.50 m.					Sand
42		Unit 2 36.25 m to 40.12 m Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional stylolite, mottled textured beds (37.90 m to 38.25 m and 39.03 m to 39.80 m) and argillaceous bedding partings. Slumped bedding structure at top 10 cm of unit.					
43		Unit 1 40.12 m to 46.20 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals and argillaceous to black shaly bedding partings, mottled textured bed (41.66 m to 42.50 m) and thin, laminar textured beds. Top of Unit 1 marked by shale parting from 40.12 m to 40.13 m. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone beds occur at 40.95 m to 41.46 m and 45.25 m to 45.50 m. Top of upper green bed marked by shaly limestone from 40.85 m to 40.95 m. Distinct white, soft marl layer occur at base of upper green bed at 41.46 m. Reddish brown, thin shaly dolostone bed at 45.50 m to 45.52 m.					
44							A well constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen.
45		*CONTINUED NEXT PAGE*					

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

BAR GEOPHYSICAL 041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4938298.2 ;E 651523.4

GEOPHYSICAL LOG OF: MW-3

DRILLING DATE: Sep. 27, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-3 (B) (A)
45		*— CONTINUED FROM PREVIOUS PAGE —*					
		Gull River Formation 29.26 m to 46.20 m (Continued - See previous page for detailed description)					
		Shadow Lake Formation 46.20 m to 54.90 m From 46.20 m to 49.68 m: Fresh, light to dark greenish grey, fine to medium grained, faintly to moderately porous, thinly to medium bedded, quartz sandstone with siltstone partings. Greenish grey sandy siltstone beds with green shale lithoclasts at 46.20 m to 46.70 mm. Transitional lower contact. From 49.68 m to 52.52 m: Fresh, medium to dark greenish grey, slake susceptible shale and shaly siltstone with dark reddish brown shale between 51.75 m and 51.98 m and interbedded dark reddish brown and green shale to 52.25 m. Transitional lower contact. From 52.25 m to 54.90 m: Fresh, light green to dark reddish brown, fine to coarse grained, faintly porous, thinly to medium bedded sandstone comprised of angular clasts of feldspar crystals and quartz. Sharp basal contact.		201.59 46.20			A well constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen. Bentonite Seal
50		*CONTINUED NEXT PAGE*					

DEPTH SCALE

1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-3

SHEET 11 OF 12

LOCATION: N 4938298.2 ;E 651523.4

DRILLING DATE: Sep. 27, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-3 (B) (A)
		— CONTINUED FROM PREVIOUS PAGE —					
50		Shadow Lake Formation 46.20 m to 54.90 m From 46.20 m to 49.68 m: Fresh, light to dark greenish grey, fine to medium grained, faintly to moderately porous, thinly to medium bedded, quartz sandstone with siltstone partings. Greenish grey sandy siltstone beds with green shale lithoclasts at 46.20 m to 46.70 mm. Transitional lower contact. From 49.68 m to 52.52 m: Fresh, medium to dark greenish grey, slake susceptible shale and shaly siltstone with dark reddish brown shale between 51.75 m and 51.98 m and interbedded dark reddish brown and green shale to 52.25 m. Transitional lower contact. From 52.25 m to 54.90 m: Fresh, light green to dark reddish brown, fine to coarse grained, faintly porous, thinly to medium bedded sandstone comprised of angular clasts of feldspar crystals and quartz. Sharp basal contact.					
51							
52							Bentonite Seal
53							
54				192.69 54.90			
55		*CONTINUED NEXT PAGE*					

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

000095

BAR_GEOPHYSICAL 04112080O-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4938298.2 ;E 651523.4

GEOPHYSICAL LOG OF: MW-3

DRILLING DATE: Sep. 27, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)
55		— CONTINUED FROM PREVIOUS PAGE —		
		Precambrian Basement 54.90 m to 58.41 m From 54.90 m to 55.70 m: Highly weathered, fractured, dark reddish brown, chlorite-feldspar-amphibole-gneiss. From 55.70 m to 57.20 m: Faintly to moderately weathered, dark grey, medium grained, strongly foliated, quartz-feldspar-amphibole gneiss with moderately to highly weathered sections between 55.90 m and 56.10 m, 56.50 m and 56.70 m, and 57.00 m and 57.20 m. From 57.20 m to 58.41 m: Fresh, dark grey, foliated, quartz-feldspar-amphibole gneiss.		
56				
57				
58				
		END OF DRILLHOLE		189.38 58.41
59				
60				

GEOPHYSICAL RECORD

GAMMA (cps): 25 50 75 100

CONDUCTIVITY (mS/m): 40 80 120 160

PIEZOMETER OR STANDPIPE INSTALLATION

MW-3

(B) (A)

Bentonite Seal

DEPTH SCALE

1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

BAR_GEOPHYSICAL_041120800-ROK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-4

SHEET 1 OF 8

LOCATION: N 4939830.4 ;E 650784.6

DRILLING DATE: Sep. 27, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)
0		GROUND SURFACE		237.41
		Topsoil		0.00 / 237.31
		Overburden		0.10
		Bobcaygeon Formation 3.35 m to 15.48 m (See next page for detailed description)		234.06 / 3.35
5		*CONTINUED NEXT PAGE*		

GEOPHYSICAL RECORD

GAMMA (cps): 25 50 75 100

CONDUCTIVITY (mS/m): 40 80 120 160

PIEZOMETER OR STANDPIPE INSTALLATION

MW-4

(B) (A)

Bentonite Seal

Sand

Open Borehole

Well B constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen.

DEPTH SCALE

1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

000097

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-4

SHEET 2 OF 8

LOCATION: N 4939830.4 ;E 650784.6

DRILLING DATE: Sep. 27, 2004
DRILL RIG: Longeyear 38
DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-4 (B) (A)
		— CONTINUED FROM PREVIOUS PAGE —					
5		Bobcaygeon Formation 3.35 m to 15.48 m Fresh, medium brownish grey to medium grey, fine grained micritic to medium grained crystalline calcarenitic, thinly to thickly bedded, interbedded argillaceous limestone to calcarenitic limestone with argillaceous shaly bedding partings. From 3.35 m to 4.70 m: Fresh, medium brown, medium grained crystalline, faintly petroliferous, medium to thickly bedded calcarenite limestone. From 4.70 m to 6.74 m: Fresh, medium brownish grey, fine to medium grained, thinly to medium bedded, nodular, argillaceous, micritic to calcarenitic limestone. From 6.74 m to 7.68 m: Fresh, medium brownish grey, fine grained, thinly bedded, nodular, argillaceous, micritic limestone with numerous dark grey to black argillaceous to shaly bedding partings up to 1 cm thick. From 7.68 m to 12.65 m: Fresh, light to medium brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone with argillaceous shaly partings interbedded with occasional brownish grey, fine to medium grained, crystalline thinly to medium beds of fossiliferous, bioclastic (crinoid, coral) calcarenitic limestone. Very thin, lithoclastic limestone bed from 9.30 m to 9.40 m. Coral or stromatoporoid fossil layer at 11.25 m to 11.30 m. From 12.65 m to 15.48 m: Fresh, light grey to creamy light grey, very fine grained, thinly to medium bedded, lithographic limestone with disseminated medium grained calcite crystals interbedded with light brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone. Soft, light grey shale parting between 14.25 m and 14.30 m. Transitional lower contact.					Open Borehole
6							
7							
8							
9							
10		*CONTINUED NEXT PAGE*					

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KAM

000098

BAR_GEOPHYSICAL_04112080O-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-4

SHEET 3 OF 8

LOCATION: N 4939830.4 ;E 650784.6

DRILLING DATE: Sep. 27, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-4 (B) (A)
10		*— CONTINUED FROM PREVIOUS PAGE —*					
		Bobcaygeon Formation 3.35 m to 15.48 m Fresh, medium brownish grey to medium grey, fine grained micritic to medium grained crystalline calcarenitic, thinly to thickly bedded, interbedded argillaceous limestone to calcarenitic limestone with argillaceous shaly bedding partings. From 3.35 m to 4.70 m: Fresh, medium brown, medium grained crystalline, faintly petroliferous, medium to thickly bedded calcarenite limestone.					
11		From 4.70 m to 6.74 m: Fresh, medium brownish grey, fine to medium grained, thinly to medium bedded, nodular, argillaceous, micritic to calcarenitic limestone. From 6.74 m to 7.68 m: Fresh, medium brownish grey, fine grained, thinly bedded, nodular, argillaceous, micritic limestone with numerous dark grey to black argillaceous to shaly bedding partings up to 1 cm thick.					
12		From 7.68 m to 12.65 m: Fresh, light to medium brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone with argillaceous shaly partings interbedded with occasional brownish grey, fine to medium grained, crystalline thinly to medium beds of fossiliferous, bioclastic (crinoid, coral) calcarenitic limestone. Very thin, lithoclastic limestone bed from 9.30 m to 9.40 m. Coral or stromatoporoid fossil layer at 11.25 m to 11.30 m.					Open Borehole
13		From 12.65 m to 15.48 m: Fresh, light grey to creamy light grey, very fine grained, thinly to medium bedded, lithographic limestone with disseminated medium grained calcite crystals interbedded with light brownish grey, fine grained, thinly to medium bedded, nodular, argillaceous, micritic limestone. Soft, light grey shale parting between 14.25 m and 14.30 m. Transitional lower contact.					
14							
15		*CONTINUED NEXT PAGE*					

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

PROJECT: 04-1120-800

LOCATION: N 4939830.4 ;E 650784.6

GEOPHYSICAL LOG OF: MW-4

DRILLING DATE: Sep. 27, 2004
DRILL RIG: Longeyear 38
DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-4 (B) (A)
15		— CONTINUED FROM PREVIOUS PAGE —					
		Gull River Formation 15.48 m to 32.32 m Unit 4 15.48 m to 19.10 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, lithographic limestone with occasional disseminated medium grained calcite crystals, mottled textured beds, laminar beds and argillaceous bedding partings. From 15.70 m to 15.72 m, slaking shale parting.		221.93 15.48			
16		Unit 3 19.10 m to 23.10 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings and mottled textured beds (19.82 m to 20.30 m and 21.00 m to 22.25 m). Shaly argillaceous limestone bedding parting at top of unit from 19.10 m to 19.15 m. Distinct, light greenish grey, fine grained, siliceous dolostone bed at 19.15 m to 19.37 m. Soft, white marl layer between 19.78 m and 19.82 m at depth where drillers reported cavity. Sharp contact with Unit 2.					
17		Unit 2 23.10 m to 27.08 m Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional stylolite, mottled textured beds (24.30 m to 24.65 m and 25.75 m to 26.08 m) and argillaceous bedding partings. Sharp contact with Unit 1.					Open Borehole
18		Unit 1 27.08 m to 32.32 m Fresh, light grey to light tan grey, fine grained, thinly to thickly bedded dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals, argillaceous bedding partings, mottled textured beds (27.73 m to 28.57 m and 28.80 m to 29.25 m) and thin, laminar textured beds. Dark grey, slaking shale from 27.08 m to 27.13 m. Silty to sandy lithoclastic dolostone at 27.13 m to 27.27 m. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone bed occurs at 27.27 m to 27.73 m. Weathered shale parting at 29.25 m. Reddish brown, thin shaly dolostone beds at 30.40 m to 30.45 m with disseminated pyrite and 31.75 m to 37.80 m.					
19							
20		CONTINUED NEXT PAGE					

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KA

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-4

LOCATION: N 4939830.4 ;E 650784.6

DRILLING DATE: Sep. 27, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-4 (B) (A)
		— CONTINUED FROM PREVIOUS PAGE —					
20		Gull River Formation 15.48 m to 32.32 m Unit 4 15.48 m to 19.10 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, lithographic limestone with occasional disseminated medium grained calcite crystals, mottled textured beds, laminar beds and argillaceous bedding partings. From 15.70 m to 15.72 m, slaking shale parting. Unit 3 19.10 m to 23.10 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings and mottled textured beds (19.82 m to 20.30 m and 21.00 m to 22.25 m). Shaly argillaceous limestone bedding parting at top of unit from 19.10 m to 19.15 m. Distinct, light greenish grey, fine grained, siliceous dolostone bed at 19.15 m to 19.37 m. Soft, white marl layer between 19.78 m and 19.82 m at depth where drillers reported cavity. Sharp contact with Unit 2. Unit 2 23.10 m to 27.08 m Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional stylolite, mottled textured beds (24.30 m to 24.65 m and 25.75 m to 26.08 m) and argillaceous bedding partings. Sharp contact with Unit 1. Unit 1 27.08 m to 32.32 m Fresh, light grey to light tan grey, fine grained, thinly to thickly bedded dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals, argillaceous bedding partings, mottled textured beds (27.73 m to 28.57 m and 28.80 m to 29.25 m) and thin, laminar textured beds. Dark grey, slaking shale from 27.08 m to 27.13 m. Silty to sandy lithoclastic dolostone at 27.13 m to 27.27 m. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone bed occurs at 27.27 m to 27.73 m. Weathered shale parting at 29.25 m. Reddish brown, thin shaly dolostone beds at 30.40 m to 30.45 m with disseminated pyrite and 31.75 m to 37.80 m.					Open Borehole
21							
22							
23							
24							
25		*CONTINUED NEXT PAGE*					

DEPTH SCALE

1 : 25

LOGGED: MK

CHECKED: KAM

PROJECT: 04-1120-800

LOCATION: N 4939830.4 ;E 650784.6

GEOPHYSICAL LOG OF: MW-4

DRILLING DATE: Sep. 27, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-4 (B) (A)
25		*— CONTINUED FROM PREVIOUS PAGE —*					
		Gull River Formation 15.48 m to 32.32 m Unit 4 15.48 m to 19.10 m: Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, lithographic limestone with occasional disseminated medium grained calcite crystals, mottled textured beds, laminar beds and argillaceous bedding partings. From 15.70 m to 15.72 m, slaking shale parting.					
26		Unit 3 19.10 m to 23.10 m Fresh, light grey, fine grained, thinly to thickly bedded dolomitic limestone to dolostone with argillaceous bedding partings and mottled textured beds (19.82 m to 20.30 m and 21.00 m to 22.25 m). Shaly argillaceous limestone bedding parting at top of unit from 19.10 m to 19.15 m. Distinct, light greenish grey, fine grained, siliceous dolostone bed at 19.15 m to 19.37 m. Soft, white marl layer between 19.78 m and 19.82 m at depth where drillers reported cavity. Sharp contact with Unit 2.					
27		Unit 2 23.10 m to 27.08 m Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional stylolite, mottled textured beds (24.30 m to 24.65 m and 25.75 m to 26.08 m) and argillaceous bedding partings. Sharp contact with Unit 1.					
		Unit 1 27.08 m to 32.32 m Fresh, light grey to light tan grey, fine grained, thinly to thickly bedded dolomitic limestone and dolostone with occasional disseminated medium grained calcite crystals, argillaceous bedding partings, mottled textured beds (27.73 m to 28.57 m and 28.80 m to 29.25 m) and thin, laminar textured beds. Dark grey, slaking shale from 27.08 m to 27.13 m. Silty to sandy lithoclastic dolostone at 27.13 m to 27.27 m. Distinct, light greenish grey, fine grained siliceous, lithoclastic dolostone bed occurs at 27.27 m to 27.73 m. Weathered shale parting at 29.25 m. Reddish brown, thin shaly dolostone beds at 30.40 m to 30.45 m with disseminated pyrite and 31.75 m to 37.80 m.					Open Borehole
28							
29							
30		*CONTINUED NEXT PAGE*					

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

DEPTH SCALE

1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-4

SHEET 7 OF 8

LOCATION: N 4939830.4 ;E 650784.6

DRILLING DATE: Sep. 27, 2004

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-4 (B) (A)
30		*— CONTINUED FROM PREVIOUS PAGE —*					
		Gull River Formation 15.48 m to 32.32 m (See previous page for detailed description)					
31							
32				205.09 32.32			
		Shadow Lake Formation 32.32 m to 35.53 m From 32.32 m to 35.15 m: Fresh, light to dark greenish grey, fine grained, thinly interbedded, siltstone, shale and minor sandstone. From 35.15 m to 35.53 m: Fresh, dark greenish grey, slake susceptible shale.					Open Borehole
33							
34							
35		*CONTINUED NEXT PAGE*					

DEPTH SCALE

1 : 25

Golder Associates

LOGGED: MK

CHECKED: KAM

000103

BAR GEOPHYSICAL 041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4939830.4 ;E 650784.6

GEOPHYSICAL LOG OF: MW-4

DRILLING DATE: Sep. 27, 2004
DRILL RIG: Longeyear 38
DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION: MW-4 (B) (A)
35		— CONTINUED FROM PREVIOUS PAGE —					
		Shadow Lake Formation 32.32 m to 35.53 m From 32.32 m to 35.15 m: Fresh, light to dark greenish grey, fine grained, thinly interbedded, siltstone, shale and minor sandstone. From 35.15 m to 35.53 m: Fresh, dark greenish grey, slake susceptible shale END OF DRILLHOLE		201.88 35.53			Open Borehole
36							
37							
38							
39							
40							

DEPTH SCALE
1 : 25

Golder Associates

LOGGED: MK
CHECKED: KAM

BAR_GEOPHYSICAL_04112080O-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-1

SHEET 1 OF 1

LOCATION: N 4938696.1 ;E 651192.6

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)
0		GROUND SURFACE		254.88
		Verulam Formation		0.00
5				
10				
15				
20				
				232.63
		Bobcaygeon Formation		22.25
25				
30				
				221.82
		END OF DRILLHOLE		33.06
35		Notes:		
		1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited		
		2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.		
40		3. Geological formation contacts inferred from geophysical logs		
45				
50				
55				
60				

GEOPHYSICAL RECORD

GAMMA (cps): 25 50 75 100

CONDUCTIVITY (mS/m): 40 80 120 160

PIEZOMETER OR STANDPIPE INSTALLATION

(C)(B) (A)

Sand

Bentonite Seal

Sand

Bentonite Seal

Sand

A and B wells constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen.

Well C constructed with 25mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen

DEPTH SCALE

1 : 300

Golder Associates

LOGGED: N/A

CHECKED: JPAC

000105

BAR_GEOPHYSICAL 041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4938896.3 ;E 651463.1

GEOPHYSICAL LOG OF: OW-2

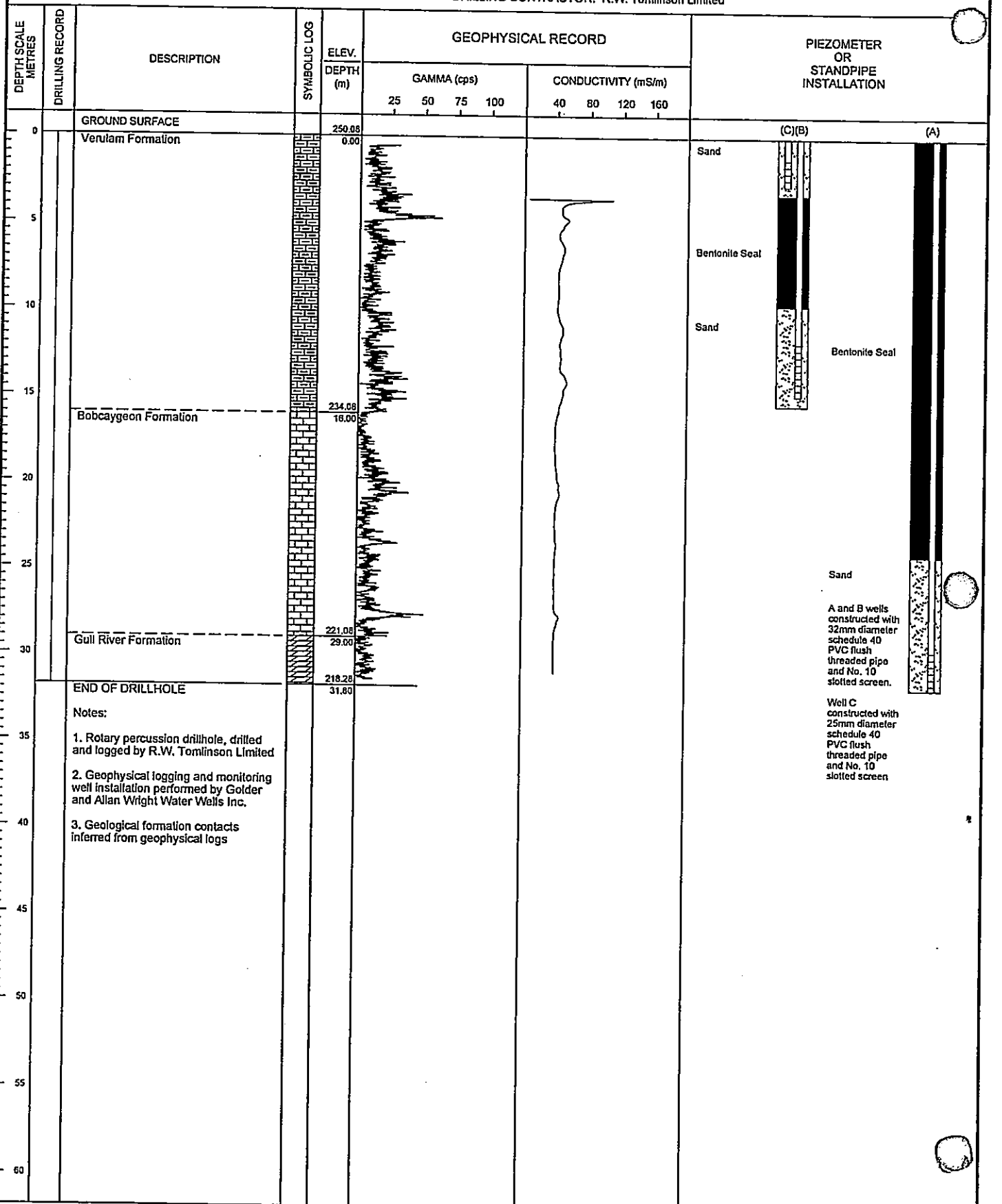
DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

SHEET 1 OF 1

DATUM: GEODETIC



Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited

2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.

3. Geological formation contacts inferred from geophysical logs

DEPTH SCALE

1 : 300

Golder Associates

LOGGED: N/A

CHECKED: JPA

000106

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-3

SHEET 1 OF 1

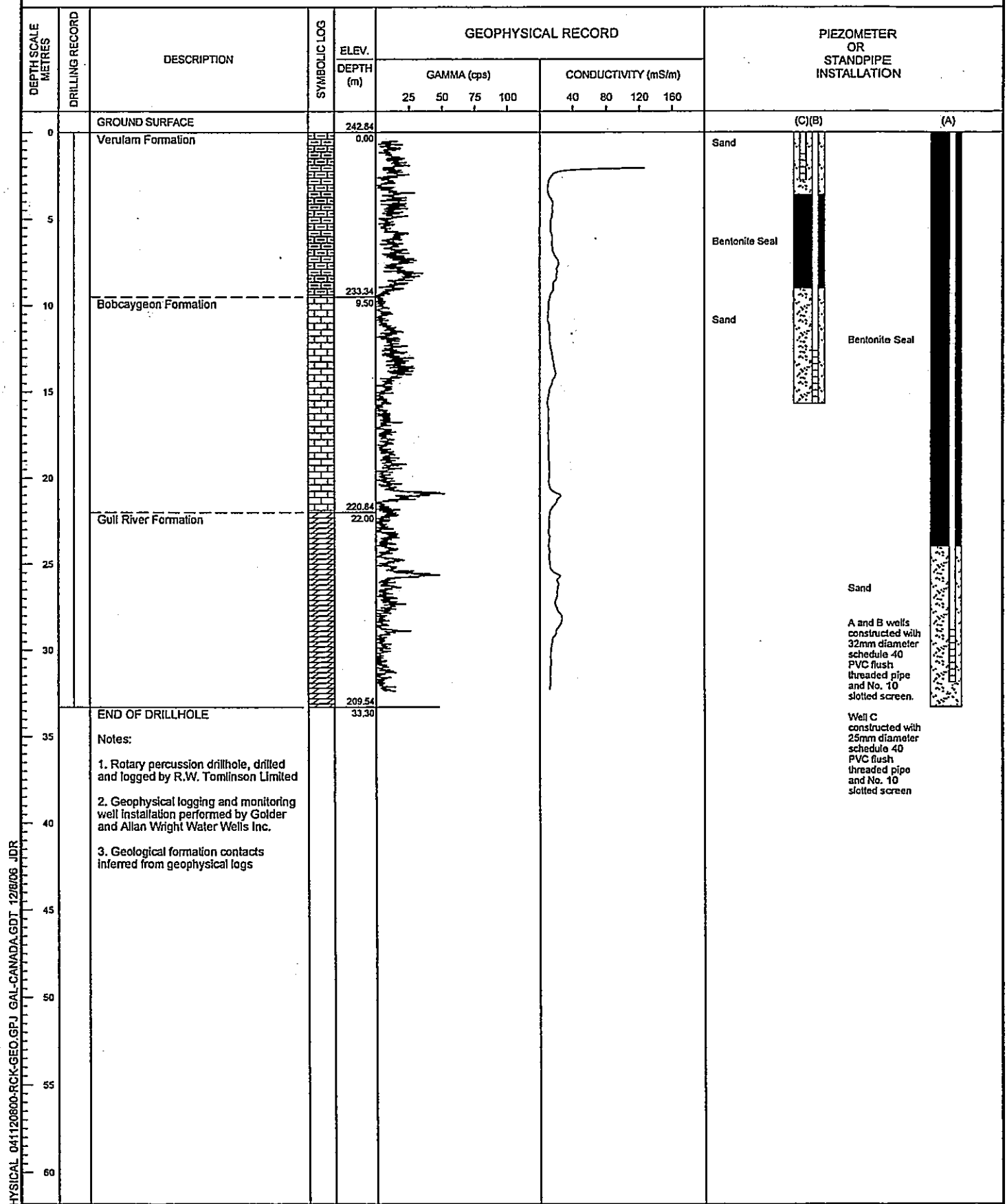
LOCATION: N 4939203.0 ;E 651038.8

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETIC



Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited

2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.

3. Geological formation contacts inferred from geophysical logs

DEPTH SCALE

1 : 300

Golder Associates

LOGGED: N/A

CHECKED: JPA

000107

BAR_GEOPHYSICAL 041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/6/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4939456.5 ;E 652030.0

GEOPHYSICAL LOG OF: OW-4

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

SHEET 1 OF 1

DATUM: GEODETIC

DEPTH SCALE METRES	DESCRIPTION	ELEV. DEPTH (m)
0	GROUND SURFACE	247.30
	Verulam Formation	0.00
10	Bobcaygeon Formation	237.30 10.00
20	Gull River Formation	224.30 23.00
30	END OF DRILLHOLE	215.40 31.90

GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100; CONDUCTIVITY (mS/m) 40 80 120 160

PIEZOMETER OR STANDPIPE INSTALLATION

(C)(B) (A)

Sand

Bentonite Seal

Sand

Bentonite Seal

Sand

A and B wells constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen.

Well C constructed with 25mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen

Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited
2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.
3. Geological formation contacts inferred from geophysical logs

DEPTH SCALE

1 : 300

Golder Associates

LOGGED: N/A

CHECKED: JPA

000108

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-5

SHEET 1 OF 1

LOCATION: N 4939682.9 ;E 651256.6

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)
		GROUND SURFACE		240.71
0		Verulam Formation		0.00
5				235.21
		Bobcaygeon Formation		5.50
10				
15				
				222.71
		Gull River Formation		18.00
20				
25				
30				
				207.66
		END OF DRILLHOLE		33.05
35				
40				
45				
50				
55				
60				

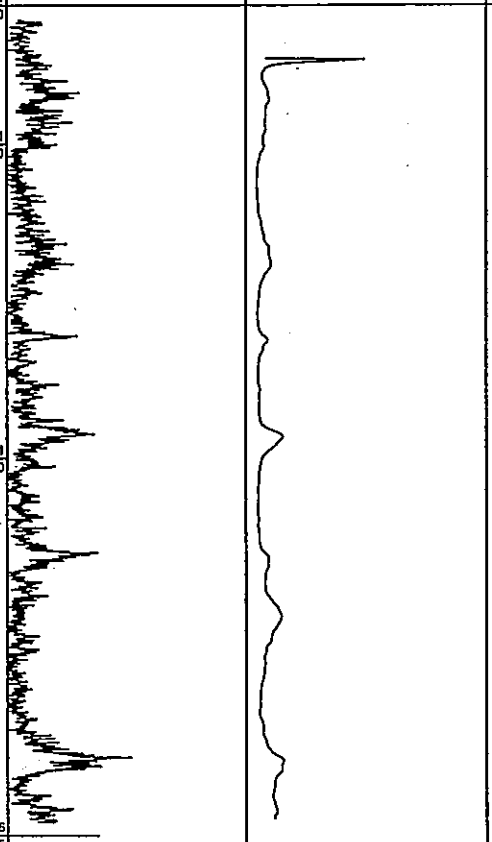
Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited

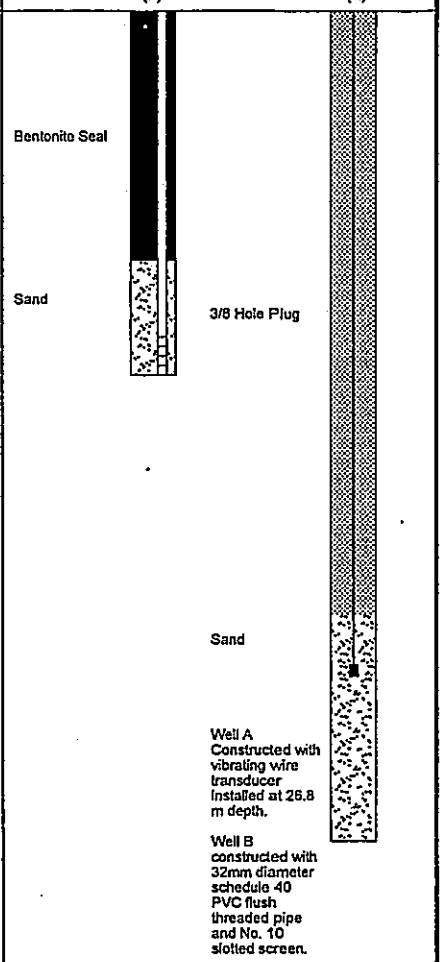
2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.

3. Geological formation contacts inferred from geophysical logs

GEOPHYSICAL RECORD



PIEZOMETER OR STANDPIPE INSTALLATION



Well A Constructed with vibrating wire transducer installed at 26.8 m depth.

Well B constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen.

DEPTH SCALE

1 : 300

Golder Associates

LOGGED: N/A

CHECKED: JPAC

000109

BAR_GEOPHYSICAL 041120600-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4939956.1 ;E 651481.8

GEOPHYSICAL LOG OF: OW-6

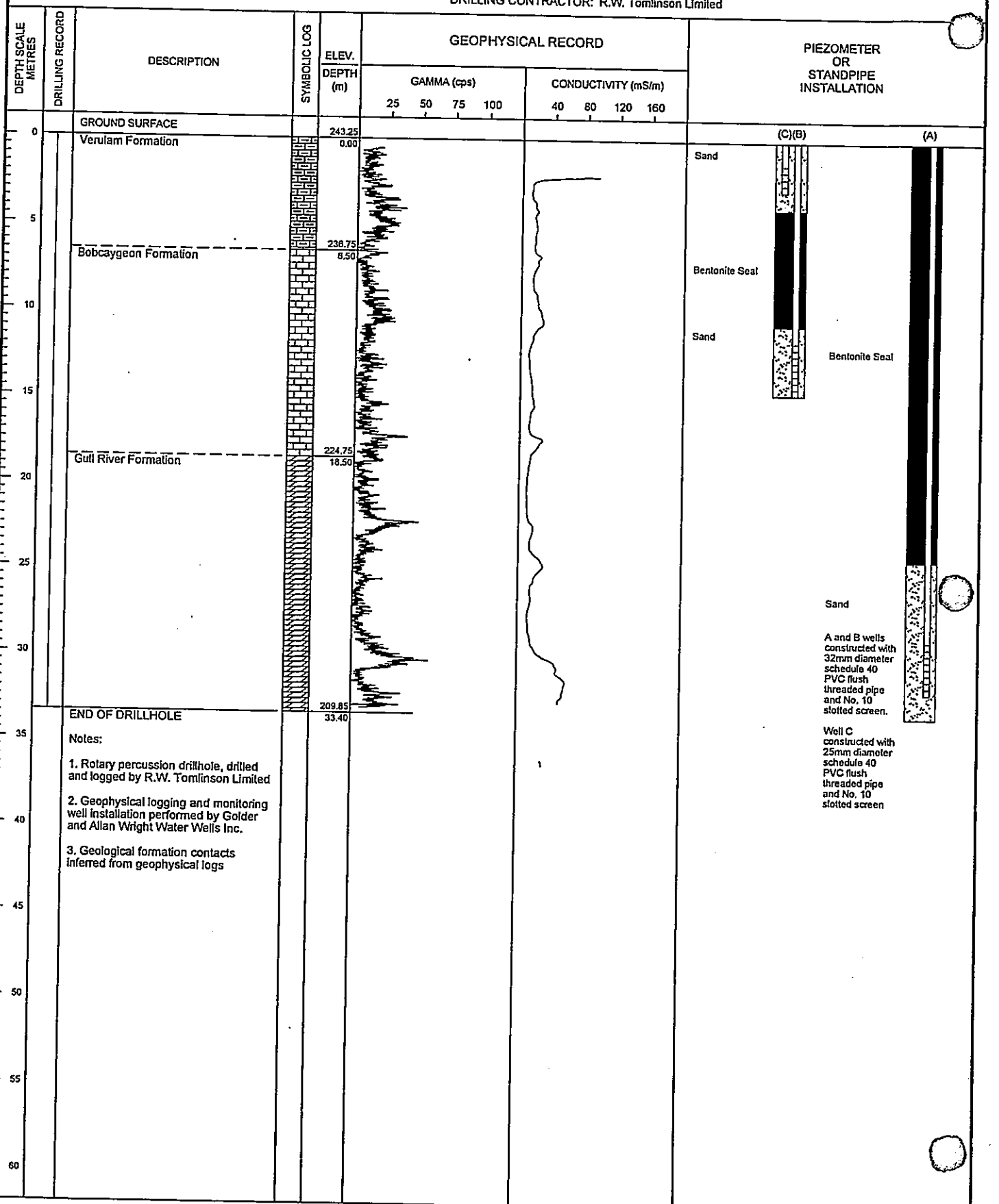
DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

SHEET 1 OF 1

DATUM: GEODETIC



Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited
2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.
3. Geological formation contacts inferred from geophysical logs

DEPTH SCALE

1:300

Golder Associates

LOGGED: N/A

CHECKED: JPA

000110

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-7

SHEET 1 OF 1

LOCATION: N 4940357.7 ;E 651916.7

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETIC

DEPTH SCALE METRES	DESCRIPTION	ELEV. DEPTH (m)
0	GROUND SURFACE	246.67
	Verulam Formation	0.00
5		
		239.87
	Bobcaygeon Formation	6.80
10		
15		
		227.17
20	Gull River Formation	19.50
25		
30		214.91
	END OF DRILLHOLE	31.76
35		
40		
45		
50		
55		
60		

Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited
2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.
3. Geological formation contacts inferred from geophysical logs

GEOPHYSICAL RECORD

GAMMA (cps): 25 50 75 100

CONDUCTIVITY (mS/m): 40 80 120 160

PIEZOMETER OR STANDPIPE INSTALLATION

(C)(B) (A)

Sand

Bentonite Seal

Sand

Bentonite Seal

Sand

A and B wells constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen.

Well C constructed with 25mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen

DEPTH SCALE

1 : 300

Golder Associates

LOGGED: N/A

CHECKED: JPA

000111

BAR GEOPHYSICAL 041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4940057.3 ;E 651789.2

GEOPHYSICAL LOG OF: OW-8

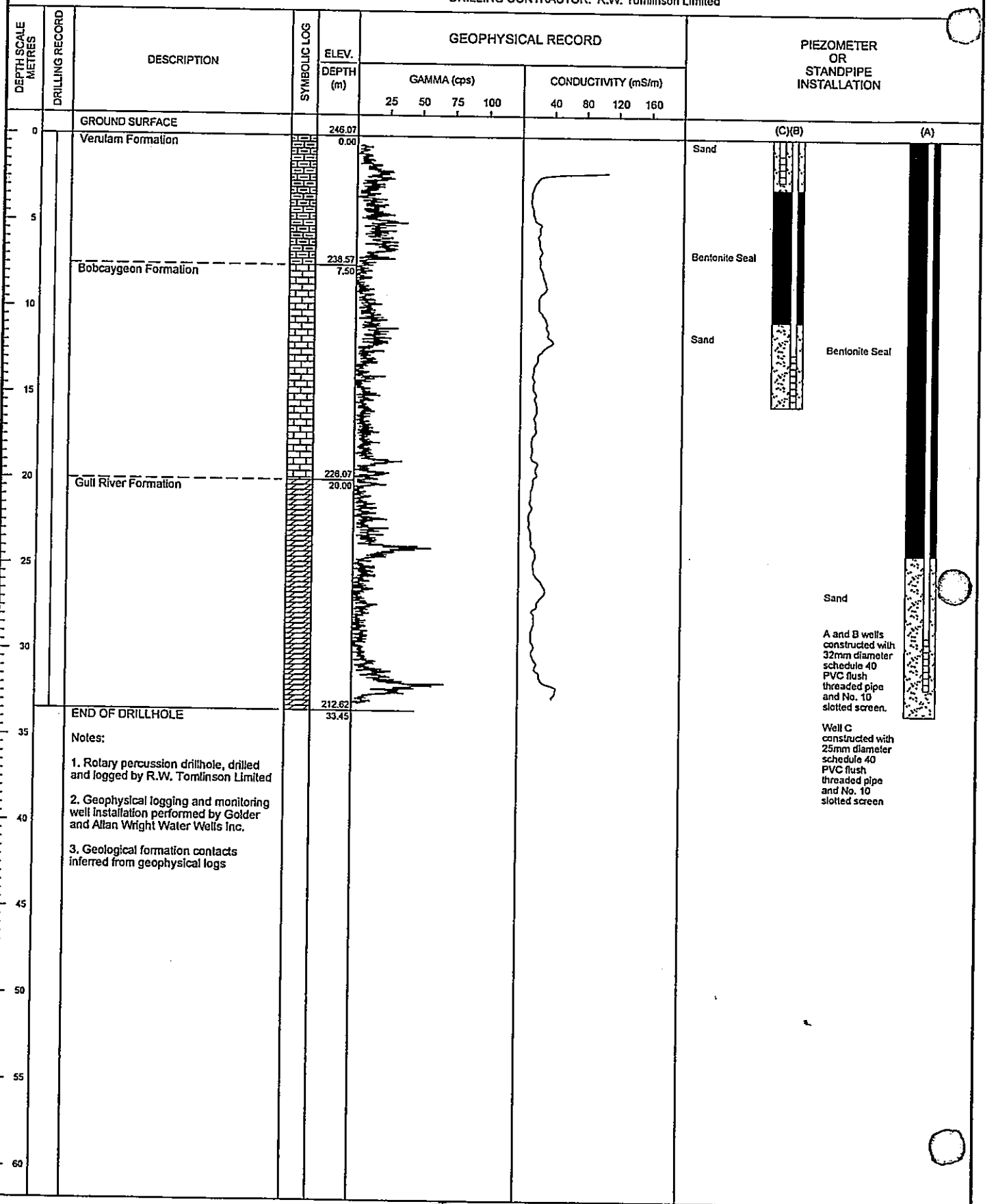
DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

SHEET 1 OF 1

DATUM: GEODETIC



Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited
2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.
3. Geological formation contacts inferred from geophysical logs

DEPTH SCALE

1 : 300

Golder Associates

LOGGED: N/A

CHECKED: JPA

000112

BAR_GEOPHYSICAL 04112080O-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-9

SHEET 1 OF 1

LOCATION: N 4939533.7 ;E 651613.8

DRILLING DATE: Aug 2004
DRILL RIG: Tamrock 1500 Hyd. Drill
DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)
0		GROUND SURFACE		246.75
		Verulam Formation		0.00
10				236.25
		Bobcaygeon Formation		10.50
20				223.75
		Gull River Formation		23.00
30				214.38
		END OF DRILLHOLE		32.39

Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited

2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.

3. Geological formation contacts inferred from geophysical logs

GEOPHYSICAL RECORD

GAMMA (cps): 25 50 75 100

CONDUCTIVITY (mS/m): 40 80 120 160

PIEZOMETER OR STANDPIPE INSTALLATION

(C)(B) (A)

Sand

Bentonite Seal

Sand

Bentonite Seal

Sand

Screen
A and B wells constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen.

Well C constructed with 25mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen

DEPTH SCALE
1 : 300

Golder Associates

LOGGED: N/A
CHECKED: JPA

000113

BAR_GEOPHYSICAL_04112080O-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4938686.8 ;E 651732.4

GEOPHYSICAL LOG OF: OW-10

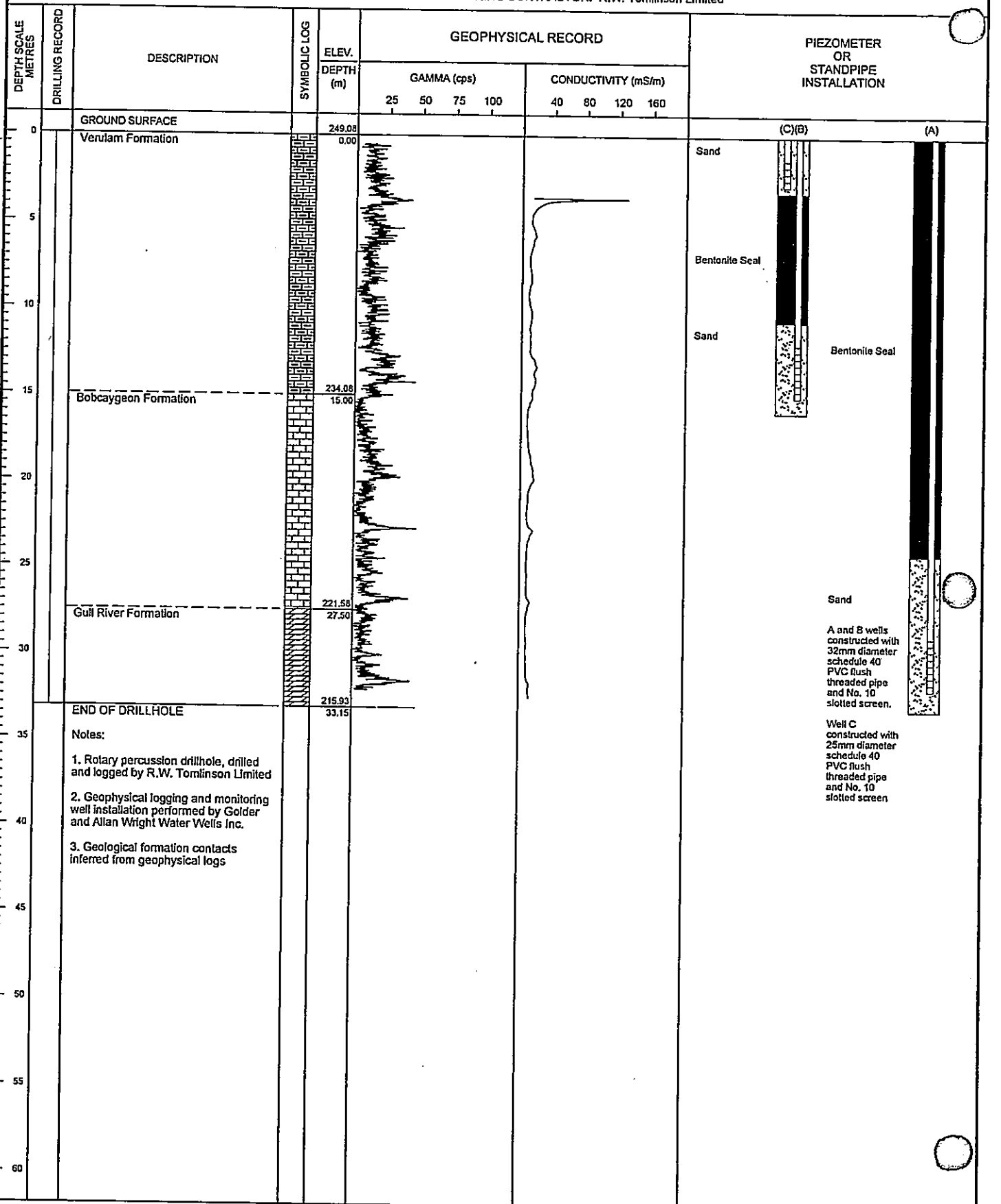
DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

SHEET 1 OF 1

DATUM: GEODETIC



Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited
2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.
3. Geological formation contacts inferred from geophysical logs

DEPTH SCALE

1 : 300

Golder Associates

LOGGED: N/A

CHECKED: JPA

000114

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-11

SHEET 1 OF 1

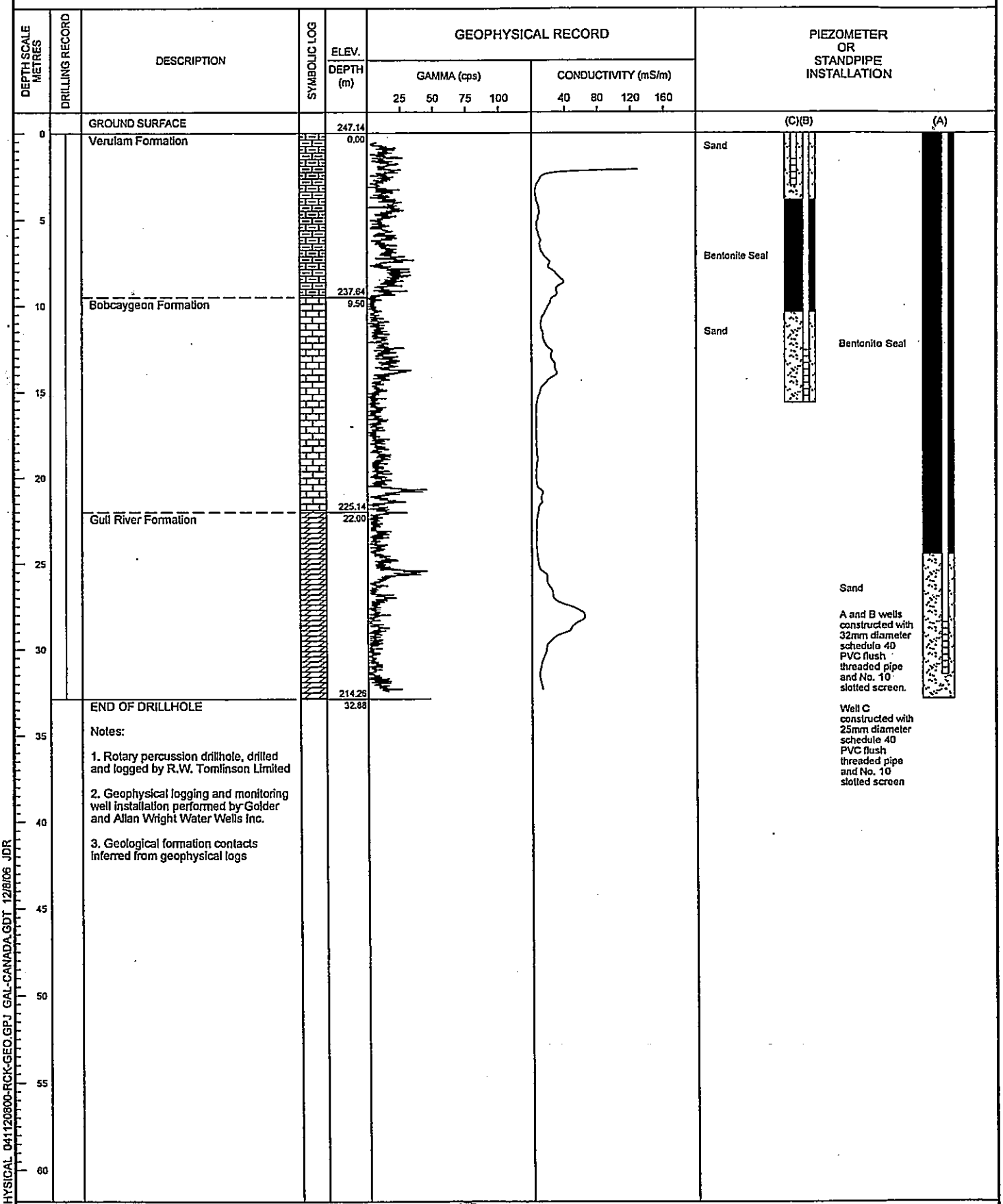
LOCATION: N 4939731.0 ;E 651843.7

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETIC



Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited
2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.
3. Geological formation contacts inferred from geophysical logs

DEPTH SCALE

1 : 300

Golder Associates

LOGGED: N/A

CHECKED: JPA

000115

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4939748.0 ;E 651868.6

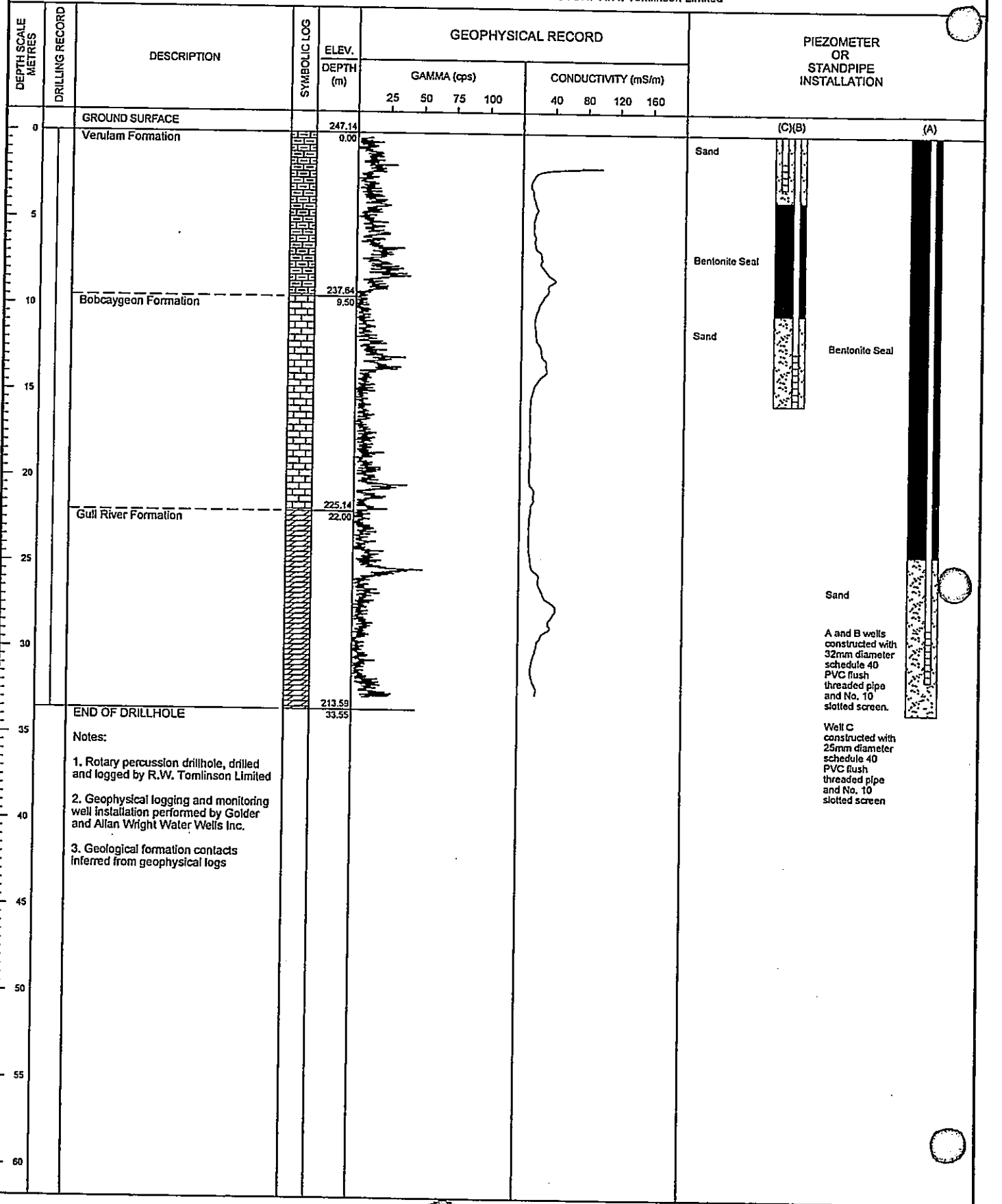
GEOPHYSICAL LOG OF: OW-12

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETIC



Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited
2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.
3. Geological formation contacts inferred from geophysical logs

DEPTH SCALE

1:300

Golder Associates

LOGGED: N/A

CHECKED: JPA

000116

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-13

SHEET 1 OF 1

LOCATION: N 4939753.9 ;E 651876.8

DRILLING DATE: Aug 2004
DRILL RIG: Tamrock 1500 Hyd. Drill
DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)
0		GROUND SURFACE		247.20
		Verulam Formation		0.00
				237.70
10		Bobcaygeon Formation		9.50
				225.20
		Gull River Formation		22.00
				214.31
		END OF DRILLHOLE		32.89

GEOPHYSICAL RECORD

GAMMA (cps): 25 50 75 100

CONDUCTIVITY (mS/m): 40 80 120 160

PIEZOMETER OR STANDPIPE INSTALLATION

(C)(B) (A)

Sand

Bentonite Seal

Sand

Bentonite Seal

Sand

A and B wells constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen.

Well C constructed with 25mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen

Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited

2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.

3. Geological formation contacts inferred from geophysical logs

DEPTH SCALE
1 : 300

Golder Associates

LOGGED: N/A

CHECKED: JPA

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4939768.5 ;E 651882.3

GEOPHYSICAL LOG OF: OW-14

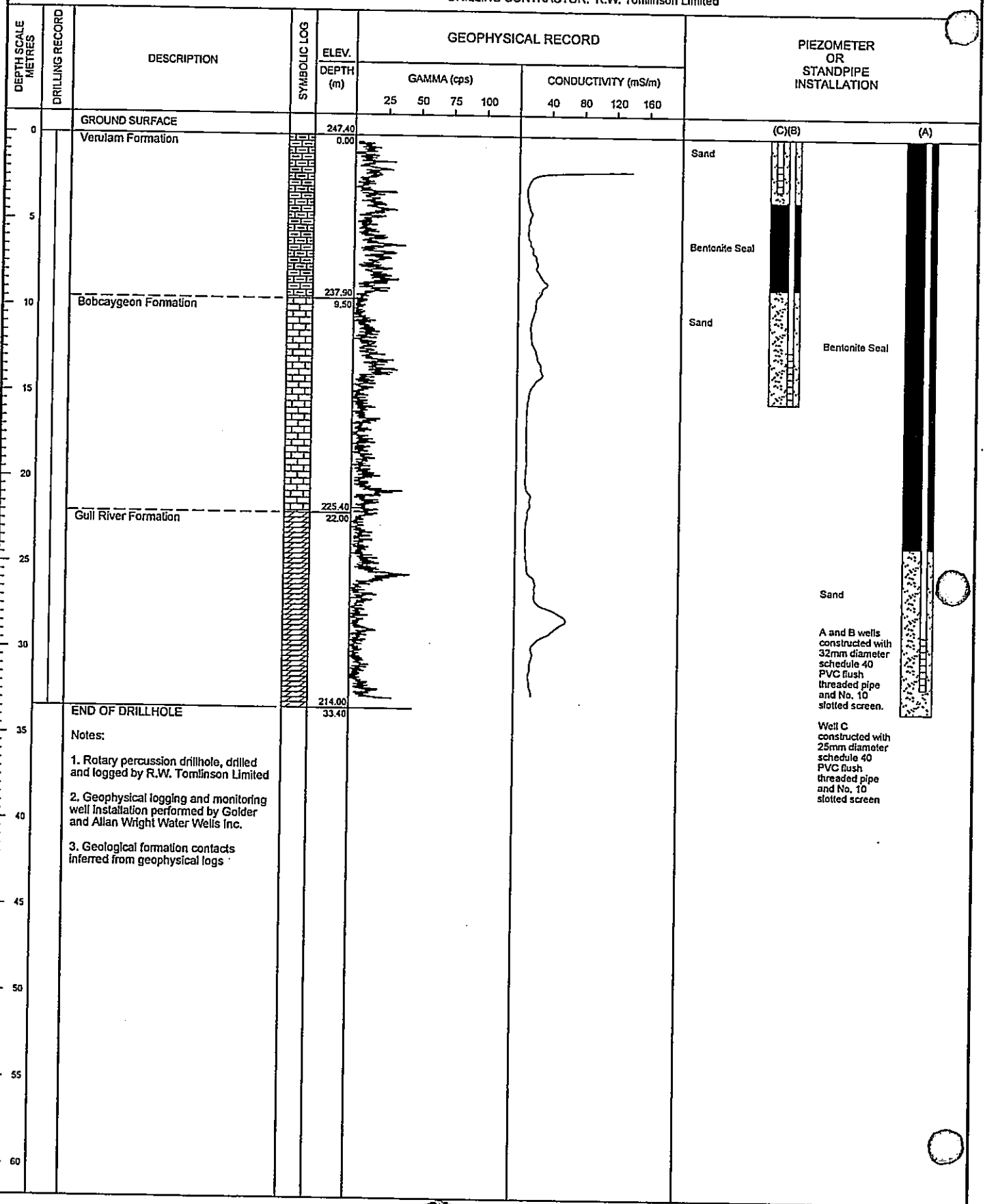
DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

SHEET 1 OF 1

DATUM: GEODETIC



Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited

2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.

3. Geological formation contacts inferred from geophysical logs

DEPTH SCALE

1 : 300

Golder Associates

LOGGED: N/A

CHECKED: JPA

000118

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

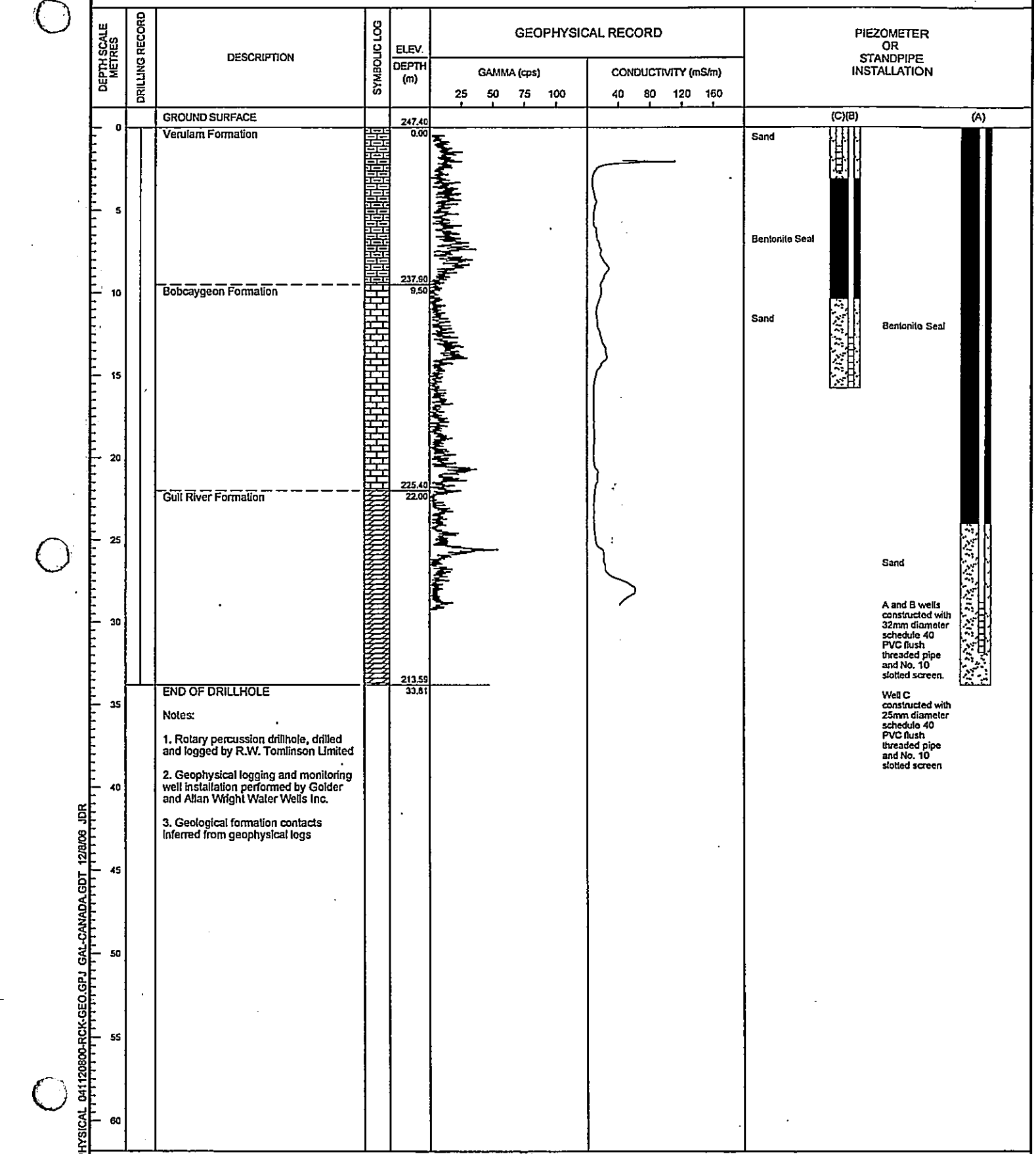
GEOPHYSICAL LOG OF: OW-15

SHEET 1 OF 1

LOCATION: N 4939777.7 ;E 651878.3

DRILLING DATE: Aug 2004
DRILL RIG: Tamrock 1500 Hyd. Drill
DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETIC



Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited
2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.
3. Geological formation contacts inferred from geophysical logs

DEPTH SCALE
1 : 300

Golder Associates

LOGGED: N/A
CHECKED: JPA

000119

BAR_GEOPHYSICAL_04112080O-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4939805.9 ;E 651867.8

GEOPHYSICAL LOG OF: OW-16

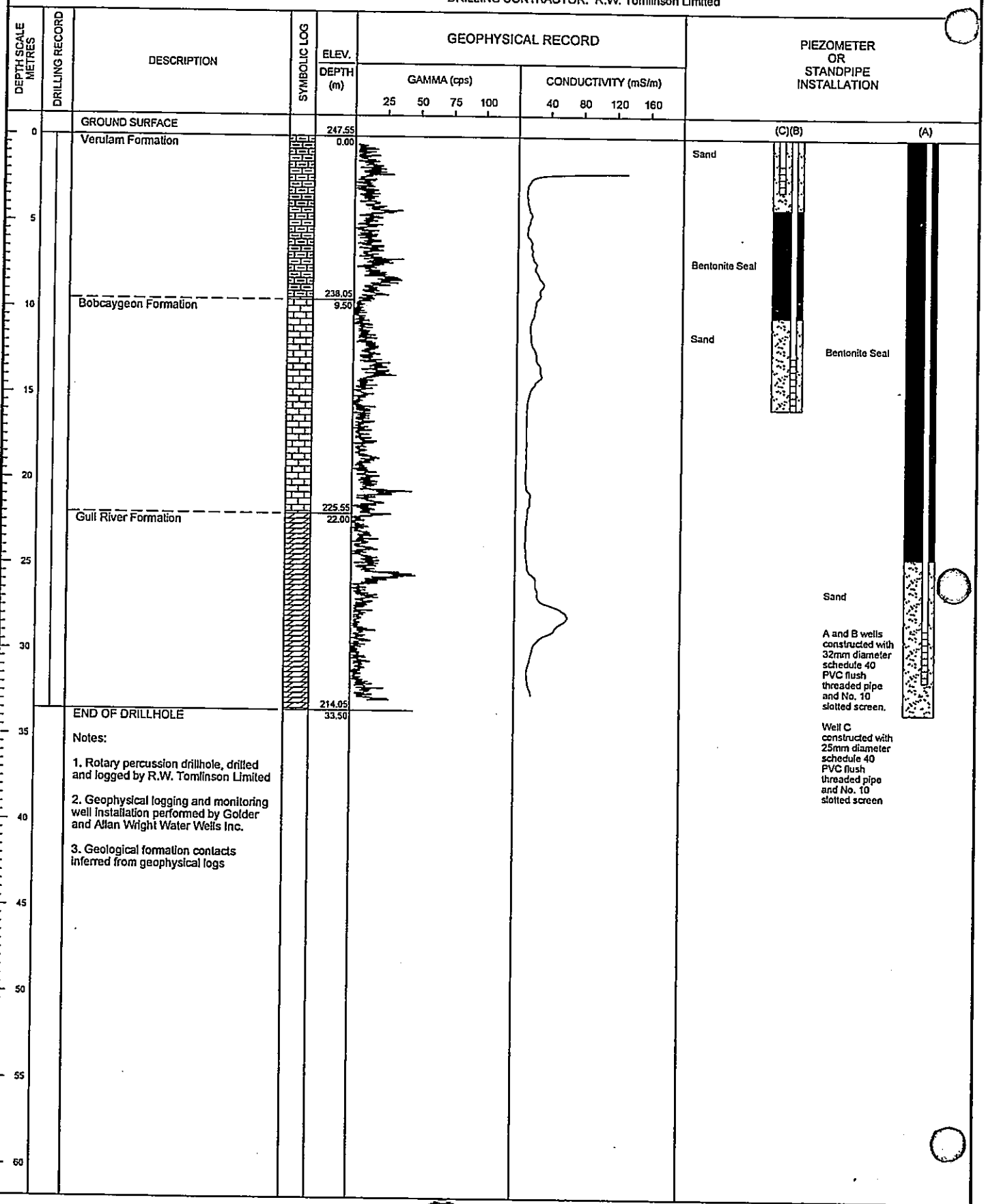
DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

SHEET 1 OF 1

DATUM: GEODETIC



Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited
2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.
3. Geological formation contacts inferred from geophysical logs

DEPTH SCALE

1:300

Golder Associates

LOGGED: N/A

CHECKED: JPA

000120

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-17

SHEET 1 OF 1

LOCATION: N 4938303.8 ;E 651468.4

DRILLING DATE: Aug 2004
DRILL RIG: Tamrock 1500 Hyd. Drill
DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)
		GROUND SURFACE		248.06
0		Verulam Formation		0.00
5				
10				
15				231.06
		Bobcaygeon Formation		17.00
20				
25				
				220.06
		Gull River Formation		28.00
30				
				215.26
		END OF DRILLHOLE		32.80
35				
40				
45				
50				
55				
60				

GEOPHYSICAL RECORD

GAMMA (cps): 25 50 75 100

CONDUCTIVITY (mS/m): 40 80 120 160

PIEZOMETER OR STANDPIPE INSTALLATION

(C)(B) (A)

Sand

Bentonite Seal

Sand

Bentonite Seal

Sand

A and B wells constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen.

Well C constructed with 25mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen

Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited

2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.

3. Geological formation contacts inferred from geophysical logs

DEPTH SCALE
1 : 300

Golder Associates

LOGGED: N/A

CHECKED: JPA

000121

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4938304.4 ;E 651498.4

GEOPHYSICAL LOG OF: OW-18

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETIC

DEPTH SCALE METRES	DESCRIPTION	ELEV. DEPTH (m)
0	GROUND SURFACE	247.66
	Verulam Formation	0.00
	Bobcaygeon Formation	231.66 / 16.20
	Gull River Formation	219.36 / 28.50
	END OF DRILLHOLE	214.54 / 33.32

GEOPHYSICAL RECORD

GAMMA (cps): 25 50 75 100

CONDUCTIVITY (mS/m): 40 80 120 160

PIEZOMETER OR STANDPIPE INSTALLATION

(C)(B)

Sand

Bentonite Seal

Sand

(A)

Bentonite Seal

Sand

A and B wells constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen.

Well C constructed with 25mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen

Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited
2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.
3. Geological formation contacts inferred from geophysical logs

DEPTH SCALE

1 : 300

Golder Associates

LOGGED: N/A

CHECKED: JPA

000122

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-19

SHEET 1 OF 1

LOCATION: N 4938304.8 ;E 651508.2

DRILLING DATE: Aug 2004
DRILL RIG: Tamrock 1500 Hyd. Drill
DRILLING CONTRACTOR: R.W. Tomlinson Limited

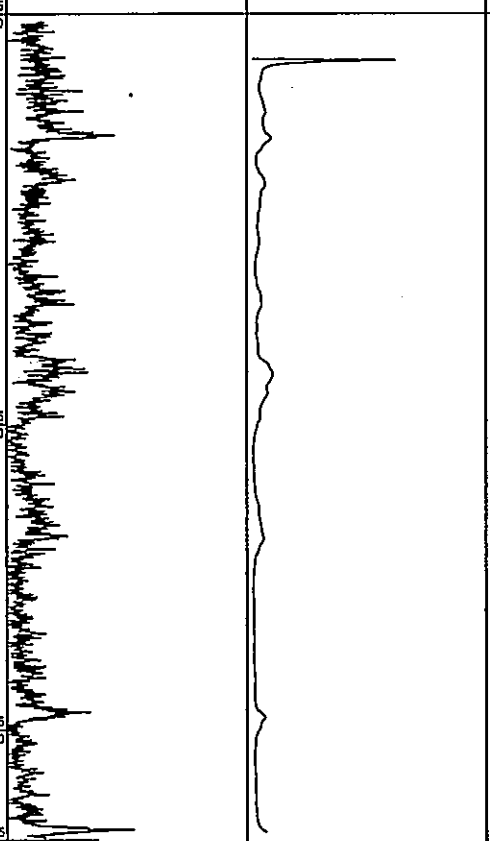
DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)
		GROUND SURFACE		247.85
0		Verulam Formation		0.00
5				
10				
15				231.55
		Bobcaygeon Formation		16.30
20				
25				219.35
		Gull River Formation		28.50
30				214.95
		END OF DRILLHOLE		32.90
35				
40				
45				
50				
55				
60				

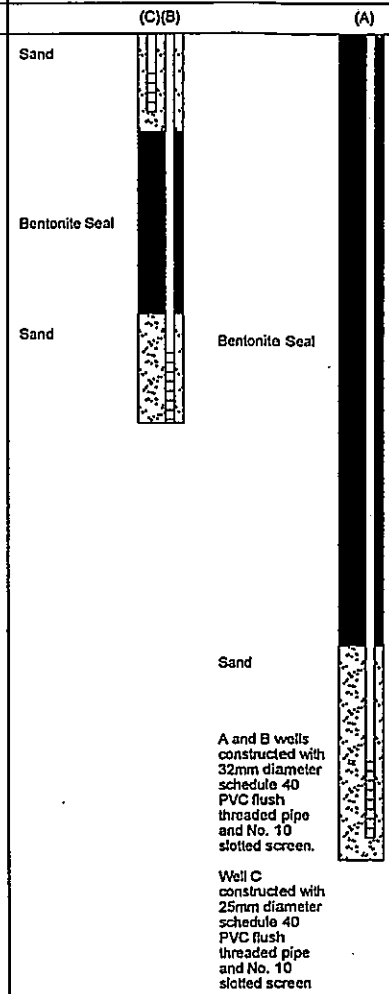
Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited
2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.
3. Geological formation contacts inferred from geophysical logs

GEOPHYSICAL RECORD



PIEZOMETER OR STANDPIPE INSTALLATION



DEPTH SCALE
1 : 300

Golder Associates

LOGGED: N/A
CHECKED: JPA

000123

BAR_GEOPHYSICAL 041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4938314.1 ;E 651520.7

GEOPHYSICAL LOG OF: OW-20

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

SHEET 1 OF 1

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)
0		GROUND SURFACE		247.94
		Verulam Formation		0.00
		Bobcaygeon Formation		231.74 16.20
		Gull River Formation		219.44 28.50
		END OF DRILLHOLE		214.74 33.20

Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited
2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.
3. Geological formation contacts inferred from geophysical logs

GEOPHYSICAL RECORD

GAMMA (cps): 25 50 75 100

CONDUCTIVITY (mS/m): 40 80 120 160

PIEZOMETER OR STANDPIPE INSTALLATION

(C)(B) (A)

Sand

Bentonite Seal

Sand

Bentonite Seal

Sand

A and B wells constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen.

Well C constructed with 25mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen

DEPTH SCALE 1 : 300

Golder Associates

LOGGED: N/A

CHECKED: JPA

000124

BAR GEOPHYSICAL 041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-21

SHEET 1 OF 1

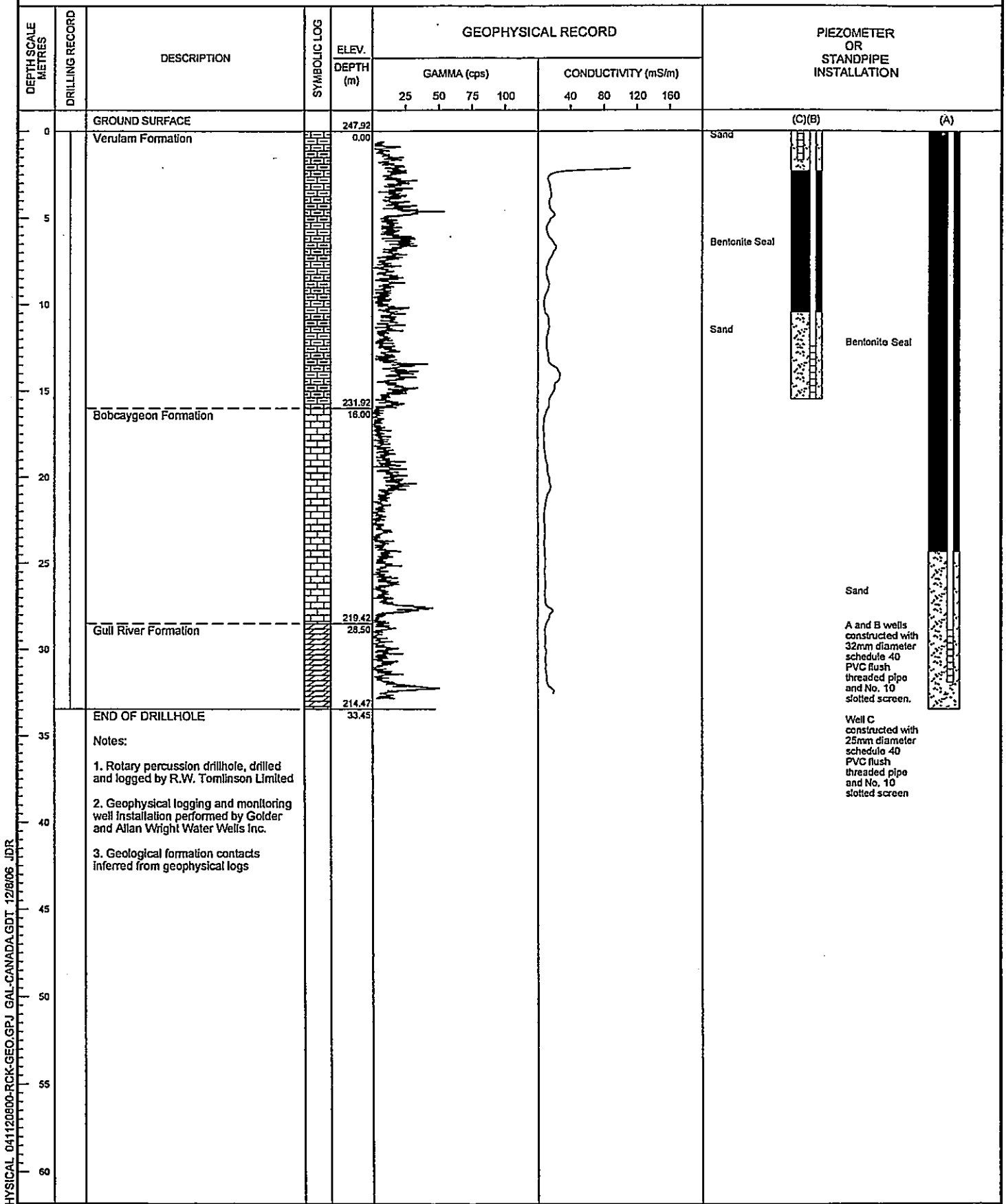
LOCATION: N 4938323.4 ;E 651523.6

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETIC



Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited

2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.

3. Geological formation contacts inferred from geophysical logs

DEPTH SCALE

1 : 300

Golder Associates

LOGGED: N/A

CHECKED: JPAC

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4938352.2 ;E 651531.8

GEOPHYSICAL LOG OF: OW-22

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

SHEET 1 OF 1

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)
0		GROUND SURFACE		248.19
		Verulam Formation		0.00
5				
10				
15				232.19
		Bobcaygeon Formation		16.00
20				
25				
30				219.69
		Gull River Formation		28.50
		END OF DRILLHOLE		214.99
35				33.20
40				
45				
50				
55				
60				

GEOPHYSICAL RECORD

GAMMA (cps): 25 50 75 100

CONDUCTIVITY (mS/m): 40 80 120 160

PIEZOMETER OR STANDPIPE INSTALLATION

(C)(B) (A)

Sand

Bentonite Seal

Sand

Bentonite Seal

Sand

A and B wells constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen.

Well C constructed with 25mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen

Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited

2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.

3. Geological formation contacts inferred from geophysical logs

DEPTH SCALE

1 : 300

Golder Associates

LOGGED: N/A

CHECKED: JPA

000126

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-23

SHEET 1 OF 1

LOCATION: N 4939109.1 ;E 651565.5

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		249.84			
		Verulam Formation		0.00			
5							
10							Bentonite Seal
		Approximate contact only		234.89			
15		Bobcaygeon Formation		14.95			
20							
25							Sand
		Approximate contact only		221.84			
		Gull River Formation		28.00			
30							Well A constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen.
				216.69			
		END OF DRILLHOLE		33.15			
35		Notes:					
		1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited					
40		2. Monitoring well installation performed by Allan Wright Water Wells Inc.					
		3. Approximate Geological contacts inferred from PW-3					
45							
50							
55							
60							

BAR GEOPHYSICAL 041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

DEPTH SCALE

1 : 300

Golder Associates

LOGGED: N/A

CHECKED: JPA

PROJECT: 04-1120-800

LOCATION: N 4939759.2 ;E 651884.9

GEOPHYSICAL LOG OF: PW-1

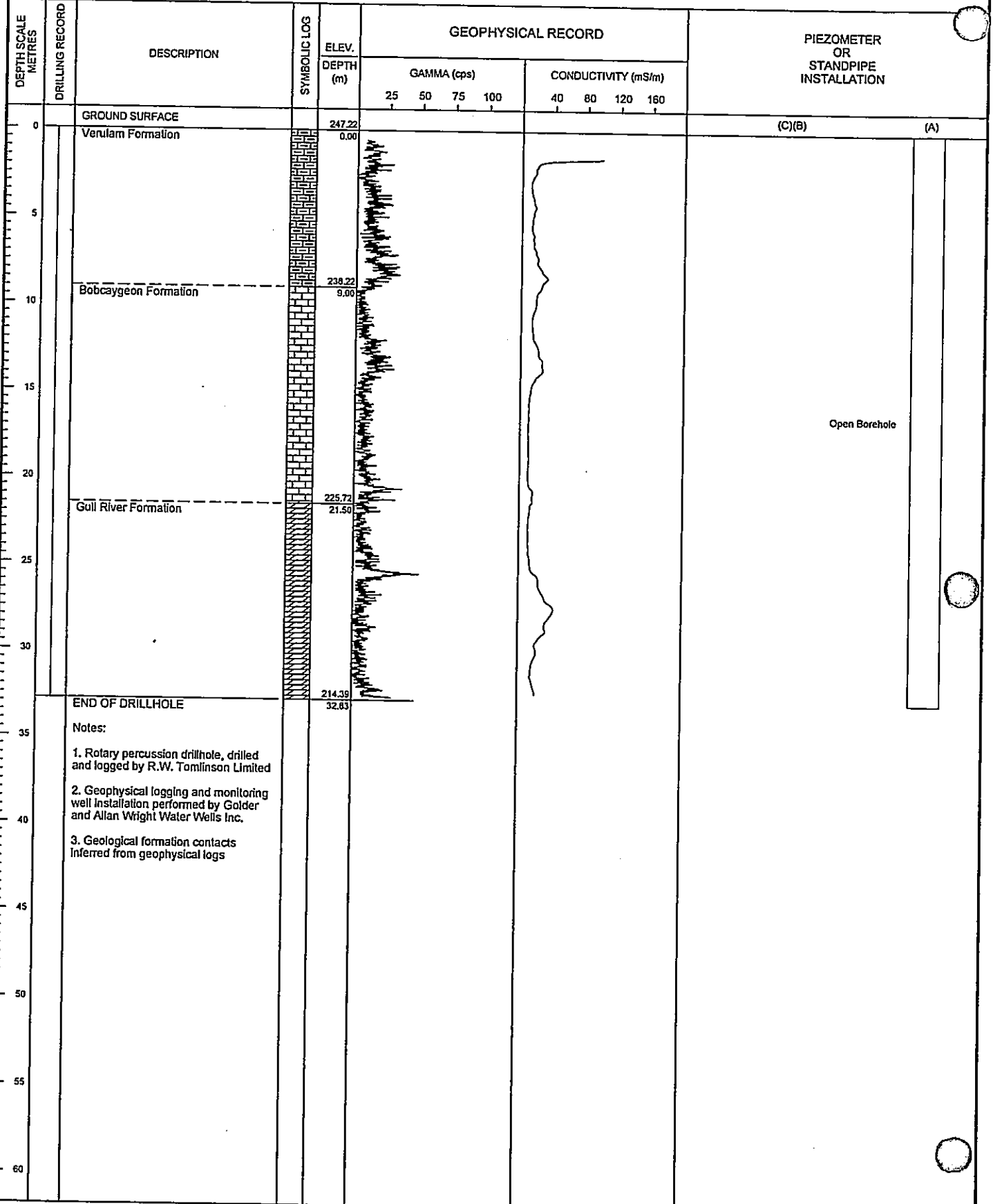
DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

SHEET 1 OF 1

DATUM: GEODETIC



Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited
2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.
3. Geological formation contacts inferred from geophysical logs

DEPTH SCALE

1 : 300

Golder Associates

LOGGED: N/A

CHECKED: JPA

000128

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: PW-2

SHEET 1 OF 1

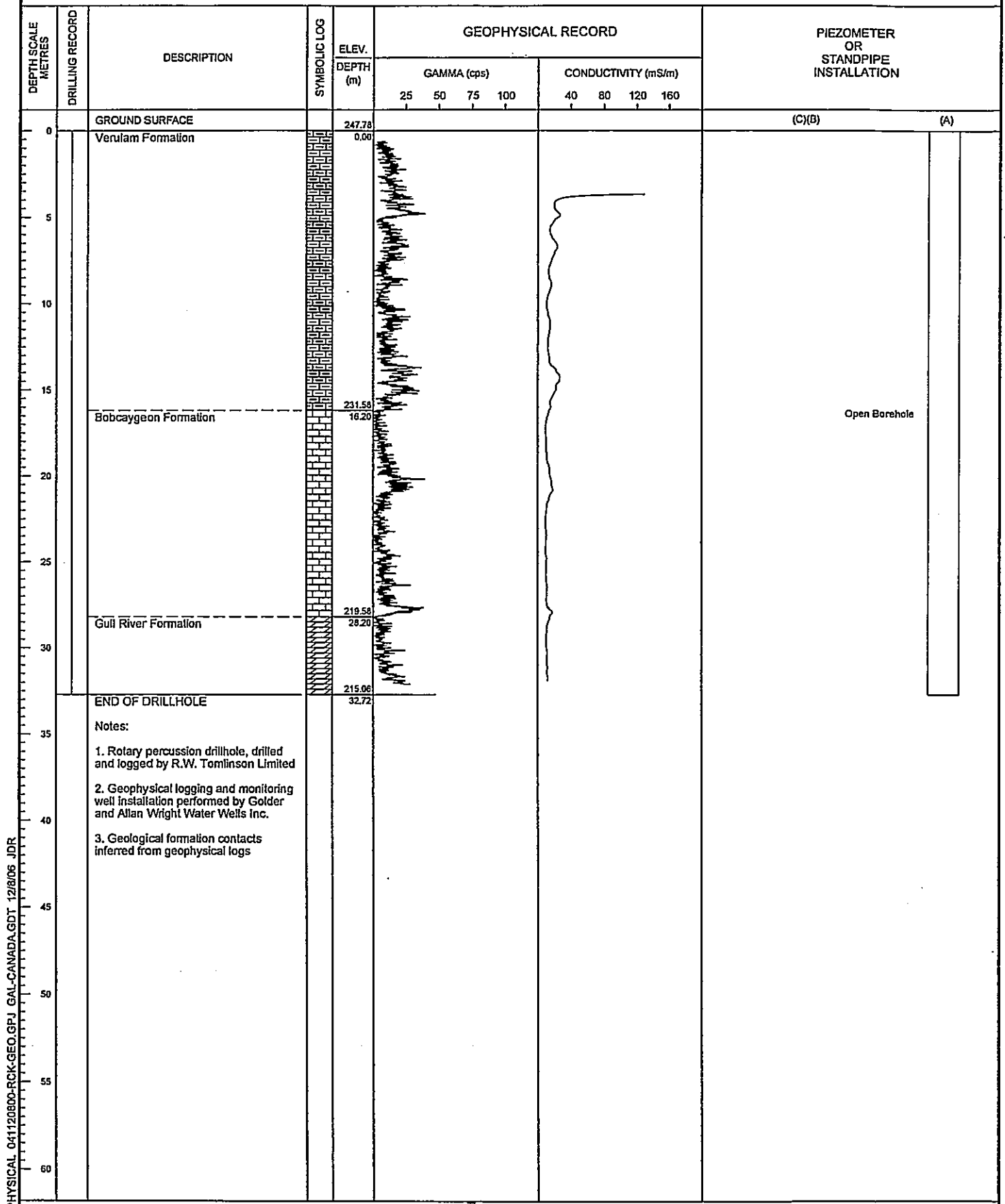
LOCATION: N 4938306.7 ;E 651517.0

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETIC



Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited

2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.

3. Geological formation contacts inferred from geophysical logs

DEPTH SCALE

1 : 300

Golder Associates

LOGGED: N/A

CHECKED: JPA

000129

BAR_GEOPHYSICAL 041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

PROJECT: 04-1120-800

LOCATION: N 4939116.8 ;E 651582.8

GEOPHYSICAL LOG OF: PW-3

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

SHEET 1 OF 1

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 40 80 120 160	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		249.44			
		Verulam Formation		0.00			
5							
10							
15				234.49			
		Bobcaygeon Formation		14.95			Open Borehole
20							
25							
30				217.74			
		END OF DRILLHOLE		31.70			
35							
40							
45							
50							
55							
60							

Notes:

1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited
2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.
3. Geological formation contacts inferred from geophysical logs

DEPTH SCALE

1 : 300

Golder Associates

LOGGED: N/A

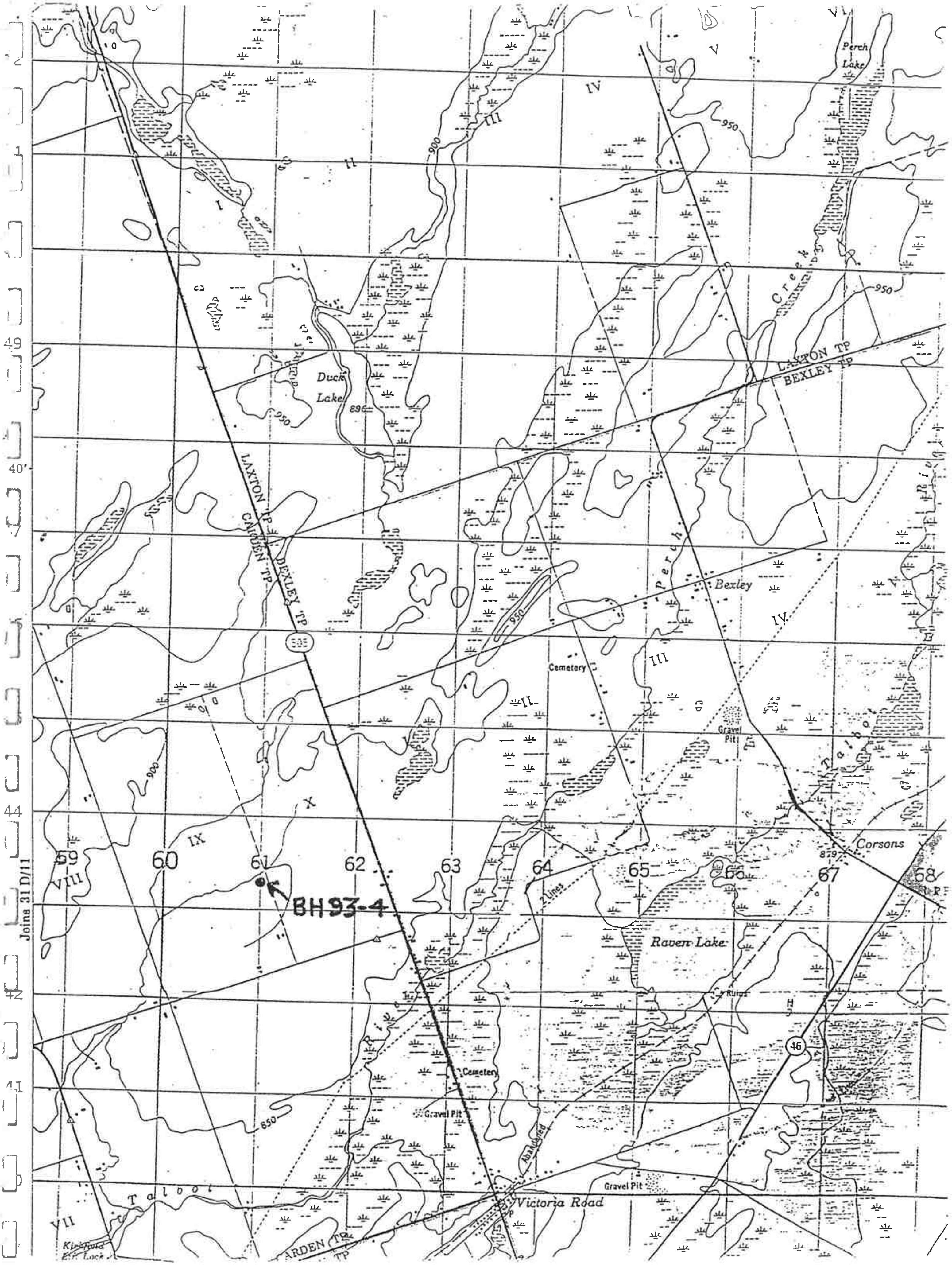
CHECKED: JPA

000130

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

Appendix D

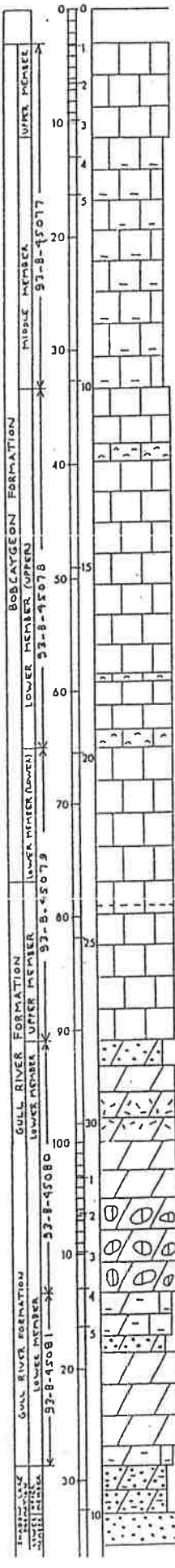
BH4 Borehole Log – 1995 Hydrotechnical Report – Oliver, Mangione, McCalla & Associates Ltd., Ferma Carden Quarry for Ferma Crushed Stone Inc.



Perch Lake
LAXTON TP
BEXLEY TP
CARDEN TP
Duck Lake
896
950
900
850
Bexley
Cemetery
Gravel Pit
Corsons
879
Raven Lake
Ruins
505
46
Victoria Road
Abandoned
2 Lines
59
60
61
62
63
64
65
66
67
68
BH93-4
49
40'
44
42
41
Joins 31 D/11

COLUMNAR SECTION

FERMA CONSTRUCTION — BH 93-4, VICTORIA ROAD
LOGGED BY D.A. WILLIAMS — JULY 1993



0.97 m — LIMESTONE, CALCISILTITE TO CALCARENITE, LIGHT OLIVE GREY TO MEDIUM LIGHT GREY TO MEDIUM DARK GREY, THIN TO THICK BEDDED, FOSSILIFEROUS, STYLOLITES, SUBORDINATE UNDULATING DARK GREY SHALY PARTINGS

3.16 m — LIMESTONE, CALCISILTITE TO CALCARENITE, MEDIUM LIGHT GREY TO MEDIUM DARK GREY, THIN TO THICK BEDDED, FOSSILIFEROUS STYLOLITES, INTRACLASTIC IN PLACES, UNDULATING DARK GREY SHALY PARTINGS, NODULAR STRUCTURE IN PLACES

10.20 m — LIMESTONE, CALCISILTITE TO CALCARENITE, MEDIUM LIGHT GREY TO MEDIUM GREY, THIN TO THICK BEDDED, FOSSILIFEROUS STYLOLITES, CALCITE BLEBS, INTRACLASTIC IN PLACES, SUBORDINATE UNDULATING DARK GREY SHALY PARTINGS

11.64 m
12.15 m
17.84 m
18.05 m
19.39 m
19.84 m — LIMESTONE, CALCILUTITE TO CALCISILTITE, PALE YELLOWISH BROWN TO LIGHT GREY TO MEDIUM DARK GREY, THIN TO THICK BEDDED, STYLOLITES, CALCITE BLEBS, INTRACLASTIC IN PLACES, SUBORDINATE UNDULATING DARK GREY SHALY PARTINGS

23.48 m — LIMESTONE, CALCILUTITE, LIGHT GREY TO MEDIUM GREY, MOTTLED (MEDIUM BLUISH GREY) IN PART, THIN TO THICK BEDDED, ABUNDANT STYLOLITES, CALCITE BLEBS, SHALY (23.17-23.16 m)

27.73 m — SILTY TO SANDY DOLOSTONE, GREENISH GREY TO DARK GREENISH GREY, MEDIUM TO THIN BEDDED

28.95 m — CALCITIC DOLOSTONE, DOLOSILTITE TO DOLOLUTITE, LIGHT GREENISH GREY TO PALE YELLOWISH BROWN, THICK TO THIN BEDDED, STYLOLITES, MINOR GYPSUM (29.31-30.15 m)

30.18 m (cont.)

32.05 m — CALCITIC DOLOSTONE, DOLOSILTITE TO DOLOLUTITE, MEDIUM LIGHT GREY TO PALE YELLOWISH BROWN, LIGHT GREY TO MEDIUM LIGHT GREY LIMESTONE REMNANTS (MOTTLED IN PART), THICK TO THIN BEDDED STYLOLITES, PYRITIC AND GLAUCONITIC

31.58 m — DOLOMITIC LIMESTONE, CALCILUTITE TO CALCISILTITE, MEDIUM LIGHT GREY, THIN TO THICK BEDDED, STYLOLITES, SHALY PARTINGS

35.72 m — SILTY TO SANDY DOLOSTONE, GREENISH GREY TO DARK GREENISH GREY, THICK TO THIN BEDDED, INTRACLASTIC IN PLACES

36.17 m — CALCITIC DOLOSTONE, DOLOSILTITE, GREENISH GREY TO LIGHT GREENISH GREY TO MEDIUM LIGHT GREY, THICK BEDDED

38.71 m — DOLOMITIC LIMESTONE, CALCILUTITE TO CALCISILTITE, MEDIUM LIGHT GREY, THIN TO THICK BEDDED, STYLOLITES, SHALY PARTINGS

39.27 m — SILTY TO SANDY DOLOSTONE, GREENISH GREY, THICK TO THIN BEDDED, SHALY PARTINGS

40.53 m — SLIGHTLY CALCAREOUS QUARTZ SANDSTONE, FINE GRAINED, GREENISH GREY TO DARK GREENISH GREY, THICK BEDDED

41.15 m

Appendix E

Well Records on File with the MECP

WA

All Measurements in feet

Ontario Ministry of the Environment

Monitoring Well WA

Well Tag No. (Sticker and print number below) A 024096

A 024096

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

[redacted]

City of Kawartha Lakes | Carden | 8 | 10

RR#/Street Number/Name: McNamee Rd. | City/Town/Village: Kirkfield | Site/Compartment/Block/Tract etc.

GPS Reading: NAD 83 | Zone 17 | Easting 660852 | Northing 4944321 | Unit Make/Model: Magellan | Mode of Operation: ☐ Undifferentiated ☐ Averaged ☐ Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From	Depth To
Brown	Topsoil		Soft	0	8"
Grey	Shale		Soft	8"	3'
Gray	Limestone		Medium Hard	3'	48'
Brown	Limestone		Soft	48	55
Lt. Grey	Limestone		Medium Hard	55	80
BlueGrey	Limestone		Medium Hard	80	92
Dk. Green	Limestone		Fractured Medium Soft	92	98
Grey	Limestone		Medium Hard	98	118
Dk. Green	Limestone		Medium Hard	118	135

Hole Diameter

Depth From	Metres To	Diameter Centimetres
0	20	10"
0	135	8"

Water Record

Water found at ___ Metres / Kind of Water

- ~~48 ft~~ ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:
- ~~94 ft~~ ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:
- ~~118 ft~~ ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:

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

Chlorinated ☐ Yes ☐ No

Construction Record

Inside diam centimetres	Material	Wall thickness centimetres	Depth From	Metres To
Casing				
8"	☑ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	.188	0	20'
			+4 Above	
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
Screen				
Outside diam 2"	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	Slot No. #10	1 @ 130' – 135' 2 @ 61' – 66' 3 @ 28' – 33'	
No Casing or Screen				
	☑ Open hole		20'	135'

Test of Well Yield

Pumping test method	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Pump intake set at - (metres)	Static Level	No		Test
Pumping rate - (litres/min)	1		1	
		Required		
Duration of pumping ____hrs +____ min	2		2	
Final water level end of pumping ____metres	3		3	
Recommended pump type. ☐ Shallow ☐ Deep	4		4	
Recommended pump depth. ____metres	5		5	
Recommended pump rate. (litres/min)	10		10	
	15		15	
If flowing give rate - (litres/min)	20		20	
	25		25	
If pumping discontinued, give reason.	30		30	
	40		40	
	50		50	
	60		60	

Plugging and Sealing Record

☑ Annular space ☐ Abandonment

Depth set at - Metres From	To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
0	20	Bentonite Slurry	37 GAL
	3	sets of Piezometers installed from:	
135	+4	Silica Sand + 3/8 Holeplug	35 Bags
66	+4	Silica Sand + 3/8 Holeplug	of Holeplug
33	+4	Silica Sand + 3/8 Holeplug	27 Bags of Sand

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: Herb Lang Well Drilling Ltd. | Well Contractor's Licence No.: 3367

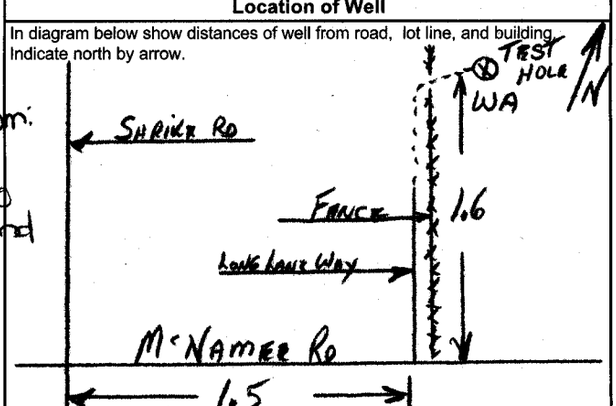
Business Address (street name, number, city etc.): 4852 Hwy #7, RR#1, Omemee, K0L 2W0

Name of Well Technician (last name, first name): Bignard, Allan | Well Technician's Licence No.: T-1868

Signature of Technician/Contractor: X | Date Submitted: 2006 YYYY 02 MM 01 DD

Location of Well

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



Audit No. Z 33077 | Date Well Completed: 2006 YYYY 02 MM 01 DD

Was the well owner's information package delivered? ☐ Yes ☒ No | Date Delivered YYYY MM DD

Ministry Use Only

Data Source | Contractor: 3367

Date Received: APR 05 2006 YYYY MM DD | Date of Inspection YYYY MM DD

Remarks | Well Record Number

W-B

All Measurements in feet

Ontario Ministry of the Environment

Monitoring Well WB

Well Tag Num: A 039611 (W)

A039611

Well Record

Regulation 903 Ontario Water Resources Act

page ___ of ___

Instructions for Completing Form

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- Please print clearly in blue or black ink only.

Ministry Use Only

MUN | CON | LOT

[redacted]

Address of Well Location (County/District/Municipality): City of Kawartha Lakes | Township: Carden | Lot: 8 | Concession: 10

RR#/Street Number/Name: McNamee Rd. | City/Town/Village: Kirkfield | Site/Compartment/Block/Tract etc.

GPS Reading: NAD 83 | Zone 17 | Easting 660982 | Northing 4944066 | Unit Make/Model: Magellan | Mode of Operation: ☐ Undifferentiated ☐ Averaged ☐ Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From	Depth To
Brown	Topsoil		Soft	0	5"
Grey	Shale		Soft	5"	3'
Grey	Limestone		Medium Hard	3'	98'
Dk. Green	Limestone		Medium Soft	98	104
Grey	Limestone		Medium Hard	104	122
Dk. Grey	Limestone		Fractured Medium Soft	122	124
Dk. Green	Limestone		Medium Soft	124	125
Grey	Limestone		Medium Hard	125	138
Dk Green	Limestone		Medium Hard	138	140

Hole Diameter

Depth From	Depth To	Diameter Centimetres
0	20	10"
0	140	8"

Water Record

Water found at ___ Metres / Kind of Water

- 27 ft ☐ Fresh ☑ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:
- 53 ft ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:
- 97 ft +123 ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:

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

Chlorinated ☐ Yes ☐ No

Construction Record

Inside diam centimetres	Material	Wall thickness centimetres	Depth From	Depth To
Casing				
8"	☑ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	.188	0	20'
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized		+4 ABOVE	
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
Screen				
Outside diam 2"	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	Slot No. #10	1 @ 135' - 140' 2 @ 61' - 66' 3 @ 26' - 31'	
No Casing or Screen				
	☑ Open hole		20'	140'

Test of Well Yield

Pumping test method	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Pump intake set at - (metres)	Static Level	NO TEST		
Pumping rate - (litres/min)	1		1	
		REQUIRED		
Duration of pumping ___hrs +___ min	2		2	
Final water level end of pumping ___metres	3		3	
Recommended pump type. ☐ Shallow ☐ Deep	4		4	
Recommended pump depth. ___metres	5		5	
Recommended pump rate. (litres/min)	10		10	
	15		15	
If flowing give rate - (litres/min)	20		20	
	25		25	
If pumping discontinued, give reason.	30		30	
	40		40	
	50		50	
	60		60	

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	20	Bentonite Slurry	36 GALS
3 sets of Piezometers were installed from			
140	+4	Silica Sand + 3/8 Hydraplug	35 Bags
66	+4	Silica Sand + 3/8 Hydraplug	of Hydraplug
31	+4	Silica Sand + 3/8 Hydraplug	27 Bags of Sand

Method of Construction

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

Water Use

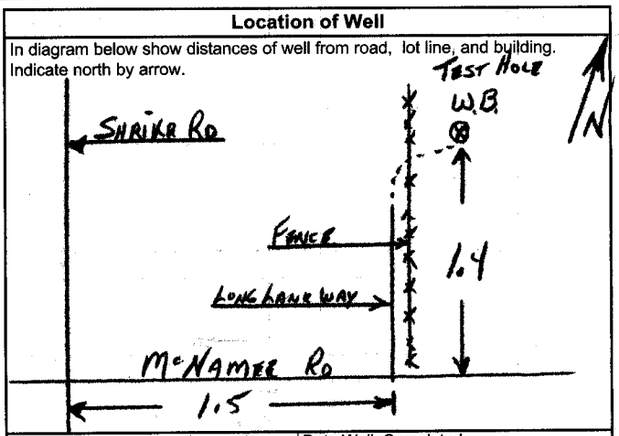
☐ Domestic ☐ Industrial ☐ Public Supply ☐ Other
☐ Stock ☑ Commercial ☐ Not used
☐ Irrigation ☐ Municipal ☐ Cooling & air conditioning

Final Status of Well

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

Location of Well

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



Audit No. Z 33076 | Date Well Completed 2006 01 30 | Was the well owner's information package delivered? ☐ Yes ☑ No | Date Delivered

Well Contractor/Technician Information

Name of Well Contractor: Herb Lang Well Drilling Ltd. | Well Contractor's Licence No. 3367

Business Address (street name, number, city etc.): 4852 Hwy #7, RR#1, Omemee, K0L2W0

Name of Well Technician (last name, first name): Richard Allan | Well Technician's Licence No. T-1868

Signature of Technician/Contractor: X | Date Submitted 2006 02 20

Ministry Use Only

Data Source | Contractor 3367

Date Received APR 05 2006 | Date of Inspection

Remarks | Well Record Number

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

All Measurements in Feet

Ontario Ministry of the Environment

Monitoring Well WF

Well Tag No. (Print number below) A039613

A039613

Well Record

Regulation 903 Ontario Water Resources Act

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- 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: [redacted] | Last Name: Ferma Aggregates Inc. | Mailing Address (Street Number/Name, RR, Lot, Concession): 2666 Rona Rd.

County/District/Municipality | Township/City/Town/Village: Mississauga | Province: Ontario | Postal Code: L4T3C8 | Telephone Number (include area code)

Address of Well Location (County/District/Municipality): City of Kawartha Lakes | Township: Carden | Lot: 7 | Concession: 9

RR#/Street Number/Name: [redacted] Shrike Rd | City/Town/Village: Kirkfield | Site/Compartment/Block/Tract etc.

GPS Reading: NAD 83 | Zone: 17 | Easting: 669528 | Northing: 4943690 | Unit Make/Model: Magellan | Mode of Operation: ☐ Undifferentiated ☐ Averaged ☐ Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From	Depth To (Metres)
Brown	Topsoil		Soft	0	4"
Grey	Shale		Soft	4"	1'
Grey	Limestone		Medium Hard	1'	41'
Brown	Limestone		Medium Hard	41'	42
Grey	Limestone			42	58
Brown	Limestone		Soft	58	61
Grey	Limestone		Medium Hard	61	87
Dk. Green	Limestone		Medium Hard	87	109
Grey	Limestone		Medium Hard	109	137

Hole Diameter

Depth From	Metres To	Diameter Centimetres
0	20	10"
0	137	8"

Water Record

Water found at Metres	Kind of Water
14 m	☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:
24 m	☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:
107-133 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

Inside diam centimetres	Material	Wall thickness centimetres	Depth From	Metres To
Casing				
8"	☑ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	.188	0	20'
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			+4 Above Ground
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
Screen				
Outside diam 2"	☐ Steel ☐ Fibreglass ☑ Plastic ☐ Concrete ☐ Galvanized	Slot No. #10	#1 @ 28' - 33' #2 @ 102' - 107' #3 @ 132 - 137'	
No Casing or Screen				
	☑ Open hole		20	137

Test of Well Yield

Pumping test method	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Pump intake set at - (metres)	Static Level	No		TEST
Pumping rate - (litres/min)	1		1	REQUIRED
Duration of pumping ____hrs +____ min	2		2	
Final water level end of pumping ____metres	3		3	
Recommended pump type. ☐ Shallow ☐ Deep	4		4	
Recommended pump depth. ____metres	5		5	
Recommended pump rate. (litres/min)	10		10	
	15		15	
If flowing give rate - (litres/min)	20		20	
	25		25	
If pumping discontinued, give reason.	30		30	
	40		40	
	50		50	
	60		60	

Plugging and Sealing Record

☑ Annular space ☐ Abandonment

Depth set at - Metres From	To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
0	20	Bentonite Slurry	36 Final
3 Sets		of piezometers were installed From:	
137	+4	Silica sand + 3/8 Hole plug	35 Bags
107	+4	" " "	of Hole plug
33	+4	" " "	26 Bags of Sand

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: Herb Lang Well Drilling Ltd. | Well Contractor's Licence No.: 3367

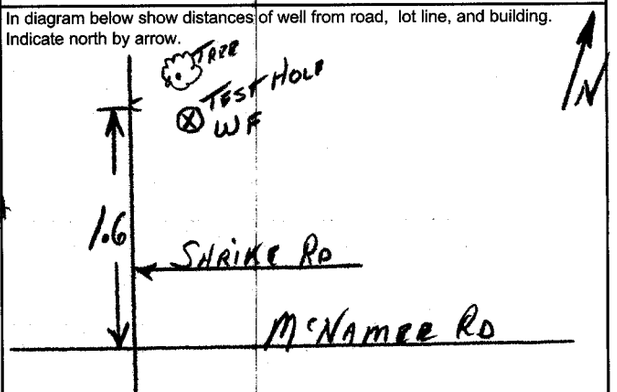
Business Address (street name, number, city etc.): 4852 Hwy #7, RR#1, Omemee, K0L2W0

Name of Well Technician (last name, first name): Richard, Allan | Well Technician's Licence No.: T-1868

Signature of Technician/Contractor: X [signature] | Date Submitted: 2006 YYYY 03 MM 20 DD

Location of Well

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



Audit No. Z 33078 | Date Well Completed: 2006 02 03 (YYYY MM DD)

Was the well owner's information package delivered? ☐ Yes ☑ No | Date Delivered

Ministry Use Only

Data Source | Contractor: 3367

Date Received: APR 28 2006 | Date of Inspection

Remarks | Well Record Number

0506E (09/03) Contractor's Copy ☐ Ministry's Copy ☑ Well Owner's Copy ☐

Cette formule est disponible en français

10-G

All Measurements in feet

Ontario Ministry of the Environment

Monitoring Well WG

Well Tag Number (Place sticker here) A039618

A039618

Well Record

Regulation 903 Ontario Water Resources Act

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Ministry Use Only

MUN | CON | LOT

Well Owner's Information and Location of Well Information

[redacted]

City of Kawartha Lakes | Carden | 6 | 9

RR#/Street Number/Name: McNamee Rd.

City/Town/Village: Kirkfield

Site/Compartment/Block/Tract etc.

GPS Reading: NAD 83 | Zone 17 | Easting 660228 | Northing 4942199

Unit Make/Model: Magellan

Mode of Operation: ☐ Undifferentiated ☐ Averaged ☐ Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From	Depth To
Brown	Topsoil		Soft	0	4"
Brown	Clay	Sand	Soft	4"	2'
Grey	Shale		Soft	2'	3'
Grey	Limestone		Medium Hard	3	34
Brown	Limestone		Medium Hard	34	39
Lt Grey	Limestone		Medium Hard	39	97
Lt Green	Limestone		Medium Hard	97	101
Brown	Limestone		Medium Hard	101	104
Grey	Limestone		Medium Hard	104	110

Hole Diameter

Depth From	Depth To	Diameter Centimetres
0	20'	10"
0	110'	8"

Water Record

Water found at ___ Metres / Kind of Water

- 23 mft ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:
- 76' mft ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:
- 94 ft ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:

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

Chlorinated ☐ Yes ☐ No

Construction Record

Casing

Inside diam centimetres	Material	Wall thickness centimetres	Depth From	Depth To
8"	☑ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	.188	0	20
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized		+4	ABOVE Ground
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			

Screen

Outside diam	Material	Slot No.	
2"	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	#10	1 @ 19' – 24' 2 @ 60' – 65' 3 @ 105' – 110'

No Casing or Screen

☑ Open hole 20' [redacted]'110'

Test of Well Yield

Pumping test method	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Pump intake set at - (metres)	Static Level	NO		TEST
Pumping rate - (litres/min)	1		1	
		REQUIRED		
Duration of pumping ___hrs +___ min	2		2	
Final water level end of pumping ___metres	3		3	
Recommended pump type. ☐ Shallow ☐ Deep	4		4	
Recommended pump depth. ___metres	5		5	
Recommended pump rate. (litres/min)	10		10	
	15		15	
If flowing give rate - (litres/min)	20		20	
	25		25	
If pumping discontinued, give reason.	30		30	
	40		40	
	50		50	
	60		60	

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	20	Bentonite Slurry	36 GAL
3 sets of Piezometers were installed from:			
110	+4	Silica Sand + 318 Hole plug	23 Bags of Hole plug
65	+4	" " + " "	
24	+4	" " + " "	27 Bags Sand

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: Herb Lang Well Drilling Ltd. | Well Contractor's Licence No.: 3367

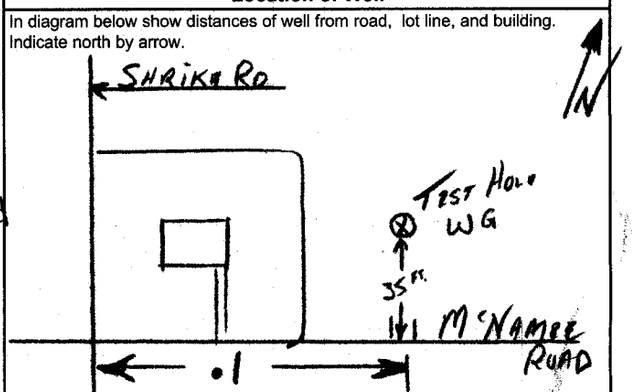
Business Address (street name, number, city etc.): 4852 Hwy #7, RR#1, Omemee, K0L 2W0

Name of Well Technician (last name, first name): Richard, Allan | Well Technician's Licence No.: T-1868

Signature of Technician/Contractor: X [signature] | Date Submitted: 2006 02 20

Location of Well

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



Audit No. Z 33079 | Date Well Completed: 2006 02 09

Was the well owner's information package delivered? ☐ Yes ☑ No | Date Delivered

Ministry Use Only

Data Source | Contractor: 3367

Date Received: APR 05 2006 | Date of Inspection

Remarks | Well Record Number

0506E (09/03) Contractor's Copy ☐ Ministry's Copy ☑ Well Owner's Copy ☐

Cette formule est disponible en français

10-A

All Measurements in feet

Ontario Ministry of the Environment

Monitoring Well WH

Well Tag No. (Plate below) A 039612

A039612

Well Record

Regulation 903 Ontario Water Resources Act

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- 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: Ferma | Last Name: Aggregates Inc. | Mailing Address (Street Number/Name, RR, Lot, Concession): 2666 Rena Rd.

County/District/Municipality | Township/City/Town/Village: Mississauga | Province: Ontario | Postal Code: L4T 3C8 | Telephone Number (include area code)

Address of Well Location (County/District/Municipality): City of Kawartha Lakes | Township: Carden | Lot: 10 | Concession: 9

RR#/Street Number/Name: Shrike Rd | City/Town/Village: Kirkfield | Site/Compartment/Block/Tract etc.

GPS Reading | NAD: 83 | Zone: 17 | Easting: 659978 | Northing: 4945316 | Unit Make/Model: Magellan | Mode of Operation: ☐ Undifferentiated ☐ Averaged ☐ Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From	Depth To (Metres)
Brown	Topsoil		Soft	0	4"
Grey	Shale		Soft	4"	2'
Grey	Limestone		Medium Hard	2'	42'
Brown	Limestone		Medium Hard	42'	52'
Lt. Grey	Limestone		Medium Hard	52	58
Brown	Limestone		Medium Hard	58	77
Dk. Green	Limestone		Fractured Medium Hard	77	84
Lt. Green	Limestone		Medium Hard	84	87
Green	Limestone		Medium Hard	87	122

Hole Diameter

Depth From	Depth To (Metres)	Diameter (Centimetres)
0	20	10"
0	122'	8"

Water Record

Water found at ___ Metres	Kind of Water
32 mft	☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:
40 mft	☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:
58 m → 104 → 118	☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:

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

Chlorinated ☐ Yes ☐ No

Construction Record

Casing

Inside diam centimetres	Material	Wall thickness centimetres	Depth From	Depth To (Metres)
8"	☑ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	.188	0	20'
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized		+4	Above Ground
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			

Screen

Outside diam		Slot No.	
2"	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	#10	1 @ 117' - 122' 2 @ 50' - 55' 3 @ 17' - 22'

No Casing or Screen

	Depth From	Depth To (Metres)
☑ Open hole	20'	122'

Test of Well Yield

Pumping test method	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Pump intake set at - (metres)	Static Level	NO		TEST
Pumping rate - (litres/min)	1		1	REQUIRED
Duration of pumping ___hrs + ___ min	2		2	
Final water level end of pumping ___metres	3		3	
Recommended pump type. ☐ Shallow ☐ Deep	4		4	
Recommended pump depth. ___metres	5		5	
Recommended pump rate. (litres/min)	10		10	
	15		15	
If flowing give rate - (litres/min)	20		20	
	25		25	
If pumping discontinued, give reason.	30		30	
	40		40	
	50		50	
	60		60	

Plugging and Sealing Record

☑ Annular space ☐ Abandonment

Depth set at - Metres From	To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
0	20	Bentonite Slurry	36 GAL
3 Sets of piezometers were installed from			
122	+4	Silica Sand + 3/8 Holeplug	12 Bags
55	+4	" " "	of Holeplug
22	+4	" " "	60 Bags of Sand

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: Herb Lang Well Drilling Ltd. | Well Contractor's Licence No.: 3367

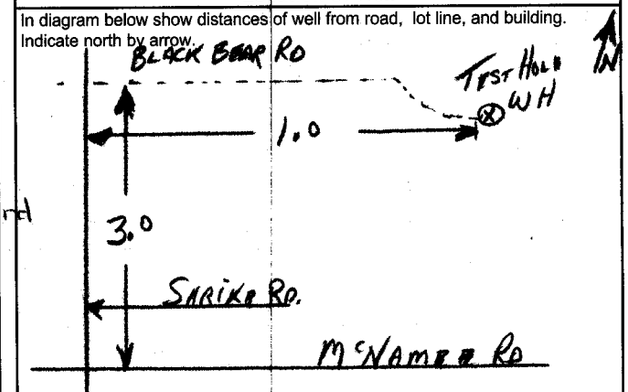
Business Address (street name, number, city etc.): 4852 Hwy #7, RR#1, Omemee, K0L2W0

Name of Well Technician (last name, first name): Richard, Allan | Well Technician's Licence No.: T-1868

Signature of Technician/Contractor: X | Date Submitted: 2006 YYYY MM 02 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 33080 | Date Well Completed: YYYY 2006 MM 07 DD 07

Was the well owner's information package delivered? ☐ Yes ☐ No | Date Delivered: YYYY MM DD

Ministry Use Only

Data Source | Contractor: 3367

Date Received: APR 28 2006 MM 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

All Measurements in feet

Ontario Ministry of the Environment

Monitoring Well WI

Well Tag Number (Plate below) A 039621

A039621

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

[redacted]

City of Kawartha Lakes | Carden | 9 | 9

RR#/Street Number/Name: McNamee Rd.

City/Town/Village: Kirkfield

Site/Compartment/Block/Tract etc.

GPS Reading: NAD 83 | Zone 17 | Easting 660277 | Northing 4944902

Unit Make/Model: Magellan

Mode of Operation: ☐ Undifferentiated ☐ Averaged ☐ Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From	Depth To
Brown	Topsoil		Soft	0	2
Brown	Shale	Sand	Soft	2	7
Grey	Limestone		Medium Hard	7	30
Brown	Limestone		Medium Hard	30	96
Dk. Green	Limestone		Fractured	96	105
Grey	Limestone		Medium Hard	105	129
Lt. Green	Limestone		Medium Hard	129	140

Hole Diameter

Depth From	Depth To	Diameter Centimetres
0	20'	10"
0	140'	8"

Water Record

Water found at ___ Metres	Kind of Water
25 m	☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:
51 ft	☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other: 1.23
96 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

Inside diam centimetres	Material	Wall thickness centimetres	Depth From	Depth To
Casing				
8"	☑ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	-188	0	20
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized		+4	Above Ground
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
Screen				
Outside diam		Slot No.		
2"	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	#10	1 @ 135'	- 140'
			2 @ 68'	- 73'
			3 @ 36'	- 41'
No Casing or Screen				
	☑ Open hole		20'	140'

Test of Well Yield

Pumping test method	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Pump intake set at - (metres)	Static Level	No		TEST
Pumping rate - (litres/min)	1		1	
		REQUIRED		
Duration of pumping ____hrs +____ min	2		2	
Final water level end of pumping ____metres	3		3	
Recommended pump type. ☐ Shallow ☐ Deep	4		4	
Recommended pump depth. ____metres	5		5	
Recommended pump rate. (litres/min)	10		10	
	15		15	
If flowing give rate - (litres/min)	20		20	
	25		25	
If pumping discontinued, give reasdn.	30		30	
	40		40	
	50		50	
	60		60	

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	20	Bentonite Slurry	36 GAL
3 sets of piezometers were installed from			
140- +4		Silica Sand + 3/8 Holeplug	19 Bag
73- +4		" " + " "	of Holeplug
41- +4		" " + " "	59 Bags of Sand

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: Herb Lang Well Drilling Ltd | Well Contractor's Licence No.: 3367

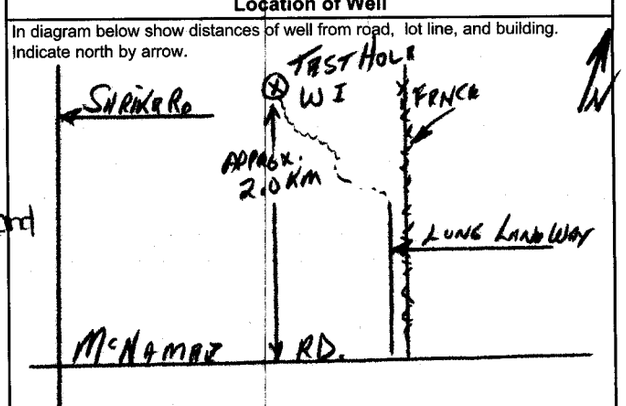
Business Address (street name, number, city etc.): 4852 Hwy #7, RR#1, Omemee, K0L2W0

Name of Well Technician (last name, first name): Richard, Allan | Well Technician's Licence No.: T-1868

Signature of Technician/Contractor: X [signature] | Date Submitted: 2006 02 20

Location of Well

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



Audit No. Z 33081 | Date Well Completed: 2006 02 14

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

Ministry Use Only

Data Source | Contractor 3367

Date Received APR 28 2006 | Date of Inspection

Remarks | Well Record Number

0506E (09/03) Contractor's Copy ☐ Ministry's Copy ☑ Well Owner's Copy ☐

Cette formule est disponible en français

Monitoring Well MW1

Ontario — Ministry of the Environment and Climate Change

Well Tag No. *(Place Sticker and/or Print Below)* Tag#: A 238594

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Measurements recorded in: ☐ Metric ☒ Imperial

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	Ferma Aggregates Inc.		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
2666 Rena Rd.	Mississauga	ON	L4T3C8	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
Horncastle Rd.	Carden	6-10	10

County/District/Municipality	City/Town/Village	Province	Postal Code
Victoria (C-K-L)	Victoria Rd	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	661270	4944313		

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
Grey	Limestone	Shale	Fractured - soft	0'	3'
Grey	Limestone		Fractured - med. hard	3'	45'
Brown	Limestone	water	Large Fractures - med. hard	45'	49'
Grey	Limestone		Fractured - Hard	49'	65'-6"

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0'	20'	Bentonite chips	500 lbs
		Bentonite slurry	24 gallon

Method of Construction

☐ Cable Tool ☐ Diamond ☐ Rotary (Conventional) ☐ Jetting ☐ Rotary (Reverse) ☐ Driving ☐ Boring ☐ Digging ☐ Air percussion ☒ Other, specify DR-12-W

Well Use

☐ Public ☐ Commercial ☐ Not used ☐ Domestic ☐ Municipal ☐ Dewatering ☐ Livestock ☐ Test Hole ☒ Monitoring ☐ Irrigation ☐ Cooling & Air Conditioning ☐ Industrial ☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6¼"	steel	.188	+2'	20'
6"	open hole		20'	65'-6"

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

☐ Water Supply ☐ Replacement Well ☐ Test Hole ☐ Recharge Well ☐ Dewatering Well ☒ Observation and/or Monitoring Hole ☐ Alteration (Construction) ☐ Abandoned, Insufficient Supply ☐ Abandoned, Poor Water Quality ☐ Abandoned, other, specify ☐ Other, specify

Water Details

Water found at Depth	Kind of Water	Hole Diameter Depth From	Depth To	Diameter (cm/in)
45' (m/ft) ☐ Gas	☒ Fresh ☒ Untested ☐ Other, specify	0'	20'	10"
49' (m/ft) ☐ Gas	☒ Fresh ☒ Untested ☐ Other, specify	20'	65'-6"	6"
(m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify			

Results of Well Yield Testing

After test of well yield, water was: ☐ Clear and sand free ☒ Other, specify cloudy

If pumping discontinued, give reason:

Pump intake set at (m/ft): 63'

Pumping rate (l/min / GPM): 60 GPM

Duration of pumping: ____ hrs + 15 min

Final water level end of pumping (m/ft): 64'

If flowing give rate (l/min / GPM): —

Recommended pump depth (m/ft): —

Recommended pump rate (l/min / GPM): —

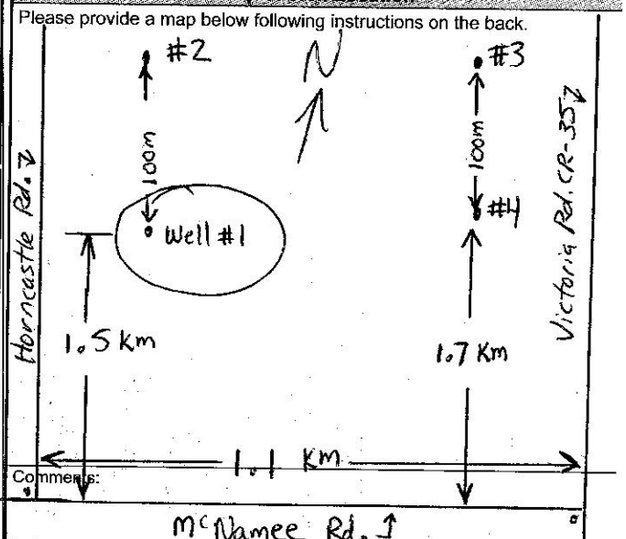
Well production (l/min / GPM): 60 GPM

Disinfected? ☒ Yes ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level		14'		
1			1	
2			2	
3			3	
4			4	
5			5	
10			10	
15		64'	15	
20			20	
25			25	
30			30	
40			40	
50			50	
60			60	

Map of Well Location

Please provide a map below following instructions on the back.



Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No
Herb Lang Well Drilling Ltd.	7160

Business Address (Street Number/Name)	Municipality	Province	Postal Code	Business E-mail Address
4852 Hwy 7	Omemee	ON	K0L2W0	

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)	Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
7052799708	Guthrie, Ken	2558	Gary Jost	2018/06/08

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☒ Yes ☐ No	2018/06/22	2018/05/18

Ministry Use Only

Audit No. Z274954

Received

0506E (2014/11)

Ministry's Copy

Monitoring Well MW2

Ontario — Ministry of the Environment and Climate Change

Well Tag No. *(Place Sticker and/or Print Below)* Tag#: A238595

Well Record

Regulation 903 Ontario Water Resources Act

Measurements recorded in: ☐ Metric ☒ Imperial

Page ____ of ____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	Ferma Aggregates		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
2666 Rena Rd.	Mississauga	ON	L4T3C8	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
Horncastle Rd.	Carden	6-10	10

County/District/Municipality	City/Town/Village	Province	Postal Code
Victoria (C-K-L)	Victoria Road	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	661218	4944389		

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
Grey	Limestone	Shale	Fractured - Soft	0'	3'
Grey	Limestone		Fractured - med. Hard	3'	51'
Grey/Brown	Limestone	water	Fractured - Hard	51'	75'

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0'	10'	Bentonite chips	200 lbs
		Bentonite slurry	24 gallon

Method of Construction

☐ Cable Tool ☐ Diamond ☐ Rotary (Conventional) ☒ Jetting ☐ Rotary (Reverse) ☐ Driving ☐ Boring ☐ Digging ☐ Air percussion ☒ Other, specify DR-12 w

Well Use

☐ Public ☐ Commercial ☐ Not used ☐ Domestic ☐ Municipal ☐ Dewatering ☐ Livestock ☐ Test Hole ☒ Monitoring ☐ Irrigation ☐ Cooling & Air Conditioning ☐ Industrial ☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	To
6+4"	Steel	.188	+3'	10'
6"	open hole		10'	75'

Status of Well

☐ Water Supply ☐ Replacement Well ☐ Test Hole ☐ Recharge Well ☐ Dewatering Well ☒ Observation and/or Monitoring Hole ☐ Alteration (Construction) ☐ Abandoned, Insufficient Supply ☐ Abandoned, Poor Water Quality ☐ Abandoned, other, specify ☐ Other, specify

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	To

Water Details

Water found at Depth (m/ft)	Gas	Kind of Water	Other, specify
51'	☐	☒ Fresh ☒ Untested	
	☐	☐ Fresh ☐ Untested	
	☐	☐ Fresh ☐ Untested	

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0'	10'	10"
10'	75'	6"

Results of Well Yield Testing

After test of well yield, water was: ☐ Clear and sand free ☒ Other, specify cloudy

If pumping discontinued, give reason:

Pump intake set at (m/ft): 73

Pumping rate (l/min / GPM): 5 GPM

Duration of pumping: hrs + 15 min

Final water level end of pumping (m/ft): 75'

If flowing give rate (l/min / GPM):

Recommended pump depth (m/ft):

Recommended pump rate (l/min / GPM):

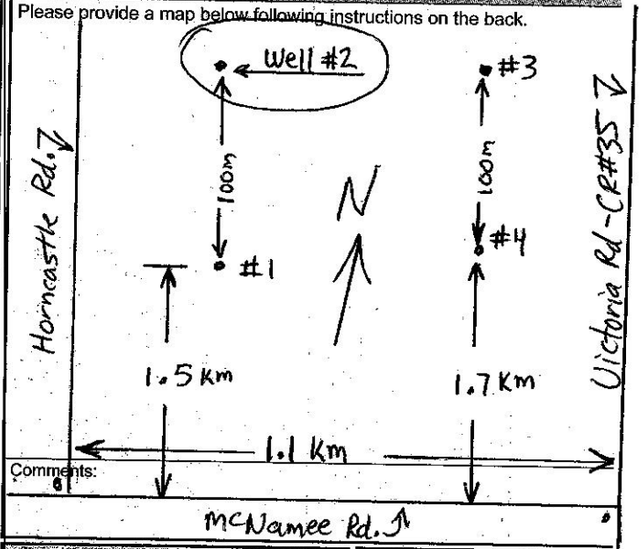
Well production (l/min / GPM): 5 GPM

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Water Level (m/ft)	Recovery Time (min)	Water Level (m/ft)
Static Level	24'		
1	75'	1	
2		2	
3		3	
4		4	
5		5	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Herb Lang Well Drilling Ltd.	7510

Business Address (Street Number/Name)	Municipality
4852 Hwy 7	Omemee

Province	Postal Code	Business E-mail Address
ON	K0L2W0	

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
7059971088	Guthrie, Ken

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
2558	Ken Guthrie	2018/06/08

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☒ Yes ☐ No	2018/06/22	2018/05/18

Ministry Use Only

Audit No. Z274955

Received

0506E (2014/11)

Ministry's Copy

Monitoring Well MW3

Ontario — Ministry of the Environment and Climate Change

Well Tag No. *(Place Sticker and/or Print Below)*: Tag#: A 238596

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Measurements recorded in: ☐ Metric ☒ Imperial

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	Ferma Aggregates		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
2666 Rena Rd.	Mississauga	ON	L4T3C8	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
Horncastle Rd.	Carden	6-10	10

County/District/Municipality	City/Town/Village	Province	Postal Code
Victoria (C-K-L)	Victoria Road	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	661674	4942560		

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
Grey	Limestone	Shale	Fractured - Soft	0'	2'
Grey	Limestone		Fractured - Med. Hard	2'	46'
Grey/Brown	Limestone	Water	Fracture	46	46'-2"
Grey	Limestone		Fractured - Hard	46'-2"	65'-6"

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m^3/ft^3)
0'	20'	Bentonite chips	450 lbs
		Bentonite slurry	24 gallon

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☐ Air percussion
☒ Other, specify DR-12W

Well Use

☐ Public ☐ Commercial ☐ Not used
☐ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6¼"	steel	.188	+2'	20'
6"	open-hole		20'	65'-6"

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

☐ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Water Details

Water found at Depth (m/ft)	Gas	Kind of Water: Fresh	Untested	Other, specify
46'	☐	☒	☒	
	☐	☐	☐	
	☐	☐	☐	

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0'	20'	10"
20'	65'-6"	6"

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☒ Other, specify cloudy

If pumping discontinued, give reason:

Pump intake set at (m/ft): 63'

Pumping rate (l/min / GPM): 30 GPM

Duration of pumping: ____ hrs + 15 min

Final water level end of pumping (m/ft): 65'-6"

If flowing give rate (l/min / GPM): —

Recommended pump depth (m/ft): —

Recommended pump rate (l/min / GPM): —

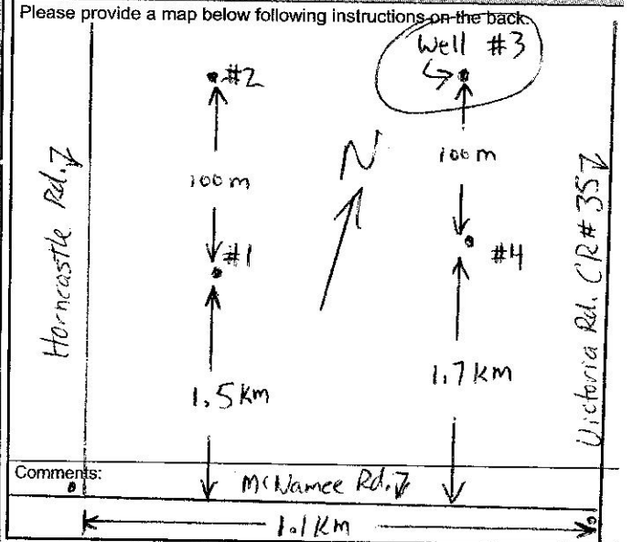
Well production (l/min / GPM): 30 GPM

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	16'-2"		
1	65'-6"	1	
2		2	
3		3	
4		4	
5		5	
10	air lift	10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Herb Lang Well Drilling Ltd.	7510

Business Address (Street Number/Name)	Municipality
4852 Hwy 7	Omemee

Province	Postal Code	Business E-mail Address
ON	K0L2W0	

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
7059797088	Guthrie, Ken

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
2558	Ken Guthrie	2018/06/08

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☒ Yes ☐ No	2018/06/22	2018/05/08

Ministry Use Only

Audit No. Z291095

Received

0506E (2014/11)

Ministry's Copy

Monitoring Well MW4

Ontario — Ministry of the Environment and Climate Change

Measurements recorded in: ☐ Metric ☒ Imperial

Well Tag No. *(Place Sticker and/or Print Below)* Tag#: A238597

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	Ferma Aggregates		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. *(inc. area code)*
2666 Rena Rd.	Mississauga	ON	L4Y 2W0	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
Horncastle Rd.	Carden	6-10	10

County/District/Municipality	City/Town/Village	Province	Postal Code
Victoria (C-K-L)	Victoria Road	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	661926	4944611		

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
Grey	Limestone	Shale	Fractured - Soft	0'	2'
Grey	Limestone		Fractured - Med. Hard	2'	45'
Brown	Limestone	Water	Fracture	45'	45'-2"
Grey	Limestone		Fractured - MED - Hard	45-2"	114'
Brown	Limestone	Water	Fracture	114'	114'-2"
Grey	Limestone		Fractured - med - hard	114'-2"	134'
Pink	Granite		Hard	134'	

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m^3/ft^3)
0'	10'	Bentonite chips	100 lbs
		Bentonite slurry	24 gallon

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☐ Air percussion
☒ Other, *specify* DR-12-W

Well Use

☐ Public ☐ Commercial ☐ Not used
☐ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☒ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, *specify*

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
10¼"	steel	.188	+1'-6"	1'-6"
8¼"	steel	.188	+3'-6"	10'
8"	open-hole		10'	134'

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

☐ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☒ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, *specify*
☐ Other, *specify*

Water Details

Water found at Depth (m/ft)	Gas	Kind of Water	Other, specify
45'	☐	☒ Fresh ☒ Untested	
114'	☐	☒ Fresh ☒ Untested	
	☐	☐ Fresh ☐ Untested	

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0'	10'	10-¾"
10'	134'	8"

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☒ Other, *specify* cloudy

If pumping discontinued, give reason:

Pump intake set at (m/ft): 133'

Pumping rate (l/min / GPM): 300 + 6PM

Duration of pumping: ____ hrs + 15 min

Final water level end of pumping (m/ft): 134'

If flowing give rate (l/min / GPM): —

Recommended pump depth (m/ft): —

Recommended pump rate (l/min / GPM): —

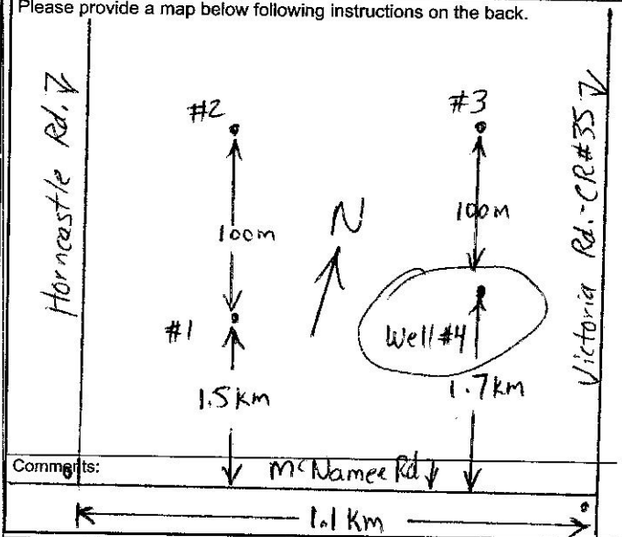
Well production (l/min / GPM): 300 + 6PM

Disinfected? ☒ Yes ☐ No

Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	16'-2"		
1	134'	1	
2		2	
3		3	
4		4	
5		5	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No
Herb Lang Well Drilling Ltd.	7560

Business Address (Street Number/Name)	Municipality
4852 Hwy 7	Omemee

Province	Postal Code	Business E-mail Address
ON	K0L 2W0	

Bus. Telephone No. *(inc. area code)*	Name of Well Technician (Last Name, First Name)
7059797088	Guthrie, Ken

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
2558	Gary Guthrie	2018 06 08

Well owner's information package delivered	Date Package Delivered	Ministry Use Only
☒ Yes ☐ No	2018 06 22	Audit No. Z291096
	Date Work Completed: 2018 05 18	Received

0506E (2014/11)

Ministry's Copy

Appendix F

Borehole and Photographic Logs of BH1-11 & BH2-11

Client: Ferma Aggregates Inc.

Borehole Number: BH1-11

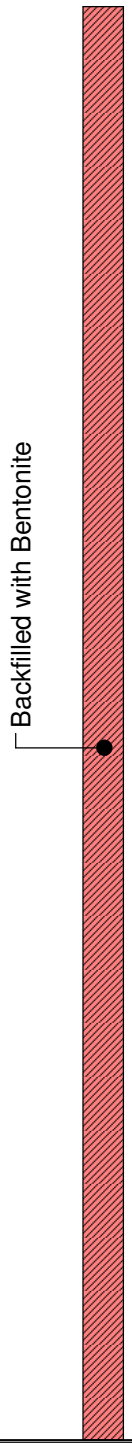
Project: Carden Quarry

Job Number: 36123-100

Location: Carden Quarry, Carden Township, ON

Drill Date: September 6, 2011

Depth (m)	Elevation (masl)	Geological Description	Run #	% Recovery	% RQD	No. of Sets	Types (s)	Orientation	Spacing	Roughness	Aperture	Filling	Staining	Fractures	Groundwater Observations and Well Details
	271.18														
	270.57	**OVERBURDEN** topsoil, clay, stones													
		BOBCAYGEON FORMATION weathered (moderately to highly) limestone, all bedding planes were < 5 cm, thinly bedded	1		0										
	269.73														
2.00		medium dark grey limestone, medium to fine grained, thinly bedded, friable minor shale, few stylolites	2	95	0										
	268.21														
4.00		medium dark grey limestone, vertical fracture with calcite crystals 4 m to 5.2 m, shaly partings at 3.7m, thinly bedded	3	96	0		J	90	W	RU	M				
	266.86														
		thinly bedded but core becoming more competent below 5.2 m. Bottom 0.6 m pieces 15 - 20 cm	4	96	29										
	265.34														
6.00		medium dark grey limestone, thinly bedded stylolite partings, competent pieces 25 cm long, weathered (slightly) shaly bedding partings, fine grained	5	100	69										
	263.81														
8.00		medium dark grey limestone, thinly laminated stylolite, competent, weathered (slightly) bedding, shaly partings 8.9 m. No sign of fossils	6	100	74										
			7	100	74										
10.00	260.76														
		medium grey limestone, fine grained crystalline, low shale %, shaly partings at 11.6 m, thinly bedded	8	100	73										



Reviewed By: PAG

Logged By: PAG

Method: Continuous Core Sampling (Contractor: Marathon Drilling)

Notes: Very little water lost. Drilling was hard. No soft spots encountered.

Sheet: 1 of 4

Client: Ferma Aggregates Inc.

Borehole Number: BH1-11

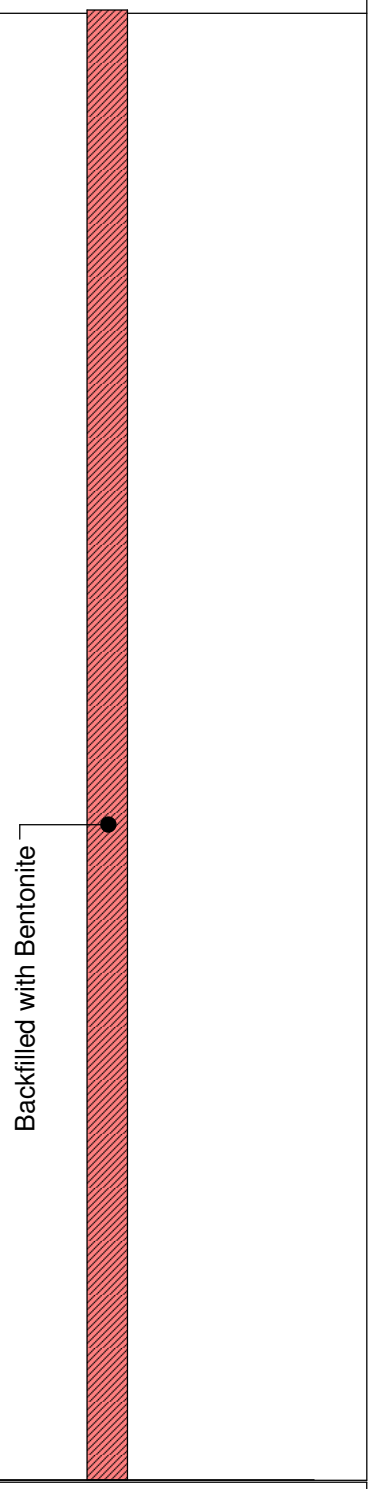
Project: Carden Quarry

Job Number: 36123-100

Location: Carden Quarry, Carden Township, ON

Drill Date: September 6, 2011

Depth (m)	Elevation (masl)	Geological Description	Run #	% Recovery	% RQD	No. of Sets	Types (s)	Orientation	Spacing	Roughness	Aperture	Filling	Staining	Fractures	Groundwater Observations and Well Details
	259.24														
		medium grey limestone, weathered wavy shale partings, brown layered bedding at 12.8 m, minor shaly layering at weathered partings	9	95	87										
13.00	257.72														
		tan layer at 13.7 m, weathered bedding 14.0 - 14.4 m	10	100	77										
15.00	256.19														
		medium grey limestone, medium to fine crystalline, stylolite wavy bedding 5 - 8 cm, weathered bedding at 15 m	11	95	79			F	M	RU	M	O			
	254.67														
17.00		brown-grey limestone, mottled in places, vertical fracture filled with calcite from 16.5 - 17.1 m, fossiliferous 17.4 - 18 m	12	95	85		J	V	M						
	253.14														
		GULL RIVER FORMATION (UPPER MEMBER) grey limestone, fine grained, competent core, thick beds, weathered partings, rough, very little shale, fossiliferous layers	13	100	95										
19.00	251.62														
		grey limestone, fine grained, thick beds, fossil layers, few partings, rough undulating bedding planes	14	100	99										
21.00	250.10														
		grey limestone, fine grained stylolites, medium bed, fossiliferous 22.25 - 22.6 m, shaly partings at 22.25m	15	100	79										
	248.57														
23.00		grey limestone, some brown, breaks, minor weathering, thick bedding	16	100	94										



Reviewed By: PAG

Logged By: PAG

Method: Continuous Core Sampling (Contractor: Marathon Drilling)

Notes: Very little water lost. Drilling was hard. No soft spots encountered.

Sheet: 2 of 4

Client: Ferma Aggregates Inc.

Borehole Number: BH1-11

Project: Carden Quarry

Job Number: 36123-100

Location: Carden Quarry, Carden Township, ON

Drill Date: September 6, 2011

Depth (m)	Elevation (masl)	Geological Description	Run #	% Recovery	% RQD	No. of Sets	Types (s)	Orientation	Spacing	Roughness	Aperture	Filling	Staining	Fractures	Groundwater Observations and Well Details
	247.05														
25.00		**GULL RIVER FORMATION (MIDDLE MEMBER)** medium to dark grey limestone, stylolites, fine to very fine crystalline	17	100	96										
	245.52	medium grey limestone, few stylolites, very competent	18	100	97										
27.00	244.00	break at 28.2 m, grey to brown	19	100	85										
	242.99	**GULL RIVER FORMATION (LOWER MEMBER)** grey limestone, fine grained crystaline, competent, greenish colour 28.3 - 29 m (upper green marker bed)	20	100	100										
29.00	241.46	grey limestone, fine grained crystaline, stylolite, break at 29.4 m	21	100	100										
	240.90	grey limestone, thick bedding	22	100	90					RU					
31.00	239.38	grey-tan limestone, weathered at 33.2 m, no shale evident	23	100	97										
	237.96	tan limestone, competent, brown stylolites at 33.5 m at rough break, thick bedding	24	100	90		B	F		RU					
33.00	236.59	change near 34.4 m, thick bedding, calcite filled dipping fracture 34.6 - 34.9 m, weather zone 36 m (zone takes up water)	25		87										
35.00															

Backfilled with Bentonite

Reviewed By: PAG

Logged By: PAG

Method: Continuous Core Sampling (Contractor: Marathon Drilling)

Notes: Very little water lost. Drilling was hard. No soft spots encountered.

Sheet: 3 of 4

Client: Ferma Aggregates Inc.

Borehole Number: BH1-11

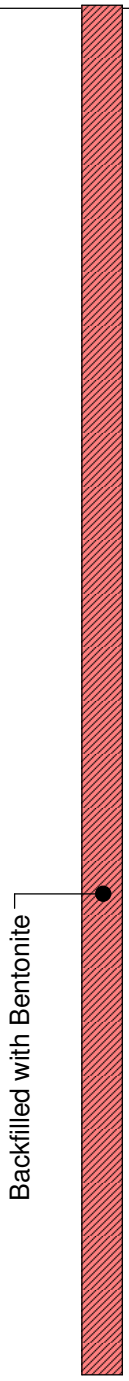
Project: Carden Quarry

Job Number: 36123-100

Location: Carden Quarry, Carden Township, ON

Drill Date: September 6, 2011

Depth (m)	Elevation (masl)	Geological Description	Run #	% Recovery	% RQD	No. of Sets	Types (s)	Orientation	Spacing	Roughness	Aperture	Filling	Staining	Fractures	Groundwater Observations and Well Details
	235.01		25												
		grey-tan limestone, competent, thick bedding	26	100	100										
37.00	233.49														
		grey-tan limestone, shaly lense at 38.7 m	27	100	97										
39.00	231.96														
		dark grey limestone, stylolite, crystaline, shaly mud layer at 40.3 m, fossiliferous	28	95	87										
	230.36														
41.00		green and purplish sandstone, laminated, coarse grained (lower green marker bed at 41.5 m)	29	100	95										
	228.84														
		SHADOW LAKE FORMATION laminated, dark grey-tan limestone, coarse grained	30	100	94										
43.00	227.29														
		red, mottled green shale	31		100										
45.00	225.76														
		red, mottled green shale	32	100	100										
	224.55														
47.00		Hole Terminated													



Reviewed By: PAG

Logged By: PAG

Method: Continuous Core Sampling (Contractor: Marathon Drilling)

Notes: Very little water lost. Drilling was hard. No soft spots encountered.

Sheet: 4 of 4

Client: Ferma Aggregates Inc.

Borehole Number: BH2-11

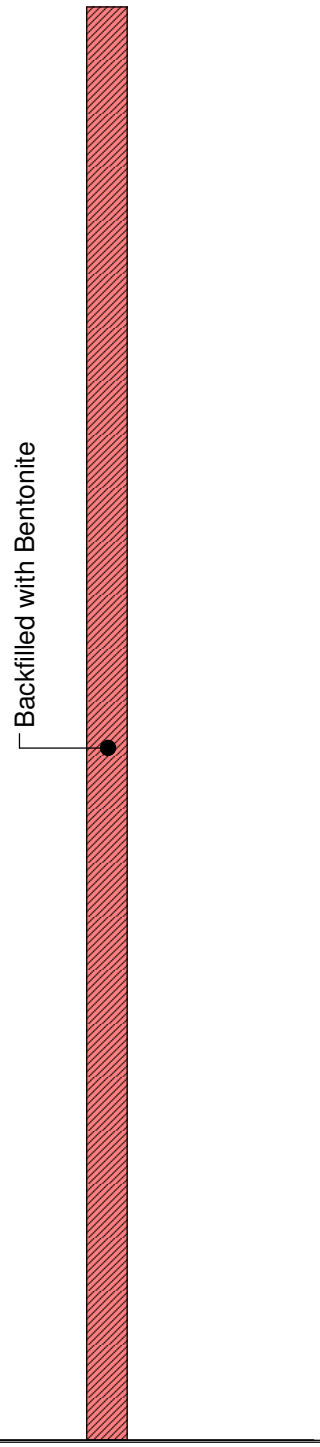
Project: Carden Quarry

Job Number: 36123-100

Location: Carden Quarry, Carden Township, ON

Drill Date: September 7, 2011

Depth (m)	Elevation (masl)	Geological Description	Run #	% Recovery	% RQD	No. of Sets	Types (s)	Orientation	Spacing	Roughness	Aperture	Filling	Staining	Fractures	Groundwater Observations and Well Details
	265.57														
		OVERBURDEN													
2.00	262.83														
		BOBCAYGEON FORMATION grey limestone, argillaceous, medium to coarse grained, weathered, thin beds	1	85	35										
4.00	261.30														
		grey limestone, argillaceous, shaley partings, medium beds	2	90	72										
	259.78														
6.00		grey limestone, argillaceous, shaley partings, weathered breaks - one piece 30 cm, thin beds	3	95	65										
	258.10														
8.00		medium to dark grey lithographic limestone, medium to coarse grained, argillaceous, thin beds	4	98	65										
	256.58														
		less argillite below 9.8 m, thin beds	5	100	53										
10.00	254.95														
		dark grey, less argillaceous, few stylolites, shaley partings pieces <25 cm, thin beds	6	98	69										



Reviewed By: PAG

Logged By: PAG

Method: Continuous Core Sampling (Contractor: Marathon Drilling)

Notes: Very little water lost. Drilling was hard. No soft spots encountered.

Sheet: 1 of 4

Client: Ferma Aggregates Inc.

Borehole Number: BH2-11

Project: Carden Quarry

Job Number: 36123-100

Location: Carden Quarry, Carden Township, ON

Drill Date: September 7, 2011

Depth (m)	Elevation (masl)	Geological Description	Run #	% Recovery	% RQD	No. of Sets	Types (s)	Orientation	Spacing	Roughness	Aperture	Filling	Staining	Fractures	Groundwater Observations and Well Details
	253.38														
		grey-some tam lithographic to sub-lithographic limestone, less argillaceous, medium to fine grained	7	100	65										
13.00	251.85														
		medium coarse grained limestone, shaley partings	8	95	55										
15.00	250.33														
	249.92	conglomerate type break at 15.65 m													
		GULL RIVER FORMATION (UPPER MEMBER) grey-tan limestone, stylolites, finer grained, longer core pieces, less or few shaley partings	9	100	73										
	248.65														
17.00		grey-tan limestone, fossils at 18 to 18.15 m (crinoids?), few partings, less argillaceous, thick beds	10	100	94										
	247.08														
		grey limestone, fine grained, competent, minor argillite, few stylolites, thick beds	11	100	92										
19.00	245.55														
		grey limestone, fine grained, very little shale, competent, few stylolites, thick beds	12	95	100										
21.00	244.03														
		grey limestone, fine grained, competent, little weathering, minor argillite, thick beds	13	100	100										
23.00	242.46														

Backfilled with Bentonite

Reviewed By: PAG

Logged By: PAG

Method: Continuous Core Sampling (Contractor: Marathon Drilling)

Notes: Very little water lost. Drilling was hard. No soft spots encountered.

Sheet: 2 of 4

Client: Ferma Aggregates Inc.

Borehole Number: BH2-11

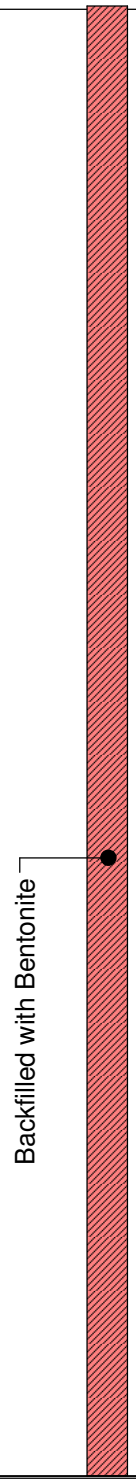
Project: Carden Quarry

Job Number: 36123-100

Location: Carden Quarry, Carden Township, ON

Drill Date: September 7, 2011

Depth (m)	Elevation (masl)	Geological Description	Run #	% Recovery	% RQD	No. of Sets	Types (s)	Orientation	Spacing	Roughness	Aperture	Filling	Staining	Fractures	Groundwater Observations and Well Details
		GULL RIVER FORMATION (MIDDLE MEMBER) tan to light grey limestone, fine to very fine grained, more argillaceous towards base, small vertical fracture at 24 m, mottled	14	95	100										
	240.88														
25.00		light grey to tan limestone, very fine grained, competent, faint stylolites, thick beds	15	100	100										
	239.33														
		tan-grey limestone, few stylolites, thick beds	16	100	100										
27.00	237.78														
		GULL RIVER FORMATION (LOWER MEMBER) tan-grey limestone, few stylolites, greenish from 28 to 28.3 m (upper green marker bed)	17	100	100										
29.00	236.31														
		grey limestone, tan 29.3 to 30.1 m, mottled, solid core to 30.8 m, thick beds	18	100	100										
	234.79														
31.00		light grey limestone, very fine grained, few stylolites, minor weathering, thick beds	19	100	100										
	233.26														
		light grey limestone, very fine grained, occassional stylolite, thick beds	20	100	100										
33.00	231.69														
		darker grey limestone, very fine grained, competent, more argillaceous, thick beds	21	100	100										
35.00	230.11														



Reviewed By: PAG

Logged By: PAG

Method: Continuous Core Sampling (Contractor: Marathon Drilling)

Notes: Very little water lost. Drilling was hard. No soft spots encountered.

Sheet: 3 of 4

Client: Ferma Aggregates Inc.

Borehole Number: BH2-11

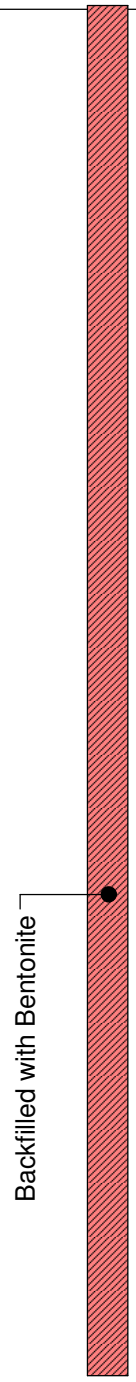
Project: Carden Quarry

Job Number: 36123-100

Location: Carden Quarry, Carden Township, ON

Drill Date: September 7, 2011

Depth (m)	Elevation (masl)	Geological Description	Run #	% Recovery	% RQD	No. of Sets	Types (s)	Orientation	Spacing	Roughness	Aperture	Filling	Staining	Fractures	Groundwater Observations and Well Details
		darker grey near top, mottled from 34.75 to 35.4 m, less argillaceous, below 34.75 m very fine grained, thick beds	22	100	100										
37.00	228.54														
		grey-brown limestone, very fine grained, competent, very minor to few stylolites, massive, more argillaceous	23	100	95										
	226.96														
39.00		more argillaceous													
	226.33	break at 39.25 m, drop in circulation at clay seam at 40 m	24	100	92		B	F	VC	SU	W	SC			
	225.39														
41.00		brown to purplish limestone into mottled green, coarse grained, fossiliferous at 40.8 m, lower green marker bed at 40.8 m	25	95	95										
	223.81	**SHADOW LAKE FORMATION** coarse grained, gritty, mottled, argillaceous	26	100	85										
43.00	222.24														
	221.47	grey limestone and shale, pinkish lenses to purple and green													
	220.76	green-purple limestone/shale, dense, medium fine grained, back to very fine grained near base	27	95	79										
45.00		purple green limestone/shale, dense, finer grained than previous	28	100	90										
	218.63														
47.00		Hole Terminated													



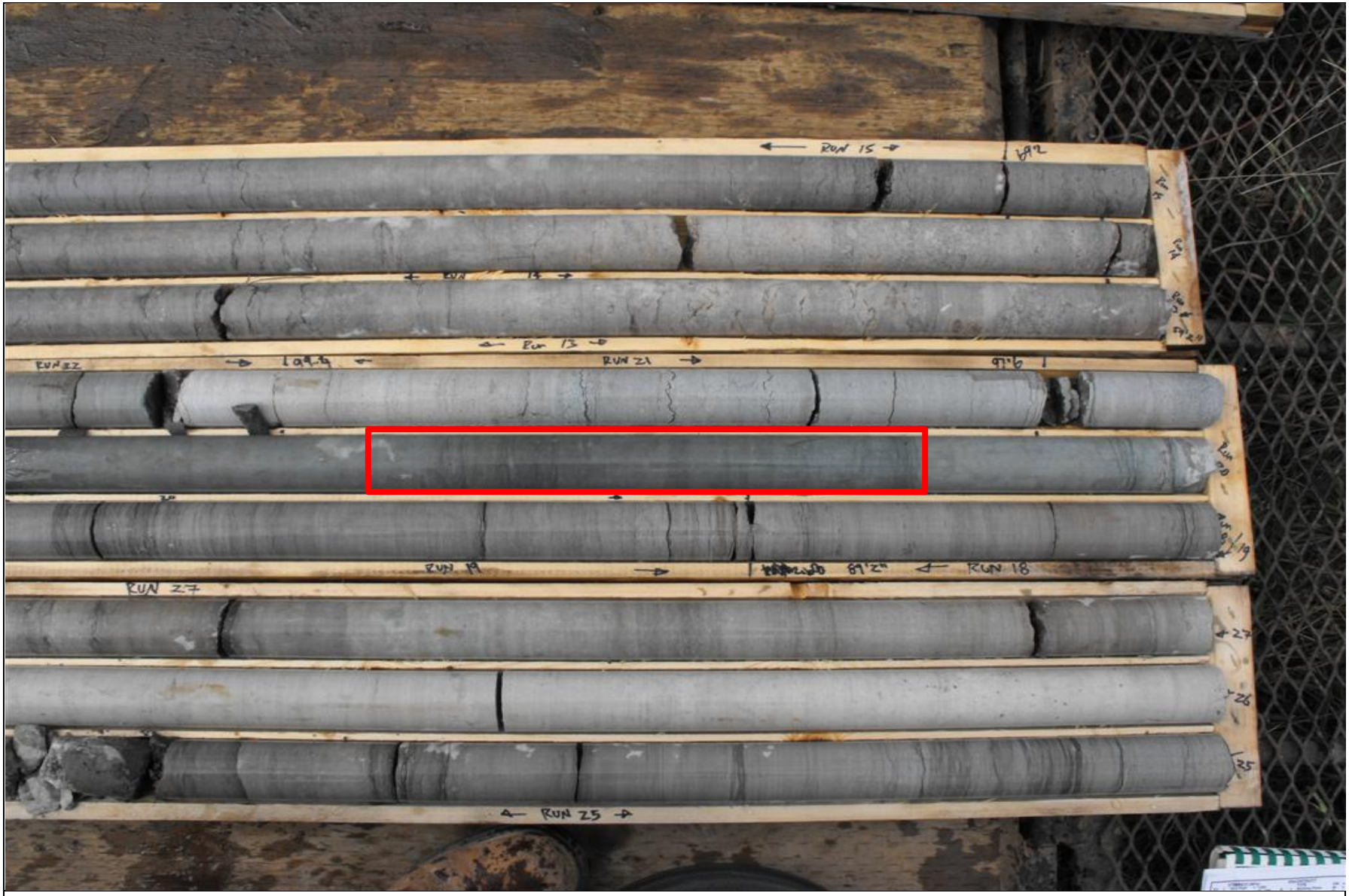
Reviewed By: PAG

Logged By: PAG

Method: Continuous Core Sampling (Contractor: Marathon Drilling)

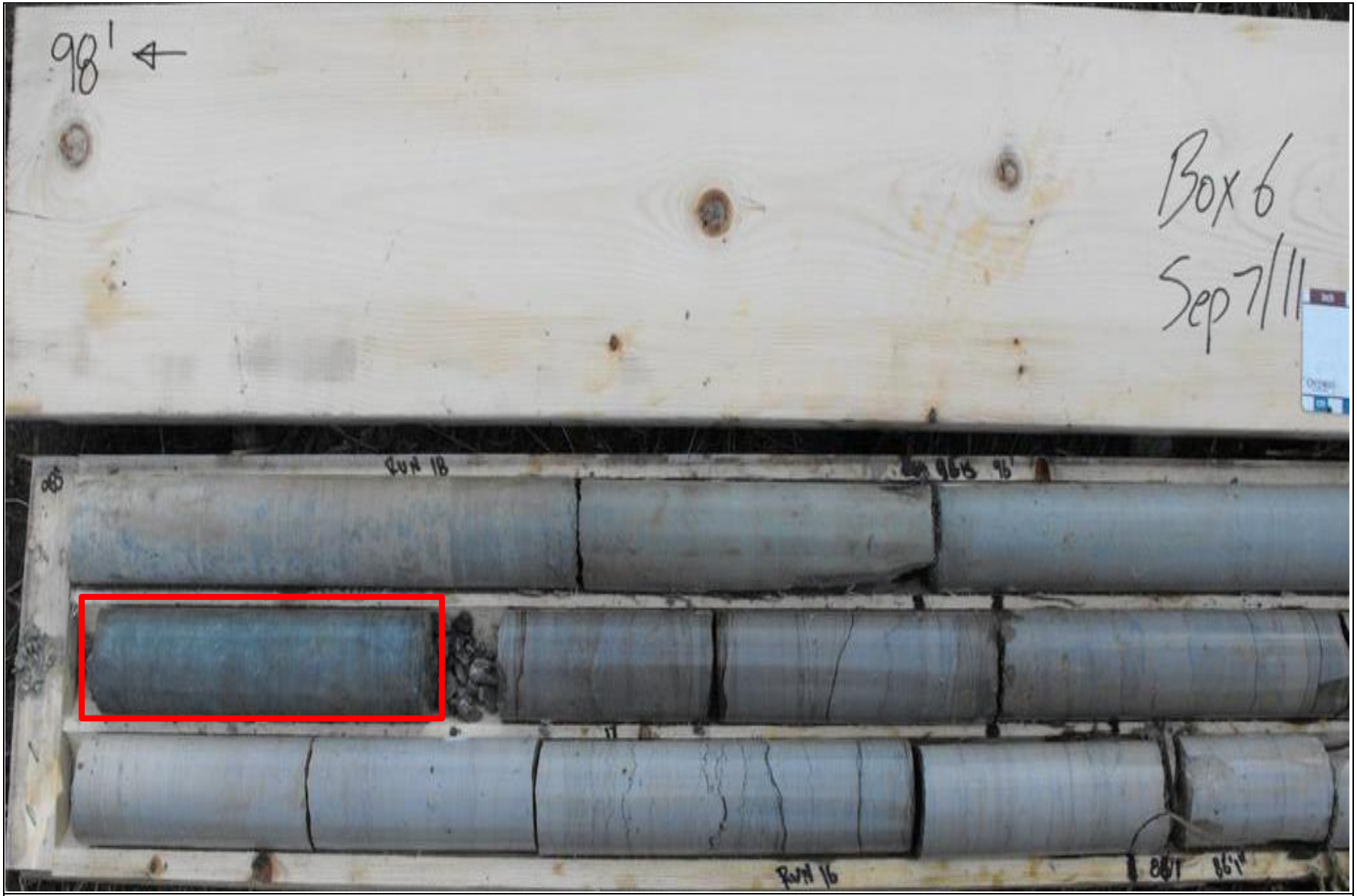
Notes: Very little water lost. Drilling was hard. No soft spots encountered.

Sheet: 4 of 4



Photograph 1.1: Approximate Location of Upper Green Marker Bed – BH1-11

Photograph 1.2: Approximate Location of Lower Green Marker Bed – BH1-11



Photograph 2.1: Approximate Location of Upper Green Marker Bed – BH2-11

Photograph 2.2: Approximate Location of Lower Green Marker Bed – BH2-11

Appendix G

EASR R-011-7169340455 and Pumping Test Design Report, March 10, 2022

Carden Quarry

Pumping Test Design Report

Project Location:

Lot 6-10, Concession 9, Geographic Township of Carden, Kawartha Lakes

Prepared for:

Ferma Aggregates Inc.
1 Steinway Boulevard, Unit 11
Etobicoke, ON M9W 6H9

Prepared by:

MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener, ON N2B 3X9

March 10, 2022

MTE File No.: 36123-200

Engineers, Scientists, Surveyors.

Contents

Figures

Tables

1.0 Introduction

Ferma Aggregates Inc. (Ferma) has retained MTE Consultants Inc. (MTE) to undertake hydraulic testing to comply with Condition 4.4 of Permit to Take Water (PTTW) 1238-BBLKNE (**Appendix A**). PTTW 1238- BBLKNE permits dewatering of the Carden Quarry located on Lot 6-10, Concession 9, former geographic township of Carden, City of Kawartha Lakes, ON. Additionally Ferma owns W ½ Lot 6 & 7 Concession 10 as well as Lot 8, Concession 10. **Figure 1** illustrates the Site location.

The objective of the hydraulic testing is to characterize the hydraulic properties of the underlying bedrock formations beneath the Site. In order to achieve this objective MTE is proposing to conduct short term pumping tests on discrete bedrock zones at an on-Site monitoring well (MW4). MW4 is located adjacent to Victoria road on Lot 8, Concession 10. The results of this testing will presented in the 2022 Annual PTTW Report.

This report provides support for an Environmental Activity and Sector Registry (EASR) application for a pumping test and discusses in detail the following:

- Proposed short term pumping test;
- Groundwater discharge plan;
- Water resources monitoring plan;
- Potential impacts to groundwater and/or surface water resources during the short term pumping test; and
- Proposed contingency measures.

2.0 Site Setting

2.1 Physiography and Topography

The Site is located within the physiographic region known as the Carden Plain (Chapman and Putnam, 1984). This region generally consists of shallow to outcropping limestone bedrock with a thin layer of overburden. As a result, on-Site elevations are generally flat, laying around 270 metres above sea level (**Figure 2**).

2.2 Surface Water and Drainage

The Site and study area are entirely within the Upper Talbot River subwatershed, which is part of the Lake Simcoe Watershed.

Watercourse mapping indicates that a tributary of the Talbot River flows through the Site (**Figure 2**). On-Site reconnaissance has indicated that only the southern reach of the Talbot River flows year round.

On-Site surface water drainage follows flows into the Talbot River tributary and eventually off-Site at the south-western portion of the Site.

2.3 Local Geology

2.3.1 Quaternary Geology

The Quaternary Geology mapping of the Site indicates much of the Site is outcropping Paleozoic bedrock. There is a small pocket of till located in the southeast corner of the Site, a pocket of organic deposits associated with a wetland in the central portion of the Site, and a

coarse-textured glaciolacustrine deposit running from the center to the west of the Site that is associated with the on-Site creek (**Figure 3**) (Finamore & Bajc, 1982).

2.3.2 Bedrock Geology

The underlying bedrock is composed of Ordovician age carbonates and shales of the Simcoe Group overlying the Precambrian basement. The Ordovician age carbonates can be subdivided into three formations (from oldest to youngest): Shadow Lake Formation, Gull River Formation, Bobcaygeon Formation. In general, these formations dip to the southwest.

Shadow Lake Formation

The Shadow Lake formation consists of a non-fossiliferous, arkosic siltstone, argillaceous sandstone conglomerate (Armstong, 2000).

Gull River Formation

The Gull River formation consists of fossiliferous, micritic limestone and dolostones (Armstong, 2000). The Gull River Formation contains features locally referred to as the green marker beds. These beds are approximately 1-3 m in thickness and are laterally extensive across the Carden Plain. These features have been reported to represent a regional aquifer (Golder Associates, 2016).

Bobcaygeon Formation

The Bobcaygeon formation overlies the Gull river formation and consists of fossiliferous course grained limestone and can be subdivided into the upper, middle and lower unit (Armstong, 2000).

2.4 Local Groundwater Use

Local area residents within the vicinity of the Site obtain water from private drilled supply wells. Based on a review of the MECP well records and Site reconnaissance, private wells are generally screened within the shallow bedrock of the Bobcaygeon formation. Additionally, the MECP database indicates that, apart from wells owned by the Client, there are no private wells within 500 m of the pumping well (MW4) (**Figure 4**). However, MTE notes there are eight private wells within 1500 m of the pumping well (MW4) (**Figure 4**). Details of private wells constructed within 1500 m of the pumping well (MW4) have been compiled from well records on file with the MECP, and are available in **Table 1**.

3.0 Pumping Test Program

Two separate intervals will be isolated in MW4 using a packer system for hydraulic testing. The intervals will be individually pumped at a maximum rate of 11.4 L/s (150 IGPM). For testing purposes MTE has separated the bedrock into three distinct zones. The “lower zone”, defined as being below the green marker beds with the Gull River Formation, a “middle zone” which is defined as the area between and including the green marker beds and a “upper zone” above the two green marker beds primarily consisting of the Bobcaygeon formation.

Step one: Install a packer such that the lower zone is hydraulically isolated, and pump at various rates to determine optimal pumping rate for testing in step 2;

Step two: Pump the lower zone at a continuous rate (not exceeding 11.4 L/s) for approximately eight hours, and measure drawdown in the lower zone.

Step three: Install a straddle packer such that the middle zone is hydraulically isolated and pump at various rates to determine optimal pumping rate for testing in step four, and;

Step four: Pump the middle zone at a continuous rate (not exceeding 11.4 L/s) for approximately eight hours, and measure drawdown in the middle zone and the upper zone.

The proposed combined maximum taking has been summarized below.

Source Name	Maximum Pumping Rate (L/min)	Maximum Number of Hours of Taking per Day	Maximum Pumping Volume (m^3/day)	Typical Pumping Volume (m^3/day)	Maximum Number of Days of Taking
MW4	682	24*	982	982	4

*Individual pumping tests for step 2 and step 4 are anticipated to last between 8-12 hours.

3.1 Monitoring Plan

Monitoring of groundwater levels will occur across the Site at select monitoring wells. These monitoring locations have been selected based on their proximity to the pumping well (MW4) and their screened interval. Monitoring of these locations will allow responses to pumping to be monitored within the various bedrock aquifers. Additionally, one private well (W4) located approximately 1100 m southeast of the pumping well (MW4) will be monitored on a daily basis and will have a data logger programmed to take readings every 60 minutes for the duration of the pumping test.

The table below outlines the locations to be monitored, the bedrock formation that the screen is installed in, and the data logger recording interval.

Monitoring Location	Approximate Distance from MW4 (m)	Screened Aquifer	Data Logger Recording Interval (min)
MW3	100	Bobcaygeon	5
MW1	710	Bobcaygeon	5
MW2b	740	Bobcaygeon	5
WAc	1,100	Gull River	5
WBc	1,100	Gull River	5
W22a	2,060	Upper Green Marker Bed (Gull River)	1
W22b	2,060	Lower Green Marker Bed (Gull River)	1
W4	1,100	Bobcaygeon	60

3.1.1 Data Loggers

During the pumping tests, select monitoring locations will be equipped with dedicated pressure transducers (data loggers) to record water levels at regular intervals.

From the commencement of pumping, data loggers within the selected monitoring locations will be programmed to collect a water level every 5 minutes, with the exception of W22a and W22b. The two nested wells at W22 are the only wells on-Site screened across the green marker beds. As such, data logger readings will be taken on one minute intervals at these two wells.

Following the conclusion of the pumping test, data loggers will be programmed to collect a water level every hour for a minimum of seven days to record recovery data.

3.1.2 Manual Measurements

Manual measurements at MW4 and select on-Site monitoring wells will be collected on a daily basis.

3.2 Groundwater Discharge Plan

Water pumped from MW4 will flow through a discharge pipe with an in-line flow meter (totalizer) and will be discharged though an orifice weir approximately 250 m to the southeast of MW4. Discharge water will be allowed to follow the existing roadside ditch down Victoria Road towards McNamee Road (**Figure 5**). South of McNamee road, an unnamed stream flows southwest through a topographic low, and ultimately empties into Canal Lake. Hay bales will be placed in the roadside ditch along Victoria Road to reduce flow/erosion and increase infiltration. As such, water from the pumping test will be discharged in such a manner as to not cause adverse impacts to the environment and at a distance which will not interfere with the results of the pumping test.

Discharge water will be sampled during Step 2 and Step 4 and will be analyzed for parameters including general chemistry and hydrocarbons.

4.0 Potential Impacts and Proposed Contingency Measures

4.1 Potential Impacts

4.1.1 Private Supply Wells

A contingency plan has been prepared to ensure that a reliable and continuous water supply is maintained should any potential interference cause an adverse effect at a local private supply well during the short-term pumping test. Details of the contingency plan have been provided in **Section 4.2**.

4.1.2 Natural Features

Based on the limited duration and discrete nature of the hydraulic testing, MTE does not anticipate any impacts to surrounding natural features. As discussed in **Section 3.2**, water from the pumping test will be discharged into an existing roadside ditch, and hay bales will be used to assist in dissipating the energy and mitigating potential increases to erosion and downstream total suspended solids.

4.2 Proposed Contingency Measures

4.2.1 Private Well Interference

Prior to the first day of the short term pumping test (approximately 48 hours), MTE will distribute a notice to private well owners within 1,500 m of MW4 (**Figure 4**). The notice will include the anticipated date, start time, and duration of the pumping test.

In addition, the notice will include a 24-hour contact number should a resident have any problems or concerns during the pumping test.

Should MTE be notified of a resident experiencing any adverse effects to their domestic well a licensed well contractor/pump installer, along with a qualified MTE representative, will be dispatched to the location of the complaint to provide corrective action. If required, the licensed well contractor will be able to disconnect the owner from their well and supply water via a temporary water storage tank for the duration of the short-term pumping test.

5.0 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 the client. It was completed in accordance with the Scope of Work referred to in Section 1.0. 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.

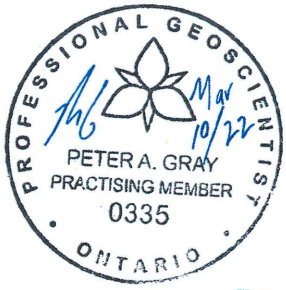
Any use which a third party makes of this report, or any reliance on, or decisions to be made based upon it, are the responsibility of such third parties. MTE accepts no responsibility for liabilities incurred by or damages, if any, suffered by any third party as a result of decisions made or actions 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.



2022-03-11

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M:\36123\200\Correspondence\2022\Pumping Test Design Report\36123-200_2022-03-10_rpt_EASR-Pumping Test Design Report.docx

6.0 References

Armstong, D. (2000). *Paleozoic geology of the northern Lake Simcoe area, south-central Ontario.* Sudbury: Ontario Geological Survey.

Finamore, P., & Bajc, A. (1982). *Quaternary geology of the Fenelon Falls area, southern Ontario.* Sudbury: Ministry of Energy, Northern Development and Mines.

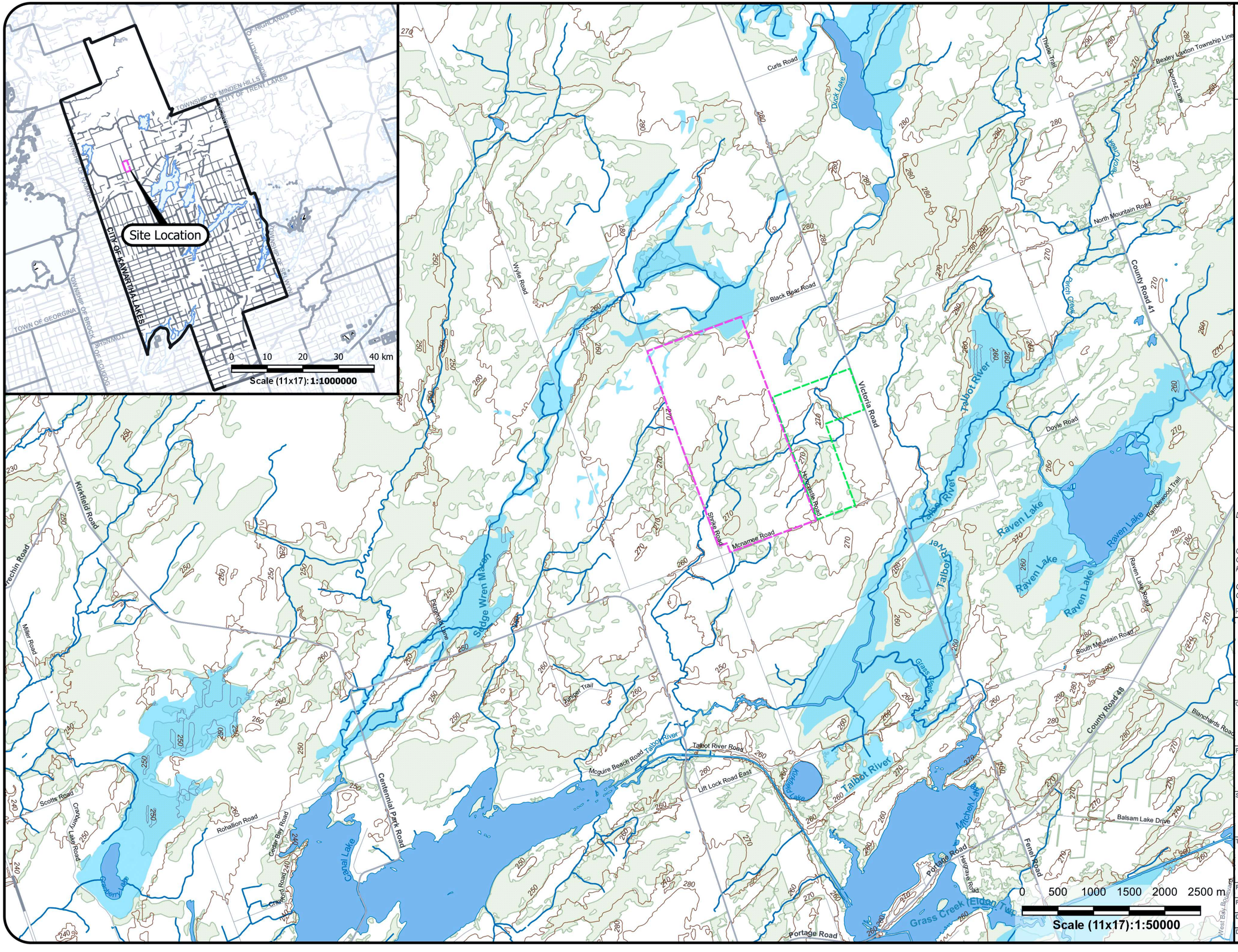
Golder Associates. (2016). *Addendum - Cumulative Impacts Assessment for Groundwater Takings in the Carden Plain Area.* Ottawa.

Figures

Project No: 36123-200 P:\P\36123\200\gis\36123_200_ar1.qgz

AR1.1

March 10, 2022 - 09:59 - Plotted By: FCummings



N
NORTH

N
PROJECT NORTH

Legend

Site Data
- Site Boundary
- Ferma Owned Lands

Base Map

Boundaries
- Municipal Boundary (Lower Tier)

Transportation
- Road

Surface Water
- Waterbody
- Watercourse
- Provincally Significant Wetland

Groundsurface
- Groundsurface Contour (10m Interval)

Landuse
- Wooded Area

Data Sources:

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Project CRS: NAD83 / UTM zone 17N

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

Client: Ferma Aggregates Inc.

Project: Carden Quarry

Site: Lot 6-10, Concession 9, Carden Township, City of Kawartha Lakes, ON

Title: **Key Map**

Reviewed By	TFC		
Prepared By	JAK	Project No	36123-200
Drawn By	JAK	Figure No	1
Date	March 2022		

Project No: 36123-200 P:\P\36123200\gis\36123_200_ar1.qgz

AR1.2

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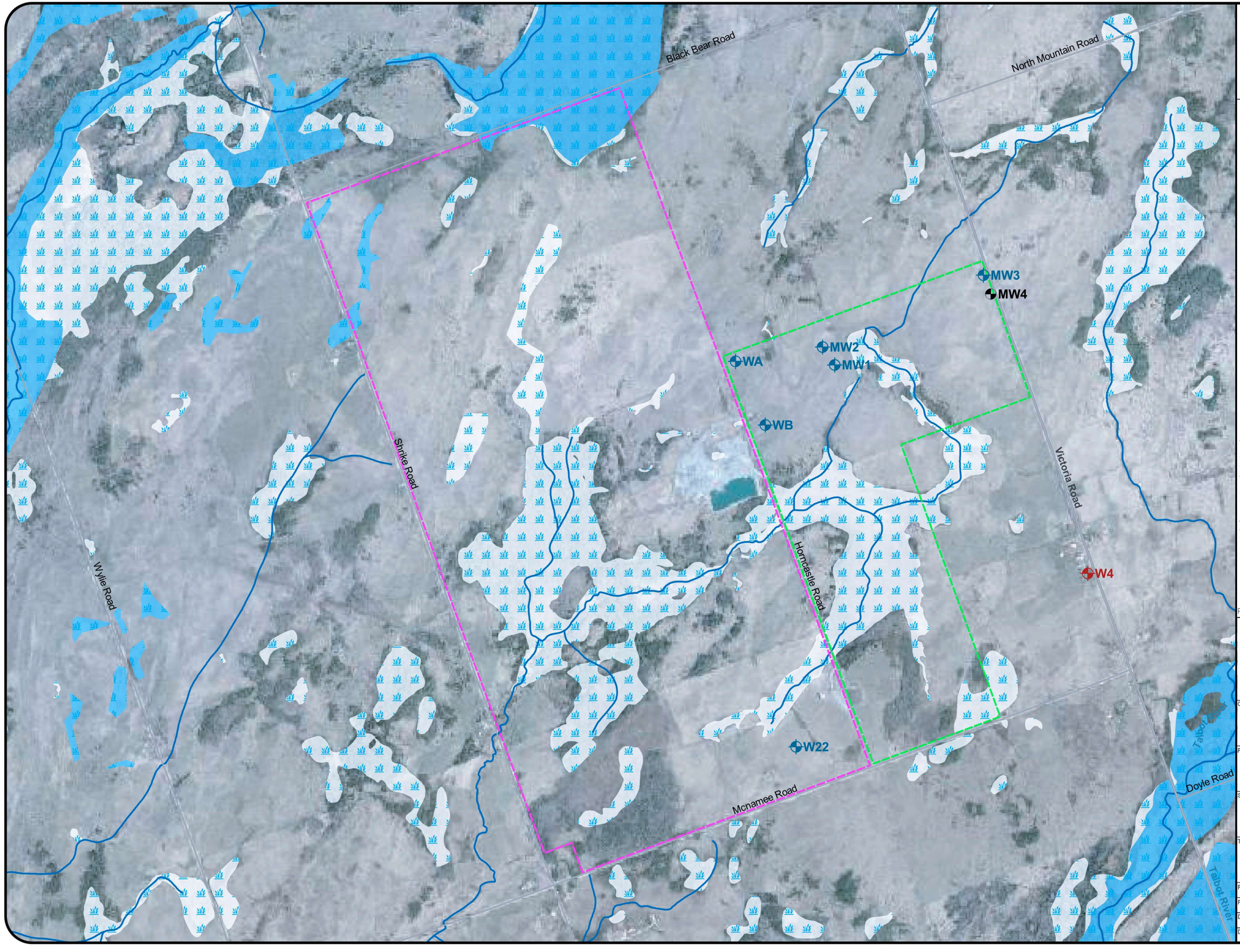

N
NORTH

N
PROJECT NORTH

Legend

Boundaries
- Licensed Boundary
- Ferma Owned Lands

Monitoring Locations
- Pumping Well
- Monitoring Well
- Private Well

Surface Water
- Watercourse (OHN)

Wetlands
- Provincally Significant Wetland
- Unevaluated Wetland

Data Sources:

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0 100 200 300 400 500 m

Scale (11x17): 1:15000

Project CRS: NAD83 / UTM zone 17N

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

Client: Ferma Aggregates Inc.

Project: Carden Quarry

Site: Lot 6-10, Concession 9, Carden Township, City of Kawartha Lakes, ON

Title: **Monitoring Locations**

Reviewed By	TFC		
Prepared By	JAK	Project No	36123-200
Drawn By	JAK	Figure No	2
Date	March 2022		

Project No: 36123-200 P:\P\36123\200\gis\36123_200_ar1.qgz

AR2.2

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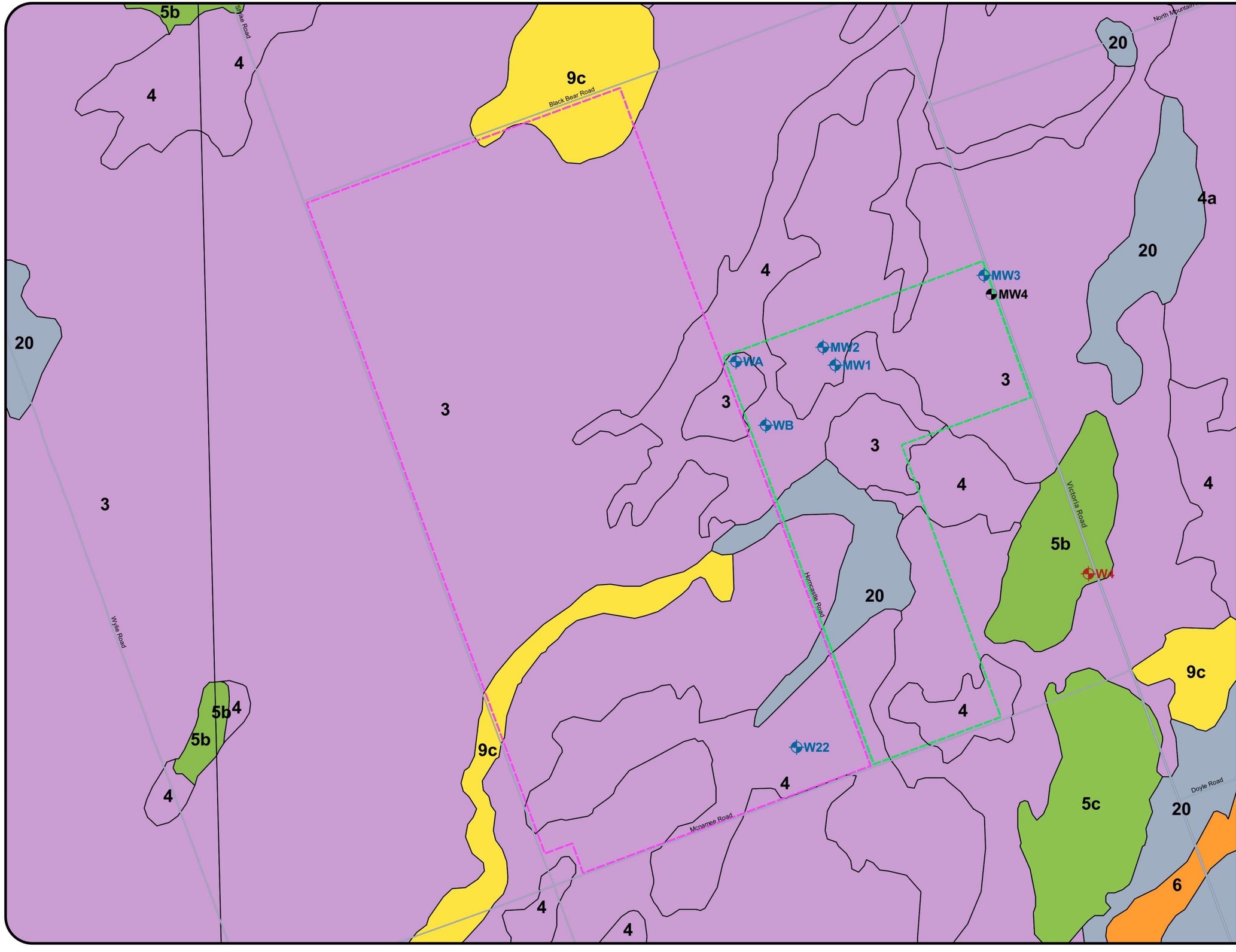

N

NORTH

N

PROJECT NORTH

Legend

Boundaries

- Licensed Boundary
- Ferma Owned Lands

Monitoring Locations

- Pumping Well
- Monitoring Well
- Private Well

Surface Water

- Watercourse (OHN)

Quaternary Geology

- 20. Organic Deposits: peat, muck, marl
- 9c. Coarse-textured glaciolacustrine deposits: sand, gravel, minor silt and clay foreshore and basinal deposits
- 6. Ice-contact stratified deposit: sand and gravel, minor silt, clay and till
- 5b. Till. Stone-poor, sandy silt to silty sand-textured till on Paleozoic terrain
- 5c. Till. Stony, sandy silt to silty sand-textured till on Paleozoic terrain
- 4. Bedrock-drift complex in Paleozoic terrain
- 3. Paleozoic bedrock

Data Sources:

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

0 100 200 300 400 500 m

Scale (11x17):1:15000

Project CRS: NAD83 / UTM zone 17N

MTE

Engineers,Scientists, Surveyors

Ph. (519) 743-6500

Client: Ferma Aggregates Inc.

Project: Carden Quarry

Site: Lot 6-10, Concession 9, Carden Township, City of Kawartha Lakes, ON

Title: **Quaternary Geology**

Reviewed By	TFC		
Prepared By	JAK	Project No	36123-200
Drawn By	JAK	Figure No	3
Date	March 2022		

Project No: 36123-200 P:\P\36123\200\gis\36123_200_ar1.qgz

AR2.3

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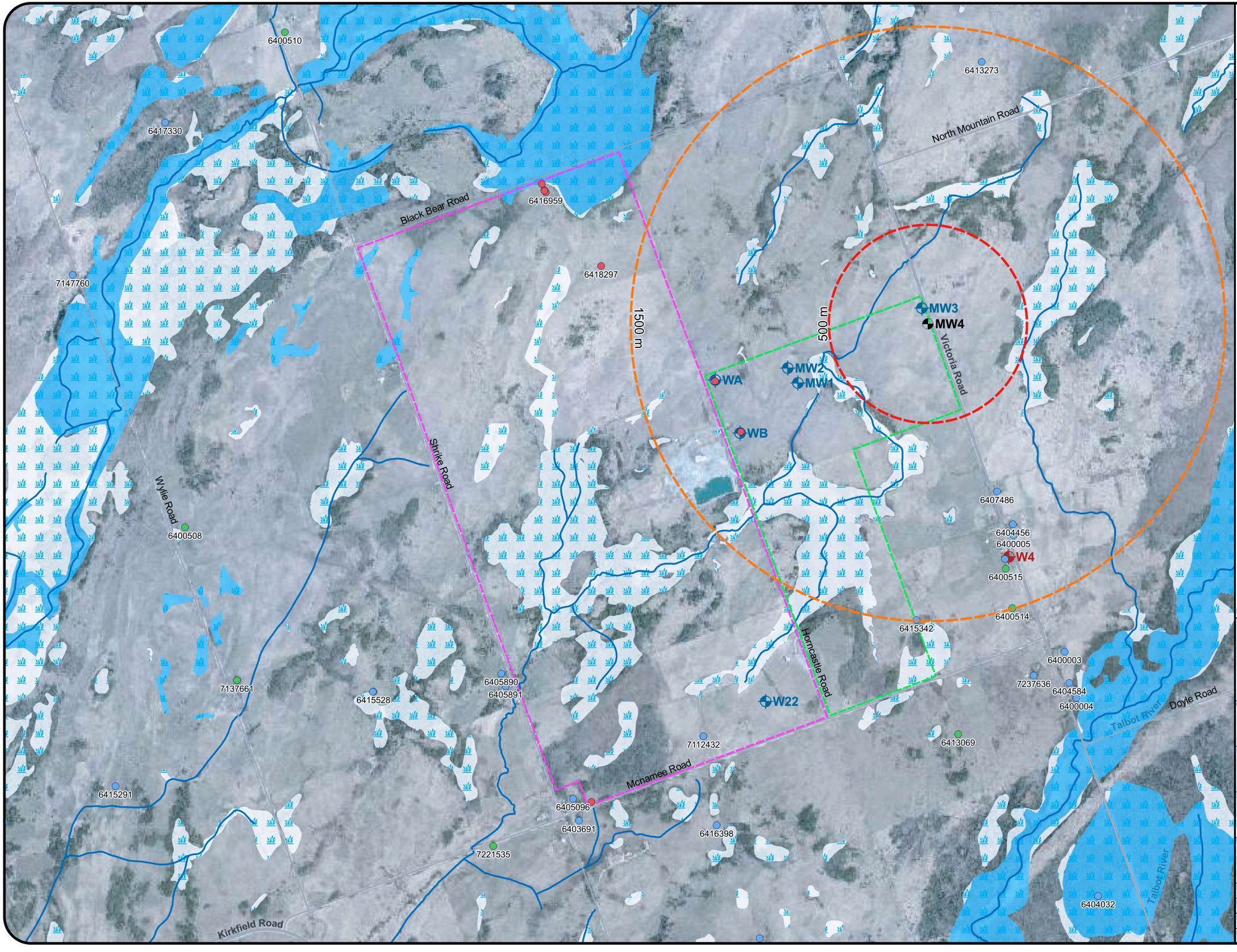

N NORTH

N PROJECT NORTH

Legend

Boundaries
- Licensed Boundary
- Ferma Owned Lands
- 500 m Buffer - MW4
- 1500 m Buffer - MW4

Monitoring Locations
- Pumping Well
- Monitoring Well
- Private Well

MECP Well Records
- Commerical
- Domestic
- Livestock

Natural Features
- Watercourse (OHN)
- Provincally Significant Wetland
- Non-Provincially Significant Wetland (Evaluated)
- Unevaluated Wetland

Data Sources:

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Aerial Imagery obtained from the Ministry of Natural

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Scale (11x17): 1:18000

Project CRS: NAD83 / UTM zone 17N

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

Client: Ferma Aggregates Inc.

Project: Carden Quarry

Site: Lot 6-10, Concession 9, Carden Township, City of Kawartha Lakes, ON

Title: **Map of Nearby Residents**

Reviewed By	TFC		
Prepared By	JAK	Project No	36123-200
Drawn By	JAK	Figure No	4
Date	March 2022		

Project No: 36123-200 P:\P\36123\200\gis\36123_200_ar1.qgz

AR2.4

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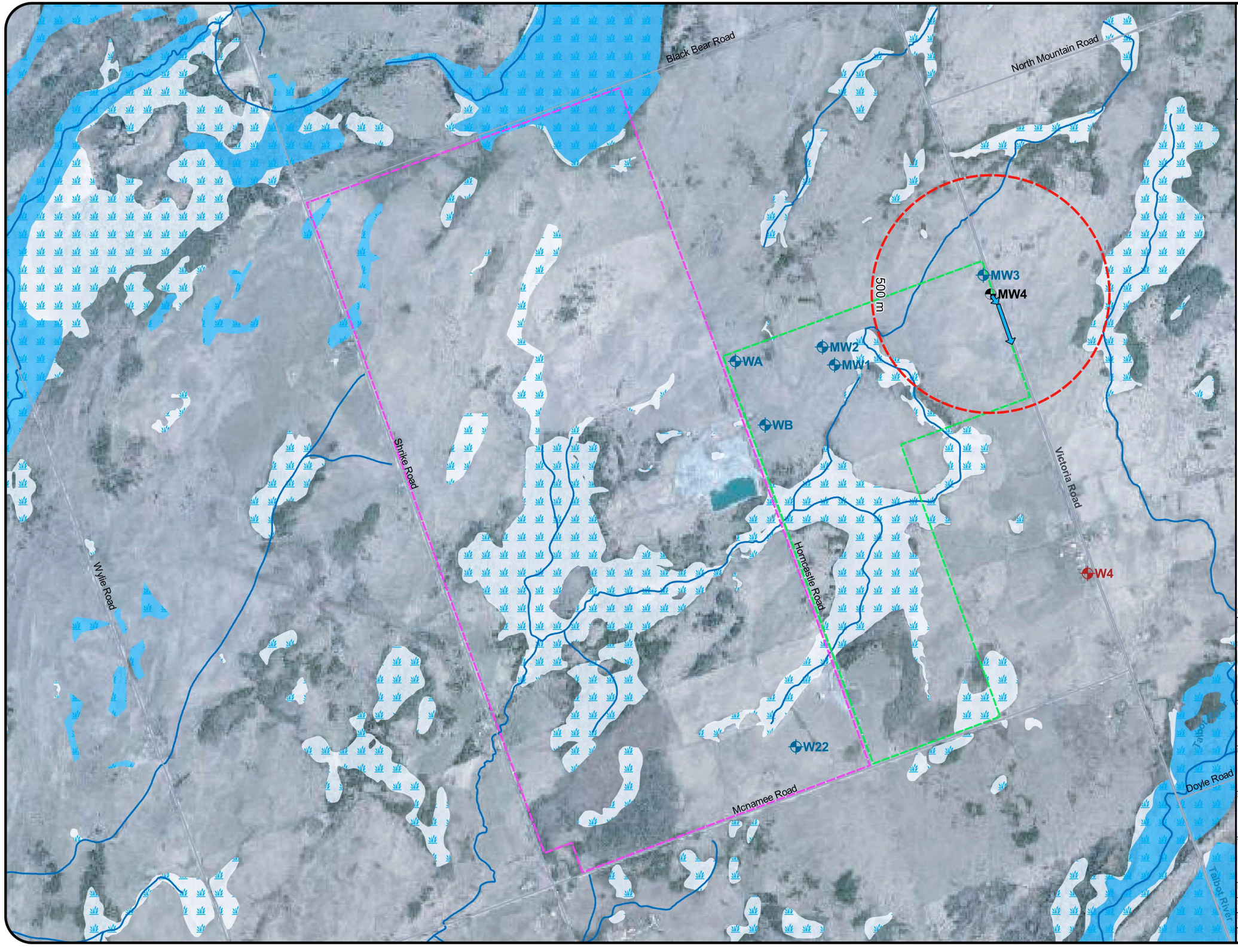

N
NORTH

N
PROJECT NORTH

Legend

Boundaries
- Licensed Boundary
- Ferma Owned Lands
- 500 m Buffer - MW4

Monitoring Locations
- Pumping Well
- Monitoring Well
- Private Well

Natural Features
- Watercourse (OHN)
- Provincally Significant Wetland
- Non-Provincially Significant Wetland (Evaluated)
- Unevaluated Wetland
- Approximate Location of Discharge Pipe

Data Sources:

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0 100 200 300 400 500 m

Scale (11x17): 1:15000

Project CRS: NAD83 / UTM zone 17N

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

Client: Ferma Aggregates Inc.

Project: Carden Quarry

Site: Lot 6-10, Concession 9, Carden Township, City of Kawartha Lakes, ON

Title: **Discharge Location**

Reviewed By	TFC		
Prepared By	JAK	Project No	36123-200
Drawn By	JAK	Figure No	5
Date	March 2022		

Tables

Table 1: Private Wells within 1.5 km of MW4 (Pumping Well)

WWR No. / Tag number	Type	Drilled	Easting	Northing	Depth	Elevation (mAMSL)	Well casing depth (mbgs)	Well casing bottom elevation (mAMSL)	Initial Static Water Level (m)	Water Found (m)	Recommended Pump Setting (m)	Initial Available Drawdown (m)	Initial Specific Capacity (gpm/ft)	Recommended Pumping Rate (gpm)	Estimated drawdown from domestic use (m)	Water Supply Aquifer
6400005	Domestic	Y	662358	4943542	13.72	270.88	NA	NA	4.57	9.45, 13.72	13.11	8.53	NA	1	NA	Bobcageon
6400514	Livestock	Y	662352	4943176	13.72	270.68	Illegible	NA	3.05	6.10	NA	NA	NA	NA	NA	Bobcageon
6400515	Livestock	Y	662319	4943375	18.29	271.60	3.66	267.94	4.57	17.68	NA	NA	NA	NA	NA	Bobcageon
6404295	Domestic	Y	662315	4943424	13.11	271.17	4.57	266.60	5.49	6.40,9.14	12.80	7.32	0.1	2	1.75	Bobcageon
6404456	Domestic	Y	662355	4943599	14.63	271.35	5.18	266.17	8.53	14.33	14.33	5.79	NA	0.5	NA	Bobcageon
6407486	Domestic	Y	662275	4943764	34.14	274.81	19.81	255.00	7.32	33.53	9.75	2.44	NA	10	NA	Gull River
6413273	Domestic	Y	662198	4945932	22.25	285.40	6.71	278.70	3.66	21.34-22.25	23.77	20.12	NA	15	NA	Bobcageon
6415342	Domestic	Y	661868	4943116	24.99	268.46	6.10	262.37	6.10	23.77-24.99	23.77	17.68	NA	7	NA	Gull River

Notes: mAMSL = metres above mean sea level, mbgs = metres below ground surface, gpm = gallons per minute

Appendix H

Multi-Level Installation Borehole Logs – MW4 and W22

ID No.: TW4-24

Project Name: Ferma-Carden Quarry

MTE File No.: 36123-200

Client: Ferma Aggregates Inc.

Site Location: Carden, Ontario

Date Completed: 1/18/2024

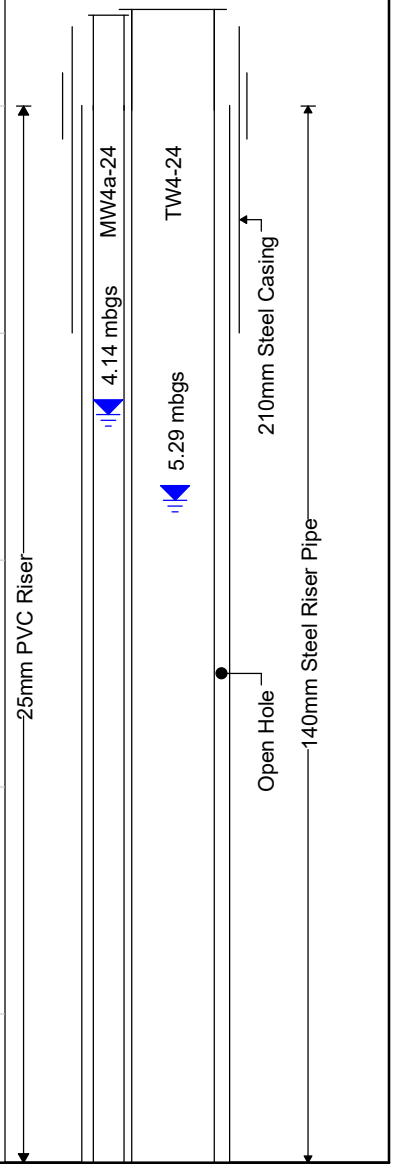
Drilling Contractor: SD Hopper Drilling

Drill Rig: n/a

Drill Method: n/a

Protective Cover: Steel Casing

Subsurface Profile			Sample					Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	Gamma (cps) 10 20 30 40 50 60 70 80 90	
ft / m		Ground Surface	273.0					
0 / 0		**LIMESTONE** BOBCAYGEON FORMATION	0.0					
2 / 0								
4 / 2								
6 / 2								
8 / 4								
10 / 4								
12 / 4								
14 / 6								
16 / 6								
18 / 6								
20 / 6								
22 / 8								
24 / 8								
26 / 8								
28 / 8								
30 / 10								
32 / 10								
34 / 10								
36 / 10								
38 / 12								
40 / 12								
42 / 12								
44 / 12								
46 / 12								



Field Technician: JAK/PAG

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: TW4-24

Project Name: Ferma-Carden Quarry

MTE File No.: 36123-200

Client: Ferma Aggregates Inc.

Site Location: Carden, Ontario

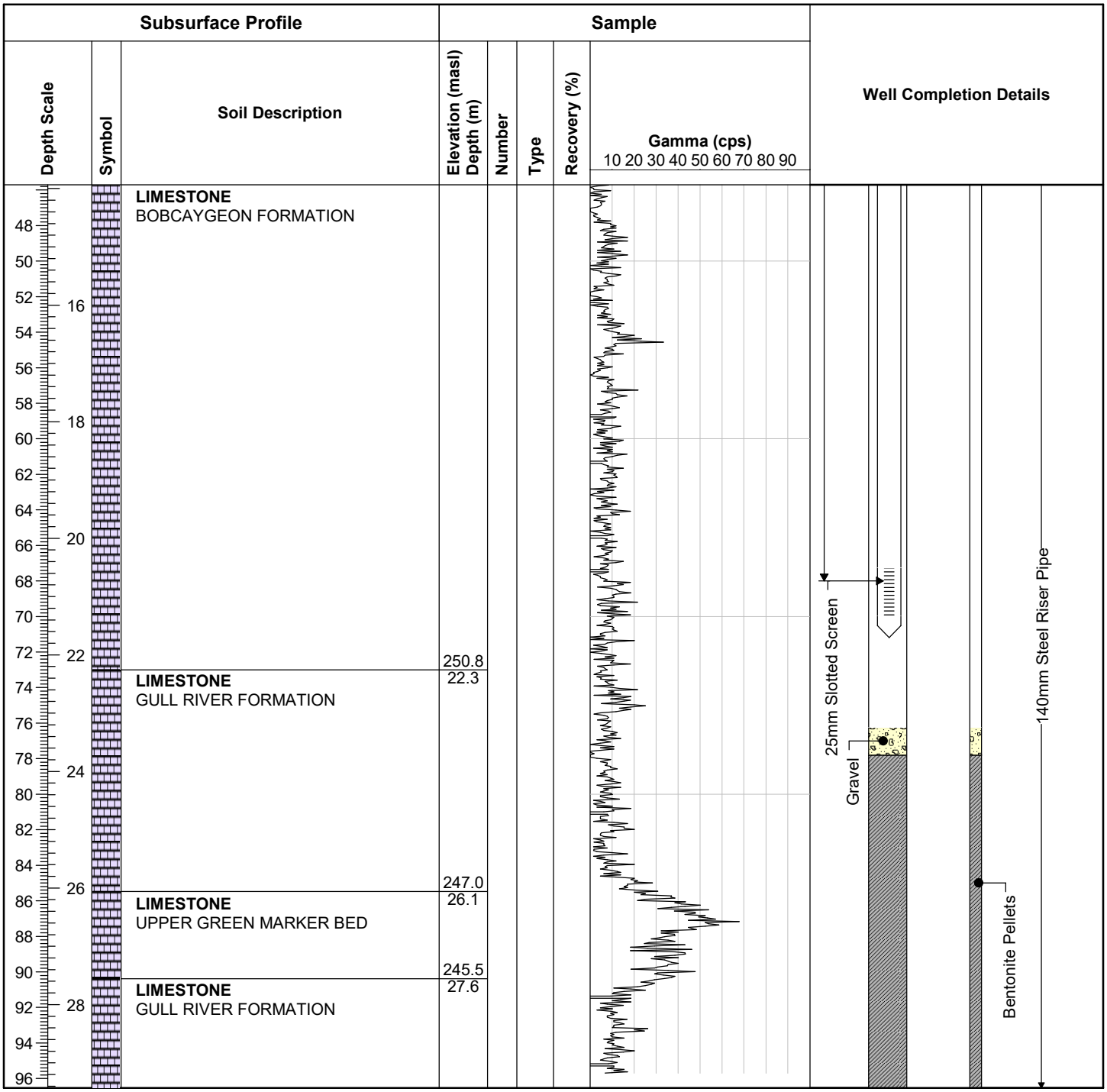
Date Completed: 1/18/2024

Drilling Contractor: SD Hopper Drilling

Drill Rig: n/a

Drill Method: n/a

Protective Cover: Steel Casing



Field Technician: JAK/PAG

Drafted by: TFC

Reviewed by: PAG

MTE

ID No.: TW4-24

Project Name: Ferma-Carden Quarry

MTE File No.: 36123-200

Client: Ferma Aggregates Inc.

Site Location: Carden, Ontario

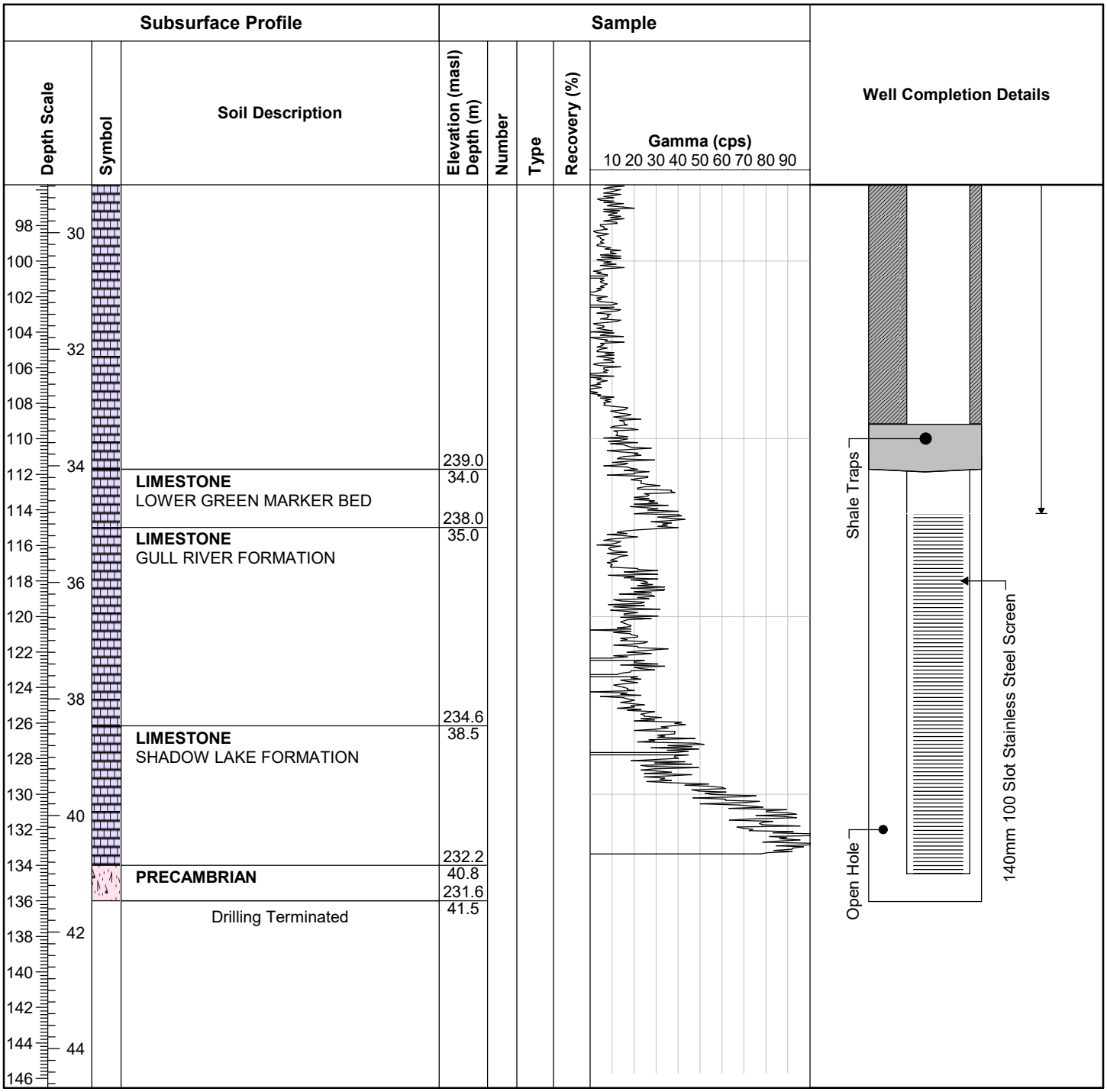
Date Completed: 1/18/2024

Drilling Contractor: SD Hopper Drilling

Drill Rig: n/a

Drill Method: n/a

Protective Cover: Steel Casing



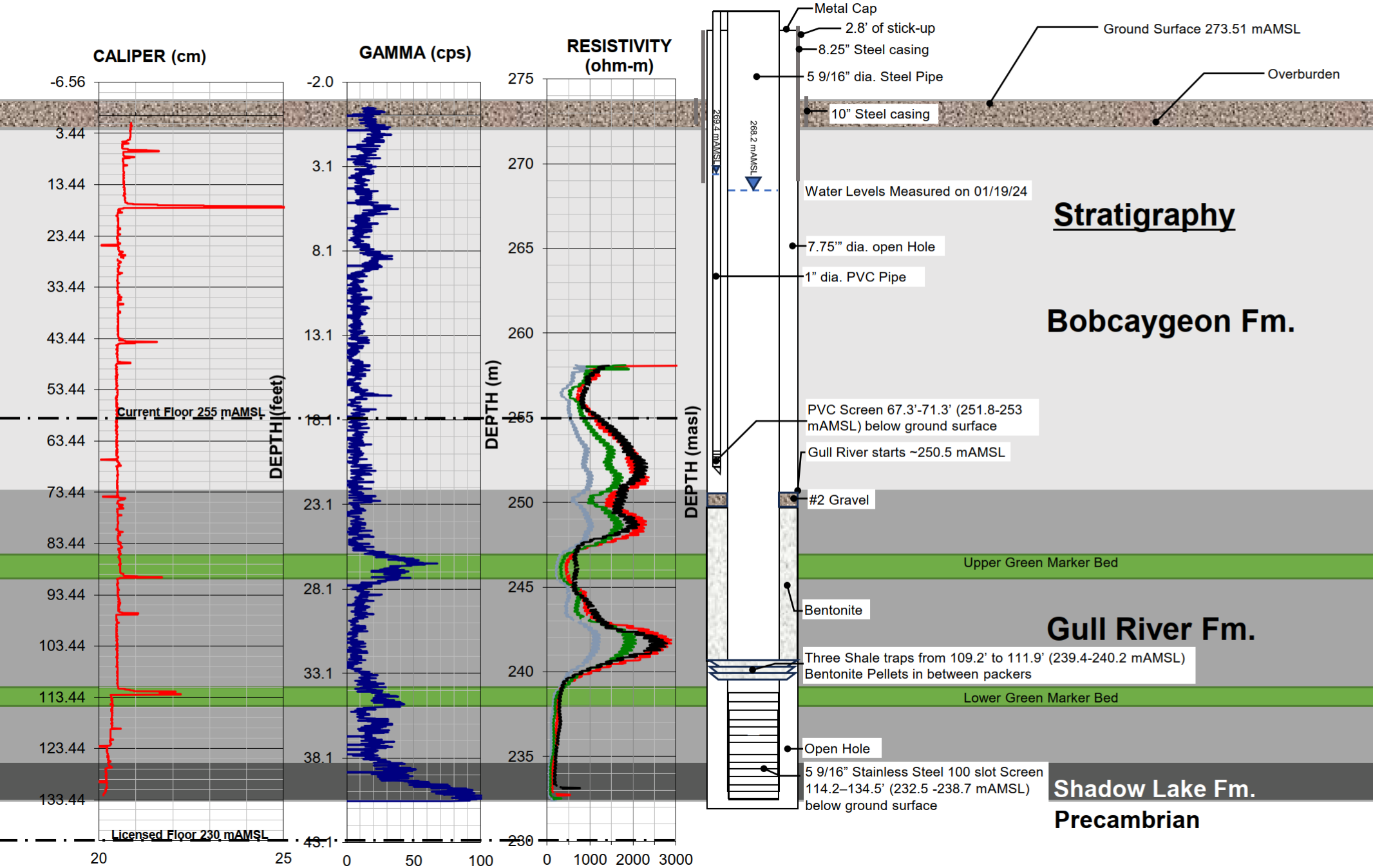
Field Technician: JAK/PAG

Drafted by: TFC

Reviewed by: PAG

Sheet: 3 of 3

MW4 – As Constructed Drawing



ID No.: W22

Project Name: Ferma-Carden Quarry

MTE File No.: 36123-200

Client: Ferma Aggregates Inc.

Site Location: Carden, Ontario

Date Completed: 11/30/2021

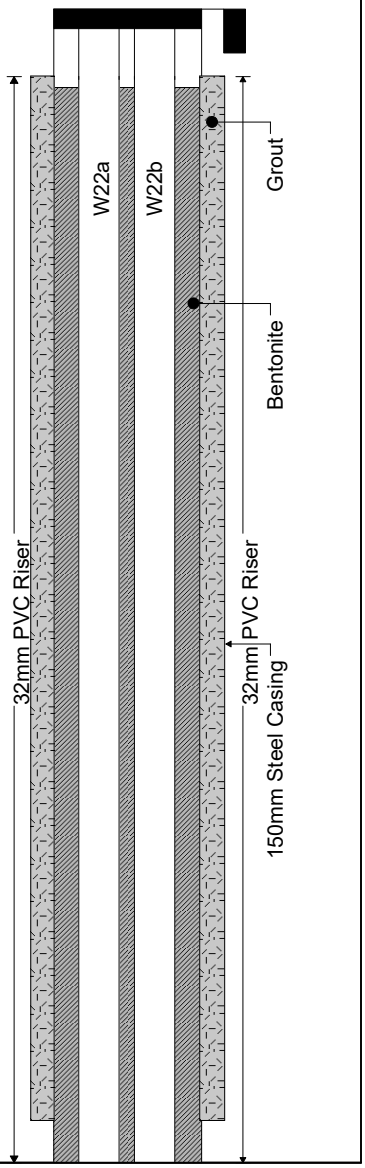
Drilling Contractor: SD Hopper Drilling

Drill Rig: n/a

Drill Method: n/a

Protective Cover: Steel Casing

Subsurface Profile			Sample					Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	Gamma (cps) 10 20 30 40 50 60 70 80 90	
ft / m		Ground Surface	271.2					
0 / 0		**TILL**	0.0					
16 / 4			266.3					
16 / 5		**LIMESTONE** BOBCAYGEON FORMATION	4.9					



Field Technician: PAG

Drafted by: JAK

Reviewed by: PAG

MTE

ID No.: W22

Project Name: Ferma-Carden Quarry

MTE File No.: 36123-200

Client: Ferma Aggregates Inc.

Site Location: Carden, Ontario

Date Completed: 11/30/2021

Drilling Contractor: SD Hopper Drilling

Drill Rig: n/a

Drill Method: n/a

Protective Cover: Steel Casing

Subsurface Profile			Sample					Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	Gamma (cps) 10 20 30 40 50 60 70 80 90	
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							32mm PVC Riser; 32mm Slotted Screen; 32mm PVC Riser

Field Technician: PAG

Drafted by: JAK

Reviewed by: PAG

MTE

ID No.: W22

Project Name: Ferma-Carden Quarry

MTE File No.: 36123-200

Client: Ferma Aggregates Inc.

Site Location: Carden, Ontario

Date Completed: 11/30/2021

Drilling Contractor: SD Hopper Drilling

Drill Rig: n/a

Drill Method: n/a

Protective Cover: Steel Casing

Depth Scale	Symbol	Soil Description	Elevation (masl) / Depth (m)	Number	Type	Recovery (%)	Gamma (cps) 10 20 30 40 50 60 70 80 90	Well Completion Details
98 – 30			241.1					32mm Slotted Screen
100		**LIMESTONE** GULL RIVER FORMATION	30.1					
102								
104 – 32								
106			238.4					Sand Pack
108		**LIMESTONE** UPPER GREEN MARKER BED	32.8					
110			237.4					
112 – 34		**LIMESTONE** GULL RIVER FORMATION	33.8					
114								
116								
118 – 36								
120								
122								Sand Pack
124 – 38								
126								
128								32mm Slotted Screen
130								
132 – 40			231.0					
134		**LIMESTONE** LOWER GREEN MARKER BED	40.2					
136								
138 – 42			229.2					Bentonite
140		**LIMESTONE** GULL RIVER FORMATION	42.0					
142			227.8					
144 – 44		Drilling Terminated	43.5					
146								

Field Technician: PAG

Drafted by: JAK

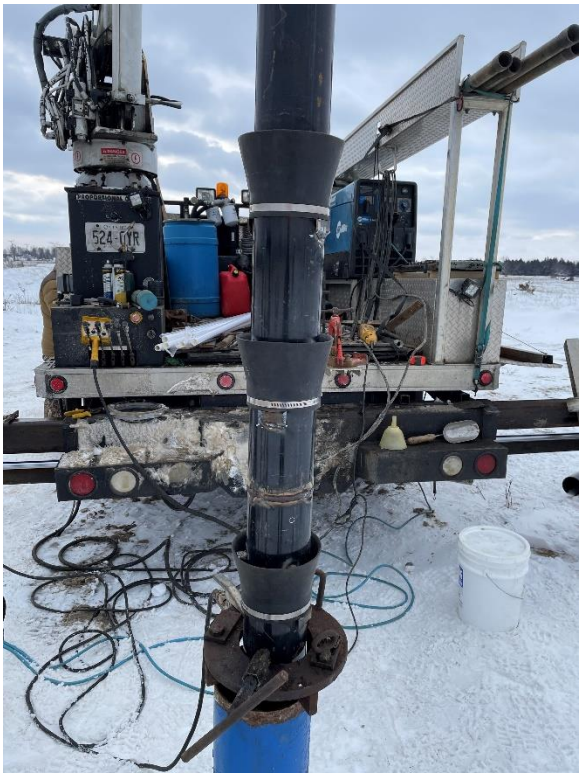
Reviewed by: PAG

MTE

Appendix I

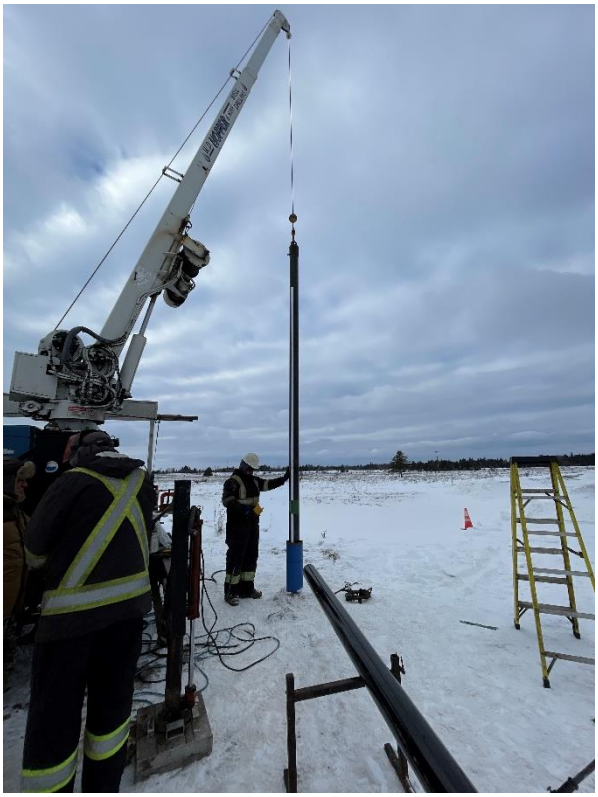
Photolog – MW4 Multi-Level Installation

Photograph No. 1 – TW4-24 Stainless Steel Screen – January 18, 2024



Photograph No. 2 – Installation of Shale Traps – January 18, 2024

Photograph No. 3 – Bentonite Pellets within Shale Traps – January 18, 2024



Photograph No. 4 – Installation of Casing for TW4-24 and MW4a-24 – January 19, 2024

Photograph No. 5 – Completed Installation – January 19, 2024