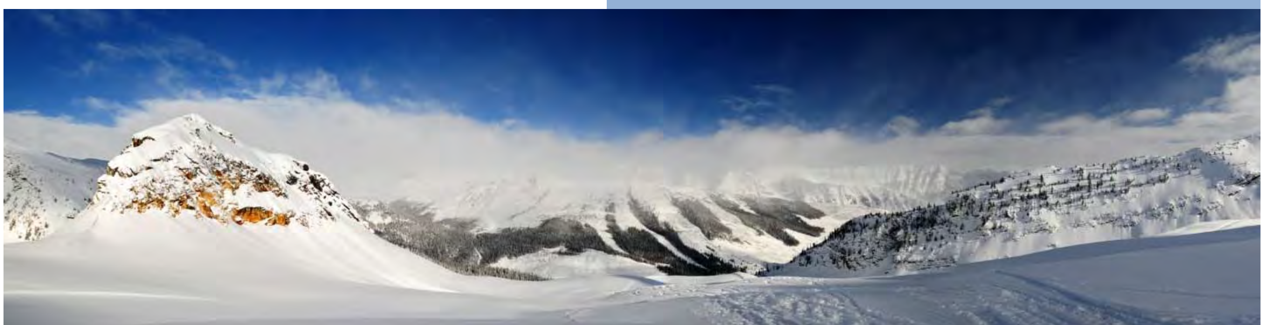
Whitewater
Hydrogeology Ltd.



2017 ADAPTIVE MANAGEMENT PLAN COMPLIANCE MONITORING REPORT

KEPPEL QUARRY

Prepared for:

Harold Sutherland CONSTRUCTION

Whitewater Hydrogeology Ltd
Phone: 705.888.7064
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Date: May 2018

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May 27, 2018

Harold Sutherland Construction
323545 East Linton Road, R.R #2
Kemble, Ontario, Canada N0H 1S0

Attention: Mr. Dave Munro

Re: Keppel Quarry: 2017 Adaptive Management Plan Compliance Monitoring Report

Dear Sir:

Whitewater Hydrogeology Ltd. (Whitewater) is pleased to present the 2017 Adaptive Management Plan Compliance Monitoring Report. Based on the monitoring data, Whitewater concludes that extraction did not cause any negative impacts to groundwater resources in 2017.
.
Subject to approval from Ministry of Natural Resources and Forestry, the Adaptive Management Plan shall be updated to include any recommended changes to the groundwater and surface water monitoring program, including trigger values. It is suggested that a pre-submission meeting with the Ministry of Natural Resources and Forestry be held to discuss the current issues with the program, including trigger values, prior to submitting the proposed revisions to the Water Resources Monitoring Program

If you have any questions, please do not hesitate to call anytime.

5/27/2018

X Tecia White

Tecia White, M.Sc., P.Geo (License 0701)
Senior Hydrogeologist / Present
Signed by: Tecia

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1.0 INTRODUCTION

Harold Sutherland Construction Ltd. (HSCL) owns and operates the Keppel Quarry located on Part Lot 28, Concession 10, in the Township of Georgian Bluffs, Grey County (Figure 1). The Keppel Quarry operates under two Aggregate Resources Act (ARA) licenses:

1. License Number 4881 (Original License: West Quarry)
2. License Number 609501 (New License: East Quarry)

Through the ARA licensing process and OMB proceedings for the New Easter Quarry, there were extensive technical studies completed to establish baseline data and to assess the potential for adverse impacts to the natural environment because of the quarry operations. This information was used to develop an Adaptive Management Plan (AMP), which includes monitoring, mitigation, and contingency measures that will be used to prevent, minimize, or, if necessary, mitigate environmental impacts. The AMP is a condition of the New Keppel Quarry license and approved ARA Site Plans.

1.1 Keppel Quarry: Extraction/Operations Plan

A detailed description of the extraction plan is provided on page 3 of the Site Plans (Bradshaw, May 2012). The sequence of operations describes the extraction from the four areas of the quarry (Area 1A, Area 1B, Area 2 and Area 3). Area 1A was a small expansion of the East Quarry and has been fully extracted to a depth of approximately 234 masl. In 2017, the operations (stripping, blasting, and extraction) were primarily in the north-east portion of Area 1B within the West Quarry. Stripping and the construction of internal haul routes continue in all areas to allow for the construction of earthen berms.

1.2 Keppel Quarry: Water Management Plan

To maintain dry operating conditions, the Keppel Quarry relies on a water management plan. An Ontario Water Resources Act Section 34 Permit to Take Water (PTTW, No.: 4028-8RCKTY) and Section 54 Environmental Compliance Approval (ECA, Number 3515-8M4PWM) have been issued to allow for the management of groundwater and surface water entering the East Quarry. The PTTW permits the pumping of 2,160,000 L/day at an instantaneous rate of 3,000 L/min for 12 hours a day.

On August 29, 2017, the Ministry of the Environment and Climate Change (MOECC) issued ECA No.:1624-ANJQ4P, which permitted the modifications to the existing sewage works for the collection, transmission, treatment, and disposal of the groundwater and surface water collected in the West Quarry footprint. On September 26, 2016, Whitewater applied for a PTTW which would permit the pumping of the West Quarry at a maximum rate of 6,000 L/min to the sewage works regulated under ECA No.:1624-ANJQ4P. As of May 21, 2018, the PTTW was still under review with the MOECC.

FIGURE 1: SITE LOCATION MAP

2.0 GROUNDWATER AND SURFACE WATER MONITORING RESULTS

The monitoring program outlined in the AMP is intended to minimize potential impacts on water resources, ecological features and monitor the effects of blasting to ensure that proposed mitigation measures are sufficient. There are three components to the monitoring program:

- Water Resources Monitoring (including Private Well Monitoring) (Main Report and Appendix A);
- Ecological Monitoring (Appendix B); and
- Blast Monitoring (Appendix C).

The Water Resources Monitoring Program is designed to track the performance of the West Quarry and the potential impacts on water resources. The Water Resources Monitoring Program tracks changes in each of the following environmental receptors:

- The bedrock groundwater flow system;
- The Shouldice Wetland; and
- The Glen Management Area.

The annual reporting for the West Quarry involves the data compilation, presentation, and evaluation of the performance monitoring data, including the trend analysis. The annual AMP monitoring reports are to be stand-alone documents that provide the reviewers/agencies with interpretations of the data collected and make recommendations to modify the monitoring programs and/or the ARA Site Plan.

The comprehensive monitoring program required under the AMP has resulted in an extensive database of water level and water quality data. Therefore, to ensure that the report provides a clear and concise interpretation the 2017 monitoring activities relative to the historical and background data, the data is provided in graphical format only. Data in raw format (in the form of extensive tables) have not been included in the report but will be made available upon request.

The AMP for the Keppel Quarry currently relies on seasonal site-specific trigger water level elevations at selected sentry monitoring wells and surface water monitoring stations. These seasonal triggers are set for four quarterly periods (highlighted on Figure 2):

- Winter: December 21st to March 21st
- Spring: March 21st to June 21st
- Summer: June 21st to September 21st
- Fall: Sept 21st to Dec 21st

Ontario experiences significant seasonal climatic variability and season creep which needs to be taken into consideration during the hydrogeological impact assessment for the Keppel Quarry. An approach to assessing how changes in climate (both temperature and precipitation) affect the hydrogeological response in groundwater and surface water regimes coupled with potential impacts from the aggregate operation is required. As a result, an assessment of the local climatic conditions has been included. Additional information on the trigger conditions is provided in Section 2.3.3.

2.1 Climatic Conditions

A key component of the groundwater and surface water assessment is understanding the climatic conditions over the monitoring period. Variability outside of the normal conditions will have a strong influence on the seasonal groundwater and surface water levels, and trends, which will impact the hydrogeological assessment. Therefore, to ensure that the database is complete, the local precipitation data that has been relied upon was collected from the Wiarton Airport Environment Canada (EC) Weather Station (located approximately 15.5 km from the site).

As shown on Figure 2, seasonal variability is evident when comparing the climatic normal to actual precipitation data collected between 2009 and 2017. This will have an influence on the seasonal variability in both groundwater levels and surface water flows.

FIGURE 2: SEASONAL PRECIPITATION TRENDS

2.2 New Keppel Quarry Activities

2.2.1 Pumping Records

Quarry dewatering in 2017 continued from the East Quarry under PTTW No.: 4028-8RCKTY. The pump that is used to dewater the East Quarry is rated at 3,000 L/min and enables the quarry to be dewatered at the maximum permitted rate. 344,406,000 L was pumped over 161 days in 2017, which is 24% from 2016 (Figure 3). The maximum daily taking was reported to be 2,149,000 L. HSCL remains in compliance with PTTW No.: 4028-8RCKTY.

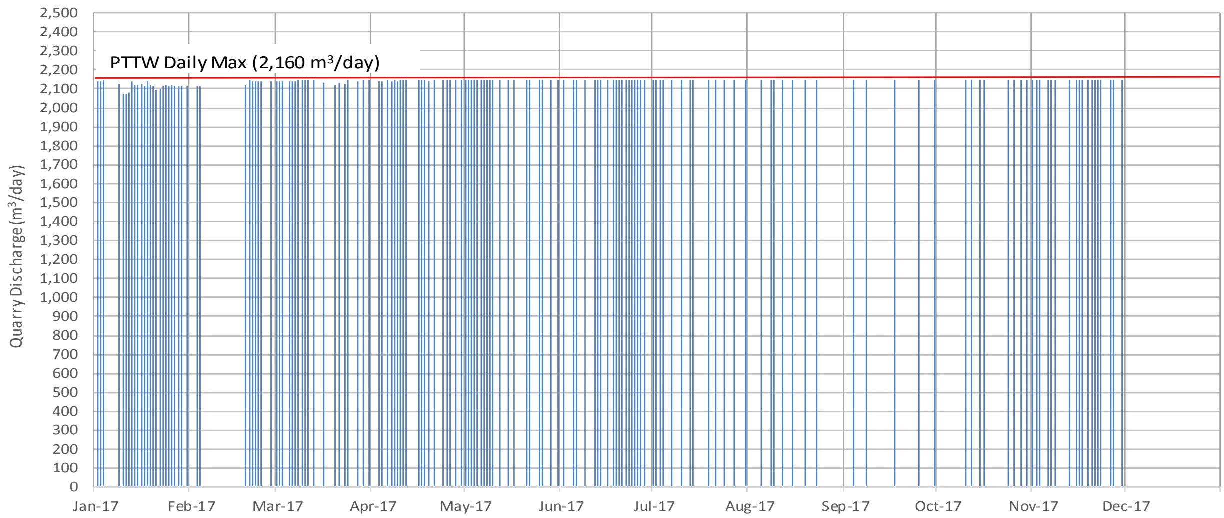


FIGURE 3: 2017 DAILY PUMPING VOLUMES

2.2.2 Water Bearing Fractures

The AMP requires visual inspections along the active quarry face after each blast for water-bearing fractures. The intent is to ensure that the quarry does not interfere with potential epi-karst pathways that might otherwise deliver water to surface water features such as springs found in the Shouldice Wetland. Visual inspections were made by HSCL staff after each blast in 2017.

There were seven blasts in total, which took place on:

- Wed, January 4 - 3:48pm
- Fri, June 2 - 1:24pm
- Mon, July 17 - 1:57pm
- Mon, August 4 - 3:18pm
- Fri, November 17 - 2:40pm
- Mon, December 4 - 3:21pm
- Wed, December 20 - 3:35pm

No concerns related to water (i.e., high flows observed in new and/or existing fractures) were reported after any of the blasts.

2.3 Groundwater Monitoring

The bedrock groundwater system includes three distinct components:

1. Epi-karst.
2. Shallow bedrock.
3. Deeper bedrock.

The groundwater elevation monitoring program, which has been designed to characterize all three groundwater flow zones over time, has been divided into two areas: the groundwater monitoring locations within the predicted area of influence (Groundwater Monitoring Wells); and the groundwater monitoring of locations outside the predicted area of influence (Sentry Groundwater Monitoring Wells). The water monitoring network is shown in Figure 4.

2.3.1 Changes to the Groundwater Monitoring Program

Several changes to the groundwater monitoring program have occurred over the years. Specifically, several wells have been destroyed because of the on-going extraction of aggregate. These wells include:

- OW11s and OW11d
- OW16s and OW16d
- OW34
- OW35
- OW36
- OW40

The AMP had proposed additional observation wells which have not yet been constructed. For example:

- OW61 - HSCL has committed to installing this observation well after logging and grading is completed in Area 1B (MTE, 2015).
- OW66, OW67, OW68 – These observation wells are in a part of the ANSI that is too sensitive for the installation of monitoring points without causing significant disturbance to the Natural Environment (Hearts-tongue Fern habitat6). MTE recommended that these locations be removed from the AMP (MTE, 2015).
- OW69 and OW70 - Given the presence of existing observation wells in proximity to their proposed locations, MTE recommended that their installation is deferred until such time that the AMP indicates the extra water level data is required (MTE, 2015).

2.3.2 Groundwater Elevations

Monthly groundwater levels are collected at 46 monitoring well locations (Figure 4). Nested groundwater wells (multi-level) are found at 30 of the 46 monitoring locations. Water level data collected from multi-level groundwater wells allow for the assessment of the horizontal flow direction within the bedrock aquifer systems as well as the vertical movement of groundwater over time.

The epi-karst (designated by the letter ‘k’) is discontinuous across the site but where present is contained within the upper 5 m. Shallow wells (designated by the letter ‘s’) extend five to 10 metres below ground surface (mbgs), while deep wells (designated by the letter ‘d’) are between 10 and 22 mbgs. Deep wells are screened at an elevation close to the current quarry floor elevation (234 masl), while shallow screens are placed about halfway between the natural grade and the finished quarry floor elevation.

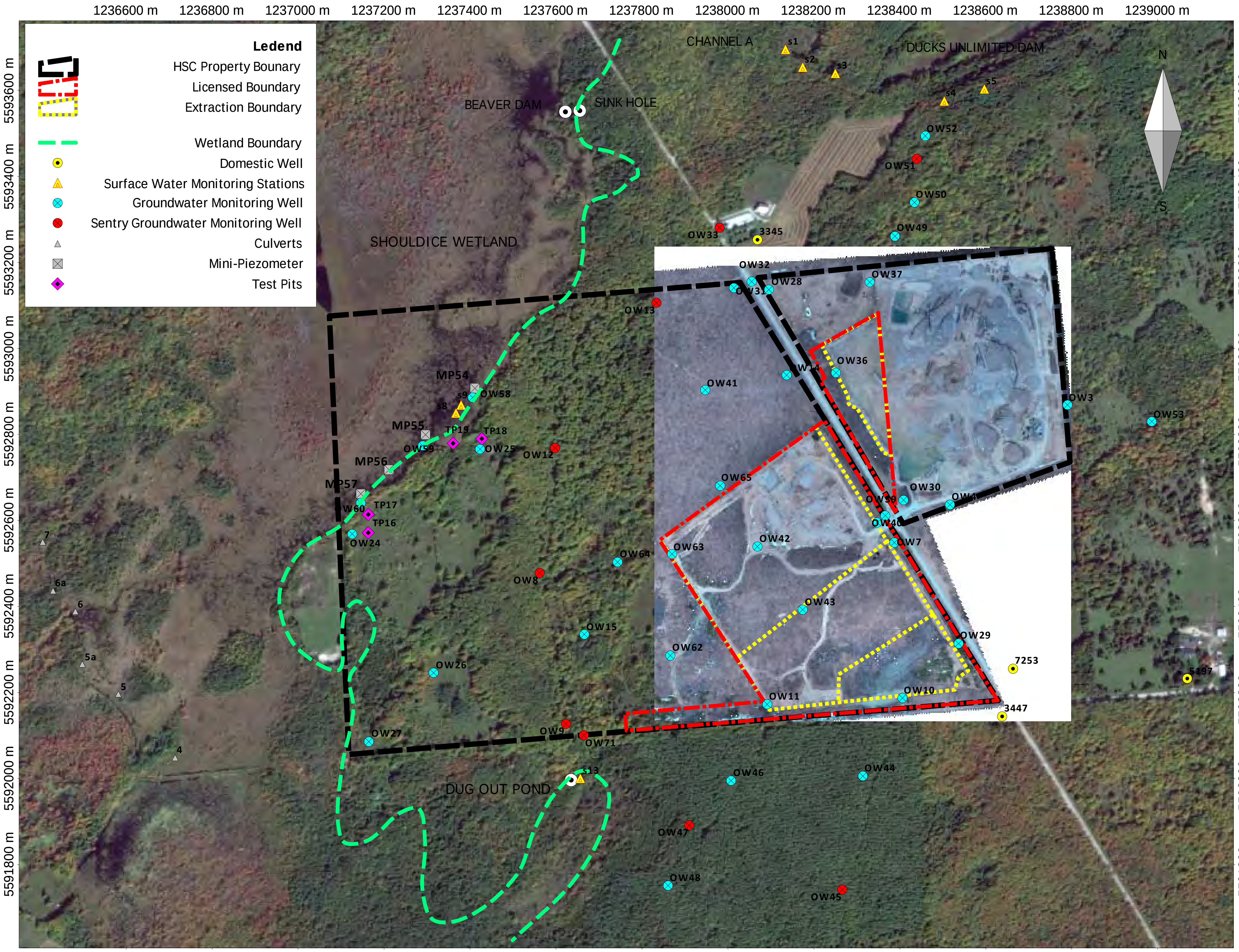


FIGURE 4: MONITORING LOCATION MAP

Monthly water levels are measured at the following groundwater monitoring wells:

- OW3d
- OW4d[1]
- OW7s and OW7d[1]
- OW10s and OW10d
- OW14s and OW14d
- OW15s and OW15d
- OW24d[2]
- OW25s[2] and OW25d[2]
- OW26d[2]
- OW27s[2] and OW27d[2]
- OW28s and OW28d
- OW29s and OW29d
- OW30s and OW30d[1]
- OW31s and OW31d
- OW32s and OW32d
- OW36d
- OW37d[1]
- OW38d[1]
- OW39d[1]
- OW41s and OW41d
- OW42s and OW42d
- OW43s and OW43d
- OW44s and OW44d
- OW46k, OW46s, and OW46d
- OW48d
- OW49d[1,3]
- OW50d[3]
- OW52d[3]
- OW53d[1]
- OW58s[2] and OW58d[2]
- OW59s[2] and OW59d[2]
- OW60s[2] and OW60d[2]
- OW62k, OW62s, and OW62d
- OW63s and OW63d
- OW64s and OW64d
- OW65s and OW65d
- OW72s (OW11 replacement)

Note:

1. Monitoring wells that have reported a drawdown / decreasing water level trend since 2009.
2. Monitoring wells that were installed to monitor groundwater levels under the Shouldice Wetland.
3. Monitoring wells that were installed to monitor groundwater levels under the Glen Management Area.

Groundwater levels have been monitored in the shallow and deep bedrock since 2003. Historical baseline groundwater levels are presented in Appendix A-1a. Trend analysis has been completed on groundwater elevation data. While linear trend (least squares regression) analysis can be a useful tool, it can also provide misleading results and must be used with caution. For example, water levels were not measured routinely in the winter and spring between 2005 and 2008, where water levels tend to be the highest. Data collected prior to 2009 would be biased toward seasonally low water levels during the summer and fall (resulting in increasing water levels with time) and would not reflect average climate conditions or potential impacts from quarry dewatering.

It wasn't until 2009 that routine monthly water level monitoring was completed and captured the true seasonal fluctuations. Water level hydrographs (with trend lines) have been generated for the period between 2009 and 2017 (Appendix A-1a). The hydrographs have a constant vertical scale which spans between 234 masl (base of the quarry floor) and 250 masl, which allows for a comparison between the water level elevations, seasonal fluctuations, and trends.

Water levels across the site remain within the historical seasonal ranges, except for the observed drawdown trends measured at monitoring wells located near the recently extracted areas in the East Quarry (final phase under the original licensed area and Area 1A). These wells include:

- OW4d
- OW7d
- OW30d
- OW37d
- OW38d
- OW39d
- OW49d
- OW53d

The water level decline at these locations (except for OW4d) is minor with less than a 1 m over the 9-year evaluation period. A 2 m drop is observed at OW4d, which is located immediately adjacent to the East Quarry face. It is anticipated that the water levels within the area of influence of the East Quarry are approaching a new equilibrium as extraction in this area is complete. On-going monitoring will identify the influence of the extraction of the West Quarry has on the existing area of influence.

Bedrock groundwater level between the Keppel Quarry and the Glen Management Area are measured at OW49, OW50, OW51, and OW52. Monitoring results indicate that water levels remain within background conditions, except for OW49. Water levels at OW49 consistently fluctuate between 237 and 248 masl. However, since 2009 there appears to be a slight downward trend. On-going monitoring will confirm the conditions at this well.

The quarry operations have had no influence on the bedrock groundwater regime at the wells that monitor the groundwater in the bedrock beneath the Shouldice Wetland (Appendix A-1b). With no measurable influence of the quarry operations on the groundwater regime beneath the wetland, changes to vertical hydraulic gradients and surface water levels should also remain within background conditions once climatic conditions have been considered. A detailed assessment of these conditions is discussed in Section 2.3.1 and 2.5.1.

2.3.3 Sentry Groundwater Monitoring Wells

To supplement the manual groundwater monitoring, 9 of the 46 monitoring locations have been equipped with automatic dataloggers. These wells are located outside the predicted zone of influence from the quarry operations and are therefore referred to as sentry well locations. As a contingency measure, the AMP identifies trigger values for the sentry wells that, if exceeded, will trigger action by HSCL so that mitigation can occur before any negative effects to the natural environment can occur.

For each of the sentry wells, there are three standard categories of trigger values; green, yellow and red. Each trigger value is accompanied by a set of actions that are implemented if these values are exceeded. Data loggers were not installed until the spring of 2017. Therefore, the monthly manual water level measurements collected in 2015, 2016, and early 2017 are spot measurements, and extrapolation between these data points on the hydrograph is interpretative.

Green trigger values were set at 15 cm above observed seasonal lows (spring, summer, autumn, and winter) reported from the monthly water level data collected between 2009 and 2014 for each of the Sentry Wells. Exceedance of a green trigger value indicates no significant negative impacts have been observed and water levels are still within the normal historical range. This will trigger a Green Action as an early response action (i.e., increase monitoring frequency and investigate). Yellow trigger values are equal to observed seasonal lows for each location. Exceedance of a yellow trigger value indicates water levels are slightly below seasonal lows, but no significant negative impacts have been observed. This is used to trigger a Yellow Action or a precautionary mitigation measure. Red trigger values were set at 15 cm below observed seasonal lows. Exceedance of a red trigger value is used to trigger Red Actions or immediate responses if the yellow actions fail to correct or reverse the impact.

Monthly and continuous water levels (collected via datalogger) are measured at the following sentry groundwater monitoring well locations:

- OW8s and OW8d
- OW9s and OW9d
- OW12s and OW12d
- OW13s and OW13d
- OW33s and OW33d
- OW45d
- OW47s and OW47d
- OW51d
- OW71k, OW71s and OW71d[1]

Note:

1. Monitoring wells were installed to monitor groundwater levels under the Shouldice Wetland.

Water level hydrographs (in comparison to the associated trigger values) have been generated for the period between 2015 and 2017 (Appendix A-1c). A review of the data indicates that generally water levels remain within historical levels. In fact, water level trends are either constant or increasing, which is not unexpected given the increase in annual precipitation from 2015 to 2017 (Section 2.1). One slight downward trend is observed at OW33s, which may be attributed to an abnormally high-water level measured on March 29, 2016 (potentially erroneous).

Although the water levels at the Sentry Wells show no drawdown because of the quarry operations, a comparison to the seasonal trigger levels has been completed with the understanding that there is climatic variability (Appendix A-1c). A summary of this assessment is provided in Table 1. Overall 44 green, 17 yellow, and 21 red triggers were exceeded between 2015 and 2017.

TABLE 1: SUMMARY OF TRIGGER EXCEEDENCES

Trigger Type	Winter	Spring	Summer	Fall
Green	6	15	5	18
Yellow	3	2	0	12
Red	3	0	2	16

Seasonal trigger levels were set at 15 cm above, 0 cm, and 15 cm below low water levels. Although there were no drawdown trends attributed to the operation of the Keppel Quarry, triggers were frequently exceeded. It is apparent from the assessment of the water level data collected since the AMP and Site Plans took effect that the application of the seasonal trigger response system as a means in providing an early warning system for potential groundwater impacts from quarry operations is ineffective. A detailed discussion on the application of triggers is provided in Section 3.0.

2.3.1 Overburden Water Levels and Groundwater Recharge

Four test pits with standpipes have been installed in the overburden within 100 m of the Shouldice Wetland boundary. These test pits (TP16, TP17, TP18, and TP19) are monitored to assess water level conditions in the overburden aquifer, which are believed to be a potential source of groundwater recharge for the wetland springs. Water levels in the overburden remain within historical ranges (Appendix A-1d).

2.3.2 Groundwater Flow

Vertical Hydraulic Gradients

The vertical movement of groundwater in the overburden sediments and the bedrock aquifer can be determined by measuring the hydraulic head difference between the units by installing a mini-piezometer (MP). A mini-piezometer is a portable drive probe that provides a comparison between the stage of a surface water body and the hydraulic head beneath the surface water body at the depth to which the screen at the end of the probe is driven. Because the MP is driven manually into the sediments, obtaining a good seal between the MP and the sediments is difficult, and data should be interpreted with caution.

At the Keppel Quarry, groundwater levels in the overburden are monitored at four mini-piezometers (MP) which are constructed in the ponded water of the Shouldice Wetland (MP54, MP55, MP56, MP57) and are monitored monthly during unfrozen conditions (Appendix A1-e). These overburden water levels were used to estimate the vertical direction of groundwater flow beneath the wetland, when wet. In 2017, the wetland was dry on occasion, and as a result, the vertical hydraulic gradients could not be calculated during these periods. The 2017 hydraulic gradients are like the historical averages.

TABLE 2: VERTICAL HYDRAULIC GRADIENTS BENEATH THE SHOULDICE WETLAND

Date	Overburden				Bedrock				
	MP54	MP55	MP56	MP57	OW58	OW59	OW60	OW71 S&K	OW71 S&D
22-Mar-17	Frozen	Frozen	0.00	0.00	0.03	0.01	-0.01	0.03	0.01
26-Apr-17	0.01	0.04	0.00	0.01	0.03	0.02	-0.01	0.04	0.03
30-May-17	0.01	0.01	0.00	0.00	0.03	0.03	0.00	0.04	0.01
21-Jun-17	Dry	Dry	0.01	0.08	0.03	0.02	0.00	0.03	0.01
26-Jul-17	0.00	Dry	0.00	0.00	0.03	0.03	0.00	0.05	0.01
28-Aug-17	Dry	Dry	0.00	-0.01	0.03	0.03	0.00	0.04	0.01
28-Sep-17	Dry	Dry	Dry	Dry	0.03	0.04	0.00	0.06	0.00
18-Oct-17	Dry	Dry	-0.07	Dry	0.03	0.04	0.00	0.05	0.00
13-Nov-17	Dry	Dry	0.00	-0.01	0.03	0.02	0.00	0.05	0.00
2017 Average	0.01	0.03	-0.01	-0.01	0.03	0.02	0.00	0.04	0.01
2016 Average	0.00	0.05	0.01	0.01	0.03	0.03	0.00	0.04	0.01
Historical Average	0.00	0.01	0.00	0.00	0.03	0.03	0.00	0.05	0.00

Groundwater vertical hydraulic gradients were also calculated using observation wells installed in the bedrock underlying the Shouldice Wetland including observation well nests OW58, OW59, OW60, and OW71. The calculated values for OW58, OW59, and OW60 showed neutral to slightly upward gradients on average (0.01 to 0.03 m/m) in 2017. The average vertical gradient for the karst bedrock to the shallow bedrock at OW71 was slightly upward (0.04 m/m), while the average vertical gradient for the shallow bedrock to deep bedrock at OW71 was neutral (0 to 0.01 m/m). These gradients were consistent with historical data at these locations. This information coupled with the gradients calculated from the mini-piezometers indicates that the groundwater vertical hydraulic gradients in the Shouldice Wetland or the bedrock underneath the wetland were not affected by extraction in 2017.

Horizontal Groundwater Flow.

The shallow and deep groundwater flow maps have been prepared based water levels collected on November 13th, 2017 to assess the dry conditions. The potentiometric surface for the shallow bedrock aquifer is presented in Figure 5. The shallow groundwater flows from a high of approximately 246 masl in the east to a low of approximately 240 masl in the west. The extraction of Area 1A and 1B appears to have had no influence on the shallow groundwater flow pattern. This is supported by the lack of drawdown trends observed in the water level data from the shallow groundwater regime (Section 2.3.2).

The potentiometric surface for the deep bedrock aquifer is presented in Figure 6. The deep groundwater flows from a high of approximately 245 masl in the central portion of the new quarry. Groundwater flows radially from this groundwater mound towards the Shouldice Wetland in the west and toward the East Quarry. The extraction of Area 1B appears to have had no influence on the deep groundwater flow pattern. The extraction in the East Quarry has resulted in an area of influence that extends between 300-500 m from the quarry face.

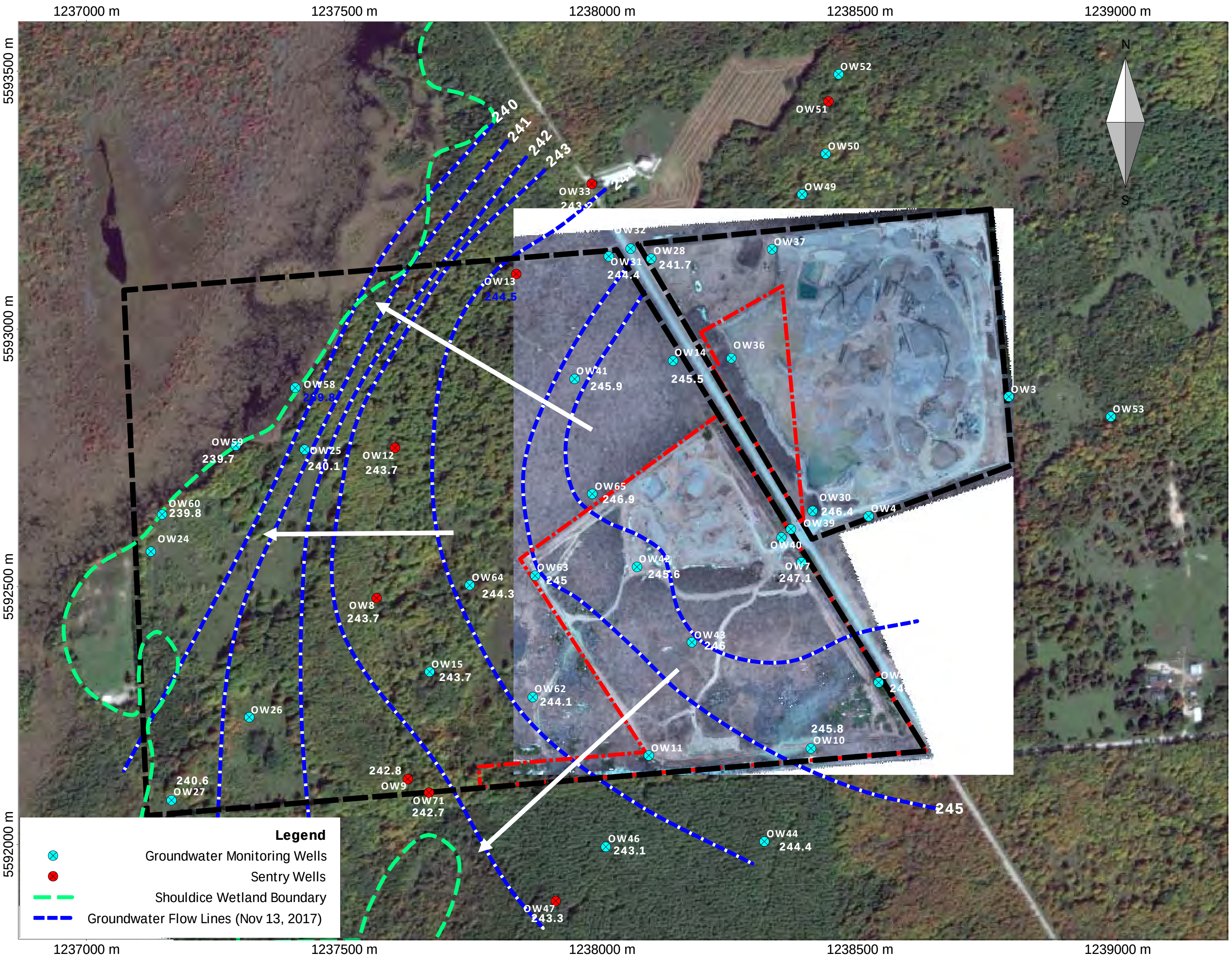


FIGURE 5: GROUNDWATER FLOW PATTERN – SHALLOW AQUIFER

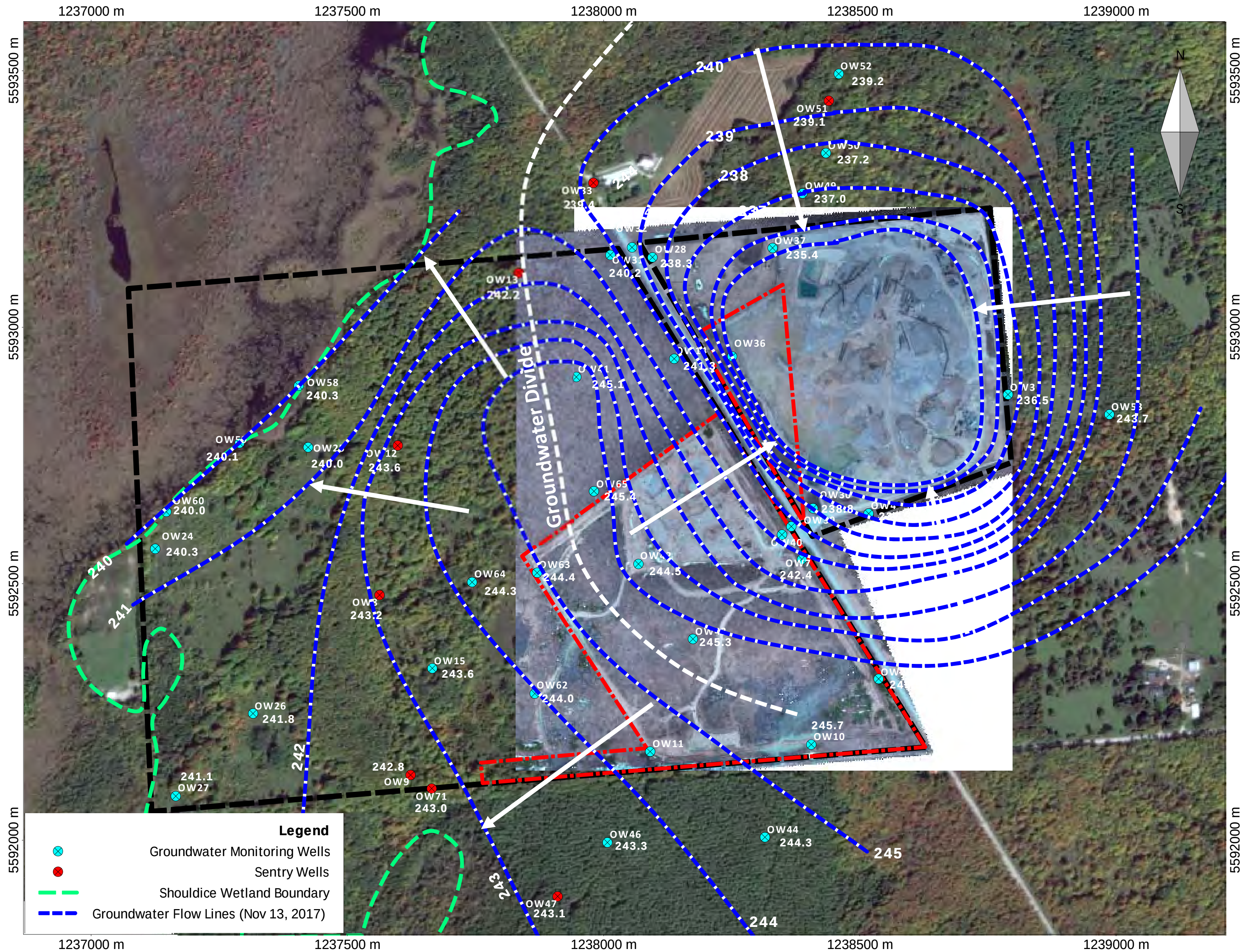


FIGURE 6: GROUNDWATER FLOW PATTERN - DEEP AQUIFER

2.3.3 Groundwater Area of Influence Assessment

The zone of influence within the bedrock aquifer has been defined by mapping the water table contours based on the seasonal low water levels (Section 2.3.2). To supplement this plan view delineation of the zone of influence and to track the changes within this area over time, distance-water level plots have been generated (Appendix A2). These distance-water elevation plots are to be generated along 9 monitoring lines outlined in the AMP. However, MTE (2016) made modifications to these lines which are:

- Line 1 starts at OW37 instead of OW36 because OW36 will be destroyed when Area 1a is extracted.
- Line 2 was changed and oriented towards the Shouldice Wetland rather than along County Road 17. Since the Shouldice Wetland is the receptor, this orientation was more useful.
- Lines 3 and 4 were combined and re-labeled Line 3 because OW65, OW66, and OW68 could not be installed due to ground conditions (MTE Tech Memo – April 10, 2015).
- Line 5 was re-labeled Line 4.
- Line 6 was removed from the assessment because OW61 could not be installed
- due to ground conditions (MTE Tech Memo – April 10, 2015).
- Line 7 was re-labeled Line 5.
- Line 8 was re-labeled Line 6.
- Line 9 was removed from the assessment because a true static condition at Private well 7253 and 3447 was unattainable due to constant operation of the pump in these wells. Instead, the groundwater condition near these private wells was assessed using Line 8.

Figure A2-1 shows the transect lines used to generate the distance – water level plots. Transect Line 1 shows an inflection point at OW50 for most of the year. Between September and December, this inflection point moves to OW52. Therefore, the area of influence that has resulted from the extraction of aggregate at the Keppel Quarry extends between 200 and 350 m in a northerly direction.

Transect Lines 2, 3, and 4 all run from the east towards the Shouldice Wetland in the west. Transect Line 2 is within the area of influence, and no inflection point is noted. Transect Line 3 and 4 extend to the Shouldice Wetland and shows inflection points 300 m at OW41 (Line 3) and 380 m (at OW42). Transect Lines 5 and 6 runs from the quarry face south. Inflection points are noted at distances of 380 m (OW43) and 495 m (at OW10).

2.4 Domestic Water Well Monitoring

A Private Domestic Water Well Monitoring Program has been developed to monitor water supplies of residents within one kilometer of the Keppel Quarry (Figure 4). Private wells have been separated into two categories:

1. Category A wells – includes those wells within or just outside the predicted zone of influence for the deep bedrock aquifer when the Keppel Quarry is at its full extent. These wells include:
    - well no. 3345 (the Ritchie well);
    - well no. 3447 (owned by HSCL);
    - well no. 5197 (the Ruthven well); and
    - well no. 7253 (the Cramp well)
2. Category B wells - includes those wells within 1 km of the Keppel Quarry license boundaries but outside the predicted zone of influence. Category B Private Wells include:
    - well no. PW1 (the Jenks well);
    - well no. PW2 (the Thompson well); and
    - well no. PW3 (the Porter well).

2.4.1 Category "A" Domestic Water Wells

1. Private well no. 3345 (the Ritchie well)

As stated in the 2015 and 2016 AMP Compliance Assessment Report (MTE, 2016 and 2017), the resident declined to be a part of the monitoring program. This remains unchanged and therefore no water level data was collected at this location in 2017.

2. Private well no. 3447 (owned by HSCL)

Access to the well is limited as it is in a locked shed occupied by the tenant's scrap material and garbage. HSCL has requested the shed be cleaned up for safer access. Levels that were collected in 2017 fluctuated around 246.8 masl. At least 8 m of water column remained in this well while extraction occurred in Area 1b in 2017. This information indicates that the water supply in Private well no. 3447 was not affected by extraction.

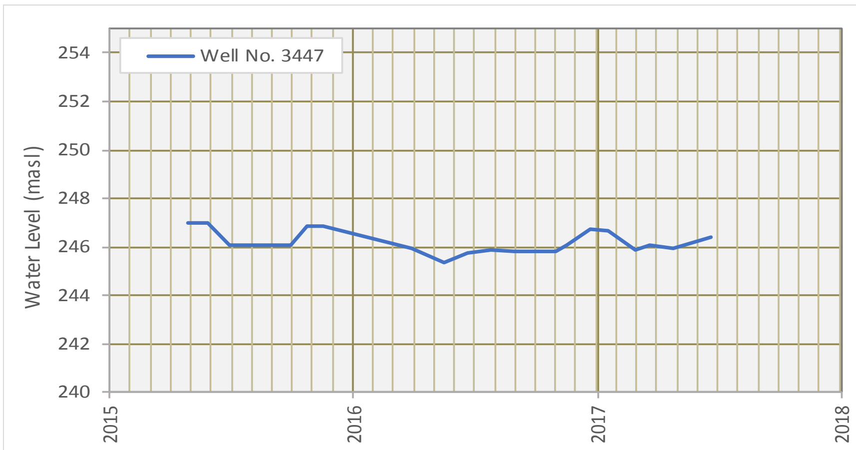


FIGURE 7: WATER LEVEL HYDROGRAPH - WELL NO.: 3447

3. Private well no. 5197 (the Ruthven well)

Water levels in Private Well No. 5197 were measured using a data logger. Water levels were like historical values fluctuating around 248 masl on average. At least 4.75 m of water column remained in this well while extraction occurred in 2017, which is like previous years. This information indicates that the water supply has not been affected by extraction.

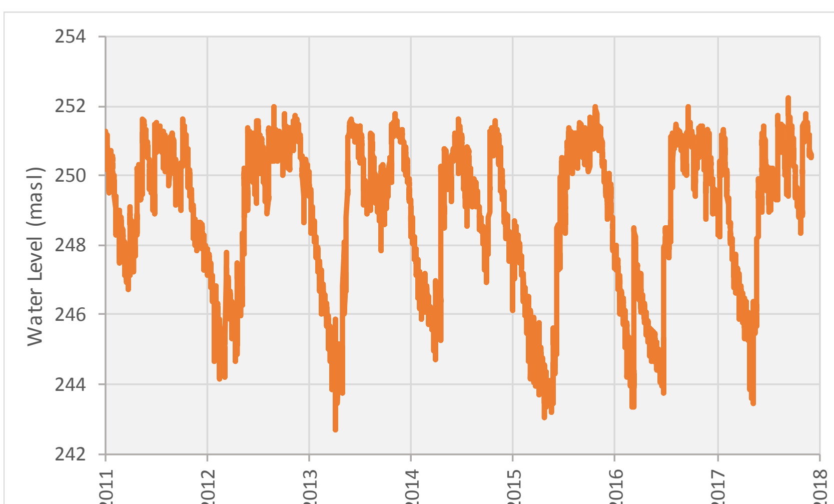


FIGURE 8: WATER LEVEL HYDROGRAPH - WELL NO.: 5197

4. Private well no. 7253 (the Cramp well)

Water levels in Private Well No. 7253 were measured using a data logger. Water levels measured in 2017 were like historical values fluctuating around 248 masl (Figure 9). At least 14 m of water column remained in this well while extraction occurred in 2017. This information indicates that the water has not been affected by extraction.

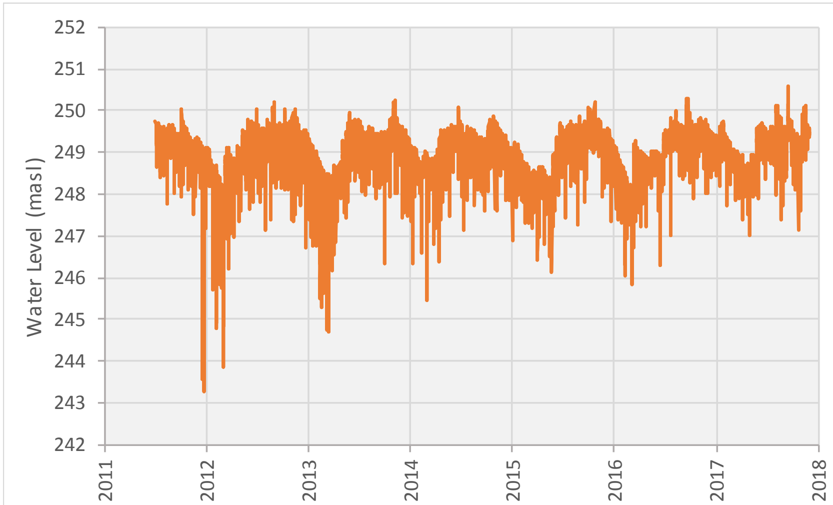


FIGURE 9: WATER LEVEL HYDROGRAPH – WELL NO.: 7253

2.4.2 Category "B" Domestic Water Wells

Water levels are to be measured manually from each of the participating Category B private wells on a seasonal basis (4 times per year). PW1, PW2, and PW3 fluctuated seasonally in 2017 with the highest water levels being measured in the spring, the lowest water level in the summer and then a small amount of recharge in the fall. Water levels measured at the Category B wells in 2017 were comparable to 2015 and 2016.

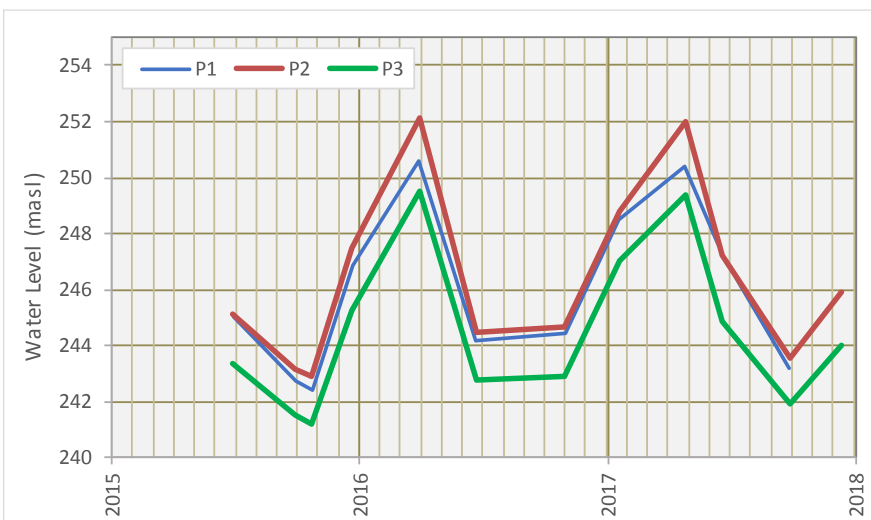


FIGURE 10: CATEGORY B - DOMESTIC WELL WATER LEVELS

2.4.3 Domestic Water Well Interference Complaints

There were no well interference complaints received by HSCL from any of the private wells in 2017.

2.5 Surface Water Monitoring

2.5.1 Shouldice Wetland

The Shouldice Wetland is a Provincially Significant Wetland (PSW). The wetland has been identified as an environmental receptor due to its ecological importance and its unique hydraulic and hydrogeologic characteristics (MTE, 2009). Key indicators used to monitor the Shouldice Wetland include:

- Bedrock Groundwater levels (refer to Section 2.3.2);
- Groundwater recharge (refer to Section 2.3.1);
- Groundwater vertical hydraulic gradients using mini-piezometers (refer to Section 2.3.1);
- Springs (s8, s9, and s13) and the dugout pond;
- Shouldice Wetland culverts; and
- Beaver dam and sinkhole.

As discussed in Sections 2.3, the groundwater conditions indicate that the vertical hydraulic gradients between the Shouldice Wetland and both the overburden and bedrock aquifers were not affected by extraction in 2017. To supplement this information and provide multi lines of evidence to effectively assess the impacts of aggregate extraction from the Keppel Quarry on the wetland, the following surface water program was conducted in 2017 to comply with the requirements of the AMP:

A. Continuous and monthly surface water levels, conductivity and temperature measurements (datalogger) at Spring s8 and s13 and dugout pond (SG1 and outflow) to characterize the hydroperiod, trends, and to determine the water source (groundwater or surface water);
B. Monthly surface water levels and flows at Spring s9;
C. Flow conditions at the Shouldice Wetland culverts to confirm the length of hydroperiod and trends; and
D. Monthly surface water flows measurements at the beaver dam sinkhole to characterize the hydroperiod and trends. Continuous water level, temperature, and conductivity monitoring to determine the water source (groundwater or surface water).

<u>*A: Surface Water Stations s8 and s13 and the Dugout Pond*</u>

Spring s8 is located along the edge of the Shouldice Wetland approximately 850m west of Area 1a. Spring s13 is located approximately one kilometer southwest of Area 1A and adjacent to the dugout pond (SG1). The spring locations are identified on Figure 4. The monthly monitoring data are provided in Table 3. Continuous water level and temperature data is presented in Figure 11.

TABLE 3: SURFACE WATER FIELD MEASUREMENTS

Date	Surface Water Springs						Dug Pond				
	s8			s13			SG1		Pond Outflow		
	Conductivity	Temperature	Flow	Conductivity	Temperature	Flow	Conductivity	Temperature	Conductivity	Temperature	Flow
	µS	°C	L/s	µS	°C	L/s	µS	°C	µS	°C	L/s
20-Jan-17	602	8.3	F	568	6.5	F	619	5.2	681	5.7	NF
27-Feb-17	522	4.6	F	501	4.1	F	723	5.3	740	5.9	NF
22-Mar-17	601	6.8	F	536	3.9	F	515	1.7	609	1.5	NF
26-Apr-17	570	6.9	F	561	6.6	NF	701	7.5	659	8	NF
31-May-17	572	8.1	F	616	7.9	NF	619	11.1	659	8	NF
22-Jun-17	632	8.7	NF	660	9.2	NF	670	9.4	670	9.4	NF
27-Jul-17	679	10.5	NF	713	14.8	NF	760	12.8	699	15.2	NF
30-Aug-17	716	13.2	NF	930	15	NF	985	17	728	18.6	NF
2-Sep-17	670	14.6	NF	1004	14.1	NF	1127	12.9	-	-	NF
20-Oct-17	-	-	D	1020	12.1	NF	1003	17	1101	18.6	NF
17-Nov-17	720	10.5	F	857	7.5	NF	721	7	998	7.9	NF
21-Dec-17	-	-	NF	718	8.1	NF	699	7.1	-	-	NF
Notes:	F = Flowing										
	NF = No Apparent Flow										
	D = Dry										

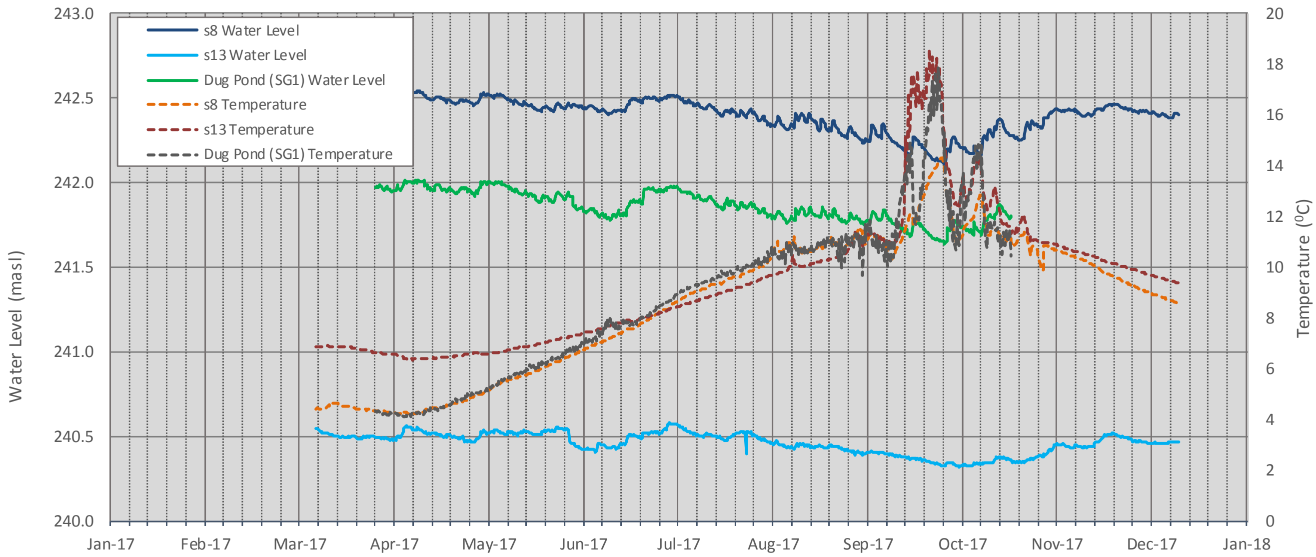


FIGURE 11: S8 AND S13 WATER LEVELS AND TEMPERATURE

Flows collected in 2017 suggest that the hydroperiod for s8 and s13 was year-round, except s8 was reported dry in October. Water levels measured in 2017 at s8 were comparable to historical values fluctuating around 240 masl. Water levels at spring s13 and the dugout pond fluctuated around 242.5 -241.3 masl and 241.7 - 242 masl, respectively, which was also consistent with historical values. Water levels at these locations were not affected by extraction in 2017.

Historical conductivity values ranged from 309 µS to 658 µS at spring s8, 342 µS to 1160 µS at spring s13 and 353 µS to 1238 µS at the dugout pond. The 2017 values are comparable to historical data collected at these locations, except conductivity, which was reported as high as 720 µS at s8 (still within acceptable range).

B: Surface Water Station s9
Spring s9 is either dry, ponded, or frozen and no flow was observed in 2017.

C: Shouldice Wetland culverts
There are several culverts (Culverts 4 through 7) that allow water to cross under a snowmobile trail constructed at the end of Gun Club Road, which through the Shouldice Wetland (Figure 2). Monthly monitoring of surface water flows (observed as 'flowing,' 'no apparent flow,' 'dry'), conductivity; and water temperature is collected to assist in evaluating the hydro-period of the Shouldice Wetland. The monitoring results from 2017 are summarized in Table 4. The monitoring locations were frozen in December, January, and February 2017.

Baseline data suggests that the hydroperiod for these culverts typically ended in July, but there were some years when these culverts flowed all year (2010, 2011, and 2012). In 2017, there was water in the culverts year-round. This information combined with the flows observed at the springs (s8 and s13) and the dugout pond indicated that the hydro-period for the Shouldice Wetland extended all summer in 2017.

The conductivity values collected in 2017 at the culverts ranged from 405 to 829 at the culverts. These values are comparable to historical data collected at these locations. Water temperature values collected in 2017 at the culverts ranged from 1 to 21°C. Historically, temperatures have risen as high as 30°C.

TABLE 4: CULVERT FIELD MEASUREMENTS

Location	Parameter	Unit	Monitoring Results								
			22-Mar-17	26-Apr-17	31-May-17	22-Jun-17	27-Jul-17	30-Aug-17	2-Sep-17	20-Oct-17	17-Nov-17
Culvert 4	Conductivity	mS	589	575	552	604	675	716	739	725	707
	Temperature	°C	1.7	18.4	16	17.5	20.1	15.5	20	16.1	9.5
	Flow	L/s	F	F	NF	NF	NF	NF	NF	NF	NF
Culvert 5	Conductivity	mS	494	498	516	490	565	654	829	661	692
	Temperature	°C	0.8	17.9	16.1	18.2	20.9	15	16	14.9	8.7
	Flow	L/s	F	F	F	NF	NF	NF	NF	NF	F
Culvert 5a	Conductivity	mS	527	467	517	512	519	603	415	542	722
	Temperature	°C	0.9	18	15.9	18.4	20.8	14.6	17.8	14.3	8.8
	Flow	L/s	F	NF	NF	NF	NF	NF	NF	NF	NF
Culvert 6	Conductivity	mS	487	428	449	405	473	498	525	495	582
	Temperature	°C	1.2	18.8	16	18.2	20.1	14.5	19.4	14.5	9.1
	Flow	L/s	F	F	F	F	F	F	NF	NF	F
Culvert 6a	Conductivity	mS	460	435	451	440	477	504	548	515	526
	Temperature	°C	0.8	17.9	15.5	17.5	19.1	14.8	16.5	15	9.6
	Flow	L/s	F	2.00	1.00	NF	NF	NF	NF	NF	NF
Culvert 7	Conductivity	mS	441	462	449	460	454	480	533	510	545
	Temperature	°C	1	18.5	15.7	18.3	20.8	17.5	18.2	15.3	9.0
	Flow	L/s	F	F	F	NF	NF	NF	NF	NF	NF
Notes:	F = Flowing										
	NF = No Apparent Flow										
	D = Dry										

D: Beaver Dam and Sinkhole

The beaver dam and sinkhole are located approximately 850 m north of the Keppel Quarry (Figure 4) in the Shouldice Wetland. The beaver dam maintains surface water levels in the north portion of the Shouldice Wetland which would otherwise recharge the shallow groundwater regime by the sinkhole located at the edge of the wetland. During high water levels, surface water drains over the dam and recharges the bedrock along a prominent joint in the limestone bedrock. This sinkhole is a discrete karst feature that is connected to springs s1-s3 in the Glen Management Area.

Monthly monitoring of surface water flows (observed as 'flowing,' 'no apparent flow,' 'dry'), conductivity; and water temperature is collected to assist in evaluating the hydro-period of the Shouldice Wetland. The monitoring results from 2017 are summarized in Table 5.

TABLE 5: BEAVER DAM AND SINK HOLE FIELD MEASUREMENTS

Date	Beaver Dam					
	Sinkhole			Dam		
	Conductivity	Temperature	Flow	Conductivity	Temperature	Flow
	µS	°C	L/s	µS	°C	L/s
20-Jan-17	550	0.4	F	565	0.6	F
27-Feb-17	443	1.5	F	382	1.5	F
22-Mar-17	481	3.7	F	455	3.7	F
26-Apr-17	465	13	F	460	13.5	F
31-May-17	533	16.8	NF	509	20.6	F
22-Jun-17	495	18.3	NF	422	21.5	F
27-Jul-17	567	20.8	NF	542	23.7	NF
30-Aug-17	na	na	NF	na	na	F
2-Sep-17	D	D	D	600	18.9	F
20-Oct-17	D	D	D	607	16	NF
17-Nov-17	D	D	D	600	8.2	F
21-Dec-17	618	4.9	F	678	4.7	F
Notes:	F = Flowing					
	NF = No Apparent Flow					
	D = Dry					

Based on the flow data collected at the beaver dam, water was observed flowing through and into the cove all year except for dry periods in July and October. Flow observations at the sinkhole are made at the eastern extent of the cove and flow ended in July with flow observed again in December. Even though flows at the sinkhole ended in July, the hydroperiod for the sinkhole is tied to the flow through the beaver dam because the bedrock joint extends through the entire cove and water sinks along
its entire length (Cowell, 2008).

Conductivity values collected in 2017 at the dam and sink hole ranged from 382 μs/cm to 678 μs/cm and 482 and 438 us/cm, respectively. The conductivity ranges fall within the historical conductivity values for these locations. Water temperature values collected in 2017 at the beaver dam and sinkhole range from 1 to 24 °C and 1 and 21°C, respectively. These values are comparable to historical data collected at these locations.

Summary

The monitoring results indicate that there has been no measurable impact on the Shouldice Wetland. This monitoring shall continue as extraction of Phase 1B and 2 proceed. The continued monitoring will provide the information required to assess the potential impact of extraction on the wetland's form and function. This assessment is needed to allow for the holding provision on Area 3 to be lifted by the MNRF and MOECC to allow for the extraction of this area.

If the monitoring results indicate a potential impact, an infiltration pond is to be constructed to augment flow to spring s13 and the Dugout Pond. If required, then the infiltration pond shall be constructed in the headwater recharge area for spring s13. As presented, the monitoring data collected in 2017 did not trigger the construction of the infiltration pond.

2.5.2 Glen Management Area

The north portion of the Glen Management Area located approximately 500 m north of the Area 1a is monitored as part of the AMP. The key indicators that are used to monitor this feature include:

- Bedrock Groundwater Levels at OW49-OW52 (refer to Section 2.3.2);
- Beaver Dam and Sink Hole (refer to Section 2.5.1);
- Glen Management Area Springs (s1, s2, and s3);
- Mud Creek (Channel A and Channel B);
- Glen Management Area Springs (s4 (a-c), s5);
- Ducks Unlimited Dam; and
- Ephemeral Pond.

As discussed in Sections 2.3.2, the groundwater conditions near the Glen Management Area have continued to fluctuate within the historical ranges except for the water levels at OW49d. The water levels at this monitoring location consistently fluctuate between 237 and 248 masl. However, since 2009 there appears to be a slight downward trend. On-going monitoring will confirm if the quarry operations have influenced the water levels at this location. There is no evidence to suggest that the quarry operations have altered the flow conditions at the beaver dam or sinkhole.

To supplement this information and provide multiple lines of evidence to effectively assess the impacts of aggregate extraction from the Keppel Quarry on the Glen Management Area, monthly surface water flows, conductivity and temperature are measured at the groundwater spring (s1, s2, and s3), Mud Creek (Channel A and B), and the Ducks Unlimited Dam (outflow weir).

A: Glen Management Area Springs (s1, s2, and s3)

The field measurements collected at the Glen Management Area springs (s1-s3) are provided in Table 6. The surface water flow data continues to show that the hydro-period for these springs extended from January through to December in 2017. This information is consistent with the historical data.

TABLE 6: GLEN MANAGEMENT SPRINGS FIELD MEASUREMENTS (S1, S2, AND S3)

Date	Surface Water Springs								
	s1			s2			s3		
	Conductivity µS	Temperature °C	Flow	Conductivity µS	Temperature °C	Flow	Conductivity µS	Temperature °C	Flow
20-Jan-17	611	2.2	F	598	2.6	F	605	2.4	F
27-Feb-17	512	1.6	F	503	1.9	F	499	1.8	F
22-Mar-17	488	3.4	F	501	3.7	F	492	3.1	F
26-Apr-17	485	9.1	F	511	8.5	F	493	9	F
31-May-17	477	12.3	F	482	12.9	F	484	13	F
22-Jun-17	462	15.5	F	480	15.5	F	494	15.7	F
27-Jul-17	540	17	F	535	18.2	F	533	18.2	F
30-Aug-17	586	14.4	F	581	15.3	F	591	16	F
2-Sep-17	607	10.9	F	621	11	F	572	11.2	F
20-Oct-17	623	13.1	F	621	14	F	625	13.6	F
17-Nov-17	542	9.7	F	602	9.7	F	588	9.9	F
21-Dec-17	608	4.4	F	604	4.2	F	595	4.3	F
Notes:	F = Flowing								
	NF = No Apparent Flow								
	D = Dry								

Conductivity values collected in 2017 range between 621 µs/cm and 484 µs/c, which is comparable to historical data. Conductivity values in this range indicates that there is a mix of groundwater and surface water flowing from these features (Cowell, 2009). Water temperature values collected in 2017 at the springs range between 1°C and 18°C. Due to inputs from groundwater at these springs, their temperatures do not raise much beyond 18°C. The water temperatures recorded at these springs in 2018 were comparable to historical data collected at these locations.

B: Mud Creek Channel A and Channel B

The headwaters for Mud Creek include springs s1-s3. There are two channels that flow from these springs into Mud Creek. These are referred to as:

- Channel A, the main channel; and
- Channel B, a secondary channel that flows intermittently.

Field measurements collected in 2017 at Mud Creek (Channel A and B) are found in Table 7. Based on the 2017 flow data collected, the hydroperiod for Channel A extended from December through to January, while Channel B was dried up in August. This information is consistent with historical data, which saw Channel B dried up regularly after the spring melt, whereas Channel A flowed almost all year.

Conductivity values ranged from 455 µs/cm to 645 µs/cm at these channels in 2017, which is comparable to historical data collected at these locations. Water temperature in Channel A ranged from 2°C to about 18°C and Channel B ranged between 4°C and 18°C. The water temperatures recorded in Mud Creek (Channel A and B) in 2016 were comparable to historical data collected at these locations.

TABLE 7: MUD CREEK FIELD MEASUREMENTS

Date	Mud Creek					
	Channel A			Channel B		
	Conductivity µS	Temperature °C	Flow	Conductivity µS	Temperature °C	Flow
20-Jan-17	590	2.1	35	Frozen	Frozen	Frozen
27-Feb-17	487	1.9	40	Frozen	Frozen	Frozen
22-Mar-17	476	4	30	455	3.9	F
26-Apr-17	492	8.9	30	525	9.2	F
31-May-17	493	13.2	30	496	13	NF
22-Jun-17	507	15.2	35	456	15.9	NF
27-Jul-17	549	18.4	25	551	17.9	NF
30-Aug-17	605	16.7	10	D	D	D
2-Sep-17	588	10.9	10	D	D	D
20-Oct-17	645	12.2	7	D	D	D
17-Nov-17	553	9.9	10	D	D	D
21-Dec-17	616	4.6	15	D	D	D
Notes:	F = Flowing					
	NF = No Apparent Flow					
	D = Dry					

C: Glen Management Area Springs (s4a, s4b, s4c, and s5)

The field measurements collected at the Glen Management Area springs (s4a, s4b, s4c, and s5) are provided in Table 8. The surface water flow data continues to show that the hydro-period for these springs extended from January through to July/August in 2017. This information is consistent with the historical data.

TABLE 8: GLEN MANAGEMENT SPRINGS FIELD MEASUREMENTS (S4 AND S5)

Date	Surface Water Springs											
	s4a			s4b			s4c			s5		
	Conductivity µS	Temperature °C	Flow	Conductivity µS	Temperature °C	Flow	Conductivity µS	Temperature °C	Flow	Conductivity µS	Temperature °C	Flow
20-Jan-17	627	2	F	607	1.9	F	Frozen	Frozen	Frozen	Frozen	Frozen	Frozen
27-Feb-17	562	2.1	F	580	2.3	F	591	2.3	F	Frozen	Frozen	Frozen
22-Mar-17	525	2.5	F	560	2.7	F	517	2.9	F	549	2.7	F
26-Apr-17	542	10.9	F	601	10.7	F	559	10.9	F	D	D	D
31-May-17	713	9.5	F	617	9.3	F	591	8.5	F	D	D	D
22-Jun-17	575	16.5	F	527	16.8	F	601	17	F	607	16.9	F
27-Jul-17	715	12.9	F	647	13.8	F	628	12.9	F	D	D	D
30-Aug-17	D	D	D	D	D	D	D	D	D	D	D	D
2-Sep-17	D	D	D	D	D	D	D	D	D	D	D	D
20-Oct-17	D	D	D	D	D	D	D	D	D	D	D	D
17-Nov-17	771	7.5	F	698	8.5	F	708	8.4	F	D	D	D
21-Dec-17	D	D	D	D	D	D	D	D	D	D	D	D
Notes:	F = Flowing											
	NF = No Apparent Flow											
	D = Dry											

D: Ducks Unlimited Dam

The field measurements collected at the Ducks Unlimited Dam outflow weir are provided in Table 9. The surface water flow data continues to show that the hydro-period for these springs extended year-round. This information is consistent with the historical data.

TABLE 9: DUCKS UNLIMITED DAM FIELD MEASUREMENTS

Date	Ducks Unlimited Dam		
	Conductivity µS	Temperature °C	Flow
20-Jan-17	587	2.2	F
27-Feb-17	423	1.5	F
22-Mar-17	509	2.9	F
26-Apr-17	602	9.7	F
31-May-17	552	13.3	F
22-Jun-17	449	15.2	F
27-Jul-17	445	23.7	F
30-Aug-17	389	20.7	F
2-Sep-17	481	12.5	F
20-Oct-17	472	9.2	F
17-Nov-17	498	8.6	F
21-Dec-17	422	4.3	F
Notes:	F = Flowing		
	NF = No Apparent Flow		
	D = Dry		

E: Ephemeral Pond

There was an ephemeral pond on Lot 26 Concession 10. The AMP requires that three years of baseline water levels be measured using a staff gauge in this feature prior to extraction occurring within Area 1B. Water levels shall be measured during the amphibian breeding season which extends from April 1 to June 30. However, due to the construction of the west berm, the ephemeral pond will likely change/relocate naturally in the spring. The bermed area has been cleared, and a ditch was dug to remove water from the area. HSCL staff along with John Morton will monitor where the water ends up, as the pond forms each spring and it is likely to begin forming in a new location just west of the berm. Once the pond area is outlined, an updated map with the location outlined will be provided in the annual report, and the staff gauge (SG2) will be installed and surveyed.

3.0 ASSESSMENT OF TRIGGER VALUES

The AMP for the Keppel Quarry currently relies on seasonal site-specific trigger water level elevations at selected sentry monitoring wells and surface water monitoring locations. Trigger values were determined based on the evaluation of baseline water level data and based these levels on the predicted the maximum extent of the cone of influence once the New Keppel Quarry is fully extracted. By defining the maximum extent of the cone of influence, suitable trigger values were set that will activate mitigation measures if the observed values collected through the Water Resources Monitoring Program are lower than predicted.

The approved trigger values were set for four quarterly seasonal periods (spring, summer, fall, and winter). For selected monitoring locations there are three standard categories of trigger values; green, yellow and red. Green trigger values were set at 15 cm above observed seasonal lows. Yellow trigger values are equal to observed seasonal lows for each location. Red trigger values were set at 15 cm below observed seasonal lows.

Since the AMP has been implemented, there have been numerous false positive trigger exceedances. The reasons for these exceedances include:

1. Seasonal conditions were assessed based on monthly spot measurements, which may not have captured actual seasonal low water level conditions;
2. The oversimplification of the approach to setting the triggers (broadly apply a 15 cm drawdown to all sentry monitoring locations; and
3. The neglect to account for the full impact of climate change during the development of the AMP.

Limiting drawdown to 15 cm at a selected sentry locations sound like a strict criterion to ensure minimal impact from quarry dewatering (as this is a relatively small change in the water level). However, the approach has one significant pitfall, which is the lack of consideration in the variability in the seasonal variation in water levels. For example, for OW51, the water level fluctuates 5 m. If the water level drops an additional 15 cm, that change only represents 3% of the variability. At OW12s the water level fluctuates only 1.38 m seasonally. If the water level drops an additional 15 cm, that change increase to 11% of the variability. Therefore, the use of seasonal trends should be reconsidered, and the development of a single site-specific trigger value for each sentry monitoring location should result in more appropriate drawdown trigger value.

In addition, the full impact of climate change must be incorporated into the development of revised trigger values. Climate change has resulted in an increase in the frequency and intensity of some types of extreme weather events. For example, warming is causing more rain to fall in heavy isolated downpours. There are also longer dry periods between rainfalls. This, coupled with more evaporation due to higher temperatures, intensifies drought conditions. In addition, season creep, which refers to observed changes in the timing of the seasons has been widely observed in Ontario (refer to Section 2.1).

Since 2015, the yellow and red triggers set for the Keppel Quarry have been exceeded numerous times. Therefore, it is recommended that the trigger mechanism for both the surface water and groundwater be re-evaluated. As per Condition 10.3 of the AMP, a Site Plan Amendment application must be submitted to the MNRF so that any revisions to the trigger values can be considered.

4.0 CONCLUSION

Based on the monitoring data, Whitewater concludes that extraction did not cause any negative impacts to groundwater resources in 2017.

5.0 RECOMMENDATIONS

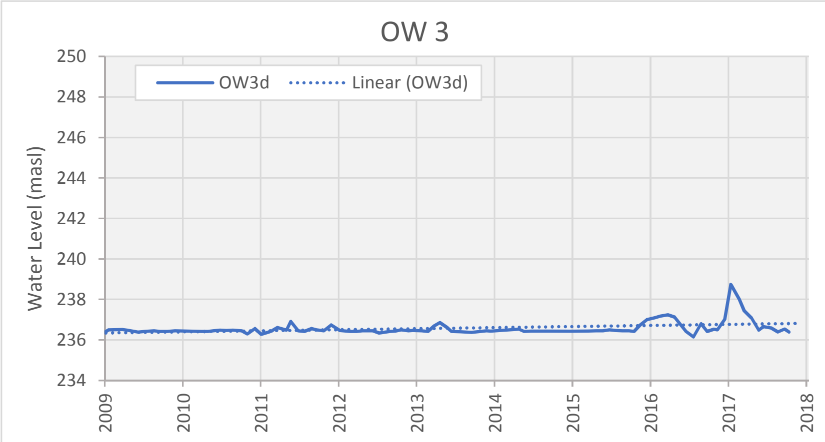
Subject to approval from MNRF, the AMP shall be updated to include any recommended changes to the groundwater and surface water monitoring program, including trigger values. It is suggested that a pre-submission meeting with the MNRF be held to discuss the current issues with the program, including trigger values, prior to submitting the proposed amended Water Resources Monitoring Program.

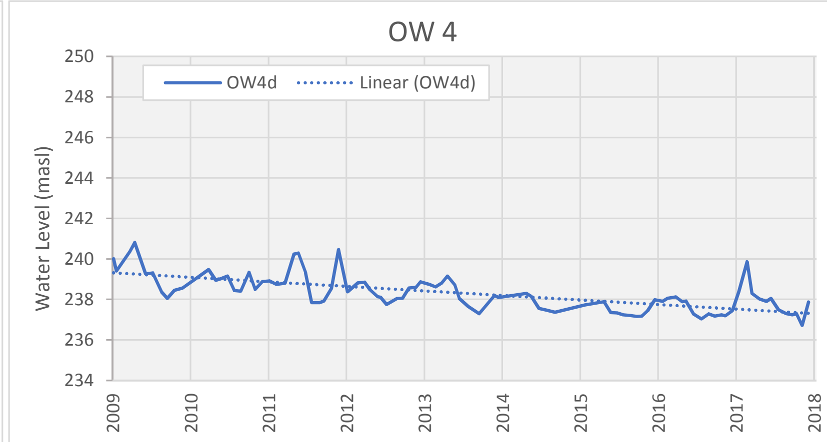
APPENDIX A: HYDROGEOLOGICAL ASSESSMENT (SUPPORTING INFORMATION)

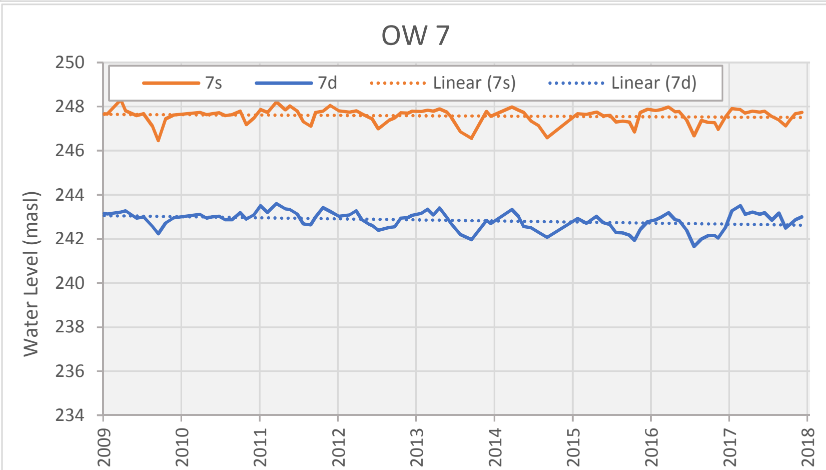
APPENDIX A-1a

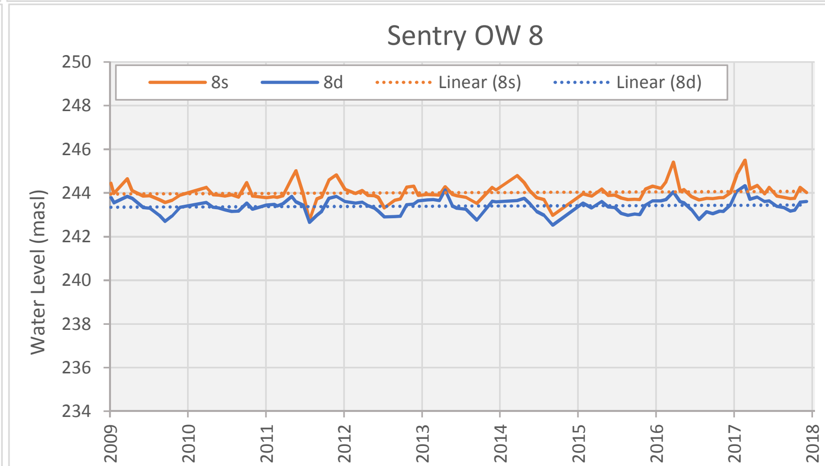
Hydrographs - Groundwater Monitoring Wells

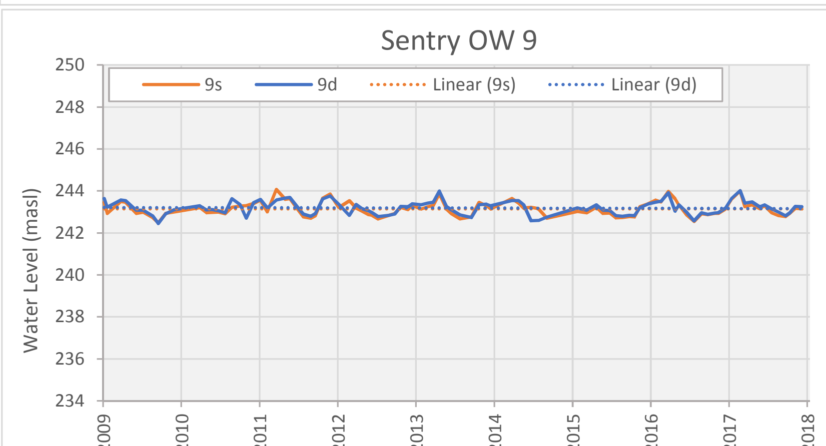
Keppel Quarry: Appendix A-1a
Groundwater Hydrographs

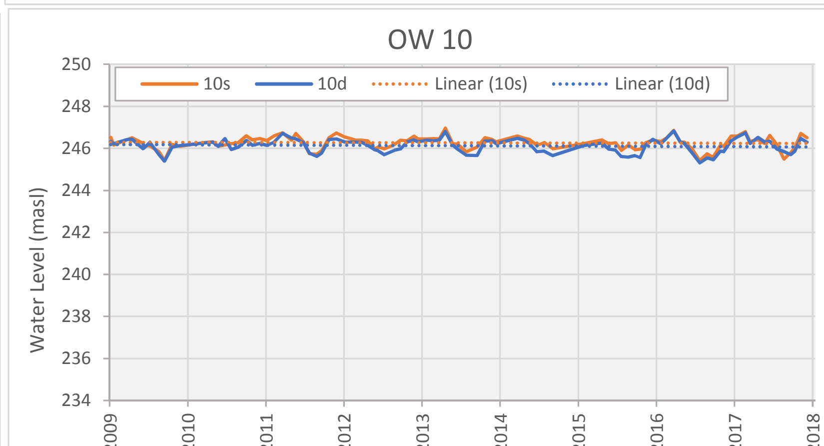




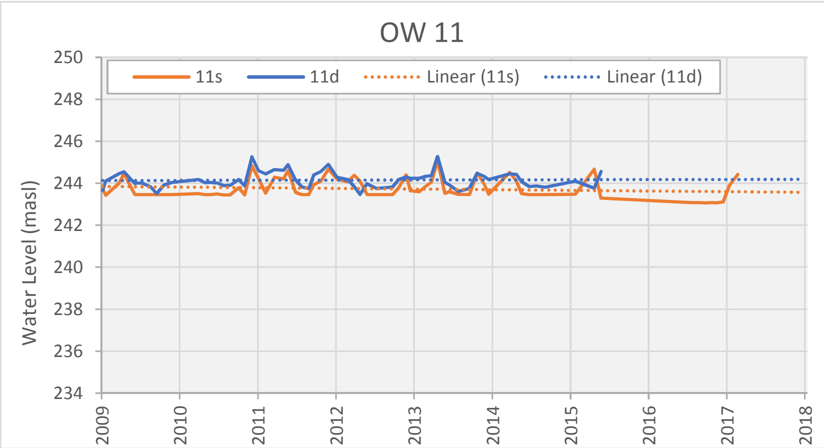


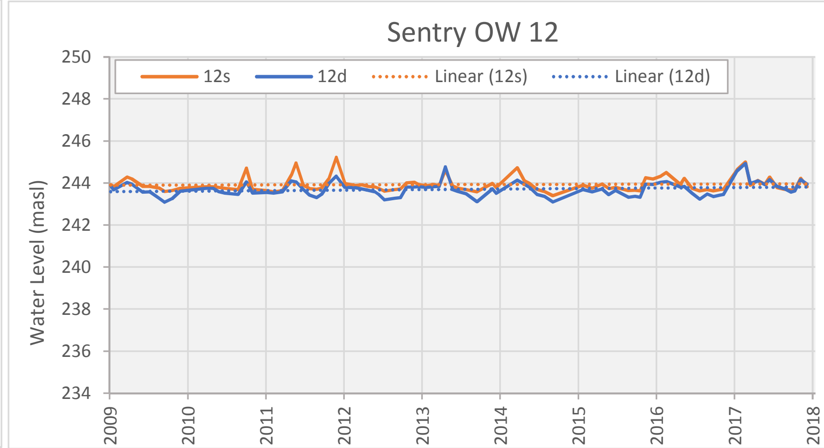


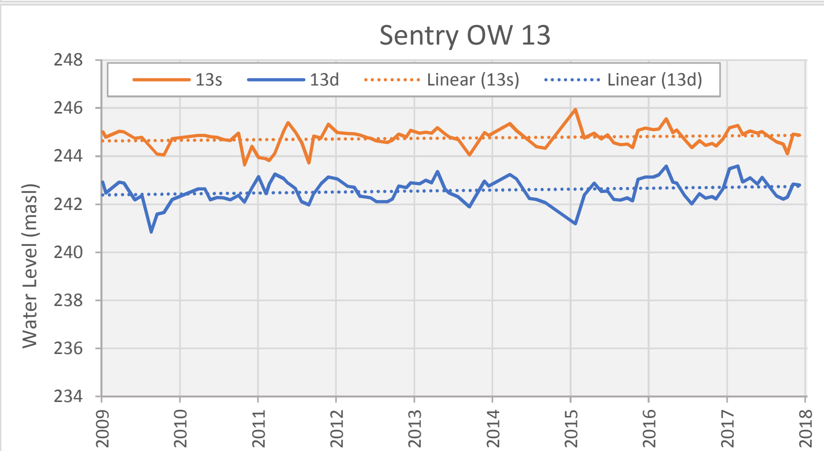


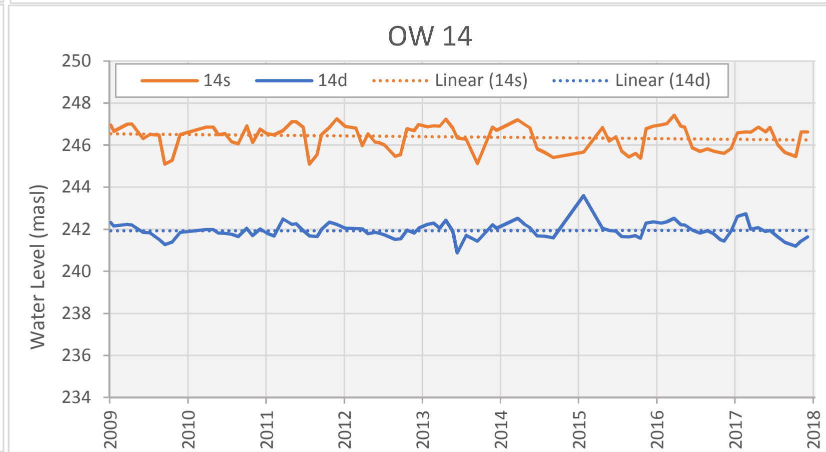


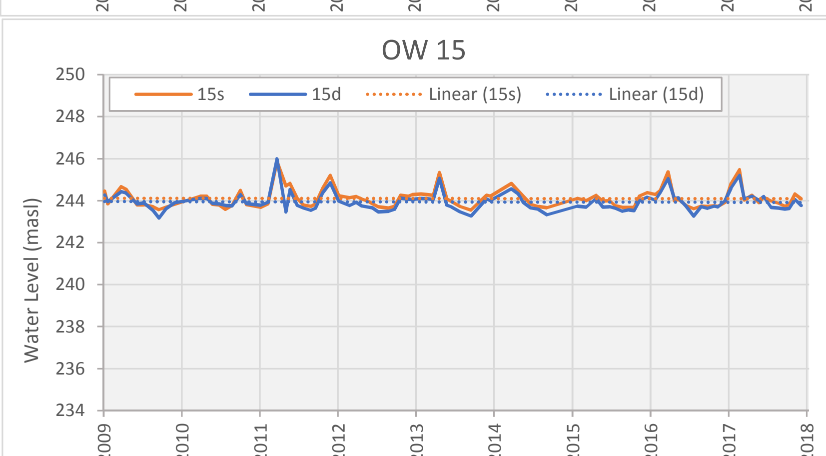
Keppel Quarry: Appendix A-1a
Groundwater Hydrographs

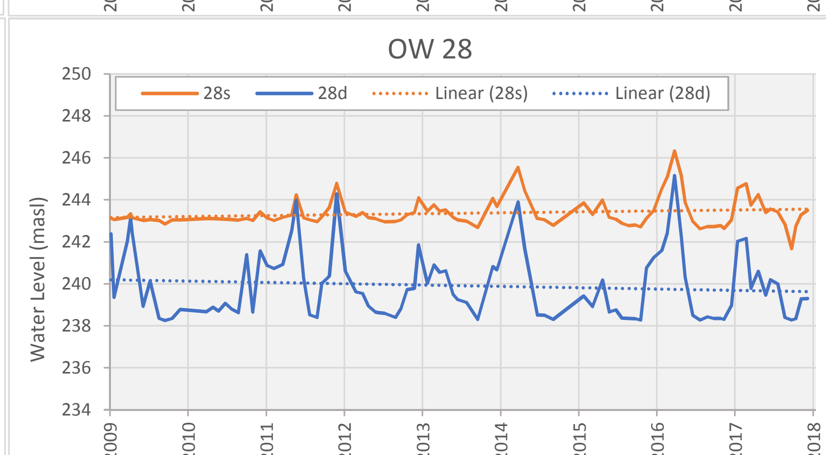




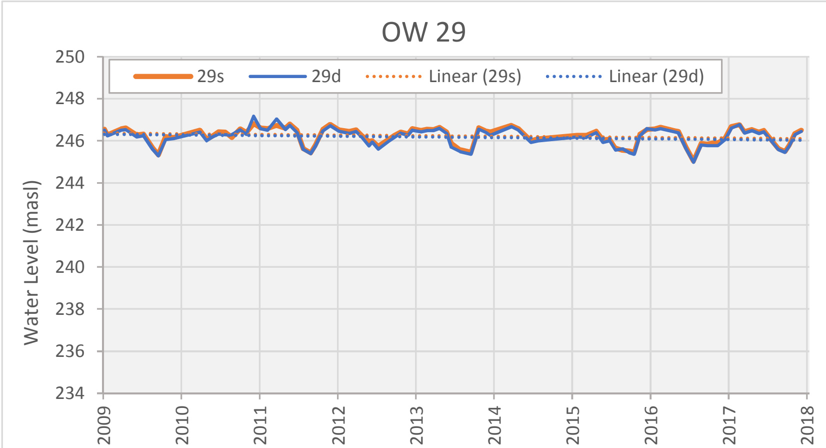


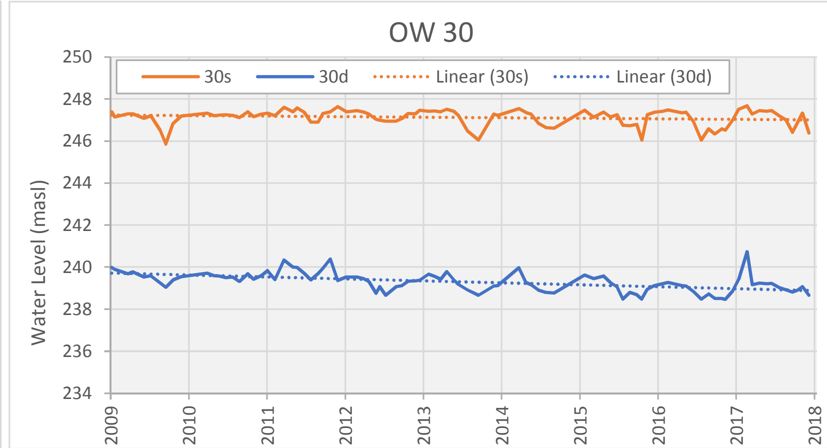


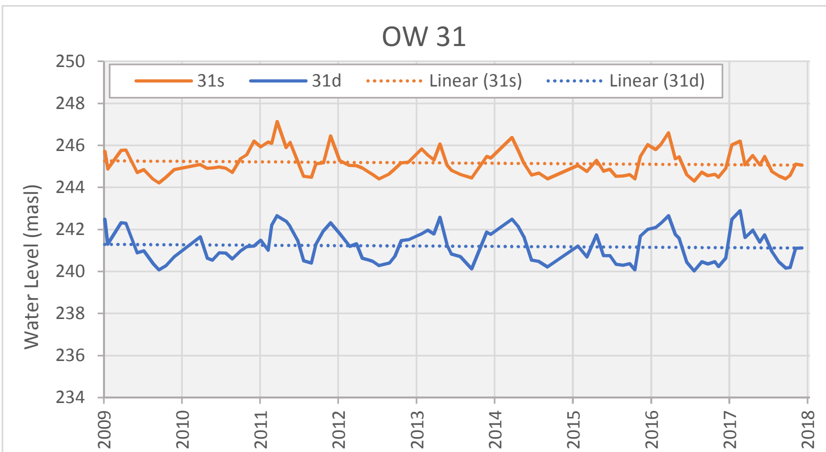


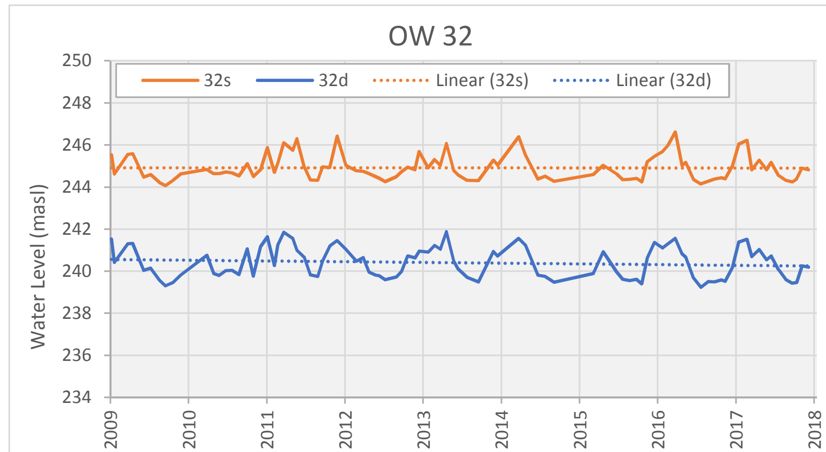


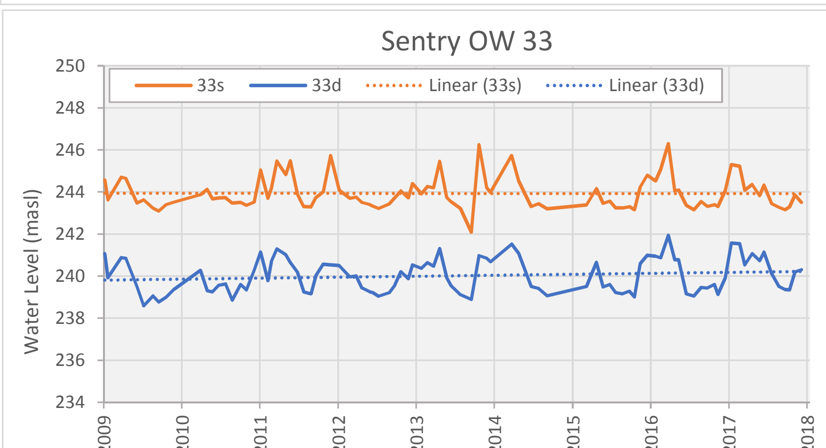
Keppel Quarry: Appendix A-1a
Groundwater Hydrographs

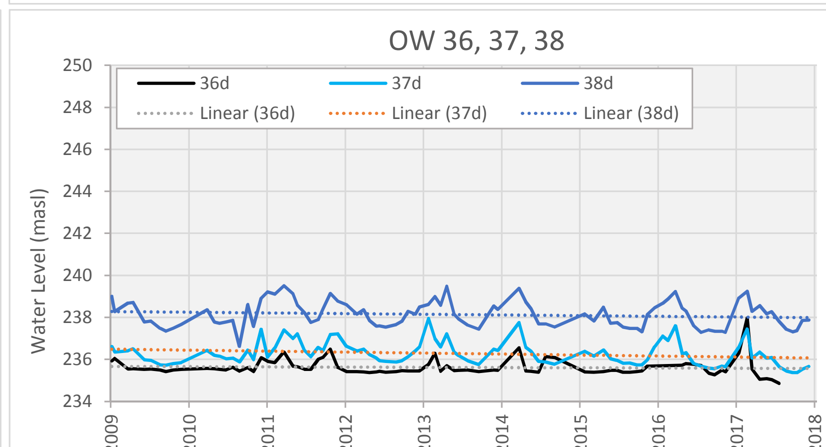


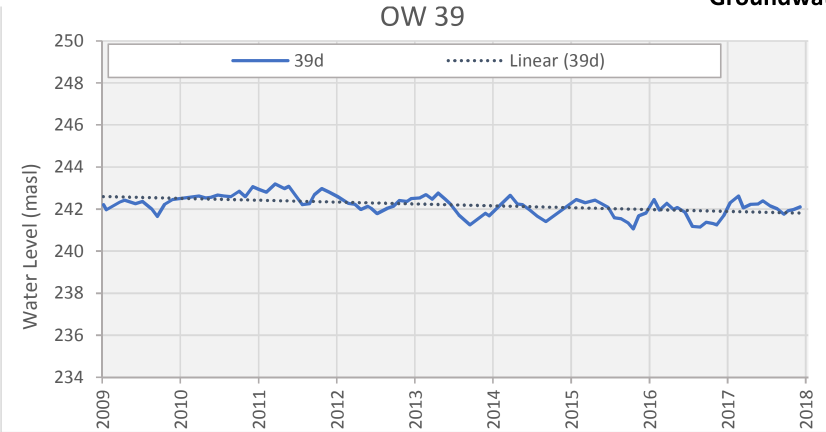


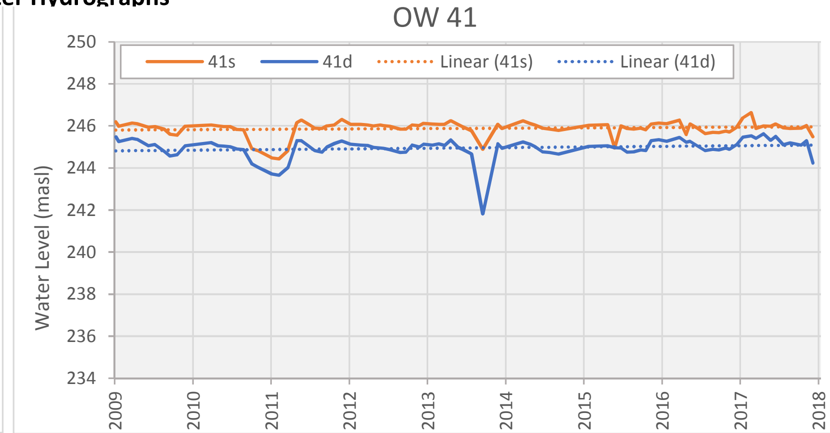


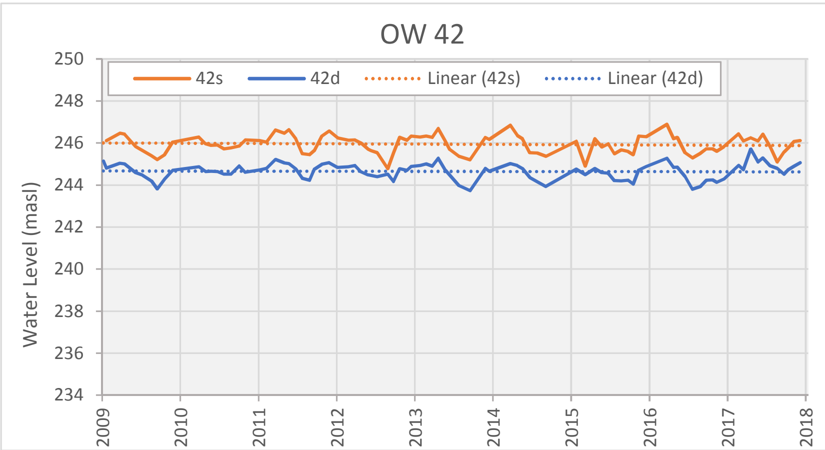







OW 39
39d
Linear (39d)
Water Level (masl)
250
248
246
244
242
240
238
236
234
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018


OW 41
41s
41d
Linear (41s)
Linear (41d)
Water Level (masl)
250
248
246
244
242
240
238
236
234
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018


OW 42
42s
42d
Linear (42s)
Linear (42d)
Water Level (masl)
250
248
246
244
242
240
238
236
234
2009
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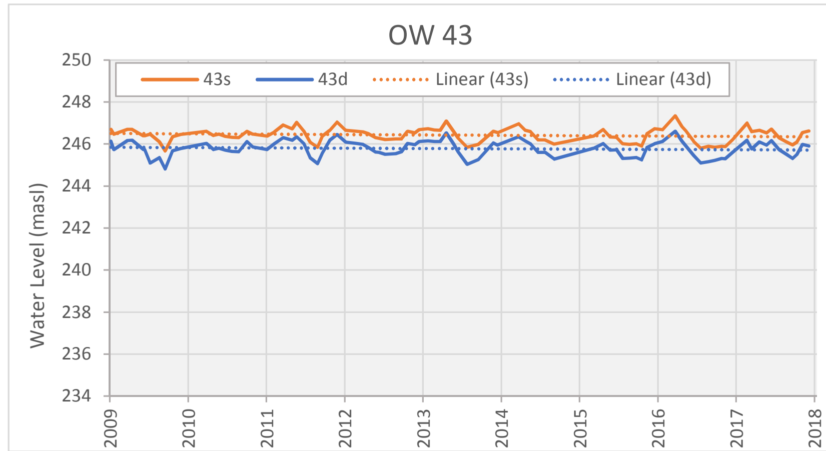
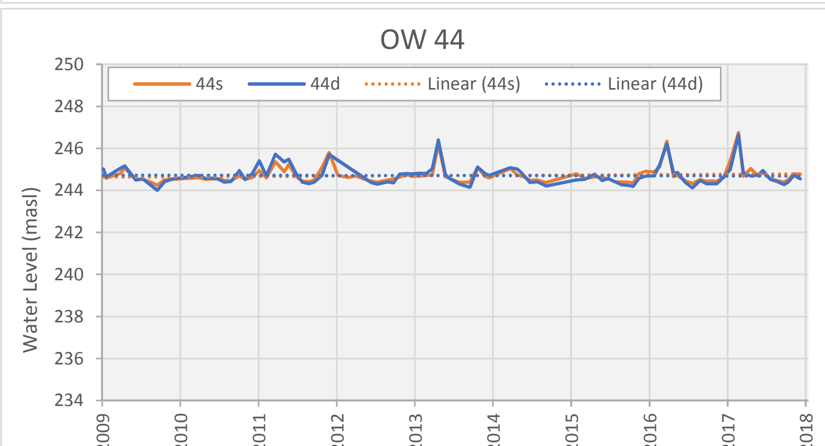
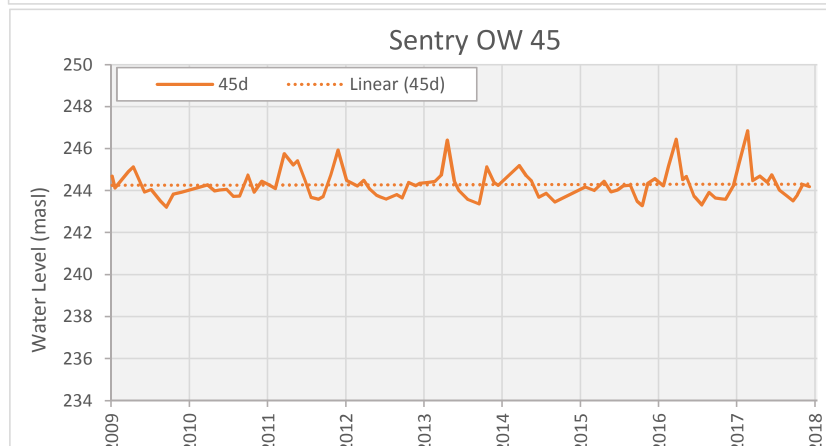
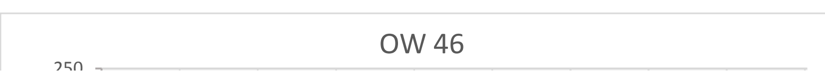
2011
2012
2013
2014
2015
2016
2017
2018


OW 43
43s
43d
Linear (43s)
Linear (43d)
Water Level (masl)
250
248
246
244
242
240
238
236
234
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018

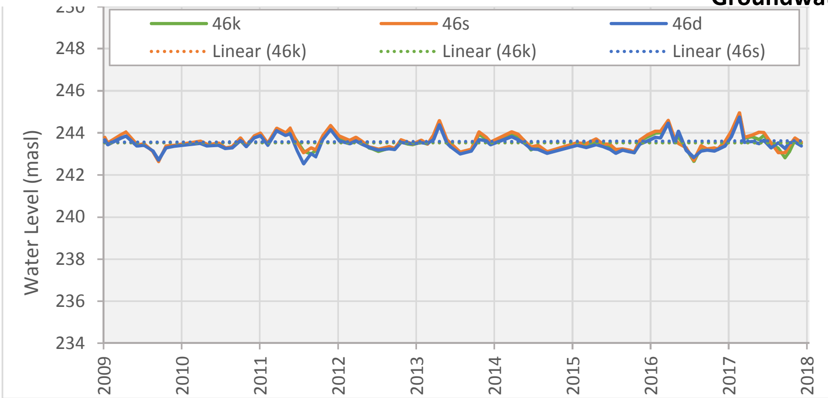

OW 44
44s
44d
Linear (44s)
Linear (44d)
Water Level (masl)
250
248
246
244
242
240
238
236
234
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018

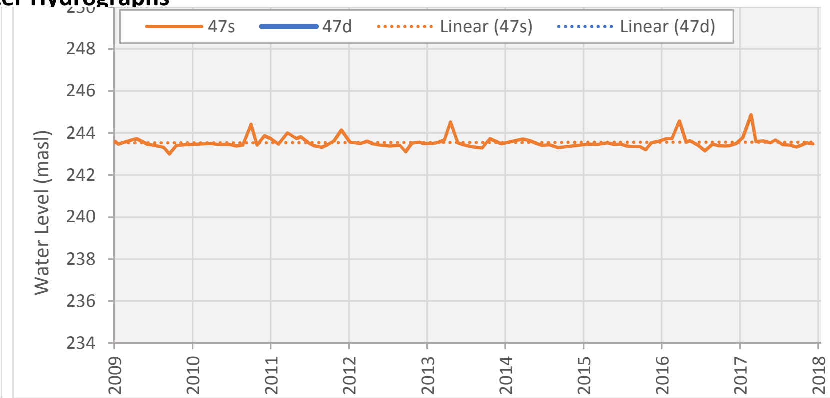

Sentry OW 45
45d
Linear (45d)
Water Level (masl)
250
248
246
244
242
240
238
236
234
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018

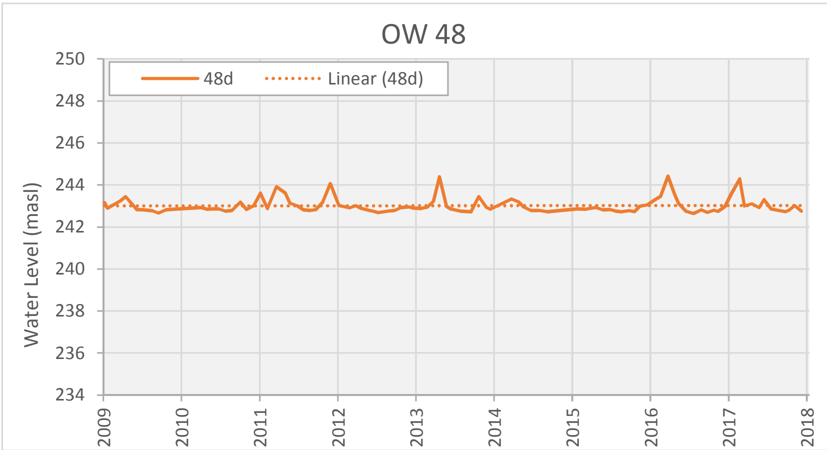

OW 46

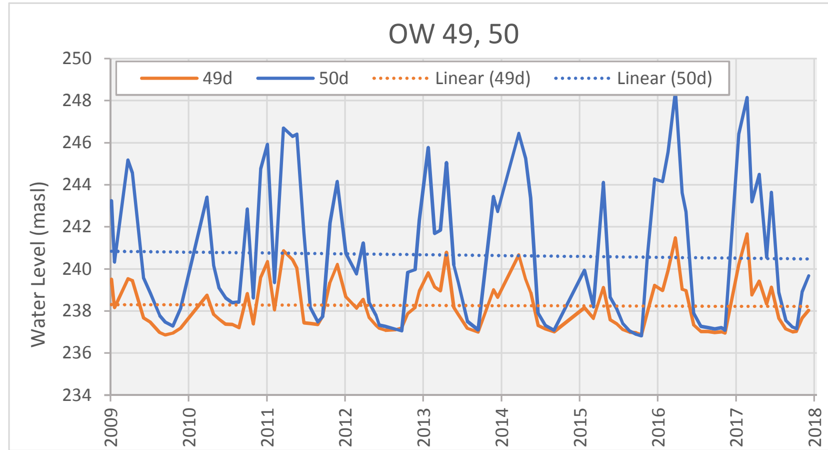

Sentry OW 47

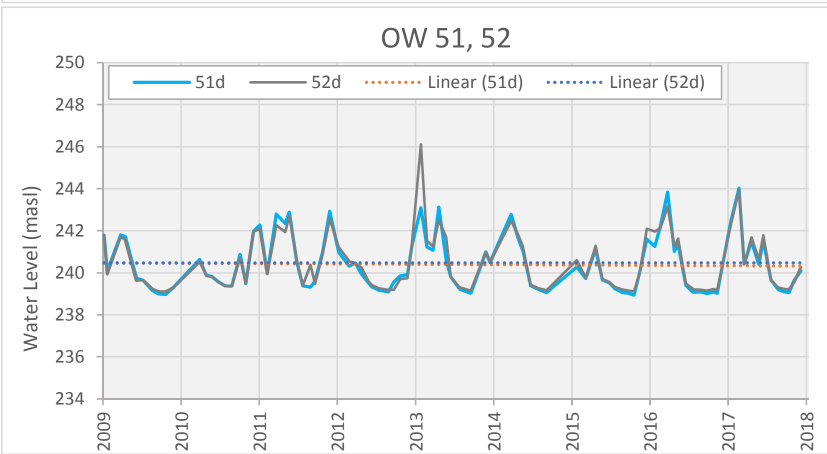
Keppel Quarry: Appendix A-1a
Groundwater Hydrographs

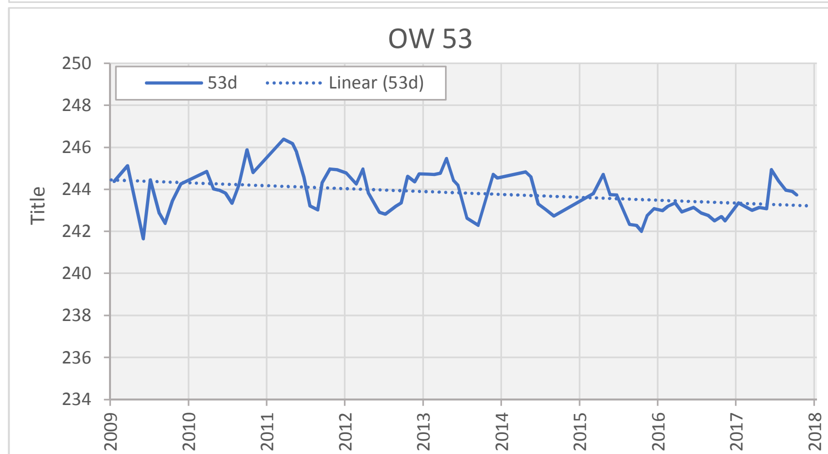


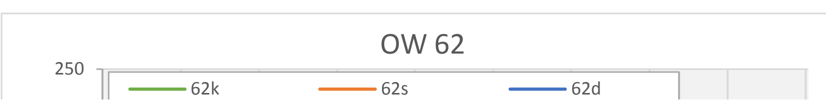


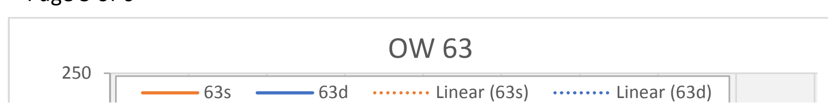




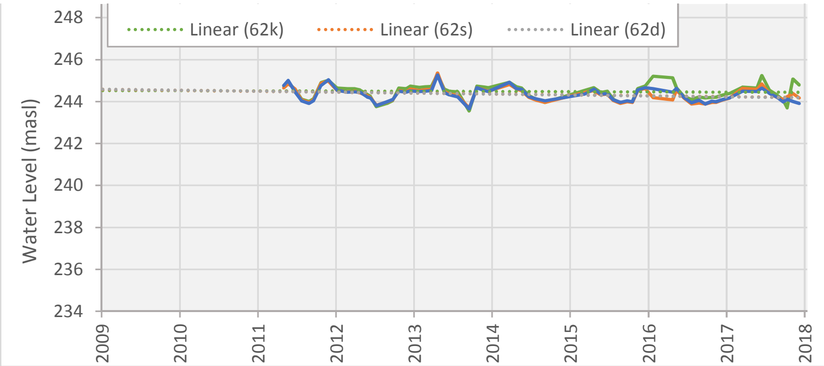


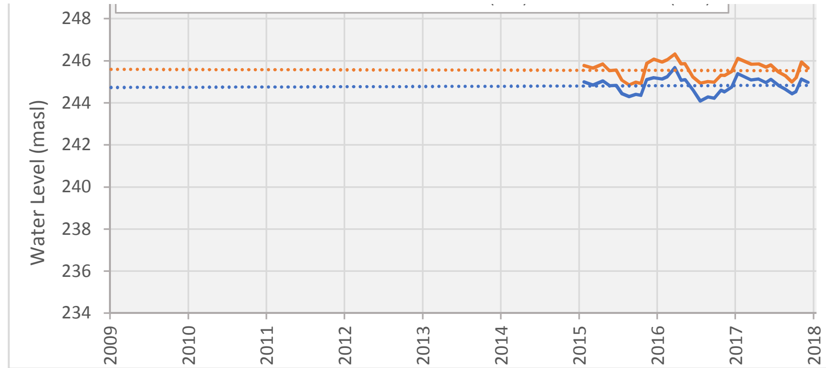


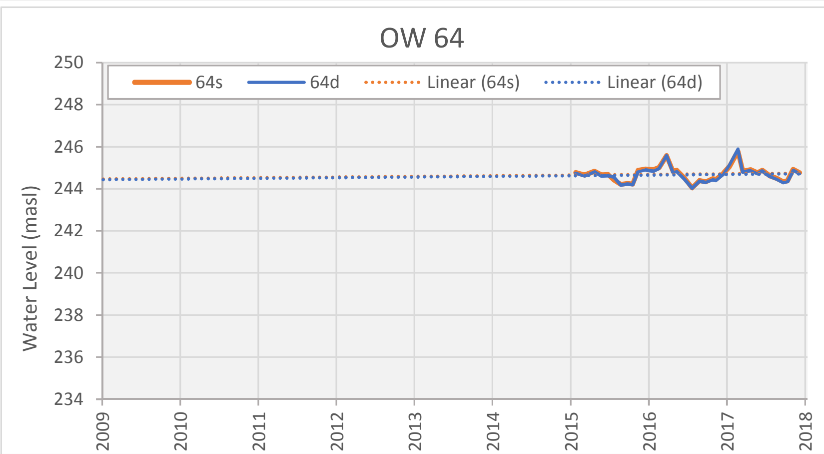


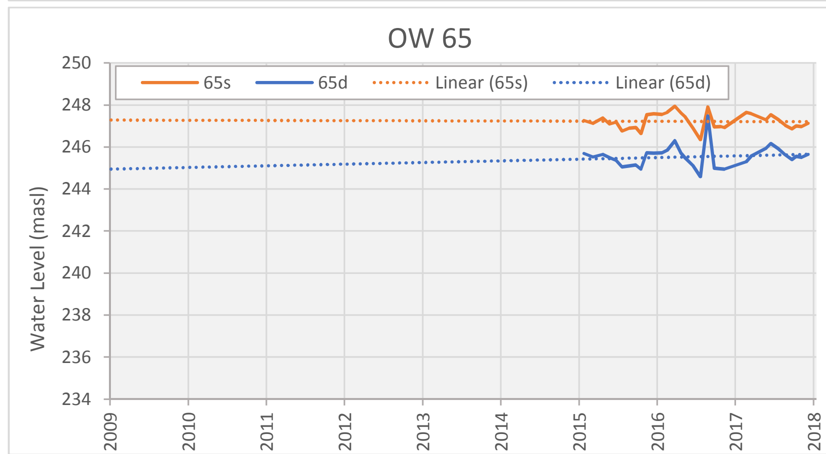


Keppel Quarry: Appendix A-1a
Groundwater Hydrographs







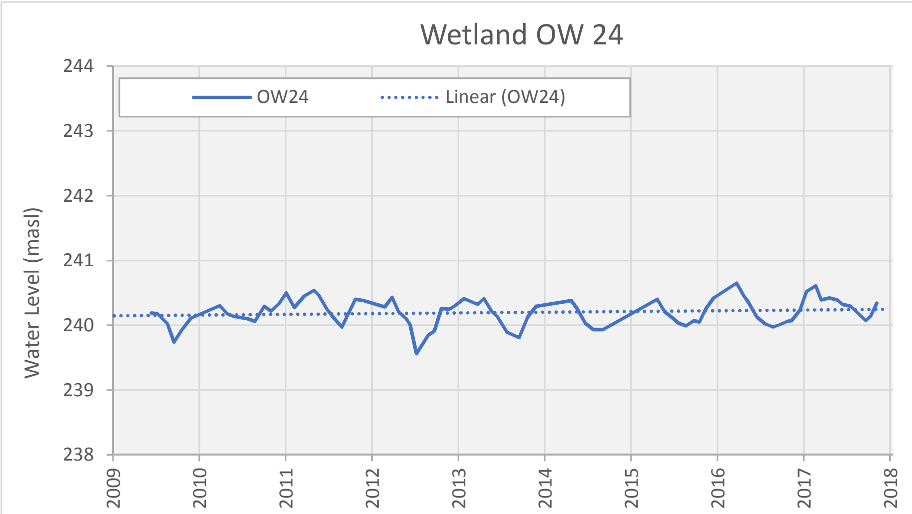


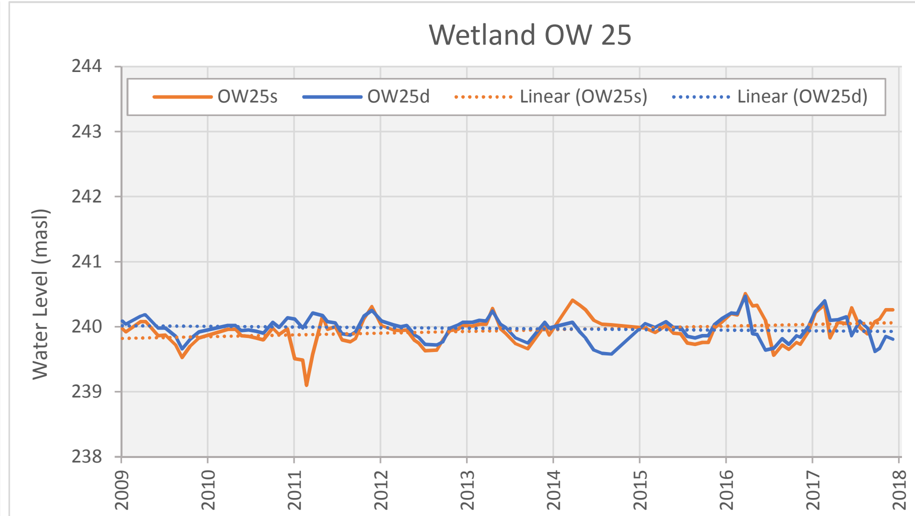
APPENDIX A: HYDROGEOLOGICAL ASSESSMENT (SUPPORTING INFORMATION)

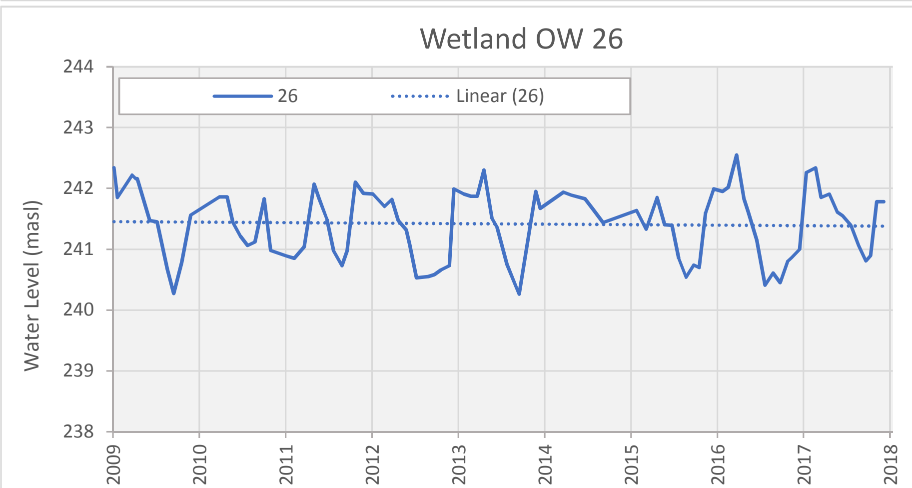
APPENDIX A-1b

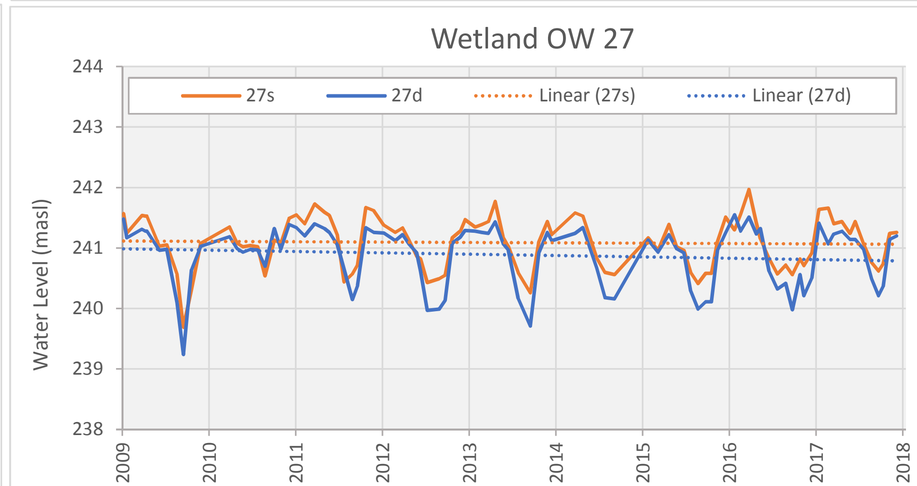
Hydrographs - Groundwater Monitoring Wells: Wetland Areas

Keppel Quarry: Appendix A-1b
Groundwater Hydrographs (Wetland Area)

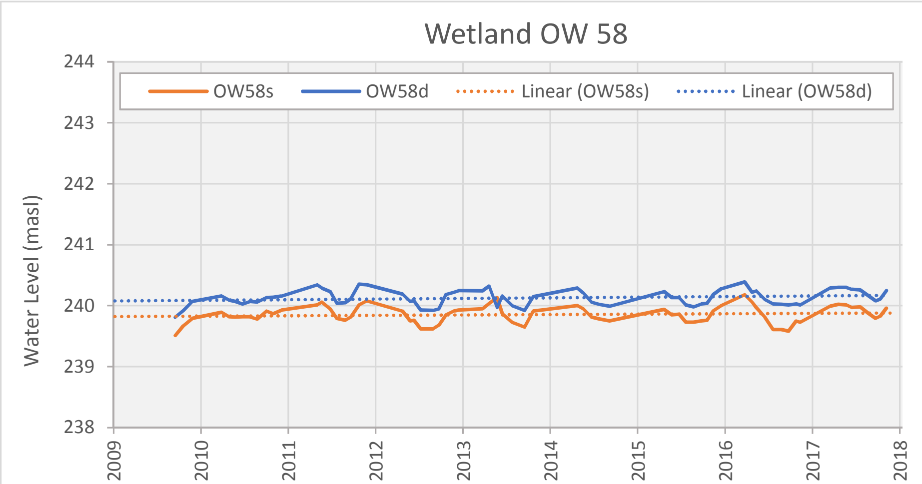


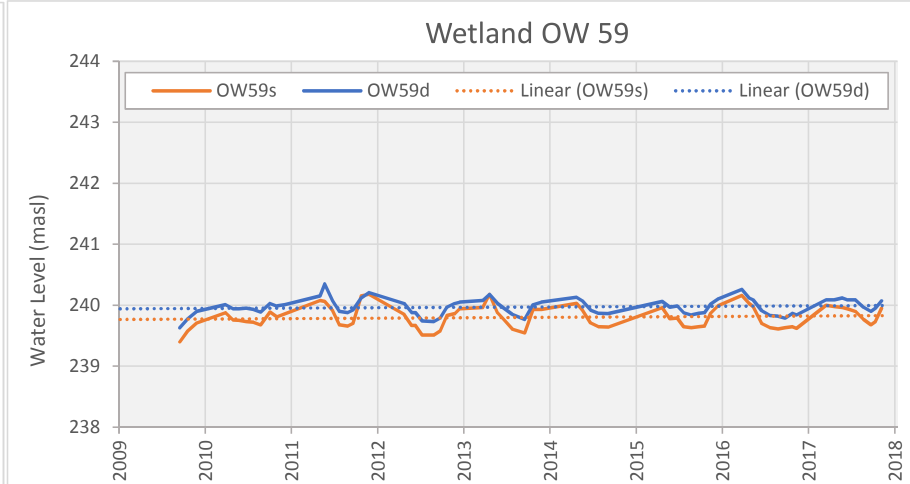


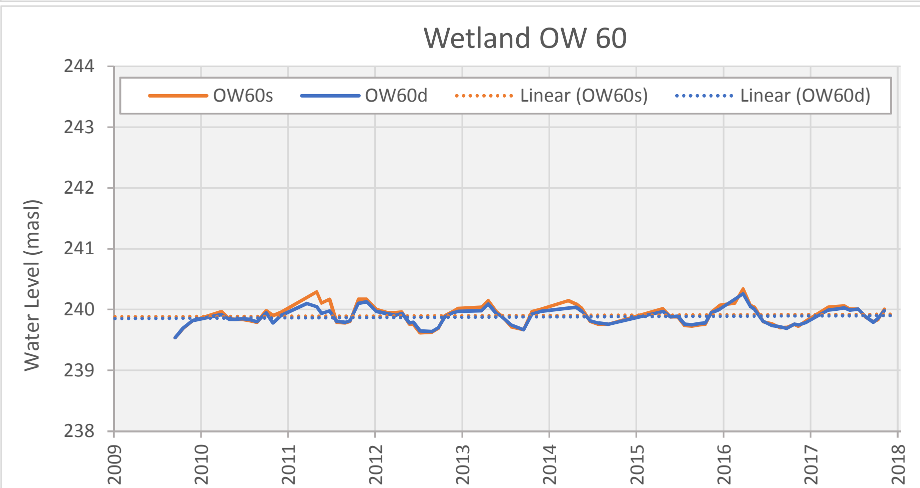


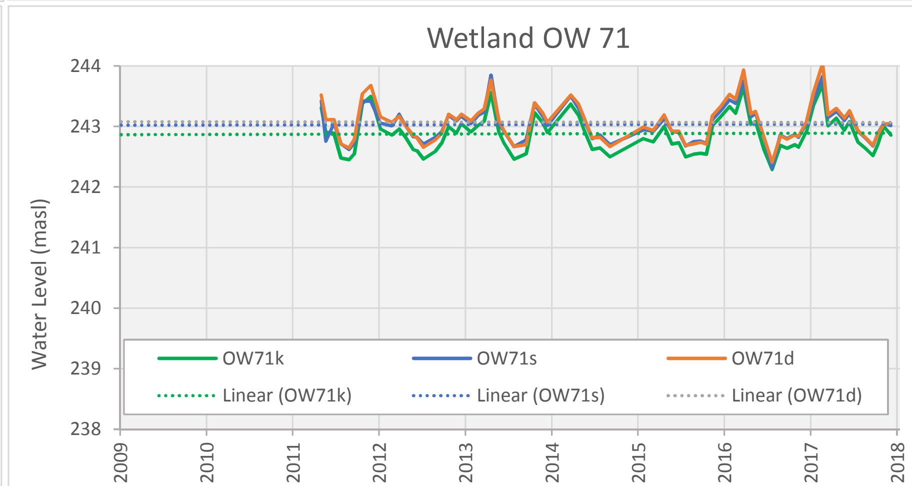


Keppel Quarry: Appendix A-1b
Groundwater Hydrographs (Wetland Area)







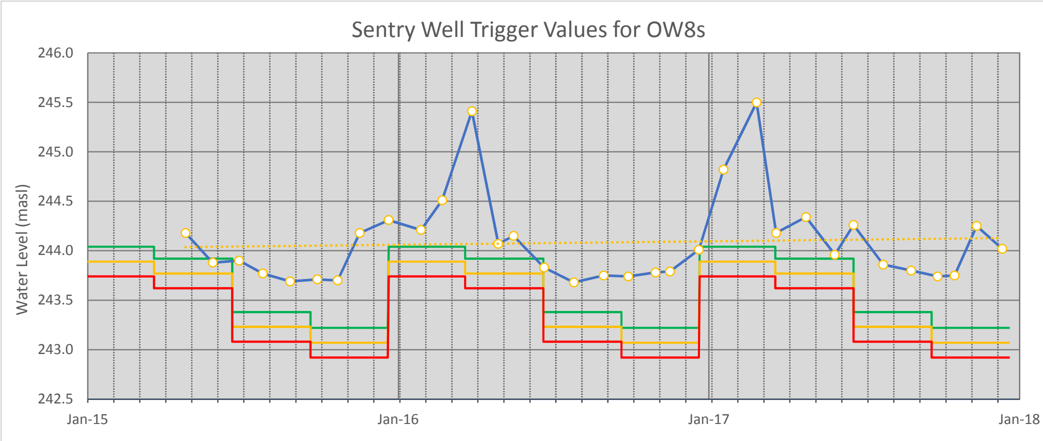


APPENDIX A: HYDROGEOLOGICAL ASSESSMENT (SUPPORTING INFORMATION)

APPENDIX A-1c

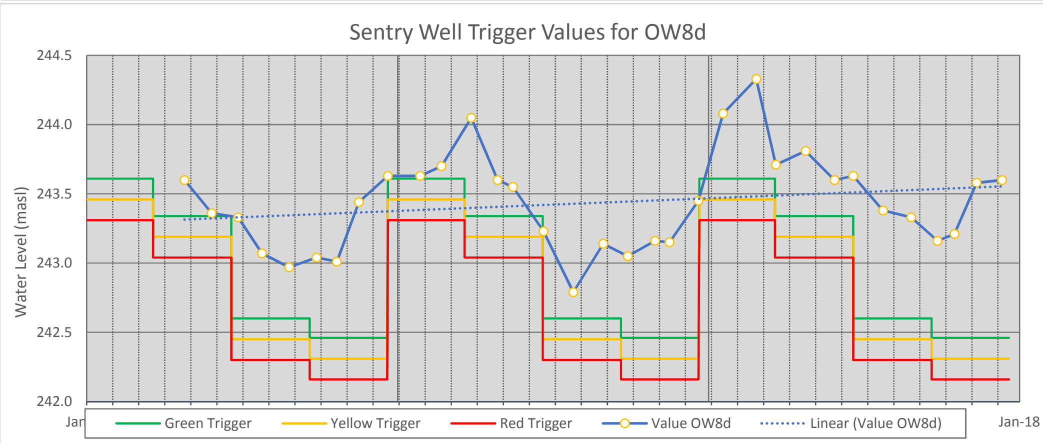
Hydrographs - Groundwater Monitoring Wells: Sentry Wells

Keppel Quarry: Appendix A-1c
Sentry Well Hydrographs and Trigger Values



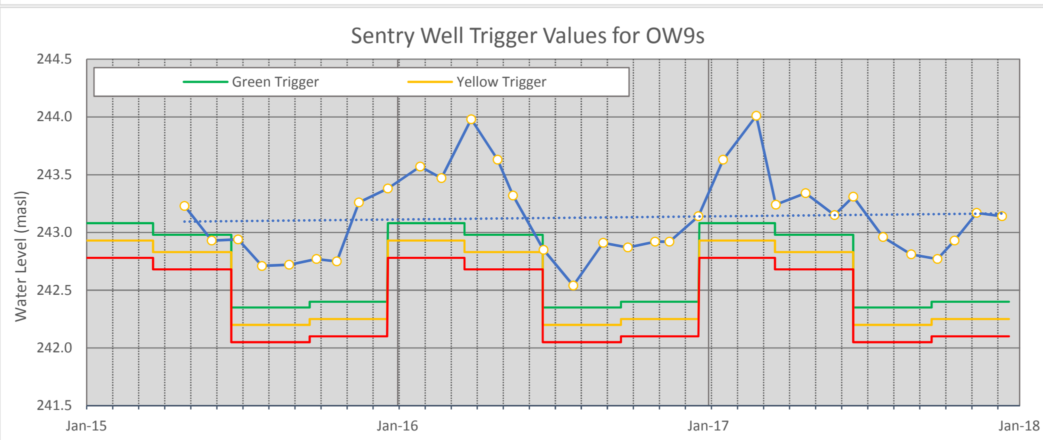
Trigger Exceedences (OW8s)

Date	Season	Trigger Type
29-May-15	Spring	Green



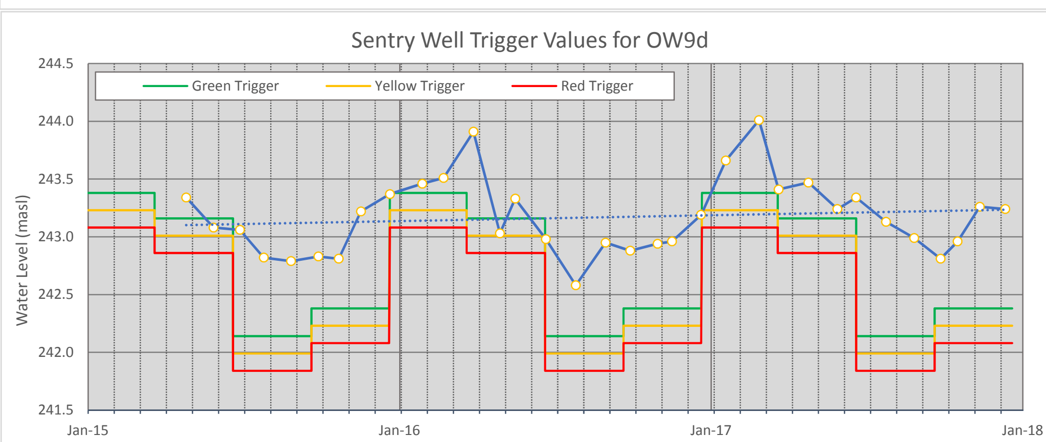
Trigger Exceedences (OW8d)

Date	Season	Trigger Type



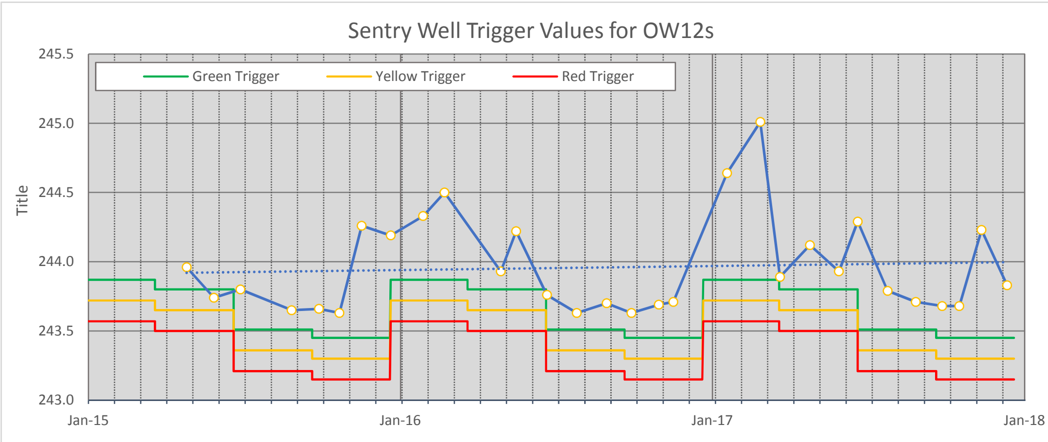
Trigger Exceedences (OW9s)

Date	Season	Trigger Type
29-May-15	Spring	Green



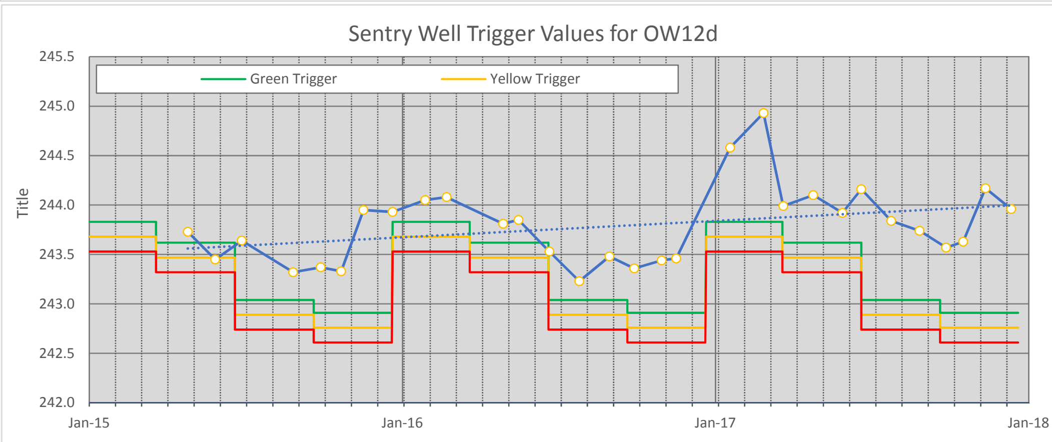
Trigger Exceedences (OW9d)

Date	Season	Trigger Type
29-May-15	Spring	Green
29-Apr-16	Spring	Green



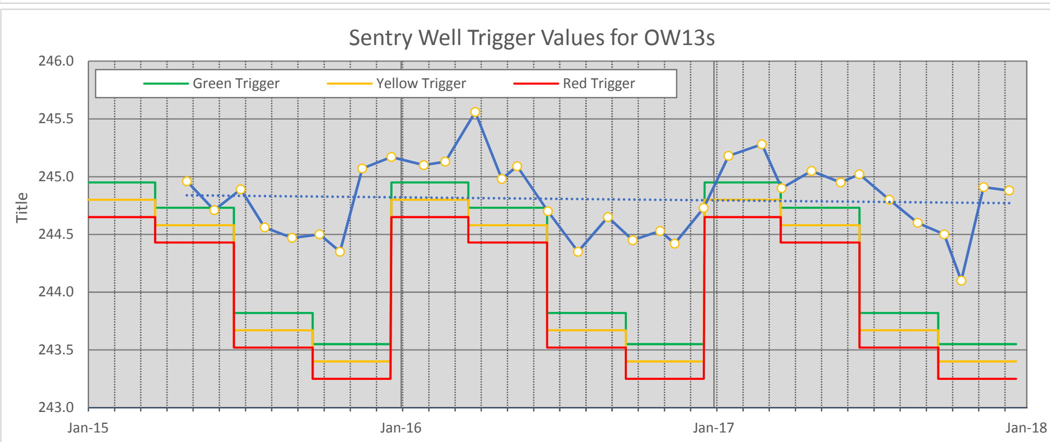
Trigger Exceedences (OW12s)

Date	Season	Trigger Type
29-May-15	Spring	Green



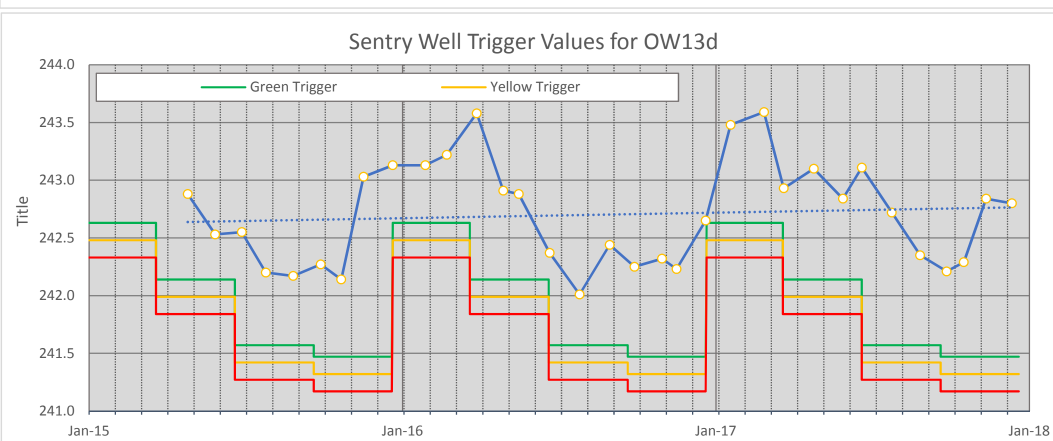
Trigger Exceedences (OW12d)

Date	Season	Trigger Type
29-May-15	Spring	Yellow



Trigger Exceedences (OW13s)

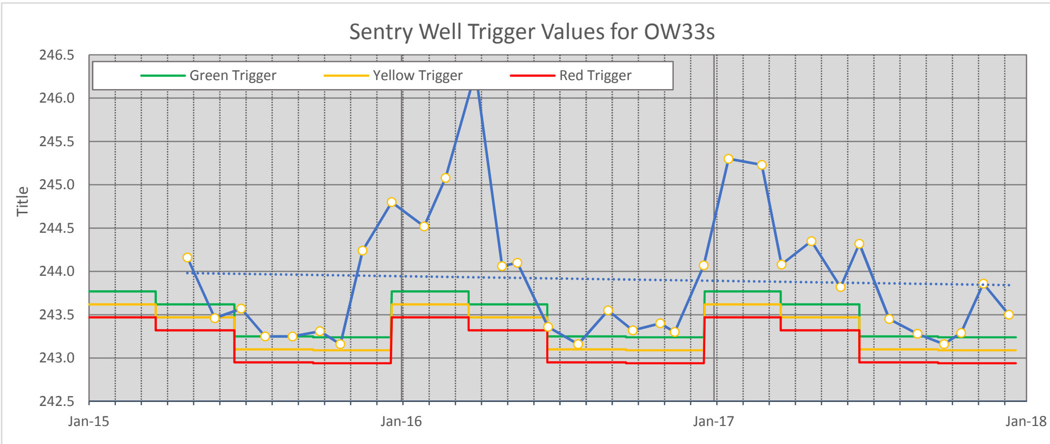
Date	Season	Trigger Type
28-May-15	Spring	Green



Trigger Exceedences (OW13d)

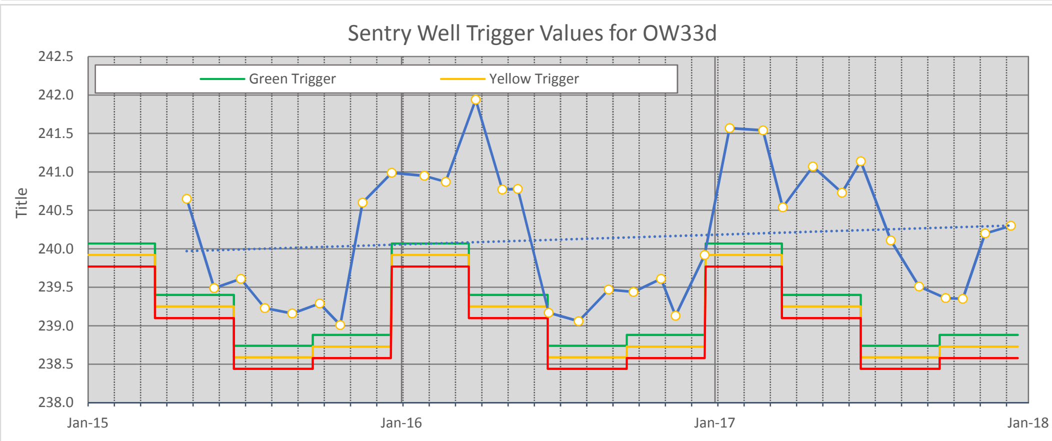
Date	Season	Trigger Type

Keppel Quarry: Appendix A-1c
Sentry Well Hydrographs and Trigger Values



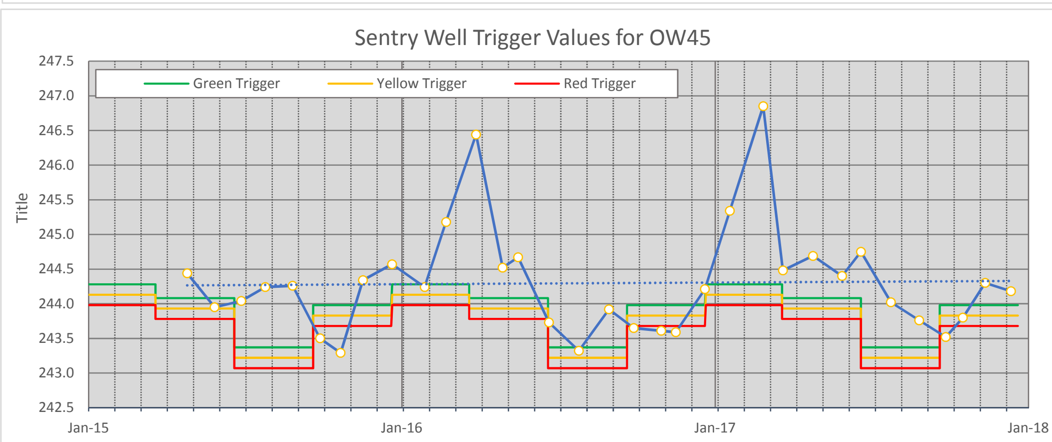
Trigger Exceedences (OW33s)

Date	Season	Trigger Type
29-May-15	Spring	Green
23-Oct-15	Fall	Green
27-Jul-16	Summer	Green
28-Sep-17	Fall	Green



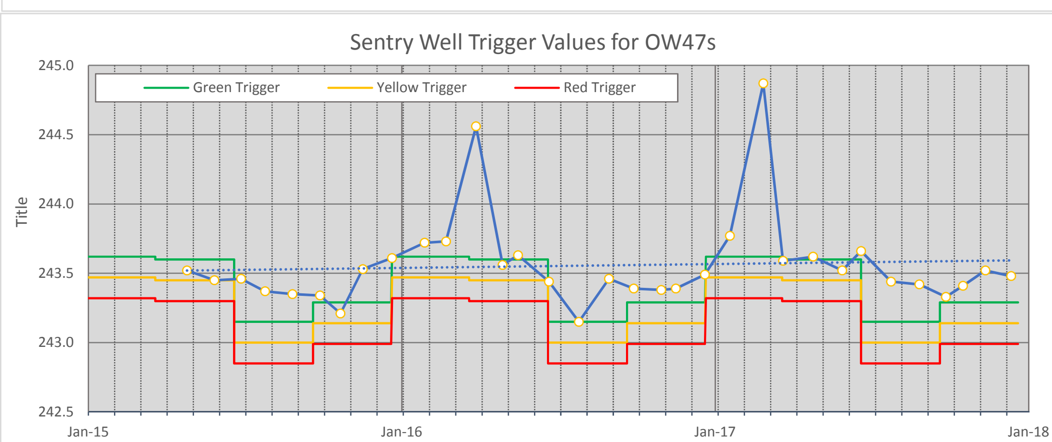
Trigger Exceedences (OW33d)

Date	Season	Trigger Type



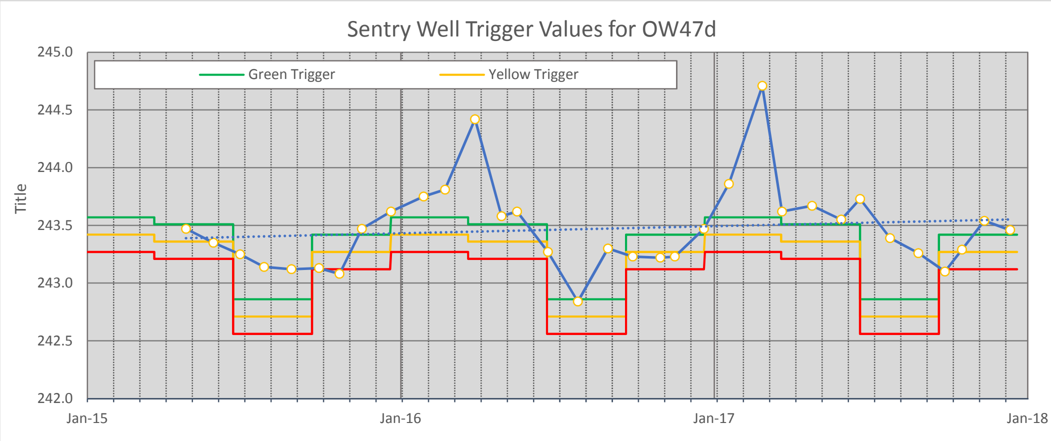
Trigger Exceedences (OW45)

Date	Season	Trigger Type
29-May-15	Spring	Green
29-Sep-15	Fall	Red
23-Oct-15	Fall	Red
28-Jan-16	Winter	Green
27-Jul-16	Summer	Green
29-Sep-16	Fall	Red
31-Oct-16	Fall	Red
17-Nov-16	Fall	Red
28-Sep-17	Fall	Red



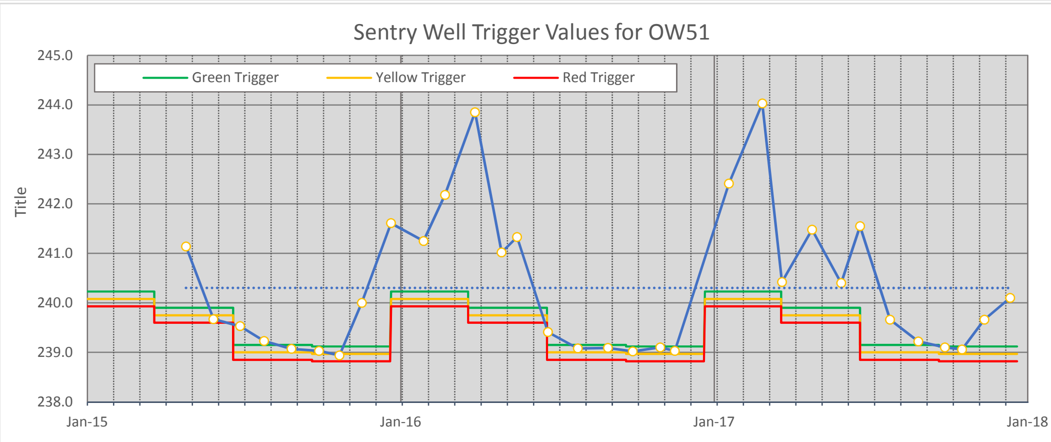
Trigger Exceedences (OW47s)

Date	Season	Trigger Type
27-Apr-15	Spring	Green
29-May-15	Spring	Green
23-Oct-15	Fall	Green
29-Apr-16	Spring	Green
22-Mar-17	Summer	Green
30-May-17	Spring	Green



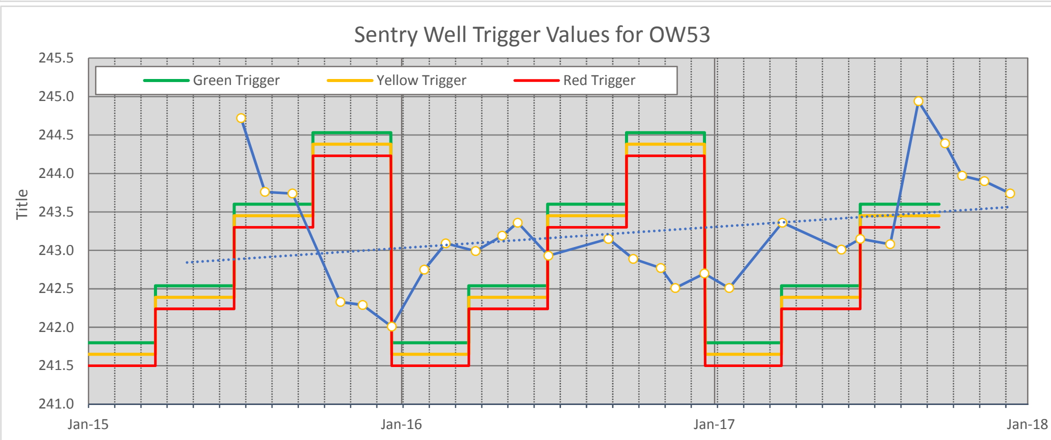
Trigger Exceedences (OW47d)

Date	Season	Trigger Type
27-Apr-15	Spring	Green
29-May-15	Spring	Yellow
29-Sep-15	Fall	Yellow
23-Oct-15	Fall	Red
26-Jul-16	Summer	Green
29-Sep-16	Fall	Yellow
31-Oct-16	Fall	Yellow
17-Nov-16	Fall	Yellow
28-Sep-17	Fall	Red
18-Oct-17	Fall	Green



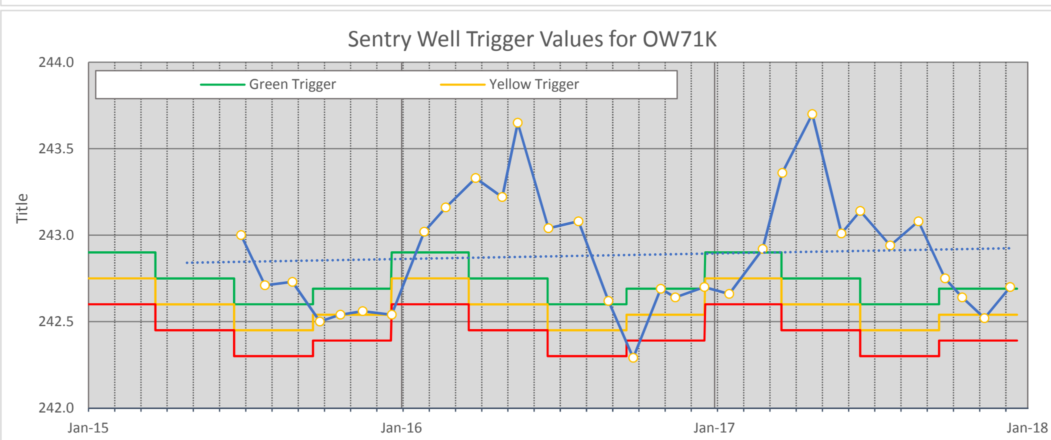
Trigger Exceedences (OW51d)

Date	Season	Trigger Type
29-May-15	Spring	Green
28-Aug-15	Spring	Green
29-Sep-15	Fall	Green
23-Oct-15	Fall	Yellow
26-Jul-16	Summer	Green
31-Aug-16	Fall	Green
29-Sep-16	Fall	Green
17-Nov-16	Fall	Green
28-Sep-17	Fall	Green
18-Oct-17	Fall	Green



Trigger Exceedences (OW53d)

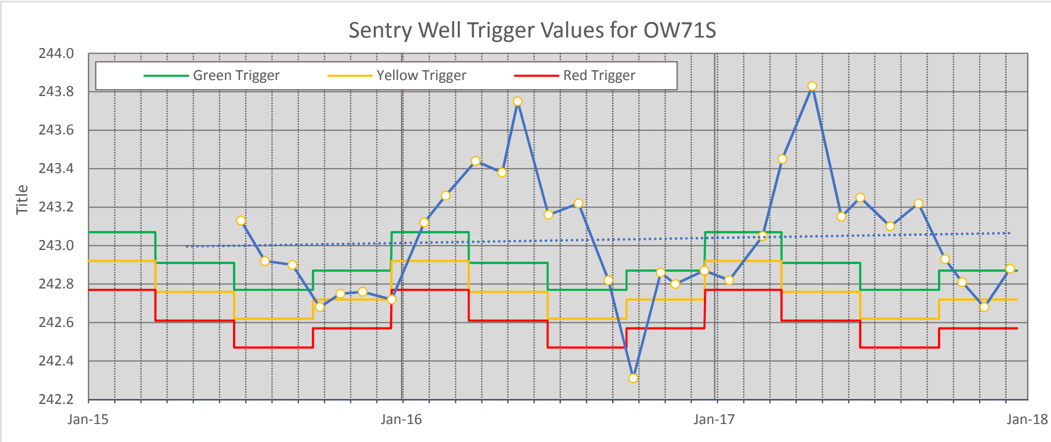
Date	Season	Trigger Type
23-Oct-15	Fall	Red
18-Nov-15	Fall	Red
31-Aug-16	Summer	Red
29-Sep-16	Fall	Red
31-Oct-16	Fall	Red
17-Nov-16	Fall	Red
26-Jul-17	Summer	Red



Trigger Exceedences (OW71K)

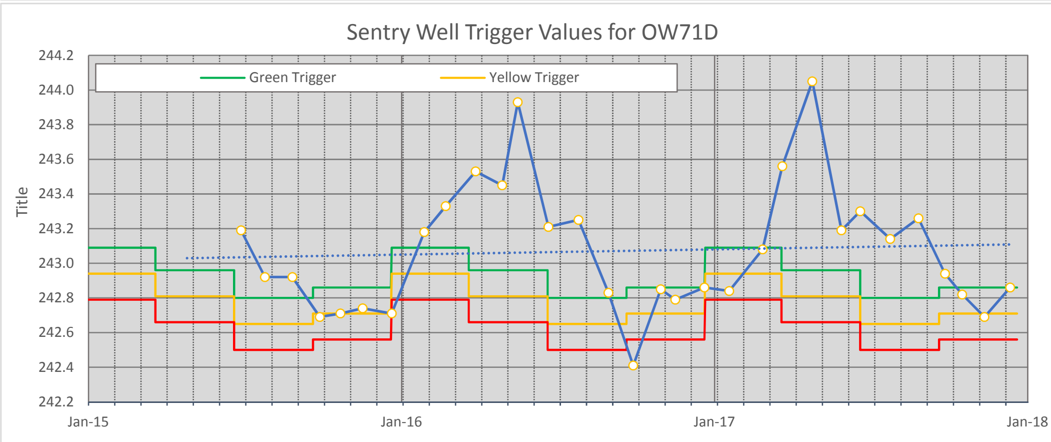
Date	Season	Trigger Type
29-Sep-15	Fall	Yellow
23-Oct-15	Fall	Yellow
18-Nov-15	Fall	Green
22-Dec-16	Winter	Red
29-Sep-16	Fall	Red
17-Nov-16	Fall	Green
21-Dec-16	Winter	Green
19-Jan-17	Winter	Yellow
18-Oct-17	Fall	Green
13-Nov-17	Fall	Yellow

Keppel Quarry: Appendix A-1c
Sentry Well Hydrographs and Trigger Values



Trigger Exceedences (OW71s)

Date	Season	Trigger Type
29-Sep-15	Fall	Yellow
22-Dec-16	Winter	Red
29-Sep-16	Fall	Red
17-Nov-16	Fall	Green
21-Dec-16	Winter	Green
19-Jan-17	Winter	Yellow
27-Feb-17	Winter	Green
18-Oct-17	Fall	Green
13-Nov-17	Fall	Yellow



Trigger Exceedences (OW71d)

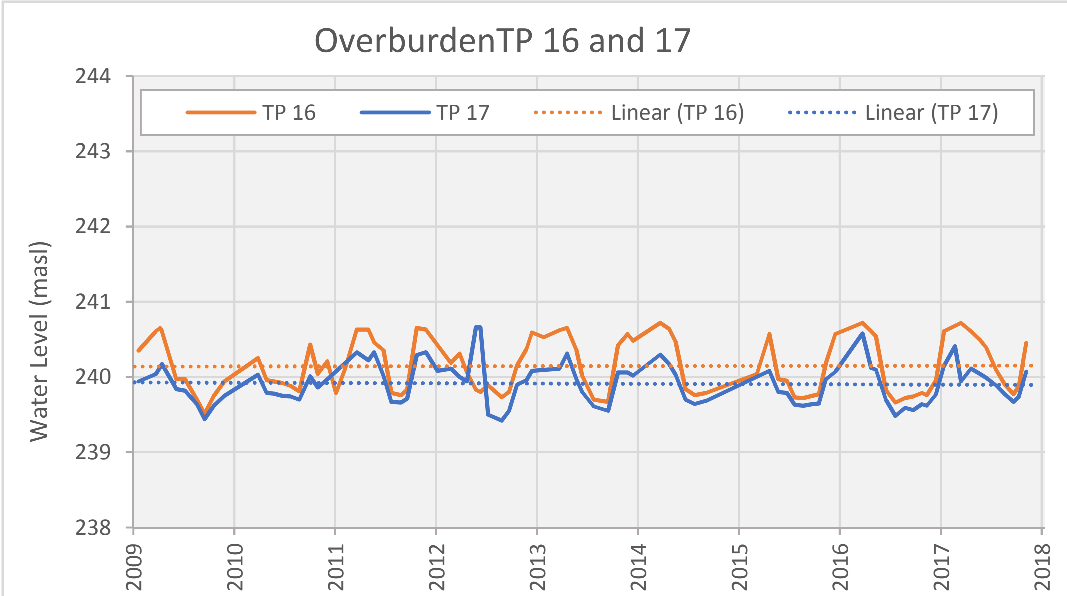
Date	Season	Trigger Type
29-Sep-15	Fall	Yellow
22-Dec-16	Winter	Red
29-Sep-16	Fall	Red
31-Oct-16	Fall	Green
17-Nov-16	Fall	Green
21-Dec-16	Winter	Green
19-Jan-17	Winter	Yellow
27-Feb-17	Winter	Green
18-Oct-17	Fall	Green
13-Nov-17	Fall	Yellow

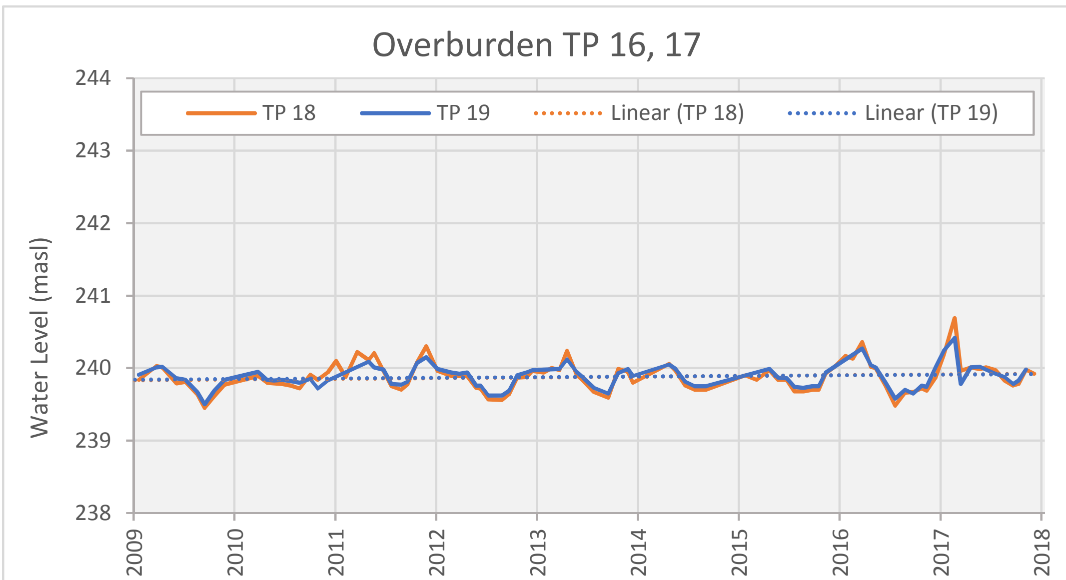
APPENDIX A: HYDROGEOLOGICAL ASSESSMENT (SUPPORTING INFORMATION)

APPENDIX A-1d

Hydrographs – Overburden Test Pits

Keppel Quarry: Appendix A-1d
Overburden Test Pits



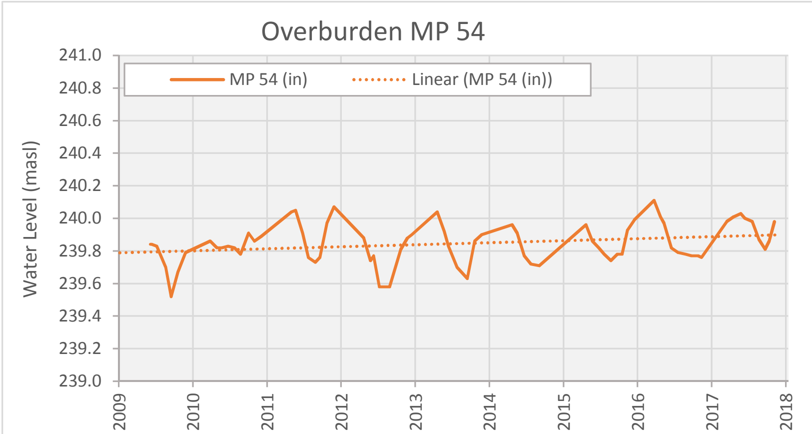


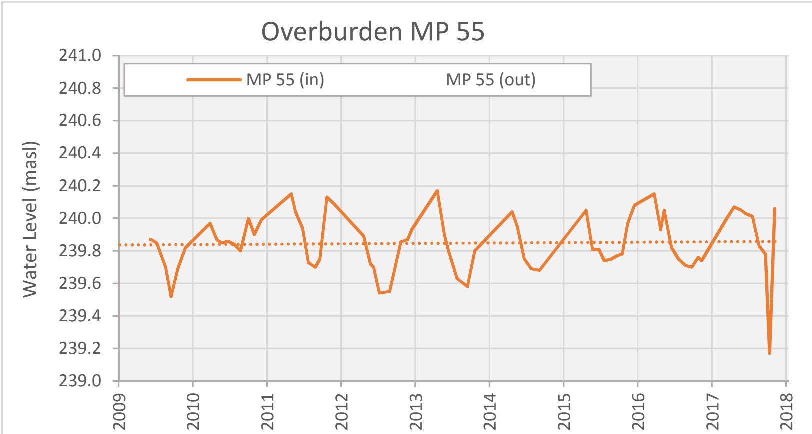
APPENDIX A: HYDROGEOLOGICAL ASSESSMENT (SUPPORTING INFORMATION)

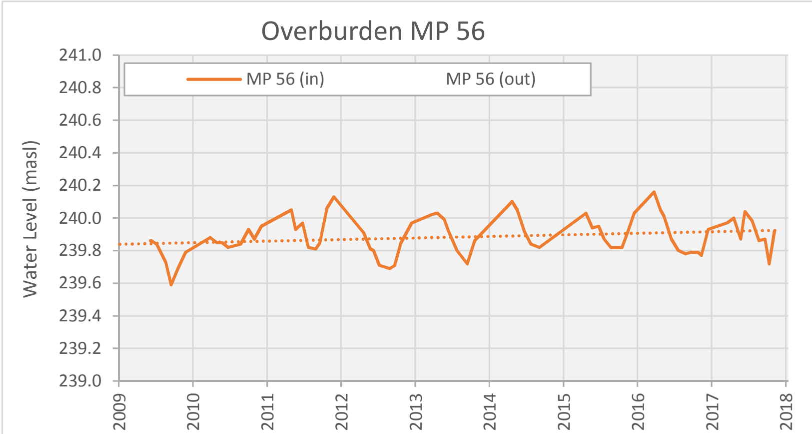
APPENDIX A-1e

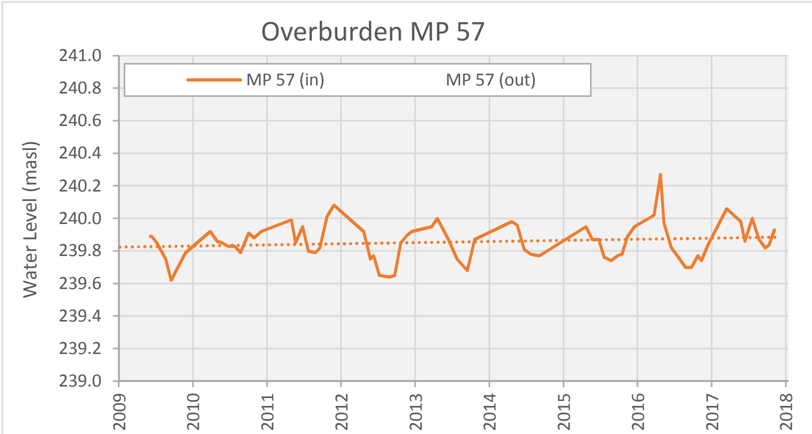
Hydrographs – Overburden Mini-Piezometers

Keppel Quarry: Appendix A1-e
Groundwater Hydrographs









APPENDIX A: HYDROGEOLOGICAL ASSESSMENT (SUPPORTING INFORMATION)

APPENDIX A-2

Distance – Water Level Plots

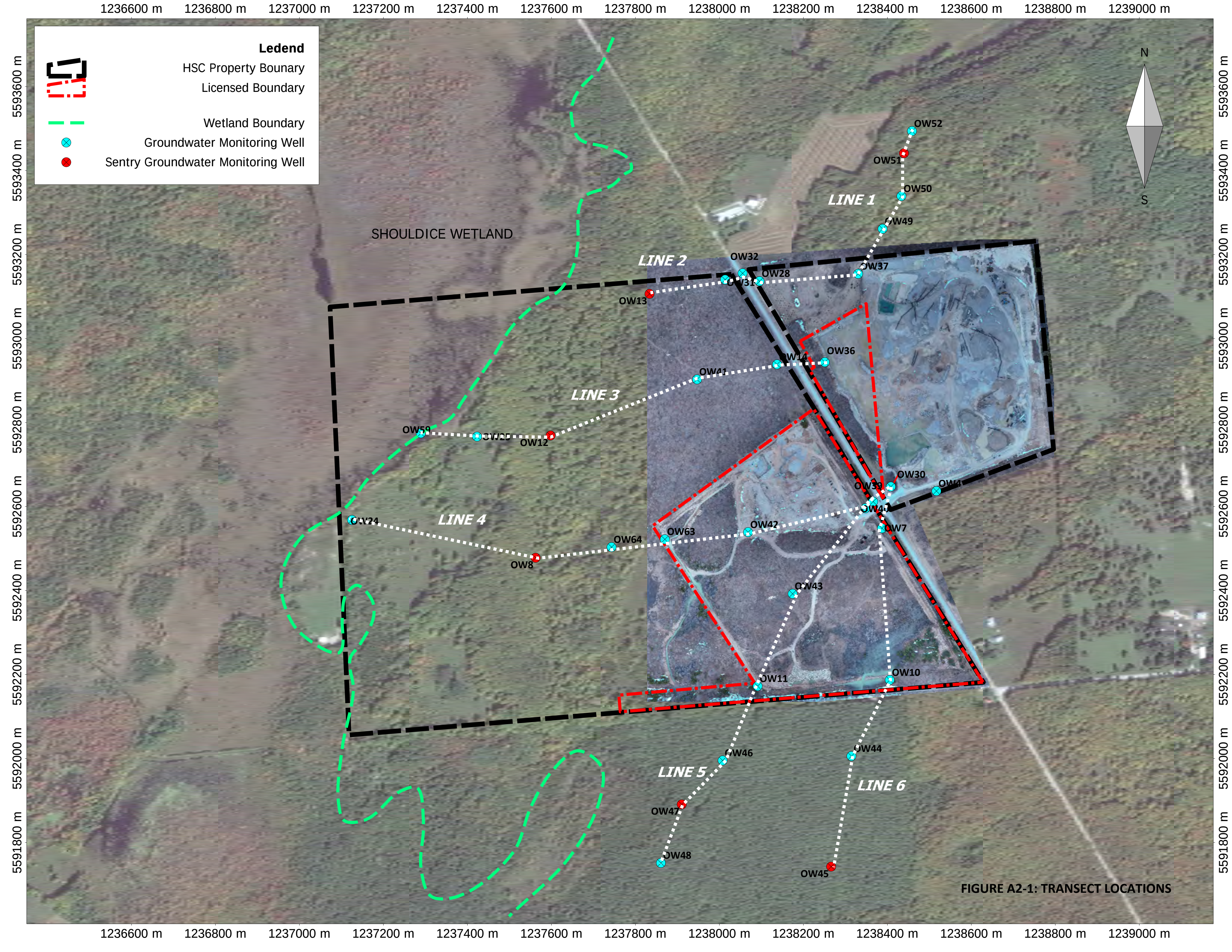
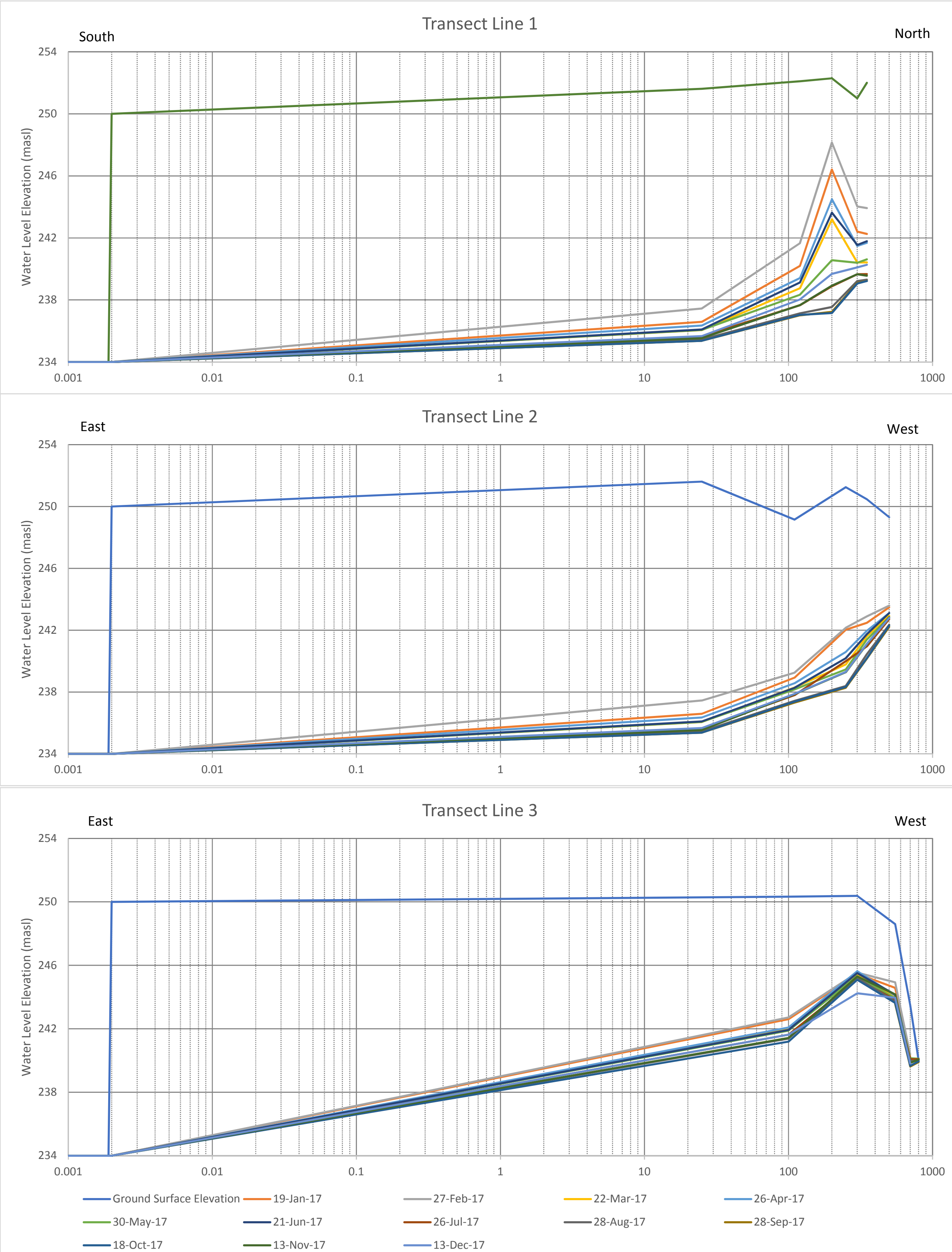
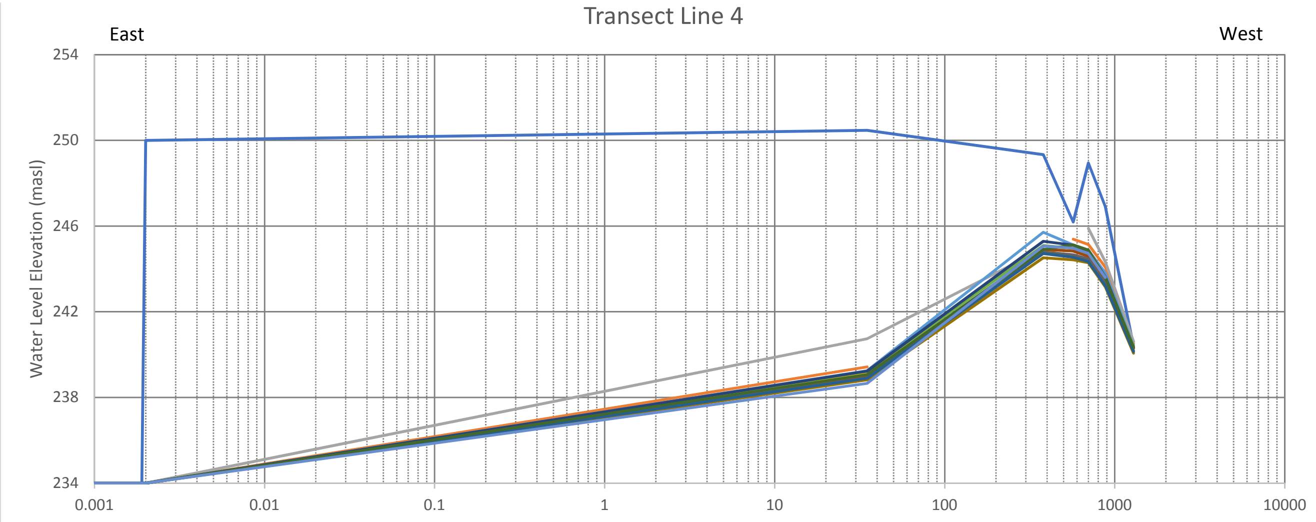


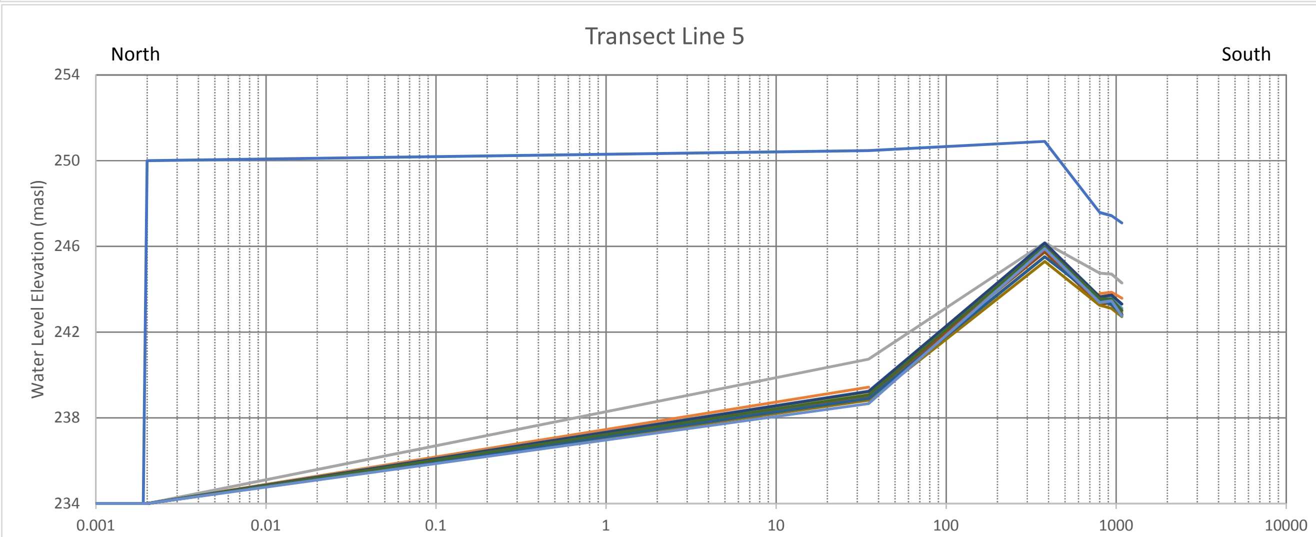
FIGURE A2-1: TRANSECT LOCATIONS

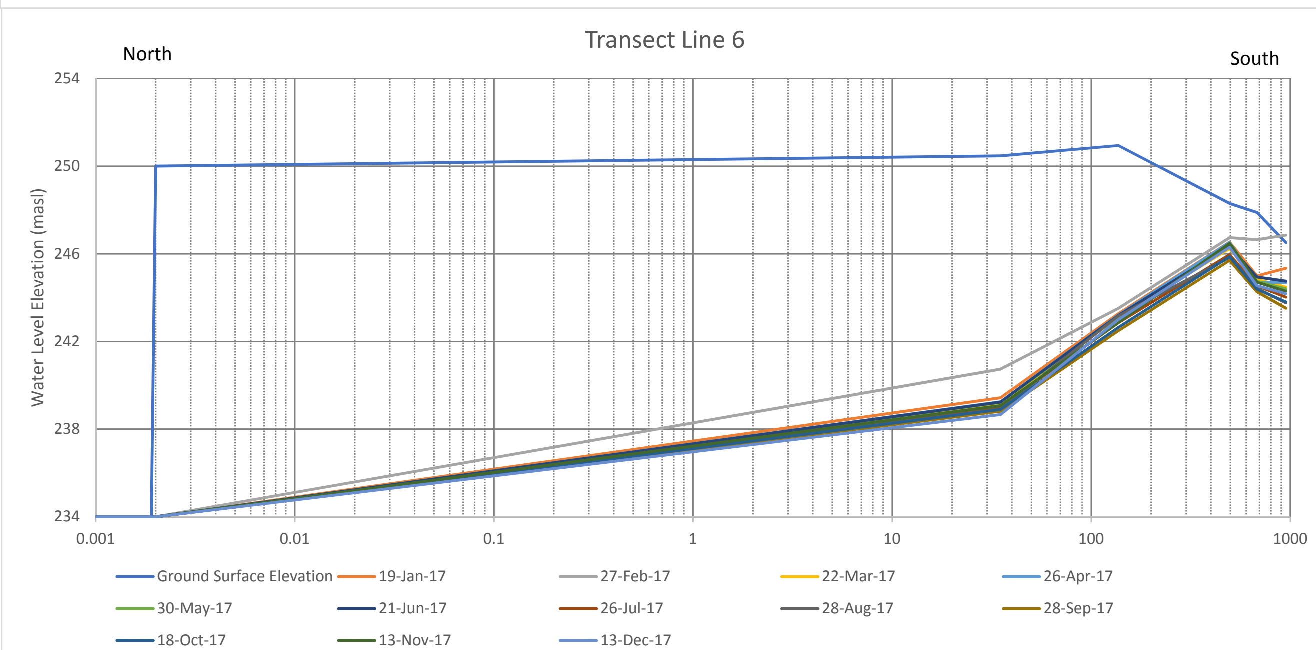
Keppel Quarry: Appendix A2
Distance-Water Level Graphs



Keppel Quarry: Appendix A2
Distance-Water Level Graphs







APPENDIX C: BLAST MONITORING

Whitewater
Hydrogeology Ltd.

80 Chamberlain Cres
Collingwood, ON L9Y 0C8
Phone: 705-888-7064
Email: tecia@white-water.ca

May 27, 2018

Harold Sutherland Construction
323545 East Linton Road, R.R #2
Kemble, Ontario, Canada N0H 1S0

Attention: Mr. Dave Munro

Re: Keppel Quarry: 2017 Blast Reporting

Dear Sir:

Whitewater Hydrogeology Ltd. (Whitewater) is pleased to present a summary of the 2017 Blasting Monitoring Program, which is a condition of the Aggregate Resource Act license for the Keppel Quarry. The Blasting Monitoring Program was developed to ensure that blasting operations are carried out in a safe and productive manner and to ensure no damage to any buildings, structures or residences surrounding the Keppel Quarry.

Blasts were designed by Austin Powder Ltd. so that the seismic activity (vibrations) and noise induced by blasting operations remain within the guidelines set by the Ministry of the Environment and Climate Change. Austin Powder Ltd. set up the primary monitors and HSCL we set up any additional monitors as required.

The Adaptive Management Plan (AMP) stipulates that all blasts be monitored for vibration and overpressure using digital seismographs. There were seven blasts in total, which took place on:

- January 4 - 3:48pm
- June 2 - 1:24pm
- July 17 - 1:57pm
- August 4 - 3:18pm
- November 17 - 2:40pm
- December 4 - 3:21pm
- December 20 - 3:35pm

The recommended limit set by the MOECC for vibration and overpressure (noise) are as follows:

- • Vibration - 12.5 mm/sec; and
- • Overpressure (Noise) - 128 dB.

Event Reports showing noise and vibration readings measured in 2017 during each blast are appended and the results are summarized in Table 1.

TABLE 1: BLAST SUMMARY RESULTS

Receptor	Date	Blast Distance (m)	Overpressure (dB)	Vibration (mm/s)	Weather
178841 Grey Rd 17	Jan 4, 2017	568.45	**167**	5.006	Light Snow
	Jun 2, 2017	378.26	117	8.814	Clear
	Jul 17, 2017	355.09	malfunction	malfunction	Clear
	Aug 18, 2017	417.27	121	5.099	Clear
	Nov 17, 2017	605.03	121	NA	Partly Cloudy
	Dec 4, 2017	619.66	116	0.311	High Cloud Cover
	Dec 20, 2017	644.35	NR	NR	Partly Cloudy
283197 Conc Rd 10	Jan 4, 2017	1,096.67	116	2.679	Light Snow
	Jun 2, 2017	1,126.24	116	0.254	Clear
	Jul 17, 2017	1,146.96	117	2.328	Clear
	Aug 18, 2017	1,088.44	117	1.836	Clear
	Nov 17, 2017	1,036.93	NR	NR	Partly Cloudy
	Dec 4, 2017	958.90	NR	NR	High Cloud Cover
	Dec 20, 2017	1,033.88	NR	NR	Partly Cloudy
178717 Grey Rd 17	Jan 4, 2017	673.91	116	3.827	Light Snow
	Jun 2, 2017	817.17	124	0.359	Clear
	Jul 17, 2017	826.62	122	0.381	Clear
	Aug 18, 2017	750.72	120	3.986	Clear
	Nov 17, 2017	NR	NR	NR	Partly Cloudy
	Dec 4, 2017	558.09	NR	NR	High Cloud Cover
	Dec 20, 2017	601.68	113	2.924	Partly Cloudy
178706 Grey Rd 17	Jan 4, 2017	730.30	118	3.646	Light Snow
	Jun 2, 2017	892.76	123	0.311	Clear
	Jul 17, 2017	901.29	120	0.311	Clear
	Aug 18, 2017	823.87	118	1.591	Clear
	Nov 17, 2017	714.76	118	NA	Partly Cloudy
	Dec 4, 2017	623.01	NR	NR	High Cloud Cover
	Dec 20, 2017	697.38	NR	NR	Partly Cloudy

Notes: NR = Not Registered

Seismograph readings showed that vibrations levels ranged from not registered 8.814 mm/sec. Overpressure readings ranged from to not registered to 167 dB average. All measured vibration levels were below the recommended MOECC limit in 2017. There was a single overpressure exceedance in 2017, which occurred at 178841 Grey Rd 17 on January 4, 2017 (167 dB). This exceedance was likely to the light snow conditions that day.

No flyrock was generated beyond the blast area in any of the blasts in 2017.

If you have any questions, please do not hesitate to call anytime.

5/27/2018

X Tecia White

Tecia White, M.Sc., P.Geo (License 0701)
Senior Hydrogeologist / Present
Signed by: Tecia

AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-01	Blast Type:	Stone Quarry/Stone Mine - Sinking Cut/ Sump	Customer:	HAROLD SUTHERLAND CONST.-KEPPLE (HAR1525-001)
Date/Time:	01/04/2017 15:41	Pit/Permit:	KEPPLE QUARRY / SHOT SERVICE	Location:	New Quarry

ENVIRONMENT

Method Used:	U.T.M.	Weather:	Light Snow	Wind From:	W
Temperature:	-7 °C	Terrain:	Flat	Wind Velocity:	20-68 km/h
Blast U.T.M.:	17N 500163 mE 4942446 mN				

NEAREST PROTECTED STRUCTURE

		Compass Point:	NNW
Structure Name:	178841 Grey Road #17	Direction/Bearing:	354 °
Structure Type:	Dwelling	Distance:	568 m
Structure U.T.M.:	17N 500101 mE 4943011 mN		

LAYOUT

		Hole Depth:	9.14-13.41 m	Material Blasted:	Limestone	Total Meters Drilled:	999.1 m
No. of Holes:	104	Subdrilling:	0.00 m	Burden:	3.05 m	Water Depth:	max 13.41 m
No. of V.P.† Holes:	100	Face Height:	9.14-13.41 m	Spacing:	3.05 m	Stem Length:	min 2.13 m
No. of Rows:	10	Drilling Angle:	0 °	Back Fill Depth:	0.00 m	Area Type:	Sinking Cut/Ditch
Diameter:	101.6 mm	Mats Used:	No	Stem Type:	Clear Stone	Method:	Weighted Average (H = 9.53 m)

† V.P. = Volume Producing

WEIGHTS

		Max. Wt. of Expl. in Overlapped Decks:	369.7 kg	Volume Produced:	7,170.0 m^3
Initiation:	Electronic	Max. Wt. of Expl. Per 8 ms Interval:	369.7 kg	Weight Produced:	18,997.5 t
Firing Device:	E*Star Blasting Machine (WRFD)	Max. No. of Holes Per 8 ms Interval:	4	Powder Factor 1:	2.374 t/kg
Other Method:		Max. Wt. of Explosive Per Hole:	119.5 kg	Powder Factor 2:	1.117 kg/m^3
Mfg and Model:	DBM1600-2-RC	Scaled Distance Factor (max charge):	52.00	Rock Density:	2.650 t/m^3
Initiation Settings:		Scaled Distance Factor (per delay):	29.57		
Series Resistance (ohms):					

SEISMOGRAPHS See seismographs on separate page

CREW

Blast occurred other than scheduled time: No   Misfire Occurred: No   Protective Cover: Loader Bucket

Last Name	First Name	License / Cert	2nd License / Cert	In Charge	Tied In	Chk. Tie-In	Driller	Layout
SMART	EVAN, C	* ON - N/A		Yes	Yes	Yes	No	Yes
BELTRAME	ALEXANDER, A			No	Yes	No	No	No
CHOLEWA	CHRISTOPHER, R			No	Yes	No	No	No
NEWTON	JOHN, D			No	Yes	Yes	No	No
O'DONOHOE	LIAM, J			No	Yes	No	No	No
REED	ADAM, G			No	Yes	No	No	No

AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-01	Blast Type:	Stone Quarry/Stone Mine - Sinking Cut/ Sump	Customer:	HAROLD SUTHERLAND CONST.-KEPPLE (HAR1525-001)
Date/Time:	01/04/2017 15:41	Pit/Permit:	KEPPLE QUARRY / SHOT SERVICE	Location:	New Quarry

PRODUCTS AND SERVICES

Number	Product Description	Quantity		Weight (kg)
11782	Electro*Star Booster - 454g (1 lb)	208.00	ea	96.22
12570	24' ELECTRO*STAR Electronic Det-CWBS	104.00	ea	0.00
12566	60' ELECTRO*STAR Electronic Det-CWBS	104.00	ea	0.00
12276	Electro*Star Bus Wire - 1250' spool	2.00	sp	0.00
07602	Hydromite 4100 Bulk	7,909.00	kg	7,909.00
12981	Mini Stem Plug - 6015	104.00	ea	0.00
	Total Weight of Explosives (Include Primers) (kg):			8,005.22

COMMENTS / EXPLANATIONS

General Comments: Imported on 1/5/2017 8:25:34 AM

Signature of Blaster in Charge

AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-01	Blast Type:	Stone Quarry/Stone Mine - Sinking Cut/ Sump	Customer:	HAROLD SUTHERLAND CONST.-KEPPLE (HAR1525-001)
Date/Time:	01/04/2017 15:41	Pit/Permit:	KEPPLE QUARRY / SHOT SERVICE	Location:	New Quarry

SEISMOGRAPH 1 - 178841 GREY ROAD #17

Data Type:	Seismic Record	Seismograph Type:	Instantel Mini-Mate II			
Date:	01/04/17	Trigger Level:	1.50 mm/s 115.00 dB	Transverse:	1.651 mm/s	30.0 Hz
Time:	15:41	Calibration Date:	01/20/16	Vertical:	3.556 mm/s	9.8 Hz
Distance From Blast:	568.45 m	Calibration Signal:		Longitudinal:	4.699 mm/s	20.0 Hz
Direction From Blast:	NNW	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:	Printed Copy	Mic. Min. Freq.:	--- Hz	Acoustic:	167 dB	
Location:	Bolted to bedrock at the front of the property. Unit #233.			Vector Sum:	5.006 mm/s	
U.T.M.:	17N 500101 mE 4943011 mN					
Reader and Firm:	Evan Smart, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	Evan Smart, Austin Powder Ltd.					

SEISMOGRAPH 2 - 283197 CONC. RD. 10

Data Type:	Seismic Record	Seismograph Type:	Instantel Mini-Mate II			
Date:	01/04/17	Trigger Level:	1.50 mm/s 115.00 dB	Transverse:	1.016 mm/s	51.0 Hz
Time:	15:41	Calibration Date:	01/20/16	Vertical:	2.54 mm/s	27.0 Hz
Distance From Blast:	1,096.67 m	Calibration Signal:		Longitudinal:	1.524 mm/s	15.0 Hz
Direction From Blast:	ESE	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:	Printed Copy	Mic. Min. Freq.:	--- Hz	Acoustic:	116 dB	
Location:	Buried at the road.			Vector Sum:	2.679 mm/s	
U.T.M.:	17N 501117 mE 4941905 mN					
Reader and Firm:	Evan Smart, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	Evan Smart, Austin Powder Ltd.					

SEISMOGRAPH 3 - 178717 GREY RD #17

Data Type:	Seismic Record	Seismograph Type:	Instantel - Minimate Blaster			
Date:	01/04/17	Trigger Level:	1.50 mm/s 115.00 dB	Transverse:	1.524 mm/s	20.0 Hz
Time:	15:41	Calibration Date:	01/20/16	Vertical:	3.683 mm/s	11.0 Hz
Distance From Blast:	673.91 m	Calibration Signal:	OK	Longitudinal:	2.032 mm/s	21.0 Hz
Direction From Blast:	SE	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:	Printed Copy	Mic. Min. Freq.:	--- Hz	Acoustic:	116 dB	
Location:	Spiked and buried.			Vector Sum:	3.827 mm/s	
U.T.M.:	17N 500660 mE 4941991 mN					
Reader and Firm:	Evan Smart, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	Evan Smart, Austin Powder Ltd.					

AUSTIN POWDER LTD.
BLAST REPORT

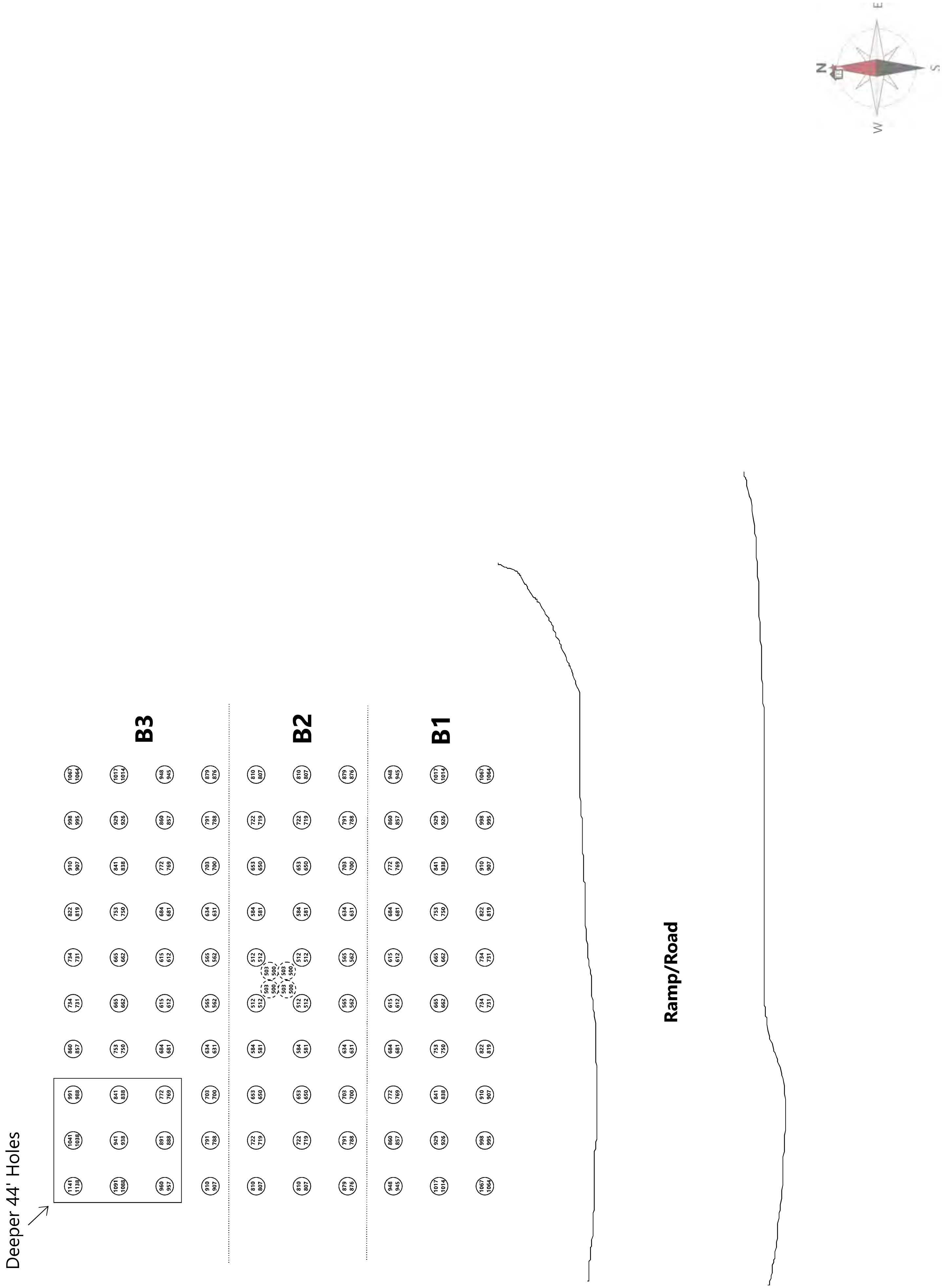
327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-01	Blast Type:	Stone Quarry/Stone Mine - Sinking Cut/ Sump	Customer:	HAROLD SUTHERLAND CONST.-KEPPLE (HAR1525-001)
Date/Time:	01/04/2017 15:41	Pit/Permit:	KEPPLE QUARRY / SHOT SERVICE	Location:	New Quarry

SEISMOGRAPH 4 - 178706 GREY RD #17

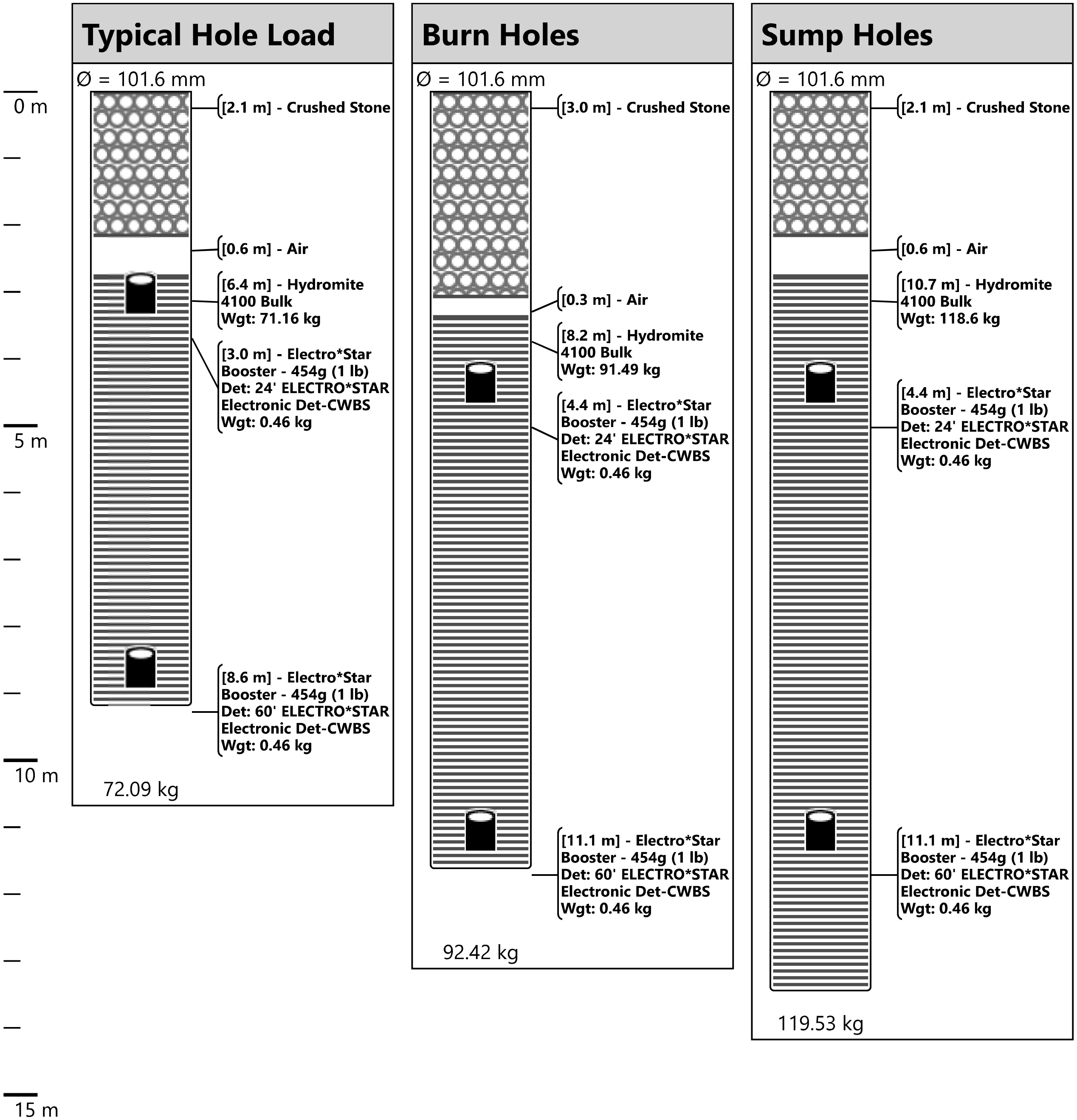
Data Type:	Seismic Record	Seismograph Type:	Instantel - Minimate Blaster				
Date:	01/04/17	Trigger Level:	1.50 mm/s	115.00 dB	Transverse:	1.651 mm/s	51.0 Hz
Time:	15:41	Calibration Date:	01/08/16		Vertical:	2.667 mm/s	11.0 Hz
Distance From Blast:	730.30 m	Calibration Signal:	OK		Longitudinal:	2.794 mm/s	32.0 Hz
Direction From Blast:	SE	Geophone Min. Freq.:	--- Hz		PPV:	--- mm/s	--- Hz
Readout:	Printed Copy	Mic. Min. Freq.:	--- Hz		Acoustic:	118 dB	
Location:	Spiked and weight bagged in the front yard.				Vector Sum:	3.646 mm/s	
U.T.M.:	17N 500660 mE 4941911 mN						
Reader and Firm:	Evan Smart, AUSTIN POWDER						
Analyst and Firm:							
Installer and Firm:	Evan Smart, Austin Powder Ltd.						

Hole Label Mode: Cumulative In-Hole Delays



Hole	Load	Surface Delay	Deck 1 Delay
A1	Sump Holes	0	1138/1141
A2	Sump Holes	0	1038/1041
A3	Sump Holes	0	988/991
A4	Typical Hole Load	0	857/860
A5	Typical Hole Load	0	731/734
A6	Typical Hole Load	0	731/734
A7	Typical Hole Load	0	819/822
A8	Typical Hole Load	0	907/910
A9	Typical Hole Load	0	995/998
A10	Typical Hole Load	0	1064/1067
B1	Sump Holes	0	1088/1091
B2	Sump Holes	0	938/941
B3	Sump Holes	0	838/841
B4	Typical Hole Load	0	750/753
B5	Typical Hole Load	0	662/665
B6	Typical Hole Load	0	662/665
B7	Typical Hole Load	0	750/753
B8	Typical Hole Load	0	838/841
B9	Typical Hole Load	0	926/929
B10	Typical Hole Load	0	1014/1017
C1	Sump Holes	0	957/960
C2	Sump Holes	0	888/891
C3	Sump Holes	0	769/772
C4	Typical Hole Load	0	681/684
C5	Typical Hole Load	0	612/615
C6	Typical Hole Load	0	612/615
C7	Typical Hole Load	0	681/684
C8	Typical Hole Load	0	769/772
C9	Typical Hole Load	0	857/860
C10	Typical Hole Load	0	945/948
D1	Typical Hole Load	0	907/910
D2	Typical Hole Load	0	788/791
D3	Typical Hole Load	0	700/703
D4	Typical Hole Load	0	631/634
D5	Typical Hole Load	0	562/565
D6	Typical Hole Load	0	562/565
D7	Typical Hole Load	0	631/634
D8	Typical Hole Load	0	700/703
D9	Typical Hole Load	0	788/791
D10	Typical Hole Load	0	876/879
E1	Typical Hole Load	0	807/810
E2	Typical Hole Load	0	719/722
E3	Typical Hole Load	0	650/653
E4	Typical Hole Load	0	581/584
E5	Typical Hole Load	0	512/512
E6	Typical Hole Load	0	512/512
E7	Typical Hole Load	0	581/584
E8	Typical Hole Load	0	650/653
E9	Typical Hole Load	0	719/722
E10	Typical Hole Load	0	807/810
F1	Typical Hole Load	0	807/810
F2	Typical Hole Load	0	719/722
F3	Typical Hole Load	0	650/653
F4	Typical Hole Load	0	581/584
F5	Typical Hole Load	0	512/512
F6	Typical Hole Load	0	512/512
F7	Typical Hole Load	0	581/584
F8	Typical Hole Load	0	650/653
F9	Typical Hole Load	0	719/722
F10	Typical Hole Load	0	807/810
G1	Typical Hole Load	0	876/879
G2	Typical Hole Load	0	788/791
G3	Typical Hole Load	0	700/703
G4	Typical Hole Load	0	631/634
G5	Typical Hole Load	0	562/565
G6	Typical Hole Load	0	562/565
G7	Typical Hole Load	0	631/634
G8	Typical Hole Load	0	700/703
G9	Typical Hole Load	0	788/791
G10	Typical Hole Load	0	876/879
H1	Typical Hole Load	0	945/948
H2	Typical Hole Load	0	857/860
H3	Typical Hole Load	0	769/772
H4	Typical Hole Load	0	681/684
H5	Typical Hole Load	0	612/615
H6	Typical Hole Load	0	612/615
H7	Typical Hole Load	0	681/684
H8	Typical Hole Load	0	769/772
H9	Typical Hole Load	0	857/860
H10	Typical Hole Load	0	945/948
I1	Typical Hole Load	0	1014/1017
I2	Typical Hole Load	0	926/929
I3	Typical Hole Load	0	838/841
I4	Typical Hole Load	0	750/753
I5	Typical Hole Load	0	662/665
I6	Typical Hole Load	0	662/665
I7	Typical Hole Load	0	750/753
I8	Typical Hole Load	0	838/841
I9	Typical Hole Load	0	926/929
I10	Typical Hole Load	0	1014/1017
J1	Typical Hole Load	0	1064/1067
J2	Typical Hole Load	0	995/998

Hole	Load	Surface Delay	Deck 1 Delay
J3	Typical Hole Load	0	907/910
J4	Typical Hole Load	0	819/822
J5	Typical Hole Load	0	731/734
J6	Typical Hole Load	0	731/734
J7	Typical Hole Load	0	819/822
J8	Typical Hole Load	0	907/910
J9	Typical Hole Load	0	995/998
J10	Typical Hole Load	0	1064/1067
ZZ103	Burn Holes	0	500/503
ZZ102	Burn Holes	0	500/503
ZZ105	Burn Holes	0	500/503
ZZ104	Burn Holes	0	500/503


Typical Hole Load
Ø = 101.6 mm
[2.1 m] - Crushed Stone
[0.6 m] - Air
[6.4 m] - Hydromite 4100 Bulk Wgt: 71.16 kg
[3.0 m] - Electro*Star Booster - 454g (1 lb) Det: 24' ELECTRO*STAR Electronic Det-CWBS Wgt: 0.46 kg
[8.6 m] - Electro*Star Booster - 454g (1 lb) Det: 60' ELECTRO*STAR Electronic Det-CWBS Wgt: 0.46 kg
72.09 kg
Burn Holes
Ø = 101.6 mm
[3.0 m] - Crushed Stone
[0.3 m] - Air
[8.2 m] - Hydromite 4100 Bulk Wgt: 91.49 kg
[4.4 m] - Electro*Star Booster - 454g (1 lb) Det: 24' ELECTRO*STAR Electronic Det-CWBS Wgt: 0.46 kg
[11.1 m] - Electro*Star Booster - 454g (1 lb) Det: 60' ELECTRO*STAR Electronic Det-CWBS Wgt: 0.46 kg
92.42 kg
Sump Holes
Ø = 101.6 mm
[2.1 m] - Crushed Stone
[0.6 m] - Air
[10.7 m] - Hydromite 4100 Bulk Wgt: 118.6 kg
[4.4 m] - Electro*Star Booster - 454g (1 lb) Det: 24' ELECTRO*STAR Electronic Det-CWBS Wgt: 0.46 kg
[11.1 m] - Electro*Star Booster - 454g (1 lb) Det: 60' ELECTRO*STAR Electronic Det-CWBS Wgt: 0.46 kg
119.53 kg
0 m
5 m
10 m
15 m

AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-02	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	06/02/2017 13:24	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	North Bench

ENVIRONMENT

Method Used:	U.T.M.	Weather:	Clear	Wind From:	NW
Temperature:	14 °C	Terrain:	Flat	Wind Velocity:	18-28 km/h
Blast U.T.M.:	17N 500384 mE 4942760 mN				

NEAREST PROTECTED STRUCTURE

		Compass Point:	NW
Structure Name:	178841 Grey Rd #17	Direction/Bearing:	312 °
Structure Type:	Dwelling	Distance:	378 m
Structure U.T.M.:	17N 500101 mE 4943011 mN		

LAYOUT

		Hole Depth:	15.24 m	Material Blasted:	Limestone	Total Meters Drilled:	1,859.3 m
No. of Holes:	122	Subdrilling:	0.61 m	Burden:	3.35 m	Water Depth:	0.00 m
No. of V.P.[†] Holes:	122	Face Height:	14.63 m	Spacing:	3.66 m	Stem Length:	min 2.44 m
No. of Rows:	5	Drilling Angle:	0 °	Back Fill Depth:	0.00 m	Area Type:	Conventional
Diameter:	114.3 mm	Mats Used:	No	Stem Type:	Clear Stone	Method:	Specified (H = 14.63 m)

† V.P. = Volume Producing

WEIGHTS

		Max. Wt. of Expl. in Overlapped Decks:	450.9 kg	Volume Produced:	21,888.7 m^3
Initiation:	Electronic	Max. Wt. of Expl. Per 8 ms Interval:	450.9 kg	Weight Produced:	57,995.6 t
Firing Device:	E*Star Blasting Machine (WRFD)	Max. No. of Holes Per 8 ms Interval:	3	Powder Factor 1:	3.250 t/kg
Other Method:		Max. Wt. of Explosive Per Hole:	150.3 kg	Powder Factor 2:	0.815 kg/m^3
Mfg and Model:	DBM1600-2-RC	Scaled Distance Factor (max charge):	30.85	Rock Density:	2.650 t/m^3
Initiation Settings:		Scaled Distance Factor (per delay):	17.81		
Series Resistance (ohms):					

SEISMOGRAPHS See seismographs on separate page

CREW

Blast occurred other than scheduled time: No Misfire Occurred: No Protective Cover: Loader Bucket

Last Name	First Name	License / Cert	2nd License / Cert	In Charge	Tied In	Chk. Tie-In	Driller	Layout
SMART	EVAN, C	* ON - N/A		Yes	No	Yes	No	Yes
BELTRAME	ALEXANDER, A			No	No	No	No	No
EDDY	MATTHEW, A			No	Yes	No	No	No
NEWTON	JOHN, D			No	Yes	Yes	No	No
O'DONOHOE	LIAM, J			No	No	No	No	No
REED	ADAM, G			No	Yes	No	No	No
SLATCHER	DOUGLAS, C			No	No	No	No	No

AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

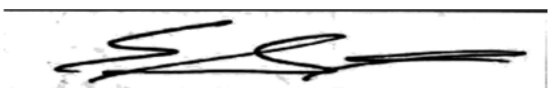
Blast No.:	2017-02	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	06/02/2017 13:24	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	North Bench

PRODUCTS AND SERVICES

Number	Product Description	Quantity		Weight (kg)
11782	Electro*Star Booster - 454g (1 lb)	246.00	ea	113.80
15001	24' E*STAR Detonator - QM	120.00	ea	0.00
15030	60' E*STAR Detonator - QM/HD	126.00	ea	0.00
12276	Electro*Star Bus Wire - 1250' spool	1.00	sp	0.00
07602	Hydromite 4100 Bulk	17,650.00	kg	17,650.00
20334	Hydromite 880 76x400 (3x16)	17.00	st	85.00
12981	Mini Stem Plug - 6015	122.00	ea	0.00
	Total Weight of Explosives (Include Primers) (kg):			17,848.80

COMMENTS / EXPLANATIONS

General Comments: Imported on 6/2/2017 2:18:40 PM



Signature of Blaster in Charge

AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.: 2017-02 | Blast Type: Stone Quarry/Stone Mine - Production | Customer: HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)

Date/Time: 06/02/2017 13:24 | Pit/Permit: KEPPEL QUARRY / SHOT SERVICE | Location: North Bench

SEISMOGRAPH 1 - 178841 GREY ROAD #17

Data Type:	Seismic Record	Seismograph Type:	Instantel - Minimate Blaster			
Date:	06/02/17	Trigger Level:	1.50 mm/s 115.00 dB	Transverse:	7.239 mm/s	24.0 Hz
Time:	13:24	Calibration Date:	02/02/17	Vertical:	3.048 mm/s	37.0 Hz
Distance From Blast:	378.26 m	Calibration Signal:	OK	Longitudinal:	8.509 mm/s	28.0 Hz
Direction From Blast:	NW	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:	Printed Copy	Mic. Min. Freq.:	--- Hz	Acoustic:	117 dB	
Location:	Bolted to bedrock.			Vector Sum:	8.814 mm/s	
U.T.M.:	17N 500101 mE 4943011 mN					
Reader and Firm:	Evan Smart, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	Evan Smart, Austin Powder Ltd.					

SEISMOGRAPH 2 - 178717 GREY RD #17

Data Type:	Seismic Record	Seismograph Type:	Instantel - Minimate Blaster			
Date:	06/02/17	Trigger Level:	1.50 mm/s 115.00 dB	Transverse:	0.127 mm/s	0.0 Hz
Time:	13:24	Calibration Date:	02/01/17	Vertical:	0.254 mm/s	0.0 Hz
Distance From Blast:	817.17 m	Calibration Signal:	OK	Longitudinal:	0.254 mm/s	0.0 Hz
Direction From Blast:	SSE	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:	Printed Copy	Mic. Min. Freq.:	--- Hz	Acoustic:	124 dB	
Location:	Spiked and buried.			Vector Sum:	0.359 mm/s	
U.T.M.:	17N 500660 mE 4941991 mN					
Reader and Firm:	Evan Smart, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	Evan Smart, Austin Powder Ltd.					

SEISMOGRAPH 3 - 178706 GREY RD #17

Data Type:	Seismic Record	Seismograph Type:	Instantel - Minimate Blaster			
Date:	06/02/17	Trigger Level:	1.50 mm/s 115.00 dB	Transverse:	0.127 mm/s	0.0 Hz
Time:	13:24	Calibration Date:	01/24/17	Vertical:	0.127 mm/s	0.0 Hz
Distance From Blast:	892.76 m	Calibration Signal:	OK	Longitudinal:	0.127 mm/s	0.0 Hz
Direction From Blast:	SSE	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:	Printed Copy	Mic. Min. Freq.:	--- Hz	Acoustic:	123 dB	
Location:	Spiked and weight bagged in front yard			Vector Sum:	0.311 mm/s	
U.T.M.:	17N 500660 mE 4941911 mN					
Reader and Firm:	Evan Smart, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	Evan Smart, Austin Powder Ltd.					

AUSTIN POWDER LTD.
BLAST REPORT

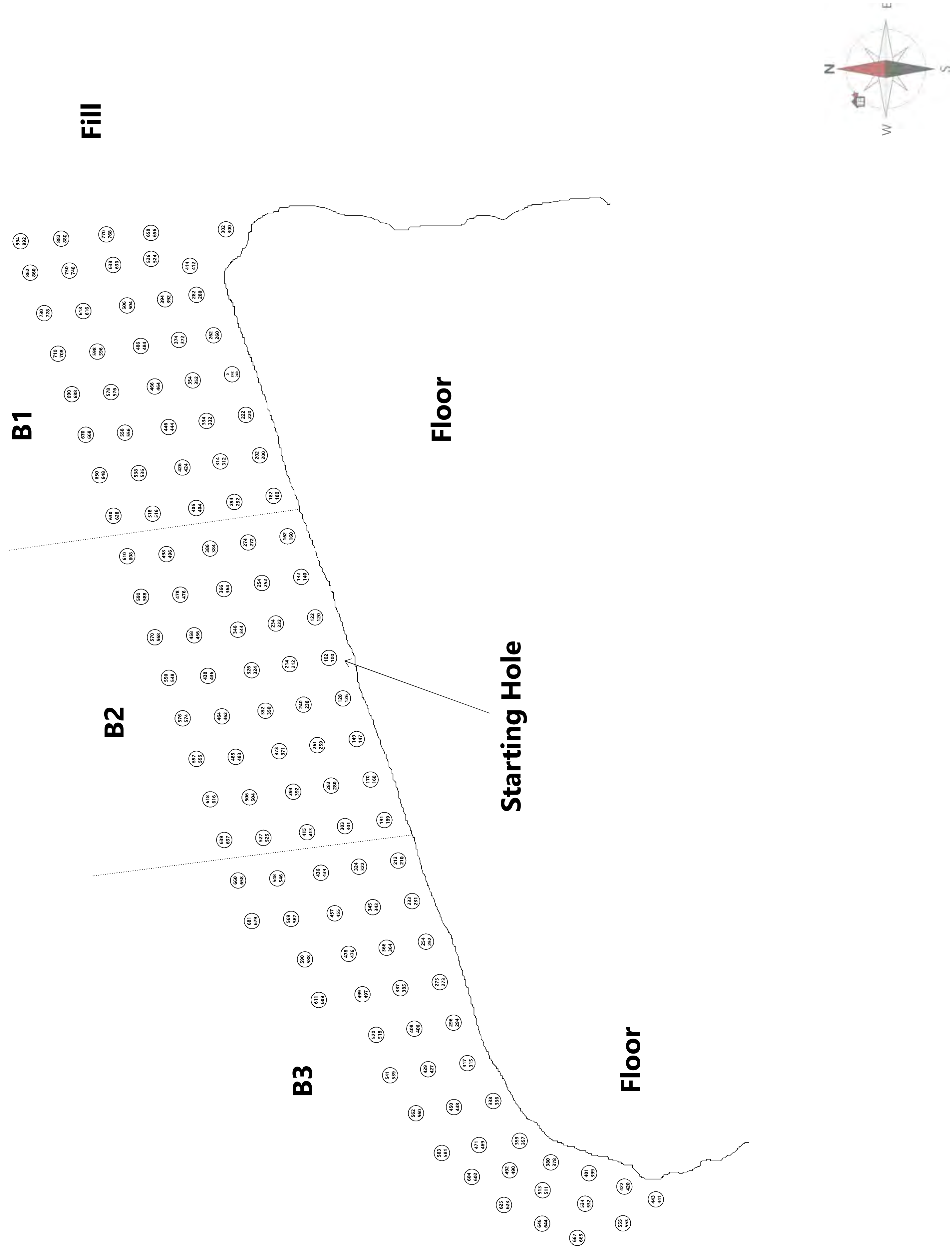
327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-02	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	06/02/2017 13:24	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	North Bench

SEISMOGRAPH 4 - 283197 CONC. RD. #10

Data Type:	Seismic Record	Seismograph Type:	Instanel - Minimate Blaster			
Date:	06/02/17	Trigger Level:	1.50 mm/s 115.00 dB	Transverse:	0.254 mm/s	0.0 Hz
Time:	13:24	Calibration Date:	01/24/17	Vertical:	0.127 mm/s	0.0 Hz
Distance From Blast:	1,126.24 m	Calibration Signal:	OK	Longitudinal:	0.127 mm/s	0.0 Hz
Direction From Blast:	SE	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:	Printed Copy	Mic. Min. Freq.:	--- Hz	Acoustic:	116 dB	
Location:	Spiked and buried.			Vector Sum:	0.254 mm/s	
U.T.M.:	17N 501117 mE 4941905 mN					
Reader and Firm:	Evan Smart, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	Evan Smart, Austin Powder Ltd.					

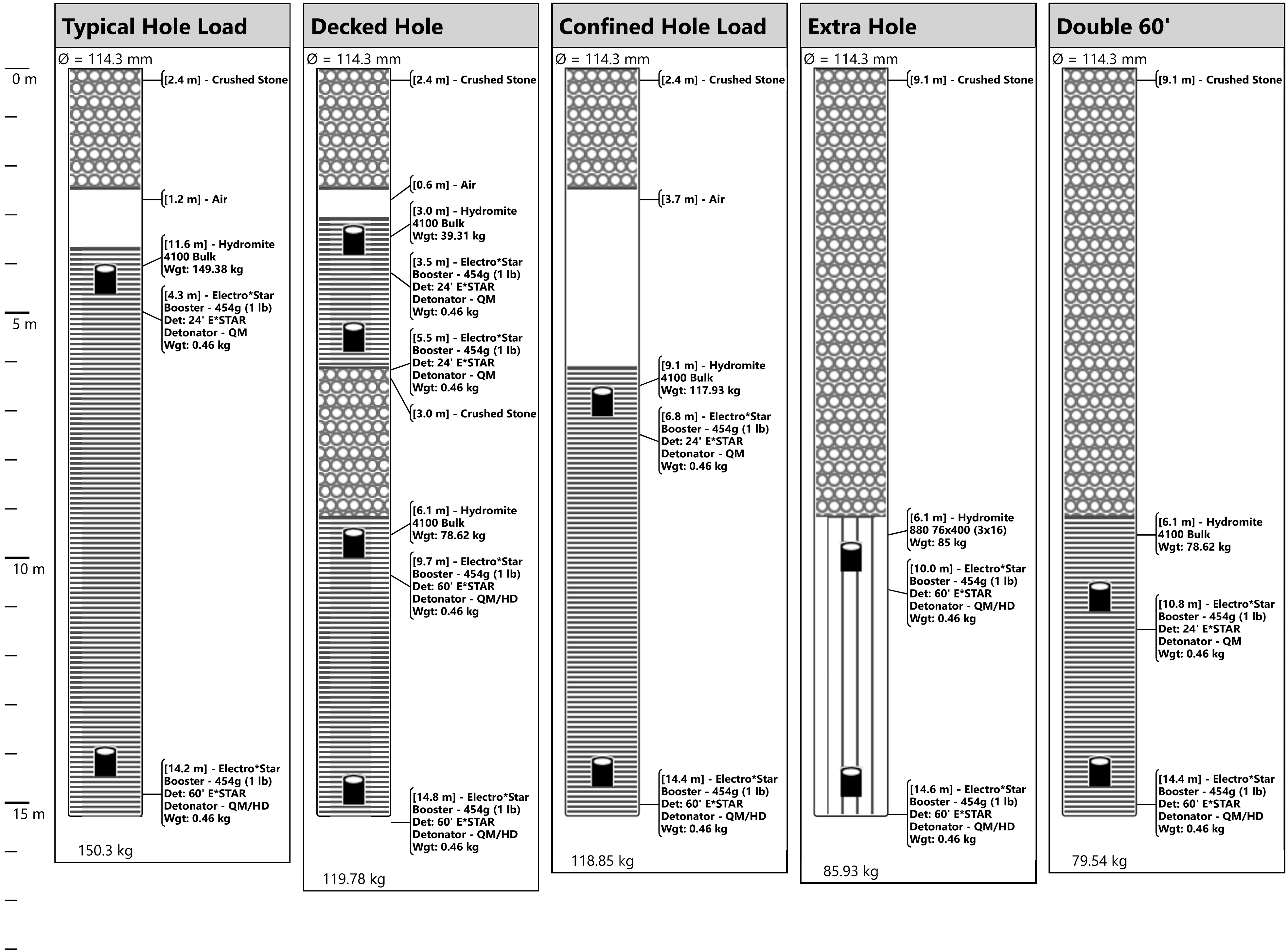
Hole Label Mode: Cumulative In-Hole Delays



Hole	Load	Surface Delay	Deck 1 Delay	Deck 2 Delay
ZZ1	Extra Hole	0	300/302	
ZZ2	Double 60'	0	412/414	
ZZ3	Typical Hole Load	0	280/282	
ZZ4	Typical Hole Load	0	260/262	
ZZ5	Decked Hole	0	240/242	0
ZZ6	Typical Hole Load	0	220/222	
ZZ7	Typical Hole Load	0	200/202	
ZZ8	Typical Hole Load	0	180/182	
ZZ9	Typical Hole Load	0	160/162	
ZZ10	Typical Hole Load	0	140/142	
ZZ11	Typical Hole Load	0	120/122	
ZZ12	Typical Hole Load	0	100/102	
ZZ13	Typical Hole Load	0	126/128	
ZZ14	Typical Hole Load	0	147/149	
ZZ15	Typical Hole Load	0	168/170	
ZZ16	Typical Hole Load	0	189/191	
ZZ17	Typical Hole Load	0	210/212	
ZZ18	Typical Hole Load	0	231/233	
ZZ19	Typical Hole Load	0	252/254	
ZZ20	Typical Hole Load	0	273/275	
ZZ21	Typical Hole Load	0	294/296	
ZZ22	Typical Hole Load	0	315/317	
ZZ23	Typical Hole Load	0	336/338	
ZZ24	Typical Hole Load	0	357/359	
ZZ25	Typical Hole Load	0	378/380	
ZZ26	Double 60'	0	399/401	
ZZ27	Typical Hole Load	0	420/422	
ZZ28	Typical Hole Load	0	441/443	
ZZ29	Confined Hole Load	0	524/526	
ZZ30	Typical Hole Load	0	392/394	
ZZ31	Typical Hole Load	0	372/374	
ZZ32	Typical Hole Load	0	352/354	
ZZ33	Typical Hole Load	0	332/334	
ZZ34	Typical Hole Load	0	312/314	
ZZ35	Typical Hole Load	0	292/294	
ZZ36	Typical Hole Load	0	272/274	
ZZ37	Typical Hole Load	0	252/254	
ZZ38	Typical Hole Load	0	232/234	
ZZ39	Typical Hole Load	0	212/214	
ZZ40	Typical Hole Load	0	238/240	
ZZ41	Typical Hole Load	0	259/261	
ZZ42	Typical Hole Load	0	280/282	
ZZ43	Typical Hole Load	0	301/303	
ZZ44	Typical Hole Load	0	322/324	
ZZ45	Typical Hole Load	0	343/345	
ZZ46	Typical Hole Load	0	364/366	

Hole	Load	Surface Delay	Deck 1 Delay
ZZ47	Typical Hole Load	0	385/387
ZZ48	Typical Hole Load	0	406/408
ZZ49	Typical Hole Load	0	427/429
ZZ50	Typical Hole Load	0	448/450
ZZ51	Typical Hole Load	0	469/471
ZZ52	Typical Hole Load	0	490/492
ZZ53	Typical Hole Load	0	511/513
ZZ54	Typical Hole Load	0	532/534
ZZ55	Typical Hole Load	0	553/555
ZZ56	Confined Hole Load	0	636/638
ZZ57	Typical Hole Load	0	504/506
ZZ58	Typical Hole Load	0	484/486
ZZ59	Typical Hole Load	0	464/466
ZZ60	Typical Hole Load	0	444/446
ZZ61	Typical Hole Load	0	424/426
ZZ62	Typical Hole Load	0	404/406
ZZ63	Typical Hole Load	0	384/386
ZZ64	Typical Hole Load	0	364/366
ZZ65	Typical Hole Load	0	344/346
ZZ66	Typical Hole Load	0	324/326
ZZ67	Typical Hole Load	0	350/352
ZZ68	Typical Hole Load	0	371/373
ZZ69	Typical Hole Load	0	392/394
ZZ70	Typical Hole Load	0	413/415
ZZ71	Typical Hole Load	0	434/436
ZZ72	Typical Hole Load	0	455/457
ZZ73	Typical Hole Load	0	476/478
ZZ74	Typical Hole Load	0	497/499
ZZ75	Typical Hole Load	0	518/520
ZZ76	Typical Hole Load	0	539/541
ZZ77	Typical Hole Load	0	560/562
ZZ78	Typical Hole Load	0	581/583
ZZ79	Typical Hole Load	0	602/604
ZZ80	Typical Hole Load	0	623/625
ZZ81	Typical Hole Load	0	644/646
ZZ82	Typical Hole Load	0	665/667
ZZ83	Confined Hole Load	0	748/750
ZZ84	Typical Hole Load	0	616/618
ZZ85	Typical Hole Load	0	596/598
ZZ86	Typical Hole Load	0	576/578
ZZ87	Typical Hole Load	0	556/558
ZZ88	Typical Hole Load	0	536/538
ZZ89	Typical Hole Load	0	516/518
ZZ90	Typical Hole Load	0	496/498
ZZ91	Typical Hole Load	0	476/478
ZZ92	Typical Hole Load	0	456/458

Hole	Load	Surface Delay	Deck 1 Delay
ZZ93	Typical Hole Load	0	436/438
ZZ94	Typical Hole Load	0	462/464
ZZ95	Typical Hole Load	0	483/485
ZZ96	Typical Hole Load	0	504/506
ZZ97	Typical Hole Load	0	525/527
ZZ98	Typical Hole Load	0	546/548
ZZ99	Typical Hole Load	0	567/569
ZZ100	Typical Hole Load	0	588/590
ZZ101	Typical Hole Load	0	609/611
ZZ102	Confined Hole Load	0	860/862
ZZ103	Typical Hole Load	0	728/730
ZZ104	Typical Hole Load	0	708/710
ZZ105	Typical Hole Load	0	688/690
ZZ106	Typical Hole Load	0	668/670
ZZ107	Typical Hole Load	0	648/650
ZZ108	Typical Hole Load	0	628/630
ZZ109	Typical Hole Load	0	608/610
ZZ110	Typical Hole Load	0	588/590
ZZ111	Typical Hole Load	0	568/570
ZZ112	Typical Hole Load	0	548/550
ZZ113	Typical Hole Load	0	574/576
ZZ114	Typical Hole Load	0	595/597
ZZ115	Typical Hole Load	0	616/618
ZZ116	Typical Hole Load	0	637/639
ZZ117	Typical Hole Load	0	658/660
ZZ118	Typical Hole Load	0	679/681
ZZ119	Confined Hole Load	0	656/658
ZZ120	Confined Hole Load	0	768/770
ZZ121	Confined Hole Load	0	880/882
ZZ122	Confined Hole Load	0	992/994


Typical Hole Load
Ø = 114.3 mm
[2.4 m] - Crushed Stone
[1.2 m] - Air
[11.6 m] - Hydromite
4100 Bulk
Wgt: 149.38 kg
[4.3 m] - Electro*Star
Booster - 454g (1 lb)
Det: 24' E*STAR
Detonator - QM
Wgt: 0.46 kg
[14.2 m] - Electro*Star
Booster - 454g (1 lb)
Det: 60' E*STAR
Detonator - QM/HD
Wgt: 0.46 kg
150.3 kg
Decked Hole
Ø = 114.3 mm
[2.4 m] - Crushed Stone
[0.6 m] - Air
[3.0 m] - Hydromite
4100 Bulk
Wgt: 39.31 kg
[3.5 m] - Electro*Star
Booster - 454g (1 lb)
Det: 24' E*STAR
Detonator - QM
Wgt: 0.46 kg
[5.5 m] - Electro*Star
Booster - 454g (1 lb)
Det: 24' E*STAR
Detonator - QM
Wgt: 0.46 kg
[3.0 m] - Crushed Stone
[6.1 m] - Hydromite
4100 Bulk
Wgt: 78.62 kg
[9.7 m] - Electro*Star
Booster - 454g (1 lb)
Det: 60' E*STAR
Detonator - QM/HD
Wgt: 0.46 kg
[14.8 m] - Electro*Star
Booster - 454g (1 lb)
Det: 60' E*STAR
Detonator - QM/HD
Wgt: 0.46 kg
119.78 kg
Confined Hole Load
Ø = 114.3 mm
[2.4 m] - Crushed Stone
[3.7 m] - Air
[9.1 m] - Hydromite
4100 Bulk
Wgt: 117.93 kg
[6.8 m] - Electro*Star
Booster - 454g (1 lb)
Det: 24' E*STAR
Detonator - QM
Wgt: 0.46 kg
[14.4 m] - Electro*Star
Booster - 454g (1 lb)
Det: 60' E*STAR
Detonator - QM/HD
Wgt: 0.46 kg
118.85 kg
Extra Hole
Ø = 114.3 mm
[9.1 m] - Crushed Stone
[6.1 m] - Hydromite
880 76x400 (3x16)
Wgt: 85 kg
[10.0 m] - Electro*Star
Booster - 454g (1 lb)
Det: 60' E*STAR
Detonator - QM/HD
Wgt: 0.46 kg
[14.6 m] - Electro*Star
Booster - 454g (1 lb)
Det: 60' E*STAR
Detonator - QM/HD
Wgt: 0.46 kg
85.93 kg
Double 60'
Ø = 114.3 mm
[9.1 m] - Crushed Stone
[6.1 m] - Hydromite
4100 Bulk
Wgt: 78.62 kg
[10.8 m] - Electro*Star
Booster - 454g (1 lb)
Det: 24' E*STAR
Detonator - QM
Wgt: 0.46 kg
[14.4 m] - Electro*Star
Booster - 454g (1 lb)
Det: 60' E*STAR
Detonator - QM/HD
Wgt: 0.46 kg
79.54 kg
0 m
5 m
10 m
15 m

AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-03	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	07/17/2017 13:57	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	Bottom Bench

ENVIRONMENT

Method Used:	U.T.M.	Weather:	Clear	Wind From:	N
Temperature:	27 °C	Terrain:	Flat	Wind Velocity:	0-3 km/h
Blast U.T.M.:	17N 500349 mE 4942757 mN				

NEAREST PROTECTED STRUCTURE

		Compass Point:	NW
Structure Name:	178841 Grey Rd #17	Direction/Bearing:	316 °
Structure Type:	Dwelling	Distance:	355 m
Structure U.T.M.:	17N 500101 mE 4943011 mN		

LAYOUT

		Hole Depth:	4.57-15.24 m	Material Blasted:	Limestone	Total Meters Drilled:	1,114.0 m
No. of Holes:	120	Subdrilling:	0.00-0.61 m	Burden:	3.35 m	Water Depth:	0.61 m
No. of V.P.† Holes:	120	Face Height:	4.57-14.63 m	Spacing:	3.35 m	Stem Length:	min 1.83 m
No. of Rows:	4	Drilling Angle:	0 °	Back Fill Depth:	0.00 m	Area Type:	Conventional
Diameter:	114.3 mm	Mats Used:	No	Stem Type:	Clear Stone	Method:	Specified (H = 9.14 m)

† V.P. = Volume Producing

WEIGHTS

		Max. Wt. of Expl. in Overlapped Decks:	310.3 kg	Volume Produced:	12,334.8 m^3
Initiation:	Electronic	Max. Wt. of Expl. Per 8 ms Interval:	310.3 kg	Weight Produced:	32,682.0 t
Firing Device:	E*Star Blasting Machine (WRFD)	Max. No. of Holes Per 8 ms Interval:	3	Powder Factor 1:	3.344 t/kg
Other Method:		Max. Wt. of Explosive Per Hole:	154.7 kg	Powder Factor 2:	0.792 kg/m^3
Mfg and Model:	DBM1600-2-RC	Scaled Distance Factor (max charge):	28.55	Rock Density:	2.650 t/m^3
Initiation Settings:		Scaled Distance Factor (per delay):	20.16		
Series Resistance (ohms):					

SEISMOGRAPHS

See seismographs on separate page

CREW

Blast occurred other than scheduled time: No   Misfire Occurred: No   Protective Cover: Loader Bucket

Last Name	First Name	License / Cert	2nd License / Cert	In Charge	Tied In	Chk. Tie-In	Driller	Layout
SMART	EVAN, C	* ON - N/A		Yes	Yes	Yes	No	Yes
BELTRAME	ALEXANDER, A			No	Yes	No	No	No
FRALICK	CRAIG, A			No	Yes	No	No	No
KLINGSPOR	DAVID, A			No	Yes	No	No	No
KOUYOUMJIAN	MACKENZIE, H			No	Yes	No	No	No
O'DONOHOE	LIAM, J			No	Yes	No	No	No
REED	ADAM, G			No	Yes	No	No	No

AUSTIN POWDER LTD.
BLAST REPORT

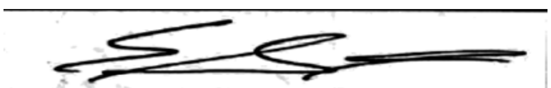
327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-03	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	07/17/2017 13:57	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	Bottom Bench

PRODUCTS AND SERVICES

Number	Product Description	Quantity	Weight (kg)
11782	Electro*Star Booster - 454g (1 lb)	240.00 ea	111.03
15001	24' E*STAR Detonator - QM	120.00 ea	0.00
15030	60' E*STAR Detonator - QM/HD	120.00 ea	0.00
12276	Electro*Star Bus Wire - 1250' spool	1.00 sp	0.00
07602	Hydromite 4100 Bulk	9,660.00 kg	9,660.00
12981	Mini Stem Plug - 6015	120.00 ea	0.00
		Total Weight of Explosives (Include Primers) (kg):	9,771.03

COMMENTS / EXPLANATIONS



Signature of Blaster in Charge

AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-03	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	07/17/2017 13:57	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	Bottom Bench

SEISMOGRAPH 1 - 178841 GREY ROAD #17

Data Type:	False Trigger	Seismograph Type:	Instantel - Minimate Blaster			
Date:	07/17/17	Trigger Level:	1.50 mm/s 115.00 dB	Transverse:	0.0 mm/s	--- Hz
Time:	13:57	Calibration Date:	02/02/17	Vertical:	0.0 mm/s	--- Hz
Distance From Blast:	355.09 m	Calibration Signal:	OK	Longitudinal:	0.0 mm/s	--- Hz
Direction From Blast:	NW	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:	Printed Copy	Mic. Min. Freq.:	--- Hz	Acoustic:	--- dB	
Location:	Bolted to Bedrock. After analyzing the waveforms it has been desided that the trigger was false due to a malfunction.			Vector Sum:	--- mm/s	
U.T.M.:	17N 500101 mE 4943011 mN					
Reader and Firm:	Evan Smart, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	Evan Smart, Austin Powder Ltd.					

SEISMOGRAPH 2 - 178717 GREY RD #17

Data Type:	Seismic Record	Seismograph Type:	Instantel - Minimate Blaster			
Date:	07/17/17	Trigger Level:	1.50 mm/s 115.00 dB	Transverse:	0.254 mm/s	0.0 Hz
Time:	13:57	Calibration Date:	02/01/17	Vertical:	0.254 mm/s	57.0 Hz
Distance From Blast:	826.62 m	Calibration Signal:	OK	Longitudinal:	0.254 mm/s	0.0 Hz
Direction From Blast:	SSE	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:	Printed Copy	Mic. Min. Freq.:	--- Hz	Acoustic:	122 dB	
Location:	Spiked and buried.			Vector Sum:	0.381 mm/s	
U.T.M.:	17N 500660 mE 4941991 mN					
Reader and Firm:	Evan Smart, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	Evan Smart, Austin Powder Ltd.					

SEISMOGRAPH 3 - 178706 GREY RD #17

Data Type:	Seismic Record	Seismograph Type:	Instantel - Minimate Blaster			
Date:	07/17/17	Trigger Level:	1.50 mm/s 115.00 dB	Transverse:	0.127 mm/s	0.0 Hz
Time:	13:57	Calibration Date:	01/24/17	Vertical:	0.127 mm/s	0.0 Hz
Distance From Blast:	901.29 m	Calibration Signal:	OK	Longitudinal:	0.127 mm/s	0.0 Hz
Direction From Blast:	SSE	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:	Printed Copy	Mic. Min. Freq.:	--- Hz	Acoustic:	120 dB	
Location:	Spiked and weight bagged in front yard			Vector Sum:	0.311 mm/s	
U.T.M.:	17N 500660 mE 4941911 mN					
Reader and Firm:	Evan Smart, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	Evan Smart, Austin Powder Ltd.					

AUSTIN POWDER LTD.
BLAST REPORT

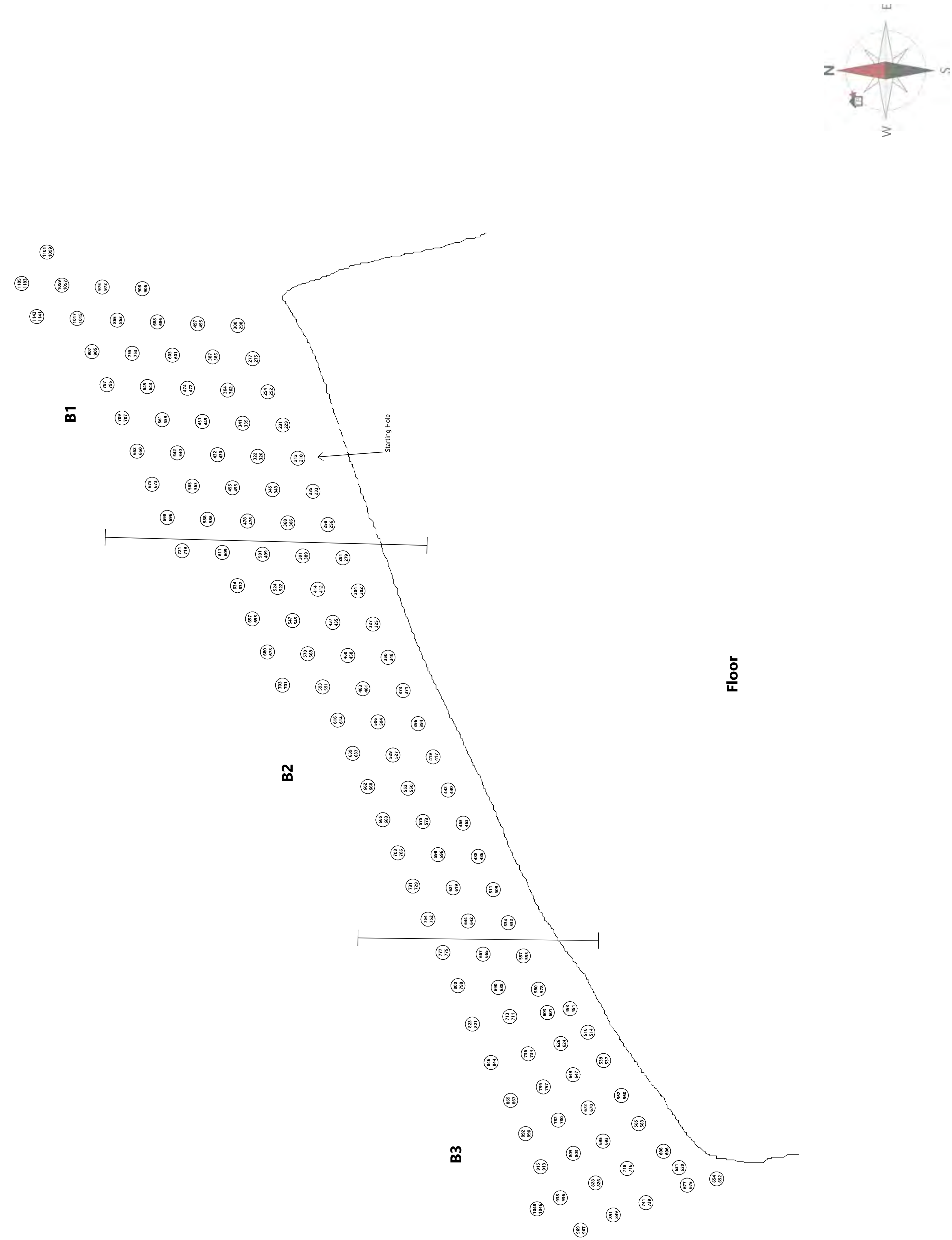
327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-03	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	07/17/2017 13:57	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	Bottom Bench

SEISMOGRAPH 4 - 283197 CONC. RD. #10

Data Type:	Seismic Record	Seismograph Type:	Instanel - Minimate Blaster			
Date:	07/17/17	Trigger Level:	1.50 mm/s 115.00 dB	Transverse:	1.778 mm/s	47.0 Hz
Time:	13:57	Calibration Date:	01/24/17	Vertical:	0.762 mm/s	43.0 Hz
Distance From Blast:	1,146.96 m	Calibration Signal:	OK	Longitudinal:	2.032 mm/s	39.0 Hz
Direction From Blast:	SE	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:	Printed Copy	Mic. Min. Freq.:	--- Hz	Acoustic:	117 dB	
Location:	Spiked and buried.			Vector Sum:	2.328 mm/s	
U.T.M.:	17N 501117 mE 4941905 mN					
Reader and Firm:	Evan Smart, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	Evan Smart, Austin Powder Ltd.					

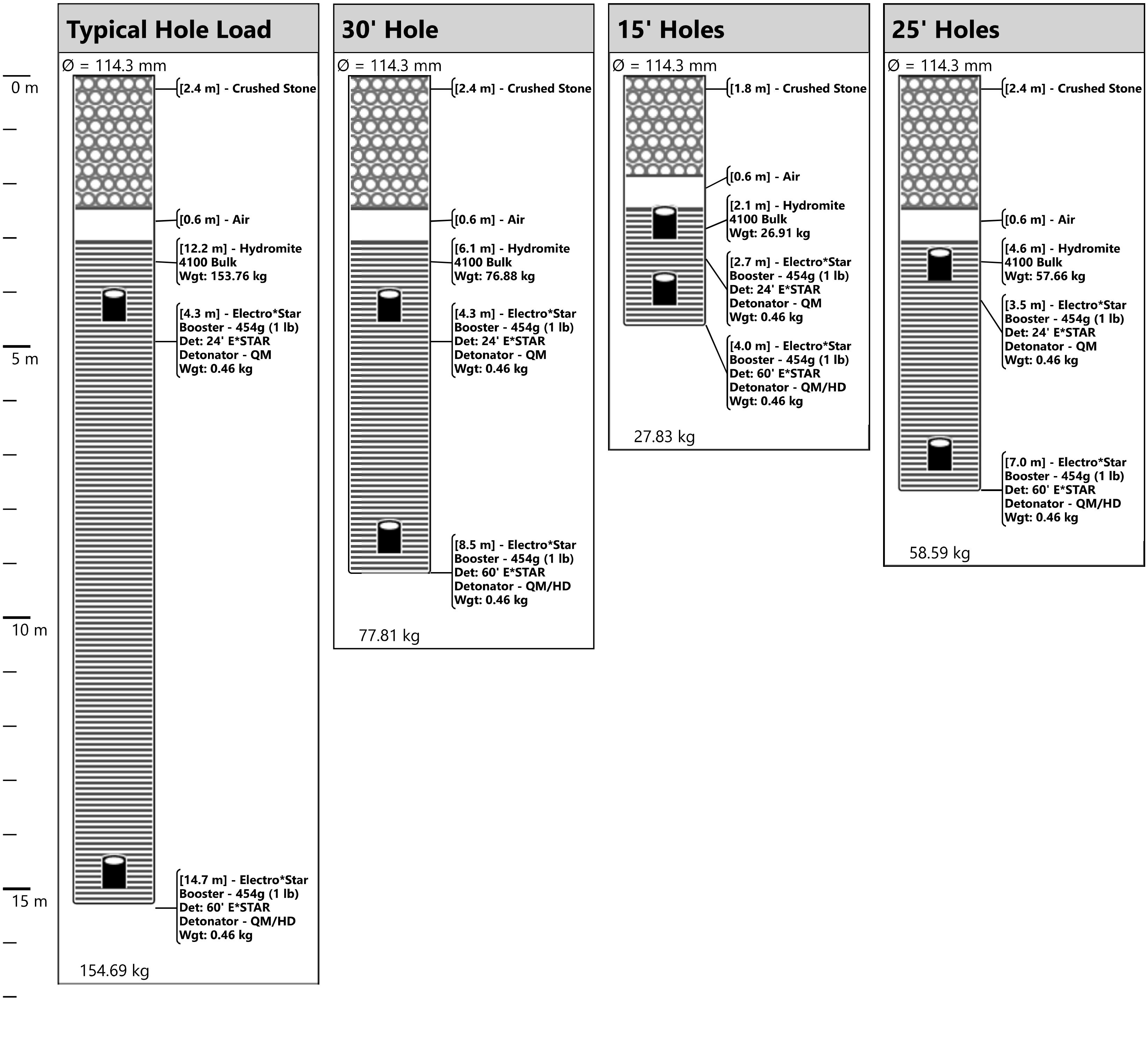
Hole Label Mode: Cumulative In-Hole Delays



Hole	Load	Surface Delay	Deck 1 Delay
ZZ1	Typical Hole Load	0	652/654
ZZ2	Typical Hole Load	0	675/677
ZZ3	Typical Hole Load	0	629/631
ZZ4	Typical Hole Load	0	606/608
ZZ5	Typical Hole Load	0	583/585
ZZ6	Typical Hole Load	0	560/562
ZZ7	Typical Hole Load	0	537/539
ZZ8	Typical Hole Load	0	514/516
ZZ9	Typical Hole Load	0	491/493
ZZ10	30' Hole	0	739/741
ZZ11	Typical Hole Load	0	716/718
ZZ12	30' Hole	0	693/695
ZZ13	30' Hole	0	670/672
ZZ14	30' Hole	0	647/649
ZZ15	30' Hole	0	624/626
ZZ16	30' Hole	0	601/603
ZZ17	30' Hole	0	578/580
ZZ18	30' Hole	0	555/557
ZZ19	30' Hole	0	532/534
ZZ20	30' Hole	0	509/511
ZZ21	30' Hole	0	486/488
ZZ22	30' Hole	0	463/465
ZZ23	30' Hole	0	440/442
ZZ24	30' Hole	0	417/419
ZZ25	30' Hole	0	394/396
ZZ26	Typical Hole Load	0	371/373
ZZ27	Typical Hole Load	0	348/350
ZZ28	Typical Hole Load	0	325/327
ZZ29	Typical Hole Load	0	302/304
ZZ30	Typical Hole Load	0	279/281
ZZ31	Typical Hole Load	0	256/258
ZZ32	Typical Hole Load	0	233/235
ZZ33	Typical Hole Load	0	210/212
ZZ34	Typical Hole Load	0	229/231
ZZ35	Typical Hole Load	0	252/254
ZZ36	Typical Hole Load	0	275/277
ZZ37	Typical Hole Load	0	298/300
ZZ39	25' Holes	0	849/851
ZZ40	30' Hole	0	826/828
ZZ41	25' Holes	0	803/805
ZZ42	25' Holes	0	780/782
ZZ43	25' Holes	0	757/759
ZZ44	25' Holes	0	734/736
ZZ45	25' Holes	0	711/713
ZZ46	25' Holes	0	688/690
ZZ47	25' Holes	0	665/667

Hole	Load	Surface Delay	Deck 1 Delay
ZZ48	25' Holes	0	642/644
ZZ49	25' Holes	0	619/621
ZZ50	25' Holes	0	596/598
ZZ51	25' Holes	0	573/575
ZZ52	25' Holes	0	550/552
ZZ53	25' Holes	0	527/529
ZZ54	25' Holes	0	504/506
ZZ55	30' Hole	0	481/483
ZZ56	30' Hole	0	458/460
ZZ57	30' Hole	0	435/437
ZZ58	30' Hole	0	412/414
ZZ59	Typical Hole Load	0	389/391
ZZ60	Typical Hole Load	0	366/368
ZZ61	Typical Hole Load	0	343/345
ZZ62	Typical Hole Load	0	320/322
ZZ63	Typical Hole Load	0	339/341
ZZ64	Typical Hole Load	0	362/364
ZZ65	Typical Hole Load	0	385/387
ZZ66	Typical Hole Load	0	495/497
ZZ67	15' Holes	0	967/969
ZZ68	25' Holes	0	936/938
ZZ69	15' Holes	0	913/915
ZZ70	15' Holes	0	890/892
ZZ71	15' Holes	0	867/869
ZZ72	15' Holes	0	844/846
ZZ73	15' Holes	0	821/823
ZZ74	15' Holes	0	798/800
ZZ75	15' Holes	0	775/777
ZZ76	15' Holes	0	752/754
ZZ77	15' Holes	0	729/731
ZZ78	15' Holes	0	706/708
ZZ79	15' Holes	0	683/685
ZZ80	15' Holes	0	660/662
ZZ81	15' Holes	0	637/639
ZZ82	15' Holes	0	614/616
ZZ83	25' Holes	0	591/593
ZZ84	25' Holes	0	568/570
ZZ85	25' Holes	0	545/547
ZZ86	25' Holes	0	522/524
ZZ87	30' Hole	0	499/501
ZZ88	30' Hole	0	476/478
ZZ89	30' Hole	0	453/455
ZZ90	30' Hole	0	430/432
ZZ91	30' Hole	0	449/451
ZZ92	30' Hole	0	472/474
ZZ93	30' Hole	0	601/603

Hole	Load	Surface Delay	Deck 1 Delay
ZZ94	Typical Hole Load	0	686/688
ZZ95	Typical Hole Load	0	906/908
ZZ97	15' Holes	0	1046/1048
ZZ98	15' Holes	0	701/703
ZZ99	15' Holes	0	678/680
ZZ100	15' Holes	0	655/657
ZZ101	15' Holes	0	632/634
ZZ102	25' Holes	0	609/611
ZZ103	25' Holes	0	586/588
ZZ104	25' Holes	0	563/565
ZZ105	25' Holes	0	540/542
ZZ106	25' Holes	0	559/561
ZZ107	25' Holes	0	643/645
ZZ108	25' Holes	0	753/755
ZZ109	30' Hole	0	863/865
ZZ110	30' Hole	0	973/975
ZZ111	15' Holes	0	719/721
ZZ112	15' Holes	0	696/698
ZZ113	15' Holes	0	673/675
ZZ114	15' Holes	0	650/652
ZZ115	15' Holes	0	707/709
ZZ116	15' Holes	0	795/797
ZZ117	15' Holes	0	905/907
ZZ118	25' Holes	0	1015/1017
ZZ119	25' Holes	0	1057/1059
ZZ120	25' Holes	0	1099/1101
ZZ121	15' Holes	0	1141/1143
ZZ122	15' Holes	0	1183/1185


0 m
5 m
10 m
15 m
Typical Hole Load
Ø = 114.3 mm
[2.4 m] - Crushed Stone
[0.6 m] - Air
[12.2 m] - Hydromite
4100 Bulk
Wgt: 153.76 kg
[4.3 m] - Electro*Star
Booster - 454g (1 lb)
Det: 24' E*STAR
Detonator - QM
Wgt: 0.46 kg
[14.7 m] - Electro*Star
Booster - 454g (1 lb)
Det: 60' E*STAR
Detonator - QM/HD
Wgt: 0.46 kg
154.69 kg
30' Hole
Ø = 114.3 mm
[2.4 m] - Crushed Stone
[0.6 m] - Air
[6.1 m] - Hydromite
4100 Bulk
Wgt: 76.88 kg
[4.3 m] - Electro*Star
Booster - 454g (1 lb)
Det: 24' E*STAR
Detonator - QM
Wgt: 0.46 kg
[8.5 m] - Electro*Star
Booster - 454g (1 lb)
Det: 60' E*STAR
Detonator - QM/HD
Wgt: 0.46 kg
77.81 kg
15' Holes
Ø = 114.3 mm
[1.8 m] - Crushed Stone
[0.6 m] - Air
[2.1 m] - Hydromite
4100 Bulk
Wgt: 26.91 kg
[2.7 m] - Electro*Star
Booster - 454g (1 lb)
Det: 24' E*STAR
Detonator - QM
Wgt: 0.46 kg
[4.0 m] - Electro*Star
Booster - 454g (1 lb)
Det: 60' E*STAR
Detonator - QM/HD
Wgt: 0.46 kg
27.83 kg
25' Holes
Ø = 114.3 mm
[2.4 m] - Crushed Stone
[0.6 m] - Air
[4.6 m] - Hydromite
4100 Bulk
Wgt: 57.66 kg
[3.5 m] - Electro*Star
Booster - 454g (1 lb)
Det: 24' E*STAR
Detonator - QM
Wgt: 0.46 kg
[7.0 m] - Electro*Star
Booster - 454g (1 lb)
Det: 60' E*STAR
Detonator - QM/HD
Wgt: 0.46 kg
58.59 kg

AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-04	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	08/14/2017 15:17	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	West Extraction Limit

ENVIRONMENT

Method Used:	U.T.M.	Weather:	Clear	Wind From:	NE
Temperature:	25 °C	Terrain:	Flat	Wind Velocity:	5-20 km/h
Blast U.T.M.:	17N 500345 mE 4942672 mN				

NEAREST PROTECTED STRUCTURE

		Compass Point:	NW
Structure Name:	178841 Grey Road #17	Direction/Bearing:	324 °
Structure Type:	Dwelling	Distance:	417 m
Structure U.T.M.:	17N 500101 mE 4943011 mN		

LAYOUT

		Hole Depth:	4.57-14.94 m	Material Blasted:	Limestone	Total Meters Drilled:	1,367.9 m
No. of Holes:	135	Subdrilling:	0.00-0.61 m	Burden:	3.35 m	Water Depth:	max 4.57 m
No. of V.P.[†] Holes:	135	Face Height:	4.57-14.33 m	Spacing:	3.66 m	Stem Length:	min 1.83 m
No. of Rows:	4	Drilling Angle:	0 °	Back Fill Depth:	0.00 m	Area Type:	Conventional
Diameter:	114.3 mm	Mats Used:	No	Stem Type:	Clear Stone	Method:	Specified (H = 9.75 m)

† V.P. = Volume Producing

WEIGHTS

		Max. Wt. of Expl. in Overlapped Decks:	479.7 kg	Volume Produced:	16,147.4 m^3
Initiation:	Electronic	Max. Wt. of Expl. Per 8 ms Interval:	479.7 kg	Weight Produced:	42,783.8 t
Firing Device:	E*Star Blasting Machine (WRFD)	Max. No. of Holes Per 8 ms Interval:	4	Powder Factor 1:	3.602 t/kg
Other Method:		Max. Wt. of Explosive Per Hole:	142.2 kg	Powder Factor 2:	0.736 kg/m^3
Mfg and Model:	DBM1600-2-RC	Scaled Distance Factor (max charge):	34.99	Rock Density:	2.650 t/m^3
Initiation Settings:		Scaled Distance Factor (per delay):	19.05		
Series Resistance (ohms):					

SEISMOGRAPHS See seismographs on separate page

CREW

Blast occurred other than scheduled time: No   Misfire Occurred: No   Protective Cover: Loader Bucket

Last Name	First Name	License / Cert	2nd License / Cert	In Charge	Tied In	Chk. Tie-In	Driller	Layout
SMART	EVAN, C	* ON - N/A		Yes	Yes	Yes	No	Yes
BELTRAME	ALEXANDER, A			No	Yes	No	No	No
KLINGSPOR	DAVID, A			No	Yes	No	No	No
NEWTON	JOHN, D			No	Yes	No	No	No

AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-04	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	08/14/2017 15:17	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	West Extraction Limit

PRODUCTS AND SERVICES

Number	Product Description	Quantity		Weight (kg)
11782	Electro*Star Booster - 454g (1 lb)	273.00	ea	126.30
15001	24' E*STAR Detonator - QM	184.00	ea	0.00
15003	40' E*STAR Detonator - QM	44.00	ea	0.00
15030	60' E*STAR Detonator - QM/HD	45.00	ea	0.00
12276	Electro*Star Bus Wire - 1250' spool	2.00	sp	0.00
07602	Hydromite 4100 Bulk	11,750.00	kg	11,750.00
12981	Mini Stem Plug - 6015	135.00	ea	0.00
	Total Weight of Explosives (Include Primers) (kg):			11,876.30

COMMENTS / EXPLANATIONS

General Comments: Imported on 8/14/2017 7:27:12 PM

Signature of Blaster in Charge

 Blast ID: ru00342705-10193 (-1) Version: 7.3.3.2 Print Date: 8/15/2017

AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-04	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	08/14/2017 15:17	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	West Extraction Limit

SEISMOGRAPH 1 - 178841 GREY ROAD #17

Data Type:	Seismic Record	Seismograph Type:	Instantel Mini-Mate II			
Date:	08/14/17	Trigger Level:	1.50 mm/s 115.00 dB	Transverse:	3.81 mm/s	43.0 Hz
Time:	15:17	Calibration Date:	02/02/17	Vertical:	3.81 mm/s	39.0 Hz
Distance From Blast:	417.27 m	Calibration Signal:		Longitudinal:	4.191 mm/s	28.0 Hz
Direction From Blast:	NW	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:	Printed Copy	Mic. Min. Freq.:	--- Hz	Acoustic:	121 dB	
Location:	Bolted to bedrock at the front of the property. Unit #233.			Vector Sum:	5.099 mm/s	
U.T.M.:	17N 500101 mE 4943011 mN					
Reader and Firm:	Evan Smart, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	Evan Smart, Austin Powder Ltd.					

SEISMOGRAPH 2 - 178717 GREY RD. 17

Data Type:	Seismic Record	Seismograph Type:	Instantel Mini-Mate II			
Date:	08/14/17	Trigger Level:	1.50 mm/s 115.00 dB	Transverse:	2.921 mm/s	43.0 Hz
Time:	15:17	Calibration Date:	01/24/17	Vertical:	1.905 mm/s	43.0 Hz
Distance From Blast:	750.72 m	Calibration Signal:		Longitudinal:	3.683 mm/s	34.0 Hz
Direction From Blast:	SSE	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:	Printed Copy	Mic. Min. Freq.:	--- Hz	Acoustic:	120 dB	
Location:	Buried at the front of the property.			Vector Sum:	3.986 mm/s	
U.T.M.:	17N 500660 mE 4941991 mN					
Reader and Firm:	Evan Smart, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	Evan Smart, Austin Powder Ltd.					

SEISMOGRAPH 3 - 178706 GREY RD. 17

Data Type:	Seismic Record	Seismograph Type:	Instantel Mini-Mate II			
Date:	08/14/17	Trigger Level:	1.50 mm/s 115.00 dB	Transverse:	1.016 mm/s	34.0 Hz
Time:	15:17	Calibration Date:	01/24/17	Vertical:	1.524 mm/s	47.0 Hz
Distance From Blast:	823.87 m	Calibration Signal:		Longitudinal:	1.27 mm/s	43.0 Hz
Direction From Blast:	SSE	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:	Printed Copy	Mic. Min. Freq.:	--- Hz	Acoustic:	118 dB	
Location:	Buried at front of property.			Vector Sum:	1.591 mm/s	
U.T.M.:	17N 500660 mE 4941911 mN					
Reader and Firm:	Evan Smart, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	Evan Smart, Austin Powder Ltd.					

AUSTIN POWDER LTD.
BLAST REPORT

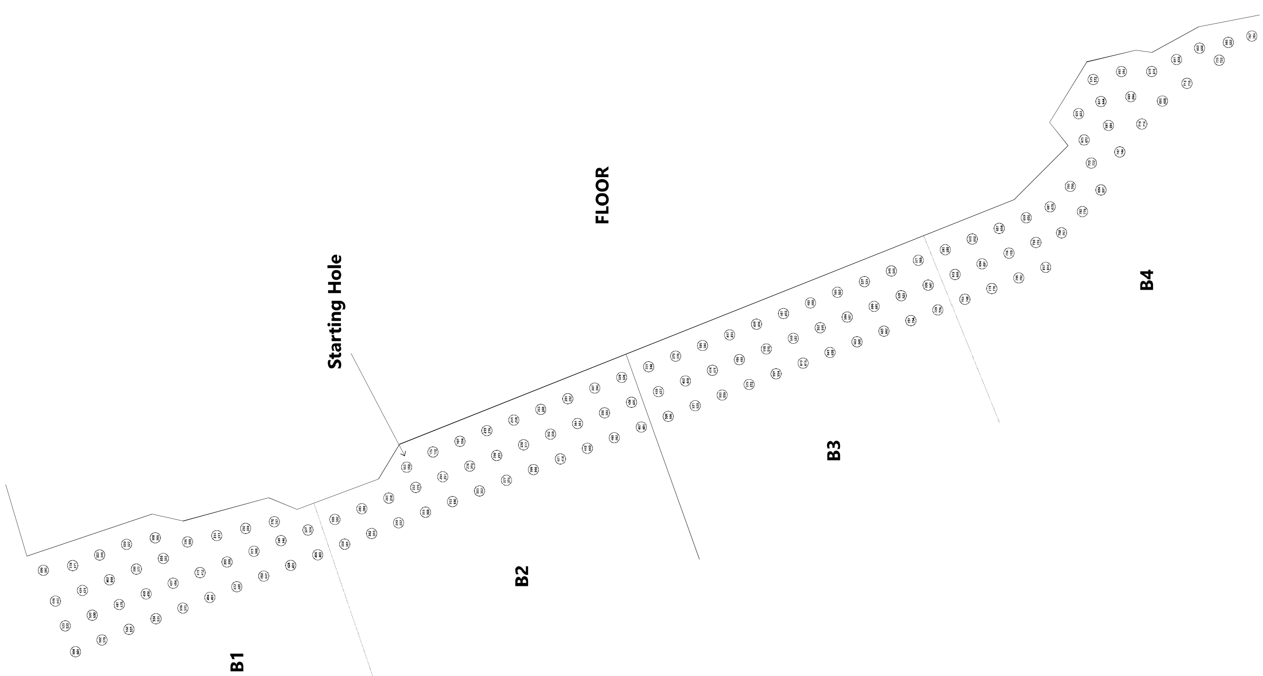
327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-04	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	08/14/2017 15:17	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	West Extraction Limit

SEISMOGRAPH 4 - 283197 CONC. RD. 10

Data Type:	Seismic Record	Seismograph Type:	Instantel Mini-Mate II			
Date:	08/14/17	Trigger Level:	1.50 mm/s 115.00 dB	Transverse:	0.762 mm/s	47.0 Hz
Time:	15:17	Calibration Date:	02/01/17	Vertical:	1.27 mm/s	37.0 Hz
Distance From Blast:	1,088.44 m	Calibration Signal:		Longitudinal:	1.778 mm/s	47.0 Hz
Direction From Blast:	SE	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:	Printed Copy	Mic. Min. Freq.:	--- Hz	Acoustic:	117 dB	
Location:	Buried at the road.			Vector Sum:	1.836 mm/s	
U.T.M.:	17N 501117 mE 4941905 mN					
Reader and Firm:	Evan Smart, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	Evan Smart, Austin Powder Ltd.					

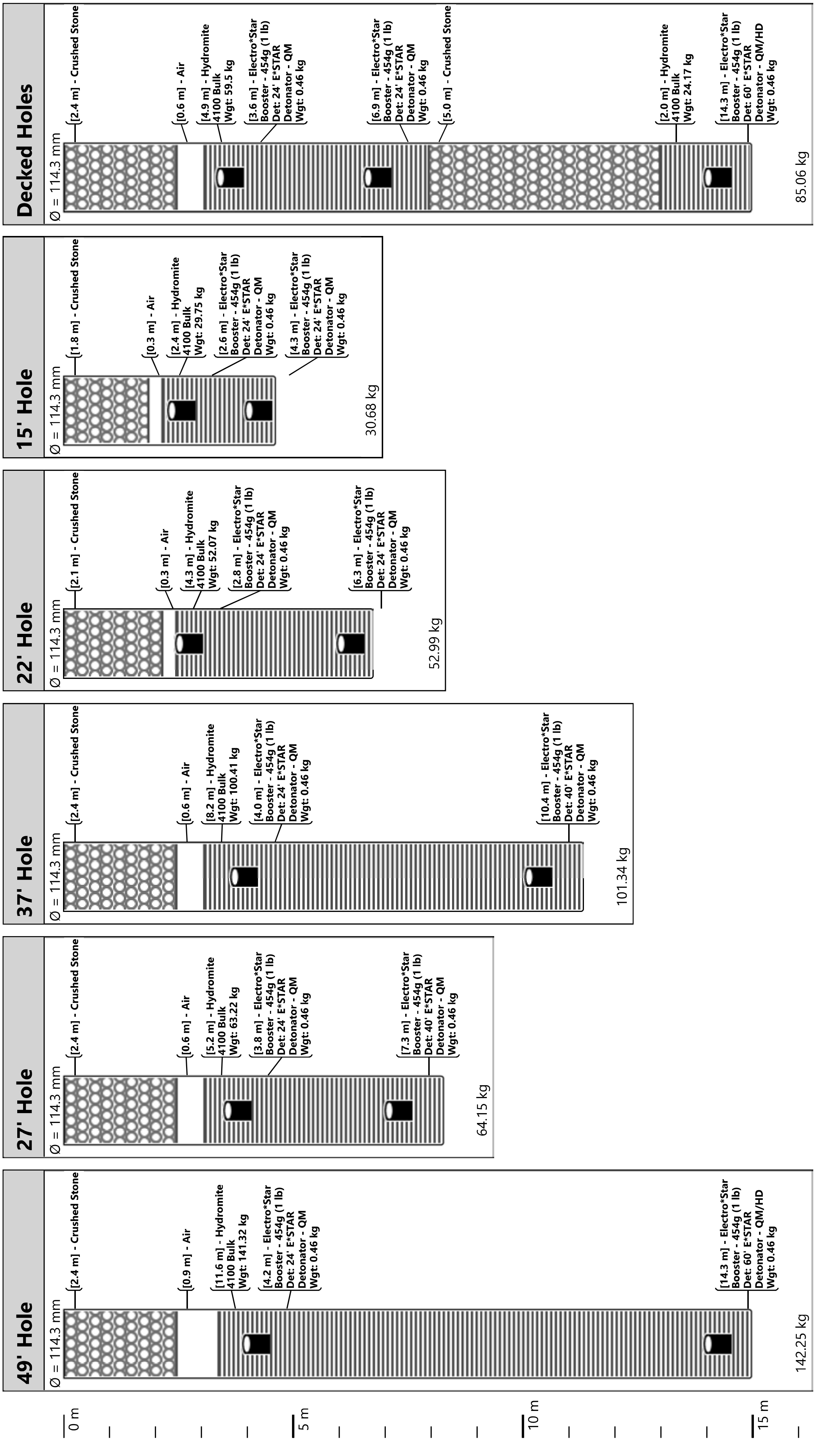
Hole Label Mode: Cumulative In-Hole Delays



Hole	Load	Surface Delay	Deck 1 Delay
ZZ115	22' Hole	0	374/377
ZZ119	22' Hole	0	462/465
ZZ40	49' Hole	0	282/285
ZZ8	Decked Holes	0	622/625
ZZ26	49' Hole	0	421/424
ZZ96	37' Hole	0	735/738
ZZ24	15' Hole	0	744/747
ZZ114	15' Hole	0	352/355
ZZ54	49' Hole	0	590/593
ZZ111	22' Hole	0	337/340
ZZ22	37' Hole	0	700/703
ZZ85	37' Hole	0	493/496
ZZ37	49' Hole	0	216/219
ZZ75	37' Hole	0	273/276
ZZ95	37' Hole	0	713/716
ZZ116	15' Hole	0	396/399
ZZ67	37' Hole	0	368/371
ZZ60	27' Hole	0	522/525
ZZ3	37' Hole	0	616/619
ZZ81	37' Hole	0	405/408
ZZ79	37' Hole	0	361/364
ZZ56	49' Hole	0	634/637
ZZ65	37' Hole	0	412/415
ZZ50	49' Hole	0	502/505
ZZ128	15' Hole	0	660/663
ZZ12	15' Hole	0	732/735
ZZ25	49' Hole	0	443/446
ZZ44	49' Hole	0	370/373
ZZ28	49' Hole	0	377/380
ZZ100	22' Hole	0	579/582
ZZ113	22' Hole	0	330/333
ZZ41	49' Hole	0	304/307
ZZ36	49' Hole	0	194/197
ZZ58	49' Hole	0	678/681
ZZ15	37' Hole	0	716/719
ZZ29	49' Hole	0	355/358
ZZ118	15' Hole	0	440/443
ZZ82	27' Hole	0	427/430
ZZ43	49' Hole	0	348/351
ZZ6	22' Hole	0	682/685
ZZ135	15' Hole	0	814/817
ZZ103	22' Hole	0	513/516
ZZ57	49' Hole	0	656/659
ZZ86	27' Hole	0	515/518
ZZ117	22' Hole	0	418/421
ZZ121	22' Hole	0	506/509

Hole	Load	Surface Delay	Deck 1 Delay
ZZ20	49' Hole	0	327/330
ZZ9	49' Hole	0	644/647
ZZ77	37' Hole	0	317/320
ZZ68	27' Hole	0	346/349
ZZ70	27' Hole	0	302/305
ZZ107	22' Hole	0	425/428
ZZ63	27' Hole	0	456/459
ZZ108	15' Hole	0	403/406
ZZ39	49' Hole	0	260/263
ZZ92	27' Hole	0	647/650
ZZ110	15' Hole	0	359/362
ZZ134	15' Hole	0	792/795
ZZ71	37' Hole	0	280/283
ZZ45	49' Hole	0	392/395
ZZ127	22' Hole	0	638/641
ZZ64	27' Hole	0	434/437
ZZ34	49' Hole	0	150/153
ZZ46	49' Hole	0	414/417
ZZ72	49' Hole	0	258/261
ZZ131	22' Hole	0	726/729
ZZ2	Decked Holes	0	594/597
ZZ49	49' Hole	0	480/483
ZZ76	27' Hole	0	295/298
ZZ93	37' Hole	0	669/672
ZZ17	49' Hole	0	393/396
ZZ94	27' Hole	0	691/694
ZZ47	49' Hole	0	436/439
ZZ10	27' Hole	0	666/669
ZZ1	Decked Holes	0	572/575
ZZ42	49' Hole	0	326/329
ZZ84	27' Hole	0	471/474
ZZ106	15' Hole	0	447/450
ZZ62	27' Hole	0	478/481
ZZ130	15' Hole	0	704/707
ZZ59	22' Hole	0	801/804
ZZ52	49' Hole	0	546/549
ZZ105	22' Hole	0	469/472
ZZ122	15' Hole	0	528/531
ZZ97	22' Hole	0	757/760
ZZ11	22' Hole	0	710/713
ZZ7	22' Hole	0	704/707
ZZ32	49' Hole	0	289/292
ZZ132	15' Hole	0	748/751
ZZ38	49' Hole	0	238/241
ZZ102	15' Hole	0	535/538
ZZ69	37' Hole	0	324/327

Hole	Load	Surface Delay	Deck 1 Delay
ZZ109	22' Hole	0	381/384
ZZ123	22' Hole	0	550/553
ZZ101	22' Hole	0	557/560
ZZ83	37' Hole	0	449/452
ZZ16	15' Hole	0	688/691
ZZ91	37' Hole	0	625/628
ZZ90	27' Hole	0	603/606
ZZ98	22' Hole	0	779/782
ZZ104	15' Hole	0	491/494
ZZ73	37' Hole	0	229/232
ZZ30	49' Hole	0	333/336
ZZ120	15' Hole	0	484/487
ZZ99	22' Hole	0	601/604
ZZ80	27' Hole	0	383/386
ZZ129	22' Hole	0	682/685
ZZ31	49' Hole	0	311/314
ZZ61	37' Hole	0	500/503
ZZ21	49' Hole	0	305/308
ZZ88	27' Hole	0	559/562
ZZ112	15' Hole	0	308/311
ZZ33	49' Hole	0	267/270
ZZ74	27' Hole	0	251/254
ZZ125	22' Hole	0	594/597
ZZ89	37' Hole	0	581/584
ZZ51	49' Hole	0	524/527
ZZ78	27' Hole	0	339/342
ZZ124	15' Hole	0	572/575
ZZ126	15' Hole	0	616/619
ZZ66	27' Hole	0	390/393
ZZ48	49' Hole	0	458/461
ZZ27	49' Hole	0	399/402
ZZ87	37' Hole	0	537/540
ZZ53	49' Hole	0	568/571
ZZ35	49' Hole	0	172/175
ZZ23	27' Hole	0	722/725
ZZ18	49' Hole	0	371/374
ZZ5	27' Hole	0	660/663
ZZ13	49' Hole	0	672/675
ZZ4	37' Hole	0	638/641
ZZ55	49' Hole	0	612/615
ZZ133	22' Hole	0	770/773
ZZ14	37' Hole	0	694/697
ZZ19	49' Hole	0	349/352


49' Hole
Ø = 114.3 mm
[2.4 m] - Crushed Stone
[0.9 m] - Air
[11.6 m] - Hydromite 4100 Bulk Wgt: 141.32 kg
[4.2 m] - Electro*Star Booster - 454g (1 lb) Det: 24' E*STAR Detonator - QM Wgt: 0.46 kg
[14.3 m] - Electro*Star Booster - 454g (1 lb) Det: 60' E*STAR Detonator - QM/HD Wgt: 0.46 kg
142.25 kg
27' Hole
Ø = 114.3 mm
[2.4 m] - Crushed Stone
[0.6 m] - Air
[5.2 m] - Hydromite 4100 Bulk Wgt: 63.22 kg
[3.8 m] - Electro*Star Booster - 454g (1 lb) Det: 24' E*STAR Detonator - QM Wgt: 0.46 kg
[7.3 m] - Electro*Star Booster - 454g (1 lb) Det: 40' E*STAR Detonator - QM Wgt: 0.46 kg
64.15 kg
37' Hole
Ø = 114.3 mm
[2.4 m] - Crushed Stone
[0.6 m] - Air
[8.2 m] - Hydromite 4100 Bulk Wgt: 100.41 kg
[4.0 m] - Electro*Star Booster - 454g (1 lb) Det: 24' E*STAR Detonator - QM Wgt: 0.46 kg
[10.4 m] - Electro*Star Booster - 454g (1 lb) Det: 40' E*STAR Detonator - QM Wgt: 0.46 kg
101.34 kg
22' Hole
Ø = 114.3 mm
[2.1 m] - Crushed Stone
[0.3 m] - Air
[4.3 m] - Hydromite 4100 Bulk Wgt: 52.07 kg
[2.8 m] - Electro*Star Booster - 454g (1 lb) Det: 24' E*STAR Detonator - QM Wgt: 0.46 kg
[6.3 m] - Electro*Star Booster - 454g (1 lb) Det: 24' E*STAR Detonator - QM Wgt: 0.46 kg
52.99 kg
15' Hole
Ø = 114.3 mm
[1.8 m] - Crushed Stone
[0.3 m] - Air
[2.4 m] - Hydromite 4100 Bulk Wgt: 29.75 kg
[2.6 m] - Electro*Star Booster - 454g (1 lb) Det: 24' E*STAR Detonator - QM Wgt: 0.46 kg
[4.3 m] - Electro*Star Booster - 454g (1 lb) Det: 24' E*STAR Detonator - QM Wgt: 0.46 kg
30.68 kg
Decked Holes
Ø = 114.3 mm
[2.4 m] - Crushed Stone
[0.6 m] - Air
[4.9 m] - Hydromite 4100 Bulk Wgt: 59.5 kg
[3.6 m] - Electro*Star Booster - 454g (1 lb) Det: 24' E*STAR Detonator - QM Wgt: 0.46 kg
[6.9 m] - Electro*Star Booster - 454g (1 lb) Det: 24' E*STAR Detonator - QM Wgt: 0.46 kg
[5.0 m] - Crushed Stone
[2.0 m] - Hydromite 4100 Bulk Wgt: 24.17 kg
[14.3 m] - Electro*Star Booster - 454g (1 lb) Det: 60' E*STAR Detonator - QM/HD Wgt: 0.46 kg
85.06 kg
0 m
5 m
10 m
15 m

AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.: 2017-05
Blast Type: Stone Quarry/Stone Mine - Production
Customer: HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time: 11/17/2017 14:40
Pit/Permit: KEPPEL QUARRY / SHOT SERVICE
Location: 10' bench across the rd

ENVIRONMENT

Method Used: Lat./Long.
Weather: Partly Cloudy
Wind From: WSW
Temperature: -3 °C
Terrain: Hilly
Wind Velocity: 2-8 km/h
Blast Lat./Long.: 44° 38' 6.400" N 80° 59' 50.200" W

NEAREST PROTECTED STRUCTURE

Compass Point: NNW
Structure Name: 178841 Grey Rd. 17
Direction/Bearing: 349 °
Structure Type: Dwelling
Distance: 602 m
Structure Lat./Long.: 44° 38' 25.580" N 80° 59' 55.233" W

LAYOUT

Hole Depth: 2.90 m
Material Blasted: Limestone
Total Meters Drilled: 865.6 m
No. of Holes: 299
Subdrilling: 0.00 m
Burden: 3.05 m
Water Depth: 1.22 m
No. of V.P.† Holes: 299
Face Height: 2.90 m
Spacing: 3.05 m
Stem Length: 1.83 m
No. of Rows: 11
Drilling Angle: °
Back Fill Depth: 0.00 m
Area Type: Conventional
Diameter: 114.3 mm
Mats Used: No
Stem Type: Clear stone
Method: Deepest Hole Load

† V.P. = Volume Producing

WEIGHTS

Max. Wt. of Expl. in Overlapped Decks: 57.5 kg
Volume Produced: 8,043.4 m^3
Initiation: Electronic
Max. Wt. of Expl. Per 8 ms Interval: 57.5 kg
Weight Produced: 19,307.4 t
Firing Device: E*Star Blasting Machine (WRFD)
Max. No. of Holes Per 8 ms Interval: 4
Powder Factor 1: 4.488 t/kg
Other Method:
Max. Wt. of Explosive Per Hole: 14.7 kg
Powder Factor 2: 0.535 kg/m^3
Mfg and Model: DBM1600-2-RC
Scaled Distance Factor (max charge): 156.94
Rock Density: 2.400 t/m^3
Initiation Settings:
Scaled Distance Factor (per delay): 79.39
Series Resistance (ohms):

SEISMOGRAPHS

See seismographs on separate page

CREW

Blast occurred other than scheduled time: No
Misfire Occurred: No
Protective Cover: Loader Bucket

Last Name	First Name	License / Cert	2nd License / Cert	In Charge	Tied In	Chk. Tie-In	Driller	Layout
REED	ADAM, G	* ON - N/A		Yes	Yes	Yes	No	Yes
BELTRAME	ALEXANDER, A			No	No	Yes	No	No
FRALICK	CRAIG, A			No	No	Yes	No	No
KOUYOUMJIAN	MACKENZIE, H			No	No	Yes	No	No
MACPHADEN	AARON, K			No	No	Yes	No	No
NEWTON	JOHN, D			No	Yes	Yes	No	No
O'DONOHOE	LIAM, J			No	No	Yes	No	No

AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-05	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	11/17/2017 14:40	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	10' bench across the rd

PRODUCTS AND SERVICES

Number	Product Description	Quantity	Weight (kg)
11743	Black Cap DC Booster - 340g (.75 lb)	300.00 ea	102.03
10751	SHOCK*STAR DualDelay 9.2m/30' 25/500	303.00 ea	0.00
15001	24' E*STAR Detonator - QM	1.00 ea	0.00
01492	30' SHOCK*STAR Quick Relay 17 ms	3.00 ea	0.00
01494	30' SHOCK*STAR Quick Relay 42 ms	16.00 ea	0.00
01849	30' SHOCK*STAR Quick Relay 67 ms	18.00 ea	0.00
00788	SHOCK*STAR Lead-In-Line- 762m(2500')	1.00 ea	0.00
07602	Hydromite 4100 Bulk	4,200.00 kg	4,200.00
12981	Mini Stem Plug - 6015	300.00 ea	0.00
		Total Weight of Explosives (Include Primers) (kg):	4,302.03

COMMENTS / EXPLANATIONS

General Comments: .

Adam Reed

Signature of Blaster in Charge

AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-05	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	11/17/2017 14:40	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	10' bench across the rd

SEISMOGRAPH 1 - 283197 10TH CONC.

Data Type:	No Trigger	Seismograph Type:	Instantel Mini-Mate II			
Date:	11/17/17	Trigger Level:	1.00 mm/s --- dB	Transverse:	--- mm/s	--- Hz
Time:	14:40	Calibration Date:	02/02/17	Vertical:	--- mm/s	--- Hz
Distance From Blast:	1,036.93 m	Calibration Signal:		Longitudinal:	--- mm/s	--- Hz
Direction From Blast:	ESE	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:		Mic. Min. Freq.:	--- Hz	Acoustic:	--- dB	
Location:	Behind the mail box.			Vector Sum:	--- mm/s	
Lat./Long.:	44° 37' 49.797" N		80° 59' 9.304" W			
Reader and Firm:	Adam Reed, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	Adam Reed Austin Powder					

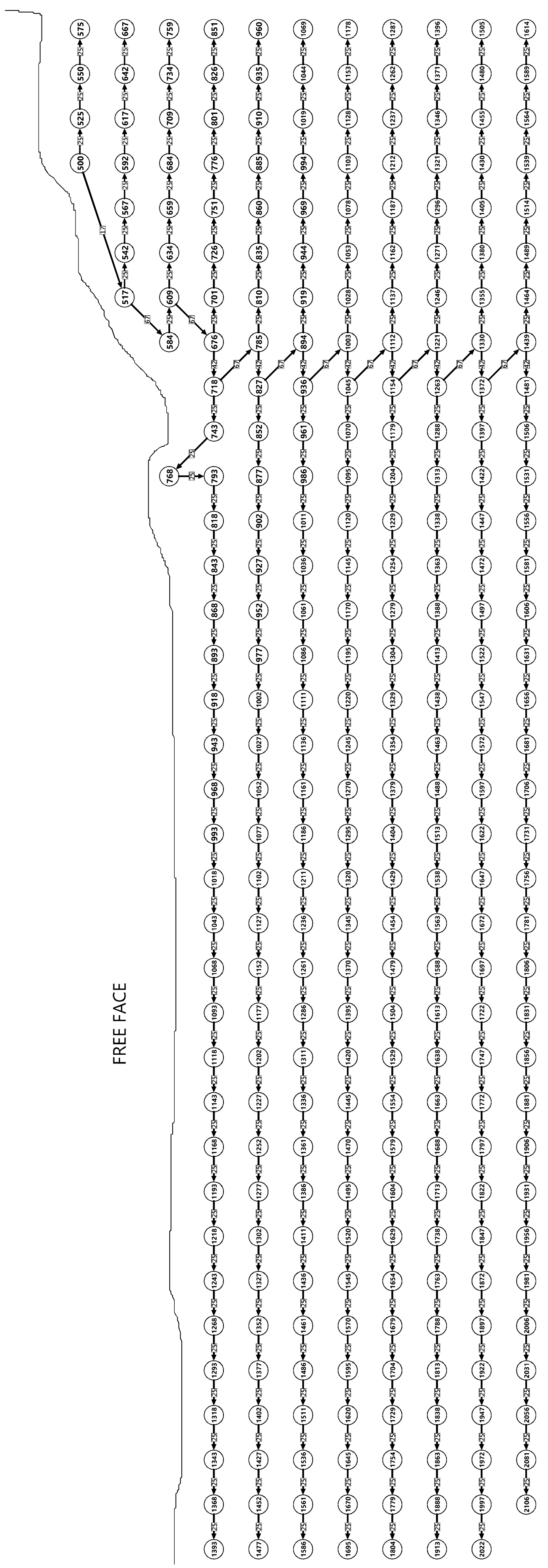
SEISMOGRAPH 2 - 178841 GREY RD. 17

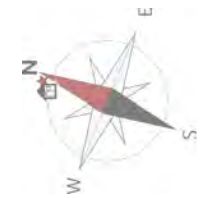
Data Type:	Seismic Record	Seismograph Type:	Instantel Minimate II			
Date:	11/17/17	Trigger Level:	1.00 mm/s --- dB	Transverse:	0.254 mm/s	--- Hz
Time:	14:40	Calibration Date:	02/02/17	Vertical:	0.254 mm/s	--- Hz
Distance From Blast:	605.03 m	Calibration Signal:		Longitudinal:	0.127 mm/s	--- Hz
Direction From Blast:	NNW	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:		Mic. Min. Freq.:	--- Hz	Acoustic:	121 dB	
Location:	Bolted to bedrock in front of property.			Vector Sum:	--- mm/s	
Lat./Long.:	44° 38' 25.645" N		80° 59' 55.415" W			
Reader and Firm:	Adam Reed, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	Adam Reed Austin Powder					

SEISMOGRAPH 3 - 178706 GREY RD. 17

Data Type:	Seismic Record	Seismograph Type:	Instantel Mini-Mate II			
Date:	11/17/17	Trigger Level:	1.00 mm/s --- dB	Transverse:	0.254 mm/s	--- Hz
Time:	14:40	Calibration Date:	02/02/17	Vertical:	0.254 mm/s	--- Hz
Distance From Blast:	714.76 m	Calibration Signal:		Longitudinal:	0.254 mm/s	--- Hz
Direction From Blast:	SE	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:		Mic. Min. Freq.:	--- Hz	Acoustic:	118 dB	
Location:	NE Corner of front lot.			Vector Sum:	--- mm/s	
Lat./Long.:	44° 37' 49.216" N		80° 59' 28.457" W			
Reader and Firm:	Adam Reed, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	Adam Reed Austin Powder					

Hole Label Mode: Cumulative In-Hole Delays





Hole	Load	Surface Delay	Deck 1 Delay
A32	Typical hole	0	500
A33	Typical hole	25	525
A34	Typical hole	50	550
A35	Typical hole	75	575
B29	Typical hole	17	517
B30	Typical hole	42	542
B31	Typical hole	67	567
B32	Typical hole	92	592
B33	Typical hole	117	617
B34	Typical hole	142	642
B35	Typical hole	167	667
C25	Typical hole	268	768
C28	Typical hole	84	584
C29	Typical hole	109	609
C30	Typical hole	134	634
C31	Typical hole	159	659
C32	Typical hole	184	684
C33	Typical hole	209	709
C34	Typical hole	234	734
C35	Typical hole	259	759
D1	Typical hole	893	1393
D2	Typical hole	868	1368
D3	Typical hole	843	1343
D4	Typical hole	818	1318
D5	Typical hole	793	1293
D6	Typical hole	768	1268
D7	Typical hole	743	1243
D8	Typical hole	718	1218
D9	Typical hole	693	1193
D10	Typical hole	668	1168
D11	Typical hole	643	1143
D12	Typical hole	618	1118
D13	Typical hole	593	1093
D14	Typical hole	568	1068
D15	Typical hole	543	1043
D16	Typical hole	518	1018
D17	Typical hole	493	993
D18	Typical hole	468	968
D19	Typical hole	443	943
D20	Typical hole	418	918
D21	Typical hole	393	893
D22	Typical hole	368	868
D23	Typical hole	343	843
D24	Typical hole	318	818
D25	Typical hole	293	793
D26	Typical hole	243	743

Hole	Load	Surface Delay	Deck 1 Delay
D27	Typical hole	218	718
D28	Typical hole	176	676
D29	Typical hole	201	701
D30	Typical hole	226	726
D31	Typical hole	251	751
D32	Typical hole	276	776
D33	Typical hole	301	801
D34	Typical hole	326	826
D35	Typical hole	351	851
E1	Typical hole	977	1477
E2	Typical hole	952	1452
E3	Typical hole	927	1427
E4	Typical hole	902	1402
E5	Typical hole	877	1377
E6	Typical hole	852	1352
E7	Typical hole	827	1327
E8	Typical hole	802	1302
E9	Typical hole	777	1277
E10	Typical hole	752	1252
E11	Typical hole	727	1227
E12	Typical hole	702	1202
E13	Typical hole	677	1177
E14	Typical hole	652	1152
E15	Typical hole	627	1127
E16	Typical hole	602	1102
E17	Typical hole	577	1077
E18	Typical hole	552	1052
E19	Typical hole	527	1027
E20	Typical hole	502	1002
E21	Typical hole	477	977
E22	Typical hole	452	952
E23	Typical hole	427	927
E24	Typical hole	402	902
E25	Typical hole	377	877
E26	Typical hole	352	852
E27	Typical hole	327	827
E28	Typical hole	285	785
E29	Typical hole	310	810
E30	Typical hole	335	835
E31	Typical hole	360	860
E32	Typical hole	385	885
E33	Typical hole	410	910
E34	Typical hole	435	935
E35	Typical hole	460	960
F1	Typical hole	1086	1586
F2	Typical hole	1061	1561

Hole	Load	Surface Delay	Deck 1 Delay
F3	Typical hole	1036	1536
F4	Typical hole	1011	1511
F5	Typical hole	986	1486
F6	Typical hole	961	1461
F7	Typical hole	936	1436
F8	Typical hole	911	1411
F9	Typical hole	886	1386
F10	Typical hole	861	1361
F11	Typical hole	836	1336
F12	Typical hole	811	1311
F13	Typical hole	786	1286
F14	Typical hole	761	1261
F15	Typical hole	736	1236
F16	Typical hole	711	1211
F17	Typical hole	686	1186
F18	Typical hole	661	1161
F19	Typical hole	636	1136
F20	Typical hole	611	1111
F21	Typical hole	586	1086
F22	Typical hole	561	1061
F23	Typical hole	536	1036
F24	Typical hole	511	1011
F25	Typical hole	486	986
F26	Typical hole	461	961
F27	Typical hole	436	936
F28	Typical hole	394	894
F29	Typical hole	419	919
F30	Typical hole	444	944
F31	Typical hole	469	969
F32	Typical hole	494	994
F33	Typical hole	519	1019
F34	Typical hole	544	1044
F35	Typical hole	569	1069
G1	Typical hole	1195	1695
G2	Typical hole	1170	1670
G3	Typical hole	1145	1645
G4	Typical hole	1120	1620
G5	Typical hole	1095	1595
G6	Typical hole	1070	1570
G7	Typical hole	1045	1545
G8	Typical hole	1020	1520
G9	Typical hole	995	1495
G10	Typical hole	970	1470
G11	Typical hole	945	1445
G12	Typical hole	920	1420
G13	Typical hole	895	1395

Hole	Load	Surface Delay	Deck 1 Delay
G14	Typical hole	870	1370
G15	Typical hole	845	1345
G16	Typical hole	820	1320
G17	Typical hole	795	1295
G18	Typical hole	770	1270
G19	Typical hole	745	1245
G20	Typical hole	720	1220
G21	Typical hole	695	1195
G22	Typical hole	670	1170
G23	Typical hole	645	1145
G24	Typical hole	620	1120
G25	Typical hole	595	1095
G26	Typical hole	570	1070
G27	Typical hole	545	1045
G28	Typical hole	503	1003
G29	Typical hole	528	1028
G30	Typical hole	553	1053
G31	Typical hole	578	1078
G32	Typical hole	603	1103
G33	Typical hole	628	1128
G34	Typical hole	653	1153
G35	Typical hole	678	1178
H1	Typical hole	1304	1804
H2	Typical hole	1279	1779
H3	Typical hole	1254	1754
H4	Typical hole	1229	1729
H5	Typical hole	1204	1704
H6	Typical hole	1179	1679
H7	Typical hole	1154	1654
H8	Typical hole	1129	1629
H9	Typical hole	1104	1604
H10	Typical hole	1079	1579
H11	Typical hole	1054	1554
H12	Typical hole	1029	1529
H13	Typical hole	1004	1504
H14	Typical hole	979	1479
H15	Typical hole	954	1454
H16	Typical hole	929	1429
H17	Typical hole	904	1404
H18	Typical hole	879	1379
H19	Typical hole	854	1354
H20	Typical hole	829	1329
H21	Typical hole	804	1304
H22	Typical hole	779	1279
H23	Typical hole	754	1254
H24	Typical hole	729	1229

Hole	Load	Surface Delay	Deck 1 Delay
H25	Typical hole	704	1204
H26	Typical hole	679	1179
H27	Typical hole	654	1154
H28	Typical hole	612	1112
H29	Typical hole	637	1137
H30	Typical hole	662	1162
H31	Typical hole	687	1187
H32	Typical hole	712	1212
H33	Typical hole	737	1237
H34	Typical hole	762	1262
H35	Typical hole	787	1287
I1	Typical hole	1413	1913
I2	Typical hole	1388	1888
I3	Typical hole	1363	1863
I4	Typical hole	1338	1838
I5	Typical hole	1313	1813
I6	Typical hole	1288	1788
I7	Typical hole	1263	1763
I8	Typical hole	1238	1738
I9	Typical hole	1213	1713
I10	Typical hole	1188	1688
I11	Typical hole	1163	1663
I12	Typical hole	1138	1638
I13	Typical hole	1113	1613
I14	Typical hole	1088	1588
I15	Typical hole	1063	1563
I16	Typical hole	1038	1538
I17	Typical hole	1013	1513
I18	Typical hole	988	1488
I19	Typical hole	963	1463
I20	Typical hole	938	1438
I21	Typical hole	913	1413
I22	Typical hole	888	1388
I23	Typical hole	863	1363
I24	Typical hole	838	1338
I25	Typical hole	813	1313
I26	Typical hole	788	1288
I27	Typical hole	763	1263
I28	Typical hole	721	1221
I29	Typical hole	746	1246
I30	Typical hole	771	1271
I31	Typical hole	796	1296
I32	Typical hole	821	1321
I33	Typical hole	846	1346
I34	Typical hole	871	1371
I35	Typical hole	896	1396

Hole	Load	Surface Delay	Deck 1 Delay
J1	Typical hole	1522	2022
J2	Typical hole	1497	1997
J3	Typical hole	1472	1972
J4	Typical hole	1447	1947
J5	Typical hole	1422	1922
J6	Typical hole	1397	1897
J7	Typical hole	1372	1872
J8	Typical hole	1347	1847
J9	Typical hole	1322	1822
J10	Typical hole	1297	1797
J11	Typical hole	1272	1772
J12	Typical hole	1247	1747
J13	Typical hole	1222	1722
J14	Typical hole	1197	1697
J15	Typical hole	1172	1672
J16	Typical hole	1147	1647
J17	Typical hole	1122	1622
J18	Typical hole	1097	1597
J19	Typical hole	1072	1572
J20	Typical hole	1047	1547
J21	Typical hole	1022	1522
J22	Typical hole	997	1497
J23	Typical hole	972	1472
J24	Typical hole	947	1447
J25	Typical hole	922	1422
J26	Typical hole	897	1397
J27	Typical hole	872	1372
J28	Typical hole	830	1330
J29	Typical hole	855	1355
J30	Typical hole	880	1380
J31	Typical hole	905	1405
J32	Typical hole	930	1430
J33	Typical hole	955	1455
J34	Typical hole	980	1480
J35	Typical hole	1005	1505
K2	Typical hole	1606	2106
K3	Typical hole	1581	2081
K4	Typical hole	1556	2056
K5	Typical hole	1531	2031
K6	Typical hole	1506	2006
K7	Typical hole	1481	1981
K8	Typical hole	1456	1956
K9	Typical hole	1431	1931
K10	Typical hole	1406	1906
K11	Typical hole	1381	1881
K12	Typical hole	1356	1856

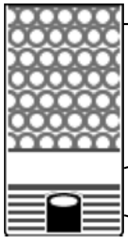
Hole	Load	Surface Delay	Deck 1 Delay
K13	Typical hole	1331	1831
K14	Typical hole	1306	1806
K15	Typical hole	1281	1781
K16	Typical hole	1256	1756
K17	Typical hole	1231	1731
K18	Typical hole	1206	1706
K19	Typical hole	1181	1681
K20	Typical hole	1156	1656
K21	Typical hole	1131	1631
K22	Typical hole	1106	1606
K23	Typical hole	1081	1581
K24	Typical hole	1056	1556
K25	Typical hole	1031	1531
K26	Typical hole	1006	1506
K27	Typical hole	981	1481
K28	Typical hole	939	1439
K29	Typical hole	964	1464
K30	Typical hole	989	1489
K31	Typical hole	1014	1514
K32	Typical hole	1039	1539
K33	Typical hole	1064	1564
K34	Typical hole	1089	1589
K35	extra	1114	1614

0 m

5 m

Typical hole

Ø = 114.3 mm



[1.8 m] - Crushed Stone

[0.5 m] - Air

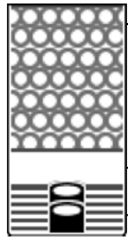
[0.6 m] - Hydromite
4100 Bulk
Wgt: 14.05 kg

[2.7 m] - Black Cap DC
Booster - 340g (.75 lb)
Det: SHOCK*STAR
DualDelay 9.2m/30'
25/500
Del: 500.00 (ms)
Con: Other Hole
Wgt: 0.34 kg

14.39 kg

extra

Ø = 114.3 mm



[1.8 m] - Crushed Stone

[0.5 m] - Air

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4100 Bulk
Wgt: 14.05 kg

[2.6 m] - Black Cap DC
Booster - 340g (.75 lb)
Det: SHOCK*STAR
DualDelay 9.2m/30'
25/500
Del: 500.00 (ms)
Con: Other Hole
Wgt: 0.34 kg

[2.8 m] - Black Cap DC
Booster - 340g (.75 lb)
Det: SHOCK*STAR
DualDelay 9.2m/30'
25/500
Del: 500.00 (ms)
Con: Other Hole
Wgt: 0.34 kg

14.73 kg

AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-06	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	12/04/2017 15:20	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	Top Bench (Across the Road)

ENVIRONMENT

Method Used:	U.T.M.	Weather:	Cloudy / High Clouds	Wind From:	NE
Temperature:	3 °C	Terrain:	Flat	Wind Velocity:	5-8 km/h
Blast U.T.M.:	17N 500314 mE 4942429 mN				

NEAREST PROTECTED STRUCTURE

Structure Name:	178841 Grey Rd #17	Compass Point:	NNW
Structure Type:	Dwelling	Direction/Bearing:	340 °
Structure U.T.M.:	17N 500101 mE 4943011 mN	Distance:	620 m

LAYOUT

		Hole Depth:	4.57 m	Material Blasted:	Limestone	Total Meters Drilled:	2,190.0 m
No. of Holes:	479	Subdrilling:	0.00 m	Burden:	3.05 m	Water Depth:	1.22 m
No. of V.P.† Holes:	479	Face Height:	4.57 m	Spacing:	3.05 m	Stem Length:	2.13 m
No. of Rows:	23	Drilling Angle:	°	Back Fill Depth:	0.00 m	Area Type:	Conventional
Diameter:	114.3 mm	Mats Used:	No	Stem Type:	Clear Stone	Method:	Deepest Hole Load

† V.P. = Volume Producing

WEIGHTS

		Max. Wt. of Expl. in Overlapped Decks:	74.9 kg	Volume Produced:	20,345.6 m^3
Initiation:	Non-Electric	Max. Wt. of Expl. Per 8 ms Interval:	74.9 kg	Weight Produced:	53,907.3 t
Firing Device:	Other	Max. No. of Holes Per 8 ms Interval:	3	Powder Factor 1:	4.508 t/kg
Other Method:	Wireless	Max. Wt. of Explosive Per Hole:	25.3 kg	Powder Factor 2:	0.588 kg/m^3
Mfg and Model:	DBM1600-2-RC	Scaled Distance Factor (max charge):	123.15	Rock Density:	2.650 t/m^3
Initiation Settings:		Scaled Distance Factor (per delay):	71.59		
Series Resistance (ohms):					

SEISMOGRAPHS See seismographs on separate page

CREW

Blast occurred other than scheduled time: No   Misfire Occurred: No   Protective Cover: Loader Bucket

Last Name	First Name	License / Cert	2nd License / Cert	In Charge	Tied In	Chk. Tie-In	Driller	Layout
SMART	EVAN, C	* ON - N/A		Yes	Yes	Yes	No	Yes
BELTRAME	ALEXANDER, A			No	No	Yes	No	No
FRALICK	CRAIG, A			No	No	Yes	No	No
KOUYOUMJIAN	MACKENZIE, H			No	No	Yes	No	No
MACPHADEN	AARON, K			No	No	Yes	No	No
NEWTON	JOHN, D			No	Yes	Yes	No	No
O'DONOHOE	LIAM, J			No	No	Yes	No	No
REED	ADAM, G			No	Yes	Yes	No	No

AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-06	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	12/04/2017 15:20	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	Top Bench (Across the Road)

PRODUCTS AND SERVICES

Number	Product Description	Quantity		Weight (kg)
11743	Black Cap DC Booster - 340g (.75 lb)	489.00	ea	166.31
10751	SHOCK*STAR DualDelay 9.2m/30' 25/500	488.00	ea	0.00
15001	24' E*STAR Detonator - QM	1.00	ea	0.00
01492	30' SHOCK*STAR Quick Relay 17 ms	5.00	ea	0.00
01494	30' SHOCK*STAR Quick Relay 42 ms	14.00	ea	0.00
01849	30' SHOCK*STAR Quick Relay 67 ms	46.00	ea	0.00
07602	Hydromite 4100 Bulk	11,790.00	kg	11,790.00
12981	Mini Stem Plug - 6015	479.00	ea	0.00
	Total Weight of Explosives (Include Primers) (kg):			11,956.31

COMMENTS / EXPLANATIONS

General Comments: Extra booster in a hole

Signature of Blaster in Charge

AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-06	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	12/04/2017 15:20	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	Top Bench (Across the Road)

SEISMOGRAPH 1 - 178717 GREY RD #17

Data Type:	No Trigger	Seismograph Type:	Instantel - Minimate Blaster			
Date:	12/04/17	Trigger Level:	1.50 mm/s 115.00 dB	Transverse:	--- mm/s	--- Hz
Time:	15:20	Calibration Date:	02/01/17	Vertical:	--- mm/s	--- Hz
Distance From Blast:	558.09 m	Calibration Signal:	OK	Longitudinal:	--- mm/s	--- Hz
Direction From Blast:	SE	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:		Mic. Min. Freq.:	--- Hz	Acoustic:	--- dB	
Location:	Spiked and buried.			Vector Sum:	--- mm/s	
U.T.M.:	17N 500660 mE 4941991 mN					
Reader and Firm:	Evan Smart, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	John Newton, Austin Powder Ltd.					

SEISMOGRAPH 2 - 178841 GREY ROAD #17

Data Type:	Seismic Record	Seismograph Type:	Instantel - Minimate Blaster			
Date:	12/04/17	Trigger Level:	1.50 mm/s 115.00 dB	Transverse:	0.254 mm/s	51.0 Hz
Time:	15:20	Calibration Date:	01/24/17	Vertical:	0.127 mm/s	0.0 Hz
Distance From Blast:	619.66 m	Calibration Signal:	OK	Longitudinal:	0.254 mm/s	0.0 Hz
Direction From Blast:	NNW	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:	Printed Copy	Mic. Min. Freq.:	--- Hz	Acoustic:	116 dB	
Location:	Bolted to Bedrock.			Vector Sum:	0.311 mm/s	
U.T.M.:	17N 500101 mE 4943011 mN					
Reader and Firm:	Evan Smart, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	John Newton, Austin Powder Ltd.					

SEISMOGRAPH 3 - 178706 GREY RD #17

Data Type:	No Trigger	Seismograph Type:	Instantel - Minimate Blaster			
Date:	12/04/17	Trigger Level:	1.50 mm/s 115.00 dB	Transverse:	--- mm/s	--- Hz
Time:	15:20	Calibration Date:	01/24/17	Vertical:	--- mm/s	--- Hz
Distance From Blast:	623.01 m	Calibration Signal:	OK	Longitudinal:	--- mm/s	--- Hz
Direction From Blast:	SE	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:		Mic. Min. Freq.:	--- Hz	Acoustic:	--- dB	
Location:	Spiked and weight bagged in front yard			Vector Sum:	--- mm/s	
U.T.M.:	17N 500660 mE 4941911 mN					
Reader and Firm:	Evan Smart, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	John Newton, Austin Powder Ltd.					

AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

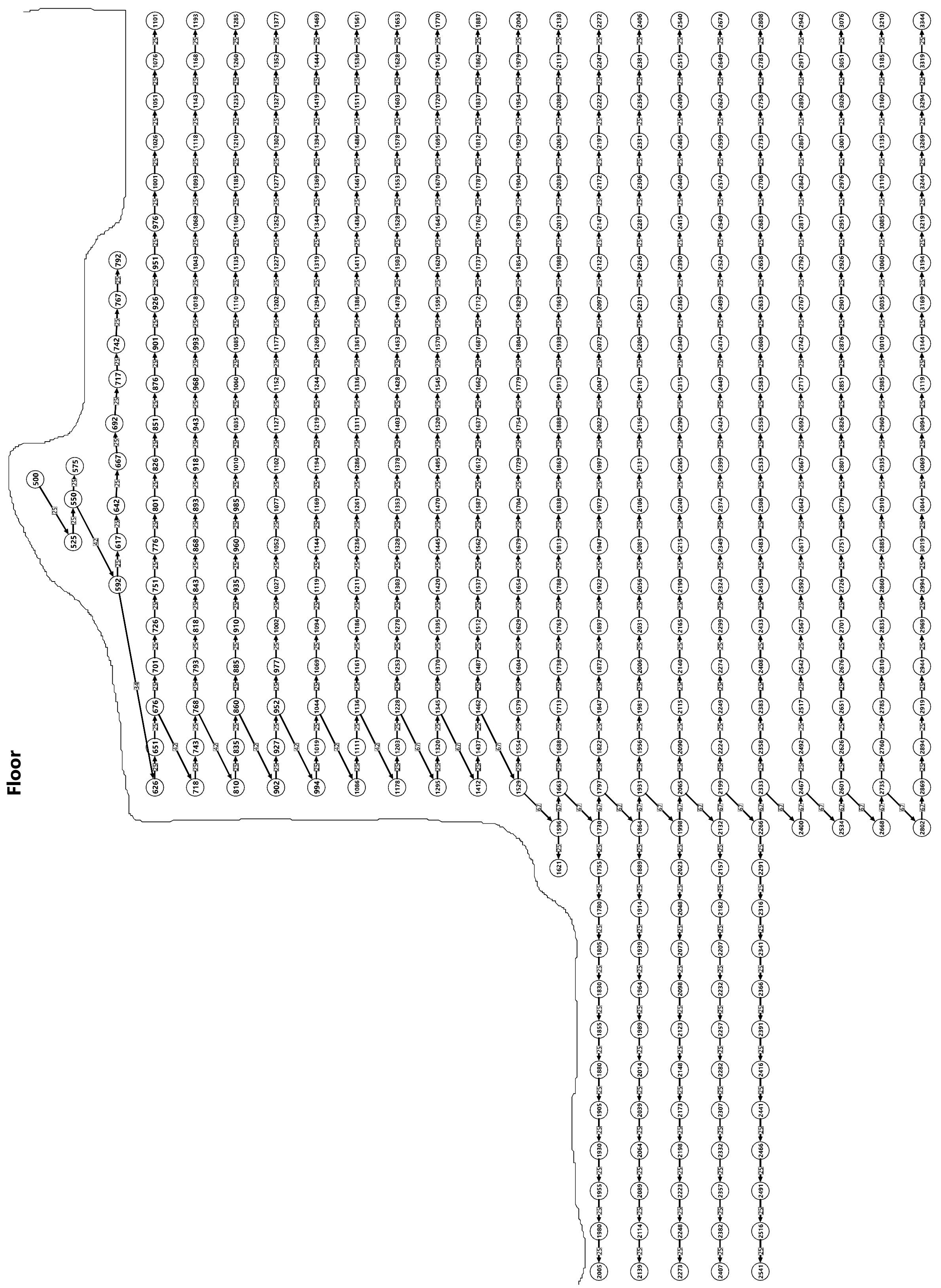
Blast No.:	2017-06	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	12/04/2017 15:20	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	Top Bench (Across the Road)

SEISMOGRAPH 4 - 283197 CONC. RD. #10

Data Type:	No Trigger	Seismograph Type:	Instanel - Minimate Blaster				
Date:	12/04/17	Trigger Level:	1.50 mm/s	115.00 dB	Transverse:	--- mm/s	--- Hz
Time:	15:20	Calibration Date:	01/24/17		Vertical:	--- mm/s	--- Hz
Distance From Blast:	958.90 m	Calibration Signal:	OK		Longitudinal:	--- mm/s	--- Hz
Direction From Blast:	ESE	Geophone Min. Freq.:	--- Hz		PPV:	--- mm/s	--- Hz
Readout:		Mic. Min. Freq.:	--- Hz		Acoustic:	--- dB	
Location:	Spiked and buried.				Vector Sum:	--- mm/s	
U.T.M.:	17N 501117 mE 4941905 mN						
Reader and Firm:	Evan Smart, AUSTIN POWDER						
Analyst and Firm:							
Installer and Firm:	John Newton, Austin Powder Ltd.						

Hole Label Mode: Cumulative In-Hole Delays

Floor



Hole	Load	Surface Delay	Deck 1 Delay
A21	Typical Hole Load	0	500
B19	Typical Hole Load	25	525
B20	Typical Hole Load	50	550
B21	Typical Hole Load	75	575
C18	Typical Hole Load	92	592
C19	Typical Hole Load	117	617
C20	Typical Hole Load	142	642
C21	Typical Hole Load	167	667
C22	Typical Hole Load	192	692
C23	Typical Hole Load	217	717
C24	Typical Hole Load	242	742
C25	Typical Hole Load	267	767
C26	Typical Hole Load	292	792
D13	Typical Hole Load	126	626
D14	Typical Hole Load	151	651
D15	Typical Hole Load	176	676
D16	Typical Hole Load	201	701
D17	Typical Hole Load	226	726
D18	Typical Hole Load	251	751
D19	Typical Hole Load	276	776
D20	Typical Hole Load	301	801
D21	Typical Hole Load	326	826
D22	Typical Hole Load	351	851
D23	Typical Hole Load	376	876
D24	Typical Hole Load	401	901
D25	Typical Hole Load	426	926
D26	Typical Hole Load	451	951
D27	Typical Hole Load	476	976
D28	Typical Hole Load	501	1001
D29	Typical Hole Load	526	1026
D30	Typical Hole Load	551	1051
D31	Typical Hole Load	576	1076
D32	Typical Hole Load	601	1101
E13	Typical Hole Load	218	718
E14	Typical Hole Load	243	743
E15	Typical Hole Load	268	768
E16	Typical Hole Load	293	793
E17	Typical Hole Load	318	818
E18	Typical Hole Load	343	843
E19	Typical Hole Load	368	868
E20	Typical Hole Load	393	893
E21	Typical Hole Load	418	918
E22	Typical Hole Load	443	943
E23	Typical Hole Load	468	968
E24	Typical Hole Load	493	993
E25	Typical Hole Load	518	1018

Hole	Load	Surface Delay	Deck 1 Delay
E26	Typical Hole Load	543	1043
E27	Typical Hole Load	568	1068
E28	Typical Hole Load	593	1093
E29	Typical Hole Load	618	1118
E30	Typical Hole Load	643	1143
E31	Typical Hole Load	668	1168
E32	Typical Hole Load	693	1193
F13	Typical Hole Load	310	810
F14	Typical Hole Load	335	835
F15	Typical Hole Load	360	860
F16	Typical Hole Load	385	885
F17	Typical Hole Load	410	910
F18	Typical Hole Load	435	935
F19	Typical Hole Load	460	960
F20	Typical Hole Load	485	985
F21	Typical Hole Load	510	1010
F22	Typical Hole Load	535	1035
F23	Typical Hole Load	560	1060
F24	Typical Hole Load	585	1085
F25	Typical Hole Load	610	1110
F26	Typical Hole Load	635	1135
F27	Typical Hole Load	660	1160
F28	Typical Hole Load	685	1185
F29	Typical Hole Load	710	1210
F30	Typical Hole Load	735	1235
F31	Typical Hole Load	760	1260
F32	Typical Hole Load	785	1285
G13	Typical Hole Load	402	902
G14	Typical Hole Load	427	927
G15	Typical Hole Load	452	952
G16	Typical Hole Load	477	977
G17	Typical Hole Load	502	1002
G18	Typical Hole Load	527	1027
G19	Typical Hole Load	552	1052
G20	Typical Hole Load	577	1077
G21	Typical Hole Load	602	1102
G22	Typical Hole Load	627	1127
G23	Typical Hole Load	652	1152
G24	Typical Hole Load	677	1177
G25	Typical Hole Load	702	1202
G26	Typical Hole Load	727	1227
G27	Typical Hole Load	752	1252
G28	Typical Hole Load	777	1277
G29	Typical Hole Load	802	1302
G30	Typical Hole Load	827	1327
G31	Typical Hole Load	852	1352

Hole	Load	Surface Delay	Deck 1 Delay
G32	Typical Hole Load	877	1377
H13	Typical Hole Load	494	994
H14	Typical Hole Load	519	1019
H15	Typical Hole Load	544	1044
H16	Typical Hole Load	569	1069
H17	Typical Hole Load	594	1094
H18	Typical Hole Load	619	1119
H19	Typical Hole Load	644	1144
H20	Typical Hole Load	669	1169
H21	Typical Hole Load	694	1194
H22	Typical Hole Load	719	1219
H23	Typical Hole Load	744	1244
H24	Typical Hole Load	769	1269
H25	Typical Hole Load	794	1294
H26	Typical Hole Load	819	1319
H27	Typical Hole Load	844	1344
H28	Typical Hole Load	869	1369
H29	Typical Hole Load	894	1394
H30	Typical Hole Load	919	1419
H31	Typical Hole Load	944	1444
H32	Typical Hole Load	969	1469
I13	Typical Hole Load	586	1086
I14	Typical Hole Load	611	1111
I15	Typical Hole Load	636	1136
I16	Typical Hole Load	661	1161
I17	Typical Hole Load	686	1186
I18	Typical Hole Load	711	1211
I19	Typical Hole Load	736	1236
I20	Typical Hole Load	761	1261
I21	Typical Hole Load	786	1286
I22	Typical Hole Load	811	1311
I23	Typical Hole Load	836	1336
I24	Typical Hole Load	861	1361
I25	Typical Hole Load	886	1386
I26	Typical Hole Load	911	1411
I27	Typical Hole Load	936	1436
I28	Typical Hole Load	961	1461
I29	Typical Hole Load	986	1486
I30	Typical Hole Load	1011	1511
I31	Typical Hole Load	1036	1536
I32	Typical Hole Load	1061	1561
J13	Typical Hole Load	678	1178
J14	Typical Hole Load	703	1203
J15	Typical Hole Load	728	1228
J16	Typical Hole Load	753	1253
J17	Typical Hole Load	778	1278

Hole	Load	Surface Delay	Deck 1 Delay
J18	Typical Hole Load	803	1303
J19	Typical Hole Load	828	1328
J20	Double Cap	853	1353
J21	Typical Hole Load	878	1378
J22	Typical Hole Load	903	1403
J23	Typical Hole Load	928	1428
J24	Typical Hole Load	953	1453
J25	Typical Hole Load	978	1478
J26	Typical Hole Load	1003	1503
J27	Typical Hole Load	1028	1528
J28	Typical Hole Load	1053	1553
J29	Typical Hole Load	1078	1578
J30	Typical Hole Load	1103	1603
J31	Typical Hole Load	1128	1628
J32	Typical Hole Load	1153	1653
K13	Typical Hole Load	795	1295
K14	Typical Hole Load	820	1320
K15	Typical Hole Load	845	1345
K16	Typical Hole Load	870	1370
K17	Typical Hole Load	895	1395
K18	Typical Hole Load	920	1420
K19	Typical Hole Load	945	1445
K20	Typical Hole Load	970	1470
K21	Typical Hole Load	995	1495
K22	Typical Hole Load	1020	1520
K23	Typical Hole Load	1045	1545
K24	Typical Hole Load	1070	1570
K25	Double Cap	1095	1595
K26	Typical Hole Load	1120	1620
K27	Typical Hole Load	1145	1645
K28	Typical Hole Load	1170	1670
K29	Typical Hole Load	1195	1695
K30	Typical Hole Load	1220	1720
K31	Typical Hole Load	1245	1745
K32	Typical Hole Load	1270	1770
L13	Typical Hole Load	912	1412
L14	Typical Hole Load	937	1437
L15	Typical Hole Load	962	1462
L16	Typical Hole Load	987	1487
L17	Typical Hole Load	1012	1512
L18	Typical Hole Load	1037	1537
L19	Typical Hole Load	1062	1562
L20	Typical Hole Load	1087	1587
L21	Typical Hole Load	1112	1612
L22	Typical Hole Load	1137	1637
L23	Typical Hole Load	1162	1662

Hole	Load	Surface Delay	Deck 1 Delay
L24	Typical Hole Load	1187	1687
L25	Typical Hole Load	1212	1712
L26	Typical Hole Load	1237	1737
L27	Typical Hole Load	1262	1762
L28	Extra Booster	1287	1787
L29	Typical Hole Load	1312	1812
L30	Typical Hole Load	1337	1837
L31	Typical Hole Load	1362	1862
L32	Typical Hole Load	1387	1887
M13	Typical Hole Load	1029	1529
M14	Typical Hole Load	1054	1554
M15	Typical Hole Load	1079	1579
M16	Typical Hole Load	1104	1604
M17	Typical Hole Load	1129	1629
M18	Typical Hole Load	1154	1654
M19	Typical Hole Load	1179	1679
M20	Typical Hole Load	1204	1704
M21	Typical Hole Load	1229	1729
M22	Typical Hole Load	1254	1754
M23	Typical Hole Load	1279	1779
M24	Typical Hole Load	1304	1804
M25	Typical Hole Load	1329	1829
M26	Typical Hole Load	1354	1854
M27	Typical Hole Load	1379	1879
M28	Typical Hole Load	1404	1904
M29	Typical Hole Load	1429	1929
M30	Typical Hole Load	1454	1954
M31	Typical Hole Load	1479	1979
M32	Typical Hole Load	1504	2004
N11	Typical Hole Load	1121	1621
N12	Typical Hole Load	1096	1596
N13	Typical Hole Load	1163	1663
N14	Typical Hole Load	1188	1688
N15	Typical Hole Load	1213	1713
N16	Typical Hole Load	1238	1738
N17	Typical Hole Load	1263	1763
N18	Typical Hole Load	1288	1788
N19	Typical Hole Load	1313	1813
N20	Typical Hole Load	1338	1838
N21	Typical Hole Load	1363	1863
N22	Typical Hole Load	1388	1888
N23	Typical Hole Load	1413	1913
N24	Typical Hole Load	1438	1938
N25	Typical Hole Load	1463	1963
N26	Typical Hole Load	1488	1988
N27	Typical Hole Load	1513	2013

Hole	Load	Surface Delay	Deck 1 Delay
N28	Typical Hole Load	1538	2038
N29	Typical Hole Load	1563	2063
N30	Typical Hole Load	1588	2088
N31	Typical Hole Load	1613	2113
N32	Typical Hole Load	1638	2138
O1	Typical Hole Load	1505	2005
O2	Typical Hole Load	1480	1980
O3	Typical Hole Load	1455	1955
O4	Typical Hole Load	1430	1930
O5	Typical Hole Load	1405	1905
O6	Typical Hole Load	1380	1880
O7	Typical Hole Load	1355	1855
O8	Typical Hole Load	1330	1830
O9	Typical Hole Load	1305	1805
O10	Typical Hole Load	1280	1780
O11	Typical Hole Load	1255	1755
O12	Typical Hole Load	1230	1730
O13	Typical Hole Load	1297	1797
O14	Typical Hole Load	1322	1822
O15	Typical Hole Load	1347	1847
O16	Typical Hole Load	1372	1872
O17	Typical Hole Load	1397	1897
O18	Typical Hole Load	1422	1922
O19	Typical Hole Load	1447	1947
O20	Typical Hole Load	1472	1972
O21	Double Cap	1497	1997
O22	Typical Hole Load	1522	2022
O23	Typical Hole Load	1547	2047
O24	Typical Hole Load	1572	2072
O25	Typical Hole Load	1597	2097
O26	Typical Hole Load	1622	2122
O27	Typical Hole Load	1647	2147
O28	Typical Hole Load	1672	2172
O29	Typical Hole Load	1697	2197
O30	Typical Hole Load	1722	2222
O31	Typical Hole Load	1747	2247
O32	Typical Hole Load	1772	2272
P1	Typical Hole Load	1639	2139
P2	Typical Hole Load	1614	2114
P3	Typical Hole Load	1589	2089
P4	Typical Hole Load	1564	2064
P5	Typical Hole Load	1539	2039
P6	Typical Hole Load	1514	2014
P7	Typical Hole Load	1489	1989
P8	Typical Hole Load	1464	1964
P9	Typical Hole Load	1439	1939

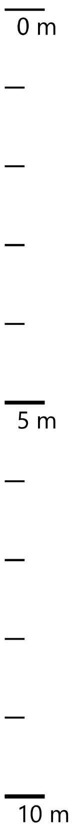
Hole	Load	Surface Delay	Deck 1 Delay
P10	Typical Hole Load	1414	1914
P11	Typical Hole Load	1389	1889
P12	Typical Hole Load	1364	1864
P13	Typical Hole Load	1431	1931
P14	Typical Hole Load	1456	1956
P15	Typical Hole Load	1481	1981
P16	Typical Hole Load	1506	2006
P17	Typical Hole Load	1531	2031
P18	Typical Hole Load	1556	2056
P19	Typical Hole Load	1581	2081
P20	Typical Hole Load	1606	2106
P21	Typical Hole Load	1631	2131
P22	Typical Hole Load	1656	2156
P23	Typical Hole Load	1681	2181
P24	Typical Hole Load	1706	2206
P25	Double Cap	1731	2231
P26	Typical Hole Load	1756	2256
P27	Typical Hole Load	1781	2281
P28	Typical Hole Load	1806	2306
P29	Typical Hole Load	1831	2331
P30	Typical Hole Load	1856	2356
P31	Typical Hole Load	1881	2381
P32	Typical Hole Load	1906	2406
Q1	Typical Hole Load	1773	2273
Q2	Typical Hole Load	1748	2248
Q3	Typical Hole Load	1723	2223
Q4	Double Cap	1698	2198
Q5	Typical Hole Load	1673	2173
Q6	Typical Hole Load	1648	2148
Q7	Double Cap	1623	2123
Q8	Typical Hole Load	1598	2098
Q9	Typical Hole Load	1573	2073
Q10	Typical Hole Load	1548	2048
Q11	Typical Hole Load	1523	2023
Q12	Typical Hole Load	1498	1998
Q13	Typical Hole Load	1565	2065
Q14	Typical Hole Load	1590	2090
Q15	Typical Hole Load	1615	2115
Q16	Typical Hole Load	1640	2140
Q17	Typical Hole Load	1665	2165
Q18	Typical Hole Load	1690	2190
Q19	Typical Hole Load	1715	2215
Q20	Typical Hole Load	1740	2240
Q21	Typical Hole Load	1765	2265
Q22	Typical Hole Load	1790	2290
Q23	Double Cap	1815	2315

Hole	Load	Surface Delay	Deck 1 Delay
Q24	Typical Hole Load	1840	2340
Q25	Typical Hole Load	1865	2365
Q26	Typical Hole Load	1890	2390
Q27	Typical Hole Load	1915	2415
Q28	Typical Hole Load	1940	2440
Q29	Typical Hole Load	1965	2465
Q30	Typical Hole Load	1990	2490
Q31	Typical Hole Load	2015	2515
Q32	Typical Hole Load	2040	2540
R1	Typical Hole Load	1907	2407
R2	Typical Hole Load	1882	2382
R3	Typical Hole Load	1857	2357
R4	Typical Hole Load	1832	2332
R5	Typical Hole Load	1807	2307
R6	Typical Hole Load	1782	2282
R7	Typical Hole Load	1757	2257
R8	Typical Hole Load	1732	2232
R9	Typical Hole Load	1707	2207
R10	Typical Hole Load	1682	2182
R11	Typical Hole Load	1657	2157
R12	Typical Hole Load	1632	2132
R13	Typical Hole Load	1699	2199
R14	Typical Hole Load	1724	2224
R15	Typical Hole Load	1749	2249
R16	Typical Hole Load	1774	2274
R17	Typical Hole Load	1799	2299
R18	Typical Hole Load	1824	2324
R19	Typical Hole Load	1849	2349
R20	Typical Hole Load	1874	2374
R21	Typical Hole Load	1899	2399
R22	Typical Hole Load	1924	2424
R23	Typical Hole Load	1949	2449
R24	Typical Hole Load	1974	2474
R25	Typical Hole Load	1999	2499
R26	Typical Hole Load	2024	2524
R27	Typical Hole Load	2049	2549
R28	Typical Hole Load	2074	2574
R29	Typical Hole Load	2099	2599
R30	Typical Hole Load	2124	2624
R31	Typical Hole Load	2149	2649
R32	Typical Hole Load	2174	2674
S1	Typical Hole Load	2041	2541
S2	Typical Hole Load	2016	2516
S3	Typical Hole Load	1991	2491
S4	Typical Hole Load	1966	2466
S5	Typical Hole Load	1941	2441

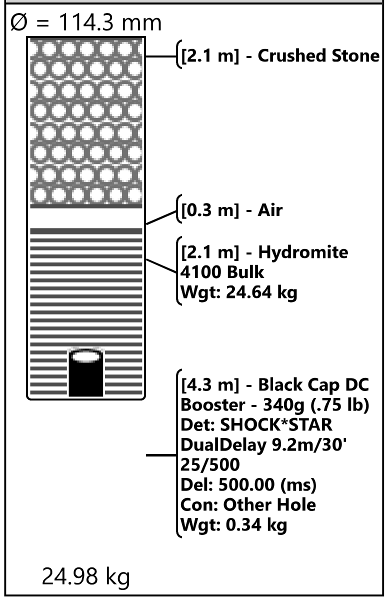
Hole	Load	Surface Delay	Deck 1 Delay
S6	Typical Hole Load	1916	2416
S7	Typical Hole Load	1891	2391
S8	Typical Hole Load	1866	2366
S9	Typical Hole Load	1841	2341
S10	Typical Hole Load	1816	2316
S11	Typical Hole Load	1791	2291
S12	Typical Hole Load	1766	2266
S13	Typical Hole Load	1833	2333
S14	Typical Hole Load	1858	2358
S15	Typical Hole Load	1883	2383
S16	Typical Hole Load	1908	2408
S17	Typical Hole Load	1933	2433
S18	Typical Hole Load	1958	2458
S19	Typical Hole Load	1983	2483
S20	Typical Hole Load	2008	2508
S21	Typical Hole Load	2033	2533
S22	Typical Hole Load	2058	2558
S23	Double Cap	2083	2583
S24	Typical Hole Load	2108	2608
S25	Typical Hole Load	2133	2633
S26	Typical Hole Load	2158	2658
S27	Typical Hole Load	2183	2683
S28	Typical Hole Load	2208	2708
S29	Typical Hole Load	2233	2733
S30	Typical Hole Load	2258	2758
S31	Typical Hole Load	2283	2783
S32	Typical Hole Load	2308	2808
T12	Typical Hole Load	1900	2400
T13	Typical Hole Load	1967	2467
T14	Typical Hole Load	1992	2492
T15	Typical Hole Load	2017	2517
T16	Typical Hole Load	2042	2542
T17	Typical Hole Load	2067	2567
T18	Typical Hole Load	2092	2592
T19	Typical Hole Load	2117	2617
T20	Typical Hole Load	2142	2642
T21	Typical Hole Load	2167	2667
T22	Typical Hole Load	2192	2692
T23	Typical Hole Load	2217	2717
T24	Typical Hole Load	2242	2742
T25	Typical Hole Load	2267	2767
T26	Typical Hole Load	2292	2792
T27	Double Cap	2317	2817
T28	Typical Hole Load	2342	2842
T29	Typical Hole Load	2367	2867
T30	Typical Hole Load	2392	2892

Hole	Load	Surface Delay	Deck 1 Delay
T31	Typical Hole Load	2417	2917
T32	Typical Hole Load	2442	2942
U12	Typical Hole Load	2034	2534
U13	Typical Hole Load	2101	2601
U14	Typical Hole Load	2126	2626
U15	Typical Hole Load	2151	2651
U16	Typical Hole Load	2176	2676
U17	Typical Hole Load	2201	2701
U18	Typical Hole Load	2226	2726
U19	Typical Hole Load	2251	2751
U20	Typical Hole Load	2276	2776
U21	Typical Hole Load	2301	2801
U22	Typical Hole Load	2326	2826
U23	Typical Hole Load	2351	2851
U24	Typical Hole Load	2376	2876
U25	Typical Hole Load	2401	2901
U26	Typical Hole Load	2426	2926
U27	Typical Hole Load	2451	2951
U28	Typical Hole Load	2476	2976
U29	Typical Hole Load	2501	3001
U30	Typical Hole Load	2526	3026
U31	Typical Hole Load	2551	3051
U32	Typical Hole Load	2576	3076
V12	Typical Hole Load	2168	2668
V13	Typical Hole Load	2235	2735
V14	Typical Hole Load	2260	2760
V15	Typical Hole Load	2285	2785
V16	Typical Hole Load	2310	2810
V17	Typical Hole Load	2335	2835
V18	Typical Hole Load	2360	2860
V19	Typical Hole Load	2385	2885
V20	Typical Hole Load	2410	2910
V21	Typical Hole Load	2435	2935
V22	Typical Hole Load	2460	2960
V23	Typical Hole Load	2485	2985
V24	Typical Hole Load	2510	3010
V25	Typical Hole Load	2535	3035
V26	Typical Hole Load	2560	3060
V27	Typical Hole Load	2585	3085
V28	Typical Hole Load	2610	3110
V29	Typical Hole Load	2635	3135
V30	Typical Hole Load	2660	3160
V31	Typical Hole Load	2685	3185
V32	Typical Hole Load	2710	3210
W12	Typical Hole Load	2302	2802
W13	Typical Hole Load	2369	2869

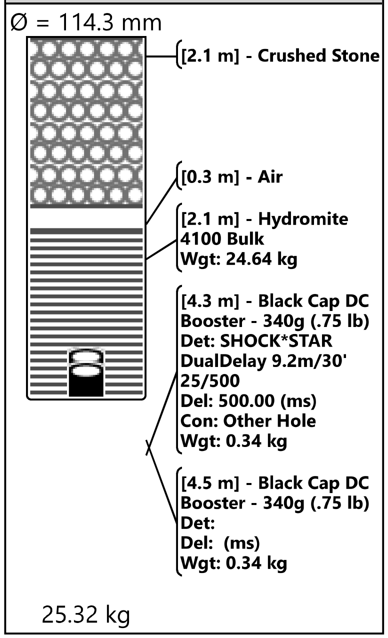
Hole	Load	Surface Delay	Deck 1 Delay
W14	Typical Hole Load	2394	2894
W15	Typical Hole Load	2419	2919
W16	Typical Hole Load	2444	2944
W17	Typical Hole Load	2469	2969
W18	Typical Hole Load	2494	2994
W19	Typical Hole Load	2519	3019
W20	Typical Hole Load	2544	3044
W21	Typical Hole Load	2569	3069
W22	Typical Hole Load	2594	3094
W23	Typical Hole Load	2619	3119
W24	Typical Hole Load	2644	3144
W25	Typical Hole Load	2669	3169
W26	Typical Hole Load	2694	3194
W27	Typical Hole Load	2719	3219
W28	Typical Hole Load	2744	3244
W29	Typical Hole Load	2769	3269
W30	Typical Hole Load	2794	3294
W31	Typical Hole Load	2819	3319
W32	Typical Hole Load	2844	3344



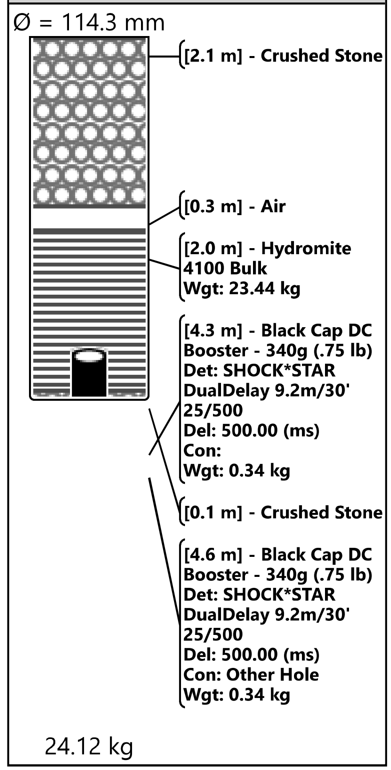
Typical Hole Load



Extra Booster



Double Cap



AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-07	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	12/20/2017 15:35	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	Across The rd

ENVIRONMENT

Method Used:	Lat./Long.	Weather:	Partly Cloudy	Wind From:	WSW
Temperature:	-3 °C	Terrain:	Hilly	Wind Velocity:	3-7 km/h
Blast Lat./Long.:	44° 38' 5.000" N 80° 59' 51.100" W				

NEAREST PROTECTED STRUCTURE

		Compass Point:	NNW
Structure Name:	178841 Grey Rd. 17	Direction/Bearing:	351 °
Structure Type:	Dwelling	Distance:	642 m
Structure Lat./Long.:	44° 38' 25.580" N 80° 59' 55.233" W		

LAYOUT

		Hole Depth:	4.57 m	Material Blasted:	Limestone	Total Meters Drilled:	1,252.7 m
No. of Holes:	274	Subdrilling:	0.00 m	Burden:	3.05 m	Water Depth:	1.22 m
No. of V.P.† Holes:	274	Face Height:	4.57 m	Spacing:	3.05 m	Stem Length:	1.98 m
No. of Rows:	15	Drilling Angle:	°	Back Fill Depth:	0.00 m	Area Type:	Conventional
Diameter:	114.3 mm	Mats Used:	No	Stem Type:	Clear stone	Method:	Deepest Hole Load

† V.P. = Volume Producing

WEIGHTS

		Max. Wt. of Expl. in Overlapped Decks:	82.5 kg	Volume Produced:	11,638.2 m^3
Initiation:	Electronic	Max. Wt. of Expl. Per 8 ms Interval:	82.5 kg	Weight Produced:	27,936.3 t
Firing Device:	E*Star Blasting Machine (WRFD)	Max. No. of Holes Per 8 ms Interval:	3	Powder Factor 1:	3.708 t/kg
Other Method:		Max. Wt. of Explosive Per Hole:	27.5 kg	Powder Factor 2:	0.647 kg/m^3
Mfg and Model:	DBM1600-2-RC	Scaled Distance Factor (max charge):	122.36	Rock Density:	2.400 t/m^3
Initiation Settings:		Scaled Distance Factor (per delay):	70.65		
Series Resistance (ohms):					

SEISMOGRAPHS

See seismographs on separate page

CREW

Blast occurred other than scheduled time: No   Misfire Occurred: No   Protective Cover: Loader Bucket

Last Name	First Name	License / Cert	2nd License / Cert	In Charge	Tied In	Chk. Tie-In	Driller	Layout
REED	ADAM, G	* ON - N/A		Yes	Yes	Yes	No	Yes
BELTRAME	ALEXANDER, A			No	Yes	No	No	No
FRALICK	CRAIG, A			No	Yes	No	No	No
KOUYOUMJIAN	MACKENZIE, H			No	Yes	Yes	No	No
MACPHADEN	AARON, K			No	Yes	Yes	No	No
NEWTON	JOHN, D			No	Yes	Yes	No	No

AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-07	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	12/20/2017 15:35	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	Across The rd

PRODUCTS AND SERVICES

Number	Product Description	Quantity		Weight (kg)
11743	Black Cap DC Booster - 340g (.75 lb)	274.00	ea	93.19
10751	SHOCK*STAR DualDelay 9.2m/30' 25/500	274.00	ea	0.00
15001	24' E*STAR Detonator - QM	1.00	ea	0.00
01492	30' SHOCK*STAR Quick Relay 17 ms	2.00	ea	0.00
01494	30' SHOCK*STAR Quick Relay 42 ms	40.00	ea	0.00
01849	30' SHOCK*STAR Quick Relay 67 ms	14.00	ea	0.00
07602	Hydromite 4100 Bulk	7,440.00	kg	7,440.00
12981	Mini Stem Plug - 6015	274.00	ea	0.00
	Total Weight of Explosives (Include Primers) (kg):			7,533.19

COMMENTS / EXPLANATIONS

Adam Reed

Signature of Blaster in Charge

AUSTIN POWDER LTD.
BLAST REPORT

327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-07	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	12/20/2017 15:35	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	Across The rd

SEISMOGRAPH 1 - 178841 GREY RD. 17

Data Type:	No Trigger	Seismograph Type:	Instantel Minimate II			
Date:	12/20/17	Trigger Level:	1.00 mm/s --- dB	Transverse:	--- mm/s	--- Hz
Time:	15:35	Calibration Date:	02/02/17	Vertical:	--- mm/s	--- Hz
Distance From Blast:	644.35 m	Calibration Signal:		Longitudinal:	--- mm/s	--- Hz
Direction From Blast:	NNW	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:		Mic. Min. Freq.:	--- Hz	Acoustic:	--- dB	
Location:	Bolted to bedrock in front of property.			Vector Sum:	--- mm/s	
Lat./Long.:	44° 38' 25.645" N		80° 59' 55.415" W			
Reader and Firm:	John newton, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	John newton/austin powder					

SEISMOGRAPH 2 - 178706 GREY RD. 17

Data Type:	No Trigger	Seismograph Type:	Instantel Mini-Mate II			
Date:	12/20/17	Trigger Level:	1.00 mm/s --- dB	Transverse:	--- mm/s	--- Hz
Time:	15:35	Calibration Date:	02/02/17	Vertical:	--- mm/s	--- Hz
Distance From Blast:	697.38 m	Calibration Signal:		Longitudinal:	--- mm/s	--- Hz
Direction From Blast:	SE	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:		Mic. Min. Freq.:	--- Hz	Acoustic:	--- dB	
Location:	NE Corner of front lot.			Vector Sum:	--- mm/s	
Lat./Long.:	44° 37' 49.216" N		80° 59' 28.457" W			
Reader and Firm:	John newton, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	John Newton, Austin Powder Ltd.					

SEISMOGRAPH 3 - 283197 10TH CONC.

Data Type:	No Trigger	Seismograph Type:	Instantel Mini-Mate II			
Date:	12/20/17	Trigger Level:	1.00 mm/s --- dB	Transverse:	--- mm/s	--- Hz
Time:	15:35	Calibration Date:	02/02/17	Vertical:	--- mm/s	--- Hz
Distance From Blast:	1,033.88 m	Calibration Signal:		Longitudinal:	--- mm/s	--- Hz
Direction From Blast:	ESE	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:		Mic. Min. Freq.:	--- Hz	Acoustic:	--- dB	
Location:	Behind the mail box.			Vector Sum:	--- mm/s	
Lat./Long.:	44° 37' 49.797" N		80° 59' 9.304" W			
Reader and Firm:	John newton, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	John Newton, Austin Powder Ltd.					

AUSTIN POWDER LTD.
BLAST REPORT

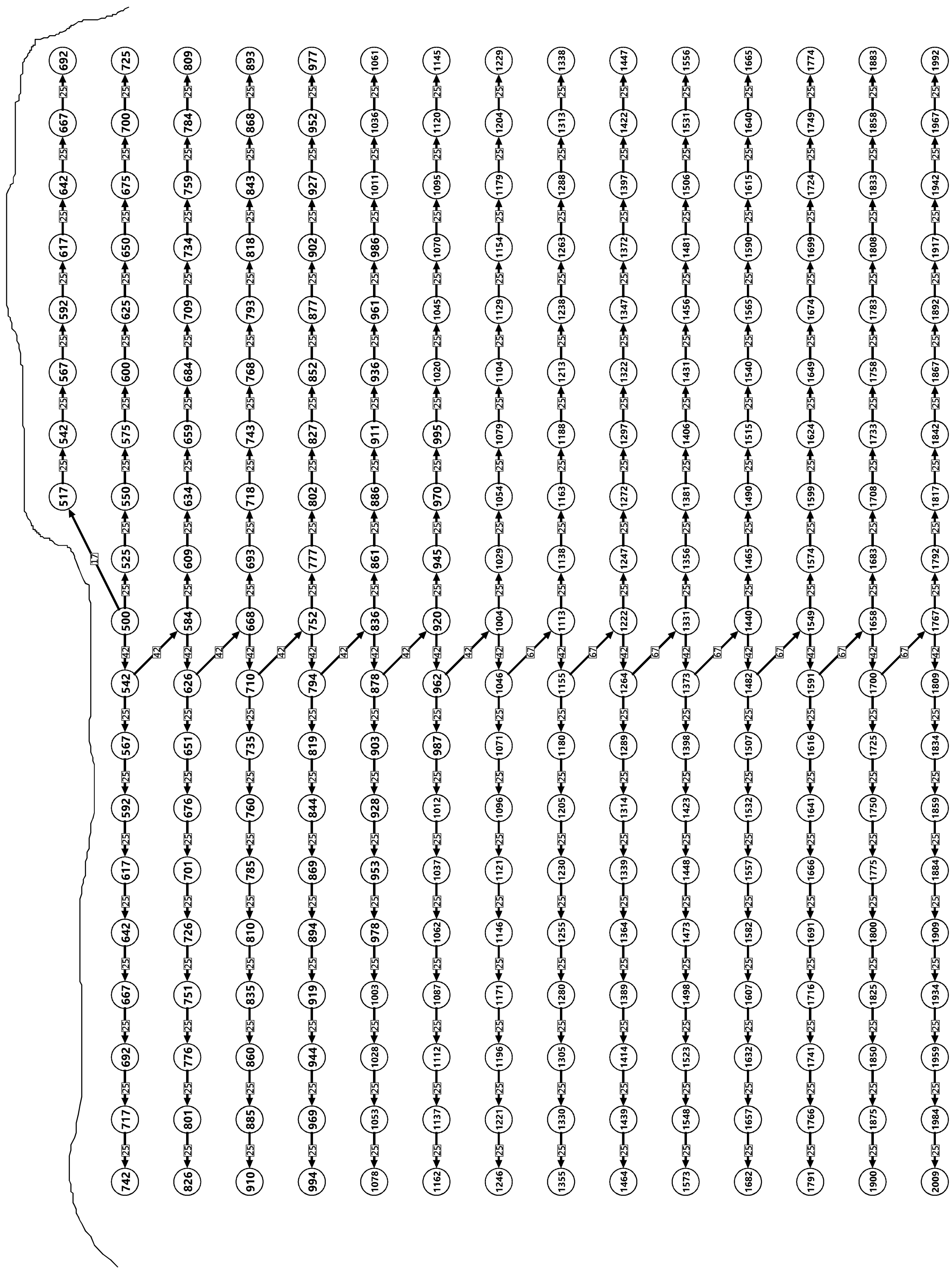
327-Orillia
RR #4 ON, Orillia, Canada L3V 1- 84

Blast No.:	2017-07	Blast Type:	Stone Quarry/Stone Mine - Production	Customer:	HAROLD SUTHERLAND CONST.-KEPPEL (HAR1525-001)
Date/Time:	12/20/2017 15:35	Pit/Permit:	KEPPEL QUARRY / SHOT SERVICE	Location:	Across The rd

SEISMOGRAPH 4 - 178717 GREY RD 17

Data Type:	Seismic Record	Seismograph Type:	instantel			
Date:	12/20/17	Trigger Level:	2.00 mm/s 120.00 dB	Transverse:	1.778 mm/s	30.0 Hz
Time:	15:35	Calibration Date:	01/24/17	Vertical:	2.794 mm/s	39.0 Hz
Distance From Blast:	601.68 m	Calibration Signal:	ok	Longitudinal:	1.905 mm/s	43.0 Hz
Direction From Blast:	ESE	Geophone Min. Freq.:	--- Hz	PPV:	--- mm/s	--- Hz
Readout:		Mic. Min. Freq.:	--- Hz	Acoustic:	113 dB	
Location:				Vector Sum:	2.924 mm/s	
Lat./Long.:	44° 37' 52.587" N		80° 59' 30.045" W			
Reader and Firm:	John newton, AUSTIN POWDER					
Analyst and Firm:						
Installer and Firm:	John Newton, Austin Powder Ltd.					

Hole Label Mode: Cumulative In-Hole Delays



Hole	Load	Surface Delay	Deck 1 Delay
A12	Typical hole	17	517
A13	Typical hole	42	542
A14	Typical hole	67	567
A15	Typical hole	92	592
A16	Typical hole	117	617
A17	Typical hole	142	642
A18	Typical hole	167	667
A19	Typical hole	192	692
B1	Typical hole	242	742
B2	Typical hole	217	717
B3	Typical hole	192	692
B4	Typical hole	167	667
B5	Typical hole	142	642
B6	Typical hole	117	617
B7	Typical hole	92	592
B8	Typical hole	67	567
B9	Typical hole	42	542
B10	Typical hole	0	500
B11	Typical hole	25	525
B12	Typical hole	50	550
B13	Typical hole	75	575
B14	Typical hole	100	600
B15	Typical hole	125	625
B16	Typical hole	150	650
B17	Typical hole	175	675
B18	Typical hole	200	700
B19	Typical hole	225	725
C1	Typical hole	326	826
C2	Typical hole	301	801
C3	Typical hole	276	776
C4	Typical hole	251	751
C5	Typical hole	226	726
C6	Typical hole	201	701
C7	Typical hole	176	676
C8	Typical hole	151	651
C9	Typical hole	126	626
C10	Typical hole	84	584
C11	Typical hole	109	609
C12	Typical hole	134	634
C13	Typical hole	159	659
C14	Typical hole	184	684
C15	Typical hole	209	709
C16	Typical hole	234	734
C17	Typical hole	259	759
C18	Typical hole	284	784
C19	Typical hole	309	809

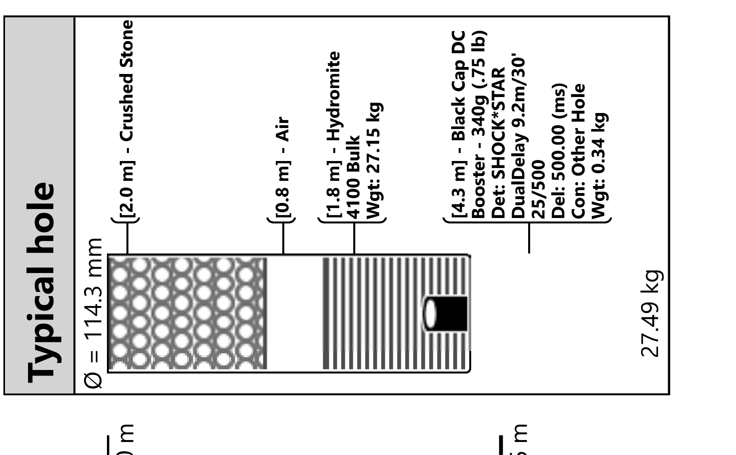
Hole	Load	Surface Delay	Deck 1 Delay
D1	Typical hole	410	910
D2	Typical hole	385	885
D3	Typical hole	360	860
D4	Typical hole	335	835
D5	Typical hole	310	810
D6	Typical hole	285	785
D7	Typical hole	260	760
D8	Typical hole	235	735
D9	Typical hole	210	710
D10	Typical hole	168	668
D11	Typical hole	193	693
D12	Typical hole	218	718
D13	Typical hole	243	743
D14	Typical hole	268	768
D15	Typical hole	293	793
D16	Typical hole	318	818
D17	Typical hole	343	843
D18	Typical hole	368	868
D19	Typical hole	393	893
E1	Typical hole	494	994
E2	Typical hole	469	969
E3	Typical hole	444	944
E4	Typical hole	419	919
E5	Typical hole	394	894
E6	Typical hole	369	869
E7	Typical hole	344	844
E8	Typical hole	319	819
E9	Typical hole	294	794
E10	Typical hole	252	752
E11	Typical hole	277	777
E12	Typical hole	302	802
E13	Typical hole	327	827
E14	Typical hole	352	852
E15	Typical hole	377	877
E16	Typical hole	402	902
E17	Typical hole	427	927
E18	Typical hole	452	952
E19	Typical hole	477	977
F1	Typical hole	578	1078
F2	Typical hole	553	1053
F3	Typical hole	528	1028
F4	Typical hole	503	1003
F5	Typical hole	478	978
F6	Typical hole	453	953
F7	Typical hole	428	928
F8	Typical hole	403	903

Hole	Load	Surface Delay	Deck 1 Delay
F9	Typical hole	378	878
F10	Typical hole	336	836
F11	Typical hole	361	861
F12	Typical hole	386	886
F13	Typical hole	411	911
F14	Typical hole	436	936
F15	Typical hole	461	961
F16	Typical hole	486	986
F17	Typical hole	511	1011
F18	Typical hole	536	1036
F19	Typical hole	561	1061
G1	Typical hole	662	1162
G2	Typical hole	637	1137
G3	Typical hole	612	1112
G4	Typical hole	587	1087
G5	Typical hole	562	1062
G6	Typical hole	537	1037
G7	Typical hole	512	1012
G8	Typical hole	487	987
G9	Typical hole	462	962
G10	Typical hole	420	920
G11	Typical hole	445	945
G12	Typical hole	470	970
G13	Typical hole	495	995
G14	Typical hole	520	1020
G15	Typical hole	545	1045
G16	Typical hole	570	1070
G17	Typical hole	595	1095
G18	Typical hole	620	1120
G19	Typical hole	645	1145
H1	Typical hole	746	1246
H2	Typical hole	721	1221
H3	Typical hole	696	1196
H4	Typical hole	671	1171
H5	Typical hole	646	1146
H6	Typical hole	621	1121
H7	Typical hole	596	1096
H8	Typical hole	571	1071
H9	Typical hole	546	1046
H10	Typical hole	504	1004
H11	Typical hole	529	1029
H12	Typical hole	554	1054
H13	Typical hole	579	1079
H14	Typical hole	604	1104
H15	Typical hole	629	1129
H16	Typical hole	654	1154

Hole	Load	Surface Delay	Deck 1 Delay
H17	Typical hole	679	1179
H18	Typical hole	704	1204
H19	Typical hole	729	1229
I1	Typical hole	855	1355
I2	Typical hole	830	1330
I3	Typical hole	805	1305
I4	Typical hole	780	1280
I5	Typical hole	755	1255
I6	Typical hole	730	1230
I7	Typical hole	705	1205
I8	Typical hole	680	1180
I9	Typical hole	655	1155
I10	Typical hole	613	1113
I11	Typical hole	638	1138
I12	Typical hole	663	1163
I13	Typical hole	688	1188
I14	Typical hole	713	1213
I15	Typical hole	738	1238
I16	Typical hole	763	1263
I17	Typical hole	788	1288
I18	Typical hole	813	1313
I19	Typical hole	838	1338
J1	Typical hole	964	1464
J2	Typical hole	939	1439
J3	Typical hole	914	1414
J4	Typical hole	889	1389
J5	Typical hole	864	1364
J6	Typical hole	839	1339
J7	Typical hole	814	1314
J8	Typical hole	789	1289
J9	Typical hole	764	1264
J10	Typical hole	722	1222
J11	Typical hole	747	1247
J12	Typical hole	772	1272
J13	Typical hole	797	1297
J14	Typical hole	822	1322
J15	Typical hole	847	1347
J16	Typical hole	872	1372
J17	Typical hole	897	1397
J18	Typical hole	922	1422
J19	Typical hole	947	1447
K1	Typical hole	1073	1573
K2	Typical hole	1048	1548
K3	Typical hole	1023	1523
K4	Typical hole	998	1498
K5	Typical hole	973	1473

Hole	Load	Surface Delay	Deck 1 Delay
K6	Typical hole	948	1448
K7	Typical hole	923	1423
K8	Typical hole	898	1398
K9	Typical hole	873	1373
K10	Typical hole	831	1331
K11	Typical hole	856	1356
K12	Typical hole	881	1381
K13	Typical hole	906	1406
K14	Typical hole	931	1431
K15	Typical hole	956	1456
K16	Typical hole	981	1481
K17	Typical hole	1006	1506
K18	Typical hole	1031	1531
K19	Typical hole	1056	1556
L1	Typical hole	1182	1682
L2	Typical hole	1157	1657
L3	Typical hole	1132	1632
L4	Typical hole	1107	1607
L5	Typical hole	1082	1582
L6	Typical hole	1057	1557
L7	Typical hole	1032	1532
L8	Typical hole	1007	1507
L9	Typical hole	982	1482
L10	Typical hole	940	1440
L11	Typical hole	965	1465
L12	Typical hole	990	1490
L13	Typical hole	1015	1515
L14	Typical hole	1040	1540
L15	Typical hole	1065	1565
L16	Typical hole	1090	1590
L17	Typical hole	1115	1615
L18	Typical hole	1140	1640
L19	Typical hole	1165	1665
M1	Typical hole	1291	1791
M2	Typical hole	1266	1766
M3	Typical hole	1241	1741
M4	Typical hole	1216	1716
M5	Typical hole	1191	1691
M6	Typical hole	1166	1666
M7	Typical hole	1141	1641
M8	Typical hole	1116	1616
M9	Typical hole	1091	1591
M10	Typical hole	1049	1549
M11	Typical hole	1074	1574
M12	Typical hole	1099	1599
M13	Typical hole	1124	1624

Hole	Load	Surface Delay	Deck 1 Delay
M14	Typical hole	1149	1649
M15	Typical hole	1174	1674
M16	Typical hole	1199	1699
M17	Typical hole	1224	1724
M18	Typical hole	1249	1749
M19	Typical hole	1274	1774
N1	Typical hole	1400	1900
N2	Typical hole	1375	1875
N3	Typical hole	1350	1850
N4	Typical hole	1325	1825
N5	Typical hole	1300	1800
N6	Typical hole	1275	1775
N7	Typical hole	1250	1750
N8	Typical hole	1225	1725
N9	Typical hole	1200	1700
N10	Typical hole	1158	1658
N11	Typical hole	1183	1683
N12	Typical hole	1208	1708
N13	Typical hole	1233	1733
N14	Typical hole	1258	1758
N15	Typical hole	1283	1783
N16	Typical hole	1308	1808
N17	Typical hole	1333	1833
N18	Typical hole	1358	1858
N19	Typical hole	1383	1883
O1	Typical hole	1509	2009
O2	Typical hole	1484	1984
O3	Typical hole	1459	1959
O4	Typical hole	1434	1934
O5	Typical hole	1409	1909
O6	Typical hole	1384	1884
O7	Typical hole	1359	1859
O8	Typical hole	1334	1834
O9	Typical hole	1309	1809
O10	Typical hole	1267	1767
O11	Typical hole	1292	1792
O12	Typical hole	1317	1817
O13	Typical hole	1342	1842
O14	Typical hole	1367	1867
O15	Typical hole	1392	1892
O16	Typical hole	1417	1917
O17	Typical hole	1442	1942
O18	Typical hole	1467	1967
O19	Typical hole	1492	1992


Typical hole
Ø = 114.3 mm
[2.0 m] - Crushed Stone
[0.8 m] - Air
[1.8 m] - Hydromite
4100 Bulk
Wgt: 27.15 kg
[4.3 m] - Black Cap DC
Booster - 340g (.75 lb)
Det: SHOCK*STAR
DualDelay 9.2m/30'
25/500
Del: 500.00 (ms)
Con: Other Hole
Wgt: 0.34 kg
27.49 kg
0 m
5 m