TECHNICAL MEMORANDUM

DATE October 21, 2025 **Project No.** CA-GLD-1791470A-VCNA

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CBM Aggregates

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SUPPLEMENTAL ASSESSMENT OF POTENTIAL IMPACTS TO PROVINCIALLY SIGNIFICANT WETLANDS – PROPOSED CBM ABERFOYLE SOUTH LAKE PIT

In December 2023, CBM Aggregates (CBM), a division of St. Marys Cement Inc. (Canada) submitted an Aggregate Resources Act application to licence the proposed Aberfoyle South Lake Pit, located at 6947 Concession Road 2, in the Township of Puslinch, County of Wellington, Ontario. WSP Canada Inc. (WSP) prepared a Level 1/2 Water Report (Water Report) and Natural Environment Report to support this application. Stakeholder comments have been received pertaining to various aspects of the application and reports.

Stakeholders have expressed concern regarding the potential for impacts to Provincially Significant Wetlands (PSWs) as a result of the proposed aggregate pit development during operations and post-rehabilitation. This technical memorandum provides a supplemental assessment of these potential impacts, in order to provide clarity and context to the predicted changes to wetland hydrology and ecology as a result of this proposed aggregate extraction development, and accordingly provides supplemental impact assessment.

BACKGROUND

Hydrological and hydrogeological investigations at the Site, presented in the Water Report (WSP 2023), characterized the PSWs by:

- Hydrological analysis of the PSWs presented in the Site Water Balance (Section 6 of the Water Report);
- Hydrogeological analysis of PSWs including:
  - Collection of groundwater levels in the water table aquifer to observe interactions of the groundwater flow system with hydrological features and the ground surface;
  - Establishment of specific wetland monitoring stations (SW5 and SW6), each including monitoring of surface water and shallow groundwater levels; and
  - Consideration of the PSWs in the numerical groundwater flow model by quantifying predicted changes to groundwater discharges to specific PSW zones relative to current conditions.
- Wetland Analysis of PSW
  - Review the existing conditions and Ecological Land Classification (ELC) designations of wetland communities and their associated moisture regime.

- Confirm wetland boundaries using Ontario Wetland Evaluation System (OWES).
- Review small pockets of wetland exhibiting proliferation of invasive species in the agricultural fields proposed for removal; and,
- Assess the proposed wetland buffers that are currently subject to agricultural ploughing and annual crop production (row crops – corn, wheat and soya beans) and potential for any Critical Function Zones in and around the wetlands and within the proposed buffer setbacks.
- Assess potential impacts to wetlands vegetation and fauna based on wetland conditions and wetland knowledge and potential changes in water regime and hydroperiods presented in the water analysis technical assessments.

Hydrological Water Balance

The hydrology of the Site is quantitatively considered by the Water Balance, which considers precipitation minus evapotranspiration to be the surplus based on land type and use. Surplus is then allocated to infiltration or runoff to model the hydrology of the Site. The water balance also considers water holding capacity (WHC) of different land uses and soil types, which represents the ability of the shallow soils to retain water.

As summarized in Tables 13 and 14 of the Water Report, the Water Balance of the Site considers the majority of the PSWs to be a forested swamp, with an annual surplus of 276 mm and a WHC of 300 mm, and a minority of the PSWs to be a marsh with a surplus of 303 mm and a WHC of 150 mm. The Water Balance shows an annual surplus which suggests that the PSWs can be supported in their current condition by precipitation combined with the WHC of their soils, particularly the high WHC of the forested swamps, which allows PSWs of this type to retain water accumulated during wet portions of the year that then supports these ecological features during extended dry periods.

The surplus in the PSWs is divided between the infiltration (67%) and runoff (33%) (as a weighted average of the two land use types), showing that on an annual average, the PSWs contribute to local groundwater recharge and contribute runoff to surface water features.

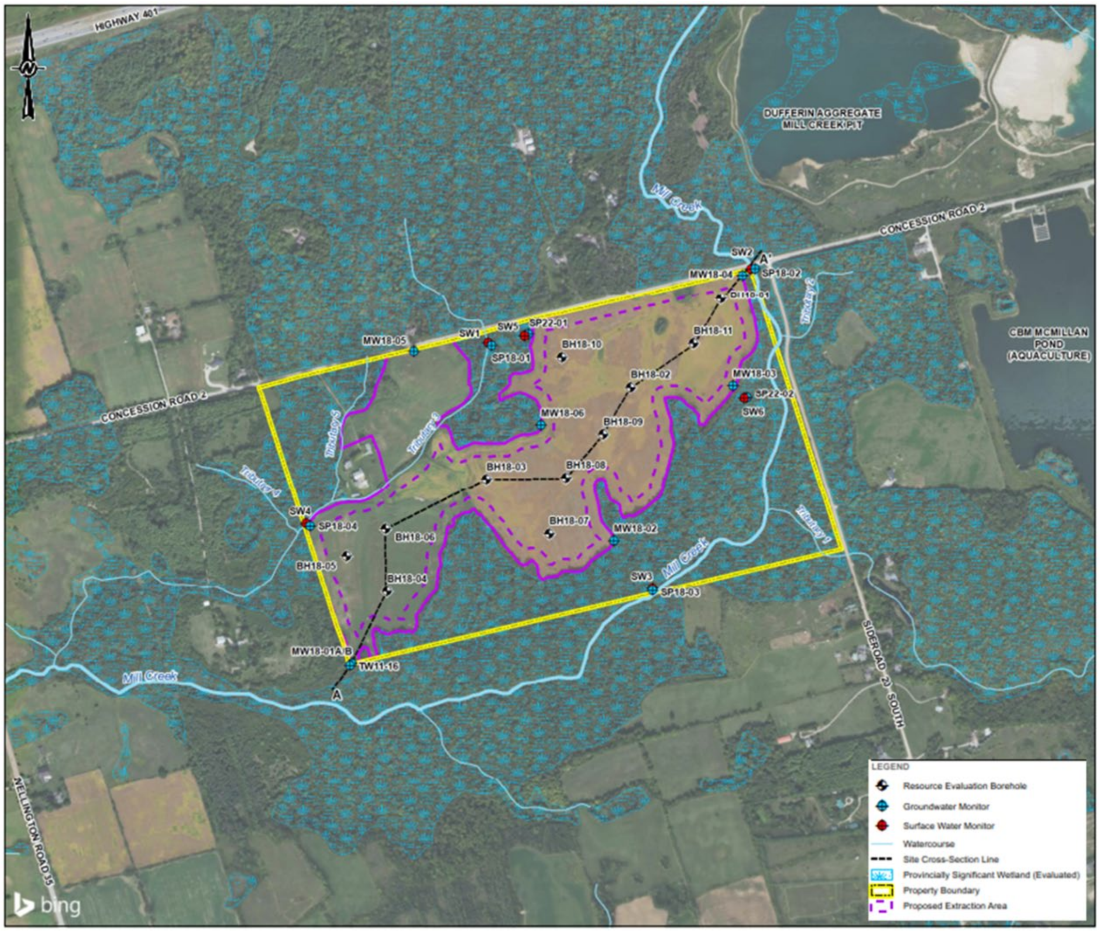


Figure 1: Site Location Plan showing Surface Water Monitors, Groundwater Monitors and PSWs

Hydrogeological Characterization of the PSWs

Groundwater levels monitored on the Site showed that the water table in portions of the Site, is near the ground surface during wet periods of the year and seasonally drop below ground surface, with overall groundwater flow through the water table aquifer being from the north to southwest with groundwater discharging to Mill Creek and Tributary 3, as discussed in detail in Section 5.2 and 5.7 of the Water Report.

Surface water monitoring locations SW5 and SW6 (Figure 1) were established to support the conceptualization of the PSWs surrounding the Site, observe hydroperiod, and groundwater gradients. Monitoring results at these locations during 2022 are presented in the Water Report, and subsequent monitoring data for 2023 to 2024 period are presented herein.

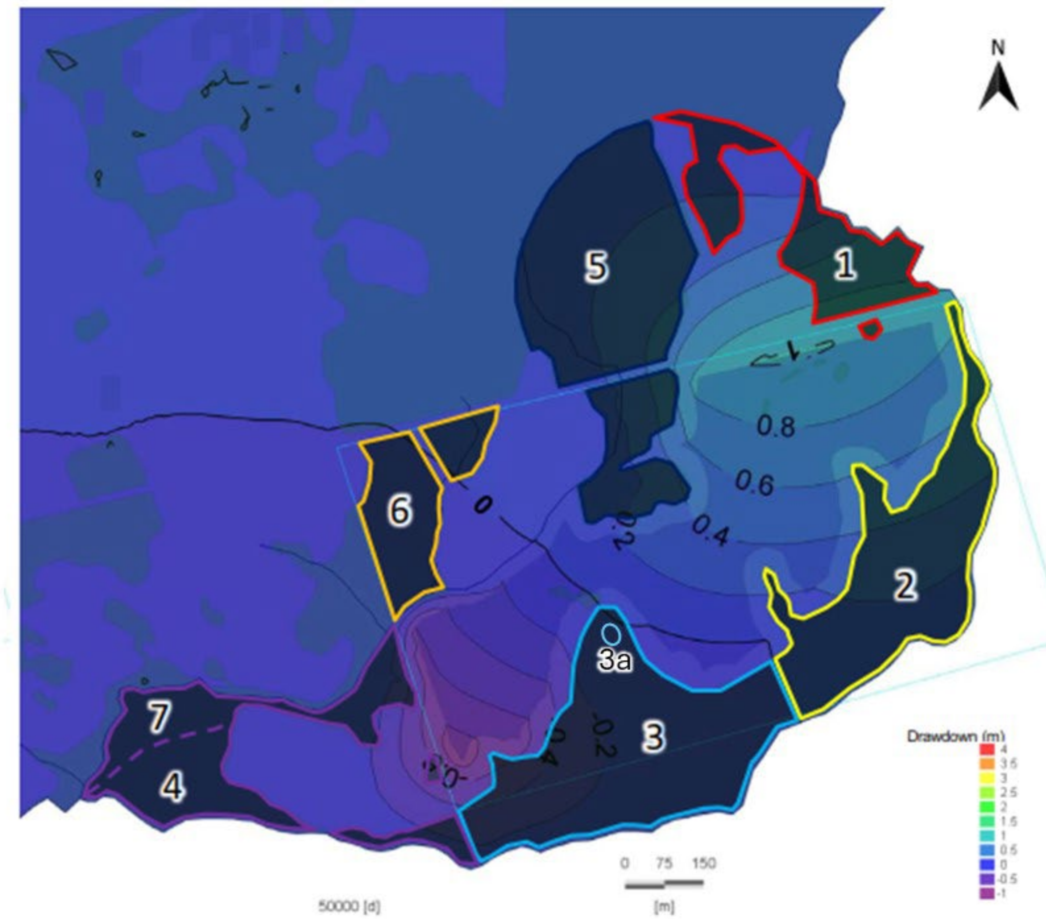


Figure 2: PSW Zonation and Groundwater Drawdown under Rehabilitated Conditions

In addition to direct observations of the Site's hydrogeology, the numerical groundwater flow model, presented in Appendix G of the Water Report, supports the understanding of groundwater interaction with the PSWs. It is important to note that the purpose of the numerical groundwater flow model is to provide a consistent interpretation of the groundwater flow system, as a basis for predicting potential impacts of changes in groundwater flow during operations and post-rehabilitation conditions, such as changes in stream baseflow and changes in groundwater levels at private water wells. The groundwater flow model is also a useful tool in representing groundwater interactions with PSWs, however the model cannot simulate hydrologic processes, such as those described in the Water Balance, which are important in understanding the overall behavior of a wetland system.

As described in the Water Report, to support the assessment of impacts on PSWs, exceptionally conservative boundary conditions were selected and the PSWs were divided it into seven zones, shown on Figure 2. A drainage boundary condition was used to represent Mill Creek (which specifies Mill Creek can receive groundwater discharge but not recharge groundwater) when assessing impacts to groundwater conditions around the PSW (as presented in Section 3.5.3 of Appendix G, in the Water Report). This assessment is an exceptionally conservative as it assumes Mill Creek will not provide any recharge and therefore overestimates drawdown and predicted impacts on the PSW. The predicted groundwater drawdown relative to current conditions is presented for during extraction operations at the end of Operational Years 2, 4 and 6 (Figure 3) and post-rehabilitation (Figure 2).

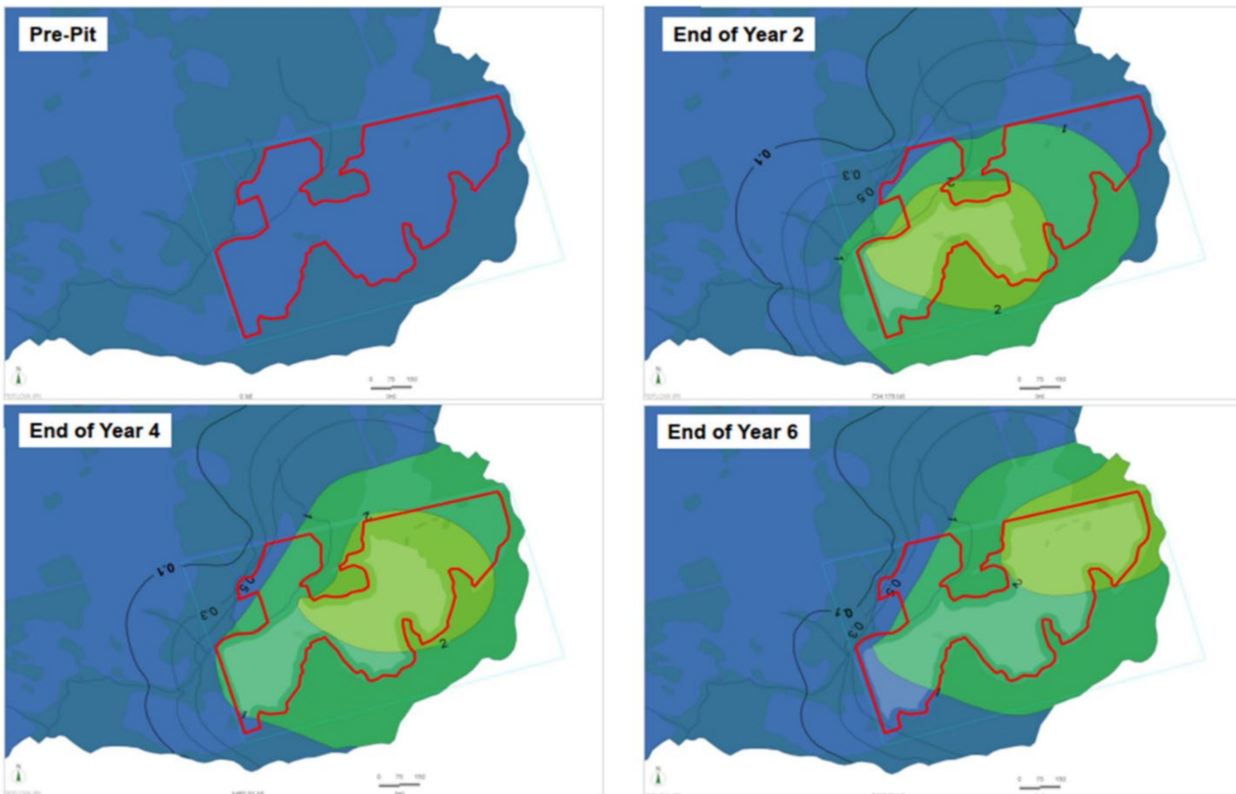


Figure 3: Predicted Groundwater Drawdown during Operation relative to Current Conditions

Table 1 presents the changes groundwater discharge relative to current conditions for each PSW zone, during operations and in post-rehabilitated conditions (based on Appendix G, Section 4.2.3 of the Water Report).

Table 1: Predicted Changes to Groundwater Discharge to Wetlands by PSW Zone

Zone	Predicted PSW Zone Discharge (mm/yr)							Area (hectares)
	Pre-Pit	Operational				Post-Rehabilitated		
		Year 2	Year 4	Year 6	Max. Difference	Flux	Difference	
Zone 1	164	62	14	6	-158	65	-99	11.2
Zone 2	266	0	0	0	-266	155	-111	14.1
Zone 3	142	0	0	6	-142	311	168	16.2
Zone 4	413	170	205	245	-243	671	258	6.7

Zone	Predicted PSW Zone Discharge (mm/yr)							Area (hectares)
	Pre-Pit	Operational				Post-Rehabilitated		
		Year 2	Year 4	Year 6	Max. Difference	Flux	Difference	
Zone 5	174	0	0	0	-174	0	-174	23.3
Zone 6	768	4	30	118	-765	885	116	6.1
Zone 7	816	335	404	485	-481	1326	511	4.8

Numerical modelling simulations predict that some PSW zones will receive reduced groundwater inputs during some stages of operations and in post-rehabilitated conditions, which could potentially lead to impacts to the PSWs. To further assess the potential for impacts to the PSWs as a result of the predicted changes in groundwater levels, a supplemental assessment was undertaken utilizing the additional monitoring data for 2023 to 2024, and additional site reconnaissance undertaken by natural environment, hydrology and hydrogeology team members in the spring of 2025.

SUPPLEMENTAL WETLAND HYDROLOGY AND IMPACT ASSESSMENT

To build on the characterization of the PSWs and impact assessment presented in the Water Report, the following steps are presented in this Technical Memorandum.

1) Wetland Hydrology Characterization: This section describes the hydrology of each wetland zone with consideration given to the varied water inputs and their relative significance in each zone of the PSW.

2) Hydrological Potential for Impact: The refined hydrological impact assessment identifies changes to the hydrology of the wetland features on a zone by zone and input by input basis to identify the degree of potential impact each zone experiences based on the hydrology of the feature.

3) Ecological Impact Assessment: The hydrological information serves to support ecological interpretations of impact on the feature.

4) Monitoring Recommendations: To mitigate potential for impacts to the wetland and verify that no negative impacts take place, enhanced monitoring is recommended, an approach to setting Trigger Setting to proactively identify potential for impacts is proposed, and corrective actions are identified.

WETLAND HYDROLOGY CHARACTERIZATION

To assess the potential impacts of changes in groundwater levels on the PSW, an assessment of wetland hydrology in each zone of the PSW was conducted. The assessment considered the relative magnitude of the sources of water maintaining the wetland feature (i.e., surface water inputs and groundwater inputs) and the potential for adverse impact on the PSW from changes to those inputs, similar to the model of wetland hydrology outlined by the TRCA (2020).

In general, wetland hydrology can be represented by fluxes in and out of a wetland system resulting in a change in storage in the wetland. Figure 4 shows a typical schematic of fluxes into and out of a wetland based on work by Hayashi, van der Kamp, and Rosenberry (2016).

The inputs considered for each wetland zone at the Site include:

- Direct Precipitation. Precipitation reporting directly to the wetland. Precipitation data presented in the Water Report indicates the annual average precipitation in the area of the Site is approximately 871 mm/year.
- Runoff. Overland flow can occur from adjoining features into wetlands under specific hydrological conditions, such as the spring freshet or during intense rainfall.
- Surface Water. Where present, channelized features can overflow the banks and inundate (i.e. flood) nearby wetland areas during intense hydrological events. This condition is referred to as a surface water input to the wetland and is considered to be distinct from overland flow / runoff.
- Groundwater Discharge. Groundwater discharge to the ground surface within wetlands can support wetland features.

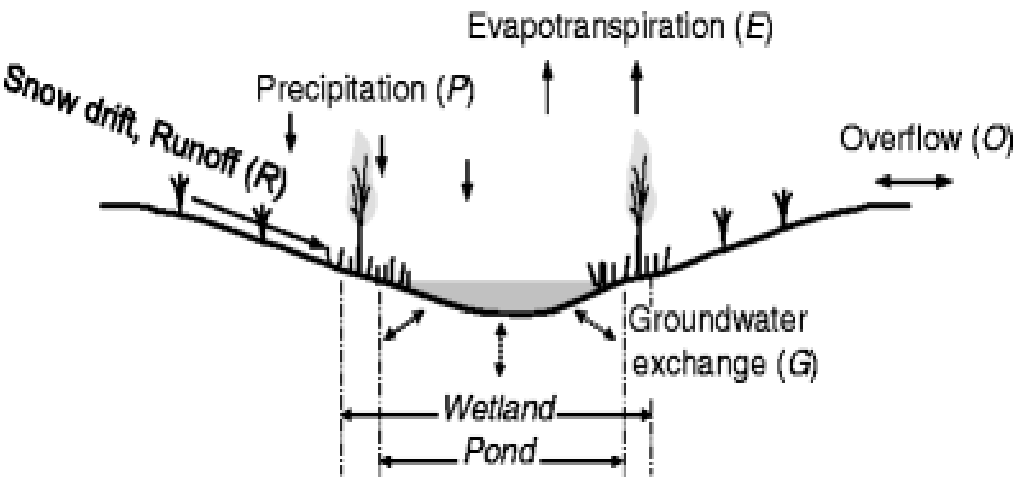


Figure 4: Wetland Hydrology Schematic (after Hayashi, van der Kamp, and Rosenberry 2016)

Direct precipitation and groundwater discharge provide water inputs to wetlands throughout the year, while event base hydrology inputs like increased surface water levels, contribute to wetland infrequently, fill storage in the wetland and can be significant factor in the annual water inputs for a wetland feature.

Outflows from wetland features include:

- Evapotranspiration. Evaporation and transpiration of the plant community, assessed to be 595 mm/year in forested swamps by the Water Balance in the Water Report.
- Runoff. Wetland features surrounding the Site are drained by surface water features, which receive runoff from the PSW.
- Infiltration. Where and when downward hydraulic gradients exist, water in the wetland infiltrates into the underlaying water table aquifer and recharges the groundwater system.

The hydrologic assessments for each PSW zone presented in the subsection below are based on observations made during more than 60 site visits over a 7 year period, continuous water level monitoring data at key surface water and groundwater stations across the Site, and a detailed understanding of topography and surface water conditions.

Qualitative Description of Wetland Water Inputs

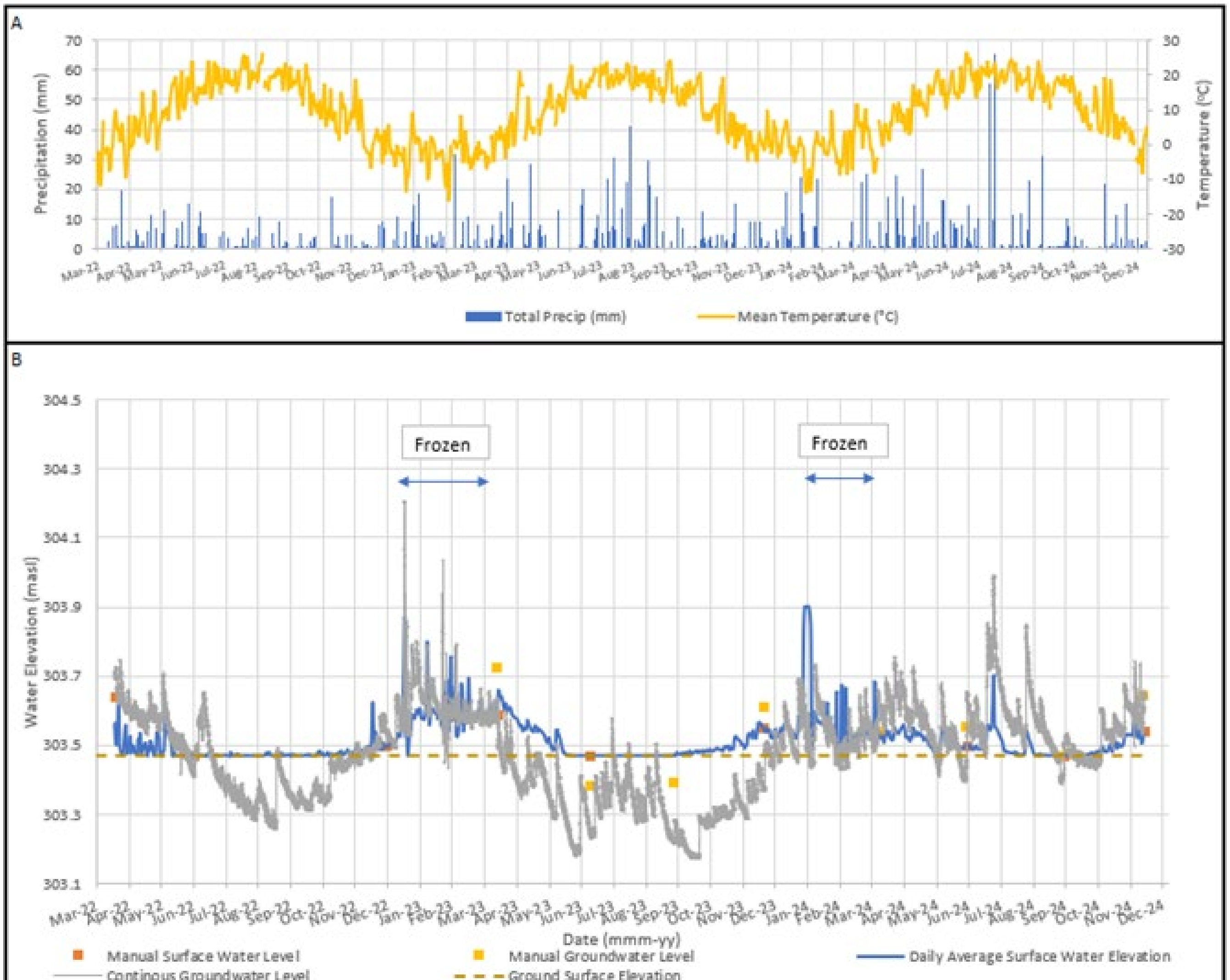
The water inputs to the PSWs are a critical factor in the hydrology of each wetland zone, as discussed below and summarized in Table 2 at the end of this subsection.

Figure 5: Photos of PSW Zone 1 Surface Water Conditions

(Note: photos taken on April 1, 2025, Pane A: Beaver dam on Mill Creek viewed from Concession Road 2 bridge, Pane B, C, portions of Zone 1 inundated by high levels resulting from the beaver dam, Pane D: Upland area in the western portion of Zone 1, unimpacted by high surface water levels.)

- Zone 1: Hydrology of PSW Zone 1 is currently dominated by surface water inputs due to beaver activity along Mill Creek, which has caused the inundation of some of the zone (Figure 5). Direct precipitation is also a significant source of water in this zone.
- Zone 2: Located to the east of the proposed area of extraction, PSW Zone 2 is monitored at SW6 which shows periodically small upward (often during wet conditions in the spring) and small downward gradients, as shown on Figure 6. The hydroperiod is short and associated with the wet part of the year. This wetland area is

supported largely by direct precipitation inputs, with minor contributions from runoff and groundwater discharge.



A. Total Daily Precipitation and Mean Daily Temperature (Kitchener/Waterloo, ON, EC Climate ID#6144239) B. Water Level

Figure 6: PSW Zone 2 Hydrograph (SW6)

- Zone 3: Located in the southern portion of the Site, is similar to Zone 2, the hydroperiod is short and associated with the wet part of the year. This wetland is supported largely by direct precipitation inputs, with minor contributions from runoff and groundwater discharge, except for Zone 3a discussed below.
- Zone 3a: Is a closed depression in the ground surface (Figure 7) located within Zone 3, which is inferred to intercept the water table and stays wetted for a longer time than the surrounding Zone 3 area. This area

receives runoff from the surrounding Zone 3 and presumably retains it above a layer of organic or fine grain material accumulated in the depression. This zone may also receive some groundwater inputs.

Figure 7: Photo of PSW Zone 3a Surface Water Conditions

(Note: photo taken on April 1, 2025)

- Zone 4: Is located in the southwest of the Site and is drained by Tributary 3. It receives water from direct precipitation and may receive minor inputs from surface water in Tributary 3, runoff, and groundwater discharge.
- Zone 5: Is significantly influenced by Tributary 3, the Concession Road 2 embankment bisecting the zone, and the culvert that transfers water beneath the road. Water levels in Zone 5 (Figure 8) are monitored at SW5, located south of Concession Road 2). The zone is considered in two portions:
  - North of Concession Road 2, surface water from a significant catchment extending more than 900 m north to Highway 401, reports to Tributary 3. The road embankment and culvert retain water north of the

road with little channelization to convey the water to the culvert, as shown on Figure 9. North of the road Zone 5 receives significant water inputs from direct precipitation and Tributary 3’s poorly defined channel wetting the area. The road and culvert structure retain surface water at an elevation greater than those observed on the south side of the road. This site condition is expected to influence local surface water and groundwater conditions within portions of Zone 5.

- South of Concession Road 2, Zone 5 receives significant water inputs from direct precipitation, Tributary 3 overtopping its banks during hydrological events, and moderate water input from groundwater discharge. Tributary 3 is monitored in Zone 5 at SW1, which has been observed to periodically overtop its banks. Additionally, it is noted that water levels during high flow events at SW1 are higher than those observed at SW5 and ground elevation in the wetland. This observation suggests that during high water events, Zone 5 receives significant amounts of water from Tributary 3. It is noted that shallow groundwater has a small upward gradient there throughout most of the monitoring period at SW5. This is influenced by the surface water head built up to the north of the Site as a result of the road embankment.

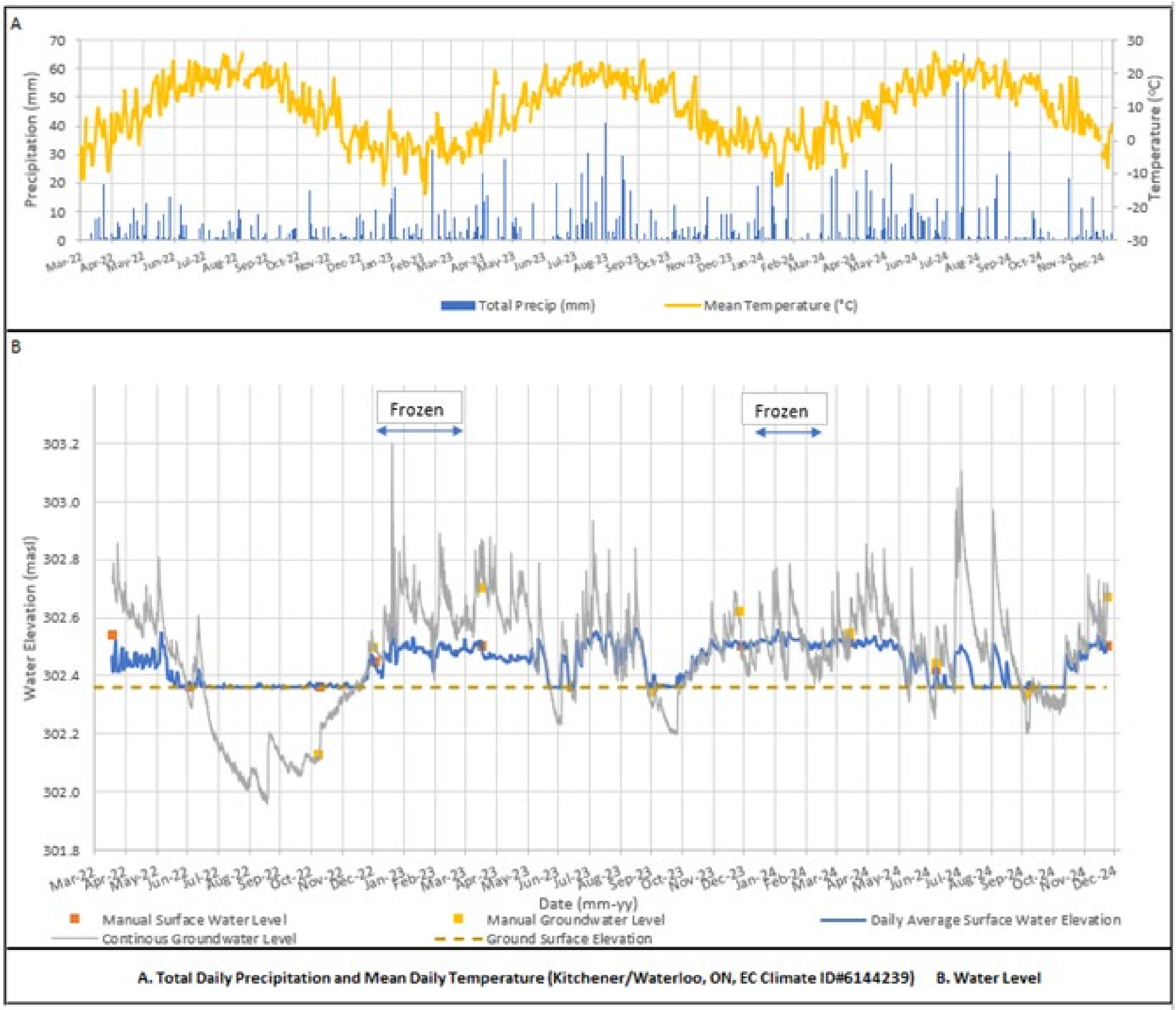


Figure 8: PSW Zone 5 Hydrograph (SW5)

Figure 9: Photo of Tributary 3 Upstream of the Culvert at Concession Road 2

(Note: photo taken on April 1, 2025)

- Zone 6: Is supported by significant water inputs from direct precipitation and surface water from Tributary 5 wetting the area. Tributary 5 has low banks, as shown on Figure 10, and water levels in the stream frequently flood over its banks and inundate the surrounding wetland zone.
- Zone 7: Similar to Zone 4, Zone 7 is located to the southwest of the and is drained by Tributary 3. It receives water from direct precipitation and may receive minor inputs from surface water in Tributary 3, runoff, and groundwater discharge.

Figure 10: Photo of Tributary 5 South of Concession Road 2

(Note: photo taken on April 1, 2025, looking south from the Tributary 5 culvert beneath Concession Road 2)

Wetland Organic Layer

As is typical of mature wetlands (USEPA, 2008), the surficial soils underlying the PSWs at the Site include a characteristic upper organic layer, which is composed of fine sediment and many years of accumulated organic material. This organic layer is effective at retaining water and generally has a low permeability in comparison to the underlying coarser grained soils.

The presence of this low permeability upper organic layer in the wetlands is consistent with the hydrologic behavior observed on the Site, i.e. very slow response of surface water levels to downward hydraulic gradients, as observed in the hydrographs on Figure 6 and Figure 8). It is also consistent with the Site Water Balance, which assigns a water holding capacity of 300 mm to the forested wetland land type. In addition to the water holding capacity, which considers the potential of shallow soils to hold water, the irregular and "potholed" surface of the wetland enhances its ability to retain water. This understanding of the organic layer's function is similar to that of the TRCA's (2020) conceptualization of a mature wetland.

In characterization of the Site, a continuous organic layer and an irregular ground surface are noted in Zones 1, 2, 3, 5, and 6, which are considered to have a high capacity to store water. No direct observations could be made about Zones 4 and 7, as they are located on private lands, so they have been conservatively assumed to have a moderate capacity to store water.

It should be noted that if the surficial soils were as permeable as the sand and gravel aquifer beneath them, they would readily drain, resulting in rapid depletion of surface water, which is contrary to the hydraulic behavior observed at the Site. This observation supports the understanding of the wetland organic layer as generally acting to retain water and slow its infiltration.

Wetland Outflows

In general, wetland outflows include evapotranspiration, runoff, and infiltration. The proposed aggregate operations will not impact evapotranspiration or the runoff characteristics of wetlands (i.e., runoff is a driven by surface water conditions, so if the water conditions are similar, runoff from the wetland will be similar). A minor impact to groundwater outflows is possible in response to predicted groundwater drawdown in some areas, however this is not expected to be a significant impact for the following reasons:

- Low permeability organic layer. The organic layer accumulated in low areas of the Site is expected to have a low permeability and exhibit a slow rate of infiltration of water in the PSW (USEPA 2008).
- Water holding capacity. As identified in the Site Water Balance, the PSWs have a high-water holding capacity, which recognizes the porosity and capillary affinity of the materials.
- Perched conditions. When the groundwater levels drop below the organic layer, an unsaturated zone is expected to develop resulting in a reduction of the soil's hydraulic conductivity (Fetter 2001).
- Capillary barrier effect. A relatively coarse-grained sand and gravel underlies the organic layer in the PSW. This situation means that there is a greater capillary affinity of organic layer than that of the underlying soil, creating a barrier to flow under low groundwater conditions (Fetter 2001).

As minor changes are anticipated to outflows from the PSW, this supplement assessment of potential impacts is focused primarily on changes to water inputs during operations and post-rehabilitation as the drivers to changes in wetland hydrology.

Summary of Existing Conditions

Table 2 summarizes this discussion of the relative importance of water sources to the PSW zones and their water storage capacity. The importance of the water contribution to a feature or zone is considered on a scale from significant, moderate, to minor contribution and its capacity to effectively retain those water inputs to maintain hydric conditions.

Table 2: Qualitative Magnitude of Water Inputs and Storage in Existing Conditions by PSW Zone

PSW Zone	Direct Precipitation	Surface Water (e.g. stream bank overflow)	Runoff	Groundwater	Storage Capacity
1	Significant	Significant	Minor	Minor	High
2	Significant	None	Minor	Minor	High
3	Significant	None	Minor	Minor	High
3a (closed depression)	Significant	None	Moderate	Moderate	High
4	Significant	Minor	Minor	Minor	Moderate
5 (north of Road 2)	Significant	Significant	Moderate	Minor	High
5 (south of Road 2)	Significant	Significant	Minor	Moderate	High
6	Significant	Significant	Minor	Minor	High
7	Significant	Minor	Minor	Minor	Moderate

The observed existing conditions are qualitatively similar to literature examples of typical wetland hydrology water budgets, specifically that some wetland types are primarily sustained by precipitation and others by a combination of surface water and precipitation inputs, with runoff and groundwater discharge as more minor factors (USEPA 2008).

HYDROLOGY POTENTIAL FOR IMPACT ASSESSMENT

Operational Impacts on Wetland Hydrology

Potential operational impacts on the hydrology of the wetlands are conservatively evaluated by identifying the operational stage at which the greatest groundwater drawdown will occur in each zone. It should be noted that no impacts are anticipated to direct precipitation inputs, surface water contributions during hydrological events (such as the spring freshet), or to the ability of a PSW zone to retain water in its substrates during any operational period.

Hydrological potential for impacts are considered on a scale of decreasing severity from significant, moderate, minor, minimal, negligible, to none. Impacts during operational periods to each zone (Figure 2) are summarized below and in Table 3.

- Zone 1: This zone experiences no change to direct precipitation, surface water, or runoff inputs, but does lose some groundwater input during active aggregate extraction. Minimal potential for impact is anticipated during operations.
- Zone 2: This zone experiences no change to direct precipitation during operations. However, there is a reduction in runoff and groundwater discharge, which were minor contributors to the PSW in this zone. Minor potential for impact is anticipated during operations.

- Zone 3: This zone experiences no change to direct precipitation during active aggregate extraction. However, there is a reduction in runoff and groundwater discharge, which were minor contributors to the PSW in this zone. Minor potential for impact is anticipated during operations.
- Zone 3a: This zone experiences no change to direct precipitation during active aggregate extraction. During Year 2 of operations over 2 m of drawdown is predicted in a feature which may receive moderate groundwater inputs. The closed depression may receive less runoff from Zone 3, as a result of reduced runoff from lands adjoining Zone 3, and groundwater discharge to Zone 3. Zone 3a is considered to have moderate potential for impacts during operations, in particular during the early stages of below water table extraction.
- Zone 4: This zone is considerably downgradient of the Site with a negligible expected impact to any aspect of its hydrology.
- Zone 5 (north of Concession Road 2): This zone experiences no change to direct precipitation, surface water, or runoff inputs, but does lose some groundwater discharge during active aggregate extraction. Minimal potential for impact is anticipated during operations.
- Zone 5 (south of Concession Road 2): This zone experiences no change to direct precipitation or to surface water inputs to the zone, but there is some reduction in modelled groundwater discharge during extraction, in particular around Year 4. As direct precipitation and surface water from Tributary 3 are the significant sources of water to this zone and are unaffected by extraction, only minor potential for impact is anticipated during operations.
- Zone 6: This zone experiences no change to direct precipitation or to surface water inputs, but there is some reduction in groundwater discharge during active aggregate extraction, in particular during the early stages of operations. Similarly to Zone 5 south of the road, direct precipitation and surface water from Tributary 5 are the significant sources of water to this zone and are unaffected by extraction, therefore minimal potential for impact is anticipated during operations.
- Zone 7: This zone is considerably downgradient of the Site with a negligible expected impact to any aspect of its hydrology.

Table 3: Qualitative Magnitude of Water Inputs and Storage Changes under Operational Conditions by PSW Zone

Zone	Direct Precipitation	Surface Water (e.g. stream bank overflow)	Runoff	Groundwater	Storage Capacity	Potential for Hydrological Impact during Operations[1]
1	Significant	Significant	Minor	Minimal	High	Minimal
2	Significant	None	Minimal	None	High	Minor
3	Significant	None	Minimal	None	High	Minor
3a (closed depression)	Significant	None	Minimal	None	High	Moderate
4	Significant	Minor	Minor	Minor	Moderate	Negligible

Zone	Direct Precipitation	Surface Water (e.g. stream bank overflow)	Runoff	Groundwater	Storage Capacity	Potential for Hydrological Impact during Operations[1]
5 (north of Road 2)	Significant	Significant	Moderate	None	High	Minimal
5 (south of Road 2)	Significant	Significant	Minimal	None	High	Minor
6	Significant	Significant	Minor	Minimal	High	Minimal
7	Significant	Minor	Minor	Minor	Moderate	Negligible

Note: 1) Water input reductions during operations compared to baseline conditions are shaded in pink. 2) Impacts are considered on a scale of decreasing severity from significant, moderate, minor, minimal, negligible, to none.

Predicted Post-Rehabilitation Impacts on Wetland Hydrology

Potential impacts on wetland hydrology of the PSW areas under post-rehabilitation conditions are summarized below and in Table 4.

It should be noted that no impacts are anticipated to direct precipitation inputs, surface water contributions during hydrological events (such as the spring freshet), or to the ability of the PSW to retain water in their near surface substrates.

- Zone 1: This zone experiences no change to direct precipitation, surface water, or runoff inputs, but does lose some groundwater discharge as a result of water table flattening. Minimal potential for impact is anticipated.
- Zone 2: This zone experiences no change to direct precipitation. However, there is a reduction in runoff and groundwater discharge, which are minor contributors to the PSW in this zone under current conditions. Minor potential for impact is anticipated in post-rehabilitation conditions.
- Zone 3 and 3a: This zone experiences no change to direct precipitation and a slight increase in groundwater discharge in post-rehabilitated conditions. There is a reduction in runoff from the reduced catchment, which was a minor contributor to this zone. The increase in groundwater input is considered to offset the minor loss of runoff, and therefore negligible impacts is anticipated in post-rehabilitation conditions.
- Zone 4: This zone is considerably downgradient of the Site with no expected impact to any aspect of its hydrology.
- Zone 5 (north of Concession Road 2): This zone experiences no change to direct precipitation, surface water, or runoff inputs, but does lose some groundwater discharge in post-rehabilitated conditions. Because drawdown in this feature is minor (0.2 m) and the feature is overwhelmingly supported by its up-stream catchment, negligible impacts are anticipated.
- Zone 5 (south of Concession Road 2): This zone experiences no change to direct precipitation or to surface water inputs to the zone, however there is some reduction in modelled groundwater discharge in post-rehabilitation conditions. As direct precipitation and surface water from Tributary 3 are the significant sources of water to this zone and are unaffected by extraction, minor potential for impact is anticipated.

- Zone 6: This zone experiences no change to direct precipitation, to surface water inputs to the zone, runoff, and groundwater discharge increases slightly, so no impact is anticipated.
- Zone 7: This zone is considerably downgradient of the Site with no expected impact to any aspect of its hydrology.

Table 4: Qualitative Magnitude of Water Inputs and Storage Changes in Post-Rehabilitated Conditions by PSW Zone

PSW Zone	Direct Precipitation	Surface Water (e.g. stream bank overflow)	Runoff	Groundwater	Storage Capacity	Potential for Hydrological Impact during Post-Rehabilitated Conditions[1]
1	Significant	Significant	Minor	Minimal	High	Minimal
2	Significant	None	Minimal	Minimal	High	Minor
3	Significant	None	Minimal	Minor (slight increased)	High	Negligible
3a (closed depression)	Significant	None	Minor	Moderate (slight increase)	High	Negligible
4	Significant	Minor	Minor	Minor (slight increased)	Moderate	None
5 (north of Road 2)	Significant	Significant	Moderate	None	High	Negligible
5 (south of Road 2)	Significant	Significant	Minor	None	High	Minor
6	Significant	Significant	Minor	Minor (slight increased)	High	None
7	Significant	Minor	Minor	Minor (slight increased)	Moderate	None

Note: 1) Water input reductions during post-rehabilitation compared to baseline conditions are shaded in pink. 2) Water input increases during post-rehabilitation compared to baseline conditions are shaded in blue. 3) Impacts are considered on a scale of decreasing severity from significant, moderate, minor, minimal, negligible, to none.

Summary of Potential for Hydrological Impacts to Wetlands

This supplemental assessment qualitatively considered the relative importance of the water inputs and outputs and the effect of the organic layer in retaining water to the hydrology of the seven PSW zones identified at the Site in the Water Report.

- The PSW zones to the north of the Site are primarily supported by direct precipitation and surface water during high water level events (such as the spring freshet), and impacts to these zones are predicted to be minor (Zone 5) to minimal (Zones 1 and 6) during operation and post-rehabilitation.

- The PSW zones to the east, south, and west of the Site primarily rely on direct precipitation with little input from runoff or groundwater discharge. Consequently, potential impacts to these wetland zones were predicted to be minor (Zones 2 and 3) to negligible (Zones 4 and 7) during operations and post-rehabilitation.
- The exception is Zone 3a in the southern central portion of the Site, in which the hydrological conditions indicate a moderate potential for impact during the early years of operation, primarily due to a short-term reduction in groundwater inputs to that PSW sub-zone as a result of aggregate extraction, which can be mitigated by corrective actions, as discussed below.

Overall, the hydrological potential for impacts to the PSW zones surrounding the Site are predicted to be minor to negligible, with the exception of PSW Zone 3a, where hydrological changes suggest a moderate potential for impact.

WETLAND FUNCATION AND ASSESSMENT OF WETLAND IMPACTS

Threshold for Impacts on Wetlands

The Provincial Planning Statement (PPS) (Ontario 2024) recognizes the critical importance of wetlands on the landscape in southern Ontario, stating:

Development and site alteration shall not be permitted in:

- *Significant wetlands in Ecoregions 5E, 6E and 7E1; and significant coastal wetlands.*
- *Development and site alteration shall not be permitted on <u>adjacent lands</u> to the natural heritage features <u>unless the ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts</u> on the natural features or on their ecological functions.*

The PPS also provides definitions of key terms to clarify their meaning to assist in examining policy compliance:

Ecological function: means the natural processes, products or services that living and non-living environments provide or perform within or between species, ecosystems, and landscapes. These may include biological, physical and socio- economic interactions.

Negative impacts: means in regard to other natural heritage features and areas, degradation that threatens the health and integrity of the natural features or ecological functions for which an area is identified due to single, multiple or successive development or site alteration activities

Therefore, establishing that “no negative impact” has taken place to a wetland, can be accomplished by understanding hydrological conditions and the potential changes resulting from extraction to water regimes and assessing the magnitude of those changes relative to naturally occurring fluctuations, and how those variances may influence the data characterizing the wetland fauna and flora in a positive or negative manner.

Natural Variability

Wetlands are subject to annual variations, resulting from climate fluctuations in temperature, as well as seasonal weather changes in southern Ontario’s temperate climate zone. Seasonal variations are associated with temperature and precipitation. The influence of these two weather conditions affects water levels through precipitation, and evaporation during periods of higher temperatures (and consequently affects the plants and wildlife, such as amphibians, that are seasonally support by water conditions at or near surface), and they also affect plant growth and health, through evapotranspiration (which vary with temperature and type of vegetation). In addition, other factors such as beaver dams, major vegetation community shifts (e.g., die-off of canopy trees due to disease), and introduction of invasive species, can influence wetland hydrology and vegetation. Variability of these factors is naturally occurring in all wetland ecosystems and there are a range of conditions in which a wetland thrives and maintains its function in the environment, without remaining static through time. The hydrographs for SW5 and SW6 illustrate that natural variation over the three years of monitoring from 2022 to 2024. The groundwater in 2022 shows the typical drop of the groundwater under deciduous swamps in the summer and into early fall, in 2024 this drop is not seasonally observed to the same degree due to the wetter summer and early fall conditions; these annual fluctuations are normal and wetland flora and fauna generally acclimatize to this variability in southern Ontario.

Wetlands, as both natural heritage features and surface water features, are a vital component of the functional connections identified above, providing the interface between water and land.

Wetland Feature Impact Assessment

The natural environmental inputs or variables such as water inputs (groundwater, run off, surface water, precipitation), temperature ranges, evaporation and evapotranspiration, along with other factors, as noted above, that maintain the biological function of wetlands are known to be variable, resulting in a range of suitable conditions to maintain wetland function, without adverse impact. Further, as one form or function changes, other forms and functions may result (e.g., a new beaver dam can create a complete shift in the wetland vegetation community and water levels, resulting in a new form and set of functions). Changes in land use that may affect wetlands, both positive and negative, are assessed in consideration of the range of possible influences. Change in any individual variable may not necessarily affect a wetland in a positive or negative manner, but rather an understanding of the magnitude of the change and interaction of those individual changes collectively, is critical to understanding the effects of change on wetland features and their ecological function. As such, individual components of wetland hydrology change can be considered relative to their level or magnitude of change: negligible, minimal, minor, moderate, significant. Table 3 and Table 4 offer a qualitative assessment of the magnitude of water related changes and hydrological potential for impact to the ecological features under operational and post-rehabilitation conditions. The hydrological understanding of the level or magnitude of change is instrumental in assessing the potential for negative impacts on ecological function of the natural heritage feature as required by the PPS.

Where hydrological conditions identify potential for impact to the wetland, an ecological assessment is made of whether the change in hydrological conditions has led to an adverse change in the form and function of the wetland outside of the range of its natural variations.

The combined hydrological and ecological wetland monitoring plan outlined below, details the approach to the identification of potential impacts based on hydrological monitoring, and the ecological monitoring to identify if impacts are taking place, and corrective actions to mitigate any impact to the wetlands.

SUMMARY

In summary, the proposed pit is predicted to cause limited changes to the hydrology of the wetlands, which demonstrate considerable variability in existing conditions. Where these changes occur outside the range of naturally occurring conditions, they represent the potential for impacts (such as those predicted during operations in Zone 3a). Where hydrological conditions identify the potential changes, ecological data will provide the basis for an assessment of impacts to the system and determine if those changes are benign to the overall form and function or the wetland. Where ecological monitoring indicates an impact could be realized, the use of trigger conditions, and corrective actions will be utilized to protect the wetland from any adverse impact.

RECOMMENDATIONS

Hydrological and Ecological Wetland Monitoring Plan

Based on this supplemental assessment of wetland hydrology at the PSW zones of the Site, the following wetland monitoring is recommended for zones with moderate or minor predicted hydrological potential for impact.

- Monitoring of surface water and groundwater at wetland stations SW5 and SW6 shall continue as currently implemented by CBM.
- A new wetland station SW7 shall be established in 2025 in PSW Zone 3 and 3a, shown on Figure 11. The scope of monitoring shall be the same as that of SW5 and SW6 currently implemented by CBM.
- Hydrological information is collected to inform ecological interpretations. Therefore, in conjunction with the hydrological monitoring of zones with moderate or minor predicted impacts (Zones 2, 3, 3a, and 5), ecological monitoring is recommended at five locations, shown on Figure 11, to compliment surface water and groundwater monitoring. The complimentary monitoring is described in the Recommended Ecological Wetland Monitoring Methodology section below. Ecological monitoring shall begin one year prior to the start of aggregate extraction, and continue during the Operational Period, and end one year after the completion of Site Rehabilitation. During the one year of monitoring prior to the start of aggregate extraction, monitoring will be carried out biannually (early summer and early fall) to provide baseline data for comparison to enhanced monitoring in the event this is required (as discussed below).

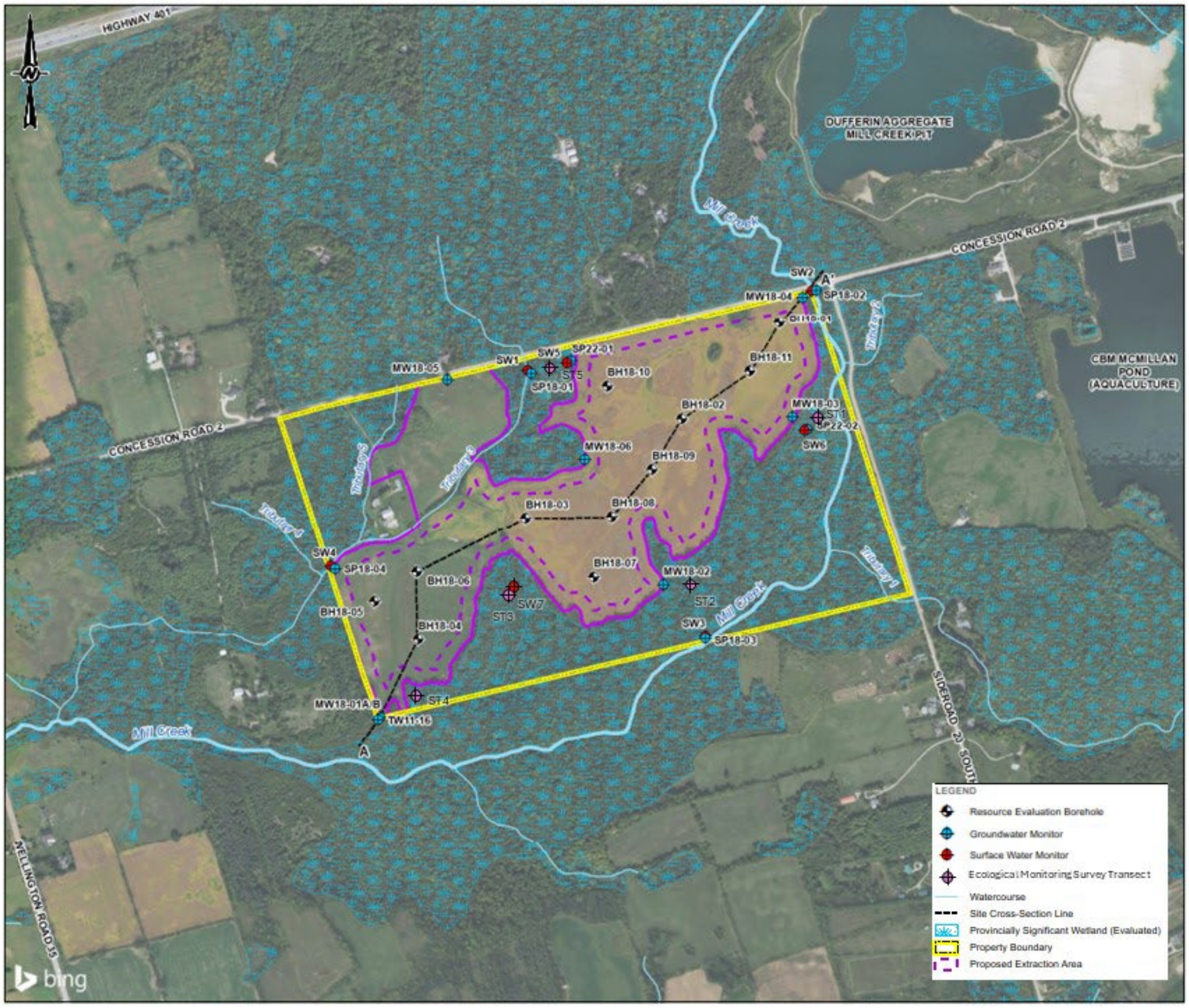


Figure 11: Recommended Monitoring Locations

Hydrological and Ecological Wetland Trigger Setting Approach and Corrective Actions

As described above, a combined hydrological and ecological approach shall be established to identify and mitigate potential impacts on the wetland. In principle, the preliminary triggers will verify that hydrological conditions remain within the historically observe range of natural variations, and if hydrological conditions indicate that there is potential for impact, ecological features shall be assessed with consideration of weather conditions.

1) Preliminary Trigger Level: Hydrological monitoring will provide information to establish the Preliminary Trigger Level. If hydrological conditions are observed to remain within their observed range, then no adverse affect is predicted. Preliminary triggers shall be selected for each season based on historic ranges of surface water and shallow groundwater levels in observed at the wetland hydrology monitoring stations (SW5, SW6, and SW7). If the condition of a preliminary trigger is met, there is potential for impact and the monitoring frequency at the affected surface water station shall be increased from quarterly to monthly and the

frequency of ecological monitoring at the associated survey transect shall be increased from annually to biannually (early summer and early fall).

2) Trigger Level: In the event that a preliminary trigger condition is met, the enhanced ecological monitoring frequency shall be used to support an assessment of whether or not impacts are taking place to the wetland's form and function, for as long as the Preliminary Trigger Level conditions persist.

3) Ecological Relationship: Following ecological monitoring, an impact assessment considering hydrological and ecological monitoring information shall be undertaken to identify whether or not pit operations are contributing to an adverse impact on the wetland, or if other factors such as weather patterns or invasive species have affected the wetland, and reported following each ecological monitoring event to the regulating agency. In the event an impact resulting from operational activities is identified, situation specific corrective actions shall be discussed with the regulating agency and implemented by the licensee. Corrective actions to consider shall include reduced extraction rate, cessation of extraction, infiltrating water in setback areas to increase groundwater levels, and / or irrigation of impacted wetland features.

Recommended Ecological Monitoring Methodology

Based on the supplemental assessment of the hydrology of the wetland features minor to no impacts on the hydrology of the wetland are anticipated. To verify that the proposed extraction will have no adverse impact the form and function of wetlands, ecological wetland monitoring is proposed to compliment to hydrological monitoring. This monitoring involves the establishment of a combination of survey transects and associated fixed sample plots, as described below.

Survey Transects

One 100 m transects is to be established in each of the wetland zones where access is available as illustrated on Figure 11 that are representative wetland vegetation communities within the wetland complex on the subject property. Reflective T-bar are used to mark start and end points, and flagging tape used to demarcate the center line at 10 m intervals along the transect. All vascular plants within 1 m of the center line of the transect are identified along the length of the transect, and the abundance for each species estimated using definitions provided in the Glossary of the ELC manual (Lee et al. 1998):

- **Rare:** only one to a few individuals in the area of interest
- **Occasional:** scattered individuals throughout a community or represented by one or more large clumps of many individuals
- **Abundant**: Referring to a plant that is represented throughout the polygon or community by large numbers of individuals or clumps. Likely to be encountered anywhere in area of interest. Usually forming > 10% ground cover
- **Dominant**: a plant with the greatest cover or biomass within a plant community and by large numbers of individuals. Visually more abundant than other species in the same layer forming > 10% of the ground cover and >35% of the vegetation cover in any one layer.

In addition, the Floristic Quality Index (FQI) is to be calculated to provide a quantitative evaluation of botanical quality. The FQI is the product of Mean *Coefficient of Conservatism* (CC) and the square root of the area's plant richness (Swink and Wilhelm 1994).

Fixed Sample Plots

Fixed sample plots are also established at varying distances from the end of each transect plot. Each plot is to be 10 m x 10 m square with corners demarcated by metal rebar. Within each plot, all vascular plant species will be identified, and the percent cover of each species within each vegetation layer will be estimated visually. Photographs are taken at the center of each fixed sample plot to compare overall plot conditions from year to year.

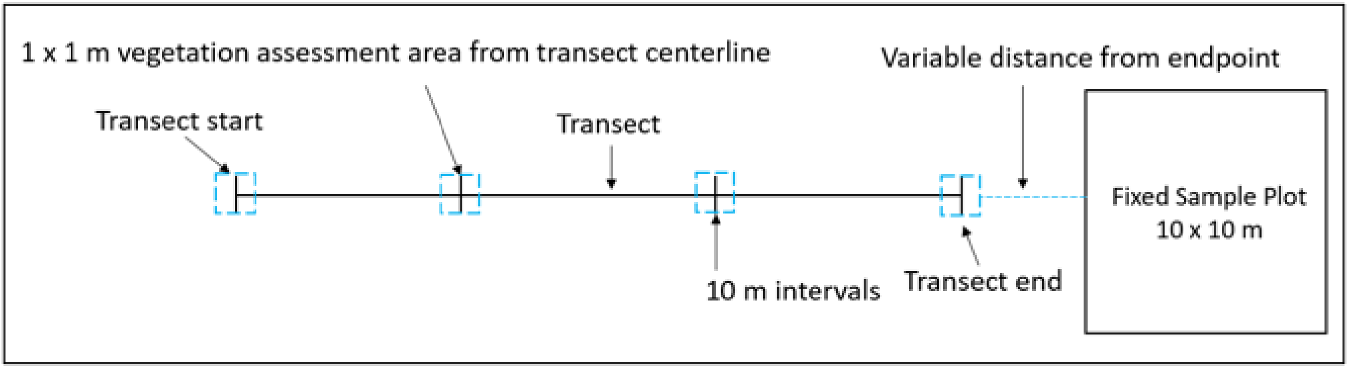


Figure 12: Schematic of Vegetation Monitoring Plot Layout

A weighted mean of *Coefficient of Conservatism* (CC) and *Coefficient of Wetness* (CW) is calculated for each vegetation layer based on species cover, and for the overall plot. The *Coefficient of Conservatism* and *Coefficient of Wetness* is based on information from the Floristic Quality Assessment System for Southern Ontario (Oldham et al. 1995). The *Coefficient of Conservatism* (CC) is a measure of habitat specificity / tolerance, and ranges in value from 0 (tolerant of a wide range of habitats) to 10 (very habitat specific) (See Table 1). The *Coefficient of Wetness* (CW) is an indicator of wetland or upland affinity, ranging in value from +5 (upland) to –5 (obligate wetland) (See Table 2). Mean CW and CC values are then calculated based on sampling data and will be compared over subsequent monitoring years. These data can provide indications of wetland condition changes in association with surface and groundwater levels, and climatic events. Total species richness and the weighted percentage of native species is also calculated for the overall plot. In addition to vascular plants, the percentage of standing water, organic detritus, and bare substrate are also estimated within each fixed sample plot. This information is used to compared over subsequent monitoring years.

Table 5. Coefficient of Conservatism (CC) Values Index

CC	RANK	DESCRIPTION
0 to 3	Tolerant	Found in a wide variety of plant communities, including disturbed sites.
4 to 6	Moderately Conservative	Typically associated with a specific plant community but tolerate moderate disturbance.

CC	RANK	DESCRIPTION
7 to 8	Conservative	Typically associated with a plant community in an advanced successional stage that has undergone minor disturbance.
9 to 10	Highly Conservative	Typically displaying a high degree of fidelity to a specific plant community or a narrow range of synecological parameters.

Adapted from Oldham et al. 1995.

Table 6. Coefficient of Wetness (CW) Values Index

CW	RANK	DESCRIPTION
- 5	OBL	**OBLIGATE WETLAND**: Occurs almost always in wetlands under natural conditions (99% probability)
- 4	FACW+	**FACULTATIVE WETLAND**: Usually occurs in wetlands, but occasionally found in non-wetlands (67-99%)
- 3	FACW	
- 2	FACW-	
- 1	FAC +	**FACULTATIVE:** Equally likely to occur in wetlands or non-wetlands (34-66%)
0	FAC	
1	FAC -	
2	FACU+	**FACULTATIVE UPLAND**: Occasionally occurs in wetlands, but usually occurs in non-wetlands (1-33%)
3	FACU	
4	FACU-	
5	UPL	**UPLAND**: Occurs almost never in wetlands under natural conditions (<1%)

Adapted from Oldham et al. 1995.

CLOSURE

We trust that this technical memorandum meets your current needs. If you have any questions or require clarification, please contact the undersigned at your earliest convenience.

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