Preliminary Adaptive Management Plan Burlington Quarry Extension, Nelson Aggregates Co.

Prepared for:

NELSON AGGREGATES

June 2022

June 9, 2022

Nelson Aggregate Co.
2433 No. 2 Sideroad
Burlington, Ontario
L7P 0G8

Attention: Mr. Quinn Moyer, President

RE: Burlington Quarry Adaptive Management Plan

Dear Mr. Moyer,

Earthfx Incorporated, Tatham Engineering Limited and GEI Consultants (formerly Savanta) are pleased to provide Nelson Aggregates Co. with the Adaptive Management Plan (AMP) for the Burlington Quarry Extension. This is Version 5.0 of the AMP and has been prepared considering key findings and recommendations stipulated in the natural heritage, hydrological, and hydrogeological assessments completed in support of the extraction plan in addition to extensive consultation with the technical staff at the Ministry of Northern Developement, Mines, Natural Resources, and Forestry (MNDMNRF).

It is recommended that the AMP (including threshold values) be finalized in consultation with the MNDMNRF once sufficient information has been collected from the new monitoring locations in the South Extension.

It is recognized that the monitoring, threshold values, and mitigation options for private water wells will be finalized through the approval of the Ministry of the Environment, Conservation and Parks (MECP) during the Permit to Take Water amendment process. Although the private well program is provided in the AMP, the MNDMNRF will respect the Memorandum of Understanding (May 2008) with the MECP.

Regards,

Dirk Kassenaar, M.Sc., P.Eng.
President, Eartfx Incorporated

Daniel Twigger, P.Eng.
Senoir Engineer, Tatham Engineering

Shannon Catton, M.Sc.
Senior Ecologist, GEI

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1 INTRODUCTION

The groundwater and surface water impact assessment for the extension of the Burlington Quarry has relied on the results of a predictive fully integrated numerical groundwater and surface water model and interpretation of the available monitoring data. The recommended groundwater and surface water monitoring programs and mitigation measures have been incorporated into the Burlington Quarry Preliminary Adaptive Management Plan (AMP). The overall monitoring program has been developed to allow for an evaluation of the local effects and facilitate insightful and strategic decision-making to mitigate unforeseen impacts resulting from quarry development. The goal is to operate the Burlington Quarry Extension without creating any adverse impacts to the natural environment or private domestic water supply wells through adaptive management.

All monitoring locations, threshold values, methodologies, and mitigation strategies presented in this AMP are considered preliminary. It is recommended that the AMP (including threshold values) be finalized in consultation with the Ministry of Northern Development, Mines, Natural Resources and Forestry (MNDMNRF) once sufficient monitoring data has been collected.

2 PURPOSE OF THE ADAPTIVE MANAGEMENT PLAN

The purpose of the AMP is to provide Nelson Aggregates Co. (Nelson) with the information needed to verify that the quarry is operating without causing adverse impacts to the natural environment or private water supplies. The AMP establishes a process to monitor operations and implement mitigation strategies, if necessary, before any unforeseen impacts occur (Figure 1). The monitoring results will be reported to the MNDMNRF, the principal reviewing/approval agency responsible for ensuring that the operator complies with the terms and conditions of the aggregate licence, including enforcing the contents of the AMP. All other interested parties will have an opportunity to review and comment on the monitoring data through their participation in the Stakeholders Liaison Committee.

The AMP allows for strategic decision-making with respect to quarry operations so potential impacts to the natural environment can be fully assessed and mitigated prior to any adverse impact. To be effective, the AMP:

1. identifies receptors to be monitored during extraction, lake filling and for a period after final rehabilitation has been completed;
2. facilitates the collection of monitoring data from the natural environment so that it can be used to evaluate the environmental impact of the extension on the function of natural features;
3. allows for trend analyses to be completed which aids in the evaluation of threshold values and, if thresholds are exceeded, initiates action by Nelson so that mitigation can occur before any negative effects occur;
4. establishes a link between Nelson, the public, stakeholders, and government agencies so that the monitoring data collected can be shared in a transparent and understandable manner;
5. defines the roles and responsibilities of Nelson, stakeholders, and governing agencies; and
6. outlines the reporting requirements under the AMP.

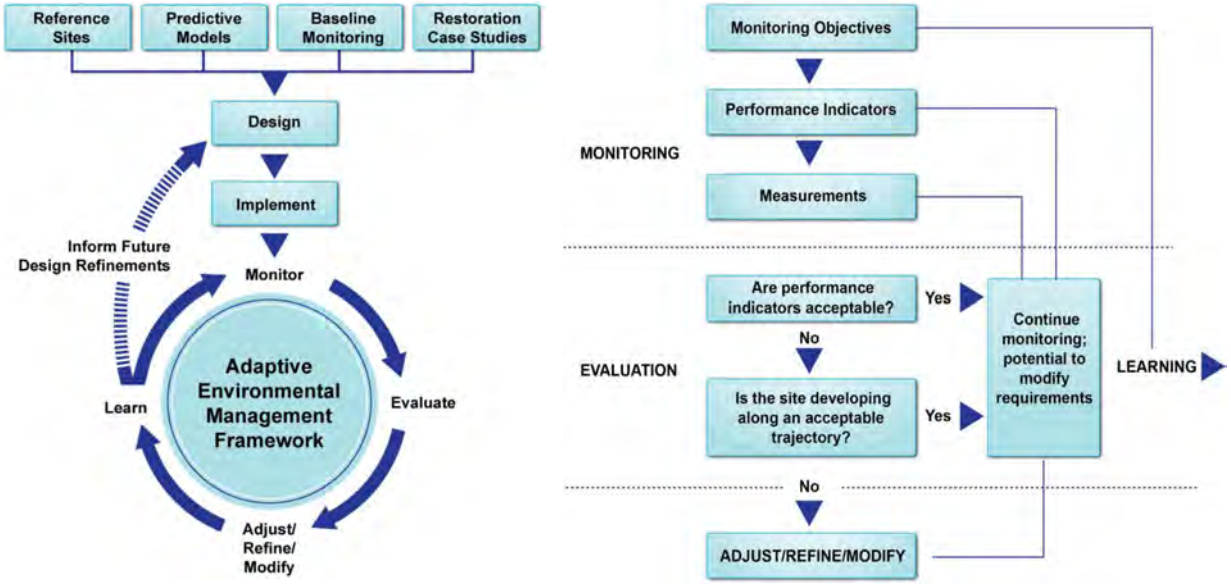


Figure 1: Adaptive Management Framework

3 OVERVIEW: BURLINGTON QUARRY SITE DEVELOPMENT

The Burlington Quarry extensions are situated directly to the south and west of the existing operations and total 76.9 ha of licenced lands of which 47.4 ha are planned for extraction. The subject lands are referred to as the South Extension and the West Extension (Figure 2).

3.1 South Extension

The South Extension consists of a licenced area of 18.1 ha, of which 14.2 ha will be extracted. Extraction will occur in two (2) phases designed to assist final rehabilitation. Phase 1 will be completed in two stages: 1A covers approximately 1.4 ha and will take the quarry floor down approximately 9 m to an elevation of 271 masl. 1B will cover approximately 0.8 ha and step down one metre from 1A to an elevation of 270 masl. The final phase in the South Extension will cover the remaining 12.0 ha and will be extracted to a total depth of approximately 30 m to 252.5 masl. The drainages areas contributing to each wetland east and south of the south extension will remain undisturbed through extraction and rehabilitation.

It is anticipated that the extraction of aggregate and rehabilitation of the South Extension will take approximately 10 years. Once the material has been removed from Phase 1 and Phase 2, the area will be allowed to fill with groundwater and surface water, creating a lake. The final rehabilitation of this area will allow for a beach and shallow swimming area, along with a deep lake for public recreational use.

The integrated surface water/groundwater model predicts that the lake will fill to an elevation of 271 m. A water level control outlet is not proposed for the lake and the lake water level will fluctuate seasonally. A high-water level overflow weir will be graded into the south corner of the lake to ensure discharge from the lake during extremely rare storm events (less frequent than the 1:100-year storm) and freshets will drain to an appropriate outlet. Discharge from the overflow weir will drain overland into Wetland 13037 and to the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek via the existing drainage channel connecting the two.

3.2 West Extension

The West Extension covers a licenced area of 58.8 ha with an extraction area of 33.1 ha. Extraction will occur in four (4) additional phases following the completion of Phase 1 and Phase 2. For all four (4) phases (Phase 3 through Phase 6) extraction will occur down to a floor elevation of 252.5 masl. It is anticipated that extraction will be completed in the West Extension after 20 years. Progressive rehabilitation will be on-going with a final rehabilitation plan of a below grade/water recreational area, complete with park land, water features, and naturalized areas including wetland and woodland habitat.

Extraction in the west extension will alter the sub-catchments draining to each existing outlet and wetland. Dewatering post extraction will also lower groundwater levels surrounding the west extension.

Prior to the surrender of the Aggregate Resources Act (ARA) licence, the licencee will provide, to the satisfaction of the MNDMNRF, confirmation that any long-term monitoring, pumping, or mitigation will not result in a financial liability to the public. The final long-term water management system approved and regulated by the MECP under the Permit to Take Water (PTTW) and the Environmental Compliance Approval (ECA) will stipulate the mandatory groundwater and surface water monitoring program for the future landowner.

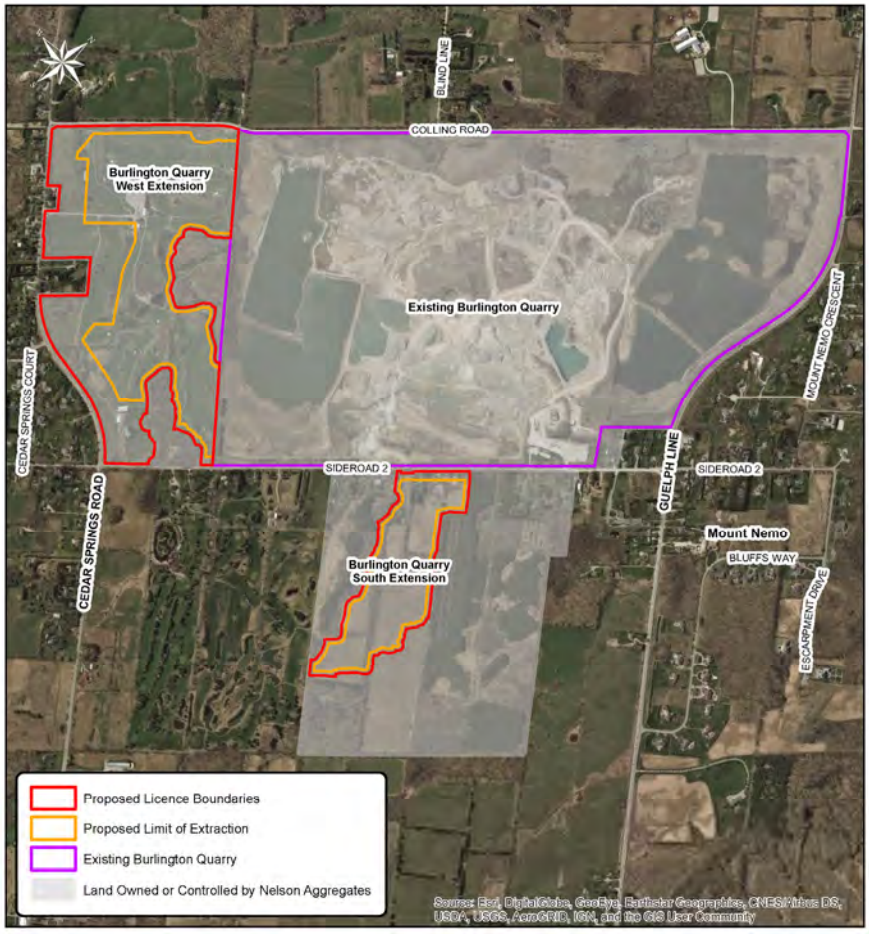


Figure 2: Burlington Quarry and Extension Areas

4 ADAPTIVE MANAGEMENT PLAN OUTLINE

4.1 Roles and Responsibilities

The environmental management and monitoring of the Burlington Quarry are multi-stakeholder tasks. Therefore, the roles and responsibilities of all regulatory agencies involved with the quarry extension are outlined below as well as the enforcement actions available to ensure the monitoring and mitigation measures, as may be required, are fully implemented over the life cycle of the quarry including rehabilitation.

The MNDMNRF is responsible for administering Ontario's aggregate resources under the ARA. As such, the MNDMNRF will be responsible for issuing and enforcing the aggregate licence issued for the quarry extension under the ARA. Since the AMP will become a condition referenced on the approved ARA Site Plans, it will be enforceable under the licence until surrendered, thereby making the MNDMNRF the regulatory agency responsible for the AMP. The MNDMNRF shall enforce all conditions of the aggregate licence issued under the ARA. In the event of non-compliance, the MNDMNRF has the authority to revoke the licence.

The MECP is responsible for administering the water of Ontario under the Ontario Water Resources Act (OWRA) and the Environmental Protection Act (EPA). Therefore, the MECP will be responsible for issuing and enforcing the conditions of the PTTW for the quarry dewatering under section 34 and 98 of the OWRA and Water Taking Regulation O. Reg. 387/04. This includes ensuring no adverse impacts occur to the quality or quantity of water supplying domestic water wells through approval of the threshold and mitigation program. The MECP will also be responsible for enforcing the conditions of the ECA for the treatment and discharge of quarry water as per Section 53 of the OWRA. All site instruments will be updated to permit the approved quarry operations and mitigation options.

The Niagara Escarpment Commission (NEC) will be responsible for issuing and enforcing the Development Permit for the quarry extension under the Niagara Escarpment Planning and Development Act. NEC shall enforce all conditions of the Development Permit.

Nelson will be responsible for meeting the requirements set forth in the aggregate licence, PTTW, ECA, and Development Permit including coordinating the monitoring requirements set forth in the AMP and ensuring the rehabilitation phase of the Burlington Quarry is completed.

4.2 Stakeholders Liaison Committee

Public consultation and liaison will be incorporated into the AMP to encourage open dialogue between Nelson and the community. To facilitate this process, a Stakeholders Liaison Committee (SLC) will be assembled that is composed of agency / government staff, and citizens groups that have a stake in the operation of the Burlington Quarry extension. The SLC will act as a sounding board and adviser to the operator regarding the implementation of the AMP. The participants that will be considered for the SLC may include but are not limited to:

- the NEC;
- the MNDMNRF;
- the MECP;
- Conservation Halton;
- Halton Region;
- City of Burlington;
- two (2) representatives of the community; and
- two (2) representatives of Nelson.

A representative of Nelson will act as chair and guide the meetings to ensure they are focused and orderly. The committee will be required to appoint a co-chair alongside Nelson. In so doing, there will be a direct transfer of information from the SLC to Nelson. The role of the appointed co-chair will be to offer guidance for the committee and present issues to Nelson they might not be aware of. The chair and co-chair will set the agenda and then conduct the meeting proceedings.

Nelson will provide the following:

- the venue for the meetings and will provide administrative staff to record the minutes and action items;
- specialists to interpret data and offer expert opinion on discussion points and monitoring reports; and
- a website to post information for the committee members to share by way of confidential passwords as well as to post information for the public.

The stakeholder and community representatives will serve on the SLC for a term of two years. To ensure there is consistency year to year, the two-year term of appointment will overlap so that there is no time at which all the members are new (saving, of course, for the initial appointment). Overlapping appointment terms will provide continuity of participation among the committee members.

The SLC shall meet a minimum of two times per year. The SLC has an important liaising role and will be required to comment on the effectiveness of the AMP (monitoring programs and mitigation measures). The SLC will also be encouraged to table other relevant issues related to the operation of the Burlington Quarry.

4.3 Adaptive Management Implementation

The quarry operation is expected to take on the order of 30 years to complete (10 years for the south extension and an additional 20 years for the west extension). As such, environmental changes to the receptors, if any, would be expected to be very gradual.

The AMP has been organized to monitor and assess groundwater and surface water features prior to, during and following post extraction until rehabilitation is complete and final groundwater levels have been established. Operations will commence within the south extension. Prior to any site operations (including tree clearing, grubbing and topsoil stripping), Nelson must obtain final written approval from the MNDMNRF on the threshold values. Background conditions will be established based on at least 3 years of monitoring data at all locations, which will allow for the establishment of threshold values.

Similarly, prior to site preparation and any alteration to surface catchments (including tree clearing, grubbing and topsoil stripping) in the Western Expansion area, Nelson must obtain final written approval from the MNDMNRF on the threshold values for key monitoring locations. It is estimated that at least 9 years of recent monitoring data will be available at all locations to establish background conditions, which will allow for the establishment of representative threshold values.

The groundwater and surface water monitoring programs shall continue through the rehabilitation phases. The South Extension groundwater and surface water monitoring programs will continue for three years after it has been determined that the quarry has reached final rehabilitation (creation of the lake feature) and a new groundwater equilibrium has been reached. Since the West Extension will remain dewatered for final rehabilitation, the groundwater and surface water monitoring programs will continue in accordance with the PTTW and ECA.

The existing quarry operation continues to pump discharge water, accumulated through surface runoff, direct precipitation and intercepted groundwater, from Sumps 0100 and 0200 to the Unnamed Tributary

of Willoughby Creek and the West Arm of the West Branch of the Mount Nemo Tributary, respectively. Current approvals for the existing quarry will stop the water discharge pumping at both locations once extraction is complete, which could have a negative impact on fish and fish habitat in both watercourses. The Rehabilitation Plan (MHBC, 2022) recommends that the dewatering and pumping continue at the same locations and in the same manner to ensure there are no negative impacts to any of the hydrological features that rely on the quarry discharge. This will result in long-term enhancements to downstream fish habitat compared to the existing approved post-extraction water management plan.

5 GROUNDWATER MONITORING PROGRAM

5.1 On-Site Groundwater Monitoring Wells

Key groundwater monitoring wells have been selected and incorporated into the long-term groundwater monitoring program. The groundwater monitoring program consists of water level and water quality monitoring. Water levels will be collected manually monthly as well as continuously with automatic water level transducers.

The on-site groundwater monitoring wells are shown on Drawing AMP-1 enclosed. Details are provided in Table 1 and

Table 2.

Table 1: South Extension - Groundwater Monitoring Network

Wetland Feature	Well Location	Monitoring ID	Hydrostratigraphic Unit	Location (NAD 27)		Top of Casing (masl)	Well Depth (m)
13015 13016	M03-30	M03-30A	Deep Bedrock	590902	4805659	279.16	19.4
		M03-30B	Shallow Bedrock	590902	4805659	279.42	8.5
	MW22-01	MW22-01B	Shallow Bedrock	590936	4805746	NA	7.7
		MW22-01C	Overburden	590936	4805746	NA	3.2
13022	M03-20	M03-20A	Deep Bedrock	591156	4805432	278.63	26.1
		M03-20B	Shallow Bedrock	591156	4805432	278.60	9.5
		M03-20C	Overburden	591156	4805432	278.55	3.8
	MW22-07	MW22-07C	Overburden	591115	4805370	NA	2.4
	MW22-08	MW22-08B	Shallow Bedrock	591078	4805468	NA	7.7
		MW22-08C	Overburden	591078	4805468	NA	3.8
	MW22-09	MW22-09C	Overburden	591001	4805631	NA	1.2
13027	MW22-06	MW22-06C	Overburden	591224	4805041	NA	3.2
	M03-07	M03-07B	Shallow Bedrock	591114	4805004	276.39	7.9
		M03-07C	Overburden	591114	4805004	276.32	3.8
	M03-23	M03-23B	Shallow Bedrock	591234	4804919	275.91	10.7
		M03-23C	Overburden	591234	4804919	275.87	3.1
	M03-28	M03-28C	Overburden	591133	4805021	276.44	3.1
	M03-29	M03-29A	Deep Bedrock	591333	4804949	278.01	29.5
		M03-29B	Shallow Bedrock	591333	4804949	277.97	10.2
		M03-29C	Overburden	591333	4804949	278.10	1.9
132037	M03-17	M03-17A	Deep Bedrock	590989	4804488	273.14	22.3
		M03-17B	Shallow Bedrock	590989	4804488	273.14	11.4
	MW22-03	MW22-03B	Shallow Bedrock	590889	4804972	NA	5.5
		MW22-03C	Overburden	590889	4804972	NA	1.8
13203	M03-15	M03-15A	Deep Bedrock	590359	4805299	276.04	25.6
		M03-15B	Shallow Bedrock	590359	4805299	276.05	10.2
		M03-15C	Overburden	590359	4805299	276.08	3.5
	M03-01	M03-01A	Deep Bedrock	590623	4804870	280.65	31.1
		M03-01B	Shallow Bedrock	590623	4804870	280.53	8.9
		M03-01C	Overburden	590623	4804870	280.88	2.3

Table 2: West Extension - Groundwater Monitoring Network

Well Location	Monitoring ID	Hydrostratigraphic Unit	Location (NAD 83)		Top of Casing (masl)	Well Depth (m)
BS-01	BS-01A	Deep Bedrock	588,765	4,805,342	NA	18.50
	BS-01B	Mid Bedrock	588,765	4,805,342	NA	15.20
BS-02	BS-02A	Deep Bedrock	589,421	4,805,342	NA	23.1
	BS-02B	Mid Bedrock	589,421	4,805,342	NA	18.9
BS-03	BS-03A	Deep Bedrock	589,368	4,805,298	NA	18.8
	BS-03B	Mid Bedrock	589,368	4,805,298	NA	12.8
BS-04	BS-04A	Deep Bedrock	589,777	4,804,855	NA	24.5
	BS-04B	Mid Bedrock	589,777	4,804,855	NA	19.9
BS-05	BS-05A	Deep Bedrock	589,015	4,805,462	NA	24.3
	BS-05B	Mid Bedrock	589,015	4,805,462	NA	18.2
BH-07	BS-07	Deep Bedrock	589,363	4,805,271	NA	25.0
MW22-04[1]	MW22-04B	Shallow Bedrock	NA	NA	NA	NA
	MW22-04C	Overburden	NA	NA	NA	NA
MW22-05	MW22-05C	Overburden	NA	NA	NA	NA
MW22-10	MW22-10B	Shallow Bedrock	NA	NA	NA	NA
	MW22-10C	Overburden	NA	NA	NA	NA
MW22-11	MW22-11C	Overburden	NA	NA	NA	NA
MW22-12	MW22-12C	Overburden	NA	NA	NA	NA
MW22-13	MW22-13A	Deep Bedrock	NA	NA	NA	NA
	MW22-13B	Mid Bedrock	NA	NA	NA	NA
MW22-14	MW22-14A	Deep Bedrock	NA	NA	NA	NA
	MW22-14B	Mid Bedrock	NA	NA	NA	NA
MW22-15	MW22-15A	Deep Bedrock	NA	NA	NA	NA
	MW22-15B	Mid Bedrock	NA	NA	NA	NA

NOTE: Well IDs that start with MW22 in the South Extension were drilled in February 2022. Well IDs that start with MW22 in the West Extension will be drilled within the first year of extraction in the South Extension.

The groundwater monitoring network consists of well nests, which monitor discrete intervals in the bedrock aquifer, as well as, open holes, which are constructed to straddle water-bearing flow zones. Well nests have monitoring wells with either A, B, or C following the well label (for example: MW03-1A, MW03-1B, and 1C). The "A" monitor is constructed in the regionally extensive lower bedrock aquifer system found below the quarry floor elevation. The "B" monitor is constructed within the upper/middle dolostone unit that intersects the quarry extraction face. The "C" monitor is constructed within the overburden aquifer.

5.2 Off-Site Domestic Water Wells

The MECP requires that all PTTW holders take the necessary actions to ensure residents and their water supplies are protected from potential impacts associated with the water takings at aggregate operations. To be proactive and to alleviate the complaint driven process, Nelson shall implement a voluntary domestic water well monitoring program to those residents located within 1 km of the Burlington Quarry extension lands. This program will be designed to act as an early warning system and would identify any potential adverse interference that may compromise the integrity of the domestic water supply.

A preliminary private door-to-door water well survey was completed by Nelson personnel and a Professional Geoscientist on July 29th and July 30th, 2019. The survey was completed for all residents located within 1 km of the extension lands, including those located on both the north and south sides of

Sideroad No. 1. In total, 156 homes were visited. The purpose of the water well survey was to collect baseline information on the local water use (quality and quantity) to ensure the sustained quality and quantity of the water supply and to discuss the Burlington Quarry extension. If residents were not home, an information package was left at their front door. The package included an informative flier on the Burlington Quarry application, details about the well monitoring program, and Nelson's contact information.

Of the 156 homes visited, only eleven (11) homeowners indicated that they were interested in participating in the monitoring program. Seven (7) of the eleven (11) private domestic water wells were accessible and, as a result, have been added to the current groundwater monitoring program.

Upon licensing, Nelson will be completing a follow-up door-to-door water well survey to inform residents that they are still able to participate in the program if interested. Furthermore, Nelson's website will have a page dedicated to the Private Well Monitoring Program, including details on the monitoring program. The website will also have a contact form that will allow a resident to schedule a meeting with Nelson personnel and their Professional Geoscientist to discuss having their well added to the monitoring program.

A pre-construction monitoring program will be offered to residents within 1 km of the extension lands by a qualified well technician (as is required by law [Ontario Regulation 903, as amended]). This program is designed to establish baseline conditions of existing domestic water wells. Domestic water wells need to be determined case-by-case as the physical characteristics of each well will need to be evaluated and documented to provide an understanding of the current conditions, including water quality, well yield and the available drawdown.

This monitoring program will be completed only at locations where permission has been granted by the property owner. Furthermore, the domestic water wells, which will be incorporated into the AMP shall be constructed to comply with Ontario Regulation 903 (as amended). The current domestic water well monitoring locations are summarized in Table 3.

Table 3: Private Monitoring Well Locations

Borehole	MECP Well ID	Survey Coordinates (NAD83)	
		Easting	Northing
DW-1	28-03833	589114	4805170
DW-2	na	589786	4807340
DW-3	7276141	589486	4804431
DW-4	na	591987	4804216
DW-5	2800063	591472	4803608
DW-6	na	591220	4803372
DW-7	na	590916	4806143

5.3 Water Well Interference Complaint Protocol

The Nelson Well Interference Complaint process is provided on Nelson's website.

https://www.nelsonaggregate.com/copy-of-licensing-1

If a water well complaint is received by the licencee, the following actions will be taken:

- The licencee will notify MNDMNRF and MECP of the complaint.
- The licencee will contact a well contractor in the event of a well malfunction and residents will be provided a temporary water supply within 24 hours, if the issue cannot be easily determined and rectified.
- The well contractor will contact the resident with the supply issue and rectify the problem as expediently as possible, provided the landowner authorizes the work. If the issue raised by the landowner is related to loss of water supply, the licensee will have a consultant/contractor determine the likely causes of the loss of water supply, which can result from a number of factors, including pump failure (owner's expense), extended overuse of the well (owner's expense) or lowering of the water level in the well from potential quarry interference (licensees expense). This assessment process will be carried out at the expense of the licensee and the results provided to the homeowner.
- If it has been determined that the quarry caused the water supply interference, the quarry shall continue to supply water at the licencee's expense until the problem is rectified. The following mitigation measures shall be considered, and the appropriate measure(s) implemented at the expense of the licencee:
    - adjust pump pressure;
    - lowering of the pump to take advantage of existing water storage within the well;
    - deepening of the well to increase the available water column;
    - widening of the well to increase the available storage of water;
    - relocation of the well to another area on the property;
    - drilling multiple wells; and
    - only at the request of a landowner would a cistern be installed.

If the issue raised by the landowner is related to water quality, the licencee will have a consultant/contractor determine the likely causes of the change in water quality, and review monitoring results at the quarry and background monitoring results from the baseline well survey to determine if there is any potential correlation with the quarry. If it has been determined that the quarry caused a water quality issue, the quarry shall continue to supply water at the licencee's expense until the problem is rectified. The licencee shall be responsible for restoring the water supply by replacing the well or providing a water treatment system. Only at the request of a landowner would a cistern be supplied. The licencee is responsible for the expense to restore the water quality.

5.4 Groundwater Effects Assessment Methodology

The AMP must identify potential receptors, outline the compliance monitoring program, as well as identify threshold values to assess and mitigate the potential impact to those receptors that may be impacted by the quarry development.

The groundwater impact assessment methodology has been developed for the initial 5 years of quarry operation, where the first year is defined by the commencement of site preparation. During these 5 years, Nelson will have only operated in the south extension. The area surrounding the south extension area

has been monitored extensively for over 7 years. In 2022, the monitoring network for the South Extension was revised after consultation with the MNDMNRF. Although it is understood how the groundwater regime behaves, the new monitoring locations added in 2022 will require 3 years of monitoring data to provide additional understanding of groundwater surface water interactions and develop the assessment tools, such as monitor-specific threshold values and threshold trend analysis, for the south extension.

The impact assessment methodology for the Burlington Quarry extension involves both an evidence-based and a predicted-based approach to ensure that the complexity of fractured rock hydrogeology is addressed. The evidence-based approach requires a comprehensive understanding of the natural variability of groundwater elevations at key monitoring locations. This understanding requires several years of monitoring data that shows the groundwater systems natural response to varying climatic conditions, including how the aquifer responds during and following dry/drought conditions. The baseline conditions allow for an improved ability to identify unforeseen trends in water level data, that could be a result of the quarry operations. A key component of the evidence-based groundwater monitoring program is the availability of background water level data that reports the natural conditions during quarry extraction.

The predictive-based approach relied upon the simulated water level drawdowns in the bedrock aquifers resulting from both climatic conditions and quarry dewatering. The predicted water levels during drought conditions represent a worst-case scenario that may be encountered during the initial phases of quarry operation (Phase 1 and 2).

5.4.1 Monitoring of Background Groundwater Conditions

To assist in the evaluation of the water levels measured as part of the groundwater monitoring program, a background monitoring well is proposed on the lands owned by Conservation Halton (Mount Nemo Lookout), pending approval. The background monitoring shall be established within the first 6 months of the ARA license being issued and be constructed as a multi-level monitoring wells located at least 500 m from the eastern licensed limits of the existing Burlington Quarry. The purpose of this background monitoring well is to document the natural variability of the groundwater elevation fluctuations and trends under various future climatic conditions.

As discussed in the following sections, the impact assessment will assess short and long-term trends identified in the data. Being able to identify trends that are resulting from either prolonged climatic changes or those which are largely associated with aquifer dewatering are a fundamental component of the AMP. On-going monitoring data from the background well will be used to represent the natural background conditions. Climatic conditions will be evaluated based on precipitation and temperature data collected from the on-site weather station.

5.4.2 Groundwater Quality Monitoring

Select groundwater monitoring wells will be sampled semi-annually for general water quality and annually for petroleum hydrocarbons. A complete list of the groundwater quality parameters is provided in Table 4.

Table 4: Groundwater Quality

Water Quality Sampling Frequency	Parameters
Semi-Annually	pH, Conductivity, Alkalinity, Hardness, Bicarbonate, Total Phosphorus, Nitrate and Nitrite, Metals (Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chloride, Cobalt, Copper, Lead, Iron, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Sodium, Silver, Strontium, Sulphate, Sulfur, Thallium, Thorium, Tin, Titanium, Tungsten, Uranium, Vanadium, Zinc),
Annual	Petroleum Hydrocarbons (BTEX, F1-F4)

5.4.3 Groundwater Thresholds

The first step in the Groundwater Effects Assessment is to assign groundwater threshold values to select wells, which if reached, will trigger a sequence of events that are determined by the overall objective of that threshold value. The groundwater thresholds have one objective: to provide an early warning that a potential unforeseen effect from quarry operations may occur at a domestic water well.

Nelson relies upon the percentile method for establishing groundwater thresholds; the same method relied upon by the MECP for calculating threshold level for Groundwater for the Ontario Low Water Response Plan. For the standard statistical method, a percentile is a statistic that gives the relative standing of a numerical data point when compared to all other data points in a distribution. A percentile value ranges from 0 to 100. The value indicates the percentage of the data is equal to or below it.

The thresholds values will be established after at least 3-years of monitoring data has been collected and will be based on the measured monthly maximum and minimum water levels reported. If the 0^{th} percentile equals the minimum water level measured, the 10^{th} and 5^{th} percentile values will be relied upon for the threshold values.

There will be two bedrock aquifer threshold conditions to assess for potential unforeseen effects from quarry operations on domestic water wells:

1. Level 1 threshold conditions occur when the measured water level falls below the Threshold 1 value (10^{th} percentile) for a 15-day period. A Level 1 threshold condition will result in an increase in groundwater monitoring frequency from monthly to weekly at the threshold location. Weekly groundwater monitoring will include retrieval of the continuously recorded monitoring data, a manual groundwater level depth measurement, and analysis of the monitoring data.
2. Level 2 threshold conditions occur when the water level falls below the Threshold 2 value (5^{th} percentile) for a 15-day period. A Level 2 threshold condition will result in the completion of a detailed trend analysis.

5.4.4 Comprehensive Groundwater Elevation Trend Analysis

A key objective of the impact assessment methodology is to utilize the important concept of long-term trends from either prolonged climatic changes or those which are largely associated with aquifer dewatering. Prolonged climatic changes mean sustained periods of departure from "normal" precipitation amounts, for example droughts. These precipitation trends, when severe and lengthy, leave noticeable effects on groundwater levels. Short-term trends (seasonal) should also be evaluated. However, they should not cause a concern if an exceptionally dry year results in water levels that drop below a minimum reported or predicted water level.

Nelson will rely on the Seasonal Mann-Kendall Test to statistically interpret trend analysis of groundwater elevations at select sentry wells. The Nottawasaga Valley Conservation Authority has relied on the Seasonal Mann-Kendall Test to interpret Provincial Groundwater Monitoring Network (PGMN) groundwater levels after it was recognized that statistically definable results can be utilized to manage groundwater resources, assess drought conditions, evaluate the impact of human activities on groundwater and evaluate long-term groundwater trends.

The Seasonal Mann-Kendall Test considers the seasonality of the data series. This means that for monthly data with seasonality of 12 months, one will not try to find a trend in the overall series, but a trend from one of January to another, and from one February and another, and so on. The Seasonal Mann-Kendall test is established on the basis that the trend is cyclically varying in relation to the seasons of the year. It is used to analyse time series data for the possible existence of an upward or downward trend, at a significance level, while accounting for the effect of seasonality.

If a decreasing trend is determined by the results of the Seasonal Mann-Kendall Test, the trend will be analyzed using a Theil-Sen slope. The Theil-Sen test is also nonparametric and provides a more robust slope estimate than the least-squares method because outliers or extreme values in the time series affect it less. Therefore, this test provides an estimate of the true slope of an existing trend (as change per year). If the trend is decreasing, the action items will be based on the monitoring location. If the trend is not decreasing, the test will conclude that the slope is not statistically decreasing and there are no adverse effects associated with the quarry operation.

For a domestic water well, a confirmed decreasing trend will provide the estimated date at which the water level is predicted to drop below a threshold of 5 m of available drawdown. The slope of the trend line is used to make a conclusion on future groundwater conditions such as timing to implement the domestic water well mitigation measures, such as deepening the domestic well to a lower bedrock aquifer (see Section 5.4.5).

For the multi-level groundwater monitoring locations that have been established to protect wetland features, a confirmed decreasing trend in the bedrock aquifer will prompt the following action items:

1. Groundwater monitoring will focus on the water level trends in the overburden aquifer. Using the same approach to the bedrock effects assessment, the overburden water levels will be reviewed to detect any impacts (groundwater drawdown) associated with the quarry operation.
2. If the trend analysis confirms a decreasing overburden water level, hydroperiod mitigation will be implemented as outlined in Section 6.2.5, if required.

5.4.5 Domestic Well Mitigation Measures

As stipulated in the General Conditions of all Ontario Water Resource Act (OWRA) Section 34 Permit to Take Water (PTTW), if the taking of water is observed to cause any negative impact to groundwater supplies, the Permit Holder shall take such action necessary to make available to those affected, a supply equivalent in quantity and quality to their normal takings. If the permitted water taking at the Burlington Quarry causes permanent interference, Nelson shall restore the water supplies of those permanently affected. Nelson acknowledges and endorses this responsibility under Section 34 of the OWRA for the replacement of the water supply, which must be of equivalent quality and quantity. To ensure a cooperative and fair treatment with all concerned, Nelson will work diligently with their neighbours on these issues.

A key finding of the Level 1 and 2 Hydrogeological Assessment and Numerical Model (Earthfx et. al., 2020), is that the drawdown associated with the extension of the Burlington Quarry does not adversely impact the available drawdown in the regional bedrock aquifer found at an elevation beneath 252 masl (elevation of the quarry floor). The available drawdown is the distance between the static water level (either pre or post quarry development) and the base of the aquifer. Interference with available drawdown can reduce the maximum yield of a well. It is generally accepted that 5 m of available drawdown is a safe available drawdown for domestic water wells constructed in bedrock aquifers.

The available drawdown at the private water wells is based on the well construction. If the well penetrates to the base the regional bedrock aquifer, available drawdown may be limited. Private wells are not always designed to obtain the maximum possible yield, but only an acceptable yield for domestic use. Nelson has determined the level of risk based on the total available drawdown for each well identified within the predicted area of influence. This information has been superimposed onto the model results showing available drawdown within the stratigraphic units, and the results show that wells can be deepened, if needed, to increase the available drawdown at each location. Data collected from existing domestic water wells along No. 2 Sideroad, which are within 80 m of the quarry, show that wells constructed in the hydrostratigraphic layer beneath the quarry floor (Layer 8) can meet peak domestic water demands with between 2 and 5 m of available drawdown.

The Seasonal Mann-Kendall Test will act as an early warning tool to identify any deviation from predicted water level trends and impacts. This test will be applied to private water wells where permission to monitor has been granted. The sentry wells are key locations to monitor trends and identify any unforeseen impacts before the influence is reported off-site. This approach limits the time required to complete traditional investigations that are triggered only if a specific water level threshold has been exceeded. Nelson will commence with planning the required mitigation and/or compensation if unforeseen trends suggest off-site impacts will be greater than predicted and threaten the available drawdown in private wells. Mitigation and/or compensation must be acceptable to the homeowner and the quarry operator and could include all or part of the costs associated with drilling of a new well, deepening a well, and abandonment of the old well.

In addition to providing a new private water supply well in a deeper aquifer system, Nelson will ensure that the quality of this source is equivalent or better than that of the well being replaced. Upon completion of the well construction, a comprehensive water quality analysis will be completed to characterize the water supply. If it is shown that the water quality has deteriorated from intercepting poor water quality at depth (for example increased chlorides and sulphates), the appropriate water treatment system will be purchased and installed.

The integrated surface water/groundwater model results predict groundwater mounding beneath the existing irrigation ponds in the West Extension. This groundwater mounding is generally maintained year-round by the diversion of quarry discharge into the irrigation ponds and raises groundwater levels in the area artificially. Through extraction, the irrigation ponds will be eliminated, and groundwater levels will be lowered in the area. To replicate the existing artificial groundwater mounding produced by the irrigation ponds, a pond will be constructed outside the extraction area within the licence boundary between the extraction limit and Cedar Springs Road. The pond will be constructed at depths and elevations consistent with the existing irrigation ponds.

6 SURFACE WATER MONITORING PROGRAM

A surface water monitoring program has been developed and implemented over the past six (6) years to establish existing baseline conditions for the surface water features on-site and in the surrounding area. The surface water program includes the monitoring of streamflow, wetland hydroperiod, and shallow groundwater levels. In 2022, new surface water monitoring locations were added to the network after consultation with the MNDMNRF. The new surface water monitoring stations in the south extension were installed in the spring of 2022 and 3 years of monitoring data will be collected from these locations to allow for establishment of threshold values prior to overburden stripping in the south extension. The new surface water monitoring stations in the west extension will be installed within the first year of extraction in the south extension.

The surface water monitoring will continue during the operational lifespan of the quarry to:

- Monitor streamflow, water quality, wetland hydroperiods and surface and groundwater interactions during operations and upon closure of the Burlington Quarry;
- Assess potential unforeseen changes and impacts to the surface water and natural heritage features on-site and in the surrounding area resulting from extraction and dewatering of the quarry; and
- Establish the cause of any potential unforeseen changes and impacts to the surface water and natural heritage features and determine if mitigation is required to address the changes/impacts.

6.1 Surface Water Monitoring Network

6.1.1 Monitoring of Background Surface Water Conditions

Streamflow monitoring has been implemented to establish existing baseline conditions for the various watercourses in the area. A continuously recording pressure transducer measuring water level and water temperature and a water level staff gauge have been installed in each watercourse at each streamflow monitoring location. Manual in-situ streamflow measurements are collected monthly at each streamflow monitoring location along with a staff gauge water level measurement and temperature reading. Rating curves (streamflow versus water level) have been developed for each streamflow monitoring location from the collected field measurements allowing streamflow to be calculated from the continuously recorded water level data.

Key streamflow water monitoring locations have been selected and incorporated into the long-term surface water monitoring program. The streamflow monitoring locations are shown on the AMP Monitoring and Thresholds Plan (Drawing AMP-1) enclosed. Details are provided in Table 5.

Table 5: Surface Water Monitoring Network

Monitoring Location	Northing	Easting	Watershed
SW1	4805833	589015	Bronte Creek
SW2	4806693	587340	Bronte Creek
SW6	4805071	590629	Grindstone Creek
SW9	4805317	591235	Grindstone Creek
SW10	4803358	591283	Grindstone Creek
SW14	4804107	589227	Bronte Creek
SW29	4804364	590180	Grindstone Creek
SW39	TBD	TBD	Grindstone Creek
SW40	TBD	TBD	Bronte Creek

Wetland hydroperiod monitoring locations have been established on-site and in the surrounding area to establish existing baseline conditions for the various wetlands in the area. A continuously recording pressure transducer measuring water level and water temperature and a water level staff gauge has been installed in each wetland at each wetland hydroperiod monitoring location. Staff gauge water level measurements and temperature readings are collected monthly at each wetland hydroperiod monitoring location. The field measurements are used to calibrate the continuously recording pressure transducer data.

In 2018, 2020, and 2022, shallow groundwater monitoring locations were established next to each wetland hydroperiod monitoring location to establish existing baseline conditions to help understand the surface water/ groundwater interactions in each wetland. A continuously recording pressure transducer measuring water level and water temperature has been installed in a drive point well in each wetland at each shallow groundwater monitoring location. Manual in-situ water level measurements are collected monthly at each shallow groundwater monitoring location. The field measurements are used to calibrate the continuously recording pressure transducer data.

Key wetland hydroperiod and shallow groundwater monitoring locations have been selected and incorporated into the long-term surface water monitoring program. The wetland hydroperiod and shallow groundwater monitoring locations are shown on the AMP Monitoring and Thresholds Plan (Drawing AMP-1) enclosed. Details are provided in Table 6.

Table 6: Wetland Hydroperiod / Shallow Groundwater Monitoring Locations

Monitoring Location	Northing	Easting	Wetland
SW11A/SW11B	4805245	591177	13027
SW12A/SW12B	4805393	591127	13022
SW13A/SW13B	4805707	590935	13016
SW16A/SW16B	4804900	590889	13037
SW36A/SW36B	TBD	TBD	13021
SW37A/SW37B	TBD	TBD	13020
MP41	TBD	TBD	13204
MP42	TBD	TBD	13204
MP43	TBD	TBD	13204
MP44	TBD	TBD	13204
MP45	TBD	TBD	13037
MP46	TBD	TBD	13015
MP47	TBD	TBD	13027
MP48	TBD	TBD	13027
MP49	TBD	TBD	13022
MP50	TBD	TBD	13022
MP51	TBD	TBD	13201
MP52	**TBD**	**TBD**	**Lake Medad Tributary**

NOTE: Wetland hydroperiod monitoring stations labelled starting WH or ending A and shallow groundwater monitoring stations (drive point wells) labelled starting MP or ending B.

6.1.2 Surface Water Quality Testing

Quarterly water quality samples were collected from select surface water monitoring locations in 2018 and 2019 to establish baseline water quality at each location. Samples were collected October 24, 2018, April 24, 2019, June 19, 2019 and September 25, 2019 from 13 total streamflow and manual in-situ streamflow monitoring locations.

Water quality sampling is also recommended during the operational lifespan of the quarry to assess the effectiveness of the quarries surface water management system in treating the quarry water prior to off-

site discharge and assess the impacts the off-site discharge has on the water quality of the surface water features. The recommended post approvals water quality sampling is detailed in the following table.

Table 7: Surface Water Quality Monitoring Program

Water Sampling Locations	Sampling Frequency	Parameters
SW1, SW2, SW6, SW10, SW14, SW29, SW40	Quarterly (once every three months)	Dissolved Organic Carbon, Ammonia, Alkalinity, BOD, COD, Conductivity, Total Hardness, Total Metals, Turbidity, Total Dissolved Solids, Total Suspended Solids, pH, Carbonate, Bicarbonate, Chloride, Sulphate, TKN, Nitrite, and Nitrate

6.1.3 MECP PTTW and ECA Requirements

In addition to the water quality sampling prescribed above, Environmental Compliance Approval Number 5203-AN6NGV issued by the Ministry of the Environment and Climate Change specifies an effluent monitoring program Nelson must conduct to confirm the effluent discharge from the quarry remains in compliance with the concentration limits stipulated within the ECA. The ECA requires monthly and quarterly (once every three months) effluent grab samples be collected from the two off-site discharges and analyzed for a variety of parameters to confirm compliance. In addition, quarterly field temperature monitoring is required at the various key points of interest downstream of the Quarry Sump 0100 discharge location to assess seasonal impacts. The effluent monitoring program as stipulated will remain in place moving forward unless modified by the Director of the Ministry of the Environment, Conservation and Parks (MECP).

After the property is rehabilitated and the licence is surrendered, off-site discharge is to continue from Quarry Sump 0100 and 0200 in accordance with the conditions of Nelson's ECA and PTTW to maintain the quarry lake water levels and baseflows in the tributary of Willoughby Creek and the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek. Prior to surrender of the Aggregate Resources Act Licence, the Licencee will provide to the satisfaction of the MNDMNRF, confirmation that long-term monitoring, pumping or mitigation will not result in financial liability to the public.

Nelson is currently authorized to withdraw water from Quarry Sump 0100 and 0200 at rates of 4,090 L/minute (5,889,600 L/day) and 945 L/minute (1,360,800 L/day), respectively in accordance with Schedule "A" of Permit to Take Water No. 96-P-3009. Water taken from Quarry Sump 0100 is discharged northwest to the roadside ditch along Colling Road which drains into a tributary of Willoughby Creek north of Colling Road. Water taken from Quarry Sump 0200 is discharged southeast across No. 2 Sideroad to the upstream end of the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek. The monitoring data collected to date shows the tributary of Willoughby Creek and West Arm depend on the quarry discharge for much of their flow.

In addition to specifying the maximum allowable water taking rates and volumes, PTTW No. 96-P-3009 requires Nelson to:

- Measure, record and submit the quantities of water taken daily to the Ministry;
- Notify the Ministry of any complaints arising from the water taking; and
- Address any negative impacts caused by the water taking.

If Nelson withdraws water from the quarry sumps, they will be required to adhere to the conditions of their PTTW including those listed above.

Nelson is authorized to withdraw water from the quarry sumps in accordance with Permit to Take Water No. 96-P-3009. As per the conditions of their PTTW, Nelson is responsible to measure, record and submit the quantities of water taken daily to the Ministry, notify the Ministry of any complaints arising from the water taking, and address any adverse impacts caused by the water taking.

Following several significant rain events, a temporary amendment to the PTTW was issued by the Ministry of the Environment and Energy August 13, 2014 increasing the maximum water taking from Quarry Sump 0100 to 8,200 L/minute. The amendment expired September 30, 2014 and the quarry has operated under the authority of PTTW No. 96-P-3009 since. It is recommended that Nelson seek to permanently increase the maximum allowable discharge rate from Quarry Sump 0100. It is recommended that a seasonal or varied (based on weather conditions and rainfall) allowable discharge rate(s) be established to provide Nelson with more operational flexibility to actively manage water on-site and allow discharge off-site when downstream channel capacities permit. Whether Nelson seeks to increase the maximum allowable discharge or not, they will have to adhere to the terms and conditions of their current or any future PTTW for the operational lifespan of the quarry.

6.2 Surface Water Impact Assessment Methodology

6.2.1 Streamflow and Water Temperature Thresholds

Willoughby Creek and the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek have been identified as fish habitat. Baseflow and water temperature are critical to the form and function of the watercourses from a natural heritage, habitat, and spawning perspective. Also, the predictive integrated surface water groundwater model predicts a measurable reduction in flow to the unnamed tributary of Lake Medad at monitoring location SW29 during operations due to extraction and quarry dewatering. As such, streamflow and water temperature thresholds will be established for these watercourses along with mitigation measures as required.

It is recommended that streamflow and water temperature thresholds be established from the results of the historic surface water monitoring completed in support of the Burlington Quarry extension. Monthly streamflow thresholds calculated from the difference between the maximum baseflow and minimum baseflow will be established as additional baseline data is collected prior to extraction. Like the groundwater domestic well thresholds, 10^{th} and 5^{th} percentile baseflow values will be established from the maximum monthly (100^{th} percentile) and minimum monthly baseflow (0^{th} percentile) measured at each streamflow monitoring location. Level 1 threshold conditions occur when the measured streamflow falls below the Level 1 threshold (10^{th} percentile) for 7 consecutive days. Level 2 threshold conditions occur when the measured streamflow falls below the Level 2 threshold (5^{th} percentile) for 7 consecutive days.

Monthly temperature thresholds (absolute values) will be established as additional baseline data is collected prior to extraction. The monthly temperature thresholds will be established from the baseline monitoring data with consideration of the ecological requirements of the fish species inhabiting the watercourse. The Level 1 temperature threshold (investigative threshold) will be established based on the recommended chronic temperature tolerance of the fish species inhabiting the watercourse. Its noted, several months a year the average daily water temperature will be below the chronic temperature tolerance and the chronic temperature tolerance won't be applicable. During these months, the Level 1 threshold will be set a $2^{o}C$ less than the Level 2 threshold discussed next. The level 2 temperature threshold (mitigative threshold) will be established as the average day maximum temperature from the monitoring data. Level 1 threshold conditions occur when the measured daily average temperature rises

above the Level 1 threshold for 7 consecutive days. Level 2 threshold conditions occur when the measured daily average temperature rises above the Level 2 threshold for 7 consecutive days.

It is anticipated that the streamflow and water temperature thresholds may be refined as additional baseline monitoring data is collected during the approvals process, prior to extraction, through consultation with the requisite approval agencies.

Currently, a minimum baseflow of 2 L/s must be maintained to the upstream end of the tributary of Willoughby Creek as specified in PTTW No. 00-P-3072 issued to Burlington Springs Golf and Country Club (BSGCC). To maintain the baseflow in the tributary of Willoughby Creek, a continuous quarry discharge is required. Similarly, to maintain baseflow year-round in the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek discharge from Quarry Sump 0200 is required.

The overall catchment area draining to Wetland 13203 and the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek will be reduced through extraction in Phases 1 and 2. Any reduction in streamflow, which maintains water levels in Wetland 13203, will be maintained through discharge from Quarry Sump 0200 in perpetuity. Similarly, the catchment area draining to Wetland 13202 and the unnamed tributary of Willoughby Creek will be reduced through extraction in Phases 3 through 6. Any reduction in streamflow, which maintains water levels in Wetland 13202, will be maintained through discharge from Quarry Sump 0100 in perpetuity.

6.2.2 Wetland Hydroperiod Thresholds

The wetlands bordering the south extension (outside the licence boundary) and within the west extension licence boundary (outside the extraction area) have been identified as natural heritage features, specifically significant wetlands for the purposes of the application. The wetland hydroperiod and water temperature are critical to the form and function of the wetland from a natural heritage, habitat, and breeding perspective. As such, wetland hydroperiod thresholds will be established for the key significant wetlands.

Maintaining a standing pool of water in each wetland during its historic hydroperiod is critical to the form and function of the wetland from a natural heritage, habitat, and breeding perspective. The species living and breeding in these wetlands rely on the standing pool of water for a period each spring. As such, the primary hydroperiod threshold represents the earliest date at which the standing pool of water reaches a depth of 0.0 m at the wetland monitoring locations as defined by the historic surface water monitoring data.

In addition to establishing the earliest date at which the standing pool of water reaches a depth of 0.0 m, threshold values will be established that represent the weekly average water depth within each wetland feature. Water levels will be monitored continuously with an automatic datalogger. Three times a week, the water levels will be reviewed (either by manual readings or telemetry) over the course of the hydroperiod. If at anytime the water levels drop below the corresponding weekly threshold limit, Nelson shall implement mitigation to raise water levels to average conditions.

It is noted that the temporary pool in each wetland was generally not re-established prior to the wetland hydroperiod monitoring device being removed mid-December to prevent freezing. The results of the wetland hydroperiod monitoring, existing condition water balance and integrated surface water/groundwater model show that the re-establishment of the temporary pool each fall/winter is highly dependent on rainfall and snowmelt and can occur between the beginning of November to mid-February.

As such, a fall hydroperiod threshold has not been established for each wetland. The need for a fall hydroperiod threshold will be re-evaluated as additional baseline monitoring data is collected during the approvals process, prior to extraction, through consultation with the requisite approval agencies.

The overall catchment area draining to each wetland (wetlands 13203, 13027, 13022, 13015/13016, and 13037) adjacent to the south extension will not be altered through extraction. The integrated surface water groundwater model analyzed likely groundwater drawdown in the bedrock aquifer beneath each wetland during operations due to extraction and quarry dewatering. However, adverse impacts are not predicted to the wetlands because the wetlands are generally perched with little (less than 1.8% of the total inflow to the wetland) to no groundwater contribution during the year. The wetland hydroperiod thresholds for these wetlands have been specified to ensure no unforeseen adverse impacts occur as a result of extraction and/or quarry dewatering. Mitigation measures have been developed as part of the quarries surface water management plan to supplement these wetlands with quarry water to maintain their hydroperiod and average water levels during operations (until final rehabilitation is complete) in case unforeseen impacts occur.

The overall catchment area draining to wetlands 13200 and 13201 (wetland monitoring locations SW36 and 37) will be reduced as part of extraction in Phases 3 through 6. Also, the integrated surface water groundwater model predicts groundwater drawdown in the bedrock beneath each wetland during operations due to extraction and quarry dewatering. Mitigation measures have been developed as part of the quarries surface water management plan to supplement these wetlands with quarry water to maintain their hydroperiod and average water levels in perpetuity.

6.2.3 Shallow Groundwater Thresholds (Medad Valley)

Seeps have been observed along the base of the Medad Valley slope which contributes water to the Medad Valley wetland (Wetland 13204). Also, the unnamed tributary of Lake Medad is known to receive groundwater discharge during periods of the year. Monthly shallow groundwater thresholds will be established for monitoring locations MP41 – MP44, SW52 along with MW22-13, MW22-14, and BS-01 to assess the quarries impact on groundwater discharge to these natural heritage features.

Shallow groundwater thresholds will be established from the results of the available monitoring data (minimum of three years). Like the groundwater thresholds, 10^{th} and 5^{th} percentile shallow groundwater values will be established from monthly maximum (100^{th} percentile) and monthly minimum (0^{th} percentile) shallow groundwater levels measured at each monitoring location. Level 1 threshold conditions occur when the measured shallow groundwater level falls below the Level 1 threshold (10^{th} percentile) for 7 consecutive days. Level 2 threshold conditions occur when the measured shallow groundwater level falls below the Level 2 threshold (5^{th} percentile) for 7 consecutive days. The shallow groundwater effects assessment methodology is consistent with the methodology described in Section 5.4.

6.2.4 Surface Water Quality Thresholds

As a condition of the quarries ECA, grab samples must be collected from the discharge pipe of Quarry Sump 0100 and 0200 monthly and quarterly (once every three months) during operations. Monthly and quarterly samples are collected from the discharge pipe of each sump and analyzed for a specified set of parameters (the monthly and quarterly sample parameters differ). As the quarry discharge will continue through extension, sampling is expected to continue long-term during operations as specified in the ECA or modified by the Director of the MECP. The following effluent limits have been established for off-site discharge:

Table 8: Environmental Compliance Approval Effluent Limits

Parameter	Concentration Limit (mg/l)
Total Suspended Solids (TSS)	25
Oil and Grease	15
pH	6.5 – 8.5 (inclusive)

Non-compliance is deemed to have occurred when the concentration of any parameter listed from any single grab sample exceeds the maximum concentration limit specified or when a single pH measurement falls outside the indicated range.

A settling pond constructed at surface is required as part of Phase 1 and 2 to manage precipitation and intercepted groundwater until sufficient extraction has occurred and a sump has been constructed in the Phase 2 quarry floor. To dewater the extraction area, water will be pumped to the settling pond for treatment prior to discharge to the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek. Once the quarry sump has been constructed, it will provide treatment and water from the sump will be pumped directly to the West Arm. It is recommended that this discharge adhere to the Environmental Compliance Approval Effluent Limits described above.

Downstream of each quarry discharge location (SW2 and SW10), water quality thresholds will be established to identify impacts on the water quality of the surface water features resulting from the quarry discharge. It is recommended that the water quality thresholds be established from the results of the historic water quality sampling completed in support of the quarry extension. Specifically, maximum, and minimum concentration limits should be established from the sample results collected while considering the Provincial Water Quality Objectives (PWQO) and role water quality plays in the Natural Heritage Features.

To date, four (4) samples have been collected from each water sampling location. Additional samples will be collected to establish suitable maximum and minimum concentration limits. As such, the water quality thresholds will be confirmed during the approvals process, prior to extraction in the extension areas, through consultation with the requisite approval agencies as additional water quality data is obtained.

6.2.5 Surface Water Mitigation Measures

Mitigation measures for the potential surface water impacts identified through the predictive water balance and integrated surface water/groundwater model have been developed. The mitigation measures include maintaining the existing off-site discharge locations, adjusting quarry discharge rates, and supplementing wetlands with water from the quarry sumps to maintain wetland hydroperiod. These mitigation measures have been incorporated into the surface water management strategy. Specifically, the mitigation measures are summarized in the following paragraphs.

The integrated surface water/groundwater model results predict groundwater mounding beneath the existing irrigation ponds on the Burlington Springs Golf and Country Club (BSGCC) property. This groundwater mounding raises groundwater levels in the area artificially and is generally maintained year-round by the diversion of quarry discharge into the irrigation ponds. Through extraction, the irrigation ponds will be eliminated, and groundwater water levels will be lowered in the area. To replicate the artificial groundwater mounding produced by the existing irrigation ponds and supplement the

groundwater recharge in the area, a pond will be constructed within the licence boundary, outside the extraction area, between the extraction limit and Cedar Springs Road during operations. The pond will be constructed at depths and elevations consistent with the existing irrigation ponds. The pond will remain post extraction as part of the rehabilitation of the site.

As discussed, Quarry Sump 0100 discharges to the roadside ditch along Colling Road which drains southwest to wetland 13202 (weir pond) located in the northeast corner of the west extension lands. A weir structure and diversion channel maintain flow to the irrigation ponds on the golf course. The diversion channel will be eliminated through extraction and will be replaced by a diversion pipe to divert a portion of the quarry discharge to the pond between the extraction limit and Cedar Springs Road. The diversion pipe will consist of an adequately sized culvert installed between Colling Road/Cedar Springs Road and the extraction limit. The diversion pipe will divert flow to the pond in a similar manner and elevation as the existing diversion channel. The diversion pipe will be installed during operations and remain in place post extraction as part of the rehabilitation of the site.

Extraction will reduce the drainage area to wetland 13201 northwest of No. 2 Sideroad forming the headwaters of the unnamed tributary of Lake Medad. Reducing the drainage area of the wetland has the potential to adversely impact the wetlands hydroperiod and groundwater discharge to the unnamed tributary of Lake Medad. As such, a mitigation strategy has been developed to supplement the flow into the wetland and unnamed tributary of Lake Medad during operations as required. A bottom draw outlet will be constructed in the southeast corner of the pond and an outlet pipe complete with a control valve will be installed to discharge water into the wetland. The wetland hydroperiod and tributary flow rate will be monitored, and water will be discharged to the wetland as required to maintain the wetland hydroperiod and tributary flows. The discharge of water, both rate and quantity, will be controlled by the control valve operated by Nelson staff during operations. The bottom draw outlet and outlet pipe complete with a control valve will remain post extraction as part of the rehabilitation of the site. Monitoring of the wetland hydroperiod and tributary flows and discharge of water, both rate and quantity, to the wetland as required to maintain the wetland hydroperiod and tributary flows will be the responsibility of the operating authority of Mount Nemo Park after the licence has been surrendered.

The result of the predictive model estimates the maximum annual reduction in water contributions (both surface runoff and groundwater influx) into Wetland 13201 to be 14,820 m^3. If the water level in the wetland drops below the wetland water level threshold (weekly average water level), water will be released into the wetland at a rate of 4 L/s (344 m^3/day) until the wetland water level reaches the weekly average water level recorded through monitoring or the wetland threshold date passes, whichever occurs first. The specified release rate represents the spring season average water contribution into the wetland. The weekly average wetland water level will be established from the monitoring data prior to removal of overburden in the west extension in consultation with the MNDMNRF.

Extraction will also reduce the drainage area to wetland 13200 located northeast of the existing irrigation ponds within the BSGCC property. Reducing the drainage area of the wetland has the potential to adversely impact the wetlands hydroperiod. As such, a mitigation strategy has been developed to supplement the flow into the wetland during operations as required. Quarry water will be pumped from Quarry Sump 0100 directly into the wetland at specified rates and volumes to maintain the wetland hydroperiod and water levels. As part of the rehabilitation of the west extension, fill will be imported into the west extension to raise the grade around the wetland to original ground level, reinstating the wetlands drainage area. The portion of the wetland's drainage area reinstated through rehabilitation will be graded to drain overland into the wetland and will be planted with trees mimicking existing conditions.

The results of the predictive model estimates the maximum annual reduction in water contributions (both surface runoff and groundwater influx) into Wetland 13200 to be 734 m^3. If the water level in the wetland drops below the wetland water level threshold (weekly average water level), water will be released into the wetland at a rate of 0.5 L/s (43 m^3/day) until the wetland water level reaches the weekly average water level recorded through monitoring or the wetland threshold date passes, whichever occurs first. The specified release rate represents the spring season average water contribution into the wetland. The weekly average wetland water level will be established from the monitoring data prior to removal of overburden in the west extension in consultation with the MNDMNRF.

Additional mitigative measures for potential streamflow, wetland hydroperiod, water temperature and water quality impacts resulting from extraction and/or quarry dewatering are as follows:

- If a streamflow threshold is triggered, the quarry discharge off-site will be reviewed, and the discharge rates adjusted (within the permissible discharge rates specified in Nelson's PTTW) to satisfy the specified baseflow thresholds.
- If a streamflow temperature threshold is triggered, the quarry discharge off-site will be reduced to reduce the discharges influence on the water temperature in the receiving watercourse. Consequently, the depth of water in the quarry sump and settling ponds will increase reducing the temperature of the water discharged off-site. In addition, the pump intake located in the quarry sump will be reviewed to ensure it is drawing off bottom where water temperatures are lowest in the water column.
- If a wetland hydroperiod threshold is triggered, the wetland will be supplemented with water from a quarry sump. Water will be pumped from the quarry sump to the wetland as required to maintain the average wetland water level in the wetland until the hydroperiod threshold date passes. Water quality samples will be collected from the discharge to confirm the water quality adheres to the effluent limits specified in the quarries ECA.
- If the effluent limits in the quarry discharge are exceeded in any individual grab sample collected, Nelson will collect a second sample to verify the results of the original sample and report the exceedance to the MECP in accordance with the reporting requirements of their ECA. If the second sample confirms the results of the first, the quarry sump and settling pond will be reviewed and the necessary modifications will be made to address the effluent limits.
- If the water quality thresholds are triggered in any individual grab sample collected, a second sample will be collected to verify the results of the original sample and a sample will be collected from the upstream quarry discharge. In addition, the quarry discharge off-site will be reduced to limit the discharges influence on the water quality of the receiving watercourse. If the second sample confirms the results of the first, the quarry sump and settling pond will be reviewed and the necessary modifications will be made to address the effluent limits.

To ensure the potential impacts on each wetland can be mitigated expeditiously, Nelson will maintain a pump(s) and a sufficient length of hose on-site to pump water from the quarry sump to the impacted wetland. A pump(s) and sufficient hose will remain on-site to feed the wetlands east and south of the south extension and the two wetlands within the west extension licence boundary. To identify an adverse impact on a wetland, the wetland hydroperiod monitoring frequency will be increased to three times a week (Monday, Wednesday, and Friday) starting March 1st each year until the spring hydroperiod threshold date has passed.

Under existing conditions, the available minimum, average and maximum annual water volumes in Burlington Quarry have been determined to be 1,766,000 m^3, 2,388,000 m^3 and 3,026,000 m^3, respectively. These volumes will increase as extraction occurs in the south and west extensions. The

average water taking (volume discharged from Sump 0100 and Sump 0200 to the unnamed tributary of Willoughby Creek and the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek) is 1,980,000 m^3. However, only 962,000 m^3 is required annually to maintain the two tributaries. A maximum of 17,400 m^3 of water is required annually to augment the water in each wetland to maintain wetland hydroperiod. As such, a total of 979,400 m^3 of water is required annually to maintain the various features while a minimum of 1,766,000 m^3 is available on-site.

The protocol for mitigating and investigating potential impacts identified by thresholds being triggered is as follows:

- The approved mitigation plan outlined in this Adaptive Management Plan will be implemented by Nelson.
- The MECP will be notified within 48 hours of a domestic well trigger being discovered;
- The MNDMNRF will be notified within 48 hours of a threshold condition being confirmed that it has been caused by the quarry operation;
- For water quality triggers, a second sample will be collected to confirm the results of the first sample;
- The cause of the trigger will be investigated;
- If the investigation determines the trigger was caused by extraction and/or quarry dewatering, the mitigation measures implemented will remain in place until the trigger is resolved; and
- If the investigation determines the trigger was not caused by extraction and/or quarry dewatering, the mitigation measures implemented will cease and operations will return to normal.

7 SOUTH EXTENSION

The extraction footprint for the south extension of the Burlington Quarry has been delineated to ensure the protection of adjacent natural heritage features, which include five wetland units and the West Arm and the East Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek.

The five wetland units are located within the groundwater area of influence and include:

- 13015/13016
- 13022
- 13027
- 13037
- 13203

The form and function of these natural heritage features will be safeguarded as no wetlands will be removed and extraction will occur outside of their catchment areas, except for Wetland 13203, where the south extension footprint will remove 11.7 ha of its catchment area (~45% reduction). This wetland is supplied with water by pumping from the existing adjacent quarry. The extension is not anticipated to have any impact on pumping or water quality related to discharge from the existing quarry. As such, the extension is not anticipated to have any impact on Wetland 13203.

The low permeability of the Halton Till underlying the wetland features is the dominant control on surface and groundwater interaction. The wetlands and streams are generally above the bedrock aquifer water level and isolated from the shallow groundwater system by the low permeability till. None of the wetlands receive significant groundwater inflow and are thus isolated from any changes in the water table due to quarry development.

A summary of each of the wetland features, their form and function, as well as the monitoring program that has been implemented to ensure their protection is outlined in the following sections. The wetlands and their feature-based monitoring programs are shown on Figure 3.

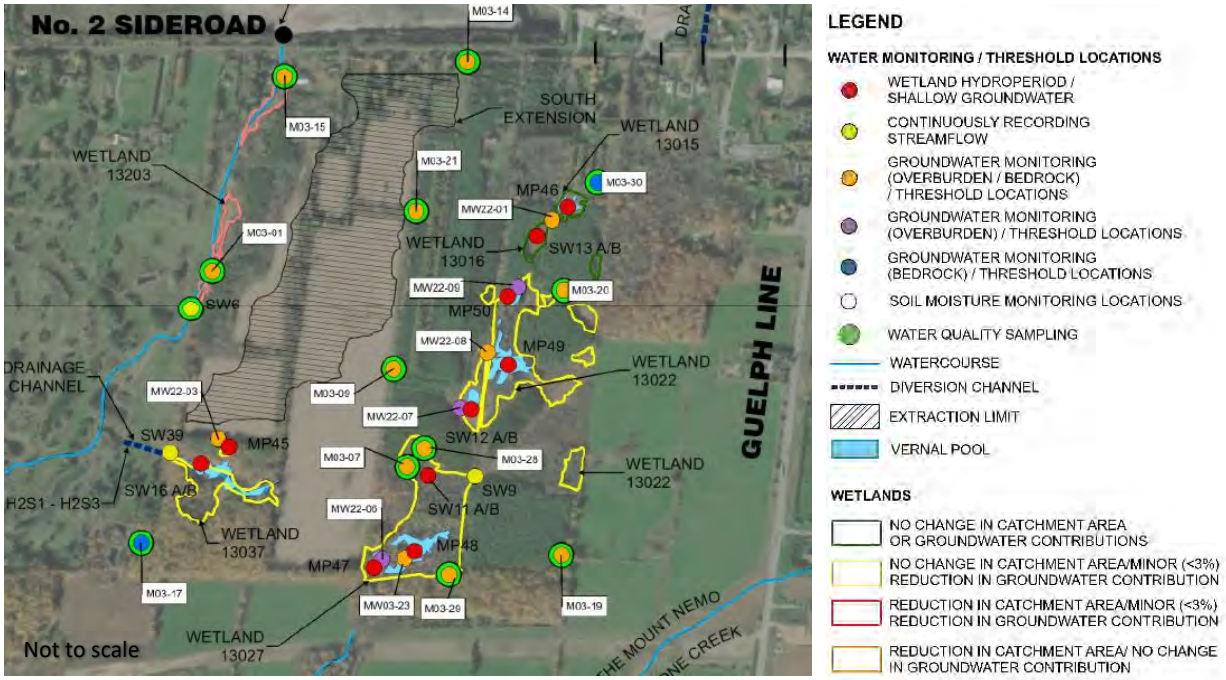


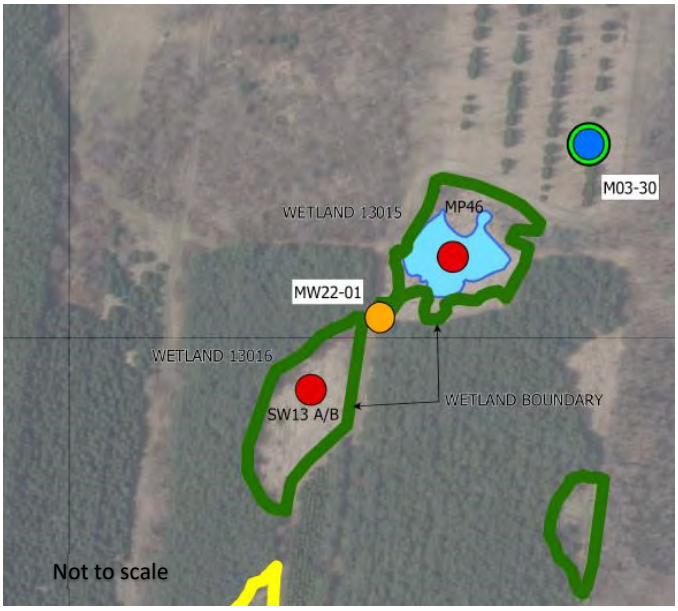
Figure 3: South Extension

7.1 Wetland Features

7.1.1 Wetland 13015 and 13016

Provincial Significance Evaluation:	Grindstone Creek Headwaters Wetland Complex – Provincially Significant
Regulated Habitat (MECP):	Jefferson Salamander and Jefferson dependent unisexuals (based on data previously collected by MNRF; 2020 and 2021 field program did not observe this species). Hydroperiod sensitive species; water presence necessary until mid to late summer.
Surface Water/Groundwater Interaction:	The wetlands and streams are generally perched above the water table and isolated from the groundwater system by the low permeability till. This wetland does not receive significant groundwater inflow and is isolated from any changes in the water table due to quarry development.
Potential Impact to Form and Function of Feature:	No wetlands will be removed, and the wetlands sub-catchment will be protected. There will be no encroachment from the project into the wetland. The limit of extraction is >120 m from the wetland boundary. Licensed boundary will be demarcated and fenced to ensure site construction and operations do not extend beyond the limits of the project.
Mitigation Measures:	Surface water augmentation with quarry discharge (if required).

Monitoring Location ID	Monitored Unit	Monitoring Type	Monitoring Period
SW13A	Vernal Pool	Wetland hydroperiod	Fall 2014 - present
SW13B	Overburden Aquifer	Groundwater elevation	Fall 2018 - present
MP46	Vernal Pool	Wetland hydroperiod	Commencing spring of 2022
M03-30A	Deep Bedrock Aquifer	Groundwater elevation	Fall 2018 - present
M03-30B	Shallow Bedrock Aquifer	Groundwater elevation	Fall 2018 - present
M03-30C	Overburden Aquifer	Groundwater elevation	Commencing spring of 2022
MW22-01B	Shallow Bedrock Aquifer	Groundwater elevation	Commencing spring of 2022
MW22-01C	Overburden Aquifer	Groundwater elevation	Commencing spring of 2022



7.1.2 Wetland 13022

Provincial Significance Evaluation: Grindstone Creek Headwaters Wetland Complex – Provincially Significant

Regulated Habitat (MECP): Jefferson Salamander and Jefferson dependent unisexuals (based on data previously collected by MNRF; 2020 and 2021 field program did not observe this species). Hydroperiod sensitive species; water presence necessary until mid to late summer.

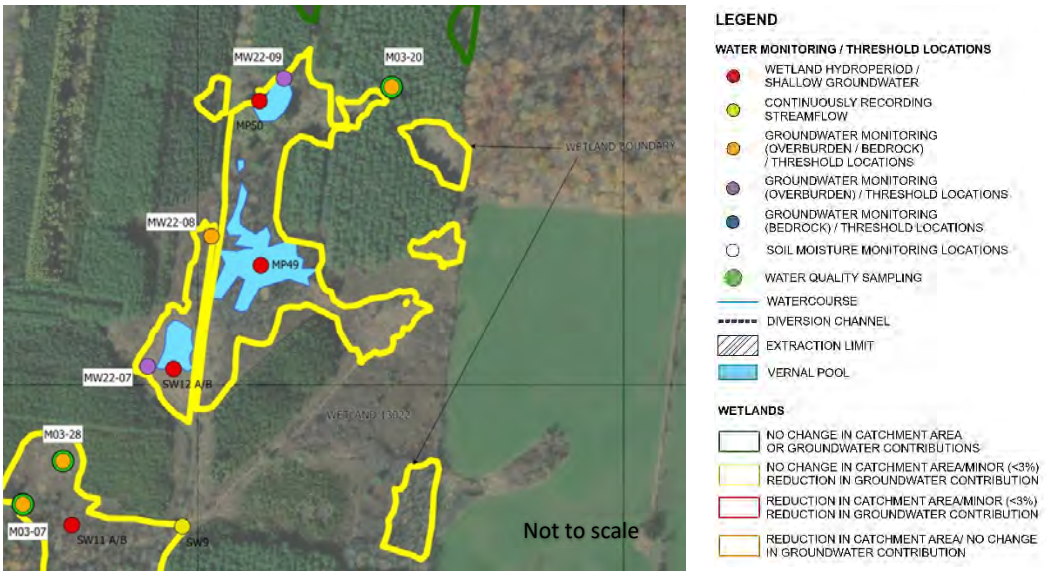
Surface Water/Groundwater Interaction: The wetlands receive some groundwater inflow but are generally isolated from any changes in the water table due to quarry development.

Potential Impact to Form and Function of Feature: No wetlands will be removed, and the wetlands sub-catchment will be protected. There will be no encroachment from the project into the wetland. The limit of extraction is >120 m from the wetland boundary. Licensed boundary will be demarcated and fenced to ensure site construction and operations do not extend beyond the limits of the project.

Mitigation Measures: Surface water augmentation with quarry discharge (if required).

Volume of Water Required for Mitigation: 733 m^3/year
Water Augmentation Discharge Rate: 0.5 L/s (43 m^3/day)

Monitoring Location ID	Monitored Unit	Monitoring Type	Monitoring Period
SW12A	Vernal Pool	Wetland hydroperiod	Fall 2014 - present
SW12B	Overburden Aquifer	Water Level	Fall 2018 - present
MP49	Vernal Pool	Wetland hydroperiod	Commencing spring of 2022
MP50	Vernal Pool	Wetland hydroperiod	Commencing spring of 2022
M03-20A	Deep Bedrock Aquifer	Water level & water quality	Commencing spring of 2022
M03-20B	Shallow Bedrock Aquifer	Water level & water quality	Commencing spring of 2022
M03-20C	Overburden Aquifer	Water level & water quality	Commencing spring of 2022
MW22-07C	Overburden Aquifer	Water level	Commencing spring of 2022
MW22-08B	Shallow Bedrock Aquifer	Water level	Commencing spring of 2022
MW22-08C	Overburden Aquifer	Water level	Commencing spring of 2022
MW22-09C	Overburden Aquifer	Water level	Commencing spring of 2022



7.1.3 Wetland 13027

Provincial Significance Evaluation: Grindstone Creek Headwaters Wetland Complex – Provincially Significant

Regulated Habitat (MECP): Jefferson Salamander and Jefferson dependent unisexuals (based on data previously collected by MNRF; 2020 and 2021 field program did not observe this species). Hydroperiod sensitive species; water presence necessary until mid to late summer.

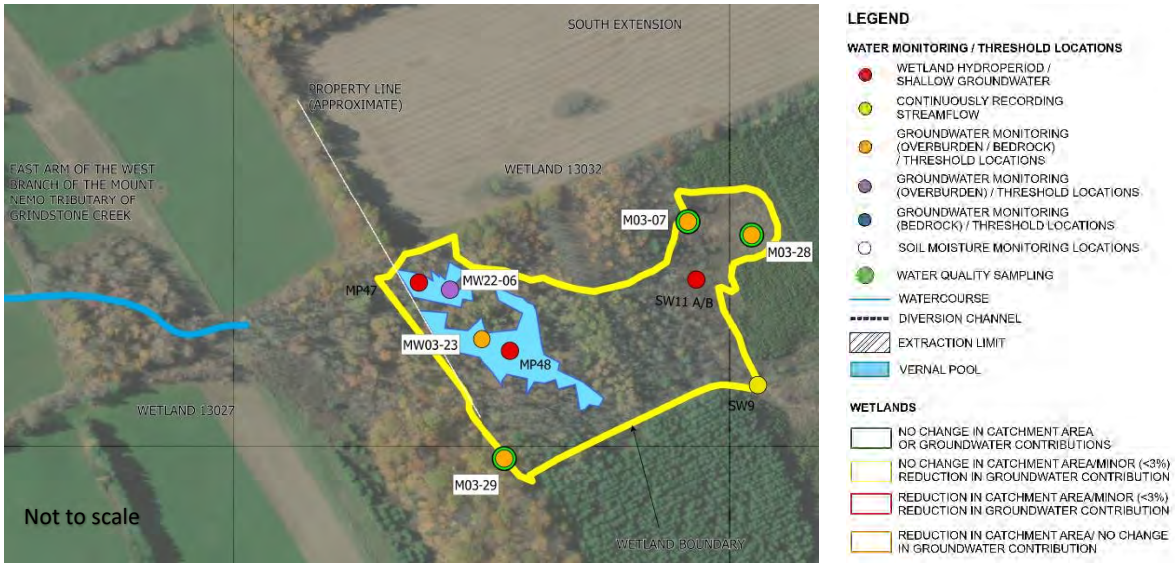
Surface Water/Groundwater Interaction: This wetland receives some groundwater inflow but is relatively isolated from any changes in the water table due to quarry development.

Potential Impact to Form and Function of Feature: No wetlands will be removed, and the wetlands sub-catchment will be protected. There will be no encroachment from the project into the wetland. The limit of extraction is >120 m from the wetland boundary. Licensed boundary will be demarcated and fenced to ensure site construction and operations do not extend beyond the limits of the project.

Mitigation Measures: Surface water augmentation with quarry discharge (if required).

Volume of Water Required for Mitigation: 866 m^3/year
Water Augmentation Discharge Rate: 0.5 L/s (43 m^3/day)

Monitoring Location ID	Monitored Unit	Monitoring Type	Monitoring Period
SW9	Watercourse	Streamflow	Fall 2014 – present
SW11A	Vernal Pool	Wetland hydroperiod	Fall 2014 – present
SW11B	Overburden Aquifer	Overburden water level	Fall 2018 – present
MP47	Vernal Pool	Wetland hydroperiod	Commencing spring of 2022
MP48	Vernal Pool	Wetland hydroperiod	Commencing spring of 2022
MW22-06C	Overburden Aquifer	Groundwater level	Commencing spring of 2022
M03-07B	Shallow Bedrock Aquifer	Groundwater level	Commencing spring of 2022
M03-07C	Overburden Aquifer	Groundwater level	Commencing spring of 2022
M03-23B	Shallow Bedrock Aquifer	Groundwater level	Commencing spring of 2022
M03-28C	Overburden Aquifer	Groundwater level	Commencing spring of 2022
M03-29A	Deep Bedrock Aquifer	Groundwater level	Fall 2018 – present
M03-29B	Shallow Bedrock Aquifer	Groundwater level	Fall 2018 – present
M03-29C	Overburden Aquifer	Groundwater level	Fall 2018 – present



7.1.4 Wetland 13037

Provincial Significance Evaluation: Grindstone Creek Headwaters Wetland Complex – Provincially Significant

Regulated Habitat (MECP): Jefferson Salamander and Jefferson dependent unisexuals (based on data previously collected by MNRF; 2020 and 2021 field program did not observe this species). Hydroperiod sensitive species; water presence necessary until mid to late summer.

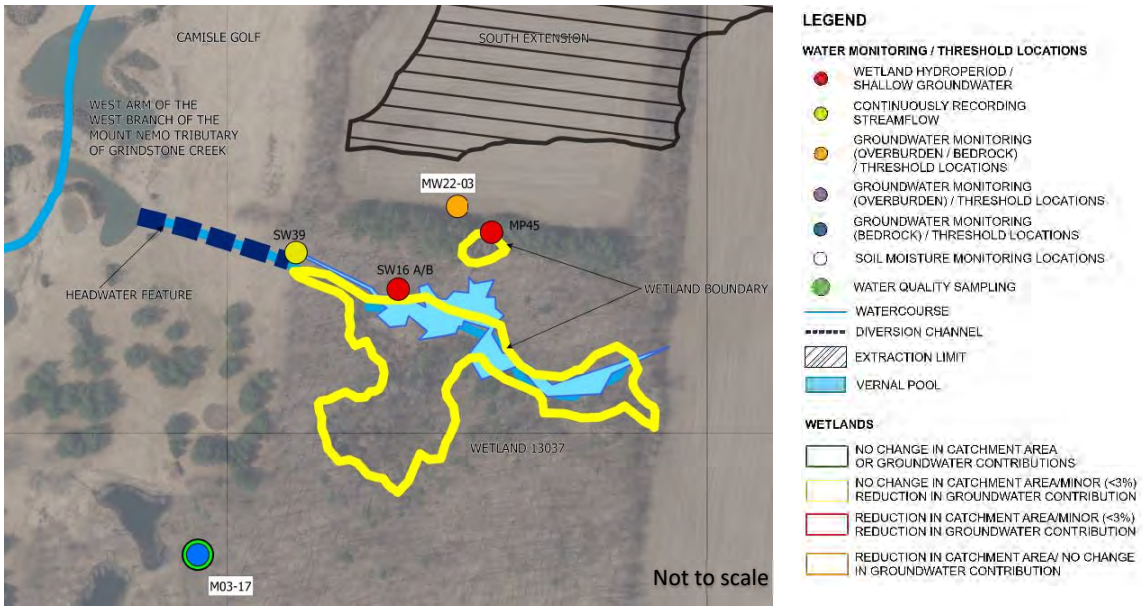
Surface Water/Groundwater Interaction: This wetland receives some groundwater inflow but is relatively isolated from changes in the water table due to quarry development.

Potential Impact to Form and Function of Feature: No wetlands will be removed, and the wetlands sub-catchment will be protected. There will be no encroachment from the project into the wetland. The limit of extraction is >120 m from the wetland boundary. Licensed boundary will be demarcated and fenced to ensure site construction and operations do not extend beyond the limits of the project.

Mitigation Measures: Surface water augmentation with quarry discharge (if required).

Volume of Water Required for Mitigation: 228 m^3/year
Water Augmentation Discharge Rate: 0.5 L/s (43 m^3/day)

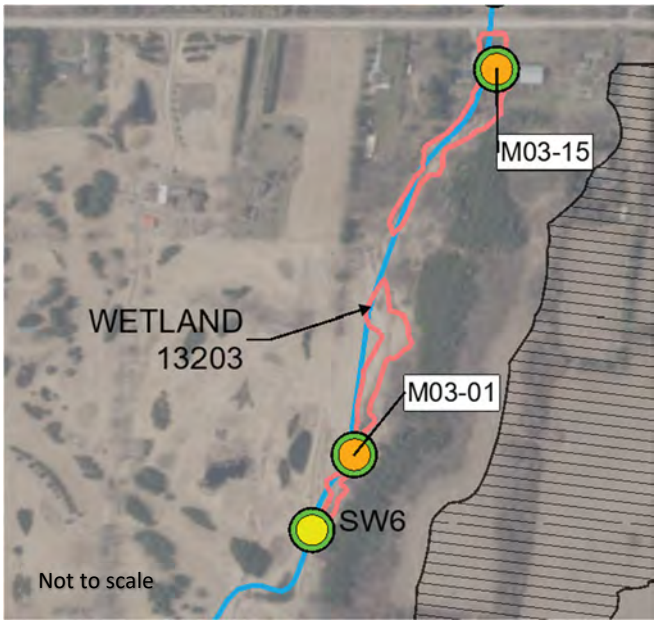
Monitoring Location ID	Monitored Unit	Monitoring Type	Monitoring Period
SW16A	Vernal Pool	Wetland hydroperiod	Fall 2018 – present
SW16B	Overburden Aquifer	Groundwater elevation	Fall 2018 – present
SW39	Watercourse	Streamflow	Spring 2021 - present
MP45	Vernal Pool	Wetland hydroperiod	Commencing spring of 2022
M03-17A	Deep Bedrock Aquifer	Groundwater elevation	Commencing spring of 2022
M03-17B	Shallow Bedrock Aquifer	Groundwater elevation	Commencing spring of 2022
M03-17C	Overburden Aquifer	Groundwater elevation	Commencing spring of 2022
MW22-02B	Shallow Bedrock Aquifer	Groundwater elevation	Commencing spring of 2022
MW22-02C	Overburden Aquifer	Groundwater elevation	Commencing spring of 2022
MW22-03C	Overburden Aquifer	Groundwater elevation	Commencing spring of 2022



7.1.5 Wetland 13203

Provincial Significance Evaluation:	Other - as determined by MNRF and it is completely dependent on pumping from the existing quarry; however, it has been designed to demonstrate no negative impacts.
Regulated Habitat (MECP):	No
Surface Water/Groundwater Interaction:	This wetland receives some groundwater inflow but is generally isolated from any changes in the water table due to quarry development.
Potential Impact to Form and Function of Feature:	The wetland is supplied with water by pumping from the existing adjacent quarry. The quarry extension is not anticipated to have any impact on pumping or water quality related to discharge from the existing quarry. Pumping and discharge are recommended to occur at the same location at the upstream end of the tributary and in the same manner as existing pumping.
Mitigation Measures:	Increase surface water augmentation through quarry discharge, if required
Volume of Water Required for Mitigation:	See West Arm of West Branch
Water Augmentation Discharge Rate:	See West Arm of West Branch

Monitoring Location ID	Monitored Unit	Monitoring Type	Monitoring Period
SW6	Watercourse	Streamflow	Fall 2014 - present
M03-15A	Deep Bedrock Aquifer	Groundwater elevation	Fall 2018 - present
M03-15B	Shallow Bedrock Aquifer	Groundwater elevation	Fall 2018 - present
M03-15C	Overburden Aquifer	Groundwater elevation	Commencing spring of 2022
M03-01A	Deep Bedrock Aquifer	Groundwater elevation	Fall 2018 - present
M03-01B	Shallow Bedrock Aquifer	Groundwater elevation	Commencing spring of 2022
M03-01C	Overburden Aquifer	Groundwater elevation	Commencing spring of 2022



7.2 Watercourses

7.2.1 East Arm of the West Branch

Primary Sources of Flow:	Surface water runoff
Discharge from Quarry/PTTW	No
Fish Habitat (Direct/Indirect and Assumed/Confirmed:	1) The upstream reaches of the East Arm (from the headwaters to approximately 540 m downstream from the Subject Lands) are indirect fish habitat. These headwater areas are ephemeral to intermittent and have been observed to dry up completely in summer. Approximately 540 m downstream of the Subject Lands, the watercourse enters a karst sink, where it flows underground for approximately 162 m before discharging to a surface pond. No fish movement is expected to be possible through the 162 m long underground flow path, therefore, given that the upstream area is intermittent and dries out completely, and there is no upstream fish movement, fish are not present in the upper reaches. This upstream reach provides indirect contributing habitat functions to support the downstream fish community. 2) The remainder of the watercourse downstream from the karst outflow provides direct fish habitat. Fish have been previously captured by MNRF at the online pond at karst discharge and are assumed to be present through the watercourse downstream.
Change in Groundwater Contributions to Watercourse:	Slight loss in seepage.
Change in Watercourse Thermal Regime:	Negative changes on water temperature are not expected given that the wetlands and catchment area feeding the East Arm will remain undisturbed.
Change in Water Quality:	Negative changes on water quality are not expected given that the wetlands and catchment area feeding the East Arm will remain undisturbed.
Potential Impact to Form and Function of Feature:	A reduction of less than 1% in groundwater contributions to the headwaters will result in immeasurable changes to flows in the feature, and this reduction is not expected to negatively impact direct fish habitat given that the small change is within the range of natural fluctuation.
Potential Impact to Identified Species and Habitat:	A reduction of less than 1% in groundwater contributions to the headwaters will result in immeasurable changes to flows in the feature, but this reduction is not expected to negatively impact fish species in the watercourse given that the small change is within the range of natural fluctuation.

Monitoring Location ID	Monitored Unit	Monitoring Type	Monitoring Period
SW9	Watercourse	Streamflow and temperature	Fall 2014 - present
SW10	Watercourse	Streamflow and temperature	Fall 2014 - present

Refer to Section 7.1.3 for the location of SW9 and AMP-1 for the location of SW10.

7.2.2 West Arm of the West Branch

Primary Sources of Flow:	Discharge from the Burlington Quarry (Sump 0200)
Discharge from Quarry/PTTW	Yes (pumping in perpetuity)
Fish Habitat (Direct/Indirect and Assumed/Confirmed:	The West Arm is known to provide direct fish habitat. For the purposes of the NETR, the entire watercourse up to the quarry discharge point at Sideroad No. 2 is assumed to provide direct fish habitat
Change in Groundwater Contributions to Watercourse:	The leakage from the watercourse will increase.
Change in Watercourse Thermal Regime:	Temperature of water being discharged from Quarry Sump 0200 is not expected to change because of the extension, therefore, no change in water temperature is anticipated.
Change in Water Quality:	1) Quality of water being discharged from Quarry Sump 0200 is not expected to change because of the Quarry Extension, therefore, no change in water quality in the major source of inflow is expected. 2) Discharge from the temporary settling pond/sump from the South Extension will meet water quality discharge objectives. Therefore, no negative impacts on water quality are expected.
Potential Impact to Form and Function of Feature:	Alterations to quarry discharge (if unmitigated) could potentially have negative impacts on the habitat form and functions of this watercourse.
Potential Impact to Identified Species and Habitat:	Alterations to quarry discharge (if unmitigated) could potentially have negative impacts on the species and habitat functions of this watercourse.
Direct Alteration Mitigation:	1) In-water work required to install the settling pond/sump outlet is recommended to be completed between July 16 and March 14 to minimize the potential for direct and indirect impacts on the reproductive activities of the fish community in the West Arm. 2) Erosion and sedimentation control measures and spill prevention and response measures will be used throughout the duration of any in-stream works in the watercourse. Work-site isolation measures should be considered depending on the final design of the outlet and installation methodology and location. 3) Any riparian areas disturbed during installation of the outlet should be rehabilitated with appropriate native vegetation species following installation of the outlet structure.
Water Quality Mitigation:	The temporary settling pond and longer-term sump that will discharge to the West Arm will be required to meet discharge water quality criteria with respect to total suspended solids and other potential contaminants.
Minimum Annual Discharge Volume:	236,520 m^3/year
Minimum Discharge Rate:	7.5 L/s (648 m^3/day)

Monitoring Location ID	Monitored Unit	Monitoring Type	Monitoring Period
SW6	Watercourse	Streamflow and temperature	Fall 2014 – present
SW10	Watercourse	Streamflow and temperature	Fall 2014 – present

Refer to Section 7.1.35 for the location of SW6 and AMP-1 for the location of SW10.

7.3 South Extension Groundwater and Surface Water Monitoring Program

7.3.1 Groundwater Monitoring Program and Thresholds

Table 9: South Extension - Groundwater Monitoring Program and Thresholds

Borehole	Well ID	Water Level Monitoring		Water Quality Sampling		Trend Analysis
		Monthly Manual	Continuous	Semi-Annual	Annual	
M03-01	M03-01A	X	X	X		X
	M03-01B	X	X	X	X	X
	M03-01C	X	X			X
M03-07	M03-07A	X	X			X
M03-09	M03-09A	X	X	X		X
	M03-09B	X	X	X	X	X
M03-15	M03-15A	X	X	X		X
	M03-15B	X	X	X	X	X
	M03-15C	X	X			X
M03-17	M03-17A	X	X	X		X
	M03-17B	X	X	X	X	X
M03-20	M03-20A	X	X	X		X
	M03-20B	X	X	X	X	X
	M03-20C	X	X			X
M03-23	M03-23B	X	X	X	X	X
	M03-23C	X	X			X
M03-28	M03-28C	X	X			X
M03-29	M03-29A	X	X	X		X
	M03-29B	X	X	X	X	X
	M03-29C	X	X			X
M03-30	M03-30A	X	X	X		X
	M03-30B	X	X	X	X	X
MW22-01	MW22-01B	X	X			X
	MW22-01C	X	X			X
MW22-02	MW22-02B	X	X			X
	MW22-02C	X	X			X
MW22-03	MW22-03C	X	X			X
MW22-06	MW22-06C	X	X			X
MW22-08	MW22-08B	X	X			X
	MW22-08C	X	X			X
MW22-09	MW22-09C	X	X			X

7.3.2 Streamflow and Water Temperature Monitoring Program and Thresholds

Table 10: South Extension: Streamflow Monitoring Program

Monitoring Location	Surface Water			
	Depth	Flow	Temperature	Quality
SW6	X	X	X	X
SW9	X	X	X	
SW10	X	X	X	X
SW39	X	X	X	

Table 11: South Extension: Streamflow 10th and 5th Percentile Thresholds

Month	Monitoring Location (Watercourse)					
	SW6 (West Arm)		SW10 (West Branch)		SW39 (H2S1 – H2S3)	
	10th Percentile	5th Percentile	10th Percentile	5th Percentile	10th Percentile	5th Percentile
January	TBD	TBD	TBD	TBD	TBD	TBD
February	TBD	TBD	TBD	TBD	TBD	TBD
March	TBD	TBD	TBD	TBD	TBD	TBD
April	TBD	TBD	TBD	TBD	TBD	TBD
May	TBD	TBD	TBD	TBD	TBD	TBD
June	TBD	TBD	TBD	TBD	TBD	TBD
July	TBD	TBD	TBD	TBD	TBD	TBD
August	TBD	TBD	TBD	TBD	TBD	TBD
September	TBD	TBD	TBD	TBD	TBD	TBD
October	TBD	TBD	TBD	TBD	TBD	TBD
November	TBD	TBD	TBD	TBD	TBD	TBD
December	TBD	TBD	TBD	TBD	TBD	TBD

Table 12: South Extension: Temperature Thresholds

Month	Monitoring Location (Watercourse)					
	SW6 (West Arm)		SW10 (West Branch)		SW39 (H2S1 – H2S3)	
	Level 1	Level 2	Level 1	Level 2	Level 1	Level 2
January	TBD	TBD	TBD	TBD	TBD	TBD
February	TBD	TBD	TBD	TBD	TBD	TBD
March	TBD	TBD	TBD	TBD	TBD	TBD
April	TBD	TBD	TBD	TBD	TBD	TBD
May	TBD	TBD	TBD	TBD	TBD	TBD
June	TBD	TBD	TBD	TBD	TBD	TBD
July	TBD	TBD	TBD	TBD	TBD	TBD
August	TBD	TBD	TBD	TBD	TBD	TBD
September	TBD	TBD	TBD	TBD	TBD	TBD
October	TBD	TBD	TBD	TBD	TBD	TBD
November	TBD	TBD	TBD	TBD	TBD	TBD
December	TBD	TBD	TBD	TBD	TBD	TBD

7.3.3 Wetland Hydroperiod Monitoring and Thresholds

Table 13: South Extension: Wetland Hydroperiod Monitoring Program

Monitoring Location	Surface Water	
	Depth	Temperature
SW11A	X	X
SW12A	X	X
SW13A	X	X
SW16A	X	X
MP45	X	X
MP46	X	X
MP47	X	X
MP48	X	X
MP49	X	X
MP50	X	X

Table 14: South Extension - Wetland Hydroperiod Thresholds

Wetland	Monitoring Location	Monitored Hydroperiod (5 Year Period)	Water Balance Hydroperiod (20 Year Period)	Spring Hydroperiod Threshold	Average Water Level (m)
13027	SW11A	May 19th (2015)	May 3rd (2001)	April 26th	TBD
	MP47	TBD	TBD	TBD	TBD
	MP48	TBD	TBD	TBD	TBD
13022	SW12A	May 11th (2015)	April 27th (2015)	April 20th	TBD
	MP49	TBD	TBD	TBD	TBD
	MP50	TBD	TBD	TBD	TBD
13016	SW13A	May 16th (2015)	May 7th (1999)	May 1st	TBD
	MP46	TBD	TBD	TBD	TBD
13037	SW16A	July 5th (2019)	May 25th (2012)	May 18th	TBD
	MP45	TBD	TBD	TBD	TBD

8 WEST EXTENSION

The extraction footprint for the west extension of the Burlington Quarry has been delineated to ensure the protection of adjacent natural heritage features, which include four wetland units as well as unnamed tributaries of Willoughby Creek and Lake Medad, and Willoughby Creek.

The four wetland units are located within the groundwater area of influence and include:

- 13200
- 13201
- 13202
- 13204 (Medad Valley)

Although no wetlands will be removed, extraction will occur within the catchment areas. Extraction will reduce the drainage area to wetland 13201 northwest of No. 2 Sideroad as well as wetland 13200 located northeast of the existing irrigation ponds within the BSGCC property. Reducing the drainage area of the wetlands has the potential to adversely impact the wetlands hydroperiod, therefore, a mitigation strategy has been developed to supplement the flow into the wetland during operations.

The low permeability of the Halton Till underlying the wetland features is the dominant control on surface and groundwater interaction. None of the wetlands receive significant groundwater inflow and are thus isolated from any changes in the water table due to quarry development.

A summary of each of the wetland features, their form and function, as well as the monitoring program that has been implemented to ensure their protection is outlined in the following sections. The wetlands and their feature-based monitoring programs are shown on 4.

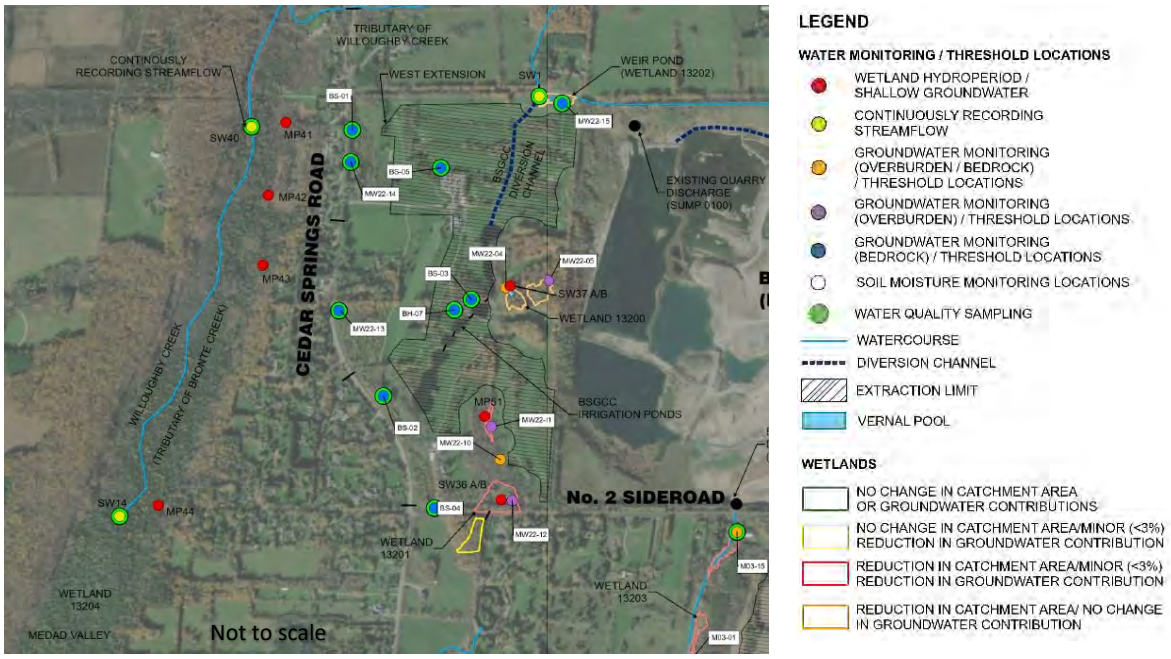


Figure 4: West Extension

8.1 Wetland Features

8.1.1 Wetland 13200

Wetland Name & Provincial Significance Evaluation:	Assumed significant for planning purposes; surveyed by Savanta and MNDMNRF (October 2021).
Regulated Habitat (MECP):	No
Surface Water/Groundwater Interaction:	This wetland does not receive significant groundwater inflow and is isolated from any changes in the water table due to quarry development.
Potential Impact to Form and Function of Feature:	Both wetlands will remain in place. There will be no encroachment from the project into the wetlands. The drainage area to these wetland units will be reduced during operations, which has the potential to adversely impact the wetland hydroperiod.
Mitigation Measures:	Surface water augmentation with quarry discharge, if required.
Volume of Water Required for Mitigation:	734 m^3/year
Water Augmentation Discharge Rate:	0.5 L/s (43 m^3/day)

Monitoring Location ID	Monitored Unit	Monitoring Type	Monitoring Period
SW37A	Vernal Pool	Wetland hydroperiod	Spring 2020 - present
MW22-04B	Shallow Bedrock	Groundwater elevation	Commencing within first year of extraction in the South Extension
MW22-04C	Overburden	Groundwater elevation	
MW22-05C	Overburden	Groundwater elevation	

8.1.2 Wetland 13201

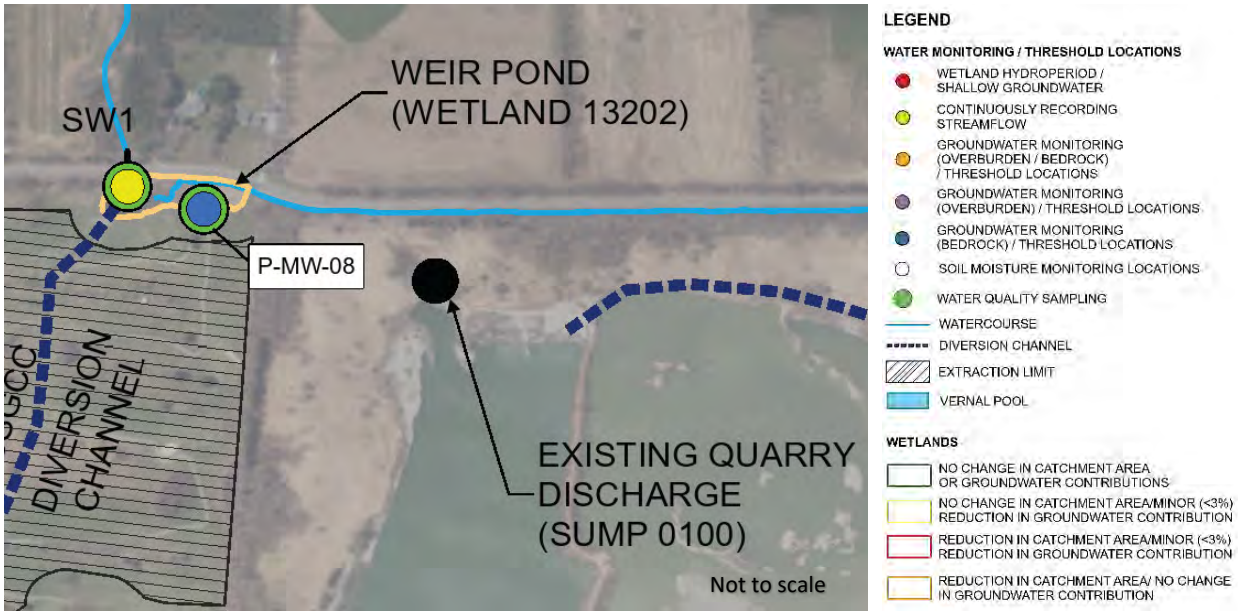
Wetland Name & Provincial Significance Evaluation:	Assumed significant for planning purposes; surveyed by Savanta and MNDMNRF (October 2021).
Regulated Habitat (MECP):	No
Surface Water/Groundwater Interaction:	This wetland receives some groundwater inflow but is relatively isolated from any changes in the water table due to quarry development.
Potential Impact to Form and Function of Feature:	Both wetlands will remain in place. There will be no encroachment from the project into the wetlands. The drainage area to these wetland units will be reduced during operations, which has the potential to adversely impact the wetland hydroperiod.
Mitigation Measures:	To mitigate this potential impact, flow to the wetlands will be supplemented by a bottom draw outlet constructed in the southeast corner of the infiltration pond and an outlet pipe with a control valve will be installed to discharge water into the wetland. The bottom draw outlet, outlet pipe and control valve will remain post extraction as part of the rehabilitation of the site (pumping in perpetuity).
Volume of Water Required for Mitigation:	14,822 m^3/year
Water Augmentation Discharge Rate:	4 L/s (344 m^3/day)

Monitoring Location ID	Monitored Unit	Monitoring Type	Monitoring Period
SW36	Vernal Pool	Wetland hydroperiod	Spring 2020 - present
MP51	Vernal Pool	Wetland hydroperiod	Commencing with first year of extraction in the South Extension
MW22-10B	Shallow Bedrock Aquifer	Groundwater Elevation	
MW22-10C	Overburden Aquifer	Groundwater Elevation	
MW22-11C	Overburden Aquifer	Groundwater Elevation	
MW22-12C	Overburden Aquifer	Groundwater Elevation	

8.1.3 Wetland 13202

Wetland Name & Provincial Significance Evaluation:	Assumed significant for planning purposes; surveyed by Savanta and MNDMNRF (October 2021).
Regulated Habitat (MECP):	No
Surface Water/Groundwater Interaction:	The wetlands and streams are generally perched above the water table and isolated from the groundwater system by the low permeability till. None of the wetlands receive significant groundwater inflow and are thus isolated from any changes in the water table due to quarry development.
Potential Impact to Form and Function of Feature:	The quarry extension is not anticipated to have any impact on pumping or water quality related to discharge from the existing quarry. Pumping and discharge are recommended to occur long-term at the same location at the upstream end of the tributary and in the same manner as existing pumping.
Mitigation Measures:	Increase surface water augmentation with quarry discharge, if required.
Volume of Water Required for Mitigation:	See Unnamed Tributary of Willoughby Creek
Water Augmentation Discharge Rate:	See Unnamed Tributary of Willoughby Creek

Monitoring Location ID	Monitored Unit	Monitoring Type	Monitoring Period
SW1	Vernal Pool	Hydroperiod and streamflow	Summer 2015 - present

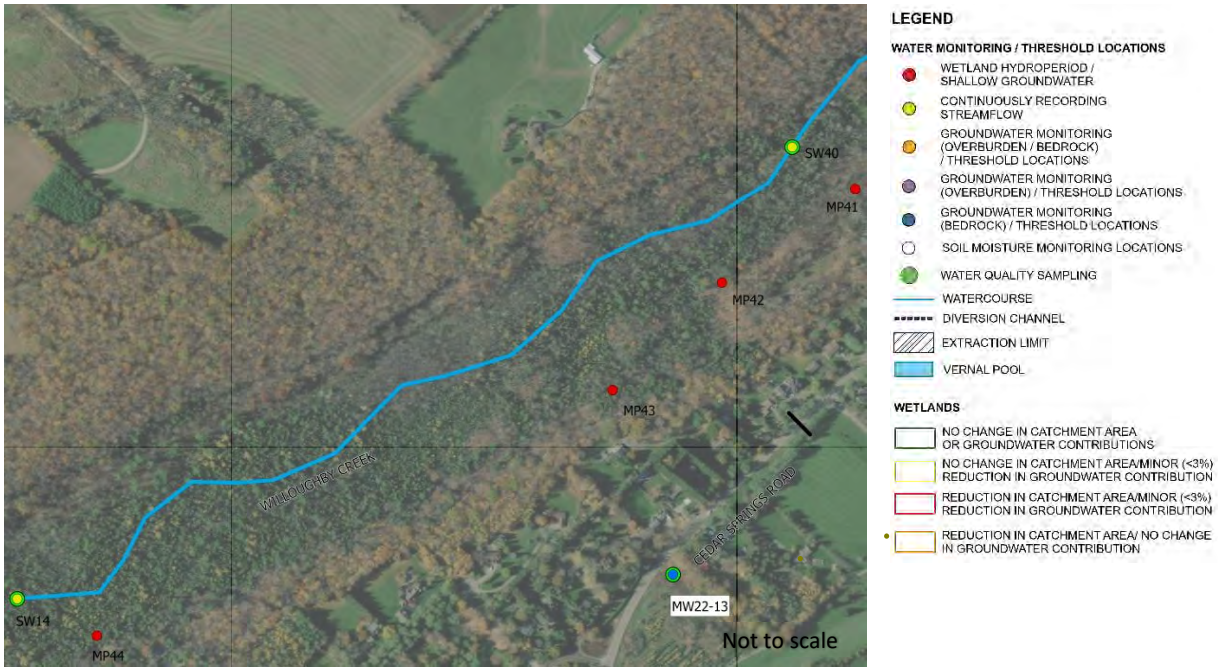


8.1.4 Wetland 13204 (Medad Valley)

Wetland Name & Provincial Significance Evaluation:	Lake Medad Valley Wetland Complex – Provincially Significant.
Regulated Habitat (MECP):	No
Surface Water/Groundwater Interaction:	The Medad Valley is a local groundwater discharge zone. Flow is supplemented by groundwater discharge to springs on the flanks of the valley.
Potential Impact to Form and Function of Feature:	Potential impacts to wetland hydroperiod due to reduction in catchment area and groundwater drawdown.
Mitigation Measures:	Construction of infiltration pond is intended to maintain seepage to the groundwater regime and will aid in maintaining groundwater levels and discharge to the Medad Valley.

Monitoring Location ID	Monitored Unit	Monitoring Type	Monitoring Period
SW14	Watercourse	Streamflow	Fall 2014 - present
SW40[1]	Watercourse	Streamflow	Commencing within first year of extraction in the South Extension
MP41[1]	Overburden	Mini-Piezometer	
MP42[1]	Overburden	Mini-Piezometer	
MP43[1]	Overburden	Mini-Piezometer	
MP44[1]	Overburden	Mini-Piezometer	

NOTE: Monitoring locations pending approval to access lands managed and owned by Conservation Halton.



8.2 Watercourses

8.2.1 Unnamed Tributary of Lake Medad

Primary Sources of Flow:	Surface Water Runoff
Discharge from Quarry/PTTW	No
Fish Habitat (Direct/Indirect and Assumed/Confirmed:	1) The uppermost reach of the watercourse (i.e., within 150 m downstream from the head of the watercourse at Sideroad No. 2) does not appear capable of providing direct fish habitat, based on aerial photo analysis, given a lack of a defined channel. Therefore, this portion of the watercourse is assumed to provide indirect fish habitat. 2) The remainder of the watercourse (i.e., beyond 150 m downstream from Sideroad No. 2) is assumed to provide direct fish habitat, although no fish community sampling is known to have been completed to confirm this assumption. There is a series of online ponds associated with the adjacent golf course approximately 150 m downstream from Sideroad No. 2 and there is a high probability that these ponds contain fish, as they appear to be permanent features.
Change in Groundwater Contributions to Watercourse:	A reduction in seepage will occur due to a decline in groundwater levels due to the excavation.
Change in Watercourse Thermal Regime:	No negative impacts on temperature expected.
Change in Water Quality:	No negative impacts on water quality expected.
Potential Impact to Form and Function of Feature:	Unmitigated flow reductions could have negative impacts on habitat availability during low flow (baseflow) periods through reductions in wetted width and depth and limiting movements throughout the watercourse.
Potential Impact to Identified Species and Habitat:	Unmitigated flow reductions could have negative impacts on fish species in the watercourse (e.g., lack of access to sufficient habitat, concentrating fish in residual features, increased competition for resources, increased vulnerability to predators).
Groundwater Contribution Mitigation:	None required. Groundwater contributions under baseline conditions equate to 1 L/s or less and overall percent change predicted at approximately 3%.
Water Quality Mitigation:	None required

Monitoring Location ID	Monitored Unit	Monitoring Type	Monitoring Period
SW29	Watercourse	Streamflow and temperature	Fall 2018 – present
MP52	Overburden	Mini-Piezometer	Commencing within first year of extraction in the South Extension

8.2.2 Unnamed Tributary of Willoughby Creek

Primary Sources of Flow:	Primary - discharge from Burlington Quarry (Sump 0100) Intermittent - discharge from Burlington Springs Golf and Country Club irrigation ponds and diversion channel.
Discharge from Quarry/PTTW	Yes
Fish Habitat (Direct/Indirect and Assumed/Confirmed:	1) The reach from the quarry discharge point to the Colling Road culvert has been identified as indirect fish habitat as no fish were captured in this reach during baseline fish community studies in 2019. The reach is directly connected to the Weir Pond on the golf course, which is known to contain a likely introduced population of Largemouth Bass. 2) The reach between Colling Road and the mouth of this Tributary at Willoughby Creek has been assumed to provide direct fish habitat. However, no fish community studies were possible in this reach due to private land access constraints.
Change in Groundwater Contributions to Watercourse:	The average increase in stream leakage will be approximately 44.97 m^3/d, which is a very small fraction of the average baseline streamflow of 4106.0 m^3/d.
Change in Watercourse Thermal Regime:	Temperature of water being discharge from Quarry Sump 0100 is not expected to change because of the quarry extension, therefore, no change in water temperature is anticipated.
Change in Water Quality:	Negative changes in water quality are not expected given that the watercourse will continue to receive its primary input from quarry discharge.
Potential Impact to Form and Function of Feature:	Unmitigated flow reductions could have negative impacts on habitat availability during low flow (baseflow) periods through reductions in wetted width and depth and limiting movements throughout the watercourse.
Potential Impact to Identified Species and Habitat:	Direct impacts associated with permanent weir plate installation and diversion pipe installation are not expected to have any negative effects on the general form and function of this portion of the watercourse, which provides indirect fish habitat.
Groundwater Contribution Mitigation:	None required. The Unnamed Tributary is generally a losing stream with minor groundwater contributions typically occurring following spring freshet. During extraction the groundwater contributions are predicted to be reduced by less than 1.0%
Water Quality Mitigation:	None required
Minimum Annual Discharge Volume: **Minimum Discharge Rate:**	725,328 m^3/year 23 L/s (1,987 m^3/day)

Monitoring Location ID	Monitored Unit	Monitoring Type	Monitoring Period
SW1	Watercourse	Streamflow and temperature	Fall 2018 - present

8.2.3 Willoughby Creek

Primary Sources of Flow:	Primary - discharge from Burlington Quarry (Sump 0100) Secondary - surface runoff Tertiary - groundwater seepage.
Discharge from Quarry/PTTW	Yes
Fish Habitat (Direct/Indirect and Assumed/Confirmed:	Willoughby Creek is known to provide direct fish habitat, based on fish community sampling information from Conservation Halton.
Change in Groundwater Contributions to Watercourse:	A small percentage of groundwater seepage will be intercepted and discharged to the Medad Valley just downstream of SW7. This change in seepage is relatively uniform over time. The loss of seepage is diffuse and will not be observable.
Change in Watercourse Thermal Regime:	Negative changes in water temperature are not expected given that the watercourse will continue to receive its primary input from quarry discharge.
Change in Water Quality:	Negative changes in water quality are not expected given that the watercourse will continue to receive its primary input from quarry discharge.
Potential Impact to Form and Function of Feature:	Predicted decreases in streamflow are very minor and are not expected to have any negative impact on form and function of the watercourse.
Potential Impact to Identified Species and Habitat:	Direct impacts associated with permanent weir plate installation and diversion pipe installation are not expected to have any negative effects on the general form and function of this portion of the watercourse, which provides indirect fish habitat.
Groundwater Contribution Mitigation:	Infiltration pond is intended to maintain seepage to GW in the vicinity of the West Extension to maintain levels and GW discharge to the Medad Valley.
Water Quality Mitigation:	None required
Volume of Water Required for Mitigation:	See Unnamed Tributary of Willoughby Creek
Water Augmentation Discharge Rate:	See Unnamed Tributary of Willoughby Creek

Monitoring Location ID	Monitored Unit	Monitoring Type	Monitoring Period
SW2	Watercourse	Streamflow and temperature	Spring 2014 - present
SW14	Watercourse	Streamflow and temperature	Fall 2014 - present
SW40	Watercourse	Streamflow and temperature	Commencing within first year of extraction in the South Extension

8.3 West Extension Groundwater and Surface Water Monitoring Program

8.3.1 Groundwater Monitoring Program and Thresholds

Table 15: West Extension - Groundwater Monitoring Program and Thresholds

Borehole	Well ID	Water Level Monitoring		Water Quality Sampling		Trend Analysis	Threshold Values		
		Monthly Manual	Continuous	Semi-Annual	Annual		Simulated Min	Level 1 (10%)	Level 2 (5%)
BS-01	BS-01A	X	X			X	TBD	TBD	TBD
	BS-01B	X	X	X	X	X	TBD	TBD	TBD
BS-02	BS-02A	X	X			X	TBD	TBD	TBD
	BS-02B	X	X	X	X	X	TBD	TBD	TBD
BS-03	BS-03A	X	X			X	TBD	TBD	TBD
	BS-03B	X	X	X	X	X	TBD	TBD	TBD
BS-04	BS-04A	X	X			X	TBD	TBD	TBD
	BS-04B	X	X	X	X	X	TBD	TBD	TBD
BS-05	BS-05A	X	X			X	TBD	TBD	TBD
	BS-05B	X	X	X	X	X	TBD	TBD	TBD
BS-07	BS-07	X	X	X	X	X	TBD	TBD	TBD
MW22-04	MW22-04B	X	X			X			
	MW22-04C	X	X			X			
MW22-05	MW22-05C	X	X			X			
MW22-10	MW22-10B	X	X			X			
	MW22-10C	X	X			X			
MW22-11	MW22-11C	X	X			X			
MW22-12	MW22-12C	X	X	X		X			
BS-08	BS-08A	X	X	X	X	X	TBD	TBD	TBD
	BS-08B	X	X			X	TBD	TBD	TBD
BS-09	BS-09A	X	X	X		X	TBD	TBD	TBD
	BS-09B	X	X	X	X	X	TBD	TBD	TBD
BS-10	BS-10A	X	X			X	TBD	TBD	TBD
	BS-10B	X	X			X	TBD	TBD	TBD
BS-11	BS-11A	X	X			X	TBD	TBD	TBD
	BS-11B	X	X			X	TBD	TBD	TBD

8.3.2 Surface Water Monitoring Program and Thresholds

Table 16: West Extension: Streamflow Monitoring Program

Monitoring Location	Surface Water			
	Depth	Flow	Temperature	Quality
SW1	X	X	X	X
SW2	X	X	X	X
SW14	X	X	X	X
SW29	X	X	X	X
SW40	X	X	X	X

Table 17: West Extension – Streamflow 10th and 5th Percentile Thresholds

Month	Monitoring Location (Watercourse)					
	SW1 (Willoughby Tributary)		SW2 (Willoughby Creek)		SW14 (Willoughby Creek)	
	10th Percentile	5th Percentile	10th Percentile	5th Percentile	10th Percentile	5th Percentile
January	TBD	TBD	TBD	TBD	TBD	TBD
February	TBD	TBD	TBD	TBD	TBD	TBD
March	TBD	TBD	TBD	TBD	TBD	TBD
April	TBD	TBD	TBD	TBD	TBD	TBD
May	TBD	TBD	TBD	TBD	TBD	TBD
June	TBD	TBD	TBD	TBD	TBD	TBD
July	TBD	TBD	TBD	TBD	TBD	TBD
August	TBD	TBD	TBD	TBD	TBD	TBD
September	TBD	TBD	TBD	TBD	TBD	TBD
October	TBD	TBD	TBD	TBD	TBD	TBD
November	TBD	TBD	TBD	TBD	TBD	TBD
December	TBD	TBD	TBD	TBD	TBD	TBD

Month	Monitoring Location (Watercourse)			
	SW40 (Willoughby Creek)		SW29 (Lake Medad Tributary)	
	10th Percentile	5th Percentile	10th Percentile	5th Percentile
January	TBD	TBD	TBD	TBD
February	TBD	TBD	TBD	TBD
March	TBD	TBD	TBD	TBD
April	TBD	TBD	TBD	TBD
May	TBD	TBD	TBD	TBD
June	TBD	TBD	TBD	TBD
July	TBD	TBD	TBD	TBD
August	TBD	TBD	TBD	TBD
September	TBD	TBD	TBD	TBD
October	TBD	TBD	TBD	TBD
November	TBD	TBD	TBD	TBD
December	TBD	TBD	TBD	TBD

Table 18: West Extension –Temperature Thresholds

Month	Monitoring Location (Watercourse)					
	SW1 (Willoughby Tributary)		SW2 (Willoughby Creek)		SW14 (Willoughby Creek)	
	Level 1	Level 2	Level 1	Level 2	Level 1	Level 2
January	TBD	TBD	TBD	TBD	TBD	TBD
February	TBD	TBD	TBD	TBD	TBD	TBD
March	TBD	TBD	TBD	TBD	TBD	TBD
April	TBD	TBD	TBD	TBD	TBD	TBD
May	TBD	TBD	TBD	TBD	TBD	TBD
June	TBD	TBD	TBD	TBD	TBD	TBD
July	TBD	TBD	TBD	TBD	TBD	TBD
August	TBD	TBD	TBD	TBD	TBD	TBD
September	TBD	TBD	TBD	TBD	TBD	TBD
October	TBD	TBD	TBD	TBD	TBD	TBD
November	TBD	TBD	TBD	TBD	TBD	TBD
December	TBD	TBD	TBD	TBD	TBD	TBD

Month	Monitoring Location (Watercourse)			
	SW40 (Willoughby Creek)		SW29 (Lake Medad Tributary)	
	Level 1	Level 2	Level 1	Level 2
January	TBD	TBD	TBD	TBD
February	TBD	TBD	TBD	TBD
March	TBD	TBD	TBD	TBD
April	TBD	TBD	TBD	TBD
May	TBD	TBD	TBD	TBD
June	TBD	TBD	TBD	TBD
July	TBD	TBD	TBD	TBD
August	TBD	TBD	TBD	TBD
September	TBD	TBD	TBD	TBD
October	TBD	TBD	TBD	TBD
November	TBD	TBD	TBD	TBD
December	TBD	TBD	TBD	TBD

8.3.3 Wetland Hydroperiod Monitoring and Thresholds

Table 19: West Extension: Wetland Hydroperiod Monitoring Program

Monitoring Location	Surface Water	
	Depth	Temperature
SW1	**X**	**X**
SW36A	**X**	**X**
SW37A	**X**	**X**
MP41	X	X
MP42	X	X
MP43	X	X
MP44	X	X
MP51	X	X

Table 20: West Extension - Wetland Hydroperiod Thresholds

Wetland	Monitoring Location	Monitored Hydroperiod (5 Year Period)	Water Balance Hydroperiod (20 Year Period)	Spring Hydroperiod Threshold	Average Water Level (m)
13201	SW36A	TBD	TBD	TBD	TBD
13200	SW37A	TBD	TBD	TBD	TBD
13201	MP51	TBD	TBD	TBD	TBD
13204	MP41	TBD	TBD	TBD	TBD
	MP42	TBD	TBD	TBD	TBD
	MP43	TBD	TBD	TBD	TBD
	MP44	TBD	TBD	TBD	**TBD**

8.3.4 Shallow Groundwater Monitoring and Thresholds

Table 21: West Extension – Shallow Groundwater Monitoring Program and Thresholds

Monitoring Location	Water Level Monitoring		Threshold Values		
	Monthly Manual	Continuous	Simulated Min	Level 1 (10%)	Level 2 (5%)
MP41	**X**	**X**	TBD	TBD	TBD
MP42	**X**	**X**	TBD	TBD	TBD
MP43	**X**	**X**	TBD	TBD	TBD
MP44	**X**	**X**	TBD	TBD	TBD
MP52	**X**	**X**	TBD	TBD	TBD

9 WATER MANAGEMENT AND MITIGATION PLAN

A surface water management strategy has been developed for the proposed quarry extension during and post extraction (during operations and after rehabilitation). This strategy includes the ability to implement mitigative measures based on the monitoring results, which involve the reliance on surface water and intercepted groundwater on-site.

9.1 Operations

During operations, Nelson will be responsible for the implementation of the surface water management strategy described herein. This includes undertaking the prescribed surface water monitoring, implementing the mitigation measures recommended in Section 6, investigating potential impacts, managing, and operating the surface water management systems developed for the quarry, and operating and maintaining the off-site discharge. The surface water management strategy recommended during extraction is described in the following sections.

9.1.1 Burlington Quarry

The existing drainage patterns within Burlington Quarry will remain as is through extraction in the south and west extensions. The quarry will drain internally to a series of settling ponds constructed in the quarry floor and water will be discharged off-site from Quarry Sump 0100 and 0200 to the two existing discharge locations. The configuration of the existing settling ponds will be altered during different phases of extraction in the west extension as operations require. The configuration will be altered to facilitate extraction in the west extension lands and to maintain dry operating conditions. However, the off-site discharge will continue as per the conditions of Nelson's PTTW and ECA.

It is estimated that 700,000 to 800,000 m^3 of active storage is required on-site through all phases of extraction to manage the intercepted groundwater, rainfall and runoff collecting in the existing Burlington Quarry. The existing quarry has approximately 520,000 m^3 of storage available to manage quarry water. As such, the existing settling ponds will be expanded and reconfigured as required during operations to store and treat the quarry water prior to off-site discharge. It is recommended that the settling ponds be expanded and reconfigured to provide at least 1 m permanent pool and active storage depth, respectively, to satisfy the water quality and quantity objectives of the operation.

9.1.2 South Extension

During extraction, water will accumulate on the quarry floor in a sump and be discharged to a settling pond constructed at surface within the extraction area. The settling pond will discharge to the West Arm after treating the quarry water at rates set to mimic existing conditions.

A temporary settling pond will be constructed for this purpose during the initial stages of extraction until sufficient extraction has occurred in Phase 2 of the south extension to construct an adequately sized sump (to both store and treat the quarry water) in the quarry floor. Water accumulating in the quarry floor will be pumped to the settling pond at a maximum rate of 50 L/s (3,000 L/min) for treatment prior to its release to the West Arm. Limiting the maximum pumping rate to 50 L/s will ensure the discharge to the West Arm occurs at rates less than or equal to existing conditions for the 1:2-year through 1:100-year design storms. A three-cell settling pond with a permanent pool depth and volume of 1 m and 1,800 m^3, respectively, will treat a maximum flow rate of 50 L/s to the effluent limits specified in Nelson's Environmental Compliance Approval.

Once approximately 5 ha of extraction has occurred in the south extension an adequately sized sump can be constructed in the quarry floor to store and treat the quarry water. Assuming approximately 1 million

tonnes of extraction per year, extraction in the south extension will take roughly nine (9) years to complete. It will take approximately three (3) years until sufficient extraction has occurred before an adequately sized sump can be constructed. As extraction continues in the south extension over the final six (6) years, the quarry sump will be enlarged to accommodate the additional intercepted rainfall, groundwater, and surface runoff from the increasing size of the open extraction area. Like the temporary settling pond, the discharge from the quarry sump will be restricted to a discharge rate of 50 L/s and will provide adequate treatment to satisfy the effluent limits of Nelson's Environmental Compliance Approval.

Discharge to the West Arm from Quarry Sump 0200 is proposed to continue throughout operations in accordance with the conditions of Nelson's PTTW and ECA that will require an amendment to include the discharge from the south extension. The settling pond design, discharge location, discharge rates and effluent limits for the south extension will be finalized through the PTTW and ECA amendment application process.

9.1.3 West Extension

To replicate the artificial groundwater mounding produced by the existing irrigation ponds and supplement the groundwater recharge in the area, a replica pond will be constructed within the licence boundary, outside the extraction area, between the extraction limit and Cedar Springs Road. The replica Infiltration Pond will be constructed into the bedrock with enhanced permeability. The objective of the Infiltration Pond is to enhance infiltration and mitigate the effects of the quarry on water levels in domestic wells as well as groundwater seepage to the Medad Valley.

A diversion pipe is proposed to divert a portion of the quarry discharge to the proposed Infiltration Pond between the extraction limit and Cedar Springs Road. A 1260 mm × 1880 mm CSPA culvert will be installed between the weir pond (wetland 13202) and the proposed pond. The diversion pipe will divert flow to the proposed pond in a similar manner and elevation as the existing diversion channel on the golf course property.

The Infiltration Pond will be designed, constructed, and tested prior to extraction in the Western Extension to ensure enhanced groundwater recharge is occurring. The assessment of the Infiltration Pond includes shall include a detailed water balance to quantify the volume of water entering the pond system (quarry discharge and surface water run-off), the water leaving the pond system (evaporation and groundwater infiltration), as well as accounting for changes in pond storage. Nelson shall provide the results to the MNDMNRF to show that the Infiltration Pond will be effective in protecting the Medad Valley Provincially Significant Wetland and Area of Natural and Scientific Interest from negative impacts or an alternative mitigation measure will be presented to MNDMNRF 3 years prior to the commencement of extraction of the Western Extension. A similar water balance assessment shall be completed annually after extraction in the Western Extension to show that infiltration is remains constant or is increasing over time. If the results indicate that infiltration is decreasing over time, standard practises to rehabilitate the pond will be required to restore recharge requirements.

A bottom draw outlet will be constructed in the southeast corner of the proposed Infiltration Pond and an outlet pipe complete with a control valve will be installed to discharge water into the upgradient portion of wetland 13201. The wetland hydroperiod will be monitored and water will be discharged to the wetland as required to maintain the wetland hydroperiod. The discharge of water, both rate and quantity, will be controlled by the control valve.

Extraction will reduce the drainage area to wetland 13200, which has the potential to adversely impact the wetland hydroperiod. As such, a mitigation strategy has been developed to supplement the flow into the wetland during operations, if required. Quarry water will be pumped from Quarry Sump 0100 directly into the wetland at a maximum rate of 0.5 L/s and daily volume of 43 m^3 to maintain the wetland hydroperiod.

Within the open extraction area in the west extension, intercepted groundwater, rainfall and runoff will accumulate on the quarry floor in a sump and be drained or pumped into the existing settling ponds in the Burlington Quarry for off-site discharge from Quarry Sump 0100 or 0200. This pumping will continue in perpetuity and managed under the sites PTTW by the new property owner. As discussed, the configuration of the existing settling ponds will be altered during different phases of extraction in the west extension as operations require. Similarly, the sump in the west extension quarry floor will be relocated as needed to facilitate extraction and maintain dry operating conditions.

9.2 Rehabilitation

During operations, Nelson will be responsible for the implementation of the surface water management strategy described herein including the implementation of the mitigation measures recommended in Section 9.1.2 and Section 9.1.3. Post rehabilitation of the site, the permanent mitigation measures discussed in these sections will remain in place and any potential impacts resulting from extraction and quarry dewatering will be resolved. The monitoring requirements will be reduced to those specified in Nelson's ECA and PTTW and a long-term discharge protocol will be developed for any impacted wetlands. Prior to the surrender of the Aggregate Resources Act Licence, the Licencee will provide to the satisfaction of the MNDMNRF, confirmation that long-term monitoring, pumping or mitigation will not result in financial liability to the public. This includes operating and maintaining the two current off-site discharges and undertaking the necessary water quality sampling and flow monitoring and reporting associated with each. The surface water management strategy recommended post rehabilitation is described in the following sections.

9.2.1 Burlington Quarry

The existing wetland constructed in the quarry floor will remain and continue to receive surface runoff from the external lands east of No. 2 Sideroad and Guelph Line. The wetland will continue to drain southwest via a drainage channel through the created landform to a lake constructed on the quarry floor. The settling ponds will be reconfigured into a permanent lake extending into the west extension lands. To manage intercepted groundwater, rainfall and runoff post extraction, the lake requires an active storage volume of approximately 700,000 – 800,000 m^3. The proposed lake has an approximate surface area of 375,000 m^2 resulting in a required active storage depth of 2.15 m.

The Burlington Quarry will be graded to drain directly into the existing wetland, drainage channel or the proposed lake. Quarry Sump 0100 and 0200 are proposed to be maintained and continue to discharge to their respective outlets. Quarry Sump 0100 will be in the proposed Lake. A drainage channel will be required to connect the proposed lake to Quarry Sump 0200. Off-site discharge is proposed in perpetuity to be maintained to feed the natural heritage features downstream of each discharge location and maintain the water levels of the lake and wetland on the quarry floor.

9.2.2 South Extension

Upon completion of extraction in the south extension, dewatering will cease, and the open extraction area will be allowed to fill with intercepted groundwater, rainfall and runoff. Quarry water from the

Burlington Quarry may also be pumped into the open excavation in the south extension to aid in the filling of the lake.

The integrated surface water groundwater model predicts that the lake will fill to an elevation of 271 m. A water level control outlet is not proposed for the lake and the lake water level will fluctuate seasonally. A high-water level overflow weir will be graded into the south corner of the lake to ensure discharge during extremely rare storm events (less frequent than the 1:100-year storm) and freshets will drain to an appropriate outlet. Discharge from the overflow weir will drain overland into wetland 13037 and to the West Arm via the existing drainage channel connecting the two.

Discharge to the West Arm from Quarry Sump 0200 is proposed to continue post extraction after the licence has been surrendered in accordance with the conditions of Nelson's PTTW and ECA.

9.2.3 West Extension

The replica pond constructed within the licence boundary, outside the extraction area, between the extraction limit and Cedar Springs Road during extraction will remain as part of the rehabilitation of the west extension to replicate the artificial groundwater mounding produced by the existing irrigation ponds and supplement groundwater recharge in the area. As discussed, the pond will be constructed at depths and elevations consistent with the existing irrigation ponds.

The bottom draw outlet constructed in the southeast corner of the proposed replica pond and the outlet pipe complete with a control valve installed to discharge water into the upgradient end of wetland 13201 will remain post extraction. The wetland hydroperiod will be monitored and water will be discharged to the wetland as required to maintain the wetland hydroperiod.

10 JEFFERSON SALAMANDER BREEDING PONDS

Although the Natural Environment Technical Report has confirmed the wetlands within 120 m of the extraction areas are not considered suitable Jefferson Salamander habitat due to the established wetland hydroperiods, there are two breeding ponds located on the adjacent property located immediately south of the South Extension. Wetland 13032 (Woodland Vernal Pool) is located approximately 550 m from the extraction area. The south pond (Wetland Vernal Pool 13034/13035), referred as Pond 1, is about 410 m from the extraction area.

Typically, permission to monitor off-site surface water features is granted by the property owner to ensure the on-going protection of the features' form and function. However, permission to monitor the two off-site ponds has not been granted. Even without permission, the protection of the Jefferson Salamander breeding ponds will be achieved. To maintain suitable breeding conditions, wetlands need to hold water long enough to support salamander development but also need to dry-out in the later summer months (i.e., August). This requires that both surface water hydrology and groundwater contributions are not disrupted, altered, or diminished.

An important improvement to the South Extension is that all surface water catchment areas will be maintained. This, coupled with the lack of hydraulic connectivity between the surface water and groundwater regimes, ensures that the habitat will be unaffected. The following sections provide a detailed discussion on the two off-site breeding ponds, as well as the monitoring and mitigation plans.

10.1 MNDMNRF Wetland 13032

Wetland 13032 is reported by the MNDMNRF to provide Jefferson Salamander breeding habitat. This feature is located approximately 550 m from the extraction boundary. Perched approximately 8 m above the water table, the surface water feature is hydraulically isolated from the groundwater regime. Although minor drawdown is predicted beneath Wetland 13032, further lowering of the regional water table will not increase the vertical hydraulic gradient between the surface water and groundwater systems. Seepage from the wetland is independent of head in the aquifer due to perched conditions. Therefore, there are no mechanisms to disrupt, alter or diminish surface water or groundwater contributions to this feature.

The field measurement of pond level recession confirms that the model correctly simulates the hydrologic processes and pond water budget. The spring recession is a relatively good time to evaluate the pond function, for the dominant loss processes in a perched wetland are evapotranspiration and leakage to groundwater. The wetland fills in the spring with snowmelt, rainfall and runoff. Water levels gradually decline over the summer through evapotranspiration and vertical leakage of water down to the water table. Both the long-term monitoring record and the long-term simulations confirm that this wetland is fully disconnected from the groundwater system. No groundwater inflows are observed or simulated into this wetland. The field observations and model simulations confirm that seasonal and inter-annual changes in the water table have no impact on the wetland. The wetland responds only to local climate-driven processes.

Although no impacts to Wetland 13032 are predicted, a monitoring station will be established in the wetland to confirm the results of the model simulations if granted permission by the landowner to do so. If permission is not granted, from a technical perspective this wetland cannot be impacted by the extension and does not need to be monitored, however a monitoring program can be developed through consultation with the approval agencies utilizing other wetlands in the surrounding area.

If adverse impacts are anticipated through the long-term monitoring program from the quarry operations, the mitigation response is to cease dewatering of Phase 1 and 2.

10.2 MNDMNRF Wetland 13034/13035 Complex

Pond 1 is a small wetland that is part of the wetland 13034/13035 complex and is reported by the MNDMNRF to provide Jefferson Salamander breeding habitat. Pre and post extraction water balance results indicate that there will be a small change in the groundwater inflows and outflows to the feature. A net reduction in groundwater inflow of approximately 1.3% to 0.0% of the overall inputs is estimated. An increase in the outflow from the wetland into groundwater system (infiltration) 2.5% to 5.8% is estimated.

Monitoring location SW11A was established in October 2014 to monitor the hydroperiod and water temperatures in wetland 13027. Wetland 13027 is located east of the south extension upstream of the wetland 13034 and 13035 at the northern extent of the wetland complex. A detailed water balance of Wetland 13027 shows that extraction will decrease groundwater inflow by 0.8 m^3/day (about 1.3 % of the total inflow to the wetland) and increase groundwater outflow by 4.6 m^3/day (3.3% of the total outflow from the wetland). Although limited influence is predicted on the surface water feature, a viable mitigation strategy has been developed to supplement the flow into the wetland during operations as required.

11 MEDAD VALLEY ANSI AND PSW

The Medad Valley Life Science Area of Natural and Scientific Interest (ANSI) contains headwater tributaries of the Grindstone and Bronte Creek watersheds. This feature consists of a valley, forest and wetland habitats. Although many of the plant species found within the ANSI are provincially common, the location and form in which they are found (limestone cliff faces and talus), make these vegetation communities provincially rare and significant, confirming the provincial significance of the ANSI and wetlands.

Seeps have been observed along the base of the Medad Valley slope, which contribute water to the PSW (described as wetland 13204 – see section 8.1.4 of the AMP). Wetland 13204 is located within the Lake Medad Valley Wetland Complex and is designated as Provincially Significant by NDMNRF. The wetland is in the Medad Valley groundwater discharge zone. The wetlands and flow in the creek are both supplemented by groundwater discharge (seeps and springs) located on the flanks of the valley. Potential impacts to seepage areas within the riparian zone are possible, due to changes in groundwater levels. The construction of an infiltration pond is intended to maintain the seeps and springs, which will aid in maintaining the functions of seepage areas within riparian zones of the Medad Valley.

If permission is granted by Conservation Halton, a qualified ecologist will conduct ecological surveys on the Conservation Halton property located within the Medad Valley to confirm the current ecological features and functions to assist in finalizing the water level targets for monitors MP41 through to MP 44, SW40, MW22-13, MW22-14, and BS-01. The ecological surveys will establish the extent and composition of the seeps in the Medad Valley located adjacent to the proposed West Extension. This data will be collected within the first year after the ARA licence is issued and again at least 3 years prior to extraction commencing in the Western Extension. This information will be incorporated in the AMP and form part of the Annual Report submitted to MNDMNRF. The ecological surveys will establish the extent (size and location) of the seepage areas, as well as select the areas that will be monitored during the duration of the excavation. The monitoring will also establish the dominant (top 5) plant species in each seepage unit that will be monitored, as well as any provincially or locally rare plant species that are dependant on the seepage habitats.

If access is not provided by Conservation Halton, the Licensee will work with NDMNRF to provide an alternative monitoring approach to confirm no negative impact to the Medad Valley PSW and ANSI.

After the commencement of extraction in the western phase, groundwater monitoring data will be analysed and reported annually. If changes in water levels in the monitoring wells are associated with the quarry development, the ecological survey of the seepage areas will be performed to evaluate whether there are negative impacts. The results and proposed mitigation measures will be presented to MNDMNRF within 3 months after establishment that the groundwater level decline is associated with the western expansion.

13 ADAPTIVE MANAGEMENT IMPLEMENTATION AND REVIEW TIMELINE

To ensure that the AMP provides a clear understanding of the implementation and review timelines, the following tasks and schedule are provided in Table 22. It is recommended that the AMP be reviewed in detail and updated every five (5) years. The objective of the 5-year timeline is to ensure that the AMP is current and has been developed to focus on assessing potential impacts to the natural environment and private water wells in relation to the current quarry operations.

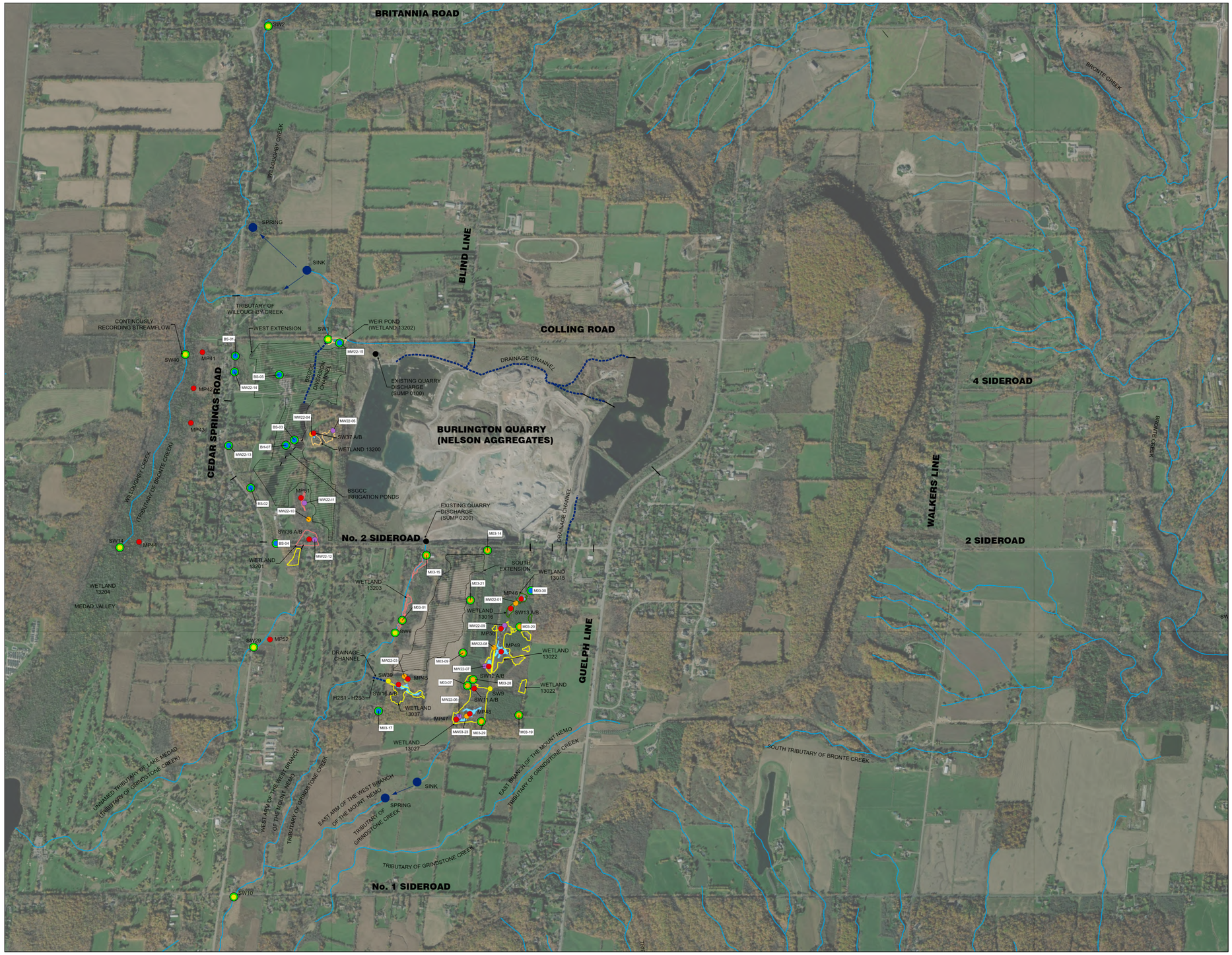
Prior to any removal of overburden, Nelson shall summarize the monitoring program, MNDMNRF approved threshold values, and mitigation measures, which will become Schedule A of the AMP. Schedule A will serve as a quick reference document for Nelson, their consultants, and the MNDMNRF to ensure compliance with the ARA License.

Table 22: AMP Timelines

Task		Timeline
1.	Commence recommended monitoring program	Historical monitoring to continue and the monitoring of new locations to commence in Spring 2022.
2.	Drill and construct Sentry Wells (West Extension)	Within the first year of the license being issued.
3.	First SLC meeting	Before stripping of topsoil from south extension lands occurs
4.	Annual Reports	Due February 1st of the following year after sink cut for the South Extension and each year after
5.	First potential revision of the AMP	After 3-years of below water extraction from the south extension lands or as required by MNDMNRF.
6.	Official Review of the AMP	The 5th year of extraction from the south extension lands.

APPENDIX A

WETLAND MONITORING DRAWINGS



LEGEND

WATER MONITORING / THRESHOLD LOCATIONS

- WETLAND HYDROPERIOD / SHALLOW GROUNDWATER
- CONTINUOUSLY RECORDING STREAMFLOW
- GROUNDWATER MONITORING (OVERBURDEN / BEDROCK) / THRESHOLD LOCATIONS
- GROUNDWATER MONITORING (OVERBURDEN) / THRESHOLD LOCATIONS
- GROUNDWATER MONITORING (BEDROCK) / THRESHOLD LOCATIONS
- WATER QUALITY SAMPLING

- WATERCOURSE
- DIVERSION CHANNEL
- EXTRACTION LIMIT

WETLANDS

- NO CHANGE IN CATCHMENT AREA OR GROUNDWATER CONTRIBUTIONS
- NO CHANGE IN CATCHMENT AREA/MINOR (<3%) REDUCTION IN GROUNDWATER CONTRIBUTION
- REDUCTION IN CATCHMENT AREA/MINOR (<3%) REDUCTION IN GROUNDWATER CONTRIBUTION
- REDUCTION IN CATCHMENT AREA/ NO CHANGE IN GROUNDWATER CONTRIBUTION

NOTE

MONITORING LOCATIONS SW40 THROUGH SW43 SUBJECT TO PERMISSION FROM CONSERVATION HALTON (PROPERTY OWNER OF SUBJECT LANDS)

No.	REVISION DESCRIPTION	DATE
1.	AMP SECOND SUBMISSION	FEB. 22
2.	AMP THIRD SUBMISSION	MAR. 22
3	AMP FOURTH SUBMISSION	MAY. 22
4.	AMP FIFTH SUBMISSION	MAY. 22

ENGINEERS STAMP

BURLINGTON QUARRY

AMP MONITORING/ THRESHOLD PLAN

TATHAM ENGINEERING

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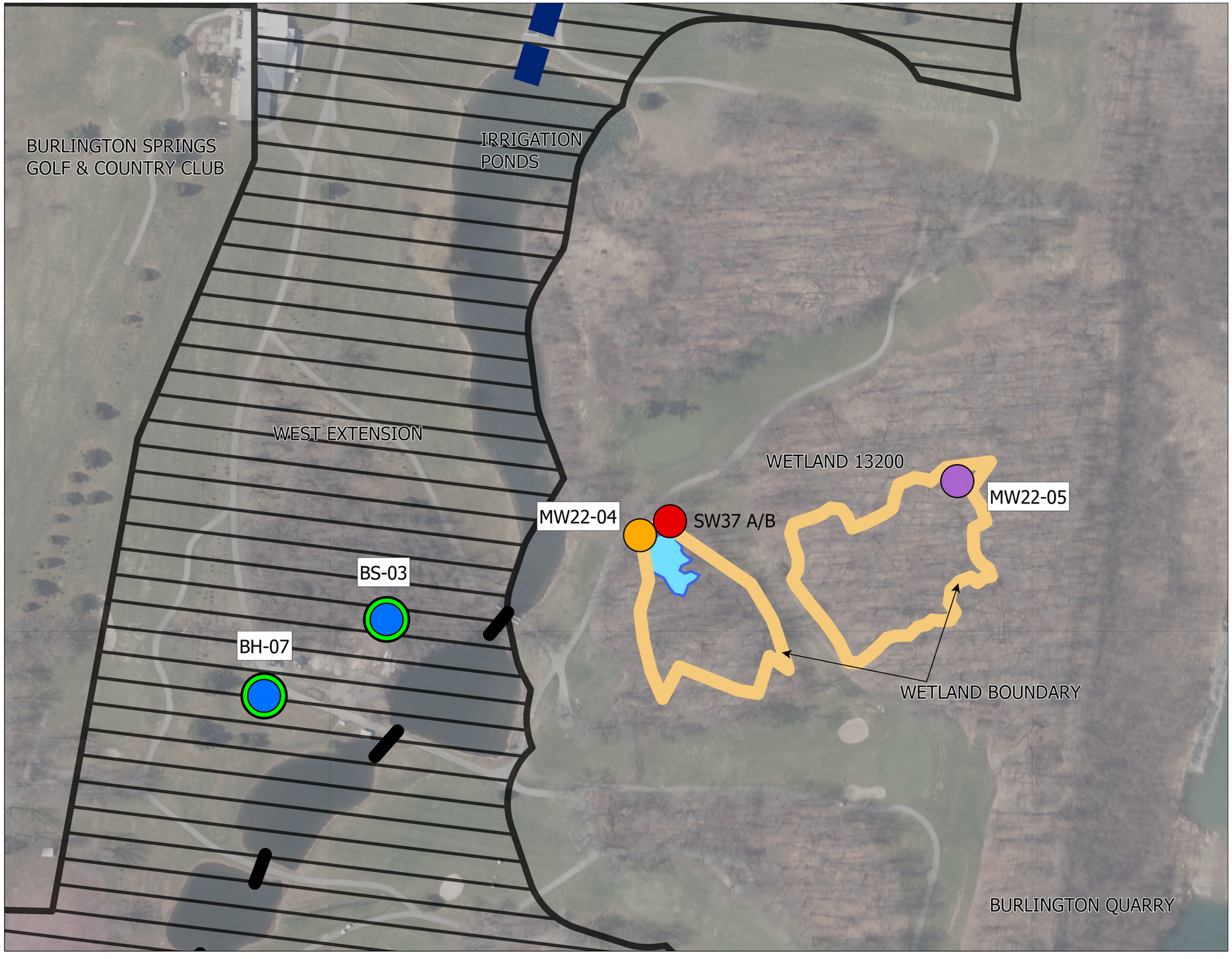

LEGEND

WATER MONITORING / THRESHOLD LOCATIONS

- WETLAND HYDROPERIOD / SHALLOW GROUNDWATER
- CONTINUOUSLY RECORDING STREAMFLOW
- GROUNDWATER MONITORING (OVERBURDEN / BEDROCK) / THRESHOLD LOCATIONS
- GROUNDWATER MONITORING (OVERBURDEN) / THRESHOLD LOCATIONS
- GROUNDWATER MONITORING (BEDROCK) / THRESHOLD LOCATIONS
- WATER QUALITY SAMPLING

- WATERCOURSE
- DIVERSION CHANNEL
- EXTRACTION LIMIT
- VERNAL POOL

WETLANDS

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No.	REVISION DESCRIPTION	DATE
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3.	AMP FOURTH SUBMISSION	MAY. 22
4.	AMP FIFTH SUBMISSION	MAY. 22

ENGINEERS STAMP

BURLINGTON QUARRY

AMP MONITORING/
THRESHOLD PLAN (WETLAND 13200)

TATHAM ENGINEERING

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DRAWN: KKS	DATE: NOV 2021	**AMP-2**	
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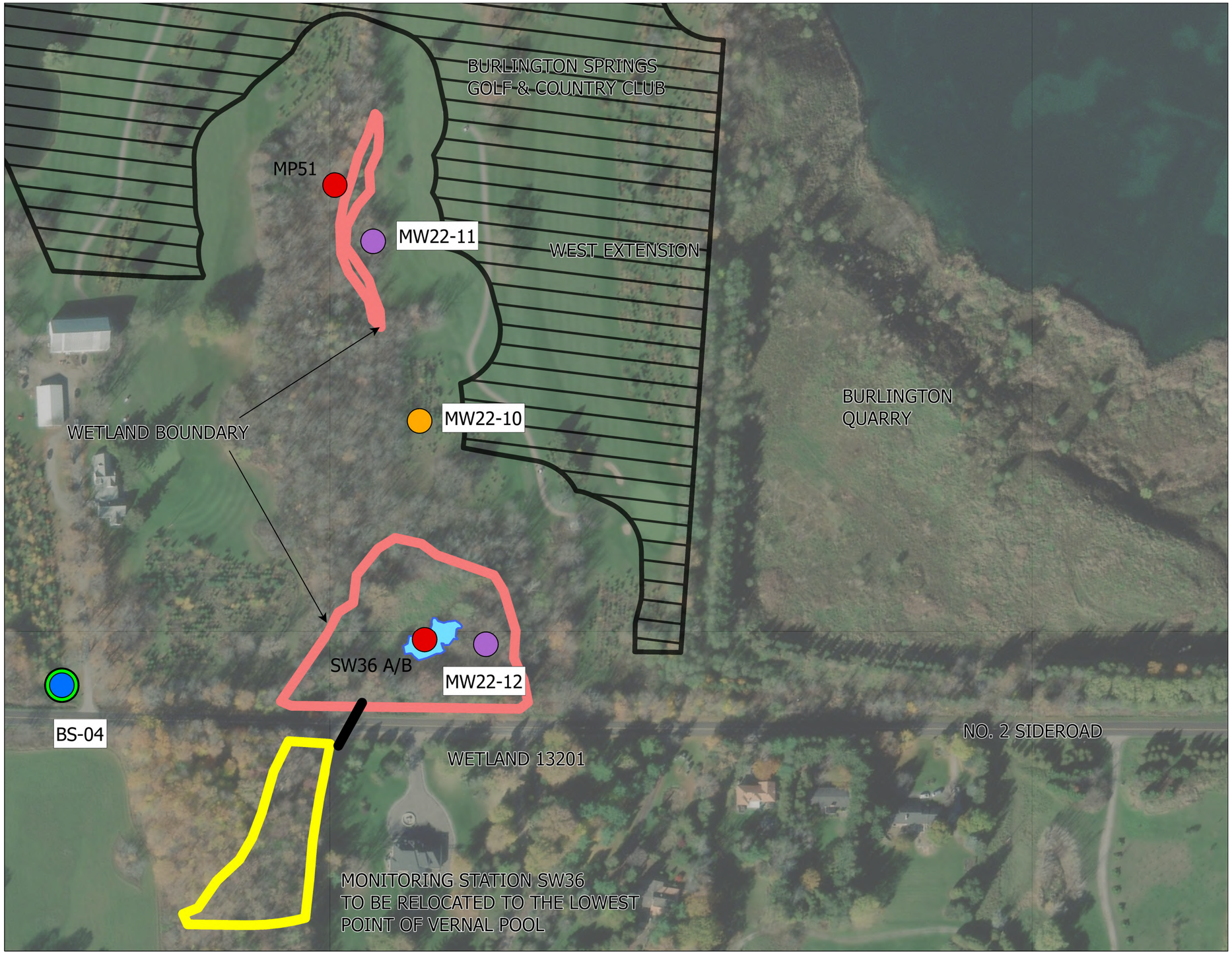

LEGEND

WATER MONITORING / THRESHOLD LOCATIONS

- WETLAND HYDROPERIOD / SHALLOW GROUNDWATER
- CONTINUOUSLY RECORDING STREAMFLOW
- GROUNDWATER MONITORING (OVERBURDEN / BEDROCK) / THRESHOLD LOCATIONS
- GROUNDWATER MONITORING (OVERBURDEN) / THRESHOLD LOCATIONS
- GROUNDWATER MONITORING (BEDROCK) / THRESHOLD LOCATIONS
- WATER QUALITY SAMPLING

- WATERCOURSE
- DIVERSION CHANNEL
- EXTRACTION LIMIT
- VERNAL POOL

WETLANDS

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No.	REVISION DESCRIPTION	DATE
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3	AMP FOURTH SUBMISSION	MAY. 22
4.	AMP FIFTH SUBMISSION	MAY. 22

ENGINEERS STAMP

BURLINGTON QUARRY

AMP MONITORING/
THRESHOLD PLAN (WETLAND 13201)

TATHAM ENGINEERING

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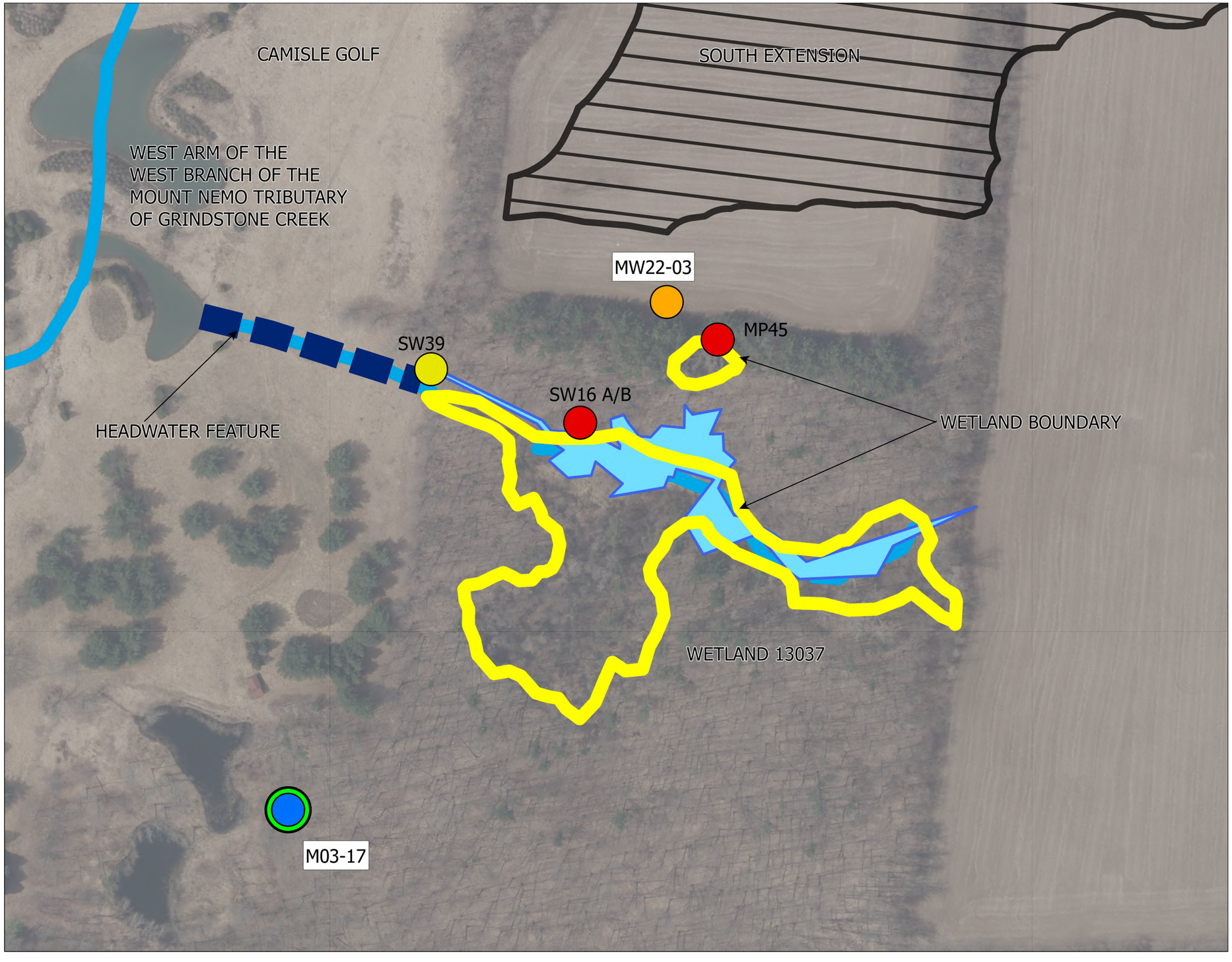

LEGEND

WATER MONITORING / THRESHOLD LOCATIONS

- WETLAND HYDROPERIOD / SHALLOW GROUNDWATER
- CONTINUOUSLY RECORDING STREAMFLOW
- GROUNDWATER MONITORING (OVERBURDEN / BEDROCK) / THRESHOLD LOCATIONS
- GROUNDWATER MONITORING (OVERBURDEN) / THRESHOLD LOCATIONS
- GROUNDWATER MONITORING (BEDROCK) / THRESHOLD LOCATIONS
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- WATERCOURSE
- DIVERSION CHANNEL
- EXTRACTION LIMIT
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WETLANDS

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4.	AMP FIFTH SUBMISSION	MAY. 22

ENGINEERS STAMP

BURLINGTON QUARRY

AMP MONITORING/
THRESHOLD PLAN (WETLAND 13037)

TATHAM ENGINEERING

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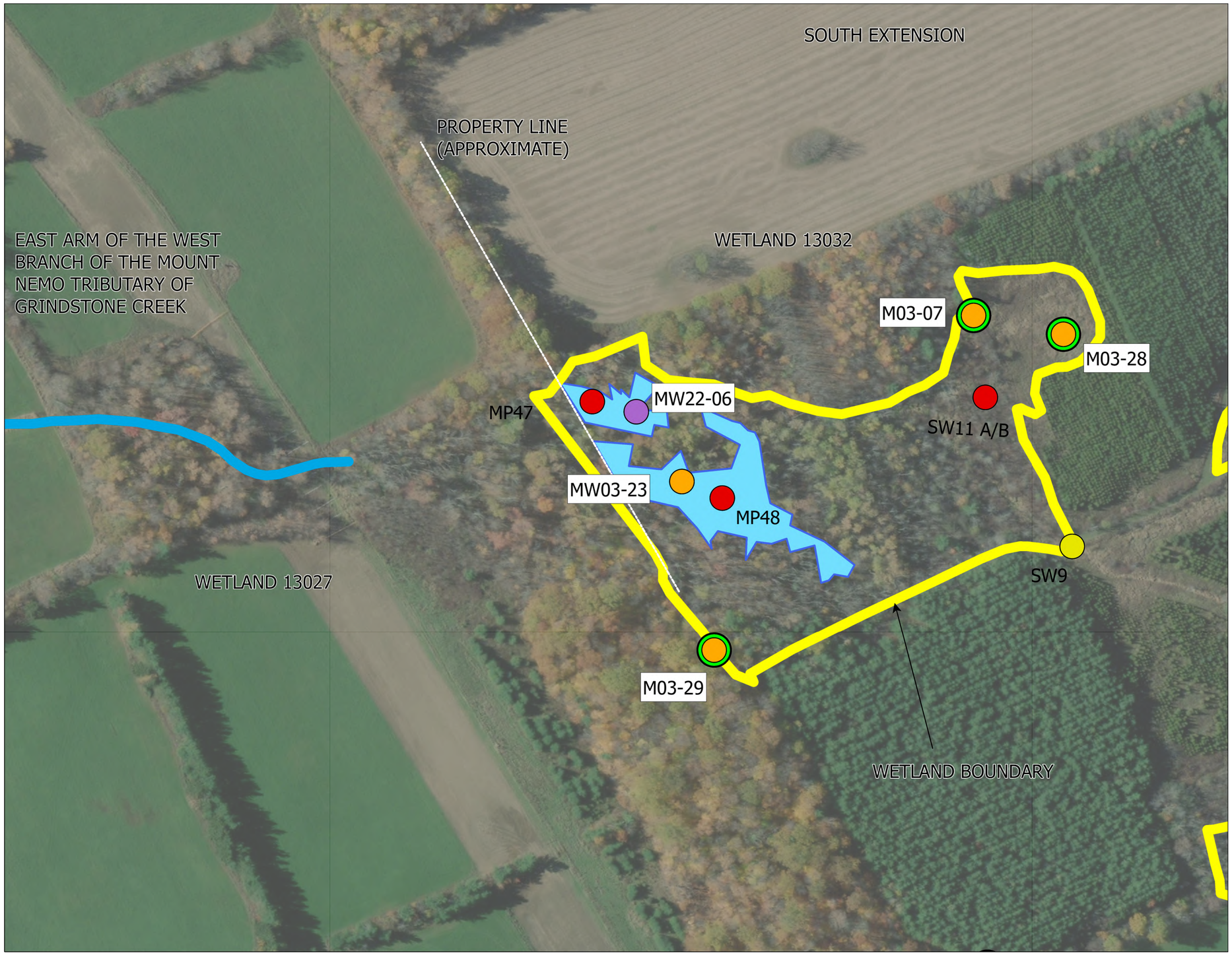

LEGEND

WATER MONITORING / THRESHOLD LOCATIONS

- WETLAND HYDROPERIOD / SHALLOW GROUNDWATER
- CONTINUOUSLY RECORDING STREAMFLOW
- GROUNDWATER MONITORING (OVERBURDEN / BEDROCK) / THRESHOLD LOCATIONS
- GROUNDWATER MONITORING (OVERBURDEN) / THRESHOLD LOCATIONS
- GROUNDWATER MONITORING (BEDROCK) / THRESHOLD LOCATIONS
- WATER QUALITY SAMPLING

- WATERCOURSE
- DIVERSION CHANNEL
- EXTRACTION LIMIT
- VERNAL POOL

WETLANDS

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4.	AMP FIFTH SUBMISSION	MAY. 22

ENGINEERS STAMP

BURLINGTON QUARRY

AMP MONITORING/
THRESHOLD PLAN (WETLAND 13027)

TATHAM ENGINEERING

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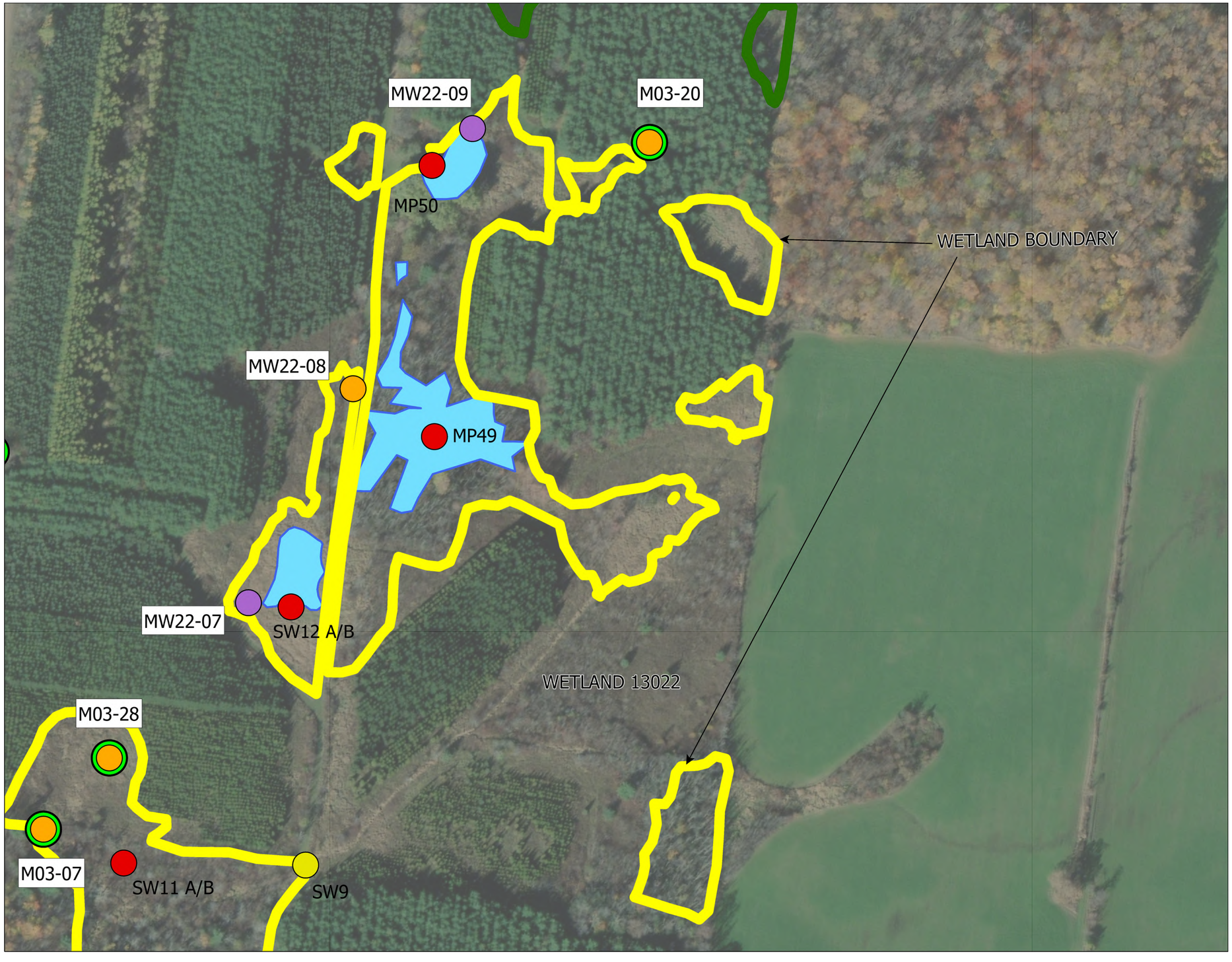

LEGEND

WATER MONITORING / THRESHOLD LOCATIONS

- WETLAND HYDROPERIOD / SHALLOW GROUNDWATER
- CONTINUOUSLY RECORDING STREAMFLOW
- GROUNDWATER MONITORING (OVERBURDEN / BEDROCK) / THRESHOLD LOCATIONS
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WETLANDS

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4.	AMP FIFTH SUBMISSION	MAY. 22

ENGINEERS STAMP

BURLINGTON QUARRY

AMP MONITORING/
THRESHOLD PLAN (WETLAND 13022)

TATHAM ENGINEERING

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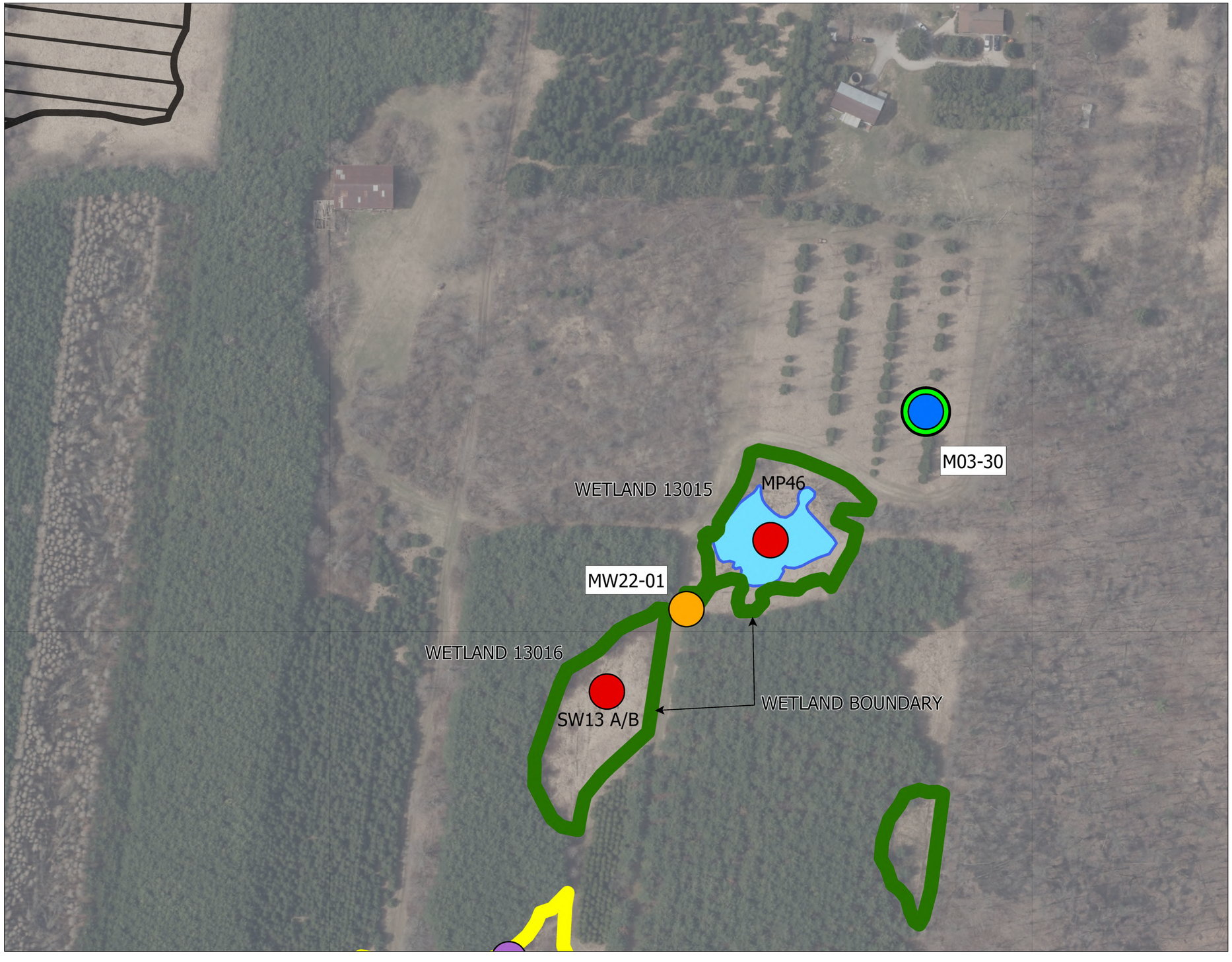

LEGEND

WATER MONITORING / THRESHOLD LOCATIONS

- WETLAND HYDROPERIOD / SHALLOW GROUNDWATER
- CONTINUOUSLY RECORDING STREAMFLOW
- GROUNDWATER MONITORING (OVERBURDEN / BEDROCK) / THRESHOLD LOCATIONS
- GROUNDWATER MONITORING (OVERBURDEN) / THRESHOLD LOCATIONS
- GROUNDWATER MONITORING (BEDROCK) / THRESHOLD LOCATIONS
- WATER QUALITY SAMPLING

- WATERCOURSE
- DIVERSION CHANNEL
- EXTRACTION LIMIT
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WETLANDS

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2.	AMP THIRD SUBMISSION	MAR. 22
3	AMP FOURTH SUBMISSION	MAY. 22
4.	AMP FIFTH SUBMISSION	MAY. 22

ENGINEERS STAMP

BURLINGTON QUARRY

AMP MONITORING/ THRESHOLD PLAN (WETLAND 13015 & 13016)

TATHAM ENGINEERING

DESIGN: JG	FILE: 113187	DWG:	
DRAWN: KKS	DATE: NOV 2021	**AMP-7**	
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LEGEND

WATER MONITORING / THRESHOLD LOCATIONS

- WETLAND HYDROPERIOD / SHALLOW GROUNDWATER
- CONTINUOUSLY RECORDING STREAMFLOW
- GROUNDWATER MONITORING (OVERBURDEN / BEDROCK) / THRESHOLD LOCATIONS
- GROUNDWATER MONITORING (OVERBURDEN) / THRESHOLD LOCATIONS
- GROUNDWATER MONITORING (BEDROCK) / THRESHOLD LOCATIONS
- WATER QUALITY SAMPLING

- WATERCOURSE
- DIVERSION CHANNEL
- EXTRACTION LIMIT
- VERNAL POOL

WETLANDS

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NOTE

MONITORING LOCATIONS SW40 THROUGH SW43 SUBJECT TO PERMISSION FROM CONSERVATION HALTON (PROPERTY OWNER OF SUBJECT LANDS)

No.	REVISION DESCRIPTION	DATE
1.	AMP SECOND SUBMISSION	FEB. 22
2.	AMP THIRD SUBMISSION	MAR. 22
3	AMP FOURTH SUBMISSION	MAY. 22
4.	AMP FIFTH SUBMISSION	MAY. 22

ENGINEERS STAMP

BURLINGTON QUARRY

AMP MONITORING/ THRESHOLD PLAN

TATHAM ENGINEERING

DESIGN: JG	FILE: 113187	DWG:	
DRAWN: KKS	DATE: NOV 2021	**AMP-8**	
CHECK: DRT	SCALE: 1:1,800		

SCHEDULE A

LIST OF TABLES

Table 1: South Extension - Groundwater Monitoring Program and Thresholds

Borehole	Well ID	Water Level Monitoring		Water Quality Sampling		Trend Analysis
		Monthly Manual	Continuous	Semi-Annual	Annual	
M03-01	M03-01A	X	X	X		X
	M03-01B	X	X	X	X	X
	M03-01C	X	X			X
M03-07	M03-07A	X	X			X
M03-09	M03-09A	X	X	X		X
	M03-09B	X	X	X	X	X
M03-15	M03-15A	X	X	X		X
	M03-15B	X	X	X	X	X
	M03-15C	X	X			X
M03-17	M03-17A	X	X	X		X
	M03-17B	X	X	X	X	X
M03-20	M03-20A	X	X	X		X
	M03-20B	X	X	X	X	X
	M03-20C	X	X			X
M03-23	M03-23B	X	X	X	X	X
	M03-23C	X	X			X
M03-28	M03-28C	X	X			X
M03-29	M03-29A	X	X	X		X
	M03-29B	X	X	X	X	X
	M03-29C	X	X			X
M03-30	M03-30A	X	X	X		X
	M03-30B	X	X	X	X	X
MW22-01	MW22-01B	X	X			X
	MW22-01C	X	X			X
MW22-02	MW22-02B	X	X			X
	MW22-02C	X	X			X
MW22-03	MW22-03C	X	X			X
MW22-06	MW22-06C	X	X			X
MW22-08	MW22-08B	X	X			X
	MW22-08C	X	X			X
MW22-09	MW22-09C	X	X			X

Table 2: West Extension - Groundwater Monitoring Program and Thresholds

Borehole	Well ID	Water Level Monitoring		Water Quality Sampling		Trend Analysis	Threshold Values		
		Monthly Manual	Continuous	Semi-Annual	Annual		Simulated Min	Level 1 (10%)	Level 2 (5%)
BS-01	BS-01A	X	X			X	TBD	TBD	TBD
	BS-01B	X	X	X	X	X	TBD	TBD	TBD
BS-02	BS-02A	X	X			X	TBD	TBD	TBD
	BS-02B	X	X	X	X	X	TBD	TBD	TBD
BS-03	BS-03A	X	X			X	TBD	TBD	TBD
	BS-03B	X	X	X	X	X	TBD	TBD	TBD
BS-04	BS-04A	X	X			X	TBD	TBD	TBD
	BS-04B	X	X	X	X	X	TBD	TBD	TBD
BS-05	BS-05A	X	X			X	TBD	TBD	TBD
	BS-05B	X	X	X	X	X	TBD	TBD	TBD
BS-07	BS-07	X	X	X	X	X	TBD	TBD	TBD
MW22-04	MW22-04B	X	X			X			
	MW22-04C	X	X			X			
MW22-05	MW22-05C	X	X			X			
MW22-10	MW22-10B	X	X			X			
	MW22-10C	X	X			X			
MW22-11	MW22-11C	X	X			X			
MW22-12	MW22-12C	X	X	X		X			
BS-08	BS-08A	X	X	X	X	X	TBD	TBD	TBD
	BS-08B	X	X			X	TBD	TBD	TBD
BS-09	BS-09A	X	X	X		X	TBD	TBD	TBD
	BS-09B	X	X	X	X	X	TBD	TBD	TBD
BS-10	BS-10A	X	X			X	TBD	TBD	TBD
	BS-10B	X	X			X	TBD	TBD	TBD
BS-11	BS-11A	X	X			X	TBD	TBD	TBD
	BS-11B	X	X			X	TBD	TBD	TBD

Table 3: Private Monitoring Well Locations

Borehole	MECP Well ID	Survey Coordinates (NAD83)	
		Easting	Northing
DW-1	28-03833	589114	4805170
DW-2	na	589786	4807340
DW-3	7276141	589486	4804431
DW-4	na	591987	4804216
DW-5	2800063	591472	4803608
DW-6	na	591220	4803372
DW-7	na	590916	4806143

Table 4: Groundwater Quality

Water Quality Sampling Frequency	Parameters
Semi-Annually	pH, Conductivity, Alkalinity, Hardness, Bicarbonate, Total Phosphorus, Nitrate and Nitrite, Metals (Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chloride, Cobalt, Copper, Lead, Iron, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Sodium, Silver, Strontium, Sulphate, Sulfur, Thallium, Thorium, Tin, Titanium, Tungsten, Uranium, Vanadium, Zinc),
Annual	Petroleum Hydrocarbons (BTEX, F1-F4)

1 SURFACE WATER MONITORING PROGRAM

Table 5: South Extension: Streamflow Monitoring Program

Monitoring Location	Surface Water			
	Depth	Flow	Temperature	Quality
SW6	X	X	X	X
SW9	X	X	X	
SW10	X	X	X	X
SW39	X	X	X	

Table 6: South Extension: Streamflow 10th and 5th Percentile Thresholds

Month	Monitoring Location (Watercourse)					
	SW6 (West Arm)		SW10 (West Branch)		SW39 (H2S1 – H2S3)	
	10th Percentile	5th Percentile	10th Percentile	5th Percentile	10th Percentile	5th Percentile
January	TBD	TBD	TBD	TBD	TBD	TBD
February	TBD	TBD	TBD	TBD	TBD	TBD
March	TBD	TBD	TBD	TBD	TBD	TBD
April	TBD	TBD	TBD	TBD	TBD	TBD
May	TBD	TBD	TBD	TBD	TBD	TBD
June	TBD	TBD	TBD	TBD	TBD	TBD
July	TBD	TBD	TBD	TBD	TBD	TBD
August	TBD	TBD	TBD	TBD	TBD	TBD
September	TBD	TBD	TBD	TBD	TBD	TBD
October	TBD	TBD	TBD	TBD	TBD	TBD
November	TBD	TBD	TBD	TBD	TBD	TBD
December	TBD	TBD	TBD	TBD	TBD	TBD

Table 7: South Extension: Temperature Thresholds

Month	Monitoring Location (Watercourse)					
	SW6 (West Arm)		SW10 (West Branch)		SW39 (H2S1 – H2S3)	
	Level 1	Level 2	Level 1	Level 2	Level 1	Level 2
January	TBD	TBD	TBD	TBD	TBD	TBD
February	TBD	TBD	TBD	TBD	TBD	TBD
March	TBD	TBD	TBD	TBD	TBD	TBD
April	TBD	TBD	TBD	TBD	TBD	TBD
May	TBD	TBD	TBD	TBD	TBD	TBD
June	TBD	TBD	TBD	TBD	TBD	TBD
July	TBD	TBD	TBD	TBD	TBD	TBD
August	TBD	TBD	TBD	TBD	TBD	TBD
September	TBD	TBD	TBD	TBD	TBD	TBD
October	TBD	TBD	TBD	TBD	TBD	TBD
November	TBD	TBD	TBD	TBD	TBD	TBD
December	TBD	TBD	TBD	TBD	TBD	TBD

Table 8: South Extension: Wetland Hydroperiod Monitoring Program

Monitoring Location	Surface Water	
	Depth	Temperature
SW11A	X	X
SW12A	X	X
SW13A	X	X
SW16A	X	X
MP45	X	X
MP46	X	X
MP47	X	X
MP48	X	X
MP49	X	X

MP50	X	X

Table 9: South Extension - Wetland Hydroperiod Thresholds

Wetland	Monitoring Location	Monitored Hydroperiod (5 Year Period)	Water Balance Hydroperiod (20 Year Period)	Spring Hydroperiod Threshold	Average Water Level (m)
13027	SW11A	May 19th (2015)	May 3rd (2001)	April 26th	TBD
	MP47	TBD	TBD	TBD	TBD
	MP48	TBD	TBD	TBD	TBD
13022	SW12A	May 11th (2015)	April 27th (2015)	April 20th	TBD
	MP49	TBD	TBD	TBD	TBD
	MP50	TBD	TBD	TBD	TBD
13016	SW13A	May 16th (2015)	May 7th (1999)	May 1st	TBD
	MP46	TBD	TBD	TBD	TBD
13037	SW16A	July 5th (2019)	May 25th (2012)	May 18th	TBD
	MP45	TBD	TBD	TBD	TBD

Table 10: West Extension: Streamflow Monitoring Program

Monitoring Location	Surface Water			
	Depth	Flow	Temperature	Quality
SW1	X	X	X	X
SW2	X	X	X	X
SW14	X	X	X	X
SW29	X	X	X	X
SW40	X	X	X	X

Table 11: West Extension – Streamflow 10th and 5th Percentile Thresholds

Month	Monitoring Location (Watercourse)					
	SW1 (Willoughby Tributary)		SW2 (Willoughby Creek)		SW14 (Willoughby Creek)	
	10th Percentile	5th Percentile	10th Percentile	5th Percentile	10th Percentile	5th Percentile
January	TBD	TBD	TBD	TBD	TBD	TBD
February	TBD	TBD	TBD	TBD	TBD	TBD
March	TBD	TBD	TBD	TBD	TBD	TBD
April	TBD	TBD	TBD	TBD	TBD	TBD
May	TBD	TBD	TBD	TBD	TBD	TBD
June	TBD	TBD	TBD	TBD	TBD	TBD
July	TBD	TBD	TBD	TBD	TBD	TBD
August	TBD	TBD	TBD	TBD	TBD	TBD
September	TBD	TBD	TBD	TBD	TBD	TBD
October	TBD	TBD	TBD	TBD	TBD	TBD
November	TBD	TBD	TBD	TBD	TBD	TBD
December	TBD	TBD	TBD	TBD	TBD	TBD

Month	Monitoring Location (Watercourse)			
	SW40 (Willoughby Creek)		SW29 (Lake Medad Tributary)	
	10th Percentile	5th Percentile	10th Percentile	5th Percentile
January	TBD	TBD	TBD	TBD
February	TBD	TBD	TBD	TBD
March	TBD	TBD	TBD	TBD
April	TBD	TBD	TBD	TBD
May	TBD	TBD	TBD	TBD
June	TBD	TBD	TBD	TBD
July	TBD	TBD	TBD	TBD
August	TBD	TBD	TBD	TBD
September	TBD	TBD	TBD	TBD
October	TBD	TBD	TBD	TBD
November	TBD	TBD	TBD	TBD
December	TBD	TBD	TBD	TBD

Table 12: West Extension –Temperature Thresholds

Month	Monitoring Location (Watercourse)					
	SW1 (Willoughby Tributary)		SW2 (Willoughby Creek)		SW14 (Willoughby Creek)	
	Level 1	Level 2	Level 1	Level 2	Level 1	Level 2
January	TBD	TBD	TBD	TBD	TBD	TBD
February	TBD	TBD	TBD	TBD	TBD	TBD
March	TBD	TBD	TBD	TBD	TBD	TBD
April	TBD	TBD	TBD	TBD	TBD	TBD
May	TBD	TBD	TBD	TBD	TBD	TBD
June	TBD	TBD	TBD	TBD	TBD	TBD
July	TBD	TBD	TBD	TBD	TBD	TBD
August	TBD	TBD	TBD	TBD	TBD	TBD
September	TBD	TBD	TBD	TBD	TBD	TBD
October	TBD	TBD	TBD	TBD	TBD	TBD
November	TBD	TBD	TBD	TBD	TBD	TBD
December	TBD	TBD	TBD	TBD	TBD	TBD

Month	Monitoring Location (Watercourse)			
	SW40 (Willoughby Creek)		SW29 (Lake Medad Tributary)	
	Level 1	Level 2	Level 1	Level 2
January	TBD	TBD	TBD	TBD
February	TBD	TBD	TBD	TBD
March	TBD	TBD	TBD	TBD
April	TBD	TBD	TBD	TBD
May	TBD	TBD	TBD	TBD
June	TBD	TBD	TBD	TBD
July	TBD	TBD	TBD	TBD
August	TBD	TBD	TBD	TBD
September	TBD	TBD	TBD	TBD
October	TBD	TBD	TBD	TBD
November	TBD	TBD	TBD	TBD
December	TBD	TBD	TBD	TBD

Table 13: West Extension: Wetland Hydroperiod Monitoring Program

Monitoring Location	Surface Water	
	Depth	Temperature
SW1	**X**	**X**
SW36A	**X**	**X**
SW37A	**X**	**X**
MP41	X	X
MP42	X	X
MP43	X	X
MP44	X	X
MP51	X	X

Table 14: West Extension - Wetland Hydroperiod Thresholds

Wetland	Monitoring Location	Monitored Hydroperiod (5 Year Period)	Water Balance Hydroperiod (20 Year Period)	Spring Hydroperiod Threshold	Average Water Level (m)
13201	SW36A	TBD	TBD	TBD	TBD
13200	SW37A	TBD	TBD	TBD	TBD
13201	MP51	TBD	TBD	TBD	TBD
13204	MP41	TBD	TBD	TBD	TBD
	MP42	TBD	TBD	TBD	TBD
	MP43	TBD	TBD	TBD	TBD
	MP44	TBD	TBD	TBD	**TBD**

Table 15: West Extension – Shallow Groundwater Monitoring Program and Thresholds

Monitoring Location	Water Level Monitoring		Threshold Values		
	Monthly Manual	Continuous	Simulated Min	Level 1 (10%)	Level 2 (5%)
MP41	**X**	**X**	TBD	TBD	TBD
MP42	**X**	**X**	TBD	TBD	TBD
MP43	**X**	**X**	TBD	TBD	TBD
MP44	**X**	**X**	TBD	TBD	TBD
MP52	**X**	**X**	TBD	TBD	TBD

Table 16: Surface Water Quality Monitoring Program

Water Sampling Locations	Sampling Frequency	Parameters
SW1, SW2, SW6, SW10, SW14, SW29, SW40	Quarterly (once every three months)	Dissolved Organic Carbon, Ammonia, Alkalinity, BOD, COD, Conductivity, Total Hardness, Total Metals, Turbidity, Total Dissolved Solids, Total Suspended Solids, pH, Carbonate, Bicarbonate, Chloride, Sulphate, TKN, Nitrite, and Nitrate

Table 17: Environmental Compliance Approval Effluent Limits

Parameter	Concentration Limit (mg/l)
Total Suspended Solids (TSS)	25
Oil and Grease	15
pH	6.5 – 8.5 (inclusive)

Table 18: AMP Timelines

Task		Timeline
1.	Commence recommended monitoring program	Historical monitoring to continue and the monitoring of new locations to commence in Spring 2022.
2.	Drill and construct Sentry Wells (West Extension)	Within the first year of the license being issued.
3.	First SLC meeting	Before stripping of topsoil from south extension lands occurs
4.	Annual Reports	Due February 1st of the following year after sink cut for the South Extension and each year after
5.	First potential revision of the AMP	After 3-years of below water extraction from the south extension lands or as required by MNDMNRF.
6.	Official Review of the AMP	The 5th year of extraction from the south extension lands.