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File: 0402

October 25, 2024

Township of Puslinch
7404 Wellington Road 34
Guelph, ON, N1H 6H9

Attention: Courtenay Hoytfox
Acting CAO and Municipal Clerk

Dear Courtenay:

Re: Hydrogeological Review – Mast-Snyder Pit 2023 Monitoring Report

We have reviewed the Groundwater Monitoring Report prepared by AECOM Canada Ltd. in October 2024. The report summarizes groundwater measurements obtained on-site between 1998 and 2023. Active above water table extraction commenced in November 2018. Below water table extraction continued in 2022 and 2023 by enlarging the southernmost pond and eventually merging with a pond excavated on the eastern side of the site. The extent of below water table extraction is shown below for April 2024.

There are water courses in the northeastern portion of the site and wetlands located south and east of the site. As below water table extraction proceeds, the annual reports are prepared to provide data showing the extent of impacts to these features, if any.

Comments on the 2023 Report

1) The extent of below water table extraction at the end of the 2023 monitoring year is not described in the text nor shown on any figures in the report.
2) Please review the Thornthwaite Water Balance program. There cannot be a negative AET value as presented for September 2023.
3) Please make the monitors more visible to field staff or cut pathways to the monitors so monthly readings are possible at all times of the year. Data acquisition from MP6 was missed due to tall grass.
4) The word temperature is misspelled on all the thermographs.

Critical Review of the 2023 Report

We are satisfied that the hydrographs for the individual monitoring locations do not indicate any unexpected impact from the below water table extraction. The last five years of data presented include a period of no springtime groundwater recharge (2021) and a year of significantly low rainfall (2022).

The expansion of the aggregate pond in a northern direction is expected to lower groundwater levels along the southern property line. This is already evident in the hydrograph BH7 which shows that water levels south of the pit are 1.5 to 2 m lower at the end of 2023 than at the beginning of 2018, in comparison to water levels obtained from BH3 which are similar at the end of 2023 as they were at the beginning of 2018.

The thermographs presented for the individual groundwater monitors do now show significant changes in groundwater temperature post aggregate extraction.

We have reviewed the hydraulic gradients between the active site extraction area and the tributary located on-site. There does not appear to be any impact on the magnitude of groundwater flow towards the tributary.

We are satisfied with the report and conclude that below-water-table extraction is proceeding as per the site plans without any significant change to groundwater or surface water elevations.

Groundwater Level Thresholds

In 2022, AECOM presented Low Water Level Triggers. Harden commented on the triggers and a response was prepared by AECOM. The response was included in the 2023

Monitoring report and we are satisfied with response and the Low Water Level Triggers as summarized below.

Location	Low Water Trigger Elevation
BH3	323.87 mASL
BH8	324.86 mASL
BH9	323.20 mASL
BH10-II	324.00 mASL

Sincerely,

Harden Environmental Services Ltd.

[redacted]

Stan Denhoed, M.Sc., P.Eng.
Senior Hydrogeologist

Hydrogeological and Natural Environment Site Plan Technical Requirements

2023 Monitoring Report for Mast-Snyder Pit, Township of Puslinch, County of Wellington

CBM Aggregates a Division of St. Marys Cement Inc. (Canada)

60700729

October 2024

Delivering a better world

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Jennifer DeLeemans
Manager, Lands & Environment
CBM Aggregates, A division of St. Marys Cement Inc. (Canada)
7152 Concession 2
Cambridge, ON N3C 2V4

October 11, 2024

Project #
60700729

Subject: Hydrogeological and Natural Environment Site Plan Technical Requirements – 2023 Monitoring Report for Mast-Snyder Pit, Township of Puslinch, County of Wellington

Dear Ms. DeLeemans:

We are pleased to provide you with the Hydrogeological and Natural Environment Report prepared to satisfy the Site Plan Technical Requirements at the Mast-Snyder Pit, in the Township of Puslinch, Wellington County, Ontario. Results from 2023 were compared to the baseline (pre-extraction) monitoring (completed prior to November 2018) and during active pit operations (commencing in 2019) to monitor site conditions as the Mast-Snyder Pit is developed.

If you have any questions or concerns, please do not hesitate to call me at 226-821-2486 or via email at brian.holden@aecom.com.

Sincerely,
AECOM Canada Ltd.

[redacted]

Brian Holden, P.Geo.
Hydrogeologist, Environment
Brian.Holden@aecom.com

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AECOM: 2015-04-13

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Appendices

1. Introduction

CBM Aggregates, a Division of St. Marys Cement Inc. (Canada) (CBM Aggregates), holds a lease agreement for a 32 ha property (Snyder) and owns a 42.4 ha property (Mast) located at the northwest corner of Forestall Road and County Road 35 (Downey Road), south of the City of Guelph in Lot 14 and 15, Concession 4, Township of Puslinch, Wellington County (**Figure 1**). The property has been licensed under the *Aggregate Resources Act* as a Category 1 – Class "A" Pit Below Water. A Hydrogeological Assessment and a Natural Environment Level 1- Level 2 reports were completed by Gartner Lee Limited (GLL, 2006a, 2006b) in support of the license and *Planning Act* applications (OMNR, 1996). AECOM Canada Inc. (AECOM, formerly Gartner Lee Limited) was retained by CBM Aggregates to complete the Site Plan technical requirements pertaining to hydrogeology and natural environment monitoring with development of the Mast-Snyder Pit.

Field investigations conducted between 1999 and 2006 (GLL 2006a) confirmed the presence of several significant environmental features within the site boundary and immediately adjacent to the limit of extraction. These features included:

- Two units of the Speed River Provincially Significant Wetland (PSW) Complex;
- Fish habitat along Tributary A and Pond A; and
- Significant Wildlife Habitat in the form of amphibian breeding habitat at the Isolated Wetland and along Tributary A.

The Site Plan and the significant environmental features are shown on **Figures 2 and 3**. To comply with the Provincial Policy Statement (MMAH 2014), development and site alteration shall not be allowed in a PSW or fish habitat. Development and site alteration shall not be allowed in Significant Wildlife Habitat of the site unless it has been demonstrated that there are no negative impacts on the feature or its ecological function. As shown on the Site Plans, there will be no extraction within the on-site Speed River PSW Complex adjacent woodlot and the required setbacks to ensure their protection and maintain their functions with pit development. However, because the pit will be excavated below the water table, there is the potential for groundwater levels to shift resulting in changes to the PSW and its function. As such, fish and fish habitat, wetland vegetation and amphibian breeding are being monitored as indicators of the wetland function.

Site preparation (berms, stripping) commenced in late spring/early summer 2018. Above and below-water extraction activities commenced in November 2018 and July 2019, respectively. Below water extraction in Area 2 commenced in late fall 2019 (**Figure 3 and Figure 4**).

A 2018 monitoring report (AECOM, 2019) was completed to collect baseline data in advance of pit extraction activities. This was followed by the 2019 monitoring report (AECOM, 2020) which documented conditions during initial stages of excavation. Previous ecological field investigations took place between 2003 and 2006, thus the 2018 results noted any changes to existing conditions in this interval. Consequently, the 2018 monitoring results provide the baseline to which future conditions will be compared through annual monitoring events (i.e., through the course of pit excavation, particularly as it occurs below the water table). This report documents the site conditions and monitoring activities undertaken by AECOM in 2023.

As per Site Plan Condition 4 of the Natural Environment Technical Recommendations, the 2019 to 2022 annual reports were submitted to the Ministry of the Environment, Conservation and Parks (MECP), Ministry of Natural Resources and Forestry (MNRF), Township, County, the City of Guelph and the Grand River Conservation Authority (GRCA). Comments on the groundwater/hydrogeological portions of the 2022 annual report were received from the GRCA (included in **Appendix A**). The MECP and the Township were in agreement with the conclusions and recommendations of the report. Comments from the GRCA pertained mainly to groundwater and surface water interactions, and potential trends related to wetland communities. The 2023 report addresses these review comments.

2. Background

Details provided in this section are reproduced from the Consolidated Hydrogeological Assessment (Gartner Lee, 2006b) and updated with information collected since that time.

2.1 Geology and Aggregate Resources

The physiography and distribution of the unconsolidated sediments in the site vicinity are due to Late Wisconsinan glacial activity. During this time, there was repeated advancement and melting of the continental ice sheets over a period of about 13,000 years.

Large amounts of sand and gravel were deposited within an outwash plain fed by glacial meltwaters from an adjacent moraine (Galt moraine). Subsequent glacial advances and retreats modified the topography of the region (OGS 1982). The CBM Aggregates site is situated within this outwash gravel on the flank of a bedrock valley (Karrow 1983). The bedrock valley trends in a roughly southwest to northeast direction. Previously published bedrock mapping of the area shows the elevation of the top of the bedrock at approximately 305 mASL beneath the site (Miller, et. al., 1979). Prior to extraction, the topographic elevation of the site ranged from 325 mASL to 331 mASL. This indicates that there is over 20 m of overburden overlying the Silurian dolostone of the Guelph Formation.

The Aggregate Resources Inventory Paper for this area identifies the Mast-Snyder property as part of an outwash deposit of primary significance that lies within a transitional area between the two physiographic regions of the Guelph Drumlin Field and Horseshoe Moraines. A study conducted by the Ontario Geological Survey (OGS) in the northern portion of the deposit showed that the deposit was generally coarser near the surface and becomes finer with depth. The deposit typically consists of a coarser layer (generally about 5 m thick) overlying a 7 m thick fine layer marginally suitable for granular use. The coarser layer appears suitable for Granular B and C, with some parts suitable for crushing into Granular A. Concrete and asphalt sand could be processed from some portions of the deposit.

Figure 5 presents the locations of geological cross-sections A-A’ and B-B’. **Figure 6** is a northeast to southwest cross-section (A-A’) and **Figure 7** is a northwest to southeast cross-section (B’B’) across the site generally perpendicular and parallel to groundwater flow, respectively. The general stratigraphy is sand and/or gravel from surface to a depth ranging from 5.9 m (BH1) to 10.3 m (BH6), underlain by silt or silty sand. All boreholes were terminated in silt, silty sand or till. BH8 and TH1, located along the northeastern property boundary, penetrated sand till from surface. Gravel was penetrated at BH1, BH2 and BH5 from surface to the top of the silt. Sand was penetrated to 6.7 m at BH4. BH 6 and BH7 penetrated 10.3 m and 8.5 m of gravelly sand/sand and gravel, respectively. BH3 penetrated 4 m of gravel overlying 3 m of fine sand.

2.2 Water Well Users

MECP well records for water wells within 500 m of the property boundary and presented in **Appendix B** and plotted on **Figure 5**. **Figure 5** presents the MECP water well record with the house number in brackets immediately below.

A door-to-door water well survey was conducted by AECOM (formerly Gartner Lee) staff in September 2003 and updated in 2010, 2011 and 2012. The surveys consisted of interviewing residents within an approximate 250 m radius of the property boundaries. Residents were asked general questions concerning their water supply and quality as well as details about their well construction and water use. The survey was conducted to confirm well details, identify any dug wells that may not have a well record and provide baseline information prior to pit development.

2.3 Monitoring Locations

2.3.1 Groundwater Monitors

AECOM carried out an initial drilling program and installed 10 groundwater monitors at eight locations on-site to establish the water table elevation and to confirm the quality of the aggregate above and below the water table. Five boreholes (with seven monitors) were completed on the Mast property (west half of the site) in August and December 1999. Three boreholes were drilled on the Snyder property (east half of the site) in May 2003. Additional monitors were drilled in June 2010 (four monitors at three locations) to fulfill Site Plan conditions. Soil samples were collected at each borehole at regular intervals using standard split-spoon sampling techniques. Each borehole was stratigraphically logged in the field by qualified AECOM staff. Groundwater monitors consisting of 51 mm diameter machine slotted PVC screen on riser pipe were installed in each borehole to monitor groundwater levels. Boreholes range in depth between 2.3 m and 12.8 m below ground surface. Borehole logs are presented in **Appendix C**.

Due to advancing below-water extraction activities, BH1-I and BH1-II were decommissioned on March 21, 2022 by Profile Drilling as per Ontario Regulation 903 with the existing loggers removed on January 31, 2022. The BH1 decommissioning log is included in **Appendix A** of the 2022 Annual Monitoring Report (AECOM, 2023).

2.3.2 Mini-Piezometers

Five mini-piezometers (MP1, MP2-I, MP2-II, MP3-I, MP3-II) were initially installed in Tributary A and the man-made pond (Pond A) located in the north part of the property on September 3, 2003. Two additional mini-piezometers (MP4 and MP5) were installed in the area of ponded water within the isolated wetland on June 29, 2003. On December 7, 2005, MP6 and MP7 were installed within the southern swale. The mini-piezometers were installed to investigate the groundwater-surface water relationship to these features. Each mini-piezometer consists of a 0.45 m length of stainless steel well point at the end of machine threaded 19 mm diameter iron pipe riser. All threaded ends were wrapped with Teflon tape to ensure a watertight seal at the joints. The mini-piezometers were installed manually with a post driver to depths ranging from 1 m to 3.1 m.

The groundwater monitors and mini-piezometers were surveyed to a geodetic benchmark. The locations of the groundwater monitors and mini-piezometers are shown on **Figure 4**. The groundwater monitor construction details and mini-piezometer installation details, including the location (UTM) and elevation of the ground and top of pipe, are presented in **Appendix C**.

3. Scope and Methods

3.1 Hydrogeology

The requirements related to hydrogeology as presented on the Site Plans are reproduced below followed by a discussion of the tasks completed to address the condition.

Operations Plan – Operations Notes:

24. *Water level data will be interpreted annually from a fisheries perspective to ensure that there are no negative impacts.*

    Below-water extraction commenced in July 2019. A fisheries biologist has reviewed the collected water level data as below-water extraction progresses, specifically as it applies to Pond A and Tributary A. The assessment is presented in Section 4.2.3 of this report.

25. *Below-water extraction will cease immediately if there are any early warning signs of impact to surrounding groundwater users, wetlands or streams that is attributed to below water operations.*

    Acknowledged.

26. *Observed or measured stream impacts will be reviewed by a surface water specialist.*

    A surface water specialist reviewed the measured MP water levels as below-water extraction progresses to examine impacts to Tributary A.

27. *Should a wash plant be required with a predicted water usage of 50,000 L/day or more, CBM Aggregates will apply to the MOE for a Permit-to-Take-Water. This permit application will be accompanied by the appropriate supporting documentation.*

    If necessary, CBM Aggregates will apply for a Permit-to-Take-Water under the above conditions, as required. No water taking requiring a PTTW has occurred at the site.

28. *Copy the County, Township and City on any information on the site that is supplied to the MOE and MNR.*

    Any information provided to the MOE (now the MECP) and MNR (now the MNRF) will also be provided to the County, Township and City.

29. *A staff gauge shall be installed in Pond A so that water depths can be monitored during site visits.*

    MP1 is located in the man-made dug pond, Pond A (**Figure 4**). It has been monitored for water levels seasonally since 2003. MP1 has been surveyed and tied into the site such that the water elevations can be monitored. The pond depth at MP1 is discussed in Section 4.2.1.2.

30. *Mini-piezometers MP2 and MP3, located in Tributary A shall be tested to ensure that they are hydraulically connected to the water table.*

    Water levels collected from MP2 and MP3 appear to reflect the water table when compared to the closest water table monitors. MP2 and MP3 have been monitored for water levels seasonally since 2003.

31. *Two sets of mini-piezometer pairs shall be installed to ensure that groundwater gradients are maintained towards Tributary A when water is flowing in the tributary. If groundwater gradients are reversed or re-directed away from Tributary A as a result of below-water extraction or pumping of groundwater at the site then these undertakings will cease.*

MP2 and MP3 are nested pairs of mini-piezometers located in Tributary A. The water levels and groundwater gradient to Tributary A are discussed in Section 4.1.1 and 4.1.2.

32. *Groundwater gradient will be monitored so that below-water extraction rates and groundwater withdrawls can be proactively managed to avoid gradient reversals from the fish habitat to the pit area.*

The 2018 aquatic assessment of Pond A and Tributary A concluded that both provide fish habitat suitable for reproduction, refuge, feeding and rearing. An aquatic assessment was not completed in 2019 because below water extraction had not yet occurred by the spring of that year. In June 2020, an aquatic habitat assessment was completed. In 2021, the Pond A summer water level was visibly lower than observed in 2018 and 2020 though this was attributed to precipitation conditions and not a result of pit activities. In 2021, baseflow from mini-piezometer readings were assessed in place of an aquatic assessment indicating no gradient reversals. In 2022, half of the Pond A was observed dry during site visit on August 25. In 2023, there was no evidence of drying in Pond A with the depth estimated to be at 1.0 m (refer to **Section 4.2.3.2**). Groundwater elevations measured at all monitors are listed in **Appendix D**.

Technical Recommendations (Hydrogeological) Monitoring Program

1. *A groundwater monitor between the below-water extraction limit and the Hanlon Creek Swamp (BH9) and a nest of two monitors at the edge of the isolated wetland (BH10) will be installed. Monitoring nest 10 will consist of a shallow monitor into the groundwater table and a deeper piezometer into the underlying silt. The monitors will be incorporated into the groundwater monitoring program for the site.*

BH9 and BH10 were installed in June 2010 (AECOM, 2011). BH9 is a water table monitor completed to 5.2 m below ground surface and screened in the underlying sand/sandy silt till. BH10 consists of a water table monitor completed to 4.6 m below ground surface and screened in the underlying sand and gravel/sand (BH10-II) and a piezometer completed to 9.8 m below ground surface and screened in the underlying sandy silt unit (BH10-I). These monitors were incorporated into the seasonal water level monitoring program upon completion.

2. *An additional mini-piezometer will be installed and maintained within the Downey West Wetland (MAM2-2 wetland unit on the west side of Downey Road) and incorporated into the established monitoring program. The new-mini-piezometer will be included in any review under the triggering mechanism but will not necessarily be used as a trigger well. The mini-piezometer and vegetation monitoring plot (discussed under natural environment, point 2) will be in the same general vicinity. The mini-piezometer will be monitored as described in point 4 and point 5 below.*

In place of a mini-piezometer, BH11 was installed in June 2010 in the Downey West Wetland (AECOM, 2011). BH11 is a water table monitor completed to 2.3 m below ground surface and screened in the underlying sand and gravel unit. It was incorporated into the seasonal water level monitoring program upon completion and was also outfitted with a baro and level logger to collect daily water levels. A vegetation transect (TR 4) was established in 2019 to further examine this area. Control transect TR 3 was abandoned since was found to be heavily grazed by cattle at the time of vegetation survey in 2020. A replacement control transect was established in wetland vegetation that was generally similar to the transects on the Mast-Snyder site (TR 5 Control at Kortright Hills, **Figure 2**) from 2020 to 2022 but permission had not been granted by City of Guelph, so it was discontinued. A suitable replacement control could not be found in 2023.

3. *The additional boreholes and mini-piezometer (discussed above) will be installed prior to any extraction on the site.*

   The required boreholes/mini-piezometers have been installed.

4. *Monthly water level measurements and groundwater temperatures will be collected during periods of below-water extraction at the monitoring points (monitoring wells and mini-piezometers) on-site for the first two years of below-water extraction. If trends are consistent over the first two years of below water extraction, the monitoring program will be reduced from monthly to quarterly.*

   There are currently 12 groundwater monitors and nine mini-piezometers on the site. These groundwater monitoring locations were instrumented with level loggers on May 8, 2018 to collect daily measurements (12:00 pm). A barologger is on-site for logger compensation. Below-water extraction activities commenced in July 2019 such that the winter of 2023 constitutes four and a half years of monitoring under below-water extraction conditions. The groundwater levels are discussed in Section 4.1.1.

5. *Seasonal (Quarterly) groundwater level measurements shall be taken from existing monitors and the mini-piezometers beginning one year prior to the commencement of below-water extraction.*

   Baseline water levels have been collected on-site since 1999 and are presented on **Figure 8**. The water level monitoring program has expanded as new monitors/mini-piezometers have been installed. As discussed above, all monitoring locations have been instrumented with level loggers. In addition, seasonal manual water level measurements of the established monitoring network were collected with an electronic water level tape during site visits conducted on April 19, May 1, August 31, and November 16, 2023. During these site visits, each logger was also checked and downloaded, if possible[1]. As discussed in Section 2.3.1, loggers at BH1-I and BH1-II were removed in January 2022 and this location was decommissioned in March 2022.

6. *A qualified geoscientist shall investigate all complaints of water well interference brought to the attention of the licensee from any property owner located within 500 m from the limits of extraction. A report on the findings shall be prepared and submitted to the licensee, with copies to the district offices of the Ministry of Natural Resources, the Ministry of the Environment, the Township, the County and the City.*

   No complaints were received by CBM Aggregates in 2023.

7. *A qualified geoscientist shall review site conditions annually.*

   Monitoring data was examined, and this report was reviewed by licensed Professional Geoscientists.

8. *A water well survey of the residences within 500 m of the property boundary shall be completed prior to the commencement of pit operations to provide baseline data and ensure that there are no off-site shallow dug wells in the vicinity. Should any shallow accessible dug wells be identified, they should be added to the quarterly monitoring program of the site provided that permission is granted by the well owner.*

   A water well survey was completed in 2010, 2011 and 2012 with the results presented in the associated annual reports (AECOM, 2011, 2012, 2013). Of the 17 well owners within 500 m of the property boundary: four well owners did not respond to our well survey package and two well owners reported that they had dug wells – 6848 Forestall Road (which was owned by Mast and rented to a tenant) and 4767 Pioneer Trail (owned by Fitton, located at the northwest edge of the 500 m mark of the property boundaries). The well at 6848 Forestall Road was later inspected and determined to be a drilled well that was decommissioned by CBM Aggregates in 2011. Mrs. Fitton, the owner of the well at 4767 Pioneer Trail was contacted by phone on January 29, 2018 to ask if their well was accessible and if they would like to participate in the water level monitoring program. Mrs. Fitton confirmed that they have a dug well that supplies their house but the well has a pump affixed to the lid and is inaccessible. Locations of private wells within 500 m of the site are shown on **Figure 5**.

1. *Loggers were occasionally frozen at some locations and could not be downloaded during the winter field visits*

3.2 Natural Environment

The requirements related to natural environment as presented on the Site Plans are reproduced below followed by a discussion of the tasks completed to address the condition.

Technical Recommendations for Natural Environment

1. *The wetland boundary and woodlot dripline on the north part of the property will be surveyed. Durable marker posts will be placed 5 m from the dripline of the woodlot or 15 m from the wetland boundary, whichever is greater. There shall be no intrusion by equipment or other disturbance, to the ground or vegetation beyond the marker posts. The temporary berm should be placed outside of this buffer*

   The Isolated Wetland and northern wetland/woodlot dripline were originally staked by a Gartner Lee terrestrial ecologist, the Township ecologist and the conservation authority in 2007. These stakes were then surveyed by Van Harten Surveying Inc. Van Harten re-surveyed the wetland limits and dripline on March 19, 2018. CBM Aggregates installed permanent markers (fence posts) such that the setback is clearly marked and the markers will not be accidentally destroyed during pit development.

2. *A qualified ecologist should inspect the site annually, once excavation occurs along the edge of the natural heritage feature or at least until the water level in the post-extraction lake stabilizes. This would include documenting general conditions on water depth and vegetation health to determine if there is any adverse impact of the pit operation on Tributary A, Pond A or the isolated wetland unit that may be related to the operation of the pit. The monitoring will include:*

   - *Amphibian surveys conducted twice in the spring during suitable weather conditions (approximately mid-April and late May) at all wetlands on site. Amphibian monitoring will begin prior to below-water extraction in Area 3 and will continue annually thereafter for as long as below-water extraction occurs.*
   - *Establishing three permanent vegetation monitoring plots to document percentage cover of plant species as a measure of change in the wetlands. They will be sampled in mid-growing season (between June 15 and August 15), once prior to below water extraction in Area 3 then annually thereafter. Soil cores will be taken and inspected visually for soil type and depth to mottles and gley, and colour at each location. The vegetation plots will be established:*

     a) *Along Tributary A west of Pond A'*
     b) *In the isolated wetland*
     c) *In the Downey West Wetland (MAM2-2 wetland unit on the west side of Downey Road)*

3. *A qualified ecologist shall annually review the monitoring and site inspection results and prepare a report on the following:*

   a) *A summary of the monitoring data from the current year and previous years;*
   b) *An assessment of whether or not the operation of the pit below the water table is adversely affecting the on-site woodlot and stream in the northern portion of the site, the Speed River PSW on the Hanlon Creek Business Park site and adjacent natural environment features;*
   c) *A recommendation regarding the adequacy of the monitoring program and any amendments that may be required; and*
   d) *The need to implement the Contingency Plan (as described in the Hydrogeological Recommendations), if necessary and warranted.*

4. *The annual report shall be prepared by both the qualified ecologist and geoscientist. The report should be submitted to the MOE, MNR, Township, County, the City and the GRCA annually and not just if the mechanism is invoked.*

5. *Monitoring will continue for as long as below water extraction occurs.*

3.2.1 2023 Field Investigations

3.2.1.1 Amphibian Surveys

Amphibian breeding surveys were completed on the evenings of April 10, May 9, and June 1, 2023 under appropriate weather conditions (**Table 1**) using protocol adapted from the Marsh Monitoring Program (BSC *et al.,* 2009). A minimum 5-minute listening period was conducted at each of the three stations: Isolated Wetland, Tributary A and Pond A (**Figure 2**). The number and species of calling frogs heard was recorded. Amphibians were also searched for during the day of the fish habitat survey on June 29, 2023.

Table 1: Weather Conditions During Amphibian Calling Surveys

Date	Time	Temperature (C°)	Cloud Cover (%)	Wind (Beaufort)
10-Apr-2023	20:20 – 20:42	12	0	1
9-May-2023	21:00 – 21:31	9	0	0
1-Jun-2023	21:30 – 21:59	23	30	0

3.2.1.2 Acoustic Monitoring

Acoustic monitoring was implemented in 2021 and in 2023 to detect early-spring breeding amphibians that might otherwise be missed during in-person surveys. Nocturnal surveys targeting vocalizing amphibians (i.e., frogs and toads) using acoustic monitors were conducted during the months of April, May and June 2023 for collecting additional data and support the Amphibian breeding survey field program. The protocol for these surveys generally followed that developed by Bird Studies Canada and Environment Canada for the Marsh Monitoring Program (BSC *et al.* 2009).

An acoustic monitor (Song Meter SM3BAT, Wildlife Acoustics) was installed at each of the two (2) representative sites within the Isolated Wetland and between Pond A and Tributary A. The monitors themselves were set to record calls at 10:00 pm for 15 minutes duration. They were programed to run from April until June 2023. Acoustic monitors were deployed in conjunction with the first visit of amphibian call survey on April 10, 2023, removed following the third visit of amphibian call survey on June 1, 2023, and maintenance checks were completed in May and June during the second and third round of amphibian call surveys. Acoustic data were recorded on SD cards within the monitor. These data were downloaded, transcribed and analyzed. Since acoustic monitors were monitoring continuously during the spring, the nights selected for analysis were based on a review of weather conditions recorded using The Weather Network's historical weather data for Guelph, ON during the monitoring period. Nights selected for analysis met the timing and weather criteria in accordance with the Marsh Monitoring Program (BSC *et al.* 2009) as follows. A five (5)-minute segment of the 15 minute acoustic data recording was analyzed to determine whether frogs and / or toads were present, identify the species and count the number of individuals per species heard calling on those selected nights.

3.2.1.3 Vegetation Sampling

In order to measure possible changes to vegetation in the PSW units at Tributary A and the Isolated Wetland, a quantitative means of documenting coverage by the various plant species was required. A systematic sampling method was established using 1x1 m quadrats along transect lines as described by Elzinga *et al.* (2001).

Permanent transects were initially established at four locations in 2018. However, Transect TR 3, which was meant to provide a control more distant from possible influence of the gravel pit, was found to be heavily grazed by cattle in 2020 and therefore was discontinued. That transect became too disturbed to be a useful control. A new control labelled TR 5 was established in 2021 but was not accessible in 2023 due to access permissions. Therefore, there was no control site in 2023 to compare background changes in vegetation against the transect locations.

Transect locations sampled in 2023 were as follows:

a) Transect TR 1 across the middle of the Isolated Wetland Unit;
b) Transect TR 2 within Tributary A just downstream of Pond A;
c) Transect TR 4 within the Downey Road Wetland.

Figure 2 shows the location of each transect in relation to the approximate Limit of Extraction and extent of below-water excavation in the fall of 2023.

The vegetation was surveyed on August 21, 2023 on a clear and calm day with the temperature ranging from 18 to 21°C. Vegetation transects consisted of 1 x 1 m quadrats that were sampled at 5 m intervals along a transect line. Each transect was 55 m long with 12 quadrats sampled along each. Metal bars had been previously installed at either ends of each transect on the subject property so that they can be easily found and replicated in subsequent years. A handheld GPS was used to locate the ends of each vegetation transect. Locations of the transects are shown on **Figure 2** and co-ordinates shown on **Table 2**. At each quadrat location, four metre sticks were laid down to form a 1 m^2 plot, which temporarily marked off the boundaries of each quadrat while it was being sampled. All plant species and their respective percent (%) cover within each quadrat were recorded. It should be noted that the individual quadrat locations were very close but not precisely the same between the different sampling events.

The transect at TR 5 (control transect) was previously set up within wetland vegetation in municipally owned parkland but was not accessible in 2023. Several sites were investigated on City of Guelph property but were deemed unsuitable because the proposed sites were not similar enough to the Mast-Snyder property.

Table 2: Location of Vegetation Transects

Wetland	Transect No.	Transect Ends	Latitude	Longitude	Distance to Excavation	Distance to Below-water
Speed River PSW	TR 1	North	43.48294°	-80.23772°	290 m	384 m
		South	43.48250°	-80.23802°		
Speed River PSW	TR 2	East	43.48474°	-80.23329°	144 m	144 m
		West	43.48487°	-80.23386°		
Downey Road Locally Significant Wetland	TR 4	North	43.48394°	-80.22926°	42 m	42 m
		South	43.48345°	-80.22936°		

A representative soil sample was taken at the approximate middle of each transect. For each soil sample, notes were taken regarding the soil type, colour, depth of mottles and gley and depth to the water table. A Dutch auger was used, and each sample penetrated a depth of approximately 1 m. It should be noted that the soil sample locations were in close proximity (within about 10 m given GPS accuracy), but not precisely the same between annual sampling events which results in apparent differences in depths. Furthermore, a soil sample derived from a Dutch auger was collected in small sections which were re-assembled upon extraction; therefore, it was not possible to gather precise measurements on soil layers.

Additionally, comments received from GRCA on February 13, 2024 based on their review of the 2022 Monitoring Report for Mast-Snyder Pit requested calculation of the average coefficient of conservatism and coefficient of wetness to support analysis and discuss perceived trends over time. The vegetation data captured in the field from 2018 to 2023 were used to determine indices that provide insight into the vegetation community quality and sensitivity. Indices included species richness (i.e., the number of species within a community), Coefficient of Conservatism (CC), Floristic Quality Index (FQI), and Wetness Index.

Vegetation community sensitivity was based on the Floristic Quality Assessments System for Southern Ontario (Oldham *et al.,* 1995) which included the calculation of the *Mean Coefficient of Conservatism,* the *Floristic Quality*

Index and the *Weediness Index* for all wetland communities and quadrats located within the Study Area. These three (3) parameters are intended to be used together in order to assign an ecological community sensitivity ranking based on plant species composition. The ranking is not intended to provide a measure of the overall value of a community, but rather reflects the sensitivity of the community to disturbance based on the grouping of plants present within the community.

Coefficient of Conservatism

These values range from 0 (low) to 10 (high) and are based on species tolerance to disturbance and fidelity to a specific habitat. Vegetation species and community sensitivity were assessed through the application of coefficient of conservatism values, assigned to each native species in southern Ontario (Oldham *et al*., 1995). The occurrence of species with a CC of 9 or 10 can be indicators of undisturbed habitats such as mature forests, fens or bogs. General habitat values associated with CC values are:

0 – 3 Species found in a wide variety of communities including disturbed sites.
4 – 6 Species associated with a specific community but tolerate moderate disturbance.
7 – 8 Species associated with a community in an advanced successional stage, tolerant of minor disturbances.
9 – 10 Species with a high degree of fidelity to a narrow range of ecological parameters.

Floristic Quality Index

The floristic quality of an area is reflected in the mean value of CC. The Floristic Quality Index (FQI) is an indication of native vegetation quality for a vegetation community area. The following summarizes the FQI rankings:

1-19 Indicates low vegetative quality
20-35 Indicates high vegetative quality and high-quality aquatic resources
> 35 Indicate "Natural Area" quality.

$$\mathbf{FQI = mean\ CC \times \sqrt{N}}$$

where $\sqrt{N}$ is the square root of the number of native species observed.

Wetness Index

All plants in southern Ontario have been assigned a wetland category, based on the designations developed for use by the United States Fish and Wildlife Service. Plants are designated into the following categories:

- OBL (Obligate Wetland: -5) occurs almost always in wetlands under natural conditions (estimated >99% probability)
- FACW (Facultative Wetland: -4 to -2) usually occurs in wetlands, but occasionally found in non-wetlands (estimated 67-99% probability)
- FAC (Facultative: -1 to 1) equally likely to occur in wetlands or non-wetlands (estimated 34-66% probability)
- FACU (Facultative Upland: 2 to 4) occasionally occurs in wetlands, but usually occurs in non-wetlands (estimated 1-33% probability)
- UPL (Upland: 5) occurs almost never in wetlands under natural conditions (estimated <1% probability)

Further refinement of the Facultative categories are denoted by a "+" or "-" to express exaggerated tendencies for those species. The "+" denotes a greater estimated probability occurring in wetlands than species in the general indicator category, but a lesser probability than species occurring in the next higher category. The "-" denotes a lesser estimated probability of occurring in wetlands than species in the general indicator category, but a greater probability than species occurring in the next lower general category. Each wetland category has been assigned a numerical value to facilitate the quantification of the wetness index. These categories are further defined in the glossary of **Appendix E.**

3.2.1.4 Aquatic Survey

Aquatic habitat and fish community surveys within Pond A and Tributary A were originally completed in 2018 prior to pit extraction. An AECOM aquatic ecologist then undertook aquatic habitat assessments at Tributary A and Pond A in 2020 to document any potential changes to the available fish habitat due to below-water extraction activities at the pit. No aquatic field investigations were conducted in 2021 or 2022.

On June 25, 2020, an AECOM aquatic ecologist completed aquatic habitat assessments at Tributary A and Pond A, which included the following:

- Documentation of surrounding natural features and land uses (i.e., wetland, agriculture, etc.);
- Channel dimensions, substrate composition, channel morphology and bank stability;
- Stream morphology dimensions:
- Substrate composition (i.e., clay, silt, sand, gravel, cobble, rock, boulder, muck and detritus);
- Indicators of water quality, water clarity, water colour, presence and type of macrophytes and algal growth, evidence of runoff;
- Basic field parameters such as pollution sources (i.e., tile drain discharges, other piped discharges and road runoff).

The results were presented in the 2020 Monitoring Report (AECOM, 2021).

On June 29, 2023, an AECOM aquatic ecologist undertook aquatic habitat assessments at Tributary A and Pond A in order to document any potential changes to the available fish habitat due to below-water extraction activities at the pit.

4. Results

4.1 Hydrogeology

4.1.1 Water Levels

Water levels have been collected from the existing on-site monitors and mini-piezometers since 1999 with seasonal water levels collected since 2002. Several off-site staff gauges in privately owned ponds north of the site were historically monitored. The staff gauges at 4767 Pioneer Trail (SG2) and 4803 Pioneer Trail (SG3) were originally installed at the request of Mr. Raymond Reid (4803 Pioneer Trail). However, monitoring of SG3 was discontinued in 2009 at Mr. Reid's request and SG2 was destroyed sometime after May 2013 and was not replaced. The water levels in the SG2 pond are regulated by an outlet and therefore, do not reflect natural pond levels. No impacts due to site operations are expected at either of these private pond locations.

The water levels measured on November 16, 2023 were plotted on **Figure 4**. Regionally, groundwater is expected to flow to the northwest towards the Speed River. This is confirmed through the on-site monitoring. The direction of groundwater flow (shown on **Figure 4**) is to the north-northwest, consistent with historic interpretations presented in the Hydrogeological Assessment (GLL, 2006b) for the site.

Water levels show natural seasonal fluctuations. Based on the daily level logger measurements, the range in 2023 water level fluctuations in the on-site monitors is from 0.33 m (BH6) and 0.71 m (BH4). This level of fluctuation is lower than those observed in 2022. Most of the low groundwater elevations measured in November 2023 were within historic ranges observed in 2003, 2008, and 2012. At most locations, groundwater levels are showing an overall decreasing trend over time. This decreasing trend does not appear to be related to pit activities as all monitors upgradient and downgradient of the below-water extraction activities show similar trends. All manual water levels appear to show comparable seasonal trends to each other. The hydrographs for the seasonal manual water level measurements from groundwater monitors BH1 to BH11 are presented on **Figure 8**.

A level logger and barologger (for compensation) were installed at BH11 on June 14, 2010 to measure water levels at regular intervals. Loggers were installed at the remaining on-site groundwater monitors and mini-piezometers on May 8, 2018 and programmed to collect daily (12:00 noon) water level and groundwater temperature measurements. The 2010 to 2023 water level information for BH11 is presented on **Figure 17** along with the daily precipitation from the Grand River Conservation Authority Guelph Dam monitoring station, located about 12 km north of the site[2]. The annual seasonal pattern of water level fluctuations is shown at BH11. The 2023 seasonal pattern for the on-site groundwater monitors show peak water levels in the spring (April) followed by fluctuating water levels throughout the summer due to significant rainfall events with some recovery in late summer/early fall then further declining water levels/stabilization to the end of the year. The total 2023 precipitation for the Guelph Dam station was 836.0 mm. Based on long-term normals (1994 to 2015 Guelph Dam data) of 918 mm, 2023 had a slightly lower amount of precipitation compared to normals and significantly higher than 2022[3]. Significant rainfall events throughout the year resulted in periods of increased water level elevations. The logger hydrographs for the northern (**Figure 9A**), central (**Figure 14A**), southern (**Figure 18A**), Southern Swale and Isolated Wetland (**Figure 22A**) and Tributary A monitors (**Figure 26A**) are grouped and plotted together. Another version plotting the rainfall amounts with each group of monitors is also included in the hydrographs for the northern (**Figure 9B**), central (**Figure 14B**), southern (**Figure 18B**), Southern Swale and Isolated Wetland (**Figure 22B**) and Tributary A (**Figure 26B**). As recommended by the Township, hydrographs for each of the individual monitoring nests have also been

2. *Originally, precipitation data from the Environment Canada Region of Waterloo International Airport was used for comparison purposes but this station has been inactive since mid-2011.*
3. *Total 2022 precipitation for the Guelph Dam station was 562.2 mm*

prepared and are presented in **Figures 10 to 13** (northern), **Figures 15 to 17** (central), **Figures 19 to 21** (southern), **Figures 23 to 25** (southern swale and isolated wetland) and Tributary A (**Figures 27 to 29**).

January 1 to December 31, 2023 water levels and groundwater temperature from the monitors located in the northern portion of the site (BH3, BH4, BH8, BH9), central portion of the site (BH2, BH10, BH11) and southern portion of the site (BH1, BH5, BH6, BH7) are included on **Figures 9 to 21**. As mentioned above, the groundwater monitors across the site show a similar trend to each other. Groundwater temperatures across the site also generally show a similar pattern to each other but with slight variations likely related to the formations the monitors are screened within and depth. Monitor water temperatures are generally lowest in March to early April and highest in mid-September to mid-October. The highest fluctuation in water temperatures in 2023 were observed at monitor BH4 which had 2023 water temperatures ranging from 4.8 degrees C to 12.9 degrees C. Monitor BH6 had 2023 water temperatures ranging from about 7.9 degrees C to 22.6 degrees C, but that is attributed to a logger malfunction.

January 1 to December 31, 2023 groundwater levels and temperature from the mini-piezometer (MP) locations located in the Isolated Wetland (MP4), the southern swale (MP6, MP7), and Tributary A (MP1, MP2, MP3) are included on **Figures 22 and 26** and individually on **Figures 23 to 25** and **Figures 27 to 29**, respectively. The water levels in the MPs showed a similar trend as the BH groundwater monitors. During the seasonal water level monitoring events, all loggers are downloaded and re-installed, if possible. The logger at MP2-I (deep) malfunctioned over the period September 2022 to November 16, 2023, with no data recorded over this period (**Figure 28**) however, seasonal manual measurements continued to be collected during this period.

4.1.2 Water Budget

As part of GRCA's review of the 2022 monitoring report, the GRCA recommended a thorough review of available meteorological data for the area to support our conclusion that the general groundwater level decreasing trend noted in many of the groundwater monitors are mainly related to local precipitation and climactic effects. Examining the 1999-2023 Groundwater Elevations – Boreholes (Figure 8), the groundwater elevations generally show a declining trend commencing in 2017. To assess the influence of climate on water levels measured during the 2017 to 2023 monitoring period, a water budget was calculated. Data for the GRCA Guelph Dam meteorological station was reviewed and used for calculation of the monthly water budget using the method described by Thornthwaite and Mather (1957) with assumed soil moisture storage of 100 mm. The 2023 water budget is presented in the table below.

Month (2023)	Mean Temperature (C)	Total Precipitation (mm)	Actual Evapotranspiration (mm)	Actual Water Balance / Surplus (mm)
JAN	-0.8	59.2	0.0	59.2
FEB	-2.3	78.2	0.0	78.2
MAR	0.2	72.8	0.6	72.2
APR	8.1	99.6	39.1	60.5
MAY	12.8	49.0	50.0	-1.0
JUN	18.8	74.8	99.8	-25.0
JUL	21.0	171.8	136.7	35.1
AUG	19.3	101.8	112.8	-11.0
SEP	17.8	23.2	-20.8	44.0
OCT	12.0	47.4	79.4	-32.0
NOV	3.6	61.0	10.8	50.2
DEC	2.3	75.0	6.1	68.9
Year		**913.8**	**514.4**	**399.4**
Average Year (Normals)*		**914**	**513**	**401**

Notes: Soil Moisture Storage Based on 100 mm. / Under Average Conditions for 2023.
** 20 year average (1994-2013) for Guelph Dam*

The detailed water budget determined that overall, 2023 was similar to an average year in terms of the water budget. The calculated total yearly surplus precipitation was 399.4 mm, which is similar to the average of 401 mm. During an average year, surplus water is available to infiltrate during the winter, spring and fall and there is a deficit of surplus due to high evapotranspiration at ground surface (average surplus) during the late spring and summer. In 2023, this was generally the case in May, June, August, and October when a negative surplus was calculated. The water surplus represents water available for infiltration and contribution to groundwater. With this in mind, the water surplus over time was plotted for 2017 to 2023 with the addition of a linear trend line.

Figure 30 shows that there is a decreasing trend in water surplus, similar to the decreasing trend in groundwater levels shown on **Figure 8**. A summary of the 2017- 2023 annual water budget is shown on the table below.

Year	Total Precipitation (mm)	Actual Evapotranspiration (mm)	Actual Water Balance/Surplus (mm)
2017	1120.1	452.1	668.0
2018	937.8	421.7	516.1
2019	1095.0	481.1	613.8
2020	1028.8	513.6	515.1
2021	961.7	565.7	396.0
2022	742.2	412.8	329.4
2023	913.8	514.4	399.4

The 2017 to 2023 annual water surplus shown on the table above also clearly shows an overall decrease in surplus available for infiltration. The above water budget assessment supports our conclusion that the general groundwater level decreasing trend noted in many of the groundwater monitors are mainly related to local precipitation and climactic effects.

4.1.3 Groundwater Gradients to Tributary A

Item 32 of the Operations Plan – Operations Notes addresses gradient reversals from the fish habitat (Tributary A, Pond A) to the pit. As discussed in Section 4.1.1, shallow groundwater flow is from the south to the north-northwest (i.e., from the pit area to Tributary A). The MP6 water levels in the southern swale, adjacent to the extraction limits, are compared to MP2-I, located within Tributary A. No groundwater flow direction determination was possible during the January (MP2-I was frozen) and August 2022 (MP6 could not be located due to heavy vegetation growth) monitoring events. The seasonal groundwater elevations collected in 2023 are presented below in **Table 3**.

Table 3: 2023 MP6 and MP2-I Groundwater Elevations

Date	MP6 Groundwater Elevation (mASL)	MP2-I Groundwater Elevation (mASL)	Difference in Groundwater Elevation between MP6 and MP2-I	Direction of Groundwater Flow
19-Apr-23	325.21	323.87	1.34	NW towards Trib A
5-May-23	-	-	-	-
31-Aug-23	325.39	-	-	-
11-Nov-23	325.41	324.29	1.12	NW towards Trib A

The April and November 2023 groundwater elevations from MP6 and MP2-I indicate that groundwater flow is to the northwest towards Tributary A. The groundwater elevations will continue to be monitored for gradient reversal.

4.2 Natural Environment

4.2.1 Amphibian Assessment

Initial field investigations in 2005 confirmed five species of breeding amphibians within the site boundary: Spring Peeper (*Pseudacris crucifer*), Gray Treefrog (*Hyla versicolor*), Wood Frog (*Lithobates sylvaticus),* Northern Leopard Frog (*Lithobates pipiens*) and Green Frog (*Lithobates clamitans*) (GLL, 2006). Two additional species were found to be present on site in 2018, American Toad (*Anaxyrus americanus*) and Bullfrog (*Lithobates catesbiana*) (AECOM 2019).

4.2.1.1 Amphibian Survey Monitoring Results

The results of the amphibian surveys in 2023 are shown in **Table 4**. Several Spring Peepers were recorded at all three stations and large numbers of Wood Frog at all three stations. The number of calling Wood Frogs in large choruses could not be reliably estimated but consisted of more than 10 calling individuals recorded in both Tributary A and Pond A. American Toads were calling at all three calling stations on the May 9 survey while several Gray Treefrogs were present at all stations on June 1. Green Frogs were heard on June 1 during nocturnal surveys and acoustics monitors for that day. They were seen during aquatic surveys on June 30, 2023 by field staff. Northern Leopard Frog were not heard during surveys as well but are assumed to have a presence at this site due to their short calling period and tendency to call more frequently during the daytime.

Table 4: Amphibian Calling in-Person Survey Results 2023

Species	Isolated Wetland			Tributary A			Pond A		
	April 10	May 9	June 1	April 10	May 9	June 1	April 10	May 9	June 1
Spring Peeper (SPPE)	1	1		2	2		4	5	
Gray Treefrog (GRTF)			6			6			5
Wood Frog (WOFR)	7			>10			>10		
American Toad (AMTO)		2	4		2			1	
Green Frog (GRFR)									3

4.2.1.2 Amphibian Assessment and Discussion

Table 5 shows the calling survey results for all years including 2023. Results from the acoustic monitor surveys in 2021 and 2023 are provided in **Appendix F.** Each species will be discussed separately.

There appeared to be sufficient water at all three locations to support breeding frogs during the 2023 survey period. In 2019 by contrast, the Isolated Wetland was dry by mid May. Nevertheless, the spring of 2022 had lower than average precipitation and July was particularly dry with only 22.4 mm reported for Guelph (Government of Canada 2022). By July 15, 2022 there was no water present at either the Isolated Wetland or Tributary A and they appeared to have been dry for some time. During 2023 fish habitat investigation on June 29, 2023, water was still present within lower sections of Tributary A. Consequently, it is uncertain if those areas hold water long enough to allow amphibian larvae to transform into adults in most years. Perhaps successful reproduction only occurs in years of above average precipitation. By contrast, Pond A holds water permanently and therefore successful larval transformation can occur there every year.

American Toad (*Anaxyrus americanus*) were present at all three stations for the second consecutive year. This species appears to be a recent colonist on-site as it was not detected prior to 2019. A single juvenile was first observed in the field near Tributary A in 2019. Although widespread and adaptable to human altered habitats, American Toad populations can fluctuate considerably at a given location. It may have been present in low numbers in previous years but was never picked up on calling counts.

Table 5.1: Amphibian Calling Survey Results All Years

Species	Isolated Wetland							Tributary A							Pond A						
Dates	**2005**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2005**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2005**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Spring Peeper	12	12	15	10	>10	>10	5	50	25	20	11	>10	>10	2					>10	>10	7
Gray Treefrog			4		A	1	6	X		1	1	A	1	6					2	3	5
Wood Frog	5	12	1		>10	4	7	30	15	20		>10	1	>10							>10
N. Leopard Frog	1				A			X													
Green Frog															X	1	X	X	X	X	3
American Bullfrog																	1				
American Toad					1	2	4					5	2	2					4	3	5

Notes: X – species was recorded incidentally during other daytime investigations in given year but not during nocturnal amphibian monitoring surveys
Species recorded through acoustic monitoring established in 2021 and 2023 (acoustic monitoring was not completed in 2022).
A – Recorded with Acoustic Monitor but not during Calling Count.

Spring Peepers were abundant breeders at both the Isolated Wetland and Tributary A during all survey years. They were first recorded in Pond A during surveys in 2021 and again in 2022. Spring Peepers were recorded at all locations in 2023 but in lower numbers than 2021 or 2022.

Small numbers of Gray Treefrogs were recorded calling at all three stations in 2023. Acoustic monitors in 2023 which recorded calling frogs over multiple nights, showed that numbers of calling treefrogs were much greater than the numbers recorded during surveys with populations apparently increasing with more individuals in 2023 compared to previous years. Only small numbers had been recorded in years prior to 2022 but comparisons cannot be made since acoustic monitors were not used then.

Wood Frogs were calling in large numbers at the Isolated Wetland, Pond A and Tributary A on April 10, 2023. Previously, abundant calling Wood Frogs were recorded in April 2021 in the Isolated Wetland and Tributary A which by chance took place on a peak night of calling. The survey night on April 10, 2023 again coincided with the peak calling period and confirms their continued presence within the study area with a new presence within the Pond A suggesting a recent colonization of that site. This species has a short but explosive breeding season in early spring and dates vary somewhat between years depending on weather.

Northern Leopard Frogs were not detected during 2023, nor have they been recorded on any of the amphibian surveys over the previous five years. The acoustic monitor that was setup at the Isolated Wetland in 2021, detected single calling individuals on two dates. Northern Leopard Frogs call less intensively than other frogs, and also call more frequently during the day which is why they usually escape detection during the brief nocturnal calling count surveys. None were picked up with the acoustic monitors in 2023 but they are assumed to still be present.

Green Frog was detected on June 1, 2023 during amphibian calling surveys. The peak calling period is later in June. For example, several Green Frogs were incidentally observed and heard calling during the daytime in Pond A on June 29, 2023 during the fish habitat assessments. It can be assumed that they were successfully breeding there as the pond provides suitable habitat and contains permanent water.

American Bullfrog (*Lithobates catesbiana*), which was first observed on-site in 2019, has not been detected since. One individual was observed in Pond A during the April survey which was an exceptionally warm night. It was not calling and is also a late season breeder. It appears that a single individual had wandered onto the site and did not breed.

As in 2021 and 2022, many amphibians were calling at Pond A in 2023, compared to years before 2021 when none were detected there during surveys. The reason is not clear for the sudden appearance of calling Wood Frogs in Pond A as well as Spring Peepers when they first appeared in Pond A in 2021. It is plausible that Spring Peepers as well as Wood Frogs have moved into the pond in recent years as a response to a potentially reduced hydroperiod at the Isolated Wetland and Tributary A. It appears that the hydroperiod at those locations may not be sufficient to allow for adults to transform into adults in most years. The pond however, holds water permanently which would allow tadpoles sufficient time to transform.

Surface water levels are monitored by AECOM in three areas where amphibians breed. **Table 6** show the results for the years of monitoring. Water depths are only recorded four times (seasonal) annually, approximately once every three months (typically only twice during the amphibian active period). These data provide some insight into trends but not the details of short-term water level fluctuations. Note that the piezometer MP1 is located at the side of Pond A and not in the deepest part, therefore when it was indicated as “dry”, Pond A has not dried up, but the water level has dropped below the piezometer location. Pond A has permanent standing water. Meanwhile MP2 and MP4 are located within the deepest portions of those surface water features and therefore “dry” indicates lack of any surface water.

Table 6: Surface Water Depths 2018 to 2023

Date	Isolated Wetland Water Depth at MP4	Tributary A Water Depth at MP2	Pond A Water Depth at MP1
5-May-2018	31 cm	20 cm	34 cm
20-Aug-2018	dry	dry	dry
16-Apr-2019	24 cm	35 cm	34 cm
23-Jul-2019	7 cm	23 cm	29 cm
5-May-2020	7 cm	20 cm	31 cm
30-Jul-2020	dry	Dry	dry
13-Apr-2021	dry	21 cm	26 cm
1-Jun-2021	dry	Dry	9 cm
14-Jul-2021	dry	4 cm	12 cm
4-May-2022	3 cm	22 cm	29 cm
25-Aug-2022	dry	Dry	dry
19-April-23	25 cm	12 cm	2 cm

The Isolated Wetland dried up early in the seasons of 2020, 2021 and 2022. It is unknown if the wetland had a sufficient hydroperiod in 2023 for amphibian larvae to successfully transform to adults. April was wet and had deep water on April 19 (**Table 6**) but May had low precipitation and June showed a substantial water deficit (see table in 4.1.2). Water depth of the Isolated Wetland Tributary was similar to that recorded in April 2019, but the water depths for Tributary A and Pond A were lower than previous years around this time.

Overall, numbers of calling amphibians in 2023 surveys looked similar to previous years (2021 and 2022) except more Wood Frogs were recorded and at an additional station as well (Pond A). Lower numbers of calling Spring Peeper were observed for this year at all three sites compared to previous years, American Toad was recorded at all three locations, an increase in Gray Treefrogs at all three stations and there was considerable amphibian calling activity in Pond A and the Isolated Wetland.

4.2.2 Wetland Vegetation

Tributary A, the Isolated Wetland and the Downey Road Locally Significant Wetland occur within the site boundary where vegetation transects were initially established in 2018 (AECOM, 2019). A new transect location (TR 5) was selected in 2021 as a control but was not completed in 2023 due to lack of accessibility. Due to the absence of a control transect data in 2023, the vegetation comparison is presented using the baseline data collected in 2018.

The location of the wetland features and vegetation transects are illustrated on **Figure 2**.

4.2.2.1 Results of Vegetation Transects

Plant species and the percent (%) cover of each was recorded within the respective transects. Results of the 2023 survey as well as from previous years are provided in **Table 7** which documents all plants with a cover of at least 1% in at least one of the transects. A detailed discussion of the results of each vegetation transect survey is provided in the sections below. The percent cover of representative plant species of the latest year of monitoring were compared with the established baseline conditions in 2018 to determine if they were increasing or decreasing. Representative photographs of the transects are shown in **Appendix E**. Quadrats were not at precisely the same locations between years and there may be some subjectivity in estimating cover, consequently any differences of species cover that varies by less than 25% are not considered significant. Differences between years that are substantially more than 25% likely reflect a real change in abundance, particularly those species with an average cover of at least 5%.

Table 8 below provides a comparison of the baseline (2018) and 2023 monitoring year metrics for the sampled transects. A full list of observed plant species within transects is presented in **Appendix G.**

4.2.2.2 TR 1 at the Isolated Wetland Unit

The Isolated Wetland was surrounded by an actively cultivated cropland (corn in 2023) which almost encroached to the wetland boundary. However, the buffer to the wetland from the cropland has become several meters wider than when the transect was initially established. The boundary of the wetland was quite disturbed with a variety of weedy species mixed with some wetland species and has more representation of upland species than the rest of the transect. Since the species composition of the edge and interior of the wetland were so different, they appear as separate columns in **Table 7**, with the edge consisting only of the first and last quadrats along the transect. The edge vegetation has become more stabilized with fewer species present as the community has become co-dominant with reed canary grass (*Phalaris arundinacea*), tall goldenrod *(Solidago altissima)*, panicled aster *(Symphotrichum lanceolatum)*, and Canada thistle *(Cirsium arvense)*.

Only the interior plots on **Table 7** are included in the results of the summary **Table 8** since those are typical of the Isolated Wetland. The wetland's interior showed an increase in plant diversity over time, partly because some upland species such as smooth brome *(Bromus inermis)* and sow-thistle *(Sonchus sp.),* were encroaching at the edges. However, obligate wetland species purple-leaved willow-herb *(Epilobium coloratum),* cut-leaved bugleweed *(Lycopus americanus),* and swamp aster *(Symphotrichum puniceum)* were recorded in 2023 within the interior transect. These species are also associated with wetland communities under natural conditions. The invasive common buckthorn *(Rhamnus catharnica)* was recorded within the edge of transect. The percent cover by reed canary grass have increased from previous years while the percent cover of broad-leaved cattail (*Typha latifolia*) continued to decline. These noted changes seem to point to an overall drying of the Isolated Wetland. Transect TR 1 **-** was established in the Organic Shallow Marsh Ecosite (MAS3) vegetation community located in the western portion of the site boundary. In general, the metrics in TR 1 were noted to be relatively constant between Baseline (2018), Year 2 (2019) to Year 7(2023) monitoring.

A total of 18 species were recorded within the transect during Year 7 (2023) surveys which was an equal with Year 6 (2022) but a increase from Year 2 (2019), Year 3 (2020), Year 4 (2021) and baseline (2018) survey results. Of these, 15 species are considered native, and three (3) species are considered invasive/exotic to the area.

The baseline Flora quality Index (FQI) recorded in 2018 was 9.65 indicating low vegetative quality within the transect. The FQI slightly increased from baseline (2018) to Year 7 (2023) but still indicated low vegetative quality. The Mean Coefficient of Conservatism (CC) also slightly increased from 2.91 in 2018 (baseline) to 3.33 in Year 7 (2023). This indicates the presence of species that can be found in a wide variety of communities, including disturbed sites. The Average Wetness Value (AWV) increasing from -1.92 in 2018 (baseline) to -2.39 Year 7 (2023), which indicated facultative and obligate wetland species have generally increased within the monitoring transect. Note that 2022 showed a dramatic drop in the AWV to -0.39 due to the presence of several obligate upland species common milkweed, smooth brome and tufted vetch. One of the limitations of the AWV is that it only considers species presence and not percent cover such that a species with 0.1% cover scores the same as one that has 50% cover. More than 90% of the vegetative cover in 2022 consisted of obligate or facultative wetland plant species. In 2023, the AWV was similar to 2019 and 2020, showing a greater component of wetland species, particularly several obligate wetland species mentioned above. Of note, species recorded along the edge of the wetland were not included in the AWV calculations because the edge had a significantly different species composition due to the agricultural influence and was only marginally wet. Species recorded in the interior TR1 were more representative of the AWV of the isolated wetland.

This changes could be due to the fluctuations in weather and precipitation from year to year. Representative photographs of the Isolated Wetland are shown in **Appendix E**, photos 1 to 4, and the analysis of floristic indices in **Table 8**.

Table 7: Percent Cover of Plants in Vegetation Transects

		TR 1 – edge						TR 1 - interior						TR 2						TR 4						TR 5	
	# of plots	2 plots						10 plots						12 plots						12 plots						12 plots	
	Year of Survey	2018	2019	2020	2021	2022	2023	2018	2019	2020	2021	2022	2023	2018	2019	2020	2021	2022	2023	2018	2019	2020	2021	2022	2023	2021	2022
Common Name	**Latin Name**																										
GRAMINOIDS																											
Smooth Brome	*Bromus inermis*					4.0						2.0															
Blue-joint Grass	*Calamagrostis canadensis*																									8.3	8.2
Tussock Sedge	*Carex stricta*																										5.0
Beaked Sedge	*Carex utriculata*		2.5					1.7	4.1	6.9	2.7	10.2	3.3														
Fox Sedge	*Carex vulpinoidea*	3.0	12.5	3																	0.2	0.3		0.8			
sedge sp.	*Carex sp.*			0.5									0.3							0.5	1.6	0.1	0.4	0.9	0.5	1.3	
Toad Rush	*Juncus bufonius*	10.0																									
Path Rush	*Juncus tenuis*	0.5	5.0	0.5																							
Reed Canary Grass	*Phalaris arundinacea*	1.5	45.0	27.5	40.0	45.0	77.5	30.3	38.6	32.9	57.0	43.0	55.5	40.2	67.7	50.4	49.6	45.8	57.5	41.8	38.0	43.3	44.0	37.1	35.0	70.4	55.7
Timothy	*Phleum pratense*																								0.1		
Common Reed	*Phragmites australis*																		1.7	0.3	2.3	1.9	7.1	8.9	1.8		
Fowl Bluegrass	*Poa palustris*				0.5						0.7							3.1		2.5	5.2	4.3		0.1			
Kentucky Bluegrass	*Poa pratensis*																					0.2		4.2		0.8	
bluegrass sp.	*Poa sp.*			0.5										0.4	1.2	0.3							5		1.7		
Black Bulrush	*Scirpus atrovirens*		0.5	7.5																							
Narrow-leaved Cattail	*Typha angustifolia*																			24.8	23.1	0.8	1.8	1.5	0.1	0.3	0.6
Broad-leaved Cattail	*Typha latifolia*							14.6	15.4	18	6.6	3.6	0.9														
Hybrid Cattail	*Typha X glauca*													0.8	0.3	0.5				0.6	0.8	13.3	0.8			0.6	0.3
FORBS																											
Common Ragweed	*Ambrosia artemissifolia*	2.0	0.5																								
Common Milkweed	*Asclepias syriaca*	7.5	1.5		2.0	8.0						0.1															
Enchanter's Nightshade	*Circaea lutetiana*													0.1	0.3	0.2	0.3	0.2	0.1								
Canada Thistle	*Cirsium arvense*				1.0	5.0	6.5					0.5	0.9	0.1		0.1									20.4		0.9
Wild Carrot	*Daucus carota*	5.0	0.5																					0.3		0.1	
Wild Cucumber	*Echinocystis lobata*														0.1		0.8	0.8									
Northern Willow-herb	*Epilobium ciliatum*															0.3											
Hairy Willow-herb	*Epilobium hirsutum*													1.4	3.6	6.1	1.5	10.0	19.6								
Purple-leaved Willow-herb	*Epilobium coloratum*												0.2														
Sm.-flower Willow-herb	*Epilobium parviflorum*	2.5	0.5		0.5																						
Field Horsetail	*Equisetum arvense*	20.0	1.0	5.0	7.5	5.0		0.3				0.4	0.2	1.2	0.8	0.3	0.1	0.8	0.2	1.8	0.9	1.4	0.3	0.8		0.2	1.3
Water Horsetail	*Equisetum fluviatile*		0.5					3.7	4.1	1.3	0.9	2.3	0.6							2.2	4.8	1	0.5	0.5			
Spotted Joepyeweed	*Eupatorium maculatum*																1.0	1.5			0.2	0.3					
Boneset	*Eupatorium perfoliatum*																								0.2		
Grass-leaved Goldenrod	*Euthamia graminifolia*		2.0	15.0	6.0	5.0	2.5						0.6							1.0	0.1	0.4					
Marsh Bedstraw	*Galium palustre*										0.1	1.8		0.1	0.2	2.3	1.8	0.2	0.3	0.2	0.1	0.3	0.1	0.2	0.9		
Yellow Avens	*Geum allepicum*																		0.2						0.2		
Spotted Jewelweed	*Impatiens capensis*													4.1	2.7	3.1	13.3	18.0	1.6							0.1	
Lesser Duckweed	*Lemna minor*													0.6													
Cut-leaved Bugleweed	*Lycopus americanus*		0.5	2.0									0.1		0.1	0.4	0.8	0.8									
Northern Bugleweed	*Lycopus uniflorus*													0.5	1.1	0.7	0.7	0.2		0.1		0.3		0.3			
Tufted Loosestrife	*Lysimachia thrysiflora*							0.6	0.5	0.7	0.8	0.6	1.4														
Wild Mint	*Mentha arvense*													0.1	0.2	0.1	1.3	0.7	0.5	0.3	0.3	0.2	0.3	0.4		0.1	1.3
Sensitive Fern	*Onoclea sensibilis*													2.8	1.6	3.7	3.0	3.7	1.0								
Wood Sorrel	*Oxalis stricta*	1.0	0.5	0.5	0.5																						
Common Plantain	*Plantago major*	2.5																									
Water Knotweed	*Persicaria amphibia*																									3.7	3.3
Lady's Thumb	*Persicaria maculosa*	1.0																									
Rough Cinquefoil	*Potentilla norvegica*	7.5			0.5																						
Bittersweet Nightshade	*Solanum dulcamara*									0.1	0.2	1.5	0.6	24.7	19.5	18.8	23.3	18.7	15.8	2.9	4.2	9	21.9	21.8		0.3	1.9
Tall Goldenrod	*Solidago altissima*	2.5	1.5		10.0	15.0	16.5			0.1	0.1	0.5	8.5	0.4	0.3	0.3		0.8		0.5	1.3	2.5	2.9	6.7	6.7	5.8	

		TR 1 – edge						TR 1 - interior						TR 2						TR 4						TR 5	
	# of plots	2 plots						10 plots						12 plots						12 plots						12 plots	
	Year of Survey	2018	2019	2020	2021	2022	2023	2018	2019	2020	2021	2022	2023	2018	2019	2020	2021	2022	2023	2018	2019	2020	2021	2022	2023	2021	2022
Common Name	**Latin Name**																										
GRAMINOIDS																											
Giant Goldenrod	*Solidago gigantea*																1		0.3								
Rough Goldenrod	*Solidago rugosa*													1.2	0.8	1.8	0.4	2.5	0.8								
Field Sow-thistle	*Sonchus arvensis*	4.0	2.0	3.5	0.5					0.1	2.6											0.1	0.4	0.4			
Prickly Sow-thistle	*Sonchus asper*					4.0						2.5															
Panicled Aster	*Symphotrichum lanceolatum*	1.5	2.5	10.5	25.5		10.0	0.1	0.2	0.1	0.4	2.0	11.6							2.1	3.8	5.6	6.6	9.3	8.2	0.9	6.3
Swamp Aster	*Symphotrichum puniceum*				1.5								10.0	3.7	1.6	2.6	4.9	3.3	6.2								
Dandelion	*Taraxacum officinalis*																								0.2		
Coltsfoot	*Tussilago farfara*				1.0																						
Blue Vervain	*Verbena hastata*	1.0	6.0	1.0																							
Cow Vetch	*Vicia cracca*	2.0	0.5	0.5	0.5					0.1	0.4	0.2															
WOODY PLANTS																											
Gray Dogwood	*Cornus racemosa*																			2.1	0.7	1.2	0.4	1.9	4.3	5.3	5.3
Red-osier Dogwood	*Cornus sericea*													0.2	0.2	1.0	1.8	0.9	1.3	7.7	13.3	11.7	14.2	11.3	8.3	0.1	8.2
Thicket Creeper	*Parthenocissus vitacea*																		0.3								
Eastern Cottonwood	*Populus deltoides*																									9.2	4.0
Common Buckthorn	*Rhamnus cathartica*												0.5					1.0	3.3								0.8
Black Currant	*Ribes americana*													0.4	0.8	1.3		0.8	0.4								
Red Raspberry	*Rubus idaeus*													0.7	2.3	2.7	1.7	5.0	1.9								
Peach-leaved Willow	*Salix amygdaloides*							7.5	7.5	7.5	7.5	5.0	9.0														
Missouri Willow	*Salix eriocephala*													5.0	2.9	12.9	12.1	8.3	5.0					0.8	6.3		
White Cedar	*Thuja occidentalis*																		0.8								
Riverbank Grape	*Vitis riparia*											0.2	0.1	0.5	0.4	0.8	0.7	0.2		0.8	0.3		0.7	1.3	1.7		
TOTAL COVER		77.0	87.0	78.0	98.0	99.0	113.0	58.8	70.4	60.3	80.1	75.1	104.2	89.2	109.3	115.5	120.2	127.9	119.6	92.3	101.4	99.1	107.8	101.5	96.6	108.5	103.3
NUMBER of SPECIES		22	22	16	16	9	5	8	7	10	14	18	18	23	26	25	22	26	22	20	22	25	19	25	17	22	17

Table 8: Vegetation Transect Monitoring Summary

Wetland	Transect #	Number of Native Species						Number of Invasive/Exotic						Flora Quality Index (FQI)						Mean Coefficient of Conservatism (CC)						Average Wetness Value (AWV)					
		2018	2019	2020	2021	2022	2023	2018	2019	2020	2021	2022	2023	2018	2019	2020	2021	2022	2023	2018	2019	2020	2021	2022	2023	2018	2019	2020	2021	2022	2023
Isolated Wetland	**TR1-interior**	11	8	12	11	12	15	1	1	3	4	5	4	9.65	11.67	13.57	11.46	10.68	12.91	2.91	4.13	3.92	3.45	3.08	3.33	-1.92	-2.60	-2.27	-1.25	-0.39	-2.39
Tributary A	**TR2**	19	23	24	19	23	19	4	3	3	4	3	3	14.36	15.34	15.34	13.54	14.39	13.54	3.21	3.13	3.13	3.11	3.00	3.11	-1.87	-1.96	-1.81	-2.00	-1.77	-1.55
Downey Wetland	**TR4**	15	16	18	13	16	12	4	4	7	5	8	5	8.52	8.25	10.14	6.93	9.88	6.40	2.20	2.06	2.39	1.92	2.47	1.85	-1.89	-1.95	-1.76	-1.44	-1.00	-1.06

The water table measured along the transect at the time of the vegetation survey showed a similar level in 2023 as in the previous two years (**Table 9**). However, the groundwater levels recorded continuously at MP4 (**Figure 22B**) are a better indication and showed that 2022 had the lowest levels in the six years. Generally, 2022 was a drier year especially during spring and summer relative to other years as indicated by the recorded precipitation in **Figure 22B.** There were fewer, high rain events with greater than 30 mm of precipitation in between longer drier periods in May and again in August 2022. During periods of low rain or drought, the soil tends to become dry, compacted, and often hydrophobic (resistant to absorbing water). When a high-rain event follows such a dry period, the ability of water to infiltrate into the ground can be significantly reduced.

This can be seen in the groundwater levels on **Figure 22B** as the groundwater levels did not quickly respond (i.e., increase in response to high volume of surface water in a short period) to those high rain events. In 2023, the groundwater levels had recovered to be about 0.5 m higher compared to 2022 which appears to be reflected in the improved AWV (i.e., greater component of wetland species) and is reflective of a generally wetter year with an increase in above average rain events between May and August (**Figure 22B**).

Outside of the transect, the rim of the wetland contained a patch of sandbar willow (*Salix exigua*) at the west end and a thicket containing a mix of sandbar, Missouri (*S. eriocephala*), peach-leaved (*S. amygdaloides*) and white willows (*S. alba*) at the east end. These have remained in approximately the same configuration since 2018.

Characteristics of the soil sample taken mid-way along transect TR 1 are shown in **Table 9** and in **Appendix E**, photo 4. No mottles were present because of the deep organic soil layer and the shallow water table. The difference in depths of layers are due to samples taken at slightly different locations. They reflect natural variability through the wetland but show a consistent pattern. Only the depth of the water table reflects a change between years; however, it should be noted that the depth to water table was not taken at the same time of each year. For this reason, **Figure 23** shows a better representation of the changes in groundwater levels across years.

Table 9: Soil Sample at Transect TR-1

Soil Characteristics	Depth 2018	Depth 2019	Depth 2020	Depth 2021	Depth 2022	Depth 2023
Depth to Water Table	7 cm	0 cm	27 cm	70 cm	80 cm	70 cm
Depth to Mottles	Not present	Not present	Not present	Not present	Not present	Not present
Fibric/Mesic Organic	0 – 30 cm	0 – 60 cm	0 – 50 cm	0 – 50 cm	0 – 50 cm	0-70 cm
Humic Organic	30 – 85 cm	60 – 110 cm	50 – 90 cm	50 – 100 cm	50 – 80 cm	70-90 cm
Grey Silt	85 – 115 cm	110 – 120 cm	90 – 110 cm	100 – 120 cm	80 – 100 cm	90-100 cm

4.2.2.3 TR 2 at Tributary A

Nearly the whole length of Tributary A consisted of reed canary grass meadow marsh, but often co-dominated with bittersweet nightshade (*Solanum dulcamara*). Overall, the species composition and number of species has remained more constant than at TR 1. The percent cover by hairy willow-herb (*Epilobium hirsutum*), and swamp aster fluctuated between years with both being abundant in 2023. The spotted jewelweed (*Impatiens capensis*) cover decreased in 2023. The amount of cover by woody shrubs remained about the same as in 2018 but has increased, as a result of natural succession. Transect TR 2 was established in the Organic Deciduous Swamp (SWD) vegetation community located in the eastern portion of the site boundary. In general, the metrics in TR 2 were noted to be relatively constant between Baseline (2018), and Year 7 (2023) monitoring.

A total of 22 species were recorded during Year 7 (2023) surveys, 19 of which were considered native and three (3) species considered as invasive/exotic to the area. No regionally rare species or SAR were observed in TR 2 through the monitoring years. The FQI in 2018 was 14.36 which indicated low vegetative quality within the transect. The FQI slightly decreased from 2018 to 2023 but still is considered to be of low vegetative quality. The CC coefficient also slightly decreased from 2018 to 2023 from 3.13 to 3.11, respectively. The Average Wetness Value decreased from 2018 to the 2023 between -1.87 to -1.55, due to a recorded decrease in facultative species within the monitoring transect. Common non-native species such as reed canary grass, common buckthorn, bittersweet nightshade, and hairy willowherb were observed during the vegetation monitoring years. The percent coverage of reed canary grass and common buckthorn, and hairy willowherb increased, but bittersweet nightshade decreased compared to previous years.

Surface water was not present in the poorly defined channel. **Table 10** shows that the water table has recovered to 15 cm below surface in 2023 compared to that seen in 2022 (**Table 6**). Representative photographs of the Tributary A are shown in **Appendix E**, photos 5 to 6, and the analysis of floristic indices in **Table 8**. The soil sample is depicted in **Appendix E**, photo 7. The persistence of wetland vegetation may be a result of this being a drainage feature which consistently receives surface flow through spring runoff and rain events.

Table 10: Soil Sample at Transect TR 2

Soil Characteristics	Depth 2018	Depth 2019	Depth 2020	Depth 2021	Depth 2022	Depth 2023
Depth to Water Table	5 cm	0 cm	17 cm	35 cm	>110 cm	15 cm
Depth to Mottles	Not present	Not present	Not present	Not present	Not present	Not present
Organic Soil, mainly Humic	0 – 95 cm	0 – 90 cm	0 – 95 cm	0 – 85 cm	0 – 90 cm	0-85 cm
Light Grey Clayey Silt	95 – 110 cm	90 – 110 cm	95 – 110 cm	85 – 110 cm	90 – 110 cm	85-105 cm

The water level in Pond A appeared to be about the same as in 2020 but lower than in previous years and no water flowed outward into Tributary A. Surface water monitoring at MP1 showed that the pond level was lower in the summer of 2022 than in 2021 but has since recovered in 2023 (**Table 6**). This is consistent with the trend observed in 2022 with it being recorded as a drier year compared to 2023 as shown on **Figure 26B** and the trends observed at TR1 at the Isolated Wetland Unit (refer to **Section 4.2.2.2**). Water was clear and stoneworts (*Chara* sp.) occupied most of the substrate. Mud-plantain (*Alisma plantago-aquatica*) was abundant along the west side of the pond and a robust patch of broad-leaved cattail. (**Appendix E**, photo 8-10). A Calico Crayfish (*Faxonius immunis*) was found in Pond A (refer to **Appendix E,** photos 11-12). This crayfish is considered native to Ontario with a relatively secure population in Ontario.

4.2.2.4 TR 4 at the Downey Road Wetland Unit

Transect TR 4 was established in the Organic Swamp Thicket Ecosite (SWT3) community located in the southeast corner of the site boundary. This small wetland unit is approximately 0.3 ha in size and situated near the edge of the active pit. The unit consists of marsh co-dominated by reed canary grass and narrow-leaved cattail (*Typha angustifolia*) surrounded by a band of willow-dogwood thicket. A small dense patch of common reed (*Phragmites australis*), an aggressively invasive wetland plant, occurs on the south side of the unit. Representative photographs of transect TR 4 are shown in **Appendix E**, photos 13 to 16, and the analysis of floristic indices in **Table 8**.

Common reed was found in the southern part of the transect, and its coverage had increased since 2020. A dense stand of common reed extended south from the end of the transect. Overall, the vegetation is shifting toward more facultative upland species, while the percentage of cattail coverage has decreased significantly. There has been a significant increase in the growth of Canada thistle, panicled aster, tall goldenrod, common timothy, and common dandelion along with a slight increase in other upland species. general, the metrics in TR 4 were noted to be relatively constant between Baseline (2018), and Year 7 (2023) monitoring, although minor negative changes in the indices were observed in the last monitoring year.

A total of 17 species were recorded within the transect during Year 7 (2023) surveys, 12 of which were considered native, and five (5) species are considered invasive/exotic to the area. No SAR, or regionally rare species was observed within the TR 4 during Baseline (2018), and Year 7 (2023) surveys. The 2018 FQI of 8.52 indicated low vegetative quality within the transect. In 2023, the FQI was 6.40, showing a slight decrease from 2018. The CC coefficient also slightly decreased from 2018 to the 2023 between 2.20 and 1.85 that showed of species found in a wide variety of communities including disturbed sites. The Average Wetness Value decreased from 2018 to 2023 between -1.89 to -1.06 which was presented that facultative species decreased within monitoring transect. Common non-native species, common reed, reed canary grass, bittersweet nightshade, and narrowed-leaved cattail *(Typha angustifolia)* was observed during the vegetation monitoring years. This is consistent with the results from 2018 to 2023).

Characteristics of the soil sample taken mid-way along the transect appear in **Table 11**. This site consisted of shallow organic soil over silty mineral soils. The water table was not reached in the soil sample taken at the time of the field investigations. However, readings at BH11 showed a gradual drop in groundwater levels from 2019 to 2022, but then a rise in 2023 (**Figure 17**) which are also generally consistent with the precipitation variation across years. Generally, 2022 was a drier year with fewer high rain events interspersed between longer periods of low rain or drought, which may have affected the infiltration rates of surface water entering the groundwater during those high rain event similar to that observed at the Isolated Wetland Unit (refer to **Section 4.2.2.2**). Changes in vegetation reflect groundwater conditions. The soil sample is depicted in **Appendix E**, photo 16.

Table 11: Soil Sample at Transect TR 4

Soil Characteristics	Depth 2018	Depth 2019	Depth 2020	Depth 2021	Depth 2022	Depth 2023
Depth to Water Table	70 cm	25 cm	47 cm	100 cm	>90 cm	>90 cm
Depth to Mottles	none	none	70 cm	60 cm	65 cm	none
Organic Soil, mainly Humic	0 - 50	0 – 30 cm	0 – 40 cm	0 – 60 cm	0 – 45 cm	0-50 cm
Silty Loam	50 – 65 cm	30 – 60 cm	40 – 70 cm	60 – 70 cm	45 – 65 cm	50-70 cm
Silty Clay	65 – 100 cm	60 – 120 cm	70 – 110 cm	70 – 110 cm	65 - 90 cm	70-90 cm

4.2.2.5 Vegetation Assessment and Discussion

The water table was farther below the surface at all three on-site locations in 2022 than in any previous monitoring event. All locations also showed a rise in levels in 2023 by about 0.5 m.

Both TR-1 and TR-4 showed a gradual shift to drier plant species over time, whereas this was less apparent at TR-2. In both TR-1 and TR-4, cattails (an obligate wetland plant) formed a significant component (roughly 20% cover) in the first few years, but had declined to about 1% by 2022. Those transects also showed presence of more facultative upland species after the first two years (e.g., Canada thistle, panicled aster and tall goldenrod). Tributary A (TR 2) transect did not show this trend. A difference may be that both the Isolated Wetland and Downey Road Wetland are palustrine wetlands where surface water mostly sits and percolates into the soil, while Tributary A is a riparian wetland that is subjected to periodic flowing water and where the water table was usually closer to the surface.

The FQI and CC metrics used for comparison slightly increased within TR 1 and decreased within TR2 and TR 4 between Baseline (2018), Year 2 (2019), Year 3 (2020), Year 4 (2021), Year 5 (2021), Year 6 (2022) and Year 7 (2023) surveys; and indicated low vegetative quality with species found in a wide variety of communities including disturbed sites. Average Wetness Value (AWV) in TR 1 was fairly constant from 2018 to 2020 but then increased in 2021 and then again in 2022 since several upland species suddenly appeared within the monitoring transect. However, the AWV declined in 2023 with a return of more wetland plant species. The AWV remained fairly constant within TR 2 between 2018 and 2023 surveys, while at TR 4 the AWV showed a gradual increase from 2018 to 2022, then remaining at that level in 2023. Nevertheless, groundwater at all three locations was at its lowest level in growing season of 2022 which then rose by about 0.5 m in 2023. Vegetation at TR 1 seemed to respond fairly quickly to improved groundwater conditions in one year, while TR 4 did not. TR 1 in the Isolated Wetland is flooded in spring while TR 4 would rarely be flooded and only for brief periods. This could account for the difference that vegetation responds more slowly at TR 4. Meanwhile change in groundwater levels is not well reflected in TR 2.

The increase of non-native species including hairy willowherb (TR2), common buckthorn (TR 1 and TR 4), common reed (TR 4) and bittersweet nightshade (TR 1 and TR 4) observed during the monitoring years indicated that non-native and invasive species are spreading within the site. In particular, common reed has the potential to spread aggressively in wetland habitats to create monoculture stands; is slowly expanding in TR 4. Additionally, that common buckthorn was observed in TR 1 and TR 4 during Year 5 (2021), Year 6 (2022), and Year 7 (2023). As a result, it is probable that this species would have extended its reach across different vegetation communities, regardless of the nearby development. The spread of non-native and invasive species within the wetland (i.e., common reed) can have an impact on a wetlands water regime by forming dense stands of vegetation, leading to an uptake in water absorption and an increase in water loss through transpiration in a wetland (MNRF, 2022).

Slight variations in the metrics of any vegetation community are to be expected over time as a result of natural ecological processes. The slight changes in metrics observed in this case may also be partly attributed to the climatic variation year over year in temperature and precipitation which might also affected the timing of emergence or senescence of some species.

4.2.3 Aquatic Features and Fish Habitat Assessment

Aquatic features within the site boundary consist of a dug pond (Pond A) and an unnamed intermittent tributary of the Speed River (Tributary A) (see **Figure 2**). Tributary A was dredged and straightened by the landowner in the 1980s (GLL, 2006). Two swales that carry surface water for short periods across agricultural fields occur upstream from Pond A. Tributary A flows intermittently but usually holds water through spring and into early summer.

4.2.3.1 Tributary A

Tributary A is located within the northern portion of the site boundary, and was assessed between the Laird Road crossing up to the narrow channel connecting the tributary to Pond A. During the 2023 assessment, Tributary A was mainly dry except for scattered pools of standing water, consisting of flooded sections of dense Reed Canary Grass (*Phalaris arundinacea*) with no defined channel due to the dense vegetation. The majority of standing water was observed in the upstream reaches, closer to Pond A than Laird Road. The mean wetted depth of the standing water was 0.12 m, with a maximum recorded depth of 0.2 m. Mean wetted width was not recorded as most of the feature was dry, and no defined channel was present through the dense emergent vegetation. Substrate was composed primarily of silt, muck and detritus. The downstream reaches through the woodland consisted of a semi-defined swale with damp soil and minor standing water. Along Laird Road, Tributary A consisted of a dry roadside ditch with dense herbaceous vegetation. Instream cover was provided predominately by Reed Canary Grass, herbaceous vegetation, and minor woody debris. Herbaceous vegetation, grasses, deciduous trees and shrubs provided riparian cover. Representative photos of site conditions can be found in **Appendix H,** Photos 1-12.

No fish community sampling was undertaken within Tributary A in 2023. Within the Study Area the tributary provides seasonal fish habitat suitable for refuge, feeding and rearing; however, conditions are non-limiting throughout, with no specialized (critically limiting spawning habitat) identified.

Tributary A has been identified as an intermittent water feature and it is expected that the tributary could be dry during the warmer months. **Table 6** shows the water depth readings taken between 2018 and 2023 in mid-summer, with substantial water depth only recorded in 2019. However, these are only single sampling events taken at 3-month intervals; therefore, their results do not indicate the length of the hydroperiod each summer.

4.2.3.2 Pond A

At the time of the 2023 assessment, the mean wetted within Pond A was approximately 30 m by 20 m and the depth was estimated to be over 1.0 m. Substrate was composed of silt, muck and detritus, and instream cover was abundant, primarily provided by submergent and emergent aquatic vegetation with limited woody debris.

Submergent vegetation consisted primarily of Stonewort (*Chara sp*.), while emergent vegetation consisted of Softstem Bulrush (*Schoenoplectus tabernaemontani*) and cattail. Northern Redbelly Dace (*Chrosomus eos*) were observed within Pond A at the time of investigation. The riparian vegetation consisted of dense herbaceous vegetation and several small trees and shrubs, including Reed Canary Grass, Eastern White Cedar (*Thuja occidentalis*), Willow (*Salix sp*.), Red-Osier Dogwood (*Cornus sericea*), Staghorn Sumac (*Rhus typhina*) and Cattail (*Typha sp*.). Conditions and water levels in Pond A appeared to be similar between 2020 and 2023. Representative photos of site conditions can be found in **Appendix H,** Photos 11 and 12.

5. Triggering Mechanisms and Contingency Plan

5.1 Triggering Mechanisms

As per the Site Plans, the Triggering Mechanisms and Contingency Plan will not be established until after the Area 2 below-water extraction is complete. Site preparation (berms, stripping) commenced in late spring/early summer 2018. Above and below-water extraction activities commenced in November 2018 and July 2019, respectively. Below water extraction in Area 2 commenced in late fall 2019 was completed in early April 2022. A low water level elevation memo was generated by AECOM and submitted to the MNRF hydrogeologist at that time (David Webster) who reviewed the rationale leading to the development of the proposed trigger elevations and found it reasonable. The trigger levels presented in this memorandum reflect the agreed upon approach, updated to consider baseline water level elevations collected up to the end of 2017, prior to any on-site extraction (see **Appendix I**).

In July 2022, the Proposed Low Water Level Triggers Memorandum was submitted to the MNRF, Township of Puslinch, County of Wellington and City of Guelph for review and comment. To-date, we have received comments from the Township only. These comments were related to consideration of ecological functions and the methodology used to establish the triggers. Our October 2022 response to the Township comments are included in **Appendix I**. In GRCA's review of the 2022 monitoring report, they question why the triggers have not been applied to the site. As there has been no further communications from the Township following our response, we have not applied the proposed triggers to the site until the proposed methodology of the establishment of the triggers has been accepted.

As presented in the hydrogeological assessment, drawdown calculations were completed under the worse case scenario of a hot, dry (no precipitation), mid-summer week with a high rate of below-water extraction (2,100 tonnes per day) for the initial excavation when a small pond is present, for near the end of the operation when a large pond is present and at the end of operations when a large pond remains but extraction operations have ceased. As the initial below-water excavation commenced in the southeast corner of the site and the trigger monitors are in the northern portion of the site, no water level impacts are expected early in the below-water extraction operations in the vicinity of Tributary A. Later in the operations when a large pond is present and there is a high rate of extraction, the drawdown at Tributary A is predicted to be in the order of 0.06 m. Once operations cease, only a minor drawdown at Tributary A (less than 0.01 m) is predicted, mainly as a result of evaporation off the pond surface. The aggregate removal effect is a temporary impact that only occurs while the pit is being extracted. Over time, additional precipitation in the pit, and groundwater recharge in the surrounding areas, will offset this effect. Furthermore, as the ponds in the pit grow larger, a "reservoir" of water is created and the effects of removing solid particles from below the water table are diminished. In light of this, the drawdown effect is considered negligible and the focus of establishing triggers is based on the baseline water levels and the effects of precipitation.

5.2 Contingency Plan

The Site Plan triggering mechanisms and contingency plans were originally based on the monthly/quarterly manual water level monitoring program, as described above under Condition 4. In May 2018, all existing groundwater monitors and mini-piezometers on-site were instrumented with level loggers collecting daily water level readings, which is a much higher frequency than the monthly/quarterly frequency originally cited in the Site Plans. As this is the case, it is proposed that as long as daily logger readings are collected at BH3, BH8, BH9 and BH10-II, the triggering mechanisms are based on groundwater levels that are recorded below the trigger elevation for seven consecutive days with an observed downward trend and attributed to be a result of below-water extraction activities before the contingency plan is implemented.

6. Conclusions

6.1 Hydrogeology

Based on the groundwater monitoring conducted at the site in 2023, the following conclusions are presented:

- Water level measurements collected across the site at the groundwater monitors and mini-piezometers reflect baseline pre-extraction conditions to November 2018. Below-water extraction commenced in July 2019. At most locations, groundwater levels are showing an overall decreasing trend over time. This decreasing trend does not appear to be related to pit activities as there are no water takings occurring on-site and all monitors upgradient and downgradient of the below-water extraction activities show similar trends. Water levels appear to be largely influenced by local precipitation conditions, as confirmed by the water budget assessment, and show natural seasonal fluctuations.
- Groundwater flow is to the north-northwest. Locally, groundwater flows from the pit area towards Tributary A, as indicated by the groundwater levels collected in the vicinity.
- There were no apparent impacts to groundwater levels and flows as a result of pit operations.

6.2 Natural Environment

The monitoring of amphibians and wetland vegetation was conducted for the sixth consecutive year in 2023. The 2018 results provided the baseline condition which have been compared with subsequent monitoring events. Below-water table excavations began in the summer of 2019 and have proceeded further since then.

During amphibian surveys in 2023, four species were calling from the Isolated Wetland on calling count surveys. Amphibians did not appear to have a successful breeding season there which was also observed in 2018, 2020, 2021 and 2022. Spring Peepers and a Gray Treefrog called from Tributary A; however, that feature also dried up and it is not known if amphibians were able to successfully reproduce there either. Those sites have likely fluctuated between successful and unsuccessful years depending on how wet the season was. In recent years there seems to have been an increase in dry years. However, more calling amphibians were recorded at Pond A (which holds permanent water) over the last three years than previously. The pond appears to be important in allowing the amphibians to persist on site.

With respect to wetland vegetation sampling, the Isolated Wetland (TR 1) showed an increase in plant diversity in 2023 due to appearance of more obligate wetland species such as purple-leaved willow-herb *(Epilobium coloratum),* cut-leaved bugleweed *(Lycopus americanus),* and swamp aster *(Symphotrichum puniceum).* As a result the Average Wetness Value (AWV) showed a noticeable improvement in 2023 over 2022. The groundwater level was at an all time low in 2022, but then rose to approximately 0.5 m higher in 2023 which favoured some wetland plants. By contrast AWV at TR 2 has been consistent throughout the six year sampling period, while TR 4 has showed a gradual reduction of wetland species over the same time period, with no visible improvement in 2023. Vegetation in TR 4 may be slower to respond to a rise in the groundwater table since it is subject to less regular flooding and is overall less wet than the other two sampling locations. The groundwater table responds to seasonable precipitation patterns which in turn is reflected in wetland vegetation. Lower precipitation in successive years of 2021 and 2022 and some increase in 2023 appears to be the reason for observed vegetation changes. As a result the improvement in groundwater table in 2023 and wetland vegetation in the Isolated Wetland in a wetter year indicates that the changes do not appear to be caused by pit extraction activities.

7. Recommendations

Based on the results of this year's monitoring program, the following recommendations are provided:

a) Groundwater level monitoring of the on-site monitors and MPs should continue as prescribed in the approved Site Plans.

b) The amphibian surveys should continue annually since below-water extraction has begun. Calling counts should be conducted three times during suitable weather conditions in April, May and June. Acoustic monitors should be employed at two locations (Isolated Wetland, and between Tributary A and Pond A) every other year (next in 2024) to provide a more complete record of calling amphibians.

c) An aquatic habitat assessment is required for Tributary A and Pond A as part of annual monitoring in 2024.

d) The vegetation transect surveys should be carried out annually in mid summer following the same procedures at TR 1, TR 2, and TR 4

e) Comparisons should be made from future monitoring results to determine if changes are occurring and if those changes are likely a result of aggregate extraction activities, particularly as it might affect the level of the groundwater table.

f) As per Site Plan Condition 4 of the Natural Environment Technical Recommendations, this annual report should be submitted to the Ministry of the Environment, Conservation and Parks (MECP), Ministry of Natural Resources and Forestry (MNRF), Puslinch Township, Wellington County, the City of Guelph and the Grand River Conservation Authority (GRCA).

8. References

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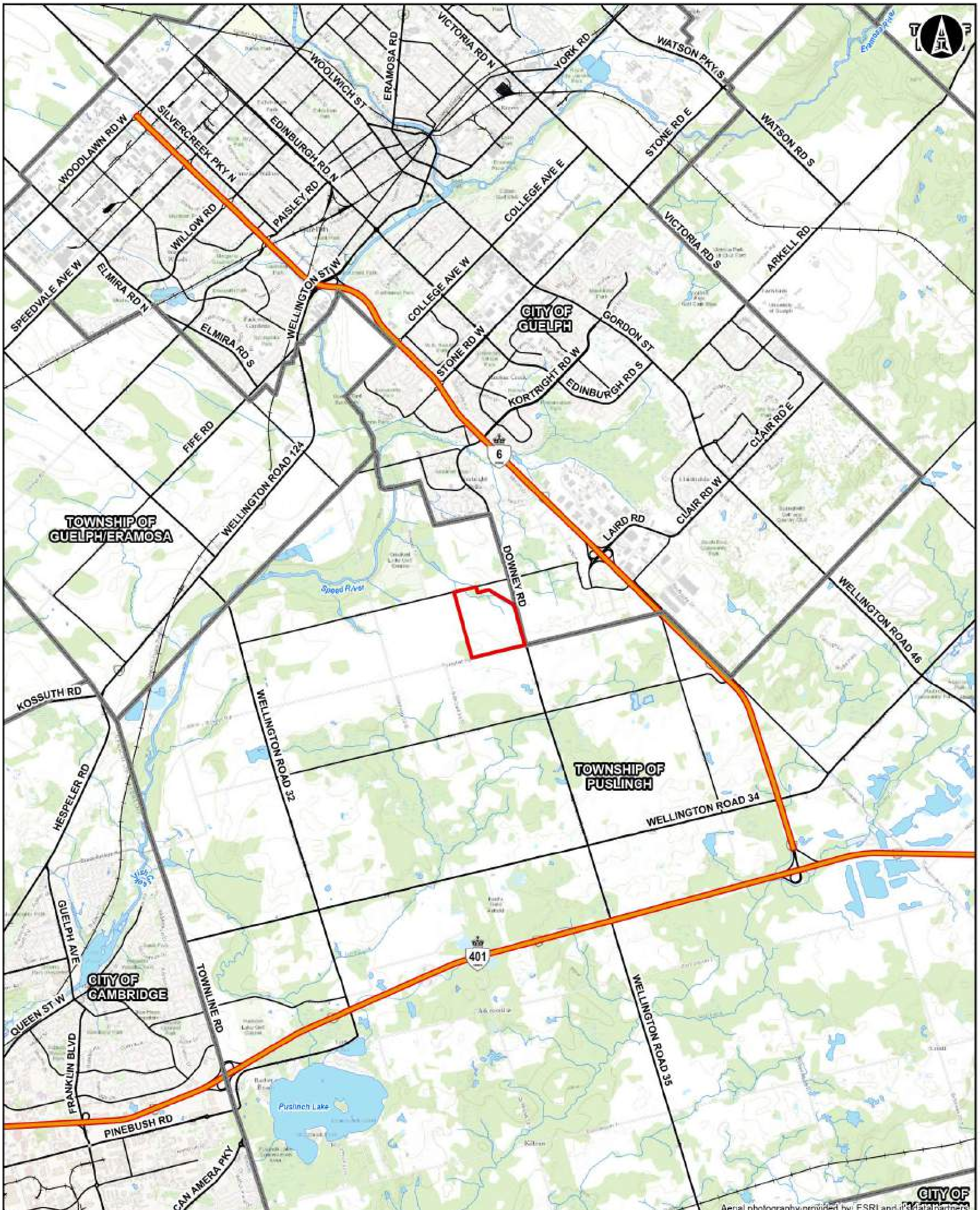
Figures



Legend

- Site Boundary
- Municipal Boundary
- Freeway
- Highway
- Major Road
- Collector Road
- Railway
- Waterbody
- Watercourse

St. Marys Mast-Snyder Property

Site Location

0 0.5 1 2 3
KM
NAD 1983 UTM Zone 17N

Sept. 2024	1:54,000	**Data Sources:** Ontario Ministry of Natural Resources and Forestry, Government Open License Data Portal
P#: 60700729	Rev:00	

AECOM

Figure 1

Legend

- Amphibian Calling Survey Locations
- Acoustic Monitor Locations
- Vegetation Transect
- Abandoned Vegetation Transect
- Watercourse
- 120m Buffer
- Property Boundary
- Approximate Limit of Extraction
- Site Boundary
- Provincially Significant Wetland
- Wetland, not evaluated per Ontario Wetland Evaluation System (OWES)

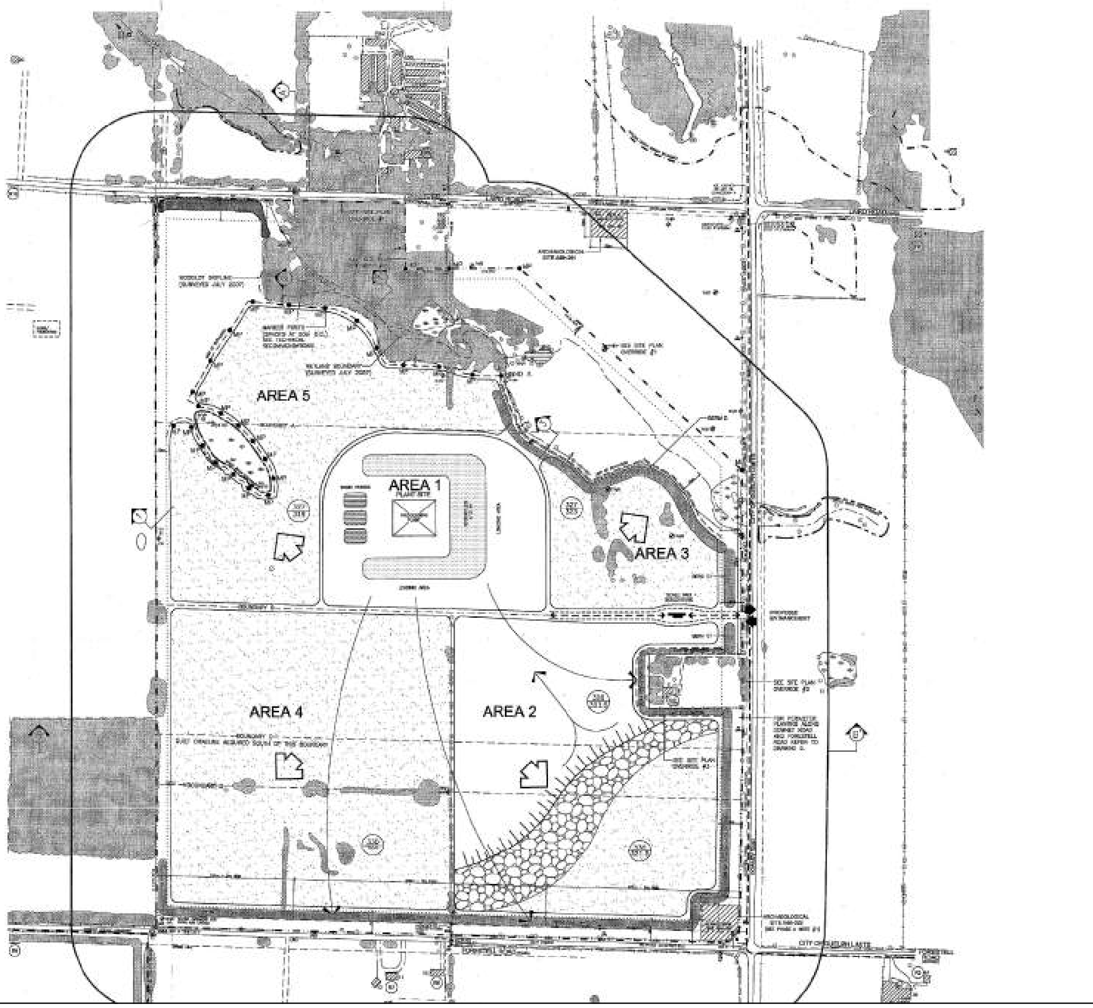
Note: On-site aerial coverage from December 8, 2023 Drone Survey
Surrounding Imagery from Esri World Imagery

0 35 70 140 210 280 350 420 490
Metres

CBM Aggregates Mast-Snyder Property

Wetlands and Vegetation Transects

Sep, 2024	1:7,000	Datum: NAD 1983 UTM Zone 17N
P#: 60700729		**Figure 2**
AECOM		



LEGEND

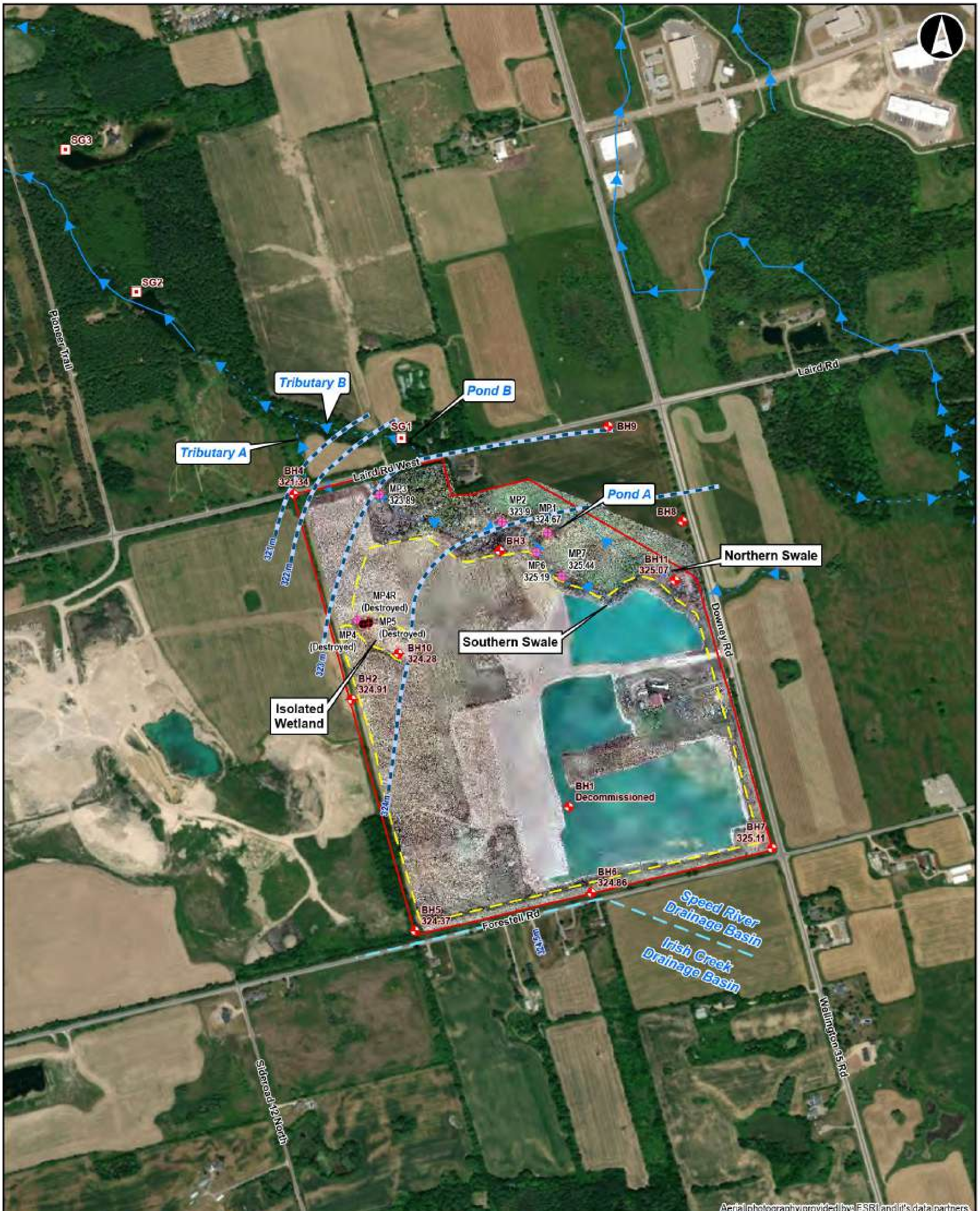
N

Source: Harrington and Hoyle Ltd., 2007: St. Marys/CBM Mast Snyder Pit Site Plans, 1:2,000 scale, December 2007

St. Mary Mast-Snyder Property

Operations Plan

Sept. 2024	N.T.S	Datum: NAD 83 UTM Zone 17
P#: 60700729	V#:	
AECOM		Figure 3



Legend

- Mini-Piezometer
- Destoryed Mini-Piezometer
- Staff Gauge
- Monitor Location
- Groundwater Contours (0.5m)
- Groundwater Divide
- Intermittent Watercourse
- Permanent Watercourse
- Site Boundary
- Approximate Limit of Extraction
- Roads
- Intermittent Watercourse
- Permanent Watercourse
- Intermittent Watercourse
- Permanent Watercourse

Note: On-site aerial coverage from December 8, 2023 Drone Survey

St. Marys Mast-Snyder Property

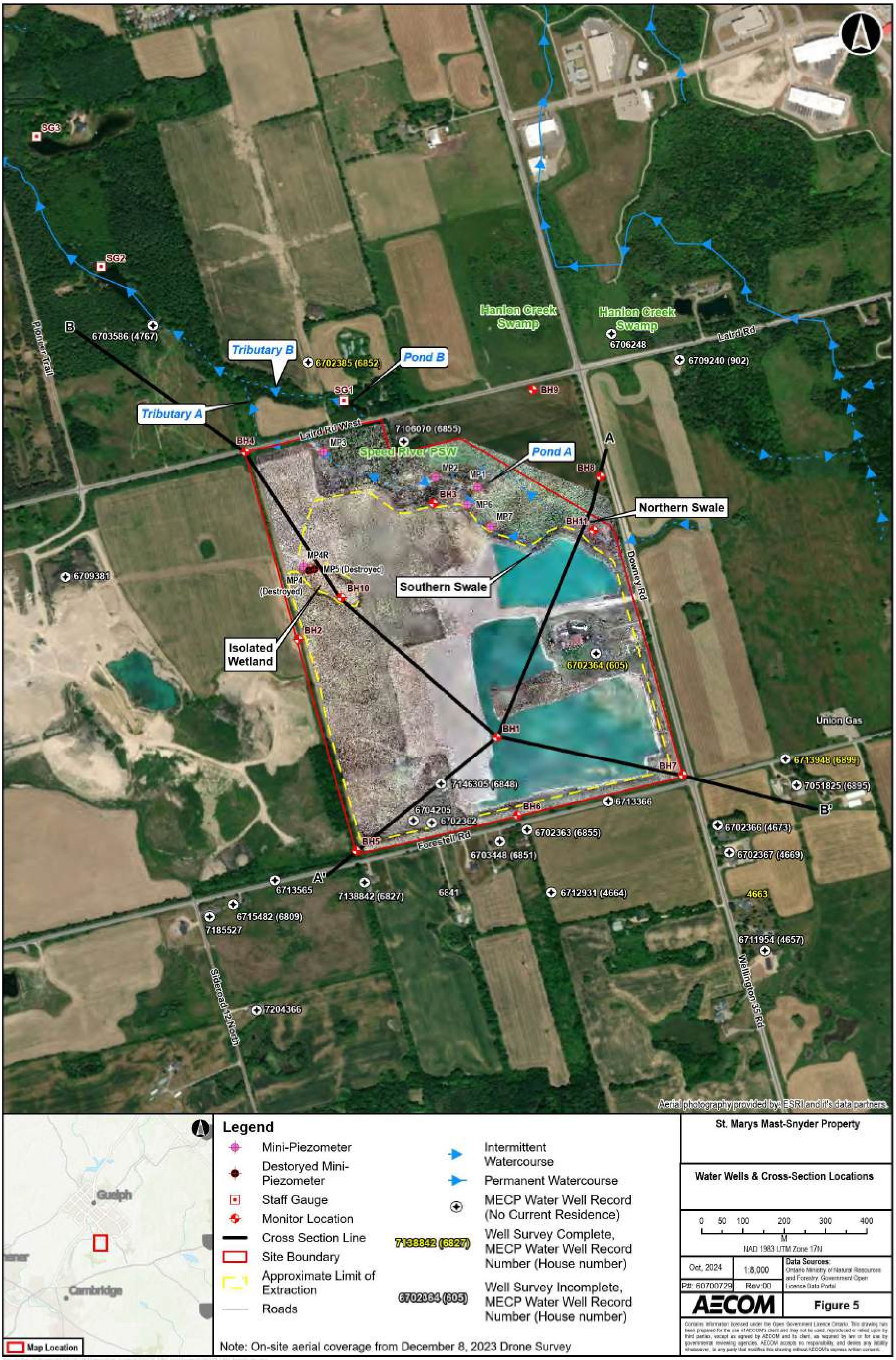
Groundwater Elevations
(November 2023)

0 50 100 200 300 400
Meters
NAD 1983 UTM Zone 17N

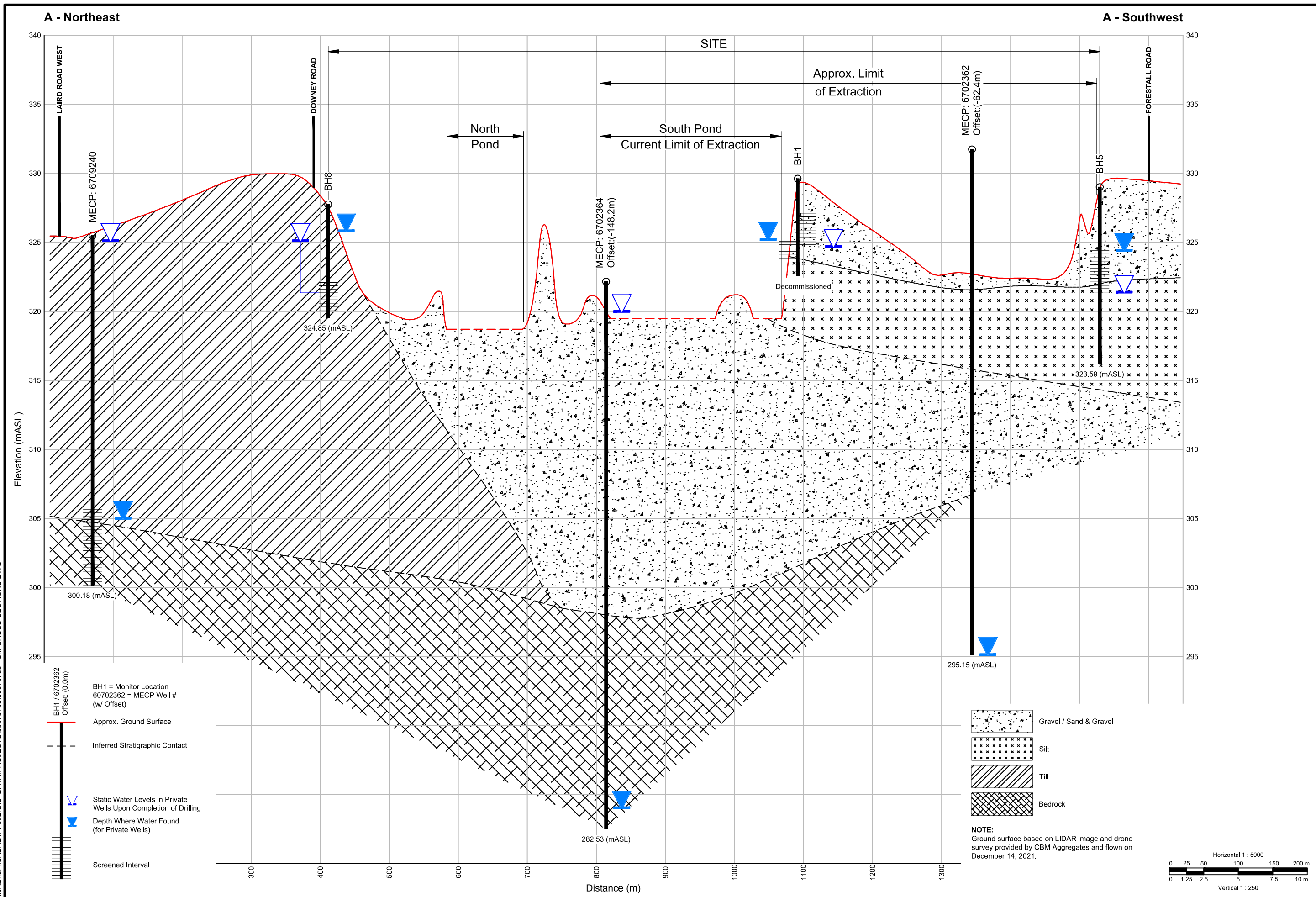
Oct 2024	1:8,000	**Data Sources:** Ontario Ministry of Natural Resources and Forestry, Government Open License Data Portal
P#: 60700729	Rev:00	

AECOM

Figure 4



SG3
SG2
SG1
B
B'
A
A'
Pioneer Trail
6703586 (4767)
Tributary B
Tributary A
6702385 (6852)
Pond B
Pond A
Hanlon Creek Swamp
Hanlon Creek Swamp
Laird Rd
6706248
6709240 (902)
BH9
Laird Rd West
7106070 (6855)
Speed River PSW
BH4
MP3
MP2
MP1
BH3
MP6
MP7
BH8
BH11
Northern Swale
Southern Swale
MP4R
MP5 (Destroyed)
MP4 (Destroyed)
BH10
BH2
Isolated Wetland
6709381
Downey Rd
6702364 (605)
BH1
Union Gas
BH7
6713948 (6899)
7051825 (6895)
7146305 (6848)
6713366
6704205
6702362
BH6
6702363 (6855)
BH5
Forestell Rd
6703448 (6851)
6702366 (4673)
6702367 (4669)
6713565
7138842 (6827)
6841
6712931 (4664)
4663
6715482 (6809)
7185527
6711954 (4657)
Sideroad 12 North
Wellington 35 Rd
7204366
Aerial photography provided by: ESRI and it's data partners.
Guelph
Cambridge
Map Location
Legend
Mini-Piezometer
Destoryed Mini-Piezometer
Staff Gauge
Monitor Location
Cross Section Line
Site Boundary
Approximate Limit of Extraction
Roads
Intermittent Watercourse
Permanent Watercourse
MECP Water Well Record (No Current Residence)
7138842 (6827) Well Survey Complete, MECP Water Well Record Number (House number)
6702364 (605) Well Survey Incomplete, MECP Water Well Record Number (House number)
Note: On-site aerial coverage from December 8, 2023 Drone Survey
St. Marys Mast-Snyder Property
Water Wells & Cross-Section Locations
0 50 100 200 300 400
M
NAD 1983 UTM Zone 17N
Oct, 2024
1:8,000
Data Sources:
Ontario Ministry of Natural Resources and Forestry, Government Open Licence Data Portal
P#: 60700729
Rev:00
AECOM
Figure 5



AECOM

Figure: 6

GEOLOGICAL
CROSS-SECTION A-A'
(Northeast to Southwest)

ST. MARYS MAST-SNYDER PROPERTY

Guelph, Ontario

Project No.: 60700729 Date: September 2024

Project Management Initials: Designer: IL Checked: PW Approved: PW ANSI B 279.4mm x 431.8mm

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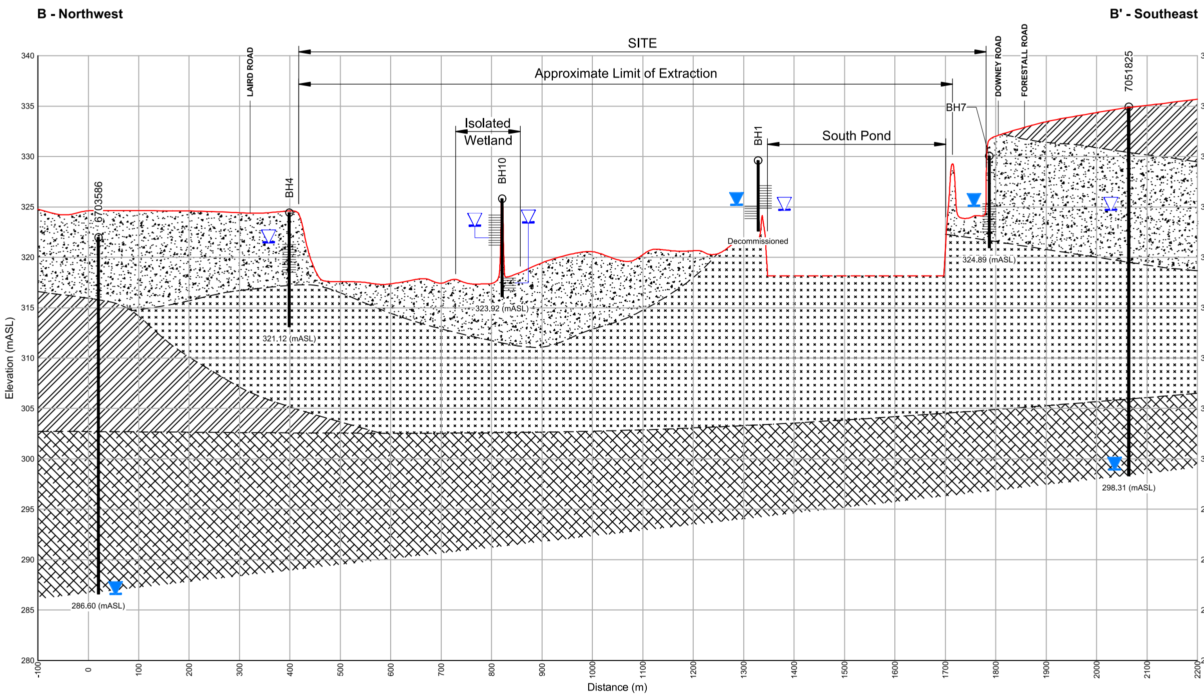

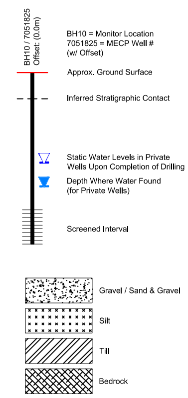

NOTE:
Ground surface based on LIDAR image and drone survey provided by CBM Aggregates and flown on December 14, 2021.

Horizontal / 20:1 Vertical
0 50 100 200 300 m
1 : 7500

Figure: 7

GEOLOGICAL
CROSS-SECTION B-B'
(Northwest to Southeast)

ST MARYS MAST-SNYDER PROPERTY

Guelph, Ontario
Project No.: 60700729 Date: September 2024

ANSI B 279.4mm x 431.8mm Approved: PW Checked: PW Designer: IL Project Management Initials:

Last saved by: MARINCS(2024-01-10) Last Plotted: 2024-01-10
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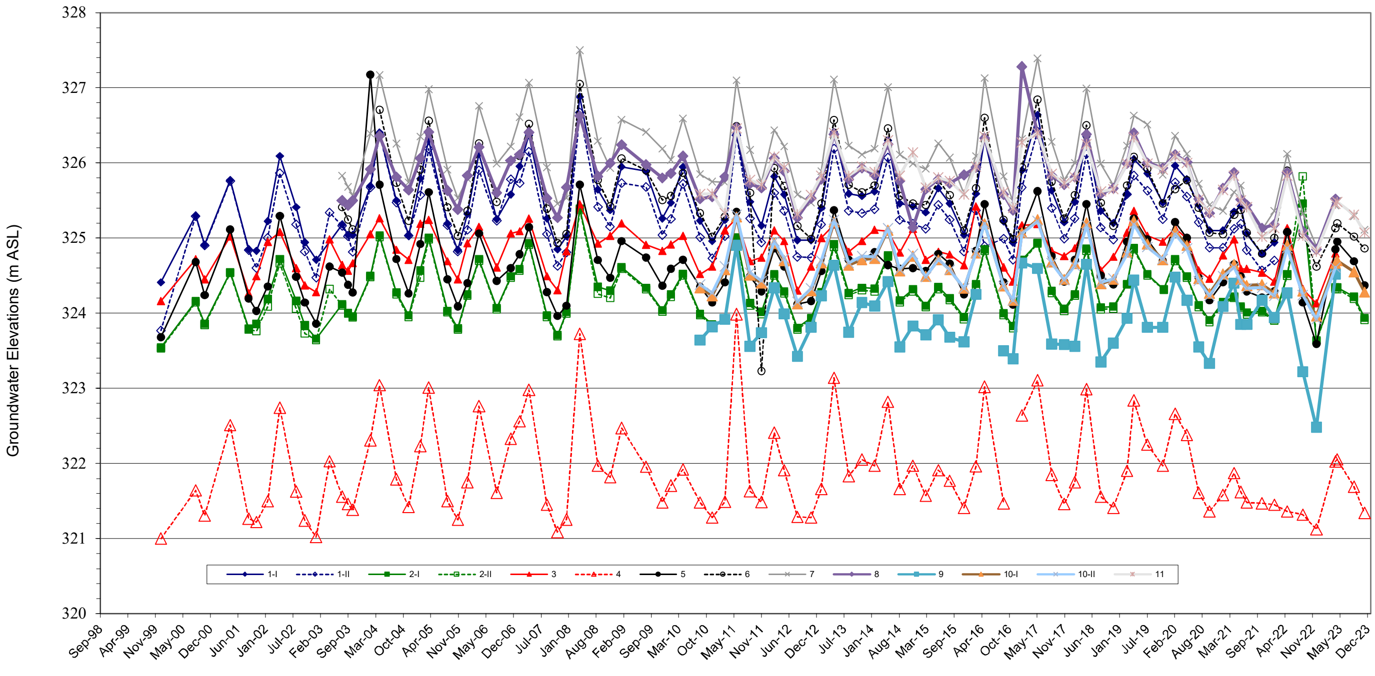


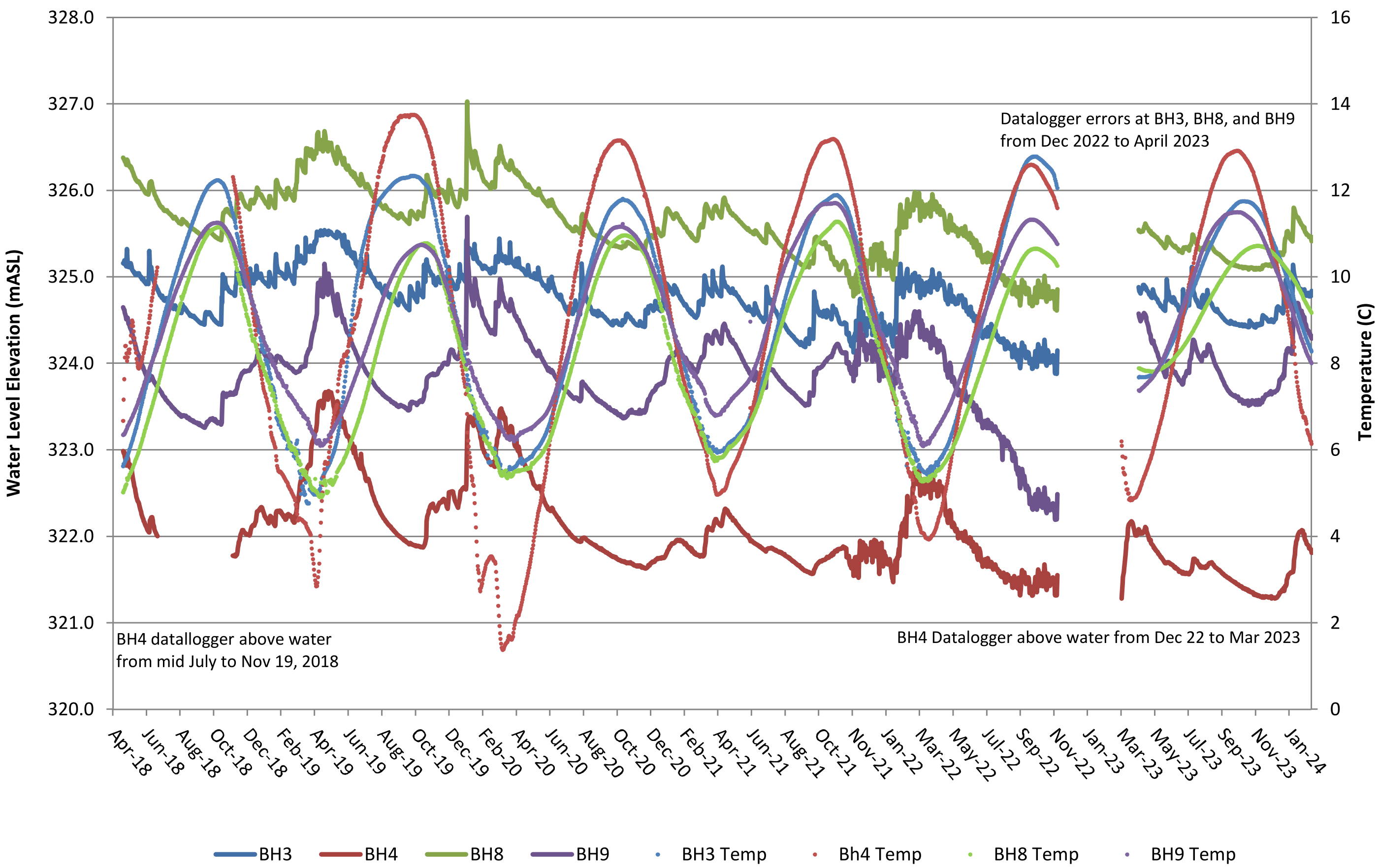
AECOM

1999 - 2023 Groundwater Elevations - Boreholes

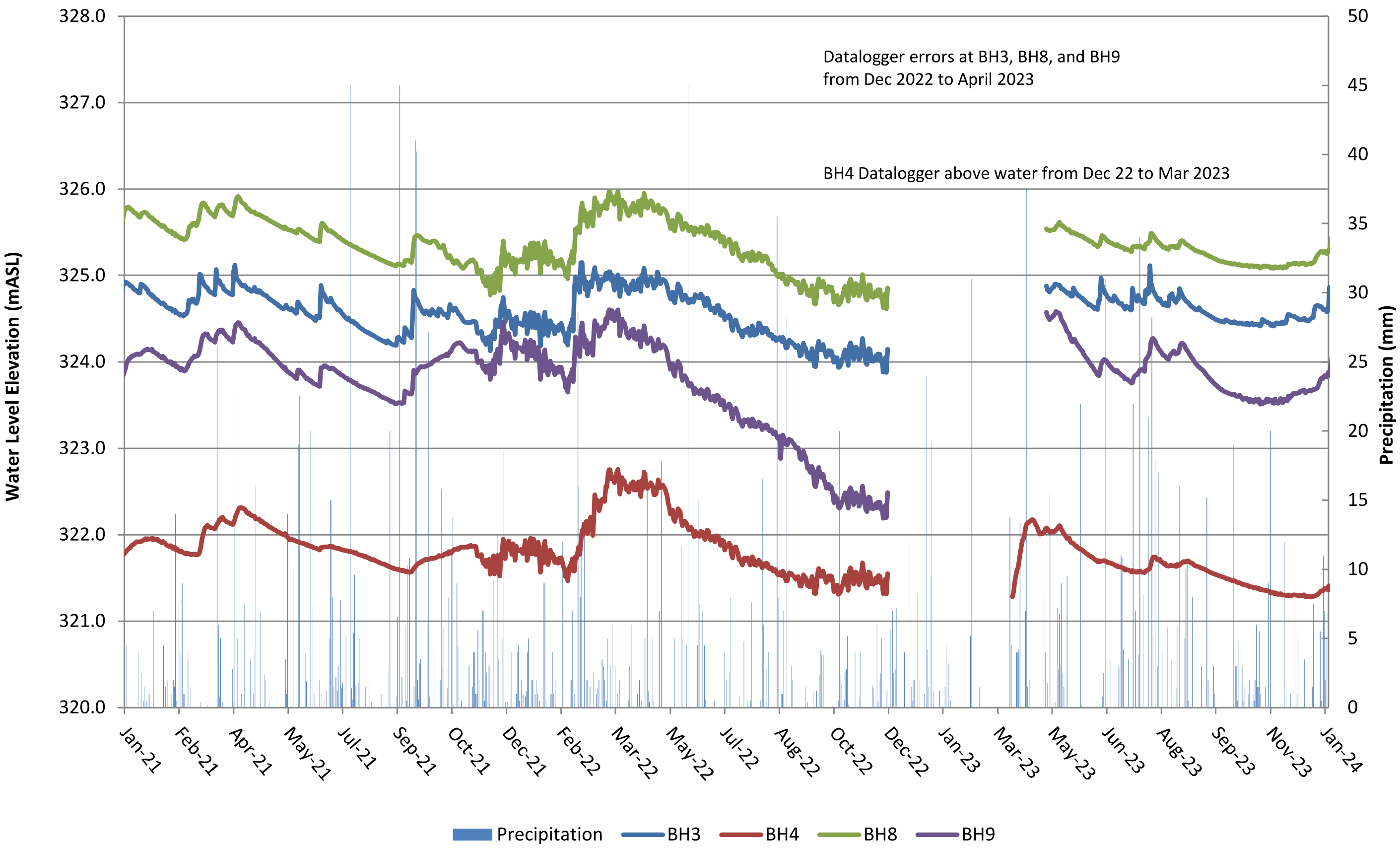
St Marys Mast-Snyder Property

FIGURE 8

Project 60700729



AECOM	**Northern Monitors (BH3, BH4, BH8, BH9)**	**Figure 9A**
	St Marys Mast Snyder Property	**Project 60700729**



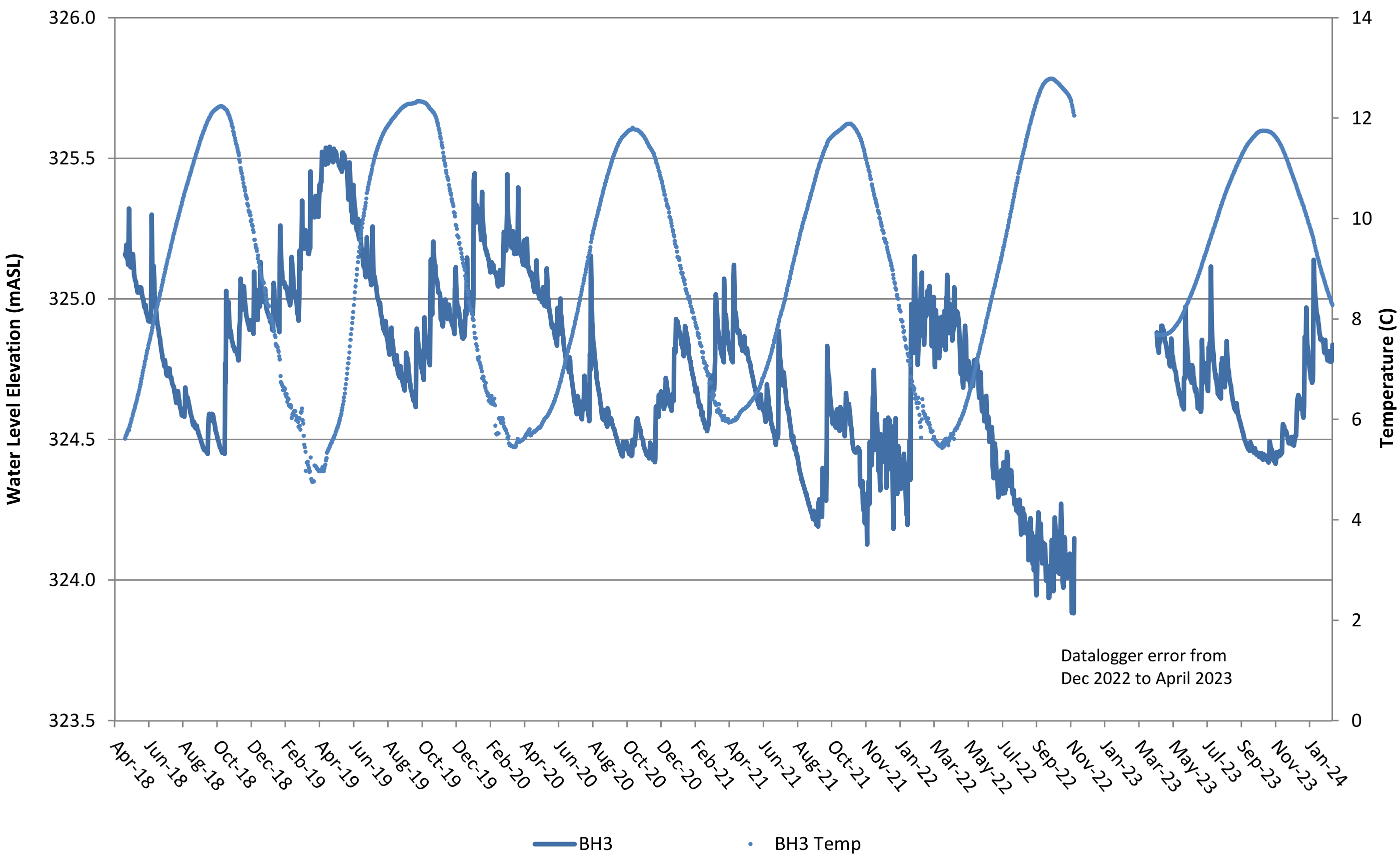
AECOM

Northern Monitors (BH3, BH4, BH8, BH9)

St Marys Mast Snyder Property

Figure 9B

Project 60700729



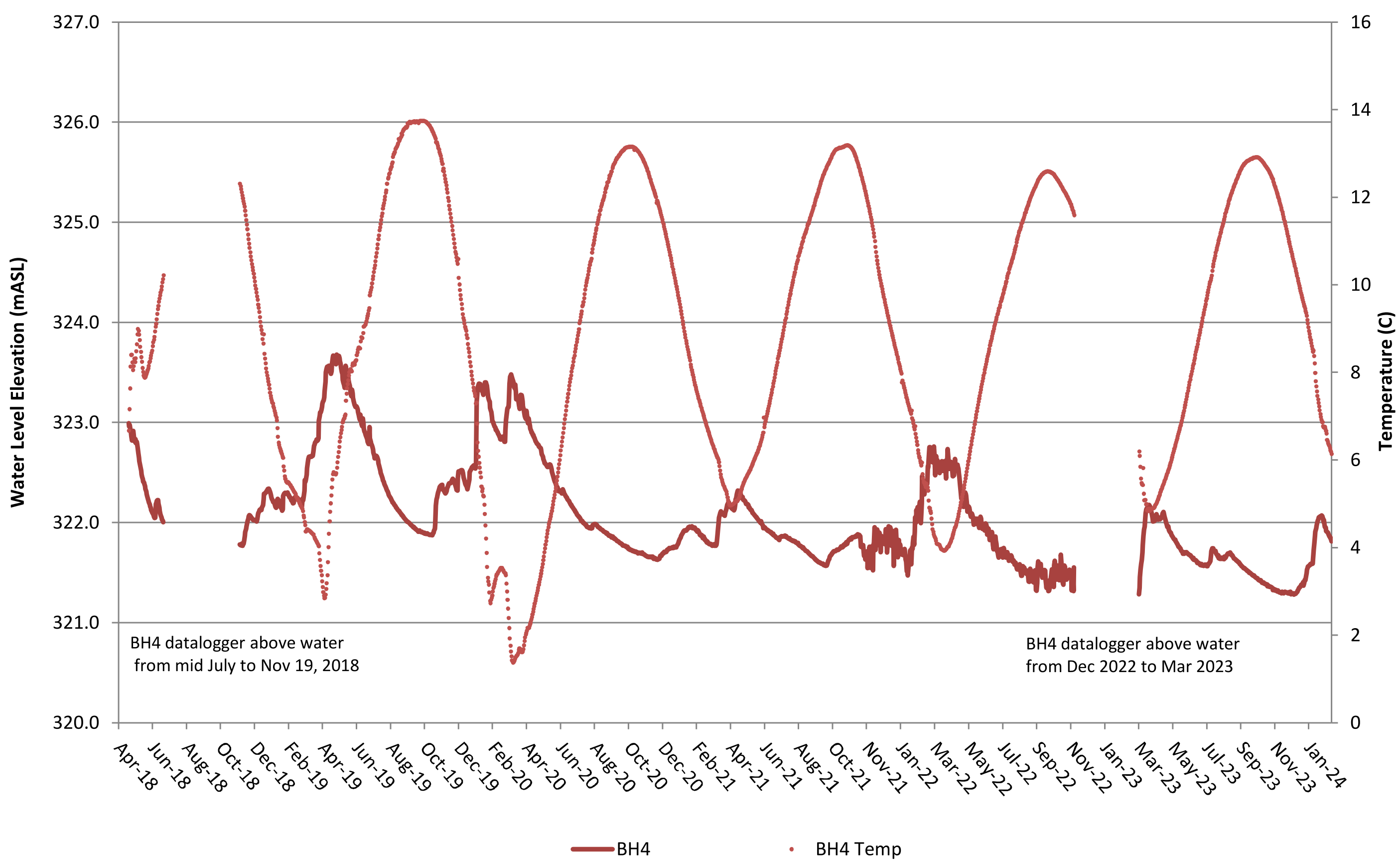
AECOM

Northern Monitor BH3 Hydrograph & Water Temprature

St Marys Mast Snyder Property

Figure 10

Project 60700729



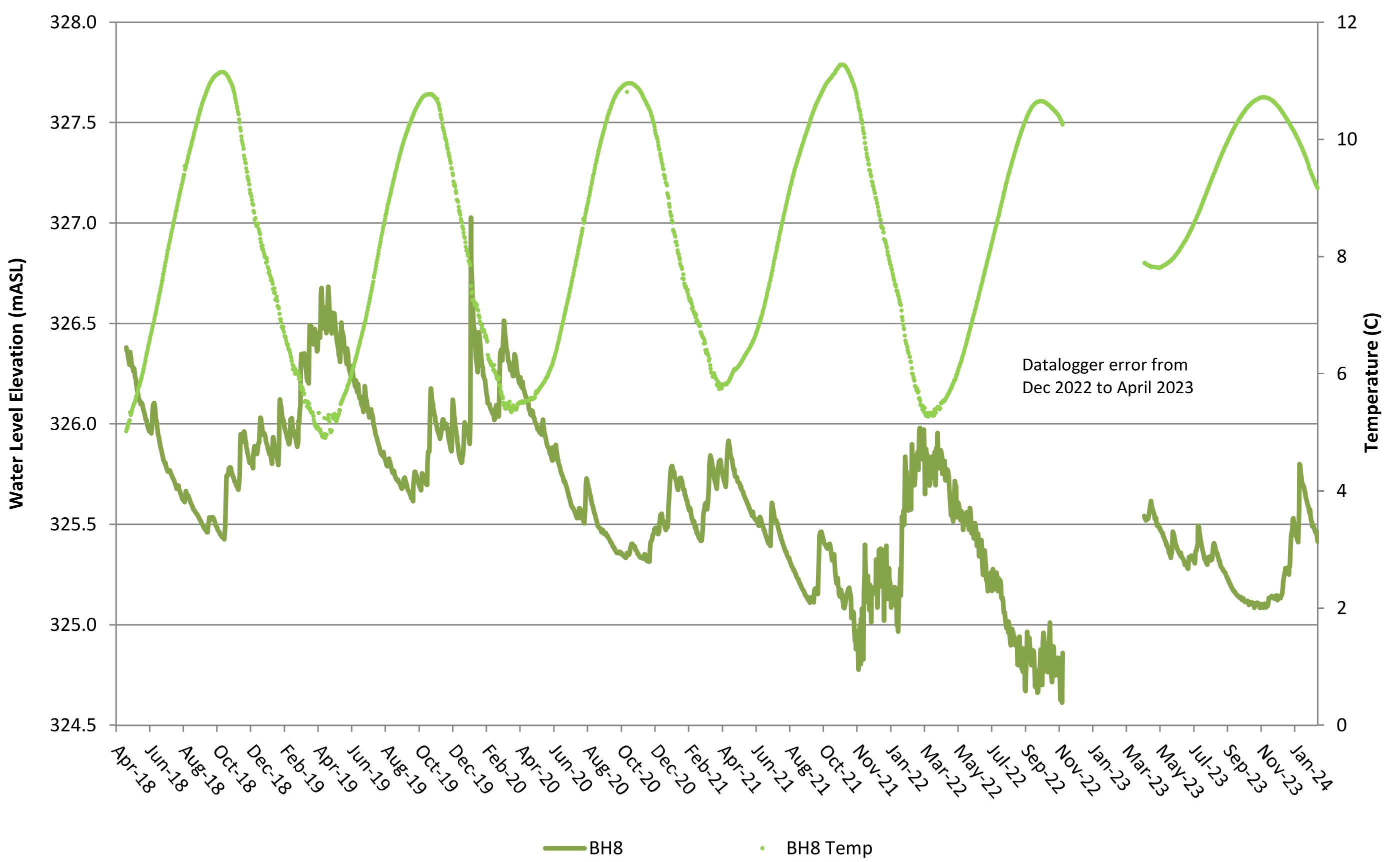
AECOM

Northern Monitor BH4 Hydrograph & Water Temprature

St Marys Mast Snyder Property

Figure 11

Project 60700729



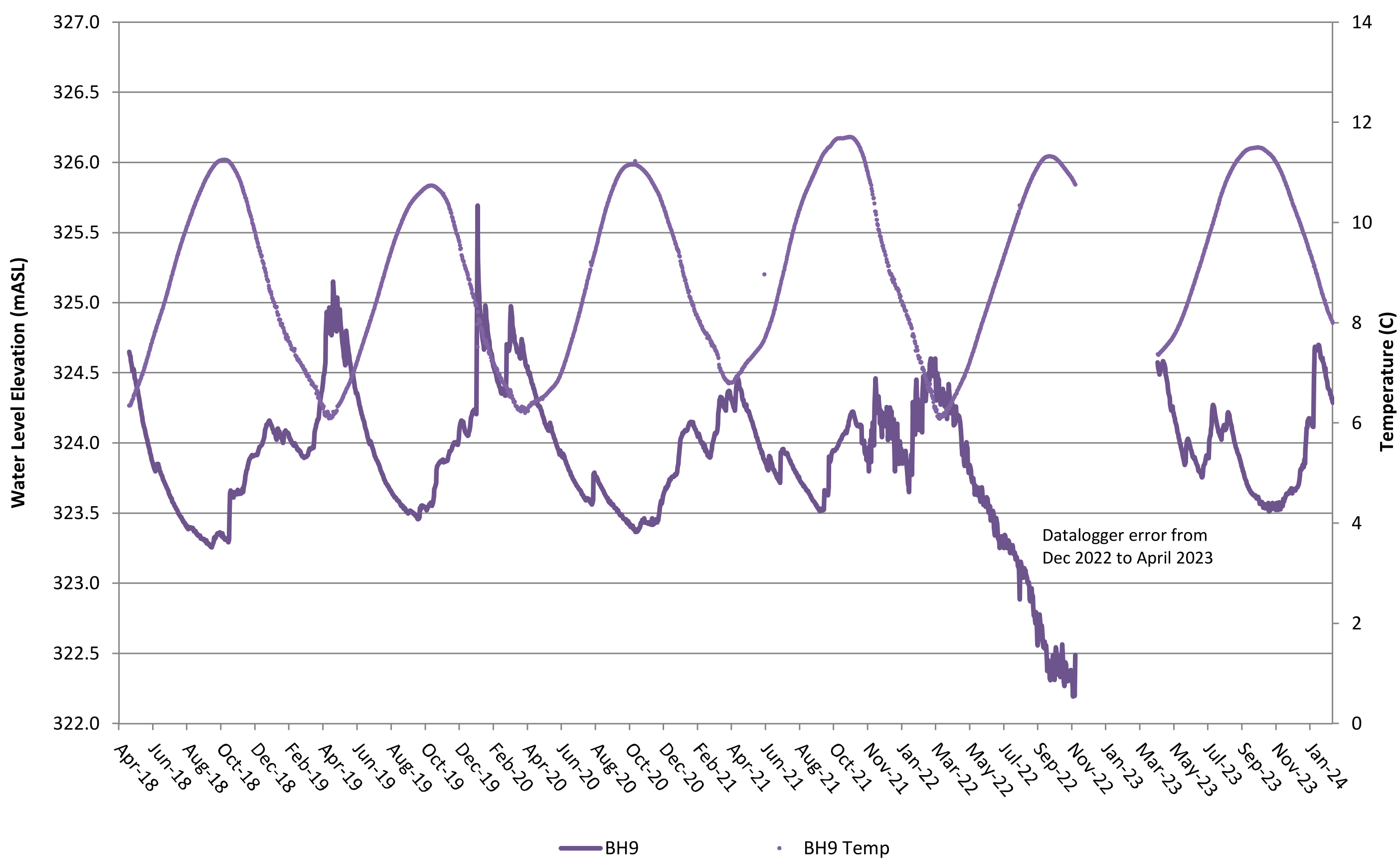
AECOM

Northern Monitor BH8 Hydrograph & Water Temprature

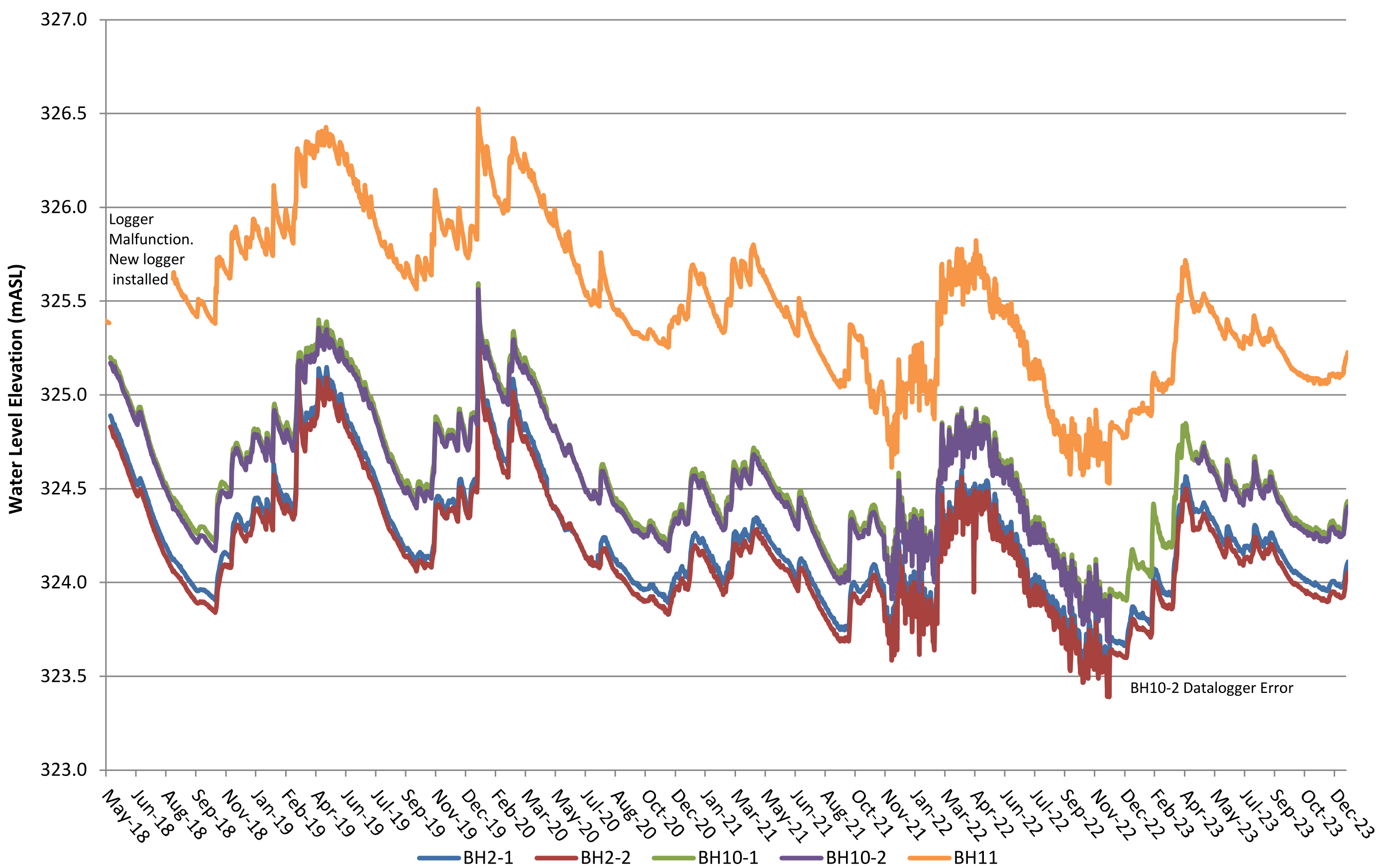
St Marys Mast Snyder Property

Figure 12

Project 60700729



AECOM	**Northern Monitor BH9 Hydrograph & Water Temprature** St Marys Mast Snyder Property	**Figure 13** **Project 60700729**



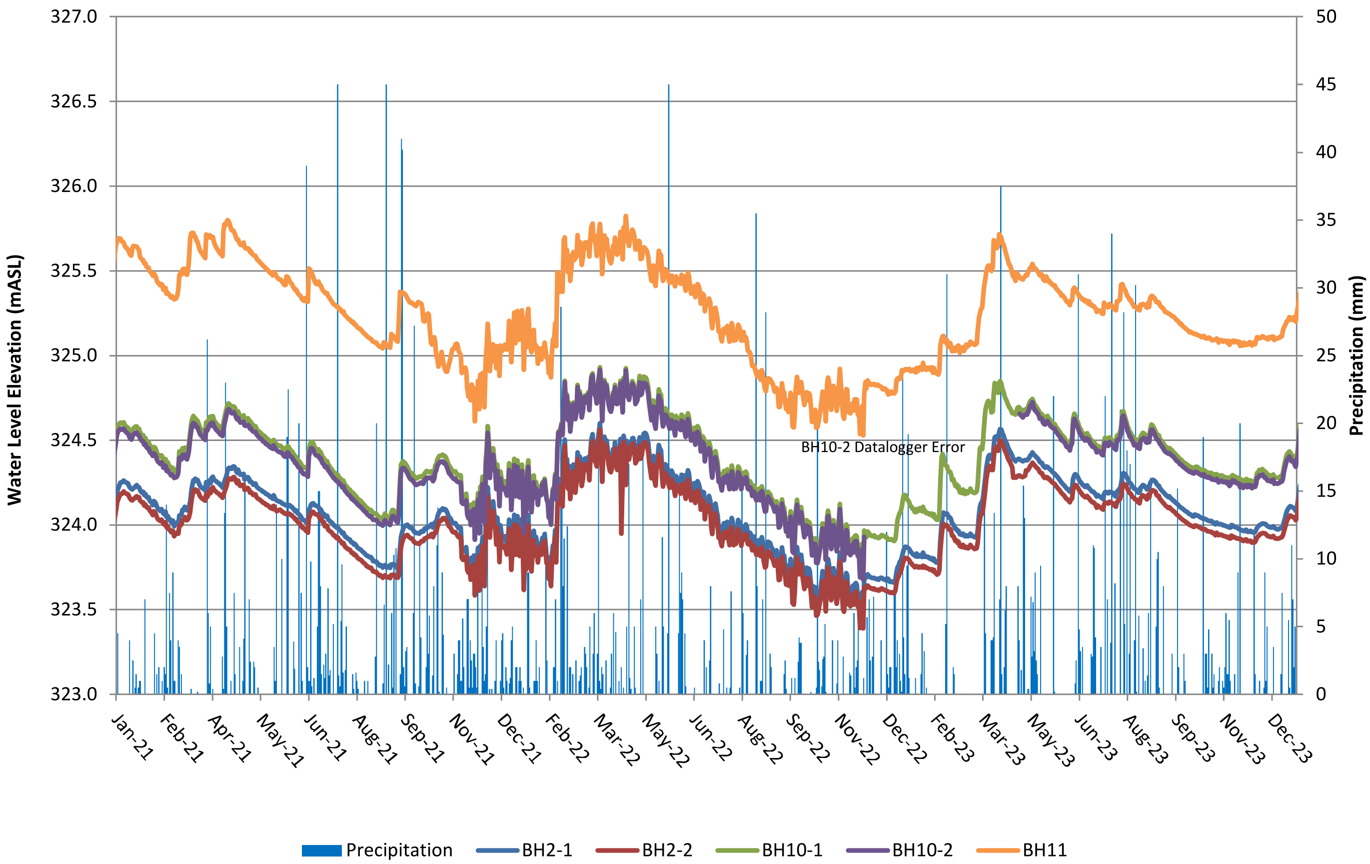
AECOM

Central Monitors (BH2, BH10, BH11)

St Marys Mast Snyder Property

Figure 14A

Project 60700729



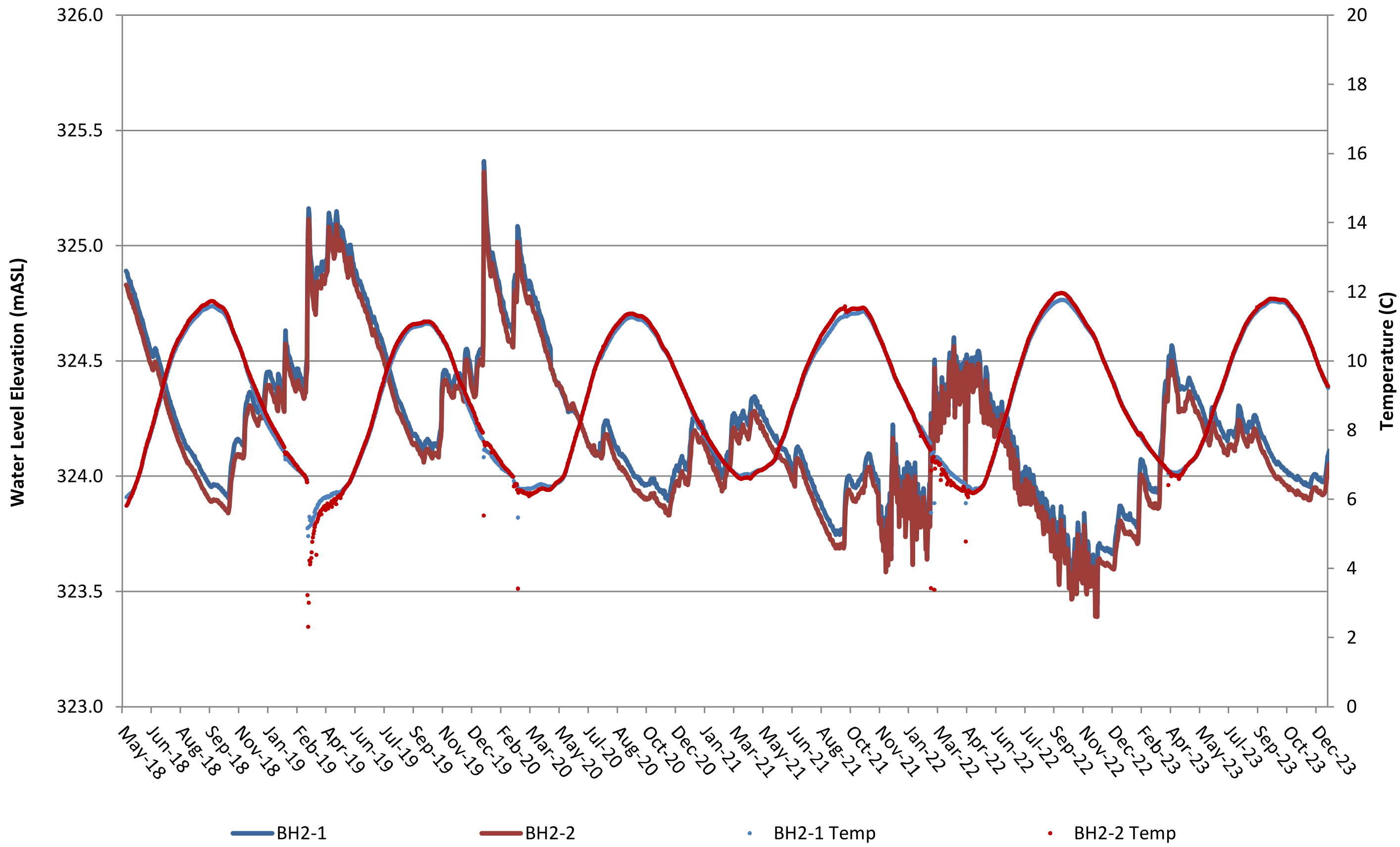
AECOM

Central Monitors (BH2,BH10,BH11) & Precipitation

St Marys Mast Snyder Property

Figure 14B

Project 60700729

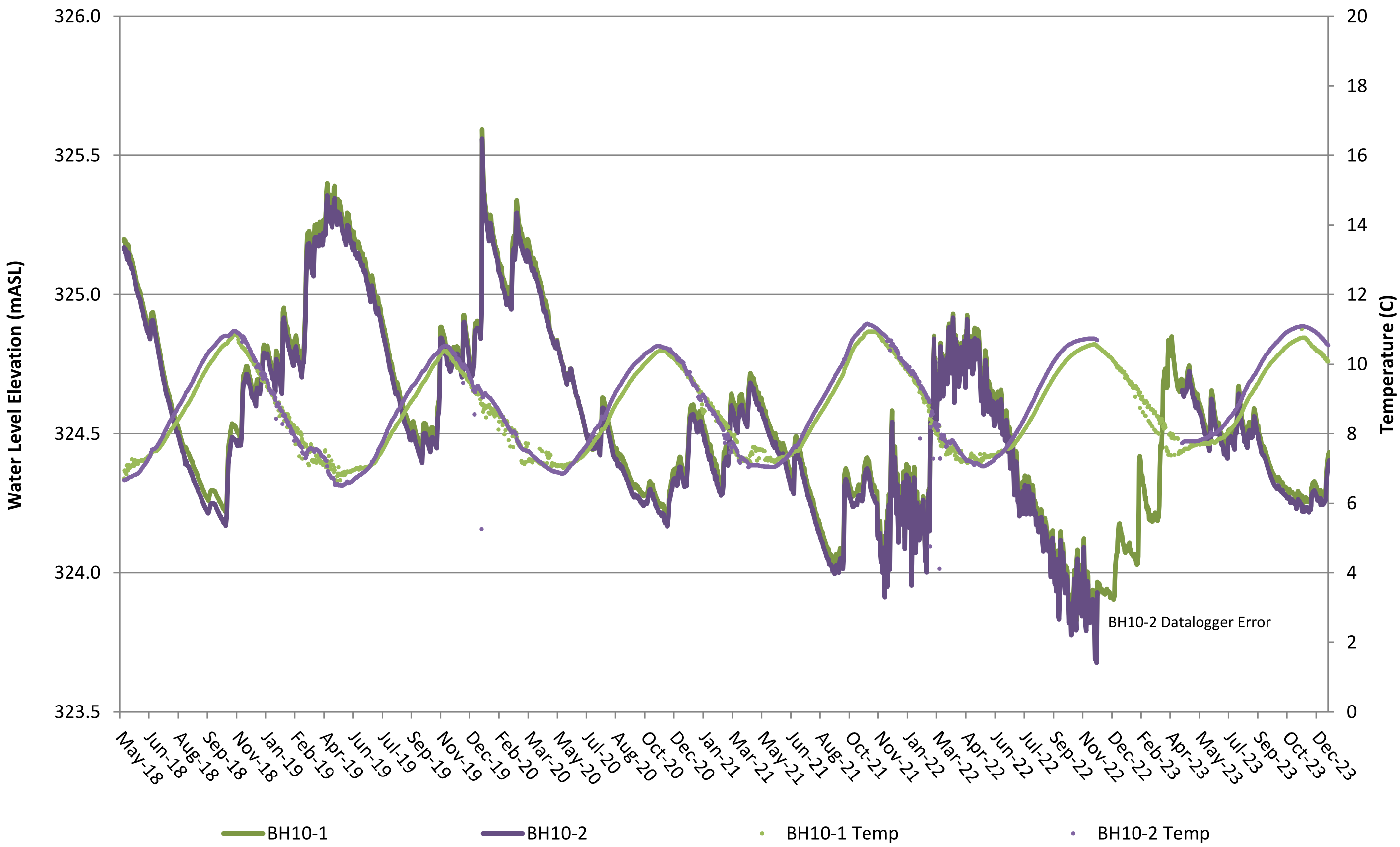


Central Monitors BH2 Hydrograph & Water Temprature

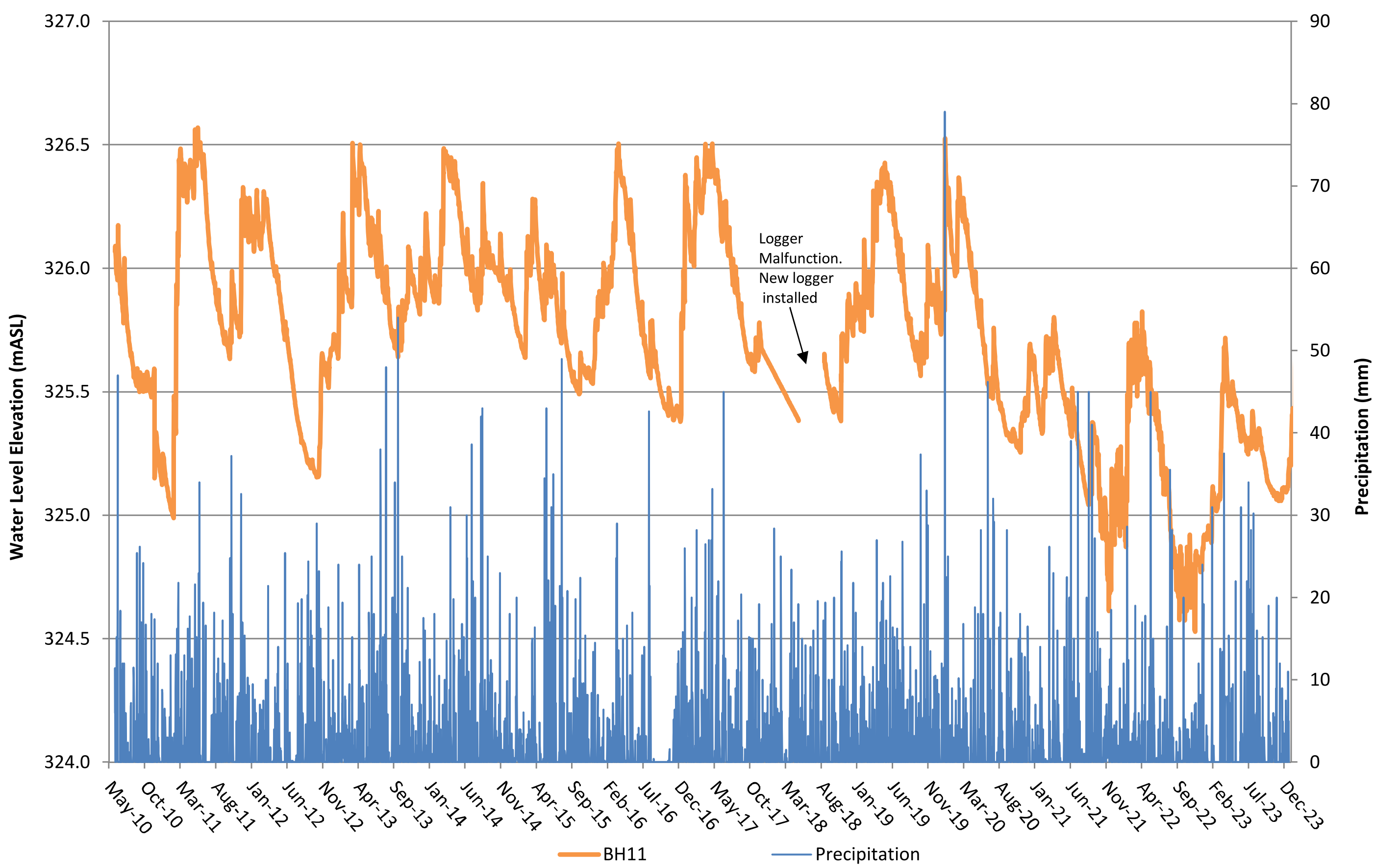
St Marys Mast Snyder Property

Figure 15

Project 60700729



AECOM	**Central Monitors BH10 Hydrograph & Water Temprature** St Marys Mast Snyder Property	**Figure 16** **Project 60700729**



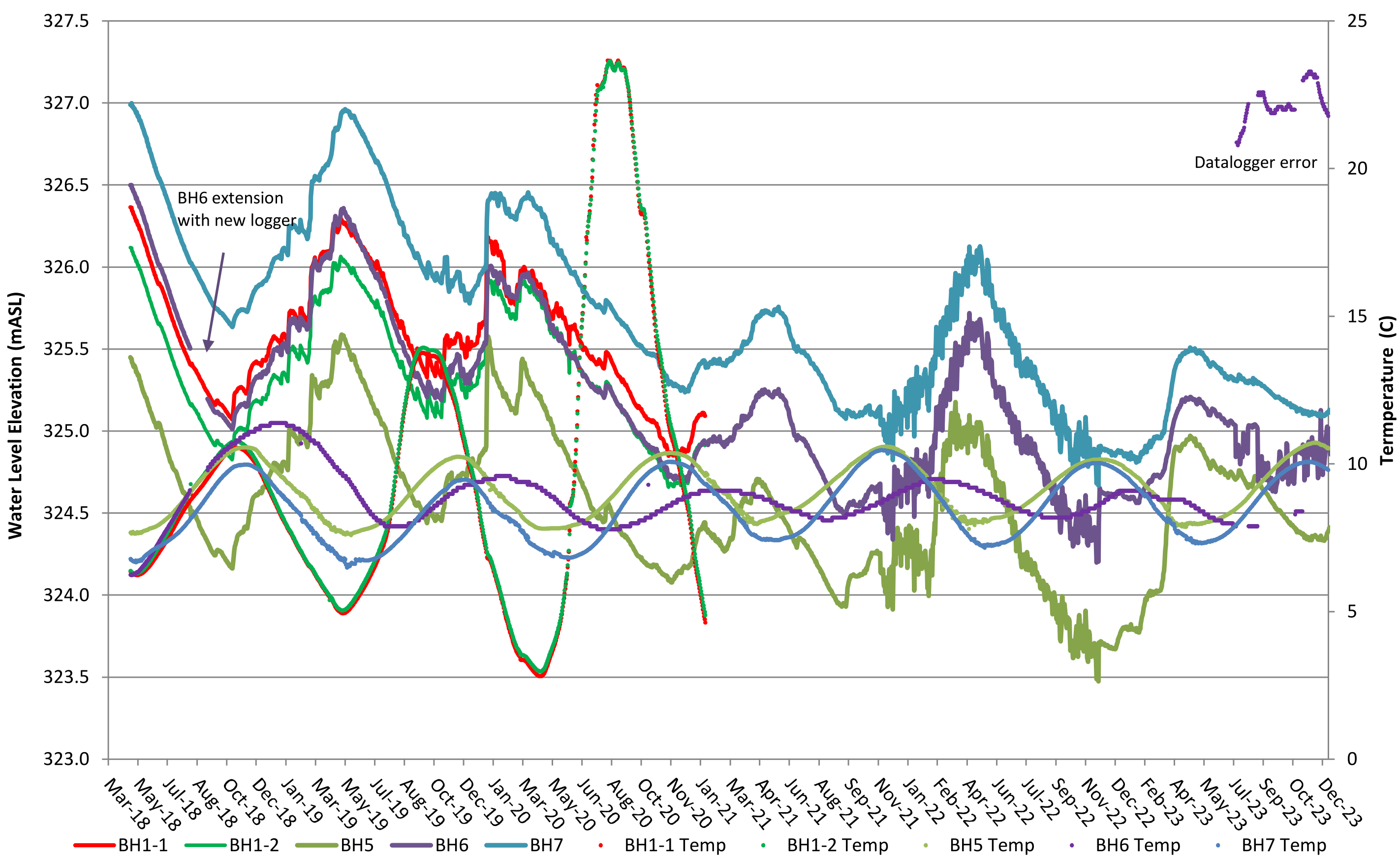
AECOM

BH11 Water Levels and Precipitation

St Marys Mast Snyder Property

Figure 17

Project 60700729



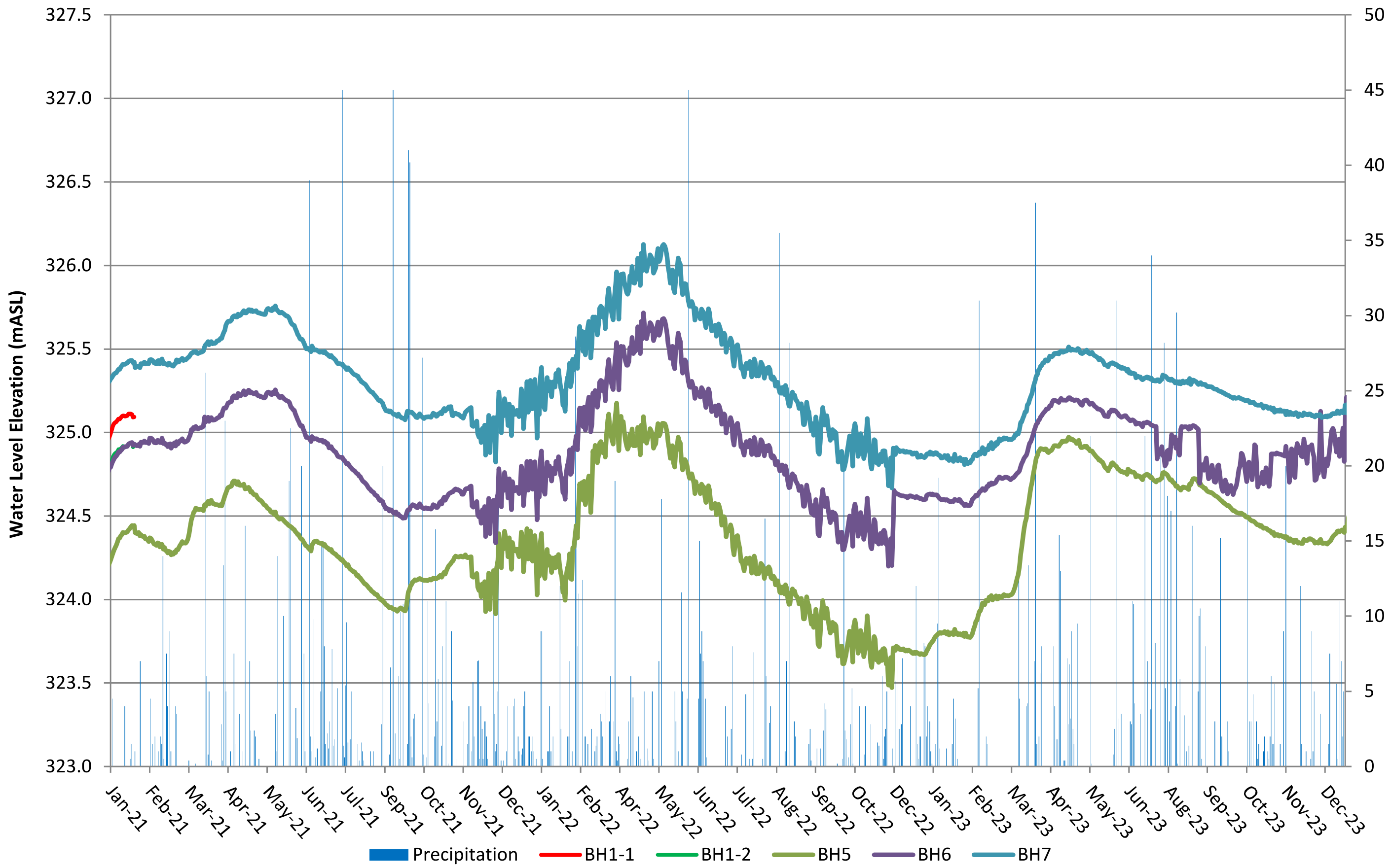
AECOM

Southern Monitors (BH1, BH5, BH6, BH7)

St Marys Mast Snyder Property

Figure 18A

Project 60700729



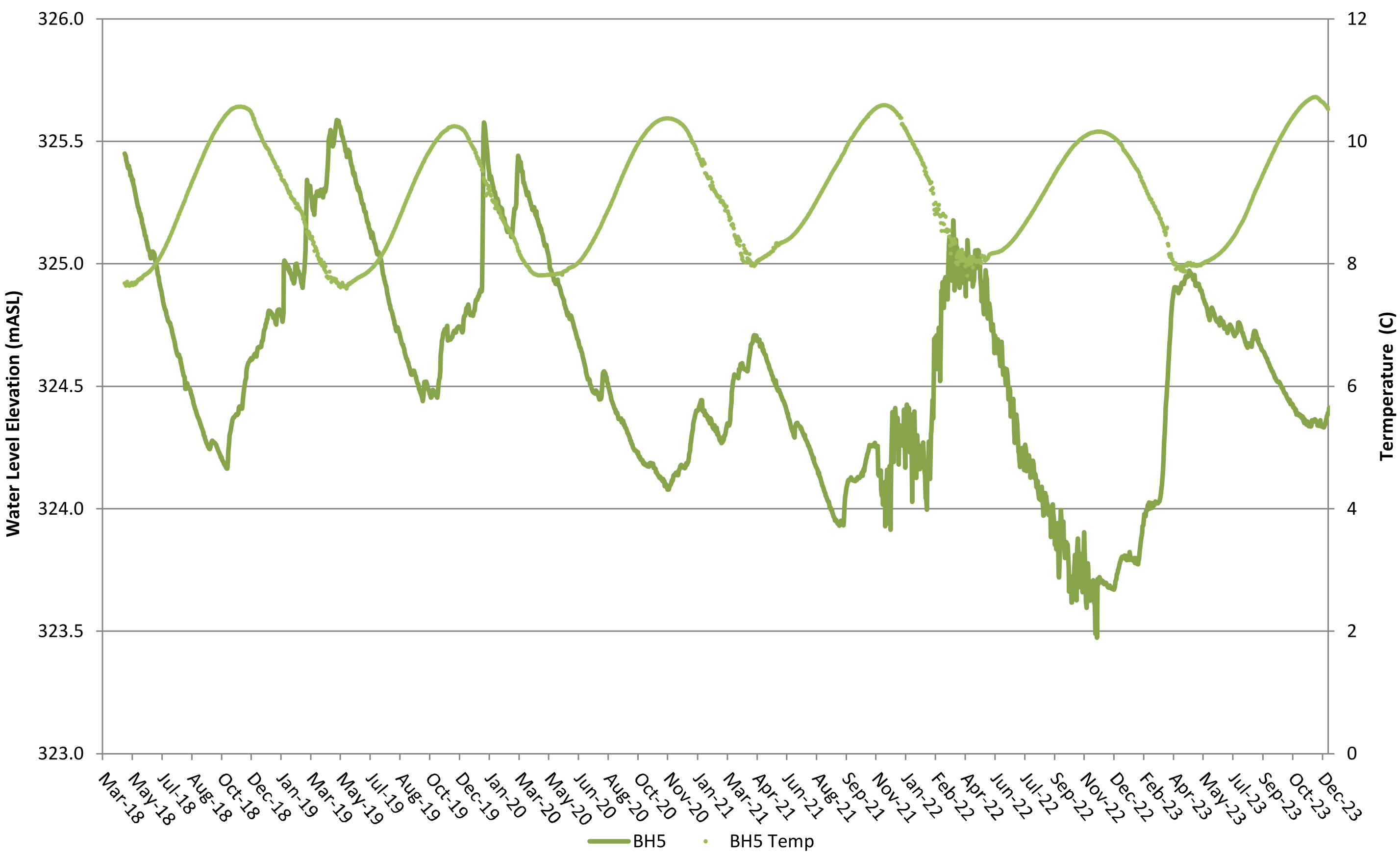
AECOM

Southern Monitors (BH1, BH5, BH6, BH7)

St Marys Mast Snyder Property

Figure 18B

Project 60700729



AECOM

Southern Monitors BH5 Hydrograph & Water Temprature

St Marys Mast Snyder Property

Figure 19

Project 60700729

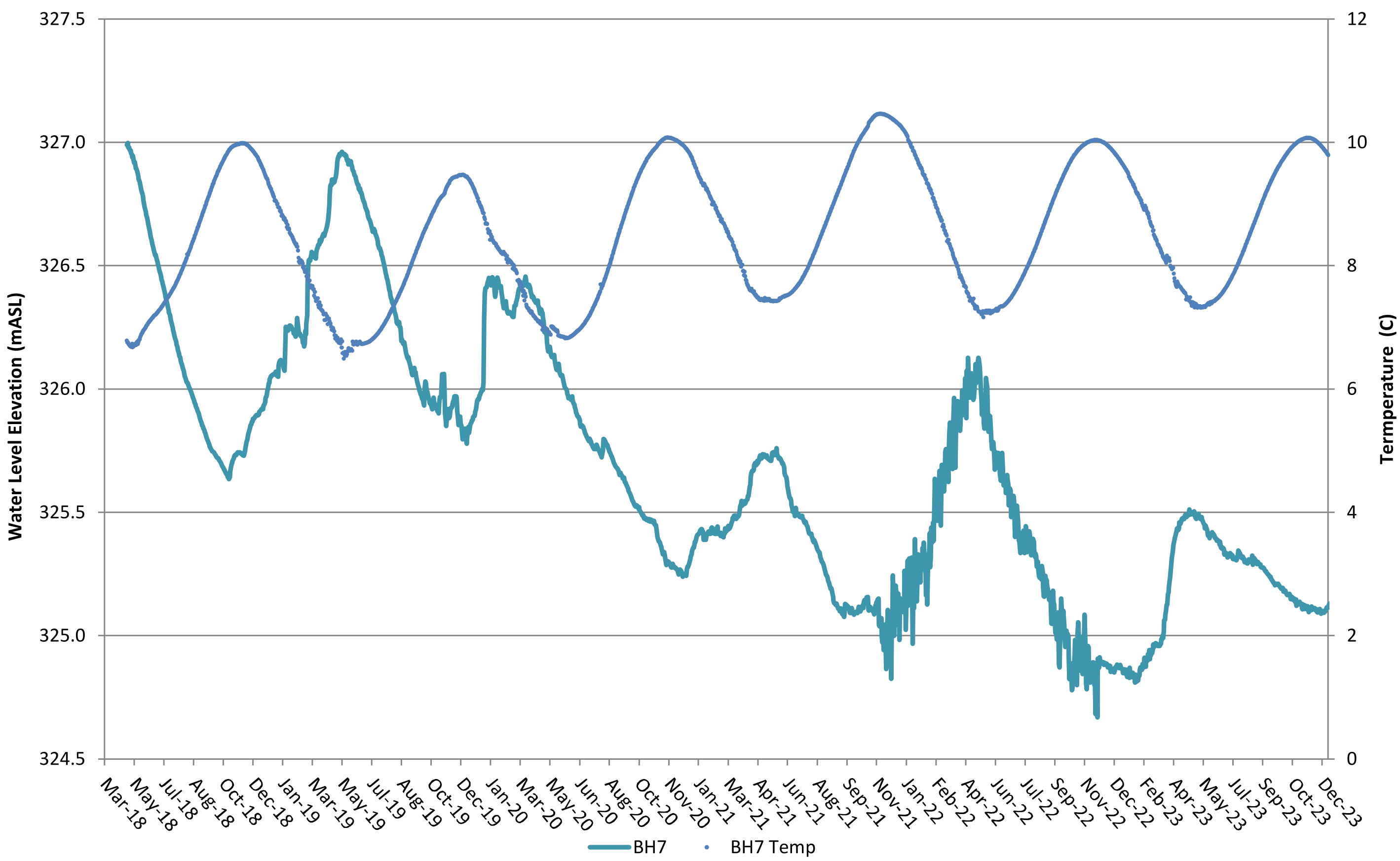
AECOM

Southern Monitors BH6 Hydrograph & Water Temprature

St Marys Mast Snyder Property

Figure 20

Project 60700729



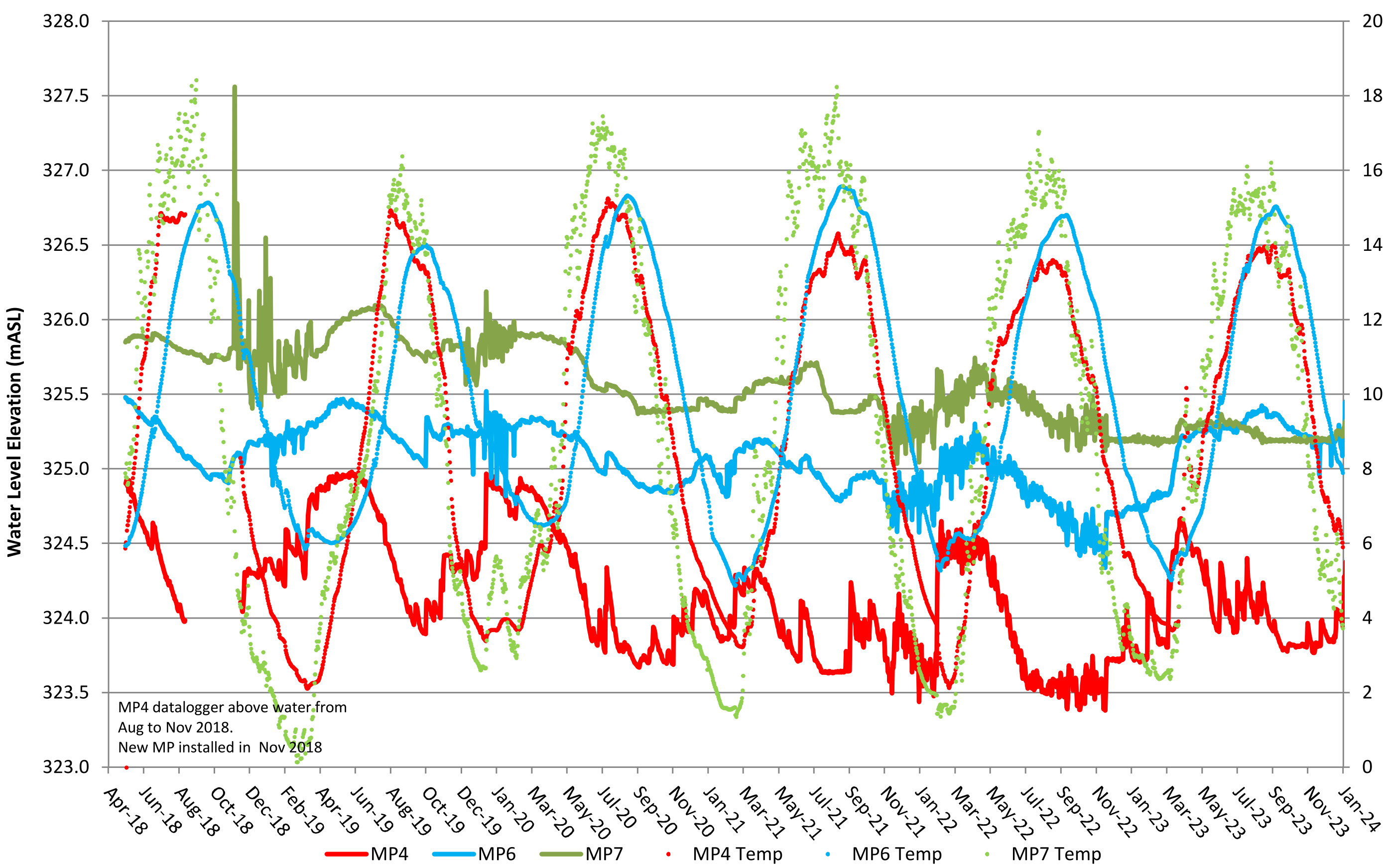
AECOM

Southern Monitors BH7 Hydrograph & Water Temprature

St Marys Mast Snyder Property

Figure 21

Project 60700729



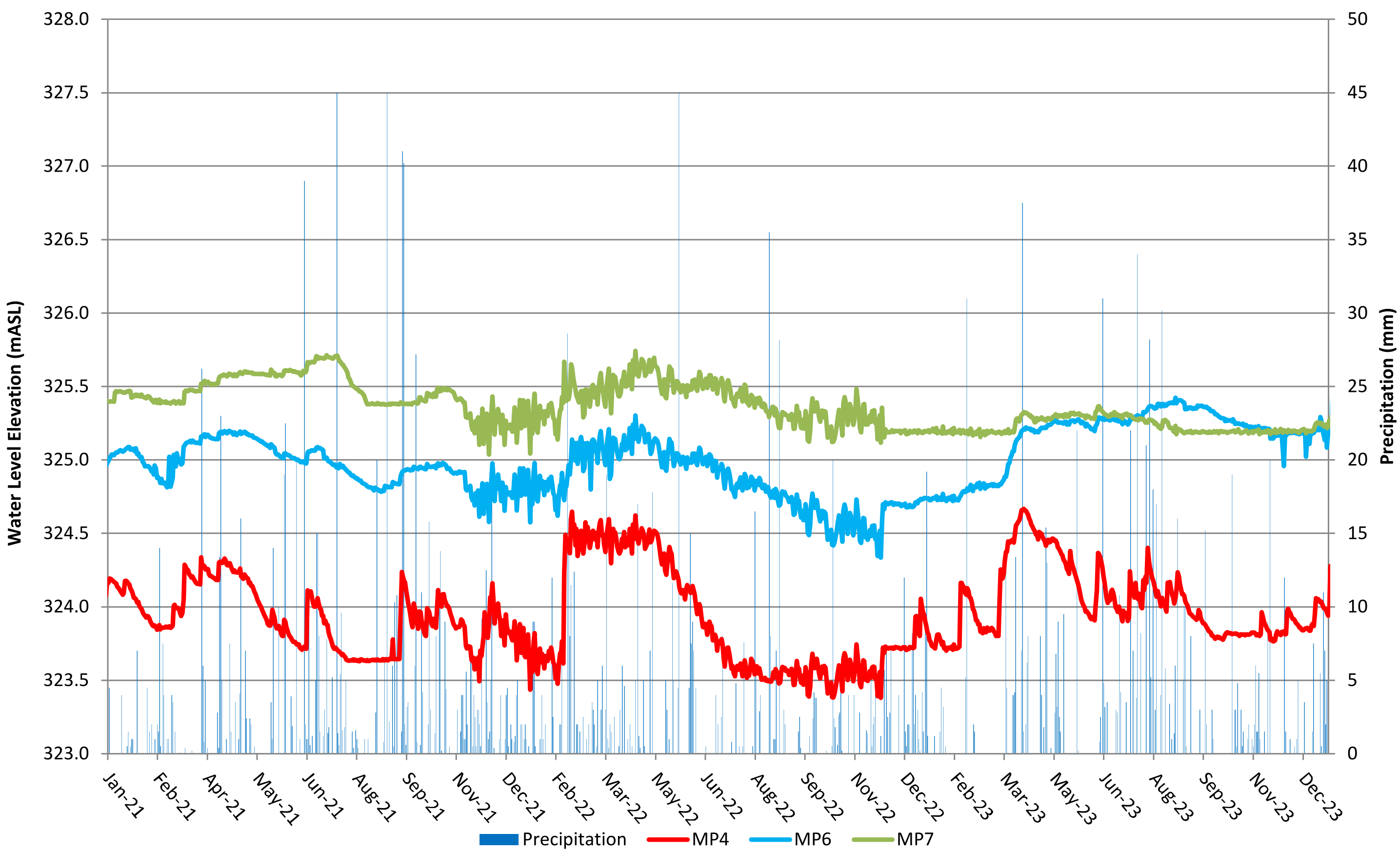
AECOM

Southern Swale (MP6, MP7) and Isolated Wetland Monitors (MP4)

St Marys Mast Snyder Property

Figure 22A

Project 60700729



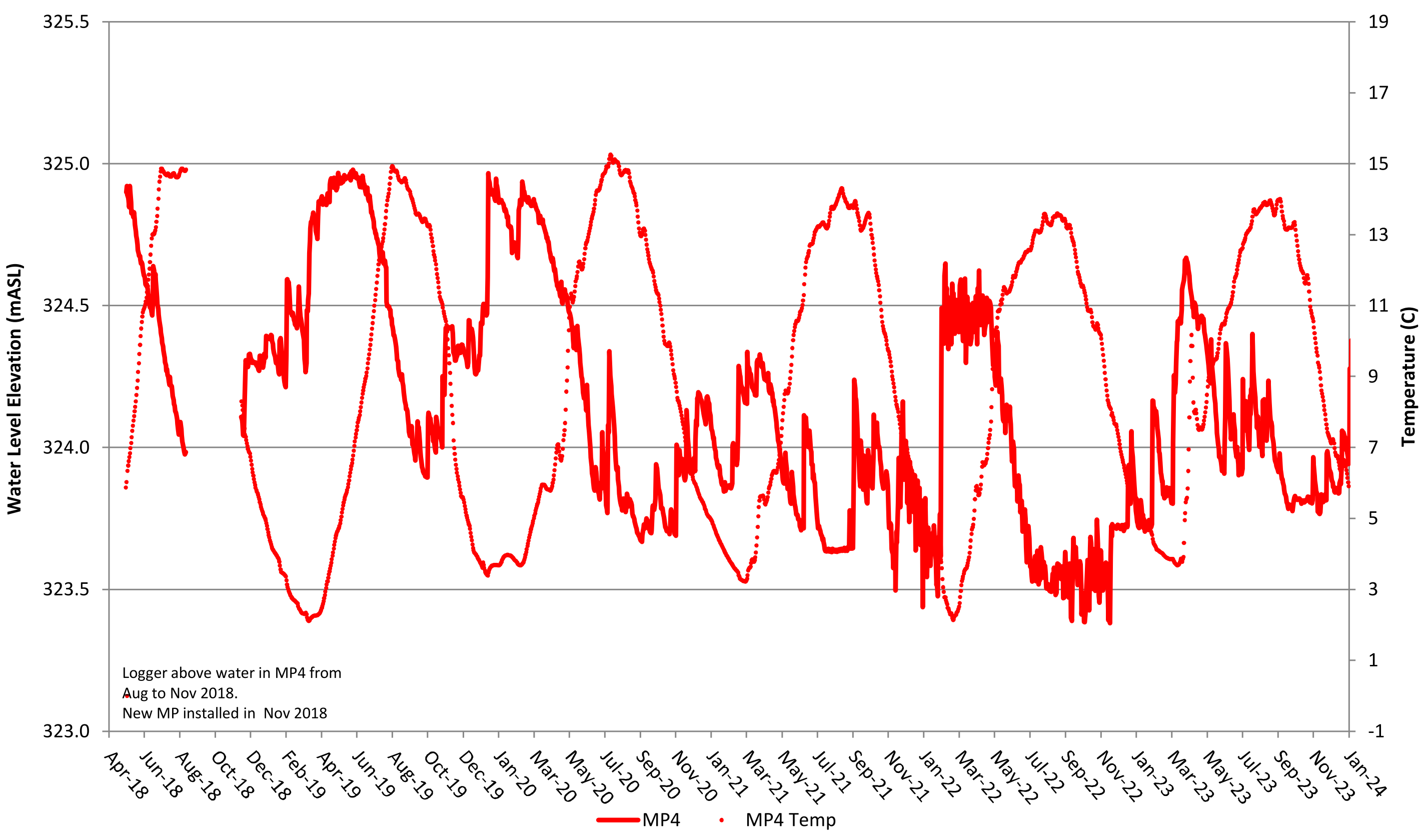
AECOM

Southern Swale (MP6, MP7) and Isolated Wetland Monitors (MP4) and Precipitation

St Marys Mast Snyder Property

Figure 22B

Project 60700729



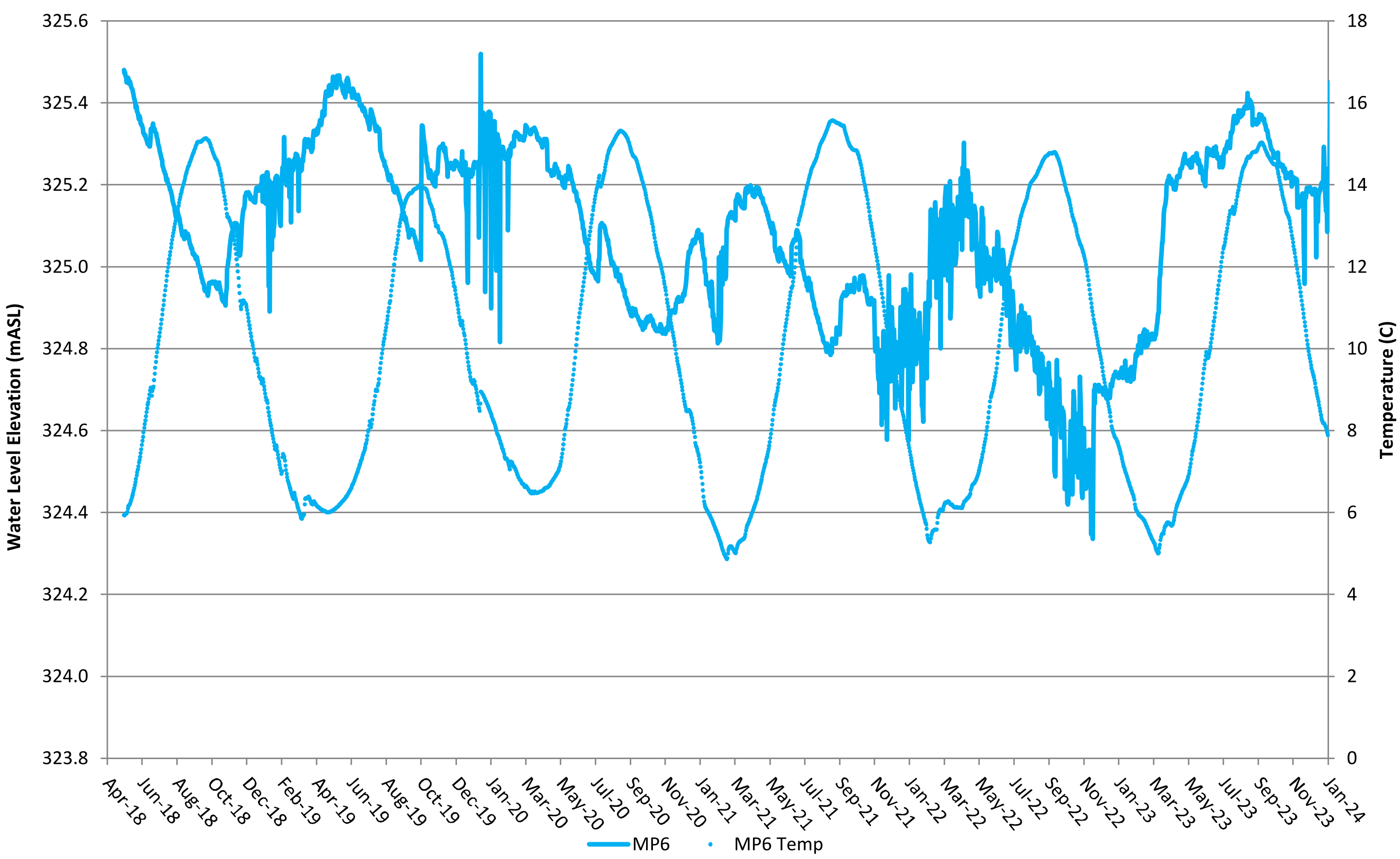
AECOM

Isolated Wetland Monitor MP4 Hydrograph & Water Temprature

St Marys Mast Snyder Property

Figure 23

Project 60700729



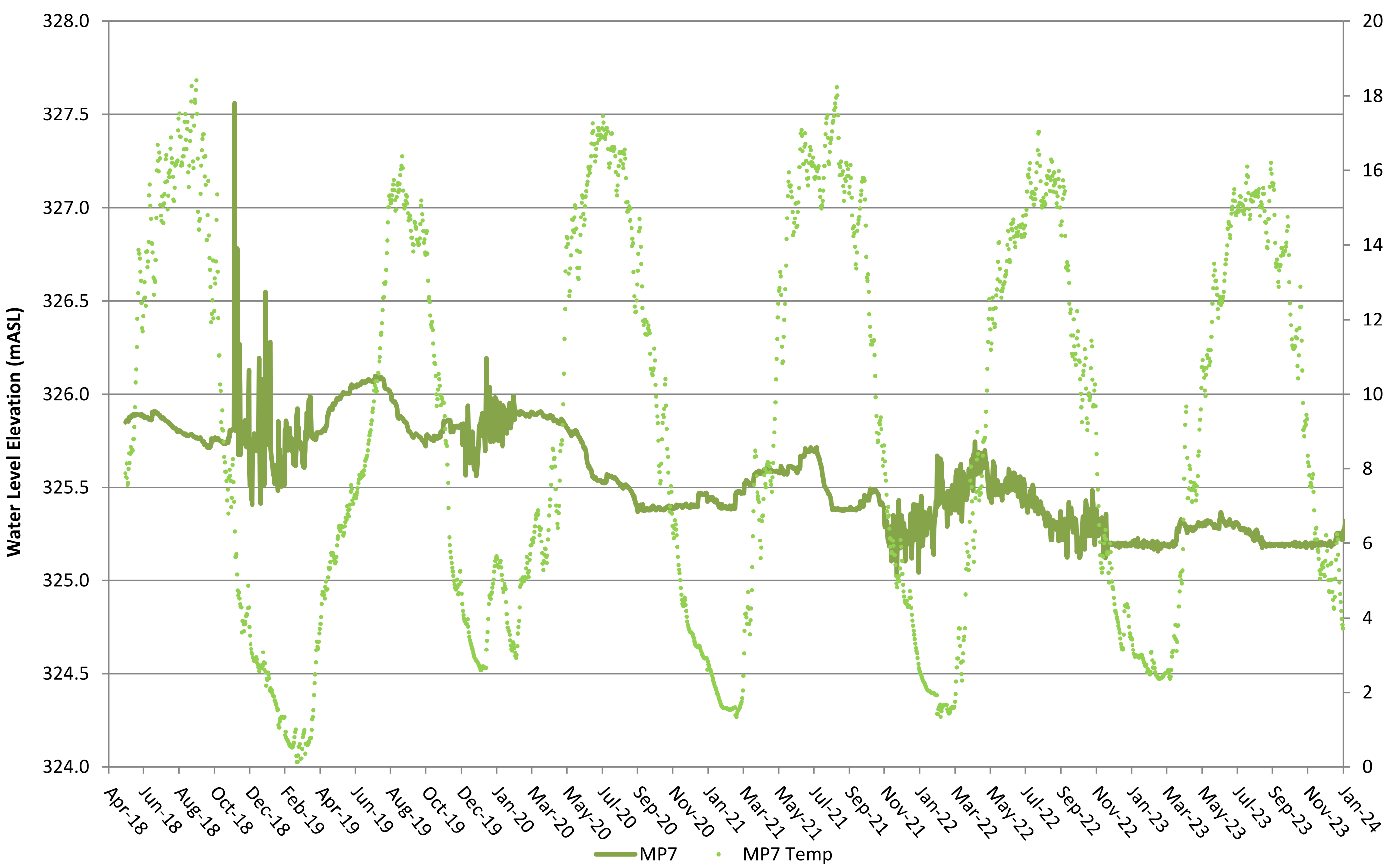
AECOM

Southern Swale Monitor MP6 Hydrograph & Water Temprature

St Marys Mast Snyder Property

Figure 24

Project 60700729



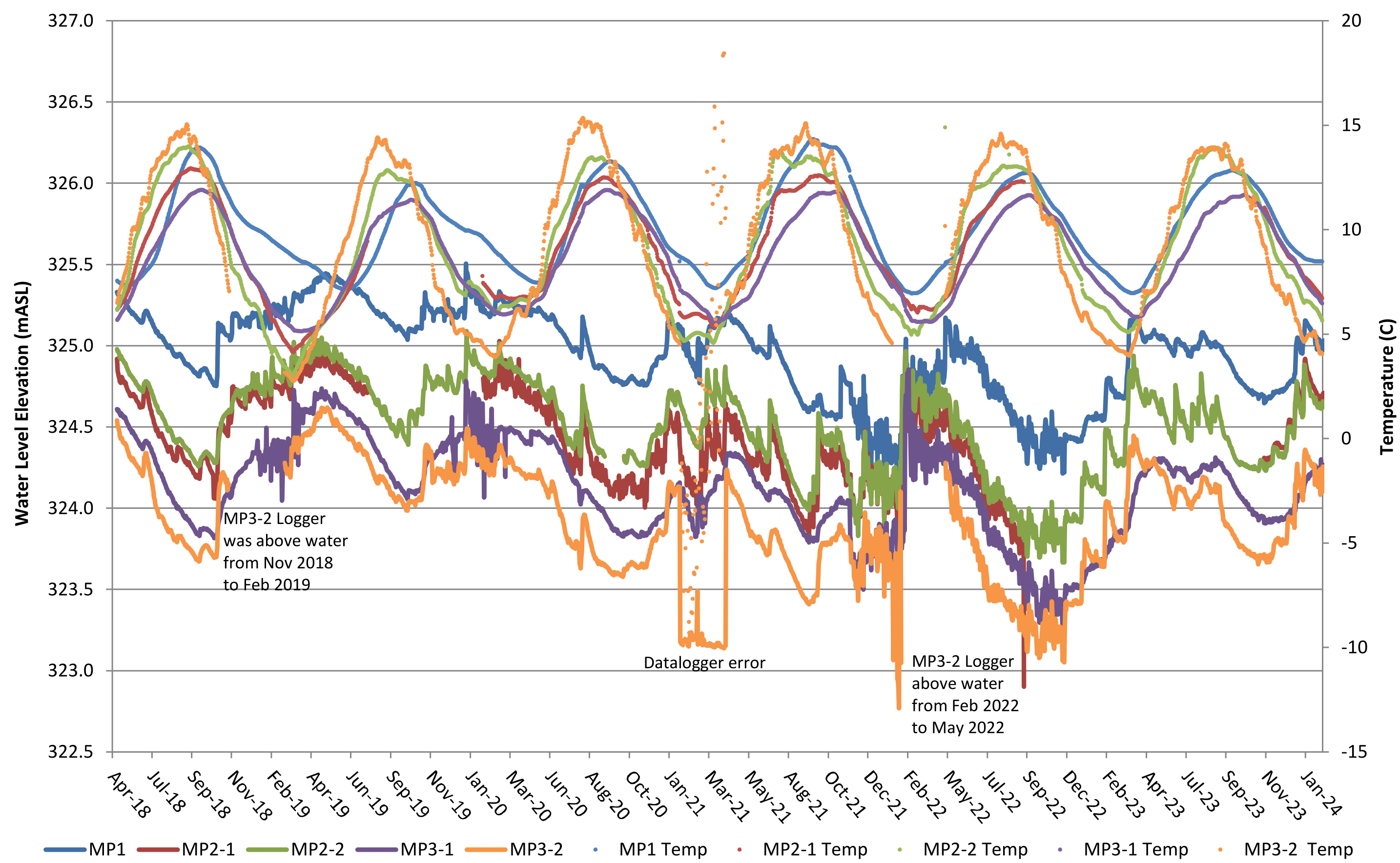
AECOM

Southern Swale Monitor MP7 Hydrograph & Water Temprature

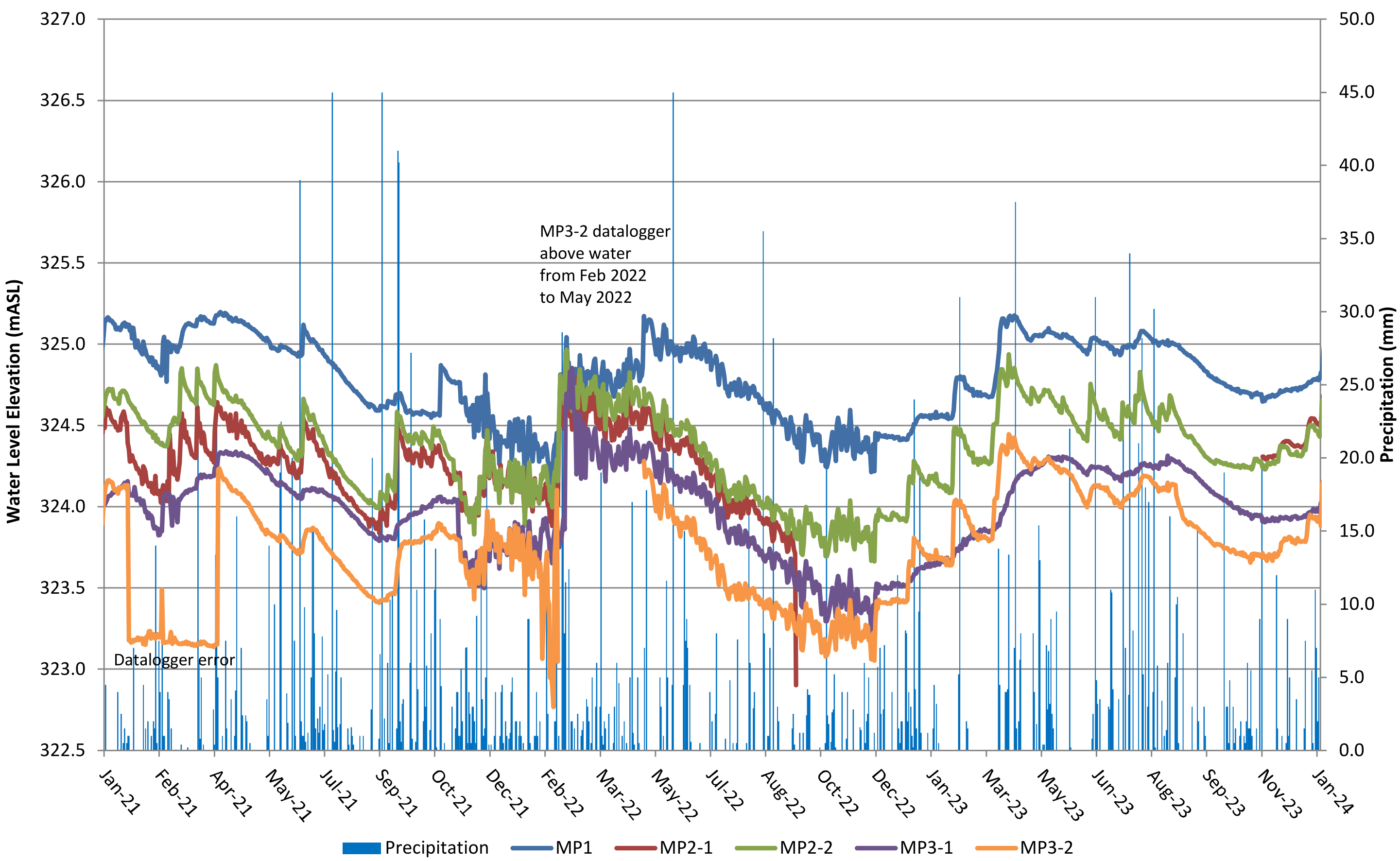
St Marys Mast Snyder Property

Figure 25

Project 60700729



AECOM	**Tributary A Monitors (MP1, MP2, MP3)** St Marys Mast Snyder Property	**Figure 26A** **Project 60700729**



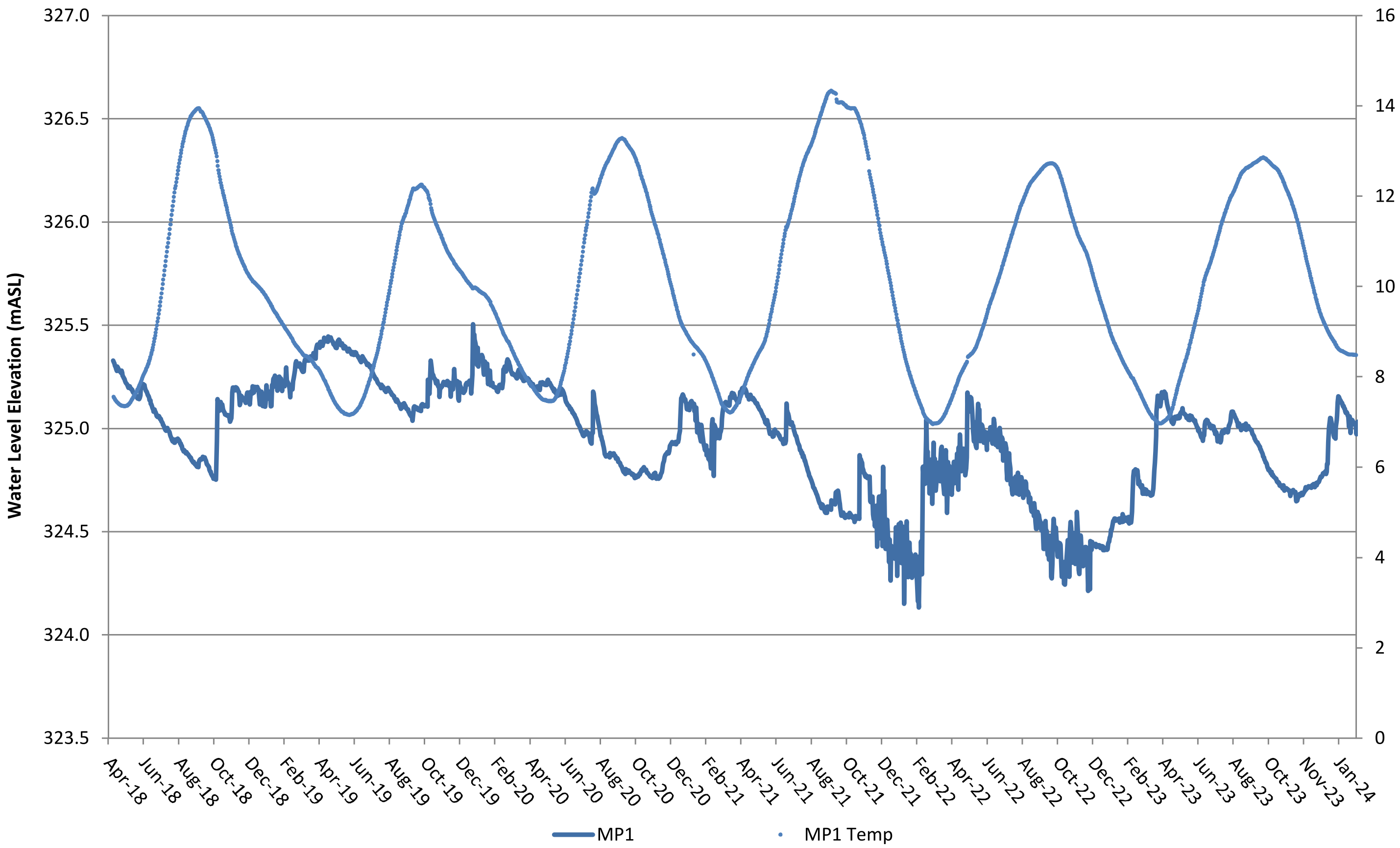
AECOM

Tributary A Monitors (MP1, MP2, MP3) and Precipitation

St Marys Mast Snyder Property

Figure 26B

Project 60700729

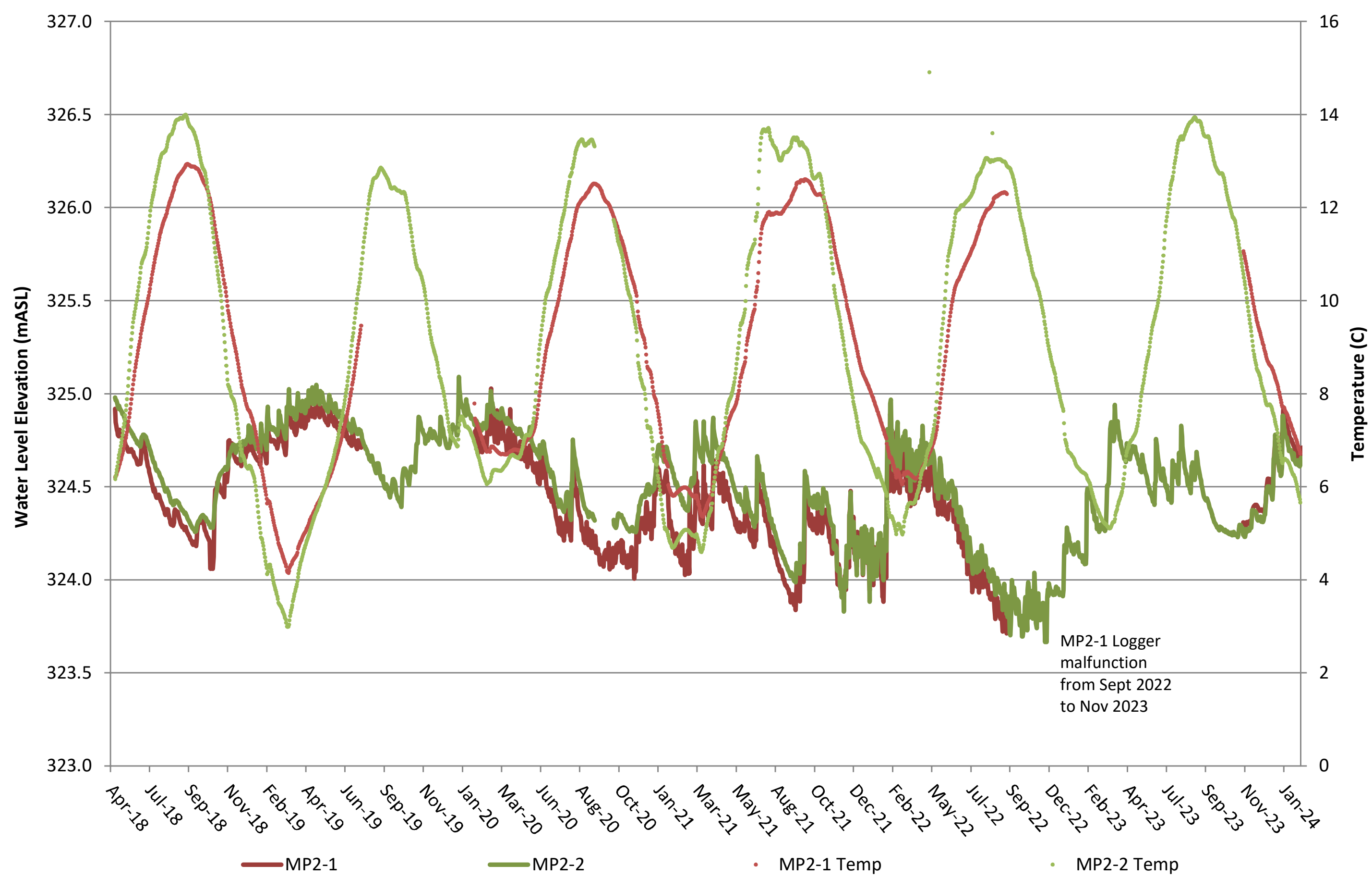


Tributary A MP1 Hydrograph & Water Temperature

St Marys Mast Snyder Property

Figure 27

Project 60700729

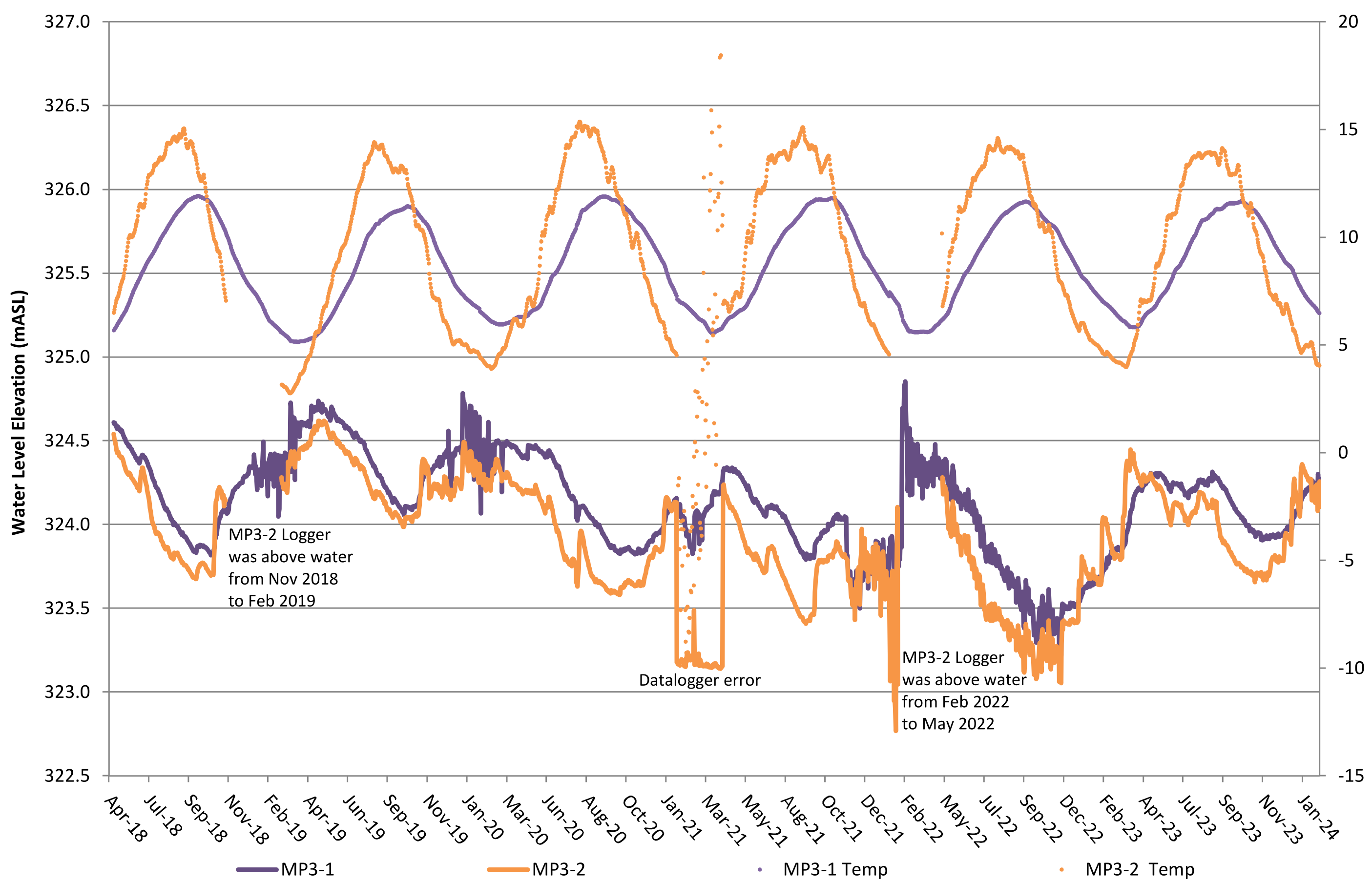


Tributary A MP2 Hydrograph & Water Temperature

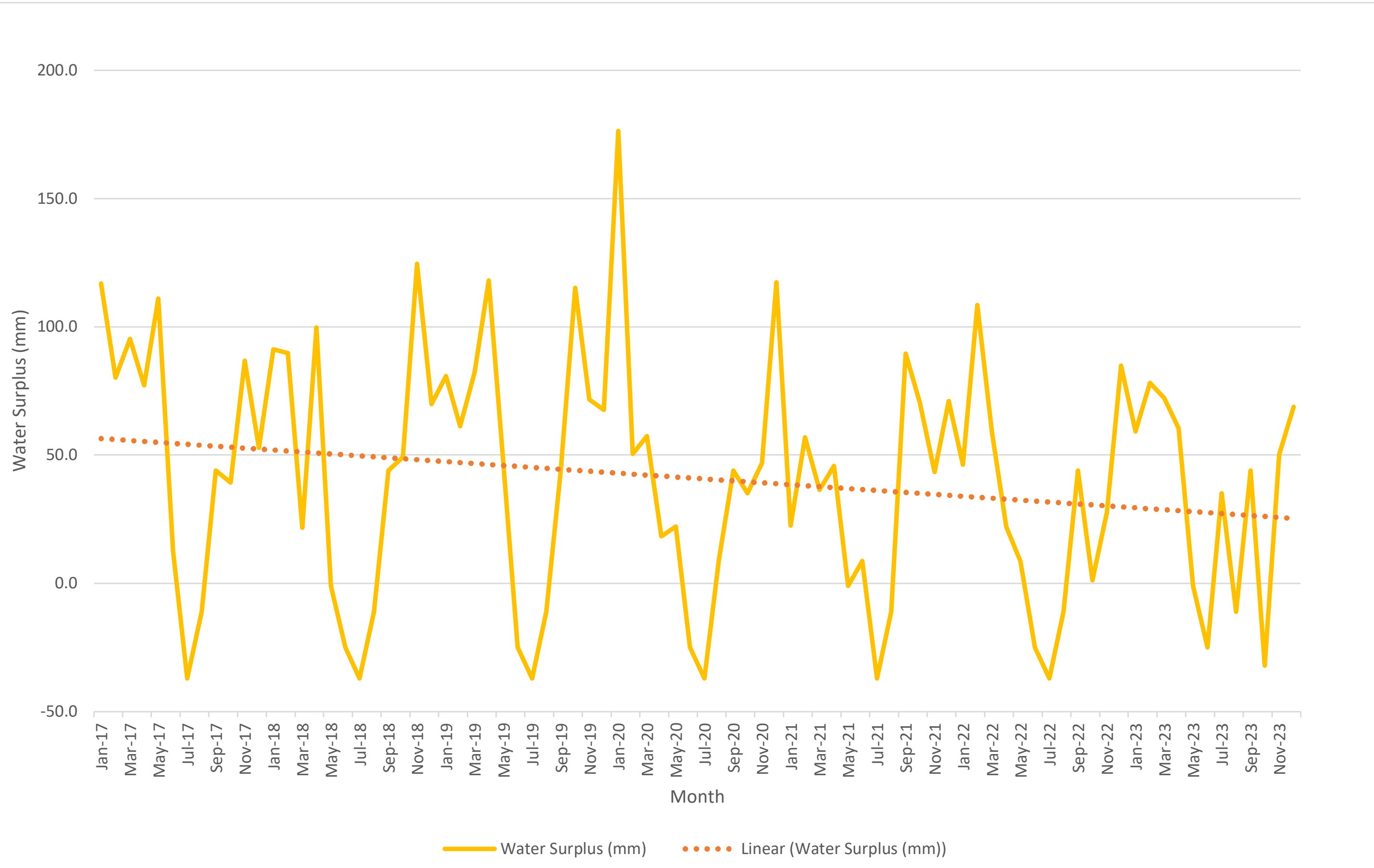
St Marys Mast Snyder Property

Figure 28

Project 60700729



AECOM	**Tributary A MP3 Hydrograph & Water Temperature** St Marys Mast Snyder Property	**Figure 29** **Project 60700729**



AECOM

Monthly 2017-2023 Water Surplus

St Marys Mast Snyder Property

Figure 30

Project 60700729

Appendix A

GRCA Comments on 2022 Annual Report

Grand River Conservation Authority
Administration Centre: 400 Clyde Road, P.O. Box 729 Cambridge, ON N1R 5W6
Phone: 519-621-2761 Toll free: 1-866-900-4722 Fax: 519-621-4844 www.grandriver.ca

February 13, 2024
Via email

Jennifer DeLeemans, Lands and Environment Manager
CBM Aggregates
7152 Concession 2
Cambridge, ON, N3C 2V4

Dear Ms. DeLeemans,

Re: 2022 Ecological and Aquatic Monitoring Report
St. Mary's Mast Snyder Pit, ARA Licence No. 129817
CBM Aggregates

Grand River Conservation Authority (GRCA) staff has reviewed the above-noted 2022 Monitoring Report for the St. Mary's Mast Snyder aggregate pit in the Township of Puslinch and offer the following comments.

Please be advised that on January 1, 2023, a new Minister's regulation (Ontario Regulation 596/22: Prescribed Acts – Subsections 21.1.1 (1.1) and 21.1.2 (1.1) of the Conservation Authorities Act) came into effect. As a result, non-mandatory technical review services that the GRCA formerly provided under agreement with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) will no longer be provided.

On this basis, we offer the following comments.

1. The report indicates that "at most locations, groundwater levels are showing a decreasing trend over time" and that this is not related to pit activities as there have been no "water takings" and monitors upstream and downstream of the extraction area have exhibited similar trends. The report also suggests that "water levels appear to be influenced by local precipitation and show natural fluctuations". Although seasonal fluctuations are to be expected, precipitation and air temperature data are needed to determine if weather or climate can account for the overall decline in groundwater levels on this site. A thorough review of the available meteorological data for this area is recommended. Did this area receive below average precipitation in 2022 and if so, why isn't supporting data presented in the current monitoring report?

2. Section 5.1 of the monitoring report does not appear to assess the actual groundwater data against the triggers that were established in a technical memo by AECOM in 2022. Water levels at BH3 (PSW and Trib. B) breached the fall trigger level (324.16 masl) in 2022. Water levels at BH10 (southern edge of isolated wetland) breached all of the seasonal trigger levels, including the corrected dry season trigger level (324 masl). The relationship between the borehole and piezometer data seems clear and needs to be reviewed more closely against long-term precipitation data.

3. It’s unclear how trends in wetland vegetation communities were assessed? In order to help analyze and discuss perceived trends over time, we recommend that the average coefficient of conservatism and coefficient of wetness be calculated for all vegetation transects.

Should you have any questions, please contact me at 519-621-2761 x 2327 or by email at vwismer@grandriver.ca.

Sincerely,

[redacted]

Tyler Slaght
Supervisor of Resource Planning
Grand River Conservation Authority

Copy: AECOM Canada Ltd (via email)
Town of Puslinch attn: Justine Brotherstone (via email)

Holden, Brian

From: Jennifer Deleemans <jennifer.deleemans@vcimentos.com>
Sent: Friday, February 23, 2024 8:58 AM
To: Vanessa Wismer; Justine Brotherston
Cc: Holden, Brian; Wong, Patty
Subject: RE: 2022 Monitoring Report - CBM Mast Snyder Pit (Licence #129817) - GRCA Comments

Perfect. Thanks for the confirmation Vanessa.

Hope you have a great weekend,

Jen

Jennifer DeLeemans, M.Sc.
CBM Aggregates
Lands and Environment Manager
Ontario

Mobile: (416) 999-6104
jennifer.deleemans@vcimentos.com
7152 Concession 2, Cambridge, Ontario, N3C 2V4

Votorantim Cimentos
www.votorantimcimentos.com
www.stmaryscement.com

From: Vanessa Wismer <vwismer@grandriver.ca>
Sent: Wednesday, February 21, 2024 3:27 PM
To: Jennifer Deleemans <jennifer.deleemans@vcimentos.com>; Justine Brotherston <jbrotherston@puslinch.ca>
Cc: Brian.Holden@aecom.com; Wong, Patty <Patty.Wong@aecom.com>
Subject: RE: 2022 Monitoring Report - CBM Mast Snyder Pit (Licence #129817) - GRCA Comments

EXTERNAL EMAIL / EMAIL EXTERNO / COURRIEL EXTERNE

Hello Jennifer,

The GRCA would be supportive of the 2023 Monitoring Report addressing the comments provided on 2024-02-14 (see below).

Cheers,

Vanessa Wismer, MSc
Temporary Resource Planner
Grand River Conservation Authority

400 Clyde Road, PO Box 729
Cambridge, ON N1R 5W6
Office: 519-621-2761 ext. 2327
Toll-free: 1-866-900-4722
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From: Jennifer Deleemans <jennifer.deleemans@vcimentos.com>
Sent: Thursday, February 15, 2024 10:51 AM
To: Justine Brotherston <jbrotherston@puslinch.ca>; Vanessa Wismer <vwismer@grandriver.ca>

Cc: Brian.Holden@aecom.com; Wong, Patty <Patty.Wong@aecom.com>
Subject: RE: 2022 Monitoring Report - CBM Mast Snyder Pit (Licence #129817) - GRCA Comments

Hi Justine,

The report will be ready to send out in early April.

Jen

Jennifer DeLeemans, M.Sc.
CBM Aggregates
Lands and Environment Manager
Ontario

Mobile: (416) 999-6104
jennifer.deleemans@vcimentos.com
7152 Concession 2, Cambridge, Ontario, N3C 2V4

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From: Justine Brotherston <jbrotherston@puslinch.ca>
Sent: Thursday, February 15, 2024 10:46 AM
To: Jennifer Deleemans <jennifer.deleemans@vcimentos.com>; Vanessa Wismer <vwismer@grandriver.ca>
Cc: Brian.Holden@aecom.com; Wong, Patty <Patty.Wong@aecom.com>
Subject: RE: 2022 Monitoring Report - CBM Mast Snyder Pit (Licence #129817) - GRCA Comments

EXTERNAL EMAIL / EMAIL EXTERNO / COURRIEL EXTERNE

Hi Jennifer,

Can you advise when you expect to submit the 2023 Mast Snyder Pit Monitoring Report?

Kind regards,

Justine Brotherston
Interim Municipal Clerk
Deputy Clerk
Township of Puslinch
7404 Wellington Rd 34, Puslinch ON N0B 2J0
519-763-1226 ext. 208 Fax 519-736-5846 www.puslinch.ca

My hours may not match your working hours. If you received this email outside of regular business hours, I do not expect an immediate response.

From: Jennifer Deleemans <jennifer.deleemans@vcimentos.com>
Sent: Thursday, February 15, 2024 9:08 AM
To: Vanessa Wismer <vwismer@grandriver.ca>
Cc: Justine Brotherston <jbrotherston@puslinch.ca>; Brian.Holden@aecom.com; Wong, Patty <Patty.Wong@aecom.com>
Subject: RE: 2022 Monitoring Report - CBM Mast Snyder Pit (Licence #129817) - GRCA Comments

Hi Vanessa,

We have received the GRCA's comments provided for the 2022 Monitoring Report. The comments and discussion points raised were planned to be incorporated into the 2023 annual monitoring report. Our consultant AECOM (copied here) is currently compiling year over year precipitation data to compare it to that of 2022.

The 2023 Monitoring Report will address the concerns outlined by the GRCA. Does that work for the GRCA?

Thanks,

Jen

Jennifer DeLeemans, M.Sc.
CBM Aggregates
Lands and Environment Manager
Ontario

Mobile: (416) 999-6104
jennifer.deleemans@vcimentos.com
7152 Concession 2, Cambridge, Ontario, N3C 2V4

Votorantim Cimentos
www.votorantimcimentos.com
www.stmaryscement.com

From: Vanessa Wismer <vwismer@grandriver.ca>
Sent: Wednesday, February 14, 2024 9:00 AM
To: Jennifer Deleemans <jennifer.deleemans@vcimentos.com>
Cc: jbrotherston@puslinch.ca; Brian.Holden@aecom.com
Subject: 2022 Monitoring Report - CBM Mast Snyder Pit (Licence #129817) - GRCA Comments

EXTERNAL EMAIL / EMAIL EXTERNO / COURRIEL EXTERNE

Hello,

Please see attached the GRCA comments provided for the 2022 Monitoring Report received for the CBM Mast Snyder Pit (Licence #129817).

If you have any questions, please do not hesitate to contact me.

Many thanks,

Vanessa Wismer, MSc
Temporary Resource Planner
Grand River Conservation Authority

400 Clyde Road, PO Box 729
Cambridge, ON N1R 5W6
Office: 519-621-2761 ext. 2327
Toll-free: 1-866-900-4722
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Appendix B

MECP Water Well Records & Survey

Water Well Survey Summary

St Marys Mast-Snyder Pit
Project No.: 60246514-8

Owner/Location (Puslinch Twp.)	Surveyed	Date Drilled	Well Diameter (m)	Total Depth (m)	Static Level (m)	Well Survey Results				
						Year Occupied Property	Number of Residents	Quality Issues	Supply Issues	Comments
Baldwin 6809 Forestall Rd. Lot 13, Conc. 4	8-Aug-12	2005		> 30		2005	2			- house has water softener and water filter - some iron
Hennick 6827 Forestall Rd. Lot 14, Conc. 4	29-Nov-10	9-Nov	0.15	53.3		2009	4	No	No	- house has water softener and UV system
Land 6841 Forestall Rd. Lot 14, Conc. 4	8-Aug-12	2005		67.7		1972	1			- some iron - formerly had a 9 m deep dug well that went dry so new well was drilled
Mast (formerly Cooper) 6848 Forestall Rd. Lot 14, Conc. 4	29-Nov-10	Dec-59	0.1	36.6	7.6	2006	2	No	No	- tenant (Veldhuis) interviewed - owned by Mast since 1961
Yates 6851 Forestall Rd. Lot 14, Conc. 4	29-Nov-10	Aug-69	0.1	36.3	7.6	1971	2-3	Yes	No	- owned property since 1971 - water has iron and black particulate, lower water levels - water problems started when Cox started extraction - house has water softener and iron filter

Water Well Survey Summary
St Marys Mast-Snyder Pit
Project No.: 60246514-8

Owner/Location (Puslinch Twp.)	Surveyed	Date Drilled	Well Diameter (m)	Total Depth (m)	Static Level (m)	Well Survey Results				
						Year Occupied Property	Number of Residents	Quality Issues	Supply Issues	Comments
Kreitzer (formerly Becker) 6855 Forestall Rd. Lot 14, Conc. 4	29-Nov-10	Jun-67	0.15	34.1	5.50	1971	2	No	No	- owned property since 1971 - house has water softener
Crawley 6895 Forestall Rd. Lot 16, Conc. 4	14-Mar-10	2007		36.6						
Arbuckle (formerly School Sec 3) 4673 Downey Rd. Lot 16, Conc. 4	28-Feb-11	Mar-62	0.13	41.2	12.2	2005	6-8	Yes	Occasional	- tenant (Lacroix) interviewed - house has water softener and iron filter - iron staining - some water shortages
Huck 4657 Downey Rd. Lot 16, Conc. 4	28-Feb-11	1996	0.15	about 46.0	about 20 m	1996	4-5	No	No	- lived on property since 1996 - house has water softener and iron filter - well also used to top up swimming pool
Farrell 4669 Downey Rd. Lot 16, Conc. 4	28-Feb-11	prior to 1999		about 21.0		1999	5	No	No	- lived on property since 1999 - house has water softener and sometimes iron filter
Hurr 6855 Laird Rd. Lot 14, Conc. 4	23-Mar-11	May-08		about 38.0		2008	3	No		- UV filter used - has water softener
Mattucci 902 Laird Rd. Lot 16, Conc. 4	24-May-11	1987		about 24.4		1987	5	No	No	- house has water softener - they don't drink the well water

Water Well Survey Summary
St Marys Mast-Snyder Pit
Project No.: 60246514-8

Owner/Location (Puslinch Twp.)	Surveyed	Date Drilled	Well Diameter (m)	Total Depth (m)	Static Level (m)	Well Survey Results				
						Year Occupied Property	Number of Residents	Quality Issues	Supply Issues	Comments
Fitton 4767 Pioneer Trail Lot 13, Conc. 5	24-May-11	1975				1975		No	No	- lived on property since 1975 but have owned the property for more than 50 years - UV filter used - water quality tested frequently - no quality issues

Note: All wells surveyed currently used for domestic purposes only.

MECP Water Well Records within 500 m of the Property Boundary

St Marys Mast-Snyder Pit

MECP Well ID	Lot	Conc.	Street	Easting (NAD83)	Northing (NAD83)	Ground Elevation (mASL)	Construction Date	Primary Water Use	Well Type	Casing Diameter (cm)	Static Level		Deepest Water Found (m)	Depth to Bedrock (m)	Well Depth	
											(mbgs)	(mASL)			(mbgs)	(mASL)
6702362	014	CON 04		561899.3	4814118	331.73	12/4/1959	Livestock	Bedrock	10.16	7.62	324.11	36.58	24.99	36.58	295.15
6702363	014	CON 04	6855 Forestell Rd	562130.3	4814101	331.47	6/28/1967	Domestic	Bedrock	15.24	5.49	325.99	33.22	30.18	34.14	297.34
6702364	015	CON 04	605 Downey Rd	562297.3	4814528	329.44	7/29/1964	Livestock	Bedrock	15.24	4.88	324.56	38.10	24.38	39.62	289.82
6702366	016	CON 04		562591.3	4814112	335.32	3/7/1962	Public	Bedrock	12.70	12.19	323.13	41.15	29.57	41.15	294.17
6702367	016	CON 04	4669 Downey Rd	562619.3	4814045	336.57	9/6/1962	Domestic	Bedrock	15.24	18.29	318.28	38.10	30.48	39.01	297.56
6702385	014	CON 05	6852 Laird Rd	561599.3	4815233	325.05	11/10/1959	Domestic	Bedrock	12.70	7.92	317.12	37.49	33.53	41.76	283.29
6703448	014	CON 04	6851 Forestell Rd	562064.3	4814073	331.52	8/18/1969	Domestic	Bedrock	10.16	7.62	323.90	35.97	31.39	36.27	295.25
6703586	013	CON 05	6767 Pioneer Trail	561224.3	4815323	321.96	9/22/1969	Domestic	Bedrock	10.16	2.13	319.82	35.36	19.20	35.36	286.60
6704205	014	CON 04		561854.3	4814123	330.74	2/25/1972	Domestic	Overburden	15.24	3.35	327.39	17.68		17.68	313.06
6706248	016	CON 05		562334.3	4815303	324.66	11/13/1976	Domestic	Bedrock	12.70			18.29	17.98	18.29	306.37
6709240	016	CON 04	902 Laird Rd	562499.3	4815240	325.48	4/18/1988	Domestic	Bedrock	15.24	0.91	324.56	21.34	20.73	25.30	300.18
6709381	012	CON 04		561012.3	4814713	326.11	7/27/1988	Industrial	Bedrock	15.24	7.62	318.49	42.67	40.54	44.20	281.91
6711954	016	CON 04	4657 Downey Rd	562705.3	4813809	335.79	3/26/1996	Domestic	Bedrock	15.24	15.85	319.94	48.77	33.83	48.77	287.03
6712931	014	CON 04	4664 Downey Rd	562189	4813949	333.97	2/25/1999	Domestic	Bedrock	15.24	28.96	305.01	67.06	29.87	67.06	266.91
6713366	015	CON 04		562326.6	4814170	332.43	6/14/2000	Domestic	Bedrock	15.24	10.36	322.07	55.47	35.05	55.47	276.96
6713565	013	CON 04		561519.1	4813978	328.51	11/15/2000	Domestic	Bedrock	15.24	5.79	322.72	32.31	31.09	32.31	296.20
6713948	016	CON 04		562755	4814273	334.60	10/12/2001	Domestic	Bedrock	15.24	11.58	323.02	43.28	32.61	43.28	291.32
6715482	013	CON 04	6809 Forestell Rd	561418	4813920	328.45	8/8/2005	Domestic	Bedrock	15.24	4.88	323.57	30.48	25.30	30.48	297.97
7051825	016	CON 04	6895 Forestell Rd	562782	4814209	334.91	7/26/2007	Domestic		15.56	10.97	323.94	35.97		36.58	298.34
7106070	014	CON 04		561831	4815042	326.62	5/13/2008	Domestic		15.88	3.66	322.97	37.49		38.71	287.91
7138842	014	CON 04	6827 Forestell Rd	561736	4813973	329.49	11/16/2009	Domestic		16.00	10.66	318.83	33.00		51.80	277.69
7146305	014	CON 04	6848 Forestell Rd	561921	4814212	330.65	3/2/2010	Domestic								
7173629	014	CON 04	6848 Forestell Rd	561923	4814212	330.62	12/5/2011	Abandoned-Other								
7185527	013	CON 04	4677 12 Sideroad	561361	4813891	328.32	7/23/2012	Domestic		15.56	4.88	323.45	17.68		17.68	310.64
7204366	013	CON 04		561475	4813664	329.98	5/8/2013	Domestic		15.24	4.27	325.72	46.33		47.85	282.13

Notes: No well screen information available
All wells in UTM Zone 17
Shaded wells correspond to residences interviewed during the water well surveys

AECOM

Appendix C

Borehole Logs & Monitor Installation Details

GRAPHICS, SYMBOLS AND ABBREVIATIONS ON LOGS

SAMPLE TYPES and TESTS

SS	Split Spoon Sample	
SN	Non-Standard Split Spoon Sample	
ST	Shelby Tube Sample : (unconfined compression or unconsolidated undrained test)	- ✦
DS	Denision Type Sample	
PS	Piston Type Sample	
CS	Continuous Sample	
GS	Grab Sample	
WS	Wash Sample	
BQ	BQ Core Sample	
HQ	HQ Core Sample	
NQ	NQ Core Sample	
DT	Dynamic Penetration Test	
VT	Field Vane Test (undisturbed)	- +
VT	Field Vane Test (remoulded)	- ⊕

PENETRATION RESISTANCES

Standard Penetration Resistance(N Value)

The number of blows by a 63.6 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) Split Spoon Sampler for a distance of 300 mm (12 in.).

ABBREVIATIONS

DTPL: Drier Than Plastic Limit
APL: About Plastic Limit
WTPL: Wetter Than Plasic Limit
K: Hydraulic Conductivity (m/s)
C_u: Undrained Shear Strength (kPa)
% REC : Percentage of Sample Recovered
% RQD : Indirect Measure of the Number of Fractures and Soundness of Rock Mass
Approximate Water Table

GRAIN SIZE CLASSIFICATION

	%
trace, "eg. trace sand"	1 - 10
some, "eg. some sand"	10 - 20
adjective, "eg. sandy"	20 - 35
and, "eg. and sand"	35 - 50
noun, "eg. sand"	>50

Note: Classification Divisions Based on Modified M.I.T. Grain Size Scale

SOIL DESCRIPTIONS

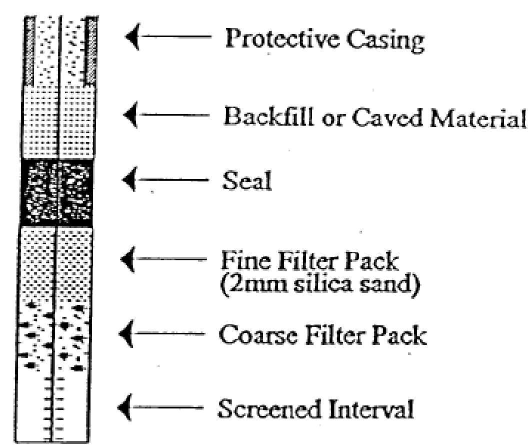
Cohesionless Soils

Relative Density	N Value
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	over 50

Cohesive Soils

Consistency	C_u(kPa)	N Value
Very soft	0 to 12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	over 200	over 30

MONITOR DETAILS



Disclaimer:

Stratigraphic boundaries shown on the attached borehole logs are inferred from non-continuous sampling and therefore represent transitions between soil types rather than exact planes of geological changes. Further, conditions will vary between and beyond the borehole locations.

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BOREHOLE LOG

PROJECT: 99-396

BOREHOLE: 1

Hydrogeological Investigation
Mast Property, Guelph
FOR: CBM

DATE: 18 August 1999
LOGGED BY GJMW
GROUND ELEV 329.60 m ASL

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	SAMPLE NUMBER	TYPE	N VALUE	% WATER	% REC
0.4	**TOPSOIL** Dark brown silty topsoil, some rootlets, moist, compact.	1	SS	11		92
0.7	**SILTY SAND AND GRAVEL FILL** Light brown silty fine sand and gravel, moist, loose.	2	SS	32		58
	GRAVEL Light brown medium to coarse gravel with medium to coarse sand, moist, dense.	3	SS	38		71
		4	SS	60		71
		5	SS	50/ 0.15 m		83
		6	SS	70		71
		7	SS	75		50
	-Changing to grey in colour and becoming wet below about 3.9 m.	8	SS	46		50
	-Becoming saturated below about 4.5 m.	9	SS	45		38
		10	SS	32		46
5.9	**SILT** Light brown silt, some clay, wet, dense.	11	SS	48		92
		12	SS	44		100
7.0	Borehole terminated at 7.01 m in silt.					

N VALUE: 15 30 45 60

WATER CONTENT (%): 10 20 30 40

>>

>>

BOREHOLE LOG

PROJECT: 99-396

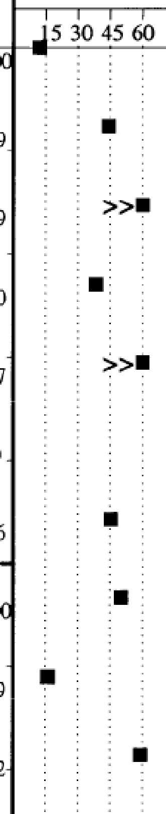
BOREHOLE: 2

Hydrogeological Investigation
Mast Property, Guelph
FOR: CBM

DATE: 18 August 1999
LOGGED BY GJMW
GROUND ELEV 325.93 m ASL

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	WATER LEVEL	SAMPLE NUMBER	TYPE	N VALUE	% WATER	% REC
0.3	**TOPSOIL** Dark brown silty topsoil, moist, loose.		1	SS	12		100
0.9	**SILT** Light brown silt, some clay, moist, loose. -Becoming dark brown below about 0.7 m.		2	SS	44		79
6.6	**GRAVEL** light brown medium to coarse gravel with fine to coarse gravel, moist, dense to very dense. -10 cm brown silt seam encountered at about 1.5 m. -Becoming grey below about 1.6 m. -Becoming saturated below about 3.0 m with increased gravel fraction and very cobbly to about 4.6 m.	∇	3	SS	68		79
			4	SS	38		50
			5	SS	71		17
			6	SS			0
			7	SS	45		96
			8	SS	50		100
			9	SS	16		79
7.5	**SILT** Light brown silt, some clay, wet, very dense.		10	SS	59		92

Borehole terminated at 7.47 m in silt.



WATER CONTENT (%)
10 20 30 40

BOREHOLE LOG

PROJECT: 99-396

BOREHOLE: 3

Hydrogeological Investigation
Mast Property, Guelph
FOR: CBM

DATE: 15 December 1999
LOGGED BY EK
GROUND ELEV 325.65 m ASL

DEPTH (m)	STRATIGRAPHIC DESCRIPTION
0.3	**TOPSOIL** Brown silty topsoil, moist.
0.7	**SILTY SAND** Light brown silty fine sand, trace gravel, moist, loose.
	GRAVEL Brown fine to coarse gravel and cobbles, trace to some medium and coarse sand, moist, dense to very dense. -Becoming saturated below about 1.5 m. -Grading into medium to coarse sand, trace fine sand below about 3.7 m.
4.0	**SAND** Brown fine sand, trace to some medium sand, trace silt, saturated, loose to compact.
7.0	**SILT** Brown silt, trace fine sand, saturated, compact. -Becoming grey below about 9.0 m.
9.8	Borehole terminated at 9.75 m in silt.

Water level: ∇ at approx. 1 m

SAMPLE NUMBER	TYPE	N VALUE	% WATER	% REC
1	SS	7		67
2	SS	53		67
3	SS	44		67
4	SS	31		58
5	SS	29		67
6	SS	38		88
7	SS	11		75
8	SS	21		71
9	SS	42		79
10	SS	35		83

N VALUE: 15 30 45 60

WATER CONTENT (%): 10 20 30 40

BOREHOLE LOG

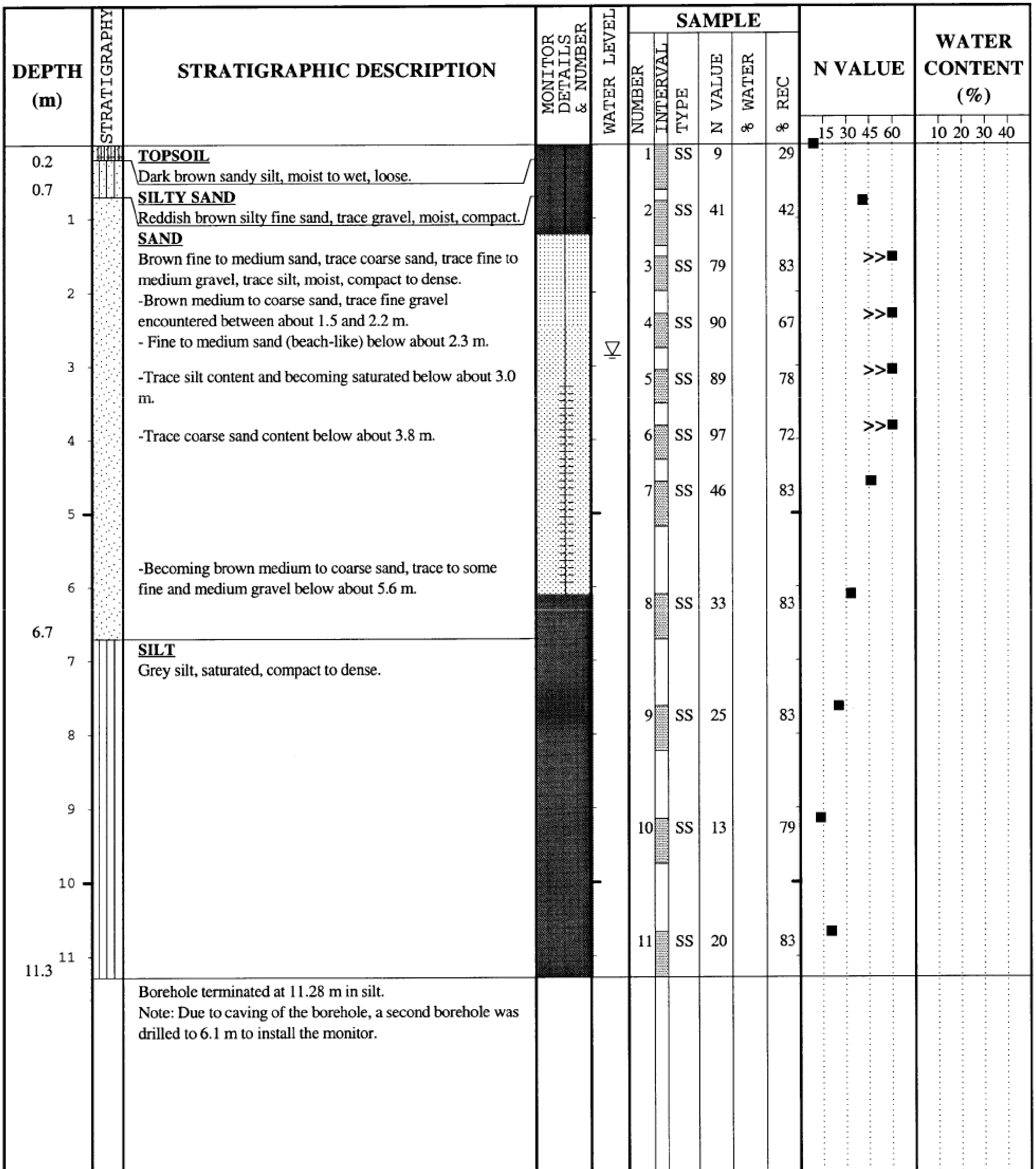
PROJECT: 99-396

BOREHOLE: 4

Hydrogeological Investigation
Mast Property, Guelph
FOR: CBM

DATE: 16 December 1999
LOGGED BY EK
GROUND ELEV 324.42 m ASL

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	SAMPLE NUMBER	TYPE	N VALUE	% WATER	% REC
0.2	**TOPSOIL** Dark brown sandy silt, moist to wet, loose.	1	SS	9		29
0.7	**SILTY SAND** Reddish brown silty fine sand, trace gravel, moist, compact.	2	SS	41		42
	SAND Brown fine to medium sand, trace coarse sand, trace fine to medium gravel, trace silt, moist, compact to dense. -Brown medium to coarse sand, trace fine gravel encountered between about 1.5 and 2.2 m. - Fine to medium sand (beach-like) below about 2.3 m.	3	SS	79		83
		4	SS	90		67
	-Trace silt content and becoming saturated below about 3.0 m.	5	SS	89		78
	-Trace coarse sand content below about 3.8 m.	6	SS	97		72
		7	SS	46		83
	-Becoming brown medium to coarse sand, trace to some fine and medium gravel below about 5.6 m.	8	SS	33		83
6.7	**SILT** Grey silt, saturated, compact to dense.	9	SS	25		83
		10	SS	13		79
11.3		11	SS	20		83
	Borehole terminated at 11.28 m in silt. Note: Due to caving of the borehole, a second borehole was drilled to 6.1 m to install the monitor.					



Printed: 08 Nov 03

Gartner Lee Limited

BOREHOLE LOG	**PROJECT:** 99-396	**BOREHOLE:** 5	

Hydrogeological Investigation Mast Property, Guelph **FOR:** CBM	**DATE:** 16 December 1999 **LOGGED BY** EK **GROUND ELEV** 329.00 m ASL

DEPTH (m)	STRATIGRAPHIC DESCRIPTION
0.2	**TOPSOIL**
	GRAVEL Brown fine to coarse gravel and cobbles with medium and coarse sand, moist, dense to very dense. -Grading into medium to coarse sand with some medium to coarse gravel and becoming saturated below about 3.7 m.
6.9	**SILT** Brown silt, saturated, compact.
8.5	**SANDY SILT** Grey sandy silt, saturated, loose to compact.
12.8	Borehole terminated at 12.80 m in sandy silt.

NUMBER	TYPE	N VALUE	% WATER	% REC
1	SS	5		67
2	SS	14		71
3	SS	37		75
4	SS	19		83
5	SS	14		67
6	SS	12		58
7	SS	17		63
8	SS	15		75
9	SS	45		79
10	SS	56		83
11	SS	17		92

N VALUE: 15 30 45 60

WATER CONTENT (%): 10 20 30 40

Printed: 08 Nov 03

Gartner Lee Limited

BOREHOLE LOG

PROJECT: 23-312

BOREHOLE: 6

Groundwater and Resource Investigation
Snyder Property, Guelph.
FOR: CBM

DATE: 27 May 2003
LOGGED BY BPW
GROUND ELEV 330.27 m ASL

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	SAMPLE NUMBER	TYPE	N VALUE	% WATER	% REC
0	**GRAVELLY SAND** Brown gravelly sand, moist, very dense.					
		1	SS	79		40
		2	SS	102		60
		3	SS	59		50
		4	SS	26		10
		5	SS	54		10
		6	SS	15		0
10.3	**SILTY SAND** Grey silty sand to sandy silt, saturated, hard.	7	SS	43		40
11.3	Borehole terminated at 11.3 m in silty sand.					

N VALUE: 15 30 45 60
WATER CONTENT (%): 10 20 30 40

Gartner Lee Limited

BOREHOLE LOG

PROJECT: 23-312

BOREHOLE: 7

Groundwater and Resource Investigation
Snyder Property, Guelph.
FOR: CBM

DATE: 26 May 2003
LOGGED BY BPW
GROUND ELEV 330.04 m ASL

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	SAMPLE NUMBER	TYPE	N VALUE	% WATER	% REC
0 – 8.5	**SAND AND GRAVEL** Brown sand and gravel, moist, very dense.					
		1	SS	88		50
		2	SS	47		50
	- Becoming a medium to fine sand, some gravel below about 7 m.	3	SS	23		90
8.5 – 9.1	**SANDY SILT** Grey sandy silt, saturated, compact.	4	SS	21		90
9.1	Borehole terminated at 9.1 m in sandy silt.					

Water level: approx. 3 m

BOREHOLE LOG

PROJECT: 23-312	**BOREHOLE:** 8 — 1 of 1
Groundwater and Resource Investigation Snyder Property, Guelph. **FOR:** CBM	**DATE:** 26 May 2003 **LOGGED BY** BPW **GROUND ELEV** 327.74 m ASL

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	SAMPLE NUMBER	TYPE	N VALUE	% WATER	% REC
0	**SANDY TILL** Brown sandy till, moist compact.					
4	- Becoming grey sandy till, saturated, very dense below about 4 m.					
		1	SS	11		60
		2	SS	73		80
		3	SS	50/ 0.08m		25
8.2	Borehole terminated at 8.2 m in sandy till.					

N VALUE scale: 15 30 45 60

WATER CONTENT (%) scale: 10 20 30 40

Printed: 08 Nov 03

Gartner Lee Limited

BOREHOLE LOG

BOREHOLE LOG	**PROJECT:** 60146419	**BOREHOLE:** BH10-I 1 of 1
Mast-Snyder Drilling Investigation Guelph **Client:** St. Marys CBM	**Northing:** N/A **Easting:** N/A **Methodology:** N/A **Contractor:** N/A	**DATE:** June 14, 2010 **LOGGED BY** CRC **GROUND ELEV** N/A m ASL

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	SAMPLE NUMBER	TYPE	N VALUE	% WATER	% REC	% RQD
	TOPSOIL Brown sandy silt topsoil, some angular gravel and stones with rootlets, compact, moist.	1	SS	28		66	
0.6	**SAND AND GRAVEL** Brown medium to coarse silty sand and gravel, some large stones approximately 5 to 8 cm in diameter, dense, saturated.	2	SS	26		57	
		3	SS	26		49	
2.4	**SAND** Brown medium to coarse sand, compact, saturated.	4	SS	25		62	
		5	SS	19		100	
		6	SS	12		100	
		7	SS	22		69	
		8	SS	32		88	
6.5	**SANDY SILT** Brown sandy silt changing to grey sandy silt at approximately 8.5 m, compact to dense, saturated.	9	SS	44		75	
		10	SS	29		100	
9.8	Borehole terminated at 9.75 m in sandy silt.						

N VALUE scale: 15 30 45 60 — WATER CONTENT (%) scale: 10 20 30 40

Printed:May 10, 11
File Location:

AECOM

BOREHOLE LOG

PROJECT: 60146419	**BOREHOLE:** BH10-II	1 of 1

Mast-Snyder Drilling Investigation
Guelph
Client: St. Marys CBM

Northing:	N/A
Easting:	N/A
Methodology:	N/A
Contractor:	N/A

DATE: June 14, 2010
LOGGED BY CRC
GROUND ELEV N/A m ASL

DEPTH (m)	STRATIGRAPHY	STRATIGRAPHIC DESCRIPTION	MONITOR DETAILS & NUMBER	SAMPLE NUMBER	INTERVAL	TYPE	N VALUE	% WATER	% REC	% RQD	N VALUE (15 30 45 60)	WATER CONTENT (%) (10 20 30 40)
0.6		**TOPSOIL** Brown sandy silt topsoil, some angular gravel and stones with rootlets, compact, moist.										
2.4		**SAND AND GRAVEL** Brown medium to coarse silty sand and gravel, some large stones approximately 5 to 8 cm in diameter, dense, saturated.										
4.6		**SAND** Brown medium to coarse sand, compact, saturated.										
		Borehole terminate at 4.57 m in sand. Borehole straight augered with no samples collected. Lithology inferred from borehole BH10-I.										

Depth scale: 1, 2, 3, 4

Printed:May 10, 11
File Location:

AECOM

BOREHOLE LOG

BOREHOLE LOG	PROJECT: 60146419	BOREHOLE: BH11 1 of 1
Mast-Snyder Drilling Investigation	Northing: N/A	DATE: June 14, 2010
Guelph	Easting: N/A	LOGGED BY CRC
Client: St. Marys CBM	Methodology: N/A	GROUND ELEV N/A m ASL
	Contractor: N/A	

DEPTH (m)	STRATIGRAPHY	STRATIGRAPHIC DESCRIPTION	MONITOR DETAILS & NUMBER	SAMPLE NUMBER	INTERVAL	TYPE	N VALUE	% WATER	% REC	% RQD	N VALUE (15 30 45 60)	WATER CONTENT (%) (10 20 30 40)
0.6		**PEAT** Brown peat with grass and rootlets throughout, loose, moist.		1		SS	12		33			
1		**SAND AND GRAVEL** Brown coarse to medium sand and gravel changing to grey at approximately 1.4 m, some stones, compact, saturated.		2		SS	28		100			
2				3		SS	31		100			
2.3		Borehole terminated at 2.29 m in sand and gravel.										

AECOM

BOREHOLE LOG	**PROJECT:** 60146419	**BOREHOLE:** BH9 1 of 1
Mast-Snyder Drilling Investigation Guelph **Client:** St. Marys CBM	**Northing:** N/A **Easting:** N/A **Methodology:** N/A **Contractor:** N/A	**DATE:** June 14, 2010 **LOGGED BY** CRC **GROUND ELEV** N/A m ASL

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	SAMPLE NUMBER	TYPE	N VALUE	% WATER	% REC	% RQD
0.6	**TOPSOIL** Brown sandy silt topsoil, some gravel and rootlets, loose, moist.	1	SS	11		49	
2.3	**SAND** Brown fine to medium sand, dense to very dense, dry becoming moist at approximately 1.5 m.	2	SS	52		100	
		3	SS	49		88	
5.2	**SANDY SILT TILL** Brown sandy silt till, some angular stones and gravel, dense to very dense, saturated.	4	SS	36		49	
		5	SS	24		100	
		6	SS	50		100	
		7	SS	50		50	
	Borehole terminated at 5.18 m in sandy silt till.						

N VALUE scale: 15 30 45 60
WATER CONTENT (%) scale: 10 20 30 40

Printed:May 10, 11
File Location:

AECOM

Monitor Installation Detals

CBM Aggregates Mast-Snyder Property

Monitor	UTM		Ground Elevation	Monitor			Monitor Installation Details															
	Easting	Northing		Type (1)	Stick up	TOP (2) Elevation	Screened Interval				Filter Pack				Sealed Interval				Backfill			
			(mASL)		(m)	(mASL) (3)	(m BG) (4)		(mASL)		(m BG) (4)		(mASL)		(m BG) (4)		(mASL)		(m BG) (4)		(mASL)	
1-I (7)	562057.026	4814324.875	329.60	P	0.94	330.54	4.28	5.80	325.32	323.80	0.60	5.80	329.00	323.80	0.00	0.60	329.60	329.00	5.80	7.01	323.80	322.59
1-II (7)	562057.026	4814324.875	329.60	S	0.82	330.42	2.26	5.31	327.34	324.29	0.60	5.80	329.00	323.80	0.00	0.60	329.60	329.00				
2-I	561576.145	4814562.008	325.93	P	1.00	326.93	4.98	6.50	320.95	319.43	0.60	6.50	325.33	319.43	0.00	0.60	325.93	325.33	6.50	7.47	319.43	318.46
		(5)			0.97	326.90																
2-II	561576.145	4814562.008	325.93	S	0.94	326.87	1.15	4.20	324.78	321.73	0.60	6.50	325.33	319.43	0.00	0.60	325.93	325.33				
3	561903.568	4814891.415	325.65	S	0.81	326.46	2.45	5.50	323.20	320.15	1.30	5.50	324.35	320.15	5.50	6.00	320.15	319.65	6.00	9.75	319.65	315.90
															0.00	1.30	325.65	324.35				
4	561447.491	4815017.093	324.42	S	0.76	325.18	3.25	6.30	321.17	318.12	1.40	6.30	323.02	318.12	6.30	11.28	318.12	313.14				
															0.00	1.40	324.42	323.02				
5	561716.044	4814050.700	329.00	S	0.66	329.66	4.50	7.10	324.50	321.90	1.30	7.10	327.70	321.90	7.10	8.55	321.90	320.45	8.55	12.80	320.45	316.20
															0.00	1.30	329.00	327.70				
6	562106.575	4814135.191	330.27	S	0.53	330.80	4.55	7.60	325.72	322.67	4.20	7.60	326.07	322.67	3.60	4.20	326.67	326.07	0.00	0.50	330.27	329.77
															0.50	0.70	329.77	329.57	7.60	11.30	322.67	318.97
																			0.61	3.60	329.66	326.67
		(6)	336.68		0.57	337.25																
7	562506.329	4814234.246	330.04	S	0.60	330.64	4.55	7.60	325.49	322.44	4.20	7.60	325.84	322.44	3.70	4.20	326.34	325.84	0.00	0.40	330.04	329.64
															0.00	0.40	330.04	329.64	7.60	9.10	322.44	320.94
																			0.80	3.60	329.24	326.44
8	562308.381	4814956.900	327.74	S	0.66	328.40	4.55	7.60	323.19	320.14	4.20	7.60	323.54	320.14	3.60	4.20	324.14	323.54	7.60	8.20	320.14	319.54
															0.35	0.61	327.39	327.13	0.61	3.60	327.13	324.14
																			0.00	0.35	327.74	327.39
9	562143.678	4815167.575	326.21	S	0.87	327.08	1.52	4.57	324.69	321.64	1.22	5.18	324.99	321.03	0.00	1.22	326.21	324.99				
10-I	561679.333	4814664.204	325.82	S	0.87	326.69	7.62	9.14	318.20	316.68	7.32	9.75	318.50	316.07	0.00	7.32	325.82	318.50				
10-II	561679.333	4814664.204	325.86	P	0.90	326.76	1.52	4.57	324.34	321.29	1.22	4.57	324.64	321.29	0.00	1.22	325.86	324.64				
11	562291.514	4814826.592	326.26	S	0.78	327.04	1.52	2.29	324.74	323.97	1.22	2.29	325.04	323.97	0.00	1.22	326.26	325.04				

Notes:
(1) S = standpipes which span the water table, P = Piezometers which monitor deeper aquifers and aquitards
(2) TOP = top of pipe
(3) mASL refers to meters above sea level
(4) m BG = meters below ground surface
(5) Monitor 2-1 PVC cut by 3.175 cm to facilitate casing closure
(6) extension to monitor PVC pipe due to berm construction
diameter monitors
(7) Decommissioned in 2022

Mini-Piezometer Installation Details

St Marys Mast-Snyder Property

Monitor	UTM Easting	UTM Northing	Ground Elevation (mASL)	Type (1)	Stick up (m)	TOP (2) Elevation (mASL) (3)	Screened Interval (m BG) (4)		Screened Interval (mASL)	
MP1	562010.33	4814931.18	324.84	S	0.75	325.59	2.61	3.06	322.23	321.78
MP2-I	561908.74	4814955.04	324.59	D	1.00	325.59	2.44	2.89	322.15	321.70
MP2-II			324.60	S	0.60	325.20	0.82	1.27	323.78	323.33
MP3-I	561637.36	4815016.20	324.11	D	0.11	324.71	2.47	2.92	321.64	321.19
MP3-II			324.04	S	1.00	325.04	1.44	1.89	322.60	322.15
MP4	561601.07	4814728.51	324.25	S	1.36	325.61	0.53	0.98	323.72	323.27
MP4R-2010 (5)			324.25	S	1.38	325.63	1.14	1.44	323.11	322.81
MP4R-2013 (5)			324.73	S	1.66	326.39	1.50	1.90	323.23	322.84
MP4R-2018 (5)	561588.58	4814737.61	324.76	S	0.91	325.67	1.01	1.46	323.75	323.30
MP5	561614.40	4814732.10	324.10	S	1.62	325.72	0.68	1.13	323.42	322.97
MP6	561985.15	4814888.44	325.14	S	0.82	325.96	2.13	2.58	323.01	322.56
MP7	562040.72	4814835.19	325.57	S	0.77	326.34	2.17	2.62	323.40	322.95

Notes:

(1) MP = mini-piezometer which penetrates the shallow water table, S = shallower installation, D = deeper installation

(2) TOP = top of pipe

(3) mASL refers to meters above sea level

(4) m BG = meters below ground surface

(5) destroyed and re-installed

All 25 mm diameter mini-piezometers

AECOM

Appendix D

Groundwater Elevations

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
1-I	330.54	329.60	15-Dec-99	6.13	324.41
			23-Aug-00	5.24	325.30
			27-Oct-00	5.63	324.91
			1-May-01	4.77	325.77
			11-Sep-01	5.69	324.85
			7-Nov-01	5.71	324.83
			28-Jan-02	5.32	325.23
			26-Apr-02	4.45	326.09
			22-Aug-02	5.13	325.41
			24-Oct-02	5.60	324.94
			14-Jan-03	5.83	324.71
			22-Jul-03	5.36	325.18
			3-Sep-03	5.50	325.04
			7-Oct-03	5.50	325.04
			12-Feb-04	4.85	325.69
			19-Apr-04	4.14	326.41
			19-Aug-04	5.04	325.50
			15-Nov-04	5.50	325.04
			9-Feb-05	4.75	325.79
			11-Apr-05	4.23	326.31
			25-Aug-05	5.35	325.19
			8-Nov-05	5.70	324.84
			16-Jan-06	5.22	325.32
			11-Apr-06	4.42	326.12
			17-Aug-06	5.29	325.25
			27-Nov-06	4.96	325.58
			30-Jan-07	4.59	325.96
			9-Apr-07	4.17	326.37
			16-Aug-07	5.28	325.26
			1-Nov-07	5.69	324.85
			6-Jan-08	5.52	325.03
			12-Apr-08	3.66	326.88
			20-Aug-08	4.90	325.65
			18-Nov-08	5.17	325.37
			9-Feb-09	4.59	325.95
			5-Aug-09	4.65	325.89
			2-Dec-09	5.28	325.26
			2-Feb-10	5.07	325.47
			30-Apr-10	4.60	325.95
			1-Sep-10	5.31	325.23
			29-Nov-10	5.58	324.96
			28-Feb-11	5.30	325.24
			24-May-11	4.15	326.39
			30-Aug-11	5.06	325.48
			21-Nov-11	5.38	325.17
			22-Feb-12	4.72	325.82
			4-May-12	4.96	325.58
			8-Aug-12	5.57	324.97
			15-Nov-12	5.57	324.97
			29-Jan-13	5.14	325.40

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
1-I	330.54	329.60	1-May-13	4.13	326.41
			16-Aug-13	4.95	325.59
			20-Nov-13	4.98	325.56
			19-Feb-14	4.92	325.62
			27-May-14	4.24	326.30
			21-Aug-14	5.08	325.46
			25-Nov-14	5.12	325.42
			26-Feb-15	5.20	325.34
			28-May-15	4.88	325.66
			19-Aug-15	5.08	325.46
			30-Nov-15	5.50	325.04
			25-Feb-16	4.95	325.59
			28-Apr-16	4.22	326.32
			12-Sep-16	5.32	325.22
			21-Nov-16	5.60	324.94
			24-Jan-17	4.64	325.90
			17-May-17	3.90	326.64
			28-Aug-17	4.91	325.63
			27-Nov-17	5.33	325.21
			12-Feb-18	5.06	325.48
			7-May-18	4.19	326.35
			20-Aug-18	5.18	325.36
			19-Nov-18	5.34	325.20
			26-Feb-19	4.95	325.59
			16-Apr-19	4.49	326.05
			23-Jul-19	4.68	325.86
			13-Nov-19	5.07	325.47
			10-Feb-20	4.58	325.96
			5-May-20	4.76	325.78
			30-Jul-20	5.10	325.44
			16-Oct-20	5.44	325.10
			22-Jan-21	5.44	325.10
			13-Apr-21	5.19	325.35
			1-Jun-21	5.12	325.42
			14-Jul-21	5.48	325.06
			2-Nov-21	5.75	324.79
			31-Jan-22	5.60	324.94
			4-May-22	Decommissioned	

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
1-II	330.42	329.60	15-Dec-99	6.65	323.77
			23-Aug-00	5.13	325.29
			27-Oct-00	5.52	324.90
			1-May-01	4.66	325.76
			11-Sep-01	5.58	324.84
			7-Nov-01	5.82	324.60
			28-Jan-02	5.42	325.00
			26-Apr-02	4.56	325.87
			22-Aug-02	5.24	325.18
			24-Oct-02	5.60	324.82
			14-Jan-03	5.95	324.47
			22-Apr-03	5.08	325.34
			22-Jul-03	5.26	325.16
			3-Sep-03	5.40	325.03
			7-Oct-03	5.61	324.82
			12-Feb-04	4.75	325.67
			19-Apr-04	4.04	326.38
			19-Aug-04	4.95	325.48
			15-Nov-04	5.39	325.03
			9-Feb-05	4.85	325.57
			11-Apr-05	4.23	326.19
			25-Aug-05	5.25	325.17
			8-Nov-05	5.60	324.82
			16-Jan-06	5.31	325.11
			11-Apr-06	4.52	325.90
			17-Aug-06	5.19	325.23
			27-Nov-06	4.64	325.78
			30-Jan-07	4.69	325.73
			9-Apr-07	4.27	326.15
			16-Aug-07	5.37	325.05
			1-Nov-07	5.79	324.63
			6-Jan-08	5.61	324.81
			12-Apr-08	3.75	326.67
			20-Aug-08	5.01	325.42
			18-Nov-08	5.27	325.15
			9-Feb-09	4.69	325.73
			5-Aug-09	4.74	325.68
			2-Dec-09	5.38	325.04
			2-Feb-10	5.17	325.26
			30-Apr-10	4.70	325.72
			1-Sep-10	5.41	325.01
			29-Nov-10	5.69	324.73
			28-Feb-11	5.40	325.03
			24-May-11	4.05	326.37
			30-Aug-11	5.16	325.26
			21-Nov-11	5.48	324.94
			22-Feb-12	4.82	325.60
			4-May-12	5.06	325.36
			8-Aug-12	5.67	324.75
			15-Nov-12	5.68	324.74

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
1-II	330.42	329.60	29-Jan-13	5.24	325.18
			1-May-13	4.23	326.19
			16-Aug-13	5.06	325.36
			20-Nov-13	5.09	325.33
			19-Feb-14	5.04	325.39
			27-May-14	4.35	326.07
			21-Aug-14	5.18	325.24
			25-Nov-14	5.23	325.19
			26-Feb-15	5.30	325.12
			28-May-15	4.98	325.44
			19-Aug-15	5.18	325.25
			30-Nov-15	5.60	324.82
			25-Feb-16	5.05	325.37
			28-Apr-16	5.53	324.89
			12-Sep-16	5.43	324.99
			21-Nov-16	5.71	324.71
			24-Jan-17	4.75	325.67
			17-May-17	4.00	326.42
			28-Aug-17	5.02	325.40
			27-Nov-17	5.43	324.99
			12-Feb-18	5.16	325.26
			7-May-18	4.30	326.12
			20-Aug-18	5.28	325.14
			19-Nov-18	5.44	324.98
			26-Feb-19	4.84	325.58
			16-Apr-19	4.59	325.83
			23-Jul-19	4.79	325.63
			13-Nov-19	5.17	325.25
			10-Feb-20	4.68	325.74
			5-May-20	4.87	325.55
			30-Jul-20	5.21	325.21
			16-Oct-20	5.55	324.87
			22-Jan-21	5.55	324.87
			13-Apr-21	5.30	325.12
			1-Jun-21	5.23	325.19
			14-Jul-21	5.58	324.84
			2-Nov-21	5.85	324.57
			31-Jan-22	5.72	324.70
			4-May-22	Decommissioned	

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
2-I	326.93	325.93	15-Dec-99	3.39	323.54
			23-Aug-00	2.77	324.16
			27-Oct-00	3.07	323.86
			1-May-01	2.39	324.55
			11-Sep-01	3.14	323.80
			7-Nov-01	3.07	323.86
			28-Jan-02	2.74	324.19
			26-Apr-02	2.21	324.72
			22-Aug-02	2.77	324.17
			24-Oct-02	3.09	323.84
			14-Jan-03	3.27	323.66
			22-Jul-03	2.81	324.12
			3-Sep-03	2.93	324.01
			7-Oct-03	2.98	323.96
			12-Feb-04	2.44	324.50
			19-Apr-04	1.90	325.04
			19-Aug-04	2.66	324.28
			15-Nov-04	2.96	323.97
			9-Feb-05	2.36	324.57
			11-Apr-05	1.93	325.00
			25-Aug-05	2.90	324.03
			8-Nov-05	3.13	323.80
			16-Jan-06	2.68	324.25
			11-Apr-06	2.21	324.72
			17-Aug-06	2.86	324.07
			27-Nov-06	2.44	324.49
			30-Jan-07	2.35	324.59
			9-Apr-07	2.00	324.93
			16-Aug-07	2.96	323.97
			1-Nov-07	3.22	323.71
			6-Jan-08	2.92	324.02
			12-Apr-08	1.54	325.39
			20-Aug-08	2.58	324.35
			18-Nov-08	2.63	324.30
			9-Feb-09	2.32	324.61
			5-Aug-09	2.59	324.34
			2-Dec-09	2.89	324.04
			2-Feb-10	2.68	324.25
			30-Apr-10	2.41	324.53
			1-Sep-10	2.94	323.99
			29-Nov-10	3.08	323.85
	326.90[4]		28-Feb-11	Frozen	
			24-May-11	1.89	325.01
			30-Aug-11	2.77	324.13
			21-Nov-11	2.88	324.02
			22-Feb-12	2.38	324.52
			4-May-12	2.61	324.29
			8-Aug-12	3.10	323.80
			15-Nov-12	2.96	323.94
			29-Jan-13	2.62	324.28

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
2-I	326.90	325.93	1-May-13	1.98	324.92
			16-Aug-13	2.63	324.27
			20-Nov-13	2.56	324.34
			19-Feb-14	2.57	324.33
			27-May-14	2.13	324.77
			21-Aug-14	2.73	324.17
			25-Nov-14	2.58	324.32
			26-Feb-15	2.80	324.10
			28-May-15	2.55	324.35
			19-Aug-15	2.70	324.20
			30-Nov-15	2.95	323.95
			25-Feb-16	2.51	324.39
			28-Apr-16	2.05	324.85
			12-Sep-16	2.90	324.00
			21-Nov-16	3.07	323.83
			24-Jan-17	2.19	324.71
			17-May-17	1.96	324.94
			28-Aug-17	2.60	324.30
			27-Nov-17	2.84	324.06
			12-Feb-18	2.65	324.25
			7-May-18	2.04	324.86
			20-Aug-18	2.82	324.08
			19-Nov-18	2.81	324.09
			26-Feb-19	2.51	324.39
			16-Apr-19	2.03	324.87
			23-Jul-19	2.38	324.52
			20-Nov-19	2.58	324.32
			10-Feb-20	2.18	324.72
			5-May-20	2.41	324.49
			30-Jul-20	2.79	324.11
			16-Oct-20	2.99	323.91
			22-Jan-21	2.75	324.15
			13-Apr-21	2.68	324.22
			1-Jun-21	2.81	324.09
			14-Jul-21	2.89	324.01
			2-Nov-21	2.87	324.03
			31-Jan-22	2.98	323.92
			4-May-22	2.38	324.52
			25-Aug-22	1.44	325.46
			2-Dec-22	3.26	323.64
			19-Apr-23	2.56	324.34
			1-May-23	2.56	324.34
			31-Aug-23	2.68	324.22
			16-Nov-23	2.96	323.94

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
2-II	326.87	325.93	15-Dec-99	3.34	323.53
			23-Aug-00	2.73	324.14
			27-Oct-00	3.03	323.84
			1-May-01	2.34	324.54
			11-Sep-01	3.09	323.78
			7-Nov-01	3.11	323.76
			28-Jan-02	2.78	324.09
			26-Apr-02	2.21	324.66
			22-Aug-02	2.81	324.06
			24-Oct-02	3.14	323.73
			14-Jan-03	3.23	323.64
			22-Apr-03	2.55	324.32
			22-Jul-03	2.77	324.10
			3-Sep-03	2.88	324.00
			7-Oct-03	2.93	323.94
			12-Feb-04	2.39	324.48
			19-Apr-04	1.86	325.01
			19-Aug-04	2.62	324.25
			15-Nov-04	2.92	323.95
			9-Feb-05	2.40	324.47
			11-Apr-05	1.89	324.98
			25-Aug-05	2.86	324.01
			8-Nov-05	3.09	323.78
			16-Jan-06	2.64	324.23
			11-Apr-06	2.17	324.70
			17-Aug-06	2.82	324.05
			27-Nov-06	2.40	324.47
			30-Jan-07	2.31	324.57
			9-Apr-07	1.96	324.91
			16-Aug-07	2.92	323.95
			1-Nov-07	3.18	323.69
			6-Jan-08	2.88	324.00
			12-Apr-08	1.50	325.37
			20-Aug-08	2.62	324.26
			18-Nov-08	2.67	324.20
			9-Feb-09	2.28	324.59
			5-Aug-09	2.56	324.32
			2-Dec-09	2.85	324.02
			2-Feb-10	2.65	324.22
			30-Apr-10	2.37	324.50
			1-Sep-10	2.90	323.97
			29-Nov-10	3.04	323.84
			28-Feb-11	Frozen	
			24-May-11	1.90	324.98
			30-Aug-11	2.77	324.10
			21-Nov-11	2.89	323.99
			22-Feb-12	2.37	324.50
			4-May-12	2.61	324.26
			8-Aug-12	3.09	323.78
			15-Nov-12	2.95	323.92

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)			
2-II	326.87	325.93	29-Jan-13	2.62	324.25
			1-May-13	1.99	324.88
			16-Aug-13	2.63	324.24
			20-Nov-13	2.57	324.31
			19-Feb-14	2.58	324.29
			27-May-14	2.12	324.75
			21-Aug-14	2.73	324.14
			25-Nov-14	2.58	324.29
			26-Feb-15	2.79	324.08
			28-May-15	2.55	324.32
			19-Aug-15	2.70	324.17
			30-Nov-15	2.95	323.92
			25-Feb-16	2.52	324.35
			28-Apr-16	2.04	324.83
			12-Sep-16	2.90	323.97
			21-Nov-16	3.07	323.80
			24-Jan-17	2.19	324.68
			17-May-17	1.94	324.93
			28-Aug-17	2.61	324.27
			27-Nov-17	2.84	324.03
			12-Feb-18	2.64	324.23
			7-May-18	2.04	324.83
			20-Aug-18	2.82	324.05
			19-Nov-18	2.81	324.06
			26-Feb-19	2.49	324.38
			16-Apr-19	2.02	324.85
			23-Jul-19	2.37	324.50
			20-Nov-19	2.56	324.31
			10-Feb-20	2.18	324.69
			5-May-20	2.40	324.47
			30-Jul-20	2.79	324.08
			16-Oct-20	2.99	323.88
			22-Jan-21	2.75	324.12
			13-Apr-21	2.67	324.20
			1-Jun-21	2.80	324.07
			14-Jul-21	2.89	323.98
			2-Nov-21	2.86	324.01
			31-Jan-22	2.97	323.90
			4-May-22	2.38	324.50
			25-Aug-22	1.05	325.82
			2-Dec-22	3.24	323.63
			19-Apr-23	2.55	324.32
			1-May-23	2.55	324.32
			31-Aug-23	2.68	324.19
			16-Nov-23	2.96	323.91

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
3	326.46	325.65	15-Dec-99	2.30	324.16
			23-Aug-00	1.74	324.72
			27-Oct-00	2.01	324.45
			1-May-01	1.44	325.02
			11-Sep-01	2.20	324.27
			7-Nov-01	1.97	324.49
			28-Jan-02	1.51	324.95
			26-Apr-02	1.38	325.08
			22-Aug-02	1.86	324.60
			24-Oct-02	2.09	324.37
			14-Jan-03	2.18	324.28
			22-Apr-03	1.48	324.98
			22-Jul-03	1.82	324.64
			3-Sep-03	1.90	324.57
			7-Oct-03	1.80	324.67
			12-Feb-04	1.41	325.05
			19-Apr-04	1.20	325.27
			19-Aug-04	1.62	324.85
			15-Nov-04	1.75	324.71
			9-Feb-05	1.27	325.19
			11-Apr-05	1.22	325.24
			25-Aug-05	1.77	324.69
			8-Nov-05	2.01	324.45
			16-Jan-06	1.53	324.93
			11-Apr-06	1.31	325.15
			17-Aug-06	1.85	324.61
			27-Nov-06	1.40	325.06
			30-Jan-07	1.37	325.09
			9-Apr-07	1.20	325.26
			16-Aug-07	1.97	324.49
			1-Nov-07	2.16	324.31
			6-Jan-08	1.64	324.83
			12-Apr-08	1.01	325.45
			20-Aug-08	1.54	324.93
			18-Nov-08	1.43	325.03
			9-Feb-09	1.27	325.20
			5-Aug-09	1.55	324.91
			2-Dec-09	1.63	324.83
			2-Feb-10	1.55	324.92
			30-Apr-10	1.43	325.03
			1-Sep-10	1.94	324.52
			29-Nov-10	1.84	324.62
			28-Feb-11	1.36	325.10
			24-May-11	1.20	325.27
			30-Aug-11	1.77	324.69
			21-Nov-11	1.72	324.74
			22-Feb-12	1.36	325.10
			4-May-12	1.50	324.96
			8-Aug-12	2.16	324.30
			15-Nov-12	1.84	324.62

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
3	326.46	325.65	29-Jan-13	1.46	325.00
			1-May-13	1.28	325.18
			16-Aug-13	1.64	324.82
			20-Nov-13	1.50	324.96
			19-Feb-14	1.35	325.11
			27-May-14	1.37	325.09
			21-Aug-14	1.66	324.81
			25-Nov-14	1.34	325.12
			26-Feb-15	1.75	324.71
			28-May-15	1.64	324.82
			19-Aug-15	1.68	324.78
			30-Nov-15	1.82	324.64
			25-Feb-16	1.04	325.42
			28-Apr-16	1.29	325.17
			12-Sep-16	1.85	324.61
			21-Nov-16	2.04	324.42
			24-Jan-17	1.29	325.17
			17-May-17	1.28	325.19
			28-Aug-17	1.63	324.83
			27-Nov-17	1.70	324.76
			12-Feb-18	1.60	324.87
			7-May-18	1.30	325.16
			20-Aug-18	1.89	324.57
			19-Nov-18	1.71	324.75
			26-Feb-19	1.39	325.07
			16-Apr-19	1.10	325.36
			23-Jul-19	1.43	325.03
			13-Nov-19	1.51	324.95
			10-Feb-20	1.33	325.13
			5-May-20	1.47	324.99
			30-Jul-20	1.89	324.57
			16-Oct-20	2.00	324.46
			22-Jan-21	1.69	324.77
			13-Apr-21	1.48	324.98
			1-Jun-21	1.87	324.59
			14-Jul-21	1.87	324.59
			2-Nov-21	1.92	324.54
			31-Jan-22	2.04	324.42
			4-May-22	1.33	325.13
			25-Aug-22	2.14	324.32
			2-Dec-22	2.33	324.13
			19-Apr-23	1.67	324.80
			1-May-23	Inaccesible	
			31-Aug-23	Inaccesible	
			16-Nov-23	Inaccesible	

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
4	325.18	324.42	15-Dec-99	4.18	321.00
			23-Aug-00	3.54	321.64
			27-Oct-00	3.88	321.31
			1-May-01	2.67	322.51
			11-Sep-01	3.92	321.27
			7-Nov-01	3.96	321.22
			28-Jan-02	3.68	321.50
			26-Apr-02	2.44	322.74
			22-Aug-02	3.56	321.63
			24-Oct-02	3.94	321.24
			14-Jan-03	4.16	321.02
			22-Apr-03	3.15	322.03
			22-Jul-03	3.62	321.56
			3-Sep-03	3.72	321.46
			7-Oct-03	3.80	321.39
			12-Feb-04	2.87	322.31
			19-Apr-04	2.14	323.04
			19-Aug-04	3.39	321.79
			15-Nov-04	3.76	321.42
			9-Feb-05	2.95	322.23
			11-Apr-05	2.17	323.01
			25-Aug-05	3.68	321.50
			8-Nov-05	3.93	321.25
			16-Jan-06	3.43	321.75
			11-Apr-06	2.42	322.76
			17-Aug-06	3.57	321.61
			27-Nov-06	2.85	322.33
			30-Jan-07	2.62	322.56
			9-Apr-07	2.20	322.98
			16-Aug-07	3.73	321.45
			1-Nov-07	4.09	321.09
			6-Jan-08	3.93	321.26
			12-Apr-08	1.46	323.73
			20-Aug-08	3.21	321.97
			18-Nov-08	3.37	321.82
			9-Feb-09	2.71	322.47
			5-Aug-09	3.23	321.96
			2-Dec-09	3.70	321.48
			2-Feb-10	3.48	321.71
			30-Apr-10	3.26	321.92
			1-Sep-10	3.70	321.48
			29-Nov-10	3.90	321.28
			28-Feb-11	3.69	321.49
			24-May-11	1.20	323.99
			30-Aug-11	3.55	321.63
			21-Nov-11	3.70	321.49
			22-Feb-12	2.77	322.41
			4-May-12	3.27	321.91
			8-Aug-12	3.89	321.29
			15-Nov-12	3.90	321.28

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
4	325.18	324.42	29-Jan-13	3.52	321.66
			1-May-13	2.04	323.14
			16-Aug-13	3.35	321.83
			20-Nov-13	3.13	322.05
			19-Feb-14	3.21	321.97
			27-May-14	2.36	322.82
			21-Aug-14	3.52	321.66
			25-Nov-14	3.21	321.97
			26-Feb-15	3.61	321.57
			28-May-15	3.27	321.91
			19-Aug-15	3.41	321.77
			30-Nov-15	3.77	321.41
			25-Feb-16	3.22	321.96
			28-Apr-16	2.16	323.02
			12-Sep-16	3.71	321.47
			21-Nov-16	Dry	
			24-Jan-17	2.54	322.64
			17-May-17	2.07	323.11
			28-Aug-17	3.33	321.85
			27-Nov-17	3.72	321.46
			12-Feb-18	3.43	321.75
			7-May-18	2.19	322.99
			20-Aug-18	3.62	321.56
			19-Nov-18	3.77	321.41
			26-Feb-19	3.28	321.90
			16-Apr-19	2.34	322.84
			23-Jul-19	2.93	322.25
			13-Nov-19	3.21	321.97
			10-Feb-20	2.52	322.66
			5-May-20	2.80	322.38
			30-Jul-20	3.57	321.61
			16-Oct-20	3.82	321.36
			22-Jan-21	3.60	321.58
			13-Apr-21	3.31	321.87
			1-Jun-21	3.56	321.62
			14-Jul-21	3.70	321.48
			2-Nov-21	3.71	321.47
			31-Jan-22	3.73	321.45
			4-May-22	3.82	321.36
			25-Aug-22	3.86	321.32
			2-Dec-22	4.06	321.12
			19-Apr-23	3.16	322.03
			1-May-23	3.13	322.06
			31-Aug-23	3.49	321.69
			16-Nov-23	3.84	321.34

Table D1. Summary of Groundwater Elevations

Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
5	329.66	329.00	15-Dec-99	5.98	323.68
			23-Aug-00	4.98	324.68
			27-Oct-00	5.42	324.24
			1-May-01	4.55	325.12
			11-Sep-01	5.47	324.20
			7-Nov-01	5.63	324.03
			28-Jan-02	5.31	324.36
			26-Apr-02	4.37	325.30
			22-Aug-02	5.18	324.49
			24-Oct-02	5.52	324.14
			14-Jan-03	5.80	323.86
			22-Apr-03	5.04	324.62
			22-Jul-03	5.12	324.54
			3-Sep-03	5.29	324.38
			7-Oct-03	5.39	324.28
			12-Feb-04	2.49	327.18
			19-Apr-04	3.95	325.71
			19-Aug-04	4.94	324.72
			15-Nov-04	5.40	324.26
			9-Feb-05	4.74	324.92
			11-Apr-05	4.05	325.61
			25-Aug-05	5.21	324.45
			8-Nov-05	5.57	324.09
			16-Jan-06	5.26	324.40
			11-Apr-06	4.60	325.06
			17-Aug-06	5.23	324.43
			27-Nov-06	5.06	324.60
			30-Jan-07	4.88	324.79
			9-Apr-07	4.52	325.15
			16-Aug-07	5.38	324.28
			1-Nov-07	5.70	323.96
			6-Jan-08	5.56	324.10
			12-Apr-08	3.95	325.71
			20-Aug-08	4.96	324.71
			18-Nov-08	5.19	324.47
			9-Feb-09	4.70	324.96
			5-Aug-09	4.92	324.74
			2-Dec-09	5.30	324.37
			2-Feb-10	5.07	324.59
			30-Apr-10	4.95	324.71
			1-Sep-10	5.31	324.35
			29-Nov-10	5.52	324.14
			28-Feb-11	5.25	324.41
			24-May-11	4.31	325.35
			30-Aug-11	5.17	324.49
			21-Nov-11	5.37	324.29
			22-Feb-12	4.80	324.86
			4-May-12	5.04	324.62
			8-Aug-12	5.54	324.12
			15-Nov-12	5.50	324.16

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
5	329.66	329.00	29-Jan-13	5.10	324.56
			1-May-13	4.29	325.37
			16-Aug-13	4.95	324.71
			20-Nov-13	4.95	324.71
			19-Feb-14	4.85	324.81
			27-May-14	5.02	324.64
			21-Aug-14	5.07	324.59
			25-Nov-14	5.06	324.60
			26-Feb-15	5.10	324.56
			28-May-15	4.87	324.79
			19-Aug-15	5.00	324.66
			30-Nov-15	5.41	324.25
			25-Feb-16	4.83	324.83
			28-Apr-16	4.21	325.45
			12-Sep-16	5.25	324.41
			21-Nov-16	5.55	324.11
			24-Jan-17	4.58	325.08
			17-May-17	4.04	325.62
			28-Aug-17	4.90	324.76
			27-Nov-17	5.24	324.42
			12-Feb-18	4.95	324.71
			7-May-18	4.21	325.45
			20-Aug-18	5.16	324.50
			19-Nov-18	5.28	324.38
			26-Feb-19	4.71	324.95
			16-Apr-19	4.40	325.26
			23-Jul-19	4.68	324.98
			13-Nov-19	4.96	324.70
			10-Feb-20	4.45	325.21
			5-May-20	4.66	325.00
			30-Jul-20	5.19	324.47
			16-Oct-20	5.49	324.17
			22-Jan-21	5.25	324.41
			13-Apr-21	5.01	324.65
			1-Jun-21	5.17	324.49
			14-Jul-21	5.37	324.29
			2-Nov-21	5.45	324.21
			31-Jan-22	5.37	324.29
			4-May-22	4.58	325.08
			25-Aug-22	5.52	324.14
			2-Dec-22	6.07	323.59
			19-Apr-23	4.81	324.85
			1-May-23	4.71	324.95
			31-Aug-23	4.97	324.69
			16-Nov-23	5.29	324.37

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
6	330.80	330.27	22-Jul-03	5.39	325.41
			3-Sep-03	5.56	325.25
			7-Oct-03	5.69	325.12
			12-Feb-04	Inaccessible	
			19-Apr-04	4.10	326.71
			19-Aug-04	5.07	325.74
			15-Nov-04	5.57	325.23
			9-Feb-05	4.89	325.91
			11-Apr-05	4.24	326.56
			25-Aug-05	5.39	325.41
			8-Nov-05	5.77	325.03
			16-Jan-06	5.44	325.36
			11-Apr-06	4.54	326.26
			17-Aug-06	5.32	325.48
			27-Nov-06	inaccessable	
			30-Jan-07	4.71	326.09
			9-Apr-07	4.28	326.52
			16-Aug-07	5.41	325.39
			1-Nov-07	5.87	324.94
			6-Jan-08	5.75	325.06
			12-Apr-08	3.75	327.05
			20-Aug-08	5.03	325.78
			18-Nov-08	5.38	325.42
			9-Feb-09	4.74	326.06
			5-Aug-09	4.90	325.90
			2-Dec-09	5.30	325.51
			2-Feb-10	5.24	325.56
			30-Apr-10	4.94	325.87
			1-Sep-10	5.47	325.33
			29-Nov-10	5.78	325.02
			28-Feb-11	5.52	325.29
			24-May-11	4.31	326.49
			30-Aug-11	5.20	325.60
			21-Nov-11	7.57	323.23
			22-Feb-12	4.87	325.93
			4-May-12	5.11	325.69
			8-Aug-12	5.64	325.16
			15-Nov-12	5.81	324.99
			29-Jan-13	5.34	325.46
			1-May-13	4.23	326.57
			16-Aug-13	5.09	325.71
			20-Nov-13	5.19	325.61
			19-Feb-14	5.10	325.70
			27-May-14	4.34	326.46
			21-Aug-14	5.24	325.56
			25-Nov-14	5.34	325.46
			26-Feb-15	5.36	325.44
			28-May-15	5.03	325.77
			19-Aug-15	5.23	325.57
			30-Nov-15	5.70	325.10
			25-Feb-16	5.14	325.66

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
6	330.80	330.27	28-Apr-16	4.20	326.60
			12-Sep-16	5.56	325.24
			21-Nov-16	5.81	324.99
			24-Jan-17	4.86	325.94
			17-May-17	3.96	326.84
			28-Aug-17	5.05	325.75
			27-Nov-17	5.54	325.26
			12-Feb-18	5.23	325.57
			7-May-18	4.30	326.50
			20-Aug-18	5.33	325.47
	337.25	336.68	19-Nov-18	12.09	325.16
			26-Feb-19	11.55	325.70
			16-Apr-19	11.17	326.08
			23-Jul-19	11.33	325.92
			13-Nov-19	11.79	325.46
			10-Feb-20	11.60	325.65
			5-May-20	11.48	325.77
			30-Jul-20	11.85	325.40
			16-Oct-20	12.18	325.07
			22-Jan-21	12.20	325.05
			13-Apr-21	11.94	325.31
			1-Jun-21	11.88	325.37
			14-Jul-21	12.18	325.07
			2-Nov-21	12.46	324.79
			31-Jan-22	12.25	325.00
			4-May-22	11.36	325.90
			25-Aug-22	12.20	325.05
			2-Dec-22	12.63	324.62
			19-Apr-23	12.12	325.13
			1-May-23	12.06	325.20
			31-Aug-23	12.23	325.02
			16-Nov-23	12.39	324.86

Table D1. Summary of Groundwater Elevations

Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
7	330.64	330.04	22-Jul-03	4.81	325.83
			3-Sep-03	4.96	325.68
			7-Oct-03	5.08	325.57
			12-Feb-04	4.25	326.39
			19-Apr-04	3.47	327.17
			19-Aug-04	4.39	326.26
			15-Nov-04	4.90	325.74
			9-Feb-05	4.29	326.35
			11-Apr-05	3.66	326.98
			25-Aug-05	4.73	325.91
			8-Nov-05	5.11	325.53
			16-Jan-06	4.85	325.79
			11-Apr-06	3.88	326.76
			17-Aug-06	4.65	325.99
			27-Nov-06	4.42	326.22
			30-Jan-07	4.03	326.61
			9-Apr-07	3.58	327.07
			16-Aug-07	4.70	325.94
			1-Nov-07	5.19	325.46
			6-Jan-08	5.11	325.54
			12-Apr-08	3.14	327.50
			20-Aug-08	4.35	326.29
			18-Nov-08	4.71	325.93
			9-Feb-09	4.07	326.58
			5-Aug-09	4.23	326.41
			2-Dec-09	4.45	326.19
			2-Feb-10	4.60	326.04
			30-Apr-10	4.05	326.59
			1-Sep-10	4.79	325.85
			29-Nov-10	4.89	325.75
			28-Feb-11	4.90	325.74
			24-May-11	3.54	327.10
			30-Aug-11	4.47	326.17
			21-Nov-11	4.90	325.74
			22-Feb-12	4.21	326.44
			4-May-12	4.42	326.22
			8-Aug-12	5.06	325.58
			15-Nov-12	5.17	325.47
			29-Jan-13	4.75	325.89
			1-May-13	3.53	327.11
			16-Aug-13	4.41	326.23
			20-Nov-13	4.53	326.11
			19-Feb-14	4.45	326.19
			27-May-14	3.64	327.01
			21-Aug-14	4.53	326.11
			25-Nov-14	4.65	325.99
			26-Feb-15	4.72	325.92
			28-May-15	4.38	326.26
			19-Aug-15	4.57	326.07
			30-Nov-15	5.05	325.59
			25-Feb-16	4.55	326.09

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
7	330.64	330.04	28-Apr-16	3.51	327.13
			12-Sep-16	4.82	325.82
			21-Nov-16	5.15	325.49
			24-Jan-17	4.32	326.32
			17-May-17	3.25	327.39
			28-Aug-17	4.36	326.28
			27-Nov-17	4.87	325.77
			12-Feb-18	4.64	326.00
			7-May-18	3.65	326.99
			20-Aug-18	4.65	325.99
			19-Nov-18	4.94	325.70
			26-Feb-19	4.41	326.23
			16-Apr-19	4.01	326.63
			23-Jul-19	4.13	326.51
			13-Nov-19	4.80	325.84
			10-Feb-20	4.28	326.36
			5-May-20	4.52	326.12
			30-Jul-20	4.92	325.72
			16-Oct-20	5.20	325.44
			22-Jan-21	5.28	325.36
			13-Apr-21	5.03	325.61
			1-Jun-21	4.94	325.70
			14-Jul-21	5.22	325.42
			2-Nov-21	5.53	325.11
			31-Jan-22	5.28	325.36
			4-May-22	4.52	326.12
			25-Aug-22	5.32	325.32
			2-Dec-22	5.75	324.89
			19-Apr-23	5.21	325.43
			1-May-23	5.15	325.49
			31-Aug-23	5.35	325.29
			16-Nov-23	5.53	325.11

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
8	328.40	327.74	22-Jul-03	2.90	325.50
			3-Sep-03	2.97	325.44
			7-Oct-03	2.90	325.50
			12-Feb-04	2.49	325.92
			19-Apr-04	2.04	326.36
			19-Aug-04	2.59	325.81
			15-Nov-04	2.76	325.64
			9-Feb-05	2.34	326.06
			11-Apr-05	1.99	326.41
			25-Aug-05	2.77	325.63
			8-Nov-05	3.02	325.38
			16-Jan-06	2.57	325.83
			11-Apr-06	2.19	326.21
			17-Aug-06	2.80	325.60
			27-Nov-06	2.37	326.03
			30-Jan-07	2.29	326.11
			9-Apr-07	2.00	326.41
			16-Aug-07	2.87	325.53
			1-Nov-07	3.13	325.27
			6-Jan-08	2.73	325.68
			12-Apr-08	1.78	326.63
			20-Aug-08	2.58	325.82
			18-Nov-08	2.41	326.00
			9-Feb-09	2.16	326.24
			5-Aug-09	2.43	325.98
			2-Dec-09	2.60	325.80
			2-Feb-10	2.54	325.86
			30-Apr-10	2.31	326.09
			1-Sep-10	2.88	325.52
			29-Nov-10	2.85	325.55
			28-Feb-11	2.59	325.82
			24-May-11	1.93	326.47
			30-Aug-11	2.68	325.72
			21-Nov-11	2.74	325.67
			22-Feb-12	2.34	326.06
			4-May-12	2.51	325.89
			8-Aug-12	3.13	325.27
			15-Nov-12	2.87	325.53
			29-Jan-13	2.62	325.78
			1-May-13	2.02	326.38
			16-Aug-13	2.62	325.78
			20-Nov-13	2.47	325.93
			19-Feb-14	2.56	325.84
			27-May-14	2.15	326.25
			21-Aug-14	2.64	325.76
			25-Nov-14	3.26	325.14
			26-Feb-15	2.75	325.65
			28-May-15	2.62	325.78
			19-Aug-15	2.67	325.73
			30-Nov-15	2.56	325.84
			25-Feb-16	2.46	325.94

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
8	328.40	327.74	28-Apr-16	2.07	326.33
			12-Sep-16	2.82	325.58
			21-Nov-16	3.03	325.37
			24-Jan-17	1.12	327.28
			17-May-17	2.01	326.39
			28-Aug-17	2.57	325.83
			27-Nov-17	2.69	325.71
			12-Feb-18	2.59	325.81
			7-May-18	2.02	326.38
			20-Aug-18	2.81	325.59
			19-Nov-18	2.74	325.66
			26-Feb-19	2.41	325.99
			16-Apr-19	2.00	326.40
			23-Jul-19	2.40	326.00
			13-Nov-19	2.47	325.93
			10-Feb-20	2.29	326.11
			5-May-20	2.39	326.01
			30-Jul-20	2.88	325.52
			16-Oct-20	3.07	325.33
			22-Jan-21	2.74	325.66
			13-Apr-21	2.53	325.87
			1-Jun-21	2.89	325.51
			14-Jul-21	2.96	325.44
			2-Nov-21	3.27	325.13
			31-Jan-22	3.22	325.18
			4-May-22	2.53	325.87
			25-Aug-22	3.31	325.09
			2-Dec-22	3.55	324.85
			19-Apr-23	2.88	325.52
			1-May-23	Inaccessible	
			31-Aug-23	Inaccessible	
			16-Nov-23	Inaccessible	

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
9	327.08	326.21	1-Sep-10	3.44	323.64
			29-Nov-10	3.26	323.82
			28-Feb-11	3.16	323.92
			24-May-11	2.18	324.91
			30-Aug-11	3.52	323.56
			21-Nov-11	3.34	323.74
			22-Feb-12	2.74	324.34
			4-May-12	3.09	323.99
			8-Aug-12	3.66	323.43
			15-Nov-12	3.27	323.81
			29-Jan-13	2.85	324.23
			1-May-13	2.44	324.64
			16-Aug-13	3.34	323.75
			20-Nov-13	2.94	324.14
			19-Feb-14	2.99	324.10
			27-May-14	2.66	324.42
			21-Aug-14	3.53	323.55
			25-Nov-14	3.25	323.83
			26-Feb-15	3.37	323.71
			28-May-15	3.17	323.91
			19-Aug-15	3.40	323.68
			30-Nov-15	3.46	323.62
			25-Feb-16	2.83	324.25
			28-Apr-16	inaccessible	
			12-Sep-16	3.58	323.50
			21-Nov-16	3.69	323.39
			24-Jan-17	2.41	324.67
			17-May-17	2.49	324.60
			28-Aug-17	3.49	323.59
			27-Nov-17	3.50	323.58
			12-Feb-18	3.52	323.56
			7-May-18	2.43	324.65
			20-Aug-18	3.73	323.35
			19-Nov-18	3.48	323.60
			26-Feb-19	3.15	323.93
			16-Apr-19	2.64	324.44
			23-Jul-19	3.27	323.81
			13-Nov-19	3.27	323.81
			10-Feb-20	2.60	324.48
			5-May-20	2.91	324.17
			30-Jul-20	3.53	323.55
			16-Oct-20	3.75	323.33
			22-Jan-21	2.99	324.09
			13-Apr-21	2.68	324.40
			1-Jun-21	3.23	323.85
			14-Jul-21	3.23	323.85
			2-Nov-21	2.91	324.17
			31-Jan-22	3.14	323.94
			4-May-22	2.81	324.27
			25-Aug-22	3.86	323.22
			2-Dec-22	4.60	322.48
			19-Apr-23	2.56	324.52
			1-May-23	Inaccesible	
			31-Aug-23	Inaccesible	
			16-Nov-23	Inaccesible	

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
10-I	326.69	325.82	1-Sep-10	2.35	324.34
			29-Nov-10	2.46	324.23
			28-Feb-11	2.11	324.58
			24-May-11	1.41	325.28
			30-Aug-11	2.19	324.51
			21-Nov-11	2.29	324.40
			22-Feb-12	1.76	324.93
			4-May-12	1.99	324.70
			8-Aug-12	2.57	324.13
			15-Nov-12	2.39	324.30
			29-Jan-13	2.02	324.67
			1-May-13	1.48	325.21
			16-Aug-13	2.05	324.64
			20-Nov-13	1.98	324.71
			19-Feb-14	1.96	324.73
			27-May-14	1.59	325.11
			21-Aug-14	2.13	324.56
			25-Nov-14	1.93	324.76
			26-Feb-15	2.20	324.49
			28-May-15	1.98	324.71
			19-Aug-15	2.11	324.58
			30-Nov-15	2.36	324.33
			25-Feb-16	1.89	324.80
			28-Apr-16	1.50	325.19
			12-Sep-16	2.33	324.36
			21-Nov-16	2.52	324.17
			24-Jan-17	1.62	325.07
			17-May-17	1.44	325.25
			28-Aug-17	2.01	324.68
			27-Nov-17	2.24	324.45
			12-Feb-18	2.03	324.66
			7-May-18	1.49	325.20
			20-Aug-18	2.30	324.39
			19-Nov-18	2.24	324.45
			26-Feb-19	1.88	324.81
			16-Apr-19	1.46	325.23
			23-Jul-19	1.77	324.92
			13-Nov-19	1.98	324.71
			10-Feb-20	1.60	325.09
			5-May-20	1.79	324.90
			30-Jul-20	2.23	324.46
			16-Oct-20	2.43	324.26
			22-Jan-21	2.17	324.52
			13-Apr-21	2.04	324.65
			1-Jun-21	2.24	324.45
			14-Jul-21	2.32	324.37
			2-Nov-21	2.31	324.38
			31-Jan-22	2.42	324.27
			4-May-22	1.79	324.91
			25-Aug-22	2.40	324.29
			2-Dec-22	2.73	323.96
			19-Apr-23	2.03	324.66
			1-May-23	1.99	324.70
			31-Aug-23	2.14	324.55
			16-Nov-23	2.41	324.28

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
10-II	326.76	325.86	1-Sep-10	2.38	324.38
			29-Nov-10	2.49	324.27
			28-Feb-11	2.14	324.62
			24-May-11	1.45	325.31
			30-Aug-11	2.22	324.54
			21-Nov-11	2.33	324.43
			22-Feb-12	1.80	324.96
			4-May-12	2.03	324.73
			8-Aug-12	2.61	324.15
			15-Nov-12	2.43	324.33
			29-Jan-13	2.06	324.70
			1-May-13	1.52	325.24
			16-Aug-13	2.09	324.67
			20-Nov-13	2.00	324.76
			19-Feb-14	2.01	324.75
			27-May-14	1.63	325.13
			21-Aug-14	2.18	324.58
			25-Nov-14	1.97	324.79
			26-Feb-15	2.28	324.48
			28-May-15	2.04	324.72
			19-Aug-15	2.18	324.58
			30-Nov-15	2.43	324.33
			25-Feb-16	1.96	324.80
			28-Apr-16	1.57	325.19
			12-Sep-16	2.40	324.36
			21-Nov-16	2.59	324.17
			24-Jan-17	1.70	325.06
			17-May-17	1.54	325.23
			28-Aug-17	2.10	324.67
			27-Nov-17	2.32	324.44
			12-Feb-18	2.13	324.63
			7-May-18	1.59	325.17
			20-Aug-18	2.35	324.41
			19-Nov-18	2.30	324.46
			26-Feb-19	1.98	324.78
			16-Apr-19	1.58	325.18
			23-Jul-19	1.88	324.88
			13-Nov-19	2.04	324.72
			10-Feb-20	1.71	325.05
			5-May-20	1.90	324.86
			30-Jul-20	2.33	324.43
			16-Oct-20	2.53	324.23
			22-Jan-21	2.27	324.49
			13-Apr-21	2.15	324.61
			1-Jun-21	2.34	324.42
			14-Jul-21	2.43	324.33
			2-Nov-21	2.42	324.34
			31-Jan-22	2.53	324.23
			4-May-22	1.90	324.87
			25-Aug-22	2.52	324.24
			2-Dec-22	2.84	323.92
			19-Apr-23	2.15	324.61
			1-May-23	Inaccessible	
			31-Aug-23	Inaccessible	
			16-Nov-23	Inaccessible	

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
11	327.04	326.26	1-Sep-10	1.46	325.59
			29-Nov-10	1.45	325.59
			28-Feb-11	1.71	325.33
			24-May-11	0.58	326.46
			30-Aug-11	1.27	325.78
			21-Nov-11	1.33	325.71
			22-Feb-12	0.96	326.08
			4-May-12	1.10	325.94
			8-Aug-12	1.72	325.32
			15-Nov-12	1.47	325.57
			29-Jan-13	1.21	325.83
			1-May-13	0.64	326.40
			16-Aug-13	1.21	325.83
			20-Nov-13	1.09	325.95
			19-Feb-14	1.16	325.88
			27-May-14	0.74	326.30
			21-Aug-14	1.21	325.83
			25-Nov-14	0.90	326.14
			26-Feb-15	1.37	325.67
			28-May-15	1.24	325.81
			19-Aug-15	1.28	325.76
			30-Nov-15	1.46	325.58
			25-Feb-16	1.09	325.95
			28-Apr-16	0.69	326.35
			12-Sep-16	1.43	325.61
			21-Nov-16	1.64	325.40
			24-Jan-17	0.77	326.27
			17-May-17	0.64	326.40
			28-Aug-17	1.19	325.86
			27-Nov-17	1.31	325.73
			12-Feb-18	1.24	325.81
			7-May-18	0.79	326.25
			20-Aug-18	1.42	325.62
			19-Nov-18	1.39	325.65
			26-Feb-19	1.05	325.99
			16-Apr-19	0.70	326.34
			23-Jul-19	1.05	325.99
			13-Nov-19	1.13	325.91
			10-Feb-20	0.95	326.09
			5-May-20	1.04	326.00
			30-Jul-20	1.53	325.51
			16-Oct-20	1.70	325.34
			22-Jan-21	1.40	325.64
			13-Apr-21	1.21	325.83
			1-Jun-21	1.54	325.50
			14-Jul-21	1.63	325.41
			2-Nov-21	2.03	325.02
			31-Jan-22	1.91	325.13
			4-May-22	1.21	325.83
			25-Aug-22	2.01	325.03
			2-Dec-22	2.22	324.82
			19-Apr-23	1.59	325.46
			1-May-23	1.56	325.48
			31-Aug-23	1.73	325.31
			16-Nov-23	1.97	325.07

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP1	325.59	324.84	3-Sep-03	0.74	324.85
			5-Sep-03	0.74	324.85
			15-Sep-03	0.75	324.85
			7-Oct-03	0.66	324.94
			12-Feb-04	0.40	325.19
			19-Apr-04	0.30	325.30
			19-Aug-04	0.51	325.08
			15-Nov-04	0.57	325.02
			9-Feb-05	frozen	-
			11-Apr-05	0.29	325.30
			25-Aug-05	0.62	324.97
			8-Nov-05	0.86	324.73
			16-Jan-06	0.45	325.15
			11-Apr-06	0.35	325.24
			17-Aug-06	0.72	324.87
			27-Nov-06	0.42	325.17
			30-Jan-07	0.37	325.23
			9-Apr-07	0.30	325.29
			16-Aug-07	0.83	324.77
			1-Nov-07	1.01	324.58
			6-Jan-08	0.64	324.96
			12-Apr-08	0.25	325.34
			20-Aug-08	0.43	325.16
			18-Nov-08	0.71	324.88
			9-Feb-09	0.64	324.95
			5-Aug-09	0.45	325.14
			2-Dec-09	0.68	324.91
			2-Feb-10	0.44	325.16
			30-Apr-10	0.54	325.05
			1-Sep-10	0.80	324.79
			29-Nov-10	0.67	324.92
			28-Feb-11	Frozen	
			24-May-11	0.23	325.37
			30-Aug-11	0.48	325.11
			21-Nov-11	0.54	325.05
			22-Feb-12	0.47	325.12
			4-May-12	0.58	325.01
			8-Aug-12	1.02	324.57
			15-Nov-12	0.66	324.93
			29-Jan-13	0.58	325.01
			1-May-13	0.30	325.29
			16-Aug-13	0.51	325.08
			20-Nov-13	0.36	325.24
			19-Feb-14	0.46	325.13
			27-May-14	0.55	325.04
			21-Aug-14	0.56	325.03
			25-Nov-14	0.38	325.21
			26-Feb-15	frozen	
			28-May-15	0.51	325.08
			19-Aug-15	0.51	325.08
			30-Nov-15	0.65	324.94

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP1	325.59	324.84	25-Feb-16	0.38	325.21
			28-Apr-16	0.33	325.26
			12-Sep-16	0.66	324.93
			21-Nov-16	0.89	324.70
			24-Jan-17	0.32	325.27
			17-May-17	0.31	325.28
			28-Aug-17	0.50	325.09
			27-Nov-17	0.54	325.05
			12-Feb-18	0.40	325.19
			7-May-18	0.26	325.33
			20-Aug-18	0.79	324.80
			19-Nov-18	0.68	324.91
			26-Feb-19	0.37	325.22
			16-Apr-19	0.40	325.19
			23-Jul-19	0.45	325.14
			13-Nov-19	0.55	325.04
			10-Feb-20	0.47	325.12
			5-May-20	0.52	325.07
			30-Jul-20	0.81	324.78
			16-Oct-20	0.98	324.61
			22-Jan-21	0.67	324.92
			13-Apr-21	0.59	325.00
			1-Jun-21	0.61	324.98
			14-Jul-21	0.76	324.83
			2-Nov-21	0.75	324.84
			31-Jan-22	frozen	
			4-May-22	0.38	325.21
			25-Aug-22	0.92	324.67
			2-Dec-22	1.14	324.45
			19-Apr-23	0.56	325.03
			1-May-23	Inaccessible	
			31-Aug-23	Inaccessible	
			16-Nov-23	0.92	324.67

Table D1. Summary of Groundwater Elevations

Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP1 (outside)[1]	325.59	324.84	3-Sep-03	0.66	324.93
			5-Sep-03	0.69	324.90
			15-Sep-03	dry	
			7-Oct-03	0.55	325.04
			12-Feb-04	frozen	
			19-Apr-04	0.43	325.16
			19-Aug-04	0.52	325.07
			15-Nov-04	0.53	325.06
			9-Feb-05	frozen	
			11-Apr-05	0.42	325.18
			25-Aug-05	0.58	325.01
			8-Nov-05	dry	
			16-Jan-06	frozen	
			11-Apr-06	0.43	325.16
			17-Aug-06	0.66	324.93
			27-Nov-06	0.45	325.14
			30-Jan-07	frozen	
			9-Apr-07	0.43	325.16
			16-Aug-07	dry	
			1-Nov-07	dry	
			6-Jan-08	frozen	
			12-Apr-08	0.35	325.24
			20-Aug-08	0.53	325.06
			18-Nov-08	0.50	325.09
			9-Feb-09	0.48	325.11
			5-Aug-09	0.49	325.10
			2-Dec-09	0.64	324.95
			2-Feb-10	0.43	325.16
			30-Apr-10	0.53	325.06
			1-Sep-10	0.70	324.89
			29-Nov-10	0.65	324.94
			28-Feb-11	frozen	
			24-May-11	0.38	325.21
			30-Aug-11	0.56	325.03
			21-Nov-11	0.54	325.06
			22-Feb-12	0.51	325.08
			4-May-12	0.60	324.99
			8-Aug-12	0.75	324.84
			15-Nov-12	0.63	324.96
			29-Jan-13	frozen	
			1-May-13	0.44	325.15
			16-Aug-13	0.54	325.05
			20-Nov-13	frozen	
			19-Feb-14	frozen	
			27-May-14	0.63	324.97
			21-Aug-14	0.51	325.08
			25-Nov-14	0.43	325.16
			26-Feb-15	frozen	
			28-May-15	0.50	325.09
			19-Aug-15	0.53	325.06
			30-Nov-15	0.60	324.99

Table D1. Summary of Groundwater Elevations

Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP1	325.59	324.84	25-Feb-16	0.45	325.14
(outside)[1]			28-Apr-16	0.45	325.14
			12-Sep-16	0.63	324.96
			21-Nov-16	dry	
			24-Jan-17	0.45	325.14
			17-May-17	0.41	325.18
			28-Aug-17	0.54	325.05
			27-Nov-17	0.54	325.05
			12-Feb-18	frozen	
			7-May-18	0.41	325.18
			20-Aug-18	dry	
			19-Nov-18	0.48	325.11
			26-Feb-19	frozen	
			16-Apr-19	0.41	325.18
			23-Jul-19	0.46	325.13
			13-Nov-19	0.48	325.11
			10-Feb-20	0.43	325.16
			5-May-20	0.44	325.15
			30-Jul-20	dry	
			16-Oct-20	dry	
			22-Jan-21	frozen	
			13-Apr-21	0.49	325.10
			1-Jun-21	0.66	324.93
			14-Jul-21	0.63	324.96
			2-Nov-21	0.76	324.83
			31-Jan-22	frozen	
			4-May-22	0.46	325.13
			25-Aug-22	dry	
			2-Dec-22	moist	
			19-Apr-23	1.21	324.38
			1-May-23	Inaccesible	
			31-Aug-23	Inaccesible	
			16-Nov-23	moist	

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP2-I	325.59	324.59	3-Sep-03	1.59	324.00
			5-Sep-03	0.98	324.61
			15-Sep-03	1.05	324.54
			7-Oct-03	0.83	324.76
			12-Feb-04	0.03	325.56
			19-Apr-04	0.43	325.16
			19-Aug-04	0.74	324.86
			15-Nov-04	0.83	324.76
			9-Feb-05	frozen	
			11-Apr-05	0.53	325.06
			25-Aug-05	0.89	324.70
			8-Nov-05	1.13	324.46
			16-Jan-06	frozen	
			11-Apr-06	0.66	324.93
			17-Aug-06	0.67	324.92
			27-Nov-06	0.63	324.96
			30-Jan-07	frozen	
			9-Apr-07	0.21	325.38
			16-Aug-07	0.82	324.77
			1-Nov-07	1.35	324.24
			6-Jan-08	frozen	
			12-Apr-08	0.43	325.16
			20-Aug-08	0.37	325.22
			18-Nov-08	0.59	325.00
			9-Feb-09	0.50	325.09
			5-Aug-09	0.63	324.96
			2-Dec-09	0.92	324.67
			2-Feb-10	covered under snow	
			30-Apr-10	could not locate	
			1-Sep-10		
			29-Nov-10	1.05	324.54
			28-Feb-11	frozen	
			24-May-11	0.56	325.03
			30-Aug-11	0.99	324.60
			21-Nov-11	1.02	324.57
			22-Feb-12	0.74	324.86
			4-May-12	1.03	324.56
			8-Aug-12	1.46	324.13
			15-Nov-12	1.09	324.50
			29-Jan-13	frozen	
			1-May-13	1.05	324.54
			16-Aug-13	0.92	324.67
			20-Nov-13	0.81	324.78
			19-Feb-14	frozen	
			27-May-14	0.64	324.96
			21-Aug-14	0.95	324.65
			25-Nov-14	0.69	324.90
			26-Feb-15	frozen	
			28-May-15	0.94	324.65
			19-Aug-15	0.46	325.13
			30-Nov-15	0.69	324.90

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP2-I	325.59	324.59	25-Feb-16	0.80	324.79
			28-Apr-16	inaccessible	
			12-Sep-16	0.58	325.01
			21-Nov-16	0.89	324.70
			24-Jan-17	0.32	325.27
			17-May-17		
			28-Aug-17	0.46	325.13
			27-Nov-17	0.67	324.92
			12-Feb-18	frozen	
			7-May-18	0.67	324.92
			20-Aug-18	1.33	324.26
			19-Nov-18	1.08	324.51
			26-Feb-19	frozen	
			16-Apr-19	0.65	324.94
			23-Jul-19	0.94	324.65
			13-Nov-19	0.92	324.67
			10-Feb-20	0.87	324.72
			5-May-20	0.95	324.64
			30-Jul-20	1.33	324.26
			16-Oct-20	1.46	324.13
			22-Jan-21	frozen	
			13-Apr-21	0.90	324.69
			1-Jun-21	1.28	324.31
			14-Jul-21	1.23	324.36
			2-Nov-21	2.87	322.72
			31-Jan-22	frozen	
			4-May-22	0.75	324.84
			25-Aug-22	2.94	322.65
			2-Dec-22	1.65	323.94
			19-Apr-23	1.85	323.74
			1-May-23	Inaccesible	
			31-Aug-23	Inaccesible	
			16-Nov-23	0.93	324.66

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG	Groundwater Elevation
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)		(m)	(m.a.s.l.)
MP2-I	325.59	324.59	3-Sep-03	0.97	324.62
(outside)[1]			5-Sep-03	dry	
			15-Sep-03	dry	
			7-Oct-03	0.78	324.81
			12-Feb-04	frozen	
			19-Apr-04	0.51	325.08
			19-Aug-04	0.59	325.00
			15-Nov-04	0.75	324.84
			9-Feb-05	frozen	
			11-Apr-05	0.64	324.95
			25-Aug-05	0.83	324.76
			8-Nov-05	dry	
			16-Jan-06	frozen	
			11-Apr-06	0.59	325.00
			17-Aug-06	dry	
			27-Nov-06	0.63	324.96
			30-Jan-07	frozen	
			9-Apr-07	0.29	325.30
			16-Aug-07	dry	
			1-Nov-07	dry	
			6-Jan-08	frozen	
			12-Apr-08	0.55	325.04
			20-Aug-08	0.33	325.26
			18-Nov-08	0.29	325.30
			9-Feb-09	0.24	325.35
			5-Aug-09	0.30	325.29
			2-Dec-09	0.74	324.85
			2-Feb-10	covered under snow	
			30-Apr-10	could not locate	
			1-Sep-10		
			29-Nov-10	frozen	
			28-Feb-11	frozen	
			24-May-11	0.63	324.96
			30-Aug-11	dry	
			21-Nov-11	dry	
			22-Feb-12	frozen	
			4-May-12	1.01	324.58
			8-Aug-12	dry	
			15-Nov-12	1.07	324.52
			29-Jan-13	frozen	
			1-May-13	1.02	324.57
			16-Aug-13	0.83	324.77
			20-Nov-13	0.76	324.83
			19-Feb-14	frozen	
			27-May-14	0.64	324.95
			21-Aug-14	0.80	324.79
			25-Nov-14	0.74	324.85
			26-Feb-15	0.77	324.82
			28-May-15	0.81	324.78
			19-Aug-15	0.53	325.06
			30-Nov-15	frozen	

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP2-I (outside)[1]	325.59	324.59	25-Feb-16	frozen	
			28-Apr-16	inaccessible	
			12-Sep-16	saturated	
			21-Nov-16	dry	
			24-Jan-17	0.36	325.23
			17-May-17		
			28-Aug-17	0.46	325.13
			27-Nov-17	frozen	
			12-Feb-18	frozen	
			7-May-18	0.80	324.79
			20-Aug-18	dry	
			19-Nov-18	frozen	
			26-Feb-19	frozen	
			16-Apr-19	0.65	324.94
			23-Jul-19	0.77	324.82
			13-Nov-19	frozen	
			10-Feb-20	frozen	
			5-May-20	0.80	324.79
			30-Jul-20	dry	
			16-Oct-20	dry	
			22-Jan-21	frozen	
			13-Apr-21	0.79	324.80
			1-Jun-21	dry	
			14-Jul-21	1.04	324.55
			2-Nov-21	dry	
			31-Jan-22	frozen	
			4-May-22	0.78	324.82
			25-Aug-22	dry	
			2-Dec-22	moist	
			19-Apr-23	0.88	324.71
			1-May-23	Inaccesible	
			31-Aug-23	inaccessible	
			16-Nov-23	moist	

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP2-II	325.20	324.60	3-Sep-03	1.03	324.17
			5-Sep-03	0.60	324.60
			15-Sep-03	0.66	324.55
			7-Oct-03	0.44	324.76
			12-Feb-04	0.49	324.72
			19-Apr-04	0.12	325.08
			19-Aug-04	0.35	324.85
			15-Nov-04	0.43	324.77
			9-Feb-05	frozen	
			11-Apr-05	0.16	325.04
			25-Aug-05	0.52	324.68
			8-Nov-05	0.75	324.45
			16-Jan-06	frozen	
			11-Apr-06	0.80	324.40
			17-Aug-06	1.05	324.15
			27-Nov-06	0.27	324.93
			30-Jan-07	frozen	
			9-Apr-07	0.49	324.71
			16-Aug-07	1.18	324.02
			1-Nov-07	0.97	324.24
			6-Jan-08	frozen	
			12-Apr-08	0.07	325.13
			20-Aug-08	0.74	324.46
			18-Nov-08	0.65	324.55
			9-Feb-09	frozen	
			5-Aug-09	0.72	324.48
			2-Dec-09	1.06	324.14
			2-Feb-10	covered under snow	
			30-Apr-10	could not locate	
			1-Sep-10		
			29-Nov-10	0.71	324.49
			28-Feb-11	frozen	
			24-May-11	0.15	325.05
			30-Aug-11	0.81	324.40
			21-Nov-11	0.82	324.38
			22-Feb-12	0.37	324.83
			4-May-12	0.65	324.56
			8-Aug-12	1.09	324.11
			15-Nov-12	0.70	324.50
			29-Jan-13	frozen	
			1-May-13	0.67	324.53
			16-Aug-13	0.50	324.71
			20-Nov-13	0.35	324.85
			19-Feb-14	0.29	324.91
			21-Aug-14	0.57	324.63
			25-Nov-14	0.42	324.78
			26-Feb-15	frozen	
			28-May-15	0.50	324.70
			19-Aug-15	0.93	324.27
			30-Nov-15	1.06	324.14
			25-Feb-16	0.80	324.40

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP2-II	325.20	324.60	28-Apr-16	inaccessible	
			12-Sep-16	1.12	324.08
			21-Nov-16	1.32	323.88
			24-Jan-17	0.72	324.48
			17-May-17	0.72	324.49
			28-Aug-17	0.93	324.27
			27-Nov-17	0.97	324.23
			12-Feb-18	frozen	
			7-May-18	0.22	324.98
			20-Aug-18	0.84	324.36
			19-Nov-18	0.67	324.53
			26-Feb-19	frozen	
			16-Apr-19	0.23	324.97
			23-Jul-19	0.48	324.72
			13-Nov-19	0.51	324.69
			10-Feb-20	0.41	324.79
			5-May-20	0.50	324.70
			30-Jul-20	0.88	324.32
			16-Oct-20	0.93	324.27
			22-Jan-21	0.41	324.79
			13-Apr-21	0.48	324.72
			1-Jun-21	0.75	324.45
			14-Jul-21	0.79	324.41
			2-Nov-21	0.77	324.43
			31-Jan-22	frozen	
			4-May-22	0.33	324.87
			25-Aug-22	2.94	322.26
			2-Dec-22	1.24	323.96
			19-Apr-23	1.72	323.48
			1-May-23	Inaccesible	
			31-Aug-23	inaccessible	
			16-Nov-23	1.30	323.90

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)			
MP2-II	325.20	324.60	3-Sep-03	0.57	324.63
(outside)[1]			5-Sep-03	dry	
			15-Sep-03	dry	
			7-Oct-03	0.43	324.77
			12-Feb-04	frozen	
			19-Apr-04	0.12	325.08
			19-Aug-04	0.21	324.99
			15-Nov-04	0.37	324.83
			9-Feb-05	frozen	
			11-Apr-05	0.25	324.95
			25-Aug-05	0.45	324.75
			8-Nov-05	dry	
			16-Jan-06	frozen	
			11-Apr-06	0.22	324.98
			17-Aug-06	dry	
			27-Nov-06	0.27	324.93
			30-Jan-07	frozen	
			9-Apr-07	0.56	324.64
			16-Aug-07	dry	
			1-Nov-07	dry	
			6-Jan-08	frozen	
			12-Apr-08	0.19	325.01
			20-Aug-08	0.68	324.52
			18-Nov-08	frozen	
			9-Feb-09	frozen	
			5-Aug-09	0.60	324.60
			2-Dec-09	1.01	324.19
			2-Feb-10	covered under snow	
			30-Apr-10	could not locate	
			1-Sep-10		
			29-Nov-10	frozen	
			28-Feb-11	frozen	
			24-May-11	0.25	324.95
			30-Aug-11	dry	
			21-Nov-11	dry	
			22-Feb-12	0.33	324.87
			4-May-12	0.63	324.57
			8-Aug-12	dry	
			15-Nov-12	0.71	324.50
			29-Jan-13	frozen	
			1-May-13	0.65	324.55
			16-Aug-13	0.45	324.75
			20-Nov-13	0.39	324.81
			19-Feb-14	frozen	
			21-Aug-14	0.43	324.77
			25-Nov-14	0.35	324.85
			26-Feb-15	frozen	
			28-May-15	0.43	324.77
			19-Aug-15	0.84	324.36
			30-Nov-15	frozen	
			25-Feb-16	frozen	

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP2-II (outside)[1]	325.20	324.60	28-Apr-16	inaccessible	
			12-Sep-16	saturated	
			21-Nov-16	dry	
			24-Jan-17	0.76	324.44
			17-May-17	0.71	324.49
			28-Aug-17	0.84	324.36
			27-Nov-17	frozen	
			12-Feb-18	frozen	
			7-May-18	0.33	324.87
			20-Aug-18	dry	
			19-Nov-18	frozen	
			26-Feb-19	frozen	
			16-Apr-19	0.30	324.90
			23-Jul-19	0.34	324.86
			13-Nov-19	frozen	
			10-Feb-20	frozen	
			5-May-20	0.39	324.81
			30-Jul-20	dry	
			16-Oct-20	dry	
			22-Jan-21	frozen	
			13-Apr-21	0.38	324.82
			1-Jun-21	dry	
			14-Jul-21	0.63	324.57
			2-Nov-21	0.72	324.48
			31-Jan-22	frozen	
			4-May-22	0.37	324.83
			25-Aug-22	dry	
			2-Dec-22	moist	
			19-Apr-23	0.76	324.44
			1-May-23	Inaccesible	
			31-Aug-23	inaccessible	
			16-Nov-23	snow	

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP3-I	324.71	324.11	3-Sep-03	3.10	321.62
			5-Sep-03	2.45	322.26
			15-Sep-03	1.18	323.54
			7-Oct-03	0.68	324.04
			12-Feb-04	Inaccessible	
			19-Apr-04	0.16	324.55
			19-Aug-04	0.47	324.24
			15-Nov-04	0.62	324.09
			9-Feb-05	frozen	
			11-Apr-05	0.08	324.63
			25-Aug-05	0.64	324.07
			8-Nov-05	0.78	323.93
			16-Jan-06	frozen	
			11-Apr-06	0.13	324.58
			17-Aug-06	0.64	324.07
			27-Nov-06	0.26	324.45
			30-Jan-07	frozen	
			9-Apr-07	0.03	324.69
			16-Aug-07	0.63	324.08
			1-Nov-07	0.93	323.78
			6-Jan-08	0.60	324.11
			12-Apr-08	Underwater	
			20-Aug-08	0.28	324.43
			18-Nov-08	0.45	324.26
			9-Feb-09	frozen	
			5-Aug-09	0.33	324.39
			2-Dec-09	0.51	324.20
			2-Feb-10	covered under snow	
			30-Apr-10	under water	
			1-Sep-10	0.74	323.98
			29-Nov-10	0.74	323.97
			28-Feb-11	frozen	
			24-May-11	0.00	324.71
			30-Aug-11	0.76	323.95
			21-Nov-11	0.52	324.19
			22-Feb-12	0.11	324.60
			4-May-12	0.31	324.40
			8-Aug-12	1.05	323.66
			15-Nov-12	0.76	323.95
			29-Jan-13	0.43	324.28
			1-May-13	0.06	324.65
			16-Aug-13	0.39	324.32
			20-Nov-13	0.33	324.38
			19-Feb-14	frozen	
			27-May-14	0.09	324.62
			21-Aug-14	0.98	323.73
			25-Nov-14	0.66	324.05
			26-Feb-15	frozen	
			28-May-15	0.36	324.35
			19-Aug-15	0.87	323.84
			30-Nov-15	0.69	324.02

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP3-I	324.71	324.11	25-Feb-16	0.62	324.09
			28-Apr-16	0.00	324.71
			12-Sep-16	0.65	324.06
			21-Nov-16	0.85	323.86
			24-Jan-17	0.32	324.39
			17-May-17	0.05	324.66
			28-Aug-17	0.53	324.18
			27-Nov-17	0.61	324.10
			12-Feb-18	frozen	
			7-May-18	0.10	324.61
			20-Aug-18	0.80	323.91
			19-Nov-18	0.37	324.34
			26-Feb-19	0.27	324.44
			16-Apr-19	0.18	324.53
			23-Jul-19	0.35	324.36
			13-Nov-19	0.74	323.97
			10-Feb-20	0.45	324.26
			5-May-20	0.39	324.32
			30-Jul-20	0.75	323.96
			16-Oct-20	0.98	323.73
			22-Jan-21	0.72	323.99
			13-Apr-21	0.54	324.17
			1-Jun-21	0.67	324.04
			14-Jul-21	0.79	323.92
			2-Nov-21	0.69	324.02
			31-Jan-22	0.72	323.99
			4-May-22	0.17	324.54
			25-Aug-22	0.82	323.89
			2-Dec-22	1.16	323.55
			19-Apr-23	inaccessible	
			1-May-23	Inaccesible	
			31-Aug-23	0.49	324.22
			16-Nov-23	0.75	323.96

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP3-I (outside)[1]	324.71	324.11	3-Sep-03	dry	
			5-Sep-03	dry	
			15-Sep-03	dry	
			7-Oct-03	dry	
			12-Feb-04	frozen	
			19-Apr-04	0.18	324.53
			19-Aug-04	0.52	324.20
			15-Nov-04	dry	
			9-Feb-05	frozen	
			11-Apr-05	0.17	324.54
			25-Aug-05	dry	
			8-Nov-05	dry	
			16-Jan-06	frozen	
			11-Apr-06	0.19	324.52
			17-Aug-06	dry	
			27-Nov-06	0.26	324.45
			30-Jan-07	frozen	
			9-Apr-07	0.25	324.46
			16-Aug-07	dry	
			1-Nov-07	dry	
			6-Jan-08	0.50	324.21
			12-Apr-08	Underwater	
			20-Aug-08	0.40	324.31
			18-Nov-08	0.29	324.43
			9-Feb-09	frozen	
			5-Aug-09	0.35	324.36
			2-Dec-09	0.50	324.21
			2-Feb-10	covered under snow	
			30-Apr-10	Underwater	
			1-Sep-10	dry	
			29-Nov-10	dry	
			28-Feb-11	frozen	
			24-May-11	0.08	324.63
			30-Aug-11	dry	
			21-Nov-11	dry	
			22-Feb-12	0.25	324.46
			4-May-12	0.32	324.39
			8-Aug-12	dry	
			15-Nov-12	dry	
			29-Jan-13	frozen	
			1-May-13	0.20	324.51
			16-Aug-13	dry	
			20-Nov-13	0.35	324.36
			19-Feb-14	frozen	
			27-May-14	0.20	324.51
			21-Aug-14	0.20	324.51
			25-Nov-14	0.55	324.16
			26-Feb-15	frozen	
			28-May-15	saturated	
			19-Aug-15	dry	
			30-Nov-15	dry	

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP3-I	324.71	324.11	25-Feb-16	0.65	324.06
(outside)[1]			28-Apr-16	0.21	324.50
			12-Sep-16	dry	
			21-Nov-16	dry	
			24-Jan-17	0.22	324.49
			17-May-17	0.23	324.48
			28-Aug-17	0.53	324.19
			27-Nov-17	dry	
			12-Feb-18	frozen	
			7-May-18	0.26	324.45
			20-Aug-18	dry	
			19-Nov-18	0.48	324.23
			26-Feb-19	frozen	
			16-Apr-19	0.24	324.47
			23-Jul-19	0.35	324.36
			13-Nov-19	0.71	324.00
			10-Feb-20	0.26	324.45
			5-May-20	0.36	324.35
			30-Jul-20	dry	
			16-Oct-20	dry	
			22-Jan-21	frozen	
			13-Apr-21	0.32	324.39
			1-Jun-21	dry	
			14-Jul-21	dry	
			2-Nov-21	dry	
			31-Jan-22	dry	
			4-May-22	0.25	324.46
			25-Aug-22	dry	
			2-Dec-22	moist	
			19-Apr-23	inaccessible	
			1-May-23	Inaccesible	
			31-Aug-23	moist	
			16-Nov-23	moist	

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)			
MP3-II	325.04	324.04	3-Sep-03	1.54	323.51
			5-Sep-03	1.19	323.85
			15-Sep-03	1.17	323.88
			7-Oct-03	0.97	324.08
			12-Feb-04	0.46	324.58
			19-Apr-04	0.47	324.58
			19-Aug-04	0.86	324.19
			15-Nov-04	0.99	324.05
			9-Feb-05	frozen	
			11-Apr-05	0.37	324.68
			25-Aug-05	1.02	324.02
			8-Nov-05	1.23	323.81
			16-Jan-06	frozen	
			11-Apr-06	0.46	324.58
			17-Aug-06	1.09	323.95
			27-Nov-06	0.59	324.45
			30-Jan-07	frozen	
			9-Apr-07	0.36	324.68
			16-Aug-07	1.23	323.81
			1-Nov-07	1.47	323.58
			6-Jan-08	0.86	324.18
			12-Apr-08	0.26	324.78
			20-Aug-08	0.66	324.39
			18-Nov-08	0.62	324.42
			9-Feb-09	frozen	
			5-Aug-09	0.72	324.32
			2-Dec-09	0.86	324.18
			2-Feb-10	covered under snow	
			30-Apr-10	0.48	324.56
			1-Sep-10	1.17	323.87
			29-Nov-10	1.06	323.98
			28-Feb-11	frozen	
			24-May-11	0.38	324.66
			30-Aug-11	1.09	323.95
			21-Nov-11	0.93	324.11
			22-Feb-12	0.58	324.46
			4-May-12	0.69	324.35
			8-Aug-12	1.41	323.63
			15-Nov-12	1.06	323.98
			29-Jan-13	frozen	
			1-May-13	0.43	324.61
			16-Aug-13	0.86	324.18
			20-Nov-13	0.68	324.36
			19-Feb-14	frozen	
			27-May-14	0.44	324.60
			21-Aug-14	0.51	324.53
			25-Nov-14	0.34	324.70
			26-Feb-15	frozen	
			28-May-15	0.83	324.21
			19-Aug-15	0.46	324.58
			30-Nov-15	1.05	323.99

Table D1. Summary of Groundwater Elevations

Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP3-II	325.04	324.04	25-Feb-16	0.29	324.75
			28-Apr-16	1.63	323.41
			12-Sep-16	1.11	323.93
			21-Nov-16	1.24	323.80
			24-Jan-17	0.52	324.52
			17-May-17	0.51	324.54
			28-Aug-17	0.53	324.51
			27-Nov-17	0.90	324.14
			12-Feb-18	frozen	
			7-May-18	0.50	324.54
			20-Aug-18	1.27	323.77
			19-Nov-18	0.93	324.11
			26-Feb-19	0.62	324.42
			16-Apr-19	0.58	324.46
			23-Jul-19	0.73	324.31
			13-Nov-19	0.56	324.48
			10-Feb-20	0.60	324.44
			5-May-20	0.79	324.25
			30-Jul-20	1.27	323.77
			16-Oct-20	1.37	323.67
			22-Jan-21	0.94	324.10
			13-Apr-21	0.75	324.29
			1-Jun-21	1.17	323.87
			14-Jul-21	1.17	323.87
			2-Nov-21	1.05	323.99
			31-Jan-22	1.22	323.82
			4-May-22	blocked	
			25-Aug-22	1.40	323.64
			2-Dec-22	1.62	323.42
			19-Apr-23	0.79	324.25
			1-May-23	Inaccesible	
			31-Aug-23	0.89	324.15
			16-Nov-23	0.65	324.39

Table D1. Summary of Groundwater Elevations

Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP3-II (outside)[1]	325.04	324.04	3-Sep-03	dry	
			5-Sep-03	dry	
			15-Sep-03	dry	
			7-Oct-03	dry	
			12-Feb-04	frozen	
			19-Apr-04	0.51	324.54
			19-Aug-04	0.85	324.20
			15-Nov-04	dry	
			9-Feb-05	frozen	
			11-Apr-05	0.49	324.55
			25-Aug-05	dry	
			8-Nov-05	dry	
			16-Jan-06	frozen	
			11-Apr-06	0.49	324.55
			17-Aug-06	dry	
			27-Nov-06	0.60	324.44
			30-Jan-07	frozen	
			9-Apr-07	0.46	324.58
			16-Aug-07	dry	
			1-Nov-07	dry	
			6-Jan-08	0.80	324.25
			12-Apr-08	0.27	324.78
			20-Aug-08	0.73	324.31
			18-Nov-08	0.67	324.37
			9-Feb-09	frozen	
			5-Aug-09	0.67	324.37
			2-Dec-09	0.82	324.22
			2-Feb-10	covered under snow	
			30-Apr-10	0.37	324.67
			1-Sep-10	dry	
			29-Nov-10	dry	
			28-Feb-11	frozen	
			24-May-11	0.44	324.60
			30-Aug-11	dry	
			21-Nov-11	dry	
			22-Feb-12	0.59	324.45
			4-May-12	0.66	324.38
			8-Aug-12	dry	
			15-Nov-12	dry	
			29-Jan-13	frozen	
			1-May-13	0.51	324.53
			16-Aug-13	dry	
			20-Nov-13	0.69	324.35
			19-Feb-14	frozen	
			27-May-14	0.55	324.49
			21-Aug-14	0.53	324.51
			25-Nov-14	0.23	324.81
			26-Feb-15	frozen	
			28-May-15	saturated	
			19-Aug-15	dry	
			30-Nov-15	dry	

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP3-II (outside)[1]	325.04	324.04	25-Feb-16	0.29	324.75
			28-Apr-16	0.55	324.49
			12-Sep-16	dry	
			21-Nov-16	dry	
			24-Jan-17	0.58	324.46
			17-May-17	0.59	324.45
			28-Aug-17	0.53	324.52
			27-Nov-17	dry	
			12-Feb-18	frozen	
			7-May-18	0.63	324.41
			20-Aug-18	dry	
			19-Nov-18	0.81	324.23
			26-Feb-19	frozen	
			16-Apr-19	0.56	324.48
			23-Jul-19	0.71	324.33
			13-Nov-19	0.33	324.71
			10-Feb-20	0.62	324.42
			5-May-20	0.75	324.29
			30-Jul-20	dry	
			16-Oct-20	dry	
			22-Jan-21	frozen	
			13-Apr-21	0.71	324.33
			1-Jun-21	dry	
			14-Jul-21	dry	
			2-Nov-21	dry	
			31-Jan-22	dry	
			4-May-22	0.65	324.40
			25-Aug-22	dry	
			2-Dec-22	moist	
			19-Apr-23	0.77	324.27
			1-May-23	Inaccesible	
			31-Aug-23	0.36	324.68
			16-Nov-23	snow	

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP4	325.61	324.25	29-Jun-04	1.19	324.43
			19-Aug-04	1.24	324.38
			9-Dec-04	1.28	324.33
			9-Feb-05	0.89	324.72
			11-Apr-05	0.37	325.24
			25-Aug-05	1.29	324.32
			8-Nov-05	1.50	324.11
			16-Jan-06	0.99	324.62
			11-Apr-06	0.57	325.04
			17-Aug-06	1.34	324.27
			27-Nov-06	Note 3	
MP4R	325.63	324.25	14-Jun-10	2.39	323.24
			1-Sep-10	1.58	324.05
			29-Nov-10	1.60	324.04
			28-Feb-11	iced over	
			24-May-11	underwater	
			30-Aug-11	destroyed	
	326.39	324.73	20-Nov-13	re-installed	
			19-Feb-14	0.94	325.46
			27-May-14		
			21-Aug-14	2.20	324.19
			25-Nov-14	1.90	324.49
			26-Feb-15	2.96	323.43
			28-May-15	1.95	324.45
			19-Aug-15		
			30-Nov-15	2.36	324.03
			25-Feb-16	1.90	324.49
			28-Apr-16	inaccessible	
			12-Sep-16	2.93	323.46
			21-Nov-16	2.55	323.84
			24-Jan-17	1.58	324.81
			17-May-17	1.42	324.97
			28-Aug-17	2.06	324.34
			27-Nov-17	2.27	324.12
			12-Feb-18	2.10	324.29
			7-May-18	1.49	324.90
			20-Aug-18	2.43	323.96
	325.67	324.76	19-Nov-18	2.28	324.11
			26-Feb-19	1.07	324.60
			16-Apr-19	0.67	325.00
			23-Jul-19	0.98	324.69
			13-Nov-19	1.13	324.54
			10-Feb-20	0.76	324.91
			5-May-20	0.92	324.75
			30-Jul-20	1.74	323.93
			16-Oct-20	1.74	323.93
			22-Jan-21	1.48	324.19
			13-Apr-21	1.23	324.44
			1-Jun-21	1.62	324.05
			14-Jul-21	1.64	324.03
			2-Nov-21	1.51	324.16
			31-Jan-22	dry	
			4-May-22	0.95	324.72
			25-Aug-22	dry	
			2-Dec-22	dry	
			19-Apr-23	1.11	324.56
			1-May-23	Inaccesible	
			31-Aug-23	inaccessible	
			16-Nov-23	1.78	323.89

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP4R (outside)[1]	325.61	324.25	29-Jun-04	0.75	324.86
			19-Aug-04	1.11	324.50
			9-Dec-04	1.28	324.33
			9-Feb-05	frozen	-
			11-Apr-05	0.26	325.35
			25-Aug-05	dry	-
			8-Nov-05	dry	-
			16-Jan-06	frozen	-
			11-Apr-06	0.44	325.17
			17-Aug-06	dry	
			27-Nov-06	Note 3	
	325.63	324.25	14-Jun-10	1.06	324.57
			1-Sep-10	1.23	324.40
			29-Nov-10	1.23	324.40
			28-Feb-11	iced over	
			24-May-11	underwater	
			30-Aug-11	destroyed	
	326.39	324.73	20-Nov-13	re-installed	
			19-Feb-14	snow	
			27-May-14	1.35	325.04
			21-Aug-14	saturated	
			25-Nov-14	saturated	
			26-Feb-15	1.46	324.93
			28-May-15	dry	
			19-Aug-15	dry	
			30-Nov-15	dry	
			25-Feb-16	dry	
			28-Apr-16	inaccessible	
			12-Sep-16	dry	
			21-Nov-16	dry	
			24-Jan-17	1.48	324.91
			17-May-17	1.34	325.05
			28-Aug-17	dry	
			27-Nov-17	dry	
			12-Feb-18	1.46	324.93
			7-May-18	1.35	325.04
			20-Aug-18	dry	
	325.67	324.76	19-Nov-18	dry	
			26-Feb-19	frozen	
			16-Apr-19	0.67	325.00
			23-Jul-19	0.84	324.83
			13-Nov-19	frozen	
			10-Feb-20	frozen	
			5-May-20	0.84	324.83
			30-Jul-20	dry	
			16-Oct-20	dry	
			22-Jan-21	0.94	324.73
			13-Apr-21	dry	
			1-Jun-21	dry	
			14-Jul-21	dry	
			2-Nov-21	dry	
			31-Jan-22	dry	
			4-May-22	0.88	324.79
			25-Aug-22	dry	
			2-Dec-22	dry	
			19-Apr-23	moist	
			1-May-23	inaccessible	
			31-Aug-23	inaccessible	
			16-Nov-23	moist	

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP5	325.72	324.10	29-Jun-04	1.53	324.19
			19-Aug-04	1.20	324.52
			9-Dec-04	1.28	324.44
			9-Feb-05	0.93	324.79
			11-Apr-05	0.36	325.36
			25-Aug-05	1.48	324.24
			8-Nov-05	1.73	323.99
			16-Jan-06	1.20	324.52
			11-Apr-06	0.72	325.00
			17-Aug-06	1.54	324.18
			27-Nov-06	0.97	324.75
			30-Jan-07	frozen	
			9-Apr-07	0.62	325.10
			16-Aug-07	1.71	324.01
			1-Nov-07	1.90	323.82
			6-Jan-08	1.45	324.27
			12-Apr-08	0.92	324.80
			20-Aug-08	1.12	324.60
			18-Nov-08	1.12	324.60
			9-Feb-09	frozen	
			5-Aug-09	1.04	324.68
			2-Dec-09	1.33	324.39
			2-Feb-10	1.11	324.61
			30-Apr-10	DESTROYED	

Table D1. Summary of Groundwater Elevations

Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP5 (outside)[1]	325.72	324.10	29-Jun-04	0.85	324.88
			19-Aug-04	1.18	324.54
			9-Dec-04	1.24	324.48
			9-Feb-05	frozen	-
			11-Apr-05	0.36	325.36
			25-Aug-05	1.35	324.37
			8-Nov-05	dry	-
			16-Jan-06	frozen	-
			11-Apr-06	0.77	324.95
			17-Aug-06	dry	
			27-Nov-06	0.84	324.88
			30-Jan-07	frozen	
			9-Apr-07	frozen	
			16-Aug-07	dry	
			1-Nov-07	dry	
			6-Jan-08	frozen	
			12-Apr-08	0.60	325.12
			20-Aug-08	1.08	324.64
			18-Nov-08	1.11	324.61
			9-Feb-09	frozen	
			5-Aug-09	0.88	324.84
			2-Dec-09	1.25	324.47
			2-Feb-10	96.00	229.72
			30-Apr-10	DESTROYED	

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP6	325.96	325.14	16-Jan-06	frozen	
			11-Apr-06	0.61	325.35
			17-Aug-06	0.83	325.13
			27-Nov-06	0.65	325.31
			30-Jan-07	frozen	
			9-Apr-07	0.53	325.43
			16-Aug-07	1.02	324.94
			1-Nov-07	1.25	324.71
			6-Jan-08	frozen	
			12-Apr-08	0.46	325.50
			20-Aug-08	0.68	325.28
			18-Nov-08	0.64	325.32
			9-Feb-09	0.55	325.41
			5-Aug-09	0.63	325.33
			2-Dec-09	0.74	325.22
			2-Feb-10	covered under snow	
			30-Apr-10	0.60	325.36
			1-Sep-10	0.72	325.24
			29-Nov-10	0.92	325.04
			28-Feb-11	0.70	325.26
			24-May-11	0.48	325.48
			30-Aug-11	0.87	325.09
			21-Nov-11	0.81	325.15
			22-Feb-12	0.64	325.32
			4-May-12	0.68	325.28
			8-Aug-12	1.24	324.72
			15-Nov-12	1.00	324.96
			29-Jan-13	0.74	325.22
			1-May-13	0.53	325.43
			16-Aug-13	0.71	325.25
			20-Nov-13	0.64	325.32
			19-Feb-14	covered under snow	
			27-May-14	0.53	325.43
			21-Aug-14	0.75	325.21
			25-Nov-14	0.65	325.31
			26-Feb-15	covered under snow	
			28-May-15	0.69	325.27
			19-Aug-15	0.74	325.22
			30-Nov-15	0.91	325.05
			25-Feb-16	0.64	325.32
			28-Apr-16	0.52	325.44
			12-Sep-16	0.86	325.10
			21-Nov-16	1.07	324.89
			24-Jan-17	0.67	325.29
			17-May-17	0.47	325.49
			28-Aug-17	0.76	325.20
			27-Nov-17	0.81	325.15
			12-Feb-18	0.67	325.30
			7-May-18	0.48	325.48
			20-Aug-18	0.95	325.01
			19-Nov-18	0.95	325.01

Table D1. Summary of Groundwater Elevations

Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP6	325.96	325.14	26-Feb-19	0.59	325.37
			16-Apr-19	0.65	325.31
			23-Jul-19	0.70	325.26
			13-Nov-19	0.75	325.21
			10-Feb-20	0.69	325.27
			5-May-20	0.72	325.24
			30-Jul-20	1.02	324.94
			16-Oct-20	1.15	324.81
			22-Jan-21	0.96	325.00
			13-Apr-21	0.84	325.12
			1-Jun-21	0.95	325.01
			14-Jul-21	0.96	325.00
			2-Nov-21	0.92	325.04
			31-Jan-22	1.00	324.96
			4-May-22	0.62	325.35
			25-Aug-22	can't locate	
			2-Dec-22	1.22	324.74
			19-Apr-23	0.75	325.21
			1-May-23	Inaccesible	
			31-Aug-23	0.57	325.39
			16-Nov-23	0.77	325.19

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP6	325.96	325.14	16-Jan-06	frozen	
(outside)[1]			11-Apr-06	0.69	325.27
			17-Aug-06	dry	
			27-Nov-06	0.71	325.25
			30-Jan-07	0.73	325.23
			9-Apr-07	0.67	325.29
			16-Aug-07	dry	
			1-Nov-07	dry	
			6-Jan-08	frozen	
			12-Apr-08	0.57	325.39
			20-Aug-08	0.77	325.20
			18-Nov-08	0.73	325.23
			9-Feb-09	0.67	325.29
			5-Aug-09	0.72	325.24
			2-Dec-09	saturated	
			2-Feb-10	covered under snow	
			30-Apr-10	0.70	325.26
			1-Sep-10	dry	
			29-Nov-10	0.81	325.15
			28-Feb-11	frozen	
			24-May-11	0.67	325.29
			30-Aug-11	dry	
			21-Nov-11	0.83	325.13
			22-Feb-12	0.73	325.23
			4-May-12	0.76	325.20
			8-Aug-12	dry	
			15-Nov-12	dry	
			29-Jan-13	frozen	
			1-May-13	0.71	325.25
			16-Aug-13	dry	
			20-Nov-13	dry	
			19-Feb-14	covered under snow	
			27-May-14	0.63	325.34
			21-Aug-14	saturated	
			25-Nov-14	0.72	325.24
			26-Feb-15	covered under snow	
			28-May-15	saturated	
			19-Aug-15	dry	
			30-Nov-15	dry	
			25-Feb-16	0.71	325.25
			28-Apr-16	0.66	325.30
			12-Sep-16	dry	
			21-Nov-16	dry	
			24-Jan-17	0.70	325.26
			17-May-17	0.66	325.31
			28-Aug-17	0.76	325.20
			27-Nov-17	dry	
			12-Feb-18	dry	
			7-May-18	0.64	325.32
			20-Aug-18	dry	
			19-Nov-18	0.76	325.20

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP6	325.96	325.14	26-Feb-19	frozen	
(outside)[1]			16-Apr-19	0.67	325.29
			23-Jul-19	0.70	325.26
			13-Nov-19	0.75	325.21
			10-Feb-20	0.69	325.27
			5-May-20	0.72	325.24
			30-Jul-20	dry	
			16-Oct-20	dry	
			22-Jan-21	frozen	
			13-Apr-21	0.75	325.21
			1-Jun-21	dry	
			14-Jul-21	dry	
			2-Nov-21	dry	
			31-Jan-22	dry	
			4-May-22	0.72	325.24
			25-Aug-22	can't locate	
			2-Dec-22	moist	
			19-Apr-23	0.80	325.16
			1-May-23	Inaccesible	
			31-Aug-23	moist	
			16-Nov-23	moist	

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP7	326.34	325.57	16-Jan-06	0.93	325.41
			11-Apr-06	0.65	325.69
			17-Aug-06	1.14	325.20
			27-Nov-06	0.77	325.57
			30-Jan-07	0.70	325.65
			9-Apr-07	0.54	325.80
			16-Aug-07	1.24	325.10
			1-Nov-07	1.51	324.83
			6-Jan-08	frozen	
			12-Apr-08	0.45	325.89
			20-Aug-08	0.86	325.49
			18-Nov-08	could not locate	
			9-Feb-09	0.62	325.72
			5-Aug-09	0.70	325.64
			2-Dec-09	0.82	325.52
			2-Feb-10	0.90	325.44
			30-Apr-10	0.67	325.67
			1-Sep-10	0.85	325.49
			29-Nov-10	1.25	325.09
			28-Feb-11	1.06	325.28
			24-May-11	0.45	325.89
			30-Aug-11	1.01	325.33
			21-Nov-11	1.10	325.24
			22-Feb-12	0.70	325.64
			4-May-12	0.86	325.48
			8-Aug-12	dry	
			15-Nov-12	1.24	325.10
			29-Jan-13	0.96	325.38
			1-May-13	0.68	325.66
			16-Aug-13	1.03	325.31
			20-Nov-13	0.86	325.48
			19-Feb-14	Covered under snow	
			27-May-14	0.72	325.62
			21-Aug-14	1.01	325.33
			25-Nov-14	0.73	325.61
			26-Feb-15	frozen	
			28-May-15	0.83	325.52
			19-Aug-15	0.83	325.51
			30-Nov-15	1.09	325.25
			25-Feb-16	0.77	325.57
			28-Apr-16	0.55	325.79
			12-Sep-16	0.97	325.37
			21-Nov-16	obstruction at 1.07	
			24-Jan-17	0.73	325.61
			17-May-17	0.42	325.92
			28-Aug-17	0.57	325.78
			27-Nov-17	0.67	325.67
			12-Feb-18	frozen	
			7-May-18	0.49	325.85
			20-Aug-18	0.60	325.74
			19-Nov-18	0.71	325.63

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP7	326.34	325.57	26-Feb-19	frozen	
			16-Apr-19	0.50	325.84
			23-Jul-19	0.31	326.03
			13-Nov-19	0.56	325.78
			10-Feb-20	0.38	325.96
			5-May-20	0.45	325.89
			30-Jul-20	0.86	325.48
			16-Oct-20	0.99	325.35
			22-Jan-21	0.97	325.37
			13-Apr-21	0.85	325.49
			1-Jun-21	0.76	325.58
			14-Jul-21	0.69	325.65
			2-Nov-21	0.87	325.47
			31-Jan-22	frozen	
			4-May-22	0.62	325.73
			25-Aug-22	can't locate	
			2-Dec-22	dry	
			19-Apr-23	0.94	325.40
			1-May-23	Inaccesible	
			31-Aug-23	0.92	325.42
			16-Nov-23	0.90	325.44

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP7 (outside)[1]	326.34	325.57	16-Jan-06	dry	
			11-Apr-06	0.74	325.60
			17-Aug-06	dry	
			27-Nov-06	0.78	325.56
			30-Jan-07	frozen	
			9-Apr-07	0.69	325.65
			16-Aug-07	dry	
			1-Nov-07	dry	
			6-Jan-08	frozen	
			12-Apr-08	0.60	325.74
			20-Aug-08	dry	
			18-Nov-08	could not locate	
			9-Feb-09	frozen	
			5-Aug-09	dry	
			2-Dec-09	dry	
			2-Feb-10	frozen	
			30-Apr-10	0.76	325.58
			1-Sep-10	dry	
			29-Nov-10	dry	
			28-Feb-11	0.49	325.85
			24-May-11	0.64	325.70
			30-Aug-11	dry	
			21-Nov-11	dry	
			22-Feb-12	0.72	325.62
			4-May-12	saturated	
			8-Aug-12	dry	
			15-Nov-12	dry	
			29-Jan-13	0.96	325.38
			1-May-13	0.70	325.64
			16-Aug-13	dry	
			20-Nov-13	dry	
			19-Feb-14	covered under snow	
			27-May-14	0.64	325.70
			21-Aug-14	dry	
			25-Nov-14	0.74	325.60
			26-Feb-15	frozen	
			28-May-15	dry	
			19-Aug-15	dry	
			30-Nov-15	dry	
			25-Feb-16	frozen	
			28-Apr-16	0.62	325.72
			12-Sep-16	dry	
			21-Nov-16	dry	
			24-Jan-17	0.67	325.67
			17-May-17	0.57	325.77
			28-Aug-17	0.77	325.57
			27-Nov-17	dry	
			12-Feb-18	frozen	
			7-May-18	0.62	325.72
			20-Aug-18	dry	
			19-Nov-18	frozen	

Table D1. Summary of Groundwater Elevations

Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP7 (outside)[1]	326.34	325.57	26-Feb-19	frozen	
			16-Apr-19	0.51	325.83
			23-Jul-19	0.58	325.76
			13-Nov-19	dry	
			10-Feb-20	dry	
			5-May-20	dry	
			30-Jul-20	dry	
			16-Oct-20	dry	
			22-Jan-21	frozen	
			13-Apr-21	dry	
			1-Jun-21	dry	
			14-Jul-21	dry	
			2-Nov-21	dry	
			31-Jan-22	dry	
			4-May-22	0.70	325.76
			25-Aug-22	can't locate	
			2-Dec-22	moist	
			19-Apr-23	inaccessible	
			1-May-23	Inaccesible	
			31-Aug-23	dry	
			16-Nov-23	moist	

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
SG1 (Mink Farm Pond)			6-May-04	0.39	
			19-Aug-04		
			9-Dec-04	0.21	
			9-Feb-05	frozen @ 0.22	
			11-Apr-05	0.25	
			25-Aug-05	Note 2	
SG2 (Middle Pond)			6-May-04	0.68	
			19-Aug-04		
			9-Dec-04	0.61	
			9-Feb-05	frozen @ 0.75	
			11-Apr-05	0.80	
			25-Aug-05	0.68	
			8-Nov-05	0.55	
			16-Jan-06	frozen	
			11-Apr-06	0.76	
			17-Aug-06	0.61	
			27-Nov-06	0.72	
			30-Jan-07	frozen	
			9-Apr-07	gate locked	
			16-Aug-07	0.62	
			1-Nov-07	0.45	
			6-Jan-08	frozen	
			12-Apr-08	0.87	
			20-Aug-08	0.81	
			18-Nov-08	0.80	
			9-Feb-09	0.92	
			5-Aug-09	0.82	
			2-Dec-09	0.77	
			2-Feb-10	0.80	
			30-Apr-10	1.03	
			1-Sep-10	0.79	
			29-Nov-10	0.68	
			28-Feb-11	iced over	
			24-May-11	0.99	
			30-Aug-11	0.77	
			21-Nov-11	0.80	
			22-Feb-12	inaccessible	
			4-May-12	0.58	
			8-Aug-12	0.28	
			15-Nov-12	0.30	
			29-Jan-13	0.98	
			1-May-13	0.97	
			16-Aug-13	destroyed	

Table D1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60700729

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
SG3 (R.Reid House Pond)			6-May-04	0.42	
			19-Aug-04		
			9-Dec-04	0.35	
			9-Feb-05	frozen @ 0.36	
			11-Apr-05	0.47	
			25-Aug-05	0.18	
			8-Nov-05	0.16	
			16-Jan-06	frozen	
			11-Apr-06	0.25	
			17-Aug-06	0.14	
			27-Nov-06	0.25	
			30-Jan-07	frozen	
			9-Apr-07	missing	
			16-Aug-07	0.04	
			1-Nov-07	dry	
			6-Jan-08	frozen	
			12-Apr-08	0.22	
			20-Aug-08	0.80	
			18-Nov-08	unable to contact owner	

Note:
1. Water level measured on the outside of the mini-piezometer.
2. Property owner decline further participation in the monitoring of the staff gauge on his property.
3. MP4 was out of the ground, track marks over MP location - MP4 possibly destroyed by a tractor
4. Monitor 2-1 PVC cut by 3.175 cm to facilitate casing closure

Appendix E

Terrestrial Photographic Log 2023

Photograph 1.
August 21, 2023. North side of the Isolated Wetland (TR 1), showing field edge.

Photograph 2.
August 21, 2023. Facing north along transect TR 1 at the Isolated Wetland.

Photograph 3.
August 21, 2023. Facing south along transect TR 1 to peach-leaved willow *(Salix amygdaloides)* at the Isolated Wetland.

Photograph 4.
August 21, 2023. Soil profile at the Isolated Wetland (TR 1) shows deep organic layer over clayey silt

Photograph 5
August 21, 2023. Facing west along Tributary A (TR 2) with abundant reed canary grass.

Photograph 6
August 21, 2023. Facing east on Tributary A (TR 2) towards Pond A

Photograph 7.
August 21, 2023. Soil profile at Tributary A (TR 2) shows deep organic layer over clayey silt

Photograph 8.
August 21, 2023. View of Pond A facing Northeast.

Photograph 9. ↑
August 21, 2023. South side of Pond A.

Photograph 10. ↑
August 21, 2023. West side of Pond A.

Photograph 11. ↑
August 21, 2023. Calico Crayfish in Pond A.

Photograph 12. ↑
August 21, 2023. Calico Crayfish in Pond A

Photograph 13.
August 21, 2023. Facing north along TR 4

Photograph 14.
August 21, 2023. Facing south along TR 4.

Photograph 15.
August 21, 2023. Common reed at south end of TR 4.

Photograph 136.
August 21, 2023. Soil profile at TR 4 showing organic layer over clay

Appendix F

Amphibian Calling Acoustic Data Results

2023 Acoustic Monitor Amphibian Calling Results

Date	Daily High Temp(ºC)	Temp (ºC) at 22:00	Isolated Wetland						Pond A						
			Amphibian Detected	AMTO	SPPE	GRTR	WOFR	NLFR	Amphibian Detected	AMTO	SPPE	GRTR	WOFR	NLFR	GRFR
10-Apr	17.7	9.9	Yes		1[1]*		7[3]*		yes		4[2]*		>10[3]*		
13-Apr	27.4	17.5	Yes	3	5		2		yes	3	6		1		
15-Apr	27.2	15.5	Yes	4	5				yes	>5	7				
21-Apr	21.2	8.2	Yes	1	4		1		yes		6				
29-Apr	10.7	8.4	Yes	1	5				yes	1	6				
9-May	16.9	8.3	Yes	2[1]*	1[1]				yes	1[1]	5[2]*				
12-May	24.9	18.6	Yes	1		2			yes	2	1	1			
21-May	21.2	11.2	Yes	2	1	6			yes	2	1	4			
28-May	26.6	14.0	Yes			6			No**						
1-Jun	30.3	11.4	Yes	4[2]*		6[2]*			No**			5[2]*			3[2]*
2-Jun	30.8	21.6	Yes			3			No**						
10-Jun	25.4	17.9	Yes			1			No**						

Note: ** Numbers in square brackets indicate results of calling survey on same night (shown as bold, see Table 4)*
*** Audio wasn't functioning*
[] Numbers within parentheses indicate code for the species.

2021 Acoustic Monitor Amphibian Calling Results

Date	Daily High Temp(ºC)	Temp (ºC) at 22:00	Isolated Wetland						Tributary A				
			Amphibian Detected	AMTO	SPPE	GRTR	WOFR	NLFR	Amphibian Detected	AMTO	SPPE	GRTR	WOFR
9-Apr	21.2	14.1	not setup		[>10]*		[>10]*		not setup		[>10]*		[>10]*
15-Apr	7.0	4.0	yes		2				yes		3		
16-Apr	6.0	4.3	no						yes		1		
17-Apr	11.2	4.6	yes		2				yes		>5		
18-Apr	13.2	2.6	yes		4				yes		>5		
19-Apr	14.8	4.3	yes		>5				yes		>5		
20-Apr	2.1	0.4	no						yes		3		
21-Apr	1.5	-3.3	no						no				
24-Apr	16.0	11.0	yes	3	>5			1	yes		>10		
28-Apr	21.0	6.8	yes		>5				yes	3	>10		
3-May	12.9	6.9	yes	1	>5				yes		>10		
10-May	11.2	4.0	yes			1			no				
18-May	25.9	13.4	yes	2 [1]*					yes	3 [5]*	2		
22-May	24.9	17.4	yes			3		1	yes	2	1		
30-May	18.6	6.1	no						no				
3-Jun	29.9	17.5	yes	2		5			yes	1		5	
12-Jun	23.0	16.7	yes			5			yes			>5	
14-Jun	23.0	16.0	no						no				
16-Jun	24.6	16.5	no						no				

Note: ** Numbers in square brackets indicate results of calling survey on same night (shown as bold, see Table 4)*
*** Audio wasn't functioning*
[] Numbers within parentheses indicate code for the species.

Appendix G

Vegetation Transect Site Plant List

Appendix G. Vascular Plant List

AECOM

Botanical Name			Isolated Wetland TR1 edge	Isolated Wetland TR1 interior	Isolated Wetland TR1 edge	Isolated Wetland TR1 interior	Isolated Wetland TR1 edge	Isolated Wetland TR1 interior	Isolated Wetland TR1 edge	Isolated Wetland TR1 interior	Isolated Wetland TR1 edge	Isolated Wetland TR1 interior	Isolated Wetland TR1 edge	Isolated Wetland TR1 interior
Common Name	Scientific Name	Family	2018 - TR1 edge	2018 - TR1 interior	2019 - TR1 edge	2019 - TR1 interior	2020 - TR1 edge	2020 - TR1 interior	2021- TR1 edge	2021- TR1 interior	2022 - TR1 edge	2022 - TR1 interior	2023 - TR1 edge	2023 TR1 interior
Common Ragweed	*Ambrosia artemisiifolia*	Asteraceae	X		X									
Common Milkweed	*Asclepias syriaca*	Apocynaceae	X		X				X		X	X		
Smooth Brome	*Bromus inermis*	Poaceae			X							X		
Awl-fruited Sedge	*Carex stipata*	Cyperaceae						X						
Northern Beaked Sedge	*Carex utriculata*	Cyperaceae		X	X	X		X		X		X		X
Fox Sedge	*Carex vulpinoidea*	Cyperaceae	X		X		X							X
Canada Thistle	*Cirsium arvense*	Asteraceae							X		X	X	X	X
Wild Carrot	*Daucus carota*	Apiaceae	X		X									
Purple-veined Willowherb	*Epilobium coloratum*	Onagraceae												X
Small-flowered Hairy Willowherb	*Epilobium parviflorum*	Onagraceae	X		X				X	X				
Field Horsetail	*Equisetum arvense*	Equisetaceae	X	X	X		X			X	X	X		X
Water Horsetail	*Equisetum fluviatile*	Equisetaceae		X	X	X		X		X		X		X
Annual Fleabane	*Erigeron annuus*	Asteraceae		X										
Canada Horseweed	*Erigeron canadensis*	Asteraceae		X										
Philadelphia Fleabane	*Erigeron philadelphicus*	Asteraceae		X				X		X				
Common Boneset	*Eupatorium perfoliatum*	Asteraceae				X								
Grass-leaved Goldenrod	*Euthamia graminifolia*	Asteraceae			X		X		X		X		X	X
Eurasian Black Bindweed	*Fallopia convolvulus*	Polygonaceae								X				
Common Marsh Bedstraw	*Galium palustre*	Rubiaceae								X		X		
Toad Rush	*Juncus bufonius*	Juncaceae	X											
Path Rush	*Juncus tenuis*	Juncaceae	X		X		X							
American Water-horehound	*Lycopus americanus*	Lamiaceae			X		X							X
Tufted Yellow Loosestrife	*Lysimachia thyrsiflora*	Primulaceae		X		X		X		X		X		X
Upright Yellow Wood-sorrel	*Oxalis stricta*	Oxalidaceae	X		X		X		X					
Spotted Lady's-thumb	*Persicaria maculosa*	Polygonaceae	X											
Reed Canarygrass	*Phalaris arundinacea*	Poaceae	X	X	X	X	X	X	X	X	X	X	X	X
Common Plantain	*Plantago major*	Plantaginaceae	X											
Fowl Bluegrass	*Poa palustris*	Poaceae						X	X					
Rough Cinquefoil	*Potentilla norvegica*	Rosaceae	X						X					
European Buckthorn	*Rhamnus cathartica*	Rhamnaceae												X
Peach-leaved Willow	*Salix amygdaloides*	Salicaceae		X		X		X		X		X		X
Dark-green Bulrush	*Scirpus atrovirens*	Cyperaceae			X		X							
Bittersweet Nightshade	*Solanum dulcamara*	Solanaceae						X		X		X		X
Tall Goldenrod	*Solidago altissima*	Asteraceae	X		X			X	X	X	X	X	X	X
Field Sow-thistle	*Sonchus arvensis*	Asteraceae	X		X		X	X	X	X				
Prickly Sow-thistle	*Sonchus asper*	Asteraceae									X	X		
Panicled Aster	*Symphyotrichum lanceolatum*	Asteraceae	X	X	X	X	X	X	X	X		X	X	X
Purple-stemmed Aster	*Symphyotrichum puniceum*	Asteraceae						X	X					X
Common Dandelion	*Taraxacum officinale*	Asteraceae				X								
Alsike Clover	*Trifolium hybridum*	Fabaceae		X		X						X		
Coltsfoot	*Tussilago farfara*	Asteraceae							X					
Broad-leaved Cattail	*Typha latifolia*	Typhaceae		X		X		X		X		X		X
Blue Vervain	*Verbena hastata*	Verbenaceae	X		X		X							
Tufted Vetch	*Vicia cracca*	Fabaceae	X		X		X	X	X	X		X		
Riverbank Grape	*Vitis riparia*	Vitaceae										X		X

Appendix G. Vascular Plant List

Common Name	Scientific Name	Family	2018 - TR1 edge	2018 - TR1 interior	2019 - TR1 edge	2019 - TR1 interior	2020 - TR1 edge	2020 - TR1 interior	2021- TR1 edge	2021- TR1 interior	2022 - TR1 edge	2022 - TR1 interior	2023 - TR1 edge	2023 TR1 interior
Floristic Summary and Analysis for Entire Study Area			**Floristic Summary and Analysis Per ELC**											
Summary														
Total Species:	45	N/A	18	12	20	10	12	15	14	16	7	18	5	18
Native Species:	30	67%	12	11	15	8	10	12	9	11	5	12	4	15
Introduced Species:	15	33%	6	1	5	2	2	3	5	5	2	6	1	3
Invasive Species:	8	18%	3	1	4	1	2	3	5	4	2	5	2	4
ESA Status														
END	0	0%	0	0	0	0	0	0	0	0	0	0	0	0
THR	0	0%	0	0	0	0	0	0	0	0	0	0	0	0
SC	0	0%	0	0	0	0	0	0	0	0	0	0	0	0
COSEWIC Status														
S3S4	0	0%	0	0	0	0	0	0	0	0	0	0	0	0
Total S1-S3:	**0**	**0%**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Local Rank														
Co-efficient of Conservatism and Floral Quality Index														
Co-efficient of Conservatism (CC) (average):	**2.55**		**1.09**	**2.91**	**2.43**	**4.13**	**2.11**	**3.92**	**2.13**	**3.45**	**0.60**	**3.08**	**1.50**	**3.33**
CC 0 to 3	lowest sensitivity	20	10	7	10	4	7	6	6	6	5	7	4	9
CC 4 to 6	moderate sensitivity	6	1	1	2	1	2	3	2	2	0	2	0	3
CC 7 to 8	high sensitivity	3	0	3	2	3	0	3	0	3	0	3	0	3
CC 9 to 10	highest sensitivity	0	0	0	0	0	0	0	0	0	0	0	0	0
Floral Quality Index (FQI)														
FQI:	**13.98**		**3.78**	**9.65**	**9.41**	**11.67**	**6.68**	**13.57**	**6.38**	**11.46**	**1.34**	**10.68**	**3.00**	**12.91**
Presence of Wetland Species														
Wetness Value (CW) (average):	**-0.44**		**0.72**	**-1.92**	**0.05**	**-2.60**	**-1.08**	**-2.27**	**1.00**	**-1.25**	**1.57**	**-0.39**	**0.00**	**-2.39**
upland	5	4	3	0	4	0	1	1	2	1	1	3	0	0
facultative upland	2 to 4	14	6	3	5	2	2	2	6	4	3	4	2	2
facultative	1 to -1	7	3	1	3	0	3	1	2	2	2	3	1	5
facultative wetland	-2 to -4	9	5	4	3	4	3	5	3	4	1	3	2	3
obligate wetland	-5	11	1	4	5	4	3	6	1	5	0	5	0	8

Glossary

Rarity Ranks	
RANK	DEFINITION
EXP	**Extirpated -** A wildlife species that no longer exists in the wild in Canada, but exists elsewhere.
END	**Endangered -** A wildlife species facing imminent extirpation or extinction.
THR	**Threatened -** A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.
SC	**Special Concern** - A wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.

SARO Status	
RANK	DEFINITION
EXP	**Extirpated** -A species that no longer exists in the wild in Ontario but still occurs elsewhere.
END	**Endangered -** A species facing imminent extinction or extirpation in Ontario.
THR	**Threatened -** A species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.
SC	**Special Concern** - A species with characteristics that make it sensitive to human activities or natural events.

Global (G) Conservation Status Ranks	
GLOBAL	DEFINITION
GX	**Presumed Extinct** (species) - Not located despite intensive searches and virtually no likelihood of rediscovery **Presumed Eliminated** (ecosystems, i.e., ecological communities and systems) - Eliminated throughout its range, due to loss of key dominant and characteristic taxa and/or elimination of the sites and ecological processes on which the type depends
GH	**Possibly Extinct** (species) or **Possibly Eliminated** (ecosystems) - Known from only historical occurrences but still some hope of rediscovery. Examples of evidence include (1) that a species has not been documented in approximately 20-40 years despite some searching and/or some evidence of significant habitat loss or degradation; (2) that a species or ecosystem has been searched for unsuccessfully, but not thoroughly enough to presume that it is extinct or eliminated throughout its range.
G1	**Critically Imperiled -** At very high risk of extinction or elimination due to very restricted range, very few populations or occurrences, very steep declines, very severe threats, or other factors.
G2	**Imperiled -** At high risk of extinction or elimination due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.
G3	**Vulnerable -** At moderate risk of extinction or elimination due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.
G4	**Apparently Secure -** At fairly low risk of extinction or elimination due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.
G5	**Secure -** At very low risk or extinction or elimination due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats.

Variant Global Conservation Status Ranks	
RANK	DEFINITION
G#G#	**Range Rank -** A numeric range rank (e.g., G2G3, G1G3) is used to indicate uncertainty about the exact status of a taxon or ecosystem type. Ranges cannot skip more than two ranks (e.g., GU should be used rather than G1G4).
GU	**Unrankable -** Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. NOTE: Whenever possible (when the range of uncertainty is three consecutive ranks or less), a range rank (e.g., G2G3) should be used to delineate the limits (range) of uncertainty.
GNR	**Unranked -** Global rank not yet assessed.
GNA	**Not Applicable -** A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities. A global conservation status rank may be not applicable for several reasons, related to its relevance as a conservation target. For species, typically the species is a hybrid without conservation value, or of domestic origin. For ecosystems, the type is typically non-native (e.g, many ruderal vegetation types), agricultural (e.g. pasture, orchard) or developed (e.g. lawn, garden, golf course).

Rank Qualifiers	
RANK	DEFINITION
?	**Inexact Numeric Rank -** Denotes inexact numeric rank; this should not be used with any of the Variant Global Conservation Status Ranks or GX or GH.
Q	**Questionable taxonomy that may reduce conservation priority -** Distinctiveness of this entity as a taxon or ecosystem type at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or inclusion of this taxon or type in another taxon or type, with the resulting taxon having a lower-priority (numerically higher) conservation status rank. The "Q" modifier is only used at a global level and not at a national or subnational level.
C	**Captive or Cultivated Only** - Taxon or ecosystem at present is presumed or possibly extinct or eliminated in the wild across their entire native range but is extant in cultivation, in captivity, as a naturalized population (or populations) outside their native range, or as a reintroduced population or ecosystem restoration, not yet established. The "C" modifier is only used at a global level and not at a national or subnational level. Possible ranks are GXC or GHC. This is equivalent to "Extinct in the Wild (EW) in IUCN's Red List terminology (IUCN 2001).

Coefficient of Wetness				
CW VALUE	ABBRV.	INDICATOR STATUS	% OCCUR. IN WETLANDS	DEFINITION
-5	OBL	Obligate Wetland	99	Almost always occur in wetlands. With few exceptions, these plants (herbaceous or woody are found in standing water or seasonally saturated soils (14 or more consecutive days) near the surface.
-4	FACW+			
-3	FACW	Facultative Wetland	67-99	Usually occur in wetlands, but may occur in non-wetlands. These plants predominately occur with hydric soils, often in geomorphic settings where water saturates the soils or floods the soil surface at lease seasonally.
-2	FACW-			
-1	FAC+			
0	FAC	Facultative	34-66	Occur in wetlands and nonwetlands. These plants can grow in hydric, mesic, or xeric habitats. The occurrence of these plants in differenct habitats represents responses to a variety of environmental variables other than just hydrology, such as shade tolerance, soil pH, and elevation, and they have a wide tolerance of soil moisture conditions.
1	FAC-			
2	FACU+			
3	FACU	Facultative Upland	1-33	Usually occur in non-wetlands, but may occur in wetlands. These plants predominately occur on drier or more mesic sites in geomorphic settings where water rarely saturates the soils or floods the soil surface seasonally.
4	FACU-			
5	UPL	Obligate Upland	1	Almost never occur in wetlands. These plants occupy mesic to xeric non-wetland habitats. They almost never occur in standing water or saturated soils. Typical growth forms include herbaceous, shrubs, woody vines, and trees.
"+" or "-" signs have been attached to the three Facultative categories to express exaggerated tendencies for those species. The "+" sign denotes that the species generally has a greater estimated probability of occurring in wetlands than species having the general indicator category, but a lesser estimated probability of occurring in wetlands than those having the next higher general indicator. The"-" sign denotes that the species generally has a lesser estimated probability of occurring in wetlands than those having the general indicator status, but a greater estimated probability of occurring in wetlands than those having				

Infraspecific Taxon Global Conservation Status Ranks	
RANK	**DEFINITION**
T#	**Infraspecific Taxon** (trinomial) - The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. Rules for assigning T-ranks follow the same principles outlined above. For example, the global rank of a critically imperiled subspecies of an otherwise widespread and common species would be G5T1. A T subrank cannot imply the subspecies or variety is more abundant than the species, for example, a G1T2 subrank should not occur. A vertebrate animal population (e.g., listed under the U.S. Endangered Species Act or assigned candidate status) may be tracked as an infraspecific taxon and given a T rank; in such cases a Q is used after the T-rank to denote the taxon's informal taxonomic status.

National (N) and Subnational (S) Conservation Status Ranks	
RANK	**DEFINITION**
NX **SX**	**Presumed Extirpated** - Species or ecosystem is believed to be extirpated from the jurisdiction (i.e., nation, or state/province). Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered. [equivalent to "Regionally Extinct" in IUCN Red List terminology]
NH **SH**	**Possibly Extirpated** - Known from only historical records but still some hope of rediscovery. There is evidence that the species or ecosystem may no longer be present in the jurisdiction, but not enough to state this with certainty. Examples of such evidence include (1) that a species has not been documented in approximately 20-40 years despite some searching and/or some evidence of significant habitat loss or degradation; (2) that a species or ecosystem has been searched for unsuccessfully, but not thoroughly enough to presume that it is no longer present in the jurisdiction.
N1 **S1**	**Critically Imperiled** - At very high risk of extirpation in the jurisdiction due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.
N2 **S2**	**Imperiled** - At high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.
N3 **S3**	**Vulnerable—** At moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.
N4 **S4**	**Apparently Secure** - At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.
N5 **S5**	**Secure -** At very low or no risk of extirpation in the jurisdiction due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats.

Variant National and Subnational Conservation Status Ranks	
RANK	**DEFINITION**
N# **S#**	**Range Rank** - A numeric range rank (e.g., S2S3 or S1S3) is used to indicate any range of uncertainty about the status of the species or ecosystem. Ranges cannot skip more than two ranks (e.g., SU is used rather than S1S4).
NU **SU**	**Unrankable** - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
NNR **SNR**	**Unranked** - National or subnational conservation status not yet assessed.
NNA **SNA**	**Not Applicable** - A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities (e.g., long distance aerial and aquatic migrants, hybrids without conservation value, and non-native species or ecosystems (see Master et al. 2012, Appendix A, pg 70 for further details).
Not Provided	Species or ecosystem is known to occur in this nation or state/province. Contact the appropriate NatureServe network program for assignment of conservation status.

Appendix H

Aquatic Photographic Log 2023

Photograph 1.
June 29, 2023. View of the roadway section of the tributary facing East.

Photograph 2.
June 29, 2023. View of the roadway section of the tributary facing West.

Photograph 3.
June 29, 2023. View of the forested section of the tributary facing East.

Photograph 4.
June 29, 2023. View of the forested section of the tributary facing West.

2023 Photographic Log

Client Name:	Report Name	Project No.
CBM Aggregates	Mast Snyder	60700729

Photograph 5 ↑
June 29, 2023. Close up view of the reed canary grass dominated section of the tributary near the forested area facing West.

Photograph 6 ↑
June 29, 2023. View of the tributary in the reed canary grass dominated section facing Northwest towards forested area.

Photograph 7. ↑
June 29, 2023. Close up view of middle part of the reed canary grass dominated section of the tributary facing West.

Photograph 8. ↑
June 29, 2023. View of the tributary in the middle of the reed canary grass dominated section facing West.

Photograph 9.
June 29, 2023. Close up view of the reed canary grass dominated section of the tributary near the pond facing West.

Photograph 10.
June 29, 2023. View of the tributary in the reed canary grass dominated section facing East towards pond.

Photograph 11.
June 29, 2023. View of the pond facing North.

Photograph 12.
June 29, 2023. Close up view of the pond and aquatic vegetation within facing Northeast.

Appendix I

Low Water Level Trigger Memo and Responses

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David Hanratty
North America | Director of Land, Resource & Environment
St Marys Cement Inc. (Canada)/CBM Aggregates
55 Industrial Street
Toronto ON M4G 3W9

October 25, 2022

Project #
60675788-10

Subject: Response to Puslinch Township Review - CBM Aggregates Mast-Snyder Pit, Proposed Low Water Level Triggers

Dear Mr. Hanratty:

AECOM Canada Ltd. (AECOM) prepared a Memorandum, Subject: CBM Aggregates Mast-Snyder Pit, Proposed Low Water Level Triggers, dated July 12, 2022, to address a Site Plan Condition requiring establishment of Triggering Mechanisms. In response to the Memorandum, Harden Environmental Services Ltd. (Harden) provided review comments on behalf of the Township of Puslinch[1]. The review comments are re-produced below followed by AECOM's response.

Comment

1. In addition to climatic conditions, the threshold groundwater elevations should also be related to the features and ecological functions that they are designed to protect. How do the proposed thresholds for BH3 and BH10-2 relate to ground elevations in on-site wetlands or watercourses? Will proposed thresholds reduce hydroperiod in the features by delaying water table rise?

AECOM Response

The proposed groundwater trigger levels where chosen based on the protection of the ecological features and their respective functions. Development of the Triggering Mechanism is required under the approved Site Plans, specifically:

> "Trigger levels for BH3, BH8 and proposed BH9 and BH10 will be established when the below-water extraction in Area 2 of the Operations Plan is complete. Trigger levels at these locations will act as a warning to unexpected groundwater impact to the Speed River wetland both on and off-site (BH3, BH8), the Hanlon Creek Swamp (BH9) and the isolated wetland (BH10)."

As specified above, the purpose of the triggers is to provide early warning to unexpected groundwater impacts. Ecological relationships within the property are reviewed and presented in the annual monitoring report that is prepared to address the Technical Recommendations of the Site Plans. It is this monitoring that has been the basis for establishing the proposed groundwater trigger levels.

BH10-II is located at the southern edge of the Isolated Wetland, with a ground elevation of 325.86 mASL. The Isolated Wetland is considered a low quality wetland. As described in the 2021 Annual Monitoring Report, the

[1] *Harden Environmental Services Ltd., 2022: Letter to Glenn Schwendinger (Township of Puslinch), Re: Hydrogeological Review – Mast-Snyder Proposed Thresholds, from Stan Denhoed (Harden Environmental Services Ltd.), dated July 28, 2022.*

Isolated Wetland is surrounded by an actively cultivated cropland (either corn or soybeans) which encroaches almost to the wetland boundary. As such, the boundary of the wetland was quite disturbed with a variety of weedy species mixed with some wetland species. In 2021, there was a significant increase in the amount of cover of tall goldenrod and panicled aster which are characteristic of established meadows. The interior of the wetland was more homogeneous with a smaller number of species present, mainly reed canary grass (Phalaris arundinacea) and field sow-thistle. The proposed low water trigger elevations for BH10-II is 324.00 mASL. Surface water elevations have been collected seasonally since 2004 from a mini-piezometer (MP4) located within the deepest portion of the Isolated Wetland. These surface water elevations have ranged from 324.33 mASL to 325.35 mASL. Of the 42 surface water measurements collected between 2004 and 2021, MP4 was dry during 45% (19 events) of the site visits and frozen during 12% (five events) of the site visits. Notably, MP4 was dry during the summer and fall during the majority of the quarterly site visits.

BH3 is located adjacent to the Speed River Provincially Significant Wetland (PSW). As described in the 2021 Annual Monitoring Report, nearly the whole length of Tributary A consists of reed canary grass meadow marsh. Overall, the species composition and number of species has remained fairly constant over the past 15 years (when vegetation surveys were initiated). Cover by spotted jewelweed (Impatiens capensis) increased significantly since 2020 while hairy willow-herb (Epilobium hirsutum) declined. The amount of cover by woody shrubs continued to increase, as a result of natural succession. Surface water was not present in the poorly defined channel (Tributary A). In July 2021, the water table was well below the surface and even lower than in 2020. Groundwater monitoring at MP2-1 showed that the water table was about 40 cm lower in the summer of 2020 compared to summer of 2019 but about the same as in 2018. The wetland immediately adjacent to BH3 has a ground elevation of about 325 mASL. The proposed low water trigger elevations for BH3 is 323.87 mASL, about 1.13 m below ground surface. A pair of mini-piezometers, MP2-I and MP2-II are located within Tributary A of the PSW, about 130m north of BH3 and is the closest location where surface water elevations are collected. Surface water elevations have been collected seasonally since 2004 from MP2-I and MP2-II. Surface water elevations at MP2-I have ranged from 324.52 mASL to 325.35 mASL. Similar to the Isolated Wetland, MP2-I dry surface water condition occurred dominantly during the summer and fall quarterly site visits.

As described above, the Isolated Wetland and The Speed River PSW are frequently dry during the summer and fall. Peak below water extraction generally occurs during the summer and fall when low water levels/low water trigger elevations would most likely occur and when the Isolated Wetland and PSW are already naturally experiencing dry (no surface water) conditions. In addition, the vegetation in the Isolated Wetland and in the Speed River PSW are not particularly sensitive to drier conditions with significant periods of no surface water/standing water and therefore, not sensitive to minor decreases in the hydroperiod. Soil materials were logged during installation of MP4 and MP2. Both installations noted that these features are underlain by clayey silt, which enhances retention of surface water and promotes the extension of the hydroperiod. The proposed low water trigger elevations will not reduce the hydroperiod in the features by delaying water table rise.

Note that, as presented on the Site Plans, the Contingency Plan is also triggered by:

> "The ecological inspection identifies unusual stress response in the PSW directly adjacent to the pit area that is not present elsewhere in the woodlot surrounding Tributary A or ecological monitoring in the Speed River PSW on or off-site identifies unusual stress response which is attributable to the operation of the pit."

This condition aids in the protection of the ecological features during pit development and operation.

Comment

2. The relationship between annual precipitation and minimum water levels in the monitoring wells has not been established. Intuitively, one expects that in a year with lower precipitation, the seasonal groundwater elevation low would be correspondingly lower as suggested by AECOM. However
   a. the regression curve of hydrographs is not linear and as water levels decline, so does the rate of decline and
   b. if there is a wet summer/fall compared to winter/spring then low groundwater elevation may not be directly relatable to annual precipitation.

   We do not think it appropriate to use a linear approach to estimate lowest water level nor is it appropriate to use annual precipitation as indicator of seasonal low water level.

AECOM Response

It is agreed that the regression curve for hydrographs is not a linear and low groundwater elevation may not be directly relatable to annual precipitation. Groundwater levels will be affected by other factors such as available surplus based on the overall Site water balance, effects of evapotranspiration on the below-water extraction pond, specific characteristics of the Site soils, etc. The reviewer does agree that intuitively, lower precipitation would result in lower groundwater levels. Barring use of a complicated methodology, a more simplistic approach based on the methodology/rationale employed for development of the approved nearby Mill Creek triggers, was agreed upon during consultation with the Ministry of Natural Resources hydrogeologist. As such, it is our position that the proposed low water triggers consider historical observed groundwater elevations at each of the monitor locations and provide a valid basis for the methodology that was used.

Comment

3. There is data for BH3 and BH8 obtained in November 2007, the year with the lowest rainfall. This should be a good indication of water levels during extreme conditions. There is likely a strong linear correlation between BH3 and BH8 groundwater elevations and those in BH9 and BH10-2 which can then be used to predict extreme low water levels in BH9 and BH10-2.

AECOM Response

The November 2007 BH3 and BH8 groundwater elevations were 324.31 mASL and 325.27 mASL, respectively. Lower groundwater elevations were observed at BH3 in December 1999 (324.16 mASL) and at BH8 in November 2014 (325.14 mASL). Total precipitation for 2007, as recorded at the Environment Canada Waterloo-Wellington Airport was 507.9 mm compared to the long term normal of 916.5 mm[2]. Our methodology for establishing the proposed low water level trigger elevations considered the seasonally low groundwater elevations measured at each trigger monitor (up to 2017) and the dry 2007 conditions (see the July 12, 2022 Memorandum). Precipitation was also factored into the trigger elevation approach. The reviewer suggests that the November 2007 BH3 and BH8 groundwater elevations should be a good indication of water levels during extreme conditions, however, in the previous Review Comment 2 also acknowledges that a linear approach is not appropriate to estimate lowest water levels. We agree that precipitation and other variables contribute, which are harder to quantify, and will affect groundwater elevations across the site. It is our opinion that the proposed low water triggers presented in our July 12, 2022 Memorandum are an appropriate early warning mechanism to initiate investigations towards formulation of contingencies/mitigations.

[2] *1981 to 2010 Canadian Climate Normals for Environment Canada Waterloo-Wellington A station (Climate ID 6149387).*

Should there be additional questions or comments, please contact the undersigned.

Sincerely,
AECOM Canada Ltd.

Brian Holden, M.Sc., P.Geo.
Hydrogeologist, Environment
Brian.Holden@aecom.com

Encl.
cc:

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To:	Jennifer DeLeemans Votorantim Cimentos CBM Aggregates| Manager, Lands & Environment	Date:	July 12, 2022
		Project #:	60651256-8
		From:	Patty Wong Brian Holden
cc:			

Memorandum

Subject: CBM Aggregates Mast-Snyder Pit, Proposed Low Water Level Triggers

CBM Aggregates, a Division of St. Marys Cement Inc. (Canada) (CBM) operates the Mast-Snyder Pit under the Aggregate Resources Act for a Category 1 – Class "A" Pit Below Water for their property in the Township of Puslinch (**Figure 1**). In 2006, the Grand River Conservation Authority (GRCA) requested low water trigger elevations on on-site groundwater monitors. This request lead to inclusion of Site Plan Conditions requiring establishment of Triggering Mechanisms and a Contingency Plan. For completeness, the Site Plan conditions are reproduced below.

Triggering Mechanisms

Trigger levels for BH3, BH8 and proposed BH9 and BH10 will be established when the below-water extraction in Area 2 of the Operations Plan is complete. Trigger levels at these locations will act as a warning to unexpected groundwater impact to the Speed River wetland both on and off-site (BH3, BH8), the Hanlon Creek Swamp (BH9) and the isolated wetland (BH10).

The trigger levels will be based on worst-case conditions (hot, dry, mid-summer week with no precipitation, plus a high rate of aggregate extraction of 2,100 tonnes per day) and baseline water level data. The trigger levels will be established in consultation with the City, the County and Township, except for BH8 which shall be based on predicted groundwater levels in May or June. Should the water level at the trigger monitors decrease to below the trigger levels, water levels will be measured again the following month. If water levels are below the trigger levels for these two consecutive monitoring events and are attributed to the below-water extraction activities, the Contingency Plan (discussed below) will be implemented.

1. *The Contingency Plan will be implemented if any of the following conditions are established:*
   a) *Groundwater levels in the monitors are reduced below the triggers (as established above), as determined by the monitoring review; or*
   b) *The ecological inspection identifies unusual stress response in the PSW directly adjacent to the pit area that is not present elsewhere in the woodlot surrounding Tributary A or ecological monitoring in the Speed River PSW on or off-site identifies unusual stress response which is attributable to the operation of the pit; or*
   c) *A water well complaint is substantiated by the investigation to have resulted from the operation of the pit.*

Note that BH9 and BH10 were installed in 2010.

a. Contingency Plan

1. *In the event that the Contingency Plan is triggered, the following actions shall be implemented:*

   b) *The operator will cease any below-water extraction operations;*

   c) *The District office of the Ministry of the Environment and the Ministry of Natural Resources, the Township, the County and the City shall be informed within seven calendar days of the impact, and the implementation of the Contingency Plan;*

   d) *Water level measurements in all on-site monitors and mini-piezometers shall be repeated as soon as possible and practical, and continue on at least a weekly basis during the period when the impact persists;*

   e) *The monitoring data and other relevant information will be reviewed by a qualified ecologist or geoscientist who will, as soon as reasonably possible, prepare a mitigation plan documenting:*

   The nature, extent and significance of the impact,
   A recommendation regarding its mitigation,
   Recommendations regarding any additional monitoring requirements, and
   Recommendations regarding the resumption of operations.
   The report shall be circulated to the District office of the Ministry of the Environment, the Ministry of Natural Resources, the Township, the County and the City; and

   f) *Subject to approval by the District office of the Ministry of the Environment and the Ministry of Natural Resources, the operator shall implement the mitigation plan.*

2. *In regard to a Contingency Plan for the isolated wetland, in the unlikely event that the water levels decrease beyond predicted levels, the deeper portion of the isolated wetland will be dredged/deepened, subject to MNR/GRCA approval. This would provide an opportunity for the dredged area to be seeded and/or planted to create a more diverse mix of wetland plant species. Details on the Contingency Plan will be shared with the Township and the County.*

As per the Site Plans, the Triggering Mechanisms and Contingency Plan will not be established until after the Area 2 below-water extraction is complete. Site preparation (berms, stripping) commenced in late spring/early summer 2018. Above and below-water extraction activities commenced in November 2018 and July 2019, respectively. Below water extraction in Area 2 commenced in late fall 2019 was completed in early April 2022. The purpose of this memo is to present the proposed trigger elevations as well as explaining the rationale behind the establishment of these levels.

In June 2006, the Ministry of Natural Resources hydrogeologist at that time (David Webster) reviewed the rationale leading to the development of the proposed trigger elevations and found it reasonable. The trigger levels presented in this memorandum reflect the agreed upon approach, updated to consider baseline water level elevations collected up to the end of 2017, prior to any on-site extraction.

As presented in the hydrogeological assessment[1], drawdown calculations were completed under the worse case scenario of a hot, dry (no precipitation), mid-summer week with a high rate of below-water extraction (2,100

[1] *Gartner Lee Limited, 2006: Consolidated Hydrogeological Assessment for Below-Water Extraction, St Marys Mast – Snyder*

tonnes per day) for the initial excavation when a small pond is present, for near the end of the operation when a large pond is present and at the end of operations when a large pond remains but extraction operations have ceased. As the initial below-water excavation commenced in the southeast corner of the site and the trigger monitors are in the northern portion of the site, no water level impacts are expected early in the below-water extraction operations in the vicinity of Tributary A. Later in the operations when a large pond is present and there is a high rate of extraction, the drawdown at Tributary A is predicted to be in the order of 0.06 m. Once operations cease, only a minor drawdown at Tributary A (less than 0.01 m) is predicted, mainly as a result of evaporation off the pond surface. The aggregate removal effect is a temporary impact that only occurs while the pit is being extracted. Over time, additional precipitation in the pit, and groundwater recharge in the surrounding areas, will offset this effect. Furthermore, as the ponds in the pit grow larger, a “reservoir” of water is created and the effects of removing solid particles from below the water table are diminished. In light of this, the drawdown effect is considered negligible and the focus of establishing triggers is based on the baseline water levels and the effects of precipitation.

Due to the highly permeable nature of the soils in the area, shallow groundwater levels are closely linked to the amount of precipitation received. During the wetter spring period, the water table rises in response to spring snowmelt and increased precipitation that typically occur. During the drier periods of the year, the water table will decrease. In establishing trigger levels, the long term meteorological data from 1981 to 2017 for the closest Environment Canada meterological station (Waterloo-Wellington Airport, climate ID 6149387), was reviewed. Groundwater monitoring at the site began in 1999 for monitors BH1 to BH5. Over time, additional groundwater monitors were installed and incorporated into the routine seasonal water level monitoring of the site (BH6 to BH8 were drilled May 2003; BH9, BH10 and BH11 were drilled in 2010). Groundwater elevations for the 11 existing on-site groundwater monitor locations were reviewed.

The Site Plan requires low level trigger elevations at BH3, BH8, BH9 and BH10. The baseline manual water level record of each of these locations were examined; 1999 to 2017 for BH3, 2003 to 2017 for BH8 and 2010 to 2017 for BH9 and BH10 to estimate the seasonal high and low water levels to determine typical water level fluctuations. The average difference between the seasonal low and high water levels recorded at each monitor was calculated. Next, the annual precipitation data from 1981 to 2017 was examined showing that 2007 had the lowest precipitation (507.9 mm) during this period. For each monitor, the years with the summer and fall low water levels was compared to the 2007 precipitation to determine how much lower was the 2007 precipitation and these were averaged. The difference between the low water level years and the driest year (2007) was applied to the average seasonal fluctuation to estimate how much lower water levels might be in a very dry year with a high rate of extraction. Then this correction was applied to the lowest observed manual water level for each specific monitor location resulting in a low water level trigger elevation.

For example, at monitor BH3, the average seasonal difference between high and low water levels was about 0.76 m for the 1999 to 2017 baseline period, prior to on-site extraction. The driest year on record (since 1981) from data at the Environment Canada Waterloo-Wellington Airport was 2007 with a total annual precipitation of 507.9 mm. Based on the water levels at BH3, the lowest seasonal water levels occurred in the summer and fall in 2001 and 1999, respectively. The 2001 and 1999 annual precipitation was approximately 39% and 37%, respectively, higher than the 2007 annual precipitation with an average between the two of about 38%. To account for a dry year, 38% of the difference between the average high and low seasonal water levels was subtracted from the predicted post-extraction lake elevation[2]. The lowest water level at BH3 occurred in December 1999 (324.16 mASL). Therefore, to account for a dry year and high rate of extraction, the correction

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Property, Township of Puslinch, County of Wellington, prepared for St. Marys Cement Inc., GLL23-312, December 14, 2006.
[2] 38.3% of 0.76 m = 0.29 m, therefore, 324.16 mASL minus 0.29 m = 323.87 mASL.

for a dry year (0.29 m) was subtracted from the lowest recorded baseline water level (324.16 mASL) to provide a BH3 trigger elevation of 323.87 mASL.

A summary of the triggers, based on the above approach is provided in the table below.

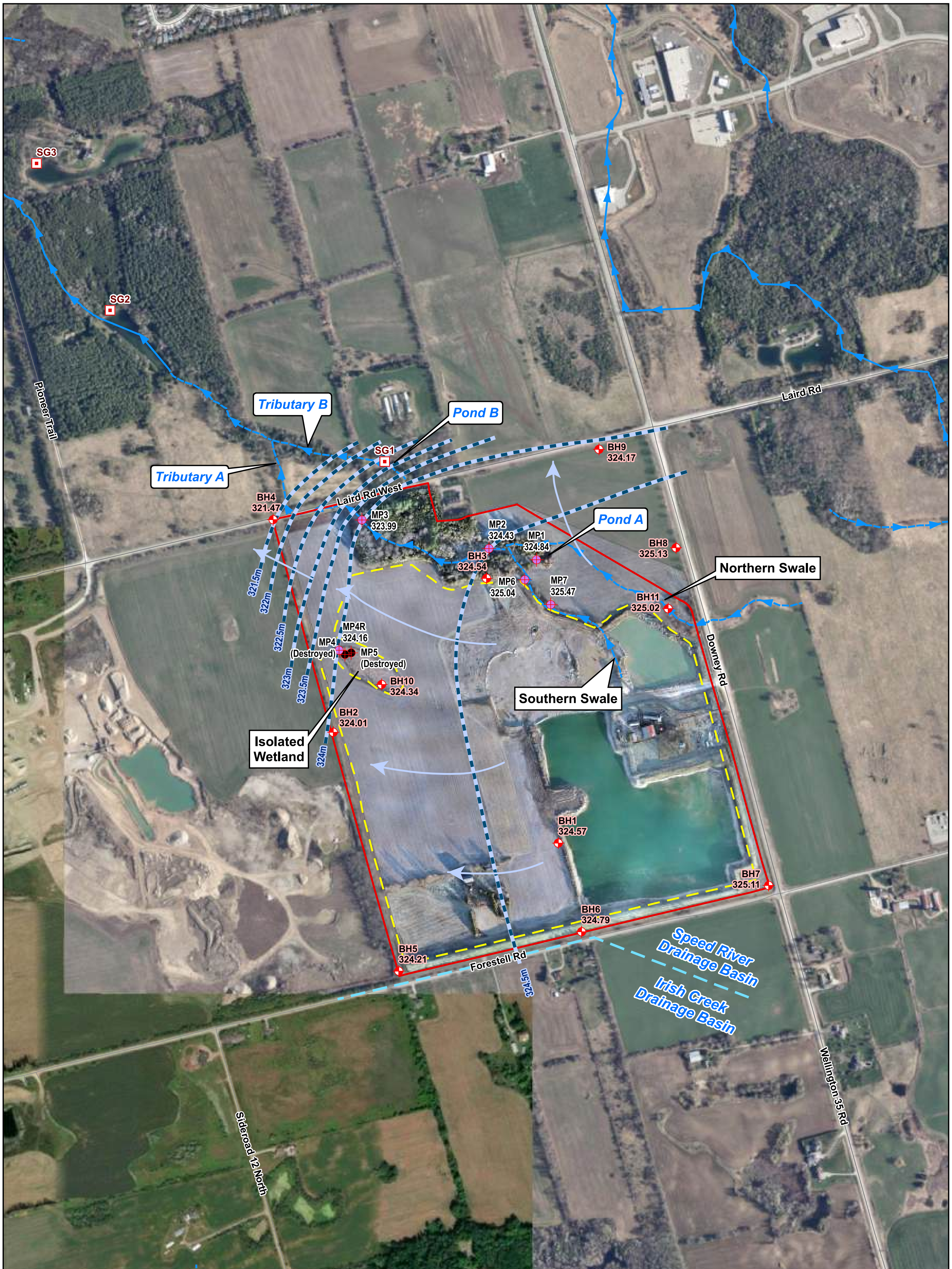
Location	Low Water Trigger Elevation
BH3	323.87 mASL
BH8	324.86 mASL
BH9	323.20 mASL
BH10-II	324.00 mASL

The detailed methodology and calculations used to set the triggers is presented in attached Tables 1 to 4.

Technical Recommendations, Hydrogeological Assessment, Site Plan Condition 4 reads:

4. Monthly groundwater level measurements and groundwater temperatures will be collected during periods of below-water extraction at the monitoring points (monitoring wells and mini-piezometers) on-site for the first two years of below-water extraction. If trends are consistent over the first two-years of below-water extraction, the monitoring program will be reduced from monthly to quarterly.

The Site Plan triggering mechanisms and contingency plans were originally based on the monthly/quarterly manual water level monitoring program, as described above under Condition 4. In May 2018, all existing groundwater monitors and mini-piezometers on-site were instrumented with level loggers collecting daily water level readings, which is a much higher frequency than the monthly/quarterly frequency originally cited in the Site Plans. As this is the case, it is proposed that as long as daily logger readings are collected at BH3, BH8, BH9 an BH10-II, the triggering mechanisms are based on groundwater levels that are recorded below the trigger elevation for seven consecutive days with an observed downward trend and attributed to be a result of below-water extraction activities before the contingency plan is implemented.



Basemapping from Ontario Ministry of Natural Resources
Orthophotography: June 2019
Note: On-site aerial coverage from Dec 14, 2021 Drone Survey

N W E S

0 100 200 400
Meters

UTM Zone 17, NAD 83

Legend

- Mini-Piezometer
- Destroyed Mini-Piezometer
- Staff Gauge
- Monitor Location
- Groundwater Contours (0.5m)
- Groundwater Divide
- Groundwater Flow Direction
- Roads
- Intermittent Watercourse
- Permanent Watercourse
- Site Boundary
- Approximate Limit of Extraction

CBM Aggregates
Mast-Snyder Property

Site Plan and Groundwater Flow (November 2021)

June 2022
Project 60651256-7

AECOM

Figure 4

Path: L:\Kitchener-CAKCN1\Legacy\CAKCN1FP001\Data\FP001Data\DATAFP001\CAKCN-Environment\Projects\60312725-9 Cedar Pit\St Mary\60651256_StMarySitPlanandGroundwaterflow_20220627.mxd

Table 1: Low Water Level Trigger Elevations - BH3

Mast-Snyder Property, PN 60624078

1999 to 2017 water level and precipitation data for BH3 was examined as background for establishing the triggers.

On-Site Seasonal Water Levels

Winter
- BH3 high seasonal winter water level 1999 to 2017 is 325.06 mASL on Nov 27, 2006
- BH3 low seasonal winter water level 1999 to 2017 is 324.28 mASL on Jan 14, 2003

  difference between high and low winter seasonal water level is 0.78 m

Spring
- BH3 high seasonal spring water level 1999 to 2017 is 325.45 mASL on Apr 12, 2008
- BH3 low seasonal spring water level 1999 to 2017 is 324.82 mASL on May 28, 2015

  difference between high and low spring seasonal water level is 0.63 m

Summer
- BH3 high seasonal summer water level 1999 to 2017 is 324.93 mASL on Aug 20, 2008
- BH3 low seasonal summer water level 1999 to 2017 is 324.27 mASL on Sept 11, 2001

  difference between high and low summer seasonal water level is 0.66 m

Fall
- BH3 high seasonal fall water level 1999 to 2017 is 325.12 mASL on Nov.25, 2014
- BH3 low seasonal fall water level 1999 to 2017 is 324.16 mASL on Dec 15, 1999

  difference between high and low fall seasonal water level is 0.96 m

The average difference between the high and low seasonal water levels at BH3 is (0.78 m + 0.63 m + 0.66 m + 0.96 m)/4 = 0.76 m

---

Precipitation

Based on the water levels at BH3, the lowest seasonal water levels occur in the summer and the fall

From 1981 to 2017 met. Data from Waterloo-Wellington Airport

annual precipitation in 1999 = 811 mm (year of seasonal low fall water level at BH3)
annual precipitation in 2001 = 835.8 mm (year of seasonal low summer water level at BH3)
annual precipitation in 2007 = 507.9 mm (driest year on record between 1981 and 2017)
507.9 mm/811 mm = 0.626
0.626 - 1 = 0.374 x 100 = 37.4%
507.9 mm/835.8 mm = 0.608
0.608 - 1 = 0.392 x 100 = 39.2%

Average of 38.3%, (37.4% + 39.2%)/2 = 38.3%

Driest year (2007) since 1981 was about 38% drier than the year in which the lowest seasonal water levels were observed on the site (1999 and 2017)

Water Level Correction for Dry Year

- Driest year since 1981 was about 38% drier than the years in which the lowest summer and fall water levels were observed on the site at BH3

  0.76 m x 38% = 0.29 m

Lowest water level observed under baseline conditions was 324.16 mASL

Therefore, to account for a dry year,
324.16 mASL - 0.29 m = 323.87 mASL

323.87 mASL is the trigger elevation for BH3

Table 2: Low Water Level Trigger Elevations - BH8

Mast-Snyder Property, PN 60624078

2003 to 2017 water level and precipitation data for BH8 was examined as background for establishing the triggers.

On-Site Seasonal Water Levels

Winter

- BH8 high seasonal winter water level 2003 to 2017 is 327.28 mASL on Jan 24, 2017
- BH8 low seasonal winter water level 2003 to 2017 is 325.65 mASL on Feb 26, 2015

  difference between high and low winter seasonal water level is 1.63 m

Spring

- BH8 high seasonal spring water level 2003 to 2017 is 326.63 mASL on Apr 12, 2008
- BH8 low seasonal spring water level 2003 to 2017 is 325.78 mASL on May 28, 2015

  difference between high and low spring seasonal water level is 0.85 m

Summer

- BH8 high seasonal summer water level 2003 to 2017 is 325.98 mASL on Aug 5, 2009
- BH8 low seasonal summer water level 2003 to 2017 is 325.27 mASL on Aug 8, 2012

  difference between high and low summer seasonal water level is 0.71 m

Fall

- BH8 high seasonal fall water level 2003 to 2017 is 326.03 mASL on Nov.27, 2006
- BH8 low seasonal fall water level 2003 to 2017 is 325.14 mASL on Nov 25, 2014

  difference between high and low fall seasonal water level is 0.89 m

The average difference between the high and low seasonal water levels at BH8 is (1.63 m + 0.85 m + 0.71 m + 0.89 m)/4 = 1.02 m

---

Precipitation

Based on the water levels at BH8, the lowest seasonal water levels occur in the summer and the fall

From 1981 to 2017 met. Data from Waterloo-Wellington Airport

annual precipitation in 2014 = 734.3 mm (year of seasonal low fall water level at BH8)
annual precipitation in 2012 = 655.5 mm (year of seasonal low summer water level at BH8)
annual precipitation in 2007 = 507.9 mm (driest year on record between 1981 and 2017)
507.9 mm/734.3 mm = 0.692
0.692 - 1 = 0.308 x 100 = 30.8%
507.9 mm/655.5 mm = 0.775
0.775 - 1 = 0.225 x 100 = 22.5%

Average of 26.7%, (30.8% + 22.5%)/2 = 26.7%

Driest year (2007) since 1981 was about 27% drier than the year in which the lowest seasonal water levels were observed on the site (2003 and 2017)

Water Level Correction for Dry Year

- Driest year since 1981 was about 27% drier than the years in which the lowest summer and fall water levels were observed on the site at BH8

  1.02 m x 27% = 0.28 m

Lowest water level observed under baseline conditions was 325.14 mASL

Therefore, to account for a dry year,
325.14 mASL - 0.28 m = 324.86 mASL

324.86 mASL is the trigger elevation for BH8

Table 3: Low Water Level Trigger Elevations - BH9

Mast-Snyder Property, PN 60624078

2010 to 2017 water level and precipitation data for BH9 was examined as background for establishing the triggers.

On-Site Seasonal Water Levels

Winter

- BH9 high seasonal winter water level 2010 to 2017 is 324.67 mASL on Jan 24, 2017
- BH9 low seasonal winter water level 2010 to 2017 is 323.71 mASL on Feb 26, 2015
  difference between high and low winter seasonal water level is 0.96 m

Spring

- BH9 high seasonal spring water level 2010 to 2017 is 324.91 mASL on May 24, 2011
- BH9 low seasonal spring water level 2010 to 2017 is 323.91 mASL on May 28, 2015
  difference between high and low spring seasonal water level is 1 m

Summer

- BH9 high seasonal summer water level 2010 to 2017 is 323.75 mASL on Aug 16, 2013
- BH9 low seasonal summer water level 2010 to 2017 is 323.43 mASL on Aug 8, 2012
  difference between high and low summer seasonal water level is 0.32 m

Fall

- BH9 high seasonal fall water level 2010 to 2017 is 324.14 mASL on Nov.20, 2013
- BH9 low seasonal fall water level 2010 to 2017 is 323.39 mASL on Nov 21, 2016
  difference between high and low fall seasonal water level is 0.75 m

The average difference between the high and low seasonal water levels at BH9 is (0.96 m + 1 m + 0.32 m + 0.75 m)/4 = 0.76 m

---

Precipitation

Based on the water levels at BH9, the lowest seasonal water levels occur in the summer and the fall

From 1981 to 2017 met. Data from Waterloo-Wellington Airport
annual precipitation in 2016 = 689.1 mm (year of seasonal low fall water level at BH9)
annual precipitation in 2012 = 655.5 mm (year of seasonal low summer water level at BH9)
annual precipitation in 2007 = 507.9 mm (driest year on record between 1981 and 2017)
507.9 mm/689.1 mm = 0.737
0.737 - 1 = 0.262 x 100 = 26.2%
507.9 mm/655.5 mm = 0.775
0.775 - 1 = 0.225 x 100 = 22.5%

Average of 24.4%, (26.2% + 22.5%)/2 = 24.4%

Driest year (2007) since 1981 was about 24% drier than the year in which the lowest seasonal water levels were observed on the site (2016 and 2012)

Water Level Correction for Dry Year

- Driest year since 1981 was about 24% drier than the years in which the lowest summer and fall water levels were observed on the site at BH9
  0.76 m x 24% = 0.19 m

Lowest water level observed under baseline conditions was 323.39 mASL
Therefore, to account for a dry year,
323.39 mASL - 0.19 m = 323.20 mASL

323.20 mASL is the trigger elevation for BH9

Table 4: Low Water Level Trigger Elevations - BH10-II

Mast-Snyder Property, PN 60624078

2010 to 2017 water level and precipitation data for BH10-II was examined as background for establishing the triggers.

On-Site Seasonal Water Levels

Winter
- BH10-II high seasonal winter water level 2010 to 2017 is 325.06 mASL on Jan 24, 2017
- BH10-II low seasonal winter water level 2010 to 2017 is 324.48 mASL on Feb 26, 2015

  difference between high and low winter seasonal water level is 0.58 m

Spring
- BH10-II high seasonal spring water level 2010 to 2017 is 325.31 mASL on May 24, 2011
- BH10-II low seasonal spring water level 2010 to 2017 is 324.72 mASL on May 28, 2015

  difference between high and low spring seasonal water level is 0.59 m

Summer
- BH10-II high seasonal summer water level 2010 to 2017 is 324.67 mASL on Aug 16, 2013
- BH10-II low seasonal summer water level 2010 to 2017 is 324.15 mASL on Aug 8, 2012

  difference between high and low summer seasonal water level is 0.52 m

Fall
- BH10-II high seasonal fall water level 2010 to 2017 is 324.79 mASL on Nov.25, 2014
- BH10-II low seasonal fall water level 2010 to 2017 is 324.17 mASL on Nov 21, 2016

  difference between high and low fall seasonal water level is 0.62 m

The average difference between the high and low seasonal water levels at BH10-II is (0.58 m + 0.59 m + 0.52 m + 0.62 m)/4 = 0.58 m

---

Precipitation

Based on the water levels at BH10-II, the lowest seasonal water levels occur in the summer and the fall

From 1981 to 2017 met. Data from Waterloo-Wellington Airport

annual precipitation in 2016 = 689.1 mm (year of seasonal low fall water level at BH9)
annual precipitation in 2012 = 655.5 mm (year of seasonal low summer water level at BH9)
annual precipitation in 2007 = 507.9 mm (driest year on record between 1981 and 2017)
507.9 mm/689.1 mm = 0.737
0.737 - 1 = 0.262 x 100 = 26.2%
507.9 mm/655.5 mm = 0.775
0.775 - 1 = 0.225 x 100 = 22.5%

Average of 24.4%, (26.2% + 22.5%)/2 = 24.4%

Driest year (2007) since 1981 was about 24% drier than the year in which the lowest seasonal water levels were observed on the site (2016 and 2012)

Water Level Correction for Dry Year

- Driest year since 1981 was about 24% drier than the years in which the lowest summer and fall water levels were observed on the site at BH9

  0.58 m x 24% = 0.14 m

Lowest water level observed under baseline conditions was 324.15 mASL

Therefore, to account for a dry year,
324.15 mASL - 0.14 m = 324.00 mASL

324.00 mASL is the trigger elevation for BH10-II

TOWNSHIP OF
PUSLINCH
EST. 1850

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August 26, 2022

RE: 10.1 Mast Snyder Pit Proposed Low Water Level Triggers

Please be advised that Township of Puslinch Council, at its meeting held on August 10, 2022 considered the aforementioned topic and subsequent to discussion, the following was resolved:

Resolution No. 2022-270: Moved by Councillor Sepulis and
Seconded by Councillor Bailey

That Council receive Correspondence item 10.1 regarding the Mast Snyder Pit Proposed Low Water Level Triggers for information; and

That the report prepared by Harden Environmental be forwarded to the pit operator for a response and that the Ministry be copied on the correspondence noting that the Township supports the recommendation outlined by Harden Environmental in the report.

CARRIED

As per the above resolution, please accept a copy of this correspondence for your information and consideration.

Sincerely,

Courtenay Hoytfox
Municipal Clerk

HARDEN

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Phone: 519.826.0099 fax: 519.826.9099 www.hardenv.com

Groundwater Studies
Geochemistry
Phase I / II
Regional Flow Studies
Contaminant Investigations
OMB Hearings
Water Quality Sampling
Monitoring
Groundwater Protection Studies
Groundwater Modelling
Groundwater Mapping

File: 0402

July 28, 2022

Township of Puslinch
7404 Wellington Road 34
Guelph, ON, N1H 6H9

Attention: Glenn Schwendinger

Dear Glenn:

Re: Hydrogeological Review – Mast-Snyder Proposed Thresholds

We have reviewed the proposed thresholds for the Mast-Snyder Pit and have the following comments. The thresholds are presented in the July 12, 2022 letter prepared by AECOM Canada Ltd. The proposed thresholds are listed in the following table.

Station	Proposed Threshold (m AMSL)	Historic Low (m AMSL)
BH3	323.87	324.16
BH8	324.86	325.14
BH9	323.20	323.39
BH10-2	324.00	324.15

Our comments are as follows;

1) In addition to climatic conditions, the threshold groundwater elevations should also be related to the features and ecological functions that they are designed to protect. How do the proposed thresholds for BH3 and BH10-2 relate to ground elevations in on-site wetlands or watercourses? Will proposed thresholds reduce hydroperiod in the features by delaying water table rise?

2) The relationship between annual precipitation and minimum water levels in the monitoring wells has not been established. Intuitively, one expects that in a year with lower precipitation, the seasonal groundwater elevation low would be correspondingly lower as suggested by AECOM. However a) the regression curve of hydrographs is not linear and as water levels decline, so does the rate of decline and b) if there is a wet summer/fall compared to winter/spring then low groundwater elevation

may not be directly relatable to annual precipitation. We do not think it appropriate to use a linear approach to estimate lowest water level nor is it appropriate to use annual precipitation as indicator of seasonal low water level.

3) There is data for BH3 and BH8 obtained in November 2007, the year with the lowest rainfall. This should be a good indication of water levels during extreme conditions. There is likely a strong linear correlation between BH3 and BH8 groundwater elevations and those in BH9 and BH10-2 which can then be used to predict extreme low water levels in BH9 and BH10-2.

Sincerely,

Harden Environmental Services Ltd.

[redacted]

Stan Denhoed, M.Sc., P.Eng.
Senior Hydrogeologist

AECOM Imagine it. Delivered.

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To: Jennifer DeLeemans
Votorantim Cimentos
CBM Aggregates| Manager, Lands & Environment

cc:

Date: July 12, 2022
Project #: 60651256-8
From: Patty Wong
Brian Holden

Memorandum

Subject: **CBM Aggregates Mast-Snyder Pit, Proposed Low Water Level Triggers**

CBM Aggregates, a Division of St. Marys Cement Inc. (Canada) (CBM) operates the Mast-Snyder Pit under the Aggregate Resources Act for a Category 1 – Class "A" Pit Below Water for their property in the Township of Puslinch (**Figure 1**). In 2006, the Grand River Conservation Authority (GRCA) requested low water trigger elevations on on-site groundwater monitors. This request lead to inclusion of Site Plan Conditions requiring establishment of Triggering Mechanisms and a Contingency Plan. For completeness, the Site Plan conditions are reproduced below.

Triggering Mechanisms

Trigger levels for BH3, BH8 and proposed BH9 and BH10 will be established when the below-water extraction in Area 2 of the Operations Plan is complete. Trigger levels at these locations will act as a warning to unexpected groundwater impact to the Speed River wetland both on and off-site (BH3, BH8), the Hanlon Creek Swamp (BH9) and the isolated wetland (BH10).

The trigger levels will be based on worst-case conditions (hot, dry, mid-summer week with no precipitation, plus a high rate of aggregate extraction of 2,100 tonnes per day) and baseline water level data. The trigger levels will be established in consultation with the City, the County and Township, except for BH8 which shall be based on predicted groundwater levels in May or June. Should the water level at the trigger monitors decrease to below the trigger levels, water levels will be measured again the following month. If water levels are below the trigger levels for these two consecutive monitoring events and are attributed to the below-water extraction activities, the Contingency Plan (discussed below) will be implemented.

1. *The Contingency Plan will be implemented if any of the following conditions are established:*
   a) *Groundwater levels in the monitors are reduced below the triggers (as established above), as determined by the monitoring review; or*
   b) *The ecological inspection identifies unusual stress response in the PSW directly adjacent to the pit area that is not present elsewhere in the woodlot surrounding Tributary A or ecological monitoring in the Speed River PSW on or off-site identifies unusual stress response which is attributable to the operation of the pit; or*
   c) *A water well complaint is substantiated by the investigation to have resulted from the operation of the pit.*

Note that BH9 and BH10 were installed in 2010.

a. Contingency Plan

1. *In the event that the Contingency Plan is triggered, the following actions shall be implemented:*

   b) *The operator will cease any below-water extraction operations;*

   c) *The District office of the Ministry of the Environment and the Ministry of Natural Resources, the Township, the County and the City shall be informed within seven calendar days of the impact, and the implementation of the Contingency Plan;*

   d) *Water level measurements in all on-site monitors and mini-piezometers shall be repeated as soon as possible and practical, and continue on at least a weekly basis during the period when the impact persists;*

   e) *The monitoring data and other relevant information will be reviewed by a qualified ecologist or geoscientist who will, as soon as reasonably possible, prepare a mitigation plan documenting:*

      The nature, extent and significance of the impact,
      A recommendation regarding its mitigation,
      Recommendations regarding any additional monitoring requirements, and
      Recommendations regarding the resumption of operations.
      The report shall be circulated to the District office of the Ministry of the Environment, the Ministry of Natural Resources, the Township, the County and the City; and

   f) *Subject to approval by the District office of the Ministry of the Environment and the Ministry of Natural Resources, the operator shall implement the mitigation plan.*

2. *In regard to a Contingency Plan for the isolated wetland, in the unlikely event that the water levels decrease beyond predicted levels, the deeper portion of the isolated wetland will be dredged/deepened, subject to MNR/GRCA approval. This would provide an opportunity for the dredged area to be seeded and/or planted to create a more diverse mix of wetland plant species. Details on the Contingency Plan will be shared with the Township and the County.*

As per the Site Plans, the Triggering Mechanisms and Contingency Plan will not be established until after the Area 2 below-water extraction is complete. Site preparation (berms, stripping) commenced in late spring/early summer 2018. Above and below-water extraction activities commenced in November 2018 and July 2019, respectively. Below water extraction in Area 2 commenced in late fall 2019 was completed in early April 2022. The purpose of this memo is to present the proposed trigger elevations as well as explaining the rationale behind the establishment of these levels.

In June 2006, the Ministry of Natural Resources hydrogeologist at that time (David Webster) reviewed the rationale leading to the development of the proposed trigger elevations and found it reasonable. The trigger levels presented in this memorandum reflect the agreed upon approach, updated to consider baseline water level elevations collected up to the end of 2017, prior to any on-site extraction.

As presented in the hydrogeological assessment[1], drawdown calculations were completed under the worse case scenario of a hot, dry (no precipitation), mid-summer week with a high rate of below-water extraction (2,100

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[1] *Gartner Lee Limited, 2006: Consolidated Hydrogeological Assessment for Below-Water Extraction, St Marys Mast – Snyder*

tonnes per day) for the initial excavation when a small pond is present, for near the end of the operation when a large pond is present and at the end of operations when a large pond remains but extraction operations have ceased. As the initial below-water excavation commenced in the southeast corner of the site and the trigger monitors are in the northern portion of the site, no water level impacts are expected early in the below-water extraction operations in the vicinity of Tributary A. Later in the operations when a large pond is present and there is a high rate of extraction, the drawdown at Tributary A is predicted to be in the order of 0.06 m. Once operations cease, only a minor drawdown at Tributary A (less than 0.01 m) is predicted, mainly as a result of evaporation off the pond surface. The aggregate removal effect is a temporary impact that only occurs while the pit is being extracted. Over time, additional precipitation in the pit, and groundwater recharge in the surrounding areas, will offset this effect. Furthermore, as the ponds in the pit grow larger, a “reservoir” of water is created and the effects of removing solid particles from below the water table are diminished. In light of this, the drawdown effect is considered negligible and the focus of establishing triggers is based on the baseline water levels and the effects of precipitation.

Due to the highly permeable nature of the soils in the area, shallow groundwater levels are closely linked to the amount of precipitation received. During the wetter spring period, the water table rises in response to spring snowmelt and increased precipitation that typically occur. During the drier periods of the year, the water table will decrease. In establishing trigger levels, the long term meteorological data from 1981 to 2017 for the closest Environment Canada meterological station (Waterloo-Wellington Airport, climate ID 6149387), was reviewed. Groundwater monitoring at the site began in 1999 for monitors BH1 to BH5. Over time, additional groundwater monitors were installed and incorporated into the routine seasonal water level monitoring of the site (BH6 to BH8 were drilled May 2003; BH9, BH10 and BH11 were drilled in 2010). Groundwater elevations for the 11 existing on-site groundwater monitor locations were reviewed.

The Site Plan requires low level trigger elevations at BH3, BH8, BH9 and BH10. The baseline manual water level record of each of these locations were examined; 1999 to 2017 for BH3, 2003 to 2017 for BH8 and 2010 to 2017 for BH9 and BH10 to estimate the seasonal high and low water levels to determine typical water level fluctuations. The average difference between the seasonal low and high water levels recorded at each monitor was calculated. Next, the annual precipitation data from 1981 to 2017 was examined showing that 2007 had the lowest precipitation (507.9 mm) during this period. For each monitor, the years with the summer and fall low water levels was compared to the 2007 precipitation to determine how much lower was the 2007 precipitation and these were averaged. The difference between the low water level years and the driest year (2007) was applied to the average seasonal fluctuation to estimate how much lower water levels might be in a very dry year with a high rate of extraction. Then this correction was applied to the lowest observed manual water level for each specific monitor location resulting in a low water level trigger elevation.

For example, at monitor BH3, the average seasonal difference between high and low water levels was about 0.76 m for the 1999 to 2017 baseline period, prior to on-site extraction. The driest year on record (since 1981) from data at the Environment Canada Waterloo-Wellington Airport was 2007 with a total annual precipitation of 507.9 mm. Based on the water levels at BH3, the lowest seasonal water levels occurred in the summer and fall in 2001 and 1999, respectively. The 2001 and 1999 annual precipitation was approximately 39% and 37%, respectively, higher than the 2007 annual precipitation with an average between the two of about 38%. To account for a dry year, 38% of the difference between the average high and low seasonal water levels was subtracted from the predicted post-extraction lake elevation[2]. The lowest water level at BH3 occurred in December 1999 (324.16 mASL). Therefore, to account for a dry year and high rate of extraction, the correction

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Property, Township of Puslinch, County of Wellington, prepared for St. Marys Cement Inc., GLL23-312, December 14, 2006.
[2] 38.3% of 0.76 m = 0.29 m, therefore, 324.16 mASL minus 0.29 m = 323.87 mASL.

for a dry year (0.29 m) was subtracted from the lowest recorded baseline water level (324.16 mASL) to provide a BH3 trigger elevation of 323.87 mASL.

A summary of the triggers, based on the above approach is provided in the table below.

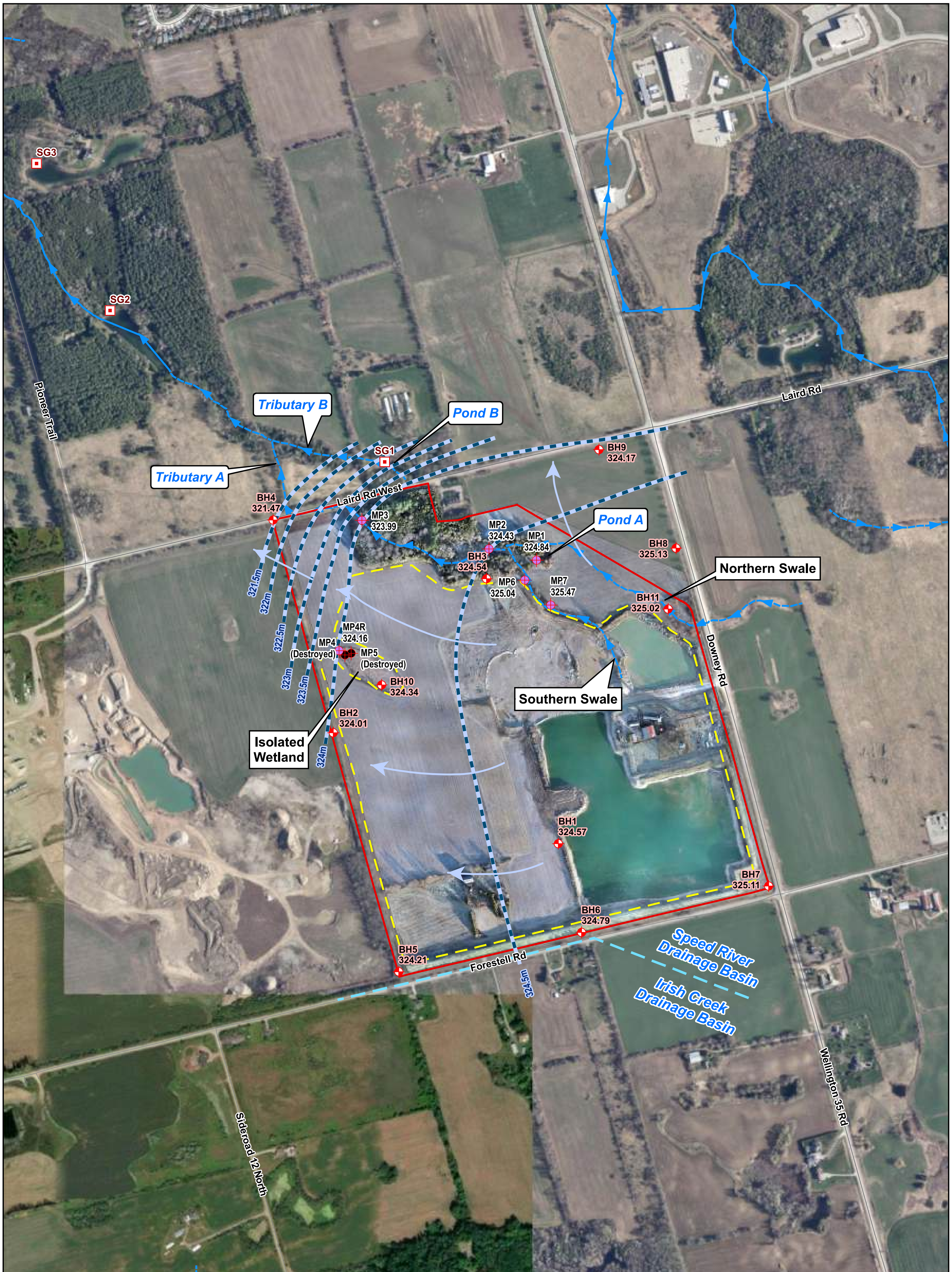
Location	Low Water Trigger Elevation
BH3	323.87 mASL
BH8	324.86 mASL
BH9	323.20 mASL
BH10-II	324.00 mASL

The detailed methodology and calculations used to set the triggers is presented in attached Tables 1 to 4.

Technical Recommendations, Hydrogeological Assessment, Site Plan Condition 4 reads:

4. Monthly groundwater level measurements and groundwater temperatures will be collected during periods of below-water extraction at the monitoring points (monitoring wells and mini-piezometers) on-site for the first two years of below-water extraction. If trends are consistent over the first two-years of below-water extraction, the monitoring program will be reduced from monthly to quarterly.

The Site Plan triggering mechanisms and contingency plans were originally based on the monthly/quarterly manual water level monitoring program, as described above under Condition 4. In May 2018, all existing groundwater monitors and mini-piezometers on-site were instrumented with level loggers collecting daily water level readings, which is a much higher frequency than the monthly/quarterly frequency originally cited in the Site Plans. As this is the case, it is proposed that as long as daily logger readings are collected at BH3, BH8, BH9 an BH10-II, the triggering mechanisms are based on groundwater levels that are recorded below the trigger elevation for seven consecutive days with an observed downward trend and attributed to be a result of below-water extraction activities before the contingency plan is implemented.



Basemapping from Ontario Ministry of Natural Resources
Orthophotography: June 2019
Note: On-site aerial coverage from Dec 14, 2021 Drone Survey

N W E S

0 100 200 400
Meters

UTM Zone 17, NAD 83

Legend

- Mini-Piezometer
- Destroyed Mini-Piezometer
- Staff Gauge
- Monitor Location
- Groundwater Contours (0.5m)
- Groundwater Divide
- Groundwater Flow Direction
- Roads
- Intermittent Watercourse
- Permanent Watercourse
- Site Boundary
- Approximate Limit of Extraction

CBM Aggregates
Mast-Snyder Property

Site Plan and Groundwater Flow (November 2021)

June 2022
Project 60651256-7

AECOM

Figure 4

Path: L:\Kitchener-CAKCN1\Legacy\CAKCN1FP001\Data\FP001Data\DATAFP001\CAKCN-Environment\Projects\60312725-9 Cedar Pit\St Mary\60651256_StMarySitPlanandGroundwaterflow_20220627.mxd

Table 1: Low Water Level Trigger Elevations - BH3

Mast-Snyder Property, PN 60624078

1999 to 2017 water level and precipitation data for BH3 was examined as background for establishing the triggers.

On-Site Seasonal Water Levels

Winter
- BH3 high seasonal winter water level 1999 to 2017 is 325.06 mASL on Nov 27, 2006
- BH3 low seasonal winter water level 1999 to 2017 is 324.28 mASL on Jan 14, 2003

  difference between high and low winter seasonal water level is 0.78 m

Spring
- BH3 high seasonal spring water level 1999 to 2017 is 325.45 mASL on Apr 12, 2008
- BH3 low seasonal spring water level 1999 to 2017 is 324.82 mASL on May 28, 2015

  difference between high and low spring seasonal water level is 0.63 m

Summer
- BH3 high seasonal summer water level 1999 to 2017 is 324.93 mASL on Aug 20, 2008
- BH3 low seasonal summer water level 1999 to 2017 is 324.27 mASL on Sept 11, 2001

  difference between high and low summer seasonal water level is 0.66 m

Fall
- BH3 high seasonal fall water level 1999 to 2017 is 325.12 mASL on Nov.25, 2014
- BH3 low seasonal fall water level 1999 to 2017 is 324.16 mASL on Dec 15, 1999

  difference between high and low fall seasonal water level is 0.96 m

The average difference between the high and low seasonal water levels at BH3 is (0.78 m + 0.63 m + 0.66 m + 0.96 m)/4 = 0.76 m

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Precipitation

Based on the water levels at BH3, the lowest seasonal water levels occur in the summer and the fall

From 1981 to 2017 met. Data from Waterloo-Wellington Airport

annual precipitation in 1999 = 811 mm (year of seasonal low fall water level at BH3)
annual precipitation in 2001 = 835.8 mm (year of seasonal low summer water level at BH3)
annual precipitation in 2007 = 507.9 mm (driest year on record between 1981 and 2017)
507.9 mm/811 mm = 0.626
0.626 - 1 = 0.374 x 100 = 37.4%
507.9 mm/835.8 mm = 0.608
0.608 - 1 = 0.392 x 100 = 39.2%

Average of 38.3%, (37.4% + 39.2%)/2 = 38.3%

Driest year (2007) since 1981 was about 38% drier than the year in which the lowest seasonal water levels were observed on the site (1999 and 2017)

Water Level Correction for Dry Year

- Driest year since 1981 was about 38% drier than the years in which the lowest summer and fall water levels were observed on the site at BH3

  0.76 m x 38% = 0.29 m

Lowest water level observed under baseline conditions was 324.16 mASL

Therefore, to account for a dry year,
324.16 mASL - 0.29 m = 323.87 mASL

323.87 mASL is the trigger elevation for BH3

Table 2: Low Water Level Trigger Elevations - BH8

Mast-Snyder Property, PN 60624078

2003 to 2017 water level and precipitation data for BH8 was examined as background for establishing the triggers.

On-Site Seasonal Water Levels

Winter

- BH8 high seasonal winter water level 2003 to 2017 is 327.28 mASL on Jan 24, 2017
- BH8 low seasonal winter water level 2003 to 2017 is 325.65 mASL on Feb 26, 2015
  difference between high and low winter seasonal water level is 1.63 m

Spring

- BH8 high seasonal spring water level 2003 to 2017 is 326.63 mASL on Apr 12, 2008
- BH8 low seasonal spring water level 2003 to 2017 is 325.78 mASL on May 28, 2015
  difference between high and low spring seasonal water level is 0.85 m

Summer

- BH8 high seasonal summer water level 2003 to 2017 is 325.98 mASL on Aug 5, 2009
- BH8 low seasonal summer water level 2003 to 2017 is 325.27 mASL on Aug 8, 2012
  difference between high and low summer seasonal water level is 0.71 m

Fall

- BH8 high seasonal fall water level 2003 to 2017 is 326.03 mASL on Nov.27, 2006
- BH8 low seasonal fall water level 2003 to 2017 is 325.14 mASL on Nov 25, 2014
  difference between high and low fall seasonal water level is 0.89 m

The average difference between the high and low seasonal water levels at BH8 is (1.63 m + 0.85 m + 0.71 m + 0.89 m)/4 = 1.02 m

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Precipitation

Based on the water levels at BH8, the lowest seasonal water levels occur in the summer and the fall

From 1981 to 2017 met. Data from Waterloo-Wellington Airport

annual precipitation in 2014 = 734.3 mm (year of seasonal low fall water level at BH8)
annual precipitation in 2012 = 655.5 mm (year of seasonal low summer water level at BH8)
annual precipitation in 2007 = 507.9 mm (driest year on record between 1981 and 2017)
507.9 mm/734.3 mm = 0.692
0.692 - 1 = 0.308 x 100 = 30.8%
507.9 mm/655.5 mm = 0.775
0.775 - 1 = 0.225 x 100 = 22.5%

Average of 26.7%, (30.8% + 22.5%)/2 = 26.7%

Driest year (2007) since 1981 was about 27% drier than the year in which the lowest seasonal water levels were observed on the site (2003 and 2017)

Water Level Correction for Dry Year

- Driest year since 1981 was about 27% drier than the years in which the lowest summer and fall water levels were observed on the site at BH8
  1.02 m x 27% = 0.28 m

Lowest water level observed under baseline conditions was 325.14 mASL
Therefore, to account for a dry year,
325.14 mASL - 0.28 m = 324.86 mASL

324.86 mASL is the trigger elevation for BH8

Table 3: Low Water Level Trigger Elevations - BH9

Mast-Snyder Property, PN 60624078

2010 to 2017 water level and precipitation data for BH9 was examined as background for establishing the triggers.

On-Site Seasonal Water Levels

Winter

- BH9 high seasonal winter water level 2010 to 2017 is 324.67 mASL on Jan 24, 2017
- BH9 low seasonal winter water level 2010 to 2017 is 323.71 mASL on Feb 26, 2015

  difference between high and low winter seasonal water level is 0.96 m

Spring

- BH9 high seasonal spring water level 2010 to 2017 is 324.91 mASL on May 24, 2011
- BH9 low seasonal spring water level 2010 to 2017 is 323.91 mASL on May 28, 2015

  difference between high and low spring seasonal water level is 1 m

Summer

- BH9 high seasonal summer water level 2010 to 2017 is 323.75 mASL on Aug 16, 2013
- BH9 low seasonal summer water level 2010 to 2017 is 323.43 mASL on Aug 8, 2012

  difference between high and low summer seasonal water level is 0.32 m

Fall

- BH9 high seasonal fall water level 2010 to 2017 is 324.14 mASL on Nov.20, 2013
- BH9 low seasonal fall water level 2010 to 2017 is 323.39 mASL on Nov 21, 2016

  difference between high and low fall seasonal water level is 0.75 m

The average difference between the high and low seasonal water levels at BH9 is (0.96 m + 1 m + 0.32 m + 0.75 m)/4 = 0.76 m

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Precipitation

Based on the water levels at BH9, the lowest seasonal water levels occur in the summer and the fall

From 1981 to 2017 met. Data from Waterloo-Wellington Airport

annual precipitation in 2016 = 689.1 mm (year of seasonal low fall water level at BH9)
annual precipitation in 2012 = 655.5 mm (year of seasonal low summer water level at BH9)
annual precipitation in 2007 = 507.9 mm (driest year on record between 1981 and 2017)
507.9 mm/689.1 mm = 0.737
0.737 - 1 = 0.262 x 100 = 26.2%
507.9 mm/655.5 mm = 0.775
0.775 - 1 = 0.225 x 100 = 22.5%

Average of 24.4%, (26.2% + 22.5%)/2 = 24.4%

Driest year (2007) since 1981 was about 24% drier than the year in which the lowest seasonal water levels were observed on the site (2016 and 2012)

Water Level Correction for Dry Year

- Driest year since 1981 was about 24% drier than the years in which the lowest summer and fall water levels were observed on the site at BH9

  0.76 m x 24% = 0.19 m

Lowest water level observed under baseline conditions was 323.39 mASL

Therefore, to account for a dry year,
323.39 mASL - 0.19 m = 323.20 mASL

323.20 mASL is the trigger elevation for BH9

Table 4: Low Water Level Trigger Elevations - BH10-II

Mast-Snyder Property, PN 60624078

2010 to 2017 water level and precipitation data for BH10-II was examined as background for establishing the triggers.

On-Site Seasonal Water Levels

Winter
- BH10-II high seasonal winter water level 2010 to 2017 is 325.06 mASL on Jan 24, 2017
- BH10-II low seasonal winter water level 2010 to 2017 is 324.48 mASL on Feb 26, 2015

  difference between high and low winter seasonal water level is 0.58 m

Spring
- BH10-II high seasonal spring water level 2010 to 2017 is 325.31 mASL on May 24, 2011
- BH10-II low seasonal spring water level 2010 to 2017 is 324.72 mASL on May 28, 2015

  difference between high and low spring seasonal water level is 0.59 m

Summer
- BH10-II high seasonal summer water level 2010 to 2017 is 324.67 mASL on Aug 16, 2013
- BH10-II low seasonal summer water level 2010 to 2017 is 324.15 mASL on Aug 8, 2012

  difference between high and low summer seasonal water level is 0.52 m

Fall
- BH10-II high seasonal fall water level 2010 to 2017 is 324.79 mASL on Nov.25, 2014
- BH10-II low seasonal fall water level 2010 to 2017 is 324.17 mASL on Nov 21, 2016

  difference between high and low fall seasonal water level is 0.62 m

The average difference between the high and low seasonal water levels at BH10-II is (0.58 m + 0.59 m + 0.52 m + 0.62 m)/4 = 0.58 m

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Precipitation

Based on the water levels at BH10-II, the lowest seasonal water levels occur in the summer and the fall

From 1981 to 2017 met. Data from Waterloo-Wellington Airport

annual precipitation in 2016 = 689.1 mm (year of seasonal low fall water level at BH9)
annual precipitation in 2012 = 655.5 mm (year of seasonal low summer water level at BH9)
annual precipitation in 2007 = 507.9 mm (driest year on record between 1981 and 2017)
507.9 mm/689.1 mm = 0.737
0.737 - 1 = 0.262 x 100 = 26.2%
507.9 mm/655.5 mm = 0.775
0.775 - 1 = 0.225 x 100 = 22.5%

Average of 24.4%, (26.2% + 22.5%)/2 = 24.4%

Driest year (2007) since 1981 was about 24% drier than the year in which the lowest seasonal water levels were observed on the site (2016 and 2012)

Water Level Correction for Dry Year

- Driest year since 1981 was about 24% drier than the years in which the lowest summer and fall water levels were observed on the site at BH9

  0.58 m x 24% = 0.14 m

Lowest water level observed under baseline conditions was 324.15 mASL

Therefore, to account for a dry year,
324.15 mASL - 0.14 m = 324.00 mASL

324.00 mASL is the trigger elevation for BH10-II

Sebastian Hackbusch
Environmental Scientist
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Olga Hropach, (Hon) B.Sc.
Terrestrial Ecologist
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Groundwater Studies
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OMB Hearings
Water Quality Sampling
Monitoring
Groundwater Protection Studies
Groundwater Modelling
Groundwater Mapping

File: 0402

February 14, 2024

Township of Puslinch
7404 Wellington Road 34
Guelph, ON, N1H 6H9

Attention: Courtenay Hoytfox
Acting CAO and Municipal Clerk

Dear Courtenay:

Re: Hydrogeological Review – Mast-Snyder Pit 2022 Monitoring Report

We have reviewed the Groundwater Monitoring Report prepared by AECOM Canada Ltd. in January 2024. The report summarizes groundwater measurements obtained on-site between 1998 and 2022. Active above water table extraction commenced in November 2018. Below water table extraction continued in 2022 and 2023 by enlarging the southernmost pond and eventually merging with a pond excavated on the eastern side of the site. Although water taking is not part of the operation, below water table extraction can have an impact on water levels from a groundwater leveling effect and replacement of aggregate removed from below the water table.

Summary of Review

Our version of the site plans dated February 2007 indicate that an annual report is to be submitted to the Township of Puslinch. This report dated January 2024 is for the calendar year 2022. It is unusual to receive an annual report so late.

As per our request, individual hydrographs and thermographs were provided.

We concur with AECOM that 2021 and 2022 were drier years and our experience is that regional water levels declined to near historic lows by the end of 2022. A review of thresholds may be warranted.

We do note that BH9 does have a significantly greater response to the droughty conditions as shown on Figures 9 and 13. Is there any explanation for the significant decline in water levels in late 2022 and did it continue in 2023?

We note that below-water-table extraction in 2022 removed an on-site feature knowns the southern swale. There do not appear to be any obvious impacts from this approved site alteration.

We are satisfied with the report and conclude that below-water-table extraction is proceeding as per the site plans without any significant change to groundwater or surface water elevations.

Sincerely,

Harden Environmental Services Ltd.

[redacted]

Stan Denhoed, M.Sc., P.Eng.
Senior Hydrogeologist

AECOM

Hydrogeological and Natural Environment Site Plan Technical Requirements

2022 Monitoring Report for Mast-Snyder Pit, Township of Puslinch, County of Wellington

CBM Aggregates a Division of St. Marys Cement Inc. (Canada)

60675788

January 2024

Delivering a better world

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Jennifer DeLeemans
Manager, Lands & Environment
CBM Aggregates, A division of St. Marys Cement Inc. (Canada)
7152 Concession 2
Cambridge, ON N3C 2V4

January 10, 2024

Project #
60675788

Subject: – 2022 Monitoring Report for Mast-Snyder Pit, Township of Puslinch, County of Wellington

Dear Ms. DeLeemans:

We are pleased to provide you with the Hydrogeological and Natural Environment Report prepared to satisfy the Site Plan Technical Requirements at the Mast-Snyder Pit, in Township of Puslinch, Wellington County, Ontario. Results from 2022 were compared to the baseline (pre-extraction) monitoring (completed prior to November 2018) and during active pit operations (commencing in 2019) to monitor site conditions as the Mast-Snyder Pit is developed.

If you have any questions or concerns, please do not hesitate to call me at 226-821-2486 or via email at brian.holden@aecom.com.

Sincerely,

AECOM Canada Ltd.

[redacted]

Brian Holden, P.Geo.
Hydrogeologist, Environment
Brian.Holden@aecom.com

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AECOM: 2015-04-13

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1. Introduction

CBM Aggregates, a Division of St. Marys Cement Inc. (Canada) (CBM Aggregates), holds a lease agreement for a 32 ha property (Snyder) and owns a 42.4 ha property (Mast) located at the northwest corner of Forestall Road and County Road 35 (Downey Road), south of the City of Guelph in Lot 14 and 15, Concession 4, Township of Puslinch, Wellington County (**Figure 1**). The property has been licensed under the *Aggregate Resources Act* as a Category 1 – Class “A” Pit Below Water. A Hydrogeological Assessment and a Natural Environment Level 1- Level 2 reports were completed by Gartner Lee Limited (GLL, 2006a, 2006b) in support of the license and *Planning Act* applications (OMNR, 1996). AECOM Canada Inc. (AECOM, formerly Gartner Lee Limited) was retained by CBM Aggregates to complete the Site Plan technical requirements pertaining to hydrogeology and natural environment monitoring with development of the Mast-Snyder Pit.

Field investigations conducted between 1999 and 2006 (GLL 2006a) confirmed the presence of several significant environmental features were identified within the site boundary and immediately adjacent to the limit of extraction. These features included:

- Two units of the Speed River Provincially Significant Wetland (PSW) Complex;
- Fish habitat along Tributary A and Pond A; and
- Significant Wildlife Habitat in the form of amphibian breeding habitat at the Isolated Wetland and along Tributary A.

The Site Plan and the significant environmental features are shown on **Figures 2 and 3**. To comply with the Provincial Policy Statement (MMAH 2014), development and site alteration shall not be allowed in a PSW or fish habitat. Development and site alteration shall not be allowed in Significant Wildlife Habitat of the site unless it has been demonstrated that there are no negative impacts on the feature or its ecological function. As shown on the Site Plans, there will be no extraction within the on-site Speed River PSW Complex, adjacent woodlot and the required setbacks to ensure their protection and maintain their functions with pit development. However, because the pit will be excavated below the water table, there is the potential for groundwater levels to shift resulting in changes to the PSW and its function. As such, fish and fish habitat, wetland vegetation and amphibian breeding are being monitored as indicators of the wetland function.

Site preparation (berms, stripping) commenced in late spring/early summer 2018. Above and below-water extraction activities commenced in November 2018 and July 2019, respectively. Below water extraction in Area 2 commenced in late fall 2019 (**Figure 3 and Figure 4**).

A 2018 monitoring report (AECOM, 2019) was completed to collect baseline data in advance of pit extraction activities. This was followed by the 2019 monitoring report (AECOM, 2020) which documented conditions during initial stages of excavation. Previous ecological field investigations took place between 2003 and 2006, thus the 2018 results noted any changes to existing conditions in this interval. Consequently, the 2018 monitoring results provide the baseline to which future conditions will be compared through annual monitoring events (i.e., through the course of pit excavation, particularly as it occurs below the water table). This report documents the site conditions and monitoring activities undertaken by AECOM in 2022.

As per Site Plan Condition 4 of the Natural Environment Technical Recommendations, the 2019 to 2021 annual reports were submitted to the Ministry of the Environment, Conservation and Parks (MECP), Ministry of Natural Resources and Forestry (MNRF), Township, County, the City of Guelph and the Grand River Conservation Authority (GRCA). Comments on the groundwater/hydrogeological portions of the 2020 annual report were received from the MECP and the Township (included in **Appendix E**). The MECP and the Township were in agreement with the conclusions and recommendations of the report. Comments pertained mainly to figure presentation and addition of background information. The 2021 report addressed the review comments and are carried forth into this 2022 report.

2. Background

Details provided in this section are reproduced from the Consolidated Hydrogeological Assessment (Gartner Lee, 2006b) and updated with information collected since that time.

2.1 Geology and Aggregate Resources

The physiography and distribution of the unconsolidated sediments in the site vicinity are due to Late Wisconsinan glacial activity. During this time, there was repeated advancement and melting of the continental ice sheets over a period of about 13,000 years.

Large amounts of sand and gravel were deposited within an outwash plain fed by glacial meltwaters from an adjacent moraine (Galt moraine). Subsequent glacial advances and retreats modified the topography of the region (OGS 1982). The CBM Aggregates site is situated within this outwash gravel on the flank of a bedrock valley (Karrow 1983). The bedrock valley trends in a roughly southwest to northeast direction. Previously published bedrock mapping of the area shows the elevation of the top of the bedrock at approximately 305 mASL beneath the site (Miller, et. al., 1979). Prior to extraction, the topographic elevation of the site ranged from 325 mASL to 331 mASL. This indicates that there is over 20 m of overburden overlying the Silurian dolostone of the Guelph Formation.

The Aggregate Resources Inventory Paper for this area identifies the Mast-Snyder property as part of an outwash deposit of primary significance that lies within a transitional area between the two physiographic regions of the Guelph Drumlin Field and Horseshoe Moraines. A study conducted by the Ontario Geological Survey (OGS) in the northern portion of the deposit showed that the deposit was generally coarser near the surface and becomes finer with depth. The deposit typically consists of a coarser layer (generally about 5 m thick) overlying a 7 m thick fine layer marginally suitable for granular use. The coarser layer appears suitable for Granular B and C, with some parts suitable for crushing into Granular A. Concrete and asphalt sand could be processed from some portions of the deposit.

Figure 5 presents the locations of geological cross-sections A-A' and B-B'. **Figure 6** is a northeast to southwest cross-section (A-A') and **Figure 7** is a northwest to southeast cross-section (B'B') across the site generally perpendicular and parallel to groundwater flow, respectively. The general stratigraphy is sand and/or gravel from surface to a depth ranging from 5.9 m (BH 1) to 10.3 m (BH6), underlain by silt or silty sand. All boreholes were terminated in silt, silty sand or till. BH 8 and TH1, located along the northeastern property boundary, penetrated sand till from surface. Gravel was penetrated at BH 1, BH 2 and BH 5 from surface to the top of the silt. Sand was penetrated to 6.7 m at BH 4. BH6 and BH 7 penetrated 10.3 m and 8.5 m of gravelly sand/sand and gravel, respectively. BH 3 penetrated 4 m of gravel overlying 3 m of fine sand.

2.2 Water Well Users

MECP well records for water wells within 500 m of the property boundary and presented in **Appendix B** and plotted on **Figure 5**. **Figure 5** presents the MECP water well record with the house number in brackets immediately below.

A door-to-door water well survey was conducted by AECOM (formerly Gartner Lee) staff in September 2003 and updated in 2010, 2011 and 2012. The surveys consisted of interviewing residents within an approximate 250 m radius of the property boundaries. Residents were asked general questions concerning their water supply and quality as well as details about their well construction and water use. The survey was conducted to confirm well details, identify any dug wells that may not have a well record and provide baseline information prior to pit development.

2.3 Monitoring Locations

2.3.1 Groundwater Monitors

AECOM carried out an initial drilling program and installed 10 groundwater monitors at eight locations on-site to establish the water table elevation and to confirm the quality of the aggregate above and below the water table. Five boreholes (with seven monitors) were completed on the Mast property (west half of the site) in August and December 1999. Three boreholes were drilled on the Snyder property (east half of the site) in May 2003. Additional monitors were drilled in June 2010 (four monitors at three locations) to fulfill Site Plan conditions. Soil samples were collected at each borehole at regular intervals using standard split-spoon sampling techniques. Each borehole was stratigraphically logged in the field by qualified AECOM staff. Groundwater monitors consisting of 51 mm diameter machine slotted PVC screen on riser pipe were installed in each borehole to monitor groundwater levels. Boreholes range in depth between 2.3 m and 12.8 m below ground surface. Borehole logs are presented in Appendix A.

Due to advancing below-water extraction activities, BH1-I and BH-II were decommissioned on March 21, 2022 by Profile Drilling as per Ontario Regulation 903. Loggers at BH1-I and BH1-II were removed on January 31, 2022. The BH1 decommissioning log is included in **Appendix A**.

2.3.2 Mini-Piezometers

Five mini-piezometers (MP1, MP2-I, MP2-II, MP3-I, MP3-II) were initially installed in Tributary A and the man-made pond (Pond A) located in the north part of the property on September 3, 2003. Two additional mini-piezometers (MP4 and MP5) were installed in the area of ponded water within the isolated wetland on June 29, 2003. On December 7, 2005, MP6 and MP7 were installed within the southern swale. The mini-piezometers were installed to investigate the groundwater-surface water relationship to these features. Each mini-piezometer consists of a 0.45 m length of stainless steel well point at the end of machine threaded 19 mm diameter iron pipe riser. All threaded ends were wrapped with Teflon tape to ensure a water tight seal at the joints. The mini-piezometers were installed manually with a post driver to depths ranging from 1 m to 3.1 m.

The groundwater monitors and mini-piezometers were surveyed to a geodetic benchmark. The locations of the groundwater monitors and mini-piezometers are shown on **Figure 4**. The groundwater monitor construction details and mini-piezometer installation details, including the location (UTM) and elevation of the ground and top of pipe, are presented in **Appendix A**.

3. Scope and Methods

3.1 Hydrogeology

The requirements related to hydrogeology as presented on the Site Plans are reproduced below followed by a discussion of the tasks completed to address the condition.

Operations Plan – Operations Notes:

24. *Water level data will be interpreted annually from a fisheries perspective to ensure that there are no negative impacts.*

    Below-water extraction commenced in July 2019. A fisheries biologist has reviewed the collected water level data as below-water extraction progresses, specifically as it applies to Pond A and Tributary A. The assessment is presented in Section 4.2.3 of this report.

25. *Below-water extraction will cease immediately if there are any early warning signs of impact to surrounding groundwater users, wetlands or streams that is attributed to below water operations.*

    Acknowledged.

26. *Observed or measured stream impacts will be reviewed by a surface water specialist.*

    A surface water specialist reviewed the measured MP water levels as below-water extraction progresses to examine impacts to Tributary A.

27. *Should a wash plant be required with a predicted water usage of 50,000 L/day or more, CBM Aggregates will apply to the MOE for a Permit-to-Take-Water. This permit application will be accompanied by the appropriate supporting documentation.*

    If necessary, CBM Aggregates will apply for a Permit-to-Take-Water under the above conditions, as required. No water taking requiring a PTTW has occurred at the site.

28. *Copy the County, Township and City on any information on the site that is supplied to the MOE and MNR.*

    Any information provided to the MOE (now the MECP) and MNR (now the MNRF) will also be provided to the County, Township and City.

29. *A staff gauge shall be installed in Pond A so that water depths can be monitored during site visits.*

    MP1 is located in the man-made dug pond, Pond A (**Figure 4**). It has been monitored for water levels seasonally since 2003. MP1 has been surveyed and tied into the site such that the water elevations can be monitored. The pond depth at MP1 is discussed in Section 4.2.1.2.

30. *Mini-piezometers MP2 and MP3, located in Tributary A shall be tested to ensure that they are hydraulically connected to the water table.*

    Water levels collected from MP2 and MP3 appear to reflect the water table when compared to the closest water table monitors. MP2 and MP3 have been monitored for water levels seasonally since 2003.

31. *Two sets of mini-piezometer pairs shall be installed to ensure that groundwater gradients are maintained towards Tributary A when water is flowing in the tributary. If groundwater gradients are reversed or re-*

directed away from Tributary A as a result of below-water extraction or pumping of groundwater at the site then these undertakings will cease.

MP2 and MP3 are nested pairs of mini-piezometers located in Tributary A. The water levels and groundwater gradient to Tributary A are discussed in Section 4.1.1 and 4.1.2.

32. *Groundwater gradient will be monitored so that below-water extraction rates and groundwater withdrawls can be proactively managed to avoid gradient reversals from the fish habitat to the pit area.*

The 2018 aquatic assessment of Pond A and Tributary A concluded that both provide fish habitat suitable for reproduction, refuge, feeding and rearing. An aquatic assessment was not completed in 2019 because below water extraction had not yet occurred by the spring of that year. In June 2020, an aquatic habitat assessment was completed. In 2021, the Pond A summer water level was visibly lower than observed in 2018 and 2020 though this was attributed to precipitation conditions and not a result of pit activities. In 2021, baseflow from mini-piezometer readings were assessed in place of an aquatic assessment. In 2022, half of the Pond A was observed dry during site visit on August 25. Groundwater elevations measured at all monitors are listed in **Appendix C**.

Technical Recommendations (Hydrogeological) Monitoring Program

1. *A groundwater monitor between the below-water extraction limit and the Hanlon Creek Swamp (BH9) and a nest of two monitors at the edge of the isolated wetland (BH10) will be installed. Monitoring nest 10 will consist of a shallow monitor into the groundwater table and a deeper piezometer into the underlying silt. The monitors will be incorporated into the groundwater monitoring program for the site.*

BH9 and BH10 were installed in June 2010 (AECOM, 2011). BH9 is a water table monitor completed to 5.2 m below ground surface and screened in the underlying sand/sandy silt till. BH10 consists of a water table monitor completed to 4.6 m below ground surface and screened in the underlying sand and gravel/sand (BH10-II) and a piezometer completed to 9.8 m below ground surface and screened in the underlying sandy silt unit (BH10-I). These monitors were incorporated into the seasonal water level monitoring program upon completion.

2. *An additional mini-piezometer will be installed and maintained within the Downey West Wetland (MAM2-2 wetland unit on the west side of Downey Road) and incorporated into the established monitoring program. The new-mini-piezometer will be included in any review under the triggering mechanism but will not necessarily be used as a trigger well. The mini-piezometer and vegetation monitoring plot (discussed under natural environment, point 2) will be in the same general vicinity. The mini-piezometer will be monitored as described in point 4 and point 5 below.*

In place of a mini-piezometer, BH11 was installed in June 2010 in the Downey West Wetland (AECOM, 2011). BH11 is a water table monitor completed to 2.3 m below ground surface and screened in the underlying sand and gravel unit. It was incorporated into the seasonal water level monitoring program upon completion and was also outfitted with a baro and level logger to collect daily water levels. A vegetation transect (TR 4) was established in 2019 to further examine this area. Control transect TR 3 was abandoned since was found to be heavily grazed by cattle at the time of vegetation survey in 2020. A new control transect was established in wetland vegetation that was fairly similar to the transects on the Mast-Snyder site (TR 5 Control at Kortright Hills, **Figure 2**).

3. *The additional boreholes and mini-piezometer (discussed above) will be installed prior to any extraction on the site.*

The required boreholes/mini-piezometers have been installed.

4. *Monthly water level measurements and groundwater temperatures will be collected during periods of below-water extraction at the monitoring points (monitoring wells and mini-piezometers) on-site for the first two years of below-water extraction. If trends are consistent over the first two years of below water extraction, the monitoring program will be reduced from monthly to quarterly.*

   There are currently 12 groundwater monitors and nine mini-piezometers on the site. These groundwater monitoring locations were instrumented with level loggers on May 8, 2018 to collect daily measurements (12:00 pm). A barologger is on-site for logger compensation. Below-water extraction activities commenced in July 2019 such that the winter of 2022 constitutes three and a half years of monitoring under below-water extraction conditions. The groundwater levels are discussed in Section 4.1.1.

5. *Seasonal (Quarterly) groundwater level measurements shall be taken from existing monitors and the mini-piezometers beginning one year prior to the commencement of below-water extraction.*

   Baseline water levels have been collected on-site since 1999 and are presented on **Figure 8**. The water level monitoring program has expanded as new monitors/mini-piezometers have been installed. As discussed above, all monitoring locations have been instrumented with level loggers. In addition, seasonal manual water level measurements of the established monitoring network were collected with an electronic water level tape during site visits conducted on January 31, May 4, August 25, and December 2, 2022. During these site visits, each logger was also checked and downloaded, if possible[1]. As discussed in Section 2.3.1, loggers at BH1-I and BH1-II were removed in January 2022 and this location was decommissioned in March 2022.

6. *A qualified geoscientist shall investigate all complaints of water well interference brought to the attention of the licensee from any property owner located within 500 m from the limits of extraction. A report on the findings shall be prepared and submitted to the licensee, with copies to the district offices of the Ministry of Natural Resources, the Ministry of the Environment, the Township, the County and the City.*

   No complaints were received by CBM Aggregates in 2022.

7. *A qualified geoscientist shall review site conditions annually.*

   Monitoring data was examined and this report was prepared and reviewed by licensed Professional Geoscientists.

8. *A water well survey of the residences within 500 m of the property boundary shall be completed prior to the commencement of pit operations to provide baseline data and ensure that there are no off-site shallow dug wells in the vicinity. Should any shallow accessible dug wells be identified, they should be added to the quarterly monitoring program of the site provided that permission is granted by the well owner.*

   A water well survey was completed in 2010, 2011 and 2012 with the results presented in the associated annual reports (AECOM, 2011, 2012, 2013). Of the 17 well owners within 500 m of the property boundary: four well owners did not respond to our well survey package and two well owners reported that they had dug wells – 6848 Forestall Road (which was owned by Mast and rented to a tenant) and 4767 Pioneer Trail (owned by Fitton, located at the northwest edge of the 500 m mark of the property boundaries). The well at 6848 Forestall Road was later inspected and determined to be a drilled well that was decommissioned by CBM Aggregates in 2011. Mrs. Fitton, the owner of the well at 4767 Pioneer Trail was contacted by phone on January 29, 2018 to ask if their well was accessible and if they would like to participate in the water level monitoring program. Mrs. Fitton confirmed that they have a dug well that supplies their house but the well has a pump affixed to the lid and is inaccessible. Locations of private wells within 500 m of the site are shown on **Figure 5**.

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1. Loggers were occasionally frozen at some locations and could not be downloaded during the winter field visits

3.2 Natural Environment

The requirements related to natural environment as presented on the Site Plans are reproduced below followed by a discussion of the tasks completed to address the condition.

Technical Recommendations for Natural Environment

1. *The wetland boundary and woodlot dripline on the north part of the property will be surveyed. Durable marker posts will be placed 5 m from the dripline of the woodlot or 15 m from the wetland boundary, whichever is greater. There shall be no intrusion by equipment or other disturbance, to the ground or vegetation beyond the marker posts. The temporary berm should be placed outside of this buffer*

   The Isolated Wetland and northern wetland/woodlot dripline were originally staked by a Gartner Lee terrestrial ecologist, the Township ecologist and the conservation authority in 2007. These stakes were then surveyed by Van Harten Surveying Inc. Van Harten re-surveyed the wetland limits and dripline on March 19, 2018. CBM Aggregates installed permanent markers (fence posts) such that the setback is clearly marked and the markers will not be accidentally destroyed during pit development.

2. *A qualified ecologist should inspect the site annually, once excavation occurs along the edge of the natural heritage feature or at least until the water level in the post-extraction lake stabilizes. This would include documenting general conditions on water depth and vegetation health to determine if there is any adverse impact of the pit operation on Tributary A, Pond A or the isolated wetland unit that may be related to the operation of the pit. The monitoring will include:*

   - *Amphibian surveys conducted twice in the spring during suitable weather conditions (approximately mid-April and late May) at all wetlands on site. Amphibian monitoring will begin prior to below-water extraction in Area 3 and will continue annually thereafter for as long as below-water extraction occurs.*
   - *Establishing three permanent vegetation monitoring plots to document percentage cover of plant species as a measure of change in the wetlands. They will be sampled in mid-growing season (between June 15 and August 15), once prior to below water extraction in Area 3 then annually thereafter. Soil cores will be taken and inspected visually for soil type and depth to mottles and gley, and colour at each location. The vegetation plots will be established:*

     a) *Along Tributary A west of Pond A'*
     b) *In the isolated wetland*
     c) *In the Downey West Wetland (MAM2-2 wetland unit on the west side of Downey Road)*

3. *A qualified ecologist shall annually review the monitoring and site inspection results and prepare a report on the following:*

   a) *A summary of the monitoring data from the current year and previous years;*
   b) *An assessment of whether or not the operation of the pit below the water table is adversely affecting the on-site woodlot and stream in the northern portion of the site, the Speed River PSW on the Hanlon Creek Business Park site and adjacent natural environment features;*
   c) *A recommendation regarding the adequacy of the monitoring program and any amendments that may be required; and*
   d) *The need to implement the Contingency Plan (as described in the Hydrogeological Recommendations), if necessary and warranted.*

4. *The annual report shall be prepared by both the qualified ecologist and geoscientist. The report should be submitted to the MOE, MNR, Township, County, the City and the GRCA annually and not just if the mechanism is invoked.*

5. *Monitoring will continue for as long as below water extraction occurs.*

3.2.1 2022 Field Investigations

3.2.1.1 Amphibian Surveys

Amphibian breeding surveys were completed on the evenings of April 7, May 10, and June 1, 2022 under appropriate weather conditions (**Table 1**) using protocol adapted from the Marsh Monitoring Program (BSC *et al.,* 2009). A minimum 5-minute listening period was conducted at each of the three stations: Isolated Wetland, Tributary A and Pond A (**Figure 2**). The number and species of calling frogs heard was recorded. Amphibians were also searched for during the day of the vegetation survey on July 15, 2022.

Table 1: Weather Conditions During Amphibian Calling Surveys

Date	Time	Temperature (C°)	Cloud Cover (%)	Wind (Beaufort)
7-Apr-2022	20:25 – 21:00	9	80	0
10-May-2022	21:05 – 21:45	16	0	0
1-Jun-2022	21:20 – 22:25	19	0	0

3.2.1.2 Acoustic Monitoring

Acoustic monitoring was implemented in 2021 to detect early-spring breeding amphibians that might otherwise be missed during in-person surveys. Nocturnal surveys targeting vocalizing amphibians (i.e., frogs and toads) using acoustic monitors were conducted during the months of April, May and June 2021 for collecting additional data and support the Amphibian breeding survey field program. The protocol for these surveys generally followed that developed by Bird Studies Canada and Environment Canada for the Marsh Monitoring Program (BSC *et al.* 2009).

An acoustic monitor (Song Meter SM3BAT, Wildlife Acoustics) was installed at each of the 2 representative sites within the Isolated Wetland and between Pond A and Tributary A. The monitors themselves were set to record calls at 10:00 pm for 15 minutes duration. They were programed to run from April until June 2021. Acoustic monitors were deployed in conjunction with the first visit of amphibian call survey on April 10, 2021, removed following the third visit of amphibian call survey on June 16, 2021, and maintenance checks were completed in May and June during the second and third round of amphibian call surveys. Acoustic data were recorded on SD cards within the monitor. These data were downloaded, transcribed and analyzed. For each survey, a five (5)-minute segment of the 15 minute acoustic data recording was analyzed to determine whether frogs and / or toads are present, identify the species and count the number of individuals per species heard calling. Since acoustic monitors were monitoring continuously during the spring, the nights selected for analysis were based on a review of weather conditions recorded using The Weather Network's historical weather data for Guelph, ON during the monitoring period. Nights selected for analysis met the timing and weather criteria in accordance with the Marsh Monitoring Program (BSC *et al.* 2008) as follows.

3.2.1.3 Vegetation Sampling

In order to measure possible changes to vegetation in the PSW units at Tributary A and the Isolated Wetland, a quantitative means of documenting coverage by the various plant species was required. A systematic sampling method using 1x1 m quadrats along transect lines described by Elzinga *et al.* (2001).

Permanent transects were initially established at four locations in 2018. However, Transect TR 3, which was meant to provide a control more distant from possible influence of the gravel pit, was found to be heavily grazed by cattle in 2020 and therefore was discontinued. That transect became too disturbed to be a useful control. A new control labelled TR-5 was established in 2021. Transect locations sampled in 2022 were as follows:

a) Transect TR 1 across the middle of the Isolated Wetland Unit;
b) Transect TR 2 within Tributary A just downstream of Pond A;

c) Transect TR 4 within the Downey Road Wetland;
d) Transect TR 5 within unnamed wetland at Kortright Hills.

Figure 2 shows the location of each transect in relation to the approximate Limit of Extraction and below-water excavation in the fall of 2022.

The vegetation was surveyed on July 15, 2022 on a clear and calm day with the temperature ranging from 20 to 26°C. Vegetation transects were established consisting of 1 x 1 m quadrats that were sampled at 5 m intervals along a transect line. Each transect was 55 m long with 12 quadrats sampled along each. Metal bars were previously installed at either ends of each transect on the subject property so that they can be easily found and replicated in subsequent years. A handheld GPS was used to locate the ends of each vegetation transect. Locations of the transects are shown on **Figure 2** and co-ordinates shown on **Table 2**. At each quadrat location, four metre sticks were laid down to form a 1 m^2 plot, which temporarily marked off the boundaries of each quadrat while it was being sampled. All plant species and their respective percent (%) cover within each quadrat were recorded. It should be noted that the quadrat locations were close but not precisely the same between the different sampling events.

The transect at TR 5 (control transect) was within wetland vegetation in municipally owned parkland similar to that found on the Mast-Snyder property.

Table 2: Location of Vegetation Transects

Wetland	Transect No.	Transect Ends	Latitude	Longitude	Distance to Excavation	Distance to Below-water
Speed River PSW	TR 1	North	43.48294°	-80.23772°	170 m	360 m
		South	43.48250°	-80.23802°		
Speed River PSW	TR 2	East	43.48474°	-80.23329°	140 m	225 m
		West	43.48487°	-80.23386°		
Downey Road LSW	TR 4	North	43.48394°	-80.22926°	30 m	40 m
		South	43.48345°	-80.22936°		
Kortright Hills (Control Site)	TR 5	East	43.49613°	-80.22939°	1400 m	Not Applicable
		West	43.49607°	-80.23005°		

A representative soil sample was taken at the approximate middle of each transect. For each soil sample, notes were taken regarding the soil type, colour, depth of mottles and gley and depth to the water table. A Dutch auger was used, and each sample penetrated a depth of approximately 1 m. It should be noted that the soil sample locations were in close proximity (within about 10 m given GPS accuracy), but not precisely the same between annual sampling events which results in apparent differences in depths. Furthermore, a soil sample derived from a Dutch auger was collected in small sections which were re-assembled upon extraction; therefore, it was not possible to gather precise measurements on soil layers.

3.2.1.4 Aquatic Survey

Aquatic habitat and fish community surveys within Pond A and Tributary were originally completed in 2018 prior to pit extraction. An AECOM aquatic ecologist then undertook aquatic habitat assessments at Tributary A and Pond A in 2020. No aquatic habitat assessments took place in 2021 or 2022 however, will be conducted in 2023.

4. Results

4.1 Hydrogeology

4.1.1 Water Levels

Water levels have been collected from the existing on-site monitors and mini-piezometers since 1999 with seasonal water levels collected since 2002. Several off-site staff gauges in privately owned ponds north of the site were historically monitored. The staff gauges at 4767 Pioneer Trail (SG2) and 4803 Pioneer Trail (SG3) were originally installed at the request of Mr. Raymond Reid (4803 Pioneer Trail). However, monitoring of SG3 was discontinued in 2009 at Mr. Reid's request and SG2 was destroyed sometime after May 2013 and was not replaced. The water levels in the SG2 pond are regulated by an outlet and therefore, do not reflect natural pond levels. No impacts due to site operations are expected at either of these private pond locations.

The water levels measured on December 2, 2022 were plotted on **Figure 4**. Regionally, groundwater is expected to flow to the northwest towards the Speed River. This is confirmed through the on-site monitoring. The direction of groundwater flow (shown on **Figure 4**) is to the north-northwest, consistent with historic interpretations presented in the Hydrogeological Assessment (GLL, 2006b) for the site.

Water levels show natural seasonal fluctuations. Based on the daily level logger measurements, the range in 2022 water level fluctuations in the on-site monitors is from 1.16 m (BH2-I) and 2.41 m (BH9). This level of fluctuation is higher than those observed in 2021. Groundwater monitors showed the low groundwater elevations measured in early December 2022, many were within historic minimum groundwater elevations observed in 1999, 2003, and 2007. At most locations, groundwater levels are showing an overall decreasing trend over time. This decreasing trend does not appear to be related to pit activities as all monitors upgradient and downgradient of the below-water extraction activities show similar trends. All manual water levels appear to show comparable seasonal trends to each other. The hydrographs for the seasonal manual water level measurements from groundwater monitors BH1 to BH11 are presented on **Figure 8**.

A level logger and barologger (for compensation) were installed at BH11 on June 14, 2010 to measure water levels at regular intervals. Loggers were installed at the remaining on-site groundwater monitors and mini-piezometers on May 8, 2018 and programmed to collect daily (12:00 noon) water level and groundwater temperature measurements. The 2010 to 2022 water level information for BH11 is presented on **Figure 17** along with the daily precipitation from the Grand River Conservation Authority Guelph Dam monitoring station, located about 12 km north of the site[2]. The annual seasonal pattern of water level fluctuations is shown at BH11. The 2022 seasonal pattern for the on-site groundwater monitors show peak water levels in the spring (April) followed by declining water levels throughout the summer with some recovery in late summer/early fall then further declining water levels/stabilization to the end of the year. The total 2022 precipitation for the Guelph Dam station was 562.2 mm. Based on long-term normals (1994 to 2015 Guelph Dam data) of 918 mm, 2022 was drier than normal. The logger hydrographs for the northern (**Figure 9**), central (**Figure 14**), southern (**Figure 18**), Southern Swale and Isolated Wetland (**Figure 22**) and Tributary A monitors (**Figure 26**) are grouped and plotted together. As recommended by the Township, hydrographs for each of the individual monitoring nests have also been prepared and are presented in **Figures 10 to 13** (northern), **Figures 15 to 17** (central), **Figures 19 to 21** (southern), **Figures 23 to 25** (southern swale and isolated wetland) and Tributary A (**Figures 27 to 29**).

[2] *Originally, precipitation data from the Environment Canada Region of Waterloo International Airport was used for comparison purposes but this station has been inactive since mid-2011.*

January 1 to December 12, 2022 water levels and groundwater temperature from the monitors located in the northern portion of the site (BH3, BH4, BH8, BH9), central portion of the site (BH2, BH10, BH11) and southern portion of the site (BH1, BH5, BH6, BH7) are included on **Figures 9 to 21**. As mentioned above, the groundwater monitors across the site show a similar trend to each other. Groundwater temperatures across the site also generally show a similar pattern to each other but with slight variations likely related to the formations the monitors are screened within and depth. Monitor water temperatures are generally lowest in March to early April and highest in mid-September to mid-October. The highest fluctuation in water temperatures in 2022 were observed at monitor BH4 with the 2022 water temperatures ranging from about 1.38 degrees C to 13.75 degrees C.

January 1 to December 31, 2022 groundwater levels and temperature from the mini-piezometer (MP) locations located in the Isolated Wetland (MP4), the southern swale (MP6, MP7), and Tributary A (MP1, MP2, MP3) are included on **Figures 22 and 26** and individually on **Figures 23 to 25** and **Figures 27 to 29**, respectively. The water levels in the MPs showed a similar trend as the BH groundwater monitors. During the seasonal water level monitoring events, all loggers are downloaded and re-installed, if possible. Logger at MP2-I (shallow) showed communication error during the winter seasonal download in December 2022, therefore data was unavailable since last seasonal download on August 24, 2022 (**Figures 28**). Logger data from February to May 2022 at MP3-II was removed as logger was above water (**Figures 29**).

4.1.2 Groundwater Gradients to Tributary A

Item 32 of the Operations Plan – Operations Notes addresses gradient reversals from the fish habitat (Tributary A, Pond A) to the pit. As discussed in Section 4.1.1, shallow groundwater flow is from the south to the north-northwest (i.e., from the pit area to Tributary A). The MP6 water levels in the southern swale, adjacent to the extraction limits, are compared to MP2-I, located within Tributary A. No groundwater flow direction determination was possible during the January (MP2-I was frozen) and August 2022 (MP6 could not be located due to heavy vegetation growth) monitoring events. The seasonal groundwater elevations collected in 2022 are presented below in **Table 3**.

Table 3: 2022 MP6 and MP2-I Groundwater Elevations

Date	MP6 Groundwater Elevation (mASL)	MP2-I Groundwater Elevation (mASL)	Difference in Groundwater Elevation between MP6 and MP2-I	Direction of Groundwater Flow
31-Jan-22	324.96	Frozen	-	
4-May-22	325.35	324.84	0.51	NW towards Trib A
24-Aug-22		322.65	-	
1-Dec-22	324.74	323.94	0.80	NW towards Trib A

The May and December 2022 groundwater elevations from MP6 and MP2-I indicate that groundwater flow is to the northwest towards Tributary A. The groundwater elevations will continue to be monitored for gradient reversal.

4.2 Natural Environment

4.2.1 Amphibian Assessment

Initial field investigations in 2005 confirmed five species of breeding amphibians within the site boundary: Spring Peeper (*Pseudacris crucifer*), Gray Treefrog (*Hyla versicolor*), Wood Frog (*Lithobates sylvaticus),* Northern Leopard Frog (*Lithobates pipiens*) and Green Frog (*Lithobates clamitans*) (GLL, 2006). Two additional species were found to be present on site in 2018, American Toad (*Anaxyrus americanus*) and Bullfrog (*Lithobates catesbiana*) (AECOM 2019).

4.2.1.1 Amphibian Survey Monitoring Results

The results of the amphibian surveys in 2022 are shown in **Table 4**. Large choruses of Spring Peepers were recorded at all three stations and a small number of Wood Frog at two stations. Numbers of calling frogs in large choruses could not be reliably estimated but consisted of more than 10 calling individuals. American Toads were calling at all three calling stations on the May 10 survey while at least one Gray Treefrog was present at all stations on June 1.

Table 4: Amphibian Calling Survey Results 2022

Species	Isolated Wetland			Tributary A			Pond A		
	April 7	May 10	June 1	April 7	May 10	June 1	April 7	May 10	June 1
Spring Peeper (SPPE)	>10	5		>10	4		>10	2	
Gray Treefrog (GRTF			1			1			3
Wood Frog (WOFR)	4			1					
American Toad (AMTO)		2			2			3	

4.2.1.2 Amphibian Assessment and Discussion

Table 5 shows the calling survey results for all years including 2022. Each species will be discussed separately.

There appeared to be sufficient water at all three locations to support breeding frogs during the 2022 survey period. In 2019 by contrast, the Isolated Wetland was dry by mid May. Nevertheless, the spring of 2022 had lower than average precipitation and July was particularly dry with only 22.4 mm reported for Guelph (Government of Canada 2022). By July 15, 2022 there was no water present at either the Isolated Wetland or Tributary A and they appeared to have been dry for some time. Consequently, it is uncertain if those areas held water long enough to allow amphibian larvae to transform into adults. Pond A held water permanently.

American Toad (*Anaxyrus americanus*) were present at all three stations for the second consecutive year. This species appears to be a recent colonist on-site as it was not detected prior to 2019. A single juvenile was first observed in field near Tributary A in 2019. Although widespread and adaptable to human altered habitats, American Toad populations can fluctuate considerably at a given location. It may have been present in low numbers in previous years but was never picked up on calling counts.

Spring Peepers were abundant breeders at both the Isolated Wetland and Tributary A during all survey years. They were also recorded calling from Pond A in 2021 and 2022 yet not on surveys in previous years.

Small numbers of Gray Treefrogs were recorded calling at all three stations in 2022. Acoustic monitors in 2021 which recorded calling frogs over multiple nights, showed that numbers of calling treefrogs were much greater than the numbers recorded during surveys. Only small numbers had been recorded in years prior to 2021. Acoustic monitors are scheduled to be used for 2023 aquatic monitoring.

Wood Frogs were calling in small numbers at the Isolated Wetland and Tributary A on April 7, 2022. The survey night did not coincide with the peak calling period but confirms their continued presence. This species has a short but explosive breeding season in early spring and dates vary somewhat between years depending on weather. Abundant calling Wood Frogs were recorded on the April 2021 survey which by chance took place on a peak night of calling.

Table 5: Amphibian Calling Survey Results All Years

Species	Isolated Wetland						Tributary A						Pond A					
Dates	**2005**	**2018**	**2019**	**2020**	**2021**	**2022**	**2005**	**2018**	**2019**	**2020**	**2021**	**2022**	**2005**	**2018**	**2019**	**2020**	**2021**	**2022**
Spring Peeper	12	12	15	10	>10	>10	50	25	20	11	>10	>10					>10	>10
Gray Treefrog			4		A	1	X		1	1	A	1					2	3
Wood Frog	5	12	1		>10	4	30	15	20		>10	1						
N. Leopard Frog	1				A		X											
Green Frog													X	1	X	X	X	X
American Toad					1	2					5	2					4	3

Notes: X – species was recorded incidentally during other daytime investigations in given year but not during nocturnal amphibian monitoring surveys
Species recorded through acoustic monitoring established in 2021 (acoustic monitoring was not completed in 2022).

Northern Leopard Frogs were not detected during 2022, nor have they been recorded on any of the amphibian surveys over the previous four years. The acoustic monitor that was setup at the Isolated Wetland in 2021, detected single calling individuals on two dates. Northern Leopard Frogs call less intensively than other frogs, and also call more frequently in the day which is why they usually escape detection during the brief nocturnal calling count surveys. They are assumed to still be present.

Green Frog was not detected during the June 1 calling count when they might be expected because this species is a late breeder, typically calling the month of June. Regardless, several Green Frogs were incidentally observed and heard calling in Pond A during the July 15, 2022 vegetation survey. It can be assumed that they were successfully breeding there as the pond provides suitable habitat and contains permanent water.

American Bullfrog (*Lithobates catesbiana*), which was first observed on-site in 2019, has not been detected since.

As in 2021, many amphibians (especially Spring Peepers) were calling at Pond A whereas none were detected there during surveys in previous years. The reason for sudden appearance of calling Spring Peepers there is not clear. It is possible that Spring Peepers have moved into the pond as a response to a reduced hydroperiod at the Isolated Wetland and Tributary A. It appears that the hydroperiod at those locations is not being sufficient to allow for adults to transform into adults in most years. The pond holds water permanently which would allow tadpoles sufficient time to transform.

Surface water levels are monitored by AECOM in three areas where amphibians breed. **Table 6** show the results for the years of monitoring. Water depths are only recorded four times (seasonal) annually, approximately once every three months (typically only twice during the amphibian active period). These data provide some insight into trends but not the details of short-term water level fluctuations. The Isolated Wetland dried up early in the summer of 2020 and indicated that it was dry throughout the spring of 2021. Note that the piezometer MP1 is located in the side of Pond A and not in the deepest part, therefore when it was indicated as “dry”, Pond A has not dried up, but the water level has dropped below the piezometer location. Pond A has permanent standing water. Meanwhile MP2 and MP4 are located within the deepest portions of those surface water features and therefore “dry” indicates lack of any surface water.

Table 6: Surface Water Depths 2018 to 2022

Date	Isolated Wetland Water Depth at MP4	Tributary A Water Depth at MP2	Pond A Water Depth at MP1
5-May-2018	31 cm	20 cm	34 cm
20-Aug-2018	dry	dry	dry
16-Apr-2019	24 cm	35 cm	34 cm
23-Jul-2019	7 cm	23 cm	29 cm
5-May-2020	7 cm	20 cm	31 cm
30-Jul-2020	dry	dry	dry
13-Apr-2021	dry	21 cm	26 cm
1-Jun-2021	dry	dry	9 cm
14-Jul-2021	dry	4 cm	12 cm
4-May-2022	3 cm	22 cm	29 cm
25-Aug-2022	dry	dry	dry

The water levels in the Isolated Wetland and Tributary A started out higher in early spring of 2022 than 2021. Surface water monitoring in **Table 6** indicate that the Isolated Wetland only held 3 cm in early May 2022, but was likely much deeper at the time of the first amphibian survey on April 7. Meanwhile Tributary A showed more typical water levels for early May (compared with previous years) and likely retained water longer. Spring was again drier than normal, and it is questionable if the hydro period was sufficient for tadpoles to transform into froglets, particularly at the Isolated Wetland. As Tributary A water levels dropped amphibian larvae may have moved into Pond A since it retained water.

Overall, numbers of calling amphibians in 2022 surveys looked similar to 2021 except that fewer Wood Frogs were recorded. Robust populations of Spring Peeper were confirmed, American Toad was recorded at all three locations, and there was considerable amphibian calling activity in Pond A.

4.2.2 Wetland Vegetation

Tributary A, the Isolated Wetland and the Downey Road Wetland occur within the site boundary where vegetation transects were initially established in 2018 (AECOM, 2019). A new transect location (TR-5) was selected in 2021 as a control which is outside of the site boundary and approximately 1.4 km from the limit of extraction. It is far enough away to not be affected by any changes in the groundwater table on site.

The location of the wetland features and vegetation transects are illustrated on **Figure 2**.

4.2.2.1 Results of Vegetation Transects

Plant species and the percent (%) cover of each was recorded within the respective transects. Results of 2022 survey as well as from previous years are provided in **Table 8** which documents all plants with a cover of at least 1% in at least one of the transects. A detailed discussion of the results of each vegetation transect survey are provided in the sections below. The percent cover of representative plant species of the latest year of monitoring were compared with the established baseline conditions in 2018 to determine if they were increasing or decreasing.

Representative photographs of the transects are shown in **Appendix D**. Quadrats were not at precisely the same locations between years and there may be some subjectivity in estimating cover, consequently any differences of species cover that varies by less than 25% are not considered significant. Differences between years that are substantially more than 25% likely reflect a real change in abundance, particularly those species with an average cover of at least 5%.

4.2.2.2 TR 1 at the Isolated Wetland Unit

The Isolated Wetland was surrounded by an actively cultivated cropland (corn in 2022) which encroaches almost to the wetland boundary. However, the buffer to the wetland from the cropland has become several meters wider than when the transect was initially established. The boundary of the wetland was quite disturbed with a variety of weedy species mixed with some wetland species. Since the species composition of the edge and interior of the wetland were so different, they appear as separate columns in **Table 8**, with the edge consisting only of the first and last quadrats along the transect. The edge vegetation has become more stabilized with fewer species present as the community has become co-dominant with reed canary grass (*Phalaris arundinacea*), tall goldenrod and panicled aster.

The interior of the wetland is showing an increase in plant diversity due to encroachment of more upland species such as smooth brome (*Bromus inermis*), sow-thistle (*Sonchus sp*.) and dandelion (*Taraxacum officinalis*) into the edges. The percent cover by reed canary grass and field sow-thistle have increased from previous years while the percent cover of and broad-leaved cattail (*Typha latifolia*) continues to decline. These noted changes point to an overall drying of the Isolated Wetland. Representative photographs of the Isolated Wetland are shown in **Appendix D**, photos 1 to 4.

Table 7: Percent Cover of Plants in Vegetation Transects

		TR 1 - edge					TR 1 - interior					TR 2					TR 4					TR 5	
	# of plots	2 plots					10 plots					12 plots					12 plots					12 plots	
	Year of Survey	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2021	2022
Common Name	**Latin Name**																						
GRAMINOIDS																							
Smooth Brome	*Bromus inermis*					4.0					2.0												
Blue-joint Grass	*Calamagrostis canadensis*																					8.3	8.2
Tussock Sedge	*Carex stricta*																						5.0
Beaked Sedge	*Carex utriculata*		2.5				1.7	4.1	6.9	2.7	10.2												
Fox Sedge	*Carex vulpinoidea*	3.0	12.5	3														0.2	0.3		0.8		
sedge sp.	*Carex sp.*			0.5													0.5	1.6	0.1	0.4	0.9	1.3	
Toad Rush	*Juncus bufonius*	10.0																					
Path Rush	*Juncus tenuis*	0.5	5.0	0.5																			
Reed Canary Grass	*Phalaris arundinacea*	1.5	45.0	27.5	40.0	45.0	30.3	38.6	32.9	57.0	43.0	40.2	67.7	50.4	49.6	45.8	41.8	38.0	43.3	44.0	37.1	70.4	55.7
Common Reed	*Phragmites australis*																0.3	2.3	1.9	7.1	8.9		
Fowl Bluegrass	*Poa palustris*				0.5					0.7						3.1	2.5	5.2	4.3		0.1		
Kentucky Bluegrass	*Poa pratensis*																		0.2		4.2	0.8	
bluegrass sp.	*Poa sp.*			0.5								0.4	1.2	0.3						5			
Black Bulrush	*Scirpus atrovirens*		0.5	7.5																			
Narrow-leaved Cattail	*Typha angustifolia*																24.8	23.1	0.8	1.8	1.5	0.3	0.6
Broad-leaved Cattail	*Typha latifolia*						14.6	15.4	18	6.6	3.6												
Hybrid Cattail	*Typha X glauca*											0.8	0.3	0.5			0.6	0.8	13.3	0.8		0.6	0.3
FORBS																							
Common Ragweed	*Ambrosia artemissifolia*	2.0	0.5																				
Common Milkweed	*Asclepias syriaca*	7.5	1.5		2.0	8.0					0.1												
Enchanter's Nightshade	*Circaea lutetiana*											0.1	0.3	0.2	0.3	0.2							
Canada Thistle	*Cirsium arvense*				1.0	5.0					0.5	0.1		0.1									0.9
Wild Carrot	*Daucus carota*	5.0	0.5																		0.3	0.1	
Wild Cucumber	*Echinocystis lobata*												0.1		0.8	0.8							
Northern Willow-herb	*Epilobium ciliatum*													0.3									
Hairy Willow-herb	*Epilobium hirsutum*											1.4	3.6	6.1	1.5	10.0							
Sm.-flower Willow-herb	*Epilobium parviflorum*	2.5	0.5		0.5																		
Field Horsetail	*Equisetum arvense*	20.0	1.0	5.0	7.5	5.0	0.3				0.4	1.2	0.8	0.3	0.1	0.8	1.8	0.9	1.4	0.3	0.8	0.2	1.3
Water Horsetail	*Equisetum fluviatile*		0.5				3.7	4.1	1.3	0.9	2.3						2.2	4.8	1	0.5	0.5		
Spotted Joepyeweed	*Eupatorium maculatum*														1.0	1.5		0.2	0.3				
Grass-leaved Goldenrod	*Euthamia graminifolia*		2.0	15.0	6.0	5.0											1.0	0.1	0.4				
Marsh Bedstraw	*Galium palustre*									0.1	1.8	0.1	0.2	2.3	1.8	0.2	0.2	0.1	0.3	0.1	0.2		
Spotted Jewelweed	*Impatiens capensis*											4.1	2.7	3.1	13.3	18.0						0.1	
Lesser Duckweed	*Lemna minor*											0.6											
Cut-leaved Bugleweed	*Lycopus americanus*		0.5	2.0									0.1	0.4	0.8	0.8							
Northern Bugleweed	*Lycopus uniflorus*											0.5	1.1	0.7	0.7	0.2	0.1		0.3		0.3		
Tufted Loosestrife	*Lysimachia thrysiflora*						0.6	0.5	0.7	0.8	0.6												
Wild Mint	*Mentha arvense*											0.1	0.2	0.1	1.3	0.7	0.3	0.3	0.2	0.3	0.4	0.1	1.3
Sensitive Fern	*Onoclea sensibilis*											2.8	1.6	3.7	3.0	3.7							
Wood Sorrel	*Oxalis stricta*	1.0	0.5	0.5	0.5																		
Common Plantain	*Plantago major*	2.5																					
Water Knotweed	*Persicaria amphibia*																					3.7	3.3
Lady's Thumb	*Persicaria maculosa*	1.0																					
Rough Cinquefoil	*Potentilla norvegica*	7.5			0.5																		
Bittersweet Nightshade	*Solanum dulcamara*								0.1	0.2	1.5	24.7	19.5	18.8	23.3	18.7	2.9	4.2	9	21.9	21.8	0.3	1.9
Tall Goldenrod	*Solidago altissima*	2.5	1.5		10.0	15.0			0.1	0.1	0.5	0.4	0.3	0.3		0.8	0.5	1.3	2.5	2.9	6.7	5.8	
Giant Goldenrod	*Solidago gigantea*														1								
Rough Goldenrod	*Solidago rugosa*											1.2	0.8	1.8	0.4	2.5							
Field Sow-thistle	*Sonchus arvensis*	4.0	2.0	3.5	0.5				0.1	2.6									0.1	0.4	0.4		
Prickly Sow-thistle	*Sonchus asper*					4.0					2.5												

		TR 1 - edge					TR 1 - interior					TR 2					TR 4					TR 5	
	# of plots	2 plots					10 plots					12 plots					12 plots					12 plots	
	Year of Survey	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2021	2022
Common Name	**Latin Name**																						
GRAMINOIDS																							
Panicled Aster	*Symphotrichum lanceolatum*	1.5	2.5	10.5	25.5	12.0	0.1	0.2	0.1	0.4	2.0						2.1	3.8	5.6	6.6	9.3	0.9	6.3
Swamp Aster	*Symphotrichum puniceum*				1.5							3.7	1.6	2.6	4.9	3.3							
Coltsfoot	*Tussilago farfara*				1.0																		
Blue Vervain	*Verbena hastata*	1.0	6.0	1.0																			
Cow Vetch	*Vicia cracca*	2.0	0.5	0.5	0.5				0.1	0.4	0.2												
WOODY PLANTS																							
Gray Dogwood	*Cornus racemosa*																2.1	0.7	1.2	0.4	1.9	5.3	5.3
Red-osier Dogwood	*Cornus sericeus*											0.2	0.2	1.0	1.8	0.9	7.7	13.3	11.7	14.2	11.3	0.1	8.2
Eastern Cottonwood	*Populus deltoides*																					9.2	4.0
Common Buckthorn	*Rhamnus cathartica*															1.0							0.8
Black Currant	*Ribes americana*											0.4	0.8	1.3		0.8							
Red Raspberry	*Rubus idaeus*											0.7	2.3	2.7	1.7	5.0							
Peach-leaved Willow	*Salix amygdaloides*						7.5	7.5	7.5	7.5	5.0												
Missouri Willow	*Salix eriocephala*											5.0	2.9	12.9	12.1	8.3					0.8		
Riverbank Grape	*Vitis riparia*										0.2	0.5	0.4	0.8	0.7	0.2	0.8	0.3		0.7	1.3		
TOTAL COVER		77.0	87.0	78.0	98.0	99.0	58.8	70.4	60.3	80.1	75.1	89.2	109.3	115.5	120.2	127.9	92.3	101.4	99.1	107.8	101.5	108.5	103.3
NUMBER of SPECIES		22	22	16	16	9	8	7	10	14	18	23	26	25	22	26	20	22	25	19	25	22	17

The water table along the transect also shows a lower level than in previous years (**Table 8**) which may account for the noted shift in plant species composition in the interior of the wetland. Outside of the transect, the rim of the wetland contained a patch of sandbar willow (*Salix exigua*) at the west end and a thicket containing a mix of sandbar, Missouri (*S. eriocephala*), peach-leaved (*S. amygdaloides*) and white willows (*S. alba*) at the east end. These have remained approximately the same size since 2018.

Characteristics of the soil sample taken mid-way along transect TR 1 are shown in **Table 8** and in **Appendix D**, photo 3. No mottles were present because of the deep organic soil layer and the shallow water table. The difference in depths of layers are due to samples taken at slightly different locations. They reflect natural variability but show a consistent pattern. Only the depth of the water table reflects a change between years. Readings taken at monitor MP4 on July 13, 2021 showed that the groundwater level was 73 cm below surface, which is consistent with results in **Table 8**.

Table 8: Soil Sample at Transect TR-1

Soil Characteristics	Depth 2018	Depth 2019	Depth 2020	Depth 2021	Depth 2022
Depth to Water Table	7 cm	0 cm	27 cm	70 cm	80 cm
Depth to Mottles	Not present	Not present	Not present	Not present	Not present
Fibric/Mesic Organic	0 – 30 cm	0 – 60 cm	0 – 50 cm	0 – 50 cm	0 – 50 cm
Humic Organic	30 – 85 cm	60 – 110 cm	50 – 90 cm	50 – 100 cm	50 – 80 cm
Grey Silt	85 – 115 cm	110 – 120 cm	90 – 110 cm	100 – 120 cm	80 – 100 cm

4.2.2.3 TR 2 at Tributary A

Nearly the whole length of Tributary A consisted of reed canary grass meadow marsh, but often co-dominated with bittersweet nightshade (*Solanum dulcamara*). Overall, the species composition and number of species has remained more constant than at TR 1. Cover by spotted jewelweed (*Impatiens capensis*) and hairy willow-herb (*Epilobium hirsutum*) fluctuate between years with both abundant in 2022. The amount of cover by woody shrubs remained about the same as in 2021 but is increasing, as a result of natural succession.

Surface water was not present in the poorly defined channel. **Table 9** shows that the water table was well below the surface again and was dry during summer of 2022 (**Table 6**). Representative photographs of the Tributary A are shown in **Appendix D**, photos 5 to 6.

Characteristics of the soil sample taken mid-way along the transect are shown in **Table 9**. The groundwater level was not encountered, and therefore was considerably lower than in any previous year of vegetation monitoring which is likely a reflection of low precipitation. The soil sample is depicted in **Appendix D**, photo 7. The persistence of wetland vegetation may be a result of this being a drainage feature which consistently receives surface flow through spring runoff and rain events.

The water level in Pond A appeared to be about the same as in 2021 but lower than in previous years and no water flowed outward into Tributary A. Surface water monitoring at MP1 showed that the pond level was lower in the summer of 2022 than in 2021 (**Table 6**). Water was clear and stoneworts (*Chara* sp.) occupied most of the substrate. Mud-plantain (*Alisma plantago-aquatica*) was abundant along the west side of the pond and a robust patch of broad-leaved cattail. (**Appendix D**, photo 8).

Table 9: Soil Sample at Transect TR-2

Soil Characteristics	Depth 2018	Depth 2019	Depth 2020	Depth 2021	Depth 2022
Depth to Water Table	5 cm	0 cm	17 cm	35 cm	>110 cm
Depth to Mottles	Not present	Not present	Not present	Not present	Not present
Organic Soil, mainly Humic	0 – 95 cm	0 – 90 cm	0 – 95 cm	0 – 85 cm	0 – 90 cm
Light Grey Clayey Silt	95 – 110 cm	90 – 110 cm	95 – 110 cm	85 – 110 cm	90 – 110 cm

4.2.2.4 TR 4 at the Downey Road Wetland Unit

This small wetland unit is approximately 0.3 ha in size and situated near the edge of the active pit. The unit consists of marsh co-dominated by reed canary grass and narrow-leaved cattail (*Typha angustifolia*) surrounded by a band of willow-dogwood thicket. A small dense patch of common reed (*Phragmites australis*), an aggressively invasive wetland plant, occurs on the south side of the unit. Representative photographs of transect TR-4 are shown in **Appendix D**, photos 9 to 11.

Common reed was present in the four southernmost quadrats (only southern two in 2021) so is expanding slowly and its cover has increased four-fold since 2020. A very dense stand of common reed extends south from the end of the transect. Overall, the vegetation is shifting toward more upland species with a significant decrease in cattail cover, while a significant increase of bittersweet nightshade, panicled aster and tall goldenrod has occurred as well as a modest increase of other upland species.

Characteristics of the soil sample taken mid-way along the transect appear in **Table 10**. This site consisted of shallow organic soil over silty mineral soils. The water table was not reached in the soil sample taken at the time of the field investigations. The soil sample is depicted in **Appendix D**, photo 12.

Table 10: Soil Sample at Transect TR-4

Soil Characteristics	Depth 2018	Depth 2019	Depth 2020	Depth 2021	Depth 2022
Depth to Water Table	70 cm	25 cm	47 cm	100 cm	>90 cm
Depth to Mottles	none	none	70 cm	60 cm	65 cm
Organic Soil, mainly Humic	0 - 50	0 – 30 cm	0 – 40 cm	0 – 60 cm	0 – 45 cm
Silty Loam	50 – 65 cm	30 – 60 cm	40 – 70 cm	60 – 70 cm	45 – 65 cm
Silty Clay	65 – 100 cm	60 – 120 cm	70 – 110 cm	70 – 110 cm	65 - 90 cm

4.2.2.5 TR 5 Control at Kortright Hills

The control transect which was established in 2021, was fairly similar to the transects on the Mast-Snyder site being dominated by reed canary grass but it had representation by some additional species particularly Canada bluejoint (*Calamagrostis canadensis*) and water smartweed (*Persicaria maculosa*). The woody cover shown in **Table 8** indicates that transect location was not precisely the same as in 2021. Characteristics of the soil sample taken mid-way along the transect appear in **Table 11**. The organic soil layer was found to be shallower than at any of the other transects. The water table had dropped even lower than in 2021 which is consistent with the other transects. Representative photographs of transect TR-5 are shown in **Appendix D**, photos 13 to 15.

Table 11: Soil Sample at Transect TR 5

Soil Characteristics	Depth 2021	Depth 2022
Depth to Water Table	90 cm	>95 cm
Depth to Mottles	30 cm	40 cm
Organic Soil, mainly Humic	0 – 10 cm	0 – 40 cm
Silty Loam	10 – 50 cm	40 – 55 cm
Silty Clay	50 – 110 cm	55 – 95 cm

4.2.2.6 Vegetation Assessment and Discussion

The water table was farther below the surface at all three on-site locations than in any previous monitoring event. The vegetation along the Isolated Wetland (TR 1) and Downey Road Wetland (TR 4) transects has shown a gradual shift to drier vegetation as cattail cover has declined while the cover of meadow species such as field sow-thistle, tall goldenrod and panicled aster has increased. Tributary A (TR 2) transect did not show this trend. A difference may be that both the Isolated Wetland and Downey Road Wetland are palustrine wetlands where surface water mostly sits and percolates into the soil, while Tributary A is a riparian wetland that is subjected to periodic flowing water and where the water table was not quite as low.

4.2.3 Aquatic Features and Fish Habitat Assessment

Aquatic features within the site boundary consist of a dug pond (Pond A) and an unnamed intermittent tributary of the Speed River (Tributary A) (See **Figure 2**). Tributary A was dredged and straightened by the landowner in the 1980s (GLL, 2006). Two swales that carry surface water for short periods across agricultural fields occur upstream from Pond A. Tributary A is intermittent but normally holds water through spring and into early summer.

Aquatic habitat and fish community surveys within Pond A and Tributary A were originally completed in 2018 (AECOM, 2019) prior to pit extraction which included the following:

- Documentation of surrounding natural features and land uses (i.e., wetland, agriculture, etc.);
- Channel dimensions, substrate composition, channel morphology and bank stability;
- Stream morphology dimensions:
- Substrate composition (i.e., clay, silt, sand, gravel, cobble, rock, boulder, muck and detritus);
- Indicators of water quality; water clarity, water colour, presence and type of macrophytes and algal growth, evidence of runoff;
- Basic field parameters such as pollution sources (i.e., tile drain discharges, other piped discharges and road runoff).

On June 25, 2020, an AECOM aquatic ecologist undertook aquatic habitat assessments at Tributary A and Pond A in order to document any potential changes to the available fish habitat due to below-water extraction activities at the pit.

4.2.3.1 Tributary A

At the time of 2020 assessment, Tributary A was mostly dry, minus pools of standing water between the assessed reach from the Laird Road crossing to the narrow channel connecting the tributary to Pond A. As such, only the bankfull width was assessed which was approximately 1.5 m. Substrate was composed of silt, muck and detritus. Instream cover was provided by grasses, watercress and woody debris. Riparian cover was provided by deciduous trees, shrubs, herbaceous vegetation and grasses.

No fish community sampling was undertaken within Tributary A since 2018. The tributary within the study area provides for seasonal fish habitat suitable for refuge, feeding and rearing; however, conditions are non-limiting throughout with no specialized (critically limiting spawning habitat) identified.

Tributary A has been identified as an intermittent water feature, so it would be expected that during the warmer months, the tributary could be dry. **Table 6** shows the water depth readings taken in mid summer between 2018 and 2022. Substantial water depth was only recorded in 2019. These are only single sampling events taken at 3-month intervals however, and therefore their results do not indicate the length of hydroperiod each summer. Tributary A was completely dry at the time of vegetation monitoring on July 15, 2022.

4.2.3.2 Pond A

At the time of 2020 assessment, the mean wetted width was at bankfull levels, approximately 30 m. Depth was not assessed due to the soft and silty substrate; however, it appeared to be over 1.0 m. Substrate was composed of silt, muck and detritus. Instream cover was abundant and largely provided by aquatic vegetation with marginal woody debris. The riparian vegetation was dense herbaceous vegetation and several small trees. There appeared to be no visible change in Pond A between 2018 and 2020.

No aquatic habitat assessments took place in 2021 or 2022 but some observations were made at the time of vegetation monitoring on July 15, 2022. Pond A water level appeared to be lower than in 2021 as there was no exposed muck or stranded water plants. Reed canary grass was abundant around the pond rim and scattered water plantain (*Alisma plantago-aquatica*) were growing in the shallows. A dense layer of submerged stoneworts (*Chara* sp.) covered most of the pond bottom (**Appendix D**, Photos 8 and 9).

5. Triggering Mechanisms and Contingency Plan

5.1 Triggering Mechanisms

As per the Site Plans, the Triggering Mechanisms and Contingency Plan will not be established until after the Area 2 below-water extraction is complete. Site preparation (berms, stripping) commenced in late spring/early summer 2018. Above and below-water extraction activities commenced in November 2018 and July 2019, respectively. Below water extraction in Area 2 commenced in late fall 2019 was completed in early April 2022. A low water level elevation memo was generated by AECOM and submitted to the MNRF hydrogeologist at that time (David Webster) reviewed the rationale leading to the development of the proposed trigger elevations and found it reasonable. The trigger levels presented in this memorandum reflect the agreed upon approach, updated to consider baseline water level elevations collected up to the end of 2017, prior to any on-site extraction.

As presented in the hydrogeological assessment, drawdown calculations were completed under the worse case scenario of a hot, dry (no precipitation), mid-summer week with a high rate of below-water extraction (2,100 tonnes per day) for the initial excavation when a small pond is present, for near the end of the operation when a large pond is present and at the end of operations when a large pond remains but extraction operations have ceased. As the initial below-water excavation commenced in the southeast corner of the site and the trigger monitors are in the northern portion of the site, no water level impacts are expected early in the below-water extraction operations in the vicinity of Tributary A. Later in the operations when a large pond is present and there is a high rate of extraction, the drawdown at Tributary A is predicted to be in the order of 0.06 m. Once operations cease, only a minor drawdown at Tributary A (less than 0.01 m) is predicted, mainly as a result of evaporation off the pond surface. The aggregate removal effect is a temporary impact that only occurs while the pit is being extracted. Over time, additional precipitation in the pit, and groundwater recharge in the surrounding areas, will offset this effect. Furthermore, as the ponds in the pit grow larger, a “reservoir” of water is created and the effects of removing solid particles from below the water table are diminished. In light of this, the drawdown effect is considered negligible and the focus of establishing triggers is based on the baseline water levels and the effects of precipitation.

5.2 Contingency Plan

The Site Plan triggering mechanisms and contingency plans were originally based on the monthly/quarterly manual water level monitoring program, as described above under Condition 4. In May 2018, all existing groundwater monitors and mini-piezometers on-site were instrumented with level loggers collecting daily water level readings, which is a much higher frequency than the monthly/quarterly frequency originally cited in the Site Plans. As this is the case, it is proposed that as long as daily logger readings are collected at BH3, BH8, BH9 and BH10-II, the triggering mechanisms are based on groundwater levels that are recorded below the trigger elevation for seven consecutive days with an observed downward trend and attributed to be a result of below-water extraction activities before the contingency plan is implemented.

6. Conclusions

6.1 Hydrogeology

Based on the groundwater monitoring conducted at the site in 2022, the following conclusions are presented:

- Water level measurements collected across the site at the groundwater monitors and mini-piezometers reflect baseline pre-extraction conditions to November 2018. Below-water extraction commenced in July 2019. At most locations, groundwater levels are showing an overall decreasing trend over time. This decreasing trend does not appear to be related to pit activities as there are no water takings occurring on-site and all monitors upgradient and downgradient of the below-water extraction activities show similar trends. Water levels appear to be largely influenced by local precipitation conditions and show natural seasonal fluctuations.
- Groundwater flow is to the north-northwest. Locally, groundwater flows from the pit area towards Tributary A, as indicated by the groundwater levels collected in the vicinity.
- There were no apparent impacts to groundwater levels and flows as a result of pit operations.

6.2 Natural Environment

The monitoring of amphibians and wetland vegetation was conducted for the fifth consecutive year in 2022. The 2018 results provided the baseline condition which have been compared with subsequent monitoring events. Below-water table excavations began in the summer of 2019 and have proceeded further since then.

During amphibian surveys in 2022, four species were calling from the Isolated Wetland on calling count surveys despite the low level of standing water, a result of a third year of drier than normal spring weather. Amphibians did not have a successful breeding season there which was also observed in 2018, 2020 and 2021. Spring Peepers and a Gray Treefrog called from Tributary A; however, that feature also dried up and it is not known if amphibians were able to successfully reproduce there either. Those sites have likely fluctuated between successful and unsuccessful years depending on how wet the season was. In recent years there seems to have been an increase in dry years. However, more calling amphibians were recorded at Pond A (which holds permanent water) over the last two years than previously. The pond may be important in allowing the amphibians to persist on site.

With respect to wetland vegetation, the relative species cover along two of the on-site vegetation transects is showing a slight shift to drier species. In particular, the cover of cattails has declined noticeably along both TR 1 and TR 4. Meanwhile this shift has not been apparent in the plant species composition along TR 2 even though it too has been drier. The trend of increasing cover by more upland plant species is likely related to the lowered groundwater table. As stated in 6.1 his decreasing trend does not appear to be related to pit activities.

7. Recommendations

Based on the results of this year's monitoring program, the following recommendations are provided:

a) Groundwater level monitoring of the on-site monitors and MPs should continue as prescribed in the approved Site Plans.

b) The amphibian surveys should continue annually since below-water extraction has begun. Calling counts should be conducted three times during suitable weather conditions in April, May and June. Acoustic monitors should be employed at two locations (Isolated Wetland, and between Tributary A and Pond A) every other year (next in 2023) to provide a more complete record of calling amphibians.

c) An aquatic habitat assessment is required for Tributary A and Pond A as part of annual monitoring in 2023.

d) The vegetation transect surveys should be carried out annually in mid summer following the same procedures at TR 1, TR 2, and TR 4; and the off-site control at TR 5.

e) Comparisons shall be made from future monitoring results to determine if changes are occurring and if those changes are likely a result of aggregate extraction activities, particularly as it might affect the level of the groundwater table.

f) As per Site Plan Condition 4 of the Natural Environment Technical Recommendations, this annual report should be submitted to the Ministry of the Environment, Conservation and Parks (MECP), Ministry of Natural Resources and Forestry (MNRF), Township, County, the City and the Grand River Conservation Authority (GRCA).

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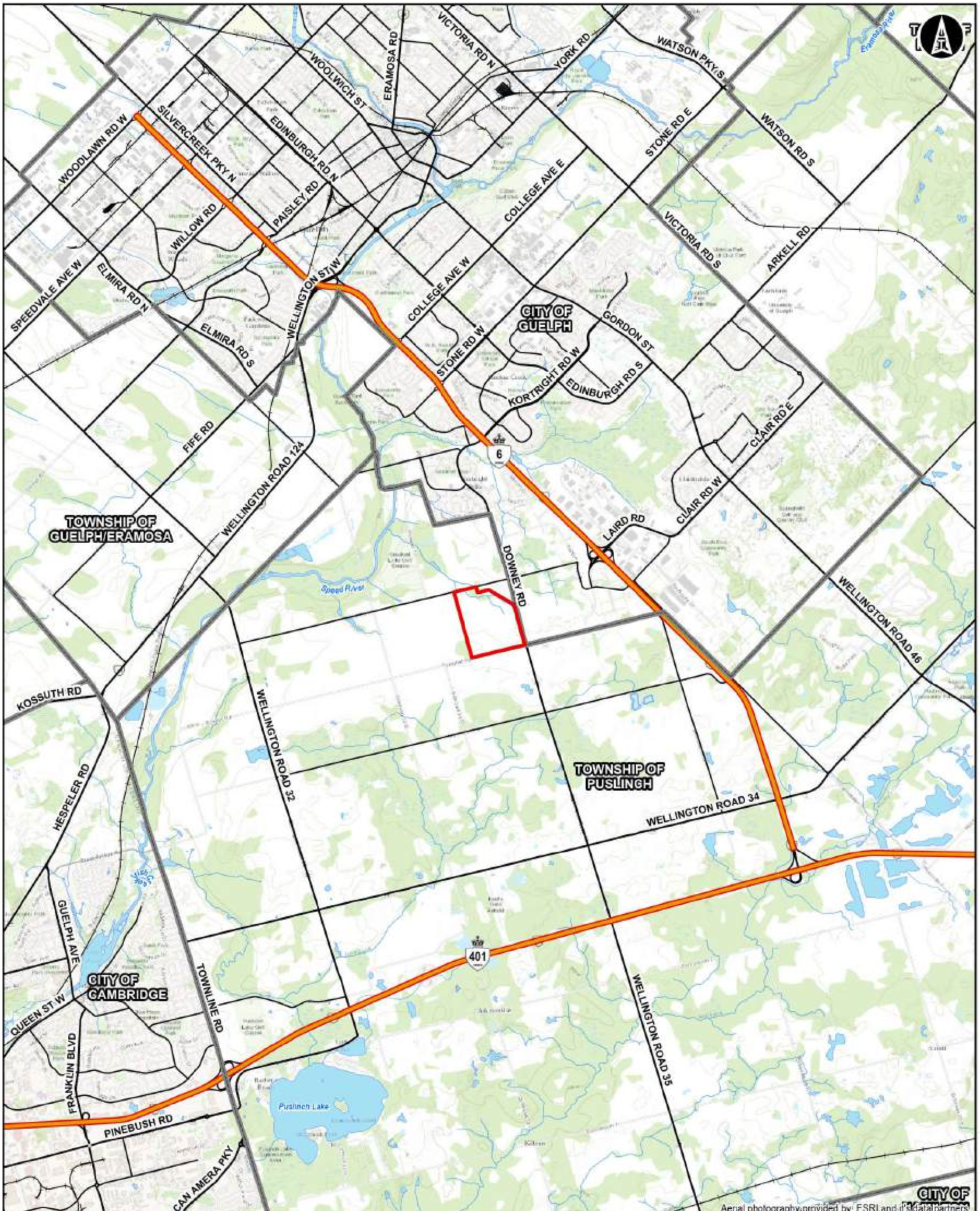
Figures



Legend

- Site Boundary
- Municipal Boundary
- Freeway
- Highway
- Major Road
- Collector Road
- Railway
- Waterbody
- Watercourse

St. Marys Mast-Snyder Property

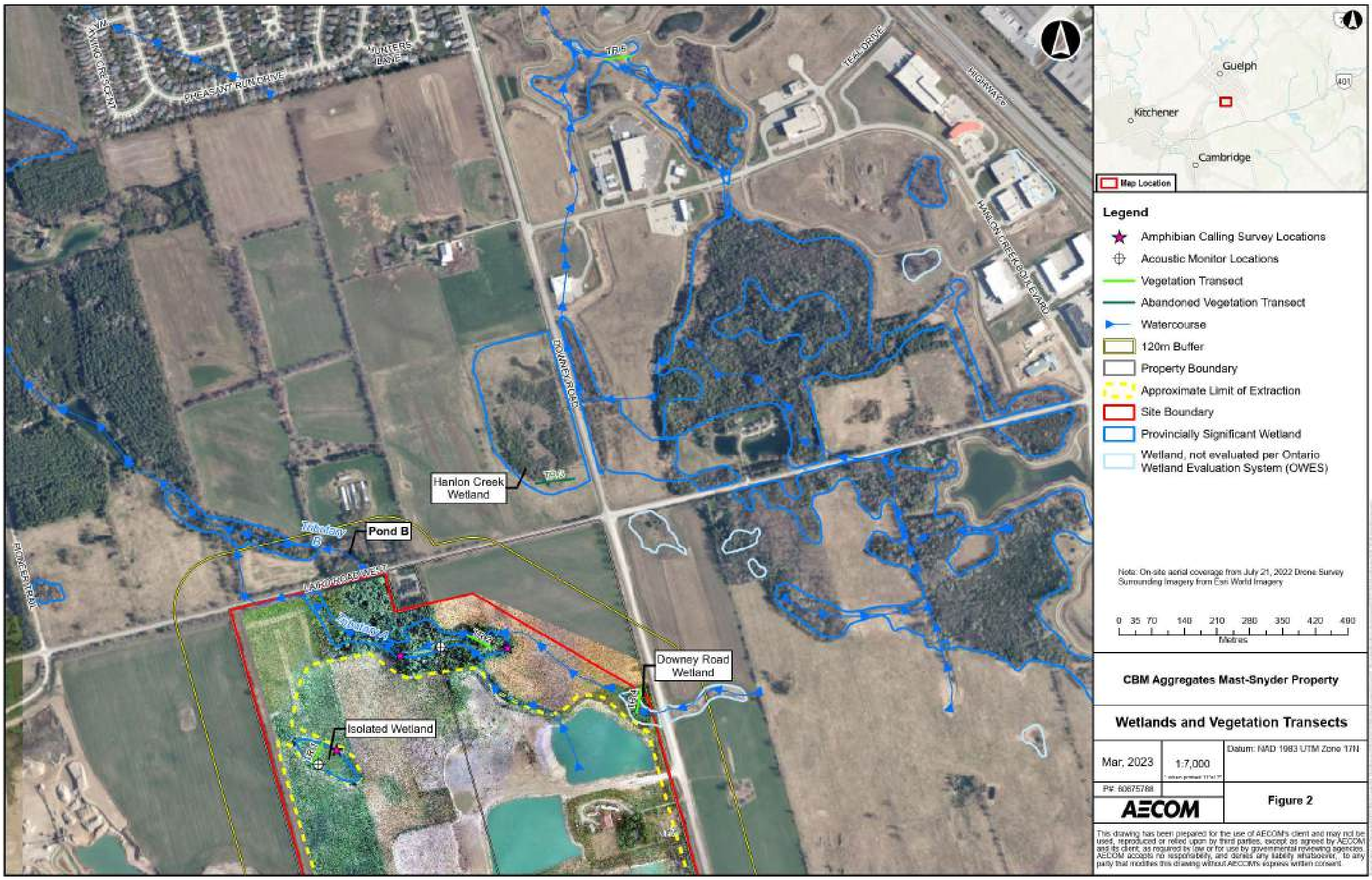
Site Location

0 0.5 1 2 3
KM
NAD 1983 UTM Zone 17N

Mar, 2023	1:54,000	**Data Sources:** Ontario Ministry of Natural Resources and Forestry, Government Open License Data Portal
P#: 60675788	Rev:00	

AECOM

Figure 1


Guelph
Kitchener
Cambridge
401
Map Location
Legend
Amphibian Calling Survey Locations
Acoustic Monitor Locations
Vegetation Transect
Abandoned Vegetation Transect
Watercourse
120m Buffer
Property Boundary
Approximate Limit of Extraction
Site Boundary
Provincially Significant Wetland
Wetland, not evaluated per Ontario Wetland Evaluation System (OWES)
Note: On-site aerial coverage from July 21, 2022 Drone Survey
Surrounding Imagery from Esri World Imagery
0 35 70 140 210 280 350 420 490
Metres
CBM Aggregates Mast-Snyder Property
Wetlands and Vegetation Transects
Mar, 2023
1:7,000
Datum: NAD 1983 UTM Zone 17N
P#: 60675788
AECOM
Figure 2
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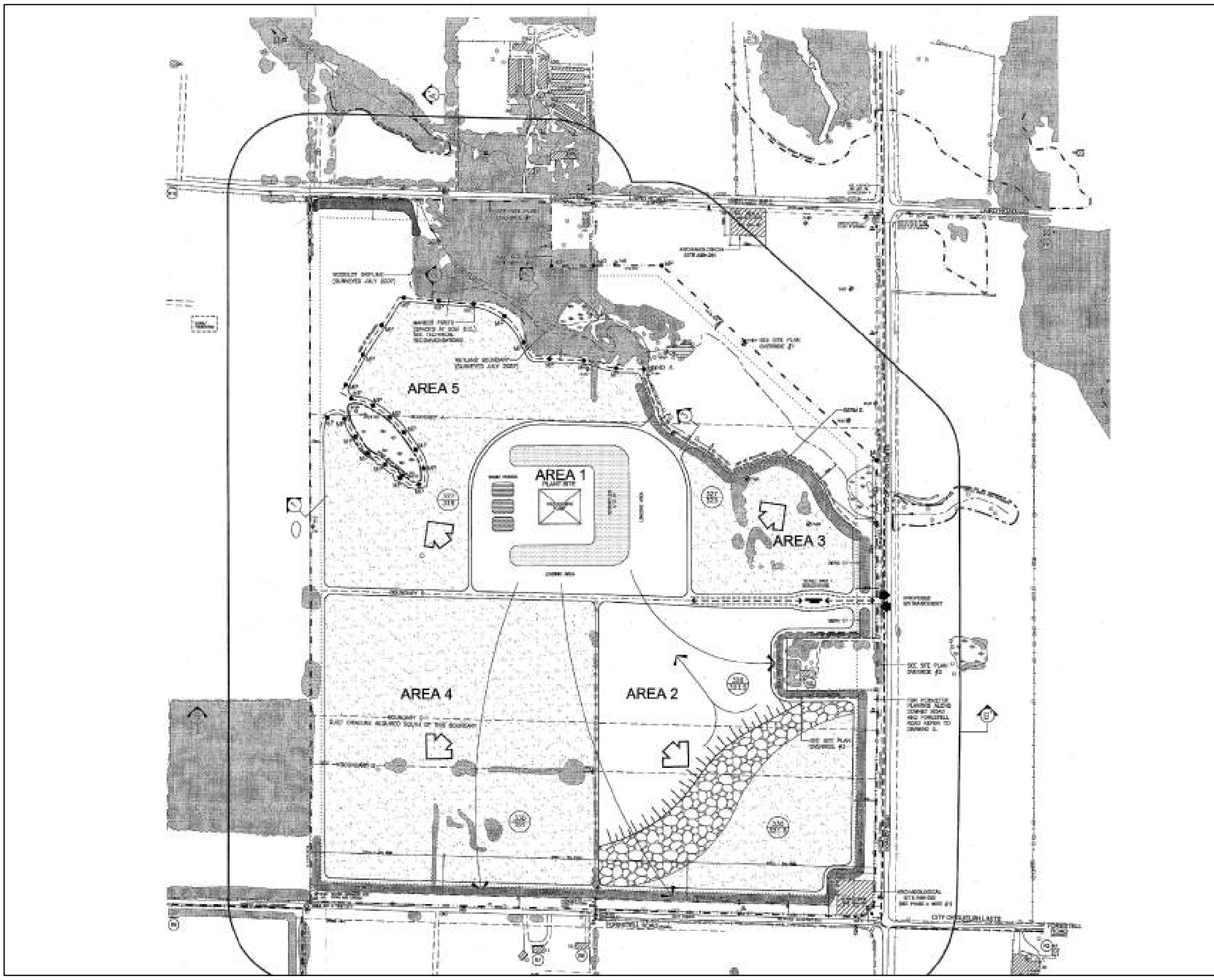
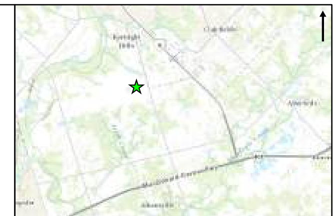
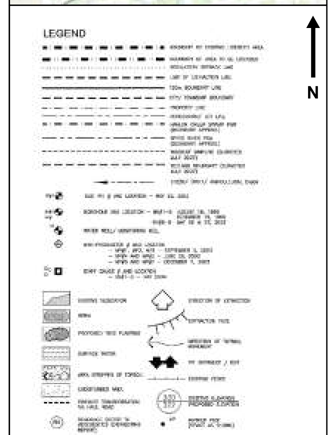
PHEASANT RUN DRIVE
HUNTERS LANE
DOWNEY ROAD
TEAL DRIVE
HIGHWAY 6
HANLON CREEK BOULEVARD
LAIRD ROAD WEST
PIONEER TRAIL
Hanlon Creek Wetland
Pond B
Tributary B
Tributary A
Downey Road Wetland
Isolated Wetland
TR-5







Source: Harrington and Hoyle Ltd., 2007: St. Marys/CBM Mast Snyder Pit Site Plans, 1:2,000 scale, December 2007

St. Mary Mast-Snyder Property

Operations Plan

March 2023	N.T.S	Datum: NAD 83 UTM Zone 17
P#: 60675788	V#:	
AECOM		Figure 3

Legend

- Mini-Piezometer
- Destoryed Mini-Piezometer
- Staff Gauge
- Monitor Location
- Groundwater Divide
- Roads
- Intermittent Watercourse
- Permanent Watercourse
- Site Boundary
- Approximate Limit of Extraction

Note: On-site aerial coverage from July 21, 2022 Drone Survey

St. Marys Mast-Snyder Property

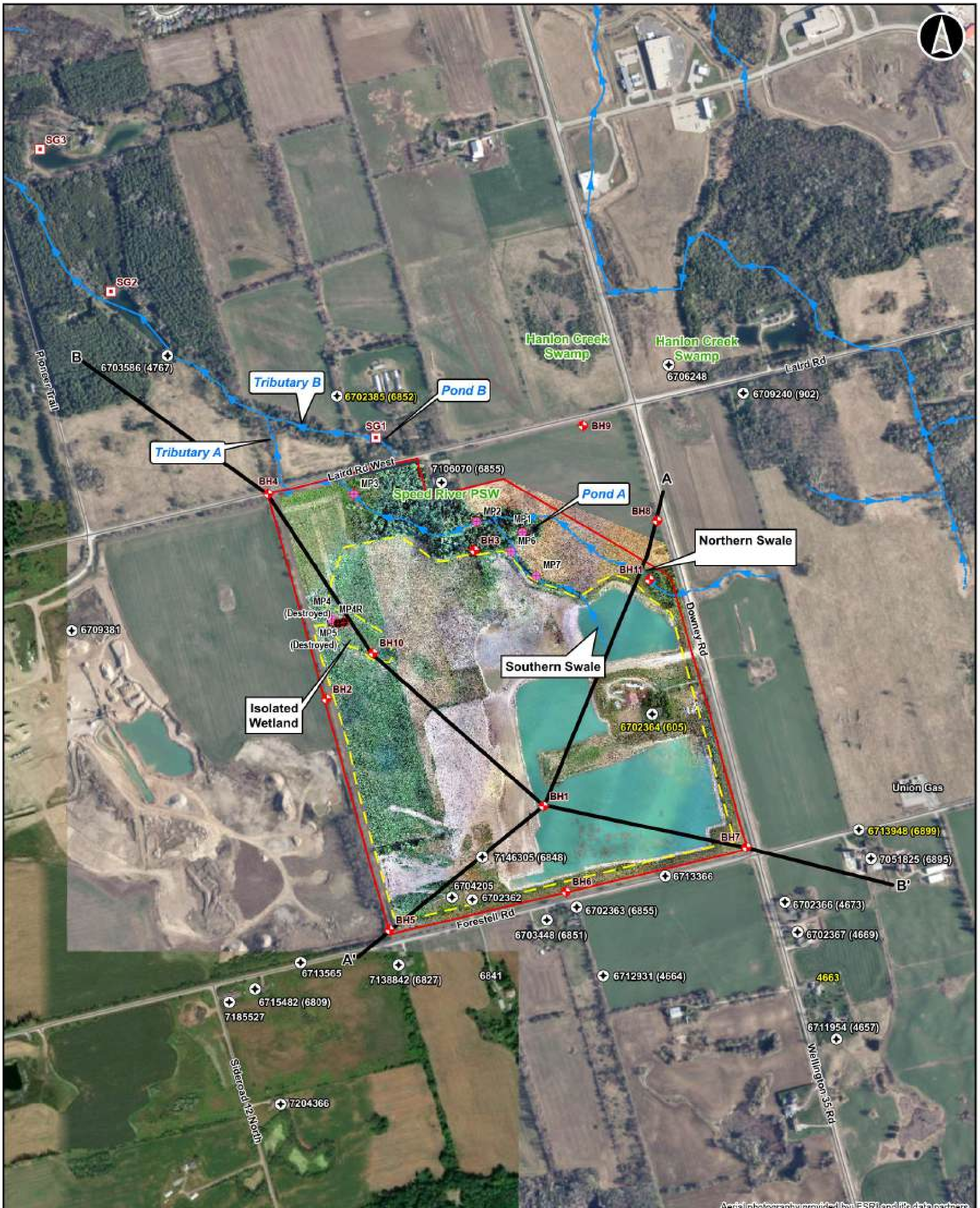
Groundwater Elevations (December 2022)

0 50 100 200 300 400
Meters
NAD 1983 UTM Zone 17N

Dec, 2022	1:8,000	Data Sources: Ontario Ministry of Natural Resources and Forestry. Government Open License Data Portal
P#: 60675788	Rev:00	

AECOM

Figure 4



Legend

- Mini-Piezometer
- Destoryed Mini-Piezometer
- Staff Gauge
- Monitor Location
- Cross Section Line
- Site Boundary
- Approximate Limit of Extraction
- Roads
- Intermittent Watercourse
- Permanent Watercourse
- MECP Water Well Record (No Current Residence)
- 7138842 (6827) Well Survey Complete, MECP Water Well Record Number (House number)
- 6702364 (605) Well Survey Incomplete, MECP Water Well Record Number (House number)

Note: On-site aerial coverage from July 21, 2022 Drone Survey

St. Marys Mast-Snyder Property

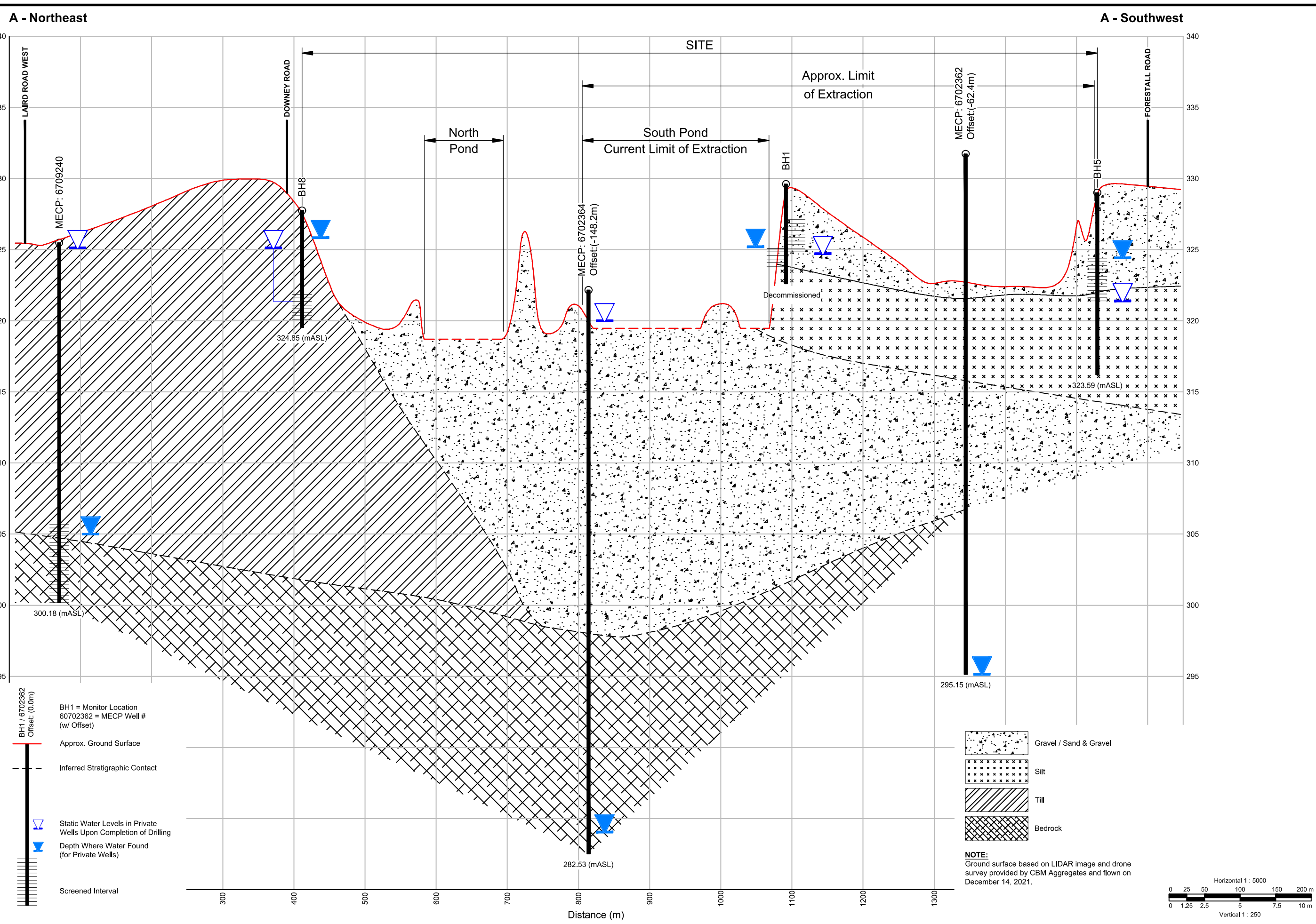
Water Wells & Cross-Section Locations

0 50 100 200 300 400
M
NAD 1983 UTM Zone 17N

Mar, 2023	1:8,000	Data Sources: Ontario Ministry of Natural Resources and Forestry, Government Open Licence Data Portal
P#: 60675788	Rev:00	

AECOM

Figure 5



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Project Management Initials: Designer: IL Checked: PW Approved: PW ANSI B 279.4mm x 431.8mm

AECOM

Figure: 6

GEOLOGICAL CROSS-SECTION A-A' (Northeast to Southwest)

CBM AGGREGATES MAST-SNYDER PROPERTY

Guelph, Ontario

Project No.: 60675788 Date: March 2023

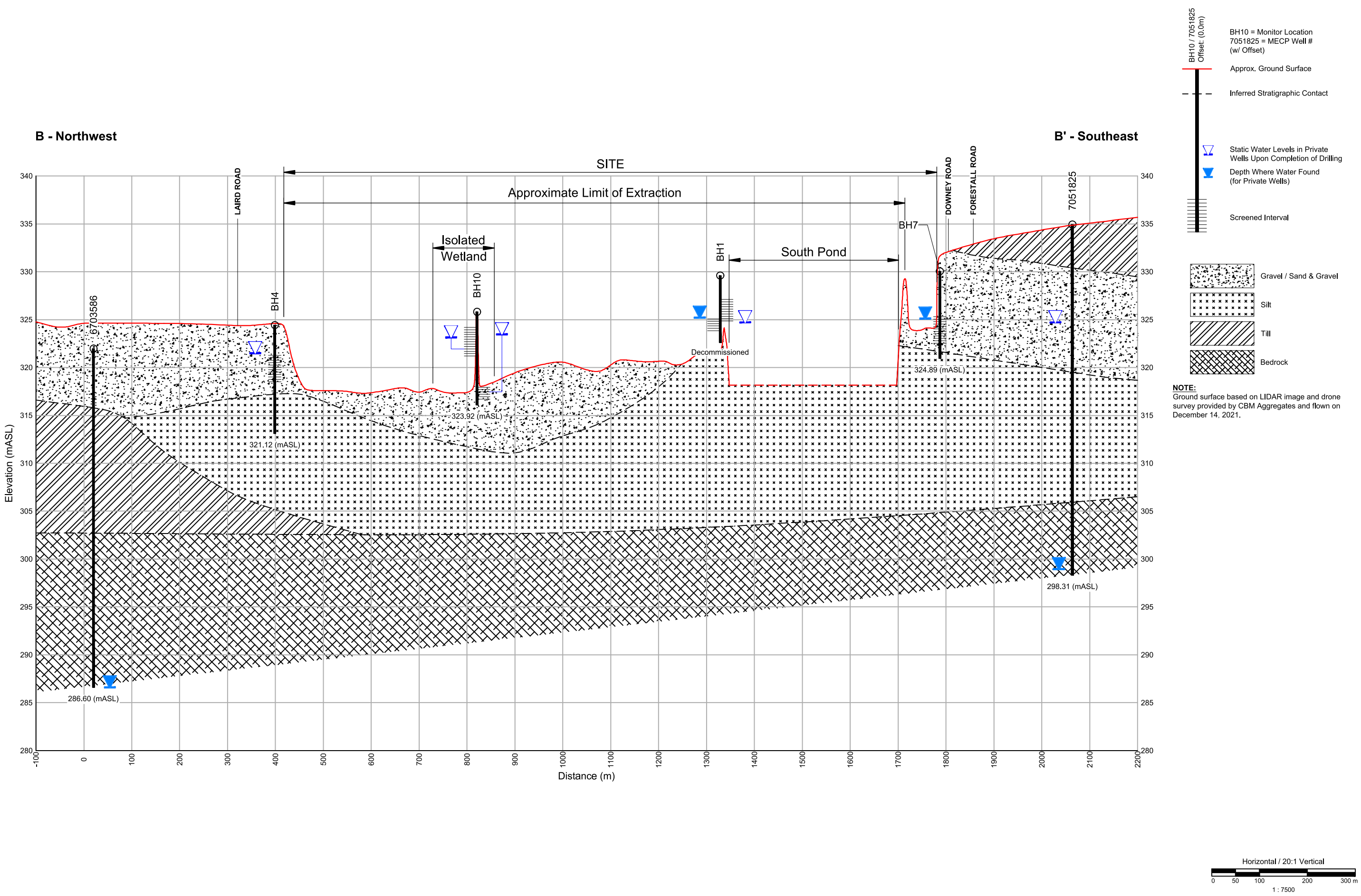

Figure: 7

GEOLOGICAL CROSS-SECTION B-B' (Northwest to Southeast)

CBM AGGREGATES MAST-SNYDER PROPERTY

Guelph, Ontario

Project No.: 60675788 Date: March 2023

Project Management Initials: Designer: IL Checked: PW Approved: PW ANSI B 279.4mm x 431.8mm

Last saved by: MARINCS(2024-01-10) Last Plotted: 2024-01-10
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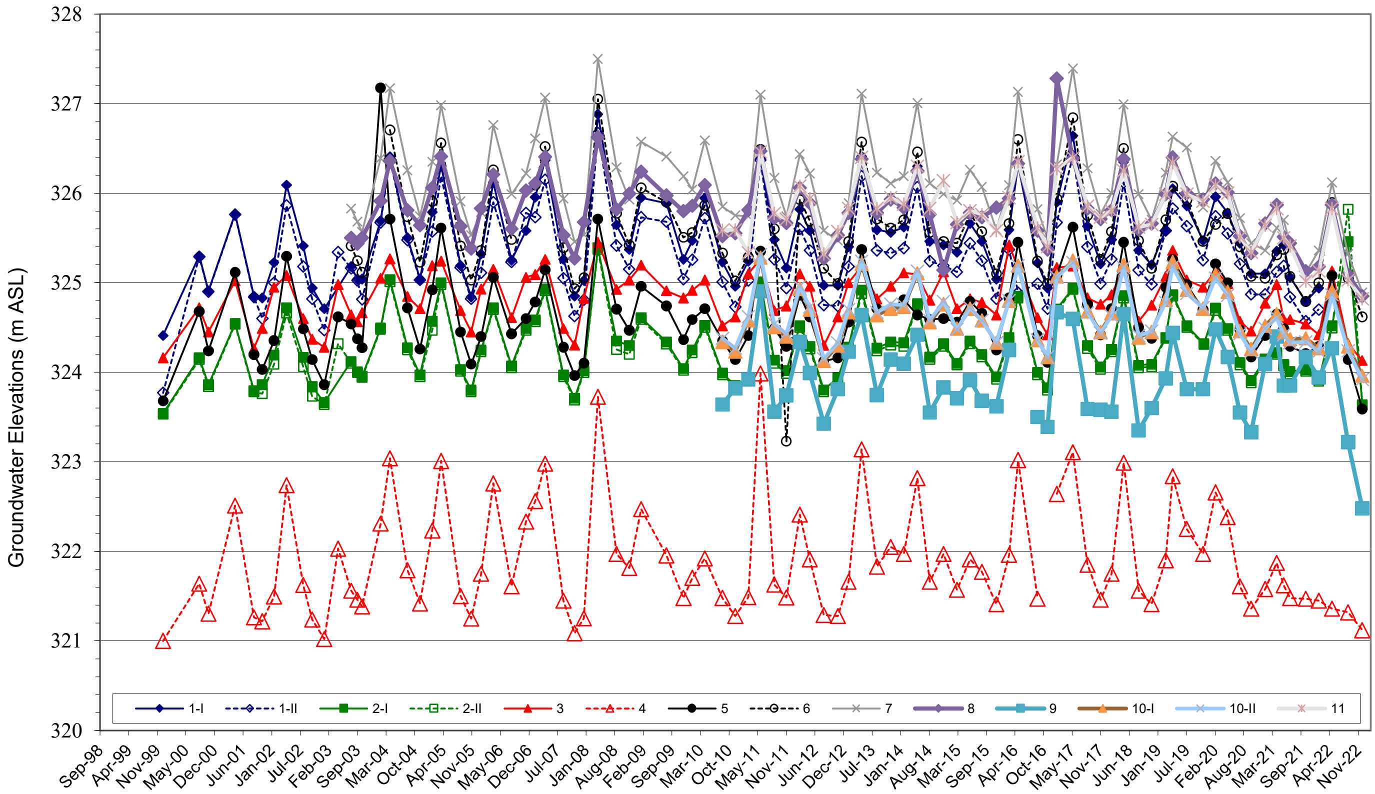


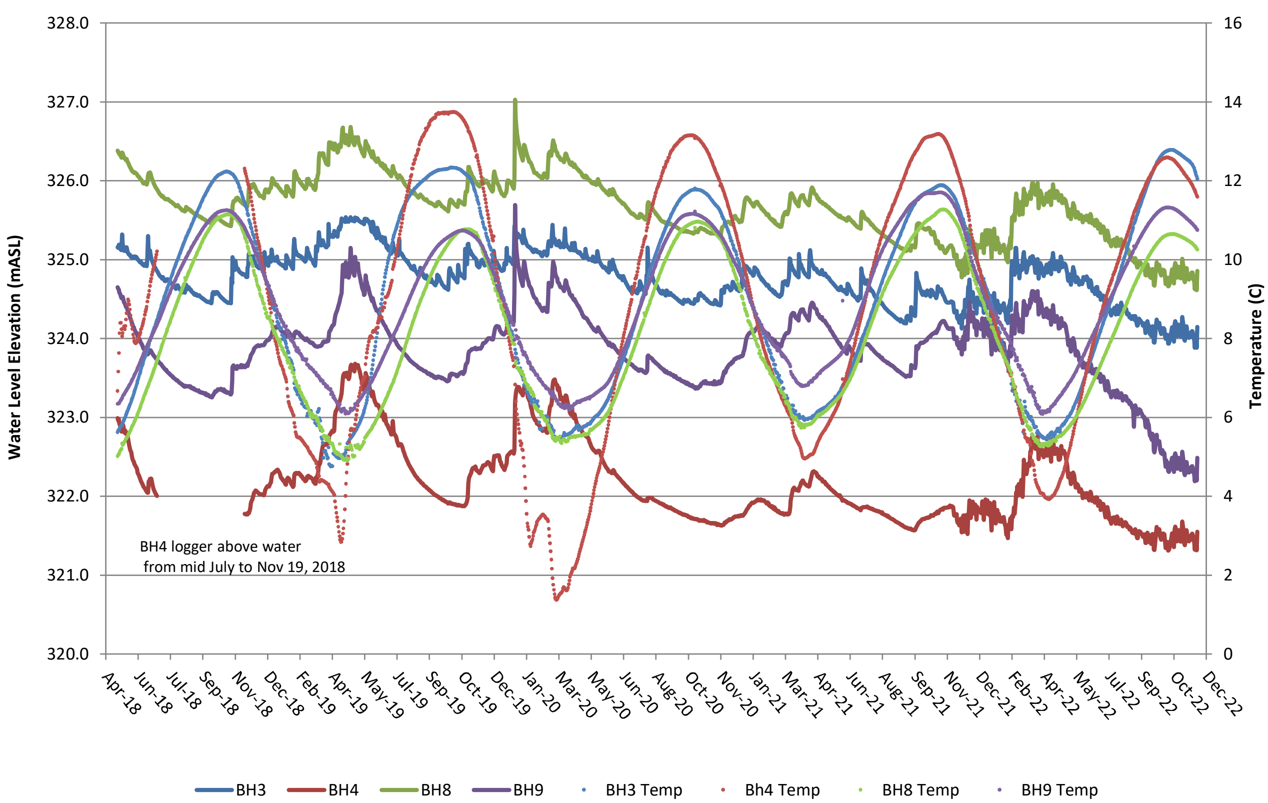
AECOM

1999 - 2022 Groundwater Elevations - Boreholes

St Marys Mast-Snyder Property

FIGURE 8

Project 60675788



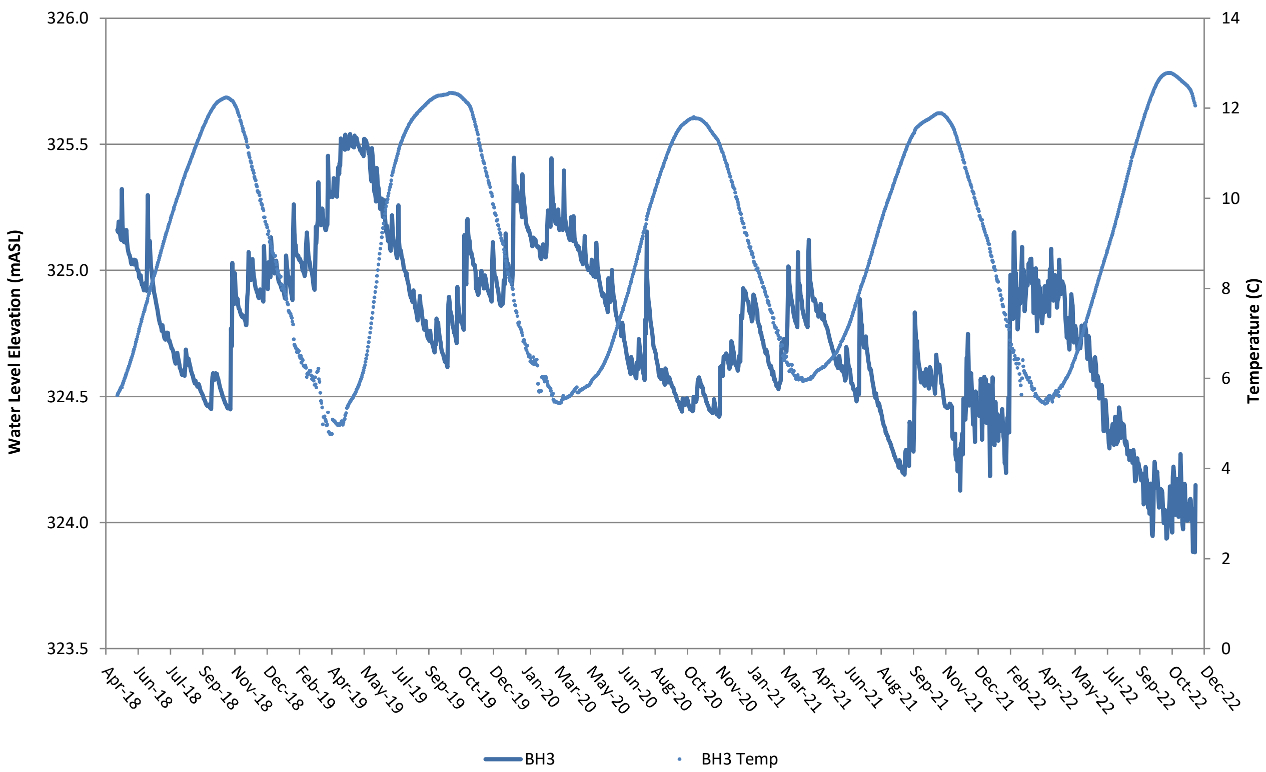
AECOM

Northern Monitors (BH3, BH4, BH8, BH9)

St Marys Mast Snyder Property

Figure 9

Project 60675788



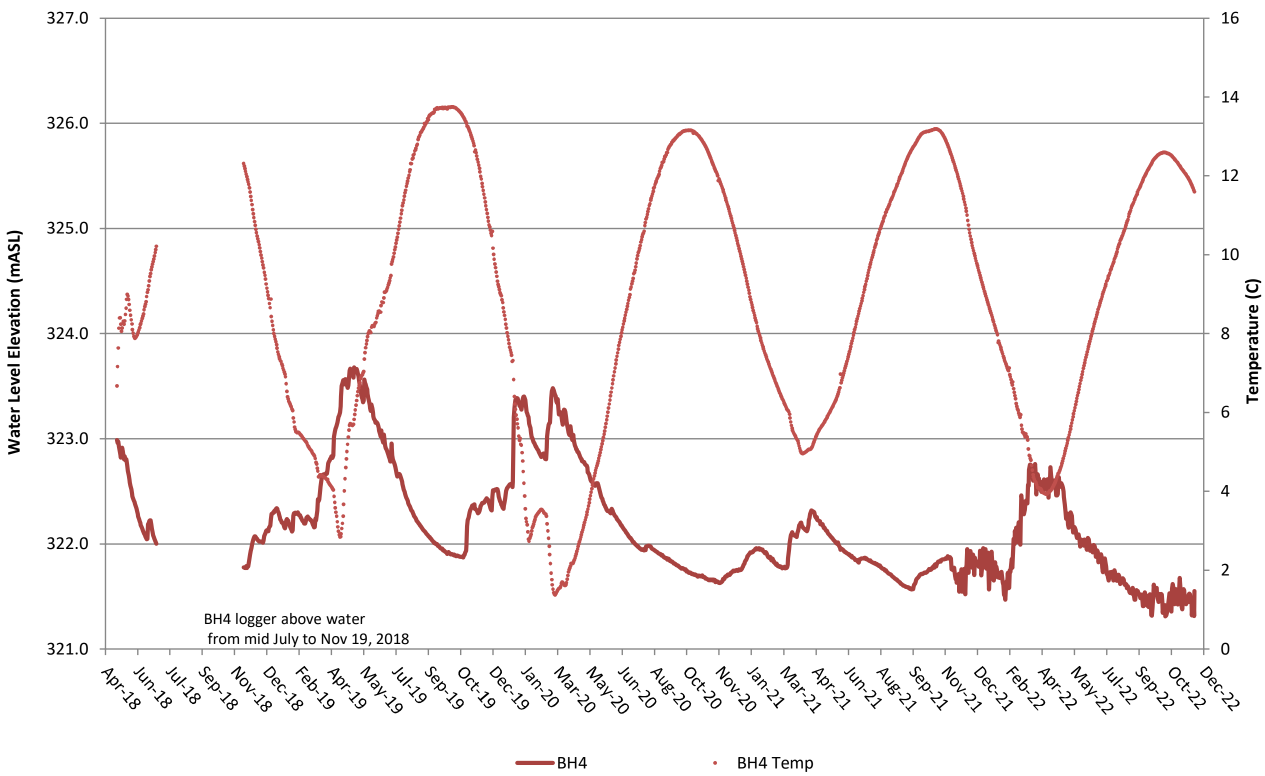
AECOM

Northern Monitor BH3 Hydrograph & Water Temprature

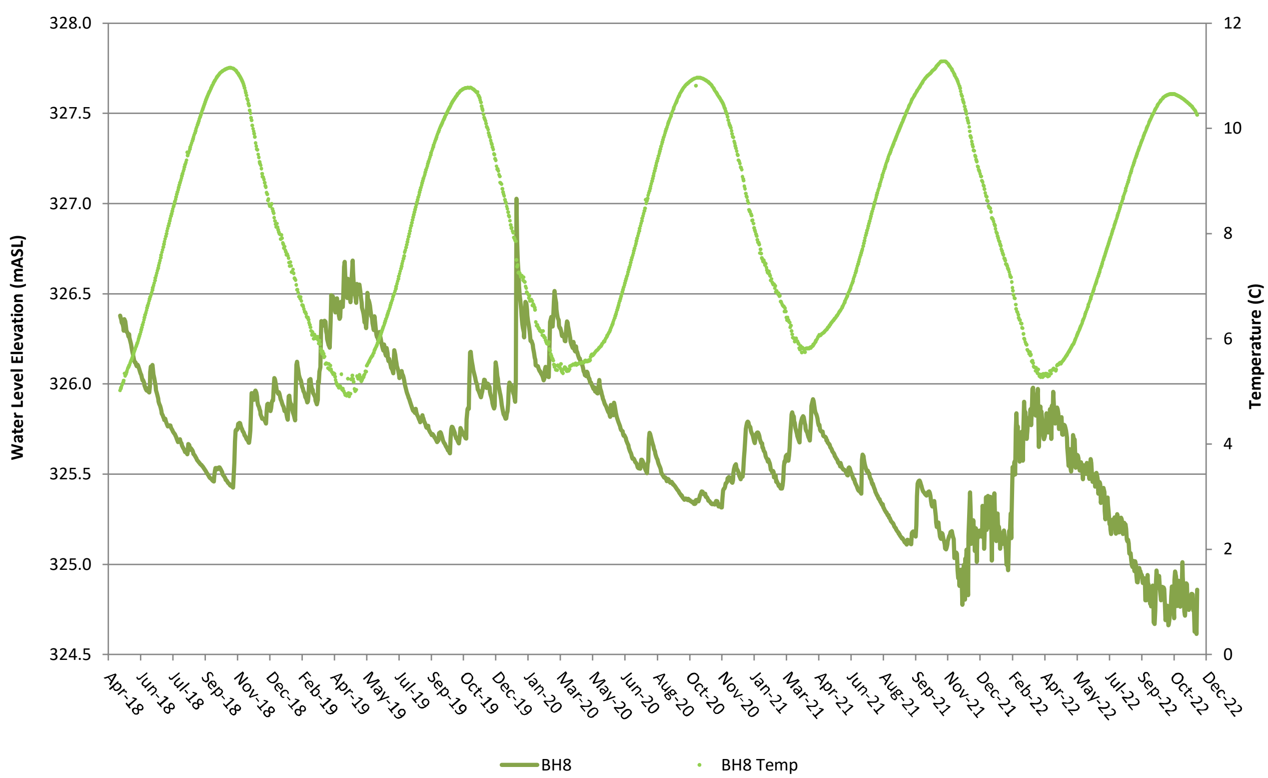
St Marys Mast Snyder Property

Figure 10

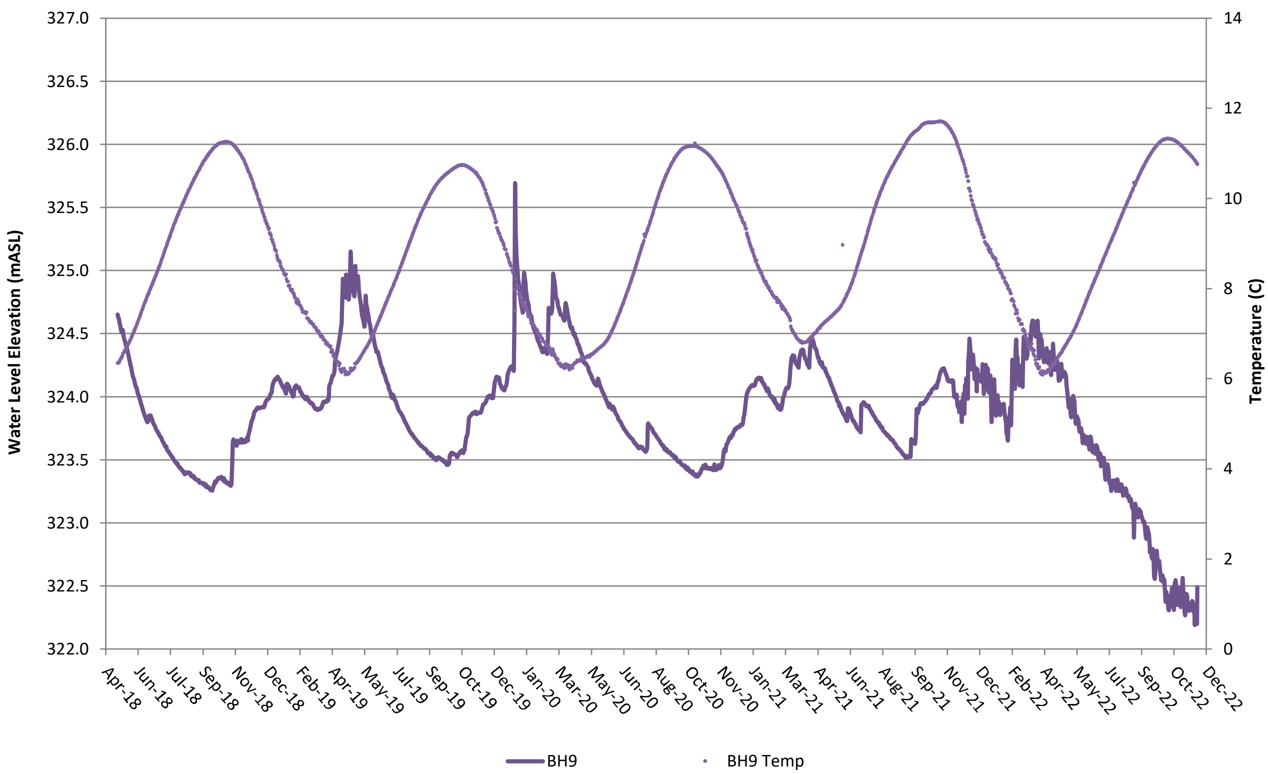
Project 60675788



Northern Monitor BH4 Hydrograph & Water Temprature	**Figure 11**
St Marys Mast Snyder Property	**Project 60675788**



AECOM	**Northern Monitor BH8 Hydrograph & Water Temprature** St Marys Mast Snyder Property	**Figure 12** **Project 60675788**



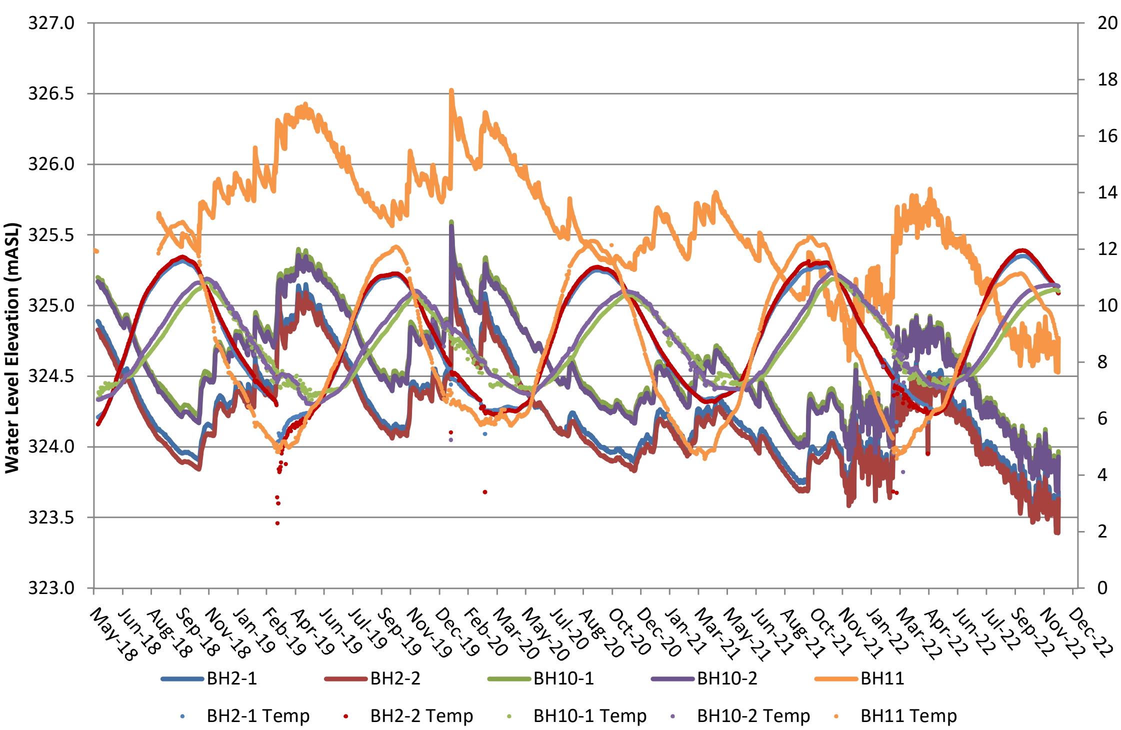
AECOM

Northern Monitor BH9 Hydrograph & Water Temprature

St Marys Mast Snyder Property

Figure 13

Project 60675788



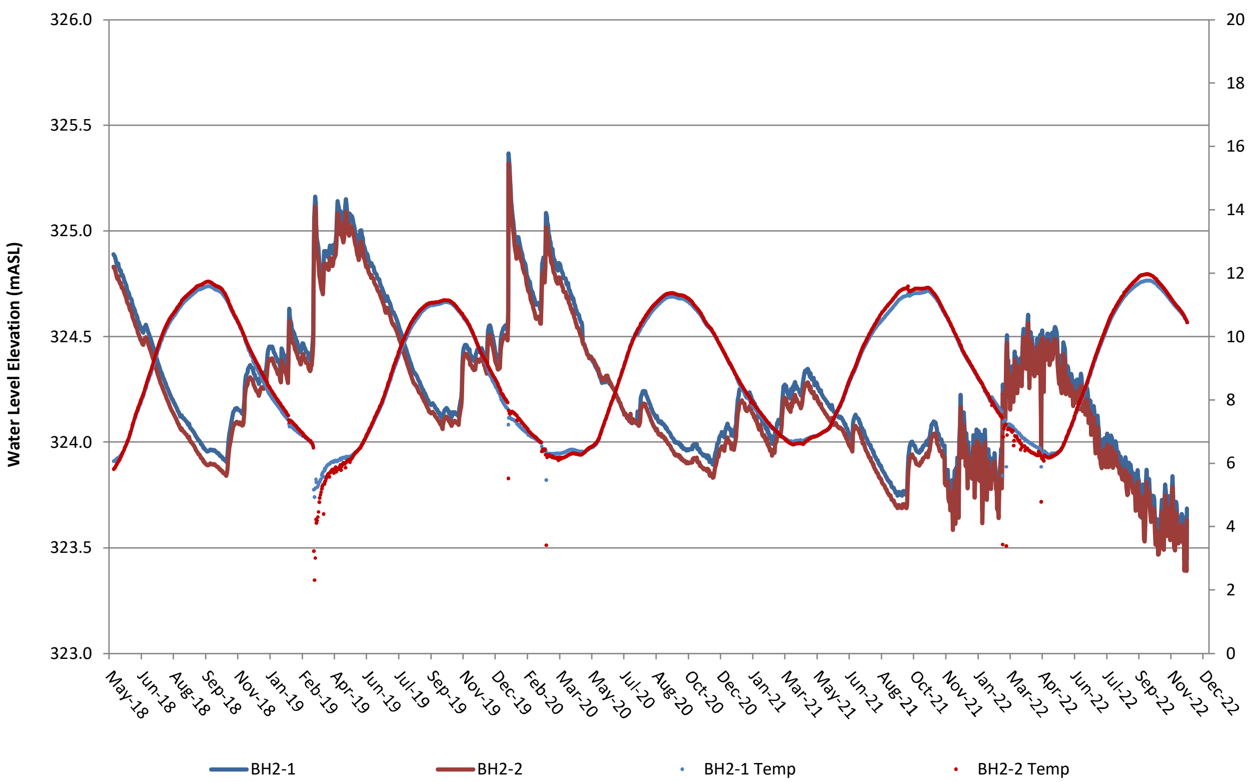
AECOM

Central Monitors (BH2,BH10,BH11)

St Marys Mast Snyder Property

Figure 14

Project 60675788



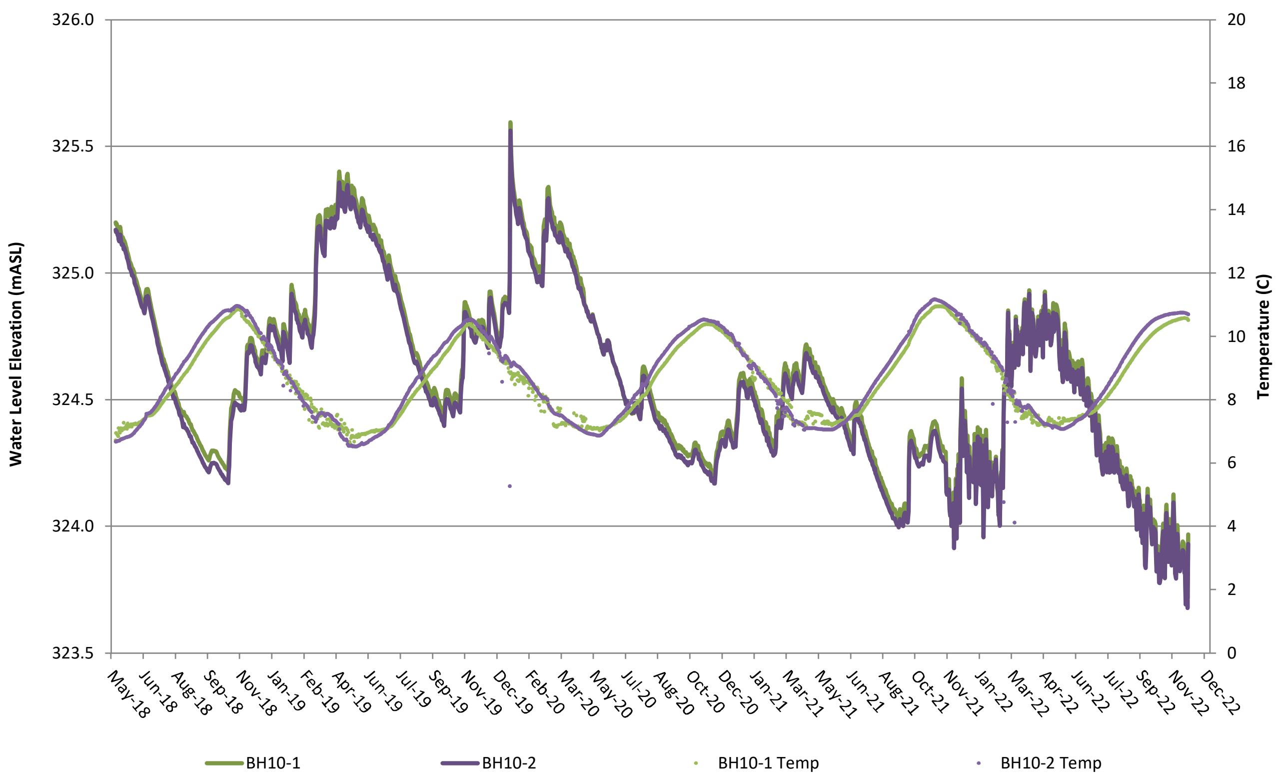
AECOM

Central Monitors BH2 Hydrograph & Water Temprature

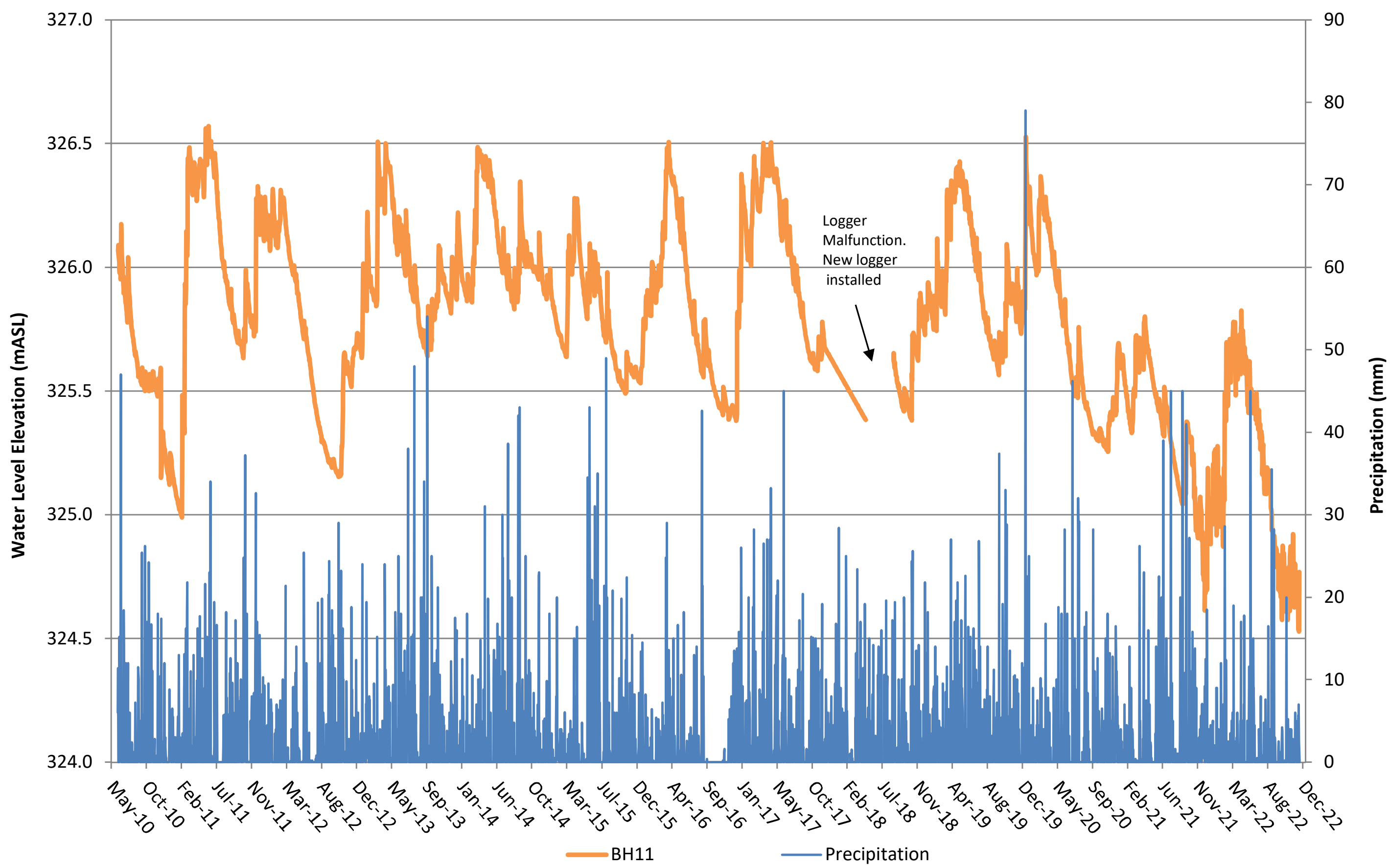
St Marys Mast Snyder Property

Figure 15

Project 60675788



AECOM	**Central Monitors BH10 Hydrograph & Water Temprature**	**Figure 16**
	St Marys Mast Snyder Property	**Project 60675788**



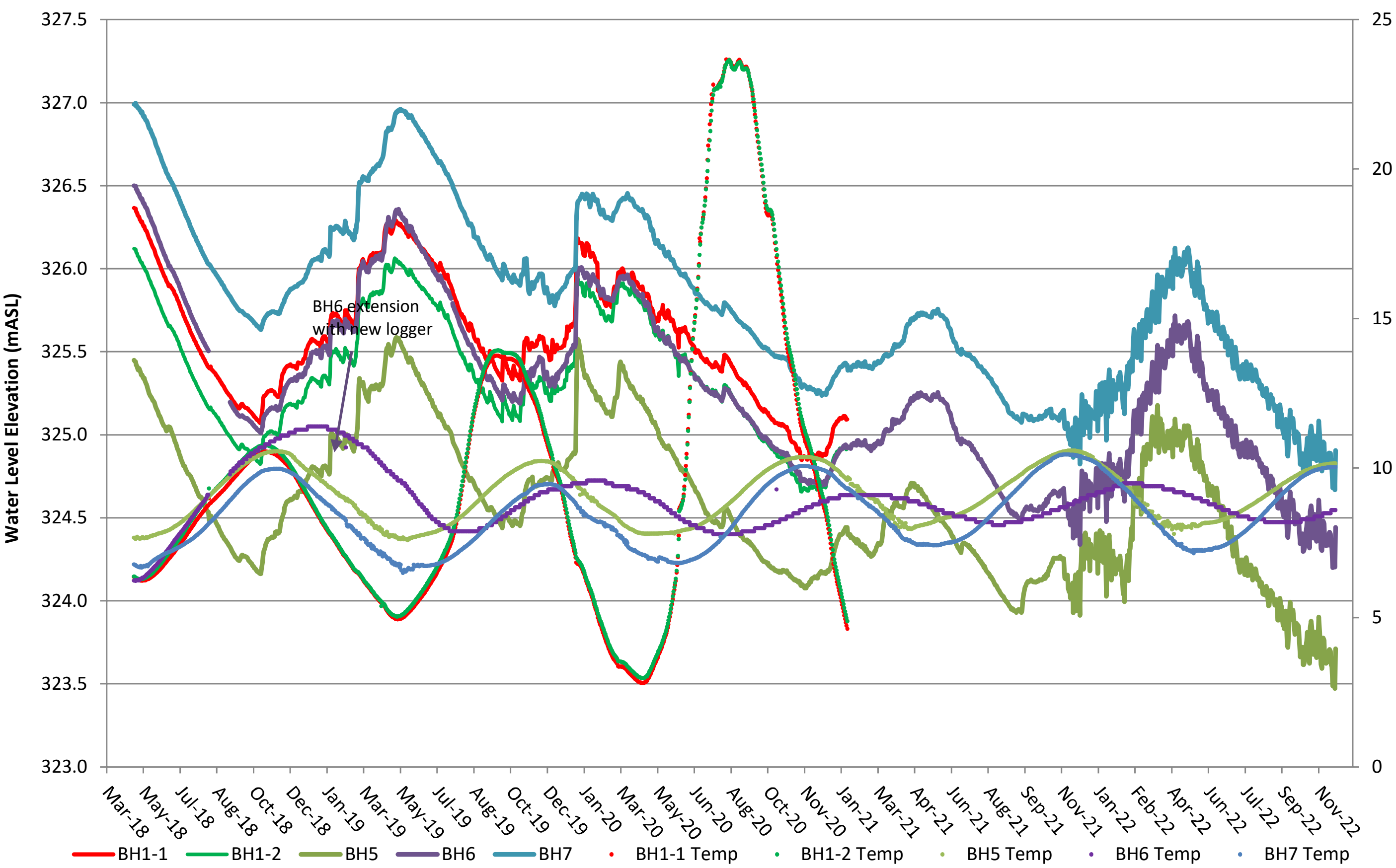
AECOM

BH11 Water Levels and Precipitation

St Marys Mast Snyder Property

Figure 17

Project 60675788



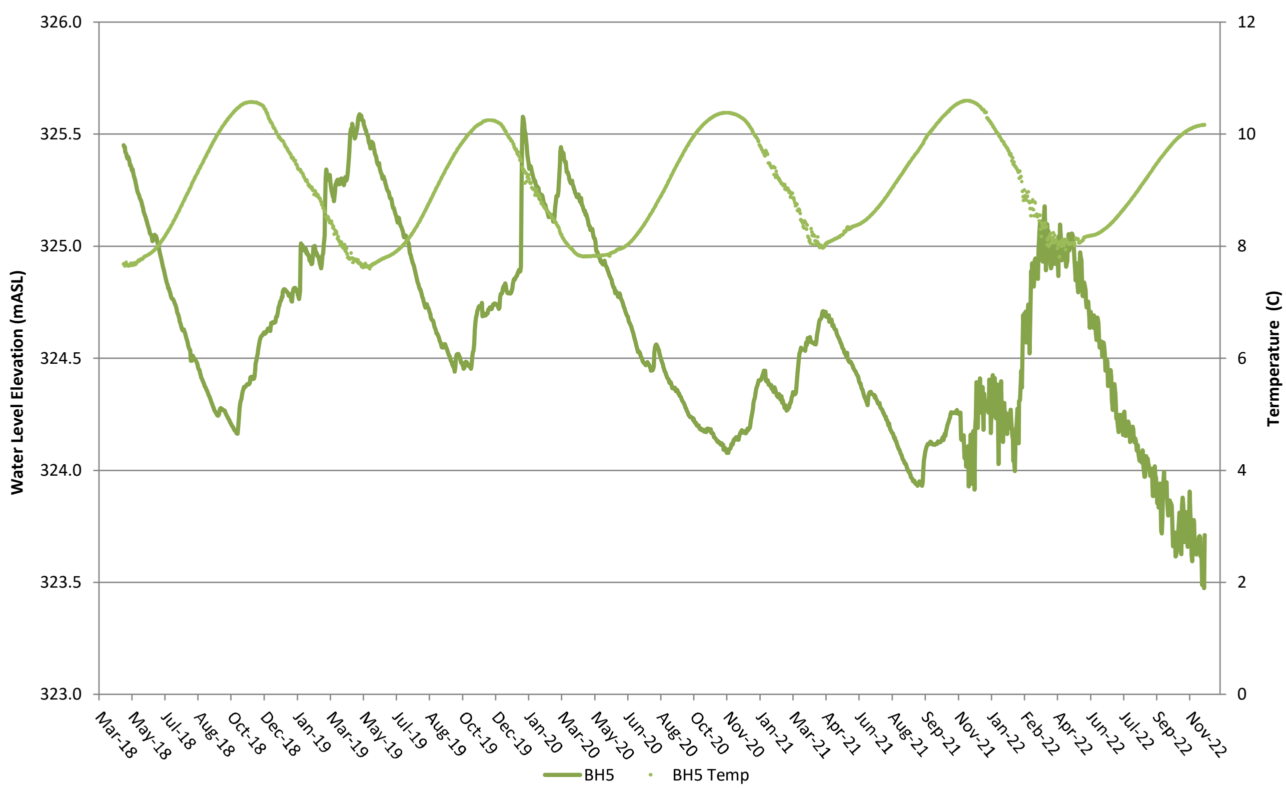
AECOM

Southern Monitors (BH1, BH5, BH6, BH7)

St Marys Mast Snyder Property

Figure 18

Project 60675788



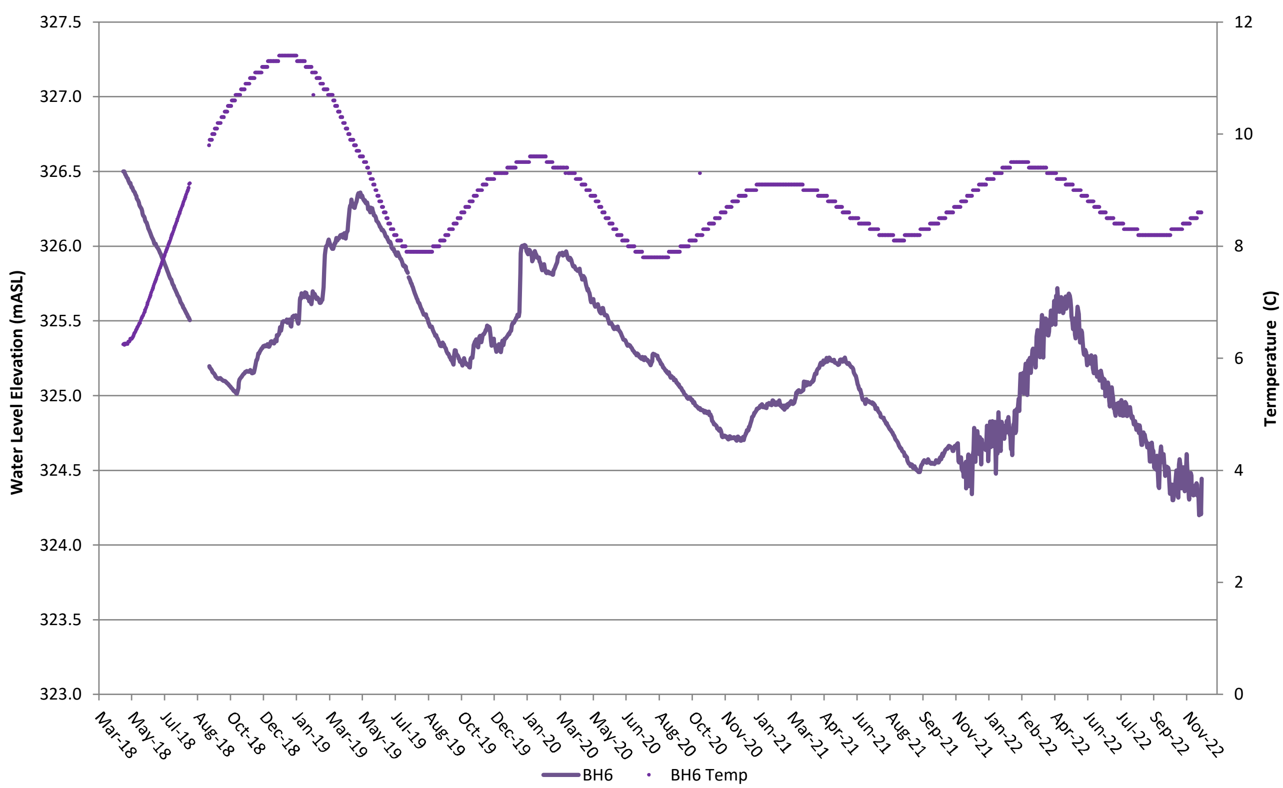
AECOM

Southern Monitors BH5 Hydrograph & Water Temprature

St Marys Mast Snyder Property

Figure 19

Project 60675788



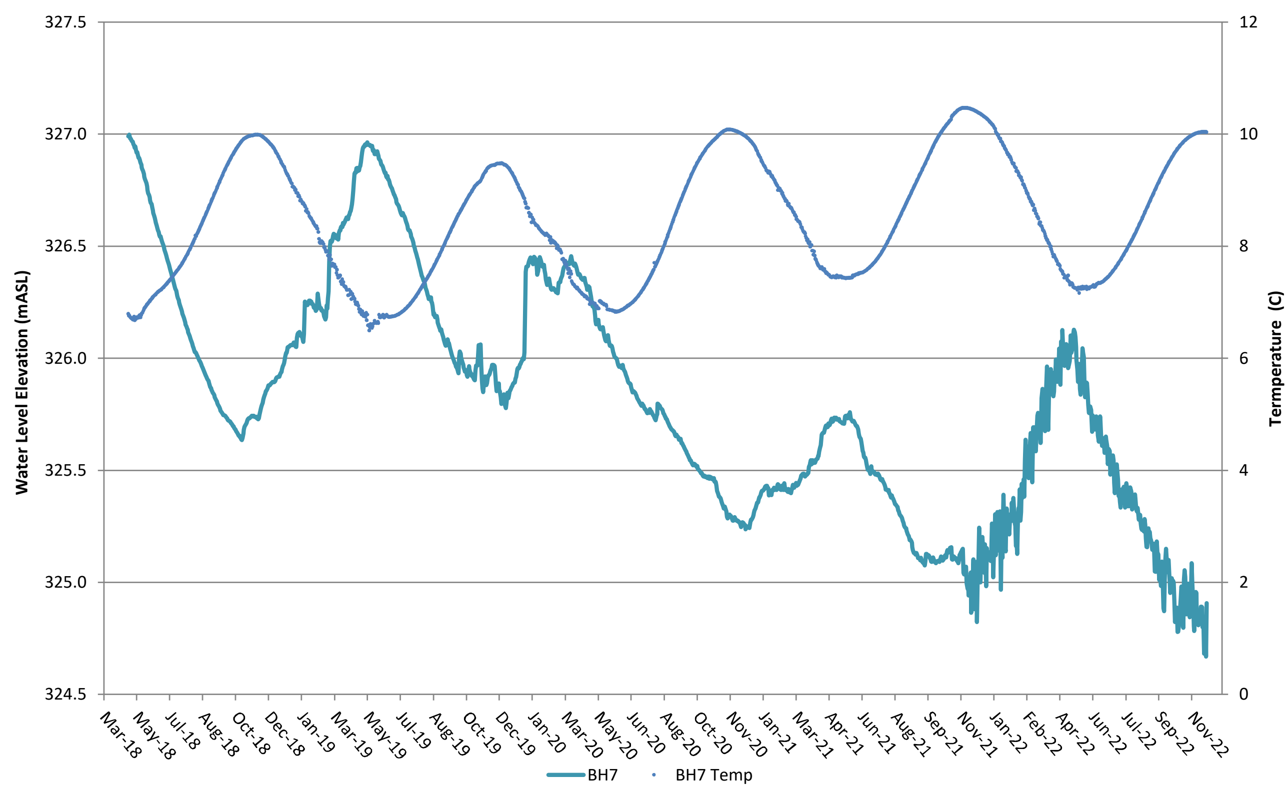
AECOM

Southern Monitors BH5 Hydrograph & Water Temprature

St Marys Mast Snyder Property

Figure 20

Project 60675788



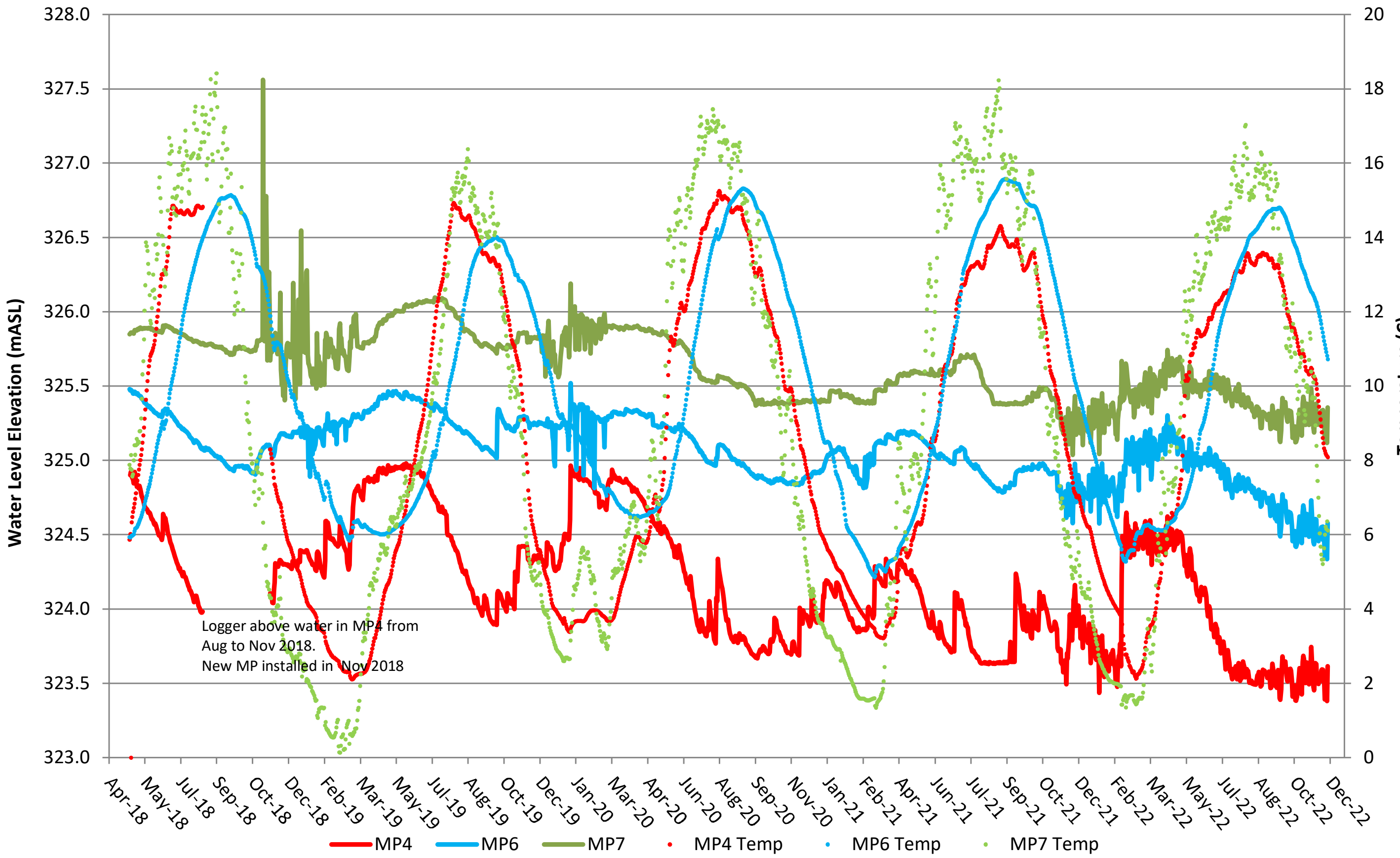
AECOM

Southern Monitors BH5 Hydrograph & Water Temprature

St Marys Mast Snyder Property

Figure 21

Project 60675788



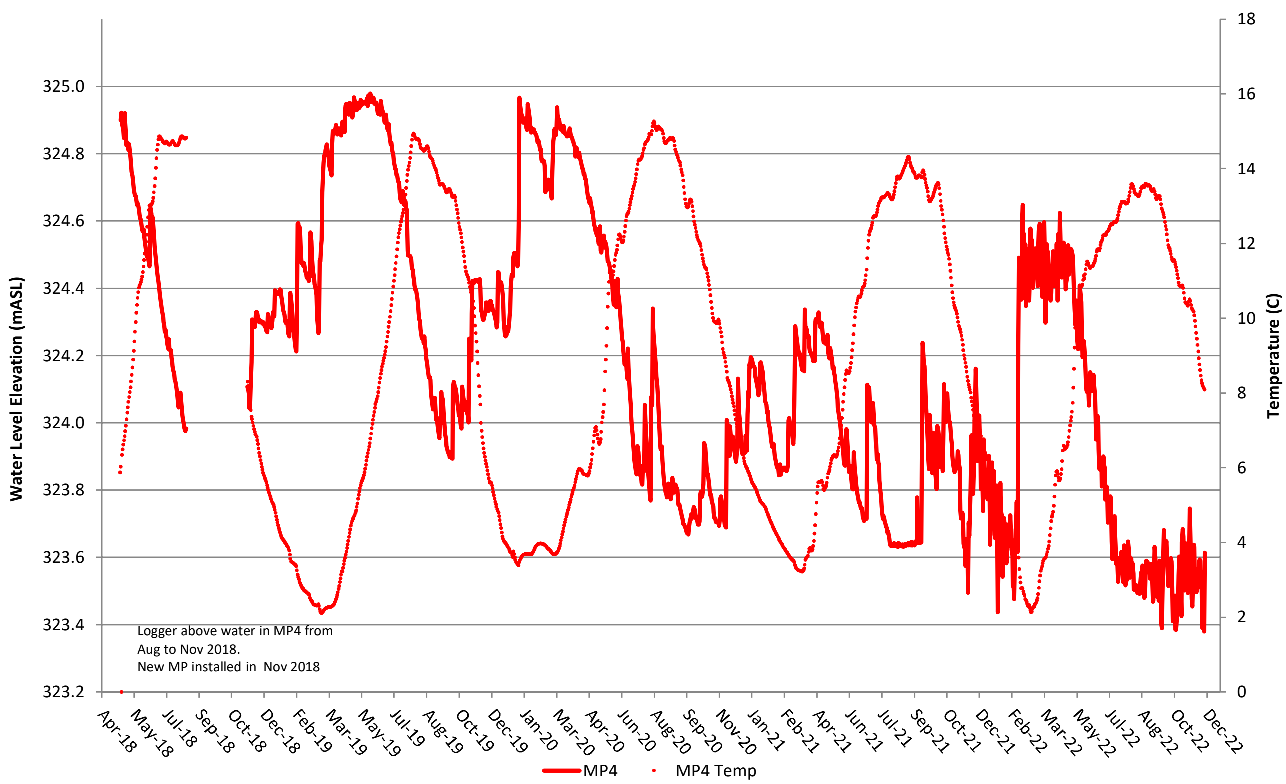
AECOM

Southern Swale (MP6, MP7) and Isolated Wetland Monitors (MP4)

St Marys Mast Snyder Property

Figure 22

Project 60675788



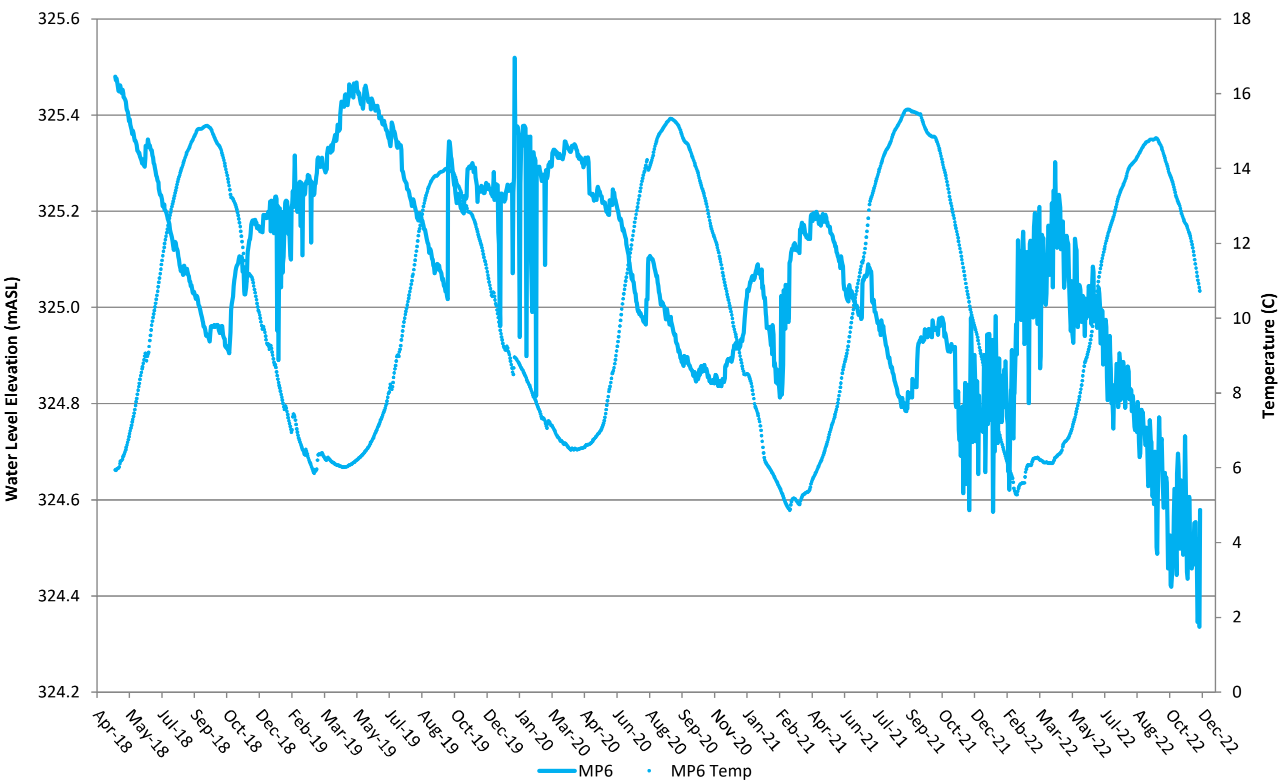
AECOM

Isolated Wetland Monitor MP4 Hydrograph & Water Temprature

St Marys Mast Snyder Property

Figure 23

Project 60675788



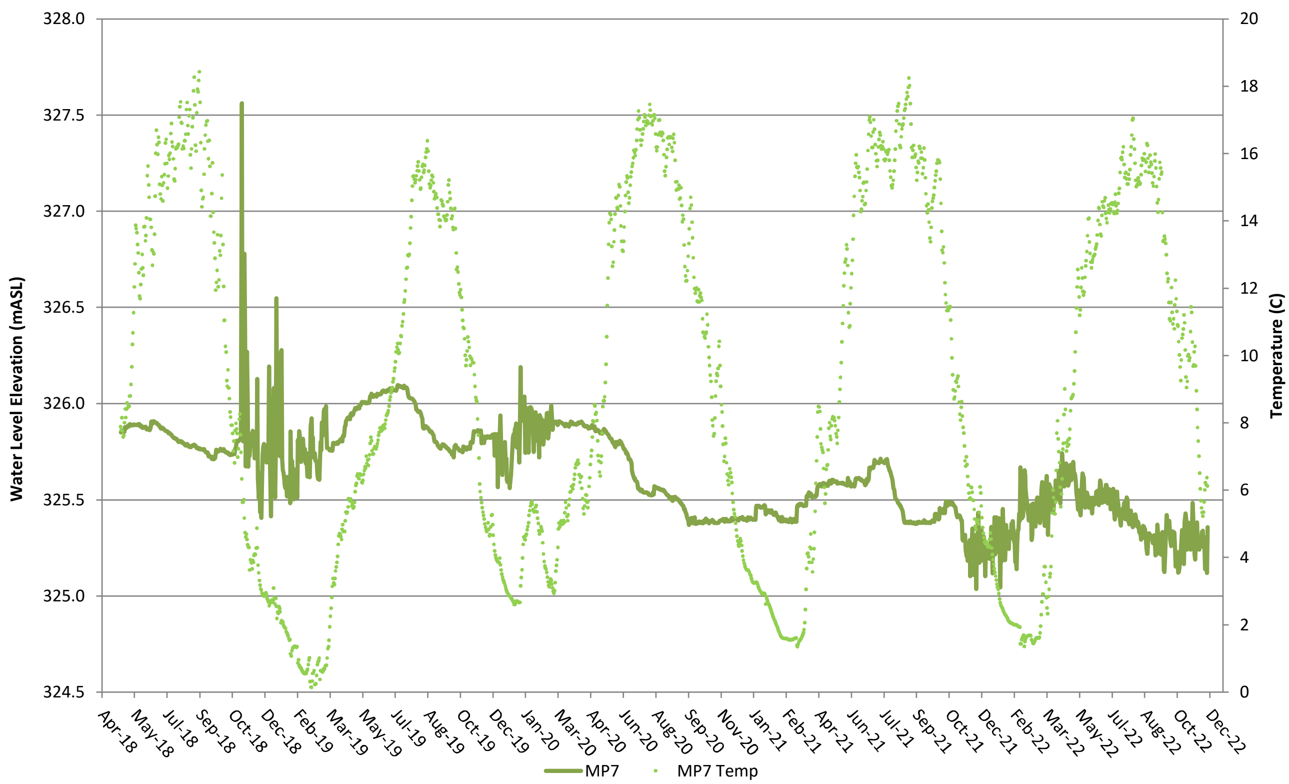
AECOM

Southern Swale Monitor MP6 Hydrograph & Water Temprature

St Marys Mast Snyder Property

Figure 24

Project 60675788



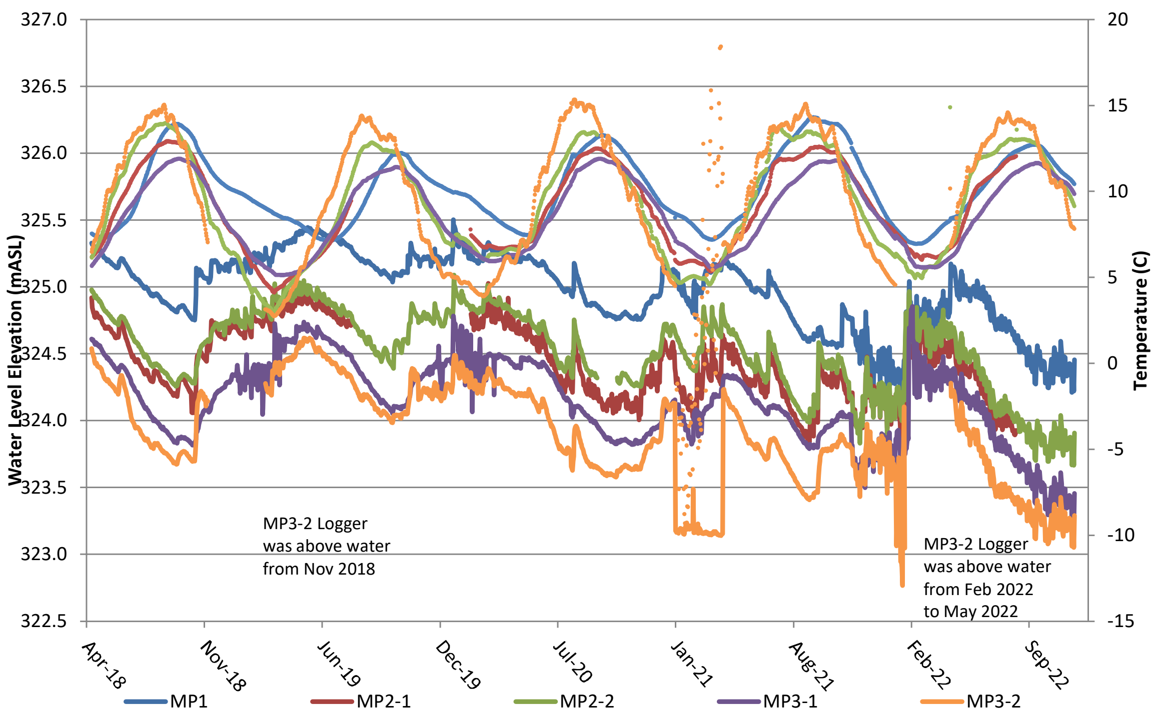
AECOM

Southern Swale Monitor MP7 Hydrograph & Water Temprature

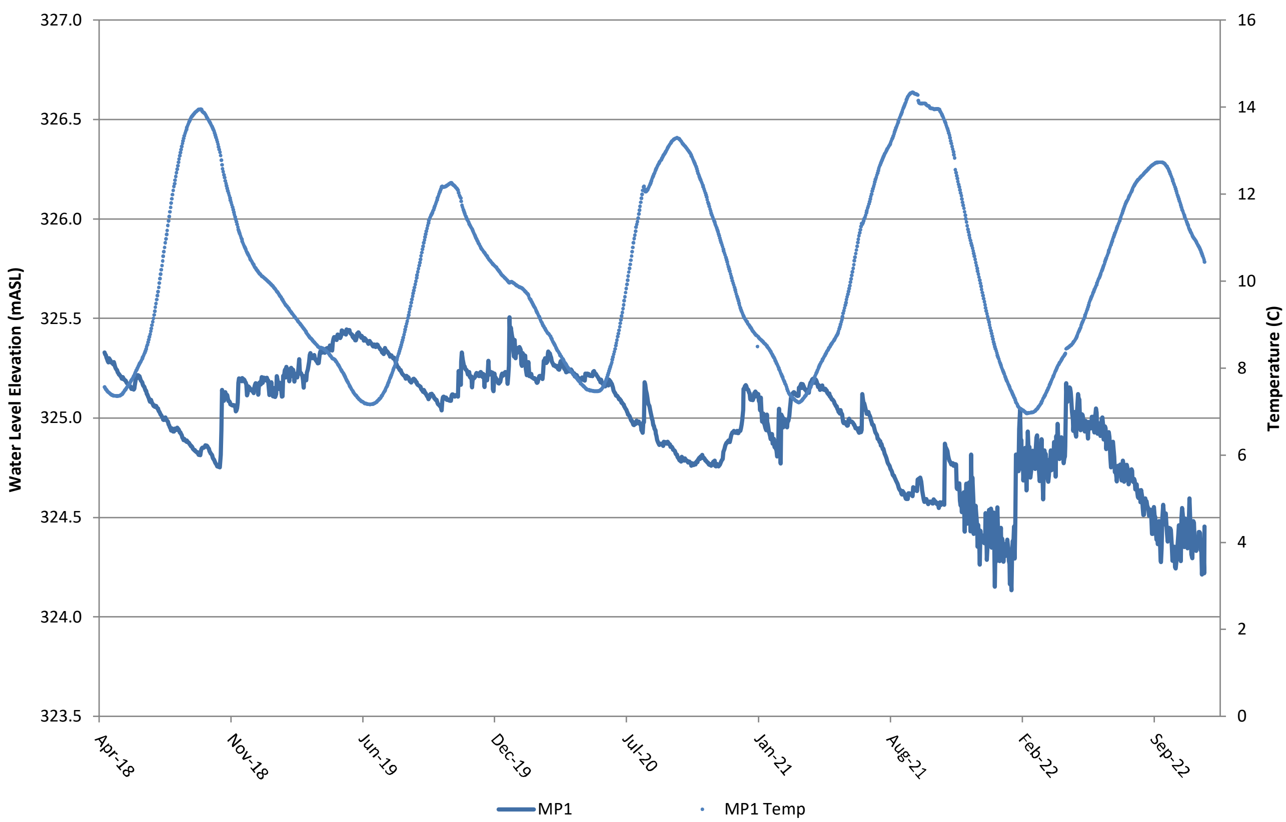
St Marys Mast Snyder Property

Figure 25

Project 60675788



AECOM	Tributary A Monitors (MP1, MP2, MP3)	Figure 26
	St Marys Mast Snyder Property	Project 60675788



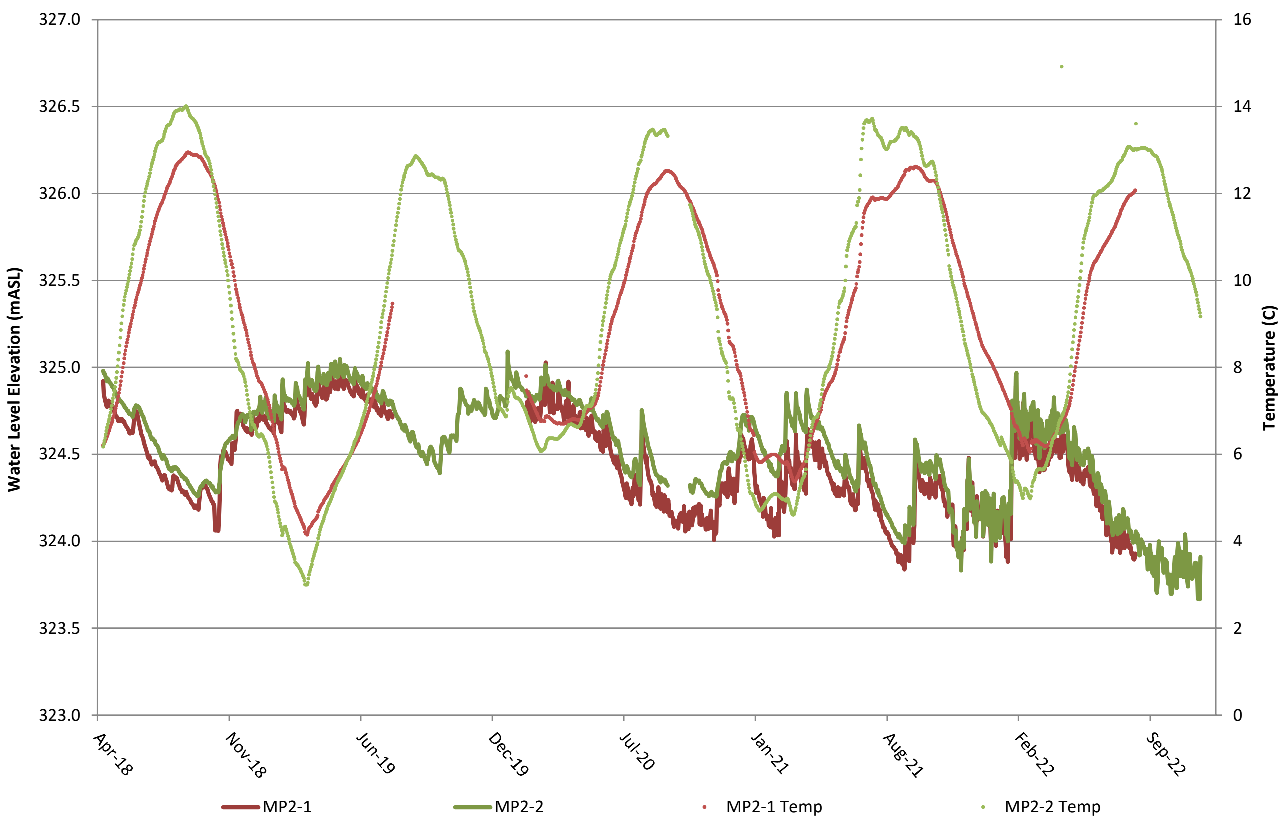
AECOM

Tributary A MP1 Hydrograph & Water Temperature

St Marys Mast Snyder Property

Figure 27

Project 60675788



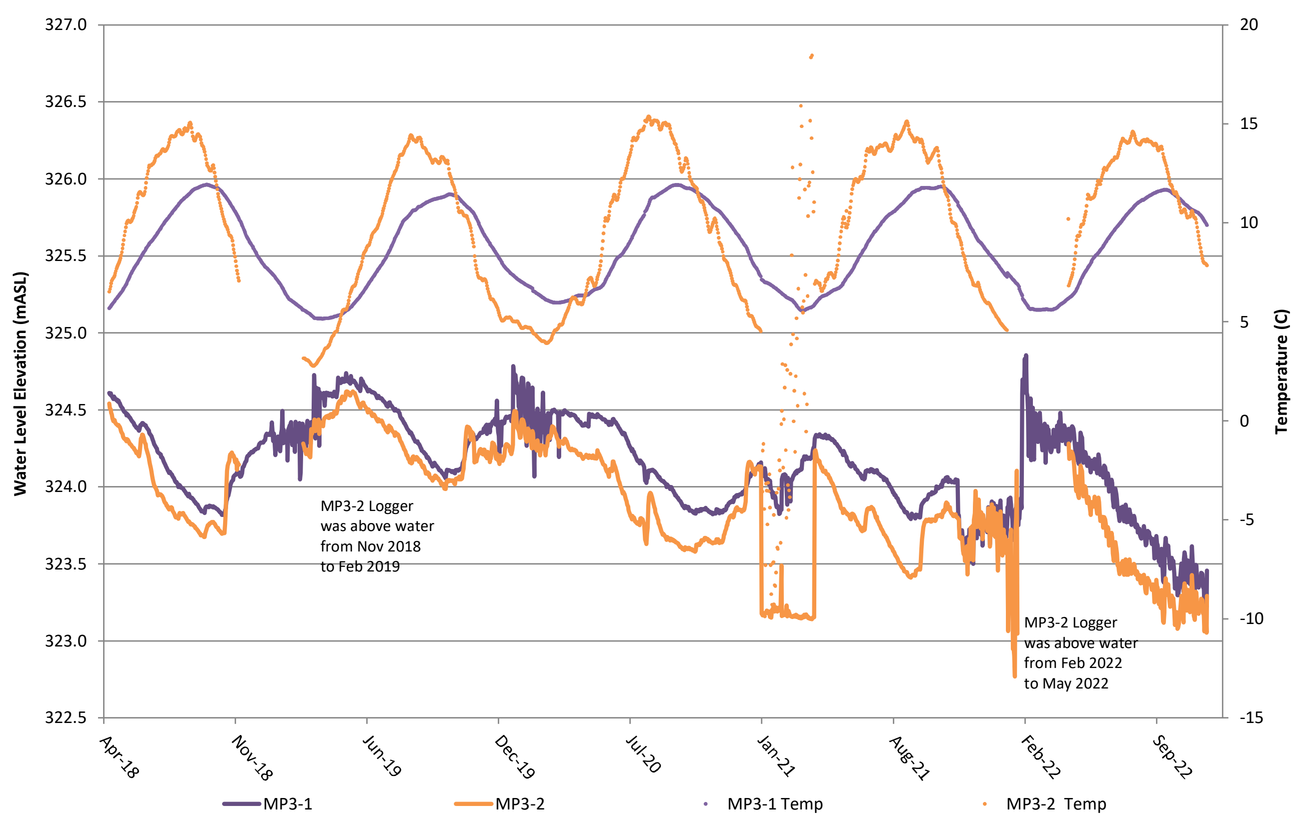
AECOM

Tributary A MP2 Hydrograph & Water Temperature

St Marys Mast Snyder Property

Figure 28

Project 60675788



AECOM

Tributary A MP3 Hydrograph & Water Temperature

St Marys Mast Snyder Property

Figure 29

Project 60675788

Appendix A

Borehole Logs & Monitor Installation Details

GRAPHICS, SYMBOLS AND ABBREVIATIONS ON LOGS

SAMPLE TYPES and TESTS

SS	Split Spoon Sample	
SN	Non-Standard Split Spoon Sample	
ST	Shelby Tube Sample : (unconfined compression or unconsolidated undrained test)	- ✦
DS	Denision Type Sample	
PS	Piston Type Sample	
CS	Continuous Sample	
GS	Grab Sample	
WS	Wash Sample	
BQ	BQ Core Sample	
HQ	HQ Core Sample	
NQ	NQ Core Sample	
DT	Dynamic Penetration Test	
VT	Field Vane Test (undisturbed)	- +
VT	Field Vane Test (remoulded)	- ⊕

PENETRATION RESISTANCES

Standard Penetration Resistance(N Value)

The number of blows by a 63.6 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) Split Spoon Sampler for a distance of 300 mm (12 in.).

ABBREVIATIONS

DTPL: Drier Than Plastic Limit
APL: About Plastic Limit
WTPL: Wetter Than Plasic Limit
K: Hydraulic Conductivity (m/s)
C_u: Undrained Shear Strength (kPa)
% REC : Percentage of Sample Recovered
% RQD : Indirect Measure of the Number of Fractures and Soundness of Rock Mass
Approximate Water Table

GRAIN SIZE CLASSIFICATION

	%
trace, "eg. trace sand"	1 - 10
some, "eg. some sand"	10 - 20
adjective, "eg. sandy"	20 - 35
and, "eg. and sand"	35 - 50
noun, "eg. sand"	>50

Note: Classification Divisions Based on Modified M.I.T. Grain Size Scale

SOIL DESCRIPTIONS

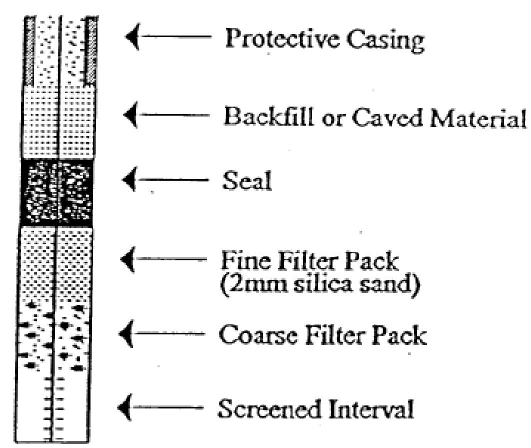
Cohesionless Soils

Relative Density	N Value
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	over 50

Cohesive Soils

Consistency	C_u(kPa)	N Value
Very soft	0 to 12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	over 200	over 30

MONITOR DETAILS



Disclaimer:

Stratigraphic boundaries shown on the attached borehole logs are inferred from non-continuous sampling and therefore represent transitions between soil types rather than exact planes of geological changes. Further, conditions will vary between and beyond the borehole locations.

BOREHOLE LOG

BOREHOLE LOG	**PROJECT:** 99-396	**BOREHOLE:** 1 — 1 of 1
Hydrogeological Investigation Mast Property, Guelph **FOR:** CBM		**DATE:** 18 August 1999 **LOGGED BY** GJMW **GROUND ELEV** 329.60 m ASL

DEPTH (m)	STRATIGRAPHIC DESCRIPTION
0.4	**TOPSOIL** Dark brown silty topsoil, some rootlets, moist, compact.
0.7	**SILTY SAND AND GRAVEL FILL** Light brown silty fine sand and gravel, moist, loose.
5.9	**GRAVEL** Light brown medium to coarse gravel with medium to coarse sand, moist, dense. -Changing to grey in colour and becoming wet below about 3.9 m. -Becoming saturated below about 4.5 m.
7.0	**SILT** Light brown silt, some clay, wet, dense.
	Borehole terminated at 7.01 m in silt.

SAMPLE

NUMBER	TYPE	N VALUE	% WATER	% REC
1	SS	11		92
2	SS	32		58
3	SS	38		71
4	SS	60		71
5	SS	50/ 0.15 m		83
6	SS	70		71
7	SS	75		50
8	SS	46		50
9	SS	45		38
10	SS	32		46
11	SS	48		92
12	SS	44		100

N VALUE: 15 30 45 60

WATER CONTENT (%): 10 20 30 40

BOREHOLE LOG

PROJECT: 99-396

BOREHOLE: 2

Hydrogeological Investigation
Mast Property, Guelph
FOR: CBM

DATE: 18 August 1999
LOGGED BY GJMW
GROUND ELEV 325.93 m ASL

DEPTH (m)	STRATIGRAPHIC DESCRIPTION
0.3	**TOPSOIL** Dark brown silty topsoil, moist, loose.
0.9	**SILT** Light brown silt, some clay, moist, loose. -Becoming dark brown below about 0.7 m.
6.6	**GRAVEL** light brown medium to coarse gravel with fine to coarse gravel, moist, dense to very dense. -10 cm brown silt seam encountered at about 1.5 m. -Becoming grey below about 1.6 m. -Becoming saturated below about 3.0 m with increased gravel fraction and very cobbly to about 4.6 m.
7.5	**SILT** Light brown silt, some clay, wet, very dense.
	Borehole terminated at 7.47 m in silt.

SAMPLE

NUMBER	TYPE	N VALUE	% WATER	% REC
1	SS	12		100
2	SS	44		79
3	SS	68		79
4	SS	38		50
5	SS	71		17
6	SS			0
7	SS	45		96
8	SS	50		100
9	SS	16		79
10	SS	59		92

N VALUE: 15 30 45 60

WATER CONTENT (%): 10 20 30 40

Printed: 08 Nov 03

Gartner Lee Limited

BOREHOLE LOG

PROJECT: 99-396

BOREHOLE: 3

Hydrogeological Investigation
Mast Property, Guelph
FOR: CBM

DATE: 15 December 1999
LOGGED BY EK
GROUND ELEV 325.65 m ASL

DEPTH (m)	STRATIGRAPHIC DESCRIPTION
0.3	**TOPSOIL** Brown silty topsoil, moist.
0.7	**SILTY SAND** Light brown silty fine sand, trace gravel, moist, loose.
4.0	**GRAVEL** Brown fine to coarse gravel and cobbles, trace to some medium and coarse sand, moist, dense to very dense. -Becoming saturated below about 1.5 m. -Grading into medium to coarse sand, trace fine sand below about 3.7 m.
7.0	**SAND** Brown fine sand, trace to some medium sand, trace silt, saturated, loose to compact.
9.8	**SILT** Brown silt, trace fine sand, saturated, compact. -Becoming grey below about 9.0 m.
	Borehole terminated at 9.75 m in silt.

SAMPLE

NUMBER	TYPE	N VALUE	% WATER	% REC
1	SS	7		67
2	SS	53		67
3	SS	44		67
4	SS	31		58
5	SS	29		67
6	SS	38		88
7	SS	11		75
8	SS	21		71
9	SS	42		79
10	SS	35		83

N VALUE: 15 30 45 60

WATER CONTENT (%): 10 20 30 40

BOREHOLE LOG

PROJECT: 99-396

BOREHOLE: 4

Hydrogeological Investigation
Mast Property, Guelph
FOR: CBM

DATE: 16 December 1999
LOGGED BY EK
GROUND ELEV 324.42 m ASL

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	WATER LEVEL	NUMBER	TYPE	N VALUE	% WATER	% REC
0.2	**TOPSOIL** Dark brown sandy silt, moist to wet, loose.		1	SS	9		29
0.7	**SILTY SAND** Reddish brown silty fine sand, trace gravel, moist, compact.		2	SS	41		42
	SAND Brown fine to medium sand, trace coarse sand, trace fine to medium gravel, trace silt, moist, compact to dense.		3	SS	79		83
	-Brown medium to coarse sand, trace fine gravel encountered between about 1.5 and 2.2 m. - Fine to medium sand (beach-like) below about 2.3 m.	▽	4	SS	90		67
	-Trace silt content and becoming saturated below about 3.0 m.		5	SS	89		78
	-Trace coarse sand content below about 3.8 m.		6	SS	97		72
			7	SS	46		83
	-Becoming brown medium to coarse sand, trace to some fine and medium gravel below about 5.6 m.		8	SS	33		83
6.7	**SILT** Grey silt, saturated, compact to dense.		9	SS	25		83
			10	SS	13		79
11.3			11	SS	20		83
	Borehole terminated at 11.28 m in silt. Note: Due to caving of the borehole, a second borehole was drilled to 6.1 m to install the monitor.						

N VALUE: 15 30 45 60 (plotted: 9, 41, >>79, >>90, >>89, >>97, 46, 33, 25, 13, 20)

WATER CONTENT (%): 10 20 30 40

Printed: 08 Nov 03

Gartner Lee Limited

BOREHOLE LOG

PROJECT: 99-396

BOREHOLE: 5

Hydrogeological Investigation
Mast Property, Guelph
FOR: CBM

DATE: 16 December 1999
LOGGED BY EK
GROUND ELEV 329.00 m ASL

DEPTH (m)	STRATIGRAPHIC DESCRIPTION
0.2	**TOPSOIL**
	GRAVEL Brown fine to coarse gravel and cobbles with medium and coarse sand, moist, dense to very dense.
	-Grading into medium to coarse sand with some medium to coarse gravel and becoming saturated below about 3.7 m.
6.9	**SILT** Brown silt, saturated, compact.
8.5	**SANDY SILT** Grey sandy silt, saturated, loose to compact.
12.8	Borehole terminated at 12.80 m in sandy silt.

SAMPLE NUMBER	TYPE	N VALUE	% WATER	% REC
1	SS	5		67
2	SS	14		71
3	SS	37		75
4	SS	19		83
5	SS	14		67
6	SS	12		58
7	SS	17		63
8	SS	15		75
9	SS	45		79
10	SS	56		83
11	SS	17		92

N VALUE: 15 30 45 60

WATER CONTENT (%): 10 20 30 40

Gartner Lee Limited

BOREHOLE LOG

PROJECT: 23-312

BOREHOLE: 6

Groundwater and Resource Investigation
Snyder Property, Guelph.
FOR: CBM

DATE: 27 May 2003
LOGGED BY BPW
GROUND ELEV 330.27 m ASL

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	SAMPLE NUMBER	TYPE	N VALUE	% WATER	% REC
0	**GRAVELLY SAND** Brown gravelly sand, moist, very dense.					
		1	SS	79		40
		2	SS	102		60
		3	SS	59		50
		4	SS	26		10
		5	SS	54		10
		6	SS	15		0
10.3	**SILTY SAND** Grey silty sand to sandy silt, saturated, hard.	7	SS	43		40
11.3	Borehole terminated at 11.3 m in silty sand.					

N VALUE: 15 30 45 60
WATER CONTENT (%): 10 20 30 40

Gartner Lee Limited

BOREHOLE LOG

PROJECT: 23-312

BOREHOLE: 7

Groundwater and Resource Investigation
Snyder Property, Guelph.
FOR: CBM

DATE: 26 May 2003
LOGGED BY BPW
GROUND ELEV 330.04 m ASL

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	SAMPLE NUMBER	TYPE	N VALUE	% WATER	% REC
0	**SAND AND GRAVEL** Brown sand and gravel, moist, very dense.					
~4.7		1	SS	88		50
~6.2		2	SS	47		50
~7.7	- Becoming a medium to fine sand, some gravel below about 7 m.	3	SS	23		90
8.5	**SANDY SILT** Grey sandy silt, saturated, compact.	4	SS	21		90
9.1	Borehole terminated at 9.1 m in sandy silt.					

Water level symbol at approx. 3 m depth.

N VALUE scale: 15 30 45 60 (sample 1 plotted as >>)
WATER CONTENT (%) scale: 10 20 30 40

Printed: 08 Nov 03

BOREHOLE LOG

PROJECT: 23-312

BOREHOLE: 8

Groundwater and Resource Investigation
Snyder Property, Guelph.
FOR: CBM

DATE: 26 May 2003
LOGGED BY BPW
GROUND ELEV 327.74 m ASL

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	SAMPLE NUMBER	TYPE	N VALUE	% WATER	% REC
0	**SANDY TILL** Brown sandy till, moist compact.					
4	- Becoming grey sandy till, saturated, very dense below about 4 m.					
		1	SS	11		60
		2	SS	73		80
8.2		3	SS	50/ 0.08m		25
	Borehole terminated at 8.2 m in sandy till.					

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8

N VALUE: 15 30 45 60

WATER CONTENT (%): 10 20 30 40

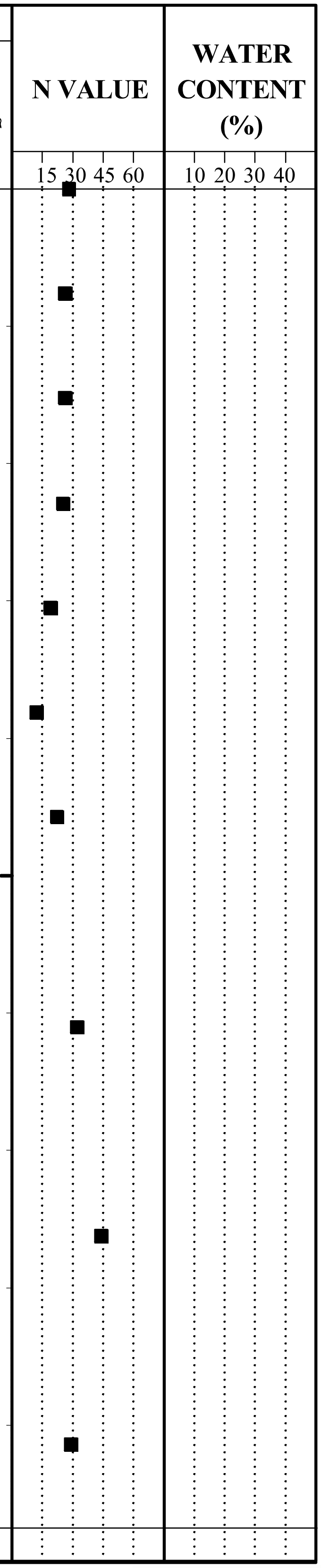
Printed: 08 Nov 03

Gartner Lee Limited

BOREHOLE LOG

BOREHOLE LOG	**PROJECT:** 60146419	**BOREHOLE:** BH10-I 1 of 1
Mast-Snyder Drilling Investigation Guelph **Client:** St. Marys CBM	**Northing:** N/A **Easting:** N/A **Methodology:** N/A **Contractor:** N/A	**DATE:** June 14, 2010 **LOGGED BY** CRC **GROUND ELEV** N/A m ASL

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	SAMPLE NUMBER	TYPE	N VALUE	% WATER	% REC	% RQD
0.6	**TOPSOIL** Brown sandy silt topsoil, some angular gravel and stones with rootlets, compact, moist.	1	SS	28		66	
2.4	**SAND AND GRAVEL** Brown medium to coarse silty sand and gravel, some large stones approximately 5 to 8 cm in diameter, dense, saturated.	2	SS	26		57	
		3	SS	26		49	
		4	SS	25		62	
6.5	**SAND** Brown medium to coarse sand, compact, saturated.	5	SS	19		100	
		6	SS	12		100	
		7	SS	22		69	
		8	SS	32		88	
9.8	**SANDY SILT** Brown sandy silt changing to grey sandy silt at approximately 8.5 m, compact to dense, saturated.	9	SS	44		75	
		10	SS	29		100	
	Borehole terminated at 9.75 m in sandy silt.						



Printed:May 10, 11
File Location:

AECOM

BOREHOLE LOG

BOREHOLE LOG	**PROJECT:** 60146419	**BOREHOLE:** BH10-II 1 of 1
Mast-Snyder Drilling Investigation Guelph **Client:** St. Marys CBM	**Northing:** N/A **Easting:** N/A **Methodology:** N/A **Contractor:** N/A	**DATE:** June 14, 2010 **LOGGED BY** CRC **GROUND ELEV** N/A m ASL

DEPTH (m)	STRATIGRAPHY	STRATIGRAPHIC DESCRIPTION	MONITOR DETAILS & NUMBER	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE N VALUE	SAMPLE % WATER	SAMPLE % REC	SAMPLE % RQD	N VALUE (15 30 45 60)	WATER CONTENT (%) (10 20 30 40)
0.6		**TOPSOIL** Brown sandy silt topsoil, some angular gravel and stones with rootlets, compact, moist.										
2.4		**SAND AND GRAVEL** Brown medium to coarse silty sand and gravel, some large stones approximately 5 to 8 cm in diameter, dense, saturated.										
4.6		**SAND** Brown medium to coarse sand, compact, saturated.										
		Borehole terminate at 4.57 m in sand. Borehole straight augered with no samples collected. Lithology inferred from borehole BH10-I.										

AECOM

BOREHOLE LOG

PROJECT: 60146419	**BOREHOLE:** BH11	1 of 1

Mast-Snyder Drilling Investigation
Guelph
Client: St. Marys CBM

Northing: N/A
Easting: N/A
Methodology: N/A
Contractor: N/A

DATE: June 14, 2010
LOGGED BY CRC
GROUND ELEV N/A m ASL

DEPTH (m)	STRATIGRAPHY	STRATIGRAPHIC DESCRIPTION	MONITOR DETAILS & NUMBER	SAMPLE NUMBER	INTERVAL	TYPE	N VALUE	% WATER	% REC	% RQD	N VALUE (15 30 45 60)	WATER CONTENT (%) (10 20 30 40)
0.6		**PEAT** Brown peat with grass and rootlets throughout, loose, moist.		1		SS	12		33			
2.3		**SAND AND GRAVEL** Brown coarse to medium sand and gravel changing to grey at approximately 1.4 m, some stones, compact, saturated.		2		SS	28		100			
				3		SS	31		100			
		Borehole terminated at 2.29 m in sand and gravel.										

Printed:May 10, 11
File Location:

AECOM

BOREHOLE LOG

BOREHOLE LOG	**PROJECT:** 60146419	**BOREHOLE:** BH9 1 of 1
Mast-Snyder Drilling Investigation Guelph **Client:** St. Marys CBM	**Northing:** N/A **Easting:** N/A **Methodology:** N/A **Contractor:** N/A	**DATE:** June 14, 2010 **LOGGED BY** CRC **GROUND ELEV** N/A m ASL

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	SAMPLE NUMBER	TYPE	N VALUE	% WATER	% REC	% RQD
0.6	**TOPSOIL** Brown sandy silt topsoil, some gravel and rootlets, loose, moist.	1	SS	11		49	
	SAND Brown fine to medium sand, dense to very dense, dry becoming moist at approximately 1.5 m.	2	SS	52		100	
2.3		3	SS	49		88	
	SANDY SILT TILL Brown sandy silt till, some angular stones and gravel, dense to very dense, saturated.	4	SS	36		49	
		5	SS	24		100	
		6	SS	50		100	
5.2		7	SS	50		50	
	Borehole terminated at 5.18 m in sandy silt till.						

N VALUE scale: 15 30 45 60

WATER CONTENT (%) scale: 10 20 30 40

Depth scale: 1, 2, 3, 4, 5

AECOM

Monitor Installation Detals
St Marys Mast-Snyder Property

Monitor	UTM		Ground Elevation	Monitor			Monitor Installation Details															
	Easting	Northing		Type (1)	Stick up	TOP (2) Elevation	Screened Interval				Filter Pack				Sealed Interval				Backfill			
			(mASL)		(m)	(mASL) (3)	(m BG) (4)		(mASL)		(m BG) (4)		(mASL)		(m BG) (4)		(mASL)		(m BG) (4)		(mASL)	
1-I	562057.026	4814324.875	329.60	P	0.94	330.54	4.28	5.80	325.32	323.80	0.60	5.80	329.00	323.80	0.00	0.60	329.60	329.00	5.80	7.01	323.80	322.59
1-II	562057.026	4814324.875	329.60	S	0.82	330.42	2.26	5.31	327.34	324.29	0.60	5.80	329.00	323.80	0.00	0.60	329.60	329.00				
2-I	561576.145	4814562.008	325.93	P	1.00	326.93	4.98	6.50	320.95	319.43	0.60	6.50	325.33	319.43	0.00	0.60	325.93	325.33	6.50	7.47	319.43	318.46
		(5)			0.97	326.90																
2-II	561576.145	4814562.008	325.93	S	0.94	326.87	1.15	4.20	324.78	321.73	0.60	6.50	325.33	319.43	0.00	0.60	325.93	325.33				
3	561903.568	4814891.415	325.65	S	0.81	326.46	2.45	5.50	323.20	320.15	1.30	5.50	324.35	320.15	5.50	6.00	320.15	319.65	6.00	9.75	319.65	315.90
															0.00	1.30	325.65	324.35				
4	561447.491	4815017.093	324.42	S	0.76	325.18	3.25	6.30	321.17	318.12	1.40	6.30	323.02	318.12	6.30	11.28	318.12	313.14				
															0.00	1.40	324.42	323.02				
5	561716.044	4814050.700	329.00	S	0.66	329.66	4.50	7.10	324.50	321.90	1.30	7.10	327.70	321.90	7.10	8.55	321.90	320.45	8.55	12.80	320.45	316.20
															0.00	1.30	329.00	327.70				
6	562106.575	4814135.191	330.27	S	0.53	330.80	4.55	7.60	325.72	322.67	4.20	7.60	326.07	322.67	3.60	4.20	326.67	326.07	0.00	0.50	330.27	329.77
															0.50	0.70	329.77	329.57	7.60	11.30	322.67	318.97
																			0.61	3.60	329.66	326.67
		(6)	336.68		0.57	337.25																
7	562506.329	4814234.246	330.04	S	0.60	330.64	4.55	7.60	325.49	322.44	4.20	7.60	325.84	322.44	3.70	4.20	326.34	325.84	0.00	0.40	330.04	329.64
															0.00	0.40	330.04	329.64	7.60	9.10	322.44	320.94
																			0.80	3.60	329.24	326.44
8	562308.381	4814956.900	327.74	S	0.66	328.40	4.55	7.60	323.19	320.14	4.20	7.60	323.54	320.14	3.60	4.20	324.14	323.54	7.60	8.20	320.14	319.54
															0.35	0.61	327.39	327.13	0.61	3.60	327.13	324.14
																			0.00	0.35	327.74	327.39
9	562143.678	4815167.575	326.21	S	0.87	327.08	1.52	4.57	324.69	321.64	1.22	5.18	324.99	321.03	0.00	1.22	326.21	324.99				
10-I	561679.333	4814664.204	325.82	S	0.87	326.69	7.62	9.14	318.20	316.68	7.32	9.75	318.50	316.07	0.00	7.32	325.82	318.50				
10-II	561679.333	4814664.204	325.86	P	0.90	326.76	1.52	4.57	324.34	321.29	1.22	4.57	324.64	321.29	0.00	1.22	325.86	324.64				
11	562291.514	4814826.592	326.26	S	0.78	327.04	1.52	2.29	324.74	323.97	1.22	2.29	325.04	323.97	0.00	1.22	326.26	325.04				

Notes:
(1) S = standpipes which span the water table, P = Piezometers which monitor deeper aquifers and aquitards
(2) TOP = top of pipe
(3) mASL refers to meters above sea level
(4) m BG = meters below ground surface
(5) Monitor 2-1 PVC cut by 3.175 cm to facilitate casing closure
(6) extension to monitor PVC pipe due to berm construction
diameter monitors

Mini-Piezometer Installation Details
St Marys Mast-Snyder Property

Monitor	UTM Easting	UTM Northing	Ground Elevation (mASL)	Type (1)	Stick up (m)	TOP (2) Elevation (mASL) (3)	Screened Interval (m BG) (4)		Screened Interval (mASL)	
MP1	562010.33	4814931.18	324.84	S	0.75	325.59	2.61	3.06	322.23	321.78
MP2-I	561908.74	4814955.04	324.59	D	1.00	325.59	2.44	2.89	322.15	321.70
MP2-II			324.60	S	0.60	325.20	0.82	1.27	323.78	323.33
MP3-I	561637.36	4815016.20	324.11	D	0.11	324.71	2.47	2.92	321.64	321.19
MP3-II			324.04	S	1.00	325.04	1.44	1.89	322.60	322.15
MP4	561601.07	4814728.51	324.25	S	1.36	325.61	0.53	0.98	323.72	323.27
MP4R-2010 (5)			324.25	S	1.38	325.63	1.14	1.44	323.11	322.81
MP4R-2013 (5)			324.73	S	1.66	326.39	1.50	1.90	323.23	322.84
MP4R-2018 (5)	561588.58	4814737.61	324.76	S	0.91	325.67	1.01	1.46	323.75	323.30
MP5	561614.40	4814732.10	324.10	S	1.62	325.72	0.68	1.13	323.42	322.97
MP6	561985.15	4814888.44	325.14	S	0.82	325.96	2.13	2.58	323.01	322.56
MP7	562040.72	4814835.19	325.57	S	0.77	326.34	2.17	2.62	323.40	322.95

Notes:
(1) MP = mini-piezometer which penetrates the shallow water table, S = shallower installation, D = deeper installation
(2) TOP = top of pipe
(3) mASL refers to meters above sea level
(4) m BG = meters below ground surface
(5) destroyed and re-installed
All 25 mm diameter mini-piezometers

Appendix B

MECP Water Well Records & Survey

Water Well Survey Summary

St Marys Mast-Snyder Pit
Project No.: 60246514-8

Owner/Location (Puslinch Twp.)	Surveyed	Date Drilled	Well Diameter (m)	Total Depth (m)	Static Level (m)	Well Survey Results				
						Year Occupied Property	Number of Residents	Quality Issues	Supply Issues	Comments
Baldwin 6809 Forestall Rd. Lot 13, Conc. 4	8-Aug-12	2005		> 30		2005	2			- house has water softener and water filter - some iron
Hennick 6827 Forestall Rd. Lot 14, Conc. 4	29-Nov-10	9-Nov	0.15	53.3		2009	4	No	No	- house has water softener and UV system
Land 6841 Forestall Rd. Lot 14, Conc. 4	8-Aug-12	2005		67.7		1972	1			- some iron - formerly had a 9 m deep dug well that went dry so new well was drilled
Mast (formerly Cooper) 6848 Forestall Rd. Lot 14, Conc. 4	29-Nov-10	Dec-59	0.1	36.6	7.6	2006	2	No	No	- tenant (Veldhuis) interviewed - owned by Mast since 1961
Yates 6851 Forestall Rd. Lot 14, Conc. 4	29-Nov-10	Aug-69	0.1	36.3	7.6	1971	2-3	Yes	No	- owned property since 1971 - water has iron and black particulate, lower water levels - water problems started when Cox started extraction - house has water softener and iron filter

Water Well Survey Summary

St Marys Mast-Snyder Pit

Project No.: 60246514-8

Owner/Location (Puslinch Twp.)	Surveyed	Date Drilled	Well Diameter (m)	Total Depth (m)	Static Level (m)	Well Survey Results				
						Year Occupied Property	Number of Residents	Quality Issues	Supply Issues	Comments
Kreitzer (formerly Becker) 6855 Forestall Rd. Lot 14, Conc. 4	29-Nov-10	Jun-67	0.15	34.1	5.50	1971	2	No	No	- owned property since 1971 - house has water softener
Crawley 6895 Forestall Rd. Lot 16, Conc. 4	14-Mar-10	2007		36.6						
Arbuckle (formerly School Sec 3) 4673 Downey Rd. Lot 16, Conc. 4	28-Feb-11	Mar-62	0.13	41.2	12.2	2005	6-8	Yes	Occasional	- tenant (Lacroix) interviewed - house has water softener and iron filter - iron staining - some water shortages
Huck 4657 Downey Rd. Lot 16, Conc. 4	28-Feb-11	1996	0.15	about 46.0	about 20 m	1996	4-5	No	No	- lived on property since 1996 - house has water softener and iron filter - well also used to top up swimming pool
Farrell 4669 Downey Rd. Lot 16, Conc. 4	28-Feb-11	prior to 1999		about 21.0		1999	5	No	No	- lived on property since 1999 - house has water softener and sometimes iron filter
Hurr 6855 Laird Rd. Lot 14, Conc. 4	23-Mar-11	May-08		about 38.0		2008	3	No		- UV filter used - has water softener
Mattucci 902 Laird Rd. Lot 16, Conc. 4	24-May-11	1987		about 24.4		1987	5	No	No	- house has water softener - they don't drink the well water

Water Well Survey Summary
St Marys Mast-Snyder Pit
Project No.: 60246514-8

Owner/Location (Puslinch Twp.)	Surveyed	Date Drilled	Well Diameter (m)	Total Depth (m)	Static Level (m)	Well Survey Results				
						Year Occupied Property	Number of Residents	Quality Issues	Supply Issues	Comments
Fitton 4767 Pioneer Trail Lot 13, Conc. 5	24-May-11	1975				1975		No	No	- lived on property since 1975 but have owned the property for more than 50 years - UV filter used - water quality tested frequently - no quality issues

Note: All wells surveyed currently used for domestic purposes only.

MECP Water Well Records within 500 m of the Property Boundary

St Marys Mast-Snyder Pit

MECP Well ID	Lot	Conc.	Street	Easting (NAD83)	Northing (NAD83)	Ground Elevation (mASL)	Construction Date	Primary Water Use	Well Type	Casing Diameter (cm)	Static Level (mbgs)	Static Level (mASL)	Deepest Water Found (m)	Depth to Bedrock (m)	Well Depth (mbgs)	Well Depth (mASL)
6702362	014	CON 04		561899.3	4814118	331.73	12/4/1959	Livestock	Bedrock	10.16	7.62	324.11	36.58	24.99	36.58	295.15
6702363	014	CON 04	6855 Forestell Rd	562130.3	4814101	331.47	6/28/1967	Domestic	Bedrock	15.24	5.49	325.99	33.22	30.18	34.14	297.34
6702364	015	CON 04	605 Downey Rd	562297.3	4814528	329.44	7/29/1964	Livestock	Bedrock	15.24	4.88	324.56	38.10	24.38	39.62	289.82
6702366	016	CON 04		562591.3	4814112	335.32	3/7/1962	Public	Bedrock	12.70	12.19	323.13	41.15	29.57	41.15	294.17
6702367	016	CON 04	4669 Downey Rd	562619.3	4814045	336.57	9/6/1962	Domestic	Bedrock	15.24	18.29	318.28	38.10	30.48	39.01	297.56
6702385	014	CON 05	6852 Laird Rd	561599.3	4815233	325.05	11/10/1959	Domestic	Bedrock	12.70	7.92	317.12	37.49	33.53	41.76	283.29
6703448	014	CON 04	6851 Forestell Rd	562064.3	4814073	331.52	8/18/1969	Domestic	Bedrock	10.16	7.62	323.90	35.97	31.39	36.27	295.25
6703586	013	CON 05	6767 Pioneer Trail	561224.3	4815323	321.96	9/22/1969	Domestic	Bedrock	10.16	2.13	319.82	35.36	19.20	35.36	286.60
6704205	014	CON 04		561854.3	4814123	330.74	2/25/1972	Domestic	Overburden	15.24	3.35	327.39	17.68		17.68	313.06
6706248	016	CON 05		562334.3	4815303	324.66	11/13/1976	Domestic	Bedrock	12.70			18.29	17.98	18.29	306.37
6709240	016	CON 04	902 Laird Rd	562499.3	4815240	325.48	4/18/1988	Domestic	Bedrock	15.24	0.91	324.56	21.34	20.73	25.30	300.18
6709381	012	CON 04		561012.3	4814713	326.11	7/27/1988	Industrial	Bedrock	15.24	7.62	318.49	42.67	40.54	44.20	281.91
6711954	016	CON 04	4657 Downey Rd	562705.3	4813809	335.79	3/26/1996	Domestic	Bedrock	15.24	15.85	319.94	48.77	33.83	48.77	287.03
6712931	014	CON 04	4664 Downey Rd	562189	4813949	333.97	2/25/1999	Domestic	Bedrock	15.24	28.96	305.01	67.06	29.87	67.06	266.91
6713366	015	CON 04		562326.6	4814170	332.43	6/14/2000	Domestic	Bedrock	15.24	10.36	322.07	55.47	35.05	55.47	276.96
6713565	013	CON 04		561519.1	4813978	328.51	11/15/2000	Domestic	Bedrock	15.24	5.79	322.72	32.31	31.09	32.31	296.20
6713948	016	CON 04		562755	4814273	334.60	10/12/2001	Domestic	Bedrock	15.24	11.58	323.02	43.28	32.61	43.28	291.32
6715482	013	CON 04	6809 Forestell Rd	561418	4813920	328.45	8/8/2005	Domestic	Bedrock	15.24	4.88	323.57	30.48	25.30	30.48	297.97
7051825	016	CON 04	6895 Forestell Rd	562782	4814209	334.91	7/26/2007	Domestic		15.56	10.97	323.94	35.97		36.58	298.34
7106070	014	CON 04		561831	4815042	326.62	5/13/2008	Domestic		15.88	3.66	322.97	37.49		38.71	287.91
7138842	014	CON 04	6827 Forestell Rd	561736	4813973	329.49	11/16/2009	Domestic		16.00	10.66	318.83	33.00		51.80	277.69
7146305	014	CON 04	6848 Forestell Rd	561921	4814212	330.65	3/2/2010	Domestic								
7173629	014	CON 04	6848 Forestell Rd	561923	4814212	330.62	12/5/2011	Abandoned-Other								
7185527	013	CON 04	4677 12 Sideroad	561361	4813891	328.32	7/23/2012	Domestic		15.56	4.88	323.45	17.68		17.68	310.64
7204366	013	CON 04		561475	4813664	329.98	5/8/2013	Domestic		15.24	4.27	325.72	46.33		47.85	282.13

Notes: No well screen information available
All wells in UTM Zone 17
Shaded wells correspond to residences interviewed during the water well surveys

Appendix C

Groundwater Elevations

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)			
1-I	330.54	329.60	15-Dec-99	6.13	324.41
			23-Aug-00	5.24	325.30
			27-Oct-00	5.63	324.91
			1-May-01	4.77	325.77
			11-Sep-01	5.69	324.85
			7-Nov-01	5.71	324.83
			28-Jan-02	5.32	325.23
			26-Apr-02	4.45	326.09
			22-Aug-02	5.13	325.41
			24-Oct-02	5.60	324.94
			14-Jan-03	5.83	324.71
			22-Jul-03	5.36	325.18
			3-Sep-03	5.50	325.04
			7-Oct-03	5.50	325.04
			12-Feb-04	4.85	325.69
			19-Apr-04	4.14	326.41
			19-Aug-04	5.04	325.50
			15-Nov-04	5.50	325.04
			9-Feb-05	4.75	325.79
			11-Apr-05	4.23	326.31
			25-Aug-05	5.35	325.19
			8-Nov-05	5.70	324.84
			16-Jan-06	5.22	325.32
			11-Apr-06	4.42	326.12
			17-Aug-06	5.29	325.25
			27-Nov-06	4.96	325.58
			30-Jan-07	4.59	325.96
			9-Apr-07	4.17	326.37
			16-Aug-07	5.28	325.26
			1-Nov-07	5.69	324.85
			6-Jan-08	5.52	325.03
			12-Apr-08	3.66	326.88
			20-Aug-08	4.90	325.65
			18-Nov-08	5.17	325.37
			9-Feb-09	4.59	325.95
			5-Aug-09	4.65	325.89
			2-Dec-09	5.28	325.26
			2-Feb-10	5.07	325.47
			30-Apr-10	4.60	325.95
			1-Sep-10	5.31	325.23
			29-Nov-10	5.58	324.96
			28-Feb-11	5.30	325.24
			24-May-11	4.15	326.39
			30-Aug-11	5.06	325.48
			21-Nov-11	5.38	325.17
			22-Feb-12	4.72	325.82
			4-May-12	4.96	325.58
			8-Aug-12	5.57	324.97
			15-Nov-12	5.57	324.97
			29-Jan-13	5.14	325.40

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
1-I	330.54	329.60	1-May-13	4.13	326.41
			16-Aug-13	4.95	325.59
			20-Nov-13	4.98	325.56
			19-Feb-14	4.92	325.62
			27-May-14	4.24	326.30
			21-Aug-14	5.08	325.46
			25-Nov-14	5.12	325.42
			26-Feb-15	5.20	325.34
			28-May-15	4.88	325.66
			19-Aug-15	5.08	325.46
			30-Nov-15	5.50	325.04
			25-Feb-16	4.95	325.59
			28-Apr-16	4.22	326.32
			12-Sep-16	5.32	325.22
			21-Nov-16	5.60	324.94
			24-Jan-17	4.64	325.90
			17-May-17	3.90	326.64
			28-Aug-17	4.91	325.63
			27-Nov-17	5.33	325.21
			12-Feb-18	5.06	325.48
			7-May-18	4.19	326.35
			20-Aug-18	5.18	325.36
			19-Nov-18	5.34	325.20
			26-Feb-19	4.95	325.59
			16-Apr-19	4.49	326.05
			23-Jul-19	4.68	325.86
			13-Nov-19	5.07	325.47
			10-Feb-20	4.58	325.96
			5-May-20	4.76	325.78
			30-Jul-20	5.10	325.44
			16-Oct-20	5.44	325.10
			22-Jan-21	5.44	325.10
			13-Apr-21	5.19	325.35
			1-Jun-21	5.12	325.42
			14-Jul-21	5.48	325.06
			2-Nov-21	5.75	324.79
			31-Jan-22	5.60	324.94
			4-May-22	Decommissioned	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)			
1-II	330.42	329.60	15-Dec-99	6.65	323.77
			23-Aug-00	5.13	325.29
			27-Oct-00	5.52	324.90
			1-May-01	4.66	325.76
			11-Sep-01	5.58	324.84
			7-Nov-01	5.82	324.60
			28-Jan-02	5.42	325.00
			26-Apr-02	4.56	325.87
			22-Aug-02	5.24	325.18
			24-Oct-02	5.60	324.82
			14-Jan-03	5.95	324.47
			22-Apr-03	5.08	325.34
			22-Jul-03	5.26	325.16
			3-Sep-03	5.40	325.03
			7-Oct-03	5.61	324.82
			12-Feb-04	4.75	325.67
			19-Apr-04	4.04	326.38
			19-Aug-04	4.95	325.48
			15-Nov-04	5.39	325.03
			9-Feb-05	4.85	325.57
			11-Apr-05	4.23	326.19
			25-Aug-05	5.25	325.17
			8-Nov-05	5.60	324.82
			16-Jan-06	5.31	325.11
			11-Apr-06	4.52	325.90
			17-Aug-06	5.19	325.23
			27-Nov-06	4.64	325.78
			30-Jan-07	4.69	325.73
			9-Apr-07	4.27	326.15
			16-Aug-07	5.37	325.05
			1-Nov-07	5.79	324.63
			6-Jan-08	5.61	324.81
			12-Apr-08	3.75	326.67
			20-Aug-08	5.01	325.42
			18-Nov-08	5.27	325.15
			9-Feb-09	4.69	325.73
			5-Aug-09	4.74	325.68
			2-Dec-09	5.38	325.04
			2-Feb-10	5.17	325.26
			30-Apr-10	4.70	325.72
			1-Sep-10	5.41	325.01
			29-Nov-10	5.69	324.73
			28-Feb-11	5.40	325.03
			24-May-11	4.05	326.37
			30-Aug-11	5.16	325.26
			21-Nov-11	5.48	324.94
			22-Feb-12	4.82	325.60
			4-May-12	5.06	325.36
			8-Aug-12	5.67	324.75
			15-Nov-12	5.68	324.74

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)			
1-II	330.42	329.60	29-Jan-13	5.24	325.18
			1-May-13	4.23	326.19
			16-Aug-13	5.06	325.36
			20-Nov-13	5.09	325.33
			19-Feb-14	5.04	325.39
			27-May-14	4.35	326.07
			21-Aug-14	5.18	325.24
			25-Nov-14	5.23	325.19
			26-Feb-15	5.30	325.12
			28-May-15	4.98	325.44
			19-Aug-15	5.18	325.25
			30-Nov-15	5.60	324.82
			25-Feb-16	5.05	325.37
			28-Apr-16	5.53	324.89
			12-Sep-16	5.43	324.99
			21-Nov-16	5.71	324.71
			24-Jan-17	4.75	325.67
			17-May-17	4.00	326.42
			28-Aug-17	5.02	325.40
			27-Nov-17	5.43	324.99
			12-Feb-18	5.16	325.26
			7-May-18	4.30	326.12
			20-Aug-18	5.28	325.14
			19-Nov-18	5.44	324.98
			26-Feb-19	4.84	325.58
			16-Apr-19	4.59	325.83
			23-Jul-19	4.79	325.63
			13-Nov-19	5.17	325.25
			10-Feb-20	4.68	325.74
			5-May-20	4.87	325.55
			30-Jul-20	5.21	325.21
			16-Oct-20	5.55	324.87
			22-Jan-21	5.55	324.87
			13-Apr-21	5.30	325.12
			1-Jun-21	5.23	325.19
			14-Jul-21	5.58	324.84
			2-Nov-21	5.85	324.57
			31-Jan-22	5.72	324.70
			4-May-22	Decommissioned	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
2-I	326.93	325.93	15-Dec-99	3.39	323.54
			23-Aug-00	2.77	324.16
			27-Oct-00	3.07	323.86
			1-May-01	2.39	324.55
			11-Sep-01	3.14	323.80
			7-Nov-01	3.07	323.86
			28-Jan-02	2.74	324.19
			26-Apr-02	2.21	324.72
			22-Aug-02	2.77	324.17
			24-Oct-02	3.09	323.84
			14-Jan-03	3.27	323.66
			22-Jul-03	2.81	324.12
			3-Sep-03	2.93	324.01
			7-Oct-03	2.98	323.96
			12-Feb-04	2.44	324.50
			19-Apr-04	1.90	325.04
			19-Aug-04	2.66	324.28
			15-Nov-04	2.96	323.97
			9-Feb-05	2.36	324.57
			11-Apr-05	1.93	325.00
			25-Aug-05	2.90	324.03
			8-Nov-05	3.13	323.80
			16-Jan-06	2.68	324.25
			11-Apr-06	2.21	324.72
			17-Aug-06	2.86	324.07
			27-Nov-06	2.44	324.49
			30-Jan-07	2.35	324.59
			9-Apr-07	2.00	324.93
			16-Aug-07	2.96	323.97
			1-Nov-07	3.22	323.71
			6-Jan-08	2.92	324.02
			12-Apr-08	1.54	325.39
			20-Aug-08	2.58	324.35
			18-Nov-08	2.63	324.30
			9-Feb-09	2.32	324.61
			5-Aug-09	2.59	324.34
			2-Dec-09	2.89	324.04
			2-Feb-10	2.68	324.25
			30-Apr-10	2.41	324.53
			1-Sep-10	2.94	323.99
			29-Nov-10	3.08	323.85
	326.90	4	28-Feb-11	Frozen	
			24-May-11	1.89	325.01
			30-Aug-11	2.77	324.13
			21-Nov-11	2.88	324.02
			22-Feb-12	2.38	324.52
			4-May-12	2.61	324.29
			8-Aug-12	3.10	323.80
			15-Nov-12	2.96	323.94
			29-Jan-13	2.62	324.28

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG	Groundwater Elevation
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)		(m)	(m.a.s.l.)
2-I	326.90	325.93	1-May-13	1.98	324.92
			16-Aug-13	2.63	324.27
			20-Nov-13	2.56	324.34
			19-Feb-14	2.57	324.33
			27-May-14	2.13	324.77
			21-Aug-14	2.73	324.17
			25-Nov-14	2.58	324.32
			26-Feb-15	2.80	324.10
			28-May-15	2.55	324.35
			19-Aug-15	2.70	324.20
			30-Nov-15	2.95	323.95
			25-Feb-16	2.51	324.39
			28-Apr-16	2.05	324.85
			12-Sep-16	2.90	324.00
			21-Nov-16	3.07	323.83
			24-Jan-17	2.19	324.71
			17-May-17	1.96	324.94
			28-Aug-17	2.60	324.30
			27-Nov-17	2.84	324.06
			12-Feb-18	2.65	324.25
			7-May-18	2.04	324.86
			20-Aug-18	2.82	324.08
			19-Nov-18	2.81	324.09
			26-Feb-19	2.51	324.39
			16-Apr-19	2.03	324.87
			23-Jul-19	2.38	324.52
			20-Nov-19	2.58	324.32
			10-Feb-20	2.18	324.72
			5-May-20	2.41	324.49
			30-Jul-20	2.79	324.11
			16-Oct-20	2.99	323.91
			22-Jan-21	2.75	324.15
			13-Apr-21	2.68	324.22
			1-Jun-21	2.81	324.09
			14-Jul-21	2.89	324.01
			2-Nov-21	2.87	324.03
			31-Jan-22	2.98	323.92
			4-May-22	2.38	324.52
			25-Aug-22	1.44	325.46
			2-Dec-22	3.26	323.64

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
2-II	326.87	325.93	15-Dec-99	3.34	323.53
			23-Aug-00	2.73	324.14
			27-Oct-00	3.03	323.84
			1-May-01	2.34	324.54
			11-Sep-01	3.09	323.78
			7-Nov-01	3.11	323.76
			28-Jan-02	2.78	324.09
			26-Apr-02	2.21	324.66
			22-Aug-02	2.81	324.06
			24-Oct-02	3.14	323.73
			14-Jan-03	3.23	323.64
			22-Apr-03	2.55	324.32
			22-Jul-03	2.77	324.10
			3-Sep-03	2.88	324.00
			7-Oct-03	2.93	323.94
			12-Feb-04	2.39	324.48
			19-Apr-04	1.86	325.01
			19-Aug-04	2.62	324.25
			15-Nov-04	2.92	323.95
			9-Feb-05	2.40	324.47
			11-Apr-05	1.89	324.98
			25-Aug-05	2.86	324.01
			8-Nov-05	3.09	323.78
			16-Jan-06	2.64	324.23
			11-Apr-06	2.17	324.70
			17-Aug-06	2.82	324.05
			27-Nov-06	2.40	324.47
			30-Jan-07	2.31	324.57
			9-Apr-07	1.96	324.91
			16-Aug-07	2.92	323.95
			1-Nov-07	3.18	323.69
			6-Jan-08	2.88	324.00
			12-Apr-08	1.50	325.37
			20-Aug-08	2.62	324.26
			18-Nov-08	2.67	324.20
			9-Feb-09	2.28	324.59
			5-Aug-09	2.56	324.32
			2-Dec-09	2.85	324.02
			2-Feb-10	2.65	324.22
			30-Apr-10	2.37	324.50
			1-Sep-10	2.90	323.97
			29-Nov-10	3.04	323.84
			28-Feb-11	Frozen	
			24-May-11	1.90	324.98
			30-Aug-11	2.77	324.10
			21-Nov-11	2.89	323.99
			22-Feb-12	2.37	324.50
			4-May-12	2.61	324.26
			8-Aug-12	3.09	323.78
			15-Nov-12	2.95	323.92

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
2-II	326.87	325.93	29-Jan-13	2.62	324.25
			1-May-13	1.99	324.88
			16-Aug-13	2.63	324.24
			20-Nov-13	2.57	324.31
			19-Feb-14	2.58	324.29
			27-May-14	2.12	324.75
			21-Aug-14	2.73	324.14
			25-Nov-14	2.58	324.29
			26-Feb-15	2.79	324.08
			28-May-15	2.55	324.32
			19-Aug-15	2.70	324.17
			30-Nov-15	2.95	323.92
			25-Feb-16	2.52	324.35
			28-Apr-16	2.04	324.83
			12-Sep-16	2.90	323.97
			21-Nov-16	3.07	323.80
			24-Jan-17	2.19	324.68
			17-May-17	1.94	324.93
			28-Aug-17	2.61	324.27
			27-Nov-17	2.84	324.03
			12-Feb-18	2.64	324.23
			7-May-18	2.04	324.83
			20-Aug-18	2.82	324.05
			19-Nov-18	2.81	324.06
			26-Feb-19	2.49	324.38
			16-Apr-19	2.02	324.85
			23-Jul-19	2.37	324.50
			20-Nov-19	2.56	324.31
			10-Feb-20	2.18	324.69
			5-May-20	2.40	324.47
			30-Jul-20	2.79	324.08
			16-Oct-20	2.99	323.88
			22-Jan-21	2.75	324.12
			13-Apr-21	2.67	324.20
			1-Jun-21	2.80	324.07
			14-Jul-21	2.89	323.98
			2-Nov-21	2.86	324.01
			31-Jan-22	2.97	323.90
			4-May-22	2.38	324.50
			25-Aug-22	1.05	325.82
			2-Dec-22	3.24	323.63

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
3	326.46	325.65	15-Dec-99	2.30	324.16
			23-Aug-00	1.74	324.72
			27-Oct-00	2.01	324.45
			1-May-01	1.44	325.02
			11-Sep-01	2.20	324.27
			7-Nov-01	1.97	324.49
			28-Jan-02	1.51	324.95
			26-Apr-02	1.38	325.08
			22-Aug-02	1.86	324.60
			24-Oct-02	2.09	324.37
			14-Jan-03	2.18	324.28
			22-Apr-03	1.48	324.98
			22-Jul-03	1.82	324.64
			3-Sep-03	1.90	324.57
			7-Oct-03	1.80	324.67
			12-Feb-04	1.41	325.05
			19-Apr-04	1.20	325.27
			19-Aug-04	1.62	324.85
			15-Nov-04	1.75	324.71
			9-Feb-05	1.27	325.19
			11-Apr-05	1.22	325.24
			25-Aug-05	1.77	324.69
			8-Nov-05	2.01	324.45
			16-Jan-06	1.53	324.93
			11-Apr-06	1.31	325.15
			17-Aug-06	1.85	324.61
			27-Nov-06	1.40	325.06
			30-Jan-07	1.37	325.09
			9-Apr-07	1.20	325.26
			16-Aug-07	1.97	324.49
			1-Nov-07	2.16	324.31
			6-Jan-08	1.64	324.83
			12-Apr-08	1.01	325.45
			20-Aug-08	1.54	324.93
			18-Nov-08	1.43	325.03
			9-Feb-09	1.27	325.20
			5-Aug-09	1.55	324.91
			2-Dec-09	1.63	324.83
			2-Feb-10	1.55	324.92
			30-Apr-10	1.43	325.03
			1-Sep-10	1.94	324.52
			29-Nov-10	1.84	324.62
			28-Feb-11	1.36	325.10
			24-May-11	1.20	325.27
			30-Aug-11	1.77	324.69
			21-Nov-11	1.72	324.74
			22-Feb-12	1.36	325.10
			4-May-12	1.50	324.96
			8-Aug-12	2.16	324.30
			15-Nov-12	1.84	324.62

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
3	326.46	325.65	29-Jan-13	1.46	325.00
			1-May-13	1.28	325.18
			16-Aug-13	1.64	324.82
			20-Nov-13	1.50	324.96
			19-Feb-14	1.35	325.11
			27-May-14	1.37	325.09
			21-Aug-14	1.66	324.81
			25-Nov-14	1.34	325.12
			26-Feb-15	1.75	324.71
			28-May-15	1.64	324.82
			19-Aug-15	1.68	324.78
			30-Nov-15	1.82	324.64
			25-Feb-16	1.04	325.42
			28-Apr-16	1.29	325.17
			12-Sep-16	1.85	324.61
			21-Nov-16	2.04	324.42
			24-Jan-17	1.29	325.17
			17-May-17	1.28	325.19
			28-Aug-17	1.63	324.83
			27-Nov-17	1.70	324.76
			12-Feb-18	1.60	324.87
			7-May-18	1.30	325.16
			20-Aug-18	1.89	324.57
			19-Nov-18	1.71	324.75
			26-Feb-19	1.39	325.07
			16-Apr-19	1.10	325.36
			23-Jul-19	1.43	325.03
			13-Nov-19	1.51	324.95
			10-Feb-20	1.33	325.13
			5-May-20	1.47	324.99
			30-Jul-20	1.89	324.57
			16-Oct-20	2.00	324.46
			22-Jan-21	1.69	324.77
			13-Apr-21	1.48	324.98
			1-Jun-21	1.87	324.59
			14-Jul-21	1.87	324.59
			2-Nov-21	1.92	324.54
			31-Jan-22	2.04	324.42
			4-May-22	1.33	325.13
			25-Aug-22	2.14	324.32
			2-Dec-22	2.33	324.13

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
4	325.18	324.42	15-Dec-99	4.18	321.00
			23-Aug-00	3.54	321.64
			27-Oct-00	3.88	321.31
			1-May-01	2.67	322.51
			11-Sep-01	3.92	321.27
			7-Nov-01	3.96	321.22
			28-Jan-02	3.68	321.50
			26-Apr-02	2.44	322.74
			22-Aug-02	3.56	321.63
			24-Oct-02	3.94	321.24
			14-Jan-03	4.16	321.02
			22-Apr-03	3.15	322.03
			22-Jul-03	3.62	321.56
			3-Sep-03	3.72	321.46
			7-Oct-03	3.80	321.39
			12-Feb-04	2.87	322.31
			19-Apr-04	2.14	323.04
			19-Aug-04	3.39	321.79
			15-Nov-04	3.76	321.42
			9-Feb-05	2.95	322.23
			11-Apr-05	2.17	323.01
			25-Aug-05	3.68	321.50
			8-Nov-05	3.93	321.25
			16-Jan-06	3.43	321.75
			11-Apr-06	2.42	322.76
			17-Aug-06	3.57	321.61
			27-Nov-06	2.85	322.33
			30-Jan-07	2.62	322.56
			9-Apr-07	2.20	322.98
			16-Aug-07	3.73	321.45
			1-Nov-07	4.09	321.09
			6-Jan-08	3.93	321.26
			12-Apr-08	1.46	323.73
			20-Aug-08	3.21	321.97
			18-Nov-08	3.37	321.82
			9-Feb-09	2.71	322.47
			5-Aug-09	3.23	321.96
			2-Dec-09	3.70	321.48
			2-Feb-10	3.48	321.71
			30-Apr-10	3.26	321.92
			1-Sep-10	3.70	321.48
			29-Nov-10	3.90	321.28
			28-Feb-11	3.69	321.49
			24-May-11	1.20	323.99
			30-Aug-11	3.55	321.63
			21-Nov-11	3.70	321.49
			22-Feb-12	2.77	322.41
			4-May-12	3.27	321.91
			8-Aug-12	3.89	321.29
			15-Nov-12	3.90	321.28

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)			
4	325.18	324.42	29-Jan-13	3.52	321.66
			1-May-13	2.04	323.14
			16-Aug-13	3.35	321.83
			20-Nov-13	3.13	322.05
			19-Feb-14	3.21	321.97
			27-May-14	2.36	322.82
			21-Aug-14	3.52	321.66
			25-Nov-14	3.21	321.97
			26-Feb-15	3.61	321.57
			28-May-15	3.27	321.91
			19-Aug-15	3.41	321.77
			30-Nov-15	3.77	321.41
			25-Feb-16	3.22	321.96
			28-Apr-16	2.16	323.02
			12-Sep-16	3.71	321.47
			21-Nov-16	Dry	
			24-Jan-17	2.54	322.64
			17-May-17	2.07	323.11
			28-Aug-17	3.33	321.85
			27-Nov-17	3.72	321.46
			12-Feb-18	3.43	321.75
			7-May-18	2.19	322.99
			20-Aug-18	3.62	321.56
			19-Nov-18	3.77	321.41
			26-Feb-19	3.28	321.90
			16-Apr-19	2.34	322.84
			23-Jul-19	2.93	322.25
			13-Nov-19	3.21	321.97
			10-Feb-20	2.52	322.66
			5-May-20	2.80	322.38
			30-Jul-20	3.57	321.61
			16-Oct-20	3.82	321.36
			22-Jan-21	3.60	321.58
			13-Apr-21	3.31	321.87
			1-Jun-21	3.56	321.62
			14-Jul-21	3.70	321.48
			2-Nov-21	3.71	321.47
			31-Jan-22	3.73	321.45
			4-May-22	3.82	321.36
			25-Aug-22	3.86	321.32
			2-Dec-22	4.06	321.12

Table C1. Summary of Groundwater Elevations

Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
5	329.66	329.00	15-Dec-99	5.98	323.68
			23-Aug-00	4.98	324.68
			27-Oct-00	5.42	324.24
			1-May-01	4.55	325.12
			11-Sep-01	5.47	324.20
			7-Nov-01	5.63	324.03
			28-Jan-02	5.31	324.36
			26-Apr-02	4.37	325.30
			22-Aug-02	5.18	324.49
			24-Oct-02	5.52	324.14
			14-Jan-03	5.80	323.86
			22-Apr-03	5.04	324.62
			22-Jul-03	5.12	324.54
			3-Sep-03	5.29	324.38
			7-Oct-03	5.39	324.28
			12-Feb-04	2.49	327.18
			19-Apr-04	3.95	325.71
			19-Aug-04	4.94	324.72
			15-Nov-04	5.40	324.26
			9-Feb-05	4.74	324.92
			11-Apr-05	4.05	325.61
			25-Aug-05	5.21	324.45
			8-Nov-05	5.57	324.09
			16-Jan-06	5.26	324.40
			11-Apr-06	4.60	325.06
			17-Aug-06	5.23	324.43
			27-Nov-06	5.06	324.60
			30-Jan-07	4.88	324.79
			9-Apr-07	4.52	325.15
			16-Aug-07	5.38	324.28
			1-Nov-07	5.70	323.96
			6-Jan-08	5.56	324.10
			12-Apr-08	3.95	325.71
			20-Aug-08	4.96	324.71
			18-Nov-08	5.19	324.47
			9-Feb-09	4.70	324.96
			5-Aug-09	4.92	324.74
			2-Dec-09	5.30	324.37
			2-Feb-10	5.07	324.59
			30-Apr-10	4.95	324.71
			1-Sep-10	5.31	324.35
			29-Nov-10	5.52	324.14
			28-Feb-11	5.25	324.41
			24-May-11	4.31	325.35
			30-Aug-11	5.17	324.49
			21-Nov-11	5.37	324.29
			22-Feb-12	4.80	324.86
			4-May-12	5.04	324.62
			8-Aug-12	5.54	324.12
			15-Nov-12	5.50	324.16

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
5	329.66	329.00	29-Jan-13	5.10	324.56
			1-May-13	4.29	325.37
			16-Aug-13	4.95	324.71
			20-Nov-13	4.95	324.71
			19-Feb-14	4.85	324.81
			27-May-14	5.02	324.64
			21-Aug-14	5.07	324.59
			25-Nov-14	5.06	324.60
			26-Feb-15	5.10	324.56
			28-May-15	4.87	324.79
			19-Aug-15	5.00	324.66
			30-Nov-15	5.41	324.25
			25-Feb-16	4.83	324.83
			28-Apr-16	4.21	325.45
			12-Sep-16	5.25	324.41
			21-Nov-16	5.55	324.11
			24-Jan-17	4.58	325.08
			17-May-17	4.04	325.62
			28-Aug-17	4.90	324.76
			27-Nov-17	5.24	324.42
			12-Feb-18	4.95	324.71
			7-May-18	4.21	325.45
			20-Aug-18	5.16	324.50
			19-Nov-18	5.28	324.38
			26-Feb-19	4.71	324.95
			16-Apr-19	4.40	325.26
			23-Jul-19	4.68	324.98
			13-Nov-19	4.96	324.70
			10-Feb-20	4.45	325.21
			5-May-20	4.66	325.00
			30-Jul-20	5.19	324.47
			16-Oct-20	5.49	324.17
			22-Jan-21	5.25	324.41
			13-Apr-21	5.01	324.65
			1-Jun-21	5.17	324.49
			14-Jul-21	5.37	324.29
			2-Nov-21	5.45	324.21
			31-Jan-22	5.37	324.29
			4-May-22	4.58	325.08
			25-Aug-22	5.52	324.14
			2-Dec-22	6.07	323.59

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
6	330.80	330.27	22-Jul-03	5.39	325.41
			3-Sep-03	5.56	325.25
			7-Oct-03	5.69	325.12
			12-Feb-04	Inaccessible	
			19-Apr-04	4.10	326.71
			19-Aug-04	5.07	325.74
			15-Nov-04	5.57	325.23
			9-Feb-05	4.89	325.91
			11-Apr-05	4.24	326.56
			25-Aug-05	5.39	325.41
			8-Nov-05	5.77	325.03
			16-Jan-06	5.44	325.36
			11-Apr-06	4.54	326.26
			17-Aug-06	5.32	325.48
			27-Nov-06	inaccessable	
			30-Jan-07	4.71	326.09
			9-Apr-07	4.28	326.52
			16-Aug-07	5.41	325.39
			1-Nov-07	5.87	324.94
			6-Jan-08	5.75	325.06
			12-Apr-08	3.75	327.05
			20-Aug-08	5.03	325.78
			18-Nov-08	5.38	325.42
			9-Feb-09	4.74	326.06
			5-Aug-09	4.90	325.90
			2-Dec-09	5.30	325.51
			2-Feb-10	5.24	325.56
			30-Apr-10	4.94	325.87
			1-Sep-10	5.47	325.33
			29-Nov-10	5.78	325.02
			28-Feb-11	5.52	325.29
			24-May-11	4.31	326.49
			30-Aug-11	5.20	325.60
			21-Nov-11	7.57	323.23
			22-Feb-12	4.87	325.93
			4-May-12	5.11	325.69
			8-Aug-12	5.64	325.16
			15-Nov-12	5.81	324.99
			29-Jan-13	5.34	325.46
			1-May-13	4.23	326.57
			16-Aug-13	5.09	325.71
			20-Nov-13	5.19	325.61
			19-Feb-14	5.10	325.70
			27-May-14	4.34	326.46
			21-Aug-14	5.24	325.56
			25-Nov-14	5.34	325.46
			26-Feb-15	5.36	325.44
			28-May-15	5.03	325.77
			19-Aug-15	5.23	325.57
			30-Nov-15	5.70	325.10
			25-Feb-16	5.14	325.66

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
6	330.80	330.27	28-Apr-16	4.20	326.60
			12-Sep-16	5.56	325.24
			21-Nov-16	5.81	324.99
			24-Jan-17	4.86	325.94
			17-May-17	3.96	326.84
			28-Aug-17	5.05	325.75
			27-Nov-17	5.54	325.26
			12-Feb-18	5.23	325.57
			7-May-18	4.30	326.50
			20-Aug-18	5.33	325.47
	337.25	336.68	19-Nov-18	12.09	325.16
			26-Feb-19	11.55	325.70
			16-Apr-19	11.17	326.08
			23-Jul-19	11.33	325.92
			13-Nov-19	11.79	325.46
			10-Feb-20	11.60	325.65
			5-May-20	11.48	325.77
			30-Jul-20	11.85	325.40
			16-Oct-20	12.18	325.07
			22-Jan-21	12.20	325.05
			13-Apr-21	11.94	325.31
			1-Jun-21	11.88	325.37
			14-Jul-21	12.18	325.07
			2-Nov-21	12.46	324.79
			31-Jan-22	12.25	325.00
			4-May-22	11.36	325.90
			25-Aug-22	12.20	325.05
			2-Dec-22	12.63	324.62

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG	Groundwater Elevation
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)		(m)	(m.a.s.l.)
7	330.64	330.04	22-Jul-03	4.81	325.83
			3-Sep-03	4.96	325.68
			7-Oct-03	5.08	325.57
			12-Feb-04	4.25	326.39
			19-Apr-04	3.47	327.17
			19-Aug-04	4.39	326.26
			15-Nov-04	4.90	325.74
			9-Feb-05	4.29	326.35
			11-Apr-05	3.66	326.98
			25-Aug-05	4.73	325.91
			8-Nov-05	5.11	325.53
			16-Jan-06	4.85	325.79
			11-Apr-06	3.88	326.76
			17-Aug-06	4.65	325.99
			27-Nov-06	4.42	326.22
			30-Jan-07	4.03	326.61
			9-Apr-07	3.58	327.07
			16-Aug-07	4.70	325.94
			1-Nov-07	5.19	325.46
			6-Jan-08	5.11	325.54
			12-Apr-08	3.14	327.50
			20-Aug-08	4.35	326.29
			18-Nov-08	4.71	325.93
			9-Feb-09	4.07	326.58
			5-Aug-09	4.23	326.41
			2-Dec-09	4.45	326.19
			2-Feb-10	4.60	326.04
			30-Apr-10	4.05	326.59
			1-Sep-10	4.79	325.85
			29-Nov-10	4.89	325.75
			28-Feb-11	4.90	325.74
			24-May-11	3.54	327.10
			30-Aug-11	4.47	326.17
			21-Nov-11	4.90	325.74
			22-Feb-12	4.21	326.44
			4-May-12	4.42	326.22
			8-Aug-12	5.06	325.58
			15-Nov-12	5.17	325.47
			29-Jan-13	4.75	325.89
			1-May-13	3.53	327.11
			16-Aug-13	4.41	326.23
			20-Nov-13	4.53	326.11
			19-Feb-14	4.45	326.19
			27-May-14	3.64	327.01
			21-Aug-14	4.53	326.11
			25-Nov-14	4.65	325.99
			26-Feb-15	4.72	325.92
			28-May-15	4.38	326.26
			19-Aug-15	4.57	326.07
			30-Nov-15	5.05	325.59
			25-Feb-16	4.55	326.09

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG	Groundwater Elevation
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)		(m)	(m.a.s.l.)
7	330.64	330.04	28-Apr-16	3.51	327.13
			12-Sep-16	4.82	325.82
			21-Nov-16	5.15	325.49
			24-Jan-17	4.32	326.32
			17-May-17	3.25	327.39
			28-Aug-17	4.36	326.28
			27-Nov-17	4.87	325.77
			12-Feb-18	4.64	326.00
			7-May-18	3.65	326.99
			20-Aug-18	4.65	325.99
			19-Nov-18	4.94	325.70
			26-Feb-19	4.41	326.23
			16-Apr-19	4.01	326.63
			23-Jul-19	4.13	326.51
			13-Nov-19	4.80	325.84
			10-Feb-20	4.28	326.36
			5-May-20	4.52	326.12
			30-Jul-20	4.92	325.72
			16-Oct-20	5.20	325.44
			22-Jan-21	5.28	325.36
			13-Apr-21	5.03	325.61
			1-Jun-21	4.94	325.70
			14-Jul-21	5.22	325.42
			2-Nov-21	5.53	325.11
			31-Jan-22	5.28	325.36
			4-May-22	4.52	326.12
			25-Aug-22	5.32	325.32
			2-Dec-22	5.75	324.89

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
8	328.40	327.74	22-Jul-03	2.90	325.50
			3-Sep-03	2.97	325.44
			7-Oct-03	2.90	325.50
			12-Feb-04	2.49	325.92
			19-Apr-04	2.04	326.36
			19-Aug-04	2.59	325.81
			15-Nov-04	2.76	325.64
			9-Feb-05	2.34	326.06
			11-Apr-05	1.99	326.41
			25-Aug-05	2.77	325.63
			8-Nov-05	3.02	325.38
			16-Jan-06	2.57	325.83
			11-Apr-06	2.19	326.21
			17-Aug-06	2.80	325.60
			27-Nov-06	2.37	326.03
			30-Jan-07	2.29	326.11
			9-Apr-07	2.00	326.41
			16-Aug-07	2.87	325.53
			1-Nov-07	3.13	325.27
			6-Jan-08	2.73	325.68
			12-Apr-08	1.78	326.63
			20-Aug-08	2.58	325.82
			18-Nov-08	2.41	326.00
			9-Feb-09	2.16	326.24
			5-Aug-09	2.43	325.98
			2-Dec-09	2.60	325.80
			2-Feb-10	2.54	325.86
			30-Apr-10	2.31	326.09
			1-Sep-10	2.88	325.52
			29-Nov-10	2.85	325.55
			28-Feb-11	2.59	325.82
			24-May-11	1.93	326.47
			30-Aug-11	2.68	325.72
			21-Nov-11	2.74	325.67
			22-Feb-12	2.34	326.06
			4-May-12	2.51	325.89
			8-Aug-12	3.13	325.27
			15-Nov-12	2.87	325.53
			29-Jan-13	2.62	325.78
			1-May-13	2.02	326.38
			16-Aug-13	2.62	325.78
			20-Nov-13	2.47	325.93
			19-Feb-14	2.56	325.84
			27-May-14	2.15	326.25
			21-Aug-14	2.64	325.76
			25-Nov-14	3.26	325.14
			26-Feb-15	2.75	325.65
			28-May-15	2.62	325.78
			19-Aug-15	2.67	325.73
			30-Nov-15	2.56	325.84
			25-Feb-16	2.46	325.94

Table C1. Summary of Groundwater Elevations

Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
8	328.40	327.74	28-Apr-16	2.07	326.33
			12-Sep-16	2.82	325.58
			21-Nov-16	3.03	325.37
			24-Jan-17	1.12	327.28
			17-May-17	2.01	326.39
			28-Aug-17	2.57	325.83
			27-Nov-17	2.69	325.71
			12-Feb-18	2.59	325.81
			7-May-18	2.02	326.38
			20-Aug-18	2.81	325.59
			19-Nov-18	2.74	325.66
			26-Feb-19	2.41	325.99
			16-Apr-19	2.00	326.40
			23-Jul-19	2.40	326.00
			13-Nov-19	2.47	325.93
			10-Feb-20	2.29	326.11
			5-May-20	2.39	326.01
			30-Jul-20	2.88	325.52
			16-Oct-20	3.07	325.33
			22-Jan-21	2.74	325.66
			13-Apr-21	2.53	325.87
			1-Jun-21	2.89	325.51
			14-Jul-21	2.96	325.44
			2-Nov-21	3.27	325.13
			31-Jan-22	3.22	325.18
			4-May-22	2.53	325.87
			25-Aug-22	3.31	325.09
			2-Dec-22	3.55	324.85

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
9	327.08	326.21	1-Sep-10	3.44	323.64
			29-Nov-10	3.26	323.82
			28-Feb-11	3.16	323.92
			24-May-11	2.18	324.91
			30-Aug-11	3.52	323.56
			21-Nov-11	3.34	323.74
			22-Feb-12	2.74	324.34
			4-May-12	3.09	323.99
			8-Aug-12	3.66	323.43
			15-Nov-12	3.27	323.81
			29-Jan-13	2.85	324.23
			1-May-13	2.44	324.64
			16-Aug-13	3.34	323.75
			20-Nov-13	2.94	324.14
			19-Feb-14	2.99	324.10
			27-May-14	2.66	324.42
			21-Aug-14	3.53	323.55
			25-Nov-14	3.25	323.83
			26-Feb-15	3.37	323.71
			28-May-15	3.17	323.91
			19-Aug-15	3.40	323.68
			30-Nov-15	3.46	323.62
			25-Feb-16	2.83	324.25
			28-Apr-16	inaccessible	
			12-Sep-16	3.58	323.50
			21-Nov-16	3.69	323.39
			24-Jan-17	2.41	324.67
			17-May-17	2.49	324.60
			28-Aug-17	3.49	323.59
			27-Nov-17	3.50	323.58
			12-Feb-18	3.52	323.56
			7-May-18	2.43	324.65
			20-Aug-18	3.73	323.35
			19-Nov-18	3.48	323.60
			26-Feb-19	3.15	323.93
			16-Apr-19	2.64	324.44
			23-Jul-19	3.27	323.81
			13-Nov-19	3.27	323.81
			10-Feb-20	2.60	324.48
			5-May-20	2.91	324.17
			30-Jul-20	3.53	323.55
			16-Oct-20	3.75	323.33
			22-Jan-21	2.99	324.09
			13-Apr-21	2.68	324.40
			1-Jun-21	3.23	323.85
			14-Jul-21	3.23	323.85
			2-Nov-21	2.91	324.17
			31-Jan-22	3.14	323.94
			4-May-22	2.81	324.27
			25-Aug-22	3.86	323.22
			2-Dec-22	4.60	322.48

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG	Groundwater Elevation
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)		(m)	(m.a.s.l.)
10-I	326.69	325.82	1-Sep-10	2.35	324.34
			29-Nov-10	2.46	324.23
			28-Feb-11	2.11	324.58
			24-May-11	1.41	325.28
			30-Aug-11	2.19	324.51
			21-Nov-11	2.29	324.40
			22-Feb-12	1.76	324.93
			4-May-12	1.99	324.70
			8-Aug-12	2.57	324.13
			15-Nov-12	2.39	324.30
			29-Jan-13	2.02	324.67
			1-May-13	1.48	325.21
			16-Aug-13	2.05	324.64
			20-Nov-13	1.98	324.71
			19-Feb-14	1.96	324.73
			27-May-14	1.59	325.11
			21-Aug-14	2.13	324.56
			25-Nov-14	1.93	324.76
			26-Feb-15	2.20	324.49
			28-May-15	1.98	324.71
			19-Aug-15	2.11	324.58
			30-Nov-15	2.36	324.33
			25-Feb-16	1.89	324.80
			28-Apr-16	1.50	325.19
			12-Sep-16	2.33	324.36
			21-Nov-16	2.52	324.17
			24-Jan-17	1.62	325.07
			17-May-17	1.44	325.25
			28-Aug-17	2.01	324.68
			27-Nov-17	2.24	324.45
			12-Feb-18	2.03	324.66
			7-May-18	1.49	325.20
			20-Aug-18	2.30	324.39
			19-Nov-18	2.24	324.45
			26-Feb-19	1.88	324.81
			16-Apr-19	1.46	325.23
			23-Jul-19	1.77	324.92
			13-Nov-19	1.98	324.71
			10-Feb-20	1.60	325.09
			5-May-20	1.79	324.90
			30-Jul-20	2.23	324.46
			16-Oct-20	2.43	324.26
			22-Jan-21	2.17	324.52
			13-Apr-21	2.04	324.65
			1-Jun-21	2.24	324.45
			14-Jul-21	2.32	324.37
			2-Nov-21	2.31	324.38
			31-Jan-22	2.42	324.27
			4-May-22	1.79	324.91
			25-Aug-22	2.40	324.29
			2-Dec-22	2.73	323.96

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
10-II	326.76	325.86	1-Sep-10	2.38	324.38
			29-Nov-10	2.49	324.27
			28-Feb-11	2.14	324.62
			24-May-11	1.45	325.31
			30-Aug-11	2.22	324.54
			21-Nov-11	2.33	324.43
			22-Feb-12	1.80	324.96
			4-May-12	2.03	324.73
			8-Aug-12	2.61	324.15
			15-Nov-12	2.43	324.33
			29-Jan-13	2.06	324.70
			1-May-13	1.52	325.24
			16-Aug-13	2.09	324.67
			20-Nov-13	2.00	324.76
			19-Feb-14	2.01	324.75
			27-May-14	1.63	325.13
			21-Aug-14	2.18	324.58
			25-Nov-14	1.97	324.79
			26-Feb-15	2.28	324.48
			28-May-15	2.04	324.72
			19-Aug-15	2.18	324.58
			30-Nov-15	2.43	324.33
			25-Feb-16	1.96	324.80
			28-Apr-16	1.57	325.19
			12-Sep-16	2.40	324.36
			21-Nov-16	2.59	324.17
			24-Jan-17	1.70	325.06
			17-May-17	1.54	325.23
			28-Aug-17	2.10	324.67
			27-Nov-17	2.32	324.44
			12-Feb-18	2.13	324.63
			7-May-18	1.59	325.17
			20-Aug-18	2.35	324.41
			19-Nov-18	2.30	324.46
			26-Feb-19	1.98	324.78
			16-Apr-19	1.58	325.18
			23-Jul-19	1.88	324.88
			13-Nov-19	2.04	324.72
			10-Feb-20	1.71	325.05
			5-May-20	1.90	324.86
			30-Jul-20	2.33	324.43
			16-Oct-20	2.53	324.23
			22-Jan-21	2.27	324.49
			13-Apr-21	2.15	324.61
			1-Jun-21	2.34	324.42
			14-Jul-21	2.43	324.33
			2-Nov-21	2.42	324.34
			31-Jan-22	2.53	324.23
			4-May-22	1.90	324.87
			25-Aug-22	2.52	324.24
			2-Dec-22	2.84	323.92

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
11	327.04	326.26	1-Sep-10	1.46	325.59
			29-Nov-10	1.45	325.59
			28-Feb-11	1.71	325.33
			24-May-11	0.58	326.46
			30-Aug-11	1.27	325.78
			21-Nov-11	1.33	325.71
			22-Feb-12	0.96	326.08
			4-May-12	1.10	325.94
			8-Aug-12	1.72	325.32
			15-Nov-12	1.47	325.57
			29-Jan-13	1.21	325.83
			1-May-13	0.64	326.40
			16-Aug-13	1.21	325.83
			20-Nov-13	1.09	325.95
			19-Feb-14	1.16	325.88
			27-May-14	0.74	326.30
			21-Aug-14	1.21	325.83
			25-Nov-14	0.90	326.14
			26-Feb-15	1.37	325.67
			28-May-15	1.24	325.81
			19-Aug-15	1.28	325.76
			30-Nov-15	1.46	325.58
			25-Feb-16	1.09	325.95
			28-Apr-16	0.69	326.35
			12-Sep-16	1.43	325.61
			21-Nov-16	1.64	325.40
			24-Jan-17	0.77	326.27
			17-May-17	0.64	326.40
			28-Aug-17	1.19	325.86
			27-Nov-17	1.31	325.73
			12-Feb-18	1.24	325.81
			7-May-18	0.79	326.25
			20-Aug-18	1.42	325.62
			19-Nov-18	1.39	325.65
			26-Feb-19	1.05	325.99
			16-Apr-19	0.70	326.34
			23-Jul-19	1.05	325.99
			13-Nov-19	1.13	325.91
			10-Feb-20	0.95	326.09
			5-May-20	1.04	326.00
			30-Jul-20	1.53	325.51
			16-Oct-20	1.70	325.34
			22-Jan-21	1.40	325.64
			13-Apr-21	1.21	325.83
			1-Jun-21	1.54	325.50
			14-Jul-21	1.63	325.41
			2-Nov-21	2.03	325.02
			31-Jan-22	1.91	325.13
			4-May-22	1.21	325.83
			25-Aug-22	2.01	325.03
			2-Dec-22	2.22	324.82

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP1	325.59	324.84	3-Sep-03	0.74	324.85
			5-Sep-03	0.74	324.85
			15-Sep-03	0.75	324.85
			7-Oct-03	0.66	324.94
			12-Feb-04	0.40	325.19
			19-Apr-04	0.30	325.30
			19-Aug-04	0.51	325.08
			15-Nov-04	0.57	325.02
			9-Feb-05	frozen	-
			11-Apr-05	0.29	325.30
			25-Aug-05	0.62	324.97
			8-Nov-05	0.86	324.73
			16-Jan-06	0.45	325.15
			11-Apr-06	0.35	325.24
			17-Aug-06	0.72	324.87
			27-Nov-06	0.42	325.17
			30-Jan-07	0.37	325.23
			9-Apr-07	0.30	325.29
			16-Aug-07	0.83	324.77
			1-Nov-07	1.01	324.58
			6-Jan-08	0.64	324.96
			12-Apr-08	0.25	325.34
			20-Aug-08	0.43	325.16
			18-Nov-08	0.71	324.88
			9-Feb-09	0.64	324.95
			5-Aug-09	0.45	325.14
			2-Dec-09	0.68	324.91
			2-Feb-10	0.44	325.16
			30-Apr-10	0.54	325.05
			1-Sep-10	0.80	324.79
			29-Nov-10	0.67	324.92
			28-Feb-11	Frozen	
			24-May-11	0.23	325.37
			30-Aug-11	0.48	325.11
			21-Nov-11	0.54	325.05
			22-Feb-12	0.47	325.12
			4-May-12	0.58	325.01
			8-Aug-12	1.02	324.57
			15-Nov-12	0.66	324.93
			29-Jan-13	0.58	325.01
			1-May-13	0.30	325.29
			16-Aug-13	0.51	325.08
			20-Nov-13	0.36	325.24
			19-Feb-14	0.46	325.13
			27-May-14	0.55	325.04
			21-Aug-14	0.56	325.03
			25-Nov-14	0.38	325.21
			26-Feb-15	frozen	
			28-May-15	0.51	325.08
			19-Aug-15	0.51	325.08
			30-Nov-15	0.65	324.94

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)			
MP1	325.59	324.84	25-Feb-16	0.38	325.21
			28-Apr-16	0.33	325.26
			12-Sep-16	0.66	324.93
			21-Nov-16	0.89	324.70
			24-Jan-17	0.32	325.27
			17-May-17	0.31	325.28
			28-Aug-17	0.50	325.09
			27-Nov-17	0.54	325.05
			12-Feb-18	0.40	325.19
			7-May-18	0.26	325.33
			20-Aug-18	0.79	324.80
			19-Nov-18	0.68	324.91
			26-Feb-19	0.37	325.22
			16-Apr-19	0.40	325.19
			23-Jul-19	0.45	325.14
			13-Nov-19	0.55	325.04
			10-Feb-20	0.47	325.12
			5-May-20	0.52	325.07
			30-Jul-20	0.81	324.78
			16-Oct-20	0.98	324.61
			22-Jan-21	0.67	324.92
			13-Apr-21	0.59	325.00
			1-Jun-21	0.61	324.98
			14-Jul-21	0.76	324.83
			2-Nov-21	0.75	324.84
			31-Jan-22	frozen	
			4-May-22	0.38	325.21
			25-Aug-22	0.92	324.67
			2-Dec-22	1.14	324.45

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP1	325.59	324.84	3-Sep-03	0.66	324.93
(outside)[1]			5-Sep-03	0.69	324.90
			15-Sep-03	dry	
			7-Oct-03	0.55	325.04
			12-Feb-04	frozen	
			19-Apr-04	0.43	325.16
			19-Aug-04	0.52	325.07
			15-Nov-04	0.53	325.06
			9-Feb-05	frozen	
			11-Apr-05	0.42	325.18
			25-Aug-05	0.58	325.01
			8-Nov-05	dry	
			16-Jan-06	frozen	
			11-Apr-06	0.43	325.16
			17-Aug-06	0.66	324.93
			27-Nov-06	0.45	325.14
			30-Jan-07	frozen	
			9-Apr-07	0.43	325.16
			16-Aug-07	dry	
			1-Nov-07	dry	
			6-Jan-08	frozen	
			12-Apr-08	0.35	325.24
			20-Aug-08	0.53	325.06
			18-Nov-08	0.50	325.09
			9-Feb-09	0.48	325.11
			5-Aug-09	0.49	325.10
			2-Dec-09	0.64	324.95
			2-Feb-10	0.43	325.16
			30-Apr-10	0.53	325.06
			1-Sep-10	0.70	324.89
			29-Nov-10	0.65	324.94
			28-Feb-11	frozen	
			24-May-11	0.38	325.21
			30-Aug-11	0.56	325.03
			21-Nov-11	0.54	325.06
			22-Feb-12	0.51	325.08
			4-May-12	0.60	324.99
			8-Aug-12	0.75	324.84
			15-Nov-12	0.63	324.96
			29-Jan-13	frozen	
			1-May-13	0.44	325.15
			16-Aug-13	0.54	325.05
			20-Nov-13	frozen	
			19-Feb-14	frozen	
			27-May-14	0.63	324.97
			21-Aug-14	0.51	325.08
			25-Nov-14	0.43	325.16
			26-Feb-15	frozen	
			28-May-15	0.50	325.09
			19-Aug-15	0.53	325.06
			30-Nov-15	0.60	324.99

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)			
MP1	325.59	324.84	25-Feb-16	0.45	325.14
(outside)[1]			28-Apr-16	0.45	325.14
			12-Sep-16	0.63	324.96
			21-Nov-16	dry	
			24-Jan-17	0.45	325.14
			17-May-17	0.41	325.18
			28-Aug-17	0.54	325.05
			27-Nov-17	0.54	325.05
			12-Feb-18	frozen	
			7-May-18	0.41	325.18
			20-Aug-18	dry	
			19-Nov-18	0.48	325.11
			26-Feb-19	frozen	
			16-Apr-19	0.41	325.18
			23-Jul-19	0.46	325.13
			13-Nov-19	0.48	325.11
			10-Feb-20	0.43	325.16
			5-May-20	0.44	325.15
			30-Jul-20	dry	
			16-Oct-20	dry	
			22-Jan-21	frozen	
			13-Apr-21	0.49	325.10
			1-Jun-21	0.66	324.93
			14-Jul-21	0.63	324.96
			2-Nov-21	0.76	324.83
			31-Jan-22	frozen	
			4-May-22	0.46	325.13
			25-Aug-22	dry	
			2-Dec-22	moist	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP2-I	325.59	324.59	3-Sep-03	1.59	324.00
			5-Sep-03	0.98	324.61
			15-Sep-03	1.05	324.54
			7-Oct-03	0.83	324.76
			12-Feb-04	0.03	325.56
			19-Apr-04	0.43	325.16
			19-Aug-04	0.74	324.86
			15-Nov-04	0.83	324.76
			9-Feb-05	frozen	
			11-Apr-05	0.53	325.06
			25-Aug-05	0.89	324.70
			8-Nov-05	1.13	324.46
			16-Jan-06	frozen	
			11-Apr-06	0.66	324.93
			17-Aug-06	0.67	324.92
			27-Nov-06	0.63	324.96
			30-Jan-07	frozen	
			9-Apr-07	0.21	325.38
			16-Aug-07	0.82	324.77
			1-Nov-07	1.35	324.24
			6-Jan-08	frozen	
			12-Apr-08	0.43	325.16
			20-Aug-08	0.37	325.22
			18-Nov-08	0.59	325.00
			9-Feb-09	0.50	325.09
			5-Aug-09	0.63	324.96
			2-Dec-09	0.92	324.67
			2-Feb-10	covered under snow	
			30-Apr-10	could not locate	
			1-Sep-10		
			29-Nov-10	1.05	324.54
			28-Feb-11	frozen	
			24-May-11	0.56	325.03
			30-Aug-11	0.99	324.60
			21-Nov-11	1.02	324.57
			22-Feb-12	0.74	324.86
			4-May-12	1.03	324.56
			8-Aug-12	1.46	324.13
			15-Nov-12	1.09	324.50
			29-Jan-13	frozen	
			1-May-13	1.05	324.54
			16-Aug-13	0.92	324.67
			20-Nov-13	0.81	324.78
			19-Feb-14	frozen	
			27-May-14	0.64	324.96
			21-Aug-14	0.95	324.65
			25-Nov-14	0.69	324.90
			26-Feb-15	frozen	
			28-May-15	0.94	324.65
			19-Aug-15	0.46	325.13
			30-Nov-15	0.69	324.90

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG	Groundwater Elevation
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)		(m)	(m.a.s.l.)
MP2-I	325.59	324.59	25-Feb-16	0.80	324.79
			28-Apr-16	inaccessible	
			12-Sep-16	0.58	325.01
			21-Nov-16	0.89	324.70
			24-Jan-17	0.32	325.27
			17-May-17		
			28-Aug-17	0.46	325.13
			27-Nov-17	0.67	324.92
			12-Feb-18	frozen	
			7-May-18	0.67	324.92
			20-Aug-18	1.33	324.26
			19-Nov-18	1.08	324.51
			26-Feb-19	frozen	
			16-Apr-19	0.65	324.94
			23-Jul-19	0.94	324.65
			13-Nov-19	0.92	324.67
			10-Feb-20	0.87	324.72
			5-May-20	0.95	324.64
			30-Jul-20	1.33	324.26
			16-Oct-20	1.46	324.13
			22-Jan-21	frozen	
			13-Apr-21	0.90	324.69
			1-Jun-21	1.28	324.31
			14-Jul-21	1.23	324.36
			2-Nov-21	2.87	322.72
			31-Jan-22	frozen	
			4-May-22	0.75	324.84
			25-Aug-22	2.94	322.65
			2-Dec-22	1.65	323.94

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)			
MP2-I	325.59	324.59	3-Sep-03	0.97	324.62
(outside)[1]			5-Sep-03	dry	
			15-Sep-03	dry	
			7-Oct-03	0.78	324.81
			12-Feb-04	frozen	
			19-Apr-04	0.51	325.08
			19-Aug-04	0.59	325.00
			15-Nov-04	0.75	324.84
			9-Feb-05	frozen	
			11-Apr-05	0.64	324.95
			25-Aug-05	0.83	324.76
			8-Nov-05	dry	
			16-Jan-06	frozen	
			11-Apr-06	0.59	325.00
			17-Aug-06	dry	
			27-Nov-06	0.63	324.96
			30-Jan-07	frozen	
			9-Apr-07	0.29	325.30
			16-Aug-07	dry	
			1-Nov-07	dry	
			6-Jan-08	frozen	
			12-Apr-08	0.55	325.04
			20-Aug-08	0.33	325.26
			18-Nov-08	0.29	325.30
			9-Feb-09	0.24	325.35
			5-Aug-09	0.30	325.29
			2-Dec-09	0.74	324.85
			2-Feb-10	covered under snow	
			30-Apr-10	could not locate	
			1-Sep-10		
			29-Nov-10	frozen	
			28-Feb-11	frozen	
			24-May-11	0.63	324.96
			30-Aug-11	dry	
			21-Nov-11	dry	
			22-Feb-12	frozen	
			4-May-12	1.01	324.58
			8-Aug-12	dry	
			15-Nov-12	1.07	324.52
			29-Jan-13	frozen	
			1-May-13	1.02	324.57
			16-Aug-13	0.83	324.77
			20-Nov-13	0.76	324.83
			19-Feb-14	frozen	
			27-May-14	0.64	324.95
			21-Aug-14	0.80	324.79
			25-Nov-14	0.74	324.85
			26-Feb-15	0.77	324.82
			28-May-15	0.81	324.78
			19-Aug-15	0.53	325.06
			30-Nov-15	frozen	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG	Groundwater Elevation
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)		(m)	(m.a.s.l.)
MP2-I	325.59	324.59	25-Feb-16	frozen	
(outside)[1]			28-Apr-16	inaccessible	
			12-Sep-16	saturated	
			21-Nov-16	dry	
			24-Jan-17	0.36	325.23
			17-May-17		
			28-Aug-17	0.46	325.13
			27-Nov-17	frozen	
			12-Feb-18	frozen	
			7-May-18	0.80	324.79
			20-Aug-18	dry	
			19-Nov-18	frozen	
			26-Feb-19	frozen	
			16-Apr-19	0.65	324.94
			23-Jul-19	0.77	324.82
			13-Nov-19	frozen	
			10-Feb-20	frozen	
			5-May-20	0.80	324.79
			30-Jul-20	dry	
			16-Oct-20	dry	
			22-Jan-21	frozen	
			13-Apr-21	0.79	324.80
			1-Jun-21	dry	
			14-Jul-21	1.04	324.55
			2-Nov-21	dry	
			31-Jan-22	frozen	
			4-May-22	0.78	324.82
			25-Aug-22	dry	
			2-Dec-22	moist	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG	Groundwater Elevation
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)		(m)	(m.a.s.l.)
MP2-II	325.20	324.60	3-Sep-03	1.03	324.17
			5-Sep-03	0.60	324.60
			15-Sep-03	0.66	324.55
			7-Oct-03	0.44	324.76
			12-Feb-04	0.49	324.72
			19-Apr-04	0.12	325.08
			19-Aug-04	0.35	324.85
			15-Nov-04	0.43	324.77
			9-Feb-05	frozen	
			11-Apr-05	0.16	325.04
			25-Aug-05	0.52	324.68
			8-Nov-05	0.75	324.45
			16-Jan-06	frozen	
			11-Apr-06	0.80	324.40
			17-Aug-06	1.05	324.15
			27-Nov-06	0.27	324.93
			30-Jan-07	frozen	
			9-Apr-07	0.49	324.71
			16-Aug-07	1.18	324.02
			1-Nov-07	0.97	324.24
			6-Jan-08	frozen	
			12-Apr-08	0.07	325.13
			20-Aug-08	0.74	324.46
			18-Nov-08	0.65	324.55
			9-Feb-09	frozen	
			5-Aug-09	0.72	324.48
			2-Dec-09	1.06	324.14
			2-Feb-10	covered under snow	
			30-Apr-10	could not locate	
			1-Sep-10		
			29-Nov-10	0.71	324.49
			28-Feb-11	frozen	
			24-May-11	0.15	325.05
			30-Aug-11	0.81	324.40
			21-Nov-11	0.82	324.38
			22-Feb-12	0.37	324.83
			4-May-12	0.65	324.56
			8-Aug-12	1.09	324.11
			15-Nov-12	0.70	324.50
			29-Jan-13	frozen	
			1-May-13	0.67	324.53
			16-Aug-13	0.50	324.71
			20-Nov-13	0.35	324.85
			19-Feb-14	0.29	324.91
			21-Aug-14	0.57	324.63
			25-Nov-14	0.42	324.78
			26-Feb-15	frozen	
			28-May-15	0.50	324.70
			19-Aug-15	0.93	324.27
			30-Nov-15	1.06	324.14
			25-Feb-16	0.80	324.40

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP2-II	325.20	324.60	28-Apr-16	inaccessible	
			12-Sep-16	1.12	324.08
			21-Nov-16	1.32	323.88
			24-Jan-17	0.72	324.48
			17-May-17	0.72	324.49
			28-Aug-17	0.93	324.27
			27-Nov-17	0.97	324.23
			12-Feb-18	frozen	
			7-May-18	0.22	324.98
			20-Aug-18	0.84	324.36
			19-Nov-18	0.67	324.53
			26-Feb-19	frozen	
			16-Apr-19	0.23	324.97
			23-Jul-19	0.48	324.72
			13-Nov-19	0.51	324.69
			10-Feb-20	0.41	324.79
			5-May-20	0.50	324.70
			30-Jul-20	0.88	324.32
			16-Oct-20	0.93	324.27
			22-Jan-21	0.41	324.79
			13-Apr-21	0.48	324.72
			1-Jun-21	0.75	324.45
			14-Jul-21	0.79	324.41
			2-Nov-21	0.77	324.43
			31-Jan-22	frozen	
			4-May-22	0.33	324.87
			25-Aug-22	2.94	322.26
			2-Dec-22	1.24	323.96

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP2-II (outside)[1]	325.20	324.60	3-Sep-03	0.57	324.63
			5-Sep-03	dry	
			15-Sep-03	dry	
			7-Oct-03	0.43	324.77
			12-Feb-04	frozen	
			19-Apr-04	0.12	325.08
			19-Aug-04	0.21	324.99
			15-Nov-04	0.37	324.83
			9-Feb-05	frozen	
			11-Apr-05	0.25	324.95
			25-Aug-05	0.45	324.75
			8-Nov-05	dry	
			16-Jan-06	frozen	
			11-Apr-06	0.22	324.98
			17-Aug-06	dry	
			27-Nov-06	0.27	324.93
			30-Jan-07	frozen	
			9-Apr-07	0.56	324.64
			16-Aug-07	dry	
			1-Nov-07	dry	
			6-Jan-08	frozen	
			12-Apr-08	0.19	325.01
			20-Aug-08	0.68	324.52
			18-Nov-08	frozen	
			9-Feb-09	frozen	
			5-Aug-09	0.60	324.60
			2-Dec-09	1.01	324.19
			2-Feb-10	covered under snow	
			30-Apr-10	could not locate	
			1-Sep-10		
			29-Nov-10	frozen	
			28-Feb-11	frozen	
			24-May-11	0.25	324.95
			30-Aug-11	dry	
			21-Nov-11	dry	
			22-Feb-12	0.33	324.87
			4-May-12	0.63	324.57
			8-Aug-12	dry	
			15-Nov-12	0.71	324.50
			29-Jan-13	frozen	
			1-May-13	0.65	324.55
			16-Aug-13	0.45	324.75
			20-Nov-13	0.39	324.81
			19-Feb-14	frozen	
			21-Aug-14	0.43	324.77
			25-Nov-14	0.35	324.85
			26-Feb-15	frozen	
			28-May-15	0.43	324.77
			19-Aug-15	0.84	324.36
			30-Nov-15	frozen	
			25-Feb-16	frozen	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG	Groundwater Elevation
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)		(m)	(m.a.s.l.)
MP2-II (outside)[1]	325.20	324.60	28-Apr-16	inaccessible	
			12-Sep-16	saturated	
			21-Nov-16	dry	
			24-Jan-17	0.76	324.44
			17-May-17	0.71	324.49
			28-Aug-17	0.84	324.36
			27-Nov-17	frozen	
			12-Feb-18	frozen	
			7-May-18	0.33	324.87
			20-Aug-18	dry	
			19-Nov-18	frozen	
			26-Feb-19	frozen	
			16-Apr-19	0.30	324.90
			23-Jul-19	0.34	324.86
			13-Nov-19	frozen	
			10-Feb-20	frozen	
			5-May-20	0.39	324.81
			30-Jul-20	dry	
			16-Oct-20	dry	
			22-Jan-21	frozen	
			13-Apr-21	0.38	324.82
			1-Jun-21	dry	
			14-Jul-21	0.63	324.57
			2-Nov-21	0.72	324.48
			31-Jan-22	frozen	
			4-May-22	0.37	324.83
			25-Aug-22	dry	
			2-Dec-22	moist	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP3-I	324.71	324.11	3-Sep-03	3.10	321.62
			5-Sep-03	2.45	322.26
			15-Sep-03	1.18	323.54
			7-Oct-03	0.68	324.04
			12-Feb-04	Inaccessible	
			19-Apr-04	0.16	324.55
			19-Aug-04	0.47	324.24
			15-Nov-04	0.62	324.09
			9-Feb-05	frozen	
			11-Apr-05	0.08	324.63
			25-Aug-05	0.64	324.07
			8-Nov-05	0.78	323.93
			16-Jan-06	frozen	
			11-Apr-06	0.13	324.58
			17-Aug-06	0.64	324.07
			27-Nov-06	0.26	324.45
			30-Jan-07	frozen	
			9-Apr-07	0.03	324.69
			16-Aug-07	0.63	324.08
			1-Nov-07	0.93	323.78
			6-Jan-08	0.60	324.11
			12-Apr-08	Underwater	
			20-Aug-08	0.28	324.43
			18-Nov-08	0.45	324.26
			9-Feb-09	frozen	
			5-Aug-09	0.33	324.39
			2-Dec-09	0.51	324.20
			2-Feb-10	covered under snow	
			30-Apr-10	under water	
			1-Sep-10	0.74	323.98
			29-Nov-10	0.74	323.97
			28-Feb-11	frozen	
			24-May-11	0.00	324.71
			30-Aug-11	0.76	323.95
			21-Nov-11	0.52	324.19
			22-Feb-12	0.11	324.60
			4-May-12	0.31	324.40
			8-Aug-12	1.05	323.66
			15-Nov-12	0.76	323.95
			29-Jan-13	0.43	324.28
			1-May-13	0.06	324.65
			16-Aug-13	0.39	324.32
			20-Nov-13	0.33	324.38
			19-Feb-14	frozen	
			27-May-14	0.09	324.62
			21-Aug-14	0.98	323.73
			25-Nov-14	0.66	324.05
			26-Feb-15	frozen	
			28-May-15	0.36	324.35
			19-Aug-15	0.87	323.84
			30-Nov-15	0.69	324.02

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP3-I	324.71	324.11	25-Feb-16	0.62	324.09
			28-Apr-16	0.00	324.71
			12-Sep-16	0.65	324.06
			21-Nov-16	0.85	323.86
			24-Jan-17	0.32	324.39
			17-May-17	0.05	324.66
			28-Aug-17	0.53	324.18
			27-Nov-17	0.61	324.10
			12-Feb-18	frozen	
			7-May-18	0.10	324.61
			20-Aug-18	0.80	323.91
			19-Nov-18	0.37	324.34
			26-Feb-19	0.27	324.44
			16-Apr-19	0.18	324.53
			23-Jul-19	0.35	324.36
			13-Nov-19	0.74	323.97
			10-Feb-20	0.45	324.26
			5-May-20	0.39	324.32
			30-Jul-20	0.75	323.96
			16-Oct-20	0.98	323.73
			22-Jan-21	0.72	323.99
			13-Apr-21	0.54	324.17
			1-Jun-21	0.67	324.04
			14-Jul-21	0.79	323.92
			2-Nov-21	0.69	324.02
			31-Jan-22	0.72	323.99
			4-May-22	0.17	324.54
			25-Aug-22	0.82	323.89
			2-Dec-22	1.16	323.55

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG	Groundwater Elevation
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)		(m)	(m.a.s.l.)
MP3-I	324.71	324.11	3-Sep-03	dry	
(outside)[1]			5-Sep-03	dry	
			15-Sep-03	dry	
			7-Oct-03	dry	
			12-Feb-04	frozen	
			19-Apr-04	0.18	324.53
			19-Aug-04	0.52	324.20
			15-Nov-04	dry	
			9-Feb-05	frozen	
			11-Apr-05	0.17	324.54
			25-Aug-05	dry	
			8-Nov-05	dry	
			16-Jan-06	frozen	
			11-Apr-06	0.19	324.52
			17-Aug-06	dry	
			27-Nov-06	0.26	324.45
			30-Jan-07	frozen	
			9-Apr-07	0.25	324.46
			16-Aug-07	dry	
			1-Nov-07	dry	
			6-Jan-08	0.50	324.21
			12-Apr-08	Underwater	
			20-Aug-08	0.40	324.31
			18-Nov-08	0.29	324.43
			9-Feb-09	frozen	
			5-Aug-09	0.35	324.36
			2-Dec-09	0.50	324.21
			2-Feb-10	covered under snow	
			30-Apr-10	Underwater	
			1-Sep-10	dry	
			29-Nov-10	dry	
			28-Feb-11	frozen	
			24-May-11	0.08	324.63
			30-Aug-11	dry	
			21-Nov-11	dry	
			22-Feb-12	0.25	324.46
			4-May-12	0.32	324.39
			8-Aug-12	dry	
			15-Nov-12	dry	
			29-Jan-13	frozen	
			1-May-13	0.20	324.51
			16-Aug-13	dry	
			20-Nov-13	0.35	324.36
			19-Feb-14	frozen	
			27-May-14	0.20	324.51
			21-Aug-14	0.20	324.51
			25-Nov-14	0.55	324.16
			26-Feb-15	frozen	
			28-May-15	saturated	
			19-Aug-15	dry	
			30-Nov-15	dry	

Table C1. Summary of Groundwater Elevations

Project Name: St Marys Mast-Snyder Property

Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP3-I	324.71	324.11	25-Feb-16	0.65	324.06
(outside)[1]			28-Apr-16	0.21	324.50
			12-Sep-16	dry	
			21-Nov-16	dry	
			24-Jan-17	0.22	324.49
			17-May-17	0.23	324.48
			28-Aug-17	0.53	324.19
			27-Nov-17	dry	
			12-Feb-18	frozen	
			7-May-18	0.26	324.45
			20-Aug-18	dry	
			19-Nov-18	0.48	324.23
			26-Feb-19	frozen	
			16-Apr-19	0.24	324.47
			23-Jul-19	0.35	324.36
			13-Nov-19	0.71	324.00
			10-Feb-20	0.26	324.45
			5-May-20	0.36	324.35
			30-Jul-20	dry	
			16-Oct-20	dry	
			22-Jan-21	frozen	
			13-Apr-21	0.32	324.39
			1-Jun-21	dry	
			14-Jul-21	dry	
			2-Nov-21	dry	
			31-Jan-22	dry	
			4-May-22	0.25	324.46
			25-Aug-22	dry	
			2-Dec-22	moist	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP3-II	325.04	324.04	3-Sep-03	1.54	323.51
			5-Sep-03	1.19	323.85
			15-Sep-03	1.17	323.88
			7-Oct-03	0.97	324.08
			12-Feb-04	0.46	324.58
			19-Apr-04	0.47	324.58
			19-Aug-04	0.86	324.19
			15-Nov-04	0.99	324.05
			9-Feb-05	frozen	
			11-Apr-05	0.37	324.68
			25-Aug-05	1.02	324.02
			8-Nov-05	1.23	323.81
			16-Jan-06	frozen	
			11-Apr-06	0.46	324.58
			17-Aug-06	1.09	323.95
			27-Nov-06	0.59	324.45
			30-Jan-07	frozen	
			9-Apr-07	0.36	324.68
			16-Aug-07	1.23	323.81
			1-Nov-07	1.47	323.58
			6-Jan-08	0.86	324.18
			12-Apr-08	0.26	324.78
			20-Aug-08	0.66	324.39
			18-Nov-08	0.62	324.42
			9-Feb-09	frozen	
			5-Aug-09	0.72	324.32
			2-Dec-09	0.86	324.18
			2-Feb-10	covered under snow	
			30-Apr-10	0.48	324.56
			1-Sep-10	1.17	323.87
			29-Nov-10	1.06	323.98
			28-Feb-11	frozen	
			24-May-11	0.38	324.66
			30-Aug-11	1.09	323.95
			21-Nov-11	0.93	324.11
			22-Feb-12	0.58	324.46
			4-May-12	0.69	324.35
			8-Aug-12	1.41	323.63
			15-Nov-12	1.06	323.98
			29-Jan-13	frozen	
			1-May-13	0.43	324.61
			16-Aug-13	0.86	324.18
			20-Nov-13	0.68	324.36
			19-Feb-14	frozen	
			27-May-14	0.44	324.60
			21-Aug-14	0.51	324.53
			25-Nov-14	0.34	324.70
			26-Feb-15	frozen	
			28-May-15	0.83	324.21
			19-Aug-15	0.46	324.58
			30-Nov-15	1.05	323.99

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP3-II	325.04	324.04	25-Feb-16	0.29	324.75
			28-Apr-16	1.63	323.41
			12-Sep-16	1.11	323.93
			21-Nov-16	1.24	323.80
			24-Jan-17	0.52	324.52
			17-May-17	0.51	324.54
			28-Aug-17	0.53	324.51
			27-Nov-17	0.90	324.14
			12-Feb-18	frozen	
			7-May-18	0.50	324.54
			20-Aug-18	1.27	323.77
			19-Nov-18	0.93	324.11
			26-Feb-19	0.62	324.42
			16-Apr-19	0.58	324.46
			23-Jul-19	0.73	324.31
			13-Nov-19	0.56	324.48
			10-Feb-20	0.60	324.44
			5-May-20	0.79	324.25
			30-Jul-20	1.27	323.77
			16-Oct-20	1.37	323.67
			22-Jan-21	0.94	324.10
			13-Apr-21	0.75	324.29
			1-Jun-21	1.17	323.87
			14-Jul-21	1.17	323.87
			2-Nov-21	1.05	323.99
			31-Jan-22	1.22	323.82
			4-May-22	blocked	
			25-Aug-22	1.40	323.64
			2-Dec-22	1.62	323.42

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG	Groundwater Elevation
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)		(m)	(m.a.s.l.)
MP3-II (outside)[1]	325.04	324.04	3-Sep-03	dry	
			5-Sep-03	dry	
			15-Sep-03	dry	
			7-Oct-03	dry	
			12-Feb-04	frozen	
			19-Apr-04	0.51	324.54
			19-Aug-04	0.85	324.20
			15-Nov-04	dry	
			9-Feb-05	frozen	
			11-Apr-05	0.49	324.55
			25-Aug-05	dry	
			8-Nov-05	dry	
			16-Jan-06	frozen	
			11-Apr-06	0.49	324.55
			17-Aug-06	dry	
			27-Nov-06	0.60	324.44
			30-Jan-07	frozen	
			9-Apr-07	0.46	324.58
			16-Aug-07	dry	
			1-Nov-07	dry	
			6-Jan-08	0.80	324.25
			12-Apr-08	0.27	324.78
			20-Aug-08	0.73	324.31
			18-Nov-08	0.67	324.37
			9-Feb-09	frozen	
			5-Aug-09	0.67	324.37
			2-Dec-09	0.82	324.22
			2-Feb-10	covered under snow	
			30-Apr-10	0.37	324.67
			1-Sep-10	dry	
			29-Nov-10	dry	
			28-Feb-11	frozen	
			24-May-11	0.44	324.60
			30-Aug-11	dry	
			21-Nov-11	dry	
			22-Feb-12	0.59	324.45
			4-May-12	0.66	324.38
			8-Aug-12	dry	
			15-Nov-12	dry	
			29-Jan-13	frozen	
			1-May-13	0.51	324.53
			16-Aug-13	dry	
			20-Nov-13	0.69	324.35
			19-Feb-14	frozen	
			27-May-14	0.55	324.49
			21-Aug-14	0.53	324.51
			25-Nov-14	0.23	324.81
			26-Feb-15	frozen	
			28-May-15	saturated	
			19-Aug-15	dry	
			30-Nov-15	dry	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG	Groundwater Elevation
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)		(m)	(m.a.s.l.)
MP3-II	325.04	324.04	25-Feb-16	0.29	324.75
(outside)[1]			28-Apr-16	0.55	324.49
			12-Sep-16	dry	
			21-Nov-16	dry	
			24-Jan-17	0.58	324.46
			17-May-17	0.59	324.45
			28-Aug-17	0.53	324.52
			27-Nov-17	dry	
			12-Feb-18	frozen	
			7-May-18	0.63	324.41
			20-Aug-18	dry	
			19-Nov-18	0.81	324.23
			26-Feb-19	frozen	
			16-Apr-19	0.56	324.48
			23-Jul-19	0.71	324.33
			13-Nov-19	0.33	324.71
			10-Feb-20	0.62	324.42
			5-May-20	0.75	324.29
			30-Jul-20	dry	
			16-Oct-20	dry	
			22-Jan-21	frozen	
			13-Apr-21	0.71	324.33
			1-Jun-21	dry	
			14-Jul-21	dry	
			2-Nov-21	dry	
			31-Jan-22	dry	
			4-May-22	0.65	324.40
			25-Aug-22	dry	
			2-Dec-22	moist	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP4	325.61	324.25	29-Jun-04	1.19	324.43
			19-Aug-04	1.24	324.38
			9-Dec-04	1.28	324.33
			9-Feb-05	0.89	324.72
			11-Apr-05	0.37	325.24
			25-Aug-05	1.29	324.32
			8-Nov-05	1.50	324.11
			16-Jan-06	0.99	324.62
			11-Apr-06	0.57	325.04
			17-Aug-06	1.34	324.27
			27-Nov-06	Note 3	
MP4R	325.63	324.25	14-Jun-10	2.39	323.24
			1-Sep-10	1.58	324.05
			29-Nov-10	1.60	324.04
			28-Feb-11	iced over	
			24-May-11	underwater	
			30-Aug-11	destroyed	
	326.39	324.73	20-Nov-13	re-installed	
			19-Feb-14	0.94	325.46
			27-May-14		
			21-Aug-14	2.20	324.19
			25-Nov-14	1.90	324.49
			26-Feb-15	2.96	323.43
			28-May-15	1.95	324.45
			19-Aug-15		
			30-Nov-15	2.36	324.03
			25-Feb-16	1.90	324.49
			28-Apr-16	inaccessible	
			12-Sep-16	2.93	323.46
			21-Nov-16	2.55	323.84
			24-Jan-17	1.58	324.81
			17-May-17	1.42	324.97
			28-Aug-17	2.06	324.34
			27-Nov-17	2.27	324.12
			12-Feb-18	2.10	324.29
			7-May-18	1.49	324.90
			20-Aug-18	2.43	323.96
	325.67	324.76	19-Nov-18	2.28	324.11
			26-Feb-19	1.07	324.60
			16-Apr-19	0.67	325.00
			23-Jul-19	0.98	324.69
			13-Nov-19	1.13	324.54
			10-Feb-20	0.76	324.91
			5-May-20	0.92	324.75
			30-Jul-20	1.74	323.93
			16-Oct-20	1.74	323.93
			22-Jan-21	1.48	324.19
			13-Apr-21	1.23	324.44
			1-Jun-21	1.62	324.05
			14-Jul-21	1.64	324.03
			2-Nov-21	1.51	324.16
			31-Jan-22	dry	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
			4-May-22	0.95	324.72
			25-Aug-22	dry	
			2-Dec-22	dry	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG	Groundwater Elevation
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)		(m)	(m.a.s.l.)
MP4R	325.61	324.25	29-Jun-04	0.75	324.86
(outside)[1]			19-Aug-04	1.11	324.50
			9-Dec-04	1.28	324.33
			9-Feb-05	frozen	-
			11-Apr-05	0.26	325.35
			25-Aug-05	dry	-
			8-Nov-05	dry	-
			16-Jan-06	frozen	-
			11-Apr-06	0.44	325.17
			17-Aug-06	dry	
			27-Nov-06	Note 3	
	325.63	324.25	14-Jun-10	1.06	324.57
			1-Sep-10	1.23	324.40
			29-Nov-10	1.23	324.40
			28-Feb-11	iced over	
			24-May-11	underwater	
			30-Aug-11	destroyed	
	326.39	324.73	20-Nov-13	re-installed	
			19-Feb-14	snow	
			27-May-14	1.35	325.04
			21-Aug-14	saturated	
			25-Nov-14	saturated	
			26-Feb-15	1.46	324.93
			28-May-15	dry	
			19-Aug-15	dry	
			30-Nov-15	dry	
			25-Feb-16	dry	
			28-Apr-16	inaccessible	
			12-Sep-16	dry	
			21-Nov-16	dry	
			24-Jan-17	1.48	324.91
			17-May-17	1.34	325.05
			28-Aug-17	dry	
			27-Nov-17	dry	
			12-Feb-18	1.46	324.93
			7-May-18	1.35	325.04
			20-Aug-18	dry	
	325.67	324.76	19-Nov-18	dry	
			26-Feb-19	frozen	
			16-Apr-19	0.67	325.00
			23-Jul-19	0.84	324.83
			13-Nov-19	frozen	
			10-Feb-20	frozen	
			5-May-20	0.84	324.83
			30-Jul-20	dry	
			16-Oct-20	dry	
			22-Jan-21	0.94	324.73
			13-Apr-21	dry	
			1-Jun-21	dry	
			14-Jul-21	dry	
			2-Nov-21	dry	
			31-Jan-22	dry	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)			
			4-May-22	0.88	324.79
			25-Aug-22	dry	
			2-Dec-22	dry	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP5	325.72	324.10	29-Jun-04	1.53	324.19
			19-Aug-04	1.20	324.52
			9-Dec-04	1.28	324.44
			9-Feb-05	0.93	324.79
			11-Apr-05	0.36	325.36
			25-Aug-05	1.48	324.24
			8-Nov-05	1.73	323.99
			16-Jan-06	1.20	324.52
			11-Apr-06	0.72	325.00
			17-Aug-06	1.54	324.18
			27-Nov-06	0.97	324.75
			30-Jan-07	frozen	
			9-Apr-07	0.62	325.10
			16-Aug-07	1.71	324.01
			1-Nov-07	1.90	323.82
			6-Jan-08	1.45	324.27
			12-Apr-08	0.92	324.80
			20-Aug-08	1.12	324.60
			18-Nov-08	1.12	324.60
			9-Feb-09	frozen	
			5-Aug-09	1.04	324.68
			2-Dec-09	1.33	324.39
			2-Feb-10	1.11	324.61
			30-Apr-10	DESTROYED	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP5 (outside)[1]	325.72	324.10	29-Jun-04	0.85	324.88
			19-Aug-04	1.18	324.54
			9-Dec-04	1.24	324.48
			9-Feb-05	frozen	-
			11-Apr-05	0.36	325.36
			25-Aug-05	1.35	324.37
			8-Nov-05	dry	-
			16-Jan-06	frozen	-
			11-Apr-06	0.77	324.95
			17-Aug-06	dry	
			27-Nov-06	0.84	324.88
			30-Jan-07	frozen	
			9-Apr-07	frozen	
			16-Aug-07	dry	
			1-Nov-07	dry	
			6-Jan-08	frozen	
			12-Apr-08	0.60	325.12
			20-Aug-08	1.08	324.64
			18-Nov-08	1.11	324.61
			9-Feb-09	frozen	
			5-Aug-09	0.88	324.84
			2-Dec-09	1.25	324.47
			2-Feb-10	96.00	229.72
			30-Apr-10	DESTROYED	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP6	325.96	325.14	16-Jan-06	frozen	
			11-Apr-06	0.61	325.35
			17-Aug-06	0.83	325.13
			27-Nov-06	0.65	325.31
			30-Jan-07	frozen	
			9-Apr-07	0.53	325.43
			16-Aug-07	1.02	324.94
			1-Nov-07	1.25	324.71
			6-Jan-08	frozen	
			12-Apr-08	0.46	325.50
			20-Aug-08	0.68	325.28
			18-Nov-08	0.64	325.32
			9-Feb-09	0.55	325.41
			5-Aug-09	0.63	325.33
			2-Dec-09	0.74	325.22
			2-Feb-10	covered under snow	
			30-Apr-10	0.60	325.36
			1-Sep-10	0.72	325.24
			29-Nov-10	0.92	325.04
			28-Feb-11	0.70	325.26
			24-May-11	0.48	325.48
			30-Aug-11	0.87	325.09
			21-Nov-11	0.81	325.15
			22-Feb-12	0.64	325.32
			4-May-12	0.68	325.28
			8-Aug-12	1.24	324.72
			15-Nov-12	1.00	324.96
			29-Jan-13	0.74	325.22
			1-May-13	0.53	325.43
			16-Aug-13	0.71	325.25
			20-Nov-13	0.64	325.32
			19-Feb-14	covered under snow	
			27-May-14	0.53	325.43
			21-Aug-14	0.75	325.21
			25-Nov-14	0.65	325.31
			26-Feb-15	covered under snow	
			28-May-15	0.69	325.27
			19-Aug-15	0.74	325.22
			30-Nov-15	0.91	325.05
			25-Feb-16	0.64	325.32
			28-Apr-16	0.52	325.44
			12-Sep-16	0.86	325.10
			21-Nov-16	1.07	324.89
			24-Jan-17	0.67	325.29
			17-May-17	0.47	325.49
			28-Aug-17	0.76	325.20
			27-Nov-17	0.81	325.15
			12-Feb-18	0.67	325.30
			7-May-18	0.48	325.48
			20-Aug-18	0.95	325.01
			19-Nov-18	0.95	325.01

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)			
MP6	325.96	325.14	26-Feb-19	0.59	325.37
			16-Apr-19	0.65	325.31
			23-Jul-19	0.70	325.26
			13-Nov-19	0.75	325.21
			10-Feb-20	0.69	325.27
			5-May-20	0.72	325.24
			30-Jul-20	1.02	324.94
			16-Oct-20	1.15	324.81
			22-Jan-21	0.96	325.00
			13-Apr-21	0.84	325.12
			1-Jun-21	0.95	325.01
			14-Jul-21	0.96	325.00
			2-Nov-21	0.92	325.04
			31-Jan-22	1.00	324.96
			4-May-22	0.62	325.35
			25-Aug-22	can't locate	
			2-Dec-22	1.22	324.74

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG	Groundwater Elevation
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)		(m)	(m.a.s.l.)
MP6	325.96	325.14	16-Jan-06	frozen	
(outside)[1]			11-Apr-06	0.69	325.27
			17-Aug-06	dry	
			27-Nov-06	0.71	325.25
			30-Jan-07	0.73	325.23
			9-Apr-07	0.67	325.29
			16-Aug-07	dry	
			1-Nov-07	dry	
			6-Jan-08	frozen	
			12-Apr-08	0.57	325.39
			20-Aug-08	0.77	325.20
			18-Nov-08	0.73	325.23
			9-Feb-09	0.67	325.29
			5-Aug-09	0.72	325.24
			2-Dec-09	saturated	
			2-Feb-10	covered under snow	
			30-Apr-10	0.70	325.26
			1-Sep-10	dry	
			29-Nov-10	0.81	325.15
			28-Feb-11	frozen	
			24-May-11	0.67	325.29
			30-Aug-11	dry	
			21-Nov-11	0.83	325.13
			22-Feb-12	0.73	325.23
			4-May-12	0.76	325.20
			8-Aug-12	dry	
			15-Nov-12	dry	
			29-Jan-13	frozen	
			1-May-13	0.71	325.25
			16-Aug-13	dry	
			20-Nov-13	dry	
			19-Feb-14	covered under snow	
			27-May-14	0.63	325.34
			21-Aug-14	saturated	
			25-Nov-14	0.72	325.24
			26-Feb-15	covered under snow	
			28-May-15	saturated	
			19-Aug-15	dry	
			30-Nov-15	dry	
			25-Feb-16	0.71	325.25
			28-Apr-16	0.66	325.30
			12-Sep-16	dry	
			21-Nov-16	dry	
			24-Jan-17	0.70	325.26
			17-May-17	0.66	325.31
			28-Aug-17	0.76	325.20
			27-Nov-17	dry	
			12-Feb-18	dry	
			7-May-18	0.64	325.32
			20-Aug-18	dry	
			19-Nov-18	0.76	325.20

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP6	325.96	325.14	26-Feb-19	frozen	
(outside)[1]			16-Apr-19	0.67	325.29
			23-Jul-19	0.70	325.26
			13-Nov-19	0.75	325.21
			10-Feb-20	0.69	325.27
			5-May-20	0.72	325.24
			30-Jul-20	dry	
			16-Oct-20	dry	
			22-Jan-21	frozen	
			13-Apr-21	0.75	325.21
			1-Jun-21	dry	
			14-Jul-21	dry	
			2-Nov-21	dry	
			31-Jan-22	dry	
			4-May-22	0.72	325.24
			25-Aug-22	can't locate	
			2-Dec-22	moist	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP7	326.34	325.57	16-Jan-06	0.93	325.41
			11-Apr-06	0.65	325.69
			17-Aug-06	1.14	325.20
			27-Nov-06	0.77	325.57
			30-Jan-07	0.70	325.65
			9-Apr-07	0.54	325.80
			16-Aug-07	1.24	325.10
			1-Nov-07	1.51	324.83
			6-Jan-08	frozen	
			12-Apr-08	0.45	325.89
			20-Aug-08	0.86	325.49
			18-Nov-08	could not locate	
			9-Feb-09	0.62	325.72
			5-Aug-09	0.70	325.64
			2-Dec-09	0.82	325.52
			2-Feb-10	0.90	325.44
			30-Apr-10	0.67	325.67
			1-Sep-10	0.85	325.49
			29-Nov-10	1.25	325.09
			28-Feb-11	1.06	325.28
			24-May-11	0.45	325.89
			30-Aug-11	1.01	325.33
			21-Nov-11	1.10	325.24
			22-Feb-12	0.70	325.64
			4-May-12	0.86	325.48
			8-Aug-12	dry	
			15-Nov-12	1.24	325.10
			29-Jan-13	0.96	325.38
			1-May-13	0.68	325.66
			16-Aug-13	1.03	325.31
			20-Nov-13	0.86	325.48
			19-Feb-14	Covered under snow	
			27-May-14	0.72	325.62
			21-Aug-14	1.01	325.33
			25-Nov-14	0.73	325.61
			26-Feb-15	frozen	
			28-May-15	0.83	325.52
			19-Aug-15	0.83	325.51
			30-Nov-15	1.09	325.25
			25-Feb-16	0.77	325.57
			28-Apr-16	0.55	325.79
			12-Sep-16	0.97	325.37
			21-Nov-16	obstruction at 1.07	
			24-Jan-17	0.73	325.61
			17-May-17	0.42	325.92
			28-Aug-17	0.57	325.78
			27-Nov-17	0.67	325.67
			12-Feb-18	frozen	
			7-May-18	0.49	325.85
			20-Aug-18	0.60	325.74
			19-Nov-18	0.71	325.63

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP7	326.34	325.57	26-Feb-19	frozen	
			16-Apr-19	0.50	325.84
			23-Jul-19	0.31	326.03
			13-Nov-19	0.56	325.78
			10-Feb-20	0.38	325.96
			5-May-20	0.45	325.89
			30-Jul-20	0.86	325.48
			16-Oct-20	0.99	325.35
			22-Jan-21	0.97	325.37
			13-Apr-21	0.85	325.49
			1-Jun-21	0.76	325.58
			14-Jul-21	0.69	325.65
			2-Nov-21	0.87	325.47
			31-Jan-22	frozen	
			4-May-22	0.62	325.73
			25-Aug-22	can't locate	
			2-Dec-22	dry	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP7	326.34	325.57	16-Jan-06	dry	
(outside)[1]			11-Apr-06	0.74	325.60
			17-Aug-06	dry	
			27-Nov-06	0.78	325.56
			30-Jan-07	frozen	
			9-Apr-07	0.69	325.65
			16-Aug-07	dry	
			1-Nov-07	dry	
			6-Jan-08	frozen	
			12-Apr-08	0.60	325.74
			20-Aug-08	dry	
			18-Nov-08	could not locate	
			9-Feb-09	frozen	
			5-Aug-09	dry	
			2-Dec-09	dry	
			2-Feb-10	frozen	
			30-Apr-10	0.76	325.58
			1-Sep-10	dry	
			29-Nov-10	dry	
			28-Feb-11	0.49	325.85
			24-May-11	0.64	325.70
			30-Aug-11	dry	
			21-Nov-11	dry	
			22-Feb-12	0.72	325.62
			4-May-12	saturated	
			8-Aug-12	dry	
			15-Nov-12	dry	
			29-Jan-13	0.96	325.38
			1-May-13	0.70	325.64
			16-Aug-13	dry	
			20-Nov-13	dry	
			19-Feb-14	covered under snow	
			27-May-14	0.64	325.70
			21-Aug-14	dry	
			25-Nov-14	0.74	325.60
			26-Feb-15	frozen	
			28-May-15	dry	
			19-Aug-15	dry	
			30-Nov-15	dry	
			25-Feb-16	frozen	
			28-Apr-16	0.62	325.72
			12-Sep-16	dry	
			21-Nov-16	dry	
			24-Jan-17	0.67	325.67
			17-May-17	0.57	325.77
			28-Aug-17	0.77	325.57
			27-Nov-17	dry	
			12-Feb-18	frozen	
			7-May-18	0.62	325.72
			20-Aug-18	dry	
			19-Nov-18	frozen	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
MP7	326.34	325.57	26-Feb-19	frozen	
(outside)[1]			16-Apr-19	0.51	325.83
			23-Jul-19	0.58	325.76
			13-Nov-19	dry	
			10-Feb-20	dry	
			5-May-20	dry	
			30-Jul-20	dry	
			16-Oct-20	dry	
			22-Jan-21	frozen	
			13-Apr-21	dry	
			1-Jun-21	dry	
			14-Jul-21	dry	
			2-Nov-21	dry	
			31-Jan-22	dry	
			4-May-22	0.70	325.76
			25-Aug-22	can't locate	
			2-Dec-22	moist	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation Top of Pipe (m.a.s.l.)	Elevation Ground (m.a.s.l.)	Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
SG1 (Mink Farm Pond)			6-May-04	0.39	
			19-Aug-04		
			9-Dec-04	0.21	
			9-Feb-05	frozen @ 0.22	
			11-Apr-05	0.25	
			25-Aug-05	Note 2	
SG2 (Middle Pond)			6-May-04	0.68	
			19-Aug-04		
			9-Dec-04	0.61	
			9-Feb-05	frozen @ 0.75	
			11-Apr-05	0.80	
			25-Aug-05	0.68	
			8-Nov-05	0.55	
			16-Jan-06	frozen	
			11-Apr-06	0.76	
			17-Aug-06	0.61	
			27-Nov-06	0.72	
			30-Jan-07	frozen	
			9-Apr-07	gate locked	
			16-Aug-07	0.62	
			1-Nov-07	0.45	
			6-Jan-08	frozen	
			12-Apr-08	0.87	
			20-Aug-08	0.81	
			18-Nov-08	0.80	
			9-Feb-09	0.92	
			5-Aug-09	0.82	
			2-Dec-09	0.77	
			2-Feb-10	0.80	
			30-Apr-10	1.03	
			1-Sep-10	0.79	
			29-Nov-10	0.68	
			28-Feb-11	iced over	
			24-May-11	0.99	
			30-Aug-11	0.77	
			21-Nov-11	0.80	
			22-Feb-12	inaccessible	
			4-May-12	0.58	
			8-Aug-12	0.28	
			15-Nov-12	0.30	
			29-Jan-13	0.98	
			1-May-13	0.97	
			16-Aug-13	destroyed	

Table C1. Summary of Groundwater Elevations
Project Name: St Marys Mast-Snyder Property
Project No.: 60675788

Monitor No.	Elevation		Date	Depth to Water Below Top of Pipe/ Reading on SG (m)	Groundwater Elevation (m.a.s.l.)
	Top of Pipe (m.a.s.l.)	Ground (m.a.s.l.)			
SG3 (R.Reid House Pond)			6-May-04	0.42	
			19-Aug-04		
			9-Dec-04	0.35	
			9-Feb-05	frozen @ 0.36	
			11-Apr-05	0.47	
			25-Aug-05	0.18	
			8-Nov-05	0.16	
			16-Jan-06	frozen	
			11-Apr-06	0.25	
			17-Aug-06	0.14	
			27-Nov-06	0.25	
			30-Jan-07	frozen	
			9-Apr-07	missing	
			16-Aug-07	0.04	
			1-Nov-07	dry	
			6-Jan-08	frozen	
			12-Apr-08	0.22	
			20-Aug-08	0.80	
			18-Nov-08	unable to contact owner	

Note:
1. Water level measured on the outside of the mini-piezometer.
2. Property owner decline further participation in the monitoring of the staff gauge on his property.
3. MP4 was out of the ground, track marks over MP location - MP4 possibly destroyed by a tractor
4. Monitor 2-1 PVC cut by 3.175 cm to facilitate casing closure

Appendix D

Vegetation Transect Site Photographs

Appendix D

Photograph 1. ↑
North side of the Isolated Wetland, showing field edge

Photograph 2. ↑
Facing south along transect TR 1 to peach-leaved willow

Photograph 3. ↑
Example of quadrat along transect TR 1.

Photograph 4. ↑
South side of TR1 showing mostly reed canary grass near peach-leaved willow.

Photograph 5. ↑
Facing west along TR 2 with abundant reed canary grass.

Photograph 1. ↑
Facing east along TR 2 with abundant reed canary grass and hairy willow-herb

Appendix D

Photograph 7. ↑
Soil profile at TR 2 shows deep organic layer over clayey silt

Photograph 8. ↑
Northwest side of Pond A

Photograph 9. ↑
Southwest side of Pond A

Photograph 10. ↑
Dense reed canary grass and bittersweet night along TR 4

Photograph 11. ↑
Common reed at south end of TR 4 expanded slightly and became denser in 2022

Photograph 12. ↑
Soil profile at TR 4 showing organic layer over clay

Appendix D

Photograph 13. 🡩
Fencepost forms east end of transect TR 5

Photograph 14. 🡩
East part of TR 5 consisted almost entirely of reed canary grass

Photograph 15. 🡩
Reed canary grass mixed with Canada bluejoint in west part of TR 5.

Photograph 16. 🡩
Soil profile along TR 5. The organic layer, above silty loam above silty clay

Appendix E

Township and MECP Review Comments

Ontario

Ministry of the Environment, Conservation and Parks
Drinking Water and Environmental Compliance Division
West Central Region

119 King Street West
12th Floor
Hamilton, Ontario L8P 4Y7
Tel.: 905 521-7640
Fax: 905 521-7820

Ministère de l'Environnement de la Protection de la nature et des Parcs
Division de la conformité en matière d'eau potable et d'environnement
Direction régionale du Centre-Ouest

119 rue King Ouest
12e étage
Hamilton (Ontario) L8P 4Y7
Tél. : 905 521-7640
Téléc. : 905 521-7820

Memorandum

Date: June 18, 2021

To: Lynnette Armour, Senior Environmental Officer
Guelph District Office, West Central Region

From: Nadia Marenco, Regional Hydrogeologist
Water Unit, Technical Support Section, West Central Region

Re: St. Mary's Cement Inc./CBM Aggregates Ltd., Hydrogeological and Natural Environment Site Plan Technical Requirements, 2020 Monitoring Report for Mast-Snyder Pit, Township of Puslinch.

I've reviewed relevant sections of the following report and where necessary, provided comments and/or recommendations from a groundwater perspective:

1. AECOM Canada Ltd., April 2021. St. Mary's Cement Inc. (Canada)/CBM Aggregates Ltd., Hydrogeological and Natural Environment Site Plan Technical Requirements, 2020 Monitoring Report for Mast-Snyder Pit, Township of Puslinch, County of Wellington.

Background

The background information in this section was gathered from both the subject report as well as our Ministry's Environmental Atlas and provides a brief overview of the site location and operations, surrounding property uses, local geology, hydrogeology and water use in the area.

St Mary's Cement Inc. (Canada)/CBM Aggregates Ltd. (St Mary's) holds a lease agreement for a 32 ha property (Snyder) and owns a 42.4 ha property (Mast) located at the northwest corner of Forestall Road and County Road 35 (Downey Road), south of the City of Guelph, Township of Puslinch, Wellington County (UTMs 561945mE, 4814627mN). Field investigations conducted between 1999 and 2006 (GLL 2006a) confirmed the presence of several significant environmental features within the site boundary and immediately adjacent to the limit of extraction. These features included:

1. Two units of the Speed River Provincially Significant Wetland (PSW) Complex;
2. Fish habitat along Tributary A and Pond A; and

3. Significant Wildlife Habitat in the form of amphibian breeding habitat at the Isolated Wetland and along Tributary A.

To comply with the Provincial Policy Statement (MMAH 2014), development and site alteration shall not be allowed in a PSW or fish habitat. Development and site alteration shall not be allowed in Significant Wildlife Habitat of the site unless it has been demonstrated that there are no negative impacts on the feature or its ecological function. To address these requirements, the Site Plan retains two units of Speed River PSW Complex that occur on site as well as the woodlot that surrounds the northern unit (refer to Figure 2). However, because the pit will be excavated below the water table, there is the potential for groundwater levels to shift resulting in changes to the PSW and its function. As such, fish and fish habitat, wetland vegetation and amphibian breeding are being monitored as indicators of the wetland function. The subject report was prepared to satisfy the Site Plan Technical Requirements at the Mast-Snyder Pit.

According to the Municipal Property Assessments (MPAC), the surrounding land uses consist of agricultural, rural residential, industrial/commercial properties and vacant land. The Ontario Base Maps indicate that the natural topographic elevations are approximately (c.) 331 in the north, south and east ends of the site, and c. 327masl in the west end. Several surface water features are mapped in the north end of the site; tributaries to the Speed River (the report identifies these as Tributary A and B) and the Provincially Significant Speed River Wetland Complex.

According to the Ontario Geological Survey (OGS), surficial and bedrock sediments beneath and around the property consist of high permeability glaciofluvial outwash sands and gravels overlying potentially karstic dolostone bedrock of the Guelph Formation. The site is located in wellhead protection area B (WHPA-B) for the City of Guelph's Downey Municipal Well located over 2km to the north of the site. There are c. 42 Water Well Records (WWRs) in our Water Well Information System (WWIS) that plot within a c. 500m radius of the site boundary, 25 of which appear to be listed as water supply wells (though the WWIS is known to be highly unreliable). These wells appear to corroborate the OGS mapping and generally indicate that the unconsolidated sediments of sand and gravel are heavily intermixed with clays and silts, down to a depth of c. 18 to 41mbgs above the bedrock. The water supply wells are cased at the overburden-bedrock contact or in the bedrock between 18 and 41mbgs, accessing a confined overburden-bedrock or confined bedrock aquifer, down to a depth of 18 to 79mbgs. According to their pump settings and depths, these water supply wells have water columns of 3 to 53m.

According to the report, a water well survey was completed in 2010 to 2012 with the results presented in the associated annual reports. Of the 17 well owners within c. 500 m of the property boundary: 4 well owners did not respond to the well survey package and 2 well owners reported that they had dug wells – 6848 Forestall Road (which was owned by Mast and rented to a tenant) and 4767 Pioneer Trail (owned by Fitton, located at the northwest edge of the 500m mark of the property boundaries). The well at 6848 Forestall Road was later inspected and determined to be a drilled well that was decommissioned by St Mary's in 2011. Mrs. Fitton, the owner of the well at 4767 Pioneer Trail was contacted by phone on January 29, 2018 to ask if their well was accessible and if they would like to participate in the water level monitoring program. Mrs. Fitton confirmed that they have a dug well that supplies their house but the well has a pump affixed to the lid and is inaccessible. No groundwater interference complaints were received by St Mary's in 2020.

Site preparation (berms, stripping) commenced in late spring/early summer 2018. *Above and below-water extraction activities commenced in November 2018 and July 2019, respectively. Below water extraction in Area 2 commenced in late fall 2019 and continued in 2020.* The subject report documents the site conditions and monitoring activities undertaken by AECOM in 2020.

There are a number of monitoring wells in and around the site and groundwater monitoring has been ongoing for some time. There are currently 14 groundwater monitors and nine mini-piezometers on the site. These groundwater monitoring locations were instrumented with level loggers on May 8, 2018 to collect daily measurements. Baseline groundwater levels have been collected from the existing on-site monitors and mini-piezometers since 1999 with seasonal water levels collected since 2002. MP1, MP2 and MP3 are in Tributary A. They have been monitored for water levels seasonally since 2003. MP4 is in the isolated wetland. MP6 (immediately adjacent to the extraction pond and in an upgradient direction from MP2) and MP7 are located in the southern swale located within Tributary A. BH9 and BH10 were installed in June 2010. BH9 is a water table monitor completed to 5.2mbgs and screened in the underlying sand/sandy silt till. BH10 consists of a water table monitor completed to 4.6mbgs and screened in the underlying sand and gravel/sand (BH10-II) and a piezometer completed to 9.8mbgs and screened in the underlying sandy silt unit (BH10-I). BH11 was installed in June 2010 in the Downey West Wetland. BH11 is a water table monitor completed to 2.3mbgs and screened in the underlying sand and gravel unit. Regionally, groundwater is expected to flow to the northwest towards the Speed River. shallow groundwater flow is from the south to the north-northwest (i.e., from the pit area to Tributary A).

From a groundwater perspective, the report concludes that based on the groundwater monitoring conducted at the site in 2020:

- Water level measurements collected across the site at the groundwater monitors and mini-piezometers reflect baseline pre-extraction conditions to November 2018. Below-water extraction commenced in July 2019. Water levels appear to be largely influenced by local precipitation conditions and show natural seasonal fluctuations.
- Groundwater flow is to the north-northwest. Locally, groundwater flows from the pit area towards Tributary A, as indicated by the groundwater levels collected in the vicinity.
- There were no apparent impacts to groundwater levels and flows as a result of pit operations.
- The current groundwater monitoring program is adequate.

Based on the results of this year's monitoring program, the following recommendations are provided from a groundwater perspective:

- Groundwater level monitoring of the on-site monitors and MPs should continue as prescribed in the approved Site Plans.
- Comparisons shall be made from future monitoring results to determine if changes are occurring and if those changes are likely a result of aggregate extraction activities, particularly as it might affect the level of the groundwater table.

Comments and Recommendations

Please note that this review doesn't include an exhaustive auditing of the accuracy of the reported information presented in the above report. You've requested a review of the report to provide comments on the recommendations for monitoring. I've reviewed the report to address your request. Sections of the report unrelated to groundwater are outside my scope. This section presents a list of groundwater-related comments and concerns outlined during this review, and where applicable, recommendations for additional work.

1. While it may not be required by the site plan's technical requirements, the report should provide information critical to a hydrogeological review. If groundwater monitoring is to continue, the following should be provided in subsequent reports – borehole and monitoring well logs; a table of well completion details including, but not limited to the borehole/monitoring well IDs, the UTMs, the top of casing elevations, the ground surface elevations, the screen top and bottom elevations (mbgs and masl), the end of hole elevations (mbgs and masl), the most recent static water levels (masl and mbgs), and if present in the original well log, where water was found at the time of well drilling/boring (masl and mbgs); the WWRs and well completion details for private wells within a c. 500m radius of the site, including their distance from the extraction boundary; and cross-sections, running parallel and perpendicular to the direction of groundwater flow, including all relevant features (e.g., the borehole/monitoring wells (screened locations shown), water table elevation, locations and depths of private wells, excavation boundary and depths of excavation, locations and depths of tributaries and wetland features, etc.…). The report's recommendations would certainly be strengthened with the addition of these data, tables and figures, as these would help establish if the existing monitoring wells are in the right special locations, both laterally and with depth.

2. For ease of review, the report should identify the water well records by their water well record numbers. Based on my own water well record search, there appear to be no water supply wells screened in the unconfined overburden aquifer. As summarized above in the Background Section of this memo, the water supply wells within a c. 500 radius of the site are cased at depth at the overburden-bedrock contact, or in the bedrock, and have access to significant water columns. The yields of these water supply wells are unlikely to be impacted by the activities at the site thus far, which do not appear to include any water taking activities subject to a PTTW despite the fact that below-water-table extraction commenced in July 2019.

3. According to Figure 4, the July 2020 water table appeared to be c. 325masl in the south end of the site and c. 321masl in the northwest end of the site, which indicates that shallow overburden flows in July 2020 were likely to the northwest towards the Speed River. This is consistent with the conclusions reached in the report, and consistent with historical groundwater elevations and contours pre- below-water-table extraction, as shown in Figure 5.

4. Figure 5 documents the groundwater elevations in boreholes 1 to 11 from 1998 (baseline conditions) to 2021. These appear to indicate normal seasonal fluctuations, with elevations in and around the site fluctuating between c. 321masl and c. 324masl at BH4 at the northwest end, and between c. 325.5masl and c. 327.5masl at BH7, at the southeast end, with no real

indications of significant declines in trends at any locations overall. These elevations confirm that flows have historically and consistently been towards the northwest, and that activities at the site thus far do not appear to have significantly impacted shallow overburden water elevations. That said, the below-water-table extractions only began in July 2019, and the report provides data to October 2020 (15 months), so the monitoring and reporting period is limited.

5. The report notes that there were periods, either due to human error or otherwise, that resulted in no data being recorded for short periods of time, but these issues appear to have been addressed (e.g., MP2-I was mistakenly not re-started after the July 2019 download, and then it appeared to be affected by cold weather such that no data was recovered during the February 2020 download, so there is a gap in the logger plot from July 2019 to February 2020).

6. The report makes notes of some concerns with surface water potentially entering MP7, affecting the water elevations and water temperatures, but it appears this issue has since been addressed with a new bentonite surface seal.

Overall, significant impacts to local groundwater users in the vicinity of the site, including surface water features and water supply wells are not anticipated as a result of the above and below water table extraction activities at the site which commenced in 2018 and 2019, respectively. At this time, the site activities are not subject to a PTTW, so significant volumes of groundwater are not being extracted and thus, changing the subsurface hydraulics in any significant capacity. I agree with the report's conclusions based on the data presented to date, which is limited, at least based on when below-water-table extraction commenced (c. 15 months). The report's recommendations could be strengthened with the addition of data, tables and figures, as stated above, which would certainly help in establishing if the existing monitoring wells are in the right special locations, both laterally and with depth.

If you have any questions, please feel free to contact me at Nadia.Marenco@ontario.ca.

Nadia Marenco, P.Geo.
cc: B. Koblik

Limitations:

The purpose of the preceding review is to provide advice to the Ministry of the Environment regarding subsurface conditions based on a review of the information provided in the above referenced document(s). The conclusions, opinions and recommendations of the reviewer are based on information provided by others. The Ministry cannot guarantee that the information that has been provided by others is accurate or complete. A lack of specific comment by the reviewer is not to be construed as endorsing the content or views expressed in the reviewed material.

HARDEN

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Groundwater Studies
Geochemistry
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OMB Hearings
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Groundwater Mapping

File: 0402

April 27, 2021

Township of Puslinch
7404 Wellington Road 34
Guelph, ON, N1H 6H9

Attention: Glenn Schwendinger

Dear Glenn:

Re: Hydrogeological Review – Mast-Snyder Pit 2020 Monitoring Report

We have reviewed the Groundwater Monitoring Report prepared by AECOM Canada Ltd. in April 2021. The report summarizes groundwater measurements obtained on-site since 1998. Active above water table extraction commenced in November 2018. Below-water-table extraction commenced in 2019 (a review of June 6, 2019 Google Earth image confirms that this has occurred).

Summary of Review

Groundwater levels have not been affected by the below water table extraction to date. Groundwater temperatures immediately adjacent to the extraction area are now reflecting those of the surface water in the pit pond increasing to 25 C in the summer and decreasing to 3 C in the winter.

Action Item: We request that future reports plot hydrographs for each monitor on separate graphs. The inclusion of several hydrographs and temperature plots on one graph make it difficult to discern trends in the data.

Our detailed review of the 2020 monitoring report is as follows;

We have reviewed the hydrographs (water level plots) for the groundwater monitor installations. All of the water levels obtained in 2020 fall within historical levels.

The monitoring data confirms that water level in the extraction area exceed those of the downstream waterway, thus ensuring that there is groundwater flow from the extraction area to the fishery.

The report states that no water quality or quantity complaints were received by CBM in 2020. We have not been advised of any complaints.

We reviewed the thermographs (temperature plots) for the monitors. BH1-1 and BH1-2 show that groundwater temperatures downgradient of the active extraction area are significantly higher in 2020 than in 2019. The groundwater temperature range at BH1 has increased from between 6 and 11 C to between 3 and 26 C. BH1 is located centrally within the site and groundwater flow is westward. There are no groundwater temperature sensitive features west of the present extraction area.

We are thus satisfied with the report and conclude that the groundwater flow directions have not been altered by the extraction. Groundwater temperatures immediately adjacent to the extraction area have increased significantly (seasonally), however, there are no groundwater temperature sensitive features downgradient from the present below-water-table extraction.

Sincerely,

Harden Environmental Services Ltd.

[redacted]

Stan Denhoed, M.Sc., P.Eng.
Senior Hydrogeologist

Appendix F

Low Water Level Trigger Memo and Responses

AECOM Canada Ltd.
50 Sportsworld Crossing Road, Suite 290
Kitchener, ON N2P 0A4 Canada

T: 519.650.5313
F: 519.650.3424
www.aecom.com

David Hanratty
North America | Director of Land, Resource & Environment
St Marys Cement Inc. (Canada)/CBM Aggregates
55 Industrial Street
Toronto ON M4G 3W9

October 25, 2022

Project #
60675788-10

Subject: Response to Puslinch Township Review - CBM Aggregates Mast-Snyder Pit, Proposed Low Water Level Triggers

Dear Mr. Hanratty:

AECOM Canada Ltd. (AECOM) prepared a Memorandum, Subject: CBM Aggregates Mast-Snyder Pit, Proposed Low Water Level Triggers, dated July 12, 2022, to address a Site Plan Condition requiring establishment of Triggering Mechanisms. In response to the Memorandum, Harden Environmental Services Ltd. (Harden) provided review comments on behalf of the Township of Puslinch[1]. The review comments are re-produced below followed by AECOM's response.

Comment

1. In addition to climatic conditions, the threshold groundwater elevations should also be related to the features and ecological functions that they are designed to protect. How do the proposed thresholds for BH3 and BH10-2 relate to ground elevations in on-site wetlands or watercourses? Will proposed thresholds reduce hydroperiod in the features by delaying water table rise?

AECOM Response

The proposed groundwater trigger levels where chosen based on the protection of the ecological features and their respective functions. Development of the Triggering Mechanism is required under the approved Site Plans, specifically:

> "Trigger levels for BH3, BH8 and proposed BH9 and BH10 will be established when the below-water extraction in Area 2 of the Operations Plan is complete. Trigger levels at these locations will act as a warning to unexpected groundwater impact to the Speed River wetland both on and off-site (BH3, BH8), the Hanlon Creek Swamp (BH9) and the isolated wetland (BH10)."

As specified above, the purpose of the triggers is to provide early warning to unexpected groundwater impacts. Ecological relationships within the property are reviewed and presented in the annual monitoring report that is prepared to address the Technical Recommendations of the Site Plans. It is this monitoring that has been the basis for establishing the proposed groundwater trigger levels.

BH10-II is located at the southern edge of the Isolated Wetland, with a ground elevation of 325.86 mASL. The Isolated Wetland is considered a low quality wetland. As described in the 2021 Annual Monitoring Report, the

[1] *Harden Environmental Services Ltd., 2022: Letter to Glenn Schwendinger (Township of Puslinch), Re: Hydrogeological Review – Mast-Snyder Proposed Thresholds, from Stan Denhoed (Harden Environmental Services Ltd.), dated July 28, 2022.*

Isolated Wetland is surrounded by an actively cultivated cropland (either corn or soybeans) which encroaches almost to the wetland boundary. As such, the boundary of the wetland was quite disturbed with a variety of weedy species mixed with some wetland species. In 2021, there was a significant increase in the amount of cover of tall goldenrod and panicled aster which are characteristic of established meadows. The interior of the wetland was more homogeneous with a smaller number of species present, mainly reed canary grass (Phalaris arundinacea) and field sow-thistle. The proposed low water trigger elevations for BH10-II is 324.00 mASL. Surface water elevations have been collected seasonally since 2004 from a mini-piezometer (MP4) located within the deepest portion of the Isolated Wetland. These surface water elevations have ranged from 324.33 mASL to 325.35 mASL. Of the 42 surface water measurements collected between 2004 and 2021, MP4 was dry during 45% (19 events) of the site visits and frozen during 12% (five events) of the site visits. Notably, MP4 was dry during the summer and fall during the majority of the quarterly site visits.

BH3 is located adjacent to the Speed River Provincially Significant Wetland (PSW). As described in the 2021 Annual Monitoring Report, nearly the whole length of Tributary A consists of reed canary grass meadow marsh. Overall, the species composition and number of species has remained fairly constant over the past 15 years (when vegetation surveys were initiated). Cover by spotted jewelweed (Impatiens capensis) increased significantly since 2020 while hairy willow-herb (Epilobium hirsutum) declined. The amount of cover by woody shrubs continued to increase, as a result of natural succession. Surface water was not present in the poorly defined channel (Tributary A). In July 2021, the water table was well below the surface and even lower than in 2020. Groundwater monitoring at MP2-1 showed that the water table was about 40 cm lower in the summer of 2020 compared to summer of 2019 but about the same as in 2018. The wetland immediately adjacent to BH3 has a ground elevation of about 325 mASL. The proposed low water trigger elevations for BH3 is 323.87 mASL, about 1.13 m below ground surface. A pair of mini-piezometers, MP2-I and MP2-II are located within Tributary A of the PSW, about 130m north of BH3 and is the closest location where surface water elevations are collected. Surface water elevations have been collected seasonally since 2004 from MP2-I and MP2-II. Surface water elevations at MP2-I have ranged from 324.52 mASL to 325.35 mASL. Similar to the Isolated Wetland, MP2-I dry surface water condition occurred dominantly during the summer and fall quarterly site visits.

As described above, the Isolated Wetland and The Speed River PSW are frequently dry during the summer and fall. Peak below water extraction generally occurs during the summer and fall when low water levels/low water trigger elevations would most likely occur and when the Isolated Wetland and PSW are already naturally experiencing dry (no surface water) conditions. In addition, the vegetation in the Isolated Wetland and in the Speed River PSW are not particularly sensitive to drier conditions with significant periods of no surface water/standing water and therefore, not sensitive to minor decreases in the hydroperiod. Soil materials were logged during installation of MP4 and MP2. Both installations noted that these features are underlain by clayey silt, which enhances retention of surface water and promotes the extension of the hydroperiod. The proposed low water trigger elevations will not reduce the hydroperiod in the features by delaying water table rise.

Note that, as presented on the Site Plans, the Contingency Plan is also triggered by:

> "The ecological inspection identifies unusual stress response in the PSW directly adjacent to the pit area that is not present elsewhere in the woodlot surrounding Tributary A or ecological monitoring in the Speed River PSW on or off-site identifies unusual stress response which is attributable to the operation of the pit."

This condition aids in the protection of the ecological features during pit development and operation.

Comment

2. The relationship between annual precipitation and minimum water levels in the monitoring wells has not been established. Intuitively, one expects that in a year with lower precipitation, the seasonal groundwater elevation low would be correspondingly lower as suggested by AECOM. However
    a. the regression curve of hydrographs is not linear and as water levels decline, so does the rate of decline and
    b. if there is a wet summer/fall compared to winter/spring then low groundwater elevation may not be directly relatable to annual precipitation.

    We do not think it appropriate to use a linear approach to estimate lowest water level nor is it appropriate to use annual precipitation as indicator of seasonal low water level.

AECOM Response

It is agreed that the regression curve for hydrographs is not a linear and low groundwater elevation may not be directly relatable to annual precipitation. Groundwater levels will be affected by other factors such as available surplus based on the overall Site water balance, effects of evapotranspiration on the below-water extraction pond, specific characteristics of the Site soils, etc. The reviewer does agree that intuitively, lower precipitation would result in lower groundwater levels. Barring use of a complicated methodology, a more simplistic approach based on the methodology/rationale employed for development of the approved nearby Mill Creek triggers, was agreed upon during consultation with the Ministry of Natural Resources hydrogeologist. As such, it is our position that the proposed low water triggers consider historical observed groundwater elevations at each of the monitor locations and provide a valid basis for the methodology that was used.

Comment

3. There is data for BH3 and BH8 obtained in November 2007, the year with the lowest rainfall. This should be a good indication of water levels during extreme conditions. There is likely a strong linear correlation between BH3 and BH8 groundwater elevations and those in BH9 and BH10-2 which can then be used to predict extreme low water levels in BH9 and BH10-2.

AECOM Response

The November 2007 BH3 and BH8 groundwater elevations were 324.31 mASL and 325.27 mASL, respectively. Lower groundwater elevations were observed at BH3 in December 1999 (324.16 mASL) and at BH8 in November 2014 (325.14 mASL). Total precipitation for 2007, as recorded at the Environment Canada Waterloo-Wellington Airport was 507.9 mm compared to the long term normal of 916.5 mm[2]. Our methodology for establishing the proposed low water level trigger elevations considered the seasonally low groundwater elevations measured at each trigger monitor (up to 2017) and the dry 2007 conditions (see the July 12, 2022 Memorandum). Precipitation was also factored into the trigger elevation approach. The reviewer suggests that the November 2007 BH3 and BH8 groundwater elevations should be a good indication of water levels during extreme conditions, however, in the previous Review Comment 2 also acknowledges that a linear approach is not appropriate to estimate lowest water levels. We agree that precipitation and other variables contribute, which are harder to quantify, and will affect groundwater elevations across the site. It is our opinion that the proposed low water triggers presented in our July 12, 2022 Memorandum are an appropriate early warning mechanism to initiate investigations towards formulation of contingencies/mitigations.

[2] *1981 to 2010 Canadian Climate Normals for Environment Canada Waterloo-Wellington A station (Climate ID 6149387).*

Should there be additional questions or comments, please contact the undersigned.

Sincerely,
AECOM Canada Ltd.

[redacted]

Brian Holden, M.Sc., P.Geo.
Hydrogeologist, Environment
Brian.Holden@aecom.com

Encl.
cc:

AECOM Canada Ltd.
105 Commerce Valley Drive West, 7th Floor
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F: 905.886.9494
www.aecom.com

To: Jennifer DeLeemans
Votorantim Cimentos
CBM Aggregates| Manager, Lands & Environment

cc:

Date: July 12, 2022
Project #: 60651256-8
From: Patty Wong
Brian Holden

Memorandum

Subject: **CBM Aggregates Mast-Snyder Pit, Proposed Low Water Level Triggers**

CBM Aggregates, a Division of St. Marys Cement Inc. (Canada) (CBM) operates the Mast-Snyder Pit under the Aggregate Resources Act for a Category 1 – Class "A" Pit Below Water for their property in the Township of Puslinch (**Figure 1**). In 2006, the Grand River Conservation Authority (GRCA) requested low water trigger elevations on on-site groundwater monitors. This request lead to inclusion of Site Plan Conditions requiring establishment of Triggering Mechanisms and a Contingency Plan. For completeness, the Site Plan conditions are reproduced below.

Triggering Mechanisms

Trigger levels for BH3, BH8 and proposed BH9 and BH10 will be established when the below-water extraction in Area 2 of the Operations Plan is complete. Trigger levels at these locations will act as a warning to unexpected groundwater impact to the Speed River wetland both on and off-site (BH3, BH8), the Hanlon Creek Swamp (BH9) and the isolated wetland (BH10).

The trigger levels will be based on worst-case conditions (hot, dry, mid-summer week with no precipitation, plus a high rate of aggregate extraction of 2,100 tonnes per day) and baseline water level data. The trigger levels will be established in consultation with the City, the County and Township, except for BH8 which shall be based on predicted groundwater levels in May or June. Should the water level at the trigger monitors decrease to below the trigger levels, water levels will be measured again the following month. If water levels are below the trigger levels for these two consecutive monitoring events and are attributed to the below-water extraction activities, the Contingency Plan (discussed below) will be implemented.

1. *The Contingency Plan will be implemented if any of the following conditions are established:*
    a) *Groundwater levels in the monitors are reduced below the triggers (as established above), as determined by the monitoring review; or*
    b) *The ecological inspection identifies unusual stress response in the PSW directly adjacent to the pit area that is not present elsewhere in the woodlot surrounding Tributary A or ecological monitoring in the Speed River PSW on or off-site identifies unusual stress response which is attributable to the operation of the pit; or*
    c) *A water well complaint is substantiated by the investigation to have resulted from the operation of the pit.*

Note that BH9 and BH10 were installed in 2010.

a. Contingency Plan

1. *In the event that the Contingency Plan is triggered, the following actions shall be implemented:*

   b) *The operator will cease any below-water extraction operations;*

   c) *The District office of the Ministry of the Environment and the Ministry of Natural Resources, the Township, the County and the City shall be informed within seven calendar days of the impact, and the implementation of the Contingency Plan;*

   d) *Water level measurements in all on-site monitors and mini-piezometers shall be repeated as soon as possible and practical, and continue on at least a weekly basis during the period when the impact persists;*

   e) *The monitoring data and other relevant information will be reviewed by a qualified ecologist or geoscientist who will, as soon as reasonably possible, prepare a mitigation plan documenting:*

      The nature, extent and significance of the impact,
      A recommendation regarding its mitigation,
      Recommendations regarding any additional monitoring requirements, and
      Recommendations regarding the resumption of operations.
      The report shall be circulated to the District office of the Ministry of the Environment, the Ministry of Natural Resources, the Township, the County and the City; and

   f) *Subject to approval by the District office of the Ministry of the Environment and the Ministry of Natural Resources, the operator shall implement the mitigation plan.*

2. *In regard to a Contingency Plan for the isolated wetland, in the unlikely event that the water levels decrease beyond predicted levels, the deeper portion of the isolated wetland will be dredged/deepened, subject to MNR/GRCA approval. This would provide an opportunity for the dredged area to be seeded and/or planted to create a more diverse mix of wetland plant species. Details on the Contingency Plan will be shared with the Township and the County.*

As per the Site Plans, the Triggering Mechanisms and Contingency Plan will not be established until after the Area 2 below-water extraction is complete. Site preparation (berms, stripping) commenced in late spring/early summer 2018. Above and below-water extraction activities commenced in November 2018 and July 2019, respectively. Below water extraction in Area 2 commenced in late fall 2019 was completed in early April 2022. The purpose of this memo is to present the proposed trigger elevations as well as explaining the rationale behind the establishment of these levels.

In June 2006, the Ministry of Natural Resources hydrogeologist at that time (David Webster) reviewed the rationale leading to the development of the proposed trigger elevations and found it reasonable. The trigger levels presented in this memorandum reflect the agreed upon approach, updated to consider baseline water level elevations collected up to the end of 2017, prior to any on-site extraction.

As presented in the hydrogeological assessment[1], drawdown calculations were completed under the worse case scenario of a hot, dry (no precipitation), mid-summer week with a high rate of below-water extraction (2,100

[1] *Gartner Lee Limited, 2006: Consolidated Hydrogeological Assessment for Below-Water Extraction, St Marys Mast – Snyder*

tonnes per day) for the initial excavation when a small pond is present, for near the end of the operation when a large pond is present and at the end of operations when a large pond remains but extraction operations have ceased. As the initial below-water excavation commenced in the southeast corner of the site and the trigger monitors are in the northern portion of the site, no water level impacts are expected early in the below-water extraction operations in the vicinity of Tributary A. Later in the operations when a large pond is present and there is a high rate of extraction, the drawdown at Tributary A is predicted to be in the order of 0.06 m. Once operations cease, only a minor drawdown at Tributary A (less than 0.01 m) is predicted, mainly as a result of evaporation off the pond surface. The aggregate removal effect is a temporary impact that only occurs while the pit is being extracted. Over time, additional precipitation in the pit, and groundwater recharge in the surrounding areas, will offset this effect. Furthermore, as the ponds in the pit grow larger, a "reservoir" of water is created and the effects of removing solid particles from below the water table are diminished. In light of this, the drawdown effect is considered negligible and the focus of establishing triggers is based on the baseline water levels and the effects of precipitation.

Due to the highly permeable nature of the soils in the area, shallow groundwater levels are closely linked to the amount of precipitation received. During the wetter spring period, the water table rises in response to spring snowmelt and increased precipitation that typically occur. During the drier periods of the year, the water table will decrease. In establishing trigger levels, the long term meteorological data from 1981 to 2017 for the closest Environment Canada meterological station (Waterloo-Wellington Airport, climate ID 6149387), was reviewed. Groundwater monitoring at the site began in 1999 for monitors BH1 to BH5. Over time, additional groundwater monitors were installed and incorporated into the routine seasonal water level monitoring of the site (BH6 to BH8 were drilled May 2003; BH9, BH10 and BH11 were drilled in 2010). Groundwater elevations for the 11 existing on-site groundwater monitor locations were reviewed.

The Site Plan requires low level trigger elevations at BH3, BH8, BH9 and BH10. The baseline manual water level record of each of these locations were examined; 1999 to 2017 for BH3, 2003 to 2017 for BH8 and 2010 to 2017 for BH9 and BH10 to estimate the seasonal high and low water levels to determine typical water level fluctuations. The average difference between the seasonal low and high water levels recorded at each monitor was calculated. Next, the annual precipitation data from 1981 to 2017 was examined showing that 2007 had the lowest precipitation (507.9 mm) during this period. For each monitor, the years with the summer and fall low water levels was compared to the 2007 precipitation to determine how much lower was the 2007 precipitation and these were averaged. The difference between the low water level years and the driest year (2007) was applied to the average seasonal fluctuation to estimate how much lower water levels might be in a very dry year with a high rate of extraction. Then this correction was applied to the lowest observed manual water level for each specific monitor location resulting in a low water level trigger elevation.

For example, at monitor BH3, the average seasonal difference between high and low water levels was about 0.76 m for the 1999 to 2017 baseline period, prior to on-site extraction. The driest year on record (since 1981) from data at the Environment Canada Waterloo-Wellington Airport was 2007 with a total annual precipitation of 507.9 mm. Based on the water levels at BH3, the lowest seasonal water levels occurred in the summer and fall in 2001 and 1999, respectively. The 2001 and 1999 annual precipitation was approximately 39% and 37%, respectively, higher than the 2007 annual precipitation with an average between the two of about 38%. To account for a dry year, 38% of the difference between the average high and low seasonal water levels was subtracted from the predicted post-extraction lake elevation[2]. The lowest water level at BH3 occurred in December 1999 (324.16 mASL). Therefore, to account for a dry year and high rate of extraction, the correction

Property, Township of Puslinch, County of Wellington, prepared for St. Marys Cement Inc., GLL23-312, December 14, 2006.
[2] *38.3% of 0.76 m = 0.29 m, therefore, 324.16 mASL minus 0.29 m = 323.87 mASL.*

for a dry year (0.29 m) was subtracted from the lowest recorded baseline water level (324.16 mASL) to provide a BH3 trigger elevation of 323.87 mASL.

A summary of the triggers, based on the above approach is provided in the table below.

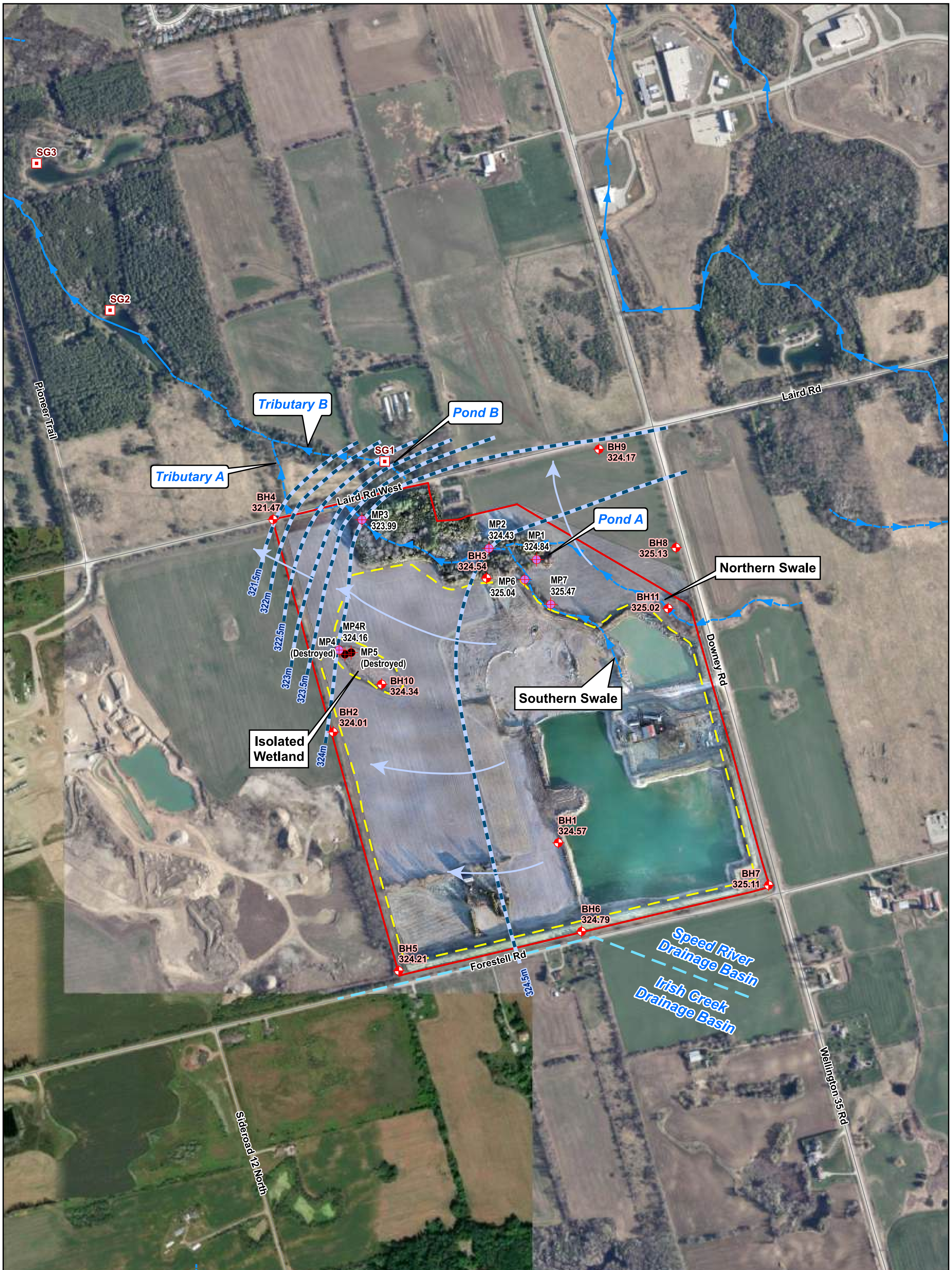
Location	Low Water Trigger Elevation
BH3	323.87 mASL
BH8	324.86 mASL
BH9	323.20 mASL
BH10-II	324.00 mASL

The detailed methodology and calculations used to set the triggers is presented in attached Tables 1 to 4.

Technical Recommendations, Hydrogeological Assessment, Site Plan Condition 4 reads:

4. Monthly groundwater level measurements and groundwater temperatures will be collected during periods of below-water extraction at the monitoring points (monitoring wells and mini-piezometers) on-site for the first two years of below-water extraction. If trends are consistent over the first two-years of below-water extraction, the monitoring program will be reduced from monthly to quarterly.

The Site Plan triggering mechanisms and contingency plans were originally based on the monthly/quarterly manual water level monitoring program, as described above under Condition 4. In May 2018, all existing groundwater monitors and mini-piezometers on-site were instrumented with level loggers collecting daily water level readings, which is a much higher frequency than the monthly/quarterly frequency originally cited in the Site Plans. As this is the case, it is proposed that as long as daily logger readings are collected at BH3, BH8, BH9 an BH10-II, the triggering mechanisms are based on groundwater levels that are recorded below the trigger elevation for seven consecutive days with an observed downward trend and attributed to be a result of below-water extraction activities before the contingency plan is implemented.



Basemapping from Ontario Ministry of Natural Resources
Orthophotography: June 2019
Note: On-site aerial coverage from Dec 14, 2021 Drone Survey

N W E S

0 100 200 400
Meters

UTM Zone 17, NAD 83

Legend

- Mini-Piezometer
- Destroyed Mini-Piezometer
- Staff Gauge
- Monitor Location
- Groundwater Contours (0.5m)
- Groundwater Divide
- Groundwater Flow Direction
- Roads
- Intermittent Watercourse
- Permanent Watercourse
- Site Boundary
- Approximate Limit of Extraction

CBM Aggregates
Mast-Snyder Property

Site Plan and Groundwater Flow (November 2021)

June 2022
Project 60651256-7

AECOM

Figure 4

Path: L:\Kitchener-CAKCN1\Legacy\CAKCN1FP001\Data\FP001Data\DATAFP001\CAKCN-Environment\Projects\60312725-9 Cedar Pit\St Mary\60651256_StMarySitPlanandGroundwaterflow_20220627.mxd

Table 1: Low Water Level Trigger Elevations - BH3

Mast-Snyder Property, PN 60624078

1999 to 2017 water level and precipitation data for BH3 was examined as background for establishing the triggers.

On-Site Seasonal Water Levels

Winter

- BH3 high seasonal winter water level 1999 to 2017 is 325.06 mASL on Nov 27, 2006
- BH3 low seasonal winter water level 1999 to 2017 is 324.28 mASL on Jan 14, 2003

difference between high and low winter seasonal water level is 0.78 m

Spring

- BH3 high seasonal spring water level 1999 to 2017 is 325.45 mASL on Apr 12, 2008
- BH3 low seasonal spring water level 1999 to 2017 is 324.82 mASL on May 28, 2015

difference between high and low spring seasonal water level is 0.63 m

Summer

- BH3 high seasonal summer water level 1999 to 2017 is 324.93 mASL on Aug 20, 2008
- BH3 low seasonal summer water level 1999 to 2017 is 324.27 mASL on Sept 11, 2001

difference between high and low summer seasonal water level is 0.66 m

Fall

- BH3 high seasonal fall water level 1999 to 2017 is 325.12 mASL on Nov.25, 2014
- BH3 low seasonal fall water level 1999 to 2017 is 324.16 mASL on Dec 15, 1999

difference between high and low fall seasonal water level is 0.96 m

The average difference between the high and low seasonal water levels at BH3 is (0.78 m + 0.63 m + 0.66 m + 0.96 m)/4 = 0.76 m

---

Precipitation

Based on the water levels at BH3, the lowest seasonal water levels occur in the summer and the fall

From 1981 to 2017 met. Data from Waterloo-Wellington Airport

annual precipitation in 1999 = 811 mm (year of seasonal low fall water level at BH3)
annual precipitation in 2001 = 835.8 mm (year of seasonal low summer water level at BH3)
annual precipitation in 2007 = 507.9 mm (driest year on record between 1981 and 2017)
507.9 mm/811 mm = 0.626
0.626 - 1 = 0.374 x 100 = 37.4%
507.9 mm/835.8 mm = 0.608
0.608 - 1 = 0.392 x 100 = 39.2%

Average of 38.3%, (37.4% + 39.2%)/2 = 38.3%

Driest year (2007) since 1981 was about 38% drier than the year in which the lowest seasonal water levels were observed on the site (1999 and 2017)

Water Level Correction for Dry Year

- Driest year since 1981 was about 38% drier than the years in which the lowest summer and fall water levels were observed on the site at BH3

0.76 m x 38% = 0.29 m

Lowest water level observed under baseline conditions was 324.16 mASL

Therefore, to account for a dry year,
324.16 mASL - 0.29 m = 323.87 mASL

323.87 mASL is the trigger elevation for BH3

Table 2: Low Water Level Trigger Elevations - BH8

Mast-Snyder Property, PN 60624078

2003 to 2017 water level and precipitation data for BH8 was examined as background for establishing the triggers.

On-Site Seasonal Water Levels

Winter

- BH8 high seasonal winter water level 2003 to 2017 is 327.28 mASL on Jan 24, 2017
- BH8 low seasonal winter water level 2003 to 2017 is 325.65 mASL on Feb 26, 2015

  difference between high and low winter seasonal water level is 1.63 m

Spring

- BH8 high seasonal spring water level 2003 to 2017 is 326.63 mASL on Apr 12, 2008
- BH8 low seasonal spring water level 2003 to 2017 is 325.78 mASL on May 28, 2015

  difference between high and low spring seasonal water level is 0.85 m

Summer

- BH8 high seasonal summer water level 2003 to 2017 is 325.98 mASL on Aug 5, 2009
- BH8 low seasonal summer water level 2003 to 2017 is 325.27 mASL on Aug 8, 2012

  difference between high and low summer seasonal water level is 0.71 m

Fall

- BH8 high seasonal fall water level 2003 to 2017 is 326.03 mASL on Nov.27, 2006
- BH8 low seasonal fall water level 2003 to 2017 is 325.14 mASL on Nov 25, 2014

  difference between high and low fall seasonal water level is 0.89 m

The average difference between the high and low seasonal water levels at BH8 is (1.63 m + 0.85 m + 0.71 m + 0.89 m)/4 = 1.02 m

---

Precipitation

Based on the water levels at BH8, the lowest seasonal water levels occur in the summer and the fall

From 1981 to 2017 met. Data from Waterloo-Wellington Airport

annual precipitation in 2014 = 734.3 mm (year of seasonal low fall water level at BH8)
annual precipitation in 2012 = 655.5 mm (year of seasonal low summer water level at BH8)
annual precipitation in 2007 = 507.9 mm (driest year on record between 1981 and 2017)
507.9 mm/734.3 mm = 0.692
0.692 - 1 = 0.308 x 100 = 30.8%
507.9 mm/655.5 mm = 0.775
0.775 - 1 = 0.225 x 100 = 22.5%

Average of 26.7%, (30.8% + 22.5%)/2 = 26.7%

Driest year (2007) since 1981 was about 27% drier than the year in which the lowest seasonal water levels were observed on the site (2003 and 2017)

Water Level Correction for Dry Year

- Driest year since 1981 was about 27% drier than the years in which the lowest summer and fall water levels were observed on the site at BH8

  1.02 m x 27% = 0.28 m

Lowest water level observed under baseline conditions was 325.14 mASL

Therefore, to account for a dry year,
325.14 mASL - 0.28 m = 324.86 mASL

324.86 mASL is the trigger elevation for BH8

Table 3: Low Water Level Trigger Elevations - BH9

Mast-Snyder Property, PN 60624078

2010 to 2017 water level and precipitation data for BH9 was examined as background for establishing the triggers.

On-Site Seasonal Water Levels

Winter

- BH9 high seasonal winter water level 2010 to 2017 is 324.67 mASL on Jan 24, 2017
- BH9 low seasonal winter water level 2010 to 2017 is 323.71 mASL on Feb 26, 2015

difference between high and low winter seasonal water level is 0.96 m

Spring

- BH9 high seasonal spring water level 2010 to 2017 is 324.91 mASL on May 24, 2011
- BH9 low seasonal spring water level 2010 to 2017 is 323.91 mASL on May 28, 2015

difference between high and low spring seasonal water level is 1 m

Summer

- BH9 high seasonal summer water level 2010 to 2017 is 323.75 mASL on Aug 16, 2013
- BH9 low seasonal summer water level 2010 to 2017 is 323.43 mASL on Aug 8, 2012

difference between high and low summer seasonal water level is 0.32 m

Fall

- BH9 high seasonal fall water level 2010 to 2017 is 324.14 mASL on Nov.20, 2013
- BH9 low seasonal fall water level 2010 to 2017 is 323.39 mASL on Nov 21, 2016

difference between high and low fall seasonal water level is 0.75 m

The average difference between the high and low seasonal water levels at BH9 is (0.96 m + 1 m + 0.32 m + 0.75 m)/4 = 0.76 m

---

Precipitation

Based on the water levels at BH9, the lowest seasonal water levels occur in the summer and the fall

From 1981 to 2017 met. Data from Waterloo-Wellington Airport

annual precipitation in 2016 = 689.1 mm (year of seasonal low fall water level at BH9)
annual precipitation in 2012 = 655.5 mm (year of seasonal low summer water level at BH9)
annual precipitation in 2007 = 507.9 mm (driest year on record between 1981 and 2017)
507.9 mm/689.1 mm = 0.737
0.737 - 1 = 0.262 x 100 = 26.2%
507.9 mm/655.5 mm = 0.775
0.775 - 1 = 0.225 x 100 = 22.5%

Average of 24.4%, (26.2% + 22.5%)/2 = 24.4%

Driest year (2007) since 1981 was about 24% drier than the year in which the lowest seasonal water levels were observed on the site (2016 and 2012)

Water Level Correction for Dry Year

- Driest year since 1981 was about 24% drier than the years in which the lowest summer and fall water levels were observed on the site at BH9

0.76 m x 24% = 0.19 m

Lowest water level observed under baseline conditions was 323.39 mASL

Therefore, to account for a dry year,
323.39 mASL - 0.19 m = 323.20 mASL

323.20 mASL is the trigger elevation for BH9

Table 4: Low Water Level Trigger Elevations - BH10-II

Mast-Snyder Property, PN 60624078

2010 to 2017 water level and precipitation data for BH10-II was examined as background for establishing the triggers.

On-Site Seasonal Water Levels

Winter

- BH10-II high seasonal winter water level 2010 to 2017 is 325.06 mASL on Jan 24, 2017
- BH10-II low seasonal winter water level 2010 to 2017 is 324.48 mASL on Feb 26, 2015

  difference between high and low winter seasonal water level is 0.58 m

Spring

- BH10-II high seasonal spring water level 2010 to 2017 is 325.31 mASL on May 24, 2011
- BH10-II low seasonal spring water level 2010 to 2017 is 324.72 mASL on May 28, 2015

  difference between high and low spring seasonal water level is 0.59 m

Summer

- BH10-II high seasonal summer water level 2010 to 2017 is 324.67 mASL on Aug 16, 2013
- BH10-II low seasonal summer water level 2010 to 2017 is 324.15 mASL on Aug 8, 2012

  difference between high and low summer seasonal water level is 0.52 m

Fall

- BH10-II high seasonal fall water level 2010 to 2017 is 324.79 mASL on Nov.25, 2014
- BH10-II low seasonal fall water level 2010 to 2017 is 324.17 mASL on Nov 21, 2016

  difference between high and low fall seasonal water level is 0.62 m

The average difference between the high and low seasonal water levels at BH10-II is (0.58 m + 0.59 m + 0.52 m + 0.62 m)/4 = 0.58 m

---

Precipitation

Based on the water levels at BH10-II, the lowest seasonal water levels occur in the summer and the fall

From 1981 to 2017 met. Data from Waterloo-Wellington Airport

annual precipitation in 2016 = 689.1 mm (year of seasonal low fall water level at BH9)
annual precipitation in 2012 = 655.5 mm (year of seasonal low summer water level at BH9)
annual precipitation in 2007 = 507.9 mm (driest year on record between 1981 and 2017)
507.9 mm/689.1 mm = 0.737
0.737 - 1 = 0.262 x 100 = 26.2%
507.9 mm/655.5 mm = 0.775
0.775 - 1 = 0.225 x 100 = 22.5%

Average of 24.4%, (26.2% + 22.5%)/2 = 24.4%

Driest year (2007) since 1981 was about 24% drier than the year in which the lowest seasonal water levels were observed on the site (2016 and 2012)

Water Level Correction for Dry Year

- Driest year since 1981 was about 24% drier than the years in which the lowest summer and fall water levels were observed on the site at BH9

  0.58 m x 24% = 0.14 m

Lowest water level observed under baseline conditions was 324.15 mASL

Therefore, to account for a dry year,
324.15 mASL - 0.14 m = 324.00 mASL

324.00 mASL is the trigger elevation for BH10-II

Michael Duvnjak
IRM Technical Specialist – Guelph District
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David Hanratty, P.Geo.
Votorantim Cimentos
North America | Director of Land,
Resource & Environment
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Township of Puslinch
7404 Wellington Road 34
Puslinch, ON N0B 2J0
www.puslinch.ca

August 26, 2022

RE: 10.1 Mast Snyder Pit Proposed Low Water Level Triggers

Please be advised that Township of Puslinch Council, at its meeting held on August 10, 2022 considered the aforementioned topic and subsequent to discussion, the following was resolved:

Resolution No. 2022-270: Moved by Councillor Sepulis and
Seconded by Councillor Bailey

That Council receive Correspondence item 10.1 regarding the Mast Snyder Pit Proposed Low Water Level Triggers for information; and

That the report prepared by Harden Environmental be forwarded to the pit operator for a response and that the Ministry be copied on the correspondence noting that the Township supports the recommendation outlined by Harden Environmental in the report.

CARRIED

As per the above resolution, please accept a copy of this correspondence for your information and consideration.

Sincerely,

Courtenay Hoytfox
Municipal Clerk

HARDEN

4622 Nassagaweya-Puslinch Townline Moffat Ontario Canada L0P 1J0
Phone: 519.826.0099 fax: 519.826.9099 www.hardenv.com

Groundwater Studies

Geochemistry

Phase I / II

Regional Flow Studies

Contaminant Investigations

OMB Hearings

Water Quality Sampling

Monitoring

Groundwater Protection Studies

Groundwater Modelling

Groundwater Mapping

File: 0402

July 28, 2022

Township of Puslinch
7404 Wellington Road 34
Guelph, ON, N1H 6H9

Attention: Glenn Schwendinger

Dear Glenn:

Re: Hydrogeological Review – Mast-Snyder Proposed Thresholds

We have reviewed the proposed thresholds for the Mast-Snyder Pit and have the following comments. The thresholds are presented in the July 12, 2022 letter prepared by AECOM Canada Ltd. The proposed thresholds are listed in the following table.

Station	Proposed Threshold (m AMSL)	Historic Low (m AMSL)
BH3	323.87	324.16
BH8	324.86	325.14
BH9	323.20	323.39
BH10-2	324.00	324.15

Our comments are as follows;

1) In addition to climatic conditions, the threshold groundwater elevations should also be related to the features and ecological functions that they are designed to protect. How do the proposed thresholds for BH3 and BH10-2 relate to ground elevations in on-site wetlands or watercourses? Will proposed thresholds reduce hydroperiod in the features by delaying water table rise?

2) The relationship between annual precipitation and minimum water levels in the monitoring wells has not been established. Intuitively, one expects that in a year with lower precipitation, the seasonal groundwater elevation low would be correspondingly lower as suggested by AECOM. However a) the regression curve of hydrographs is not linear and as water levels decline, so does the rate of decline and b) if there is a wet summer/fall compared to winter/spring then low groundwater elevation

may not be directly relatable to annual precipitation. We do not think it appropriate to use a linear approach to estimate lowest water level nor is it appropriate to use annual precipitation as indicator of seasonal low water level.

3) There is data for BH3 and BH8 obtained in November 2007, the year with the lowest rainfall. This should be a good indication of water levels during extreme conditions. There is likely a strong linear correlation between BH3 and BH8 groundwater elevations and those in BH9 and BH10-2 which can then be used to predict extreme low water levels in BH9 and BH10-2.

Sincerely,

Harden Environmental Services Ltd.

[redacted]

Stan Denhoed, M.Sc., P.Eng.
Senior Hydrogeologist

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T: 905.886.7022
F: 905.886.9494
www.aecom.com

To: Jennifer DeLeemans
Votorantim Cimentos
CBM Aggregates| Manager, Lands & Environment

cc:

Date: July 12, 2022
Project #: 60651256-8
From: Patty Wong
Brian Holden

Memorandum

Subject: **CBM Aggregates Mast-Snyder Pit, Proposed Low Water Level Triggers**

CBM Aggregates, a Division of St. Marys Cement Inc. (Canada) (CBM) operates the Mast-Snyder Pit under the Aggregate Resources Act for a Category 1 – Class “A” Pit Below Water for their property in the Township of Puslinch (**Figure 1**). In 2006, the Grand River Conservation Authority (GRCA) requested low water trigger elevations on on-site groundwater monitors. This request lead to inclusion of Site Plan Conditions requiring establishment of Triggering Mechanisms and a Contingency Plan. For completeness, the Site Plan conditions are reproduced below.

Triggering Mechanisms

Trigger levels for BH3, BH8 and proposed BH9 and BH10 will be established when the below-water extraction in Area 2 of the Operations Plan is complete. Trigger levels at these locations will act as a warning to unexpected groundwater impact to the Speed River wetland both on and off-site (BH3, BH8), the Hanlon Creek Swamp (BH9) and the isolated wetland (BH10).

The trigger levels will be based on worst-case conditions (hot, dry, mid-summer week with no precipitation, plus a high rate of aggregate extraction of 2,100 tonnes per day) and baseline water level data. The trigger levels will be established in consultation with the City, the County and Township, except for BH8 which shall be based on predicted groundwater levels in May or June. Should the water level at the trigger monitors decrease to below the trigger levels, water levels will be measured again the following month. If water levels are below the trigger levels for these two consecutive monitoring events and are attributed to the below-water extraction activities, the Contingency Plan (discussed below) will be implemented.

1. *The Contingency Plan will be implemented if any of the following conditions are established:*
   a) *Groundwater levels in the monitors are reduced below the triggers (as established above), as determined by the monitoring review; or*
   b) *The ecological inspection identifies unusual stress response in the PSW directly adjacent to the pit area that is not present elsewhere in the woodlot surrounding Tributary A or ecological monitoring in the Speed River PSW on or off-site identifies unusual stress response which is attributable to the operation of the pit; or*
   c) *A water well complaint is substantiated by the investigation to have resulted from the operation of the pit.*

Note that BH9 and BH10 were installed in 2010.

a. Contingency Plan

1. *In the event that the Contingency Plan is triggered, the following actions shall be implemented:*

   b) *The operator will cease any below-water extraction operations;*

   c) *The District office of the Ministry of the Environment and the Ministry of Natural Resources, the Township, the County and the City shall be informed within seven calendar days of the impact, and the implementation of the Contingency Plan;*

   d) *Water level measurements in all on-site monitors and mini-piezometers shall be repeated as soon as possible and practical, and continue on at least a weekly basis during the period when the impact persists;*

   e) *The monitoring data and other relevant information will be reviewed by a qualified ecologist or geoscientist who will, as soon as reasonably possible, prepare a mitigation plan documenting:*

   The nature, extent and significance of the impact,
   A recommendation regarding its mitigation,
   Recommendations regarding any additional monitoring requirements, and
   Recommendations regarding the resumption of operations.
   The report shall be circulated to the District office of the Ministry of the Environment, the Ministry of Natural Resources, the Township, the County and the City; and

   f) *Subject to approval by the District office of the Ministry of the Environment and the Ministry of Natural Resources, the operator shall implement the mitigation plan.*

2. *In regard to a Contingency Plan for the isolated wetland, in the unlikely event that the water levels decrease beyond predicted levels, the deeper portion of the isolated wetland will be dredged/deepened, subject to MNR/GRCA approval. This would provide an opportunity for the dredged area to be seeded and/or planted to create a more diverse mix of wetland plant species. Details on the Contingency Plan will be shared with the Township and the County.*

As per the Site Plans, the Triggering Mechanisms and Contingency Plan will not be established until after the Area 2 below-water extraction is complete. Site preparation (berms, stripping) commenced in late spring/early summer 2018. Above and below-water extraction activities commenced in November 2018 and July 2019, respectively. Below water extraction in Area 2 commenced in late fall 2019 was completed in early April 2022. The purpose of this memo is to present the proposed trigger elevations as well as explaining the rationale behind the establishment of these levels.

In June 2006, the Ministry of Natural Resources hydrogeologist at that time (David Webster) reviewed the rationale leading to the development of the proposed trigger elevations and found it reasonable. The trigger levels presented in this memorandum reflect the agreed upon approach, updated to consider baseline water level elevations collected up to the end of 2017, prior to any on-site extraction.

As presented in the hydrogeological assessment[1], drawdown calculations were completed under the worse case scenario of a hot, dry (no precipitation), mid-summer week with a high rate of below-water extraction (2,100

[1] *Gartner Lee Limited, 2006: Consolidated Hydrogeological Assessment for Below-Water Extraction, St Marys Mast – Snyder*

tonnes per day) for the initial excavation when a small pond is present, for near the end of the operation when a large pond is present and at the end of operations when a large pond remains but extraction operations have ceased. As the initial below-water excavation commenced in the southeast corner of the site and the trigger monitors are in the northern portion of the site, no water level impacts are expected early in the below-water extraction operations in the vicinity of Tributary A. Later in the operations when a large pond is present and there is a high rate of extraction, the drawdown at Tributary A is predicted to be in the order of 0.06 m. Once operations cease, only a minor drawdown at Tributary A (less than 0.01 m) is predicted, mainly as a result of evaporation off the pond surface. The aggregate removal effect is a temporary impact that only occurs while the pit is being extracted. Over time, additional precipitation in the pit, and groundwater recharge in the surrounding areas, will offset this effect. Furthermore, as the ponds in the pit grow larger, a “reservoir” of water is created and the effects of removing solid particles from below the water table are diminished. In light of this, the drawdown effect is considered negligible and the focus of establishing triggers is based on the baseline water levels and the effects of precipitation.

Due to the highly permeable nature of the soils in the area, shallow groundwater levels are closely linked to the amount of precipitation received. During the wetter spring period, the water table rises in response to spring snowmelt and increased precipitation that typically occur. During the drier periods of the year, the water table will decrease. In establishing trigger levels, the long term meteorological data from 1981 to 2017 for the closest Environment Canada meterological station (Waterloo-Wellington Airport, climate ID 6149387), was reviewed. Groundwater monitoring at the site began in 1999 for monitors BH1 to BH5. Over time, additional groundwater monitors were installed and incorporated into the routine seasonal water level monitoring of the site (BH6 to BH8 were drilled May 2003; BH9, BH10 and BH11 were drilled in 2010). Groundwater elevations for the 11 existing on-site groundwater monitor locations were reviewed.

The Site Plan requires low level trigger elevations at BH3, BH8, BH9 and BH10. The baseline manual water level record of each of these locations were examined; 1999 to 2017 for BH3, 2003 to 2017 for BH8 and 2010 to 2017 for BH9 and BH10 to estimate the seasonal high and low water levels to determine typical water level fluctuations. The average difference between the seasonal low and high water levels recorded at each monitor was calculated. Next, the annual precipitation data from 1981 to 2017 was examined showing that 2007 had the lowest precipitation (507.9 mm) during this period. For each monitor, the years with the summer and fall low water levels was compared to the 2007 precipitation to determine how much lower was the 2007 precipitation and these were averaged. The difference between the low water level years and the driest year (2007) was applied to the average seasonal fluctuation to estimate how much lower water levels might be in a very dry year with a high rate of extraction. Then this correction was applied to the lowest observed manual water level for each specific monitor location resulting in a low water level trigger elevation.

For example, at monitor BH3, the average seasonal difference between high and low water levels was about 0.76 m for the 1999 to 2017 baseline period, prior to on-site extraction. The driest year on record (since 1981) from data at the Environment Canada Waterloo-Wellington Airport was 2007 with a total annual precipitation of 507.9 mm. Based on the water levels at BH3, the lowest seasonal water levels occurred in the summer and fall in 2001 and 1999, respectively. The 2001 and 1999 annual precipitation was approximately 39% and 37%, respectively, higher than the 2007 annual precipitation with an average between the two of about 38%. To account for a dry year, 38% of the difference between the average high and low seasonal water levels was subtracted from the predicted post-extraction lake elevation[2]. The lowest water level at BH3 occurred in December 1999 (324.16 mASL). Therefore, to account for a dry year and high rate of extraction, the correction

Property, Township of Puslinch, County of Wellington, prepared for St. Marys Cement Inc., GLL23-312, December 14, 2006.
[2] 38.3% of 0.76 m = 0.29 m, therefore, 324.16 mASL minus 0.29 m = 323.87 mASL.

for a dry year (0.29 m) was subtracted from the lowest recorded baseline water level (324.16 mASL) to provide a BH3 trigger elevation of 323.87 mASL.

A summary of the triggers, based on the above approach is provided in the table below.

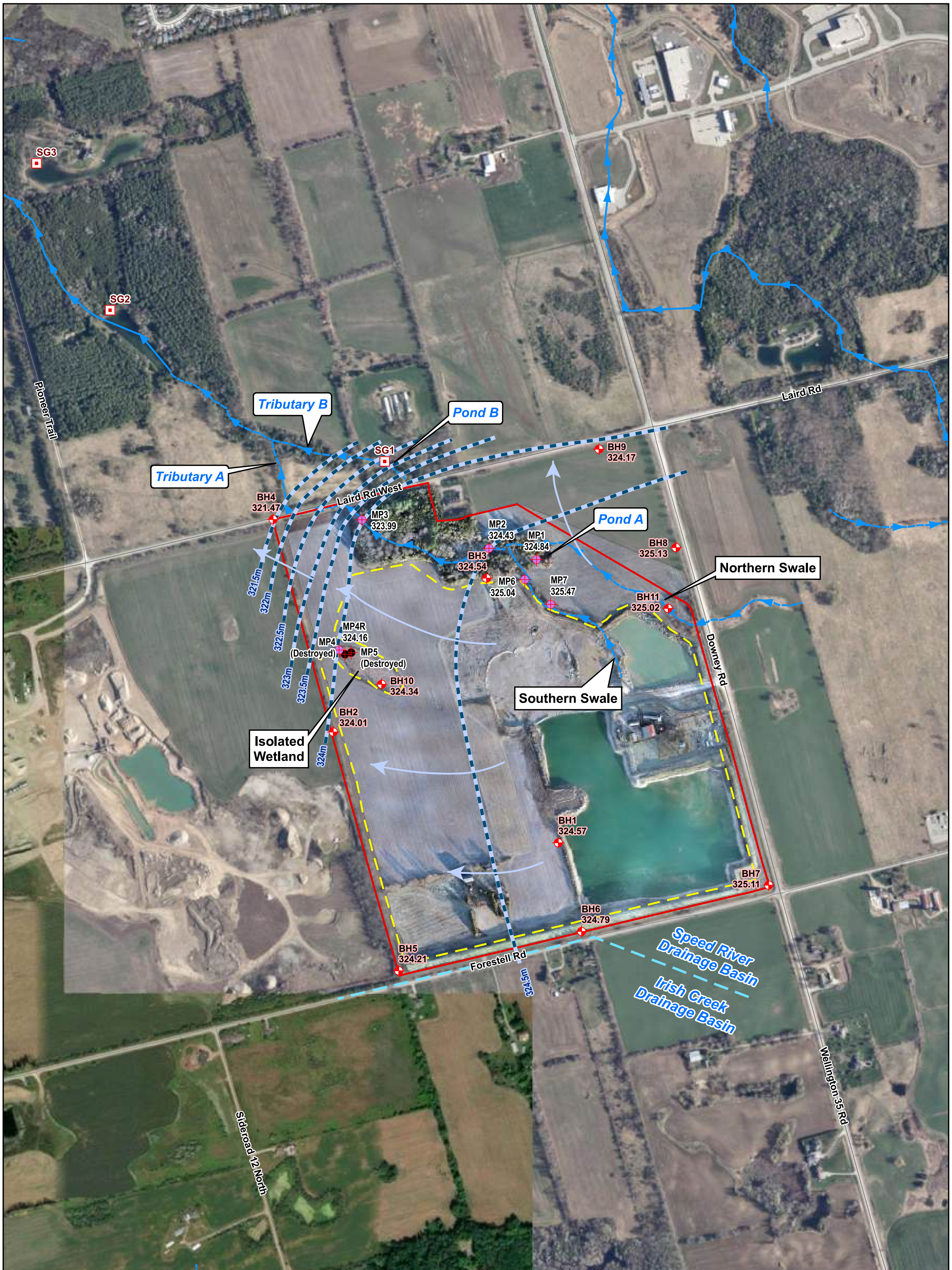
Location	Low Water Trigger Elevation
BH3	323.87 mASL
BH8	324.86 mASL
BH9	323.20 mASL
BH10-II	324.00 mASL

The detailed methodology and calculations used to set the triggers is presented in attached Tables 1 to 4.

Technical Recommendations, Hydrogeological Assessment, Site Plan Condition 4 reads:

4. Monthly groundwater level measurements and groundwater temperatures will be collected during periods of below-water extraction at the monitoring points (monitoring wells and mini-piezometers) on-site for the first two years of below-water extraction. If trends are consistent over the first two-years of below-water extraction, the monitoring program will be reduced from monthly to quarterly.

The Site Plan triggering mechanisms and contingency plans were originally based on the monthly/quarterly manual water level monitoring program, as described above under Condition 4. In May 2018, all existing groundwater monitors and mini-piezometers on-site were instrumented with level loggers collecting daily water level readings, which is a much higher frequency than the monthly/quarterly frequency originally cited in the Site Plans. As this is the case, it is proposed that as long as daily logger readings are collected at BH3, BH8, BH9 an BH10-II, the triggering mechanisms are based on groundwater levels that are recorded below the trigger elevation for seven consecutive days with an observed downward trend and attributed to be a result of below-water extraction activities before the contingency plan is implemented.



Basemapping from Ontario Ministry of Natural Resources
Orthophotography: June 2019
Note: On-site aerial coverage from Dec 14, 2021 Drone Survey

N W E S

0 100 200 400
Meters
UTM Zone 17, NAD 83

Legend

- Mini-Piezometer
- Destroyed Mini-Piezometer
- Staff Gauge
- Monitor Location
- Groundwater Contours (0.5m)
- Groundwater Divide
- Groundwater Flow Direction
- Roads
- Intermittent Watercourse
- Permanent Watercourse
- Site Boundary
- Approximate Limit of Extraction

CBM Aggregates
Mast-Snyder Property

Site Plan and Groundwater Flow (November 2021)

June 2022
Project 60651256-7

AECOM

Figure 4

Path: L:\Kitchener-CAKCN1\Legacy\CAKCN1FP001\Data\FP001Data\DATAFP001\CAKCN-Environment\Projects\60312725-9 Cedar Pit\St Mary\60651256_StMarySitPlanandGroundwaterflow_20220627.mxd

Table 1: Low Water Level Trigger Elevations - BH3

Mast-Snyder Property, PN 60624078

1999 to 2017 water level and precipitation data for BH3 was examined as background for establishing the triggers.

On-Site Seasonal Water Levels

Winter
- BH3 high seasonal winter water level 1999 to 2017 is 325.06 mASL on Nov 27, 2006
- BH3 low seasonal winter water level 1999 to 2017 is 324.28 mASL on Jan 14, 2003
  difference between high and low winter seasonal water level is 0.78 m

Spring
- BH3 high seasonal spring water level 1999 to 2017 is 325.45 mASL on Apr 12, 2008
- BH3 low seasonal spring water level 1999 to 2017 is 324.82 mASL on May 28, 2015
  difference between high and low spring seasonal water level is 0.63 m

Summer
- BH3 high seasonal summer water level 1999 to 2017 is 324.93 mASL on Aug 20, 2008
- BH3 low seasonal summer water level 1999 to 2017 is 324.27 mASL on Sept 11, 2001
  difference between high and low summer seasonal water level is 0.66 m

Fall
- BH3 high seasonal fall water level 1999 to 2017 is 325.12 mASL on Nov.25, 2014
- BH3 low seasonal fall water level 1999 to 2017 is 324.16 mASL on Dec 15, 1999
  difference between high and low fall seasonal water level is 0.96 m

The average difference between the high and low seasonal water levels at BH3 is (0.78 m + 0.63 m + 0.66 m + 0.96 m)/4 = 0.76 m

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Precipitation

Based on the water levels at BH3, the lowest seasonal water levels occur in the summer and the fall

From 1981 to 2017 met. Data from Waterloo-Wellington Airport
annual precipitation in 1999 = 811 mm (year of seasonal low fall water level at BH3)
annual precipitation in 2001 = 835.8 mm (year of seasonal low summer water level at BH3)
annual precipitation in 2007 = 507.9 mm (driest year on record between 1981 and 2017)
507.9 mm/811 mm = 0.626
0.626 - 1 = 0.374 x 100 = 37.4%
507.9 mm/835.8 mm = 0.608
0.608 - 1 = 0.392 x 100 = 39.2%

Average of 38.3%, (37.4% + 39.2%)/2 = 38.3%

Driest year (2007) since 1981 was about 38% drier than the year in which the lowest seasonal water levels were observed on the site (1999 and 2017)

Water Level Correction for Dry Year

- Driest year since 1981 was about 38% drier than the years in which the lowest summer and fall water levels were observed on the site at BH3
  0.76 m x 38% = 0.29 m

Lowest water level observed under baseline conditions was 324.16 mASL
Therefore, to account for a dry year,
324.16 mASL - 0.29 m = 323.87 mASL

323.87 mASL is the trigger elevation for BH3

Table 2: Low Water Level Trigger Elevations - BH8

Mast-Snyder Property, PN 60624078

2003 to 2017 water level and precipitation data for BH8 was examined as background for establishing the triggers.

On-Site Seasonal Water Levels

Winter

- BH8 high seasonal winter water level 2003 to 2017 is 327.28 mASL on Jan 24, 2017
- BH8 low seasonal winter water level 2003 to 2017 is 325.65 mASL on Feb 26, 2015

difference between high and low winter seasonal water level is 1.63 m

Spring

- BH8 high seasonal spring water level 2003 to 2017 is 326.63 mASL on Apr 12, 2008
- BH8 low seasonal spring water level 2003 to 2017 is 325.78 mASL on May 28, 2015

difference between high and low spring seasonal water level is 0.85 m

Summer

- BH8 high seasonal summer water level 2003 to 2017 is 325.98 mASL on Aug 5, 2009
- BH8 low seasonal summer water level 2003 to 2017 is 325.27 mASL on Aug 8, 2012

difference between high and low summer seasonal water level is 0.71 m

Fall

- BH8 high seasonal fall water level 2003 to 2017 is 326.03 mASL on Nov.27, 2006
- BH8 low seasonal fall water level 2003 to 2017 is 325.14 mASL on Nov 25, 2014

difference between high and low fall seasonal water level is 0.89 m

The average difference between the high and low seasonal water levels at BH8 is (1.63 m + 0.85 m + 0.71 m + 0.89 m)/4 = 1.02 m

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Precipitation

Based on the water levels at BH8, the lowest seasonal water levels occur in the summer and the fall

From 1981 to 2017 met. Data from Waterloo-Wellington Airport

annual precipitation in 2014 = 734.3 mm (year of seasonal low fall water level at BH8)
annual precipitation in 2012 = 655.5 mm (year of seasonal low summer water level at BH8)
annual precipitation in 2007 = 507.9 mm (driest year on record between 1981 and 2017)
507.9 mm/734.3 mm = 0.692
0.692 - 1 = 0.308 x 100 = 30.8%
507.9 mm/655.5 mm = 0.775
0.775 - 1 = 0.225 x 100 = 22.5%

Average of 26.7%, (30.8% + 22.5%)/2 = 26.7%

Driest year (2007) since 1981 was about 27% drier than the year in which the lowest seasonal water levels were observed on the site (2003 and 2017)

Water Level Correction for Dry Year

- Driest year since 1981 was about 27% drier than the years in which the lowest summer and fall water levels were observed on the site at BH8

1.02 m x 27% = 0.28 m

Lowest water level observed under baseline conditions was 325.14 mASL

Therefore, to account for a dry year,
325.14 mASL - 0.28 m = 324.86 mASL

324.86 mASL is the trigger elevation for BH8

Table 3: Low Water Level Trigger Elevations - BH9

Mast-Snyder Property, PN 60624078

2010 to 2017 water level and precipitation data for BH9 was examined as background for establishing the triggers.

On-Site Seasonal Water Levels

Winter

- BH9 high seasonal winter water level 2010 to 2017 is 324.67 mASL on Jan 24, 2017
- BH9 low seasonal winter water level 2010 to 2017 is 323.71 mASL on Feb 26, 2015

difference between high and low winter seasonal water level is 0.96 m

Spring

- BH9 high seasonal spring water level 2010 to 2017 is 324.91 mASL on May 24, 2011
- BH9 low seasonal spring water level 2010 to 2017 is 323.91 mASL on May 28, 2015

difference between high and low spring seasonal water level is 1 m

Summer

- BH9 high seasonal summer water level 2010 to 2017 is 323.75 mASL on Aug 16, 2013
- BH9 low seasonal summer water level 2010 to 2017 is 323.43 mASL on Aug 8, 2012

difference between high and low summer seasonal water level is 0.32 m

Fall

- BH9 high seasonal fall water level 2010 to 2017 is 324.14 mASL on Nov.20, 2013
- BH9 low seasonal fall water level 2010 to 2017 is 323.39 mASL on Nov 21, 2016

difference between high and low fall seasonal water level is 0.75 m

The average difference between the high and low seasonal water levels at BH9 is (0.96 m + 1 m + 0.32 m + 0.75 m)/4 = 0.76 m

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Precipitation

Based on the water levels at BH9, the lowest seasonal water levels occur in the summer and the fall

From 1981 to 2017 met. Data from Waterloo-Wellington Airport

annual precipitation in 2016 = 689.1 mm (year of seasonal low fall water level at BH9)
annual precipitation in 2012 = 655.5 mm (year of seasonal low summer water level at BH9)
annual precipitation in 2007 = 507.9 mm (driest year on record between 1981 and 2017)
507.9 mm/689.1 mm = 0.737
0.737 - 1 = 0.262 x 100 = 26.2%
507.9 mm/655.5 mm = 0.775
0.775 - 1 = 0.225 x 100 = 22.5%

Average of 24.4%, (26.2% + 22.5%)/2 = 24.4%

Driest year (2007) since 1981 was about 24% drier than the year in which the lowest seasonal water levels were observed on the site (2016 and 2012)

Water Level Correction for Dry Year

- Driest year since 1981 was about 24% drier than the years in which the lowest summer and fall water levels were observed on the site at BH9

0.76 m x 24% = 0.19 m

Lowest water level observed under baseline conditions was 323.39 mASL

Therefore, to account for a dry year,
323.39 mASL - 0.19 m = 323.20 mASL

323.20 mASL is the trigger elevation for BH9

Table 4: Low Water Level Trigger Elevations - BH10-II

Mast-Snyder Property, PN 60624078

2010 to 2017 water level and precipitation data for BH10-II was examined as background for establishing the triggers.

On-Site Seasonal Water Levels

Winter
- BH10-II high seasonal winter water level 2010 to 2017 is 325.06 mASL on Jan 24, 2017
- BH10-II low seasonal winter water level 2010 to 2017 is 324.48 mASL on Feb 26, 2015

    difference between high and low winter seasonal water level is 0.58 m

Spring
- BH10-II high seasonal spring water level 2010 to 2017 is 325.31 mASL on May 24, 2011
- BH10-II low seasonal spring water level 2010 to 2017 is 324.72 mASL on May 28, 2015

    difference between high and low spring seasonal water level is 0.59 m

Summer
- BH10-II high seasonal summer water level 2010 to 2017 is 324.67 mASL on Aug 16, 2013
- BH10-II low seasonal summer water level 2010 to 2017 is 324.15 mASL on Aug 8, 2012

    difference between high and low summer seasonal water level is 0.52 m

Fall
- BH10-II high seasonal fall water level 2010 to 2017 is 324.79 mASL on Nov.25, 2014
- BH10-II low seasonal fall water level 2010 to 2017 is 324.17 mASL on Nov 21, 2016

    difference between high and low fall seasonal water level is 0.62 m

The average difference between the high and low seasonal water levels at BH10-II is (0.58 m + 0.59 m + 0.52 m + 0.62 m)/4 = 0.58 m

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Precipitation

Based on the water levels at BH10-II, the lowest seasonal water levels occur in the summer and the fall

From 1981 to 2017 met. Data from Waterloo-Wellington Airport

annual precipitation in 2016 = 689.1 mm (year of seasonal low fall water level at BH9)
annual precipitation in 2012 = 655.5 mm (year of seasonal low summer water level at BH9)
annual precipitation in 2007 = 507.9 mm (driest year on record between 1981 and 2017)
507.9 mm/689.1 mm = 0.737
0.737 - 1 = 0.262 x 100 = 26.2%
507.9 mm/655.5 mm = 0.775
0.775 - 1 = 0.225 x 100 = 22.5%

Average of 24.4%, (26.2% + 22.5%)/2 = 24.4%

Driest year (2007) since 1981 was about 24% drier than the year in which the lowest seasonal water levels were observed on the site (2016 and 2012)

Water Level Correction for Dry Year

- Driest year since 1981 was about 24% drier than the years in which the lowest summer and fall water levels were observed on the site at BH9

    0.58 m x 24% = 0.14 m

Lowest water level observed under baseline conditions was 324.15 mASL

Therefore, to account for a dry year,
324.15 mASL - 0.14 m = 324.00 mASL

324.00 mASL is the trigger elevation for BH10-II

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