



December 21, 2018
MTE File No.: C36123-200

Mr. Shawn Trimper
Hydrogeologist
Technical Support Section
Ministry of the Environment, Conservation and Parks – Eastern Region
1259 Gardiners Road, Unit 3
Kingston, ON K7P 3J6

Dear Mr. Trimper:

**Zone-of-Influence Assessment - Addendum Report
Re: 10 Year Permit to Take Water Application,
Carden Quarry**

1.0 INTRODUCTION

On January 9, 2018, MTE Consultants Inc. (MTE) submitted an application for a Category 3 Permit to Take Water (PTTW) on behalf of Ferma Aggregates Inc. (Ferma), for the Carden Quarry. The Carden Quarry is a Class A, Category 2, quarry below-water-table located on Lot 6-10, Concession 9, Township of Carden, Kawartha Lakes, ON (hereby referred to as the “Site”) (**Figure 1**).

On April 9, 2018, a consultation teleconference regarding the January 2018 PTTW application took place between representatives from the Ministry of Environment, Conservation and Parks (MECP), MTE and Ferma. The MECP expressed concerns regarding the lack of water level data collected to the east of the Carden Quarry (along Victoria Road) and requested additional work be completed prior to the approval of a new long term PTTW for the Site. As such, this letter is submitted as additional technical data to support the January 2018 application. Specifically, this letter will address additional work completed on the Site in 2018 and will update the zone-of-influence estimation based on data gathered in 2018.

The Site currently has PTTW No. 6475-AVGMXB for the purposes of dewatering which expires on May 1, 2019; prior to this the Carden Quarry held PTTW No. 3358-AKYGHJ which expired on April 30, 2018.

2.0 FIELD STUDIES

During the spring/summer of 2018, MTE continued the characterization of groundwater conditions east of the Site. This characterization involved:

- Conducting a private well survey;

- Installing four new monitoring wells located to the east of the quarry;
- Installing a multilevel monitoring well nest in one of the newly drilled wells;
- Installing data loggers in new monitoring wells and select private wells; and
- Conducting borehole geophysical logging of select open boreholes on-Site.

2.1 Private Well Survey

On May 7, 2018, representatives from MTE conducted a private well survey along Victoria Road and North Mountain Road. Completed MTE private well inspection forms and accompanying MECP Well Records (if available) can be seen in **Attachment 1**. Through this process the resident at 2195 Victoria Road (W4, see **Figure 1**) was added to the private well monitoring program.

2.2 Installation of New Monitoring Wells

In order to supplement the data being gathered from W4 along Victoria Road and to monitor potential drawdown east of the Site, Ferma constructed four new open borehole monitoring wells. Between May 9 and May 17, 2018, monitoring wells MW1, MW2, MW3 and MW4 were constructed by Herb Lang Well Drilling Ltd. on-Site (**Figure 1**). The construction of on-Site monitoring wells was completed through the use of a dual rotary drill rig (DR-12-W). A copy of the submitted MECP well record for each well can be found in **Attachment 2**. Three of the four monitoring wells (MW1, MW2 & MW3) were completed to an approximate elevation of 250 metres above mean sea level (mAMSL). This elevation was chosen for the following reasons:

- 250 mAMSL is five meters lower than the current proposed quarry floor depth (255 mAMSL) for Phase 1 of the Carden Quarry;
- 250 mAMSL is a similar depth to discretely screened wells WAB and WBB that have shown a direct response to quarry dewatering in the past; and
- 250 mAMSL is within the approximate depth range of domestic wells located along Victoria Road.

MW4 was drilled down to Precambrian bedrock (~ 230 mAMSL) in order to assess the water bearing capacity of the entire Paleozoic sequence and to identify deeper water bearing units that could be incorporated into the contingency measured for the Site. During the drilling of MW4, the drillers noted a high producing fresh water zone located approximately at the contact between the Shadow Lake Formation and the Precambrian bedrock (~ 233 mAMSL). The drillers estimated the flow rate of this high producing zone to be between 300 and 400 gallons per minute.

2.3 Installation of Multilevel Well Nest in MW2

To better characterize the effects groundwater dewatering may have east of the quarry, MW2 was instrumented with three discreetly screened wells. A borehole log for this installation can be found in **Attachment 2** and a summary of the approximate elevations at which these piezometers were screened is provided below:

- MW2A – (249-252 mAMSL)
- MW2B – (256-259 mAMSL)
- MW2C – (262-265 mAMSL)

The screened elevations were based on results from geophysical logging, borehole logs, screened elevations of wells in close proximity (WA & WB) and fractures encountered during drilling.

MW2A and MW2C were screened at 249-252 mAMSL and 260-263 mAMSL respectively, to allow for groundwater elevations in these wells to be compared to those in close proximity shallow (WAA & WBA) and intermediate (WAB & WBB) wells. MW2B was screened at the elevation of 255-258 mAMSL as the borehole log for MW1 noted large fractures between approximately 255 and 256 mAMSL.

Conversely, MW1, MW3 and MW4 were completed as open boreholes to simulate how an open borehole domestic well at that location would respond/be affected by pumping and dewatering activities at the quarry.

2.4 Installation of Data Loggers

MTE installed dedicated pressure transducers (data loggers) to record water levels every hour within MW1, MW2, MW3 & MW4 in May and June 2018. Additionally in July 2018 a data logger was installed in W4. Preliminary water level data from MW1, MW2, MW3 & MW4 are presented on **Hydrograph 1** and appear to respond in a similar manner as wells installed within the lower Bobcaygeon Formation (WAB & WBB). The logger in WAB malfunctioned between the dates of September 18, 2018 and October 25, 2018. The data logger in MW2 was moved to MW2C when MW2 was instrumented with a multilevel monitoring well nest.

2.5 Borehole Geophysical Logging

The objective of the borehole geophysical logging was to better characterize the lithological units encountered on-Site and to aid in the identification of water bearing or key geologic units. On June 28 and 29, 2018, Lotowater Technical Services Inc. geophysically logged open borehole W22 and MW4 (**Figure 1**).

These two wells (located approximately 2 km apart) were chosen as they and are the two deepest open boreholes on-Site. As such, they are therefore capable of providing the most complete geophysical profile at the Site. The geophysical logging techniques used include:

- Hole caliper;
- Natural gamma;
- Resistivity;
- Conductivity; and
- Temperature

Hole caliper measures the size of the borehole and can identify if the borehole intersects any large voids within the rock. Natural gamma measures the natural radioactivity of the rock forming minerals. Materials with higher clay type content tend to have a higher natural radioactivity because they often contain weathered materials which are naturally radioactive (ie. K, Ar).

Resistivity measures how easily an electrical current moves through the rock. Materials which have larger grains and therefore larger pore sizes do not allow for an electrical current to pass through as easily compared to those materials with smaller grain and pore sizes and are subsequently represented by higher resistivity values.

Water conductivity can aid in the determination of the source of the water and temperature can assist in determining groundwater inflow and/or outflow zones. These metrics as well as geologic observations made during drilling were used to assist in the characterization of the geologic profile and water bearing zones.

The results of geophysical logging can be seen in **Figure 2** and **Figure 3**.

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 submission (ref: A-2018-05968) to the MECP for information related to hydrogeology and geophysics for the R.W. Tomlinson – Brechin Quarry, located approximately 10.5 km to the southwest.

Based on MTE's interpretation of the borehole geophysical data from W22 and MW4, as well as a review of supplementary information¹ the elevations of the different lithological units in the area were inferred and are identified on **Figures 2** and **3**. These lithological units included:

¹ Supplementary information included:

- Borehole geophysical logs from the Tomlinson – Brechin Quarry (Golder Associated Ltd., 2009) (**Attachment 3**);
- Cumulative Impacts Assessment for Groundwater Taking in the Carden Plain Area- Addendum Report (Golder Associates Ltd., 2016) (**Attachment 4**).

- The Bobcaygeon Formation;
- The Gull River Formation;
- Locally referred to Green Marker Beds;
- The Shadow Lake Formation; and
- The Precambrian Bedrock

2.6 Groundwater Elevations

Groundwater elevation data from all monitoring locations from 2012 to 2018 can be found in **Table 1** as well as **Hydrographs 2-30**. The hydrographs also indicate the bottom elevation of each well.

2.7 On-Site Dewatering

Groundwater dewatering took place on-Site between August 7, 2018 and October 31, 2018. Daily pumping records supplied by the client to MTE have been summarized in **Table 2**.

3.0 ZONE-OF-INFLUENCE ASSESSMENT

In MTE's January 2018 Zone-of-Influence Assessment, the zone-of-influence for both the current extent (Scenario 1) of extraction (2017) and full extraction of Phase 1 (Scenario 2) was estimated using the Thiem equation and dewatering information collected in 2017. Using data collected in 2018 from on-Site monitoring locations and from the newly constructed wells (MW1-MW4) MTE was able to refine the zone-of-influence estimation for the current quarry extent (Scenario 1) and the full extraction of Phase 1 (Scenario 2).

As in MTE's January 2018 Zone-of-Influence Assessment, for the purposes of this analytical model MTE assumes that the bedrock groundwater system at the Site acts as an ideal confined aquifer with the following characteristics (Fetter, 2001):

- The aquifer is bounded on the bottom by a confining layer;
- All geological formations are horizontal and have an infinite extent;
- The potentiometric surface of the aquifer is horizontal prior to the start of dewatering;
- All changes in the positions of the potentiometric surface are due to the effect of dewatering;
- The aquifer is homogeneous and isotropic;
- All flow is radial to the quarry;
- Groundwater flow is horizontal;
- Darcy's Law is valid;

- Groundwater has a constant density and viscosity;
- The quarry (well) is 'screened' over the entire thickness of the aquifer; and
- The quarry (well) has an infinitesimal diameter and is 100% efficient.

3.1 Scenario 1a - Current Conditions

The current extraction area of the quarry covers a base area of approximately 1.7 ha (**Figure 1**), with the excavated area at approximately 261 mAMSL. In addition there is a small trench in the south-east corner covering an area of approximately 3.3×10^{-2} ha with a base at approximately 258 mAMSL.

2018 Zone of Influence

The 2018 zone-of-influence was estimated using groundwater monitoring data collected during pumping (dewatering) in 2018. Data from monitoring wells WCA, WBB, WAB, MW1, MW3 & MW4 were then plotted on a log distance vs drawdown plot (**Hydrograph 31**). WCA, WBB, WAB, MW1, MW3 & MW4 were analyzed as these wells either show drawdown from dewatering and/or are upgradient in regards to groundwater flow direction from the current quarry extent. By drawing a line of best fit on the log distance vs drawdown plot, drawdown from dewatering can be estimated at various distances from the quarry face (Driscoll, 1987). This drawdown data was then used to create a zone-of-influence map for the current extent of the quarry (**Figure 4**).

MTE considers measurable drawdown to be one meter. Drawdown of less than one meter is indiscernible from seasonal water table fluctuations. As such, the zone-of-influence was assessed to a distance where drawdown was equal to one meter. As a result of the assumptions listed above, the zone influence extends roughly the same in every direction.

The 2018 zone-of-influence was contained within lands owned by Ferma Aggregates and does not extend to any nearby domestic well users.

2018 Zone of Influence vs. Historical Drawdown (2016-2018)

The 2018 zone-of-influence was compared to actual drawdown measured in on-Site wells in order to validate the methodology used. In order to minimize variability in water levels, average (2016-2018) pre-pumping and pumping water levels were calculated for wells² within the lower Bobcaygeon Formation (based on a screen mid-point depth between approximately 251 and 265 mAMSL and previously collected water level data). Water levels from 2016-2018 were selected due to the consistent collection of water levels over this period of time. Average pre-pumping water levels were calculated using

² Monitoring locations installed or added to the monitoring program following 2016 were not assessed.

water level data collected from spring and/or summer prior to when pumping began. Average water levels during pumping were calculated using water level data from one month following the beginning of pumping to when pumping ceased. The first month following the beginning of pumping was not used as water levels during this month were not representative of either pre-pumping or pumping levels. The average drawdown was then calculated by subtracting average pumping water levels from average pre-pumping levels (**Table 3**). W8 was not included in this assessment due to its poor condition and tendency to go dry.

The comparison between the 2018 zone-of-influence and average drawdown (2016-2018) can be seen on **Figure 5**. For the majority of monitoring locations the drawdown estimated by the distance drawdown plot was within approximately one meter of the average drawdown. BH4A was calculated to have an average drawdown of 0.6 m compared to the estimated 4.0 m, this is interpreted to be as a result of BH4A being influenced by the tributary of the Talbot River which is approximately 50 m away. MTE's opinion is that the method to estimate the zone-of-influence outlined above is a technically sound approach, on which additional drawdown predictions can be reliably and conservatively based.

3.1.1 Determination of Aquifer Characteristics

Aquifer Thickness (b)

The aquifer thickness is required in order to calculate the hydraulic conductivity of the system, as hydraulic conductivity is a function of the aquifer thickness and the transmissivity. The aquifer thickness was estimated by reviewing borehole logs from MW2C and water level data from MW2. Based on the slow recovery in water levels, MW2C appears to be screened in a very competent zone of rock which may form an aquitard, therefore the bottom elevation of the aquifer was set at the top of the sand pack for MW2C (252.78 mAMSL). The top of the aquifer was estimated to be the highest groundwater elevation recorded at MW2 which based on logger data was found to be 266.92 mAMSL. As such, the aquifer thickness is estimated to be 15.1 m (266.92 – 252.78 mAMSL).

Drawdown vs. Time

Water level data from SG1, WAB, WBB, WCA, MW1, MW3 & MW4 indicate a steady decline in water levels from August 7 to October 2, 2018. As such, drawdown vs. log time data from this time period was used to calculate aquifer coefficients, including transmissivity, storativity and hydraulic conductivity at each location listed above. Data was analyzed using AquiferTest© software and the Cooper & Jacob Straight Line method.

For the purposes of AquiferTest© analysis the “centre of the pumping well” is considered to be the centre of the currently excavated area. This resulted in transmissivity values ranging between 20.6 and 74.1 m²/day; storativity values ranging between 1.6×10^{-3} and 1.5×10^{-2} ; and hydraulic conductivity values ranging between 1.4 and 4.9 m/day. AquiferTest© data sheets are provided in **Attachment 5**.

Drawdown vs. Distance

Drawdown vs. log distance data collected from WAB, WBB, WCA, MW1, MW3 & MW4 was used to calculate the aquifer coefficients transmissivity, storativity and hydraulic conductivity using AquiferTest© software and the Cooper & Jacob analysis. When analyzing the distance drawdown data an assessment time must be selected; October 2nd was selected as this date corresponds to the maximum drawdown which occurred during initial dewatering (**Hydrograph 31**). Analysis of the time drawdown plot resulted in a transmissivity of 46.3 m²/day; a storativity of 3.3×10^{-3} ; and a hydraulic conductivity of 3.1 m/day. AquiferTest© data sheets are provided in **Attachment 5**. The transmissivity, storativity and hydraulic conductivity values generated using the Drawdown vs. Distance analytical solution show good agreement with those same values estimated using the Drawdown vs. time solutions.

A summary of transmissivity, storativity and hydraulic conductivity values generated from AquiferTest© are provided in **Table 4**.

3.2 SCENARIO 1b - Full Extraction Depth - Current

Prior to estimating the zone-of-influence for the full extraction (quarry floor = 255 mAMSL) of Phase 1, the zone-of-influence was estimated for the full extraction of the current extent of the quarry down to 255 mAMSL. The drawdown for the full extraction of current quarry extent was estimated by creating a drawdown vs. log time plot for the 2018 drawdown data (**Hydrograph 32**). Based on a static water level in the quarry of 266.3 mAMSL and a final floor elevation of 255 mAMSL, the maximum drawdown within the quarry is 11.3 m. Drawdown data from 2018 indicates that monitoring wells: WCA, WBB, WAB, MW1, MW3 & MW4 have a near instantaneous reaction to pumping. This was also observed in 2016 and 2017 drawdown data.

Extending the drawdown slope observed in the quarry (SG1) indicates that, had the rate of drawdown continued, a drawdown of 11.3 m would have been achieved by approximately 3×10^5 minutes (~208 days) (**Hydrograph 32**). The following assumptions were made when applying this concept to other wells on-Site:

- The final drawdown within the bedrock will be the same regardless of the pumping rate; and
- Drawdown within the bedrock will reach pseudo steady state instantaneously once drawdown within the quarry sump is equal to 11.3 m or at 3×10^5 minutes.

Using the above assumptions the estimated drawdown at each monitoring well can then be assessed by applying the same principles. The estimated drawdown in each of the monitoring wells when the current quarry has been dewatered to an elevation of 255 mAMSL (quarry floor) can be seen in **Table 4**. Using this data a drawdown vs log distance plot was created (**Hydrograph 33**).

The drawdown at various distances from the quarry face was estimated using the equation of the line of best fit as shown on **Hydrograph 33**. This drawdown data was used to create a zone-of-influence map for full extraction of the current extent of the quarry (**Figure 6**).

3.3 SCENARIO 2 - Full Extraction Depth – Phase 1

As the final drawdown in the bedrock (i.e. 11.3 m) will be the same as in Scenario 1b, regardless of the size of the quarry, the zone-of-influence will only expand laterally as a result of the extent of the quarry becoming larger. Using the methodology and assumptions outlined above the zone of influence for the full extraction of Phase 1 was estimated (**Figure 7**).

Prediction Analysis - Scenario 2

As a result of the assumptions listed above, the zone-of-influence extends approximately an equal distance in every direction. As this zone-of-influence estimate is based primarily on up-gradient wells, the drawdown west and south of Phase 1 may be overestimated.

There are a number of domestic wells located east of the Site along Victoria Road, most of which are located south east of the Phase 1 (**Figure 8**). Based on the zone-of-influence estimation for full extraction of Phase 1, several domestic wells (MECP Well Record #: 6404295 (W4), 6407486, 6404456, 6400005, 6400515 and 6400514) may experience between two and three meters of drawdown as a result of the complete extraction of Phase 1. Several other wells may experience up to one meter of drawdown following full extraction of Phase 1. However, as noted above the zone-of-influence is estimated to primarily effect those wells up gradient and as such will likely not impact those wells along McNamee Road or those along the southern portion of Victoria Road.

There are three domestic wells located along Shrike road west of the Site, two of which are currently monitored (W3 & W2). Drawdown at W3 is predicted to be approximately three meters whereas drawdown at W2 is predicted to be approximately 3.5 m. The predicted drawdown for the resident (W1) located directly west across Shrike Rd. from BH1 for which an MECP well record could not be found is estimated to also be approximately 3.5m.

4.0 DISCUSSION

4.1 Comparison to 2017 Results

Scenario 1

Figure 9 presents the interpreted Scenario1 zone-of-influence as presented in MTE's January 5, 2018 Zone-of-Influence Assessment. Due to the lack of data east of WA or WB the zone-of-influence extended much further northeast when compared to that presented on **Figure 4**. **Figure 9** does however show less of an impact to the west and south of the current extraction. This is a result of the drawdown presented in **Figure 4** being based on wells upgradient and therefore likely overestimates the amount of drawdown west and south of the current excavation.

Scenario 2

As with Scenario 1, Scenario 2 presented in the January 5, 2018 Zone-of-influence Assessment estimated a large zone-of-influence extending northeast of the Site (**Figure 10**). Again this was based on no water level data east of the Site. Given the installation of the new wells (MW1-MW4) in 2018, the zone-of-influence was able to be more refined and thus more accurately predicted herein. This has resulted in an updated zone-of-influence to the north east being reduced by almost half the size to that presented in the previous report. As with **Figure 4** the drawdown results presented in **Figure 7** are based on wells upgradient and therefore likely over estimate the amount of drawdown west and south of Phase 1.

The results presented herein were also compared to that of the 1995 Hydrotechnical Report by Oliver, Mangione, McCalla & Associates Ltd. (**Attachment 6**). The zone-of-influence presented in the 1995 report was based on a two dimensional model with a quarry floor for Phase 1 of 251 mAMSL **Attachment 6**. This figure indicates that much of the drawdown will be constrained to within lands owned by Ferma Aggregates with a minor amount extending west of the Site along Shrike Road. The zone-of-influence presented herein (**Figure 7**) is similar to that presented in the 1995 report for drawdown west of Phase 1 along Shrike Road. The zone-of-influence presented herein does estimate a larger zone-of-influence north and east than that presented in the 1995 report which may be a result of the additional groundwater data acquired from MW1-MW4.

4.2 Trigger Values

Trigger values are intended to work as an early warning system to indicate if nearby domestic wells may be affected by drawdown in the near future. The trigger values as set out in MTE's January 5, 2018 Zone-of-influence Assessment for W2 (263 mAMSL) and BH3A (259 mAMSL) are interpreted to still be appropriate and therefore will not be reassessed.

Using data gathered in 2018 trigger values have also been assessed for those wells west of Phase 1 along Victoria Road. As there are no on-Site monitoring wells in close proximity to W4 a trigger value will have to be applied to W4 itself. The trigger value for W4 was developed by reviewing the results of Scenario 2, which indicated a potential drawdown at this location of approximately 2.5 m and by taking into consideration the amount of available drawdown (8 m) (**Hydrograph 34**). Taking this information into account a trigger value of 261 mAMSL is recommended for W4.

A trigger value has also been established for MW3, which was installed to a similar depth as those domestic wells along Victoria Road. Based on preliminary water level data gathered in 2018, MW3 appears to fluctuate between 266.5 mAMSL and 269 mAMSL (**Hydrograph 26**). It is estimated that MW3 may experience up to 3 m of drawdown (263.5 mAMSL). As such, a trigger value equivalent to 4.5 m of drawdown (262 mAMSL) has been established to indicate if drawdown is becoming greater than that predicted, while also considering natural fluctuations due to climatic conditions.

Should quarry activities result in adverse effects to nearby domestic wells, the contingency measures as outlined on the Site Operational Plan shall be implemented.

4.3 Pumping Rate

Ferma Aggregates is requesting for the continued pumping rate of 60 L/s (3600 L/min) as per PTTW 6475-AVGMXB. A pumping rate of 60 L/s is required by Ferma to quickly dewater and maintain dry working conditions within the quarry during initial spring dewatering or following significant precipitation events.

Currently the maintenance rate or the pumping rate which is required to maintain dry working floor conditions based on 2018 pumping rates is 845 m³/day (587 L/min). As the quarry expands the maintenance rate will be required to increase to maintain dry quarry floor conditions over a larger area.

The maintenance rate, or rate at which water will drain into the quarry from the surrounding formation was estimated using an analytical solution developed by S.S. Papadopoulos & Associates, Inc. This analytical model is used to calculate confined flow to an approximately square excavation with a nearby boundary (S.S. Papadopoulos & Associates Inc., 2013):

$$Q = KD(H - h_{ex}) \left[\frac{2(a+b)}{L_0} + \pi \right] \quad Eq. 1.0$$

Where: Q = drainage/pumping rate (m³/day)
K = hydraulic conductivity (m/day) = 2.6 m/day
D = aquifer thickness (m) = 15.1 m
a = Rectangular excavation length (m) = 1190 m

b = Rectangular excavation width (m) = 490 m
H = Head at constant head boundary (m) = 15.1 m
 h_{ex} = Aquifer Head in excavation (quarry) = 2.2 m
 L_o = Distance to recharge boundary (m) = 3000 m

Distance to the recharge boundary was projected to be 3000 m based on **Hydrograph 33** where the line of best fit intersects the x axis. The aquifer head inside the quarry was calculated to be 2.2 m (quarry floor elevation (255 mAMSL) – bottom of aquifer (252.8 mAMSL)). The aquifer head at the constant recharge boundary is assumed to be equal to the aquifer thickness (15.1 m). Using *Eq. 1.0* the maintenance rate was calculated to be approximately 2,134 m³/day or 1,482 L/min.

This method was verified by calculating the maintenance rate based on current quarry extent. The current maintenance rate was calculated to be 809 m³/day, which is in good agreement with that measured in 2018 (845 m³/day). In order to meet their current needs and anticipated future needs, Ferma Aggregates requests that Table A of PTTW 6475-AVGMXB be amended to reflect the changes shown on the chart below:

Source Name/ Description:	Source Type:	Taking Specific Purpose:	Taking Major Category:	Max. Taken per Minute (L):	Max. Num. Of Hrs Taken per Day:	Max. Taken per Day (L):	Max. Num. Of Days Taken per Year:
Carden Quarry Sump Pond A - Spring & Rainfall Dewatering	Pond Quarry	Other - Dewatering	Dewatering	3,600	24	5,184,000	60
Carden Quarry Sump Pond A - Maintenance Dewatering	Pond Quarry	Other - Dewatering	Dewatering	1,500	24	2,160,000	305
Carden Quarry Sump Pond A – Dust Suppression	Pond Quarry	Other - Miscellaneous	Miscellaneous	1,080	24	842,400	365
Total Taking:						5,184,000	

4.4 Open Borehole vs. Discretely Screened

To better understand potential impacts future quarry dewatering may have on nearby domestic wells, water levels in discretely screened MW2A, MW2B and MW2C will be compared to that of MW1. This was done in order to compare the effects of dewatering between an open borehole (similar to many domestic wells) and that of discretely screened wells which appear to show the greatest impact from dewatering on-Site

(WBB, WAB, WCA etc.). MW1 is an open borehole completed within close proximity (~90m) to MW2 and was completed at a similar depth to nearby domestic wells. Based on previous water level data from WAB and WBB during pumping in 2016 and 2017, MTE predicted that MW2C (which is screened at a similar discrete elevation to WAB & WBB) would be directly impacted by quarry dewatering. Following the installation and development of the three discretely screened wells (MW2A, MW2B & MW2C) within MW2, manual water levels indicated that groundwater elevations in MW2B were much closer to that in MW1. The water levels collected from MW2C indicate that the well is screened in a very competent zone as water levels are slowly recovering and are more than 12 m below that of MW2B or MW1. Water levels in MW2A, MW2B & MW2C will continue to be monitored and compared to those in MW1 to better understand how water levels in open boreholes compare to those of which have discrete screened intervals.

5.0 MONITORING PROGRAM

As per Condition 4.7 (5) of PTTW 6475-AVGMXB MTE has assessed the adequacy of the existing monitoring plan and proposes an updated monitoring plan as presented in **Table 6**. MTE proposes that the monitoring program be adjusted during the months of December to March when on-Site monitoring locations may become inaccessible. During the months of December to March when pumping is occurring MTE proposes that only monitoring locations SG1, BH3A, BH3C, WFA, WFB, WFC, BH1A, BH1C, MW3 & MW4 be monitored. These wells, with the exception of SG1 (which is located within the quarry sump) were selected as they are easily accessible, located at the perimeter of the Site, and are the closest to off-Site receptors (domestic wells). This will ensure that the potential impacts to off-site receptors will continue to be monitored throughout the year. Domestic wells are not included during these months as they become inaccessible in freezing conditions due to the concrete well cap either becoming buried in snow or frozen shut.

6.0 SUMMARY & CONCLUSIONS

A summary of work completed in 2018 is presented below:

- Well survey completed along Victoria and N Mountain Road;
- The installation of four new monitoring wells east of the Site (MW1, MW2, MW3 & MW4);
- The installation of data loggers in MW1, MW2, MW3, MW4;
- Inclusion of a new domestic well to the monitoring program, located east of the Site, W4;
- Borehole geophysical logging of MW4 and W22; and
- Installation of a multi-level piezometer nest in MW2.

Additionally MTE reassessed the zone-of-influence estimate. Based on water level data from the newly installed wells (MW1-MW4) MTE revised the zone-of-influence to be approximately half of that which was predicted previously east of the quarry. Scenario 2 zone-of-influence results were found to be in better agreement with that presented in the 1995 Hydrotechnical Report by Oliver, Mangione, McCalla & Associates Ltd.. MTE will continue to monitor groundwater levels across the Site and nearby domestic wells into the future to ensure mitigation measures are in place for those domestic wells which may be negatively impacted from dewatering.

If you have any questions or comments, please do not hesitate to contact the undersigned directly at (519) 743-6500.

Respectfully submitted,

MTE CONSULTANTS INC.



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



Peter A. Gray, P.Geo., QP_{ESA}
VP, Senior Hydrogeologist



TFC:dem

Attach.

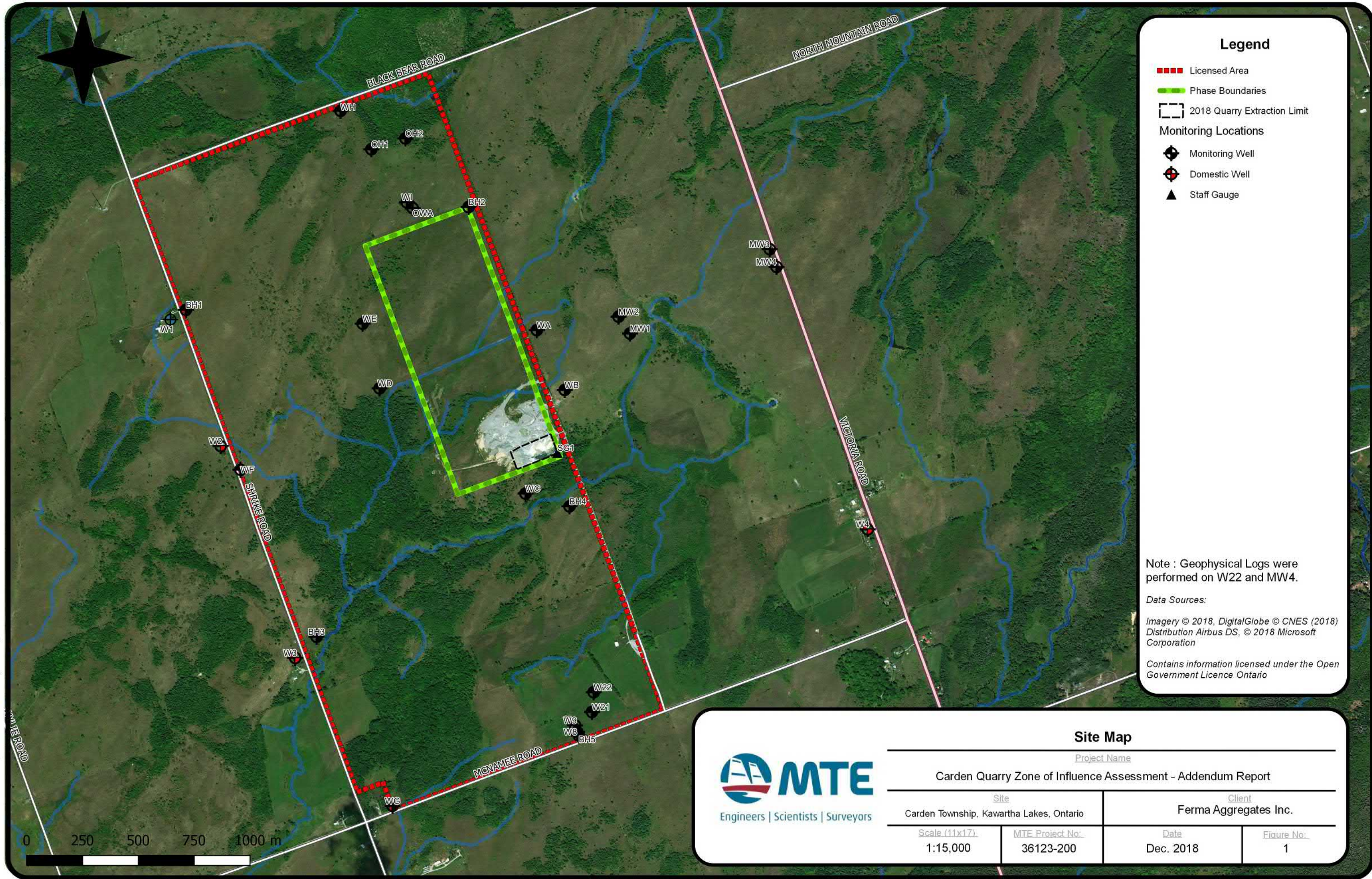
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7.0 REFERENCES

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FIGURES



Legend

- Licensed Area
- Phase Boundaries
- 2018 Quarry Extraction Limit

Monitoring Locations

- Monitoring Well
- Domestic Well
- Staff Gauge

Note : Geophysical Logs were performed on W22 and MW4.

Data Sources:

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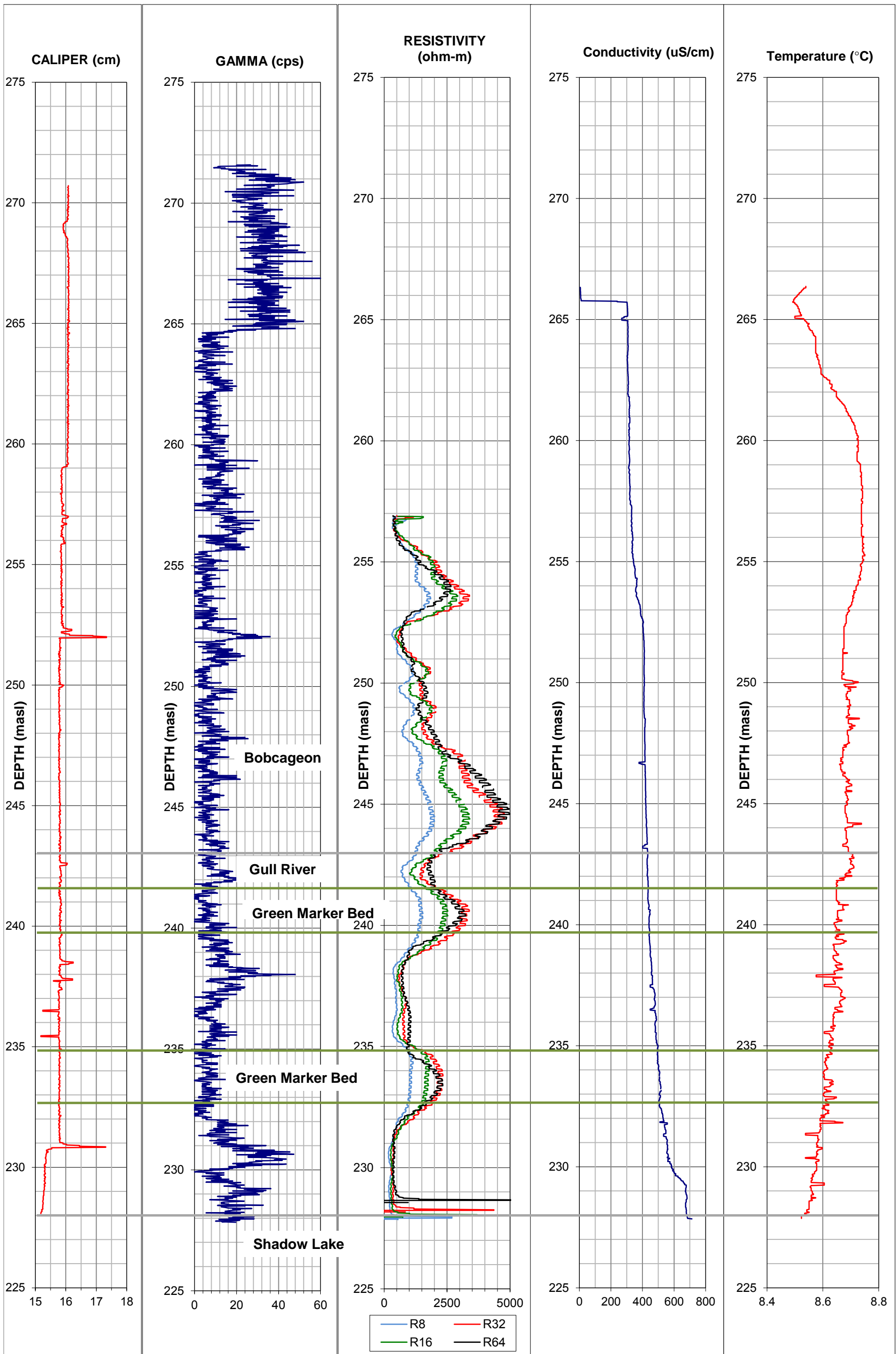
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Site Map

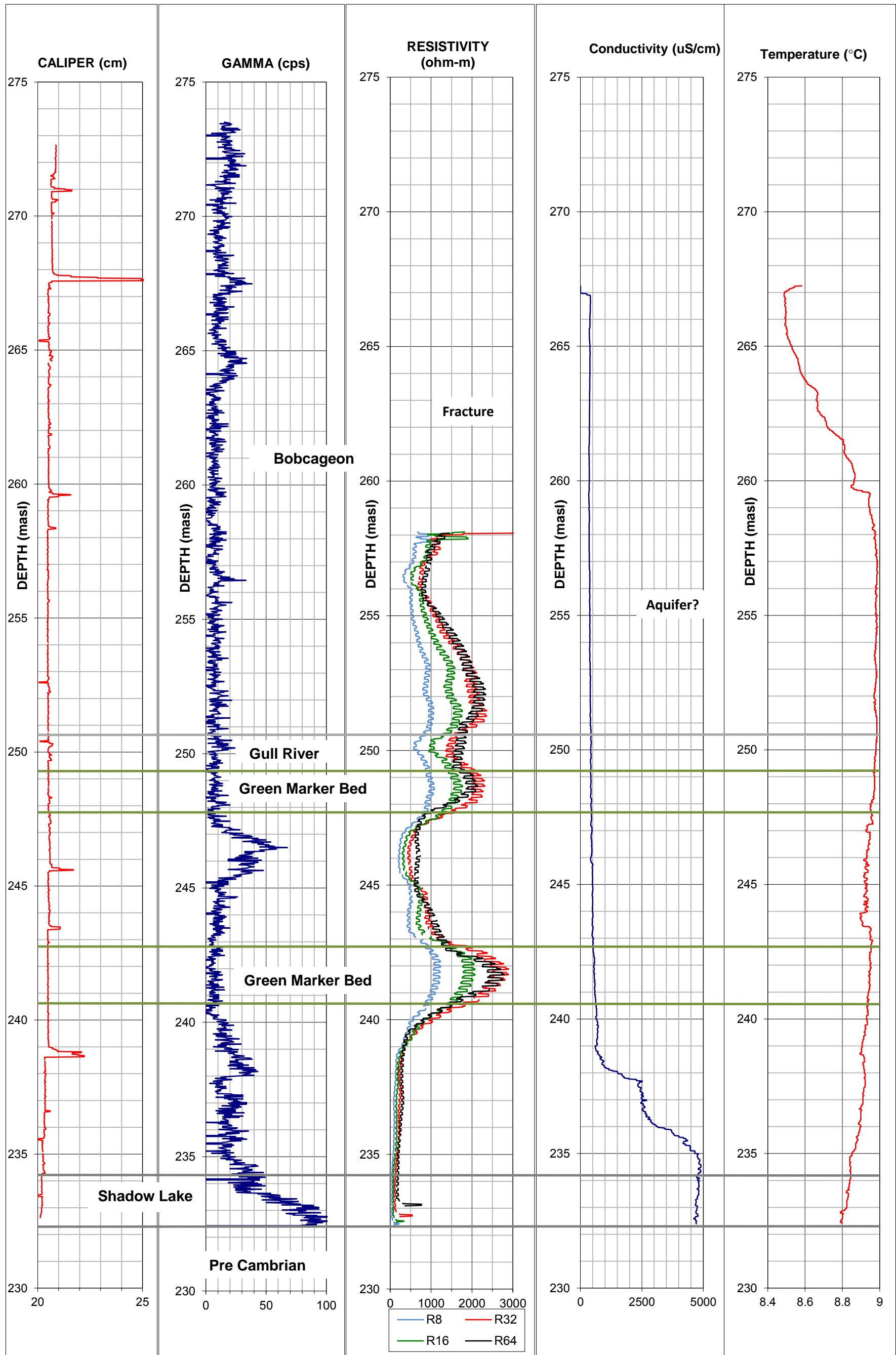
<u>Project Name</u> Carden Quarry Zone of Influence Assessment - Addendum Report			
<u>Site</u> Carden Township, Kawartha Lakes, Ontario		<u>Client</u> Ferma Aggregates Inc.	
<u>Scale (11x17)</u> 1:15,000	<u>MTE Project No.</u> 36123-200	<u>Date</u> Dec. 2018	<u>Figure No.</u> 1

Figure 2: Borehole Geophysical Log of W22

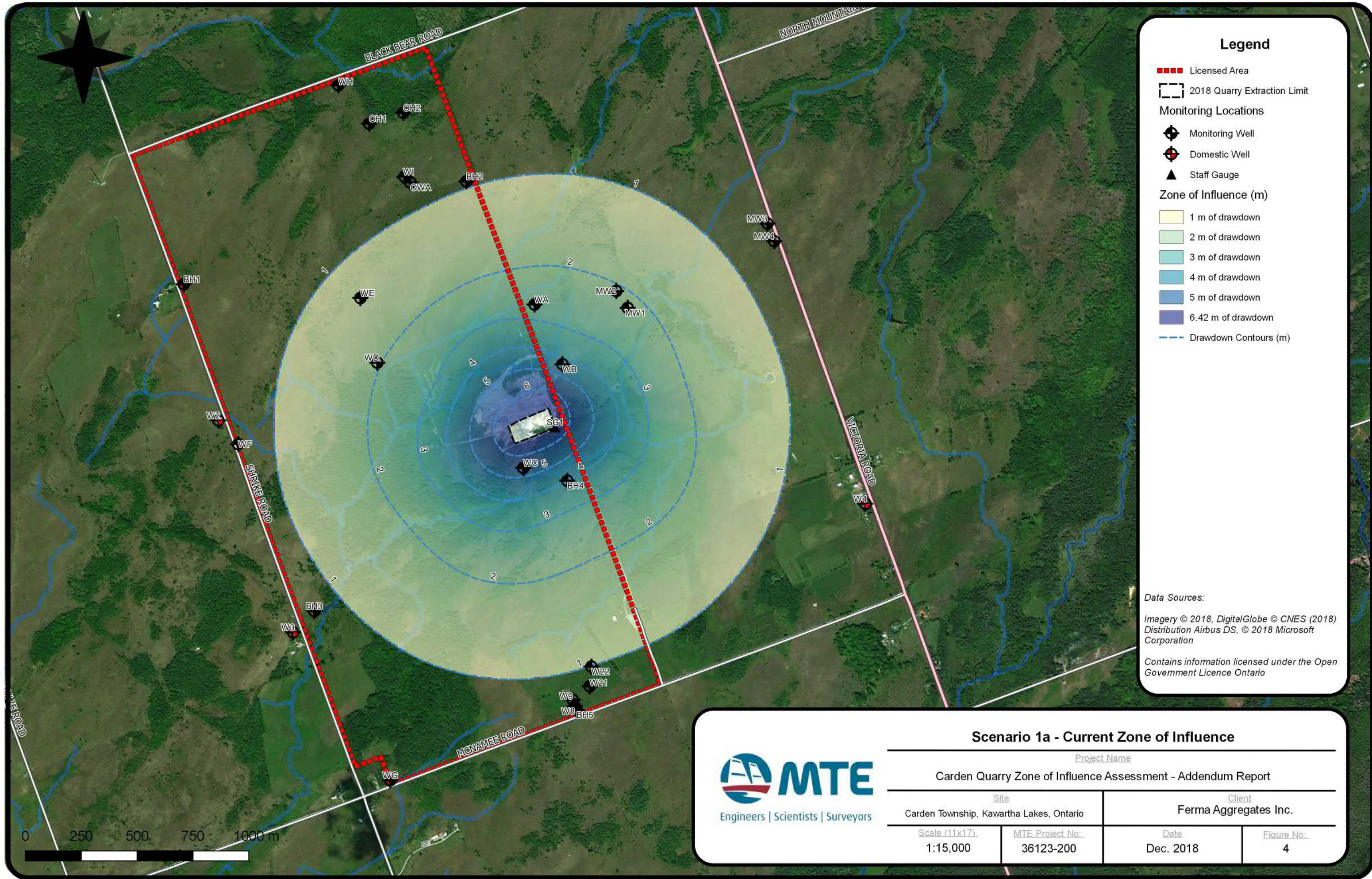


Notes:
 Reference Point: TOC
 Date Logged: 2018/06/28

Figure 3: Borehole Geophysical Log of MW4



Notes:
 Reference Point: TOC
 Date Logged: 2018/06/29



Legend

- - - Licensed Area
- 2018 Quarry Extraction Limit
- Monitoring Locations**
- M Monitoring Well
- D Domestic Well
- Staff Gauge
- Zone of Influence (m)**
- 1 m of drawdown
- 2 m of drawdown
- 3 m of drawdown
- 4 m of drawdown
- 5 m of drawdown
- 6.42 m of drawdown
- Drawdown Contours (m)

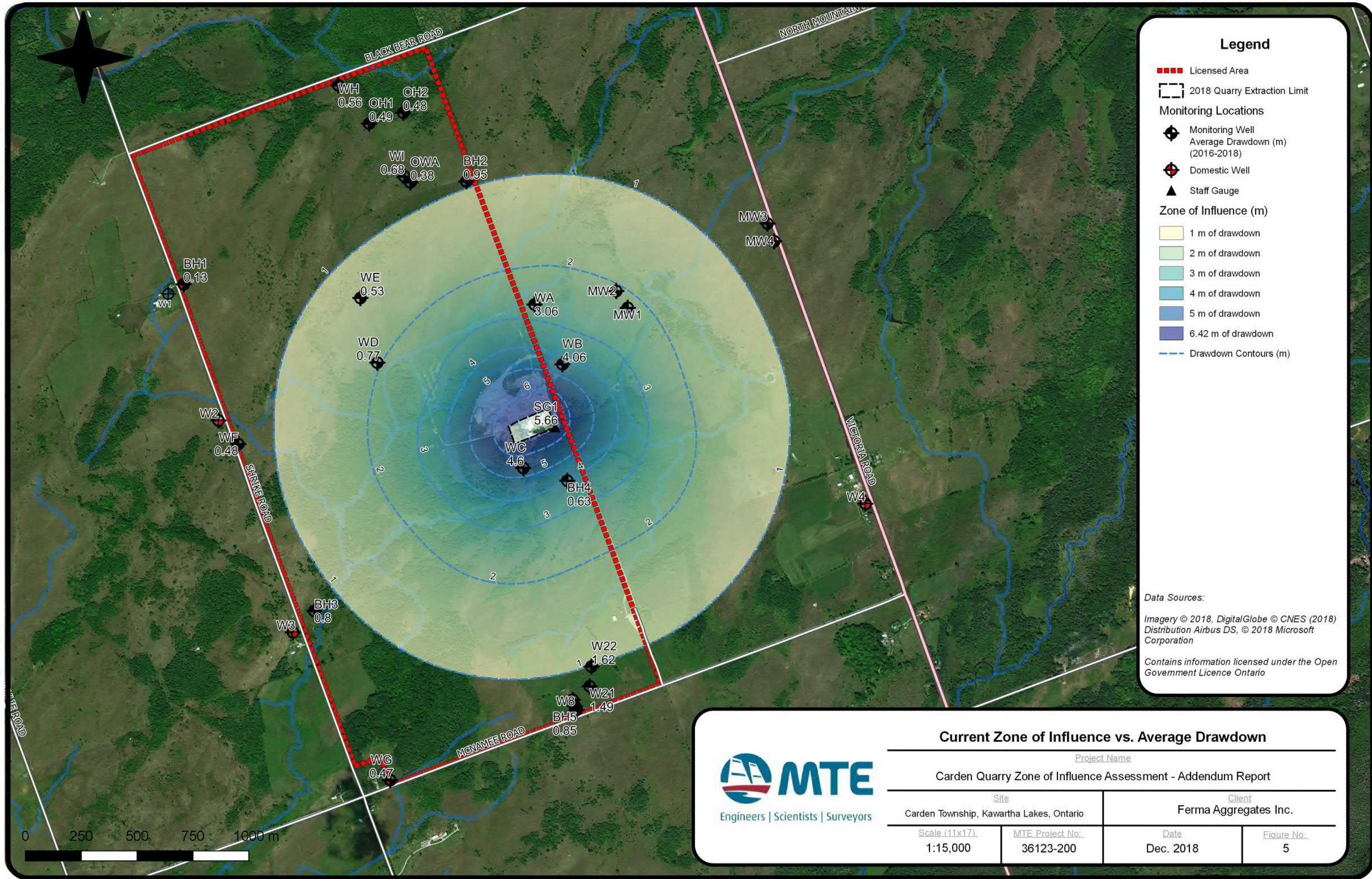
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Scenario 1a - Current Zone of Influence



<i>Project Name</i>			
Carden Quarry Zone of Influence Assessment - Addendum Report			
<i>Site</i>		<i>Client</i>	
Carden Township, Kawartha Lakes, Ontario		Ferma Aggregates Inc.	
<i>Scale (11x17)</i>	<i>MTE Project No.</i>	<i>Date</i>	<i>Figure No.</i>
1:15,000	36123-200	Dec. 2018	4



Legend

- - - Licensed Area
- 2018 Quarry Extraction Limit

Monitoring Locations

- Monitoring Well
Average Drawdown (m)
(2016-2018)
- Domestic Well
- Staff Gauge

Zone of Influence (m)

- 1 m of drawdown
- 2 m of drawdown
- 3 m of drawdown
- 4 m of drawdown
- 5 m of drawdown
- 6.42 m of drawdown

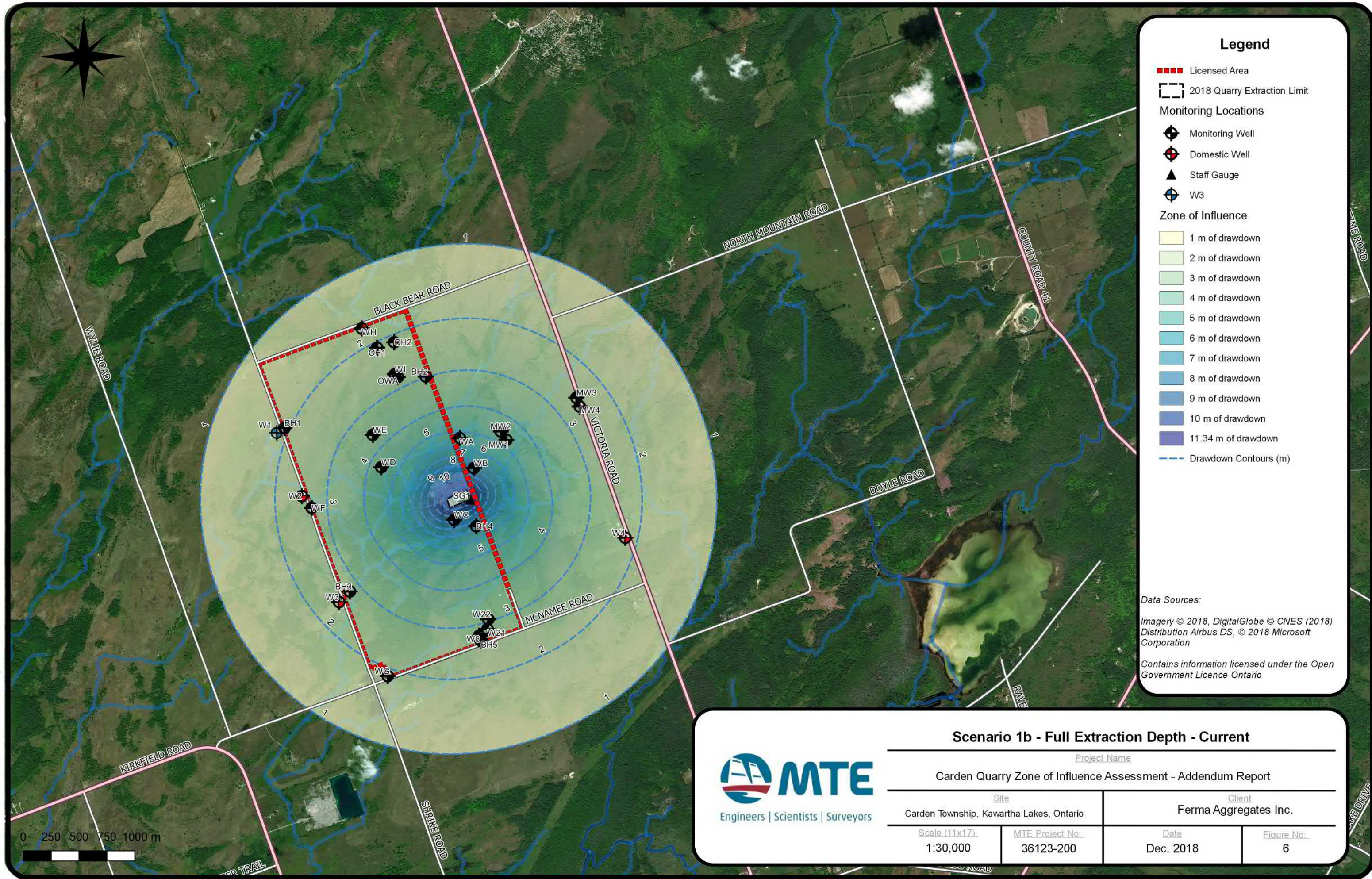
Drawdown Contours (m)

Data Sources:
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Current Zone of Influence vs. Average Drawdown



<i>Project Name</i>			
Carden Quarry Zone of Influence Assessment - Addendum Report			
<i>Site</i>		<i>Client</i>	
Carden Township, Kawartha Lakes, Ontario		Ferma Aggregates Inc.	
<i>Scale (11x17)</i>	<i>MTE Project No.</i>	<i>Date</i>	<i>Figure No.</i>
1:15,000	36123-200	Dec. 2018	5



Legend

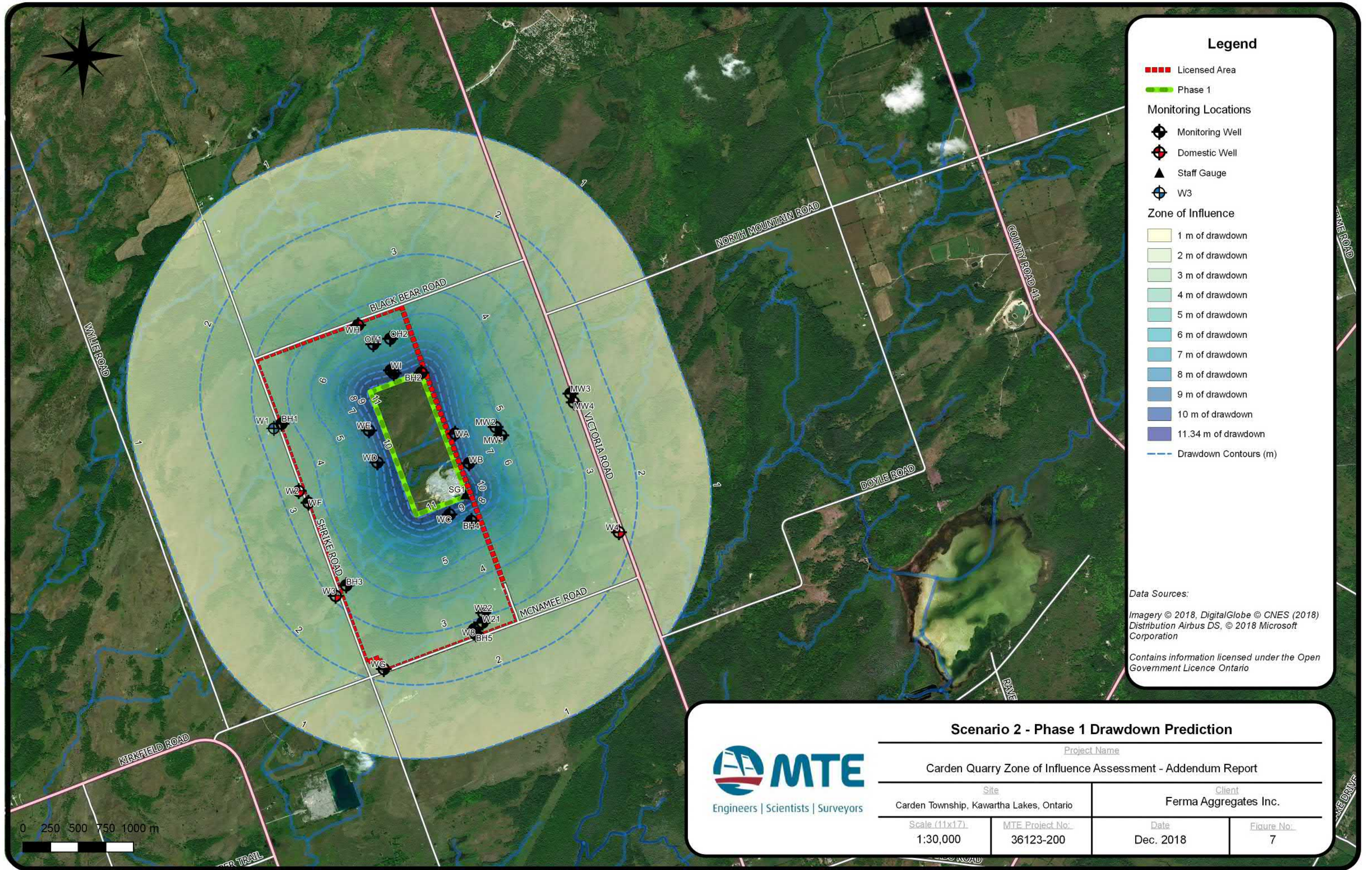
- ▬▬▬ Licensed Area
- 2018 Quarry Extraction Limit
- Monitoring Locations**
- Monitoring Well
- Domestic Well
- Staff Gauge
- W3
- Zone of Influence**
- 1 m of drawdown
- 2 m of drawdown
- 3 m of drawdown
- 4 m of drawdown
- 5 m of drawdown
- 6 m of drawdown
- 7 m of drawdown
- 8 m of drawdown
- 9 m of drawdown
- 10 m of drawdown
- 11.34 m of drawdown
- Drawdown Contours (m)

Data Sources:
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Scenario 1b - Full Extraction Depth - Current

<i>Project Name</i>			
Carden Quarry Zone of Influence Assessment - Addendum Report			
<i>Site</i>		<i>Client</i>	
Carden Township, Kawartha Lakes, Ontario		Ferma Aggregates Inc.	
<i>Scale (11x17)</i>	<i>MTE Project No.</i>	<i>Date</i>	<i>Figure No.</i>
1:30,000	36123-200	Dec. 2018	6



Legend

- Licensed Area
- Phase 1

Monitoring Locations

- Monitoring Well
- Domestic Well
- Staff Gauge
- W3

Zone of Influence

- 1 m of drawdown
- 2 m of drawdown
- 3 m of drawdown
- 4 m of drawdown
- 5 m of drawdown
- 6 m of drawdown
- 7 m of drawdown
- 8 m of drawdown
- 9 m of drawdown
- 10 m of drawdown
- 11.34 m of drawdown
- Drawdown Contours (m)

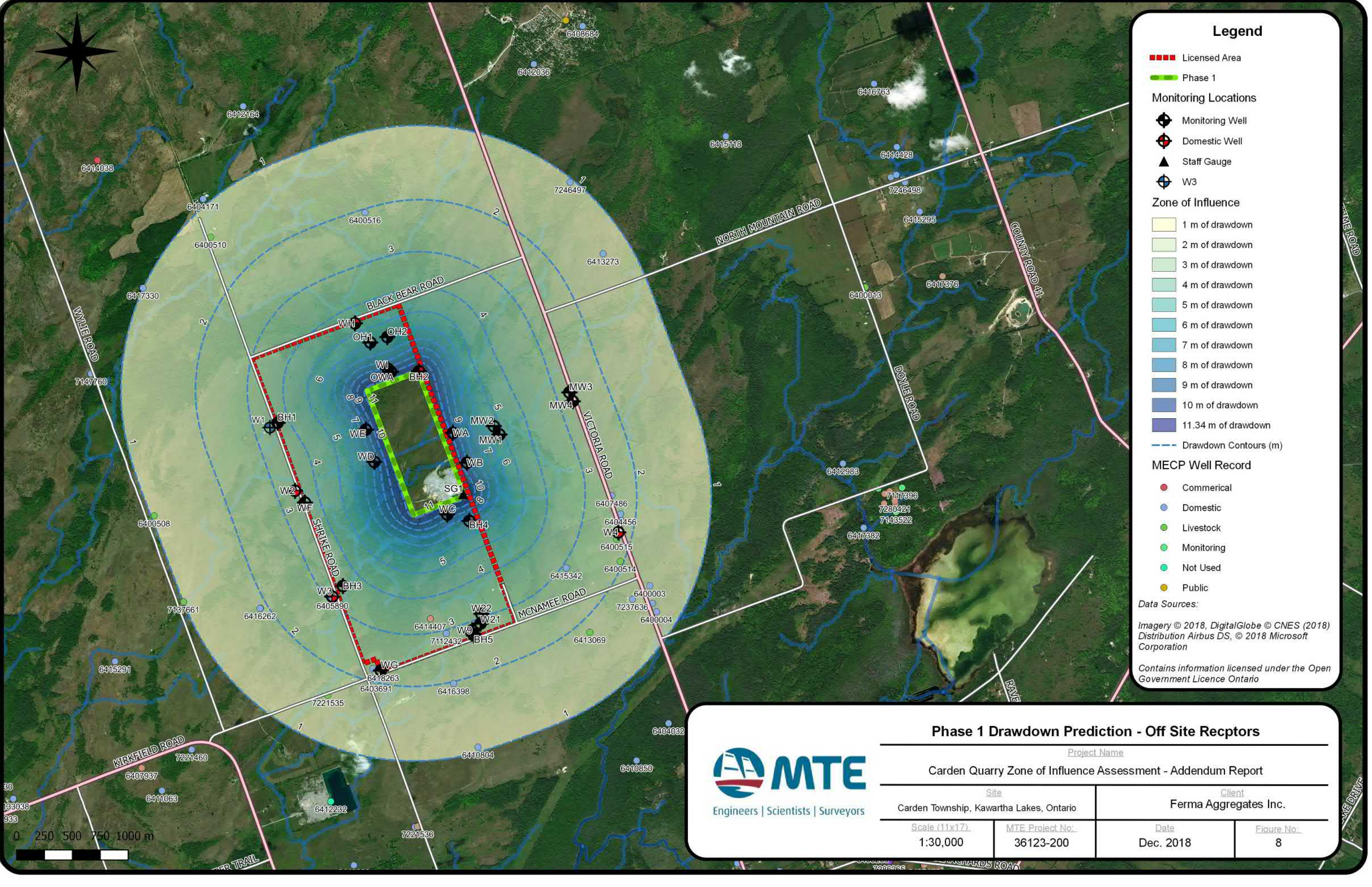
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Scenario 2 - Phase 1 Drawdown Prediction



<i>Project Name</i> Carden Quarry Zone of Influence Assessment - Addendum Report			
<i>Site</i> Carden Township, Kawartha Lakes, Ontario		<i>Client</i> Ferma Aggregates Inc.	
<i>Scale (11x17)</i> 1:30,000	<i>MTE Project No.</i> 36123-200	<i>Date</i> Dec. 2018	<i>Figure No.</i> 7





Legend

- Licensed Area
- Phase 1

Monitoring Locations

- Monitoring Well
- Domestic Well
- Staff Gauge
- W3

Zone of Influence

- 1 m of drawdown
- 2 m of drawdown
- 3 m of drawdown
- 4 m of drawdown
- 5 m of drawdown
- 6 m of drawdown
- 7 m of drawdown
- 8 m of drawdown
- 9 m of drawdown
- 10 m of drawdown
- 11.34 m of drawdown
- Drawdown Contours (m)

MECP Well Record

- Commercial
- Domestic
- Livestock
- Monitoring
- Not Used
- Public

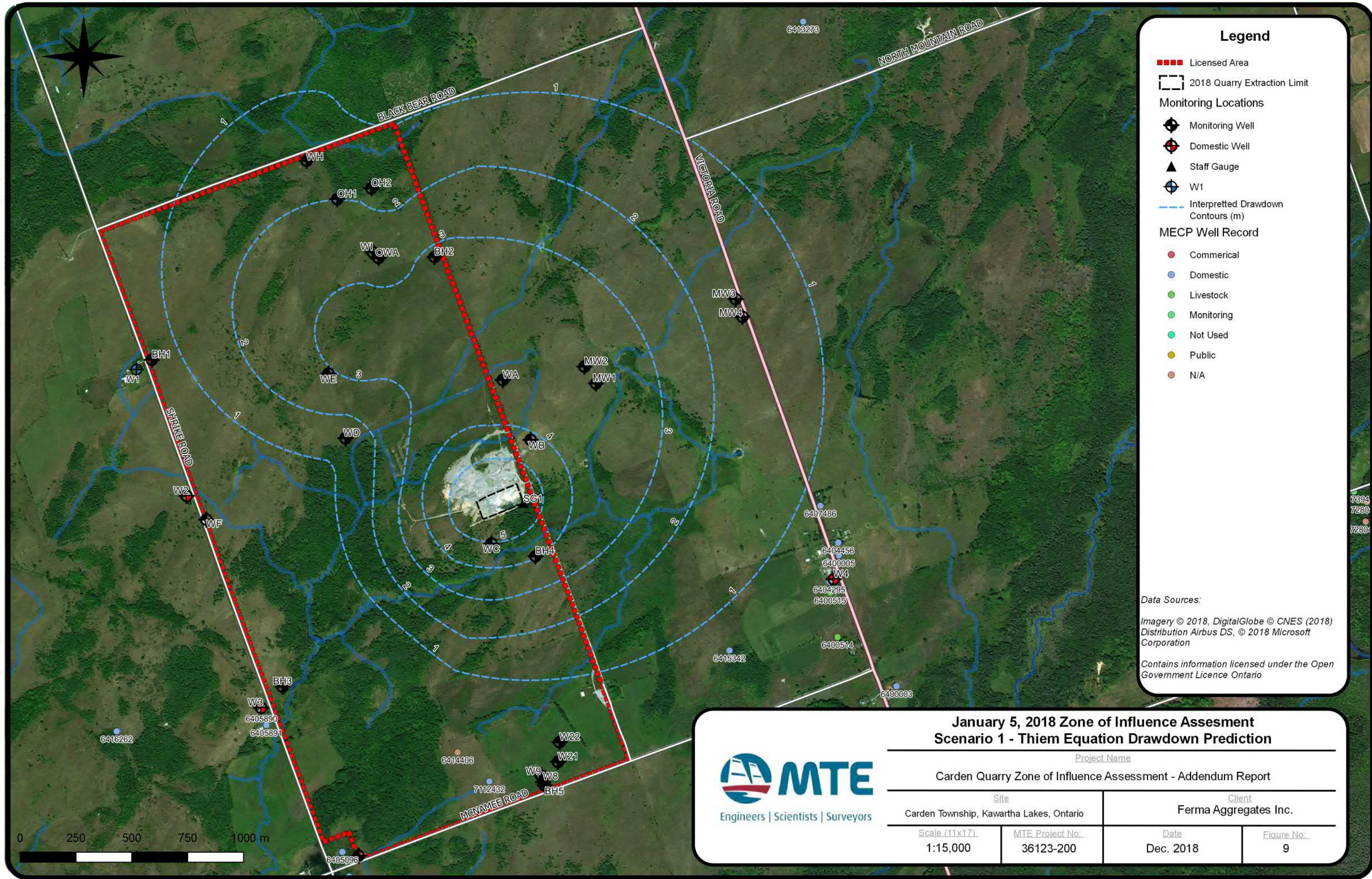
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Phase 1 Drawdown Prediction - Off Site Receptors

Project Name Carden Quarry Zone of Influence Assessment - Addendum Report			
Site Carden Township, Kawartha Lakes, Ontario		Client Ferma Aggregates Inc.	
Scale (11x17) 1:30,000	MTE Project No. 36123-200	Date Dec. 2018	Figure No. 8





Legend

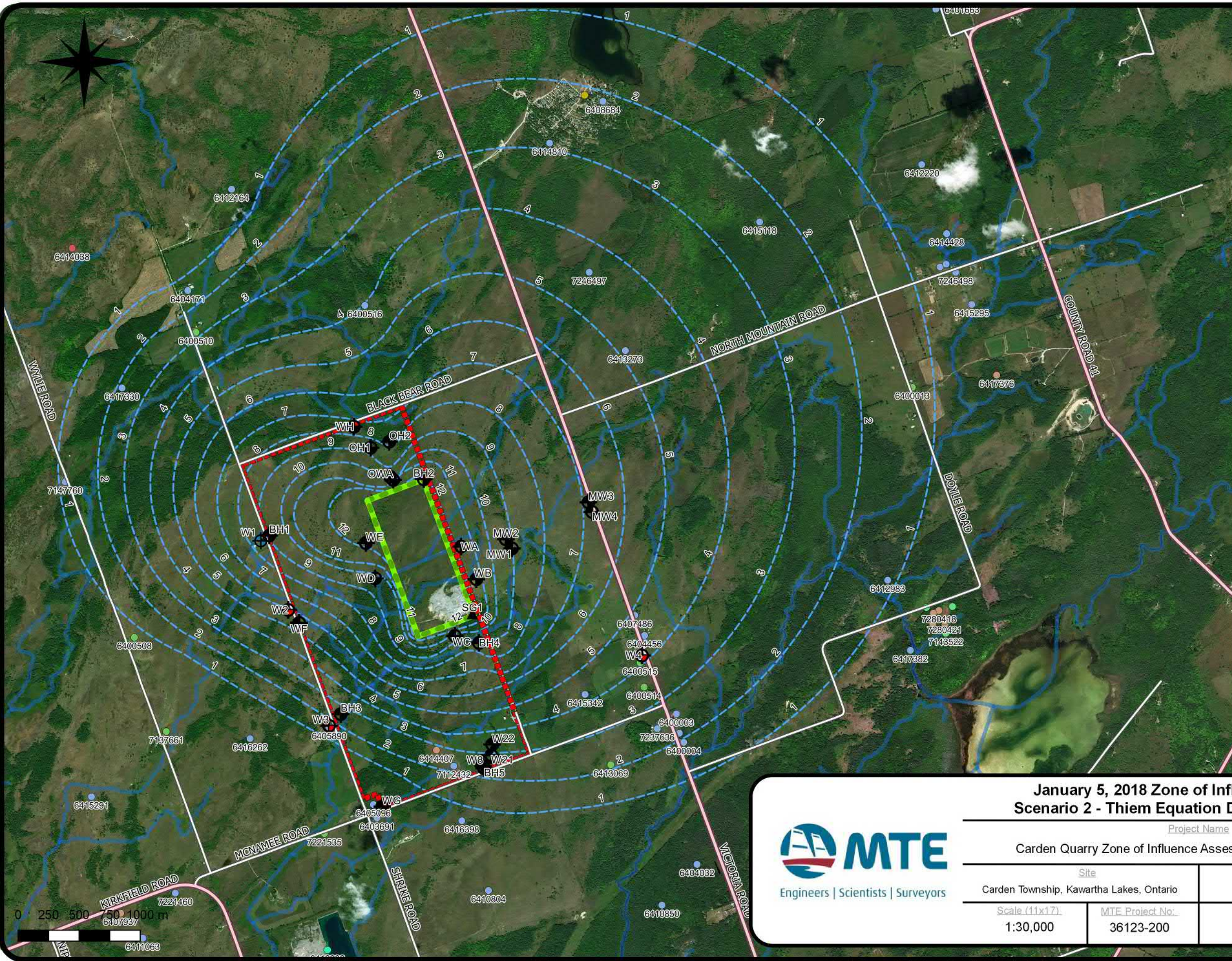
- Licensed Area
- 2018 Quarry Extraction Limit
- Monitoring Locations**
- Monitoring Well
- Domestic Well
- ▲ Staff Gauge
- W1
- Interpretted Drawdown Contours (m)
- MECP Well Record**
- Commerical
- Domestic
- Livestock
- Monitoring
- Not Used
- Public
- N/A

Data Sources:
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January 5, 2018 Zone of Influence Assesment Scenario 1 - Thiem Equation Drawdown Prediction



<i>Project Name</i>			
Carden Quarry Zone of Influence Assessment - Addendum Report			
<i>Site</i>		<i>Client</i>	
Carden Township, Kawartha Lakes, Ontario		Ferma Aggregates Inc.	
<i>Scale (11x17)</i>	<i>MTE Project No.</i>	<i>Date</i>	<i>Figure No.</i>
1:15,000	36123-200	Dec. 2018	9



Legend

- ▬ Licensed Area
- ▬ Phase 1

Monitoring Locations

- ⊕ Monitoring Well
- ⊕ Domestic Well
- ▲ Staff Gauge
- ⊕ W3
- Interpreted Drawdown Contours (m)

MECP Well Record

- Commerical
- Domestic
- Livestock
- Monitoring
- Not Used
- Public
- N/A

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January 5, 2018 Zone of Influence Assessment Scenario 2 - Thiem Equation Drawdown Prediction

<u>Project Name</u> Carden Quarry Zone of Influence Assessment - Addendum Report		<u>Client</u> Ferma Aggregates Inc.	
<u>Site</u> Carden Township, Kawartha Lakes, Ontario		<u>Scale (11x17)</u> 1:30,000	
<u>MTE Project No.</u> 36123-200	<u>Date</u> Dec. 2018	<u>Figure No.</u> 10	



TABLES

Table 1: Groundwater Elevations (mAMSL) Manual Measurements - 2012 - 2018

	BH1A	BH1C	BH2A	BH2B	BH2C	BH3A	BH3C	BH4A	BH4C	OH1A	OH1B	OH2A	OH2B	OWA	W8	W9	W21	W22	WAA	WAB	WAC
T/case	274.33	274.33	272.24	272.24	272.24	265.55	265.55	268.36	268.36	269.29	269.29	267.91	267.91	273.02	269.98	270.21	271.86	272.14	271.59	271.59	271.59
T/PVC	274.43	274.45	272.22	272.22	272.23	265.41	265.36	268.49	268.43	269.25	269.13	267.93	267.92	No PVC Casing Installed					271.57	271.51	271.49
1-Jun-12	268.53	268.57	-	-	266.61	262.22	262.36	-	-	266.88	263.55	266.33	263.72	-	-	-	267.47	266.54	266.43	263.83	266.54
21-Jun-12	268.25	268.47	266.46	266.71	266.39	261.87	261.90	265.98	266.22	266.78	263.39	266.22	263.72	266.00	267.34	265.46	266.67	265.83	266.36	263.56	266.39
27-Jul-12	268.17	268.37	265.80	-	265.91	261.64	261.48	265.82	265.77	266.42	263.02	265.60	263.34	265.20	267.54	264.81	265.87	265.07	265.92	263.17	265.80
23-Aug-12	267.69	268.19	265.72	265.73	265.75	261.79	261.45	265.75	265.61	266.46	263.10	265.44	263.20	265.04	-	264.57	265.45	264.76	265.89	263.14	265.73
23-Nov-12	269.13	268.45	267.63	267.57	267.20	262.89	263.31	266.32	267.01	267.66	263.70	266.52	263.84	267.02	267.97	266.41	268.48	268.00	267.50	264.23	267.35
30-Oct-13	268.84	269.29	267.98	267.97	267.41	264.20	262.68	266.50	267.06	267.62	263.77	266.58	263.93	267.15	268.45	266.60	268.65	268.39	267.20	264.27	267.36
10-Sep-14	268.37	268.24	266.51	266.31	266.19	261.87	261.84	265.81	266.23	267.00	263.60	266.14	263.73	265.23	-	264.98	266.00	265.16	266.47	263.44	266.14
14-May-15	268.84	268.81	267.60	267.80	267.02	263.01	262.73	266.55	267.03	267.41	263.83	266.49	263.96	266.52	268.67	266.11	268.26	267.30	267.33	266.47	267.03
18-Jun-15	268.58	268.52	267.44	267.09	266.67	262.87	262.41	266.55	266.69	267.31	263.69	266.33	263.90	266.49	268.11	266.07	267.08	267.21	267.35	266.36	266.66
30-Jul-15	268.79	268.72	267.50	267.46	266.76	262.29	262.33	266.45	266.75	267.04	263.62	266.32	263.81	266.81	267.79	265.69	267.54	266.52	267.53	266.34	266.76
27-Aug-15	268.69	268.22	267.00	266.96	266.38	261.97	261.92	266.55	266.39	266.57	263.59	266.20	263.79	266.12	*	265.29	266.61	265.55	267.29	266.19	266.37
21-Sep-15	268.24	268.45	267.36	267.05	266.46	262.67	262.33	266.48	266.45	267.18	263.64	266.22	263.80	266.16	*	265.55	266.31	266.14	267.36	266.33	266.44
15-Oct-15	268.25	268.53	267.08	266.96	266.37	262.10	261.92	266.40	266.37	266.57	263.55	266.12	263.74	266.15	*	265.15	265.13	266.49	267.35	266.13	266.36
16-Dec-15	269.05	269.01	267.99	267.86	267.22	264.04	263.19	266.66	267.21	267.58	263.82	266.55	263.93	267.61	268.30	266.58	268.12	268.44	267.49	266.85	267.21
10-May-16	266.74	269.07	267.69	267.78	267.00	263.03	262.76	266.56	267.02	267.36	263.74	266.49	263.95	267.07	268.61	266.19	268.42	267.54	267.44	266.65	266.99
28-Jun-16	268.15	268.73	266.90	266.94	266.37	261.97	262.04	266.39	266.40	266.52	263.46	266.12	263.68	266.43	267.47	265.39	266.83	265.69	267.14	265.16	266.36
19-Jul-16	267.84	268.61	266.42	266.61	266.12	262.01	261.96	265.94	266.17	266.43	263.40	266.01	263.59	266.01	267.28	265.22	266.34	265.47	266.52	263.50	266.11
12-Aug-16	-	268.49	265.97	266.23	265.79	261.88	261.83	265.62	265.83	266.17	262.94	265.39	263.13	265.18	267.23	264.77	265.98	265.02	266.19	262.80	265.78
24-Aug-16	267.84	268.43	266.25	266.09	265.98	262.17	262.01	265.80	266.04	266.73	263.33	265.82	263.51	265.77	*	265.11	265.87	265.59	266.14	263.37	265.98
21-Sep-16	267.84	268.37	265.98	265.86	265.90	262.08	261.92	265.68	265.97	266.22	263.19	265.40	263.35	265.68	*	264.66	265.55	264.75	266.10	262.73	265.89
31-Oct-16	267.79	268.27	265.95	265.60	265.91	262.07	261.85	265.82	265.96	266.75	263.27	265.45	263.42	265.62	*	264.47	265.32	264.63	266.03	263.18	265.90
23-Nov-16	267.97	268.28	266.10	265.61	265.99	262.01	261.81	265.71	266.06	266.35	263.22	265.32	263.34	265.57	*	264.43	265.23	264.61	266.01	262.60	265.98
16-Dec-16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	-	-	-	-	-
21-Dec-16	268.71	268.54	267.27	267.13	266.57	262.89	262.39	265.97	266.61	267.42	263.51	-	-	-	*	265.47	266.20	266.45	266.63	263.81	266.56
20-Apr-17	269.28	269.25	268.15	268.22	267.62	263.83	263.46	266.68	267.65	267.43	263.79	266.56	264.04	267.52	269.24	266.66	268.66	268.34	267.46	266.55	267.62
26-May-17	269.00	269.21	267.74	268.02	267.21	263.25	262.88	266.62	267.24	267.39	263.78	266.49	264.02	266.19	268.80	266.33	268.50	267.67	267.62	266.68	267.20
21-Jun-17	268.83	269.13	267.60	267.63	266.94	262.79	262.56	266.57	266.98	267.25	263.74	266.47	263.99	267.07	268.37	266.11	268.23	267.29	267.56	266.62	266.92
28-Jul-17	269.04	269.09	267.71	267.73	267.06	263.00	262.68	266.39	267.12	267.13	263.62	266.49	263.90	266.95	268.36	266.12	268.28	267.60	267.57	265.10	267.05
3-Aug-17	268.80	269.07	267.32	267.35	266.85	262.51	262.31	266.20	266.90	266.87	263.54	266.44	263.82	266.65	268.17	265.94	268.18	267.14	267.30	264.18	266.83
21-Aug-17	268.95	268.44	266.75	266.76	266.45	262.00	261.93	265.95	266.50	266.74	263.54	266.34	263.79	266.37	267.78	265.58	267.45	266.04	266.76	263.61	266.44
18-Sep-17	268.12	268.79	266.44	266.43	266.20	261.78	261.77	265.90	266.26	266.47	263.42	266.09	263.68	265.78	*	265.22	266.49	265.44	266.51	263.53	266.19
26-Oct-17	268.53	268.62	267.34	267.37	266.45	262.16	262.07	266.04	266.50	267.29	263.53	266.22	263.76	266.88	*	265.59	266.29	266.26	266.76	263.76	266.43
23-Nov-17	269.18	269.14	268.02	267.91	267.31	264.31	263.90	266.34	267.35	267.47	263.74	266.58	263.99	267.95	268.26	266.66	268.10	268.54	267.07	264.60	267.29
14-May-18	269.11	269.15	267.76	268.06	267.36	263.17	262.82	266.60	267.40	267.24	263.75	266.52	264.05	265.28	268.86	266.26	268.56	267.77	267.49	266.48	267.32
28-Jun-18	268.17	268.87	266.96	267.08	266.81	261.79	261.77	266.31	266.86	266.39	263.46	266.14	263.77	265.81	267.61	265.35	266.93	265.72	267.08	266.05	266.76
25-Jul-18	268.06	268.71	267.18	266.69	266.84	262.92	262.78	266.52	266.84	267.16	263.58	266.19	263.85	266.53	*	265.80	266.30	267.04	267.02	266.36	266.81
22-Aug-18	268.65	268.74	267.69	267.75	267.76	262.94	262.74	266.60	267.77	267.40	263.69	266.42	264.00	266.18	*	265.83	267.58	266.67	267.48	265.86	267.74
18-Sep-18	268.83	268.78	267.40	267.64	267.44	262.15	262.07	266.20	267.46	266.88	263.52	266.33	263.84	266.65	*	265.48	267.16	266.04	267.21	264.11	267.40
25-Oct-18	269.01	268.80	267.72	267.70	267.62	263.18	262.85	266.19	267.64	267.30	263.63	266.37	263.93	267.30	267.61	266.11	267.54	267.67	267.03	263.67	267.58
12-Nov-18	269.21	268.90	268.03	268.00	268.27	264.03	263.59	266.42	Frozen	267.37	263.75	266.59	264.05	267.32	268.51	266.60	268.22	268.44	267.14	264.55	268.24

Notes: mAMSL = metres above mean sea level
T/case = top of steel casing
T/PVC = top of PVC Riser Pipe
- = not measured
* = Dry

Table 1: Groundwater Elevations (mAMSL) Manual Measurements - 2012 - 2018

	WBA	WBB	WBC	WCA	WCB	WCC	WDA	WDB	WDC	WEA	WEB	WEC	WFA	WFB	WFC	WGA	WGB	WGC	WHA	WHB	WHC
T/case	272.81	272.81	272.81	271.47	271.47	271.47	268.04	268.04	268.04	270.19	270.19	270.19	271.56	271.56	271.56	264.20	264.20	264.20	268.96	268.96	268.96
T/PVC	272.78	272.72	272.69	271.44	271.44	271.44	268.02	268.00	268.00	270.15	270.14	270.13	271.55	271.55	271.53	264.15	264.17	264.16	269.04	269.06	269.07
1-Jun-12	265.43	263.09	266.59	264.91	266.49	266.48	264.44	265.68	266.53	267.21	266.55	266.56	264.40	261.03	259.35	261.34	262.23	260.29	266.47	264.36	266.77
21-Jun-12	265.37	262.81	266.37	264.65	266.40	266.26	264.31	265.40	266.31	266.98	266.32	266.31	264.36	260.70	259.03	261.29	262.13	260.08	266.40	264.14	266.51
27-Jul-12	265.08	262.63	265.90	264.23	266.26	265.78	263.76	264.77	265.81	266.56	265.84	265.83	263.96	260.24	258.58	260.84	261.97	259.74	266.17	264.06	266.03
23-Aug-12	265.18	262.57	265.69	264.31	266.17	265.64	263.71	263.57	265.69	266.45	265.72	265.72	263.91	260.12	258.51	260.87	261.83	259.62	265.84	264.60	265.86
23-Nov-12	265.58	263.34	266.88	265.08	265.81	267.17	265.35	265.86	267.13	267.96	267.16	267.17	265.13	261.55	260.05	261.85	261.64	261.01	266.16	263.95	267.40
30-Oct-13	266.12	263.38	267.29	265.01	265.15	267.31	265.92	265.86	267.34	268.30	267.38	267.38	265.26	261.40	259.76	261.96	261.87	261.09	266.30	264.20	267.59
10-Sep-14	265.53	262.47	266.08	262.32	264.74	266.06	264.33	265.05	266.13	267.18	266.15	266.17	264.27	258.57	260.29	261.21	261.92	259.95	266.34	264.70	266.38
14-May-15	266.78	266.72	267.14	266.66	265.20	266.92	265.16	265.76	266.96	267.69	266.98	266.99	264.72	261.43	259.55	261.76	262.16	260.62	266.45	264.52	267.20
18-Jun-15	266.82	266.69	266.55	266.72	265.30	266.62	264.89	265.45	266.97	267.37	266.19	266.29	264.74	260.60	258.75	261.84	262.11	260.59	266.41	264.49	266.85
30-Jul-15	266.69	266.69	266.76	267.41	265.47	266.70	264.72	265.36	266.70	267.48	266.72	266.73	264.51	260.77	258.81	261.34	262.03	260.31	266.42	264.48	266.95
27-Aug-15	266.60	266.54	266.36	266.65	265.54	266.35	264.50	265.26	266.65	267.30	266.61	266.39	264.16	260.30	258.30	261.33	261.94	260.03	266.37	264.44	266.56
21-Sep-15	266.76	266.64	266.37	266.70	265.63	266.42	265.02	265.02	266.40	267.25	266.41	266.42	264.59	260.33	258.41	261.60	261.86	260.31	266.32	264.43	266.63
15-Oct-15	266.41	266.44	266.51	266.54	265.67	266.34	264.31	264.89	266.31	266.98	266.33	266.34	264.18	260.28	258.30	261.32	261.78	260.02	266.29	264.41	266.57
16-Dec-15	267.03	267.05	267.12	266.94	265.83	267.12	265.67	265.72	267.16	268.03	267.18	267.19	265.03	261.35	259.47	262.00	261.81	260.78	266.37	264.38	267.42
10-May-16	266.84	266.90	267.05	266.87	266.17	266.90	265.18	265.62	266.93	267.70	266.95	266.95	264.75	261.53	259.61	261.69	262.33	260.80	266.56	264.75	267.18
28-Jun-16	266.25	265.00	266.37	264.91	266.23	266.25	264.30	264.83	266.31	266.78	266.32	266.33	264.18	260.35	258.32	261.29	262.27	260.09	266.42	264.61	266.56
19-Jul-16	265.55	262.72	266.11	262.48	266.14	266.00	264.15	264.57	266.07	266.58	266.08	266.08	264.10	260.12	258.10	261.32	262.17	260.01	266.32	264.54	266.31
12-Aug-16	265.19	262.00	265.78	261.84	265.88	265.69	263.77	264.27	265.73	266.47	265.74	265.75	264.01	259.90	257.95	260.86	262.04	259.76	266.08	264.46	265.99
24-Aug-16	265.35	262.63	265.80	262.40	265.76	265.88	264.08	264.40	265.93	266.70	265.94	265.95	264.14	260.00	258.20	261.36	261.97	260.04	266.00	264.46	266.19
21-Sep-16	265.24	261.88	265.86	261.47	265.48	265.80	263.83	264.30	265.85	266.56	265.85	265.87	263.92	259.93	257.95	261.03	261.82	259.75	265.73	264.42	266.10
31-Oct-16	265.19	262.49	265.76	262.41	265.13	265.80	264.13	264.26	265.85	266.68	265.86	265.87	263.94	259.88	257.94	261.08	261.62	259.67	265.35	264.38	266.11
23-Nov-16	265.21	261.71	265.94	261.36	264.93	265.88	264.10	264.35	265.93	266.74	265.94	265.96	263.82	260.01	258.03	261.17	261.54	259.58	265.40	264.36	266.20
16-Dec-16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21-Dec-16	265.71	262.94	266.41	262.50	264.78	266.44	264.77	264.94	266.46	267.59	266.53	266.52	265.02	260.65	258.85	261.65	261.50	260.21	265.49	264.35	266.77
20-Apr-17	266.98	266.64	267.77	267.53	265.03	266.50	265.82	266.17	267.58	268.06	267.58	267.58	265.19	261.84	259.94	261.95	262.09	261.24	266.54	263.97	267.80
26-May-17	266.89	266.90	267.42	266.86	265.31	267.13	265.31	265.83	267.16	267.70	267.17	267.17	264.98	261.81	259.88	261.94	262.20	261.01	267.46	263.96	267.37
21-Jun-17	266.83	266.84	266.96	266.83	265.51	266.85	265.19	265.44	266.89	267.53	266.90	266.90	264.77	261.44	259.47	261.78	262.24	260.74	266.91	263.92	267.12
28-Jul-17	266.36	264.58	267.10	264.12	265.68	266.95	265.25	265.54	266.99	267.67	267.01	267.01	264.85	261.50	259.58	261.46	262.23	260.75	266.68	263.83	267.25
3-Aug-17	265.94	263.36	266.93	262.72	265.64	266.74	265.02	265.33	266.80	267.43	266.82	266.81	264.65	261.32	259.29	261.32	262.20	260.48	266.65	263.76	267.03
21-Aug-17	265.73	262.69	266.48	262.13	265.44	266.34	264.64	264.85	266.40	267.06	266.41	266.41	264.42	260.72	258.62	261.27	262.17	260.06	266.57	263.74	266.64
18-Sep-17	265.60	262.70	266.16	262.28	265.26	266.11	264.32	264.57	266.16	266.73	266.16	266.17	264.17	260.23	258.20	261.23	262.05	259.91	266.43	263.63	266.39
26-Oct-17	265.79	262.87	266.26	262.34	265.06	266.35	264.95	264.79	266.40	267.38	266.42	266.41	264.60	260.36	258.50	261.38	261.90	260.20	266.28	263.72	266.65
23-Nov-17	266.26	263.68	267.02	262.90	264.89	267.21	265.74	265.69	267.24	268.05	267.28	267.27	265.44	261.23	259.43	261.96	261.88	261.02	266.32	263.92	267.50
14-May-18	266.83	266.51	267.55	266.37	265.21	267.29	265.53	265.89	267.32	267.72	267.35	267.33	264.95	264.58	259.90	261.77	262.31	260.82	266.61	263.99	267.52
28-Jun-18	266.42	266.24	266.86	266.31	265.49	266.72	264.31	265.07	266.76	266.66	266.77	266.78	264.17	260.64	258.43	261.25	262.23	259.93	266.43	263.70	266.99
25-Jul-18	266.62	266.46	266.43	266.42	265.74	266.73	265.12	264.85	266.77	267.01	266.81	266.79	264.48	260.45	258.48	261.68	262.10	259.96	266.29	263.81	267.03
22-Aug-18	266.73	265.60	267.70	265.31	265.82	267.67	265.23	266.11	267.71	267.43	267.74	267.68	264.83	261.38	259.06	261.62	261.99	260.31	266.36	263.93	267.95
18-Sep-18	266.08	263.28	267.51	262.65	265.71	267.34	265.06	265.76	267.39	267.37	267.39	267.40	264.59	261.37	259.18	261.30	261.92	260.15	266.39	263.78	267.62
25-Oct-18	266.14	262.64	267.57	261.58	264.92	267.53	265.24	265.84	267.57	267.70	267.58	267.59	264.93	261.40	259.45	261.74	261.85	260.69	266.38	263.87	267.81
12-Nov-18	266.32	263.60	268.15	262.77	264.77	268.18	265.83	266.48	267.95	267.97	268.23	268.24	265.14	261.77	259.83	261.94	261.86	260.96	266.40	263.99	268.46

Notes: mAMSL = metres above mean sea level
T/case = top of steel casing
T/PVC = top of PVC Riser Pipe
- = not measured
* = Dry

Table 1: Groundwater Elevations (mAMSL) Manual Measurements - 2012 - 2018

	WIA	WIB	WIC	SG1	MW1	MW2A	MW2B	MW2C	MW3	MW4	W2	W3	W4
T/case	273.92	273.92	273.92	No Casing	270.88	272.96	272.96	272.96	274.27	274.12	N/A	265.69	270.26
T/PVC	273.85	273.88	273.87	268.97	No PVC	272.90	272.85	272.90	No PVC	No PVC	271.35	265.46	270.11
1-Jun-12	265.63	263.49	266.58	-	-	-	-	-	-	-	-	-	-
21-Jun-12	265.38	263.46	266.38	-	-	-	-	-	-	-	-	-	-
27-Jul-12	264.78	263.10	265.83	-	-	-	-	-	-	-	-	-	-
23-Aug-12	264.31	263.06	265.76	-	-	-	-	-	-	-	-	-	-
23-Nov-12	266.28	263.65	267.20	-	-	-	-	-	-	-	-	-	-
30-Oct-13	266.29	263.70	267.41	-	-	-	-	-	-	-	-	-	-
10-Sep-14	264.73	263.53	266.20	-	-	-	-	-	-	-	-	-	-
14-May-15	265.42	263.76	267.06	-	-	-	-	-	-	-	-	-	-
18-Jun-15	265.23	263.70	266.69	-	-	-	-	-	-	-	-	-	-
30-Jul-15	265.41	263.62	266.79	-	-	-	-	-	-	-	-	-	-
27-Aug-15	265.00	263.59	266.39	-	-	-	-	-	-	-	-	-	-
21-Sep-15	265.05	263.62	266.48	-	-	-	-	-	-	-	-	-	-
15-Oct-15	264.94	263.54	266.39	-	-	-	-	-	-	-	-	-	-
16-Dec-15	265.86	263.83	267.24	-	-	-	-	-	-	-	-	-	-
10-May-16	265.40	263.76	267.01	-	-	-	-	-	-	-	-	-	-
28-Jun-16	264.77	263.47	266.38	-	-	-	-	-	-	-	-	-	-
19-Jul-16	264.16	263.39	266.15	260.96	-	-	-	-	-	-	-	-	-
12-Aug-16	263.20	262.95	265.81	260.54	-	-	-	-	-	-	-	-	-
24-Aug-16	263.86	263.32	266.00	261.25	-	-	-	-	-	-	-	-	-
21-Sep-16	263.67	263.19	265.92	260.04	-	-	-	-	-	-	-	-	-
31-Oct-16	263.64	263.26	265.92	261.41	-	-	-	-	-	-	-	-	-
23-Nov-16	263.63	263.19	266.01	259.33	-	-	-	-	-	-	-	-	-
16-Dec-16	-	-	-	260.59	-	-	-	-	-	-	-	-	-
21-Dec-16	-	-	-	261.51	-	-	-	-	-	-	-	-	-
20-Apr-17	265.64	263.83	267.65	266.40	-	-	-	-	-	-	-	-	-
26-May-17	265.03	263.82	267.24	266.85	-	-	-	-	-	-	-	-	-
21-Jun-17	265.24	263.79	266.98	266.81	-	-	-	-	-	-	-	-	-
28-Jul-17	265.21	263.80	267.08	263.44	-	-	-	-	-	-	-	-	-
3-Aug-17	264.96	263.60	266.87	261.66	-	-	-	-	-	-	-	-	-
21-Aug-17	264.71	263.58	266.48	260.97	-	-	-	-	-	-	-	-	-
18-Sep-17	264.07	263.46	266.23	261.27	-	-	-	-	-	-	-	-	-
26-Oct-17	265.24	263.56	266.48	261.29	-	-	-	-	-	-	269.77	262.25	-
23-Nov-17	265.95	263.78	267.34	261.88	-	-	-	-	-	-	270.48	265.19	-
14-May-18	264.67	263.86	267.39	266.34	267.20	-	267.22	-	-	-	269.94	263.92	-
28-Jun-18	264.14	263.58	266.85	266.32	266.37	-	266.55	-	266.90	266.89	269.73	261.58	-
25-Jul-18	264.71	263.70	266.87	266.43	266.95	-	266.94	-	267.21	266.90	270.29	263.13	265.65
22-Aug-18	265.02	263.81	267.81	265.05	266.82	-	266.98	-	268.14	267.90	270.41	263.26	265.46
18-Sep-18	265.05	263.64	267.46	261.78	265.61	267.35	265.59	265.62	267.70	267.54	269.75	262.36	265.56
25-Oct-18	265.37	263.73	267.65	260.17	265.51	267.46	265.61	252.24	267.97	267.79	269.96	264.06	265.84
12-Nov-18	265.50	263.86	268.51	261.88	266.24	267.63	266.32	252.92	268.66	268.48	270.39	265.33	265.93

Notes: mAMSL = metres above mean sea level
T/case = top of steel casing
T/PVC = top of PVC Riser Pipe
- = not measured
* = Dry

Table 2: 2018 Daily Pumping Log

Date	Time	Discharge Rate (L/min)	Cumulative Discharge (L)	Daily (L)	Staff Gauge (m)	Notes
7-Aug-18	14:00	1960	27,009,900		2.47	Install & Start
8-Aug-18	16:15	1733	29,777,900	2,768,000		
9-Aug-18				4,331,500		No Readings
10-Aug-18	12:30	1784	34,109,400	2,376,100	2.71	
11-Aug-18	16:00	1776	36,946,500	2,837,100		
12-Aug-18	16:30	1762	39,635,500	2,689,000		
13-Aug-18	14:00	1736	41,872,900	2,237,400		
14-Aug-18	15:35	1728	44,549,600	2,676,200	3.27	
15-Aug-18	16:10	1736	47,084,000	2,534,440		
16-Aug-18	15:30	1741	49,490,400	2,507,040	3.50	
17-Aug-18	16:00		51,301,200	1,810,800		No Hydro
18-Aug-18						No Hydro (Fuse)
19-Aug-18	16:30	2141	51,352,400	1,862,000		Fixed
20-Aug-18	15:30	2058	54,182,600	2,830,200	3.70	
21-Aug-18	16:10	1962	57,148,200	2,965,600		
22-Aug-18	15:35	1973	59,661,200	2,513,000		
23-Aug-18	15:50	1999	62,773,300	3,112,100		
24-Aug-18	15:00	1875	65,521,500	2,748,200	4.27	
25-Aug-18	15:10	1864	68,136,000	2,614,500		
26-Aug-18	15:20	1866	70,938,000	2,802,000		
27-Aug-18	15:30	1912	73,655,500	2,717,500	4.69	
28-Aug-18	16:10	1813	76,394,400	2,738,900		
29-Aug-18	16:00	1813	78,586,500	2,192,100		
30-Aug-18	15:00	1845	81,522,700	2,936,200	5.50	
31-Aug-18	15:45	1834	84,241,000	2,718,300		
1-Sep-18	16:20	1850	86,967,500	2,726,500		
2-Sep-18	16:00	1818	89,577,100	2,609,600		
3-Sep-18	15:30	1765	92,054,900	2,477,800		
4-Sep-18	15:45	1704	94,609,900	2,555,000		
5-Sep-18	15:55	1693	97,098,800	2,485,900		
6-Sep-18	15:15	1683	99,468,300	2,369,500		
7-Sep-18	14:30	1690	1,901,900	2,332,200		
8-Sep-18	15:30	1656	2,384,600	2,484,000		
9-Sep-18						No Records
10-Sep-18	10:00	1666	5,820,700	2,399,040		
11-Sep-18	10:15	1670	9,156,000	2,404,800	6.64	
12-Sep-18	10:00	1685	11,520,800	2,364,800		
13-Sep-18	9:55	1635	13,528,000	2,007,200		
14-Sep-18	10:00	1626	16,306,600	2,778,600		
15-Sep-18	10:15	1578	18,646,000	2,339,400		
16-Sep-18	10:15		18,665,600	19,600		No Hydro
17-Sep-18	16:00	1970	19,331,300	1,665,700	7.06	No Hydro (Fixed at 14:00)
18-Sep-18	16:00	1874	22,041,300	2,710,000		Blown Fuse (Running Today Ok)
19-Sep-18	15:45	1664	24,554,500	2,513,200		
20-Sep-18	15:40	1589	26,826,400	2,271,900		
21-Sep-18		1720	29,288,500	2,462,100		
22-Sep-18	17:00	1658	30,555,400	1,266,900		Hydro Off for a few hours (Fixed 13:00)
23-Sep-18	16:00	1592	32,739,900	2,184,500		
24-Sep-18	16:00	1557	34,480,200	1,740,300		Hydro Off from 8:00 - 13:15
25-Sep-18	13:50	1949	36,143,300	1,976,200	8.65	Hydro Off - Back on 8:00 - Shut Down at 13:00 for Clean Out Started Backup at 13:50
	16:00	1904	36,419,500			
26-Sep-18	16:30	643	37,224,700	805,200	8.52	No Power from 16:00 on 25th - 7:00 on 26th Shut Down at 14:00 Changed Pump
27-Sep-18	15:30	674	38,129,100	904,400		Maintain Constant
28-Sep-18	14:00	653	39,052,000	922,900		Dry Quarry Floor
29-Sep-18	14:45	655	40,019,200	1,000,000	8.76	
30-Sep-18	16:00	658	41,018,000	998,800		
1-Oct-18	15:45	632	41,929,800	909,800		Tape caught on rocks
2-Oct-18	15:40	610	42,798,600	870,800		No Reading
3-Oct-18	16:00	578	43,694,500	895,900		No Tape Reading
4-Oct-18	16:00	564	44,512,200	817,700		
5-Oct-18	16:20	560	45,325,100	812,900		
6-Oct-18	13:00	550	45,963,500	638,400		Rain All Day
7-Oct-18	13:00	559	46,609,300	645,800		
8-Oct-18	14:30	575	47,018,500	409,200		Power Blip
9-Oct-18	16:20	557	48,040,500	1,022,000		
10-Oct-18	16:00	555	48,931,500	891,000		
11-Oct-18	13:30	546	49,558,400	626,900		
12-Oct-18	15:00	554	50,837,200	1,278,800		
13-Oct-18	16:10	509	51,774,400	937,200		
14-Oct-18	15:30	514	52,448,200	673,800		
15-Oct-18	15:30	538	53,187,800	739,600	8.79	Cleaned Screen
16-Oct-18	14:30	546	53,742,000	554,200		
17-Oct-18	16:30	548	54,661,700	919,700		
18-Oct-18	14:15	546	54,484,300	822,600	8.58	
19-Oct-18	15:55	554	56,340,000	855,700		
20-Oct-18	16:00	559	57,136,700	796,700		
21-Oct-18	15:00	557	57,802,800	666,100		
22-Oct-18	16:30	509	58,744,000	941,200		
23-Oct-18	15:30	511	59,231,200	487,200		
24-Oct-18	17:10	671	60,215,600	984,400		
25-Oct-18	15:45	661	61,119,500	903,900		
26-Oct-18	15:30	658	62,037,300	917,800		
27-Oct-18	17:00	650	63,042,800	1,005,500		
28-Oct-18	16:08	640	63,965,300	922,500		
29-Oct-18	15:00	623	64,829,900	864,600		
30-Oct-18	15:30	612	65,748,900	919,000	9.00	
31-Oct-18	12:15	608	66,511,500	762,600	8.82	Stopped Pumping - Shut Off Hydro

Table 3: Drawdown Comparison - Average vs. Estimated

Well ID	BH1A	BH2A	BH3A	BH4A	BH5A	OH1A	OH2A	OWA	W9	W21	W22	WAB	WBB	WCA	WDA	WEA	WFA	WGA	WHA	WIA
Average Pre-Pumping Groundwater Elevation*	268.45	267.58	262.97	266.55	266.22	267.17	266.40	266.50	266.10	267.94	267.34	266.48	266.64	266.74	265.20	267.48	264.75	261.72	266.68	264.97
Average Pumping Groundwater Elevation*	268.32	266.63	262.16	265.92	265.37	266.68	265.93	266.12	265.21	266.45	265.72	263.42	262.58	262.14	264.44	266.95	264.27	261.25	266.13	264.29
Average Drawdown (2016-2018)	0.13	0.95	0.80	0.63	0.85	0.49	0.48	0.38	0.88	1.49	1.62	3.06	4.06	4.60	0.77	0.53	0.48	0.47	0.56	0.68
Estimated Drawdown	0.18	0.94	0.78	3.95	0.70	0.30	0.33	0.78	0.78	0.84	0.99	2.61	4.23	5.42	1.95	1.36	0.72	0.15	0.03	0.72
Diff. Average vs Estimated Drawdown	-0.04	0.00	0.02	-3.32	0.15	0.19	0.15	-0.41	0.11	0.65	0.63	0.45	-0.17	-0.82	-1.19	-0.83	-0.24	0.32	0.52	-0.04

Notes:

* Data measured in 2016-2018

Table 4: Summary of Aquifer Test Results

Drawdown v. Time (Cooper & Jacob)	Transmissivity (m²/day)	Storage Coefficient	Hydraulic Conductivity (m/day)
WAB	3.37E+01	2.87E-03	2.22
WBB	2.45E+01	6.96E-03	1.62
WCA	2.06E+01	1.50E-02	1.36
MW1	3.78E+01	3.21E-03	2.49
MW3	5.91E+01	1.61E-03	3.91
MW4	7.41E+01	2.09E-03	4.9
Distance v. Drawdown (Cooper & Jacob)			
2-Oct-18	4.63E+01	3.27E-03	3.06
Geomean (All)	3.87E+01	3.76E-03	2.56

Table 5: Estimated Drawdown Full Extraction - Current Extent (2018)

Monitoring Location	Drawdown (m)
MW1	4.05
MW3	2.95
MW4	2.70
SG1	11.34
WAB	5.15
WBB	8.00
WCA	9.00

Table 6: Water Monitoring Program

Item	Station	Type of Monitoring	Number of Events												
			Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	
Groundwater Monitors	WAA,WAB,WAC,WBA, WBB, WBC, WCA, WCB, WCC, WDA, WDB, WDC, WEA, WEB, WEC, WFA, WFB, WFC, WGA, WGB, WGC, WHA, WHB, WHC, WIA, WIB, WIC, BH1A, BH1C, BH2A, BH2B, BH2C,BH3A, BH3C, BH4A, BH4C,BH5A, BH5C, W21, W22, OWA, OH1A, OH1B OH2A, OH2B, SG1, MW1, MW2A, MW2B, MW2C, MW3, MW4	Water Level	1*	1*	1*	1	1	1	1	1	1	1	1	1	1*
Domestic Wells	W2, W3, W4	Water Level				1	1	1	1	1	1	1	1	1	

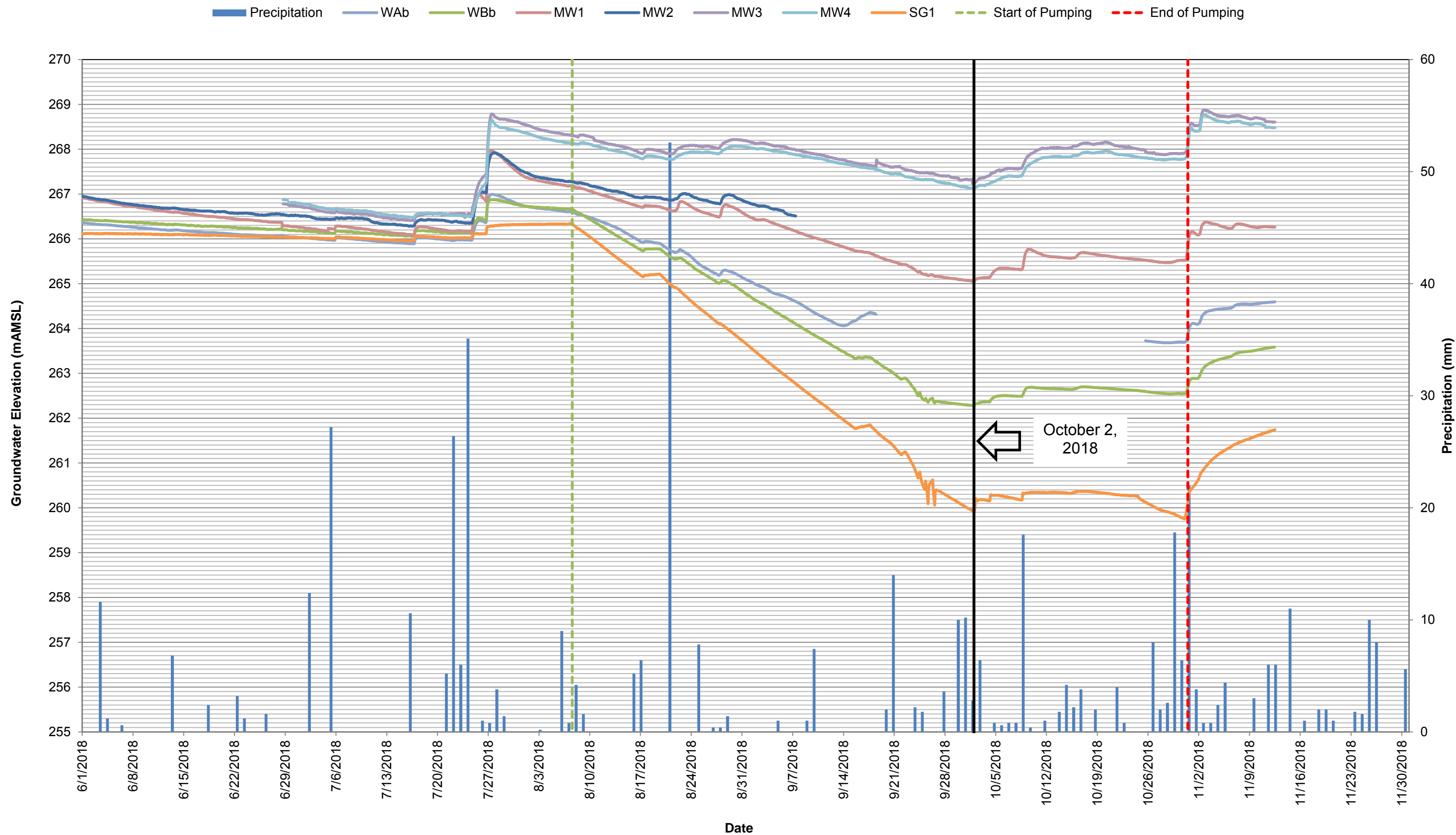
*During the months of December to March when pumping occurs water levels will be gathered only from SG1, BH3A, BH3C WFA, WFB, WFC, BH1A, BH1C, MW3 & MW4.



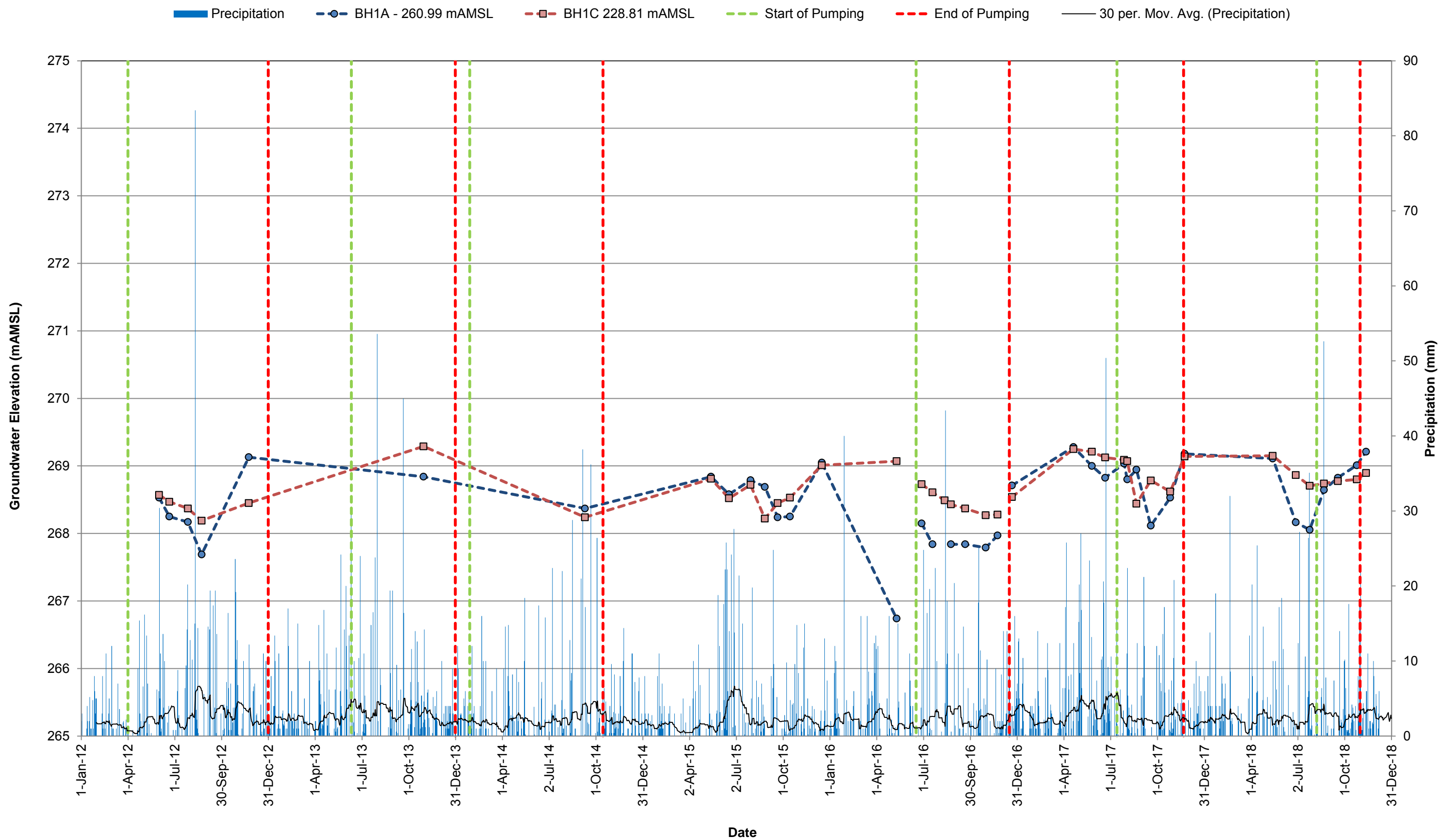
HYDROGRAPHS

Drawing on experience...Building on strength.

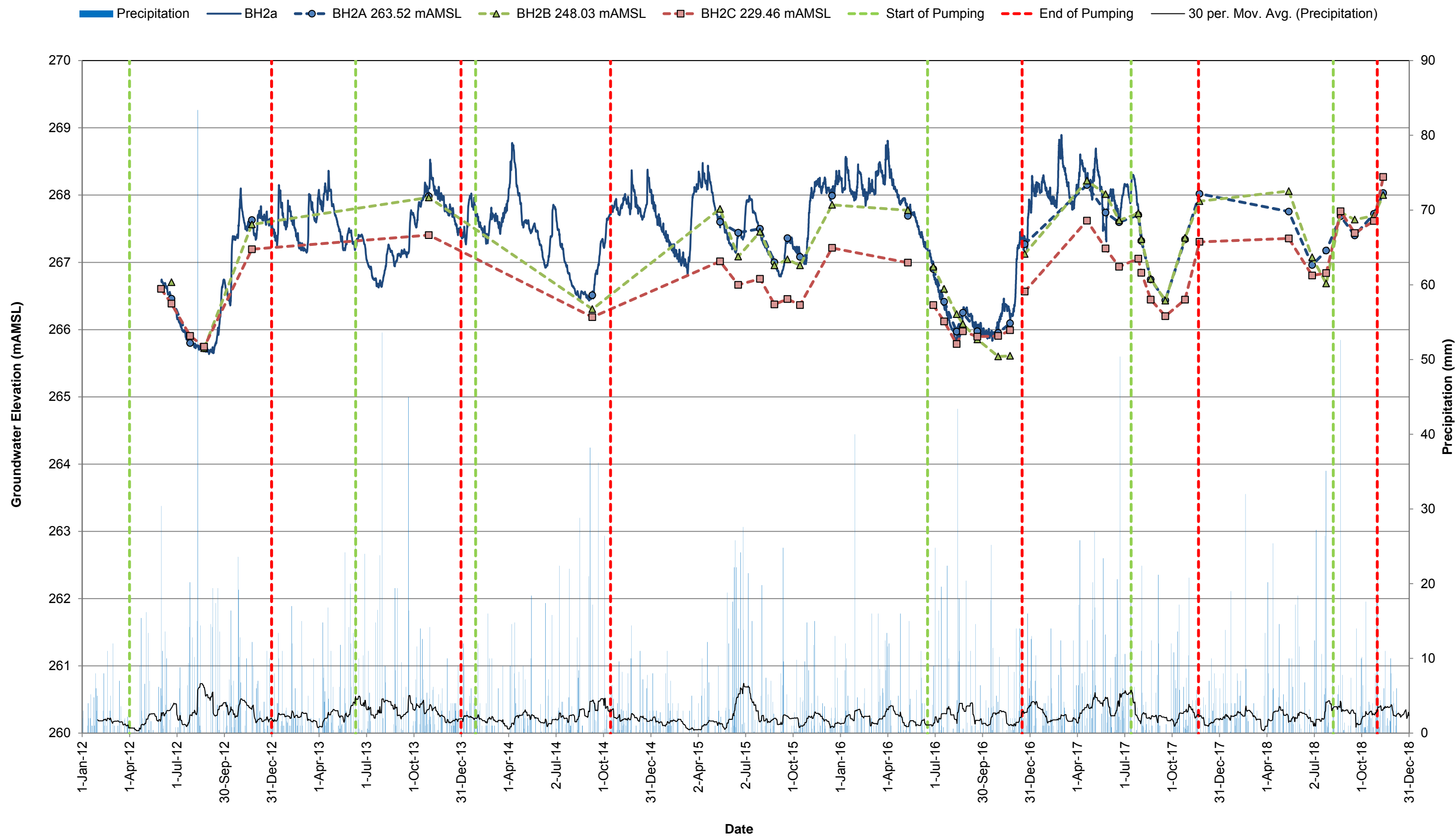
Hydrograph 1: Groundwater Elevations (mAMSL) - Carden Quarry - 2018



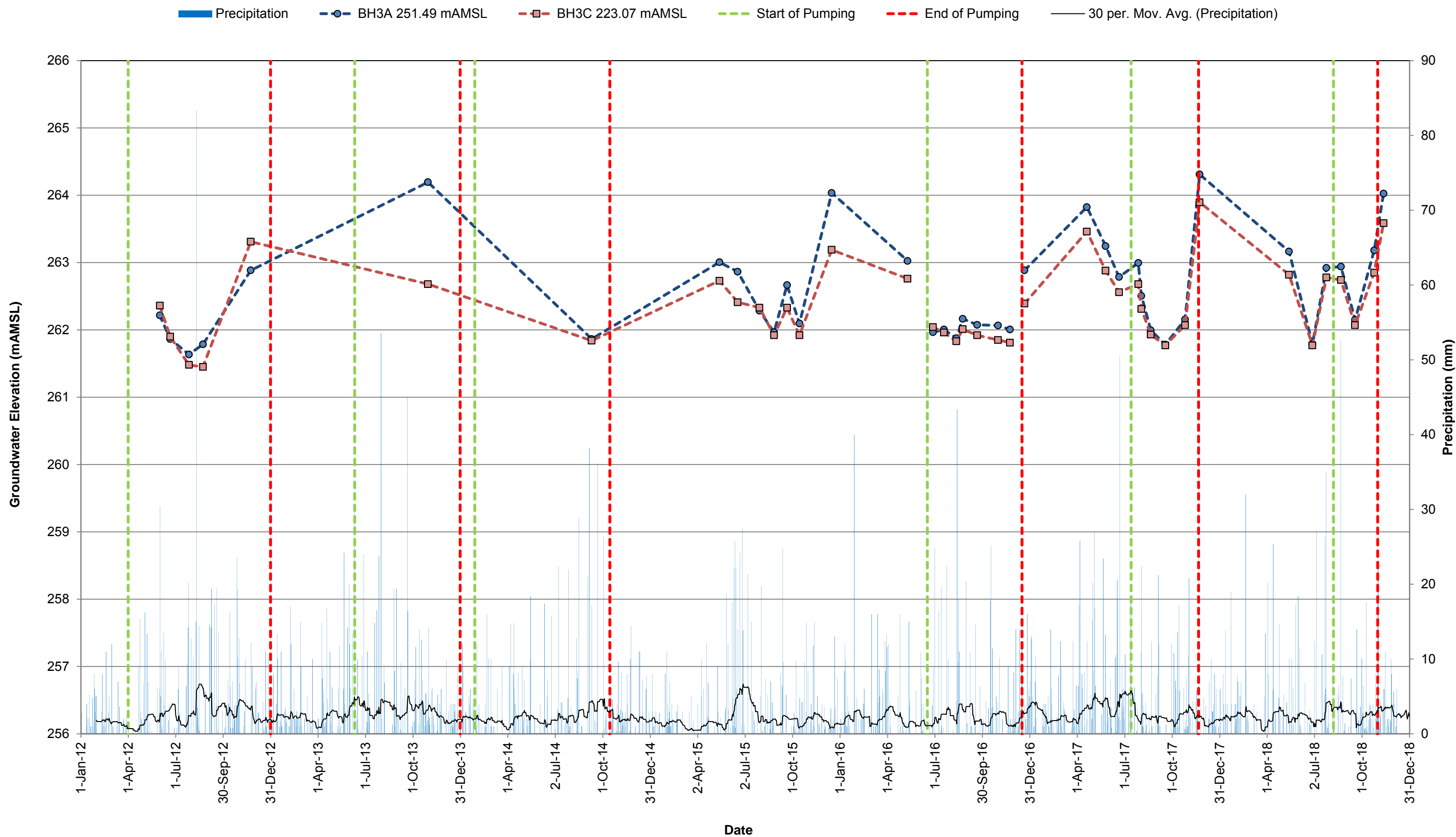
Hydrograph 2: Groundwater Elevations (mAMSL) - BH1 - Carden Quarry - 2012 - 2018



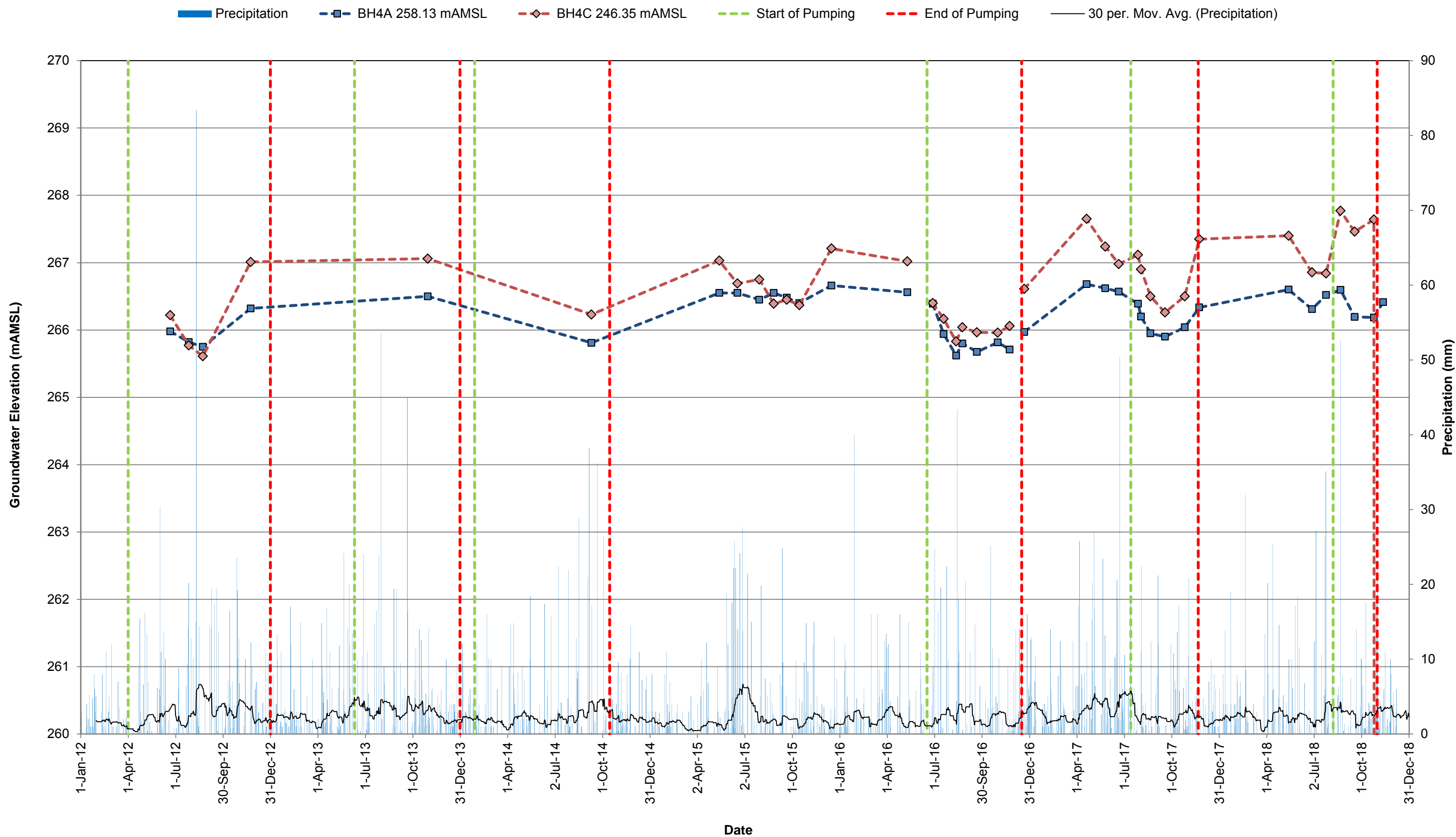
Hydrograph 3: Groundwater Elevations (mAMSL) - BH2 - Carden Quarry - 2012 - 2018



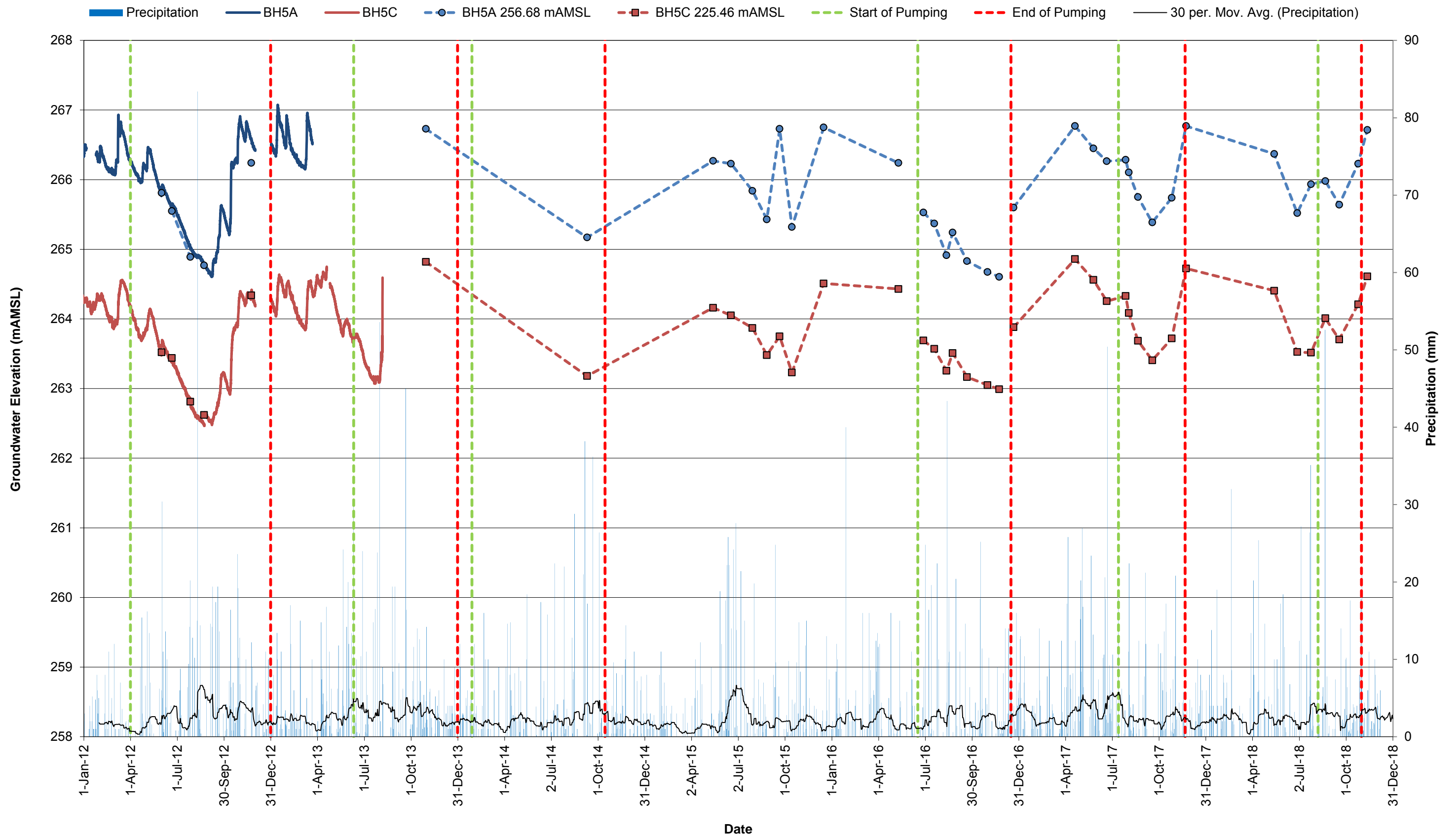
Hydrograph 4: Groundwater Elevations (mAMS�) - BH3 - Carden Quarry - 2012 -2018



Hydrograph 5: Groundwater Elevations (mAMSL) - BH4 - Carden Quarry - 2012- 2018

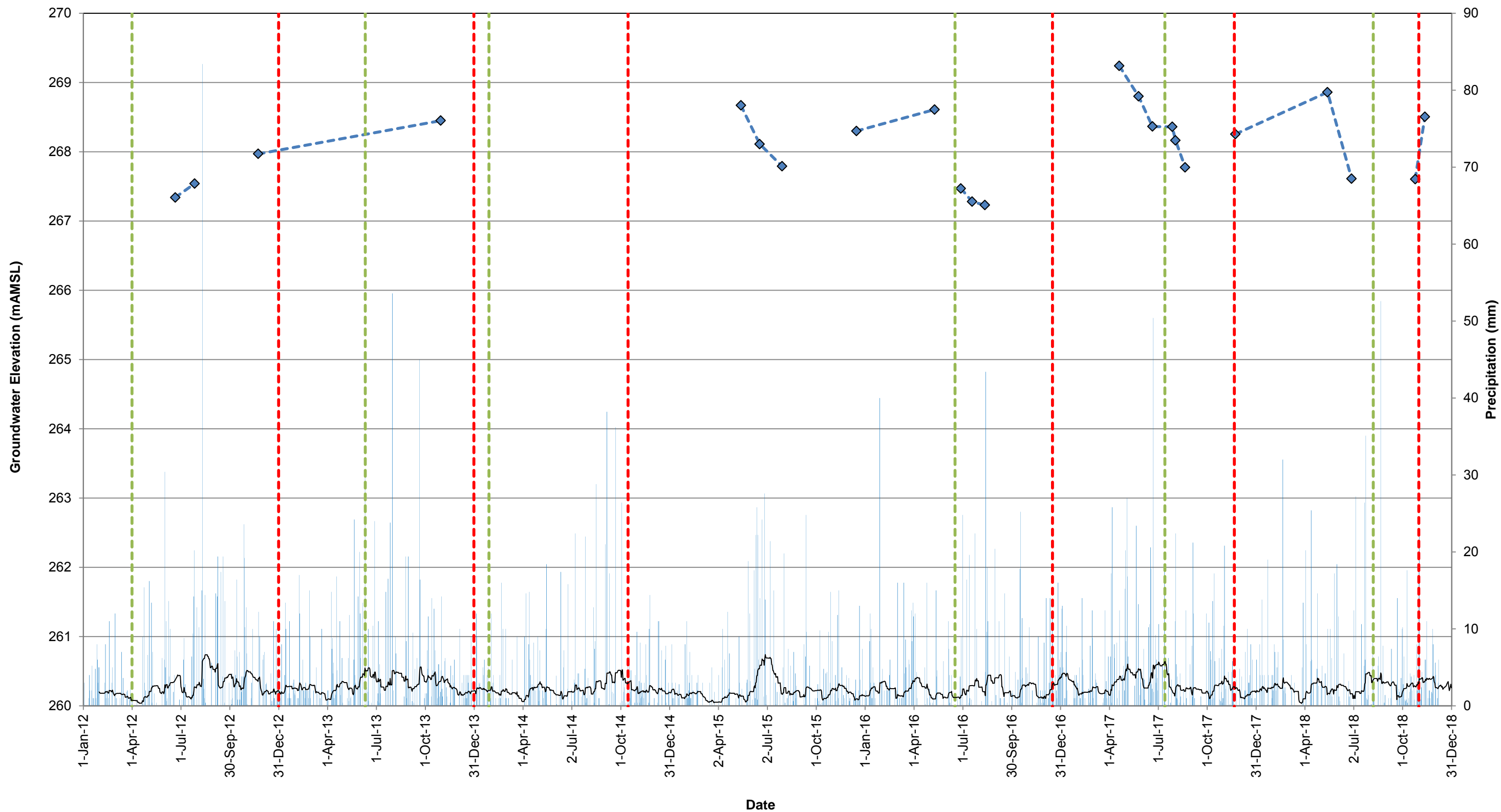


Hydrograph 6: Groundwater Elevations (mAMSL) - BH5 - Carden Quarry - 2012 - 2018



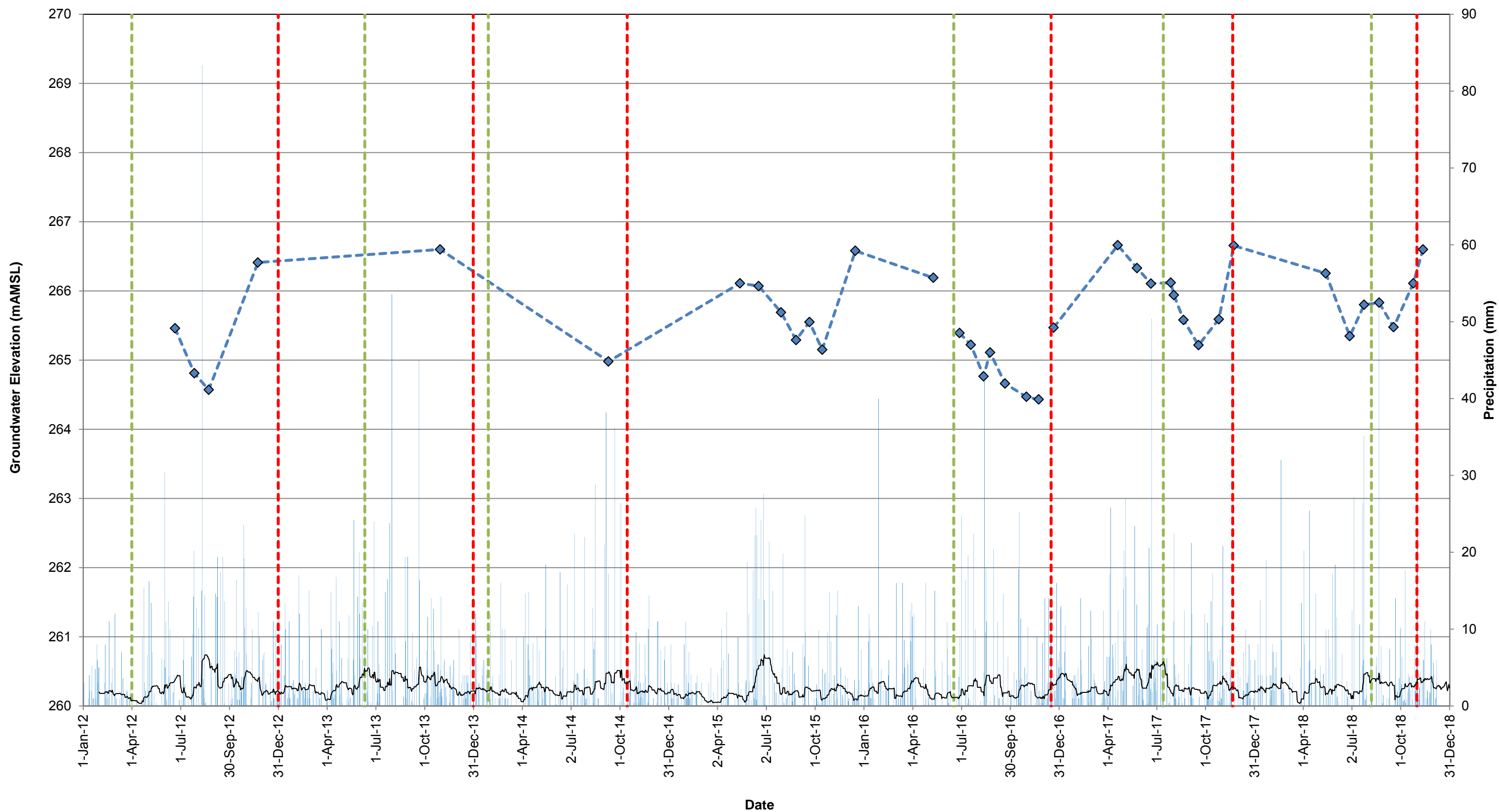
Hydrograph 7: Groundwater Elevations (mAMSL) -W8- Carden Quarry - 2012 - 2018

■ Precipitation
 ◆ W8 263.64 mAMSL
 - - - Start of Pumping
 - - - End of Pumping
 — 30 per. Mov. Avg. (Precipitation)

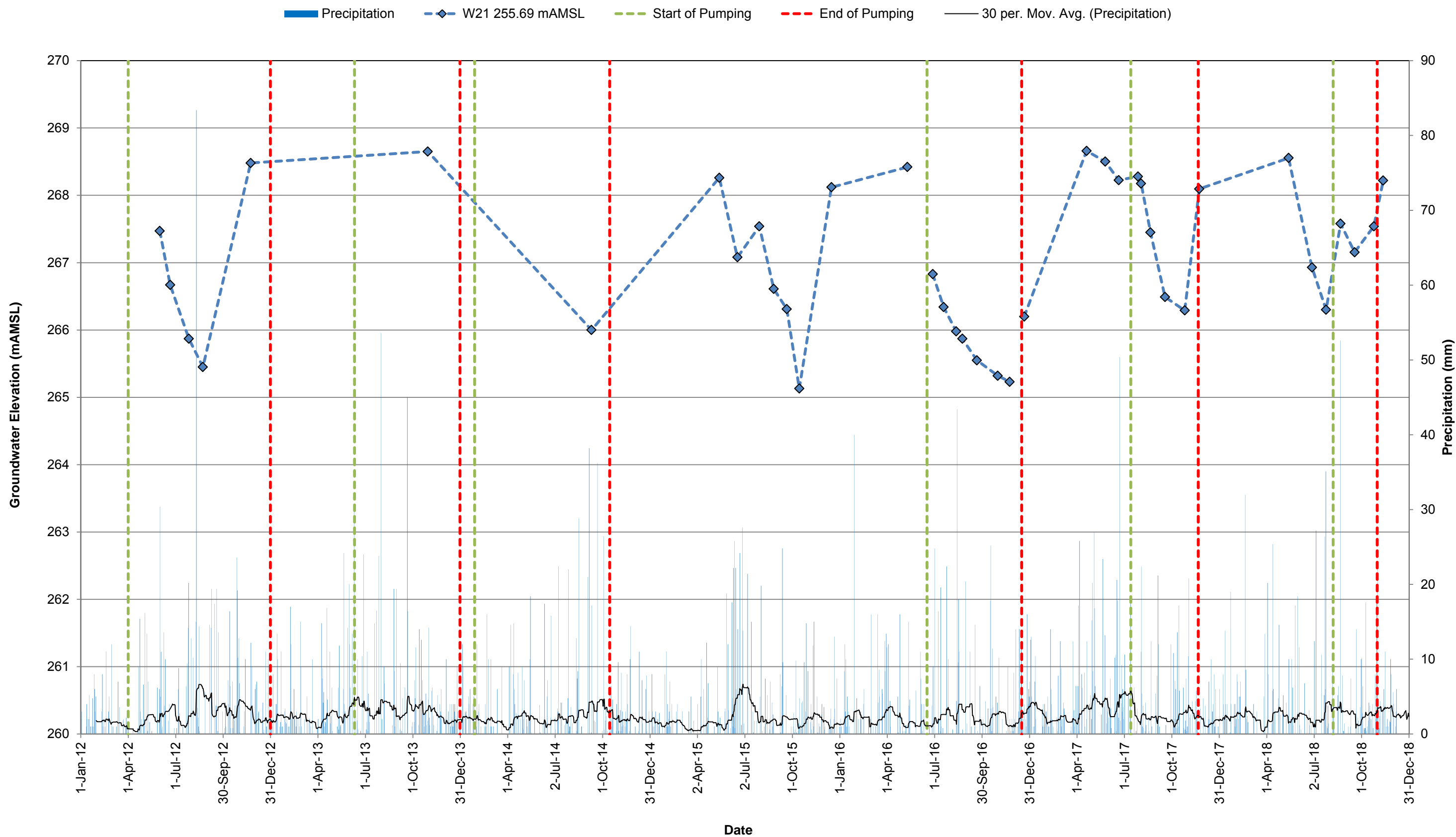


Hydrograph 8: Groundwater Elevations (mAMS�) - W9 - Carden Quarry - 2012 - 2018

■ Precipitation
 —◆— W9 257.27 mAMS�
 - - - Start of Pumping
 - - - End of Pumping
 — 30 per. Mov. Avg. (Precipitation)

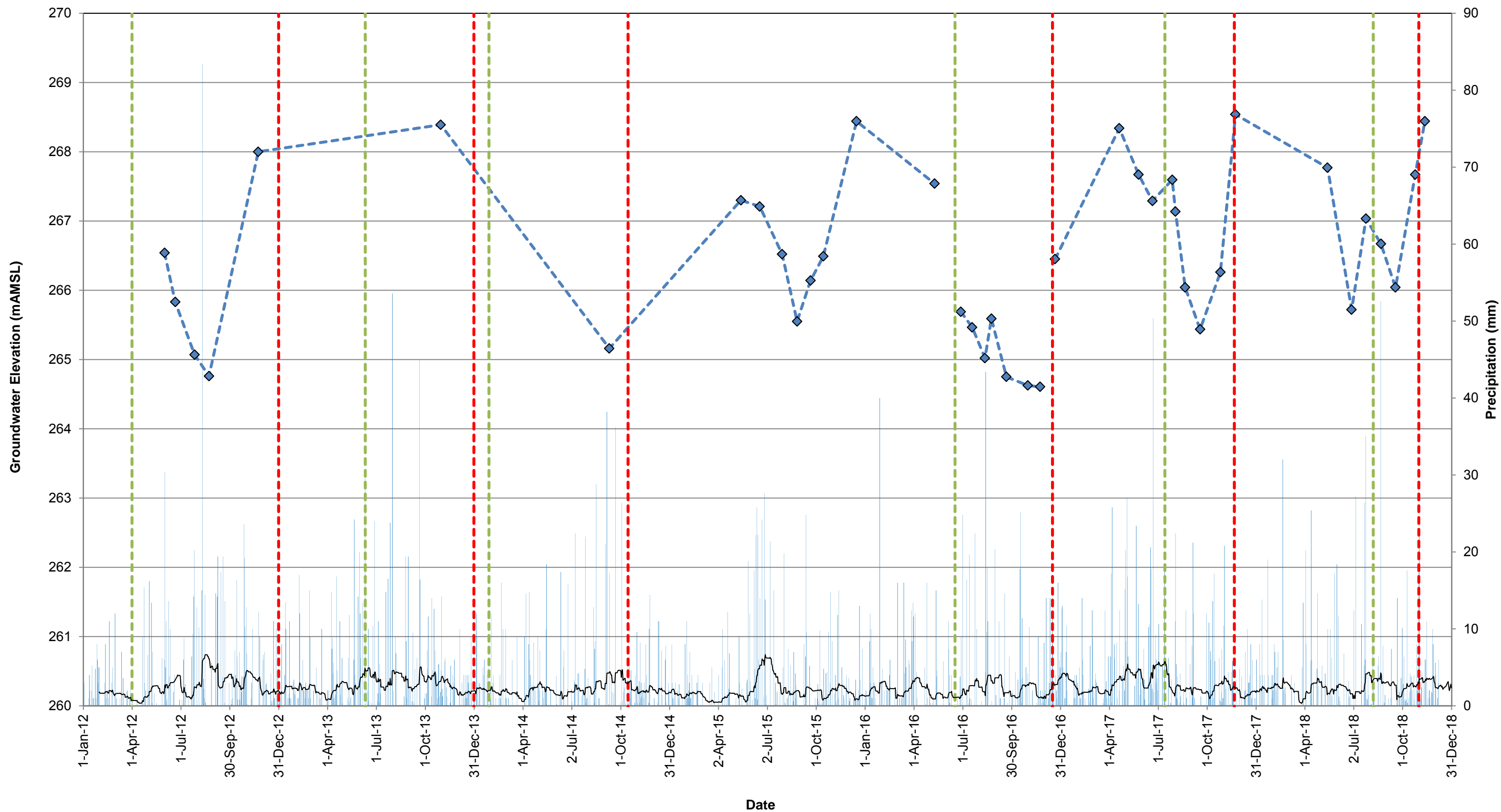


Hydrograph 9: Groundwater Elevations (mAMSL) -W21 - Carden Quarry - 2012 - 2018

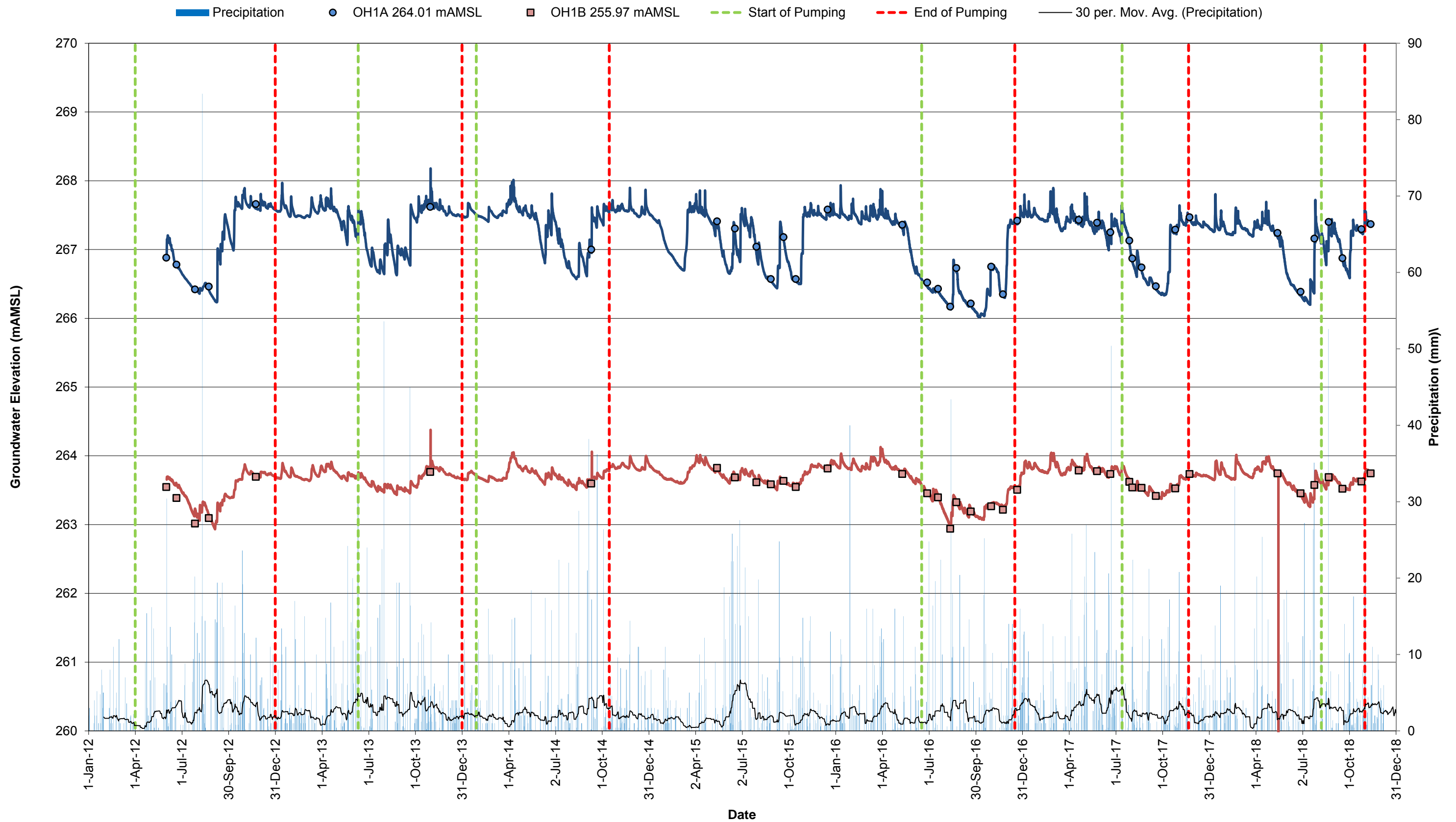


Hydrograph 10: Groundwater Elevations (mAMSL) -W22 - Carden Quarry - 2012 -2018

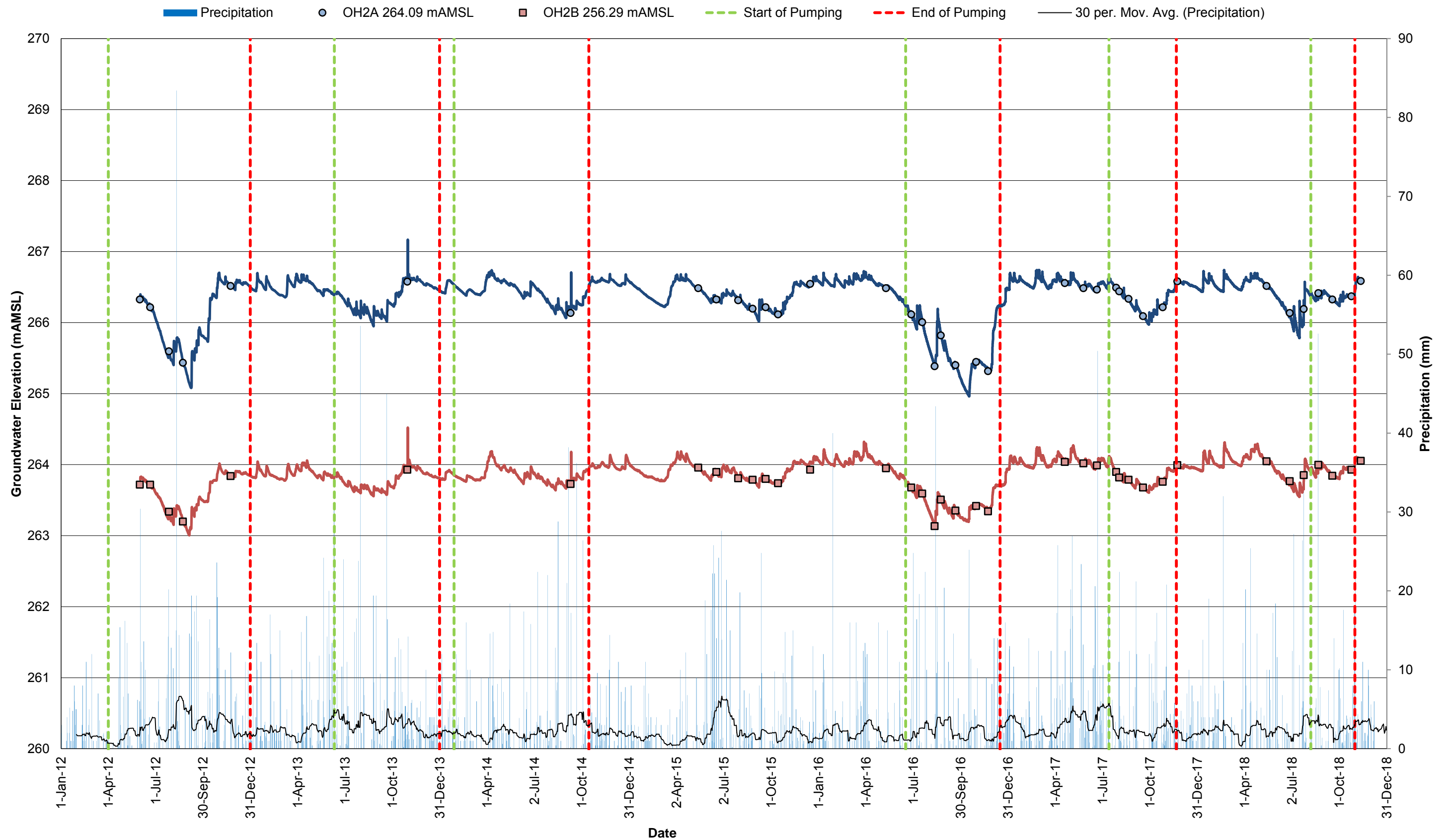
■ Precipitation
 ◆ W22 228.56 mAMSL
 - - - Start of Pumping
 - - - End of Pumping
 — 30 per. Mov. Avg. (Precipitation)



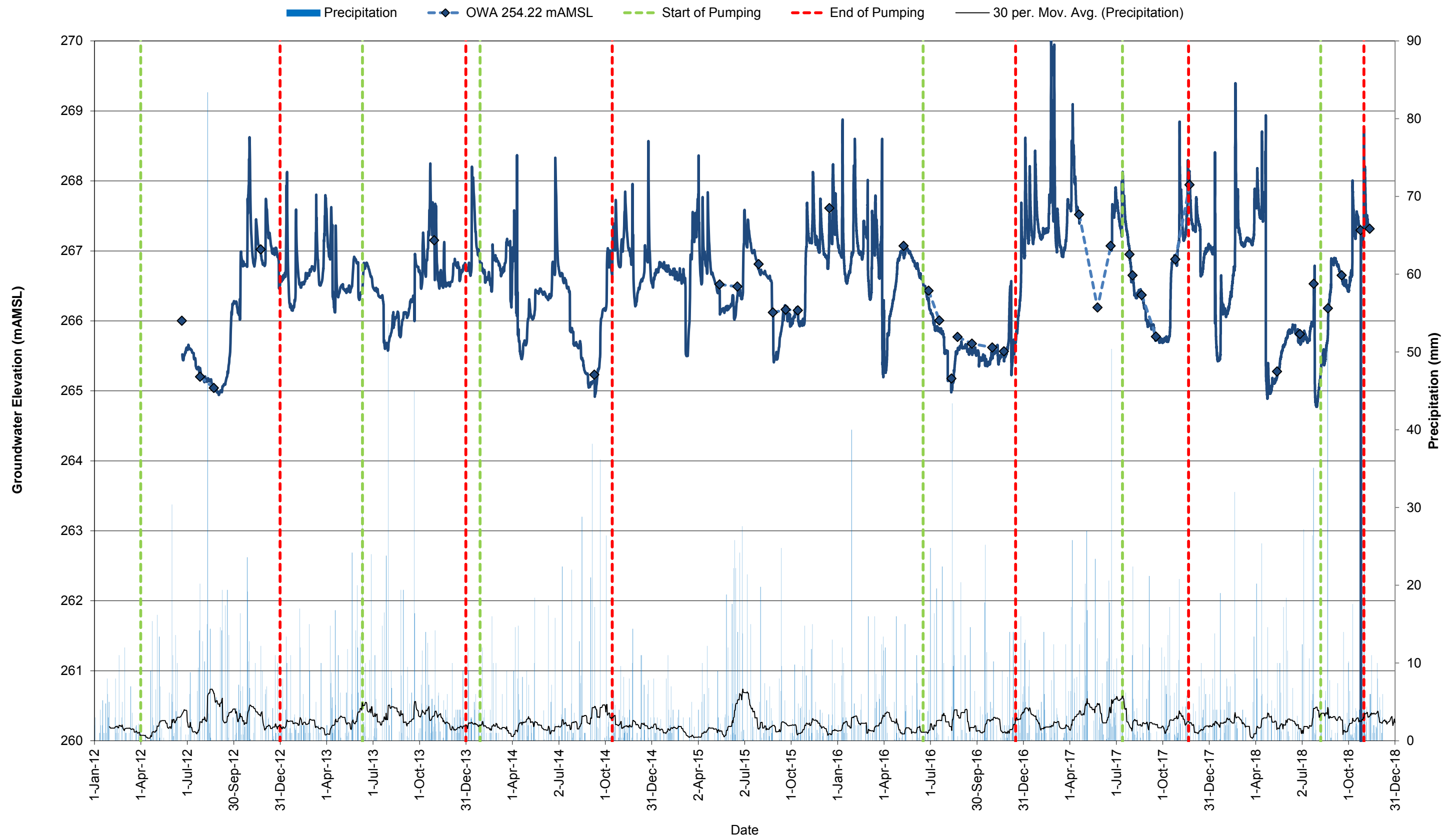
Hydrograph 11: Groundwater Elevations (mAMSL) - OH1 - Carden Quarry - 2012- 2018



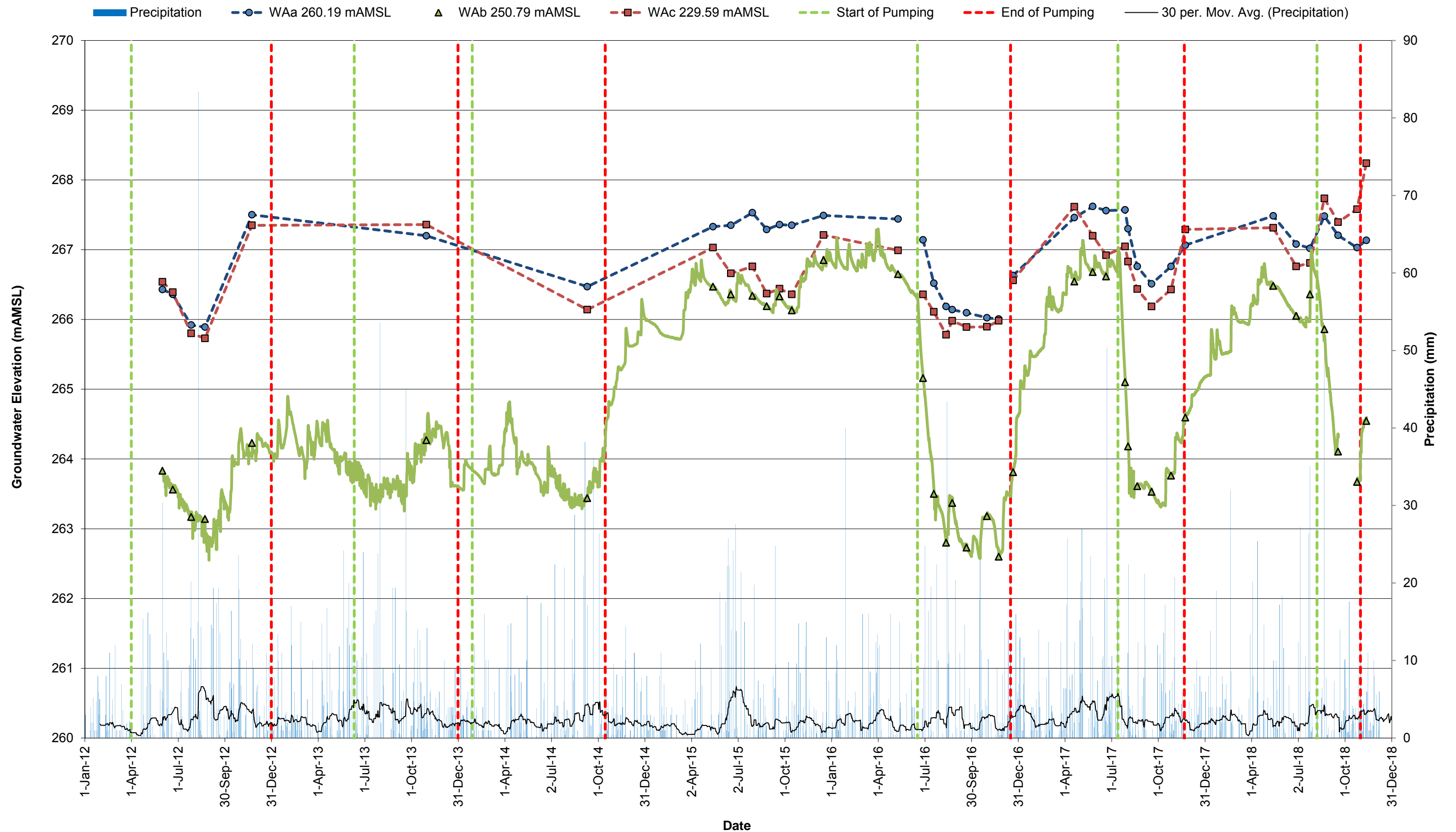
Hydrograph 12: Groundwater Elevations (mAMS�) - OH2 - Carden Quarry - 2012- 2018



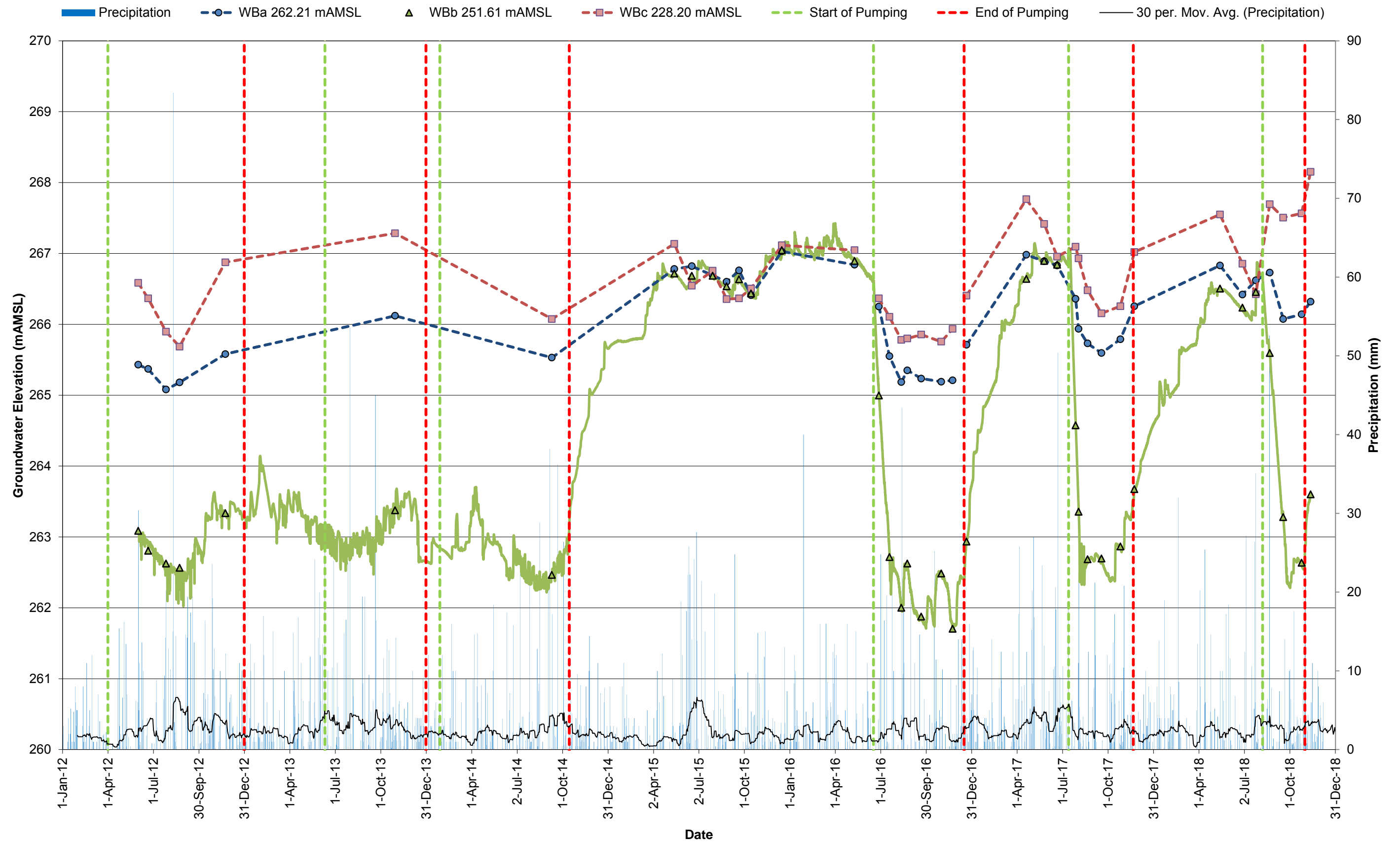
Hydrograph 13: Groundwater Elevations (mAMSL) - OWA - Carden Quarry - 2012-2018



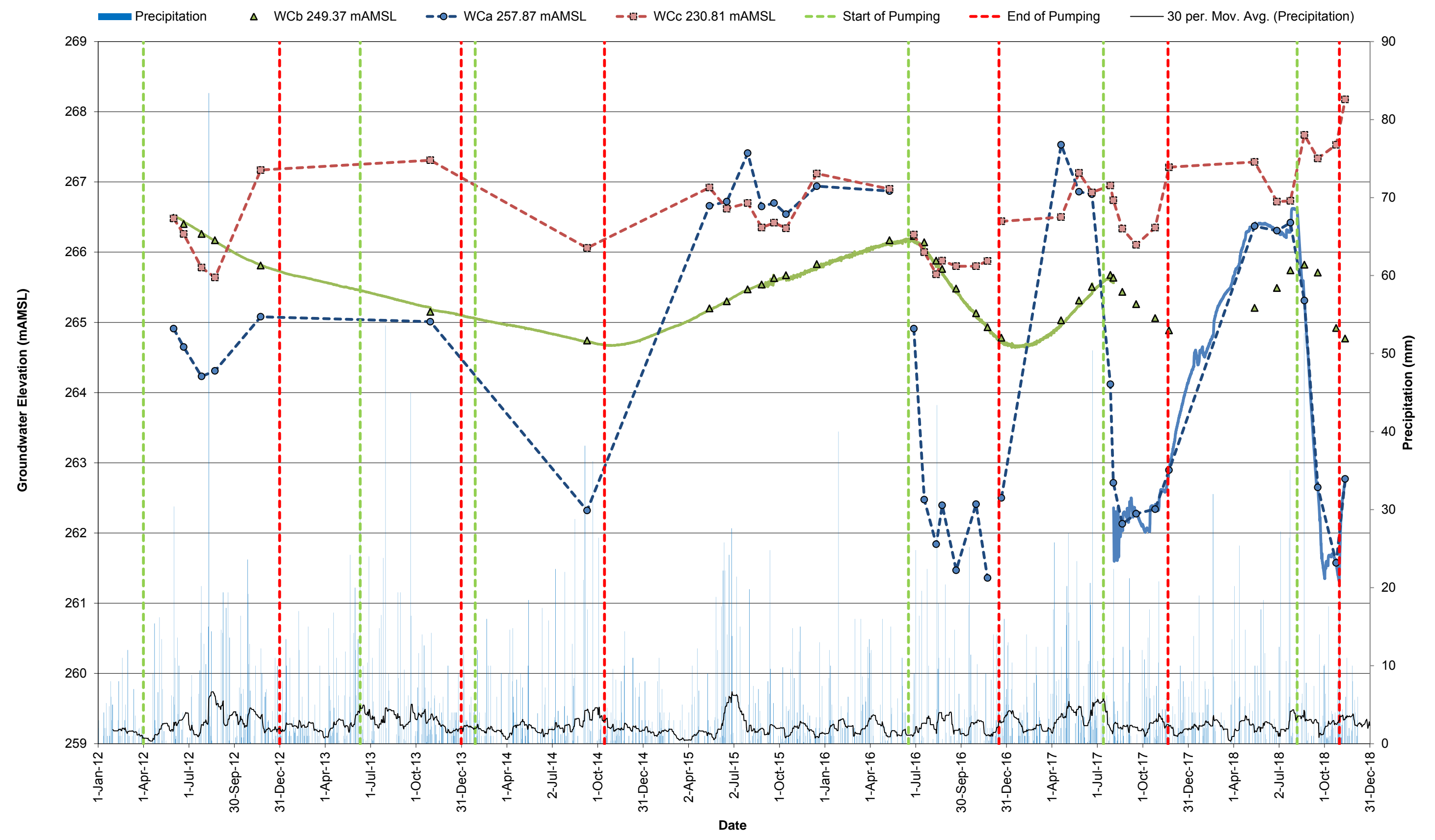
Hydrograph 14: Groundwater Elevations (mAMSL) - WA - Carden Quarry - 2012- 2018



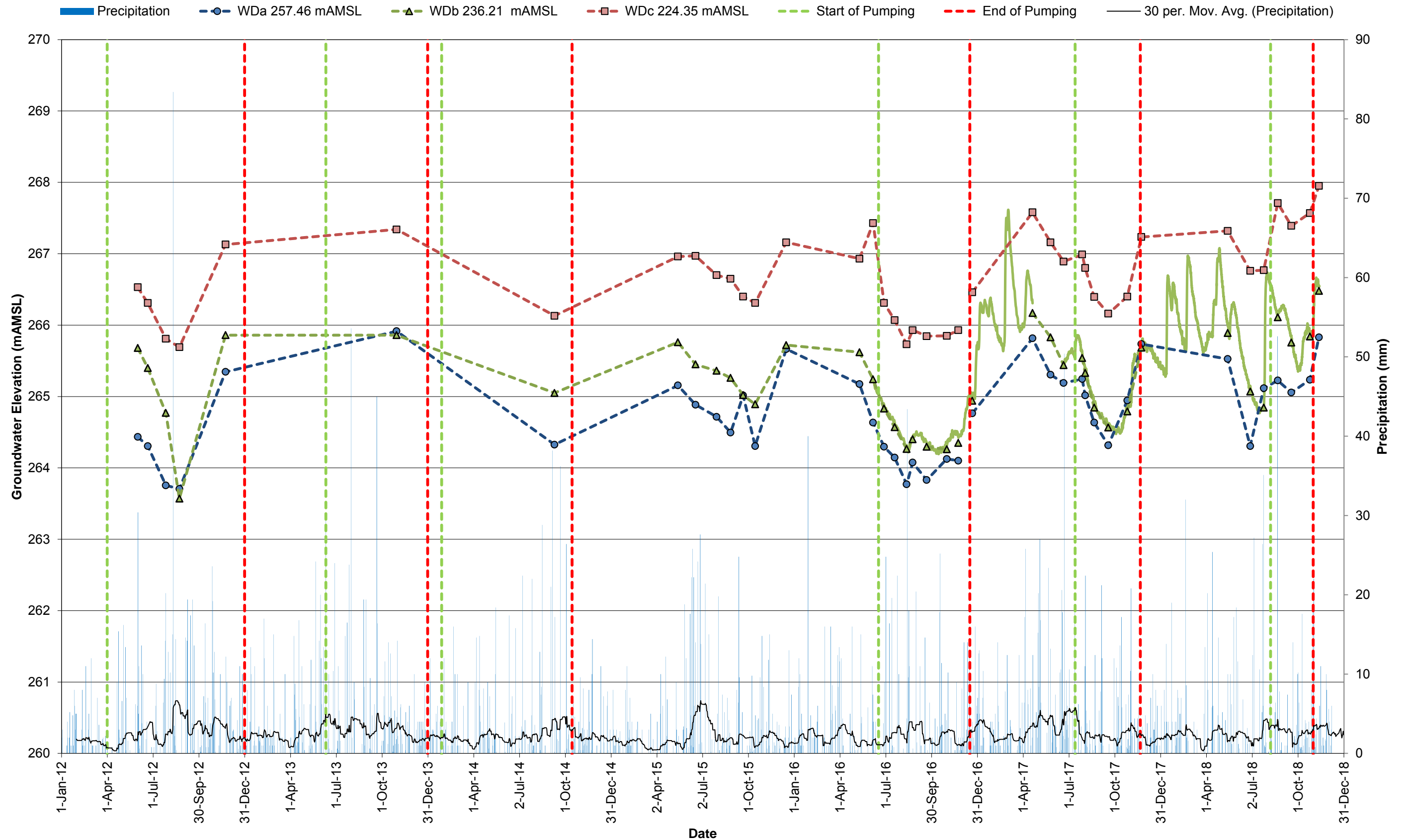
Hydrograph 15: Groundwater Elevations (mAMSL) - WB - Carden Quarry - 2012- 2018



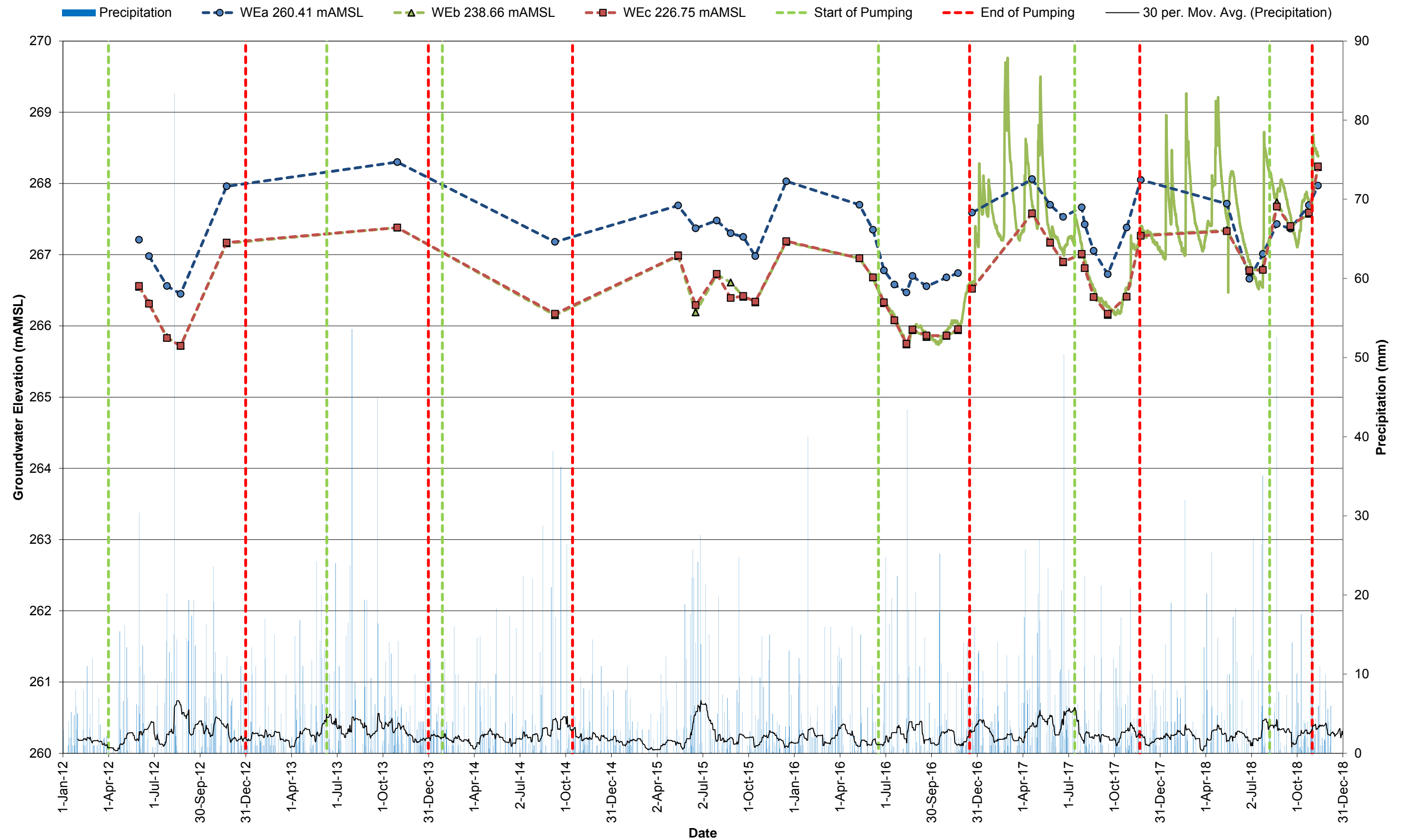
Hydrograph 16: Groundwater Elevations (mAMSL) - WC - Carden Quarry - 2012 - 2018



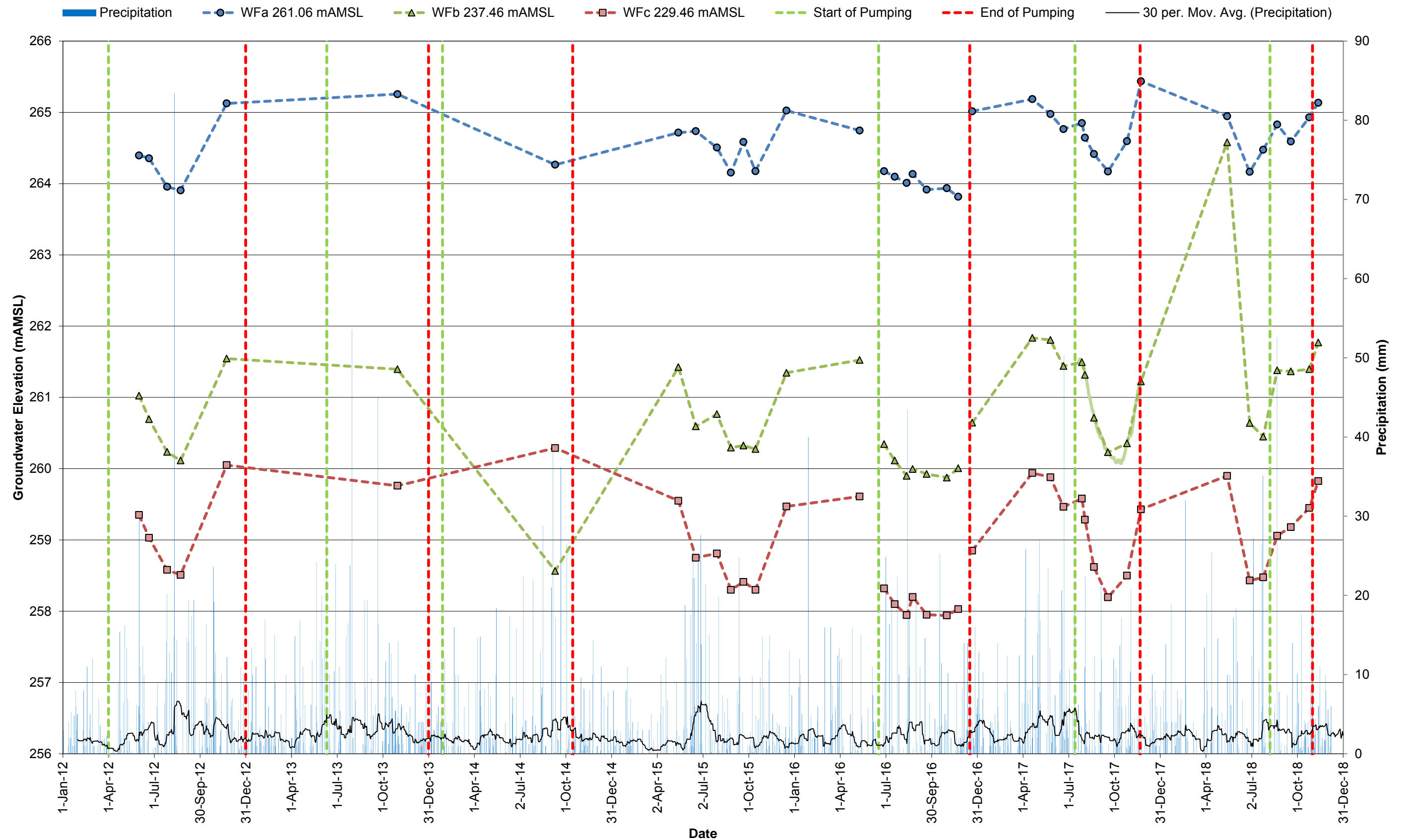
Hydrograph 17: Groundwater Elevations (mAMSL) - WD - Carden Quarry - 2012 - 2018



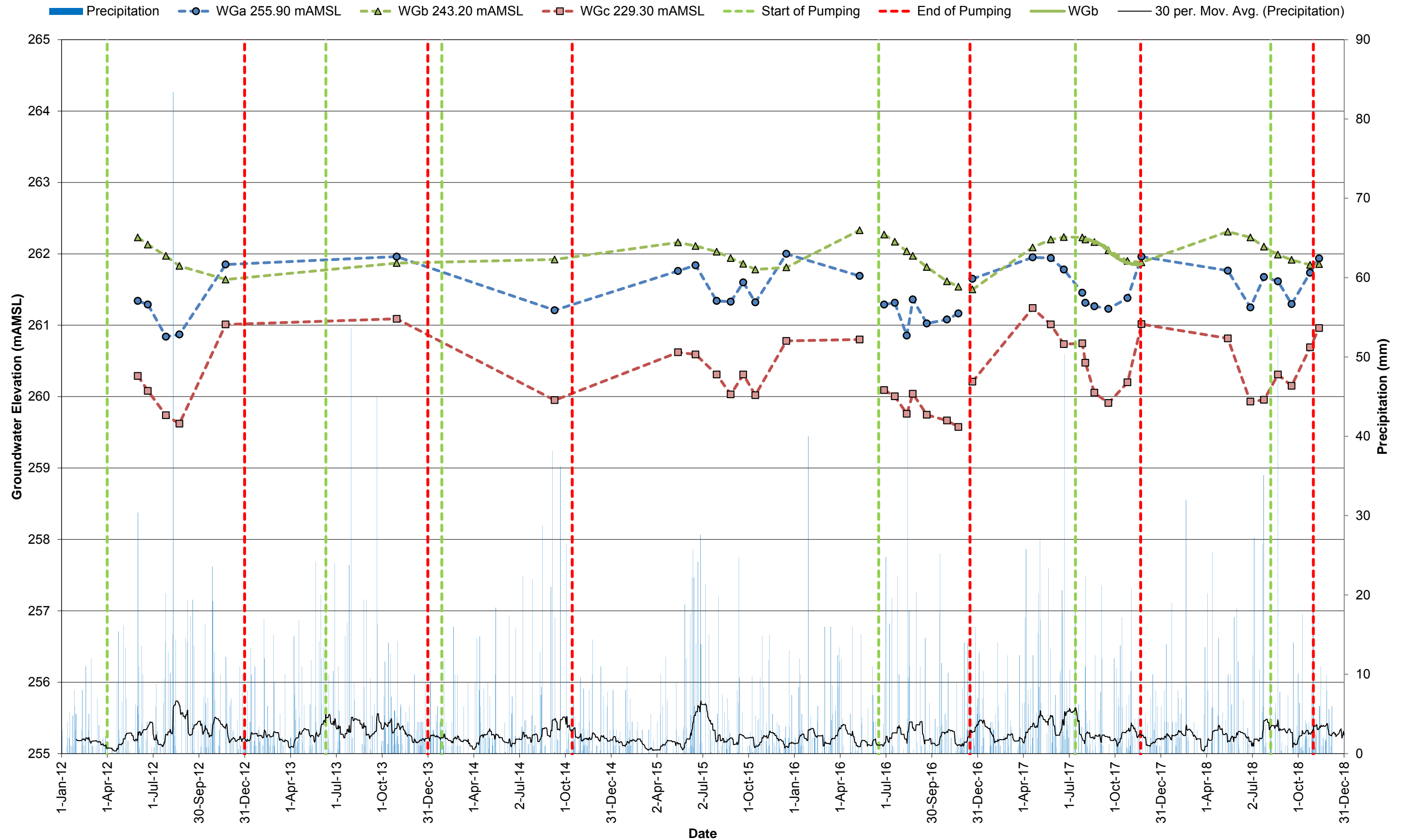
Hydrograph 18: Groundwater Elevations (mAMSL) - WE - Carden Quarry - 2012 - 2018



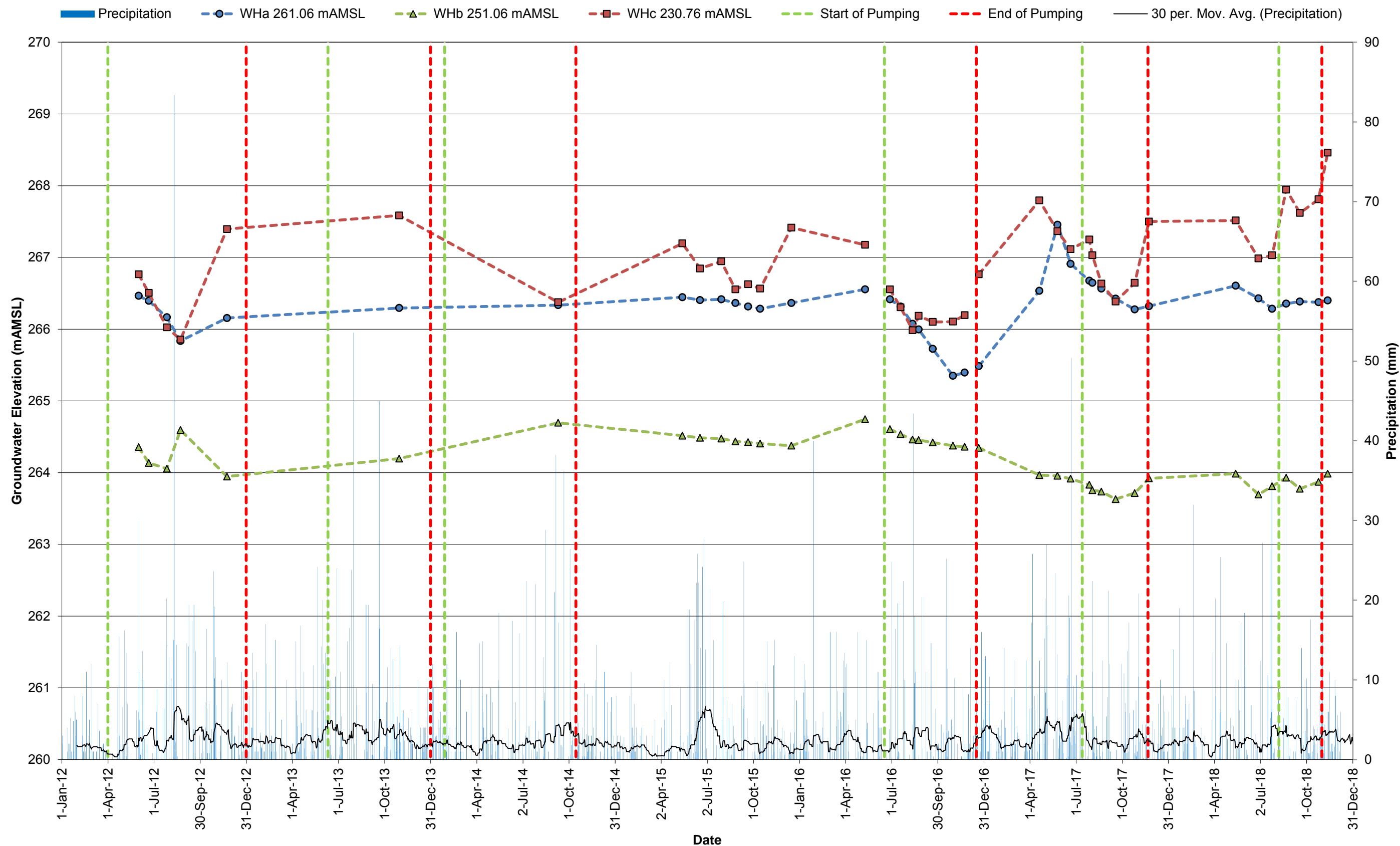
Hydrograph 19: Groundwater Elevations (mAMSL) - WF - Carden Quarry - 2012 - 2018



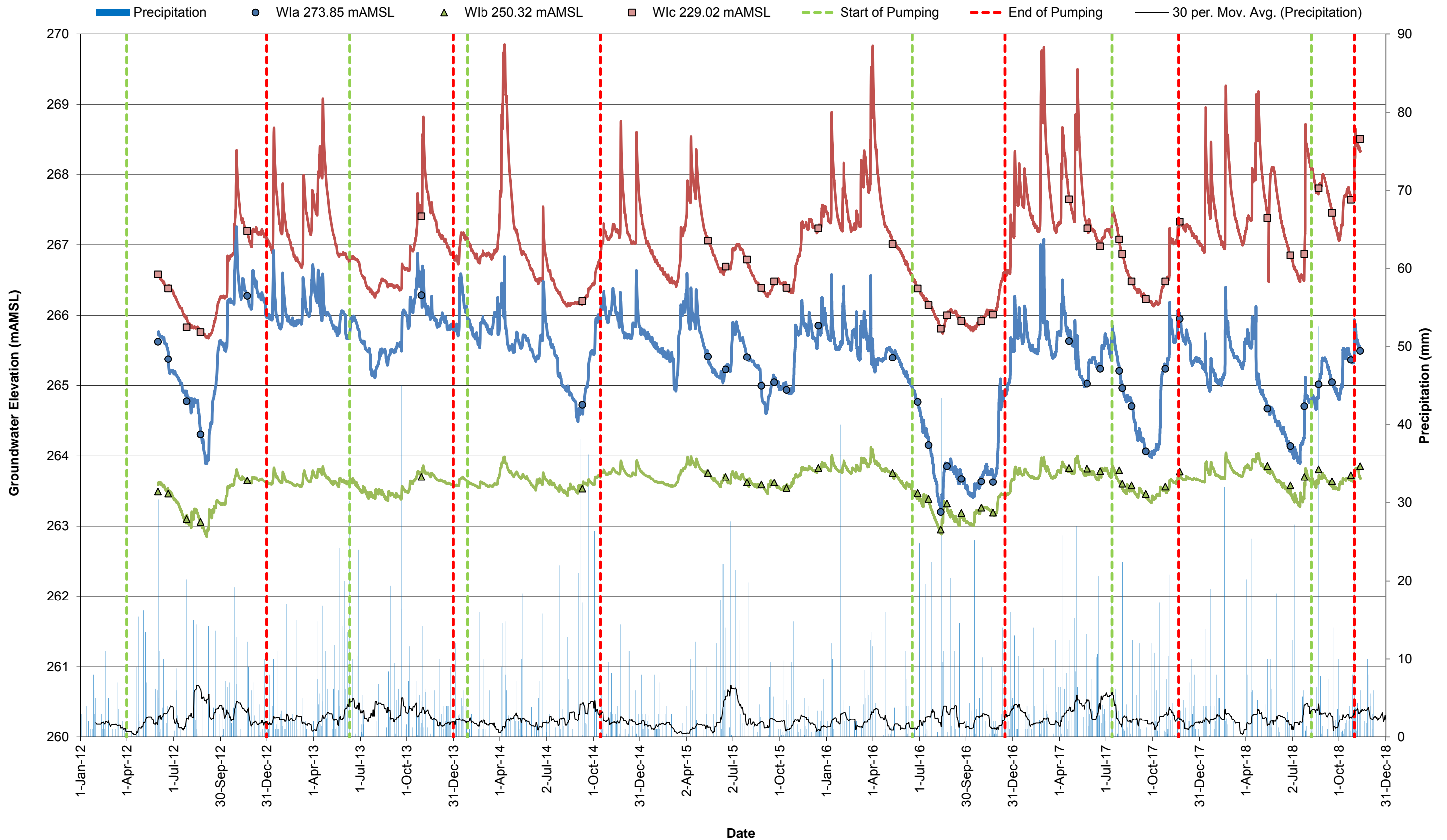
Hydrograph 20: Groundwater Elevations (mAMSL) - WG - Carden Quarry - 2012 - 2018



Hydrograph 21: Groundwater Elevations (mAMSL) - WH - Carden Quarry - 2012 - 2018

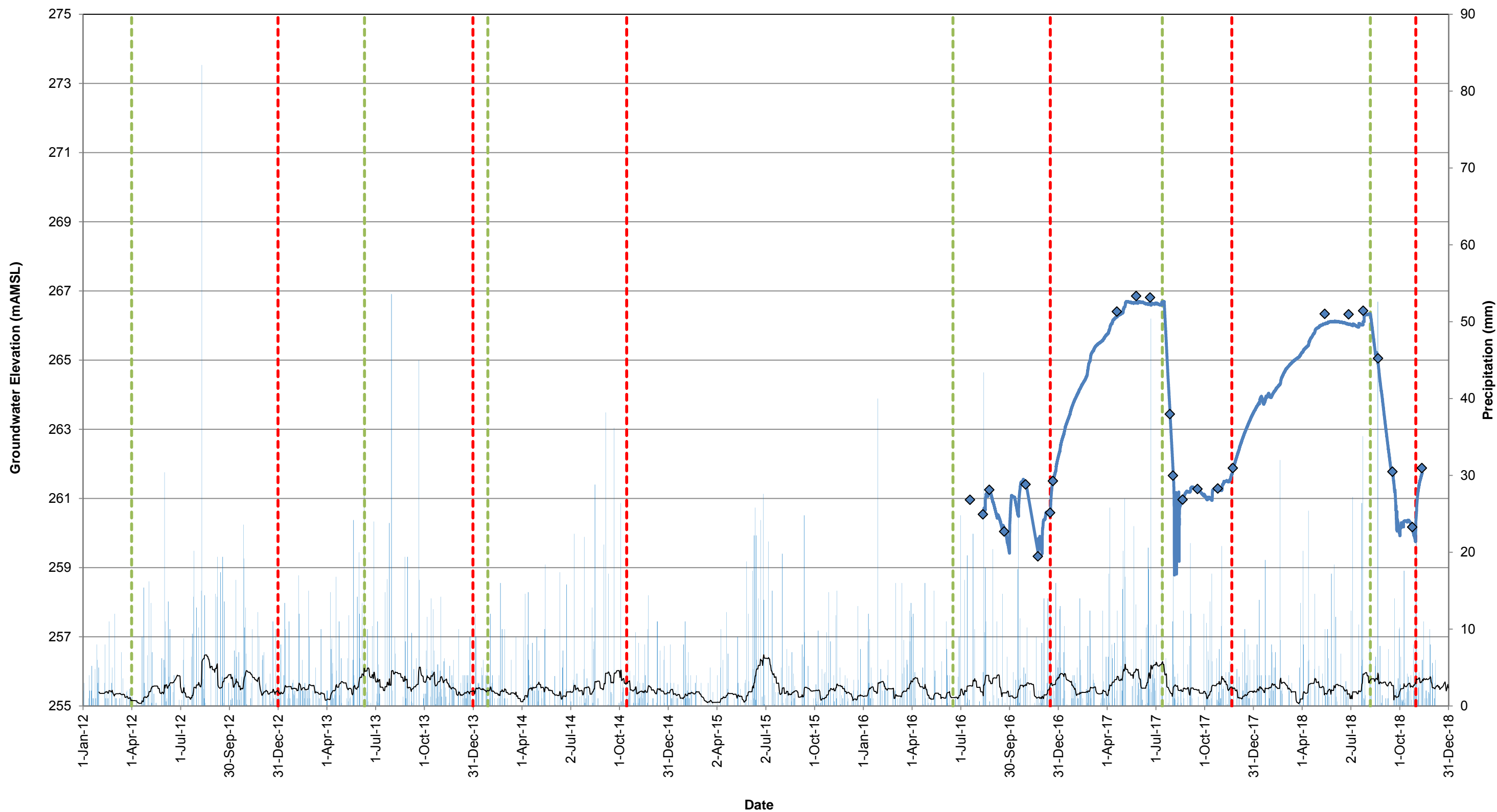


Hydrograph 22: Groundwater Elevations (mAMSL) - WI - Carden Quarry - 2012 - 2018



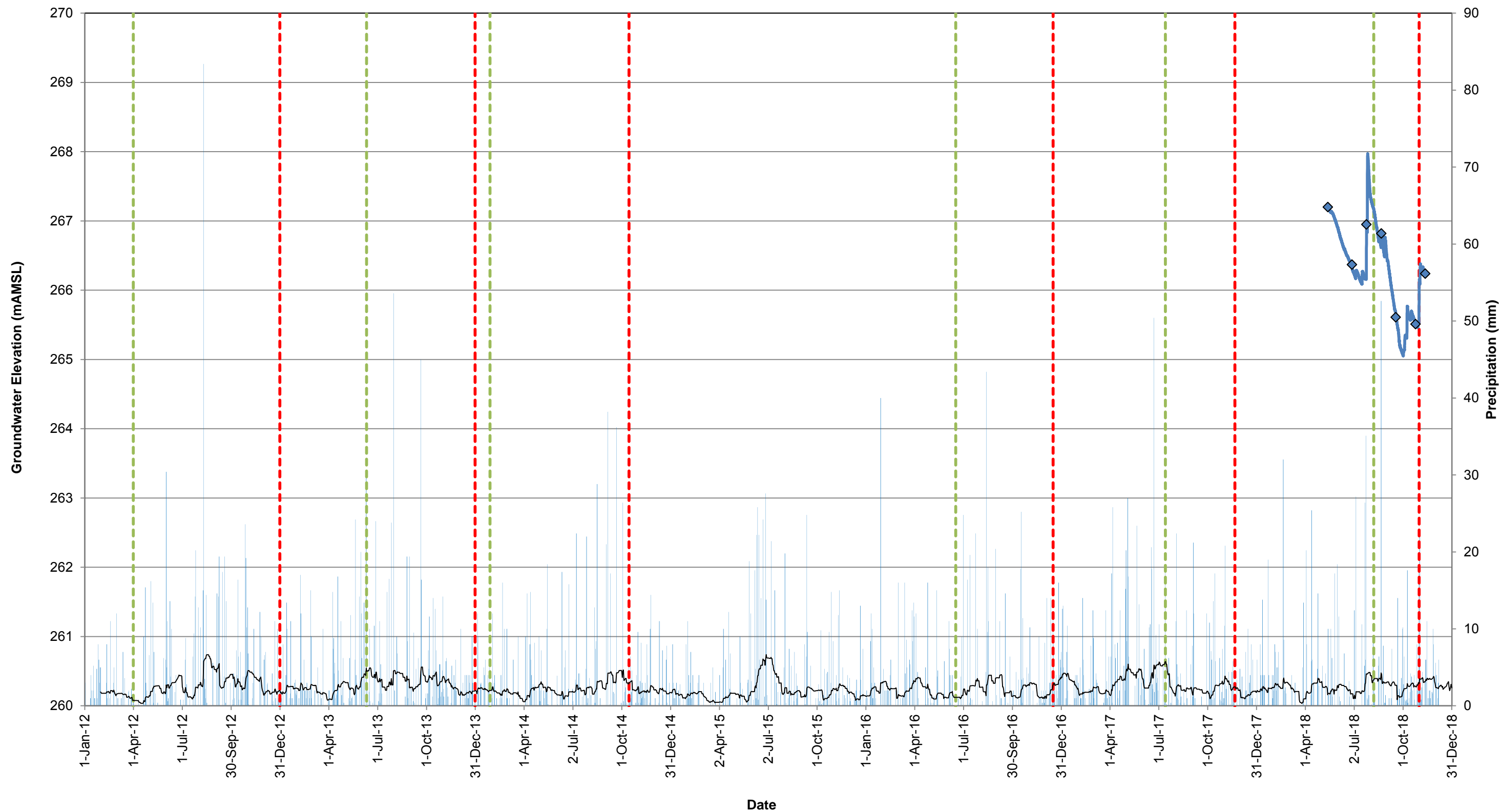
Hydrograph 23: Surface Water Elevations (mAMSL) - SG1 - Carden Quarry - 2012- 2018

■ Precipitation
 ◆ SG1
 - - - Start of Pumping
 - - - End of Pumping
 — 30 per. Mov. Avg. (Precipitation)



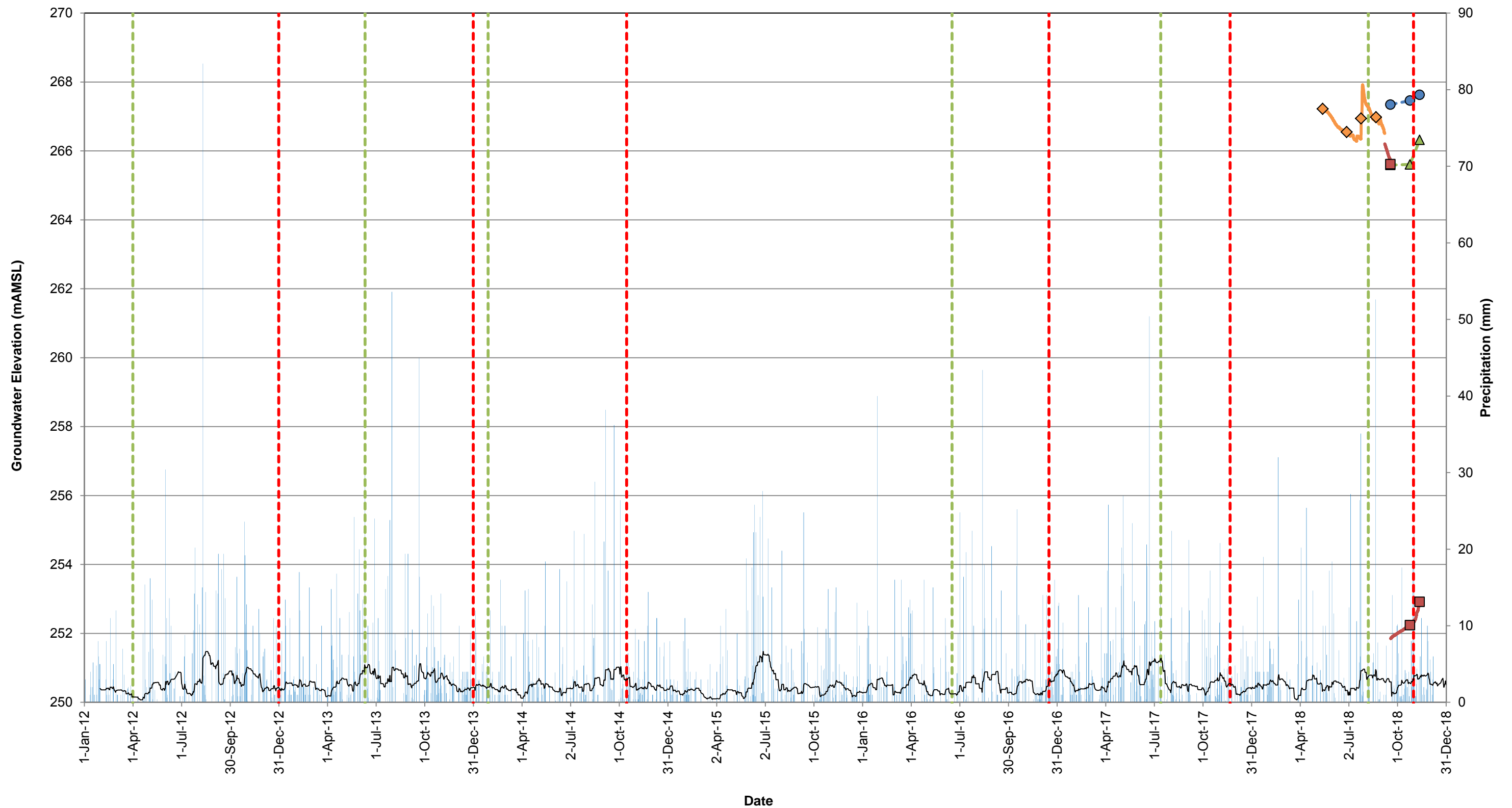
Hydrograph 24: Groundwater Elevations (mAMSL) - MW1- Carden Quarry - 2012- 2018

■ Precipitation
 ◆ MW1 250.31 mAMSL
 - - - Start of Pumping
 - - - End of Pumping
 — 30 per. Mov. Avg. (Precipitation)



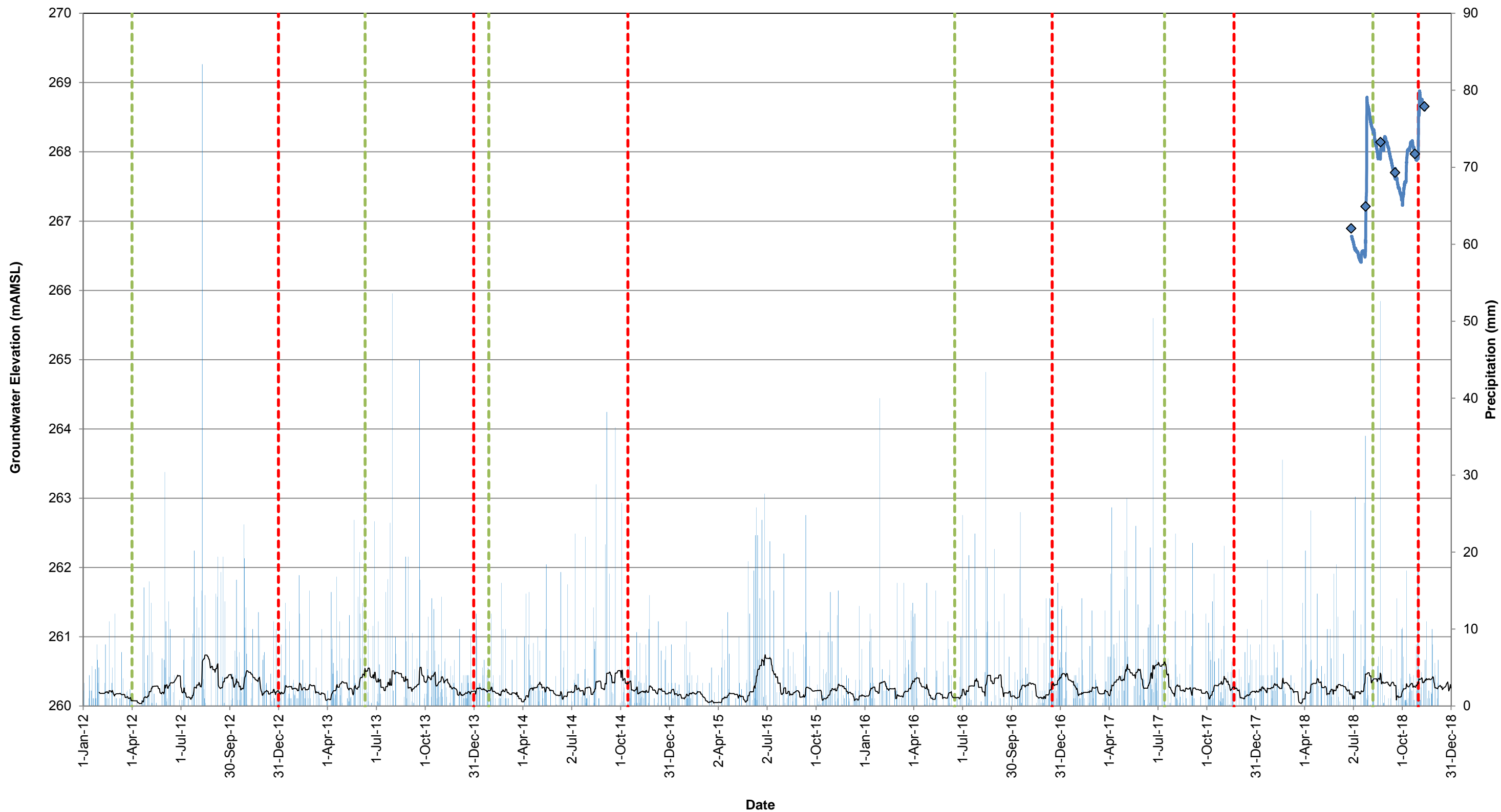
Hydrograph 25: Groundwater Elevations (mAMSL) - MW2- Carden Quarry - 2012- 2018

■ Precipitation
 ◆ MW2 249.34 mAMSL
 ● MW2A 262.29 mAMSL
 ▲ MW2B 256.23 mAMSL
 ■ MW2c 249.41 mAMSL
 - - - Start of Pumping
 - - - End of Pumping
 — 30 per. Mov. Avg. (Precipitation)



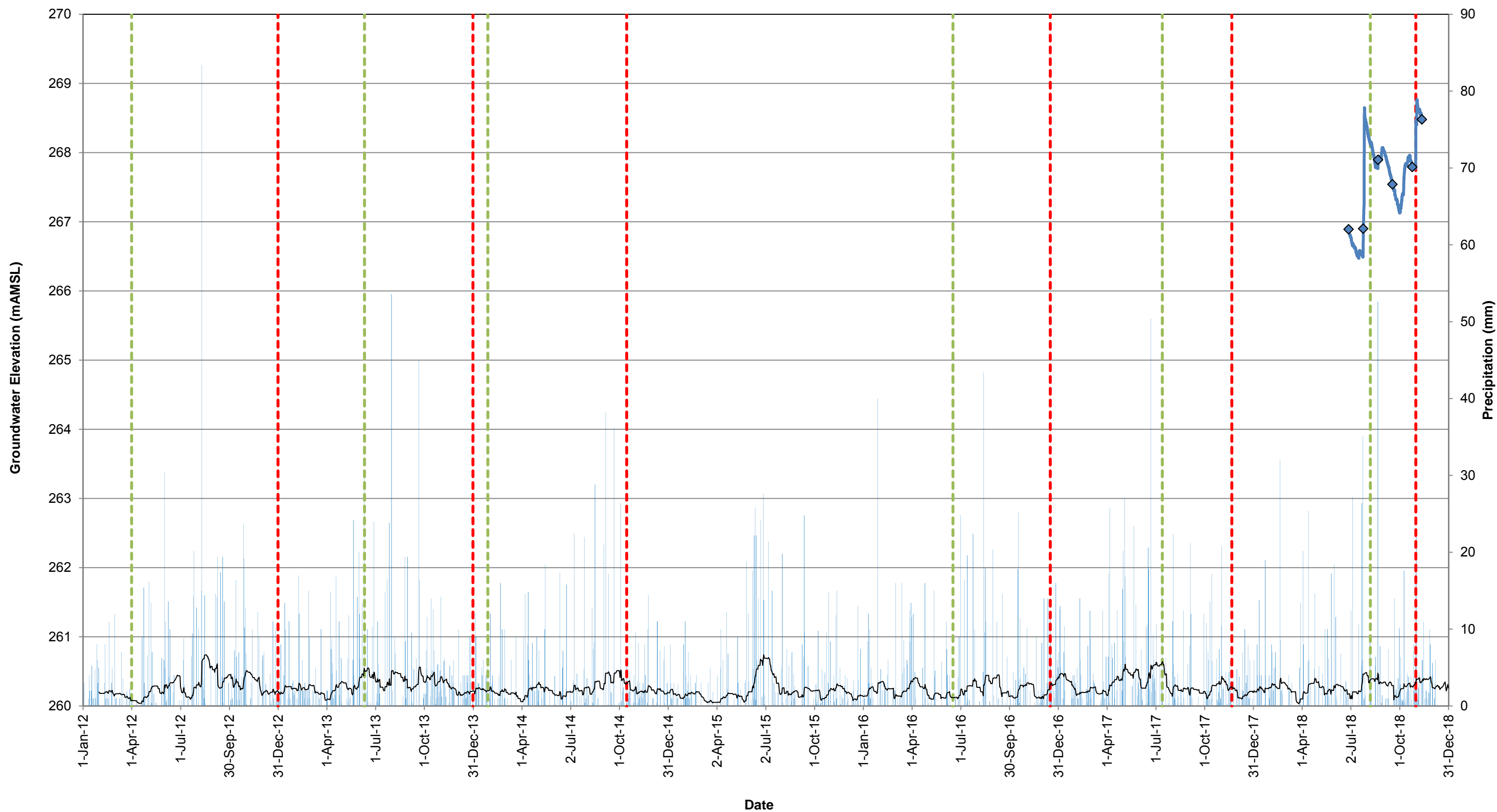
Hydrograph 26: Groundwater Elevations (mAMSL) - MW3- Carden Quarry - 2012- 2018

█ Precipitation
 ◆ MW3 253.74 mAMSL
 - - - Start of Pumping
 - - - End of Pumping
 — 30 per. Mov. Avg. (Precipitation)



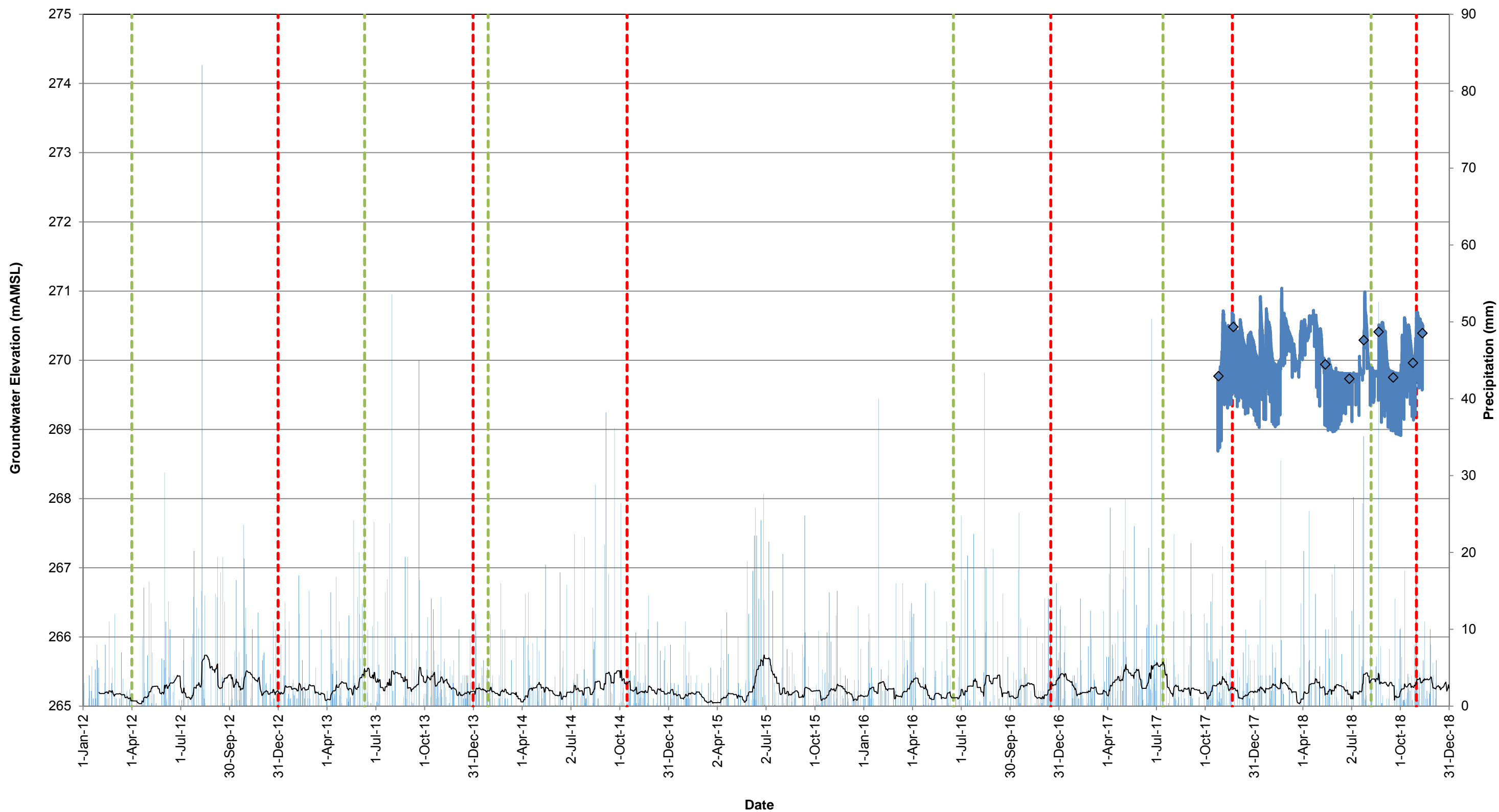
Hydrograph 27: Groundwater Elevations (mAMSL) - MW4- Carden Quarry - 2012- 2018

█ Precipitation
 ◆ MW4 232.21 mAMSL
 - - - Start of Pumping
 - - - End of Pumping
 — 30 per. Mov. Avg. (Precipitation)



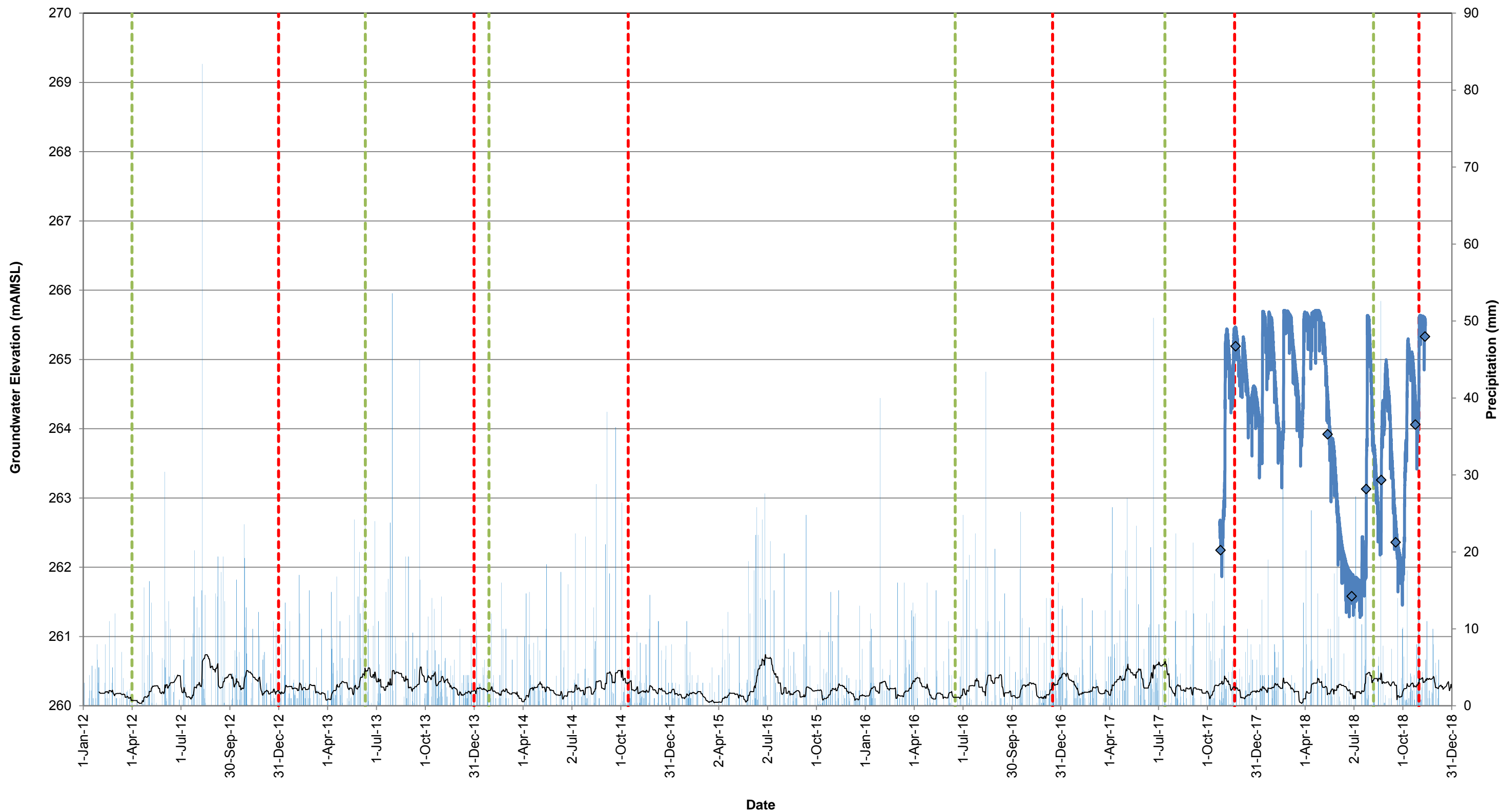
Hydrograph 28: Groundwater Elevations (mAMS�) - W2- Carden Quarry - 2012- 2018

■ Precipitation
 ◆ W2 257.48 mAMS�
 - - - Start of Pumping
 - - - End of Pumping
 — 30 per. Mov. Avg. (Precipitation)



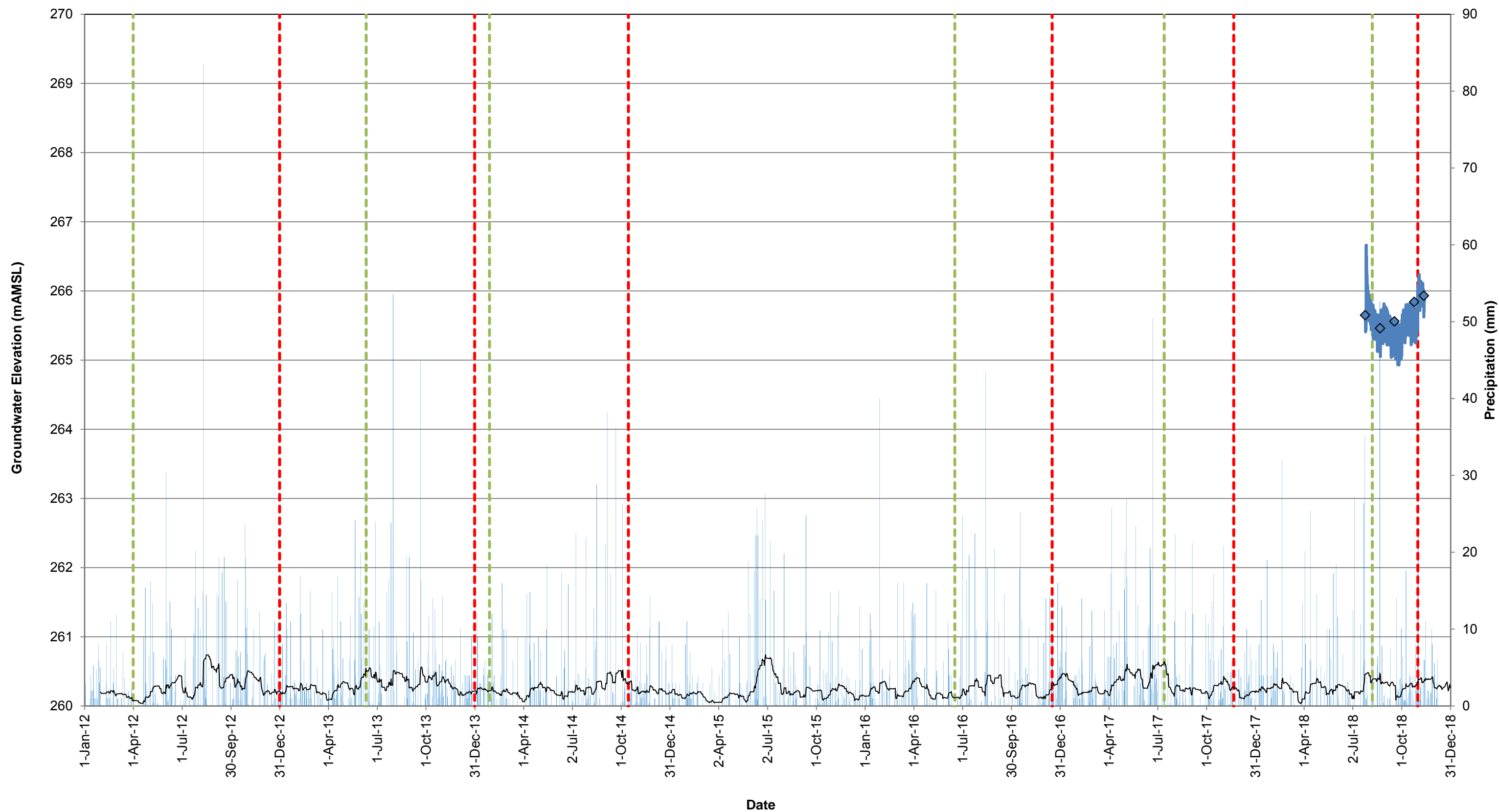
Hydrograph 29: Groundwater Elevations (mAMSL) - W3 - Carden Quarry - 2012- 2018

■ Precipitation
 ◆ W3 254.91 mAMSL
 - - - Start of Pumping
 - - - End of Pumping
 — 30 per. Mov. Avg. (Precipitation)



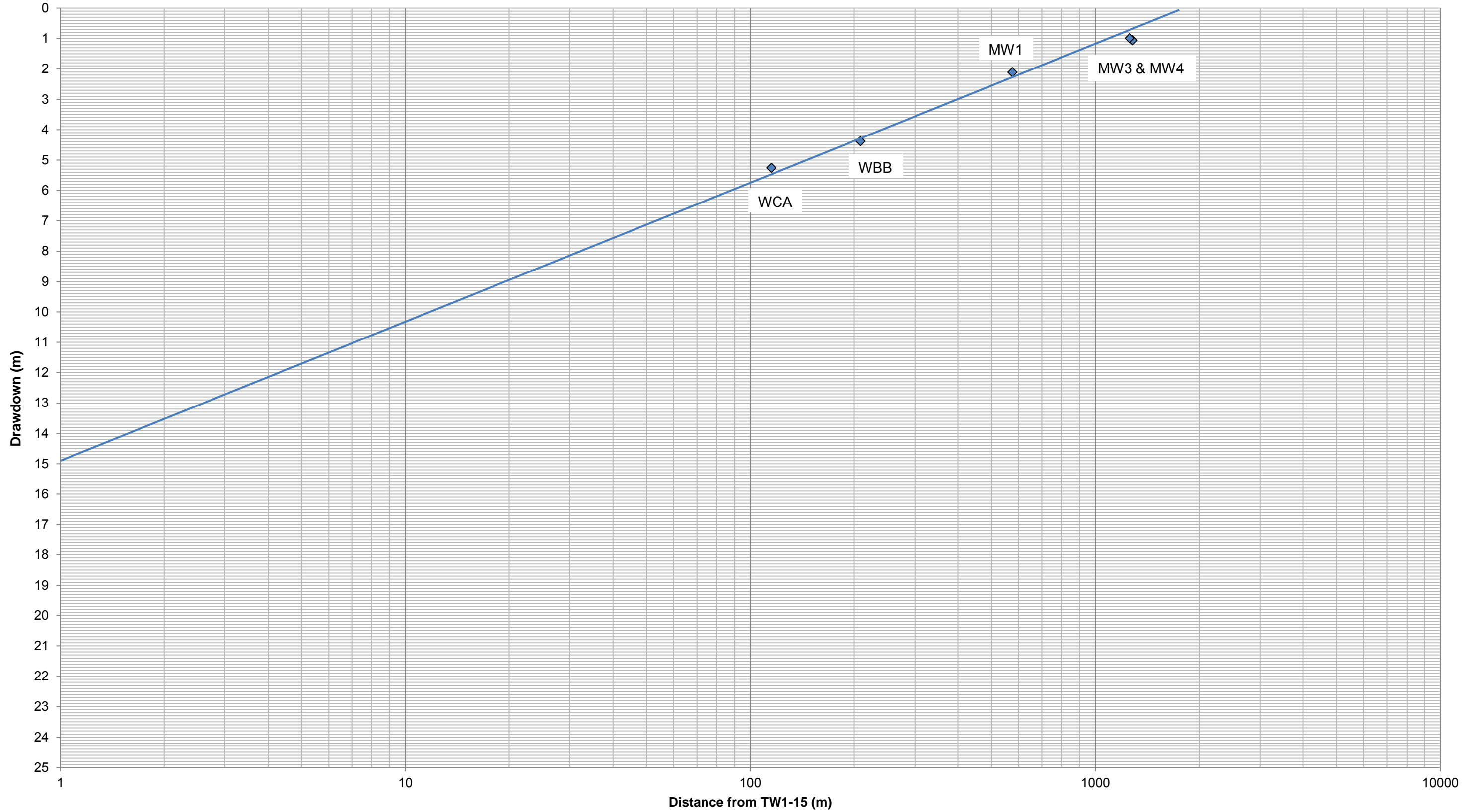
Hydrograph 30: Groundwater Elevations (mAMSL) - W4 - Carden Quarry - 2012- 2018

■ Precipitation
 ◆ W4 257.15 mAMSL
 - - - Start of Pumping
 - - - End of Pumping
 — 30 per. Mov. Avg. (Precipitation)

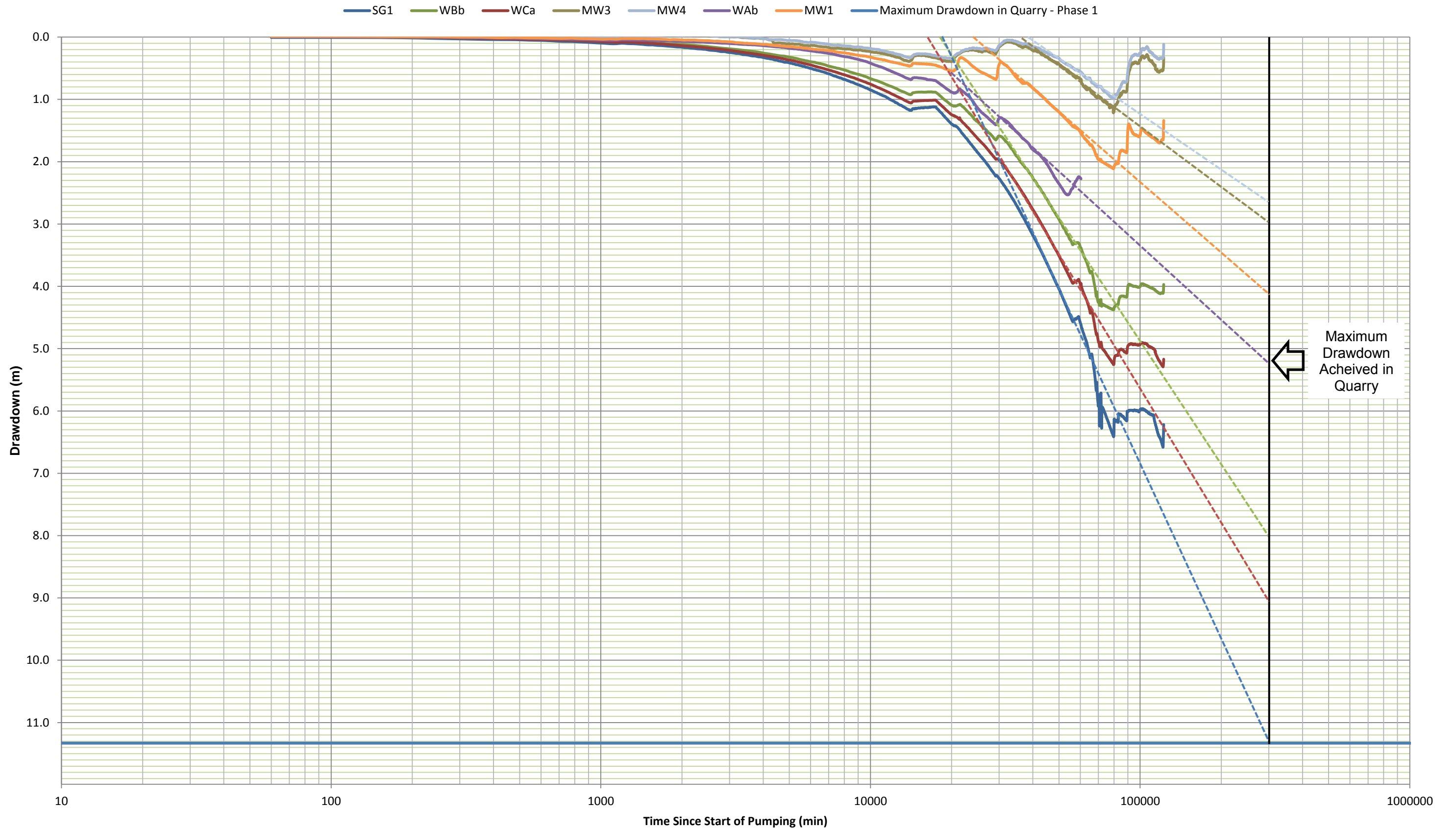


Hydrograph 31: Distance vs. Drawdown - Current Extraction - 2018

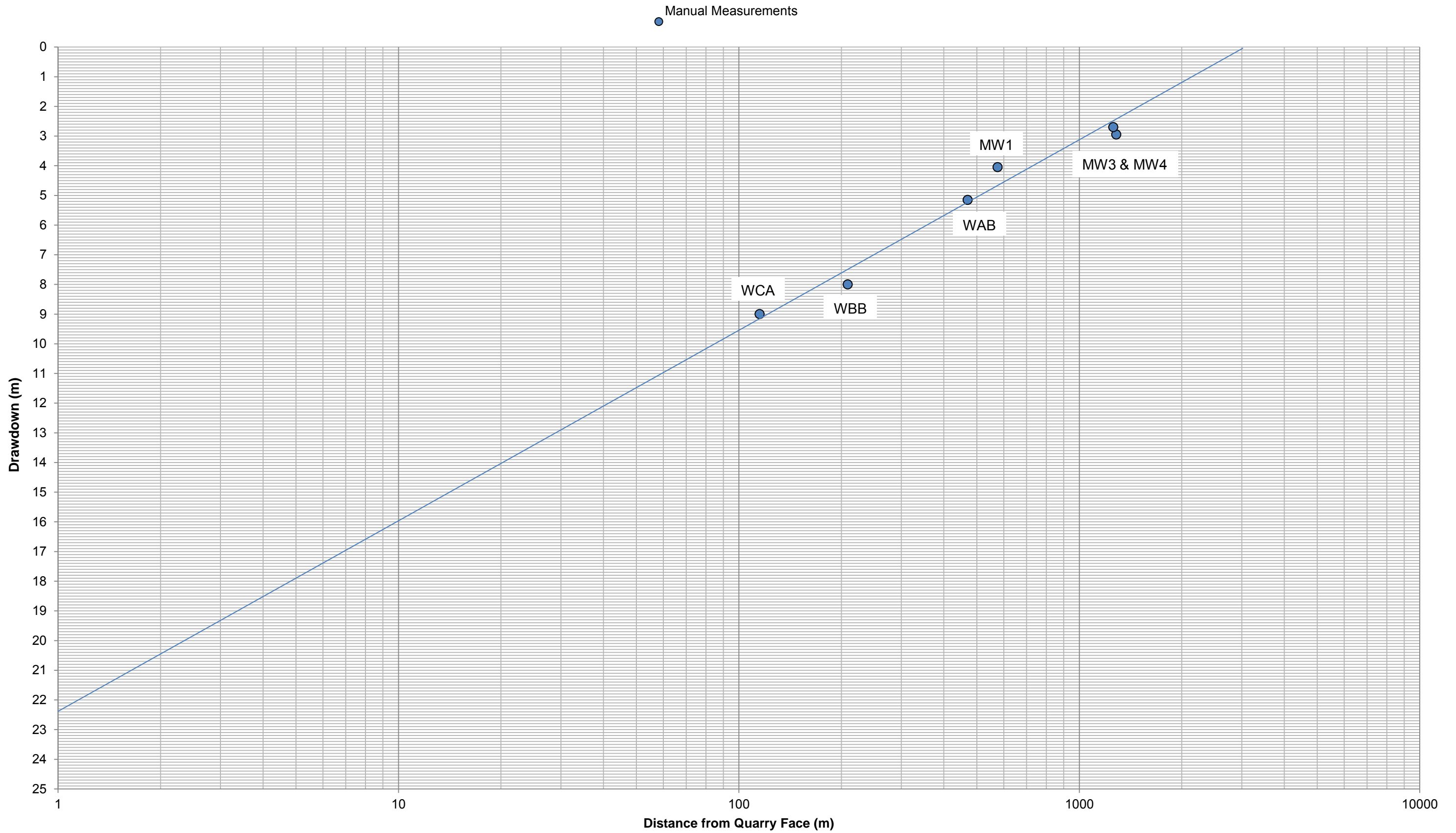
◆ October 2, 2018



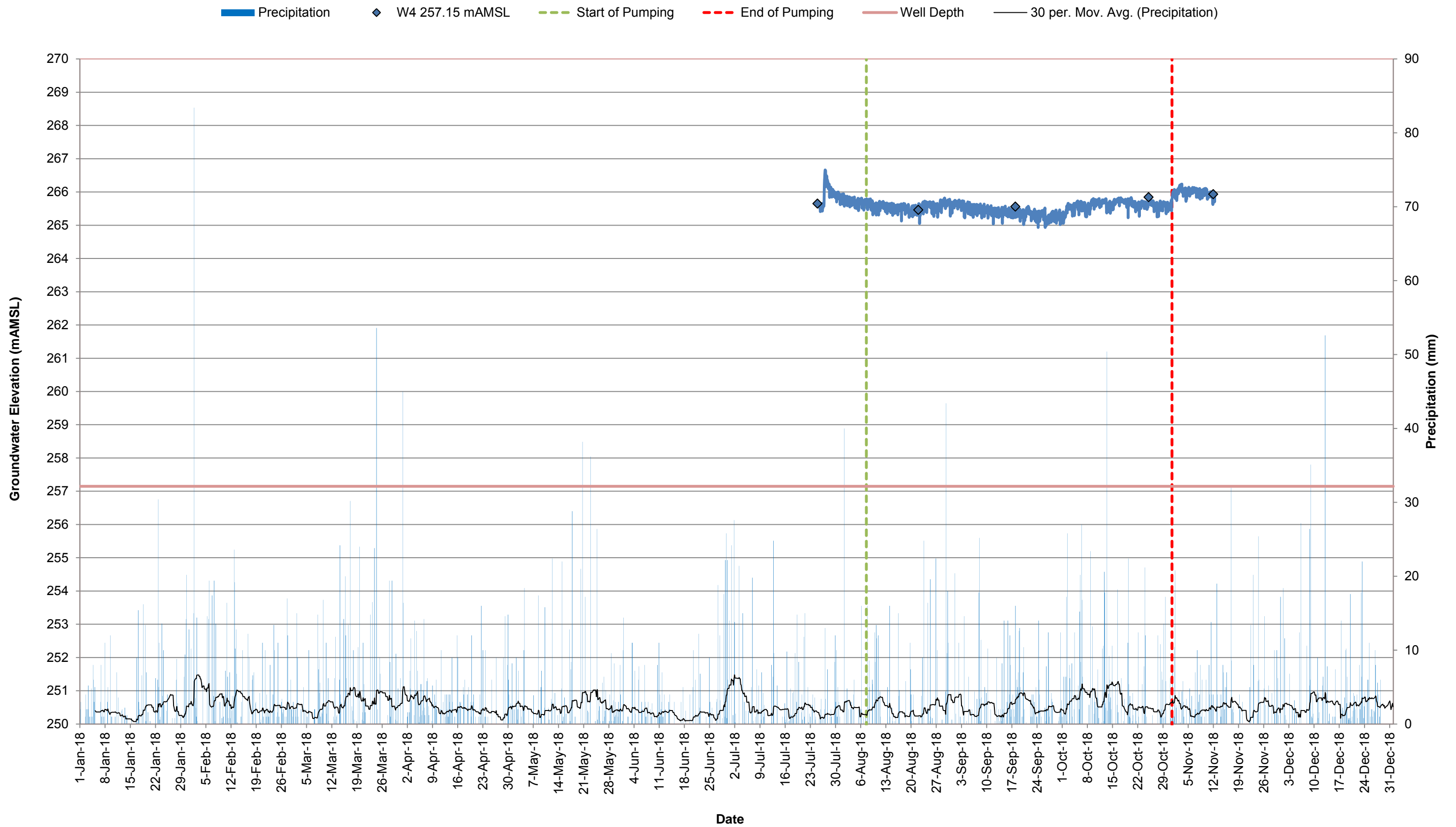
Hydrograph 32: Drawdown vs. Time



Hydrograph 33: Distance vs. Drawdown - Full Extraction (255 mAMSL) - Current Extraction



Hydrograph 34: Groundwater Elevations (mAMSL) - W4 - Carden Quarry - 2012- 2018





ATTACHMENT 1

**PRIVATE WELL INSPECTION FORMS AND
MECP WELL RECORDS**

WATER WELL INVENTORY

Resident Name: _____

911 Number: _____ Road: _____

Address: _____

Phone Number: _____ Email: _____

Property Owner: Yes No If No, Property Owner's Name: _____

Previous Property Owners: _____

Number of Wells on Property: _____ Don't Know

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

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

Depth of Well: _____ Don't Know

Depth of Water: _____ Don't Know

Pump Depth: _____ Don't Know

Pump Type: _____ Don't Know

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

Name of Well Driller: _____ Don't Know

Date Installed: _____ Don't Know

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

MOE Water Well Record Number: _____ Don't Know

Type of Water Use: Domestic Farm Irrigation Industrial Other _____

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

Other Water Treatment: _____ Don't Know

WATER WELL INVENTORY

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

Any problems with water quantity in the past? Yes No

Any problem with water quality in the past? Yes No

If yes, what type? Sulphur smell Iron Taste Brown Water Bacteria

Other: _____

Location of Septic Bed: _____

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

Other: _____

Is the well easily accessible? Yes No

If Yes, may we measure water levels in this well? Yes No

If necessary, could we sample your well for water quality testing? Yes No

Describe Well Location _____



Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

11

6415342

Municipality 64002 Con. COM 10

County or District: [Redacted] Township/Borough/City/Town/Village: **CARDEN** Con block tract survey, etc.: **10** Lot: **6**
Address: **R.R.#4 BIRKFIELD ONT Kom 280** Date completed: **10** day **7** month **95** year

Northings: 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50
RC: [] Elevation: [] RC: [] Basin Code: []

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)					
General colour	Most common material	Other materials	General description	Depth - feet	
				From	To
GREY	ROCK			0	3
GREY	LIMESTONE			3	78
GREEN	LIMESTONE			78	82

31: [] 32: []

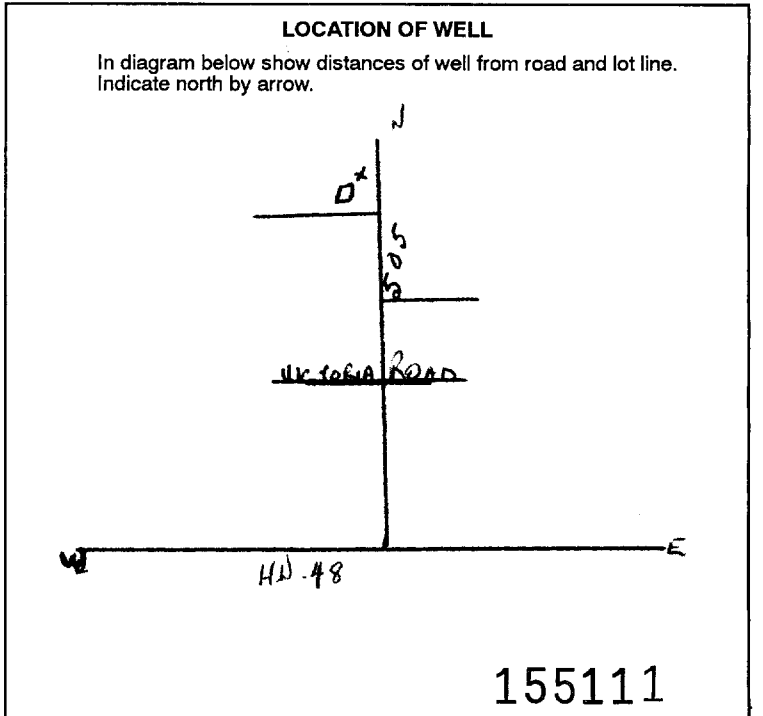
WATER RECORD			
Water found at - feet	Kind of water		
10-13	<input checked="" type="checkbox"/> Fresh	<input type="checkbox"/> Sulphur	<input type="checkbox"/> Minerals
	<input type="checkbox"/> Salty	<input type="checkbox"/> Gas	
15-18	<input type="checkbox"/> Fresh	<input type="checkbox"/> Sulphur	<input type="checkbox"/> Minerals
	<input type="checkbox"/> Salty	<input type="checkbox"/> Gas	
20-23	<input type="checkbox"/> Fresh	<input type="checkbox"/> Sulphur	<input type="checkbox"/> Minerals
	<input type="checkbox"/> Salty	<input type="checkbox"/> Gas	
25-28	<input type="checkbox"/> Fresh	<input type="checkbox"/> Sulphur	<input type="checkbox"/> Minerals
	<input type="checkbox"/> Salty	<input type="checkbox"/> Gas	
30-33	<input type="checkbox"/> Fresh	<input type="checkbox"/> Sulphur	<input type="checkbox"/> Minerals
	<input type="checkbox"/> Salty	<input type="checkbox"/> Gas	

CASING & OPEN HOLE RECORD				
Inside diam inches	Material	Wall thickness inches	Depth - feet	
			From	To
10-11	<input checked="" type="checkbox"/> Steel			
	<input type="checkbox"/> Galvanized			
	<input type="checkbox"/> Concrete			
	<input type="checkbox"/> Open hole			
	<input type="checkbox"/> Plastic			
17-18	<input type="checkbox"/> Steel			
	<input type="checkbox"/> Galvanized			
	<input type="checkbox"/> Concrete			
	<input type="checkbox"/> Open hole			
	<input type="checkbox"/> Plastic			
24-25	<input type="checkbox"/> Steel			
	<input type="checkbox"/> Galvanized			
	<input type="checkbox"/> Concrete			
	<input type="checkbox"/> Open hole			
	<input type="checkbox"/> Plastic			

SCREEN	Sizes of opening (Slot No.)	Diameter	Length
		inches	feet

PLUGGING & SEALING RECORD			
<input type="checkbox"/> Annular space		<input type="checkbox"/> Abandonment	
Depth set at - feet		Material and type (Cement grout, bentonite, etc.)	
From	To		
10-13	14-17		
18-21	22-25		
26-29	30-33		

71 Pumping test method		Pumping rate	Duration of pumping
<input checked="" type="checkbox"/> Pump	<input type="checkbox"/> Bailer	8 GPM	1 Hours 15 Mins
PUMPING TEST	Static level	Water level end of pumping	Water levels during
	19-21	22-24	15 minutes 26-28
	20 feet	70 feet	32 feet 54 feet
			70 feet 70 feet
	If flowing give rate	Pump intake set at	Water at end of test
	GPM	78 feet	<input checked="" type="checkbox"/> Clear <input type="checkbox"/> Cloudy
	Recommended pump type	Recommended pump setting	Recommended pump rate
	<input type="checkbox"/> Shallow <input checked="" type="checkbox"/> Deep	78 feet	7 GPM



FINAL STATUS OF WELL

Water supply Abandoned, insufficient supply Unfinished
 Observation well Abandoned, poor quality Replacement well
 Test hole Abandoned (Other)
 Recharge well Dewatering

WATER USE

Domestic Commercial Not used
 Stock Municipal Other
 Irrigation Public supply
 Industrial Cooling & air conditioning

METHOD OF CONSTRUCTION

Cable tool Air percussion Driving
 Rotary (conventional) Boring Digging
 Rotary (reverse) Diamond Other
 Rotary (air) Jetting

Name of Well Contractor: **CARL BALDWIN WELL DRILLING** Well Contractor's Licence No.: **1312**
Address: **R.R.#1 KIRKFIELD ONT**
Name of Well Technician: **CARL BALDWIN** Well Technician's Licence No.: **T0300**
Signature of Technician/Contractor: *Carl Baldwin* Submission date: **SEP 27 1997**

MINISTRY USE ONLY

Data source: **1312** Contractor: **1312** Date received: **SEP 29 1997**
Date of inspection: [] Inspector: []
Remarks: []

WATER WELL INVENTORY

Resident Name: _____

911 Number: _____ Road: _____

Address: _____

Phone Number: _____ Email: _____

Property Owner: Yes No If No, Property Owner's Name: _____

Previous Property Owners: _____

Number of Wells on Property: _____ Don't Know

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

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

Depth of Well: _____ Don't Know

Depth of Water: _____ Don't Know

Pump Depth: _____ Don't Know

Pump Type: _____ Don't Know

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

Name of Well Driller: _____ Don't Know

Date Installed: _____ Don't Know

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

MOE Water Well Record Number: _____ Don't Know

Type of Water Use: Domestic Farm Irrigation Industrial Other _____

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

Other Water Treatment: _____ Don't Know

WATER WELL INVENTORY

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

Any problems with water quantity in the past? Yes No

Any problem with water quality in the past? Yes No

If yes, what type? Sulphur smell Iron Taste Brown Water Bacteria

Other: _____

Location of Septic Bed: _____

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

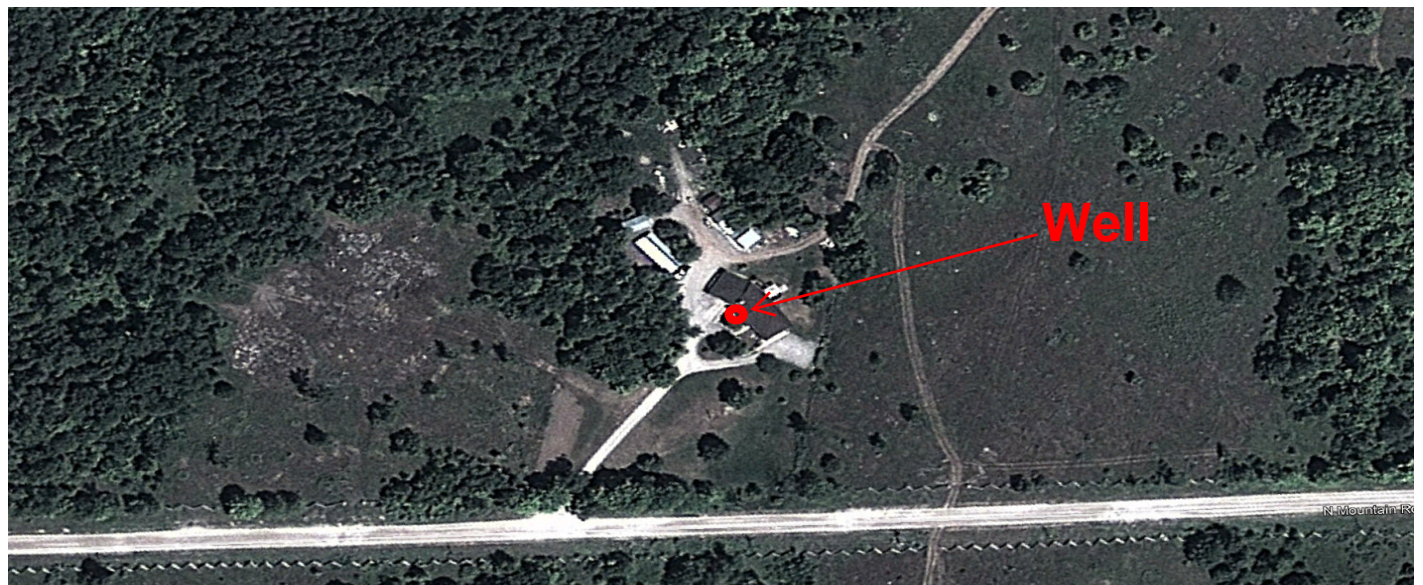
Other: _____

Is the well easily accessible? Yes No

If Yes, may we measure water levels in this well? Yes No

If necessary, could we sample your well for water quality testing? Yes No

Describe Well Location _____



5/96

Print only in spaces provided. Mark correct box with a checkmark, where applicable.

11

6415118

Municipality 6400

County or District: West Township/Borough/City/Town/Village: Berkeley Con block tract survey, etc. Lot: 2 part A T T

Owner's surname: [Redacted] First name: [Redacted] Address: 1850 Victoria Park Ave Date completed: 28 day 5 month 96 year

Northings: [Scale] Elevation: [Scale] Basin Code: [Scale]

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)						
General colour	Most common material	Other materials	General description		Depth - feet	
					From	To
	<u>Topsoil</u>				<u>0</u>	<u>1</u>
	<u>Clay and stone</u>				<u>1</u>	<u>27</u>
	<u>Limestone</u>				<u>27</u>	<u>29</u>

41 WATER RECORD

Water found at - feet	Kind of water					
<u>28</u>	<input checked="" type="checkbox"/> Fresh	<input type="checkbox"/> Salty	<input type="checkbox"/> Sulphur	<input type="checkbox"/> Minerals	<input type="checkbox"/> Gas	
	<input type="checkbox"/> Fresh	<input type="checkbox"/> Salty	<input type="checkbox"/> Sulphur	<input type="checkbox"/> Minerals	<input type="checkbox"/> Gas	
	<input type="checkbox"/> Fresh	<input type="checkbox"/> Salty	<input type="checkbox"/> Sulphur	<input type="checkbox"/> Minerals	<input type="checkbox"/> Gas	
	<input type="checkbox"/> Fresh	<input type="checkbox"/> Salty	<input type="checkbox"/> Sulphur	<input type="checkbox"/> Minerals	<input type="checkbox"/> Gas	
	<input type="checkbox"/> Fresh	<input type="checkbox"/> Salty	<input type="checkbox"/> Sulphur	<input type="checkbox"/> Minerals	<input type="checkbox"/> Gas	

51 CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth - feet	
			From	To
<u>6.4</u>	<input checked="" type="checkbox"/> Steel	<u>1.88</u>	<u>0</u>	<u>27</u>
	<input type="checkbox"/> Galvanized			
	<input type="checkbox"/> Concrete			
	<input type="checkbox"/> Open hole			
	<input type="checkbox"/> Plastic			
	<input type="checkbox"/> Steel		<u>27</u>	<u>29</u>
	<input type="checkbox"/> Galvanized			
	<input type="checkbox"/> Concrete			
	<input type="checkbox"/> Open hole			
	<input type="checkbox"/> Plastic			

54 SCREEN

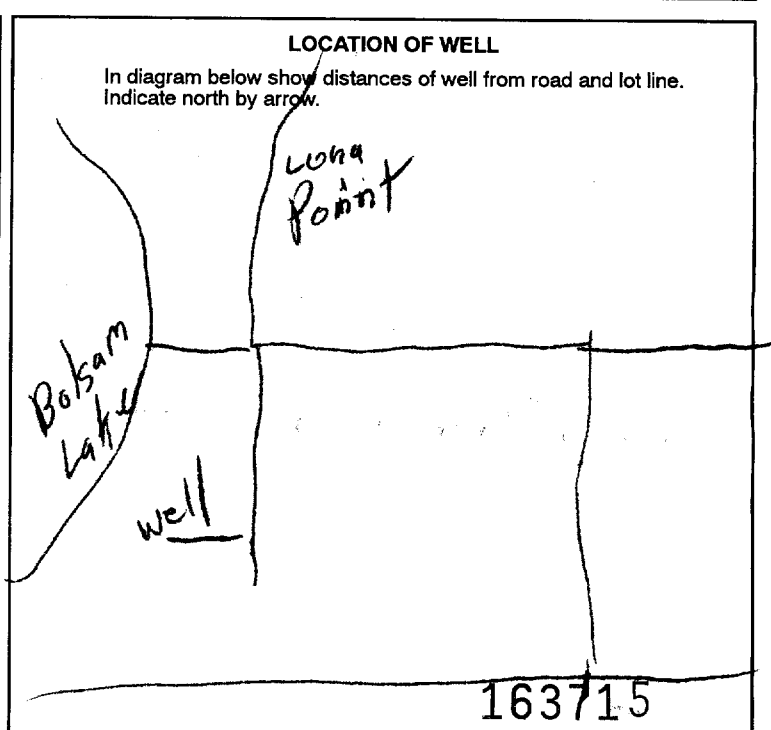
Sizes of opening (Slot No.)	Diameter inches	Length feet
Material and type		Depth at top of screen feet

61 PLUGGING & SEALING RECORD

Depth set at - feet		Material and type (Cement grout, bentonite, etc.)
From	To	
<u>10-13</u>	<u>14-17</u>	
<u>18-21</u>	<u>22-25</u>	
<u>26-29</u>	<u>30-33</u>	

71 PUMPING TEST

Pumping test method	Pumping rate	Duration of pumping
<input checked="" type="checkbox"/> Pump	<u>5</u> GPM	<u>4</u> Hours
Static level	Water level end of pumping	Water levels during
<u>5</u> feet	<u>20</u> feet	15 minutes: <u>20</u> feet, 30 minutes: <u>20</u> feet, 45 minutes: <u>20</u> feet, 60 minutes: <u>20</u> feet
If flowing give rate	Pump intake set at	Water at end of test
	<u>25</u> feet	<input type="checkbox"/> Clear <input type="checkbox"/> Cloudy
Recommended pump type	Recommended pump setting	Recommended pump rate
<input checked="" type="checkbox"/> Shallow <input checked="" type="checkbox"/> Deep		<u>5</u> GPM



FINAL STATUS OF WELL

Water supply Abandoned, insufficient supply Unfinished

Observation well Abandoned, poor quality Replacement well

Test hole Abandoned (Other)

Recharge well Dewatering

WATER USE

Domestic Commercial Not used

Stock Municipal Other

Irrigation Public supply

Industrial Cooling & air conditioning

METHOD OF CONSTRUCTION

Cable tool Air percussion Driving

Rotary (conventional) Boring Digging

Rotary (reverse) Diamond Other

Rotary (air) Jetting

Name of Well Contractor: Gordon Weaver Well Contractor's Licence No.: 5415

Address: Coboconk

Name of Well Technician: Gordon Weaver Well Technician's Licence No.: T-0246

Signature of Technician/Contractor: [Signature] Submission date: 28 day 5 mo 95 yr

MINISTRY USE ONLY

Data source: 5415 Date received: OCT 01 1996

Date of inspection: _____ Inspector: _____

Remarks: _____

CSS.ES

W4

WATER WELL INVENTORY

Resident Name: _____

911 Number: _____ Road: _____

Address: _____

Phone Number: _____ Email: _____

Property Owner: Yes No If No, Property Owner's Name: _____

Previous Property Owners: _____

Number of Wells on Property: _____ Don't Know

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

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

Depth of Well: _____ Don't Know

Depth of Water: _____ Don't Know

Pump Depth: _____ Don't Know

Pump Type: _____ Don't Know

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

Name of Well Driller: _____ Don't Know

Date Installed: _____ Don't Know

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

MOE Water Well Record Number: _____ Don't Know

Type of Water Use: Domestic Farm Irrigation Industrial Other _____

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

Other Water Treatment: _____ Don't Know

WATER WELL INVENTORY

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

Any problems with water quantity in the past? Yes No

Any problem with water quality in the past? Yes No

If yes, what type? Sulphur smell Iron Taste Brown Water Bacteria

Other: _____

Location of Septic Bed: _____

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

Other: _____

Is the well easily accessible? Yes No

If Yes, may we measure water levels in this well? Yes No

If necessary, could we sample your well for water quality testing? Yes No

Describe Well Location _____





The Ontario Water Resources Commission Act

WATER WELL RECORD

31 Nov

Water management in Ontario

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

11

6404295

MUNICIP

64002

CON

CDN

10

COUNTY OR DISTRICT

Victoria

TOWNSHIP, BOROUGHS, CITY, TOWN, VILLAGE

Carden

SECTION, BLOCK, TRACT, SURVEY, ETC.

X

LOT

25-27

DATE COMPLETED

04 Nov 20

33200

RC

ELEVATION

6855

RC

BASIN CODE

22

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET	
				FROM	TO
Grey	Limestone	clay	Broken	0	12
Brown	Limestone			12	21
Grey	Limestone			21	43

31

001221515

0021615

0043215

32

41

WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER			
0021	<input checked="" type="checkbox"/> FRESH	<input type="checkbox"/> SALTY	<input type="checkbox"/> SULPHUR	<input type="checkbox"/> MINERAL
0030	<input checked="" type="checkbox"/> FRESH	<input type="checkbox"/> SALTY	<input type="checkbox"/> SULPHUR	<input type="checkbox"/> MINERAL
30-43	<input type="checkbox"/> FRESH	<input type="checkbox"/> SALTY	<input type="checkbox"/> SULPHUR	<input type="checkbox"/> MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET	
			FROM	TO
10 1/4	STEEL	188	0	15
6 1/4	GALVANIZED		15	43

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER	LENGTH

61

PLUGGING & SEALING RECORD

DEPTH SET AT - FEET	MATERIAL AND TYPE
10-13	
18-21	
26-29	

71

PUMPING TEST METHOD
 PUMP TRAILER

PUMPING RATE
 0002 GPM

DURATION OF PUMPING
 01 HOURS 00 MINS.

STATIC LEVEL
 018 FEET

WATER LEVEL END OF PUMPING
 035 FEET

WATER LEVELS DURING

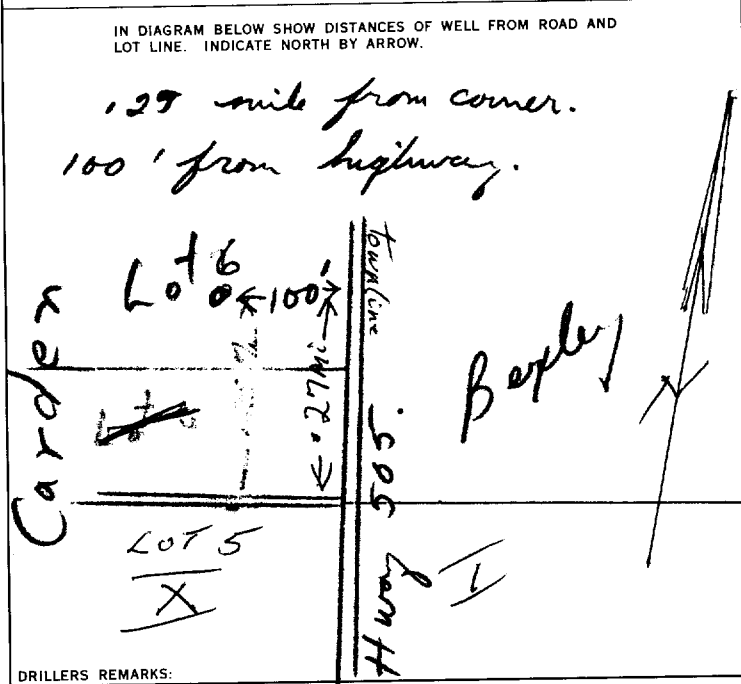
15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
018	018	018	018

RECOMMENDED PUMP TYPE
 SHALLOW DEEP

RECOMMENDED PUMP SETTING
 042 FEET

RECOMMENDED PUMPING RATE
 0002 GPM

LOCATION OF WELL



FINAL STATUS OF WELL

WATER SUPPLY
 OBSERVATION WELL
 TEST HOLE
 RECHARGE WELL

WATER USE

DOMESTIC
 STOCK
 IRRIGATION
 INDUSTRIAL
 OTHER

METHOD OF DRILLING

TABLE TOOL
 ROTARY (CONVENTIONAL)
 ROTARY (REVERSE)
 ROTARY (AIR)
 AIR PERCUSSION

CONTRACTOR

NAME OF WELL CONTRACTOR: Baldwin Well Drilling
 ADDRESS: RR#1 Kirkfield
 LICENCE NUMBER: 312

NAME OF DRILLER OR BORER: Bert Benson
 LICENCE NUMBER: [blank]

SIGNATURE OF CONTRACTOR: Carl Baldwin
 SUBMISSION DATE: 29 Jan 71

OFFICE USE ONLY

DATA SOURCE: 1
 CONTRACTOR: 1312
 DATE RECEIVED: 120271

DATE OF INSPECTION: Nov. 4/91
 INSPECTOR: P/J.B.

REMARKS: [blank]



ATTACHMENT 2

BOREHOLE LOGS

Measurements recorded in: Metric Imperial

Page ___ of ___

Well Owner's Information

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

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

Well Location

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

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

UTM Coordinates Zone: _____ Easting: **83170660270** Northing: **49483113** Municipal Plan and Sublot Number: _____ Other: _____

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 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)	Type of Sealant Used (Material and Type)	Volume Placed (m ³ /ft ³)
0' 20'	Bentonite chips	500 lbs
	Bentonite slurry	24 gallon

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

Time (min)	Draw Down		Recovery	
	Water Level (m/ft)	Time (min)	Water Level (m/ft)	Time (min)
Static Level	14'			
1		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		

Method of Construction

Cable Tool Diamond Public Commercial Not used

Rotary (Conventional) Jetting Domestic Municipal Dewatering

Rotary (Reverse) Driving Livestock Test Hole Monitoring

Boring Digging Irrigation Cooling & Air Conditioning

Air percussion Industrial Other, specify _____

Other, specify **DR-12-W**

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		Status of Well
			From	To	
6 1/4"	steel	.188	+2'	20'	<input type="checkbox"/> Water Supply <input type="checkbox"/> Replacement Well <input type="checkbox"/> Test Hole <input type="checkbox"/> Recharge Well <input type="checkbox"/> Dewatering Well <input checked="" type="checkbox"/> Observation and/or Monitoring Hole <input type="checkbox"/> Alteration (Construction) <input type="checkbox"/> Abandoned, Insufficient Supply <input type="checkbox"/> Abandoned, Poor Water Quality <input type="checkbox"/> Abandoned, other, specify _____ <input type="checkbox"/> Other, specify _____
6"	open hole		20'	65'-6"	

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft)		Status of Well
			From	To	
					<input type="checkbox"/> Other, specify _____

Water Details

Water found at Depth (m/ft)	Kind of Water:	Hole Diameter
45' (m/ft) <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	<input checked="" type="checkbox"/> Fresh <input checked="" type="checkbox"/> Untested	Depth (m/ft) Diameter (cm/in)
49' (m/ft) <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	<input checked="" type="checkbox"/> Fresh <input checked="" type="checkbox"/> Untested	0' 20' 10"
(m/ft) <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	<input type="checkbox"/> Fresh <input type="checkbox"/> Untested	20' 65'-6" 6"

Well Contractor and Well Technician Information

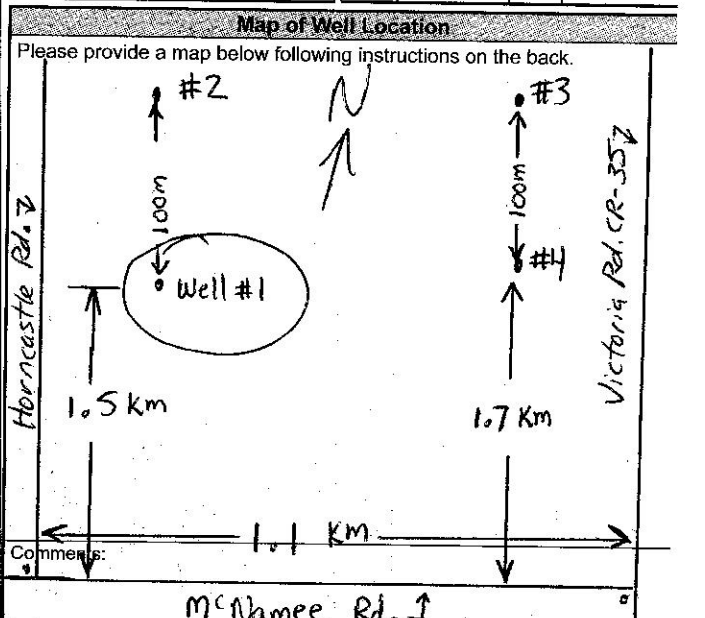
Business Name of Well Contractor: **Herb Lang Well Drilling Ltd.** Well Contractor's Licence No.: **7151610**

Business Address (Street Number/Name): **4852 Hwy 7** Municipality: **Omemee**

Province: **ON** Postal Code: **K1O12W0** Business E-mail Address: _____

Bus. Telephone No. (inc. area code): **7057997080** Name of Well Technician (Last Name, First Name): **Gothrie, Ken**

Well Technician's Licence No.: **2558** Signature of Technician and/or Contractor: **Garry Jost** Date Submitted: **20180608**



Well owner's information package delivered: Yes No

Date Package Delivered: **20180622** (YYMMDD)

Date Work Completed: **20180518** (YYMMDD)

Ministry Use Only

Audit No.: **2274954**

Received: _____

Measurements recorded in: Metric Imperial

Page _____ of _____

Well Owner's Information

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

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

Well Location

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

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

UTM Coordinates Zone Easting Northing **NAD 83 17 66 1 2 1 8 4 9 4 4 3 8 9** Municipal Plan and Sublot Number _____ Other _____

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	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 (m ³ /ft ³)
0' 10'	Bentonite chips Bentonite slurry	200 lbs 24 gallon

Method of Construction

Cable Tool Diamond Public Commercial Not used

Rotary (Conventional) Jetting Domestic Municipal Dewatering

Rotary (Reverse) Drilling Livestock Fresh Hole Monitoring

Boring Digging Irrigation Cooling & Air Conditioning

Air percussion Industrial Other, specify _____

Other, specify **DR-12W**

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		Status of Well
			From	To	
64"	steel	.188	3'	10'	<input type="checkbox"/> Water Supply <input type="checkbox"/> Replacement Well <input type="checkbox"/> Test Hole <input type="checkbox"/> Recharge Well <input type="checkbox"/> Dewatering Well <input checked="" type="checkbox"/> Observation and/or Monitoring Hole <input type="checkbox"/> Alteration (Construction) <input type="checkbox"/> Abandoned, Insufficient Supply <input type="checkbox"/> Abandoned, Poor Water Quality <input type="checkbox"/> Abandoned, other, specify _____ <input type="checkbox"/> Other, specify _____
6"	open hole		10'	75'	

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)	Kind of Water: <input checked="" type="checkbox"/> Fresh <input checked="" type="checkbox"/> Untested <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	Hole Diameter	
		Depth (m/ft) From To	Diameter (cm/in)
		51'	
		10' 75'	6"

Well Contractor and Well Technician Information

Business Name of Well Contractor **Herb Lang Well Drilling Ltd.** Well Contractor's Licence No. **751610**

Business Address (Street Number/Name) **4852 Hwy 7** Municipality **Omenece**

Province **ON** Postal Code **K0L2W0** Business E-mail Address _____

Bus. Telephone No. (inc. area code) **705 799 7088** Name of Well Technician (Last Name, First Name) **Guthrie, Ken**

Well Technician's Licence No. **2558** Signature of Technician and/or Contractor **Garry Joff** Date Submitted **20180608**

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 + min **15 min**

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

Following give rate (l/min / GPM) _____

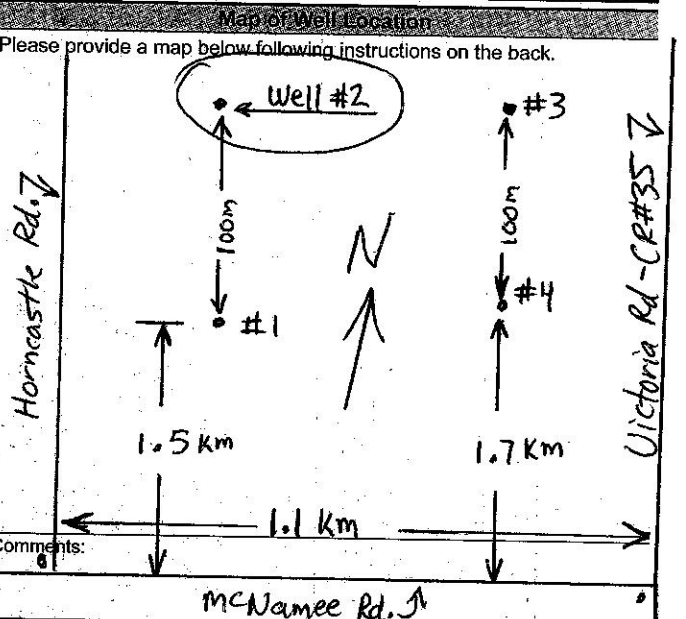
Recommended pump depth (m/ft) _____

Recommended pump rate (l/min / GPM) _____

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

Disinfected? Yes No

Time (min)	Draw-Down		Recovery	
	Water Level (m/ft)	Time (min)	Water Level (m/ft)	Time (min)
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		



Well Owner's Information

Date Package Delivered **20180622** Ministry Use Only

Information package delivered Yes No Date Work Completed **20180518** Audit No. **2274955**



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 (Ferma Aggregates), E-mail Address, Mailing Address (2666 Rena Rd.), Municipality (Mississauga), Province (ON), Postal Code (L4T3C8), Telephone No.

Well Location

Address of Well Location (Horncastle Rd.), Township (Carleton Place), Lot (6-10), Concession (10), County/District/Municipality (Victoria C-K-L), City/Town/Village (Victoria Road), Province (Ontario), UTM Coordinates Zone (NAD 83), Easting (17661674), Northing (4942560).

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

Table with columns: General Colour, Most Common Material, Other Materials, General Description, Depth (m/ft) From, To. Rows include Limestone, Shale, Fractured - Soft, Fractured - Med. Hard, Fracture, Fractured - Hard.

Annular Space table with columns: Depth Set at (m/ft) From, To; Type of Sealant Used (Material and Type); Volume Placed (m³/ft³). Rows include Bentonite chips (450 lbs) and Bentonite slurry (24 gallon).

Results of Well Yield Testing table with columns: Time (min), Water Level (m/ft), Time (min), Water Level (m/ft). Includes draw down and recovery data for various depths.

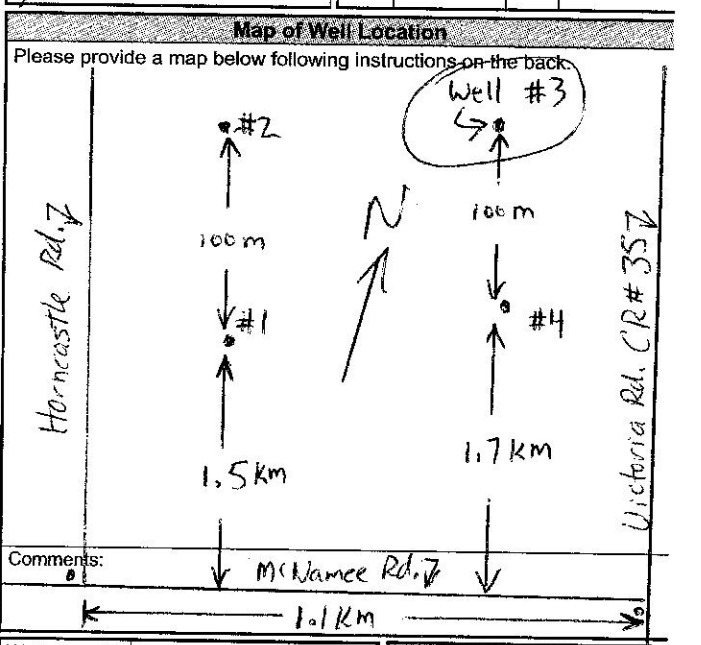
Method of Construction and Well Use checkboxes. Includes options like Cable Tool, Rotary, Boring, and various well uses like Public, Commercial, etc.

Construction Record - Casing table with columns: Inside Diameter (cm/in), Open Hole OR Material, Wall Thickness (cm/in), Depth (m/ft) From, To. Rows include 6 1/2" steel and 6" open-hole.

Construction Record - Screen table with columns: Outside Diameter (cm/in), Material, Slot No., Depth (m/ft) From, To. Includes status of well checkboxes.

Water Details and Hole Diameter tables. Water Details include depth and kind of water. Hole Diameter includes depth and diameter.

Well Contractor and Well Technician Information. Includes Business Name (Herb Lang Well Drilling Ltd.), Business Address (4852 Hwy 7), and Well Technician (Guthrie, Ken).



Well owner's information package delivered (20180630), Date Work Completed (20180618), Well Technician's Licence No. (25518), Signature of Technician (Carmy Jodi).

Ministry Use Only section with Audit No. (2291095) and Received stamp.



Well Tag No. (Place Sticker and/or Print Below)

Tag #: A 238597

Well Record

Regulation 903 Ontario Water Resources Act

Page of

Measurements recorded in: Metric Imperial

Well Owner's Information

First Name, Last Name / Organization (Ferma Aggregates), E-mail Address, Mailing Address (2666 Rena Rd.), Municipality (Mississauga), Province (ON), Postal Code (K0L 2W0), Telephone No.

Well Location

Address of Well Location (Horncastle Rd.), Township (Canden), Lot (6-10), Concession (10), County/District/Municipality (Victoria (C-K-L)), City/Town/Village (Victoria Road), Province (Ontario), UTM Coordinates.

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

Table with columns: General Colour, Most Common Material, Other Materials, General Description, Depth (m/ft) From, To. Rows include Limestone, Shale, Fractured-Soft, Fractured-Med. Hard, Fracture, Fractured-MED-Hard, Fracture, Fractured-med-hard, Hard.

Annular Space

Table with columns: Depth Set at (m/ft) From, To; Type of Sealant Used (Material and Type); Volume Placed (m³/ft³). Rows include Bentonite chips (100 lbs) and Bentonite slurry (24 gallon).

Results of Well Yield Testing

After test of well yield, water was: Other, specify cloudy. Draw Down and Recovery table with Time (min), Water Level (m/ft), and Pumping rate (300 + 6 GPM).

Method of Construction

Well Use

Method of Construction: Other, specify DR-12-W. Well Use: Monitoring.

Construction Record - Casing

Status of Well

Construction Record - Casing table with columns: Inside Diameter, Open Hole OR Material, Wall Thickness, Depth (m/ft) From, To. Status of Well: Observation and/or Monitoring Hole.

Construction Record - Screen

Construction Record - Screen table with columns: Outside Diameter, Material, Slot No., Depth (m/ft) From, To.

Water Details

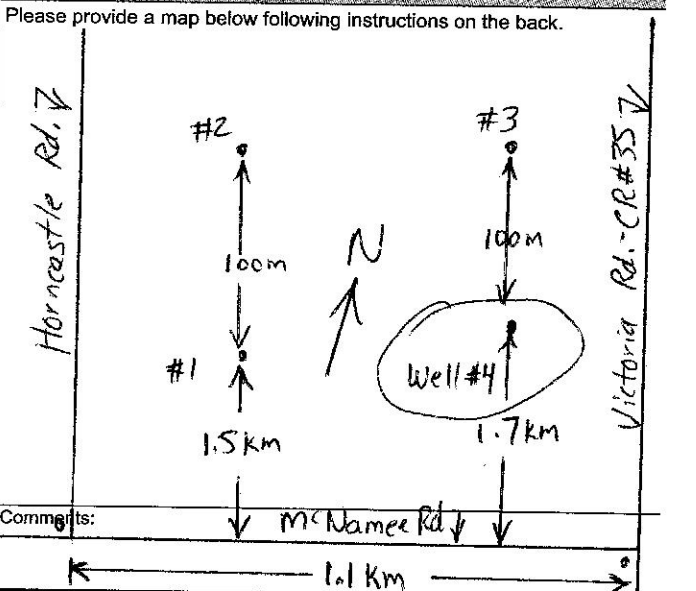
Hole Diameter

Water Details: Water found at Depth 45', 114', 134'. Kind of Water: Fresh Untested. Hole Diameter: Depth 0' to 10' (10.34"), 10' to 134' (8").

Well Contractor and Well Technician Information

Business Name of Well Contractor (Herb Lang Well Drilling Ltd.), Well Contractor's Licence No (75610), Business Address (4852 Hwy 7), Municipality (omcmce), Province (ON), Postal Code (K0L2W0), Business E-mail Address, Bus. Telephone No (705 799 7088), Name of Well Technician (Guthrie, Ken), Well Technician's Licence No (25158), Signature of Technician and/or Contractor (Gary Jeff), Date Submitted (20180608).

Map of Well Location



Well owner's information package delivered: Yes. Date Package Delivered: 20180622. Date Work Completed: 20180518. Ministry Use Only: Audit No. 2291096.

ID Number: MW2-18

Project Name: 36123-200

Project No: 36123-200

Client: Ferma Aggregates

Site Location: Kirkfield

Date Completed: 9/27/2018

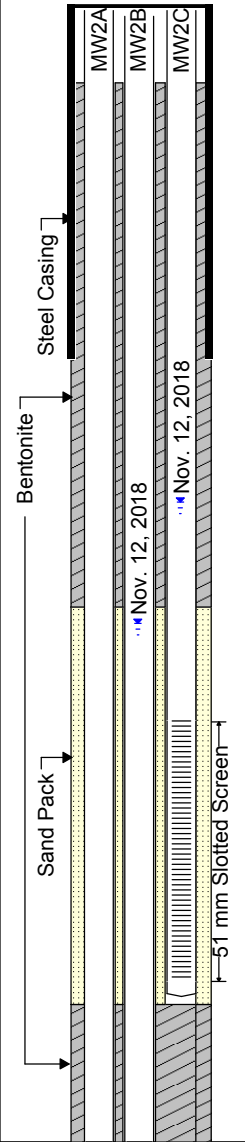
Drilling Contractor: Herb Lang Drilling

Drill Rig: Dual Rotary Drill Rig (DR-12-W)

Drill Method: Dual Rotary

Protective Cover: Steel Casing

SUBSURFACE PROFILE		SAMPLE				SPT	MOISTURE	Well Completion Details
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value Blows/305mm 20 40 60 80	
ft m								
0		Ground Surface	272.2					
0		LIMESTONE Grey fractured (soft) limestone	0.0					
2			271.3					
4		Grey fractured (medium/hard) limestone	0.9					
6	2							
8								
10								
12								
14	4							
16								
18								
20	6							
22								
24								
26	8							
28								
30								
32								
34	10							
36								



Field Technician:

Drafted by: TFC

Reviewed by: PAG



ID Number: MW2-18

Project Name: 36123-200

Project No: 36123-200

Client: Ferma Aggregates

Site Location: Kirkfield

Date Completed: 9/27/2018

Drilling Contractor: Herb Lang Drilling

Drill Rig: Dual Rotary Drill Rig (DR-12-W)

Drill Method: Duel Rotary

Protective Cover: Steel Casing

SUBSURFACE PROFILE		SAMPLE				SPT	MOISTURE	Well Completion Details	
Depth Scale	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type	Recovery (%)	N-Value • Blows/305mm • 20 40 60 80		Moisture Content % 10 20 30
38	12								Sand Pack
40									
42	14								Sand Pack
44									
46	16	LIMESTONE Gray/brown fractured (hard) limestone Large fractures noted by drillers between 255.3 - 256.5 in nearby MW1.	256.7						51 mm Slotted Screen
48				15.5					
50	18								Bentonite
52									
54	20								Nov. 12, 2018
56									
58	22								51 mm Slotted Screen
60									
62									Sand Pack
64									
66									
68									
70									
72									
74		Drilling Terminated	249.3						
76				22.9					

Field Technician:

Drafted by: TFC

Reviewed by: PAG





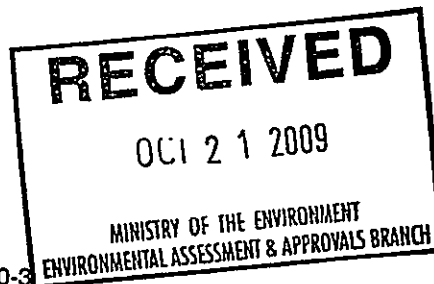
ATTACHMENT 3

**R.W. TOMLINSON LTD. – BRECHIN QUARRY
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

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LIST OF ABBREVIATIONS

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

<p>I. SAMPLE TYPE</p> <p>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</p>	<p>III. SOIL DESCRIPTION</p> <p style="text-align: center;">(a)</p> <p>Density Index (Relative Density)</p> <p>Very loose Loose Compact Dense Very dense</p> <p style="text-align: center;">(b)</p> <p>Consistency</p> <p>Very soft Soft Firm Stiff Very stiff Hard</p>	<p style="text-align: center;">Cohesionless Soils</p> <p style="text-align: center;">N <u>Blows/300 mm</u> <u>Or Blows/ft.</u></p> <p style="text-align: center;">0 to 4 4 to 10 10 to 30 30 to 50 over 50</p> <p style="text-align: center;">Cohesive Soils $C_{u2}S_u$</p> <p style="text-align: center;"><u>Kpa</u> <u>Psf</u></p> <p style="text-align: center;">0 to 12 0 to 250 12 to 25 250 to 500 25 to 50 500 to 1,000 50 to 100 1,000 to 2,000 100 to 200 2,000 to 4,000 Over 200 Over 4,000</p>
<p>II. PENETRATION RESISTANCE</p> <p>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.)</p> <p>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° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).</p> <p>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</p> <p>Peizo-Cone Penetration Test (CPT): An electronic cone penetrometer with a 60° conical tip and a projected end area of 10 cm² 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.</p>	<p>IV. SOIL TESTS</p> <p>w water content w_p plastic limited w_l liquid limit C consolidation (oedometer) test CHEM chemical analysis (refer to text) CID consolidated isotropically drained triaxial test¹ CIU consolidated isotropically undrained triaxial test with porewater pressure measurement¹ 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</p>	

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		(a) Index Properties (cont'd.)	
π	= 3.1416	w	water content
$\ln x$	natural logarithm of x	w_L	liquid limit
$\log_{10} x$ or $\log x$	logarithm of x to base 10	w_p	plastic limit
g	Acceleration due to gravity	I_p	plasticity Index = $(w_L - w_p)$
t	time	w_s	shrinkage limit
F	factor of safety	I_L	liquidity index = $(w - w_p) / I_p$
V	volume	I_c	consistency index = $(w_L - w) / I_p$
W	weight	e_{max}	void ratio in loosest state
II. STRESS AND STRAIN		e_{min}	void ratio in densest state
γ	shear strain	I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)
Δ	change in, e.g. in stress: $\Delta \sigma'$	(b) Hydraulic Properties	
ϵ	linear strain	h	hydraulic head or potential
ϵ_v	volumetric strain	q	rate of flow
η	coefficient of viscosity	v	velocity of flow
ν	Poisson's ratio	i	hydraulic gradient
σ	total stress	k	hydraulic conductivity (coefficient of permeability)
σ'	effective stress ($\sigma' = \sigma - u$)	j	seepage force per unit volume
σ'_{vo}	initial effective overburden stress	(c) Consolidation (one-dimensional)	
$\sigma_1 \sigma_2 \sigma_3$	principal stresses (major, intermediate, minor)	C_c	compression index (normally consolidated range)
σ_{oct}	mean stress or octahedral stress = $(\sigma_1 + \sigma_2 + \sigma_3) / 3$	C_r	recompression index (overconsolidated range)
τ	shear stress	C_s	swelling index
u	porewater pressure	C_a	coefficient of secondary consolidation
E	modulus of deformation	m_v	coefficient of volume change
G	shear modulus of deformation	c_v	coefficient of consolidation
K	bulk modulus of compressibility	T_v	time factor (vertical direction)
III. SOIL PROPERTIES		U	degree of consolidation
(a) Index Properties		σ'_p	pre-consolidation pressure
$\rho(\gamma)$	bulk density (bulk unit weight*)	OCR	Overconsolidation ratio = σ'_p / σ'_{vo}
$\rho_d(\gamma_d)$	dry density (dry unit weight)	(d) Shear Strength	
$\rho_w(\gamma_w)$	density (unit weight) of water	τ_p, τ_r	peak and residual shear strength
$\rho_s(\gamma_s)$	density (unit weight) of solid particles	ϕ'	effective angle of internal friction
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)	δ	angle of interface friction
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) formerly (G_s)	μ	coefficient of friction = $\tan \delta$
e	void ratio	c'	effective cohesion
n	porosity	c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
S	degree of saturation	P	mean total stress $(\sigma_1 + \sigma_3) / 2$
*	Density symbol is ρ . Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density x acceleration due to gravity)	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

<u>Description</u>	<u>Bedding Plane Spacing</u>
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

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

GRAIN SIZE

<u>Term</u>	<u>Size*</u>
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° 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
	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.

DEPTH SCALE METRES	DRILLING RECORD	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (mm/min)	FLUSH COLOUR & RETURN	FR/FX-FRACTURE-F-FAULT		SM-SMOOTH	FL-FLEXURED	BC-BROKEN CORE		NOTES WATER LEVELS INSTRUMENTATION
							CL-CLEAVAGE	J-JOINT	R-ROUGH	UE-UNEVEN	MB-MECH. BREAK	B-BEDDING	
							SH-SHEAR	P-POLISHED	ST-STEPPED	W-WAVY			
RECOVERY		R.O.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY				DIAMETRAL POINT LOAD INDEX (MPa)			
TOTAL CORE %	SOLID CORE %			DIP #1 CORE AXIS	TYPE AND SURFACE DESCRIPTION	K ₁ cm/sec	K ₂ cm/sec	K ₃ cm/sec	K ₄ cm/sec				
0	GROUND SURFACE		249.65										MW-1
	Topsoil		0.00										
	Venulam Formation 0.1 m to 15.0 m		249.55										
1	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.		0.10										
2	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.												
3													
4													
5													

Bentonite Seal

CONTINUED NEXT PAGE

MISS ROCK 041120800-RCK-GEOMW.GPJ GLDR CAN.GDT 12/06 JDR

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAN 000024

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	SYMBOLIC LOG	ELEV. DEPTH (m) *	RUN NO.	PENETRATION RATE (m/min)	FLUSH	COLOUR	% RETURN	FR/FX-FRACTURE-FAULT		SM-SMOOTH		FL-FLEXURED		BC-BROKEN CORE		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION	
									CL-CLEAVAGE	J-JOINT	R-ROUGH	UE-UNEVEN	MB-MECHL BREAK	MB-BEDDING					
									SH-SHEAR	P-POLISHED	ST-STEPPED	WW-WAVY	B-BEDDING						
RECOVERY		R.O.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY			DIP w.r.t. CORE AXIS										
TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION		10 ⁻⁹	10 ⁻⁷	10 ⁻⁵	10 ⁻¹	10 ¹	10 ³								
5	— CONTINUED FROM PREVIOUS PAGE —																		
5	Verulam Formation 0.1 m to 15.0 m																		
6	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.			5															
6	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.																		
6	Broken weathered core occurs again at 3.40 m to 3.50 m.																		
7																			
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10																			
10	CONTINUED NEXT PAGE																		

Bentonite Seal

14

MISS ROCK 041120800-RCK-GEOMW.GPJ GLDR_CAN.GDT 12/06 JDR

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAM

000025

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR	RETURN %	FR/FX-FRACTURE-FAULT		SM-SMOOTH		FL-FLEXURED		BC-BROKEN CORE		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION	
										CL-CLEAVAGE	J-JOINT	R-ROUGH	UE-UNEVEN	MB-MECH. BREAK	B-BEDDING					
										SH-SHEAR	P-POLISHED	ST-STEPPED	W-WAVY							
		— CONTINUED FROM PREVIOUS PAGE —								RECOVERY	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY K cm/sec					
										TOTAL CORE %	SOLID CORE %	DIP w.r.t. CORE AXIS	TYPE AND SURFACE DESCRIPTION		10 ⁻⁴	10 ⁻³	10 ⁻²			
10		Verulam Formation 0.1 m to 15.0 m								88.9	88.9	88.9								
		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																				
13																				
14																				
15				234.85																
		CONTINUED NEXT PAGE																		

Bentonite Seal

MISS. ROCK 041120800-RCK-GEOMW.GPJ GLDR CAN.GDT 12/8/06 JDR

DEPTH SCALE
1:25



LOGGED: MK
CHECKED: KAN 000026

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR & RETURN	FR/FX-FRACTURE-FAULT		SM-SMOOTH		FL-FLEXURED		BC-BROKEN CORE		DIAMETRAL POINT LOAD INDEX (NIP)	NOTES WATER LEVELS INSTRUMENTATION		
									CL-CLEAVAGE	J-JOINT	R-ROUGH	UE-UNEVEN	MB-MECH. BREAK	B-BEDDING						
									SH-SHEAR	P-POLISHED	ST-STEPPED	W-WAVY								
									VN-VEIN	S-SLICKENSIDED	PL-PLANAR	C-CURVED								
RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY			DIP w.r.t. CORE AXIS		TYPE AND SURFACE DESCRIPTION	K, cm/sec								
TOTAL CORE %	SOLID CORE %			10 ⁴	10 ³	10 ²	10 ¹	10 ⁰	10 ⁰	10 ¹		10 ²								
		— CONTINUED FROM PREVIOUS PAGE —																		
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																
23				17																
24				18																
25		CONTINUED NEXT PAGE																		

MISS. ROCK 041120800-RCK-GEOMW.GPJ GLDR CAN.GDT 12/8/06 JDR

DEPTH SCALE
1:25



LOGGED: MK
CHECKED: KA 000028

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH COLOUR % RETURN	RECOVERY		R.O.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY K _v cm/sec			DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
								TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION		10 ⁻⁴	10 ⁻³	10 ⁻²		
								FRFX-FRACTURE-FAULT CL-CLEAVAGE SH-SHEAR VN-VEIN	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				
25		--- CONTINUED FROM PREVIOUS PAGE ---																
		Bobcaygeon Formation 15.0 m to 28.35 m (Continued - see previous page for detailed description)																
26				16														
27				19														
28				221.30 28.35														
29		Gull River Formation 28.35 m to 45.10 m 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.		20														
30				21														
		CONTINUED NEXT PAGE																

MISS. ROCK 041120800-RC-K-GEOMW/GPJ GLDR. CAN.GDT. 12/06 JDR

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAM

000029

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	FR/FX-FRACTURE-FAULT			SM-SMOOTH		FL-FLEXURED		BC-BROKEN CORE		DIAMETRAL PORE LOSS INDEX (DPLI)	NOTES WATER LEVELS INSTRUMENTATION	
									CL-CLEAVAGE	J-JOINT	R-ROUGH	R-ROUGH	UE-UNEVEN	MB-MECH. BREAK	B-BEDDING					
									SH-SHEAR	P-POLISHED	ST-STEPPED	W-WAVY								
RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY														
TOTAL CORE %	SOLID CORE %			DIP W.I.L. CORE AXIS	TYPE AND SURFACE DESCRIPTION	10 ⁻⁸	10 ⁻⁷	10 ⁻⁶												
— CONTINUED FROM PREVIOUS PAGE —																				
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 stylonite (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 (33.28 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.			22															
		Unit 2 35.55 m to 38.88 m																		
32		Fresh, light creamy grey, very fine grained, medium to thickly bedded, lithographic limestone with occasional stylonite (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 stylonite (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															
33		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					24															
35																				

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

MW-1

CONTINUED NEXT PAGE

MISS. ROCK 041120800-RCK-GEOMW.GPJ GLDR CAN.GDT 12/8/06 IDR

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAN 000030

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN NO.	PENETRATION RATE (m/min)	FLUSH	COLOUR	% RETURN	FR/FX-FRACTURE-FAULT		SM-SMOOTH		FL-FLEXURED		BC-BROKEN CORE		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION		
										CL-CLEAVAGE	J-JOINT	R-ROUGH	UE-UNEVEN	MB-MECH. BREAK	B-BEDDING						
										SH-SHEAR	P-POLISHED	ST-STEPPED	W-WAVY								
RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY K _c cm/sec															
TOTAL CORE %	SOLID CORE %			DP W/LL CORE AXIS	TYPE AND SURFACE DESCRIPTION	10 ⁻⁴	10 ⁻³	10 ⁻²	10 ⁻¹	10 ⁰	10 ¹	10 ²									
--- CONTINUED FROM PREVIOUS PAGE ---																					
35		Gull River Formation 28.35 m to 45.10 m Unit 4 28.35 m to 31.80 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.	24																		
36																					
37																					
38																				Bentonite Seal	
39																					
40		CONTINUED NEXT PAGE																			

MISS. ROCK 041120800-RCK-GEOMW.GPJ GLDR. CAN.GDT. 12/06. JDR



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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	FRFX-FRACTURE-FAULT CL-CLEAVAGE SH-SHEAR VN-VEIN	J-JOINT P-POLISHED S-SUCKERSIDED	SM-SMOOTH R-ROUGH ST-STEPPED PL-PLANAR	FL-FLEXURED UE-UNEVEN W-WAVY C-CURVED	BC-BROKEN CORE MB-MECH. BREAK B-BEDDING	RECOVERY		R.O.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY K _v cm/sec				DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
													TOTAL CORE %	SOLID CORE %			DIP W.I.L. CORE AXIS	TYPE AND SURFACE DESCRIPTION	10 ⁻⁴	10 ⁻³	10 ⁻²	10 ⁻¹		
													88888	88888			88888	88888	88888	88888	88888	88888		
— CONTINUED FROM PREVIOUS PAGE —																								
40		Gull River Formation 28.35 m to 45.10 m																						
		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 stylonite (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.																						
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.																						
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 stylonite (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.																						
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 stylonite (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		
44																								
45		CONTINUED NEXT PAGE																						

MISS ROCK 041120800-RCK-GEOMW.GPJ GLDR CAN.GDT 12/8/06 JDR

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAN000032

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH COLOUR % RETURN	FR/FX-FRACTURE-FAULT				SM-SMOOTH			FL-FLEXURED			BC-BROKEN CORE			DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
							CL-CLEAVAGE		J-JOINT		R-ROUGH			UE-UNEVEN			MB-MECH. BREAK				
							SH-SHEAR		P-POLISHED		ST-STEPPED			W-WAVY			B-BEDDING				
VN-VEIN		S-SUCKERSIDED		PL-PLANAR			C-CURVED														
				RECOVERY		R.Q.D. %		FRACT. INDEX PER 0.3		DISCONTINUITY DATA			HYDRAULIC CONDUCTIVITY								
				TOTAL CORE %		SOLID CORE %		DIP w/L CORE AXES		TYPE AND SURFACE DESCRIPTION			K cm/sec								
				8898		8898		8888					10 ⁻⁴ 10 ⁻³ 10 ⁻²								
				204.55																	
				45.10																	
— CONTINUED FROM PREVIOUS PAGE —																					
45		Shadow Lake Formation 45.10 m to 53.51 m		31																	
		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.																			
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																	
48				33																	
49				34																	
50		CONTINUED NEXT PAGE																			

Bentonite Seal

MISS. ROCK 041120800-RCK-GEOMW.GPJ GLDR. CAN.GDT. 12/06 JDR

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAM

000033

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (mm/min)	FLUSH	COLOUR & RETURN	FR/FX-FRACTURE-FAULT		SM-SMOOTH		FL-FLEXURED		BC-BROKEN CORE		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
								CL-CLEAVAGE	J-JOINT	R-ROUGH	UE-UNEVEN	MB-MECH. BREAK	B-BEDDING				
								SH-SHEAR	P-POLISHED	ST-STEPPED	W-WAVY						
RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY K cm/sec				DIP w.r.t. CORE AXIS		MW-1					
TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION		10 ⁻⁴	10 ⁻⁵	10 ⁻⁶	10 ⁻⁷								
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, thin 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 50.55 m to 50.80 m. Transitional lower contact.																
	From 51.25 m 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																	
53																	
	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																

Bentonite Seal

MISS. ROCK 041120800-RCK-GEOMW.GPJ GLDR. CAN.GDT. 12/8/06 JDR

DEPTH SCALE
1:25



LOGGED: MK
CHECKED: KAI00034

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.

DEPTH SCALE METRES	DRILLING RECORD	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (cm/min)	FLUSH	COLOUR	% RETURN	FR/FX-FRACTURE-FAULT		SM-SMOOTH		FL-FLEXURED		BC-BROKEN CORE		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION			
									RECOVERY		R.O.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY						
									TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION	K _v cm/sec	10 ⁻⁶	10 ⁻⁵			10 ⁻⁴		
— CONTINUED FROM PREVIOUS PAGE —																					
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.	[Symbolic Log Pattern]																	MW-1		
			37																		
			38																		
56			39																		
57																					
58																					
59																					
60	END OF DRILLHOLE		189.72 59.93																		

Bentonite Seal

MISS. ROCK 041120800-RCK-GEOMW.GPJ GLDR CAN.GDT 12/8/06 JDR

DEPTH SCALE
1:25



LOGGED: MK
CHECKED: KAM 000035

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (cm/hr)	FLUSH	COLOUR & TEXTURE	PREFIX-FRACTURE-F-AULT		SM-SMOOTH		FL-FLEXURED		BC-BROKEN CORE		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION		
									CL-CLEAVAGE	J-JOINT	R-ROUGH	UE-UNEVEN	MB-MECH. BREAK	DISCONTINUITY DATA	HYDRAULIC CONDUCTIVITY					
									SH-SHEAR	P-POLISHED	ST-STEPPED	W-WAVY	B-BEDDING		K ₁ cm/sec	K ₂ cm/sec			K ₃ cm/sec	K ₄ cm/sec
0	GROUND SURFACE			246.87																
	Topsoil			0.00																
	Verulam Formation			0.05																
	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.																			
1																				
2																				
3																				
4																				
5																				

CONTINUED NEXT PAGE

MISS. ROCK 041120800-RCK-GEOMW.GPJ GLDR. CAN.GDT. 12/8/05 .JDR

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KA000036

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (cm/min)	FLUSH	COLOUR % RETURN	FR/FX-FRACTURE-FAULT			SM-SMOOTH			FL-FLEXURED			BC-BROKEN CORE			DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
									CL-CLEAVAGE	J-JOINT	S-SUCKENSIDED	R-ROUGH	UE-UNEVEN	MB-MECH. BREAK	SH-SHEAR	P-POLISHED	ST-STEPPED	W-WAVY	B-BEDDING			
									VI-VEIN	S-SUCKENSIDED	PL-PLANAR	C-CURVED	RECOVERY	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY K cm/sec				
TOTAL CORE %	SOLID CORE %		DIP W/L CORE AXIS	TYPE AND SURFACE DESCRIPTION		10'	10'	10'	10'	10'												
-- CONTINUED FROM PREVIOUS PAGE --																						MW-2
10		Bobcaygeon Formation 9.00 m to 21.95 m																				(B) (A)
		Sharp contact with Verulam Formation.																				Bentonite Seal
		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.																				
15		CONTINUED NEXT PAGE																				

MISS. ROCK 041120800-RCK-GEOMW/GPJ GLDR. CAN.GDT. 12/06 JDR

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KA/000038

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR	% RETURN	FR/FX-FRACTURE-FULT		SM-SMOOTH		FL-FLEXURED		BC-BROKEN CORE		DIAMETRAL POINT LOAD INDEX (NPA)	NOTES WATER LEVELS INSTRUMENTATION	
										CL-CLEAVAGE	J-JOINT	R-ROUGH	UE-UNEVEN	MB-MECH. BREAK	B-BEDDING					
										SH-SHEAR	P-POLISHED	ST-STEPPED	W-WAVY							
RECOVERY		DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY																
TOTAL CORE %	SOLID CORE %	R.O.D. %	FRACT. INDEX PER 0.3	DPWELL CORE AXIS	TYPE AND SURFACE DESCRIPTION	10 ⁻⁵	10 ⁻⁴	10 ⁻³	10 ⁻²	10 ⁻¹	10 ⁰	10 ¹	10 ²	10 ³						
15		— CONTINUED FROM PREVIOUS PAGE —																		MW-2 (B) (A)
		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																				
18																				
19																				
20		CONTINUED NEXT PAGE																		

MISS. ROCK 041120800-RCK-GEOMW/GPJ GLDR. CAN.GDT. 12/8/05 JDR

DEPTH SCALE
1:25



LOGGED: MK
CHECKED: KAM

000039

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN NO.	PENETRATION RATE (m/min)	FLUSH COLOUR % RETURN	FR/FX-FRACTURE-FAULT		SM-SMOOTH		FL-FLEXURED		BC-BROKEN CORE		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION	
								CL-CLEAVAGE	J-JOINT	R-ROUGH	UE-UNEVEN	MS-MECH. BREAK	DISCONTINUITY DATA	HYDRAULIC CONDUCTIVITY				
								SH-SHEAR	P-POLISHED	ST-STEPPED	W-WAVY	B-BEDDING		10 ⁻²	10 ⁻¹			10 ⁰
25	— CONTINUED FROM PREVIOUS PAGE —																MW-2 (B) (A)	
		<p>Gull River Formation 21.95 m to 35.50 m</p> <p>Unit 4 21.95 m to 25.35 m:</p> <p>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.</p> <p>Unit 3 25.35 m to 28.88 m</p> <p>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.</p> <p>Unit 2 28.88 m to 34.70 m</p> <p>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.</p> <p>Unit 1 34.70 m to 35.50 m</p> <p>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.</p>																
26				19														
27				20														
28				21														
29				22														
30		CONTINUED NEXT PAGE																

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

MISS ROCK D41120800-ROK-GEOMW/GPJ GLDR CAN GDT 12/08 JDR

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAM

000041

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (mm/min)	FLUSH % RETURN	FR/FX-FRACTURE-FAULT		SM-SMOOTH	FL-FLEXURED	BC-BROKEN CORE	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
								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			
RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY K, cm/sec								
TOTAL CORE %	SOLID CORE %			DIP W/E CORE AXIS	TYPE AND SURFACE DESCRIPTION	10 ⁻⁴	10 ⁻³	10 ⁻²						
0		GROUND SURFACE		247.79										
		Topsoil		0.00										(B) ∇ (A)
		Verulam Formation 0.06 m to 16.30 m		0.06										(B)
1		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, pelyceopods) 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										
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



LOGGED: MK
CHECKED: KA 000044

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (mm/HR)	FLUSH	RECOVERY		R.O.D. %	FRACT INDEX PER 0.3	DISCONTINUITY DATA		HYDRALIC CONDUCTIVITY				DIAMETER POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
							TOTAL CORE %	SOLID CORE %			DIP WITH CORE AXIL	TYPE AND SURFACE DESCRIPTION	10 ³	10 ²	10 ¹	10 ⁰		
							FRFX-FRACTURE-F-FAULT	SM-SMOOTH			FL-FLEXURED	BC-BROKEN CORE	CL-CLEAVAGE	J-JOINT	R-ROUGH	UE-UNEVEN		
10	— CONTINUED FROM PREVIOUS PAGE —						8888	8888	8888	222	888		10 ³	10 ²	10 ¹	10 ⁰	2	MW-3
11	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, pelyceps) 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)
12			9															
13			10															
14			11															
15	CONTINUED NEXT PAGE																	

Bentonite Seal

3/2

MISS. ROCK 041120800-RCK-GEOMW.GPJ GLDR. CAN.GDT. 12/06 JDR

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAN000046

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH % RETURN	FR/FX-FRACTURE-Fault		SM-SMOOTH		FL-FLEXURED		BC-BROKEN CORE		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION			
							CL-CLEAVAGE	J-JOINT	R-ROUGH	UE-UNEVEN	MB-MECH. BREAK	B-BEDDING	RECOVERY	R.O.D. %			FRACT. INDEX PER 0.3	DISCONTINUITY DATA	HYDRAULIC CONDUCTIVITY K _v cm/sec
							SH-SHEAR	P-POLISHED	ST-STEPPED	W-WAVY	C-CURVED	TOTAL CORE %							
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, pelyceps) 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															
			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.	12															
			From 16.30 m to 17.55 m: Fresh medium brown, medium grained, crystalline, faintly petrolierous, 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.	13															
			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															
			CONTINUED NEXT PAGE																

MISS. ROCK 041120800-RCK-GEOMW.GPJ GLDR. CAN.GDT. 12/06 JDR

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAM

000047

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	COLLOUR	FLUSH	RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY				DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
									TOTAL CORE %	SOLID CORE %			DIP w.r.t. CORE AXIS	TYPE AND SURFACE DESCRIPTION	10 ⁻⁴	10 ⁻³	10 ⁻²	10 ⁻¹		
									FRFX-FRACTURE-Fault	SM-SMOOTH			FL-FLEXURED	BC-BROKEN CORE						
— CONTINUED FROM PREVIOUS PAGE —																				MW-3
20		Bobcaygeon Formation 18.30 m to 29.26 m																		(B) (A)
		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.																		
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.																		
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.																		
		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.																		
23																				
24																				
25		CONTINUED NEXT PAGE																		

MISS ROCK 041120800-RCK-GEOMW.GPJ GLDR CAN.GDT 12/06 JDR

DEPTH SCALE
1:25



LOGGED: MK
CHECKED: KA 000048

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (cm/min)	COLOUR (cm/min)	FR/FX-FRACTURE-FAULT		SM-SMOOTH		FL-FLEXURED		BC-BROKEN CORE		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION	
								CL-CLEAVAGE	J-JOINT	R-ROUGH	UE-UNEVEN	MS-MECH BREAK	B-BEDDING					
								SH-SHEAR	P-POLISHED	ST-STEPPED	WW-WAVY							
W-V-VEIN	S-SLICKENSIDED	PL-PLANAR	C-CURVED															
RECOVERY		R.O.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY			TYPE AND SURFACE DESCRIPTION									
TOTAL CORE %	SOLID CORE %			DIP w/L CORE AXIS				K, cm/sec										
FLUSH		CORRECTION		CORRECTION		CORRECTION		CORRECTION		CORRECTION		CORRECTION		CORRECTION				
22222		22222		22222		22222		22222		22222		22222		22222				
--- CONTINUED FROM PREVIOUS PAGE ---																		
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, thin 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.																
26				18														
27				19														
28				20														
29				21														
		Gull River Formation 29.26 m to 46.20 m (See next page for detailed description)		218.53 29.26														
30		CONTINUED NEXT PAGE																

MISS. ROCK 041120800-FCK-GEOMW.GPJ GLDR. CAN.GDT 12/18/06 JDR

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAM
000049

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	RECOVERY	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA	HYDRAULIC CONDUCTIVITY K cm/sec	DIAMETRAL POINT LOAD INDEX (kPa)	NOTES WATER LEVELS INSTRUMENTATION				
															FR/FX-FRACTURE-FAULT	SM-SMOOTH	FL-FLEXURED	BC-BROKEN CORE
															CL-CLEAVAGE	J-JOINT	R-ROUGH	UE-UNEVEN
-- CONTINUED FROM PREVIOUS PAGE --																		
30		Gull River Formation 29.26 m to 46.20 m												MW-3 (B) (A)				
		Unit 4 29.28 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										Bentonite Seal				
31		Unit 3 32.62 m to 38.25 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														
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																

MISS ROCK 041120800-RCK-GEOMW.GPJ GLDR CAN.GDT 12/8/06 JDR

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAN000050

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR	% RETURN	FR/FX-FRACTURE-FAULT			SM-SMOOTH			FL-FLEXURED			BC-BROKEN CORE			DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION	
										CL-CLEAVAGE	J-JOINT	R-ROUGH	UE-UNEVEN	MB-MECH. BREAK	B-BEDDING	RECOVERY			FRACT. INDEX PER 0.3	DISCONTINUITY DATA				
										SH-SHEAR	P-POLISHED	ST-STEPPED	W-WAVY	B-BEDDING	TOTAL CORE %	SOLID CORE %	R.O.D. %	DP W/L CORE AXIS		TYPE AND SURFACE DESCRIPTION				HYDRAULIC CONDUCTIVITY K _s cm/sec
— CONTINUED FROM PREVIOUS PAGE —																						(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. 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. 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. 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 41.48 m. Reddish brown, thin shaly dolostone bed at 45.50 m to 45.52 m.		24																			Bentonite Seal	
36				25																				
37				26																				
38				27																				
39																								
40		CONTINUED NEXT PAGE																						

MISS. ROCK 041120800-RCK-GEOMW.GPJ GLDR. CAN.GDT. 12/08 JDR

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAM
000051

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR RETURN	FR-FRACTURE-F-FAULT		SM-SMOOTH		FL-FLEXURED		BC-BROKEN CORE		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION	
									CL-CLEAVAGE	J-JOINT	R-ROUGH	U-UNEVEN	MB-MECH BREAK	B-BEDDING					
									SH-SHEAR	P-POLISHED	ST-STEPPED	W-WAVY							
RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY K cm/sec				DIP W.I.L. CORE AXES		TYPE AND SURFACE DESCRIPTION							
TOTAL CORE %	SOLID CORE %			DIP W.I.L. CORE AXES		10 ¹	10 ²	10 ³	10 ⁴	10 ¹	10 ²								
-- CONTINUED FROM PREVIOUS PAGE --																			
40		Gull River Formation 29.26 m to 46.20 m		27															Bentonite Seal
		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.																	
41		Unit 3 32.62 m to 36.25 m		28															Sand
		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.																	
42		Unit 2 36.25 m to 40.12 m		29															
		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		30															
		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				31															
45																			
CONTINUED NEXT PAGE																			

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

MISS. ROCK 041120800-RCK-GEOMW.GPJ GLDR. CAN.GDT. 12/8/06 JDR

DEPTH SCALE

1:25



LOGGED: MK

CHECKED: KAN000052

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN NO.	PENETRATION RATE (m/min)	FLUSH	COLOUR & RETURN	FR/FX-FRACTURE-FAULT		SM-SMOOTH		FL-FLEXURED		BC-BROKEN CORE		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
								CL-CLEAVAGE	J-JOINT	R-ROUGH	UE-UNEVEN	MB-MECH. BREAK	B-BEDDING				
								SH-SHEAR	P-POLISHED	ST-STEPPED	W-WAVY						
								VN-VEIN	S-SLICKENSIDED	PL-PLANAR	C-CURVED						
RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY			2	3	4	5					
TOTAL CORE %	SOLID CORE %			DIP w/1 CORE ARC	TYPE AND SURFACE DESCRIPTION	K ₁ cm/sec	K ₂ cm/sec	K ₃ cm/sec									
8888		8888	8888	8888	8888	8888											
45	--- CONTINUED FROM PREVIOUS PAGE ---																(B) (A)
	Gull River Formation 29.26 m to 46.20 m (Continued - See previous page for detailed description)			31													A well constructed with 32mm diameter schedule 40 PVC flush threaded pipe and No. 10 slotted screen.
46	Shadow Lake Formation 46.20 m to 54.90 m		201.59 46.20														
47	From 46.20 m to 49.68 m: Fresh, light to dark greenish grey, fine to medium grained, faintly to moderately porous, thin 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.			32													
	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, thin to medium bedded sandstone comprised of angular clasts of feldspar crystals and quartz. Sharp basal contact.																
48																	
49																	Bentonite Seal
50	CONTINUED NEXT PAGE																

MISS ROCK 041120800-ROK-GEOMW.GPJ GLDR-CAN.GDT 12/8/06 JDR

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAM

000053

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (mm/min)	FLUSH	COLOUR	% RETURN	FR/FX-FRACTURE-F FAULT		SM-SMOOTH		FL-FLEXURED		BC-BROKEN CORE		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION	
										CL-CLEAVAGE	J-JOINT	R-ROUGH	UE-UNEVEN	MB-MECH. BREAK	B-BEDDING					
										SH-SHEAR	P-POLISHED	ST-STEPPED	W-WAVY							
RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY			DIP w/1 CORE AXIS		TYPE AND SURFACE DESCRIPTION									
TOTAL CORE %	SOLID CORE %			10°	10°	10°	K _u cm/sec													
8888		8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	8888	
55		— CONTINUED FROM PREVIOUS PAGE —																		
		Precambrian Basement 54.90 m to 58.41 m			37															
		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.																		
56		From 57.20 m to 58.41 m: Fresh, dark grey, foliated, quartz-feldspar-amphibole gneiss.			38															
57																				
58																				
		END OF DRILLHOLE				189.38														
						58.41														
59																				
60																				

Bentonite Seal

MW-3
(B) (A)

MISS ROCK 041120800-RCK-GEOMW.GPJ GLDR CAN.GDT 12/06 JDR

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAM

000055

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH COLOUR % RETURN	FR/FX-FRACTURE-F-FAULT				SM-SMOOTH				FL-FLEXURED				BC-BROKEN CORE				DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION				
								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		RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY									
								TOTAL CORE %	SOLID CORE %	DIP w/L CORE AXIS	TYPE AND SURFACE DESCRIPTION	10 ⁻⁵	10 ⁻⁴	10 ⁻³	10 ⁻²														
0		GROUND SURFACE		237.41				3333	3333	3333	3333	3333	3333	3333	3333	3333	3333	3333	3333	3333	3333	3333							
		Topsoil		0.00																									
		Overburden		0.10																									
1																													
2																													
3																													
4																													
5																													
		Bobcaygeon Formation 3.35 m to 15.48 m (See next page for detailed description)		234.06 3.35																									

CONTINUED NEXT PAGE

MISS. ROCK 041120800-ROCK-GEOMW.GPJ GLDR. CAN.GDT. 12/8/06 JDR

DEPTH SCALE
1:25



LOGGED: MK
CHECKED: KA 000056

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN NO.	PENETRATION RATE (m/min)	FLUSH COLOUR % RETURN	RECOVERY		R.O.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY K _v cm/sec			DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
								TOTAL CORE %	SOLID CORE %			DIP w.r.t CORE AXIS	TYPE AND SURFACE DESCRIPTION	10 ⁻³	10 ⁻²	10 ⁻¹		
								FR-FRACTURE-FAULT	CL-CLEAVAGE			J-JOINT	SM-SMOOTH	FL-FLEXURED	BC-BROKEN CORE			
— 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.																
6																		
7																		
8																		
9																		
10		CONTINUED NEXT PAGE																

MISS ROCK 041120800-RCK-GEOMW.GPJ GLDR CAN.GDT 12/8/08 JDR

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAM 000057

PROJECT: 04-1120-800

RECORD OF BOREHOLE: MW-4

SHEET 3 OF 8

LOCATION: N 4939830.4 ; E 650784.6

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (mm/min)	FLUSH COLOUR % RETURN	FRFX-FRACTURE-FAULT			SM-SMOOTH			FL-FLEXURED			BC-BROKEN CORE			DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION						
								CL-CLEAVAGE	J-JOINT	R-ROUGH	UE-UNEVEN	MB-MECH. BREAK	SH-SHEAR	P-POUSHED	ST-STEPPED	W-WAVY	B-BEDDING	RECOVERY	R.Q.D. %			FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY		
								SH-SHEAR	P-POUSHED	ST-STEPPED	W-WAVY	B-BEDDING	TOTAL CORE %	SOLID CORE %	FRACT. INDEX PER 0.3	DIP WALL CORE AXIS	TYPE AND SURFACE DESCRIPTION	10 ⁻⁶	10 ⁻⁵			10 ⁻⁴	10 ⁻³				
— CONTINUED FROM PREVIOUS PAGE —																						MW-4					
10		Bobcaygeon Formation 3.35 m to 15.48 m																			(B) (A)						
		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.																									
		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.																									
13																											
14																											
15																											
CONTINUED NEXT PAGE																											

MISS. ROCK 041120800-RCK-GEOMW.GPJ GLDR CAN.GDT 12/8/06 JDR

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAI 000058

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/hr)	COLOUR & RETURN FLUSH	FRFX-FRACTURE-FAULT				SM-SMOOTH		FL-FLEXURED		BC-BROKEN CORE		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION	
								CL-CLEAVAGE		J-JOINT		R-ROUGH		UE-UNEVEN		MB-MECH. BREAK				
								SH-SHEAR		P-POLISHED		ST-STEPPED		W-WAVY		B-BEDDING				
VN-VEIN		S-SUCKERSIDED		FL-PLANAR		C-CURVED														
RECOVERY		R.Q.D. %		FRACT. INDEX PER 0.3		DIP w.r.t. CORE AXIS		DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY K cm/sec										
TOTAL CORE %		SOLID CORE %						TYPE AND SURFACE DESCRIPTION		10 ⁶		10 ⁷								
— CONTINUED FROM PREVIOUS PAGE —																				
15				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.																		
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.																		
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																		

MISS. ROCK 041120800-ROK-GEOMW.GPJ GLDR. CAN.GDT 12/8/06 JDR

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAM 000059

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN NO.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	FRFX-FRACTURE-FAULT			SM-SMOOTH			FL-FLEXURED			BC-BROKEN CORE			DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
									CL-CLEAVAGE	J-JOINT	S-SMOOTH	R-ROUGH	UE-UNEVEN	MB-MECH. BREAK	SH-SHEAR	P-POLISHED	ST-STEPPED	W-WAVY	B-BEDDING			
									WN-VEIN	S-SUCKENSIDED	PL-PLANAR	C-CURVED	RECOVERY	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY				
TOTAL CORE %	SOLID CORE %	%	TYPE AND SURFACE DESCRIPTION	K cm/sec	10 ⁻⁴	10 ⁻²	10 ⁻¹	10 ⁰														
-- CONTINUED FROM PREVIOUS PAGE --																						MW-4
20		Gull River Formation 15.48 m to 32.32 m		15																	(B) (A)	
		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.																				
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.		18																		
		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.																				
22		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.		17																		
23				18																		
24				19																		
CONTINUED NEXT PAGE																						

MISS. ROCK 041120800-RCK-GEOMW.GPJ GLDR CAN.GDT 12/8/06 JDR

DEPTH SCALE
1:25



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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR	% RETURN	FRFX-FRACTURE-FAULT		SM-SMOOTH	FL-FLEXURED	BC-BROKEN CORE	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION		
										CL-CLEAVAGE	J-JOINT	R-ROUGH	UE-UNEVEN	MB-MECH. BREAK				
										SH-SHEAR	P-POLISHED	ST-STEPPED	W-WAVY	B-BEDDING				
RECOVERY		R.O.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY			INDEX (MPa)									
TOTAL CORE %	SOLID CORE %			EXP W/L CORE AXES	TYPE AND SURFACE DESCRIPTION	10 ²	10 ³	10 ⁴	2	4	8							
— CONTINUED FROM PREVIOUS PAGE —																		
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.																
26																		
27																		
28																		
29																		
30																		
CONTINUED NEXT PAGE																		

MISS. ROCK 041120800-RCK-GEOMW.GPJ GLDR. CAN.GDT 12/06 JDR

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAM 000061

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: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN NO.	PENETRATION RATE (m/min)	FLUSH	COLOUR	% RETURN	RECOVERY			FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY			DIAMETRAL POINT LOG INDEX (MPI)	NOTES WATER LEVELS INSTRUMENTATION
										TOTAL CORE %	SOLID CORE %	R.O.D. %		TYPE AND SURFACE DESCRIPTION		K cm/sec				
										FR/FX-FRACTURE-FAULT	CL-CLEAVAGE	J-JOINT		SM-SMOOTH	FL-FLEXURED	BC-BROKEN CORE				
		--- CONTINUED FROM PREVIOUS PAGE ---								88	88	88	0.2			10 ⁻⁹	10 ⁻⁹	10 ⁻⁹	2	MW-4
30		Gull River Formation 15.48 m to 32.32 m (See previous page for detailed description)																		(B) (A)
31																				
32																				
		Shadow Lake Formation 32.32 m to 35.53 m		205.09 32.32																
		From 32.32 m to 35.15 m: Fresh, light to dark greenish gray, fine grained, thinly interbedded, siltstone, shale and minor sandstone.																		
		From 35.15 m to 35.53 m: Fresh, dark greenish grey, slake susceptible shale.																		
33																				
34																				
35		CONTINUED NEXT PAGE																		

MISS. ROCK 041120800-RCK-GEOMW/GPJ GLDR. CAN.GDT. 12/05 JDR

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAN 000062

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

DATUM: GEODETIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION MW-1	
				ELEV. DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)				
					25	50	75	100	40	60	120		160
0		GROUND SURFACE		249.65									
		Topsoil		0.60									
		Verulam Formation 0.1 m to 15.0 m		249.55									
		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.		0.10									
1		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.											
2													
3													
4													
5													
		CONTINUED NEXT PAGE											

Bentonite Seal

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ_GAL-CANADA.GDT_12/8/06_JDR

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAM 000065

PROJECT: 04-1120-800

LOCATION: N 4939121.7 ;E 651592.4

GEOPHYSICAL LOG OF: MW-1

SHEET 2 OF 12

DRILLING DATE: Aug. 11-12, 2004

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION
					GAMMA (cps)				CONDUCTIVITY (mS/m)				
					25	50	75	100	40	80	120	160	
		— CONTINUED FROM PREVIOUS PAGE —											MW-1
5		<p>Verulam Formation 0.1 m to 15.0 m</p> <p>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 thin 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.</p> <p>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.</p> <p>Broken weathered core occurs again at 3.40 m to 3.50 m.</p>											
6													
7													
8													Bentonite Seal
9													
10		CONTINUED NEXT PAGE											

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

DEPTH SCALE
1:25



LOGGED: MK
CHECKED: KAN 000066

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

DATUM: GEODETIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION MW-1	
				ELEV. DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)				
					25	50	75	100	40	80	120		160
10		<p>--- CONTINUED FROM PREVIOUS PAGE ---</p> <p>Verulam Formation 0.1 m to 15.0 m</p> <p>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 thin 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.</p> <p>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.</p> <p>Broken weathered core occurs again at 3.40 m to 3.50 m.</p>											
11													
12													
13													
14													
15													
		CONTINUED NEXT PAGE											

Bentonite Seal

234.65

BAR_GEOPHYSICAL_041120800-ROK-GEO.GPJ_GAL-CANADA.GDT_12/8/06_JDR

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAM

000067

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-1

SHEET 4 OF 12

LOCATION: N 4939121.7 ; E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DATUM: GEODETIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION
					GAMMA (cps)				CONDUCTIVITY (mS/m)				
					25	50	75	100	40	80	120	160	
		— CONTINUED FROM PREVIOUS PAGE —											MW-1
15		Bobcaygeon Formation 15.0 m to 28.35 m		15.00									
		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.											
16		From 15.00 m to 16.60 m: Fresh medium brown, medium grained crystalline, faintly petrolierous, 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.											
17		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.											
18													
													Bentonite Seal
19													
20													
		CONTINUED NEXT PAGE											

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ_GAL-CANADA.GDT_12/8/06_IDR

DEPTH SCALE

1 : 25



LOGGED: MK
CHECKED: KAN 000068

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

DATUM: GEODETIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION MW-1
					GAMMA (cps)				CONDUCTIVITY (mS/m)				
					25	50	75	100	40	80	120	160	
20		<p>--- CONTINUED FROM PREVIOUS PAGE ---</p> <p>Bobcaygeon Formation 15.0 m to 28.35 m</p> <p>Sharp contact with Verulam Formation.</p> <p>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.</p> <p>From 15.00 m to 16.60 m: Fresh medium brown, medium grained crystalline, faintly petroliferous, medium to thickly bedded calcarenite limestone.</p> <p>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.</p> <p>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.</p> <p>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 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.</p> <p>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.</p>											
21													
22													
23												Bentonite Seal	
24													
25		CONTINUED NEXT PAGE											

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

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAM 000069

PROJECT: 04-1120-800

LOCATION: N 4939121.7 ; E 651592.4

GEOPHYSICAL LOG OF: MW-1

SHEET 6 OF 12

DRILLING DATE: Aug. 11-12, 2004

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.		GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION MW-1	
				DEPTH (m)		GAMMA (cps)				CONDUCTIVITY (mS/m)					
				25	50	75	100	40	80	120	160				
25		--- CONTINUED FROM PREVIOUS PAGE --- Bobcaygeon Formation 15.0 m to 28.35 m (Continued - see previous page for detailed description)													
26															
27															
28															
28.35				221.38											
28.35				28.35											
29		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.													
30															
		CONTINUED NEXT PAGE													

Bentonite Seal

Sand

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/08 JDR

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAI 000070

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

DATUM: GEODETIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)				PIEZOMETER OR STANDPIPE INSTALLATION MW-1
					25	50	75	100	40	80	120	160	
-- CONTINUED FROM PREVIOUS PAGE --													
36		<p>Gull River Formation 28.35 m to 45.10m</p> <p>Unit 4 28.35 m to 31.60 m:</p> <p>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.</p> <p>Unit 3 31.60 m to 35.55 m</p> <p>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.</p> <p>Unit 2 35.55 m to 38.88 m</p> <p>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 37.08 m and 38.10 m to 38.88 m) and argillaceous bedding partings.</p> <p>Unit 1 38.88 m to 45.10 m</p> <p>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.</p> <p>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.</p>											
31													
32													
33													
34													
35													
CONTINUED NEXT PAGE													

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

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ_GAL-CANADA.GDT_12/8/06_JDR

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAM 000071

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-1

SHEET 8 OF 12

LOCATION: N 4939121.7 ; E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DATUM: GEODETIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD						PIEZOMETER OR STANDPIPE INSTALLATION			
				ELEV. DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)				
					25	50	75	100	40		80	120	160
		— 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. 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.											
36													
37													
38											Bentonite Seal		
39													
40													
		CONTINUED NEXT PAGE											

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

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAN
000072

PROJECT: 04-1120-800
 LOCATION: N 4939121.7 ; E 651592.4

GEOPHYSICAL LOG OF: MW-1

SHEET 9 OF 12
 DATUM: GEODETIC

DRILLING DATE: Aug. 11-12, 2004
 DRILL RIG: Longyear 38
 DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION MW-1	
				ELEV. DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)				
					25	50	75	100	40	80	120		160
— CONTINUED FROM PREVIOUS PAGE —													
40		Gull River Formation 28.35 m to 45.10 m 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 stylonite (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 stylonite (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 stylonite (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.											
41													
42													
43													
44													
45													
CONTINUED NEXT PAGE													

Bentonite Seal

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

DEPTH SCALE
1 : 25



LOGGED: MK
 CHECKED: KAM 000073

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-1

SHEET 10 OF 12

LOCATION: N 4939121.7 ; E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DATUM: GEODETTIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD				PIEZOMETER OR STANDPIPE INSTALLATION	
					GAMMA (cps)			CONDUCTIVITY (mS/m)		
					25	50	75 100	40		80 120 160
		— CONTINUED FROM PREVIOUS PAGE —							MW-1	
45		Shadow Lake Formation 45.10 m to 53.51 m		204.55 45.10						
		From 45.10 m to 47.70 m: Fresh, light to dark greenish grey, fine to medium grained, faintly to moderately porous, thin 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.								
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.								
48									Bentonite Seal	
49										
50		CONTINUED NEXT PAGE								

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

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAJ 000074

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

DATUM: GEODETIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION MW-1		
				ELEV.		GAMMA (cps)				CONDUCTIVITY (mS/m)				
				DEPTH (m)		25	50	75	100	40	80		120	160
50		<p>--- CONTINUED FROM PREVIOUS PAGE ---</p> <p>Shadow Lake Formation 45.10 m to 53.51 m</p> <p>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.</p> <p>From 47.70 m to 48.90 m: Fresh, dark greenish grey, slake susceptible shale and shaly siltstone. Transitional lower contact.</p> <p>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.</p> <p>From 51.25 m 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.</p>												
51														
52														
53														
				196.14										
				53.51										
		<p>Precambrian Basement 53.51 m to 59.93 m</p> <p>From 53.51 m to 53.76 m: Completely weathered, dark brown, micaceous, gneissic regolith.</p> <p>From 53.76 m to 54.80 m: Highly weathered, dark reddish brown, chlorite-feldspar-amphibole-gneiss.</p> <p>From 54.80 m to 56.25 m: Faintly to moderately weathered, dark grey, medium grained, strongly foliated, feldspar - amphibole gneiss.</p> <p>From 56.25 m to 56.55 m: Highly weathered gneiss.</p> <p>From 56.55 m to 59.93 m: Fresh, dark grey diorite gneiss. Last open weathered fracture at 57.10 m.</p>												
54														
55														
		CONTINUED NEXT PAGE												

Bentonite Seal

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

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAN 000075

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-1

SHEET 12 OF 12

LOCATION: N 4939121.7 ;E 651592.4

DRILLING DATE: Aug. 11-12, 2004

DATUM: GEODETIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION
					GAMMA (cps)				CONDUCTIVITY (mS/m)				
					25	50	75	100	40	80	120	160	
		-- 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.											
56		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.											
57													
58													
59													
60		END OF DRILLHOLE		189.72 59.93									

Bentonite Seal

BAR: GEOPHYSICAL_041120800-RCK-GEO.GPJ CAL-CANADA.GDT 12/8/06 JDR

DEPTH SCALE

1 : 25



LOGGED: MK
CHECKED: KAI 000076

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

DATUM: GEODETIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION		
				ELEV. DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)				MW-2	
					25	50	75	100	40	80	120	160		
0		GROUND SURFACE		246.87									(B)	(A)
		Topsoil		0.00										
		Verulam Formation 0.05 m to 9.00 m		0.05										
1		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 thin 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.												
2													Bentonite Seal	
3														Bentonite Seal
4														
5													Sand	

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

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAN 000077

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-2

SHEET 3 OF 8

LOCATION: N 4939749.9 ; E 851897.5

DRILLING DATE: Sep. 16, 2004

DATUM: GEODETIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION		
				ELEV. DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)				MW-2	
					25	50	75	100	40	80	120	160		
10		<p>— CONTINUED FROM PREVIOUS PAGE —</p> <p>Bobcaygeon Formation 9.00 m to 21.95 m</p> <p>Sharp contact with Verulam Formation.</p> <p>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.</p> <p>From 9.00 m to 10.50 m: Fresh medium brown, medium grained crystalline, faintly petroliferous, medium to thickly bedded calcarenite limestone.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>										(B)	(A)	
11														
12														
13														
14														
15														

Bentonite Seal

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BAR_GEOPHYSICAL_041120800-RCK-GEO_GP3_GAL-CANADA.GDT_12/8/05_JDR

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAM 000079

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

DATUM: GEODETIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

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

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

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAM

000081

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-2

SHEET 6 OF 8

LOCATION: N 4939749.9 ; E 651897.5

DRILLING DATE: Sep. 16, 2004

DATUM: GEODETTIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION
					GAMMA (cps)				CONDUCTIVITY (mS/m)				
					25	50	75	100	40	80	120	160	
-- CONTINUED FROM PREVIOUS PAGE --											MW-2		
25		<p>Gull River Formation 21.95 m to 35.50 m</p> <p>Unit 4 21.95 m to 25.35 m:</p> <p>Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, stylonitic, 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.</p>										(B)	(A)
26		<p>Unit 3 25.35 m to 28.88 m</p> <p>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.</p>											
27		<p>Unit 2 28.88 m to 34.70 m</p> <p>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.</p>											
28		<p>Unit 1 34.70 m to 35.50 m</p> <p>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.</p>											
29													
30													

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

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

CONTINUED NEXT PAGE

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAN 000082

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

DATUM: GEODETIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION MW-2	
				ELEV. DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)				
					25	50	75	100	40	80	120		160
30		<p>--- CONTINUED FROM PREVIOUS PAGE ---</p> <p>Gull River Formation 21.95 m to 35.50 m</p> <p>Unit 4 21.95 m to 25.35 m:</p> <p>Fresh, light creamy grey to whitish grey, very fine grained, thinly to thickly bedded, stylonitic, 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.</p> <p>Unit 3 25.35 m to 28.88 m</p> <p>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.</p> <p>Unit 2 28.88 m to 34.70 m</p> <p>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.</p> <p>Unit 1 34.70 m to 35.50 m</p> <p>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.</p>											
31													
32													
33													
34													
35		CONTINUED NEXT PAGE											

Bentonite Seal

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ_GAL-CANADA.GDT_12/06_JDR

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAM 000083

PROJECT: 04-1120-800
 LOCATION: N 4939749.9 ; E 651897.5

GEOPHYSICAL LOG OF: MW-2

SHEET 8 OF 8
 DATUM: GEODETIC

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

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

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

DEPTH SCALE
 1 : 25



LOGGED: MK
 CHECKED: KAN 000084

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

DATUM: GEODETIC

DRILL RIG: Longeyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION			
				ELEV.	DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)				MW-3	
						25	50	75	100	40	80	120	160		
0		GROUND SURFACE		247.79									(B)	(A)	
		Topsoil		0.00											
		Verulam Formation 0.06 m to 16.30 m		0.06											
1		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 thin to medium bedded, brownish grey, fine to medium crystalline, fossiliferous (crinoids, corals, pelyceps) 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													
2															
3															
4															
5															

Sand

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

Bentonite Seal

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BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ_GAL-CANADA.GDT_12/28/06_JDR

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAM

000085

PROJECT: 04-1120-800
 LOCATION: N 4938298.2 ; E 651523.4

GEOPHYSICAL LOG OF: MW-3

SHEET 3 OF 12
 DATUM: GEODETIC

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

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION	
					GAMMA (cps)				CONDUCTIVITY (mS/m)					
					25	50	75	100	40	80	120	160		
		— CONTINUED FROM PREVIOUS PAGE —											(B)	(A)
10		<p>Verulam Formation 0.06 m to 16.30 m</p> <p>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</p>												
11														
12														
13														
14														
15														
		CONTINUED NEXT PAGE												

Bentonite Seal

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

DEPTH SCALE
 1 : 25



LOGGED: MK
 CHECKED: KAM 000087

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

DATUM: GEODETIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION	
				ELEV. DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)				
					25	50	75	100	40	60	120		160
		— CONTINUED FROM PREVIOUS PAGE —										(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. 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.											
21													
22													
23													
24													
25													
		CONTINUED NEXT PAGE											

Bentonite Seal

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

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAM

000089

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

DATUM: GEODETIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD				PIEZOMETER OR STANDPIPE INSTALLATION								
				ELEV. DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)				MW-3			
					25	50	75	100	40	80	120	160				
		— CONTINUED FROM PREVIOUS PAGE —								(B)	(A)					
30		<p>Gull River Formation 29.26 m to 46.20 m</p> <p>Unit 4 29.26 m to 32.62 m:</p> <p>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.</p> <p>Unit 3 32.62 m to 36.25 m</p> <p>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.</p> <p>Unit 2 36.25 m to 40.12 m</p> <p>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.</p> <p>Unit 1 40.12 m to 46.20 m</p> <p>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.</p>														
31																
32																
33																
34																
35		CONTINUED NEXT PAGE														

Bentonite Seal

BAR_GEOPHYSICAL_041120800-RCK.GEO.GPJ GAL-CANADA.GDT_12/8/06_JDR

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAM
000091

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-3

SHEET 8 OF 12

LOCATION: N 4938298.2 ; E 651523.4

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD				PIEZOMETER OR STANDPIPE INSTALLATION	
					GAMMA (cps)		CONDUCTIVITY (mS/m)			
					25	50	75	100		40
-- CONTINUED FROM PREVIOUS PAGE --									MW-3	
35		<p>Gull River Formation 29.26 m to 46.20 m</p> <p>Unit 4 29.26 m to 32.62 m:</p> <p>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.</p>							(B)	(A)
36		<p>Unit 3 32.62 m to 36.25 m</p> <p>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.</p>								
37		<p>Unit 2 36.25 m to 40.12 m</p> <p>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.</p>								
38		<p>Unit 1 40.12 m to 46.20 m</p> <p>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.</p>								Bentonite Seal
39										
40										
CONTINUED NEXT PAGE										

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

DEPTH SCALE

1:25



LOGGED: MK

CHECKED: KAN 000092

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

DATUM: GEODETIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION		
				ELEV. DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)				MW-3	
					25	50	75	100	40	80	120	160	(B)	(A)
40		<p>--- CONTINUED FROM PREVIOUS PAGE ---</p> <p>Gulf River Formation 29.26 m to 46.20 m</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>												
41														
42														
43														
44														
45														

Bentonite Seal

Sand

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

CONTINUED NEXT PAGE

BAR GEOPHYSICAL 041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/08 JDR

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAM 000093

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-3

SHEET 10 OF 12

LOCATION: N 4938298.2 ; E 851523.4

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD					PIEZOMETER OR STANDPIPE INSTALLATION				
				ELEV. DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)		MW-3 (B) (A)		
					25	50	75	100	40	80			120
45		-- CONTINUED FROM PREVIOUS PAGE -- Gull River Formation 29.26 m to 46.20 m (Continued - See previous page for detailed description)											
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 m. 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.
47													
48													
49													Bentonite Seal
50		CONTINUED NEXT PAGE											

BAR GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAN 000094

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

DATUM: GEODETIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION MW-3
					GAMMA (cps)				CONDUCTIVITY (mS/m)				
					25	50	75	100	40	80	120	160	
50		<p>--- CONTINUED FROM PREVIOUS PAGE ---</p> <p>Shadow Lake Formation 46.20 m to 54.90 m</p> <p>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 m. Transitional lower contact.</p> <p>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.</p> <p>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.</p>										(B)	(A)
51													
52													
53													
54													
55					192.69 54.90								

Bentonite Seal

CONTINUED NEXT PAGE

BAR_GEOPHYSICAL_041120800-RCK.GEO.GPJ_GAL-CANADA.GDT_12/06 JDR

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAM 000095

PROJECT: 04-1120-800

LOCATION: N 4938298.2 ; E 651523.4

GEOPHYSICAL LOG OF: MW-3

SHEET 12 OF 12

DRILLING DATE: Sep. 27, 2004

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DATUM: GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD				PIEZOMETER OR STANDPIPE INSTALLATION		
					GAMMA (cps)			CONDUCTIVITY (mS/m)		MW-3	
					25	50	75	100			40
55		— CONTINUED FROM PREVIOUS PAGE —								(B)	(A)
		<p>Precambrian Basement 54.90 m to 58.41 m</p> <p>From 54.90 m to 55.70 m: Highly weathered, fractured, dark reddish brown, chlorite-feldspar-amphibole-gneiss.</p> <p>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.</p> <p>From 57.20 m to 58.41 m: Fresh, dark grey, foliated, quartz-feldspar-amphibole gneiss.</p>									
56											
57											
58											
		END OF DRILLHOLE		189.38 58.41							
59											
60											

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

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAM 000096

PROJECT: 04-1120-800
 LOCATION: N 4939830.4 ; E 650784.6

GEOPHYSICAL LOG OF: MW-4

SHEET 3 OF 8
 DATUM: GEODETIC

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

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION	
					GAMMA (cps)				CONDUCTIVITY (mS/m)				MW-4	
					25	50	75	100	40	80	120	160		
		— CONTINUED FROM PREVIOUS PAGE —											(B)	(A)
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.												
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.												
		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.												
12		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.												
13														
14														
15		CONTINUED NEXT PAGE												

Open Borehole

BAR: GEOPHYSICAL 041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/18/06 JDR

DEPTH SCALE
1 : 25



LOGGED: MK
 CHECKED: KAM
 000099

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-4

SHEET 5 OF 8

LOCATION: N 4939830.4 ; E 650784.6

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION		
					GAMMA (cps)				CONDUCTIVITY (mS/m)				MW-4		
					25	50	75	100	40	80	120	160	(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.													
21															
22															
23															
24															
25		CONTINUED NEXT PAGE													

Open Borehole

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

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAM
000101

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

DATUM: GEODETIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD				PIEZOMETER OR STANDPIPE INSTALLATION		
				ELEV. DEPTH (m)	GAMMA (cps)		CONDUCTIVITY (mS/m)		MW-4	
					25	50	75	100		
30		— CONTINUED FROM PREVIOUS PAGE — Gull River Formation 15.48 m to 32.32 m (See previous page for detailed description)							(B)	(A)
31										
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.		205.09 32.32						
33										Open Borehole
34										
35		CONTINUED NEXT PAGE								

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ_CAL-CANADA.GDT_12/8/06_JDR

DEPTH SCALE
1 : 25



LOGGED: MK
CHECKED: KAM 000103

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: MW-4

SHEET 8 OF 8

LOCATION: N 4939830.4 ; E 650784.6

DRILLING DATE: Sep. 27, 2004

DATUM: GEODETTIC

DRILL RIG: Longyear 38

DRILLING CONTRACTOR: Marathon Drilling Ltd.

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

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

DEPTH SCALE

1 : 25



LOGGED: MK

CHECKED: KAN 000104

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-1

SHEET 1 OF 1

LOCATION: N 4938696.1 ; E 651192.6

DRILLING DATE: Aug 2004

DATUM: GEODETIC

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD					PIEZOMETER OR STANDPIPE INSTALLATION					
				ELEV. DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)				(C)(B)	(A)
					25	50	75	100	40	80	120	160		
0		GROUND SURFACE		254.88										
0		Verulam Formation		0.00										
5														
10														
15														
20														
25		Bobcaygeon Formation		232.63										
25				22.25										
30														
35		END OF DRILLHOLE		221.82										
35		Notes:		33.06										
40		1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited												
40		2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.												
45		3. Geological formation contacts inferred from geophysical logs												
50														
55														
60														

BAR: GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT_12/06 JDR

DEPTH SCALE
1 : 300



LOGGED: N/A
CHECKED: JPAC

000105

PROJECT: 04-1120-800

LOCATION: N 4938896.3 ;E 651463.1

GEOPHYSICAL LOG OF: OW-2

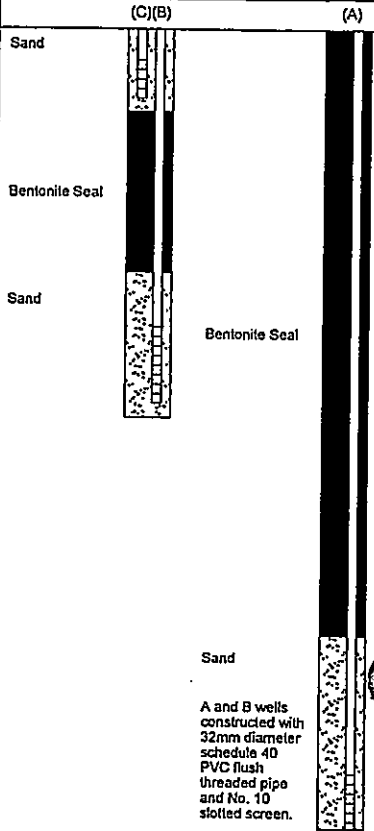
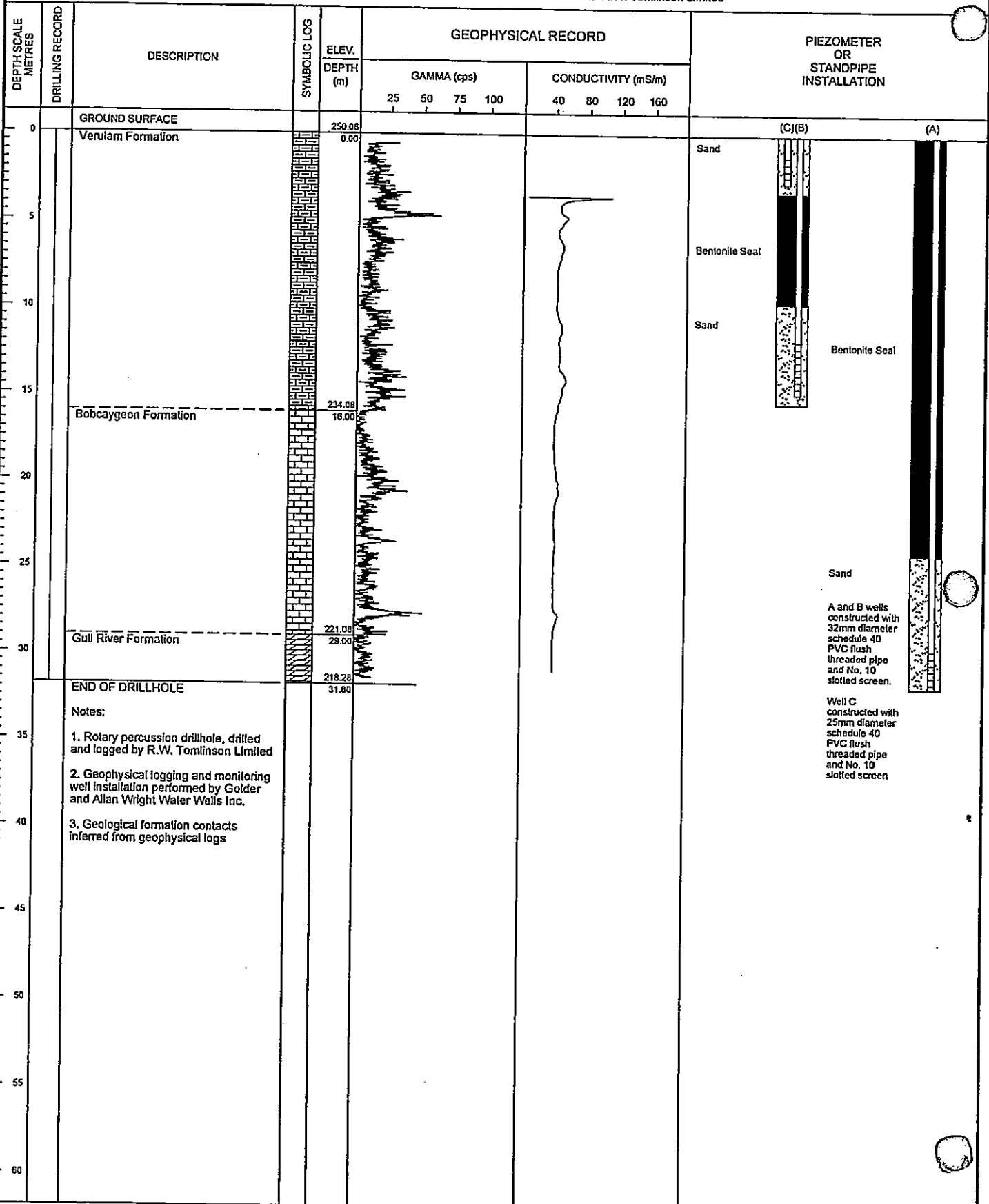
SHEET 1 OF 1

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETIC



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

DEPTH SCALE
1:300



LOGGED: N/A
CHECKED: JPA 000106

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-3

SHEET 1 OF 1

LOCATION: N 4939203.0 ; E 651038.8

DRILLING DATE: Aug 2004

DATUM: GEODETIC

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION		
					GAMMA (cps)				CONDUCTIVITY (mS/m)						
					25	50	75	100	40	80	120	160			
0		GROUND SURFACE		242.84										(C)(B)	(A)
0		Verulam Formation		0.00									Sand		
5													Bentonite Seal		
10		Bobcaygeon Formation		233.34 9.50									Sand	Bentonite Seal	
15															
20															
25		Gull River Formation		220.84 22.00											
30															
35		END OF DRILLHOLE		209.54 33.30											
40		Notes:													
45		1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited													
50		2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.													
55		3. Geological formation contacts inferred from geophysical logs													
60															

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

BAR: GEOPHYSICAL_041120800-RCK-GEO.GPJ CAL-CANADA.GDT_12/8/06_JDR

DEPTH SCALE
1 : 300



LOGGED: N/A
CHECKED: JPA 000107

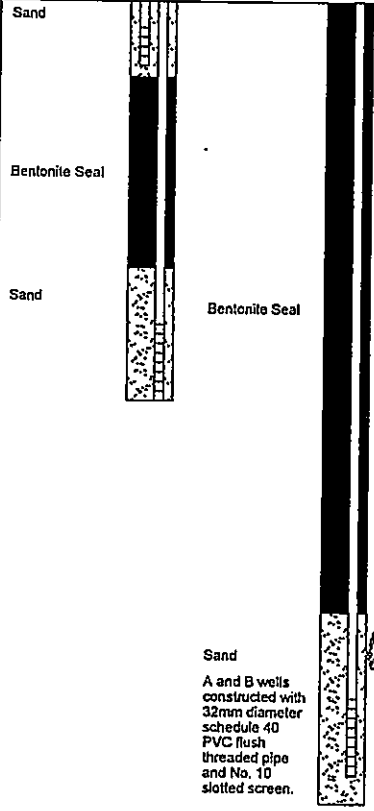
PROJECT: 04-1120-800
 LOCATION: N 4939456.5 ;E 652030.0

GEOPHYSICAL LOG OF: OW-4

SHEET 1 OF 1
 DATUM: GEODETIC

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

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD				PIEZOMETER OR STANDPIPE INSTALLATION					
				ELEV. DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)		(C)(B)	(A)	
					25	50	75	100	40	80			120
0		GROUND SURFACE		247.30									
0		Venlam Formation		0.00									
5													
10		Bobcaygeon Formation		237.30 10.00									
15													
20													
25		Gulf River Formation		224.30 23.00									
30													
35		END OF DRILLHOLE		215.40 31.90									
40		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											
45													
50													
55													
60													



BAR GEOPHYSICAL 041120800-ROK-GEO.GPJ GAL-CANADA.GDT 12/05 JDR

DEPTH SCALE
 1 : 300



LOGGED: N/A
 CHECKED: JPA 000108

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-5

SHEET 1 OF 1

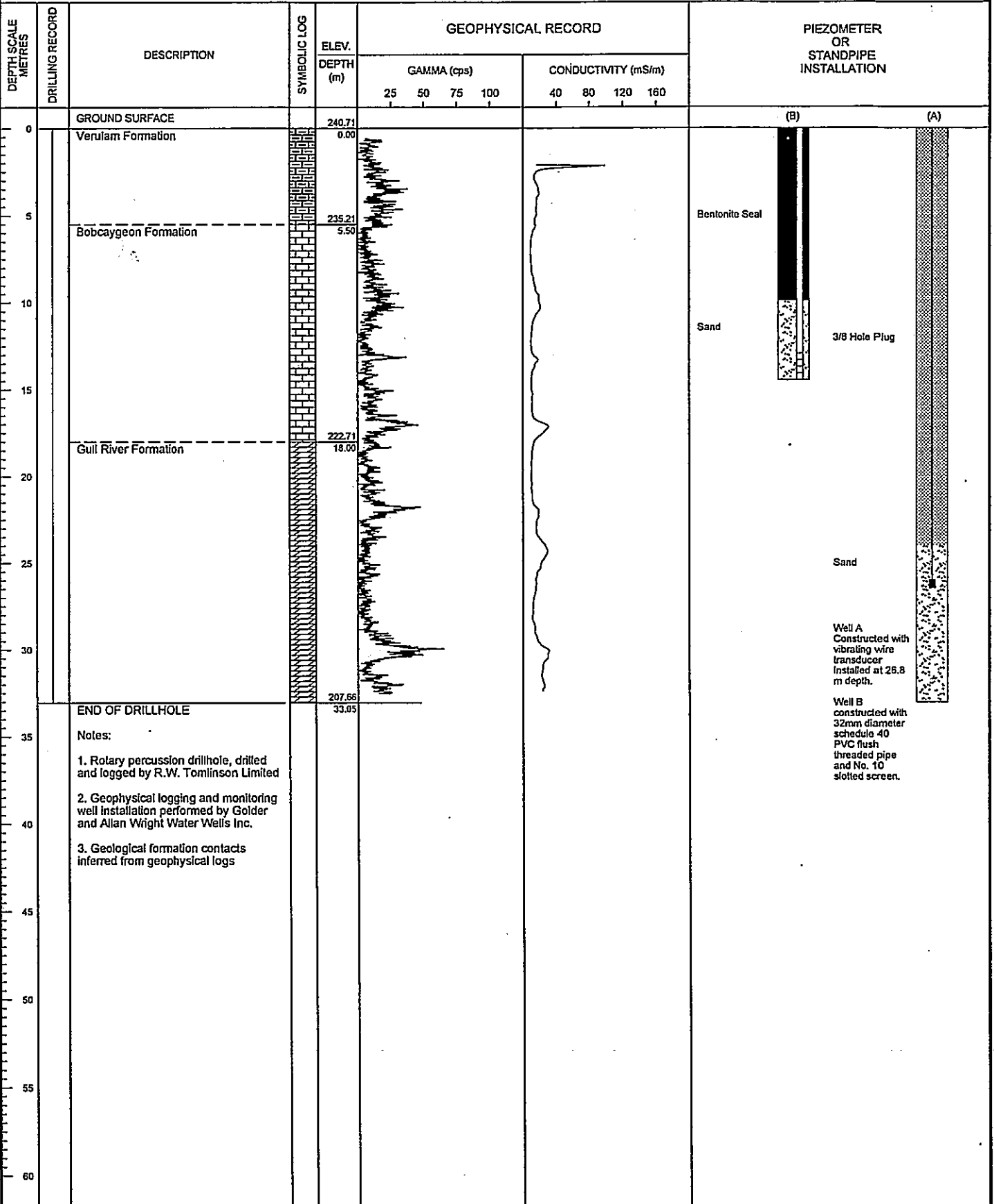
LOCATION: N 4939682.9 ; E 651256.6

DRILLING DATE: Aug 2004

DATUM: GEODETIC

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited



BAR: GEOPHYSICAL_041120800-RCK-GEO.GPJ CAL-CANADA.GDT_12/8/06_JDR

DEPTH SCALE
1 : 300



LOGGED: N/A
CHECKED: JPAC

000109

PROJECT: 04-1120-800

LOCATION: N 4939956.1 ;E 651481.8

GEOPHYSICAL LOG OF: OW-6

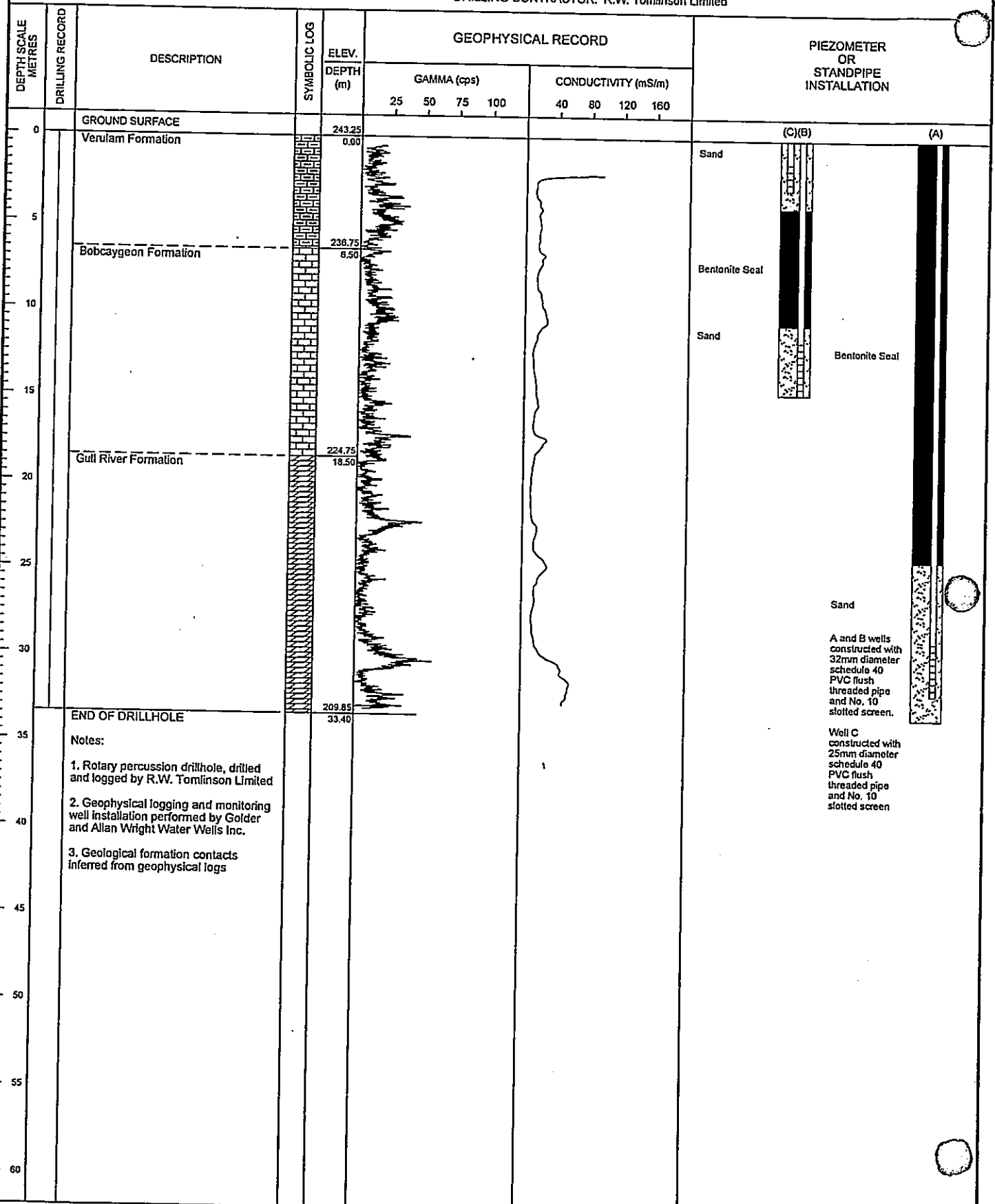
SHEET 1 OF 1

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETIC



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.

BAR: GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT_12/06_JDR

DEPTH SCALE
1:300



LOGGED: N/A
CHECKED: JPA 000110

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-7

SHEET 1 OF 1

LOCATION: N 4940357.7 ; E 651916.7

DRILLING DATE: Aug 2004

DATUM: GEODETIC

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD				PIEZOMETER OR STANDPIPE INSTALLATION				
				ELEV. DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)		(C)(B)	(A)
					25	50	75	100	40	80		
0		GROUND SURFACE		246.67								
0		Verulam Formation		0.00								
5												
6		Bobcaygeon Formation		239.87 6.80								
10												
15												
19		Gull River Formation		227.17 19.50								
20												
25												
30												
31		END OF DRILLHOLE		214.91 31.76								
35		Notes:										
35		1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited										
35		2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.										
35		3. Geological formation contacts inferred from geophysical logs										
40												
45												
50												
55												
60												

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

DEPTH SCALE

1 : 300



LOGGED: N/A

CHECKED: JPA

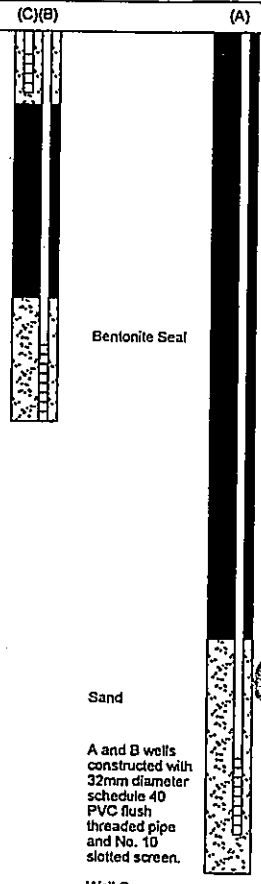
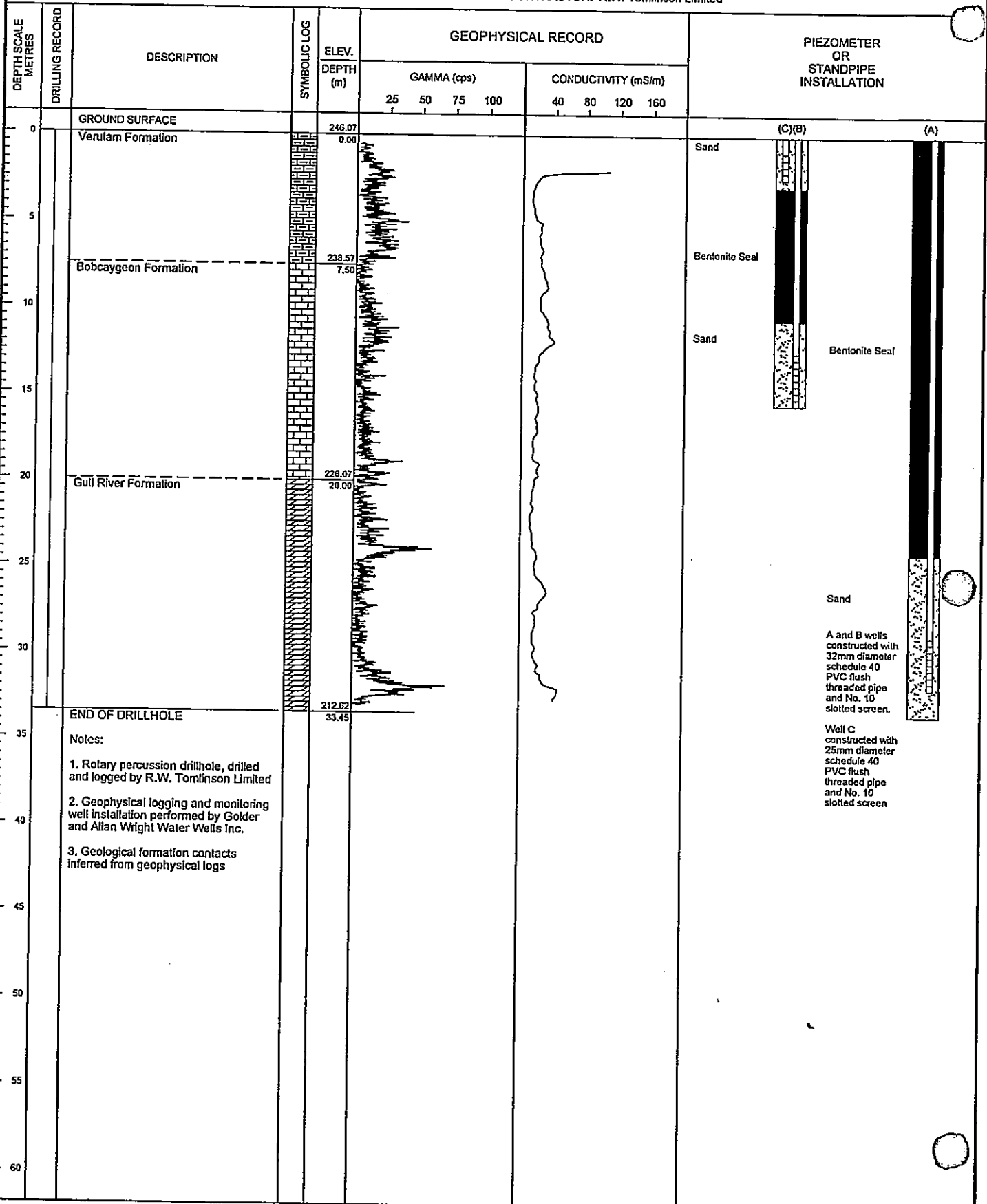
000111

PROJECT: 04-1120-800
 LOCATION: N 4940057.3 ;E 651789.2

GEOPHYSICAL LOG OF: OW-8

SHEET 1 OF 1
 DATUM: GEODETIC

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



BAR_GEOPHYSICAL 041120800-R0K-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

DEPTH SCALE
 1 : 300



LOGGED: N/A
 CHECKED: JPA 000112

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-9

SHEET 1 OF 1

LOCATION: N 4939533.7 ; E 651613.8

DRILLING DATE: Aug 2004

DATUM: GEODETIC

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD				PIEZOMETER OR STANDPIPE INSTALLATION						
					GAMMA (cps)				CONDUCTIVITY (mS/m)				(C)(B)	(A)	
					25	50	75	100	40	80	120	160			
0		GROUND SURFACE		248.75											
0		Verulam Formation		0.00									Sand		
10		Bobcaygeon Formation		238.25 10.50									Bentonite Seal		
23		Gull River Formation		223.75 23.00											
33		END OF DRILLHOLE		214.38 32.39											
35		Notes:													
35		1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited													
35		2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.													
35		3. Geological formation contacts inferred from geophysical logs													
60															

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

DEPTH SCALE
1 : 300



LOGGED: N/A
CHECKED: JPA/000113

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-10

SHEET 1 OF 1

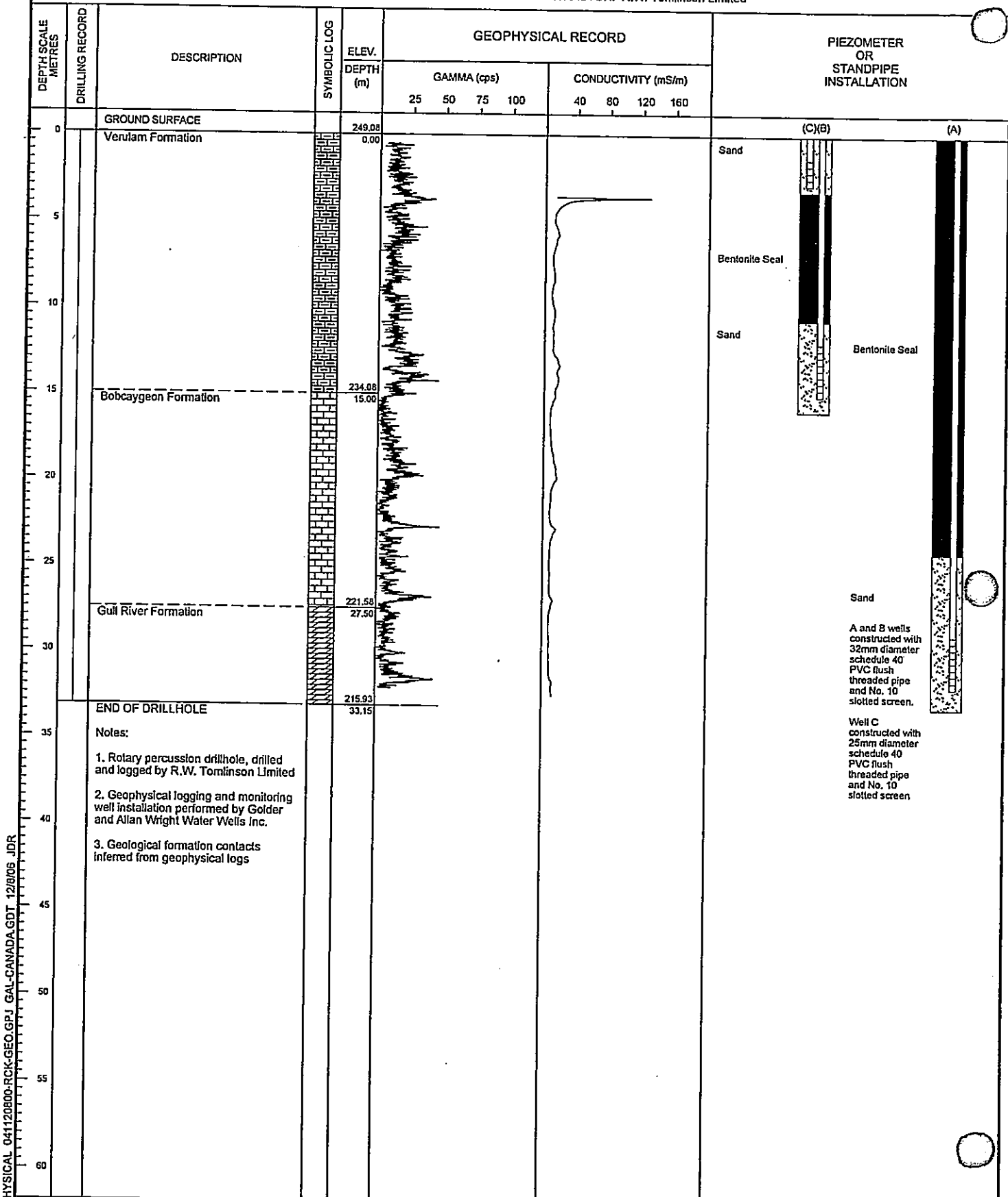
LOCATION: N 4938686.8 ; E 651732.4

DRILLING DATE: Aug 2004

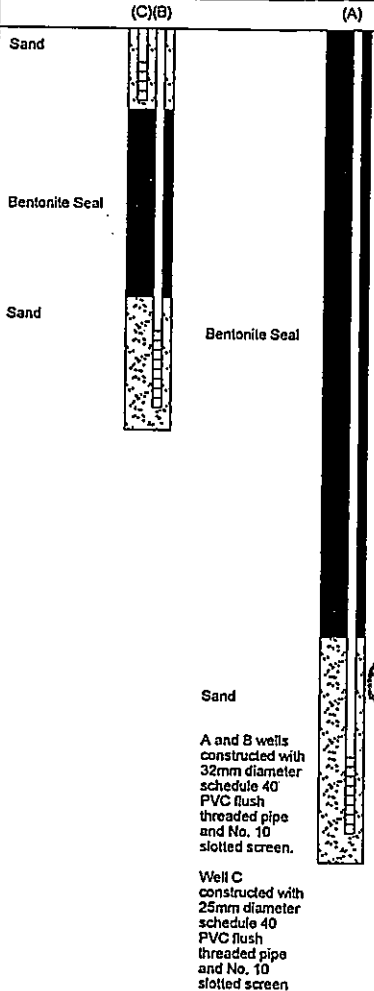
DATUM: GEODETIC

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited



BAR: GEOPHYSICAL_041120800-RCK-GEO.GPJ_GAL-CANADA.GDT_12/8/06_JDR



DEPTH SCALE
1:300



LOGGED: NA
CHECKED: JPA 000114

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-11

SHEET 1 OF 1

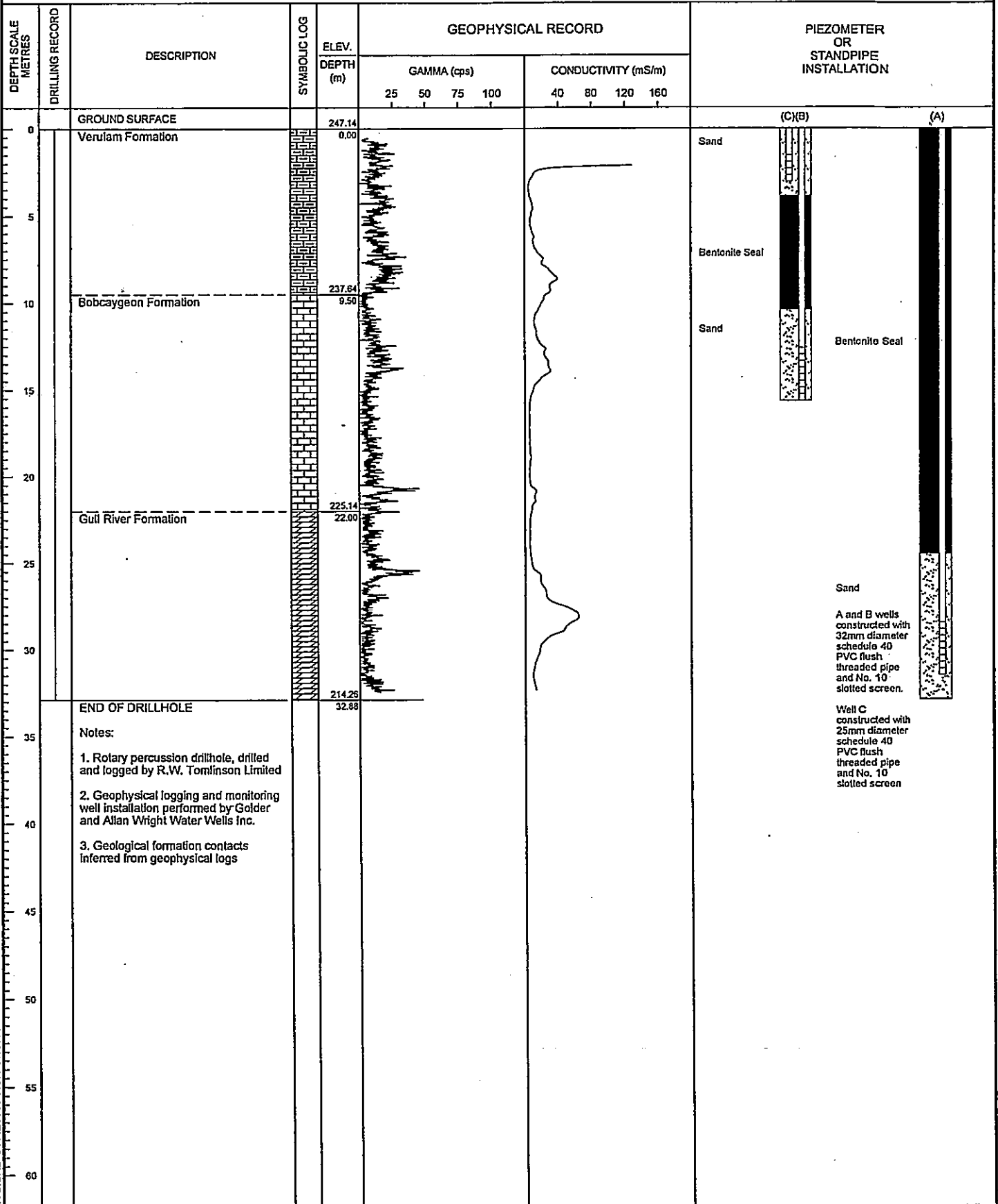
LOCATION: N 4939731.0;E 651843.7

DRILLING DATE: Aug 2004

DATUM: GEODETIC

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited



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

DEPTH SCALE
1 : 300



LOGGED: N/A
CHECKED: JPA 000115

PROJECT: 04-1120-800

LOCATION: N 4939748.0 ; E 651868.6

GEOPHYSICAL LOG OF: OW-12

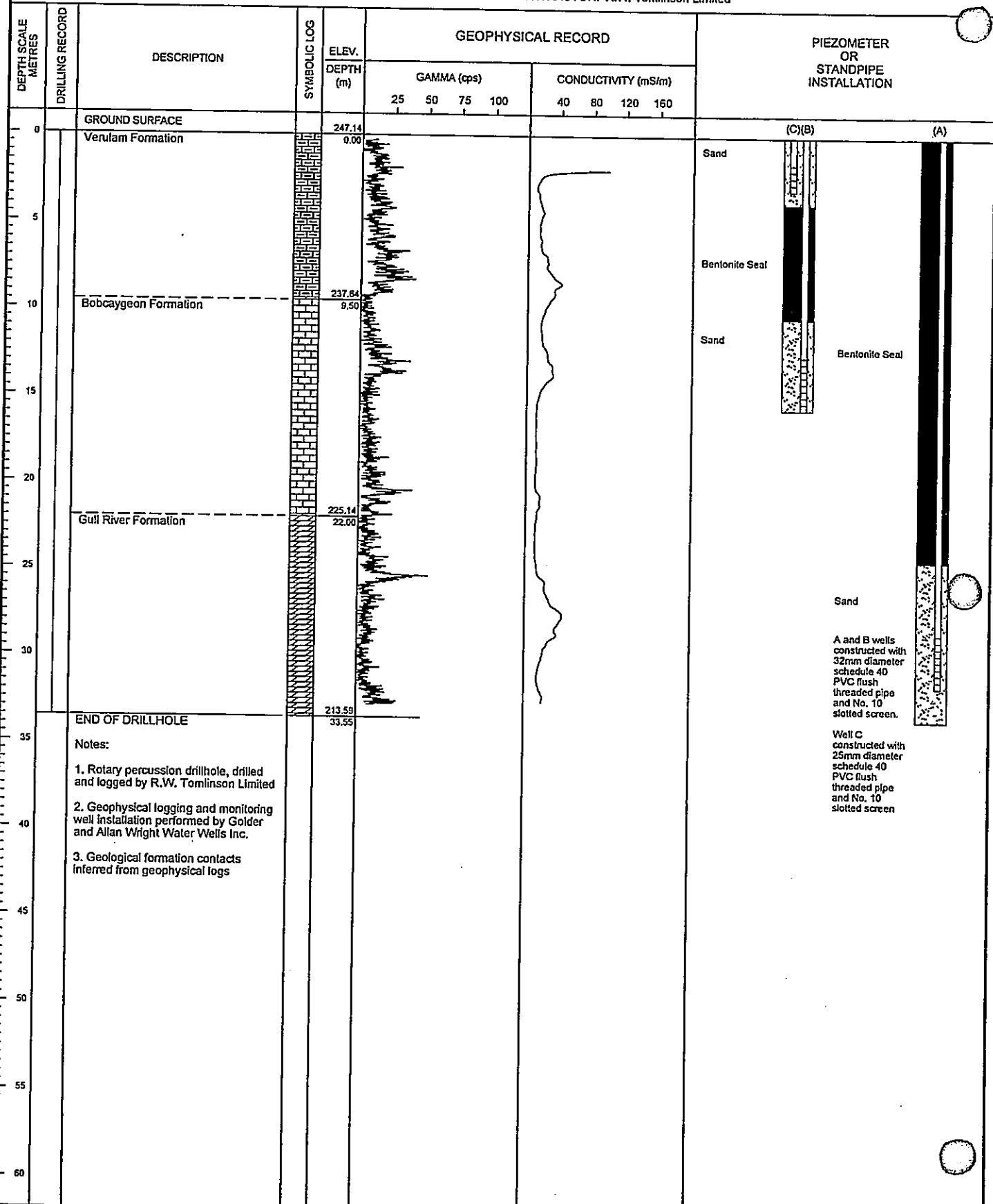
SHEET 1 OF 1

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETTIC



BAR: GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

DEPTH SCALE
1:300



LOGGED: N/A
CHECKED: JPA 000116

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-13

SHEET 1 OF 1

LOCATION: N 4939753.9 ; E 851876.8

DRILLING DATE: Aug 2004

DATUM: GEODETIC

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD				PIEZOMETER OR STANDPIPE INSTALLATION				
				ELEV. DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)		(C)(B)	(A)
					25	50	75	100	40	80		
0		GROUND SURFACE		247.20								
0		Verulam Formation		0.00								
5												
10		Bobcaygeon Formation		237.70 9.50								
15												
20												
25		Gull River Formation		225.20 22.00								
30												
35		END OF DRILLHOLE		214.31 32.69								
35		Notes:										
40		1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited										
40		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												

BAR GEOPHYSICAL_041120800-RCK-GEO.GPJ CAL-CANADA.GDT 12/8/06 JDR

DEPTH SCALE
1 : 300



LOGGED: N/A
CHECKED: JPA 000117

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

PROJECT: 04-1120-800

LOCATION: N 4939768.5 ; E 651882.3

GEOPHYSICAL LOG OF: OW-14

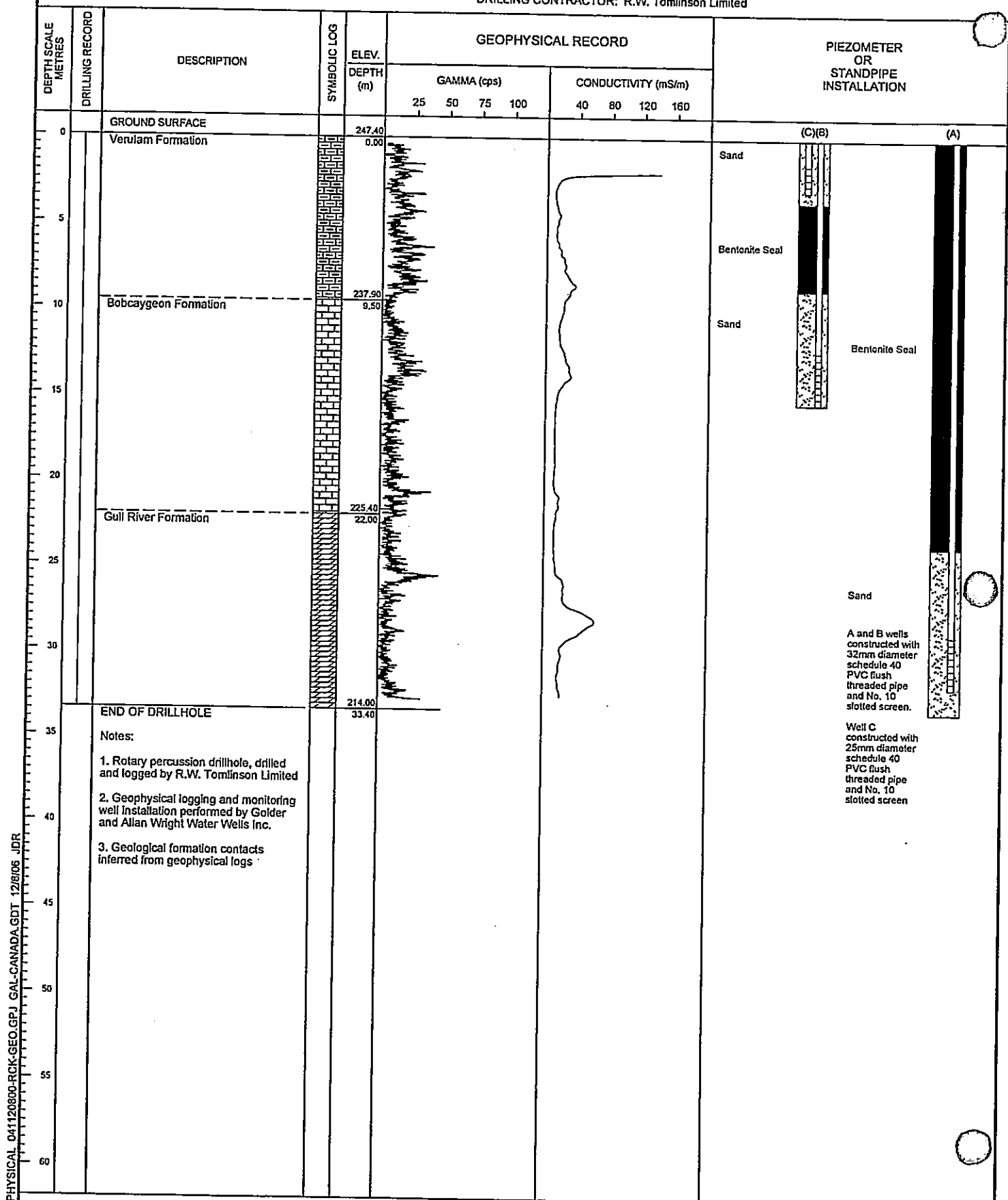
SHEET 1 OF 1

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETTIC



BAR GEOPHYSICAL_041120800-RCK-GEO.GPJ_GAL-CANADA.GDT 12/8/06 JDR

DEPTH SCALE

1 : 300



LOGGED: N/A

CHECKED: JPA

000118

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-15

SHEET 1 OF 1

LOCATION: N 4939777.7 ; E 851878.3

DRILLING DATE: Aug 2004

DATUM: GEODETIC

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD						PIEZOMETER OR STANDPIPE INSTALLATION			
				ELEV. DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)		(C)(B)	(A)	
					25	50	75	100	40	80			120
0		GROUND SURFACE		247.40									
0		Verulam Formation		0.00							Sand		
5													
10		Bobcaygeon Formation		237.60 9.50							Bentonite Seal		
15													
20													
25		Gull River Formation		225.40 22.00									
30													
35		END OF DRILLHOLE		213.59 33.81									
40		Notes:											
45		1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited											
50		2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.											
55		3. Geological formation contacts inferred from geophysical logs											
60													

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.

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

DEPTH SCALE
1 : 300



LOGGED: N/A
CHECKED: JPA 000119

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-16

SHEET 1 OF 1

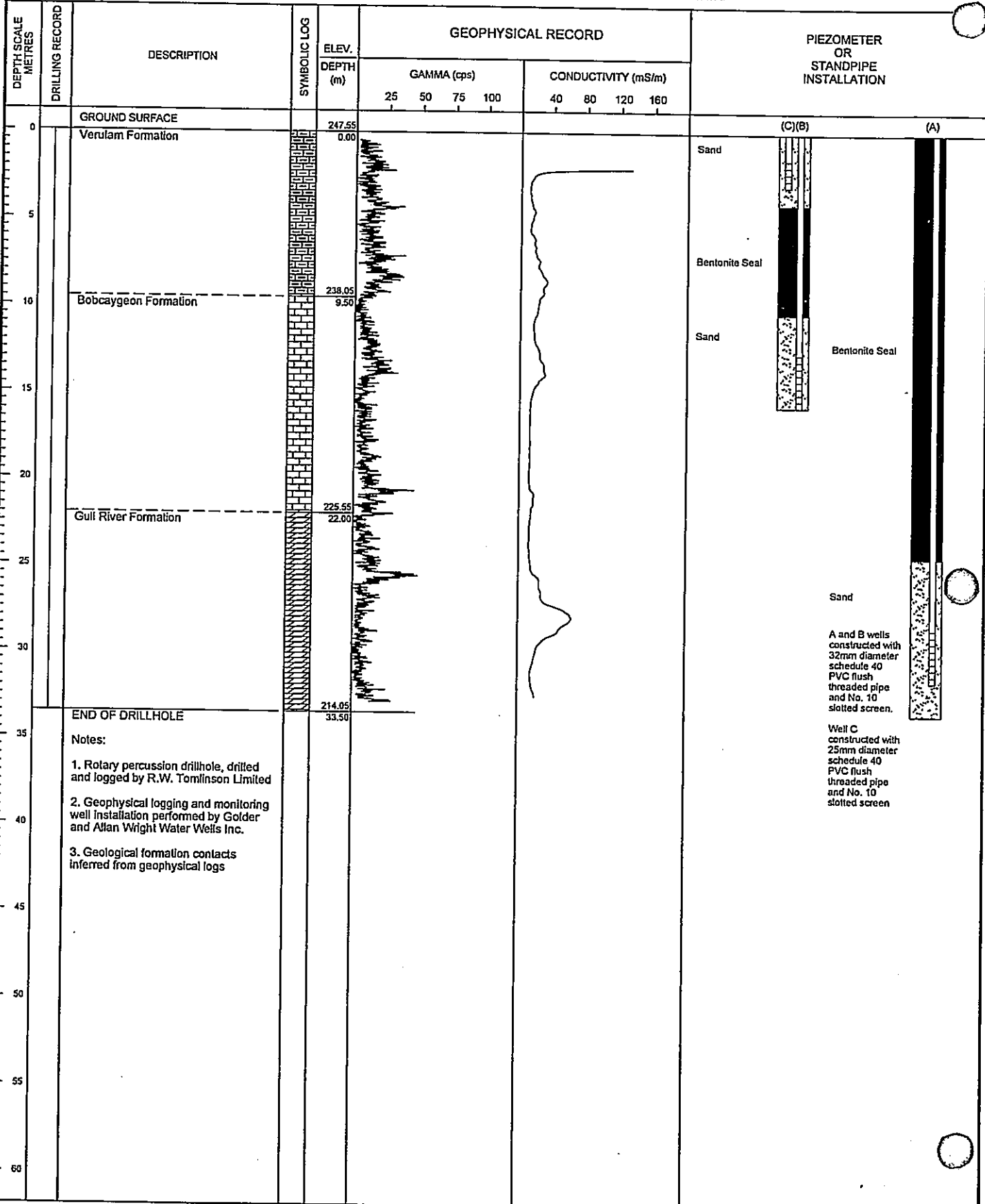
LOCATION: N 4939805.9 ; E 651867.8

DRILLING DATE: Aug 2004

DATUM: GEODETIC

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited



Notes:

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

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

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

DEPTH SCALE
1:300



LOGGED: N/A
CHECKED: JPA 000120

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-17

SHEET 1 OF 1

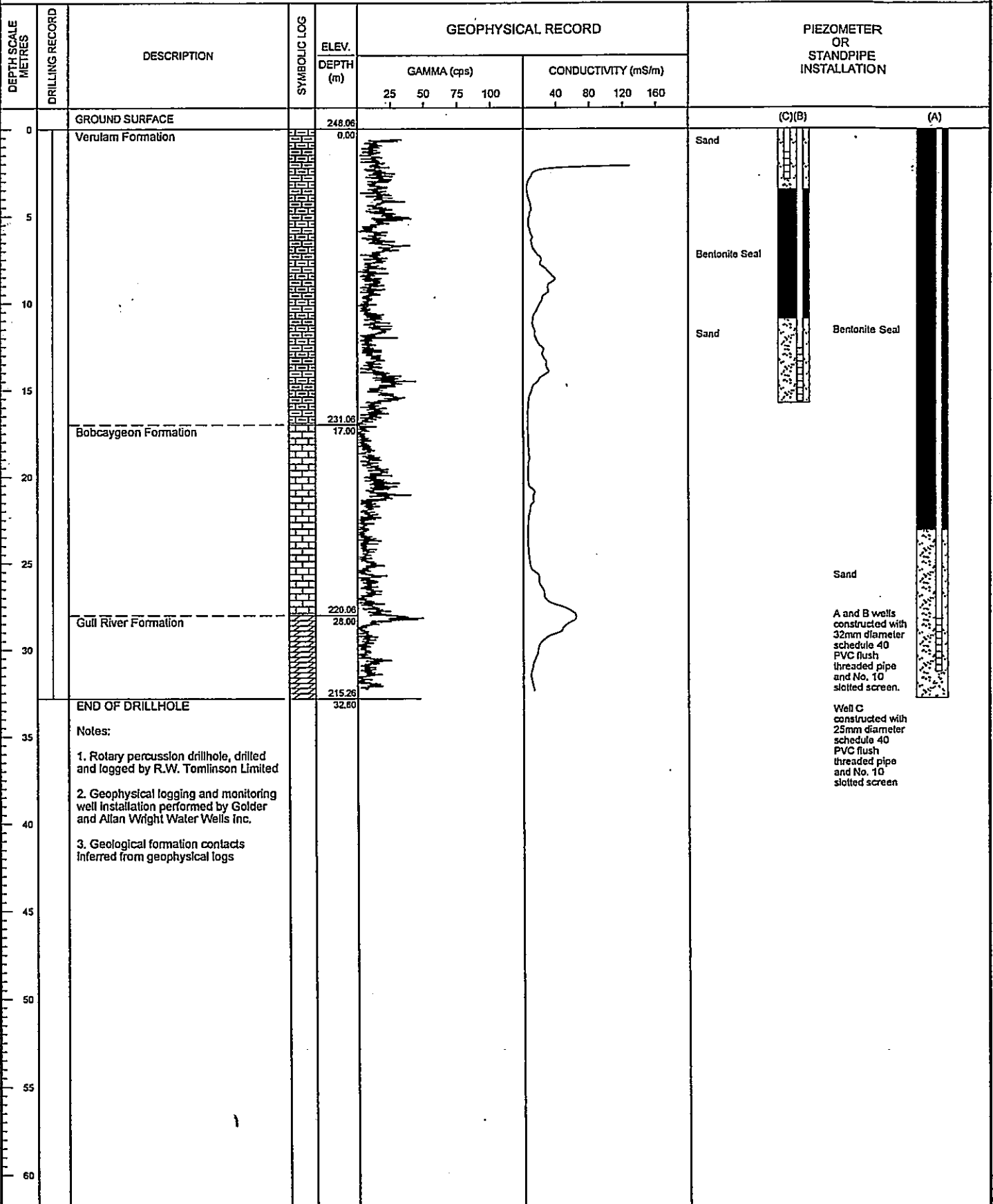
LOCATION: N 4938303.8 ;E 651468.4

DRILLING DATE: Aug 2004

DATUM: GEODETIC

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited



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

DEPTH SCALE
1 : 300



LOGGED: N/A
CHECKED: JPA 000121

PROJECT: 04-1120-800

LOCATION: N 4938304.4 ; E 651498.4

GEOPHYSICAL LOG OF: OW-18

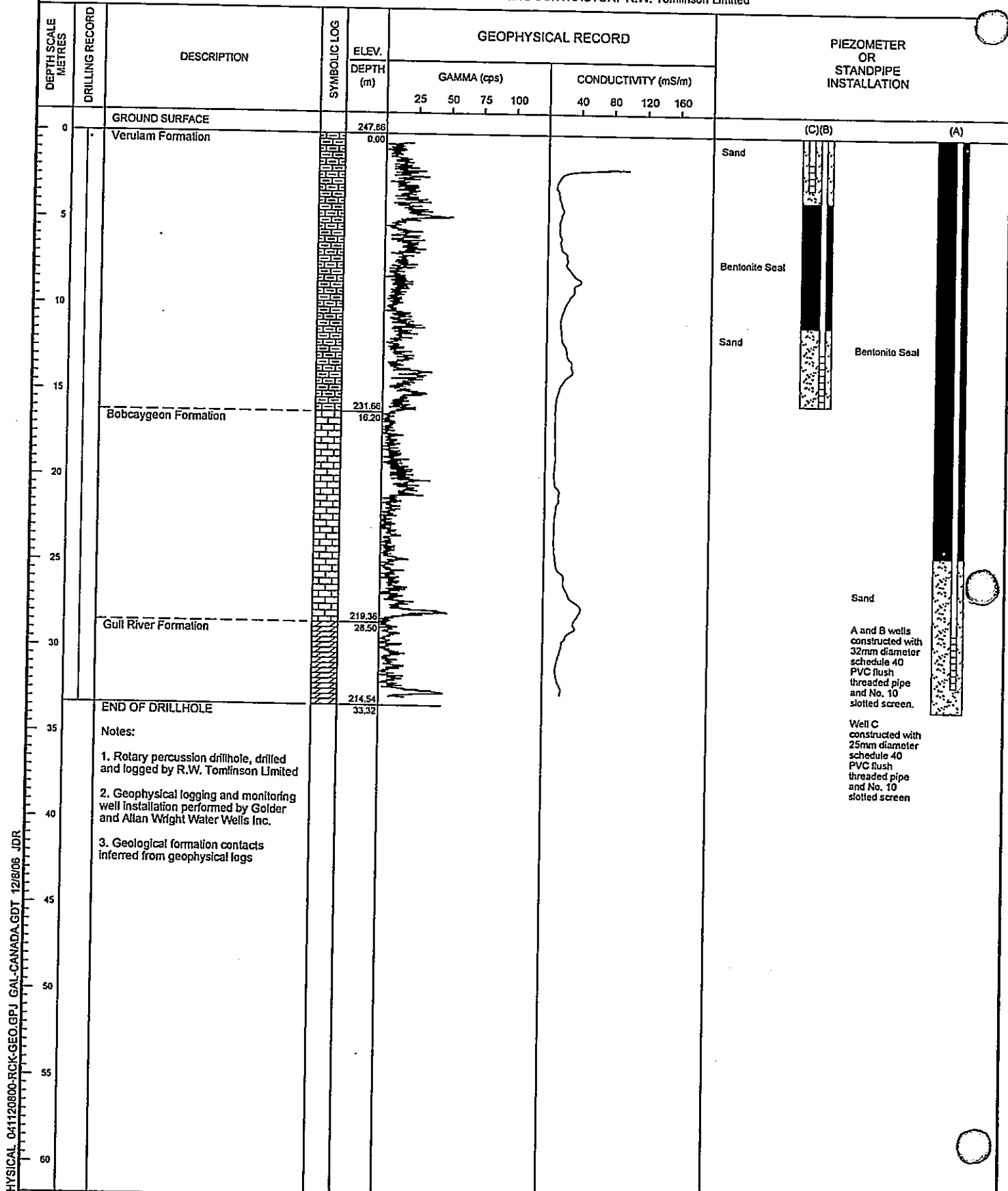
SHEET 1 OF 1

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETIC



BAR GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

DEPTH SCALE
1:300



LOGGED: N/A
CHECKED: JPA 000122

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-19

SHEET 1 OF 1

LOCATION: N 4938304.8 ; E 651508.2

DRILLING DATE: Aug 2004

DATUM: GEODETIC

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD					PIEZOMETER OR STANDPIPE INSTALLATION					
				ELEV. DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)				(C)(B)	(A)
					25	50	75	100	40	80	120	160		
0		GROUND SURFACE		247.85										
0		Verulam Formation		0.00										
5														
10														
15														
16		Bobcaygeon Formation		231.55										
16.30				16.30										
20														
25														
28		Gull River Formation		219.35										
28.50				28.50										
30														
32		END OF DRILLHOLE		214.95										
32.90				32.90										
35		Notes:												
40		1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited												
45		2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.												
50		3. Geological formation contacts inferred from geophysical logs												
55														
60														

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

DEPTH SCALE

1 : 300



LOGGED: N/A

CHECKED: JPA 000123

PROJECT: 04-1120-800

LOCATION: N 4938314.1; E 651520.7

GEOPHYSICAL LOG OF: OW-20

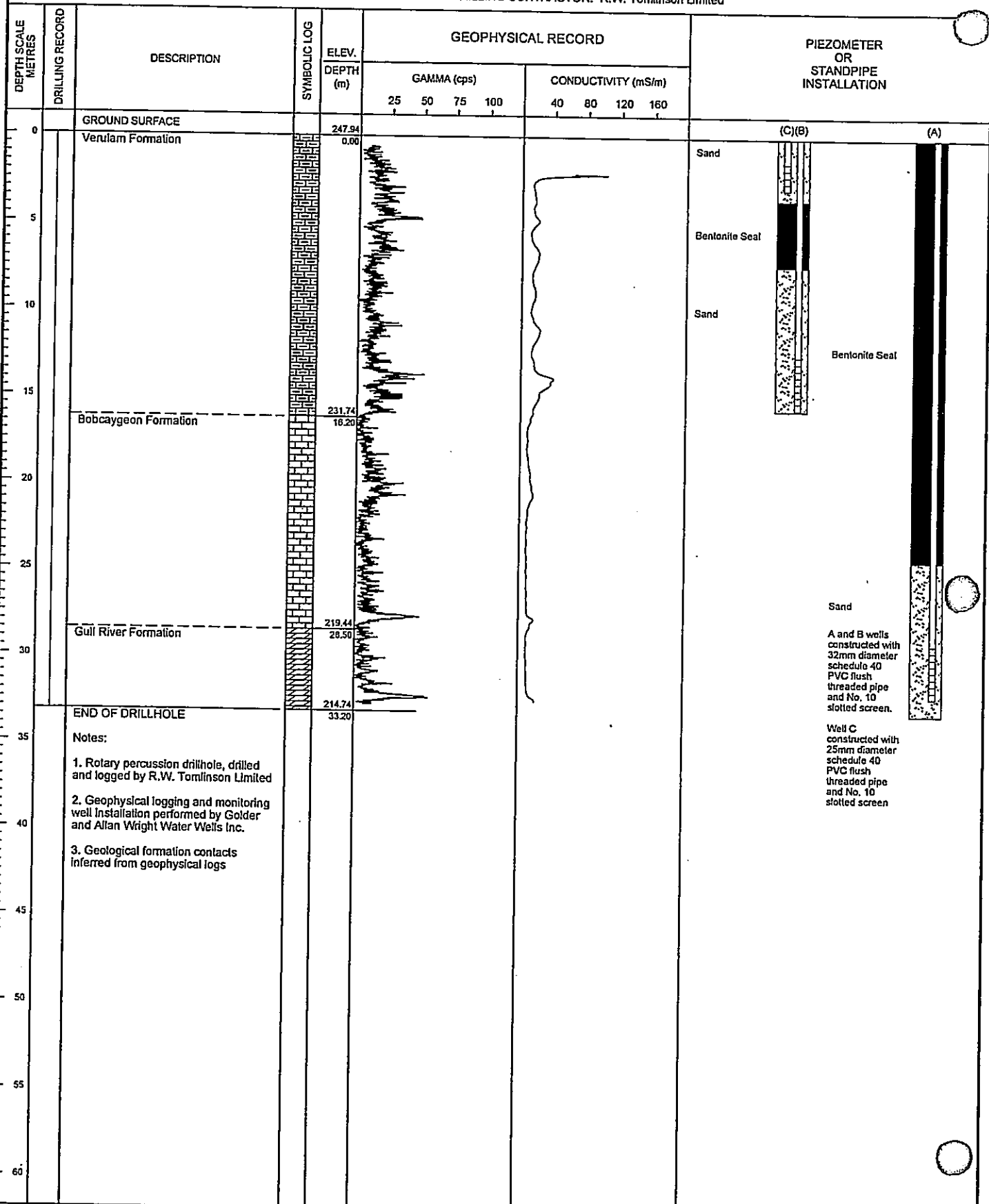
SHEET 1 OF 1

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETIC



BAR: GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/8/06 JDR

DEPTH SCALE
1:300



LOGGED: N/A
CHECKED: JPA 000124

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-21

SHEET 1 OF 1

LOCATION: N 4938323.4 ;E 651523.6

DRILLING DATE: Aug 2004

DATUM: GEODETIC

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD				PIEZOMETER OR STANDPIPE INSTALLATION					
				ELEV. DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)		(C)(B)	(A)	
					25	50	75	100	40	80			120
0		GROUND SURFACE		247.92									
		Verulam Formation		0.00									
5													
10													
15													
		Bobcaygeon Formation		231.92 18.00									
20													
25													
30													
		Gull River Formation		219.42 28.50									
35		END OF DRILLHOLE		214.47 33.45									
40		Notes:											
45		1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited											
50		2. Geophysical logging and monitoring well installation performed by Golder and Allan Wright Water Wells Inc.											
55		3. Geological formation contacts inferred from geophysical logs											
60													

BAR: GEOPHYSICAL_041120800-RCK-GEO.GPJ GAL-CANADA.GDT_12/8/06 .JDR

DEPTH SCALE
1 : 300



LOGGED: N/A
CHECKED: JPAC 000125

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: OW-23

SHEET 1 OF 1

LOCATION: N 4939109.1 ;E 651565.5

DRILLING DATE: Aug 2004

DATUM: GEODETIC

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD								PIEZOMETER OR STANDPIPE INSTALLATION		
				ELEV.		GAMMA (cps)				CONDUCTIVITY (mS/m)				
				DEPTH (m)		25	50	75	100	40	80		120	160
0		GROUND SURFACE		249.84										
		Verulam Formation		0.00										
5														
10														
15		Approximate contact only Bobcaygeon Formation		234.89 14.95										
20														
25														
30		Approximate contact only Gull River Formation		221.84 28.00										
35		END OF DRILLHOLE		218.69 33.15										
40		Notes: 1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited 2. Monitoring well installation performed by Allan Wright Water Wells Inc. 3. Approximate Geological contacts inferred from PW-3												
45														
50														
55														
60														

Bentonite Seal

Sand

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

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

DEPTH SCALE

1 : 300



LOGGED: N/A

CHECKED: JPA 000127

PROJECT: 04-1120-800

LOCATION: N 4939759.2 E 651884.9

GEOPHYSICAL LOG OF: PW-1

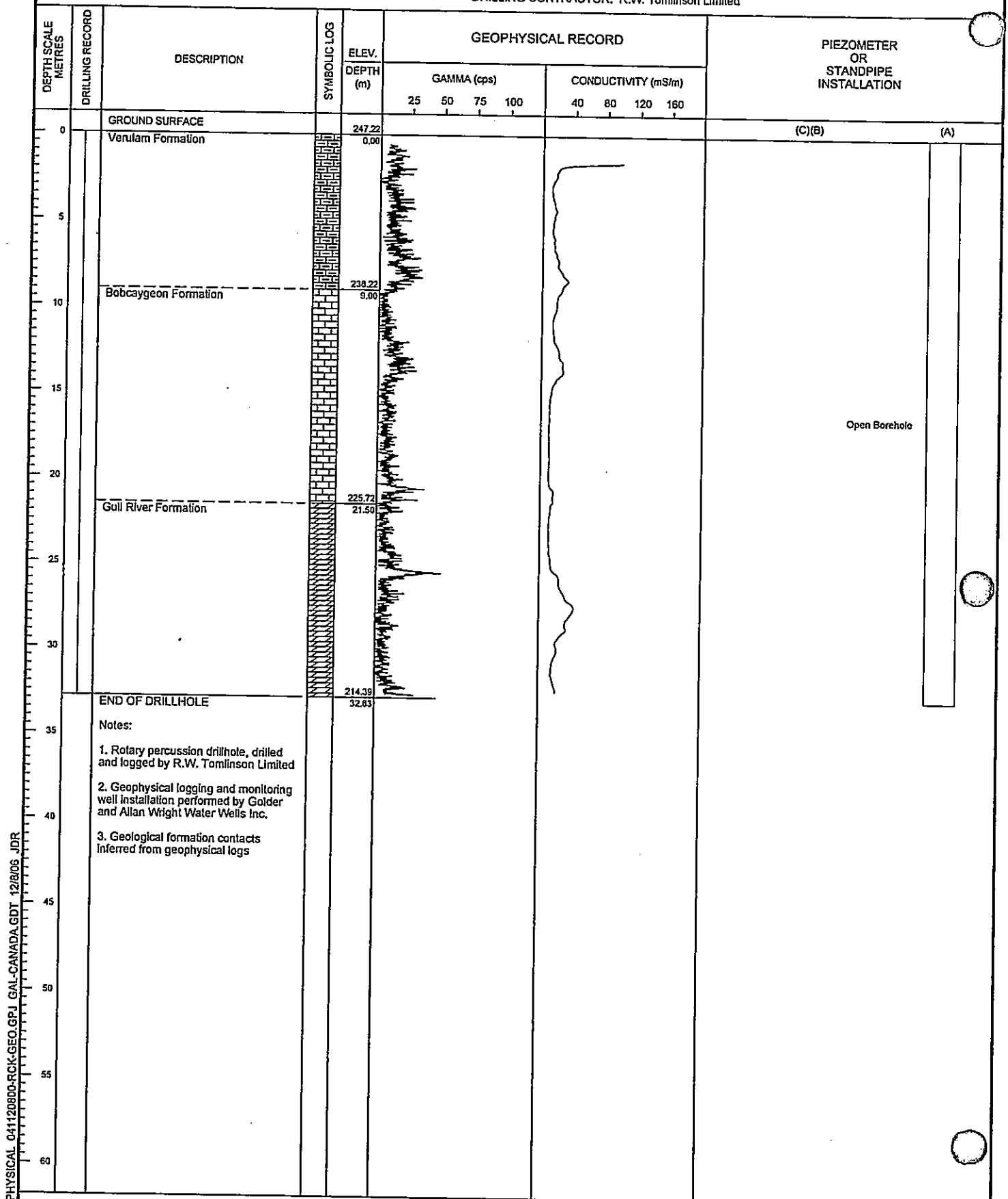
SHEET 1 OF 1

DRILLING DATE: Aug 2004

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DATUM: GEODETIC



BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ_GAL-CANADA.GDT_12/8/06_JDR

DEPTH SCALE
1 : 300



LOGGED: N/A
CHECKED: JPA 000128

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: PW-2

SHEET 1 OF 1

LOCATION: N 4938306.7 ;E 651517.0

DRILLING DATE: Aug 2004

DATUM: GEODETIC

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	GEOPHYSICAL RECORD				PIEZOMETER OR STANDPIPE INSTALLATION						
				ELEV. DEPTH (m)	GAMMA (cps)				CONDUCTIVITY (mS/m)					
					25	50	75	100	40	80	120	160		
0		GROUND SURFACE		247.78							(C)(B)	(A)		
0		Verulam Formation		0.00										
15		Bobcaygeon Formation		231.58 16.20										
30		Gull River Formation		219.58 28.20										
32.72		END OF DRILLHOLE		215.06 32.72										
35		Notes:												
40		1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited												
40		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												
60														

Open Borehole

BAR_GEOPHYSICAL_041120800-RCK-GEO.GPJ_GAL-CANADA.GDT_12/8/06_JDR

DEPTH SCALE
1 : 300



LOGGED: N/A
CHECKED: JPA/000129

PROJECT: 04-1120-800

GEOPHYSICAL LOG OF: PW-3

SHEET 1 OF 1

LOCATION: N 4939116.8 ; E 651582.8

DRILLING DATE: Aug 2004

DATUM: GEODETTIC

DRILL RIG: Tamrock 1500 Hyd. Drill

DRILLING CONTRACTOR: R.W. Tomlinson Limited

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	GEOPHYSICAL RECORD						PIEZOMETER OR STANDPIPE INSTALLATION	
					GAMMA (cps)				CONDUCTIVITY (mS/m)			
					25	50	75	100	40	80		120
0		GROUND SURFACE		249.44								
0		Verulam Formation	[Symbolic Log]	0.00	[Hand-drawn Geophysical Record]							
15		Bobcaygeon Formation	[Symbolic Log]	234.49 14.95	[Hand-drawn Geophysical Record]							
33		END OF DRILLHOLE	[Symbolic Log]	217.74 31.70	[Hand-drawn Geophysical Record]							
35		Notes:										
35		1. Rotary percussion drillhole, drilled and logged by R.W. Tomlinson Limited										
40		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										

Open Borehole

BAR: GEOPHYSICAL 041120800-RCK-GEO.GPJ GAL-CANADA.GDT 12/06 IDR

DEPTH SCALE

1:300



LOGGED: N/A

CHECKED: JPA 000130



ATTACHMENT 4

**CUMULATIVE IMPACTS ASSESSMENT FOR
GROUNDWATER TAKINGS IN THE
CARDEN PLAIN AREA – ADDENDUM REPORT**



March 2016

ADDENDUM REPORT TO

Cumulative Impacts Assessment for Groundwater Takings in the Carden Plain Area

Submitted to:

Ontario Stone, Sand & Gravel Association
5720 Timberlea Blvd., Suite 103
Mississauga, Ontario
L4W 4W2

REPORT



Report Number: 1407839

Distribution:

1 e-copy - Ontario Stone, Sand & Gravel Association
1 copy - Golder Associates Ltd.





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3.0 MODEL HYDROSTRATIGRAPHY	3
4.0 CLOSURE.....	5
5.0 REFERENCES.....	6

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Figure 2 – Elevation of Top of Bedrock Surface

Figure 3 – Elevation of Top of Verulam Formation Surface

Figure 4 – Elevation of Top of Bobcaygeon Formation Surface

Figure 5 – Elevation of Top of Gull River Formation Surface

Figure 6 – Elevation of Top of Gull River Formation Green Beds

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Figure 8 – Elevation of Top of Shadow Lake Formation Surface

Figure 9 – Elevation of Top of Precambrian Bedrock Surface



1.0 BACKGROUND

In 2012, Golder Associates (Golder) completed a multi-disciplinary study of the potential cumulative impact assessment (CIA) of the Carden Plain Area at the request of the Ontario Stone, Sand and Gravel Association. As a part of this work, estimates of the groundwater drawdown and rates of groundwater inflow to the twelve quarries in the Carden area were provided for the present conditions and future development scenarios. This involved construction and calibration of a groundwater flow model, which was adapted for use in predictive simulations, as documented in the Carden CIA Report (Golder, 2012). This report also details Golder's interpretation of the available data and provides context for how the data was incorporated into the conceptual model (which formed the basis of the groundwater flow model). Further, the Carden CIA Report includes many of the input parameters that were selected for the construction and calibration of the numerical groundwater flow model. For example, the model boundary conditions, hydraulic conductivity distribution, recharge distribution, and scenario descriptions are provided in the Carden CIA Report. Although conceptual and numerical cross-sections were included in the Carden CIA Report (which illustrate the hydrostratigraphic and model layering), a detailed representation of these surfaces was not provided. As such, based solely on the contents of the Carden CIA Report (Golder, 2012), it would not be possible for a third party to re-construct the numerical groundwater flow model.



ADDENDUM - CARDEN PLAIN CUMULATIVE IMPACT ASSESSMENT

2.0 OBJECTIVE

This document serves as an Addendum Report to the Carden CIA Report and is subject to same "Limitations and Use of Report" as defined in Section 8.0 of the Carden CIA Report (Golder, 2012).

The objective of this Addendum Report is to provide supplemental information, which, when combined with the information provided in the Carden CIA Report, could be used by a third party to construct a similar groundwater flow model of the Carden area. It should be noted that the Carden CIA model was constructed using data collected up to and including the year 2010. An evaluation of data collected subsequent to 2010, and comparison to how those data are aligned with the Carden CIA model would be required for future modelling updates.



3.0 MODEL HYDROSTRATIGRAPHY

The approach to numerical layering adapted for the Carden CIA groundwater flow model was based on the development of hydrostratigraphic surfaces that represented the top elevation of the various hydrostratigraphic units identified in the Carden area. In general, these hydrostratigraphic units were selected to correspond to bedrock formational units. The hydrostratigraphic surfaces were developed on a regional basis following the assembly of interpreted geological contact elevations from the available borehole information across the study area. The surfaces were corrected to the regional topographic digital elevation model (DEM) in any location where the surface interpolation extended above ground surface (i.e., a “top-down” correction was applied).

A summary of the model layering was provided in Section 2.4.4.1 of the Carden CIA Report (Golder, 2012). This is provided below, with additional elaboration and reference to the accompanying figures that illustrate the model surfaces:

- **Unit 1 – Overburden (Model Layer 1).** A thin veneer of overburden is present over the majority of the study area, with thicker deposits found in isolated pockets. The overburden is composed of a mix of organic deposits, alluvium, fine-grained glaciolacustrine deposits, glacial tills, stratified drift and occasional sand deposits. Regionally, the overburden deposits were represented as a bulk unit with a hydraulic conductivity value that was ultimately determined through the calibration process (discussed in Section 2.4.6 of the Carden CIA Report). The overburden was represented in the model as a single numerical layer. In some places within the model domain, no overburden is present at surface. In these areas, the underlying weathered bedrock is defined at surface. The top surface of Layer 1 is defined by topography, based on DEM data (MNR, 2002), illustrated in Figure 1. The bottom surface of this layer is defined as the top of bedrock, which was calculated based on all available borehole information, including logs from boreholes on the quarry sites, as well as data from the Ministry of the Environment and Climate Change Water Well Information System database (following screening for consistency and location accuracy). The top of bedrock surface is illustrated in Figure 2. It is noted that the difference between the DEM (Figure 1) and the top of bedrock surface (Figure 2) represents the interpreted overburden thickness;
- **Unit 2 – Upper Weathered Bedrock (Model Layers 2 and 3).** The upper weathered bedrock unit represents a zone of enhanced fracturing as a result of weathering that is typically found within the upper 3 to 6 m of bedrock throughout the study area. This was represented in the model as two numerical layers. The top surface of these layers was defined as the top of rock. As it is not possible to map the thickness of this unit with the amount of data currently available, this layer was specified with a minimum total thickness of approximately 4 m. However, the material properties of the upper weathered bedrock were extended into lower model layers where underlying geological surfaces “pinch-out” and minimum numerical layer thicknesses were specified, effectively extending the thickness of the weathered zone in these areas;
- **Unit 3 – Verulam Formation (Model Layer 4).** This layer represents the Verulam Formation bedrock. The thickness of this unit is variable and increases towards the south. In areas where the Verulam Formation is not present, a minimum layer thickness of 1 m was used, and the material properties of the overlying (weathered bedrock) unit were applied. It should be noted that this unit is incorporated within model layer 3 within Model Domain Zone 3. The top surface of this unit, corresponding to the top of Model Layer 4, is illustrated in Figure 3;



ADDENDUM - CARDEN PLAIN CUMULATIVE IMPACT ASSESSMENT

- **Unit 4 – Bobcaygeon Formation (Model Layer 5).** Generally found throughout the study area, this layer is considered to be a thick, continuous unit of relatively low permeability (based on available hydraulic conductivity data). The top surface of this unit, corresponding to the top of Model Layer 5, is illustrated on Figure 4;
- **Unit 5 – Upper Gull River Formation (Model Layer 6).** This layer represents the upper portion of the Gull River Formation and is approximately 5 m thick across the study area. This unit is considered to be an aquitard with hydraulic properties similar to those of the overlying Bobcaygeon Formation. The elevation of the upper surface of this unit is illustrated on Figure 5;
- **Unit 6 – Gull River Formation Green Beds (Model Layer 7).** Layer 7 represents the “Green Bed” unit, found approximately 5 m below the Gull River-Bobcaygeon formational contact. This unit is approximately 1 m to 3 m thick across the study area. Despite its limited thickness, this unit generally represents a regionally extensive aquifer capable of supplying significant volumes of water. The surface elevation of the top of the “Green Bed” unit is illustrated in Figure 6;
- **Unit 7 – Lower Gull River Formation (Model Layer 8).** This model layer represents the lower Gull River Formation, consisting of limestone of varying thickness across the study area. This unit is interpreted to be an aquitard. The top surface elevation of this unit (corresponding to the base of the “Green Bed” unit) is illustrated on Figure 7;
- **Unit 8 – Shadow Lake Formation (Model Layer 9).** This model layer represents the Shadow Lake Formation of relatively consistent thickness (8 m – 12 m) across the study area. This unit is interpreted to be an aquitard. The top surface elevation of this unit is illustrated on Figure 8; and,
- **Unit 9 – Shadow Lake / Precambrian Contact (Model Layer 10).** A zone of enhanced fracturing is sometimes found at the contact between the Shadow Lake Formation and the underlying Precambrian basement rock, and is considered as a continuous aquifer across the study area. Numerical model layer 10 was specified as a constant 5 m thick layer draped below the top of the Precambrian rock surface to represent this zone. The top of the Precambrian surface is irregular across the study area, and cuts through the overlying formations in places (*Note: the surfaces were corrected from the top down based on the DEM, and also from the bottom up, to account for the presence of the Precambrian Contact Zone*). The top surface elevation of this unit is illustrated in Figure 9. The base of this layer forms the base of the numerical model, as it is assumed that the competent Precambrian rock found below the weathered zone at the Shadow Lake / Precambrian contact is impermeable relative to the overlying formations.



ADDENDUM - CARDEN PLAIN CUMULATIVE IMPACT ASSESSMENT

4.0 CLOSURE

We trust that the information provided herein satisfies your current requirements. Please contact us should you have any questions.

GOLDER ASSOCIATES LTD.

N. Bishop



Nick Bishop, M.Sc., P.Eng.
Geological Engineer, Groundwater Modeller

Kris Marentette

Kris Marentette, M.Sc., P. Geo.
Senior Hydrogeologist/Principal

NB/KAM

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5.0 REFERENCES

Golder Associates Ltd., 2012. Report on Cumulative Impacts Assessment for Groundwater Takings in the Carden Plain Area, September 2012 (Golder File No. 09-1112-6065)

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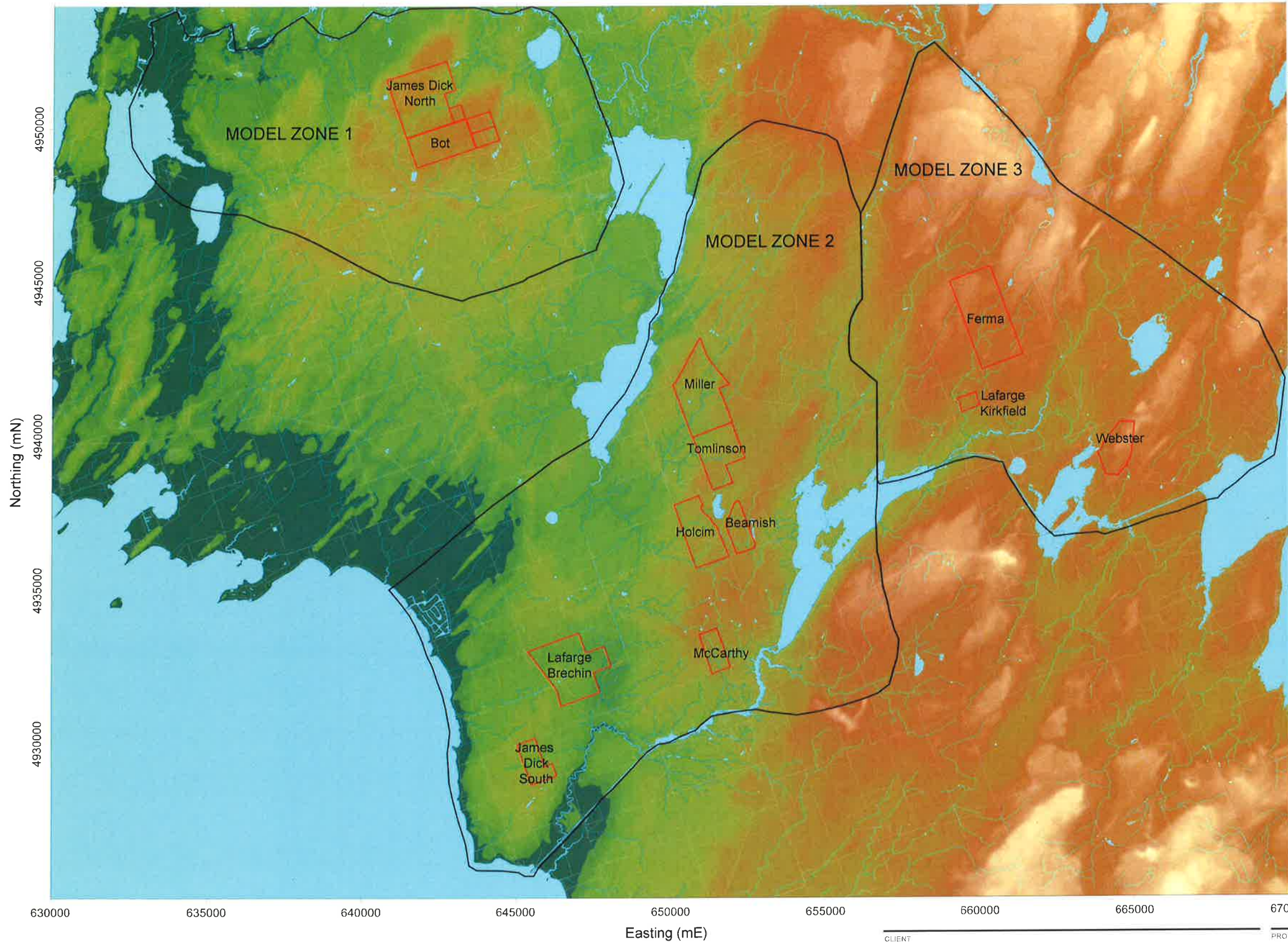
For more information, visit golder.com

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Asia	+ 86 21 6258 5522
Austrasia	+ 61 3 8862 3500
Europe	+ 44 1628 851851
North America	+ 1 800 275 3281
South America	+ 56 2 2616 2000

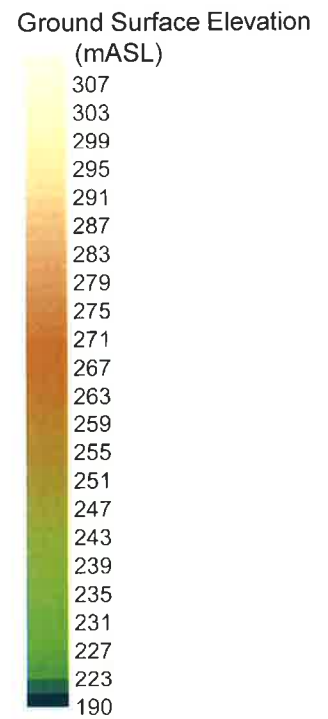
solutions@golder.com
www.golder.com

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1931 Robertson Road
Ottawa, Ontario, K2H 5B7
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T: +1 (613) 592 9600





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



CLIENT
Ontario Stone, Sand & Gravel Association

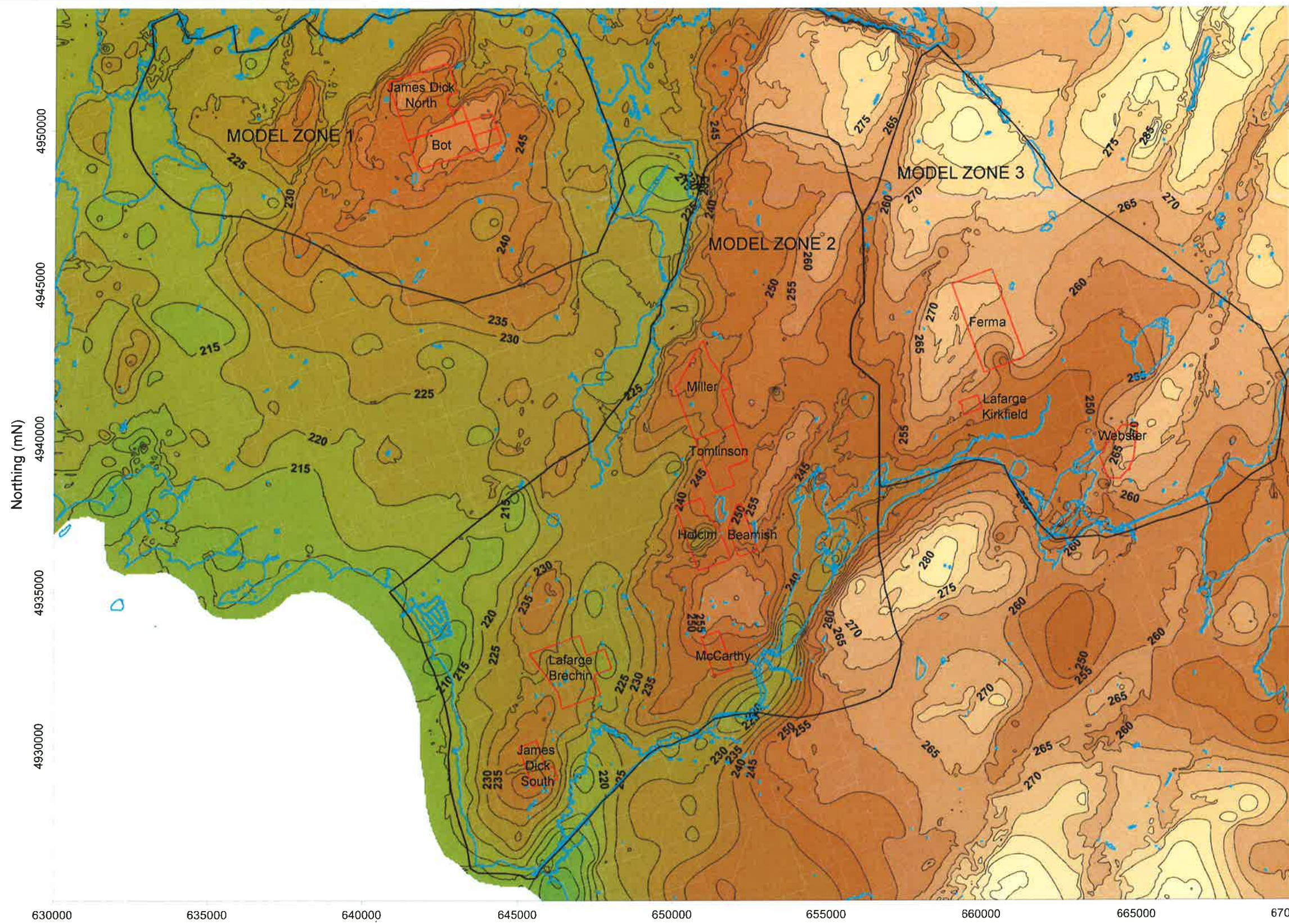
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Addendum Report

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	DESIGN	NFB
	REVIEW	KAM
	APPROVED	KAM

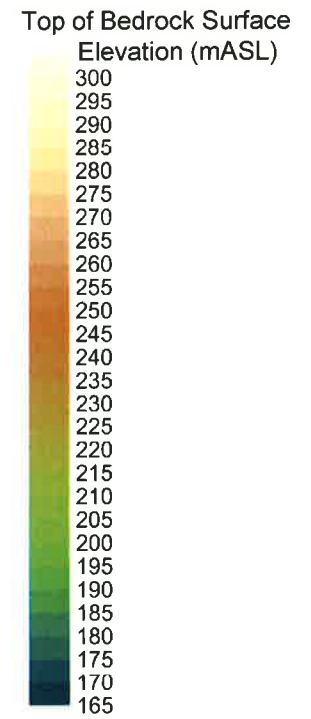
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PROJECT No	Phase	Rev.
1407839	4000	0





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



Northing (mN)

4950000
4945000
4940000
4935000
4930000

Easting (mE)

630000 635000 640000 645000 650000 655000 660000 665000 670000

CLIENT
Ontario Stone, Sand & Gravel Association

PROJECT
Carden Plain Cumulative Impact Assessment
Addendum Report

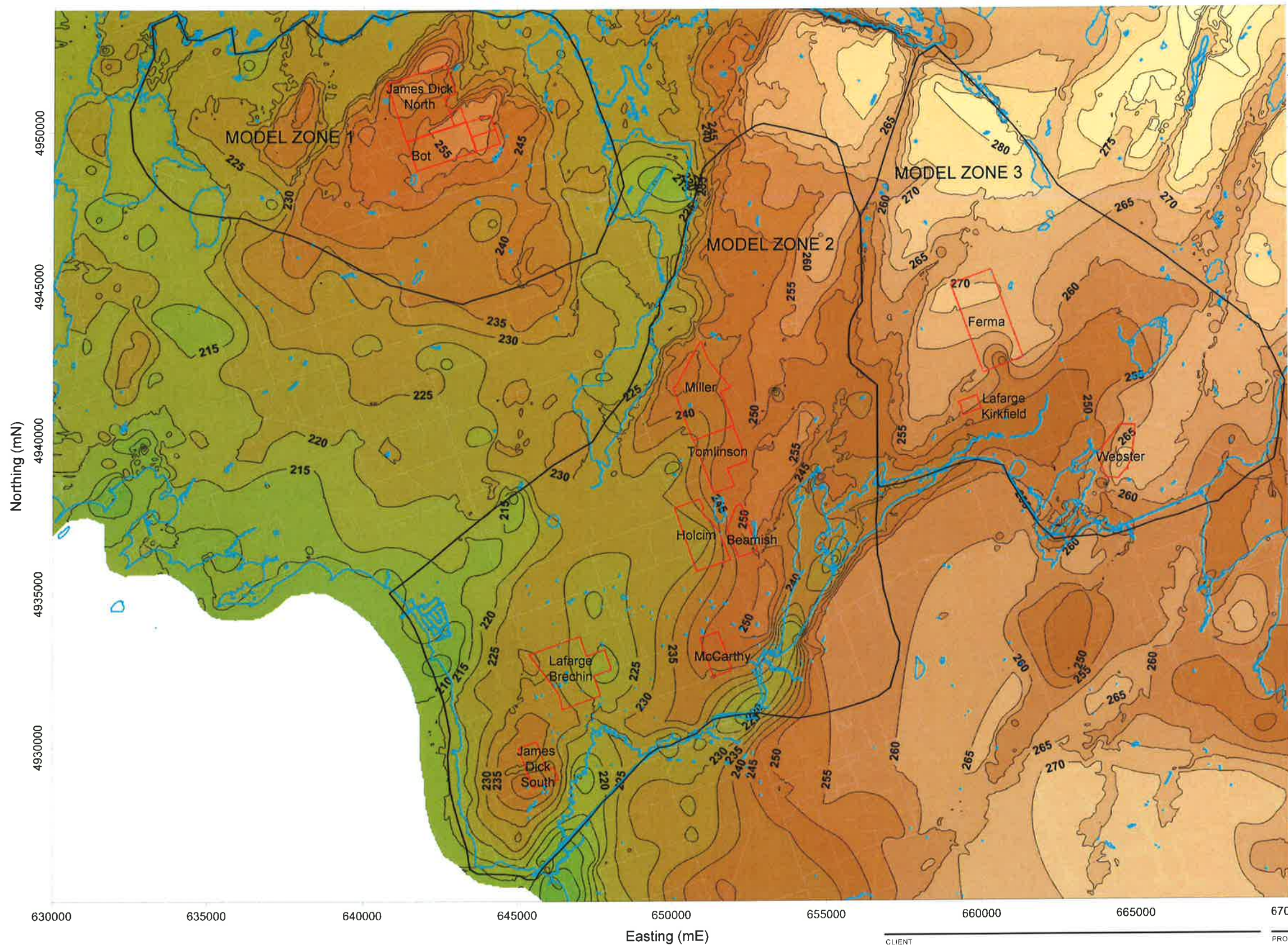
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	REVIEW	KAM
	APPROVED	KAM



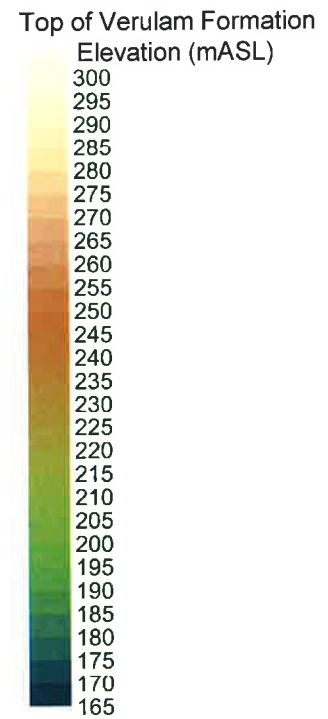
TITLE
Elevation of Top of Bedrock Surface

PROJECT No 1407839 Phase 4000 Rev 0

FIGURE 2



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



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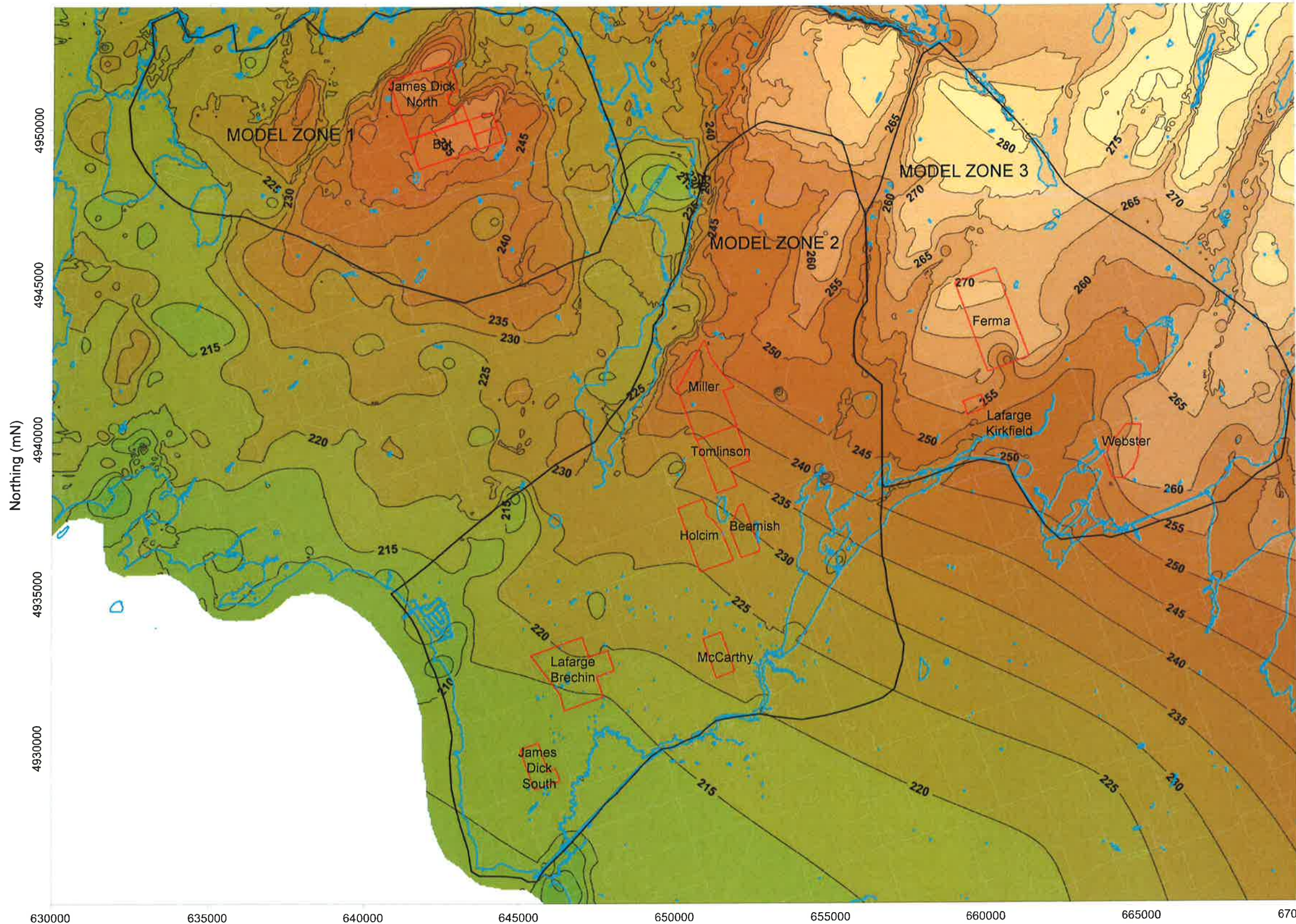
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Addendum Report

CONSULTANT
Golder Associates

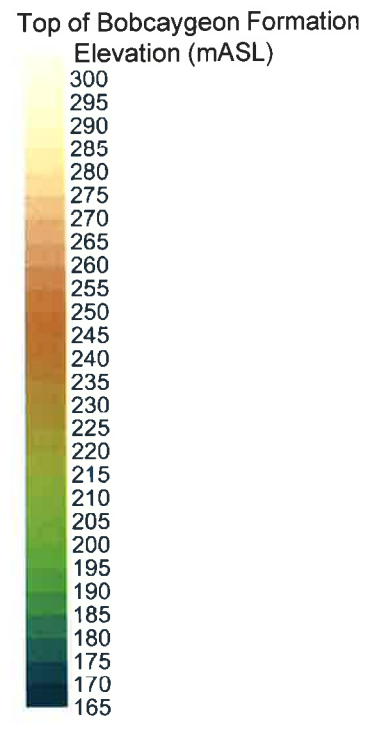
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DESIGN	NFB
REVIEW	KAM
APPROVED	KAM

TITLE
Elevation of Top of Verulam Formation
Surface

PROJECT No	Phase	Rev	FIGURE
1407839	4000	0	3



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



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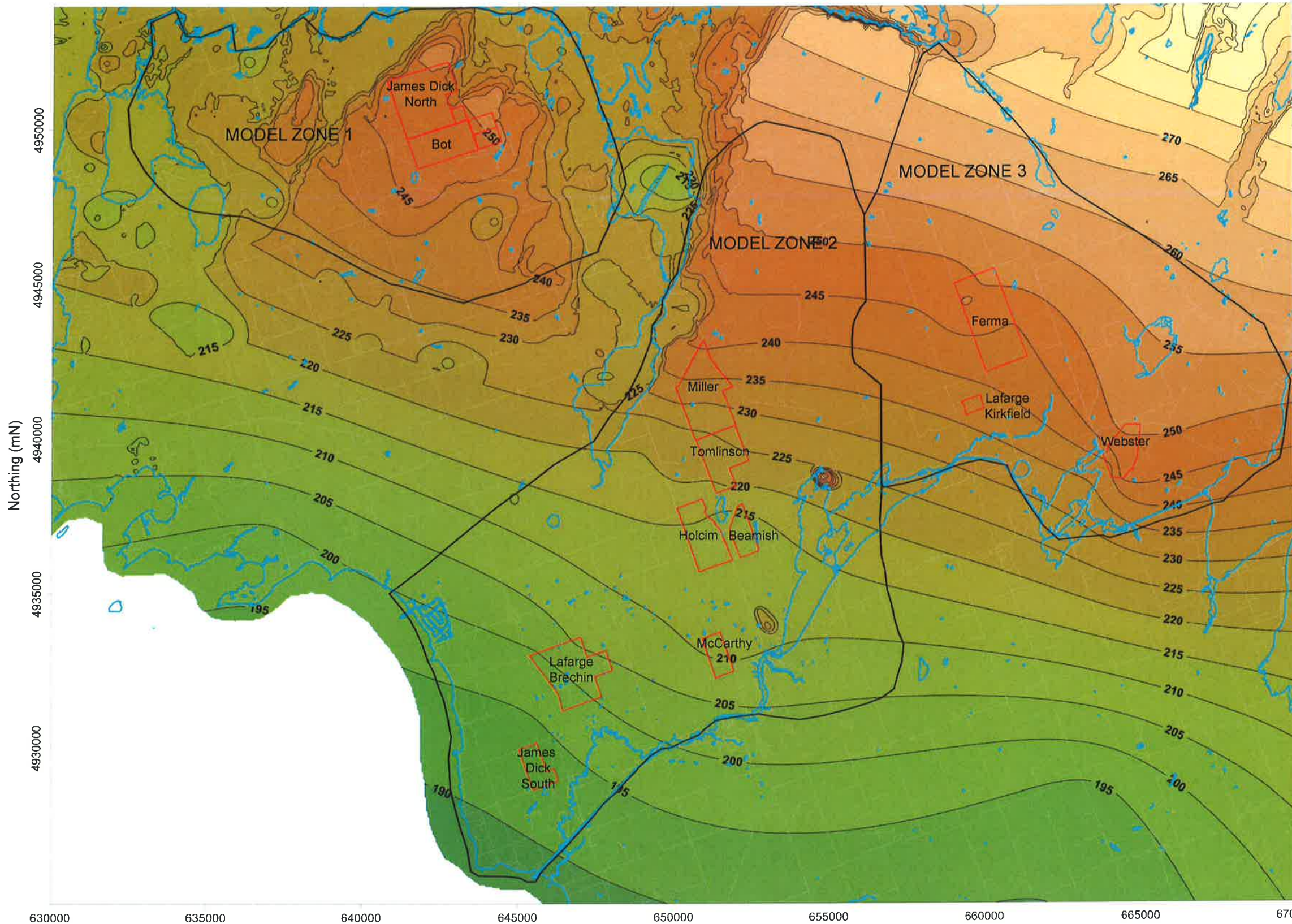
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Addendum Report

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	DESIGN	NFB
	REVIEW	KAM
	APPROVED	KAM

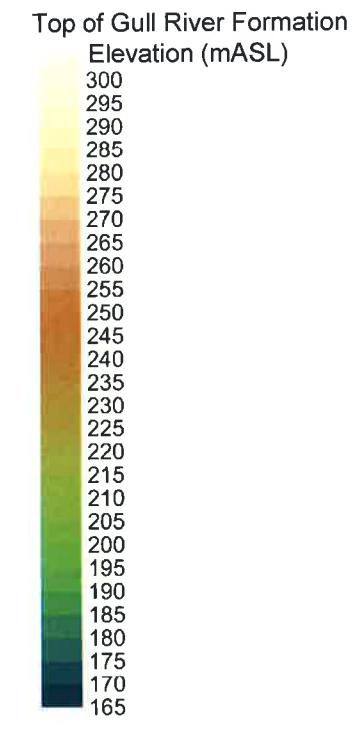
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Elevation of Top of Bobcaygeon Formation
Surface

PROJECT No	Phase	Rev
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- LEGEND**
- Roads
 - Waterbodies
 - Watercourses
 - Quarry License Boundaries
 - Extents of Groundwater Flow Model Domain Zones



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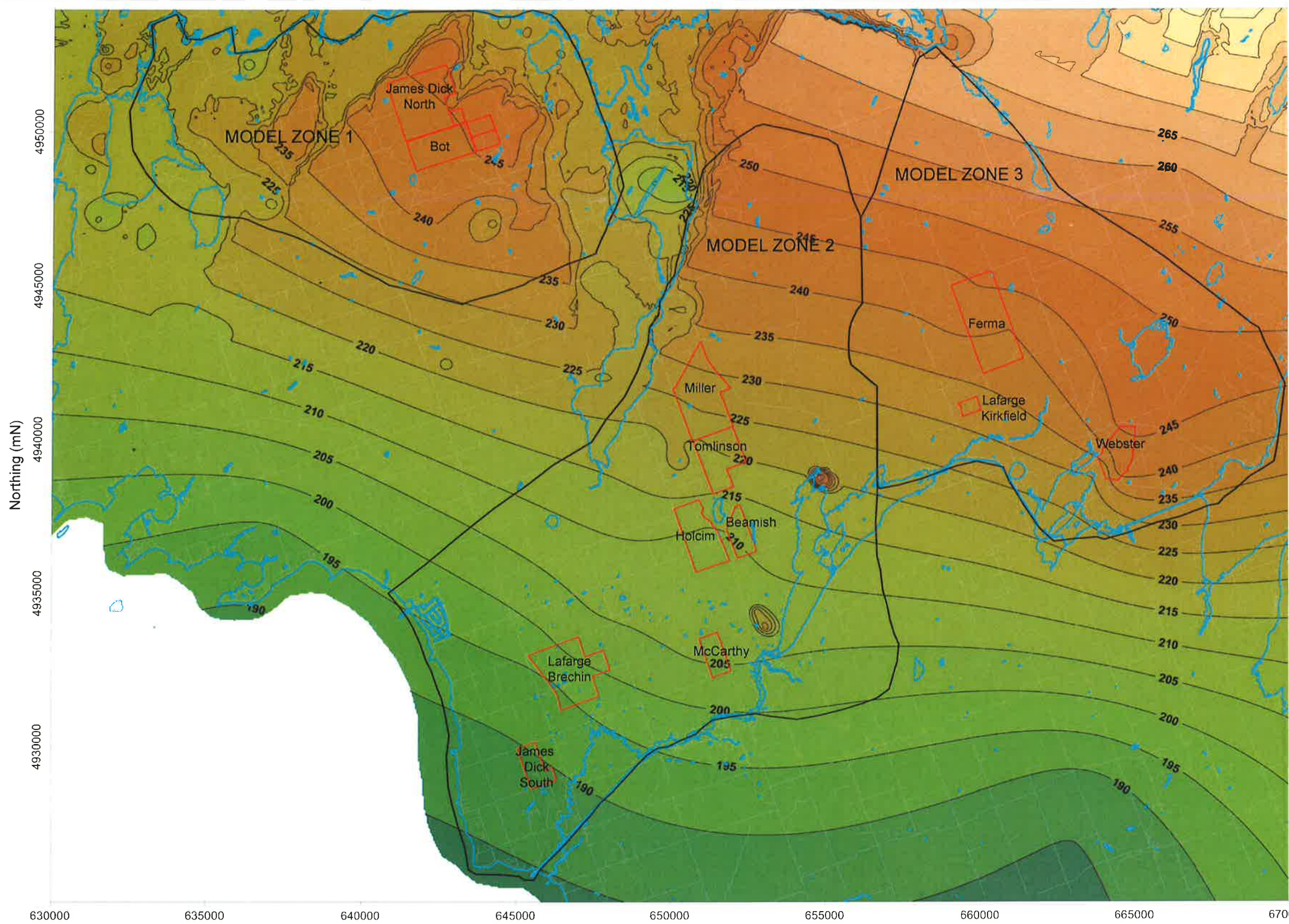
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Addendum Report

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	REVIEW	KAM
	APPROVED	KAM

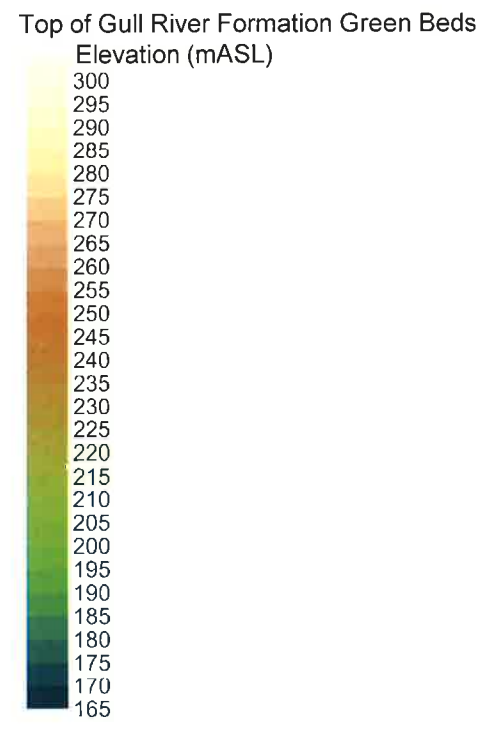
TITLE
Elevation of Top of Gull River Formation
Surface

PROJECT No	Phase	Rev
1407839	4000	0





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



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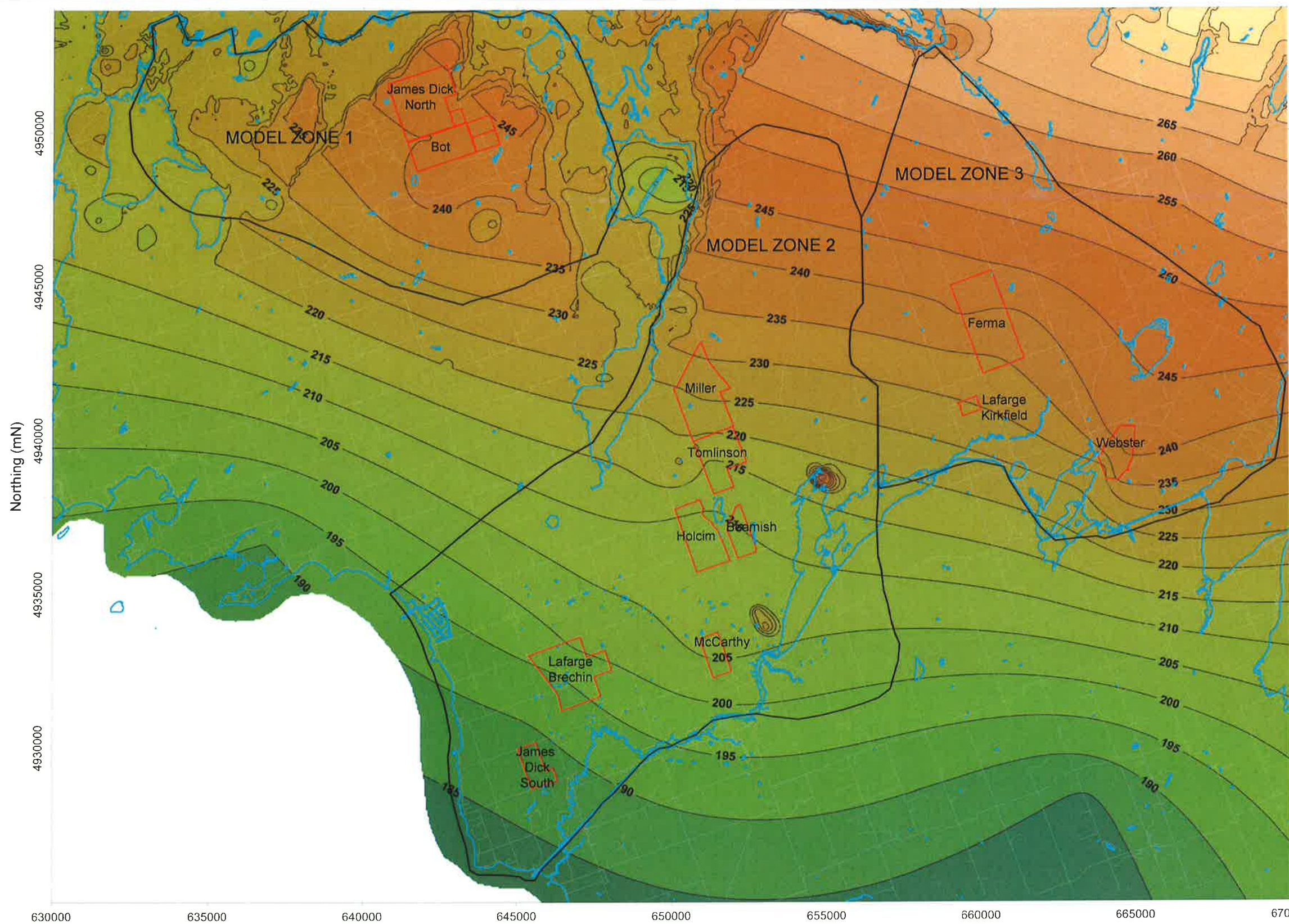
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	APPROVED	KAM

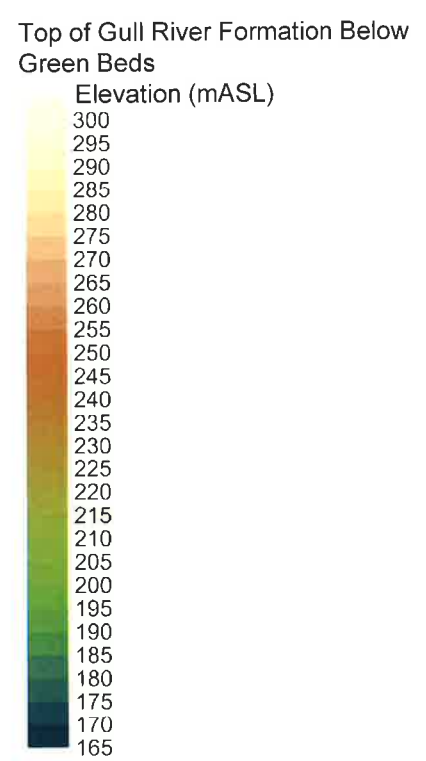


TITLE
Elevation of Top of Gull River Formation
Green Beds

PROJECT No	Phase	Rev.	FIGURE
1407839	4000	0	6



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



630000 635000 640000 645000 650000 655000 660000 665000 670000

4930000 4935000 4940000 4945000 4950000

Northing (mN)

Easting (mE)

CLIENT
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PROJECT
Carden Plain Cumulative Impact Assessment
Addendum Report

CONSULTANT

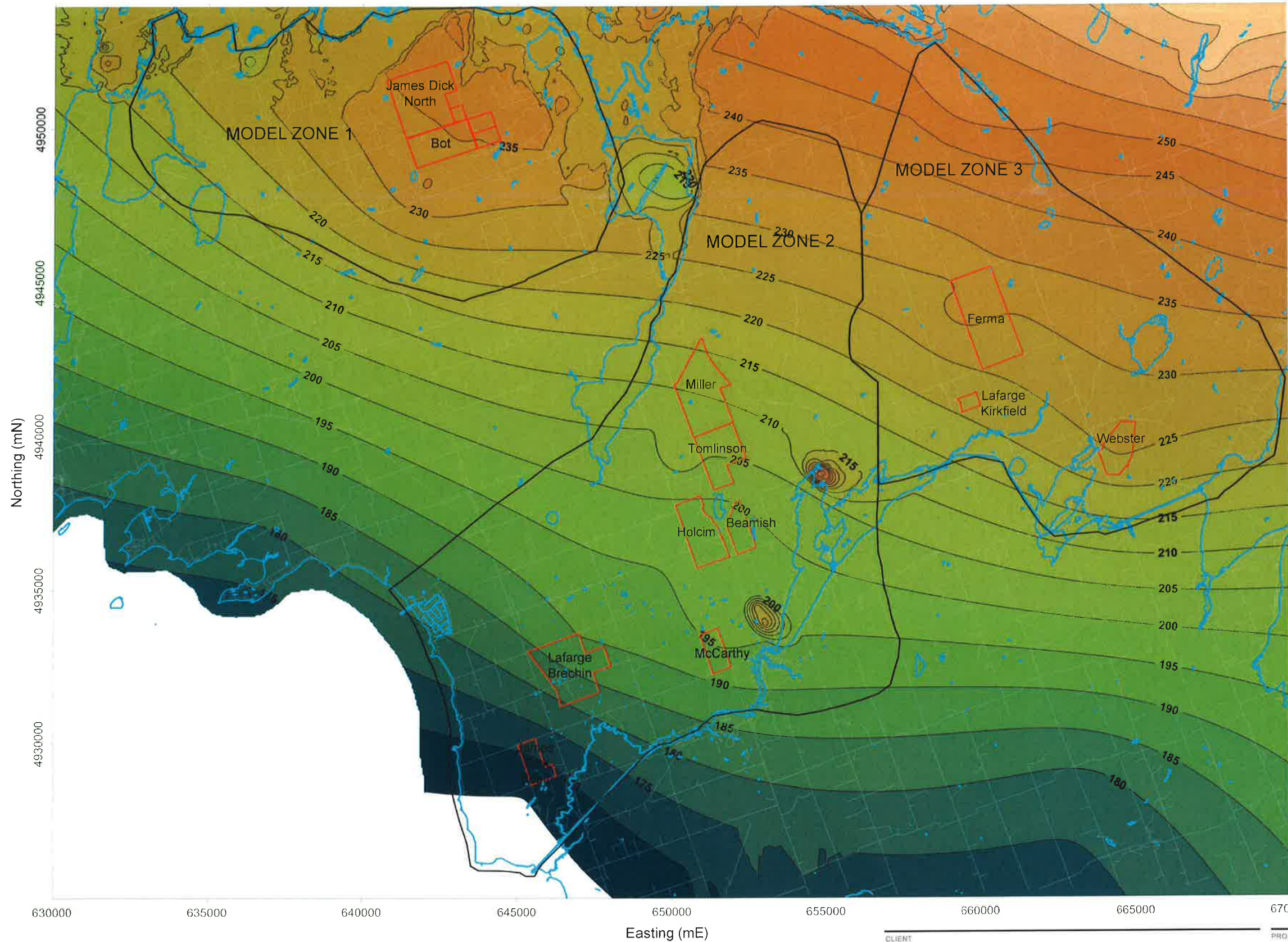


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PREPARED NFB
DESIGN NFB
REVIEW KAM
APPROVED KAM

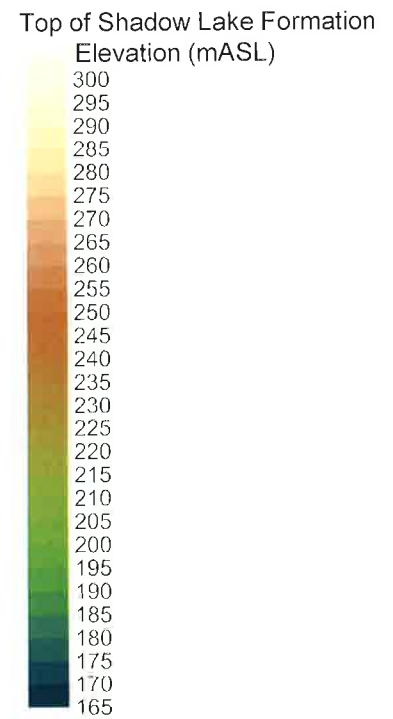
TITLE
Elevation of Top of Lower Gull River Formation
Below Green Beds

PROJECT No. 1407839
Phase 4000
Rev 0

FIGURE 7



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



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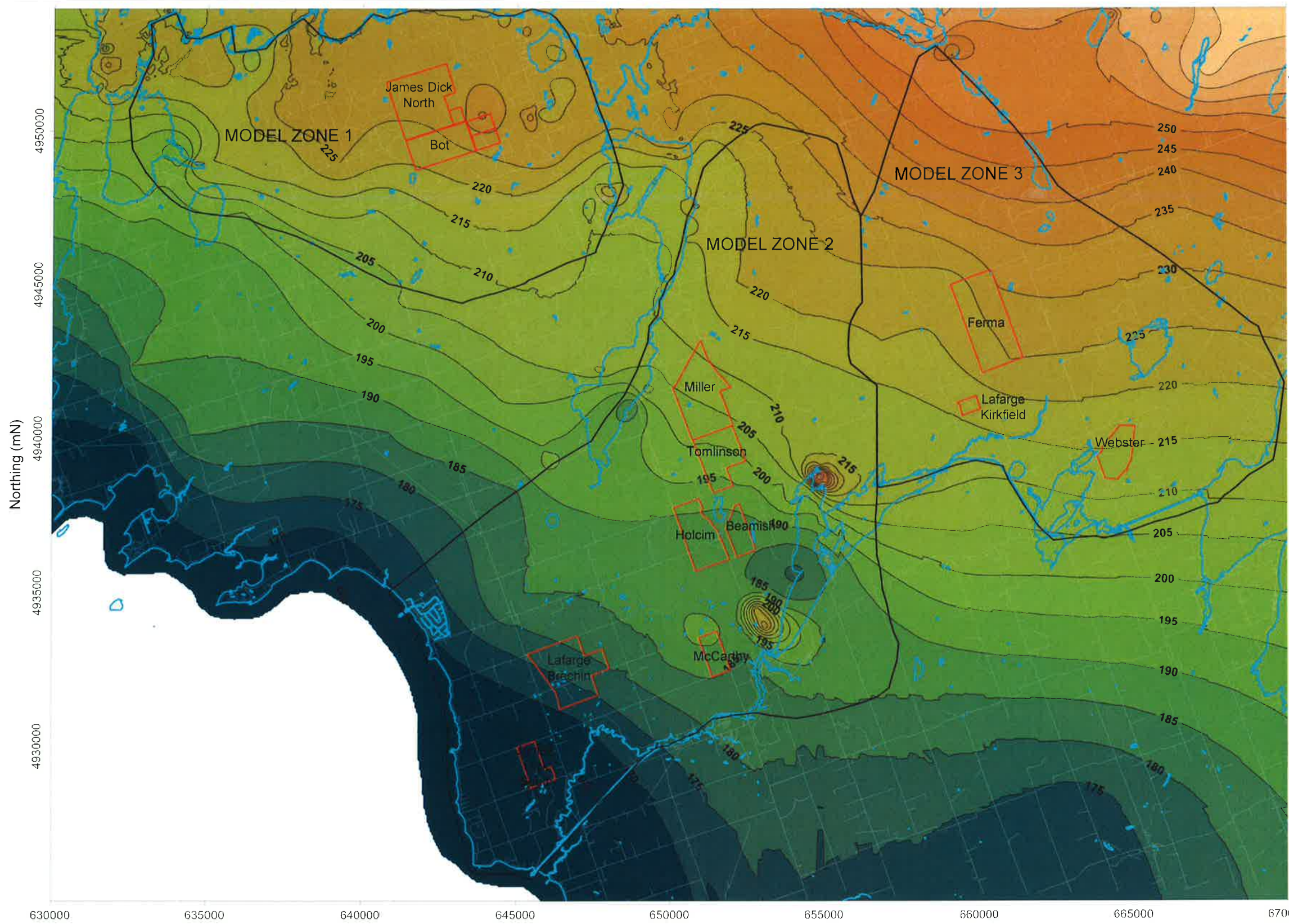
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Addendum Report

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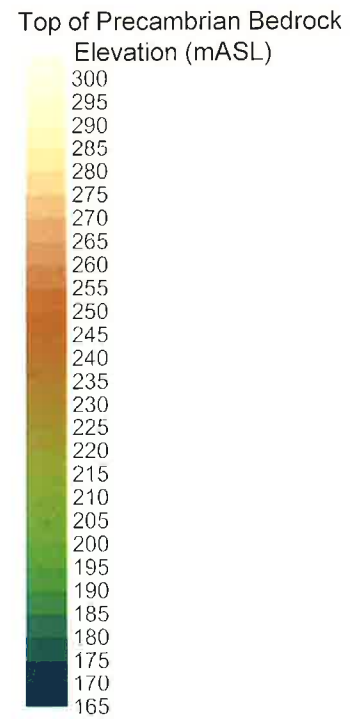
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PREPARED	NFB
DESIGN	NFB
REVIEW	KAM
APPROVED	KAM

TITLE
Elevation of Top of Shadow Lake Formation
Surface

PROJECT No	Phase	Rev.	FIGURE
1407839	4000	0	8



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



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4930000 4935000 4940000 4945000 4950000

Northing (mN)

Easting (mE)

CLIENT
Ontario Stone, Sand & Gravel Association

PROJECT
Carden Plain Cumulative Impact Assessment
Addendum Report

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



TITLE
Elevation of Top of Precambrian Bedrock
Surface

PROJECT No	Phase	Rev.	FIGURE
1407839	4000	0	9



ATTACHMENT 5

AQUIFER TEST © DATA SHEETS



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520 Bingham Centre Drive
Kitchener Ontario

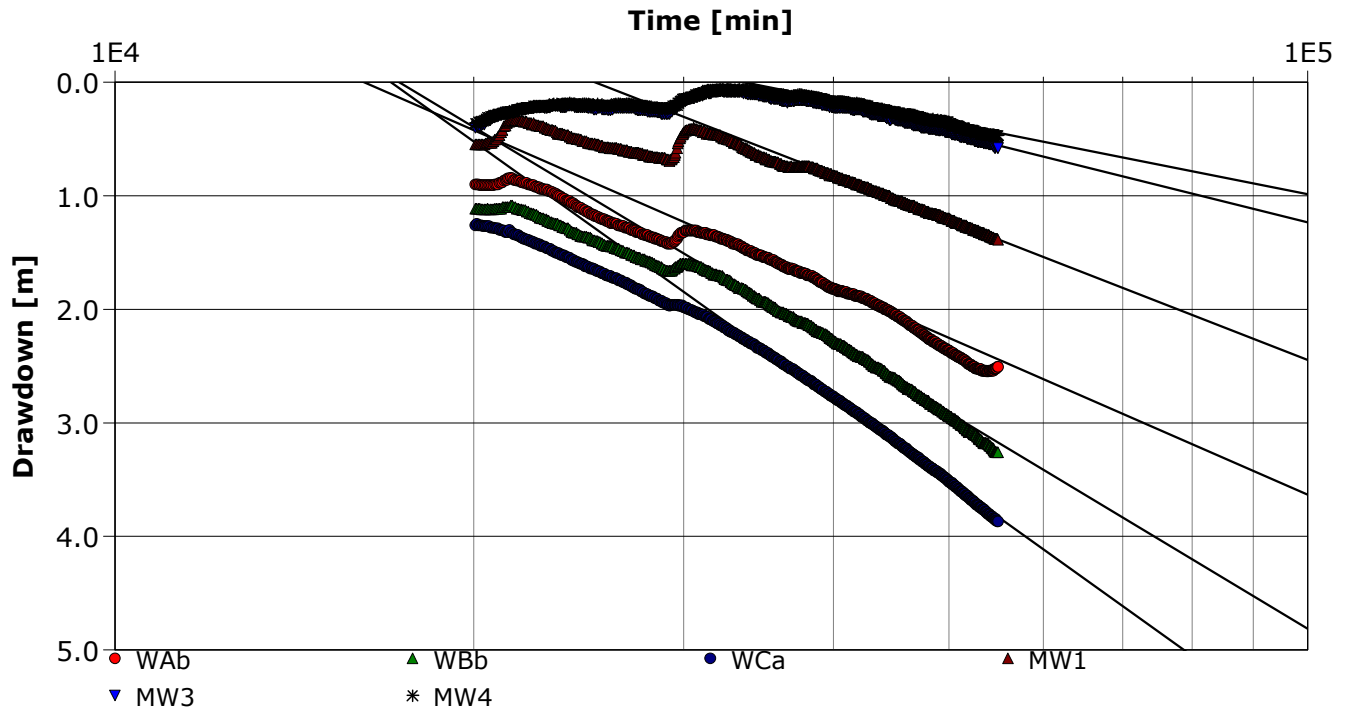
Pumping Test Analysis Report

Project: Carden Quarry

Number: 36123-200

Client: Ferma Aggregates

Location: Kirkfield	Pumping Test: 2018	Pumping Well: SG1
Test Conducted by:		Test Date: 11/28/2018
Analysis Performed by: TFC	Cooper Jacob	Analysis Date: 11/30/2018
Aquifer Thickness: 15.14 m	Discharge Rate: 845 [m ³ /d]	



Calculation using COOPER & JACOB

Observation Well	Transmissivity [m ² /d]	Hydraulic Conductivity [m/d]	Storage coefficient	Radial Distance to PW [m]
WAb	3.37×10^1	2.22×10^0	2.87×10^{-3}	545.19
WBb	2.45×10^1	1.62×10^0	6.96×10^{-3}	308.46
WCa	2.06×10^1	1.36×10^0	1.50×10^{-2}	190.85
MW1	3.78×10^1	2.49×10^0	3.21×10^{-3}	681.63
MW3	5.91×10^1	3.91×10^0	1.61×10^{-3}	1391.13
MW4	7.41×10^1	4.90×10^0	2.09×10^{-3}	1364.86
Average	4.16×10^1	2.75×10^0	5.29×10^{-3}	



MTE Consultants Inc.
520 Bingham Centre Drive
Kitchener Ontario

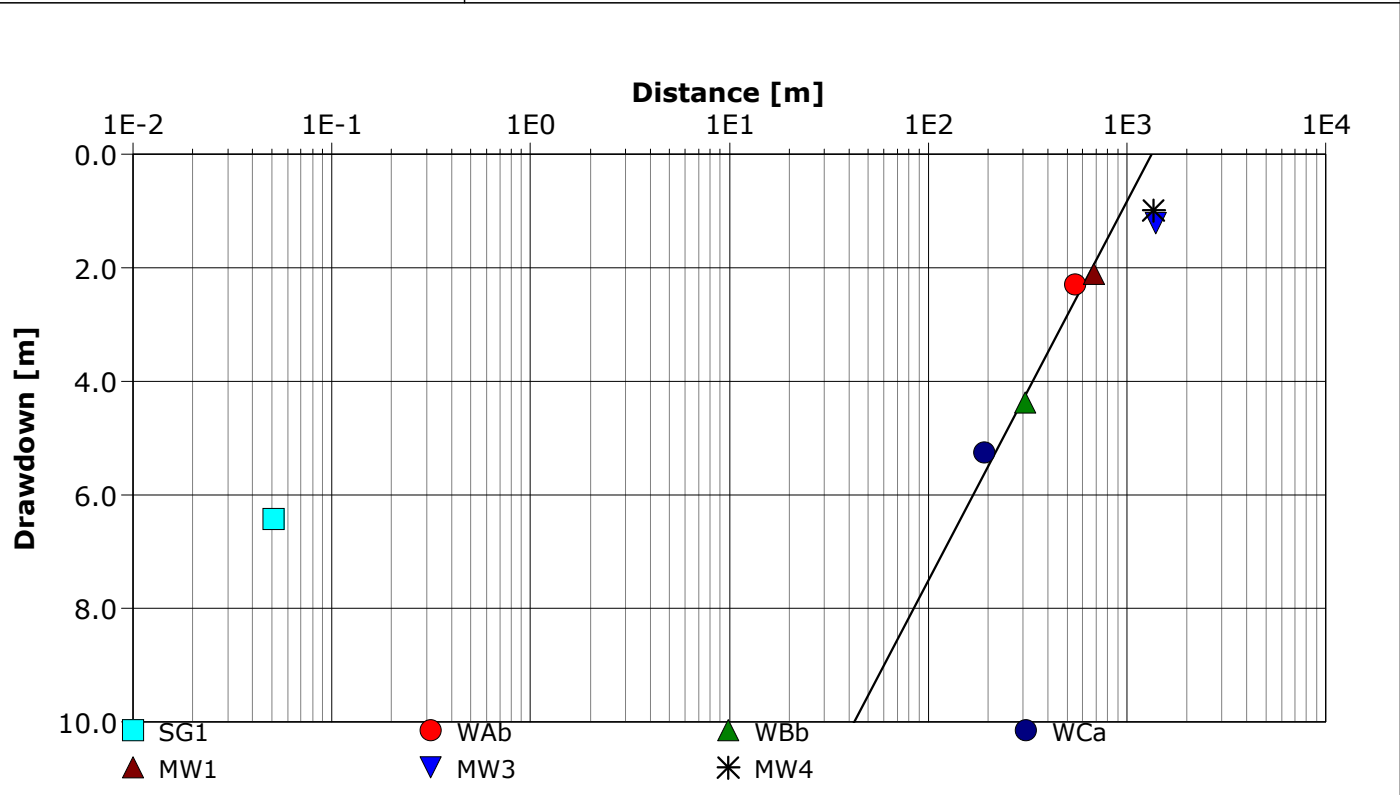
Pumping Test Analysis Report

Project: Carden Quarry

Number: 36123-200

Client: Ferma Aggregates

Location: Kirkfield	Pumping Test: 2018	Pumping Well: SG1
Test Conducted by:		Test Date: 11/28/2018
Analysis Performed by: TFC	Distance Drawdown	Analysis Date: 11/30/2018
Aquifer Thickness: 15.14 m	Discharge Rate: 845 [m ³ /d]	



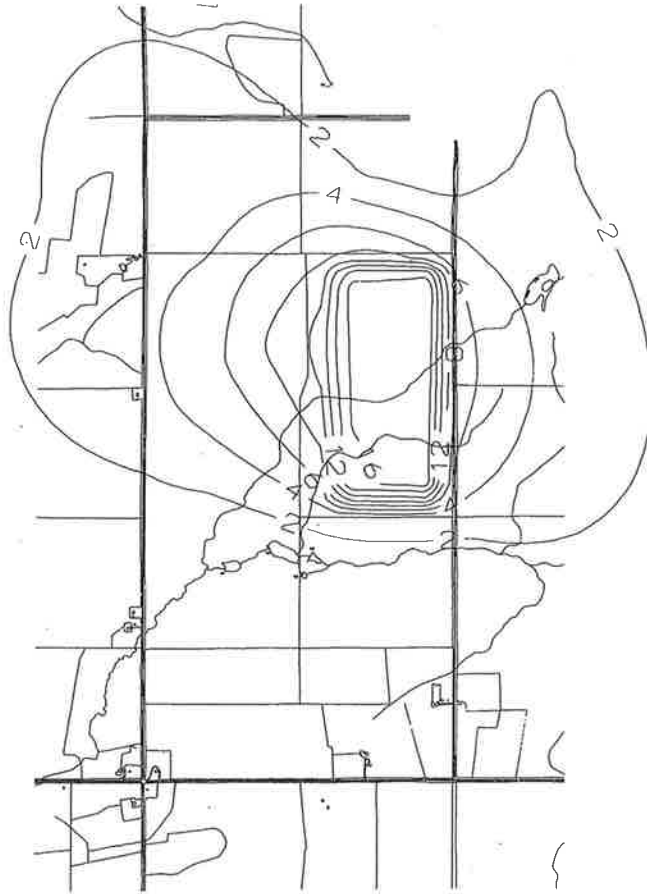
Calculation using COOPER & JACOB

	Transmissivity [m ² /d]	Hydraulic Conductivity [m/d]	Storage coefficient
Point of time [min]: 79800	4.63×10^1	3.06×10^0	3.27×10^{-3}



ATTACHMENT 6

APRIL 1995 HYDROTECHNICAL REPORT FIGURE J5



Drawdown in metres
Mining to 251 m.a.s.l.
Two Dimensional Model
Upper Bedrock Aquifer
Reduced Northern Quarry (2)



OLIVER MANGIONE McCALLA

& ASSOCIATES LIMITED

CONSULTING ENGINEERS, HYDROGEOLOGISTS AND PLANNERS

NEPEAN, ONTARIO

DATE

April, 1995

SCALE:

1:35,000

DRAWING NO

Fig. J5