



Appendix D – Water Resources and Environmental Monitoring

WOODVILLE PIT EXPANSION PROJECT

WATER BALANCE ASSESSMENT

Prepared by Mr. Jim Fraser, M.A.SC, P. Geo,

Date: June 18, 2026

1.0 INTRODUCTION

This document outlines the Water Balance Assessment undertaken for the proposed Woodville Pit Expansion Project, located in Woodville, King's County, Nova Scotia. Dexter Construction Company Limited (Dexter) operates a Nova Scotia Environment and Climate Change (NSECC) approved pit of less than 4 hectares at this location. The existing pit serves as a strategic source of construction aggregate to support local construction and roadwork, as well as Nova Scotia Department of Public Works projects in the area. The existing approximate 4-hectare pit is proposed to be expanded to a total of 19.6-hectares. The proposed pit expansion is intended to provide additional aggregate reserves to support the long-term sustainability of the site. It is anticipated that the rate of pit development will progress gradually, at a rate consistent with aggregate demand in the area and growth of the local market.

The Water Balance Assessment presented herein is an assessment of the estimated effects on surrounding surface water features resulting from the proposed pit expansion. The methodology used for this water balance assessment is consistent with the approach used recently to assess similar pit and quarry expansion projects undergoing Environmental Assessment.

For this water balance assessment, three (3) site conditions were analyzed; existing (baseline) conditions, pit full development conditions, and reclaimed pit conditions. Existing conditions include a pit area of approximately 4-hectares, which includes the highwall and crusher set-up and stockpile areas. Pit full development conditions consider a development area of 19.6-hectares. Reclamation conditions are representative of the site upon removal of all construction equipment and buildings, after re-contouring, and following the re-introduction of vegetative cover over the pit areas.

Where practical, progressive reclamation will occur throughout the development and operation phases of the pit, as per the established Reclamation Plan for the site. As the site is developed and aggregate reserves are depleted, disturbed areas no longer required for aggregate production or site related activities will be progressively rehabilitated. This includes using grubbing material originating onsite for site grading, slope construction, and re-vegetation efforts. Temporarily stockpiling and then re-use of overburden as a growing medium for the establishment of vegetation is anticipated to simulate pre-development conditions. Areas that have been progressively rehabilitated would be expected to have reduced surface water runoff and increased infiltration, reflective of natural conditions in the area. This Water Balance Assessment does not account for progressive reclamation, so the development scenarios presented represent the worst-case for each scenario with respect to runoff quantity.

Due to the range of infiltration rates possible, the water balance was completed for two (2) infiltration scenarios. The two infiltration scenarios represent the range of possible outcomes from existing/natural infiltration (most likely) to 100% impervious (worst case, no infiltration).

1.1 Data Collection

1.1.1 Topographic Data

The Woodville Pit and associated study area are located in Woodville, King's County on the southern slope of the North Mountain. Elevations are generally 100 to 190 m above sea level. Topography at the site is described as predominantly hilly and steeply sloping to the south. The general area is predominantly woodland, underlain by sandy loam.

The proposed pit expansion area is within a single (1) Catchment Area encompassing a total of 275.3 hectares.

A LiDAR digital elevation model (DEM) was prepared using provincially available LiDAR data. Catchment areas were manually determined using provincial watercourse mapping layer and a 2-meter contour layer from the DEM. A provincial 5-meter contour layer was then used to validate and confirm the catchment areas.

1.1.2 Climate Data

Precipitation and temperature data were collected from the Waterville Cambridge Climate Station (1991-2020), which is located approximately 10 kilometers (km) from the pit. Monthly lake evaporation data was obtained from the Environment Canada Truro Station (1981-2010). The Truro station is the closest climate station to the Project Site that collects lake evaporation data and is located approximately 120 km away from the pit. Monthly potential evapotranspiration data was calculated using the Hamon equation (1961) (Lu, et al., 2005). The Hamon equation requires monthly average hours of daylight and monthly average temperature as input. Monthly average hours of daylight were calculated for the site using the Sunrise and Sunset Calculator (<https://www.timeanddate.com/sun/>, last accessed on June 10, 2026).

Table 1 - Climate Normal Data

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	TOTAL
Temperature¹ (°C)	-4.8	-4.4	-0.5	5.5	11.5	16.5	20.3	19.7	15.6	9.7	4.6	-1.0	-
Precipitation¹ (mm)	113.2	91.4	96.9	89.5	87.5	86	78.8	86	107.4	120.4	125.1	133.5	1,216
Lake Evaporation² (mm)	0.0	0.0	0.0	0.0	89.9	102.0	117.8	96.1	69.0	40.3	0.0	0.0	515
PET³ (mm)	0.0	0.0	0.0	33.5	53.6	76.1	95.9	90.8	64.3	39.6	25.0	0.0	479

¹ Values obtained from the Waterville Cambridge Climate Station

² Values obtained from the Truro Climate Station

³ Potential Evapotranspiration was calculated using the Hamon equation (1961), Lu, et al., 2005) Average Daylight Hours from <https://www.timeanddate.com/> (Woodville, NS)

2.0 METHODOLOGY

The Water Balance Assessment for the Woodville Pit was prepared to assess predicted changes in local flow characteristics during an average year for the three site conditions (existing/full development/reclaimed pit) and two infiltration scenarios (pervious/impervious). The methodology used for this water balance assessment is consistent with the approach used recently to assess similar pit and quarry expansion projects undergoing Environmental Assessment.

2.1 Watershed Delineation

The area potentially affected by the proposed pit expansion is located within a single catchment area. All runoff from the expanded pit is expected to remain within the catchment area. The pre and post development Catchment Area encompasses a total of 273.5 ha.

The catchment area delineation, boundary of existing pit operations, and the proposed pit expansion area are attached.

2.2 Evaporation and Evapotranspiration Potential

Evaporation (E) describes the process of the return of moisture to the atmosphere from open water and land surfaces. Evaporation from plant surfaces is referred to as evapotranspiration (ET). The magnitude of evaporation and evapotranspiration over time is a function of the climate, soil, and vegetation in the area. Evaporation rates tend to peak in the summer months when temperatures are the highest; daylight hours are the longest, sun intensity is greatest, and the growing season is at its peak.

Lake evaporation (LE) is the amount of evaporation from an open body of water. In Atlantic Canada, the lake evaporation rate is greater than the standard evaporation rate because of the constant availability of water. Based on aerial photos and available wetland mapping it is noted that there are no open water sources and/or identified wetlands within Catchment Area A. So, for this water balance assessment lake evaporation has been determined to be 0% of available water.

Evapotranspiration rates were calculated using the Hamon equation (1961), which is based on average monthly temperatures and daylight hours. Potential evapotranspiration rates for the 4 months of January through March and December were set to zero due to low temperatures resulting in minimal potential for evapotranspiration. The total potential evapotranspiration used for this water balance is 479 mm/year. July represents the month with the highest PET at 95.9 mm. **Table 1** includes a summary of the potential evapotranspiration rates used as a water loss parameter in the water balance assessment.

2.3 Infiltration Factor

Water storage/infiltration has been estimated using the infiltration factors taken from Table 3.1 of the Ontario Ministry of Environment, Conservation and Parks (OMEC) Stormwater Management Planning and Design Manual (2003). Calculations using the OMEC Table 3.1 account for slope, soil types, and vegetation cover when estimating the water holding capacity for an area. Using an area ratio method, the slope, soil type, and vegetative cover within the pre and post development catchment area were used to determine the scenario infiltration factor. Undeveloped areas within the catchment area were determined to be hilly (0.1), predominantly woodland (0.2), and sandy loam soil (0.4). Developed areas were considered to be flat (0.3), cultivated (0.1), and impervious (0.0) or sand loam soil (0.4), depending on the scenario assessed.

Two scenarios were assessed for the infiltration conditions during existing and pit full development conditions; (1) an impervious pit floor where no infiltration occurred through the floor of the pit; and (2) a pervious pit floor consisting of similar infiltration capabilities as existing surficial soils (sand loam). Due to the nature of the surficial soils, it is unlikely the soil will have greater infiltration at the floor of the pit than the existing surface. In this regard, these two scenarios represent the maximum and minimum values for expected infiltration in the pit. These two scenarios provide a range of potential outcomes resulting from pit development. New infiltration factors for these scenarios were calculated using an area-ratio method.

Reclamation conditions were expected to be similar to pre-development conditions, with the exception of Flat Land (0.3) in the area where the pit is developed. An area-ratio method was applied to determine the appropriate infiltration factor for the slope and land use in the pit catchment area.

Runoff volumes for this water balance were assumed to equal the total precipitation less the potential evapotranspiration, lake evaporation, and infiltration. Infiltration includes groundwater recharge and groundwater that contributes to surface water resources as baseflow. This Water Balance Assessment does not distinguish between the two, and as such groundwater recharge was not included in this water balance assessment. The proposed pit expansion is not planned to enter the deep bedrock groundwater table and overall is not anticipated to significantly impact or alter groundwater. If future pit operations are required to enter the water table, a hydrological study will be prepared to assess potential impacts to groundwater, and prior approval from NSECC will be obtained.

3.0 WATER BALANCE ANALYSIS

3.1 Woodville Pit Catchment Area

The existing conditions include a 4-hectare pit fully located within a single Catchment Area. The Water Balance Assessment assumes that the existing Pit will be expanded to a maximum 19.6-ha. Surface water runoff from the existing pit and proposed expansion area will follow the local topography, ultimately discharging south towards an unnamed tributary to Killam Brook. **Table 2** summarizes the details of the Water Balance Assessment for the Catchment Area A under the three development scenarios considered (existing/full development/reclaimed pit) and two infiltration (pervious/impervious) scenarios.

Table 2 – Water Balance – Woodville Pit Catchment Area

Pit Catchment Area	Area (ha)	Available Water (m ³)	Lake Evaporation (m ³)	PET (m ³)	Infiltration (m ³)	Runoff (m ³)	Change in Infiltration from Existing Conditions	Change in Runoff from Existing Conditions
Existing Conditions: Impervious Pit Floor	275.3	3,346,822	0	1,318,245	1,408,214	620,363	-	-
Pit Full Development: Impervious Pit Floor	275.3	3,346,822	0	1,318,245	1,362,234	666,343	-3.3%	7.4%
Existing Conditions: Pervious Pit Floor	275.3	3,346,822	0	1,318,245	1,422,951	605,626	-	-
Pit Full Development: Pervious Pit Floor	275.3	3,346,822	0	1,318,245	1,434,466	594,131	0.8%	-1.9%
Pit Reclamation: Pervious Pit Floor	275.3	3,346,822	0	1,318,245	1,441,667	586,909	1.3%	-3.1%

Based on the results of the Water Balance Assessment, it is estimated that the change in infiltration for the Catchment Area from Existing Conditions to Full Development ranges between -3.3% (Impervious Pit Floor) to 1.3% (Pervious Pit Floor). Following Pit Reclamation, infiltration is expected to increase slightly.

It is estimated that the change in runoff for the Catchment Area from Existing Conditions to Full Development ranges from 7.4% (Impervious Pit Floor) to -3.1% (Pervious Pit Floor). Following Pit Reclamation, runoff is expected to decrease slightly.

4.0 SUMMARY

The Woodville Pit Water Balance Assessment was prepared to estimate potential changes in surface water flow and assess the potential impact of the proposed pit expansion on the local hydrological regime. The

methodology used for this Water Balance Assessment is consistent with the approach used recently to assess similar pit and quarry expansion projects undergoing Environmental Assessment.

Based on the results of the Water Balance Assessment, it is estimated that the potential change in infiltration for the Catchment Area ranges between -3.3% (Impervious Pit Floor) to 1.3% (Pervious Pit Floor). Following Pit Reclamation, infiltration is expected to increase slightly.

It is estimated that the potential change in runoff for the Catchment Area ranges from 7.4% (Impervious Pit Floor) to -3.1% (Pervious Pit Floor). Following Pit Reclamation, runoff is expected to decrease slightly.

It is noted that the pit is only operated on an as-needed basis to supply aggregate for local construction projects. The continued development and expansion of the site is expected to be gradual, with aggregate incrementally removed from the excavation area, as needed. The estimated changes in infiltration and runoff would slowly occur over the next several decades, which will allow field data to be collected to measure any actual changes and provide the local environment with an opportunity to adapt to any changes.

The results of the Water Balance Assessment will be used to form the basis of further analysis and design of surface water management infrastructure at the pit in the future. It is anticipated that conditions of any Environmental Assessment approval issued for the proposed pit expansion will require a detailed surface water monitoring plan, groundwater monitoring plan, and erosion and sediment control plan. These items will be developed following Environmental Assessment approval for the project, as part of the subsequent Industrial Approval amendment process. Water management and monitoring plans will be used to validate the findings of the water balance assessment.

5.0 CONCLUSION

The Woodville Pit Water Balance Assessment was prepared to estimate changes in surface water flow and assess the potential impact of the proposed pit expansion on the local hydrological regime. The methodology used for this water balance assessment is consistent with the approach used recently to assess similar pit/quarry expansion projects undergoing Environmental Assessment.

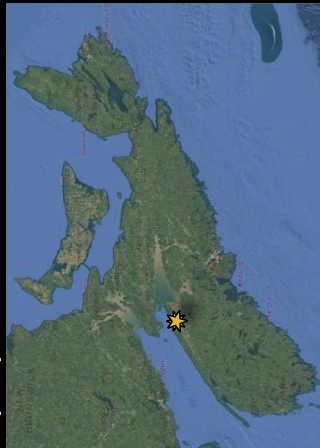
Water management and monitoring plans will be implemented as part of the Industrial Approval process to validate the findings of the water balance assessment.

6.0 REFERENCES

Lu et al. (2005). "A Comparison of Six Potential Evapotranspiration Methods for Regional Use in the Southeastern United States". *Journal of the American Water Resources Association*, 41, 621-633.

Ontario Ministry of the Environment. (2003). *Stormwater Management Planning and Design Manual*.

Climate Normal Data (Data taken from Waterville Cambridge and Truro Environment Canada Stations).



Legend

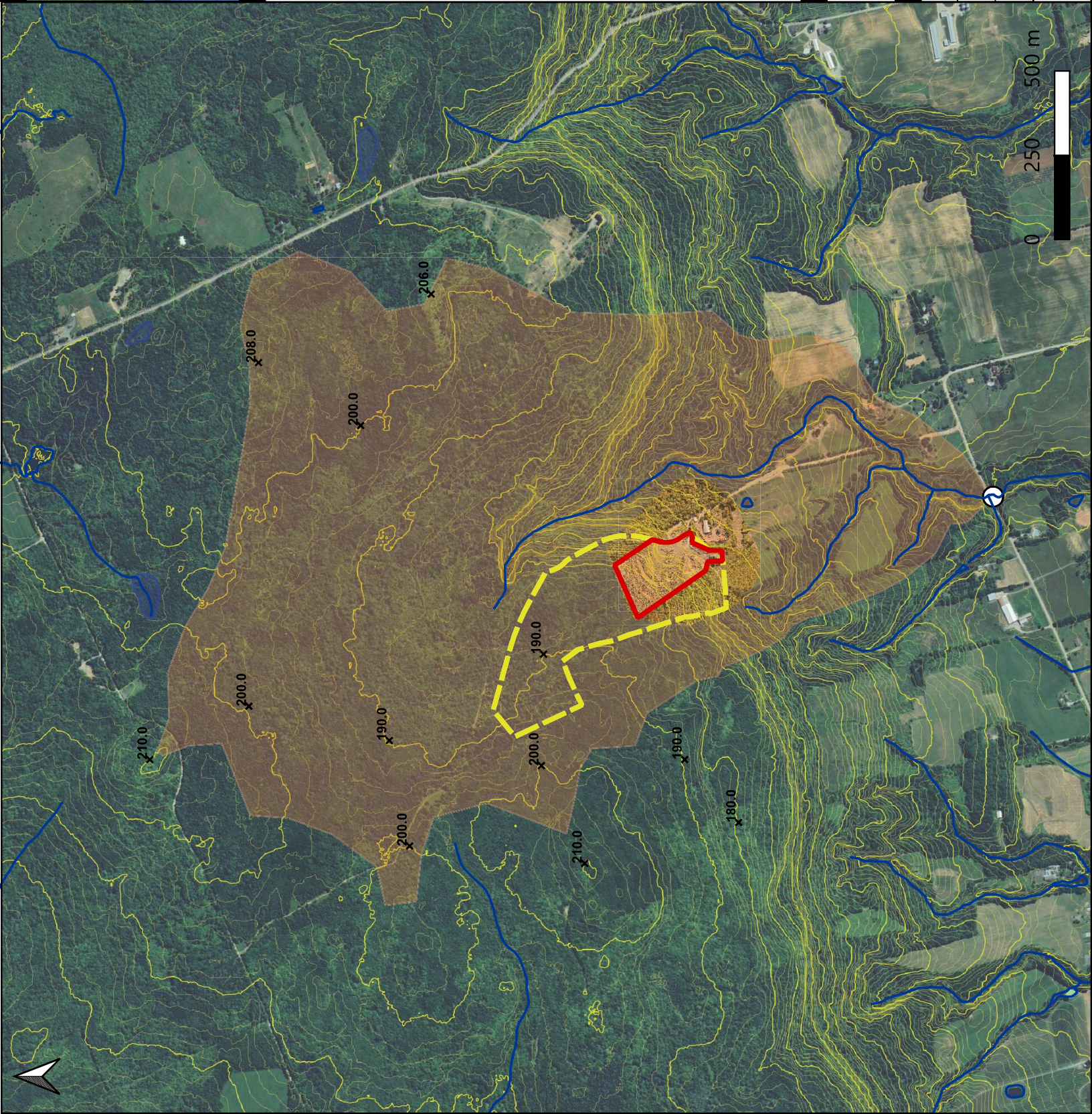
- Current Permit Area (± 4 ha)
- Proposed Expansion Area (± 19.6 ha)
- Watercourses (1:10,000)
- Point of Interest
- Catchment Area ($\pm 2,753,000$ m²)
- LIDAR Contours
- 2 Meter Contour Interval
- 10 Meter Contour Interval
- Spot Elevation (from LIDAR)

Project

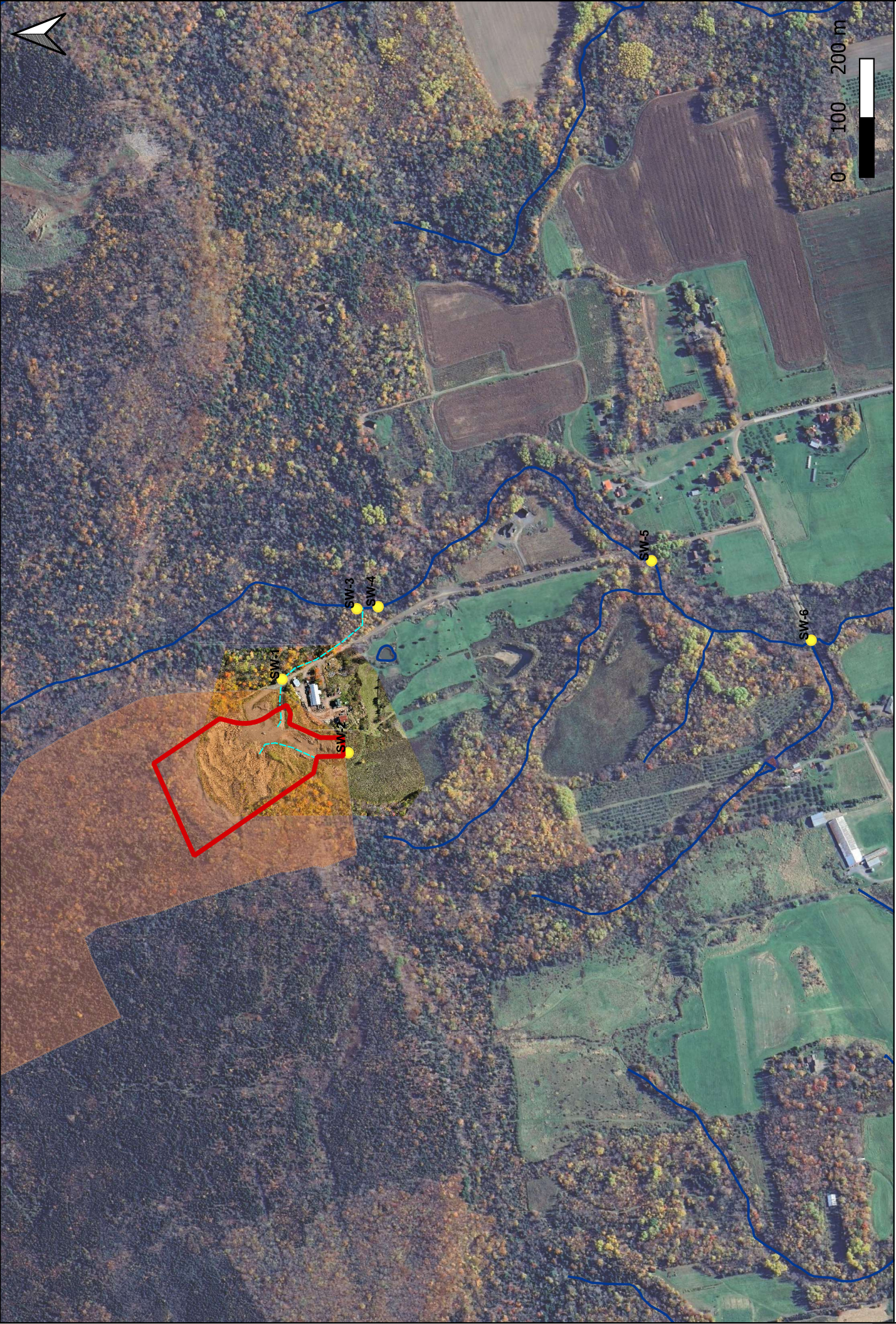
Woodville Pit
Pre / Post Development Catchment

Figure Details

Drawn By:	RT	Reviewed By:	JF
Date:	06 / 12 / 2026	Imagery Date:	N/A
Datum:	NAD83 CSRS	Projection:	UTM ZONE 20N



Baseline Surface Water Quality Monitoring (2025/2026)



Woodville Pit Expansion Project
Proposed Baseline Water Monitoring Locations

Date: July 23, 2025



MUNICIPAL GROUP OF COMPANIES

Legend

— NSECC Approved Permit Area Boundary (<4 ha)

EA Study Area (27.1 ha)

--- Site Drainage Ditches

— Watercourses (1:10,000)

● Baseline Water Monitoring Locations

**Woodville Pit
Surface Water Monitoring Results**

SAMPLING PARAMETERS			UNITS	CCME Guidelines*	SW-1				SW-2				SW-3				SW-4				SW-5				SW-6					
					2025		2026		2025		2026		2025		2026		2025		2026		2025		2026		2025		2026			
Q3	Q4	10-Oct	20-Feb	23-Jun	Q3	Q4	10-Oct	20-Feb	23-Jun	Q3	Q4	10-Oct	20-Feb	23-Jun	Q3	Q4	10-Oct	20-Feb	23-Jun	Q3	Q4	10-Oct	20-Feb	23-Jun	Q3	Q4	10-Oct	20-Feb	23-Jun	
RCAP CALCULATIONS																														
Anion Sum			meq/L	-	1.05	1.24	0.97	1.01	Not enough water to collect sample				1.1	1.25	1.02				1.35	3.97				4.14						
Bicarbonate (as CaCO ₃)			mg/L	-	40	46	33	39	Not enough water to collect sample				42	47	40				51	49				85						
Total Dissolved Solids			mg/L	500	76	82	67	70	Not enough water to collect sample				77	85	70				270	260				70						
Carbonate (as CaCO ₃)			mg/L	-	ND	ND	ND	ND	Not enough water to collect sample				ND	ND	ND				ND	ND				ND						
Cation Sum			meq/L	-	1.23	1.21	1.03	1.04	Not enough water to collect sample				1.2	1.32	1.1				1.31	4.03				4.42						
Hardness (as CaCO ₃)			mg/L	-	47	47	40	41	Not enough water to collect sample				47	51	43				51	180				200						
Ion Balance			%	-	7.89	1.22	3	1.46	Not enough water to collect sample				4.35	2.72	3.77				1.5	0.75				3.27						
Langlier Index (@20C)			-	-	-0.911	-0.829	-1.18	-0.888	Not enough water to collect sample				-0.808	-0.823	-0.868				-0.629	-0.256				-0.209						
Langlier Index (@4C)			-	-	-1.16	-1.08	-1.43	-1.14	Not enough water to collect sample				-1.06	-1.07	-1.12				-0.881	-0.505				-0.404						
Nitrate (as N)			mg/L	13	0.061	0.094	0.091	0.073	Not enough water to collect sample				ND	ND	0.056				ND	0.53				0.53						
Saturation pH (@20C)			-	-	8.64	8.58	8.79	8.69	Not enough water to collect sample				8.62	8.54	8.68				8.51	7.64				7.64						
Saturation Ph (@4C)			-	-	8.89	8.83	9.04	8.94	Not enough water to collect sample				8.87	8.79	8.93				8.77	8.2				7.89						
INORGANICS																														
Alkalinity (as CaCO ₃)			mg/L	-	40	47	33	39	Not enough water to collect sample				42	47	40				52	50				85						
Dissolved Chloride			mg/L	120	5.9	7.5	7.8	5.5	Not enough water to collect sample				6.5	8	5.4				8.2	9.8				9.8						
Color			TCU	-	6.2	ND	ND	ND	Not enough water to collect sample				9.1	7.7	7.4				11	23				18						
Nitrate + Nitrite (an N)			mg/L	-	0.061	0.094	0.091	0.073	Not enough water to collect sample				ND	ND	0.056				ND	0.53				0.53						
Nitrite			mg/L	60	ND	ND	ND	ND	Not enough water to collect sample				ND	ND	ND				ND	ND				ND						
Nitrogen (Ammonia N)			mg/L	-	0.055	ND	ND	ND	Not enough water to collect sample				ND	ND	ND				ND	ND				ND						
Total Organic Carbon			mg/L	-	1	1.8	1.3	1.2	Not enough water to collect sample				1.5	2.3	2.2				2.6	4.8				2.7						
Ortho Phosphate (as P)			mg/L	-	0.014	ND	ND	ND	Not enough water to collect sample				ND	ND	ND				ND	0.012				0.02						
pH			pH	6.5 - 8.5	7.73	7.75	7.61	7.8	Not enough water to collect sample				7.81	7.72	7.81				7.88	7.7				7.85						
Reactive Silica (as SiO ₂)			mg/L	-	19	20	16	18	Not enough water to collect sample				19	20	17				20	15				13						
Total Suspended Solids			mg/L	25	6.8	4.6	3	2.2	Not enough water to collect sample				4	2.4	28				19	2.2				3.4						
Dissolved Sulphate			mg/L	-	3.7	4.2	3.8	3.3	Not enough water to collect sample				3.2	4.4	3.1				4.4	130				100						
Turbidity			NTU	8	11	7	3.1	1.6	Not enough water to collect sample				11	5.8	6.6				5.5	1.2				0.44						
Conductance			uS/cm	-	120	130	98	100	Not enough water to collect sample				120	130	100				130	420				440						
METALS																														
Aluminum			ug/L	100	510	210	160	100	Not enough water to collect sample				310	210	710				310	52				15						
Antimony			ug/L	-	ND	ND	ND	ND	Not enough water to collect sample				ND	ND	ND				ND	ND				ND						
Arsenic			ug/L	5	ND	ND	ND	ND	Not enough water to collect sample				ND	ND	ND				ND	1.9				ND						
Barium			ug/L	-	9.5	5.8	5.7	8.2	Not enough water to collect sample				4.5	4.1	6.9				4.4	55				150						
Beryllium			ug/L	-	ND	ND	ND	ND	Not enough water to collect sample				ND	ND	ND				ND	ND				ND						
Bismuth			ug/L	-	ND	ND	ND	ND	Not enough water to collect sample				ND	ND	ND				ND	ND				ND						
Boron			ug/L	1,500	ND	ND	ND	ND	Not enough water to collect sample				ND	ND	ND				ND	ND				ND						
Cadmium			ug/L	0.09	ND	ND	ND	ND	Not enough water to collect sample				ND	ND	ND				ND	ND				ND						
Calcium			ug/L	-	12000	12000	10000	11000	Not enough water to collect sample				12000	13000	11000				13000	58000				69000						
Chromium			ug/L	1	1.6	ND	ND	ND	Not enough water to collect sample				1.1	ND	1.3				ND	ND				ND						
Cobalt			ug/L	-	0.58	ND	ND	ND	Not enough water to collect sample				ND	ND	0.46				ND	ND				ND						
Copper			ug/L	2	4.4	2.4	1.8	1.8	Not enough water to collect sample				3.2	2.5	3.5				3	1.2				0.72						
Iron			ug/L	300	1100	420	270	200	Not enough water to collect sample				550	330	900				450	79				75						
Lead			ug/L	1	ND	ND	ND	ND	Not enough water to collect sample				ND	ND	ND				ND	ND				ND						
Magnesium			ug/L	-	4100	4000	3300	3300	Not enough water to collect sample				4000	4400	3700				4500	7600				6400						
Manganese			ug/L	-	41	64	25	19	Not enough water to collect sample				14	13	34				17	6.7				3.2						
Molybdenum			ug/L	73	ND	ND	ND	ND	Not enough water to collect sample				ND	ND	ND				ND	ND				ND						
Nickel			ug/L	25	ND	ND	ND	ND	Not enough water to collect sample				ND	ND	ND				ND	ND				ND						
Phosphorus			ug/L	-	ND	ND	ND	ND	Not enough water to collect sample				ND	ND	ND				ND	ND				ND						
Potassium			ug/L	-	420	570	310	300	Not enough water to collect sample				520	800	420				810	1800				1500						
Selenium			ug/L	1	ND	ND	ND	ND	Not enough water to collect sample				ND	ND	ND				ND	ND				ND						
Silver			ug/L	0.1	ND	ND	ND	ND	Not enough water to collect sample				ND	ND	ND				ND	ND				ND						
Sodium			ug/L	-	5200	5300	5100	4600	Not enough water to collect sample				5200	6000	4700				6000	11000				8800						
Strontium			ug/L	-	47	49	37	41	Not enough water to collect sample				47	51	39				51	180				290						
Thallium			ug/L	0.8	ND	ND	ND	ND	Not enough water to collect sample				ND	ND	ND				ND	ND				ND						
Tin			ug/L	-	ND	ND	ND	ND	Not enough water to collect sample				ND	ND	ND				ND	ND				ND						
Titanium			ug/L	-	8.2	4.2	2.3	ND	Not enough water to collect sample				5.6	4.5	14				6.6	2.5				ND						
Uranium			ug/L	15	ND	ND	ND	ND	Not enough water to collect sample				ND	ND	ND				ND	ND				0.93						
Vanadium			ug/L	-	14	8.1	7.2	9.6	Not enough water to collect sample				7.9	5.3	7.6				5.2	7.6				ND						
Zinc			ug/L	30	ND	7.2	ND	5.1	Not enough water to collect sample				ND	ND	5.3				ND	ND				ND						

*CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life - Freshwater

Woodville Pit - Surface Water Monitoring Photos



Woodville SW1 June 23 2026.jpg



Woodville SW2 June 23 2026.jpg



Woodville SW3 June 23 2026.jpg

Woodville Pit - Surface Water Monitoring Photos



Woodville SW4 June 23 2026.jpg



Woodville SW4 June 23 2026_1.jpg

Woodville Pit - Surface Water Monitoring Photos



Woodville SW5 June 23 2026.jpg



Woodville SW6 June 23 2026.jpg