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2019 Post-construction Wetland Monitoring Report

Atlantic Gold
A St Barbara Ltd Company

2020 Post-Construction Wetland Monitoring Report

Touquoy Gold Mine (15-065)
Moose River, Nova Scotia

Prepared for:
Atlantic Mining NS Inc.
6749 Moose River Rd, RR#2
Middle Musquodoboit Nova Scotia, B0N 1X0

Prepared by:
McCallum Environmental Ltd.
2 Bluewater Road, Suite 115
Bedford, NS
B4B 1G7

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Executive Summary

Atlantic Mining NS Inc. (AMNS) has received approval to alter 58.86 ha of wetland habitat associated with the Touquoy Gold Mine (Nova Scotia Environment Approval No. 2016-095967-04). The Touquoy Gold Mine is an open pit gold mine located in Moose River Gold Mines in Halifax County, NS (Figure 1, Appendix A). Construction of the Touquoy Gold Mine began in 2016 and wetland alteration activities are expected to occur throughout the lifetime of mine development.

To satisfy the conditions presented by Nova Scotia Environment (NSE) within the approval listed above, a Wetland Monitoring Plan (WMP) and associated baseline monitoring was completed in 2016, the results of which were provided to NSE in the Wetland Monitoring Plan and 2016 Baseline Wetland Monitoring Report (January 31, 2017). As per the recommendations in that report, Post-Construction Monitoring (PCM) was completed in July and August 2020 whereby detailed vegetation and hydrology was evaluated in combination with the completion of general assessments at the previously established baseline locations within the remaining unaltered wetland habitat. Modifications including reductions and additions to PCM program have been made throughout the program and are discussed herein. The 2020 post-construction monitoring results are compared to baseline and 2019 observations to determine whether areas of unaltered wetland habitat remain viable, and present healthy wetland characteristics.

The purpose of this report is to review the methods implemented and evaluate the results obtained from the 2020 PCM program and determine whether there is evidence of potential direct or indirect impacts to wetland habitat as a result of Project activities. Based on the evaluation completed, this report provides clear recommendations and scheduling for future monitoring programs.

As well, this report provides an updated 2020 wetland alteration footprint as a result of Project infrastructure.

The following conclusions were made as a result of the 2020 PCM program and completion of this report:

Wetland Monitoring Results

- No definitive trends are present in the observed changes to hydrological indicators when comparing all monitoring events from 2016 to 2020. In general, hydrological indicators are similar from year to year with minor variations (e.g., no water-stained leaves recorded in Wetland 30 in 2016) attributed to seasonal and previous precipitation variations;
- No evidence of indirect wetland alteration (flooding, drying, sedimentation, etc.) were observed at the general observation locations in 2020;
- No invasive species were recorded at any detailed or general vegetation observation locations;
- The seasonal timing of data collected in 2017 is considered a better representation of baseline conditions. The Relative Percent Difference (RPD) results indicate that no transects exceeded the threshold for change (> 30%) between 2017 and all subsequent PCM years.
- Vegetation remains hydrophytic (PI ≤ 3) in all wetlands and was not observed to be stressed;
- Detailed vegetation visual assessments indicate minor vegetative community changes in dominant species composition between baseline, 2017, 2018, 2019 and 2020 PCM, although seasonal effects and observer bias can play a part in the results of this analysis;

- Substrate characteristics remained predominantly consistent with only a few instances of minor variations from across all PCM events which can be attributed to natural succession of moss cover or natural disturbances;
- Visual topographic survey results indicate that no changes have occurred in the assessed wetlands;
- The average Relative Groundwater Depths (RGWDs) in MW 6-1 and 6-2 responded accordingly to total precipitation during the monitoring period (i.e., higher average during higher precipitation totals). Whereas, MWs 22-1 and 22-2 have been trending drier since monitoring began in 2016 regardless of seasonal precipitation values. No discernible trends in average RGWDs in MWs 1-1, 1-2, 15, 22-3, 32 and 33 were observed;
- All monitoring wells except for MW 22-1 and 22-2 displayed RGWDs of greater than -30 cm for two consecutive weeks in the growing season yet remained below +30 cm for prolonged periods of time. Additionally, MW 22-1 saw a fluctuation in average RGWD of greater than 20 cm of its recorded baseline value (2016). MW 22-1 ranged from a maximum RGWD of -26.8 cm to a minimum of -76.8 cm. However, it should be noted that the minimum recorded value of -76.8 cm is the installation depth of the level logger and the actual minimum RGWD at MW 22-1 is presumed to be lower in reality; and
- Monitoring wells 22-1 and 22-2 did not record RGWD of greater than -30 cm for two consecutive weeks during the growing season. These areas of WL22 were observed to be relatively dry prior to mine development. Although there has been no evidence of changes in vegetation composition, invasive plants and/or species dominance, hydrological data suggests that conditions have become drier every year since the PCM program started. This is likely an indication of a reduction in water source such as up gradient water sources that no longer exist (i.e., ponds, mini pit) or run-off water contribution from previously existing upland that now comprises the mine, less frequent flooding of the Moose River, potential changes to groundwater table near the pit or a combination of these factors.

Wetland Alterations

- A total of 47.50 ha of the 58.86 ha permitted area has currently been directly altered as a result of the Touquoy Gold Mine Project. An additional 1.11 ha of wetland habitat has been determined altered as a result of indirect wetland alterations in remaining fragmented wetlands that have been partially altered in the past.
- An annual Wetland Compensation Plan discussing compensation for these alterations is provided under a separate cover.

PCM Program Modifications

- Modifications to the PCM program throughout its implementation (2016 onward) are presented in this report.
- Additional modifications to the PCM Program have been presented in this report for wetlands that have not been monitored to date. This additional monitoring is recommended for wetlands initially proposed for complete alteration that have not been altered or have been partially altered, for wetlands which are downgradient from wetlands that have been directly or partially altered

but not previously monitored, and for wetlands that lie adjacent to the clay borrow expansion area.

The following recommendations are provided:

(1) The Study Team recommends implementation of the modifications presented in this report during the 2021 field season. This includes:
- Reinstatement of monitoring in WL 28 now that the property (PID 00642793) is owned by AMNS.
- Reinstatement of the monitoring station in WL 27 due to no imminent wetland alterations planned in this extent of the wetland.
- Initiation of a general visual observation (station WL 2.3) in the northern, western lobe of WL 2.
- Initiation of general visual observation monitoring within wetlands that have not been monitored to date (WL's 20, 23, 42, 14, 17, 26, and 35)
- Initiation of monitoring within WL's 34 and 35 which are adjacent to the clay borrow expansion area.

(2) MEL recommends further investigation of the extent of the potential indirect wetland changes within WL22 during the 2021 growing season. In consultation with the NSE wetland specialist, a scope of work should be designed for evaluating the extent of potential indirect wetland loss within WL 22 and potential wetland compensation requirements associated with the losses. The detailed monitoring plan for WL 22 should be submitted for approval to NSE in Spring 2021 in order for it to be implemented on or before June 01, 2021.

(3) MEL recommends that the PCM study continues in 2021 for future comparability of conditions to occur. Surveys should be completed during the same time period as 2020 surveys and by the same personnel (where possible) to reduce seasonal and surveyor bias. A 2021 PCM report will present the results of 2021 monitoring and compare conditions to the 2016, 2017, 2018, 2019 and 2020 monitoring data. The report will be submitted to NSE on or before March 31, 2021. Wetland approval conditions state that post-construction wetland monitoring shall be conducted for a period of no less than 5 years after all wetland alterations are complete or as directed by the Department.

LIST OF TABLES

APPENDICIES

1.0 INTRODUCTION

Atlantic Mining NS Inc. (AMNS) has received approval to alter 58.86 ha of wetland habitat associated with the Touquoy Gold Mine (Nova Scotia Environment Approval No. 2016-095967-04). The Touquoy Gold Mine is an open pit gold mine located in Moose River Gold Mines in Halifax County, NS (Figure 1, Appendix A). Construction of the Touquoy Gold Mine began in 2016 and wetland alteration activities are expected to occur throughout the lifetime of mine development.

To satisfy the conditions presented by Nova Scotia Environment (NSE) within the approval listed above, a Wetland Monitoring Plan (WMP) and associated baseline monitoring was completed in 2016, the results of which were provided to NSE in the Wetland Monitoring Plan and 2016 Baseline Wetland Monitoring Report (January 31, 2017). As per the recommendations in that report, Post-Construction Monitoring (PCM) has been completed annually, Monitoring was completed in July and August 2020 via implementation of detailed vegetation and hydrological evaluations, in combination with the completion of general visual assessments at previously established baseline locations within remaining unaltered wetland habitat. Modifications including reductions and additions to PCM program have been made throughout the program and are discussed herein. The 2020 post-construction monitoring results are compared to 2016 (baseline), 2017 and 2019 observations to determine whether areas of unaltered wetland habitat remain viable, and present healthy wetland characteristics.

2.0 OBJECTIVES

The objectives of the 2020 post-construction wetland monitoring program are as follows:

- Provide detailed descriptions of sampling methods and locations completed during 2020 as established and modified through the lifetime of the monitoring program as described in previous reports;
- Undertake substrate, vegetation and hydrology characterization within wetland habitats subject to alteration and/or subject to indirect alteration;
- Use specific performance indicators and sampling methodologies to determine whether remaining wetland habitat adjacent to new infrastructure has been indirectly impacted;
- Provide updated alteration footprint areas to inform the wetland compensation requirements for the Project; and
- Provide clear recommendations and scheduling for the future PCM program.

This report provides the 2020 PCM results from data collected during monitoring assessments. The results of this report are quantitatively and qualitatively compared to baseline and previous monitoring data collected between 2016 to 2019.

3.0 MONITORING SCHEDULE

As noted in the NSE Wetland Approval document #2016-095967-04, five years (or as determined by NSE) of PCM is required. It should be acknowledged that that potential indirect impacts as a result of up-gradient alteration activities may not be realized within down-gradient, or adjacent wetlands for multiple

years. Therefore, the PCM schedule will be approached as a dynamic process and based upon the observations recorded during previous years of PCM and the footprint of infrastructure across the Project Site. Based on the results of 2020 PCM, recommendations for future PCM are provided in this document (Section 8). Future PCM methods (beyond 2021) will be determined based on the current year's observations and are likely to comprise a combination of monitoring methods (i.e., detailed monitoring and general observations). Design and schedule of the PCM program will be adapted each year and outlined in each annual report thereafter.

3.1 Seasonal Considerations

As discussed in previous PCM reports for the Project, consistency in implementation timing of the PCM is a crucial in determining potential changes in wetland conditions. This is especially relevant to vegetation assessments completed along transects where the percentage of aerial coverage was assessed and has been compared over the life of the PCM program in addition to visual observation of hydrology. Detailed hydrological assessments (via MW and level loggers) were evaluated across the entire growing season and therefore results can be compared year to year with a high level of confidence.

To date, field assessments (general observations and vegetation assessments) completed for the PCM program were performed at the following dates:

- 2016: All general observation and vegetation assessments were completed in the last two weeks of May except for general observations completed in WL 22 and 40 which were completed the second week of June.
- 2017: All general observation and vegetation assessments were completed between July 13th and 19th.
- 2018: All general observation and vegetation assessments were completed during the middle two weeks of July except for general observations in WL 6 which were completed the third week of September.
- 2019: All general observations were completed in either the first or third week of August. All vegetation assessments were completed between July 31 and August 1.
- 2020: All general observations were completed in the last week of July and all vegetation assessments were completed during the second week of August.

As can be seen above, 2016 baseline evaluations were completed in late May-early June 2016. Completion of baseline surveys at this time was done so in order to obtain wetland characteristics prior to construction of Project Site infrastructure during June 2016. This time period reflects early growing season conditions when vegetation is typically exhibiting early season leaf out conditions and limited aerial cover. As a result, for this PCM program, seasonal timing of the baseline vegetative evaluation work is somewhat problematic for its applicability as a comparative tool moving through the subsequent monitoring years. While vegetation is a potential indicator of change in wetland functional characteristics, unless a drastic change is occurring (i.e., flooding, or extreme drying), shifts in vegetative composition and health is likely not identifiable for many years. As such it is used as one of multiple indicators of potential change to a wetland and is a component that is best used in tandem with other assessment criteria (i.e., hydrological monitoring, invasive species presence or visual observation etc.). As discussed in more detail within Section 5.1, analysis of vegetation has been done so by comparing multiple different years across the PCM program. While timing in surveying has been relatively consistent since 2017, it is

recommended that the comparative analysis of vegetation data between 2017 and 2020 be used as the precursor to potential change, which is explored more in Section 5.1. Furthermore, comparison of visual hydrological conditions throughout the monitoring period has not been limited to the single monitoring event completed in 2016 (baseline). Rather, conditions have been evaluated over the entire monitoring period (4 years) to understand potential trends and shifts in conditions and wetland characteristics (if occurring).

4.0 METHODS

The 2020 PCM methods draw on the specific terms and conditions from the NSE approval and recommendations provided in previous PCM reports, general current NSE guidance, and methods utilized during the 2016 baseline monitoring program. The MEL team was composed of Andy Walter (project management and study design) and Ryan Gardiner (field monitoring and report writer). *Curriculum Vitae* for the MEL team members are provided in Appendix B.

2019 PCM methodologies were repeated during the 2020 PCM program in order to evaluate wetland health, topography, vegetation, and hydrological conditions within remaining wetland habitat of altered wetlands, or within wetlands down gradient of project infrastructure. It should be noted that the one location (WL 41) which is located within 30m and downgradient from Project infrastructure was monitored for the first time in 2017, therefore 2017 results are considered baseline conditions for this wetland, whereas 2016 is considered baseline results for all other wetlands.

Some monitoring locations were removed and not monitored during the 2020 PCM due to additional wetland alteration requests (WLs 36, 43 and 44) and a property access issue (WL28). These instances are discussed separately in Sections 4.1, 4.3 and 6.0. The data gathered during the monitoring program will be used to record any potential impact to overall wetland health as a result of construction activities/project infrastructure, and to compare hydrological, topographical, substrate and vegetative conditions to determine potential shifts in wetland characteristics and functions.

Design of the wetland PCM program was done in 2016 and based on proposed mine infrastructure locations and footprint. As discussed further in Section 6, as part of the 2020 PCM program the Project team have reviewed the current PCM program and monitoring locations in relation to current and proposed mine infrastructure and have recommended modifications accordingly.

4.1 Vegetation Monitoring

General and detailed vegetation assessments were completed in July 2020.

NSE (2017) state that forested swamps are capable of receiving as much as +30 cm of short-term inundation and are described as being the most sensitive to long term inundation as a result of their woody plant composition which is ill accustomed to prolonged inundation. As such, forested swamps which become inundated on a consistent basis are likely to see vegetation dying in comparison to other wetland types, (wet meadows, fens and marshes) which are composed primarily of perennial non-woody vegetation and are capable of re-establishing quicker during drier periods from seed banks left in the substrate (Keddy, 2010).

Conversely, reductions in the supply of water into a wetland can cause a drying effect which can cause plant responses such as wilting and lack of leaves, poor flower development and encroachment and establishment of woody vegetation that established better in drier conditions. Establishment of alien and invasive plants can also be used as an indicator of change within wetlands subject to in-direct alteration.

The following sections outline the methods of monitoring completed at the Project Site to determine if the above scenarios are occurring.

4.1.1 General Wetland Health Observations

General observations were completed at numerous locations and consisted of evaluating wetlands directly adjacent (i.e., within 30 m) to alterations as well as wetlands downstream from project infrastructure to monitor for indirect impacts (Figure 2, 2A-C, Appendix A). Vegetative observations were completed visually to assess overall vegetative composition, vegetation health, and presence of invasive species or species at risk. The presence of additional wetland stressors (siltation/sedimentation, ground disturbance/rutting, etc.) were also recorded for comparison of overall wetland health to baseline observations. General observation locations, and changes to the monitoring program compared to the 2019 program are described in Table 1.

Table 1: 2020 PCM General Assessment Locations

Wetland ID	Location ID	Zone	Location UTM		2019 PCM	2020 PCM
			Easting	Northing		
1	1-1	20	504813	4980881	No Change	No Change
6	6-1	20	505747	4980676	No Change	No Change
	6-2	20	505742	4980831	No Change	No Change
15	15-3	20	505322	4982235	No Change	No Change
	15-4	20	505642	4982080	No Change	No Change
	15-5	20	505379	4982367	No Change	No Change
22	22-1	20	504222	4981611	No Change	No Change
	22-2	20	504042	4981544	No Change	No Change
	22-3	20	503981	4981522	No Change	No Change
30	30-1	20	505466	4981334	No Change	No Change
33	33-1	20	506898	4979870	No Change	No Change
36*	36-1	20	505285	4981447	No Change	Removed – Wetland approved for complete alteration
40	40-3	20	504535	4980673	No Change	No Change
	40-4	20	504777	4980691	No Change	No Change
41**	41-1	20	504647	4980645	No Change	No Change
43*	43-1	20	504563	4980766	No Change	Removed – Wetland approved for complete alteration

Wetland ID	Location ID	Zone	Location UTM		2019 PCM	2020 PCM
			Easting	Northing		
44*	44-1	20	505674	4981525	No Change	Removed – Wetland approved for complete alteration

**General Observation sites 36, 43 and 44 were removed from the 2020 PCM having been approved for complete wetland alteration under the 2016-095967-04 Amendment.*

*** Indicates a wetland being monitored as a result of it being within 30m of development. Baseline conditions recorded in 2017.*

4.1.2 Detailed Vegetation Transects

Detailed vegetation transects (VT) were established during the baseline monitoring program and revisited annually (Figure 2 and 2A-C, Appendix A). Transects were comprised of three to four quadrats (Quadrat 1 to Quadrat 5) each and extended approximately 30 m to 40 m away from alteration areas. Table 2 provides the locations of transects and indicates instances of changes to the program since 2016 as a result of unforeseen Project activities.

Table 2: 2020 PCM Vegetation Transect Locations

WL ID	Transect #	(2016) # of quadrats	(2020) # of quadrats	Transect Origin UTM		PCM Comments
				Easting	Northing	
1	1	4	4	506611	4980139	No Change
6	1	4	4	505735	4980690	Loss of Q1 in 2017[1] Establishment of Q5 in 2018
	2	4	3	505733	4980837	Loss of Q1 and Q2 in 2017[1] Establishment of Q5 in 2018[2]
	3	0	4	505707	4980605	Establishment of transect in 2018 as per 2017 recommendations
	4	0	4	505585	4980943	Establishment of transect in 2018 as per 2017 recommendations
15	1	4	4	505469	4981790	Loss of Q1 in 2017[1] Establishment of Q5 in 2018
	2	4	4	505397	4982081	Loss of Q1 in 2017[1] Establishment of Q5 in 2018
22	1	4	4	504212	4981138	No Change
	2	4	4	504209	4980981	No Change
	3	0	4	504206	4980948	Establishment of transect in 2018 as per 2017 recommendations
	4	0	3	504183	4981007	Establishment of transect in 2018 as per 2017 recommendations[3]
	5	0	4	504165	4981083	Establishment of transect in 2018 as per 2017 recommendations
32	1	4	4	504815	4981581	No Change
40	1	4	4	504796	4980615	No Change
	2	4	4	504571	4980586	No Change

[1] *Original baseline monitoring quadrats have been lost as a result of project activities.*

[2] *Q6 could not be established due to open water bisecting the wetland habitat.*

[3] *Q4 could not be established due to insufficient space between wetland edge and Moose River*

A rigid 1 m x 1 m gridded sampling frame was used to clearly delineate the boundaries of the quadrats. Vegetation was assessed via species absolute percent cover estimation; the herb stratum was assessed by documenting all species and their percent cover. Absolute percent cover estimates were also completed for shrub and trees within an estimated 10 m radius of the quadrat for the tree stratum, and 5 m radius of the quadrat for the shrub stratum. Tree and shrub strata were assessed by visual assessment for indications of wetland stressors and plant health.

Characteristics of wetland substrates were recorded within each sampling quadrat, including percent cover of water, muck, moss, and exposed stone or mineral soil (adding up to 100 with the exception of when standing water was observed and substrate was visible through standing water).

The above data was utilized as part of the evaluation of the following three performance indicators. This approach recognizes that several indicators will capture the complexity of impacts and responses that may occur in remaining wetland habitat post-construction, better than a single indicator.

4.1.2.1 Invasive Alien Species

MEL documented percent cover and number of invasive alien species (IAS) observed in all quadrat locations during the study. Invasive species present in the wetland were identified using a list compiled from several sources, including Hill and Blaney (2009), Belliveau (2012), and CARP (2007). A change in the vegetation community is indicated when the occurrence of alien or invasive plants increases significantly. This indicator is satisfied when either of the following criteria are achieved:

- The absolute percent cover of IAS increases by more than 20% within a single transect, from the baseline value, or
- The number of invasive alien species present within a single transect increases by two between any two consecutive years of monitoring.

4.1.2.2 Prevalence Index

The Prevalence Index (PI) for each transect was calculated using the species-specific wetland indicator ranking of the NSE 2011 Wetland Plant Indicator list and the respective absolute abundance of each species in the herbaceous stratum. PI uses the methodology described by the U.S. Army Corps of Engineers (2009). It serves as a tool to evaluate change in vegetation communities (Spieles *et al*, 2006). The PI identifies with a numerical value the overall wetness or dryness of the plant community. The higher the number, the drier the plant community. Vegetation is considered hydrophytic where the PI value is less than or equal to three.

MEL determined the relative percent difference (RPD) of the PI between transects (using identical quadrat locations) across the herbaceous stratum. Year to year change in the PI greater than 30% is considered an indicator of change, warranting further investigation. This threshold was also adopted from ECA methodologies (2011) and is considered conservative and should be reviewed in the future as more duplicate analysis becomes available.

The following calculation is used to calculate relative percent difference (RPD):

$RPD = 100 * |X_1-X_2|/((X_1+X_2)/2))$

Where X_1 and X_2 are the two measurements being compared from year prior and current year respectively and the "|" symbol means *absolute value*, so negative becomes positive.

4.1.2.3 Visual Assessment

Making use of photographic documentation, visual surface profile assessments, dominant species compositions and professional judgement, a qualitative assessment of changes to biological and vegetative aspects of the wetland was made by experienced wetland scientists. Photographic documentation, substrate characteristics and dominant species cover per detailed vegetation transect were recorded. This information was examined within the context of any quantitative changes observed.

4.2 Topography

Wetland topography is described using visual assessments of surface grade trends to identify potential macro changes (concave vs. convex vs. sloped) in surface topography resulting from construction activities. Concave surfaces include basin type surface wetlands, convex are raised wetland surfaces which slope down away from the wetland in all directions and sloped include an identifiable dominant sloped wetland surface. Topographical observations were completed at all general observation locations and detailed vegetation transects as described in Tables 2 and 3 (Figure 2 and 2A-C, Appendix A).

4.3 Hydrology

General and detailed hydrology assessments were completed for the 2020 PCM program. General hydrology observations were completed concurrently with general vegetation observations in July 2020. Detailed hydrology was performed by utilizing level loggers in monitor wells.

4.3.1 General Hydrology Observations

General hydrology observations were completed concurrent to general vegetation observations at locations described in Section 4.1.1 and Table 1 above. General hydrological observations included a general overview of hydrology and other pertinent information (i.e., drainage characteristics, evidence of flooding/drying etc.). All field data was incorporated into the General Observation data sheets described in Section 4.1.1 and provided in Appendix C. Representative photographs of wetland hydrology indicators (*e.g.*, saturated surfaces, pooling water, standing water, drainage channels etc.) were collected to document the general conditions and characteristics at each location, a sample of which are also incorporated into the data sheets provided in Appendix C.

4.3.2 Detailed Hydrology

Monitoring wells (MW) were installed during the 2016 baseline monitoring event with the exception of MWs 6-2 and 22-3 which were incorporated into the monitoring program in 2018. Leveloggers were installed within monitoring wells on June 2, 2020 and recorded water levels until November 2020. The measurement of each monitor well portion existing above ground was recorded as the well height in June 2020. This was done to account for potential frost heave or settling that may have occurred since the baseline monitoring event. Monitor Well locations are provided in Table 3. The level logger within MW 6-2 malfunctioned on September 20, 2020 with no data collected beyond that date.

Table 3: MW Locations

Wetland ID	Monitor Well ID	Monitor Well UTM (Zone 20)	
		Easting	Northing
1	MW1-1	506622	4980104
	MW1-2	506671	4980551
6	MW6-1	505685	4980590
	MW6-2	505582	4980935
15	MW15	505448	4981791
22	MW22-1	504184	4980983
	MW22-2	504202	4981106
	MW22-3	504165	4981378
32	MW32	504814	4981591
33	MW33	506878	4979869

A Solinst levelogger was deployed in each of the monitor wells. The leveloggers were labeled with the established location and were attached to the j-plug cap with a string. A measurement of the length from the top of the monitoring well to the bottom of the levelogger was recorded as the levelogger depth. The levelogger was then lowered into the monitor well.

The leveloggers were set to collect data hourly. The software used to set and download the data is Levelogger 4.3.3. The data reading provides a pressure calculation in centimeters of water above the levelogger sensor. The data reading was compensated for barometric pressure using the data wizard tool in conjunction with barometric data collected by a Solinst barologger located at the Touquoy Project Site and managed by AMNS.

Relative ground water depth (RGWD) was calculated as a function of the well height less the levelogger depth plus the compensated data reading. Data was retrieved from each logger throughout each of the 2016, 2017, 2018, 2019 and 2020 monitoring periods, and the relative ground water average for the growing season (June 1 to September 30) was calculated and compared during the annual PCM events.

5.0 EVALUATION OF RESULTS

The methodology and data collection techniques used during the baseline and annual PCM programs will facilitate repetition of the process during subsequent years, enabling conclusions to be drawn regarding ecological integrity of the wetlands being studied.

The following sections (and associated data presented in Appendices C-F, outline the results of the 2020 PCM program and compare conditions throughout the PCM program to identify potential changes from baseline conditions as well as overall trends across the PCM program.

5.1 Vegetation

The vegetation monitoring completed at the Project Site is one component of evaluating whether in-direct impacts are occurring in any of the wetlands being monitored as part of the PCM program. As discussed

in Section 3.1, due to the timing of the 2016 baseline surveys (late May/early June 2016), the 2017 vegetation data is considered a more accurate baseline dataset to compare to for the vegetative component as a result of seasonal timing consistency in surveying over the program. However, general discussion of trends is provided in the sections below for results across the entire PCM program to date.

5.1.1 General Vegetation Results

General assessment tables (C1-C14) are provided in Appendix C. The upper section of each table outlines the hydrological and wetland health conditions observed during the baseline (2016 and PCM (2017 to 2020) periods, including preceding rainfall events. The lower section of each table provides comparison photographs of representative wetland habitat from baseline (2016), 2019 and 2020 PCM. The following is a summary of observations regarding wetland health noted throughout the evaluation.

- General observation locations 36, 43 and 44 were not assessed in 2020 as the remaining wetland habitat was approved for complete alteration under Approval # 2016-095967-04;
- Baseline photographic documentation and observations made by experienced wetland scientists confirmed that no invasive species or species at risk were recorded at any of the general observation locations.
- No visual evidence of changes to the health or composition of vegetation were observed at the general observation locations in 2020, nor have any trends of the same been identified across the PCM program to date.

5.1.2 Detailed Vegetation Results

As described in Section 4.1.2, three indicators (Invasive Alien Plants, Prevalence Index and Visual Assessment) were used to evaluate potential impact to ecological health of remaining wetland habitat. The following sections provide the results of the 2020 PCM detailed vegetation assessments.

Representative photographs from baseline (2016), Year 3 (2019) and Year 4 (2020) PCM are provided in Photos E1 - E45 (Appendix E).

5.1.2.1 Indicator 1: Invasive Alien Plants

Detailed vegetation transects used the presence of Invasive or Alien Species as indicators of change to assess the ecological health of remaining wetland habitat. As is evident in data tables D1-15 provided in Appendix D, no invasive or alien species were identified within any quadrats assessed as part of baseline, and subsequent years of PCM monitoring studies. This indicates that the wetlands evaluated at the detailed vegetation locations are not exhibiting an in-direct change in vegetative characteristics (as indicated by invasive alien plants) as a result of site activities.

5.1.2.2 Indicator 2: Prevalence Index

Detailed vegetation transects used the RPD of the herbaceous stratum PI values as an indicator of change to assess the ecological health of remaining wetland habitat. Estimated species absolute abundance coverage at quadrat locations are provided for each transect in Tables D1-15 in Appendix D. Results indicate that minor vegetative community changes did occur between baseline and subsequent monitoring periods, which includes some vegetation species becoming more established and some species becoming less dominant through natural variation and seasonal differences between monitoring events. Vegetation

documented throughout this process indicated the presence of viable wetland communities and typical species composition for the wetland types to which the species were colonized.

Table 4 presents the transect average prevalence indices as calculated using the respective quadrat herbaceous stratum data. The data will be used to determine whether the wetland vegetation is trending towards a drier or wetter moisture regime in amounts greater than natural variability using relative percent difference (RPD).

Table 4: Transect Average Prevalence Index (PI) and Relative Percent Difference (RPD) values

WL #	Transect #	Transect Average PI Value					RPD (%)[2]		
		2016	2017	2018	2019	2020	2016 -2020	2017 - 2020	2019 - 2020
1	1	2.55	2.70	2.65	2.84	2.59	+1.56	-4.16	-9.21
6	1	1.74[1]	2.03	1.83	1.75	1.74	0.00	-15.38	-0.57
	2	1.60[1]	1.04	1.03	1.03	1.21	-27.76	+15.11	-16.07
	3	-	-	1.84	1.92	1.98	---	---	+3.08
	4	-	-	2.23	2.14	2.11	---	---	-1.41
15	1	2.16[1]	2.41	1.90	2.54	2.62	+19.25	+8.35	+3.10
	2	2.52[1]	2.79	2.63	2.48	2.58	+2.35	-7.82	+3.95
22	1	1.83	2.31	2.20	2.20	2.13	+15.15	-8.11	-3.23
	2	1.69	2.18	2.12	1.92	2.55	**+40.57**	+15.64	+28.19
	3	-	-	1.95	2.10	2.06	---	---	-1.92
	4	-	-	2.03	2.03	1.96	---	---	-3.51
	5	-	-	1.96	1.90	1.97	---	---	+3.62
32	1	2.40	2.55	2.25	2.54	2.63	+9.15	+3.09	+3.48
40	1	1.99	2.19	2.13	1.87	1.83	-8.38	-17.91	-2.16
	2	2.58	2.74	2.57	2.81	2.81	+8.53	+2.52	0.00

Note: A prevalence index value equal to or less than 3 indicates hydrophytic vegetation

**Baseline PI values for Wetland 6 Transect 1 and Transect 2 as well as Wetland 15 Transect 1 and Transect 2 were adjusted to compare only the PI average for quadrats that remained during both, 2019 and 2020 PCM.*

[2] A + value indicates that the PI Value has shifted to a drier plant composition, whereas a – value indicates a wetter plant composition.

PI values calculated for 2020 indicated the presence of a hydrophytic vegetation (< 3) in all wetlands monitored. None of the transects assessed during the 2020 PCM program were observed to have a > 30% change in PI values when compared to the previous year (2019) or to 2017 (when timing of seasonal assessments was consistent to 2020).

However, the PI Value of Transect 2 in Wetland 22 was observed to be 2.55 in 2020 which is an increase in RPD of 40.57% from baseline (2016) data, indicating a drier trend in the vegetative composition. The increase in PI within Transect 2 in Wetland 22 is due to the increased prevalence of Blackberry (*Rubus allegheniensis*) observed from 2017 to date as described in Table E4 (Appendix E). The observed increased aerial cover of Blackberry in Transect 2 in Wetland 22 may be explained by seasonal variability as baseline data was collected in May 2016. Table 5 provides a comparison of annual RPD of PI values in

Wetland 22, Transect 2 and displays that the > 30% threshold is not surpassed if 2017 data is considered representative of baseline conditions (reducing seasonal variability). However, it should also be noted that when comparing 2017 results to subsequent monitoring years, RPD values indicate a wetter shift in 2018 and 2019 but a drier shift in 2020. Therefore, in summary these results do not provide a definitive conclusion regarding vegetative conditions at this monitoring station and are best coupled with results of detailed hydrological monitoring to determine if there is a trend occurring at this monitoring location (See Section 5.3.2).

Table 5: Annual Relative Percent Difference of Prevalence Index Values in Wetland 22, Transect 2.

Wetland 22, Transect 2 RPD (%)				
Comparison Year	**Monitoring Year**			
	2017	**2018**	**2019**	**2020**
2016	+25.32	+22.57	+12.74	+40.57
2017	---	-2.79	-12.68	+15.64

A + value indicates that the PI Value has shifted to a drier plant composition, whereas a – value indicates a wetter plant composition.

5.1.2.3 Indicator 3: Visual Assessment of Wetland

Visual assessment of remaining wetland habitat qualitatively evaluated dominant species composition and substrate characteristics. Photographic documentation was recorded during the detailed vegetation monitoring to support the evaluation of assessing the health of remaining wetland habitat (Photos E1-E45).

Dominant Species

Dominant species composition of detailed vegetation transects are provided in Tables E1-E6, Appendix E. Results indicate that minor vegetative community changes appear to have occurred over the PCM program, which includes some vegetation species becoming more established (i.e., dominant) over the monitoring period, and some species becoming less dominant. However, based on the variable seasonal timings of surveys, and inherent nature of surveyor bias from year to year, none of the individual instances of dominance changes across the PCM program are considered substantial enough to classify them permanent shifts in vegetative composition within the wetlands assessed.

Substrate

Wetland substrate characteristics were predominantly consistent across all PCM monitoring events. No evidence of increased water was observed at any quadrat locations during the 2020 PCM. Minor shifts in in the presence of surface water, muck and moss were observed in Wetlands 6 and 22 but are attributed to the natural succession of moss over exposed surfaces and seasonal timing of surveys (surface water). Similarly, the increase of exposed mineral soil or stone observed in Wetlands 15 and 22 can be attributed to natural factors (e.g., upturned tree roots from blow down). Substrate characteristic results are provided in Tables E7-12 (Appendix E).

Baseline photographs and observations collected by the experienced wetland scientist indicates that overall wetland health and vegetative cover appear unaltered at all detailed vegetation monitoring locations.

5.2 General Topography Results

Topographical visual surveys were completed in July and August 2020 the results of which are presented in the general observation and substrate data tables provided in Appendix C and E respectively. Aside from recorded variations in Wetland 30 as discussed in previous reports, no variations in general topography were observed within the remaining wetland habitat monitored (i.e., no evidence of wetlands changing from concave to sloped or convex surfaces during the PCM program).

5.3 Hydrology

5.3.1 General Hydrology

General observation data sheets are provided in Tables C1-C17 (Appendix C). The upper section of each table outlines the hydrological conditions observed during each baseline and Year 1 to Year 4 PCM, including preceding rainfall events. The lower section of each table provides comparison photographs of representative wetland habitat from baseline (2016, 2019 and 2020 PCM).

General observations indicate all wetlands assessed retain healthy hydrological characteristics. Minor visual changes in hydrological indicators were observed between the 2019 and 2020 PCM periods at General Observation points 15-3, 15-4, 40-3, 40-4 and 41 (observed intermittent surface water present in 2020) and General Observation points 20-3 (observed dry season water table in 2020). General observations were completed following a recent precipitation event during 2020 PCM which is likely to have influenced the above changes in secondary hydrological indicator observations. At this time, these outliers do not indicate a hydrological change.

No definitive hydrological trends or changes in conditions were identified when comparing all monitoring events from 2016 to 2020. In general, hydrological indicators are similar from year to year with minor variations (e.g., no water-stained leaves recorded Wetland 30 in 2016) attributed to seasonal and previous precipitation variations. Vegetation and future hydrological conditions will continue to be monitored to determine if wetland characteristics are being affected.

5.3.2 Detailed Hydrology Results

The US Army Corp (2009) stipulates that wetland hydrology is defined as saturation of soils 20cm below the surface or groundwater levels within 30cm of the surface for a period of two consecutive weeks in the growing season. As such, recorded hydrology was determined to be ecologically healthy for wetland habitat if the following conservative conditions were met:

- Relative ground water depth was greater than -30cm for at least two consecutive weeks in the growing season;
- Relative ground water depths did not exceed +30cm for a prolonged period; and,
- That hydrological trends are consistent (while allowing for seasonal variability) across the PCM program.

Wetlands regularly undergo seasonal Relative Groundwater Depth (RGWD) fluctuations in response to annual precipitation, seasonal variability and frequency of local precipitation events. Geographically isolated wetlands have been reported to have seasonal fluctuations ranging as high as ±20cm by Keddy, 2010. Conversely the same publication stated that wetlands associated with lakes and watercourses were

found to have seasonal variability as high as ± 1.5m. As such, comparison between baseline and subsequent monitoring hydrology results is discussed using the relative ground water average with a fluctuation greater than ± 20cm determined to warrant further investigation. The relative ground water average was calculated for each of the baseline and subsequent monitoring events using the data collected during the growing season (June 1 to September 30).

Detailed hydrology results including hydrographs indicating water levels during all monitoring years within wetlands are provided in Figures F1-F10 (Appendix F).

Calculated average water levels between all PCM events are provide in Table 6.

Table 6: 2016 to 2020 Average Relative Ground Water Depths and Precipitation Totals

MW ID	June 1 to September 30 Average RGWD (cm)					Change in Average RGWD 2016 to 2020 (cm)
	2016	2017	2018	2019	2020	
MW 1-1	-8.1	-3.9	-3.2	-9.0	-2.0	+6.1
MW 1-2	-15.8	-11.7	-3.2	-2.6	-19.3	-3.5
MW 6-1	-23.2	-19.8	-30.7	-30.5	-36.7	-13.5
MW 6-2	-	-	-30.8	-18.3	-22.7	+8.1
MW 15	-8.7	-11.3	-11.3	-4.8	-6.7	+2.0
MW 22-1	-40.0	-47.3	-53.9	-65.3	-69.4	-29.4
MW 22-2	-21.6	-25.0	-28.0	-30.5	-28.6	-7.0
MW 22-3	-	-	-9.4	-12.0	-12.5	-3.1
MW 32	-11.3	-10.3	-7.8	-11.3	-9.5	+1.8
MW 33	-14.9	-13.1	5.6	3.4	0.1	+15.0
	May 15 to September 30 Total Precipitation (mm)					
	320.3	495.5	440.7	454.4	409.0	

From 2016 to 2020 the Halifax Airport weather station recorded precipitation amounts between 320.3 mm to 495.5 mm from May 15 to September 30. In 2020, 409 mm of precipitation was recorded during this time period. As discussed in previous reports, 2016 (320.3 mm) was an uncharacteristically dry year in Nova Scotia with Environment Canada recording only 29% of the normal rainfall expected in Southwestern Nova Scotia (Saltwire Network 2016).

The RGWDs in MWs 6-2, 22-1 and 22-2 were observed to be below the minimum capacity of the sensor at multiple points throughout the 2020 monitoring periods, as displayed by a straight line in the 2020 data in Figures F9, F6 and F5 respectively. As such, the calculated averages displayed in Table 5 for these monitoring wells represent a higher value than average RGWD in reality (i.e., they are showing wetter conditions than actually present).

All monitoring wells with the exception of MW 22-1 and 22-2 displayed RGWDs of greater than -30 cm for two consecutive weeks in the growing season yet remained below +30 cm for prolonged periods of time. Additionally, MW 22-1 saw a fluctuation in average RGWD of greater than 20 cm of its recorded baseline value (2016). As can be noted in Figure F5 (Appendix F) MW 22-1 ranged from a maximum RGWD of -26.8 cm to a minimum of -76.8 cm. However, it should be noted that the minimum recorded

value of -76.8 cm is the installation depth of the level logger and the actual minimum RGWD at MW 22-1 is presumed to be even lower in reality[1].

The average RGWDs in MW 6-1 and 6-2 responded accordingly to total precipitation during the monitoring period (i.e., higher average during higher rainfall amounts). Whereas, MWs 22-1 and 22-2 have been trending drier since monitoring began in 2016 regardless of seasonal precipitation values. No discernible trends in average RGWDs in MWs 1-1, 1-2, 15, 22-3, 32 and 33 were observed.

Wetland 22

Monitoring wells 22-1 and 22-2 did not record RGWD of greater than -30 cm for two consecutive weeks during the growing season. The US Army Corp (2009) specifies that this must occur in order for a positive determination of wetland hydrology to be made. Floodplain wetlands can often present dry conditions during the growing season due to lack of riverine flooding. This can lead to a lack in evidence of Primary Wetland Indicators that are required to be present as per the US Army Corp (2009) methodologies for determining wetland habitat. Upon review of biophysical information collected within WL22 during 2015 field assessments (in support of provincial wetland permitting), generally conditions across the wetland included evidence of a dry season water table within 30 cm, saturated surfaces within 20 cm and intermittent surface water in some areas of the wetland. However, no detailed soil pits and associated examination of hydrology were completed in close proximity to the monitoring stations being evaluated as part of the PCM program. The sandy soils and vegetation (blackberry) present at MW22-1 (and surrounding VT's) suggests that the wetland habitat directly adjacent to Moose River at this location was always a borderline wetland habitat as per the Army Corps methods. Based on the relatively dry nature of this portion of the wetland prior to mine development, it is a plausible to conclude that any reduction in hydrological input to the system (whether via river flooding, or up -gradient sources) has potential to effect hydrological characteristics and associated wetland designation. Additional discussion regarding WL 22 and its viability as well as future monitoring in this wetland is provided in Section 6.2.1.

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[1] *This is evident in Figure F6 (Appendix F), by a flat line on the hydrograph during 2020 as the level logger was not deep enough to be below ground water. This varies from previous years where the logger was able to be installed approximately 10 cm deeper than it was during 2020. Monitoring well 22-1 was shifted slightly from a downed tree during winter 2020 and shallow soils prevented it from being installed to the depth it was done so during 2020.*

6.0 PROGRAM MODIFICATIONS

As discussed in Section 3.0, design of the wetland PCM program was done so in 2016 and based on proposed mine infrastructure locations and footprint. Since 2016 infrastructure layout for mining operations within the Project Site have varied in some cases. This has resulted in the need to obtain amendments to the Project wetland alteration approval to permit additional wetland alterations. In other cases, less wetland area has been altered than initially permitted in 2016 (this can be seen in Table 7). As a result of infrastructure layout changes, the locations of monitoring stations designed for the Project Site in 2016 have been reviewed for their applicability in the PCM program moving forward. Other wetlands proposed for alteration, but which may not be altered have been considered under the perspective of whether they warrant wetland monitoring moving forward.

6.1 Modifications Review

Table 7 (below) has been compiled the review all modifications made to date throughout the PCM program, the year and method of communication to NSE and a up to date evaluation of recommendations moving forward. All monitoring stations are presented on Figure 2 (Appendix A).

Table 7: PCM Modifications Review

Wetland Monitoring ID	Type of Monitoring	Modification Rationale and Communication Method	Recommendations for 2021 Program	Included for Compensation in Table 9?
2.1	General	Stated in 2018 PCM report that wetland indirectly altered and no monitoring moving forward.	None	Yes
2.2	General	Stated in 2019 PCM report that wetland indirectly altered and no monitoring moving forward. Further assessment of field conditions indicates that the western lobe of northern portion of remaining wetland habitat is still viable.	Initiate monitoring in western lobe of northern extent of wetland, compensate for eastern lobe.	Yes, eastern lobe of northern extent of WL 2.
11.1	General	Stated in 2019 PCM report that wetland indirectly altered and no monitoring moving forward.	None	Yes
27	VT and MW	Initially proposed for alteration as per the July 2019 Wetland Alteration Amendment for the Touquoy Gold Mine submission. Alteration was planned as part of proposed pit expansion IA Amendment Application which was retracted in 2020. No monitoring in 2020 as communicated in the 2019 PCM report.	No current plans to alter additional area within WL 27. Therefore, reinstallation of the monitoring station within unaltered portion of WL 27 will commence in 2021.	Yes, altered areas only

Wetland Monitoring ID	Type of Monitoring	Modification Rationale and Communication Method	Recommendations for 2021 Program	Included for Compensation in Table 9?
28	VT and MW	Monitoring removed due to inaccessibility to private land as communicated in the 2019 PCM report.	Land has been purchased by AMNS in 2020. Reinstallation of the monitoring station within unaltered portion of WL 28 will commence in 2021.	Yes, altered areas only
29	General	Stated in 2019 PCM report that wetland indirectly altered and no monitoring moving forward.	None	Yes
36.1	General	Initially proposed for alteration as per the July 2019 Wetland Alteration Amendment for the Touquoy Gold Mine submission. No monitoring in 2020 as communicated in the same document.	No plans to alter within WL 36. Therefore, initiate monitoring during 2021.	No
43.1	General	Wetland fully altered (directly). No monitoring in 2020 or moving forward as communicated in the July 2019 Wetland Alteration Amendment for the Touquoy Gold Mine submission.	None	Yes
44.1	General	Initially proposed for alteration as per the July 2019 Wetland Alteration Amendment for the Touquoy Gold Mine submission. No monitoring in 2020 as communicated in the same document.	No plans to alter within WL 44. Therefore, initiate monitoring during 2021.	No
45.1	General	Stated in 2017 PCM report that wetland directly altered and no monitoring completed post 2016.	None	Yes

As can be noted, multiple small, fragmented areas of wetlands that have been previously altered have been subject to various extents of indirect alteration and were considered by the Study Team in previous years as fully altered (WL's 2.1, 2.2, 11.1, 29 and 45.1). These recommendations and subsequent modifications to the PCM program were communicated in previous PCM annual reports and wetland alteration applications. In one instance (WL monitoring location 2.2), which is in the eastern lobe of the northern extent of remaining WL 2, wetland conditions have been indirectly altered and this portion of the wetland is considered altered (See Figure 3, Appendix A). However, in the western lobe, wetland conditions appear unchanged, and monitoring will be initiated within it during 2021.

In two instances (WL's 36.1 and 44.1), adjacent mine activities warranted additional permitting for proposed alteration and subsequently monitoring was not completed in the wetlands during 2020. However, based on current development plans for mine infrastructure and activities, additional alteration

in these wetlands is not currently expected. As such, monitoring is proposed to be reinstated in WL's 36.1 and 44.1 during 2021.

Wetland 43.1 was permitted in 2020 and fully altered and as such monitoring will not proceed moving forward.

Wetland 27 was monitored between 2016 and 2018, however in 2019, AMNS proposed and intended to alter the remaining area of the wetland as part of previously proposed pit expansion and monitoring was stopped. Development plans within the area have since changed and at this time there is currently no plan to alter additional area within WL 27. Therefore, the Study Team recommends reinstalling the monitoring station within unaltered portion of WL 27 and continuing to evaluate its conditions throughout the PCM program.

WL 28 was monitored between 2016 and 2018 however in 2019 the monitoring station was removed from WL 28 due to it being located on private property. This property (PID#00642793) has since been purchased by AMNS and therefore reinstatement of the monitoring station will occur in 2021.

6.2 Recommended Future Modifications

The Project Team have also reviewed the locations of wetlands across the site that were not included as part of the original 2016 monitoring plan, but which may require monitoring as a result of project infrastructure and site activities today.

The recommendations presented in Table 8 fall into one of the following categories:

1) Wetlands previously proposed for complete alteration (2016 or subsequent amendment) where no alteration has occurred, and no wetland monitoring has occurred to date;
2) Wetlands previously proposed for complete alteration (2016) where a partial alteration has occurred, and no monitoring has occurred to date;
3) Wetlands hydrologically connected to upgradient wetlands either directly or indirectly altered and no monitoring occurred to date; and,
4) Wetlands adjacent to the clay borrow expansion area where initiation of monitoring is recommended due to nearby site activities.

Table 8: Modifications Recommendations

Wetland Monitoring ID	Discussion	Recommendation
1) No Alteration, No Monitoring		
20	Development alongside wetland boundary.	Initiate monitoring in 2021.
23	Mooseland Road adjacent to wetland boundary.	Initiate monitoring in 2021.
42	Mooseland Road adjacent to wetland boundary.	Initiate monitoring in 2021.

2) Partial Alteration, No Monitoring		
14	Partially altered. No additional alteration currently planned.	Initiate monitoring in 2021.
17	Partially altered. No additional alteration currently planned.	Initiate monitoring in 2021.
3) Hydrologically Connected, No Monitoring		
26	Down gradient and hydrologically connected to former WL 1 and the TMF.	Initiate monitoring in 2021.
4) Adjacent to Clay Borrow Expansion Area		
34 and 35	Down gradient and hydrologically connected to WL 29 and WL 30. WL 34 contains blue felt lichen (see discussion below).	Initiate monitoring in 2021.

As can be noted, three wetlands (WL's 20, 23 and 42) are unaltered but due to adjacent infrastructure general wetland monitoring is proposed to occur in 2021 to document conditions.

In two wetlands (WL's 14 and 17), partial alteration has occurred within wetlands that are completely permitted. Since no additional alteration is currently planned in these wetlands, general wetland monitoring is proposed to initiate in 2021.

Two wetlands (WL's 26 and 34) exist down gradient and hydrologically connected to wetlands that have been altered by mine activities. WL 26 which is fully permitted is down gradient from extensive up-gradient wetland alteration (former WL 1), is not currently planned to be altered and as such general wetland monitoring is proposed to initiate in 2021.

Wetland 34 is an unpermitted wetland which is hydrologically connected to WL's 29 and 30 (previously altered) and is also adjacent to the clay borrow expansion area (Figure 3, Appendix A). An application for amendment to the Project Industrial Approval (IA) was submitted to NSE in Fall 2020 pertaining to the clay borrow expansion area and included a commitment to monitor WL's 34 and 35 which lie approximately 100 m east of the clay borrow area extent. An out of season monitoring assessment was completed by MEL in November 2020 within both wetlands to document conditions with an intention to add them to the monitoring program in 2021 and in the future. This commitment was provided to NSE Mining Engineer Christine Hynes via an email from Melissa Nicholson on November 4, 2020 and approved by NSE on November 6, 2020 when the amended IA was issued. During the said monitoring event a blue felt lichen was identified in WL 34 hence classifying it as a Wetland of Special Significance (WSS). As such proposed monitoring within WL 34 during 2021 and moving forward is proposed to include the installation of a monitoring well and datalogger (adjacent to the lichen) as well as installation of a vegetation transect and visual observations within the wetland. WL 35 will also be monitored in 2021 via general visual observations to ensure that the adjacent clay borrow activities are not indirectly affecting its characteristics and viability.

The Project Team recommends initiation of the monitoring within the wetlands discussed above during Summer 2021. The monitoring will compare conditions with those observations collected during baseline

wetland delineation and functional assessment surveys and a determination of whether viable, natural wetland communities and characteristics exist will be made. Results will be documented within the 2021 wetland PCM report.

6.2.1 Wetland 22

As discussed in Section 5.3.2, Monitoring wells 22-1 and 22-2 did not record RGWD of greater than -30 cm for two consecutive weeks during the growing season. The US Army Corp (2009) specifies that this must occur in order for a positive determination of wetland hydrology to be made. This is likely an indication of a reduction in water source such as up gradient water sources that no longer exist (i.e., ponds, mini pit) or run-off water contribution from previously existing upland that now comprises the mine, less frequent flooding of the Moose River, potential changes to groundwater table near the pit or a combination of these factors.

Conditions appear to have been indirectly altered at the specific monitoring stations within WL 22 since the start of the PCM program (2016) and MEL recommends further investigation of the extent of the potential indirect wetland changes within WL22 during the 2021 growing season. In consultation with the NSE wetland specialist, AMNS propose to design a monitoring plan specific to WL 22 that will focus on identification of the extent of potential indirect wetland loss within WL 22. Consultation and formalization of the plan will take place in Spring 2021 in order for implementation of the plan to occur within the growing season of 2021 (June 01 – September 30). Results of the specific monitoring will support potential additional compensation for lost wetland function within WL 22. Results will be discussed in detail in the 2021 Wetland PCM Report.

7.0 WETLAND ALTERATIONS

Since 2017 MEL have been utilizing a combination of drone imagery and GIS resources and field observations to identify the direct impact to wetland habitat across the Project Site. This process was also completed in 2020. However, in some cases (as discussed in Section 6), some wetlands have seen indirect effects as a result of adjacent mine activities, have been fully permitted and monitoring has ceased. As such, for the purposes of this report, the total area of wetland habitat altered across the site accounts for direct wetland alteration area AND areas of wetland habitat indirectly impacted and considered “altered”.

The results of the above process have determined that a total of **48.61** ha of wetland habitat has been altered (directly and indirectly) as of December 2020 across the Project Site. A visual representation of the current infrastructure footprint, and wetland alteration areas across the Project Site is provided in Figure 3 (Appendix A). Drone imagery is provided on Figure 4 (Appendix A).

Table 9 (below) identifies the direct alteration areas and wetlands considered indirectly altered as well as permitting that has been completed for the Project to date. **It should be noted that ALL wetlands considered directly or indirectly altered have been permitted.**

Table 9: Touquoy Wetland Alterations and Permits

Wetland ID	Original Permitted WL Alteration Area (ha)	March 2019 Amendment Additions (ha)	July 2019 Amendment Additions (ha)	January 2020 Amendment Additions (ha)	Unintentional Alterations (March 2019 Amendment)	Total Permitted WL Alteration Area (September 2020) - Not Including Unintentional	Direct Impact Alteration Area (ha, as of Dec 31, 2020)	Indirect Impact Alteration Area (ha, as of Dec 31, 2020)
1	27.5281	0	0	0	0.11	27.5281	25.72	0.00
2	6.0909	0.35	0	0	0.1318	6.4409	6.28	0.22
3	0.0613	0	0	0	0	0.0613	0.00	0.00
4	0.4529	0	0	0	0	0.4529	0.45	0.00
5	0.333	0	0	0	0	0.333	0.33	0.00
6	1.1608	0	0	0	0.49	1.1608	1.66	0.00
7	0.409	0	0	0	0	0.409	0.39	0.02
8	0.9961	0	0	0	0	0.9961	1.00	0.00
10	0.309	0	0	0	0	0.309	0.31	0.00
11	0.1093	0.14	0	0	0.1846	0.2493	0.33	0.10
12	0.0124	0	0	0	0	0.0124	0.01	0.00
13	0.9254	0	0	0	0	0.9254	0.88	0.04
14	1.9984	0	0	0	0	1.9984	0.82	0.00
15	4.1061	0	0	0	0.32	4.1061	0.99	0.00
16	0.1603	0	0	0	0	0.1603	0.16	0.00
17	0.606	0	0	0	0	0.606	0.02[1]	0.00
18	0.2317	0	0	0	0	0.2317	0.23	0.00
19	0.0483	0	0	0	0	0.0483	0.00[1]	0.00
20	0.0587	0	0	0	0	0.0587	0.00[1]	0.00
21	0.0702	0	0	0	0	0.0702	0.07[1]	0.00
22	2.3369	0	0	0	0	2.3369	1.70	0.06
23	0.2397	0	0	0	0	0.2397	0.00[1]	0.00
24	0.5693	0	0	0	0	0.5693	0.57	0.00
25	0.1057	0	0	0	0	0.1057	0.11	0.00
26	0.3234	0	0	0	0	0.3234	0.00	0.00

Wetland ID	Original Permitted WL Alteration Area (ha)	March 2019 Amendment Additions (ha)	July 2019 Amendment Additions (ha)	January 2020 Amendment Additions (ha)	Unintentional Alterations (March 2019 Amendment)	Total Permitted WL Alteration Area (September 2020) - Not Including Unintentional	Direct Impact Alteration Area (ha, as of Dec 31, 2020)	Indirect Impact Alteration Area (ha, as of Dec 31, 2020)
27	2.153	0.28	2.4643	0	0	4.8973	2.68	0.00
28	0.3002	0	0	0.07	0	0.3702	0.37	0.00
29	1.5568	0.51	0	0	0.2	2.0668	1.59	0.66
30	0.3715	0.14	0	0	0.11	0.5115	0.44	0.01
31	0.0617	0	0	0	0	0.0617	0.06	0.00
32	0.513	0.05	0	0	0	0.563	0.00	0.00
36	0	0	0.1458	0	0	0.1458	0.01	0.00
40	0.1788	0	0	0	0	0.1788	0.07	0.00
42	0	0	0.0354	0	0	0.0354	0.00	0.00
43	0	0	0.1151	0	0	0.1151	0.12	0.00
44	0	0	0.1526	0	0	0.1526	0.00	0.00
45	0	0.0122	0	0	0.1153	0.0122	0.13	0.00
Totals	**54.3779**	**1.4822**	**2.9132**	**0.07**	**1.6617**	**58.86**	**47.50.[1]**	**1.11**
				Total Direct and Indirect Alteration Area			**48.61**	

[1] *The alteration areas in wetlands 17, 19, 20, 21 and 23 were over reported in the 2019 PCM report resulting in a total of 48.64 ha alteration area being reported. The correct and up to date total alteration area for the Touquoy Mine Project as of December 31, 2020 is 48.61 ha.*

As part of analyzing current alteration areas across the Project Site, an error in alteration area calculations presented in the 2019 PCM report has been identified. In the 2019 report alteration areas within Wetlands 17, 19, 20, 21 and 23 were each over reported resulting in a total overture of 1.13 ha being presented in 2019. In total 48.64 ha was reported as altered at the end of 2019 whereas the total alteration area should have been reported as 47.51 ha. This error has been rectified as presented in Table 9 (above).

As required by Condition 7g of Approval #2016-095967-04, AMNS is to provide NSE a Wetland Compensation Plan to address the wetland alterations across the Project Site since 2016. This will be provided to NSE under a separate cover.

Wetland alteration areas will be determined at the end of 2021 and provided in the 2021 Wetland Monitoring Report. Associated future wetland compensation requirements will be updated to reflect the wetlands altered.

8.0 CONCLUSIONS

The following conclusions were made as a result of the 2020 PCM program and completion of this report:

Wetland Monitoring Results

- No definitive trends are present in the observed changes to hydrological indicators when comparing all monitoring events from 2016 to 2020. In general, hydrological indicators are similar from year to year with minor variations (e.g., no water-stained leaves recorded in Wetland 30 in 2016) attributed to seasonal and previous precipitation variations;
- No evidence of indirect wetland alteration (flooding, drying, sedimentation, etc.) were observed at the general observation locations in 2020;
- No invasive species were recorded at any detailed or general vegetation observation locations;
- The seasonal timing of data collected in 2017 is considered a better representation of baseline conditions. The Relative Percent Difference (RPD) results indicate that no transects exceeded the threshold for change (> 30%) between 2017 and all subsequent PCM years.
- Vegetation remains hydrophytic (PI $\leq$ 3) in all wetlands and was not observed to be stressed;
- Detailed vegetation visual assessments indicate minor vegetative community changes in dominant species composition between baseline, 2017, 2018, 2019 and 2020 PCM, although seasonal effects and observer bias can play a part in the results of this analysis;
- Substrate characteristics remained predominantly consistent with only a few instances of minor variations from across all PCM events which can be attributed to natural succession of moss cover or natural disturbances;
- Visual topographic survey results indicate that no changes have occurred in the assessed wetlands;
- The average Relative Groundwater Depths (RGWDs) in MW 6-1 and 6-2 responded accordingly to total precipitation during the monitoring period (i.e., higher average during higher precipitation totals). Whereas, MWs 22-1 and 22-2 have been trending drier since monitoring began in 2016 regardless of seasonal precipitation values. No discernible trends in average RGWDs in MWs 1-1, 1-2, 15, 22-3, 32 and 33 were observed;

- All monitoring wells except for MW 22-1 and 22-2 displayed RGWDs of greater than -30 cm for two consecutive weeks in the growing season yet remained below +30 cm for prolonged periods of time. Additionally, MW 22-1 saw a fluctuation in average RGWD of greater than 20 cm of its recorded baseline value (2016). MW 22-1 ranged from a maximum RGWD of -26.8 cm to a minimum of -76.8 cm. However, it should be noted that the minimum recorded value of -76.8 cm is the installation depth of the level logger and the actual minimum RGWD at MW 22-1 is presumed to be lower in reality; and,
- Monitoring wells 22-1 and 22-2 did not record RGWD of greater than -30 cm for two consecutive weeks during the growing season. These areas of WL22 were observed to be relatively dry prior to mine development. Although there has been no evidence of changes in vegetation composition, invasive plants and/or species dominance, hydrological data suggests that conditions have become drier every year since the PCM program started. This is likely an indication of a reduction in water source such as up gradient water sources that no longer exist (i.e., ponds, mini pit) or run-off water contribution from previously existing upland that now comprises the mine, less frequent flooding of the Moose River, potential changes to groundwater table near the pit or a combination of these factors.

Wetland Alterations

- A total of 47.50 ha of the 58.86 ha permitted area has currently been directly altered as a result of the Touquoy Gold Mine Project. An additional 1.11 ha of wetland habitat has been determined altered as a result of indirect wetland alterations in remaining fragmented wetlands that have been partially altered in the past.
- An annual Wetland Compensation Plan discussing compensation for these alterations is provided under a separate cover.

PCM Program Modifications

- Modifications to the PCM program throughout its implementation (2016 onward) are presented in this report.
- Additional modifications to the PCM Program have been presented in this report for wetlands that have not been monitored to date. This additional monitoring is recommended for wetlands initially proposed for complete alteration that have not been altered or have been partially altered, for wetlands which are downgradient from wetlands that have been directly or partially altered but not previously monitored, and for wetlands that lie adjacent to the clay borrow expansion area.

9.0 RECOMMENDATIONS

(1) The Study Team recommends implementation of the modifications presented in this report during the 2021 field season. This includes:
    - Reinstatement of monitoring in WL 28 now that the property (PID 00642793) is owned by AMNS.
    - Reinstatement of the monitoring station in WL 27 due to no imminent wetland alterations planned in this extent of the wetland.

- Initiation of a general visual observation (station WL 2.3) in the northern, western lobe of WL 2.
- Initiation of general visual observation monitoring within wetlands that have not been monitored to date (WL's 20, 23, 42, 14, 17, 26, and 35)
- Initiation of monitoring within WL's 34 and 35 which are adjacent to the clay borrow expansion area.

(2) MEL recommends further investigation of the extent of the potential indirect wetland changes within WL22 during the 2021 growing season. In consultation with the NSE wetland specialist, a scope of work should be designed for evaluating the extent of potential indirect wetland loss within WL 22 and potential wetland compensation requirements associated with the losses. The detailed monitoring plan for WL 22 should be submitted for approval to NSE in Spring 2021 in order for it to be implemented on or before June 01, 2021.

(3) MEL recommends that the PCM study continues in 2021 for future comparability of conditions to occur. Surveys should be completed during the same time period as 2020 surveys and by the same personnel (where possible) to reduce seasonal and surveyor bias. A 2021 PCM report will present the results of 2021 monitoring and compare conditions to the 2016, 2017, 2018, 2019 and 2020 monitoring data. The report will be submitted to NSE on or before March 31, 2021. Wetland approval conditions state that post-construction wetland monitoring shall be conducted for a period of no less than 5 years after all wetland alterations are complete or as directed by the Department.

10.0 CLOSURE

This report has been completed for the sole benefit of Atlantic Mining NS Inc.. Any other person or entity may not rely on this report without the express written consent of McCallum Environmental Ltd. and Atlantic Mining NS Inc..

The conclusions presented in this report represent the best judgement of the assessor based on the current environmental standards. The assessor is unable to certify against undiscovered environmental liabilities due to the nature of the investigation and the limited data available.

Should additional information become available, McCallum Environmental Ltd. requests that this information be brought to our attention immediately so that we can re-assess the conclusions presented in this report. This report was prepared by Ryan Gardiner (BSc), and reviewed by Andy Walter (BSc), Senior Project Manager.

11.0 REFERENCES

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APPENDIX A : SITE FIGURES

Prepared For:

Atlantic Gold

FIGURE 1

Touquoy Gold Mine

Wetland Monitoring Report- 2020

Project Location

Project Location

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 1,000 2,000 4,000 m

1:75,000 Scale when printed @ 11" x 17"

Drawn By: R. Gardiner

Date: 2020-02-25

McCallum Environmental Ltd.

Document Name: 200225_2019_Project Location

500000

510000

4990000

4980000

Prepared For:

Atlantic Gold

FIGURE 2
Touquoy Gold Mine

Wetland Monitoring Report- 2020

Monitoring Locations

- Monitoring Well
- Proposed 2021 Monitoring Well
- Removed (2017 to 2020) Monitoring
- General Observation Location
- Proposed 2021 General Observation Locations
- Removed (2017 to 2020) General Observation Location
- Detailed Vegetation
- Proposed 2021 Detailed Vegetation
- Removed (2017 to 2020) Detailed Vegetation Transect
- Field Delineated Watercourse
- NSTDB Mapped Watercourse
- Field Delineated Wetland
- Wetland Study Area

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:12,000 Scale when printed @ 11" x 17"

Drawn By: R. Gardiner Date: 2021-03-30

McCallum Environmental Ltd.

Document Name: 210225_WLMonitoringLocationsALL

Prepared For:

Atlantic Gold

FIGURE 2a
Touquoy Gold Mine

Wetland Monitoring Report- 2020

Monitoring Locations

- Monitoring Well
- Proposed 2021 Monitoring Well
- General Observation Location
- Proposed 2021 General Observation Locations
- Removed (2017 to 2020) General Observation Location
- Detailed Vegetation
- Proposed 2021 Detailed Vegetation
- Field Delineated Watercourse
- NSTDB Mapped Watercourse
- Field Delineated Wetland
- Wetland Study Area

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

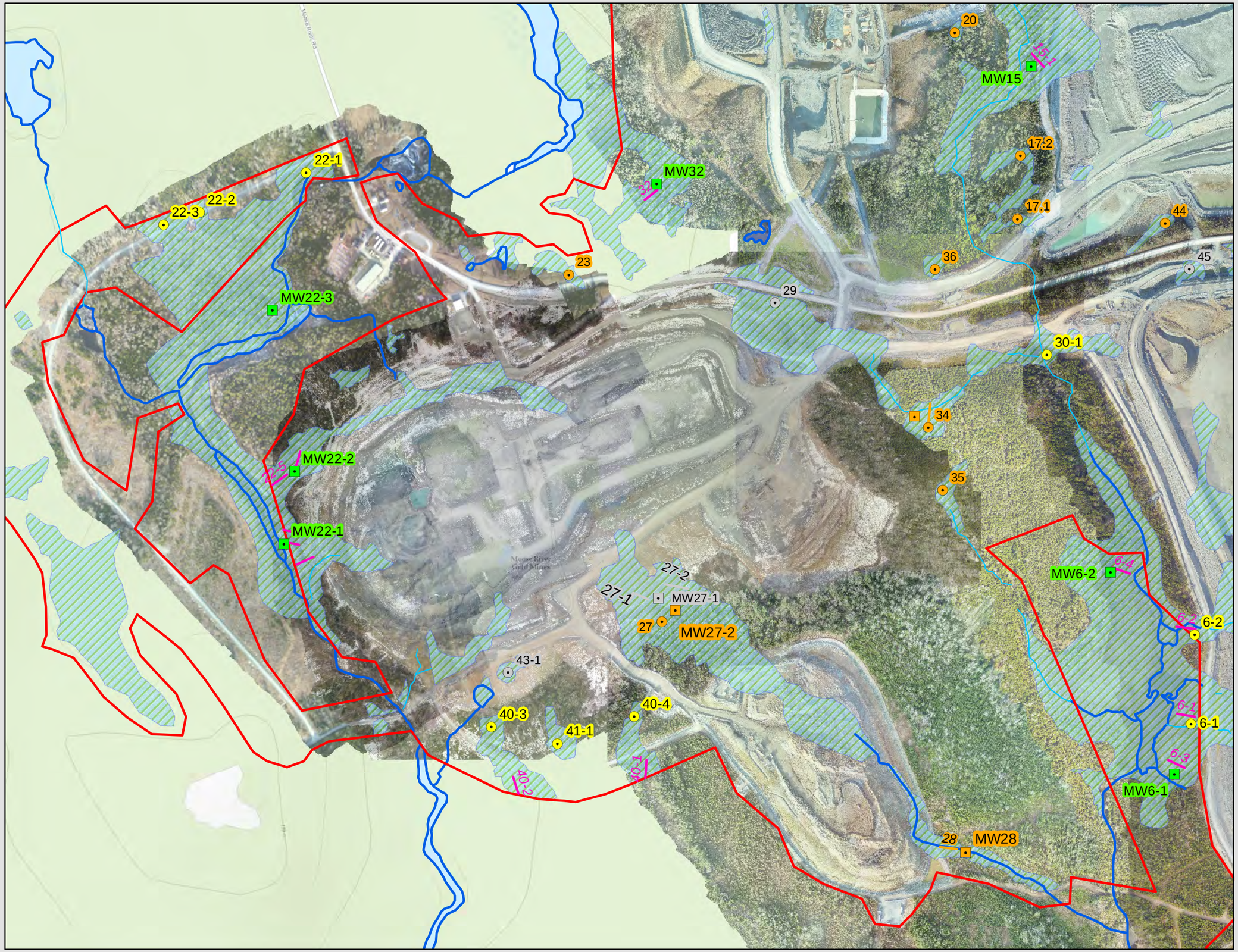
0 62.5 125 250 m

1:6,000 Scale when printed @ 11" x 17"

Drawn By: R. Gardiner Date: 2021-03-30

McCallum Environmental Ltd.

Document Name: 210225_WLMonitoringLocationsN



Prepared For:

Atlantic Gold

FIGURE 2b
Touquoy Gold Mine

Wetland Monitoring Report- 2020

Monitoring Locations

- Monitoring Well
- Proposed 2021 Monitoring Well
- Removed (2017 to 2020) Monitoring Well
- General Observation Location
- Proposed 2021 General Observation Locations
- Removed (2017 to 2020) General Observation Location
- Detailed Vegetation Transect
- Proposed 2021 Detailed Vegetation Transect
- Removed (2017 to 2020) Detailed Vegetation Transect
- Field Delineated Watercourse
- NSTDB Mapped Watercourse
- Field Delineated Wetland
- Wetland Study Area

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 62.5 125 250 m

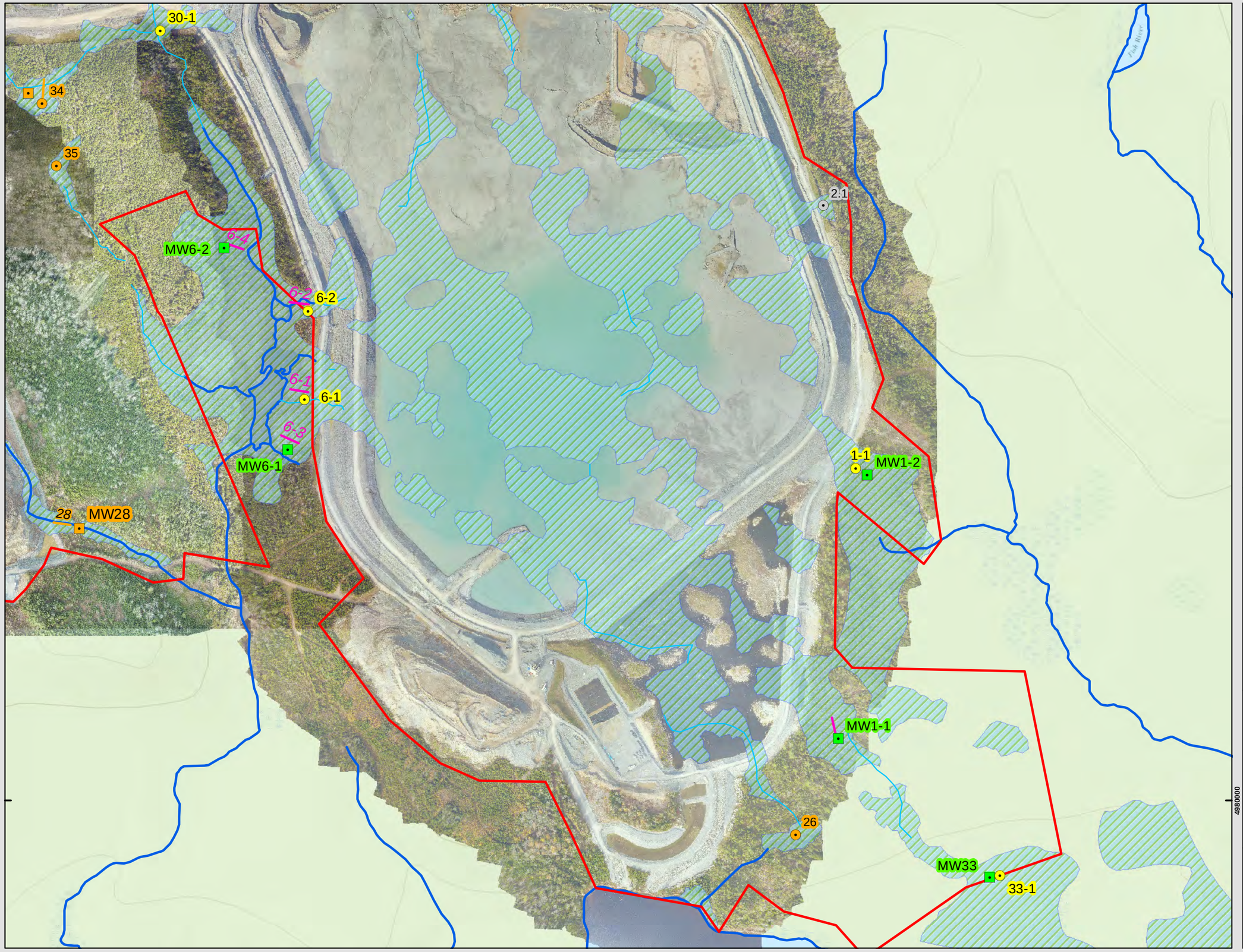
1:6,000 Scale when printed @ 11" x 17"

Drawn By: R. Gardiner

Date: 2021-03-30

McCallum Environmental Ltd.

Document Name: 210225_WLMonitoringLocationsW



Prepared For:

Atlantic Gold

FIGURE 2c
Touquoy Gold Mine

Wetland Monitoring Report- 2020

Monitoring Locations

- Monitoring Well
- Proposed 2021 Monitoring Well
- General Observation Location
- Proposed 2021 General Observation Locations
- Removed (2017 to 2020) General Observation Location
- Detailed Vegetation Transect
- Proposed 2021 Detailed Vegetation Transect
- Field Delineated Watercourse
- NSTDB Mapped Watercourse
- Field Delineated Wetland
- Wetland Study Area

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 62.5 125 250 m

1:6,000 Scale when printed @ 11" x 17"

Drawn By: R. Gardiner

Date: 2021-03-30

McCallum Environmental Ltd.

Document Name: 210225_WLMonitoringLocationsSE

Prepared For:

Atlantic Gold

FIGURE 3

Touquoy Gold Mine

Wetland Monitoring Report- 2020

2020 Wetland Impacts

- Field Delineated Watercourse
- NSTDB Mapped Watercourse
- 2020 Direct Impact
- 2020 Indriect Impact
- Non-permitted Alteration
- Approved Alteration
- Field Delineated Wetland

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:10,000 Scale when printed @ 11" x 17"

Drawn By: R. Gardiner

Date: 2021-03-29

McCallum Environmental Ltd.

Document Name: 210225_2020_Wetland_Impacts

APPENDIX B: PROJECT TEAM MEMBER CVS

Andy Walter, BSc. (Hort)
andy@mccallumenvironmental.com
Senior Project Manager

Years in Practice
13 years

Certifications
Nova Scotia Advanced Wetlands Delineator and Evaluator

Memberships
Nova Scotia Wetlands Delineation, Maritime College of Forest Technology

Education
- BSc. (Horticulture), Essex University (UK), 2003-2005

Training
- Wetland Functional Assessment Training Workshop, NSE 2013
- Urban Wetland Restoration: A Watershed Approach, 2012
- Nova Scotia Advanced Wetlands Delineation and Evaluation Course, 2010;
- Water Management and Wetland Restoration Training Course, 2014;
- Identifying and Delineating Wetlands for Nova Scotia, 2009
- Watercourse Alteration Certification (Nova Scotia Environment) (2008)
- Wetland Ecosystem Services Protocols (Freshwater, Tidal) – Nova Scotia / New Brunswick, 2016
- Saint John Ambulance Emergency First Aid, AED, CPR(C). 2016

Summary
Mr. Walter is a trained biologist and wetland specialist, and has extensive experience managing technical biophysical projects within Atlantic Canada. Mr. Walter is knowledgeable in federal, provincial, and municipal environmental regulations and guidelines applicable to Atlantic Canada, and works closely with all necessary regulatory agencies to facilitate project implementation. As senior project manager, Mr. Walter ensures biophysical field programs are tailored to the needs of the client and project, while meeting regulatory standards. Mr. Walter has provided environmental support to the planning process in a wide range of project types including residential development, industrial projects (mining, pit and quarry), transmission line and hydro dam infrastructure and highway construction to name a few. Mr. Walter has managed the environmental processes associated with multiple wind energy developments in Nova Scotia, including compilation of provincial environmental assessment (EA) documents, public and First Nation engagement and consultation and implementation of associated EA biophysical field surveys required to support regulatory permitting.

As a trained field biologist, Mr. Walter utilizes his extensive experience completing technical field programs to lead a team of biologists in support of his ongoing project portfolio. Mr. Walter's previous technical experience includes completion of terrestrial and aquatic habitat assessments including desktop reviews and characterization of biophysical environments. Mr. Walter also completes numerous fish habitat/watercourse assessments for effects monitoring, watercourse alteration, and HADD authorization projects. As a qualified wetland delineator and wetland function evaluator for Atlantic Canada, Andy has completed delineation of hundreds of wetlands. Projects often involve the completion of species at risk assessments, functions assessments, and detailed wetland characterization in support of provincial wetland alteration applications. Mr. Walter has designed and implemented multiple large and small-scale wetland monitoring programs throughout Atlantic Canada.

Mr. Walter is a wetland restoration professional and manages the identification and implementation of wetland restoration, enhancement, expansion and creation projects. This includes reviewing of databases, mapping, and aerial imagery, ground truthing and consultation with local environmental groups and government to identify potential restoration opportunities. Mr. Walter engages with landowners to secure land for restoration projects and manages the construction and monitoring of these initiatives to meet regulatory requirements.

Project Experience
- Management and implementation of wetland restoration projects including a 20 hectare and 12-hectare agricultural wetland restoration project in NS.
- Planning and feasibility studies for a floodplain and a shrub/treed swamp wetland restoration project in NS (2020-ongoing).
- Managing, and currently in the process of implementing a new wetland functional assessment tool for use in Nova Scotia. This Project included the collection of baseline wetland information across Nova Scotia by completing 125 wetland functional assessments using the Wetland Ecosystem Services Protocol (WESP). This project was completed in collaboration with Nova scotia Environment and Dr. Paul Adamus (developer of the WESP-AC).
- Managing four Provincial Environmental Assessments (baseline surveys, effects assessment and mitigation) for quarry expansion projects, NS (2018 - 2020).

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Andy Walter, BSc. (Hort)
andy@mccallumenvironmental.com
Senior Project Manager

- Managing a Provincial Environmental Assessment (baseline surveys, effects assessment and mitigation) for new quarry development in Coclchester County, NS (2019-ongoing).
- Design and implementation of extensive wetland post-construction monitoring projects associated with mine and highway development (2016-ongoing).
- Managing environmental CEAA screening and associated wetland and watercourse alteration permits for the Paqtnkek Interchange Project for NSTIR (2014-2018).
- Managing a Provincial Environmental Impact Assessment for a proposed 20MW wind Project in New Brunswick.
- Managing an environmental screening and associated wetland and watercourse alteration permits for the NSTIR Highway 102/103 Interchange project (2016-2018.
- Management and completion of terrestrial habitat mapping, wetland delineation and vegetation surveys in support of EA and regulatory permitting for the South Canoe Wind Project (80MW wind Project in Nova Scotia) 2011-2014.
- Management of a multi-faceted avian study in support of a provincial EA at Aulds Cove, NS.
- Project management, regulatory consultation and associated environmental considerations related to multiple proposed development projects throughout NS.
- Completion of six provincial environmental assessments and baseline surveys for community wind projects in Nova Scotia in 2012-2014.
- Terrestrial habitat mapping, wetland delineation and vegetation surveys in support of a 65km distribution transmission line in central Nova Scotia.
- Utilization of the WESP-AC wetland functional assessment tool in > 100 wetlands across Nova Scotia in support of regulatory wetland alteration permitting, provincial and federal environmental assessment and wetland monitoring. (2016 – 2021).
- Wetland delineation, species at risk, watercourses and flora surveys at the site of a proposed quarry in Nova Scotia. Subsequent facilitation of wetland alteration permit to alter in excess of 20 hectares of wetland.
- Implemented the passive wetland restoration strategy at a disturbed wetland on NSDNR property. Completed regular monitoring of vegetation, soil, and hydrology conditions and developed project recommendations accordingly (2009-2011).
- Wetland delineation, species at risk, watercourses and flora surveys at the site of a proposed 22km railway line and shipping container terminal in eastern Nova Scotia (2012-2014).
- Completion of wetland delineation and watercourse identification and associated regulatory permitting at multiple developments in Nova Scotia (2009-2016)

McCallum Environmental Ltd.

Andy Walter, BSc. (Hort)
andy@mccallumenvironmental.com
Senior Project Manager

Work Experience

Strum Environmental Services Ltd., Nova Scotia 2008-2015

Environmental Specialist/Project Manager- provided project management expertise for development clients across Atlantic Canada. Projects included environmental assessment, large scale commercial, residential and wind power developments, wetland and watercourse alteration projects, wetland compensation planning and implementation, wetland restoration and creation projects, avian studies, and regulatory consultation.

Years in Practice
7

Education
Bachelor Environmental Science 2011, Dalhousie University

Training
- Bat Acoustics Training (Techniques and Analysis) – Ontario, 2017
- Saint John Ambulance Emergency First Aid, AED, CPR(A), 2017
- Wetland Ecosystem Services Protocols (Freshwater, Tidal) – Nova Scotia / New Brunswick, 2016
- Watercourse Alteration Certification for Sizers - Nova Scotia, 2016
- Watercourse Alteration Certification for Installers - Nova Scotia, 2016
- Wetland Delineator's Course – Nova Scotia/New Brunswick, 2014
- Watercourse Alteration Certification – New Brunswick, 2018

Summary

Ryan has worked in biology related environmental consulting since 2011. He has worked on both research related field assessments and project related field assessments in Nova Scotia, New Brunswick, Newfoundland, Ontario, Saskatchewan, Alberta, and Honduras.

Environmental Work Experience

McCallum Environmental Ltd., Halifax, Nova Scotia
Environmental Specialist
June – August 2013; September 2014 - Present

Completing biophysical assessments, including flora and fauna surveys including acoustic bat surveys and analysis, fish and terrestrial habitat assessments, water quality and hydraulic flow volume surveys. Completing wetland and watercourse delineations and functional assessments. Developing and coordinating field monitoring programs. Communicating field survey results and methodologies for Environmental Assessments and other provincial regulatory applications.

Tasks
- Develop and conduction Post Construction Monitoring Plans in wetland habitat
- Develop and conduct surface water quality sampling programs
- Develop and conduct surface water quantity monitoring programs
- Develop stage discharge curves for hydrometric study
- Wetland and watercourse delineation, functions assessments and alteration applications
- Biophysical assessments including species at risk assessments
- Bat surveys (presence/absence, acoustic surveys, and interpretation)
- Flora, fauna and habitat field surveys
- Construction monitoring
- Develop sediment and erosion control management plans
- Reporting of methodology and results
- Provincial regulatory applications
- Manage large datasets
- GIS and GPS utilization

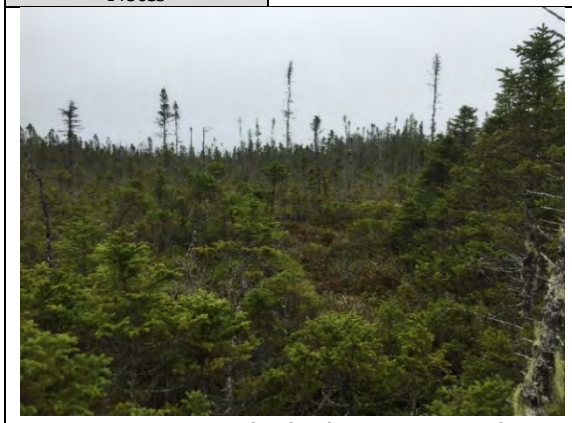
APPENDIX C: GENERAL OBSERVATION DATA SHEETS

Appendix C: General Observation Data Sheets

General observation data sheets for wetlands monitored since 2016 are provided in Tables C1 – 13 and the general observation data sheet for Wetland 41, added to the monitoring program in 2017, is provided in Table C14.

Table C1: General Observation Data of Wetland 1, location 1.

Location ID		**WL 1**						**Topography**				
Date of Assessment		**24-July-20**					**B: 2016**	**PCM: 2017**	**PCM: 2018**	**PCM: 2019**	**PCM: 2020**
Coordinates (UTM)	**N**	4980881					concave	concave	concave	concave	concave
	E	504813									
Hydrological Indicator Present Y/N?	**B: 2016**	**PCM: 2017**	**PCM: 2018**	**PCM: 2019**	**PCM: 2020**	**Wetland Observation Details**	**B: 2016**	**PCM: 2017**	**PCM: 2018**	**PCM: 2019**	**PCM: 2020**
Surface water	Y	Y	Y	Y	Y	Siltation/Sedimentation	N	N	N	N	N
Dry season water table	Y	Y	Y	Y	Y	Flooding	N	N	N	N	N
Saturated at surface	Y	Y	Y	Y	Y	Drying	N	N	N	N	N
Saturated within 20cm	Y	Y	Y	Y	Y	Ground disturbance/rutting	N	N	N	N	N
Water-stained leaves	N	N	N	N	N	Artificial channelization	N	N	N	N	N
H_2SO_4	N	N	Y	Y	Y	Invasive/Exotic Species	N	N	N	N	N
Other	/	/	/	/	/	Dying Vegetation	N	N	N	N	N
PRECEEDING RAINFALL (mm)						Other	/	/	/	/	/
24 Hrs	0.2	0	0	0	15.8						
5 days prior	2.8	0	7	0	17.8						
Notes											



Representative Wetland Habitat During Baseline Monitoring (2016)

Representative Wetland Habitat During Year 3 PCM (2019)

Representative Wetland Habitat During Year 4 PCM (2020)

Table C2: General Observation Data of Wetland 6, location 1.

Location ID		WL 6.1						Topography				
Date of Assessment		24-July-2020						B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Coordinates	N	4980676						concave	concave	concave	concave	concave
	E	505747										
Hydrological Indicator Present Y/N?		B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020	Wetland Observation Details	B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Surface water		Y	Y	N	N	N	Siltation/Sedimentation	N	Y	N	N	N
Dry season water table		Y	Y	Y	Y	Y	Flooding	N	N	N	N	N
Saturated at surface		N	Y	Y	Y	Y	Drying	N	N	N	N	N
Saturated within 20cm		Y	Y	Y	Y	Y	Ground disturbance/rutting	N	Y	N	N	N
Water-stained leaves		N	N	N	N	N	Artificial channelization	N	N	N	N	N
H_2SO_4		Y	Y	Y	Y	Y	Invasive/Exotic Species	N	N	N	N	N
Other		/	/	/	/	/	Dying Vegetation	N	N	N	N	N
PRECEEDING RAINFALL (mm)							Other	/	/	/	/	/
24 Hrs		0.2	0	0	0	15.8						
5 days prior		7.8	0.6	7.8	0	17.8						
Notes												

Representative Wetland Habitat During Baseline Monitoring (2016)

Representative Wetland Habitat During Year 3 PCM (2019)

Representative Wetland Habitat During Year 4 PCM (2020)

Note: B=Baseline, PCM = Post Construction Monitoring

Table C3: General Observation Data of Wetland 6, location 2.

Location ID		WL 6.2						Topography				
Date of Assessment		24-July-2020						B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Coordinates	N	4980831						concave	concave	concave	concave	concave
	E	505742										
Hydrological Indicator Present Y/N?		B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020	Wetland Observation Details	B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Surface water		Y	Y	N	N	N	Siltation/Sedimentation	N	N	N	N	N
Dry season water table		N	Y	Y	Y	Y	Flooding	N	N	N	N	N
Saturated at surface		Y	Y	Y	Y	Y	Drying	N	N	N	N	N
Saturated within 20cm		Y	Y	Y	Y	Y	Ground disturbance/rutting	N	Y	N	N	N
Water-stained leaves		N	N	N	N	N	Artificial channelization	N	N	N	N	N
H_2SO_4		N	N	N	N	N	Invasive/Exotic Species	N	N	N	N	N
Other		/	/	/	/	/	Dying Vegetation	N	N	N	N	N
PRECEEDING RAINFALL (mm)							Other	/	/	/	/	/
24 Hrs		0.2	0	0	0	15.8						
5 days prior		7.8	0.6	7.8	0	17.8						
Notes												

Representative Wetland Habitat During Baseline Monitoring (2016)

Representative Wetland Habitat During Year 3 PCM (2019)

Representative Wetland Habitat During Year 4 PCM (2020)

Note: B=Baseline, PCM = Post Construction Monitoring

Table C4: General Observation Data of Wetland 15, location 3.

Location ID		WL 15.3						Topography				
Date of Assessment		24-July-2020						B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Coordinates	N	4982235						concave	concave	concave	concave	concave
	E	505322										
Hydrological Indicator Present Y/N?		B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020	Wetland Observation Details	B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Surface water		Y	N	N	N	Y	Siltation/Sedimentation	N	N	N	N	N
Dry season water table		Y	Y	Y	Y	Y	Flooding	N	N	N	N	N
Saturated at surface		Y	Y	Y	Y	Y	Drying	N	N	N	N	N
Saturated within 20cm		Y	Y	Y	Y	Y	Ground disturbance/rutting	N	N	N	N	N
Water-stained leaves		N	N	N	N	N	Artificial channelization	N	N	N	N	N
H_2SO_4		Y	Y	N	N	N	Invasive/Exotic Species	N	N	N	N	N
Other		/	/	/	/	/	Dying Vegetation	N	N	N	N	N
PRECEEDING RAINFALL (mm)							Other	/	/	/	/	/
24 Hrs		0.2	0	0	Trace	15.8						
5 days prior		2.8	0.6	7	1.8	17.8						
Notes												

Representative Wetland Habitat During Baseline Monitoring (2016)

Representative Wetland Habitat During Year 3 PCM (2019)

Representative Wetland Habitat During Year 4 PCM (2020)

Note: B=Baseline, PCM = Post Construction Monitoring

Table C5: General Observation Data of Wetland 15, location 4.

Location ID		WL 15.4						Topography				
Date of Assessment		24-July-2020						B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Coordinates	N	4982080						concave	concave	concave	concave	concave
	E	505642										
Hydrological Indicator Present Y/N?		B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020	Wetland Observation Details	B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Surface water		Y	N	N	N	Y	Siltation/Sedimentation	N	N	N	N	N
Dry season water table		Y	Y	Y	Y	Y	Flooding	N	N	N	N	N
Saturated at surface		Y	Y	Y	Y	Y	Drying	N	N	N	N	N
Saturated within 20cm		Y	Y	Y	Y	Y	Ground disturbance/rutting	N	N	N	N	N
Water-stained leaves		N	Y	N	N	N	Artificial channelization	N	N	N	N	N
H_2SO_4		N	N	N	N	N	Invasive/Exotic Species	N	N	N	N	N
Other		/	/	/	/	/	Dying Vegetation	N	N	N	N	N
PRECEEDING RAINFALL (mm)							Other	/	/	/	/	/
24 Hrs		0.2	0	0	Trace	15.8						
5 days prior		2.8	0.6	7	1.8	17.8						
Notes												

Representative Wetland Habitat During Baseline Monitoring (2016)

Representative Wetland Habitat During Year 3 PCM (2019)

Representative Wetland Habitat During Year 4 PCM (2020)

Note: B=Baseline, PCM = Post Construction Monitoring

Table C6: General Observation Data of Wetland 15, location 5.

Location ID		WL 15.5						Topography				
Date of Assessment		24-July-2020						B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Coordinates	N	4982367						concave	concave	concave	concave	concave
	E	505379										
Hydrological Indicator Present Y/N?		B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020	Wetland Observation Details	B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Surface water		N	N	N	N	N	Siltation/Sedimentation	N	N	N	N	N
Dry season water table		N	Y	Y	Y	Y	Flooding	N	N	N	N	N
Saturated at surface		Y	Y	Y	Y	Y	Drying	N	N	N	N	N
Saturated within 20cm		Y	Y	Y	Y	Y	Ground disturbance/rutting	N	N	N	N	N
Water-stained leaves		N	N	Y	N	N	Artificial channelization	N	N	N	N	N
H_2SO_4		N	N	N	N	N	Invasive/Exotic Species	N	N	N	N	N
Other		/	/	/	/	/	Dying Vegetation	N	N	N	N	N
PRECEEDING RAINFALL (mm)							Other	/	/	/	/	/
24 Hrs		0.2	0	0	Trace	15.8						
5 days prior		2.8	0.6	7	1.8	17.8						
Notes												

Representative Wetland Habitat During Baseline Monitoring (2016)

Representative Wetland Habitat During Year 3 PCM (2019)

Representative Wetland Habitat During Year 4 PCM (2020)

Note: B=Baseline, PCM = Post Construction Monitoring

Table C7: General Observation Data of Wetland 22, location 1

Location ID		WL 22.1						Topography				
Date of Assessment		24-July-2020						B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Coordinates	N	504222						concave	concave	concave	concave	concave
	E	4981611										
Hydrological Indicator Present Y/N?		B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020	Wetland Observation Details	B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Surface water		Y	N	N	N	N	Siltation/Sedimentation	N	N	N	N	N
Dry season water table		Y	Y	Y	Y	Y	Flooding	N	N	N	N	N
Saturated at surface		Y	Y	Y	Y	Y	Drying	N	N	N	N	N
Saturated within 20cm		Y	Y	Y	Y	Y	Ground disturbance/rutting	N	N	N	N	N
Water-stained leaves		N	N	Y	N	N	Artificial channelization	N	N	N	N	N
H_2SO_4		N	N	N	N	N	Invasive/Exotic Species	N	N	N	N	N
Other		/	/	/	/	/	Dying Vegetation	N	N	N	N	N
PRECEEDING RAINFALL (mm)							Other	/	/	/	/	/
24 Hrs		1.1	0	0	Trace	15.8						
5 days prior		8.5	0.6	0	1.8	17.8						
Notes												

Representative Wetland Habitat During Baseline Monitoring (2016)

Representative Wetland Habitat During Year 3 PCM (2019)

Representative Wetland Habitat During Year 4 PCM (2020)

Note: B=Baseline, PCM = Post Construction Monitoring

Table C8: General Observation Data of Wetland 22, location 2.

Location ID		WL 22.2						Topography				
Date of Assessment		24-July-2020						B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Coordinates	N	4981544						concave	concave	concave	concave	concave
	E	504042										
Hydrological Indicator Present Y/N?		B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020	Wetland Observation Details	B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Surface water		Y	N	N	N	N	Siltation/Sedimentation	N	N	N	N	N
Dry season water table		Y	Y	Y	Y	Y	Flooding	N	N	N	N	N
Saturated at surface		Y	Y	Y	Y	Y	Drying	N	N	N	N	N
Saturated within 20cm		Y	Y	Y	Y	Y	Ground disturbance/rutting	N	N	N	N	N
Water-stained leaves		N	Y	Y	N	N	Artificial channelization	N	N	N	N	N
H_2SO_4		N	N	N	N	N	Invasive/Exotic Species	N	N	N	N	N
Other		/	/	/	/	/	Dying Vegetation	N	N	N	N	N
PRECEEDING RAINFALL (mm)							Other	/	/	/	/	/
24 Hrs		1.1	0	0	Trace	15.8						
5 days prior		8.5	0.6	0	1.8	17.8						
Notes												

Representative Wetland Habitat During Baseline Monitoring (2016)

Representative Wetland Habitat During Year 3 PCM (2019)

Representative Wetland Habitat During Year 4 PCM (2020)

Note: B=Baseline, PCM = Post Construction Monitoring

Table C9: General Observation Data of Wetland 22, location 3.

Location ID		WL 22.3						Topography				
Date of Assessment		24-July-2020						B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Coordinates	N	4981522						concave	concave	concave	concave	concave
	E	5503981										
Hydrological Indicator Present Y/N?		B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020	Wetland Observation Details	B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Surface water		Y	N	N	N	N	Siltation/Sedimentation	N	N	N	N	N
Dry season water table		Y	N	N	N	Y	Flooding	N	N	N	N	N
Saturated at surface		Y	Y	Y	Y	Y	Drying	N	N	N	N	N
Saturated within 20cm		Y	Y	Y	Y	Y	Ground disturbance/rutting	N	N	N	N	N
Water-stained leaves		N	Y	Y	N	N	Artificial channelization	N	N	N	N	N
H_2SO_4		N	N	N	N	N	Invasive/Exotic Species	N	N	N	N	N
Other		/	/	/	/	/	Dying Vegetation	N	N	N	N	N
PRECEEDING RAINFALL (mm)							Other	/	/	/	/	/
24 Hrs		1.1	0	0	Trace	15.8						
5 days prior		8.5	0.6	0	1.8	17.8						
Notes												

Representative Wetland Habitat During Baseline Monitoring (2016)

Representative Wetland Habitat During Year 3 PCM (2019)

Representative Wetland Habitat During Year 4 PCM (2020)

Note: B=Baseline, PCM = Post Construction Monitoring

Table C10: General Observation Data of Wetland 30, location 1.

Location ID		WL 30						Topography				
Date of Assessment		24-July-2020						B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Coordinates	N	4981334						sloped	sloped	concave	concave	concave
	E	505466										
Hydrological Indicator Present Y/N?		B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020	Wetland Observation Details	B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Surface water		Y	Y	Y	Y	Y	Siltation/Sedimentation	N	N	N	N	N
Dry season water table		Y	Y	Y	Y	Y	Flooding	N	N	N	N	N
Saturated at surface		Y	Y	Y	Y	Y	Drying	N	N	N	N	N
Saturated within 20cm		Y	Y	Y	Y	Y	Ground disturbance/rutting	N	N	N	N	N
Water-stained leaves		N	Y	Y	Y	Y	Artificial channelization	N	N	N	N	N
H_2SO_4		Y	Y	N	N	N	Invasive/Exotic Species	N	N	N	N	N
Other		/	/	/	/	/	Dying Vegetation	N	N	N	N	N
PRECEEDING RAINFALL (mm)							Other	/	/	/	/	/
24 Hrs		0	0	0	0	15.8						
5 days prior		1.2	35.8	7	0	17.8						
Notes												

Representative Wetland Habitat During Baseline Monitoring (2016)

Representative Wetland Habitat During Year 3 PCM (2019)

Representative Wetland Habitat During Year 4 PCM (2020)

Note: B=Baseline, PCM = Post Construction Monitoring

Table C11: General Observation Data of Wetland 33, location 1.

Location ID		WL 33						Topography				
Date of Assessment		24-July-2020						B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Coordinates	N	4979870						concave	concave	concave	concave	concave
	E	506898										
Hydrological Indicator Present Y/N?		B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020	Wetland Observation Details	B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Surface water		Y	N	Y	Y	Y	Siltation/Sedimentation	N	N	N	N	N
Dry season water table		Y	Y	Y	Y	Y	Flooding	N	N	N	N	N
Saturated at surface		N	Y	Y	Y	Y	Drying	N	N	N	N	N
Saturated within 20cm		Y	Y	Y	Y	Y	Ground disturbance/rutting	N	N	N	N	N
Water-stained leaves		N	N	N	N	N	Artificial channelization	N	N	N	N	N
H_2SO_4		Y	Y	Y	Y	Y	Invasive/Exotic Species	N	N	N	N	N
Other		/	/	/	/	/	Dying Vegetation	N	N	N	N	N
PRECEEDING RAINFALL (mm)							Other	/	/	/	/	/
24 Hrs		0.2	0	0	0	15.8						
5 days prior		2.8	0	7	0	17.8						
Notes												

Representative Wetland Habitat During Baseline Monitoring (2016)

Representative Wetland Habitat During Year 3 PCM (2019)

Representative Wetland Habitat During Year 4 PCM (2020)

Note: B=Baseline, PCM = Post Construction Monitoring

Table C12: General Observation Data of Wetland 40, location 3.

Location ID		WL 40.3						Topography				
Date of Assessment		24-July-2020						B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Coordinates	N	4980673						concave	concave	concave	concave	concave
	E	504535										
Hydrological Indicator Present Y/N?		B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020	Wetland Observation Details	B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Surface water		Y	N	Y	N	Y	Siltation/Sedimentation	N	N	N	N	N
Dry season water table		Y	Y	Y	Y	Y	Flooding	N	N	N	N	N
Saturated at surface		Y	Y	Y	Y	Y	Drying	N	N	N	N	N
Saturated within 20cm		Y	Y	Y	Y	Y	Ground disturbance/rutting	N	N	N	N	N
Water-stained leaves		N	N	N	N	N	Artificial channelization	N	N	N	N	N
H_2SO_4		N	N	N	N	N	Invasive/Exotic Species	N	N	N	N	N
Other		/	/	/	/	/	Dying Vegetation	N	N	N	N	N
PRECEEDING RAINFALL (mm)							Other	/	/	/	/	/
24 Hrs		2.1	0	0	Trace	15.8						
5 days prior		49.3	0.6	0	1.8	17.8						
Notes												

Representative Wetland Habitat During Baseline Monitoring (2016)

Representative Wetland Habitat During Year 3 PCM (2019)

Representative Wetland Habitat During Year 4 PCM (2020)

Note: B=Baseline, PCM = Post Construction Monitoring

Table C13: General Observation Data of Wetland 40, location 4.

Location ID		WL 40.4						Topography				
Date of Assessment		24-July-2020						B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Coordinates	N	4980691						concave	concave	concave	concave	concave
	E	504777										
Hydrological Indicator Present Y/N?		B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020	Wetland Observation Details	B: 2016	PCM: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Surface water		Y	Y	Y	N	Y	Siltation/Sedimentation	N	N	N	N	N
Dry season water table		Y	Y	Y	Y	Y	Flooding	N	N	N	N	N
Saturated at surface		Y	Y	Y	Y	Y	Drying	N	N	N	N	N
Saturated within 20cm		Y	Y	Y	Y	Y	Ground disturbance/rutting	N	N	N	N	N
Water-stained leaves		N	N	N	N	N	Artificial channelization	N	N	N	N	N
H_2SO_4		N	N	N	N	N	Invasive/Exotic Species	N	N	N	N	N
Other		/	/	/	/	/	Dying Vegetation	N	N	N	N	N
PRECEEDING RAINFALL (mm)							Other	/	/	/	/	/
24 Hrs		2.1	0	0	Trace	15.8						
5 days prior		49.3	0.6	0	1.8	17.8						
Notes												

Representative Wetland Habitat During Baseline Monitoring (2016)

Representative Wetland Habitat During Year 3 PCM (2019)

Representative Wetland Habitat During Year 4 PCM (2020)

Note: B=Baseline, PCM = Post Construction Monitoring

Table C14: General Observation Data of Wetland 41, location 1.

Location ID		WL 41					Topography			
Date of Assessment		24-July-2020					B: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Coordinates	N	4980645					concave	concave	concave	concave
	E	504647								
Hydrological Indicator Present Y/N?		B: 2017	PCM: 2018	PCM: 2019	PCM: 2020	Wetland Observation Details	B: 2017	PCM: 2018	PCM: 2019	PCM: 2020
Surface water		Y	Y	N	Y	Siltation/Sedimentation	N	N	N	N
Dry season water table		Y	Y	Y	Y	Flooding	N	N	N	N
Saturated at surface		Y	Y	Y	Y	Drying	N	N	N	N
Saturated within 20cm		Y	Y	Y	Y	Ground disturbance/rutting	N	N	N	N
Water-stained leaves		N	N	N	N	Artificial channelization	N	N	N	N
H_2SO_4		N	N	N	N	Invasive/Exotic Species	N	N	N	N
Other		/	/	/	/	Dying Vegetation	N	N	N	N
PRECEEDING RAINFALL						Other	/	/	/	/
24 Hrs		0	0	Trace	15.8					
5 days prior		0.6	7	1.8	17.8					
Notes		No representative photo was taken during baseline monitoring in 2017								

Representative Wetland Habitat During Year 1 PCM (2018)

Representative Wetland Habitat During Year 2 PCM (2019)

Representative Wetland Habitat During Year 3 PCM (2020)

Note: B=Baseline, PCM = Post Construction Monitoring

APPENDIX D: DETAILED VEGETATION DATA SHEETS

Table D1: Vegetation transect data for Wetland 1, Transect 1.

Transect 1, Wetland 1														
Stratum	**Species**	**WL Indicator Status**	**Q1**			**Q2**			**Q3**			**Q4**		
			B: 2016 %	**PCM 2019 %**	**PCM 2020 %**	**B: 2016 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2016 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2016 %**	**PCM 2019 %**	**PCM 2020 %**
Herb	*Rhododendron groenlandicum*	facw+	12	8	10	25	7	17	10	15	10	12	18	18
	Kalmia angustifolia	fac	6	5	8	8	10	10	40	30	30	35	25	25
	Maianthemum canadense	fac	1	0	0	1	0	0	0	0	0	0	0	0
	Viburnum nudum	fac	3	6	6	3	8	8	0	0	0	0	20	20
	Osmunda cinnamomea	fac	4	10	18	10	12	16	5	10	10	0	0	0
	Gaultheria hispidula	fac	1	4	4	1	3	0	20	20	15	5	8	10
	Cornus canadensis	fac	2	7	7	2	18	8	4	10	10	5	18	18
	*Vaccinium myrtilloides**	fac	0	0	0	0	0	0	0	0	6	0	0	0
	Carex trisperma	obl	0	0	0	10	45	45	0	0	0	0	10	10
	Carex magellanica	obl	0	3	3	0	0	0	0	0	0	0	0	0
	Larix laricina	fac	0	0	0	1	0	5	0	0	0	0	0	0
	*Trientalis borealis^*	fac	0	0	0	0	0	0	0	5	0	0	0	0
	Rhododendron canadense	fac	0	17	17	0	0	0	0	0	0	0	0	0
	*Vaccinium vitis-idaea**	fac	2	4	4	1	3	3	8	6	6	1	0	0
Shrub	*Picea mariana*	facw	40	30	30	0	0	0	0	10	10	0	0	0
	Ilex mucronata	fac	18	0	0	20	20	20	20	10	10	5	0	0

Note: B=Baseline, Q = Quadrat ID, % = Percentage vegetation cover, PCM = Post Construction Monitoring

* Denotes a new species recorded in the transect during the Year 4 (2020) assessment that was not present in baseline (2016) or Year 3 (2019) assessments.

^ Denotes a species previously recorded during the baseline (2016) or Year 3 (2019) assessments that was not observed during the Year 4 (2020) assessment.

Table D2: Vegetation Transect Data for Wetland 6, Transect 1.

Transect 1, Wetland 6													
Stratum	**Species**	**WL Indicator Status**	**Q2**			**Q3**			**Q4**			**Q5[1]**		
			B: 2016 %	**PCM 2019 %**	**PCM 2020 %**	**B: 2016 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2016 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2018 %**	**PCM 2019 %**	**PCM 2020 %**
Herb	*Eriophorum virginicum*	obl	0	0	0	25	28	30	5	0	0	0	0	0
	Kalmia angustifolia	fac	35	8	8	40	12	5	50	20	20	6	6	8
	Chamaedaphne calyculata	obl	30	45	45	25	25	25	30	45	45	35	50	50
	Rhododendron groenlandicum	facw+	15	10	10	1	8	0	5	5	5	15	8	8
	Kalmia polifolia	obl	0	0	0	0	0	0	1	0	0	8	6	0
	Rhododendron canadense	fac	0	8	10	0	12	15	0	18	10	10	8	8
	Empetrum nigrum	fac	0	0	0	0	0	0	0	0	0	10	10	18
	Vaccinium myrtilloides	fac	0	10	10	0	0	0	0	0	0	0	0	0

Table D3: Vegetation Transect Data for Wetland 6, Transect 2.

Transect 2, Wetland 6											
Stratum	**Species**	**WL Indicator Status**	**Q3**			**Q4**			**Q5[1]**		
			B: 2016 %	**PCM 2019 %**	**PCM 2020 %**	**B: 2016 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2018 %**	**PCM 2019 %**	**PCM 2020 %**
Herb	*Kalmia polifolia*	obl	0	0	0	20	25	35	10	15	20
	Chamaedaphne calyculata	obl	5	30	10	10	20	20	15	8	8
	Carex stricta	obl	5	30	30	45	15	15	20	10	5
	Rhododendron groenlandicum	facw+	0	0	0	5	0	0	0	0	0
	Sarracenia purpurea	obl	0	0	0	2	0	4	6	6	6
	Rosa nitida	obl	0	12	12	0	0	0	0	0	0
	Myrica gale	obl	0	10	10	0	18	10	0	10	20
	Spiraea alba	fac	0	4	8	0	0	0	0	0	0
	Rubus pubescens^	fac	3	0	0	0	0	0	0	0	0
	Kalmia angustifolia^	fac	10	0	0	0	0	0	0	0	0
	*Rhododendron canadense**	fac	0	0	20	0	0	0	0	0	0
	*Vaccinium macrocarpon**	obl	0	0	0	0	0	0	0	0	1
Shrub	*Larix laricina*	fac	0	0	0	8	5	10	0	0	0
	Viburnum nudum ^	fac	55	0	0	0	0	0	0	0	0

Note: B=Baseline, Q = Quadrat ID, % = Percentage vegetation cover, PCM = Post Construction Monitoring

[1] Quadrat 5 was added in 2018 to Transect 1 to replaced Quadrat 1 and Transect 2to replace Quadrats 1 and 2 that were removed.

* Denotes a new species recorded in the transect during the Year 4 (2020) assessment that was not present in baseline (2016) or Year 3 (2019) assessments.

^ Denotes a species previously recorded during the baseline (2016) or Year 3 (2019) assessments that was not observed during the Year 4 (2020) assessment.

Table D4: Vegetation Transect Data for Wetland 15, Transect 1.

Transect 1, Wetland 15														
Stratum	**Species**	**WL Indicator Status**	**Q2**			**Q3**			**Q4**			**Q5[1]**		
			B: 2016 %	**PCM 2019 %**	**PCM 2020 %**	**B: 2016 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2016 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2018 %**	**PCM 2019 %**	**PCM 2020 %**
Herb	*Rhododendron groenlandicum*	facw+	0	0	0	0	0	0	20	40	40	0	0	0
	Gaultheria hispidula	fac	0	0	0	0	18	20	16	0	0	3	2	2
	Kalmia angustifolia	fac	6	5	0	4	18	10	4	6	16	20	40	40
	Carex trisperma	obl	10	5	5	6	4	4	20	8	4	8	25	30
	Cornus canadensis	fac	0	8	18	0	0	0	2	15	25	0	0	12
	Abies balsamea	fac	0	0	0	2	0	2	5	4	4	0	0	0
	Linnaea borealis	fac	0	0	0	0	0	0	2	4	4	6	0	0
	Maianthemum canadense	fac	0	0	0	8	4	2	0	0	0	0	0	0
	Trientalis borealis	fac	0	0	2	5	6	10	0	0	0	4	2	0
	Gaylussacia baccata^	fac	0	0	0	4	0	0	0	0	0	0	0	0
	Acer rubrum^	fac	0	0	0	0	0	0	0	0	0	4	0	0
	Rubus pubescens	fac	0	15	25	0	0	0	0	0	0	0	0	0
	Coptis trifolia^	fac	0	0	0	0	0	0	0	0	0	3	2	0
	Ilex mucronata	fac	0	0	0	0	8	8	0	0	0	0	0	0
	Vaccinium myrtilloides	fac	0	0	0	0	6	6	0	0	0	0	3	6
Shrub	*Acer rubrum*	fac	0	0	0	0	0	0	15	8	8	0	0	0
	Viburnum nudum	fac	0	0	0	0	0	0	10	8	8	0	0	6
	Alnus incana	facw	0	0	0	0	25	25	15	30	30	0	0	0
	Picea mariana^	facw	0	0	0	4	0	0	0	0	0	0	0	0
	Abies balsamea^	fac	10	0	0	0	0	0	0	0	0	0	0	0

Note: B=Baseline, Q = Quadrat ID, % = Percentage vegetation cover, PCM = Post Construction Monitoring

[1] Quadrat 5 was added in 2018 to replaced Quadrat 1 that was removed

^ Denotes a species previously recorded during the baseline (2016) or Year 3 (2019) assessments that was not observed during the Year 4 (2020) assessment.

Table D5: Vegetation Transect Data for Wetland 15, Transect 2.

Transect 2, Wetland 15														
Stratum	**Species**	**WL Indicator Status**	**Q2**			**Q3**			**Q4**			**Q5[1]**		
			B: 2016 %	**PCM 2019 %**	**PCM 2020 %**	**B: 2016 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2016 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2018 %**	**PCM 2019 %**	**PCM 2020 %**
Herb	*Dryopteris cristata*	facw	0	10	10	0	0	0	1	6	6	0	0	0
	*Coptis trifolia^*	fac	0	0	0	0	0	0	1	0	0	0	0	0
	Carex trisperma	obl	0	0	0	3	2	2	0	4	0	2	4	4
	Rubus pubescens	fac	1	12	12	1	3	3	0	0	0	6	6	6
	Viburnum nudum	fac	0	6	6	0	0	0	0	0	0	0	0	0
	Linnaea borealis	fac	0	0	0	2	4	4	0	0	0	0	0	0
	Cornus canadensis	fac	0	0	0	2	6	6	0	0	4	0	0	0
	Rubus hispidus	facw	1	0	0	0	0	0	0	2	2	0	0	0
	*Abies balsamea^*	fac	3	0	0	0	0	0	0	0	0	0	0	0
	Equisetum sylvaticum	fac	0	6	0	0	2	2	0	0	0	0	0	0
	Solidago rugosa	fac	0	4	4	0	0	0	0	0	0	2	3	3
	*Ilex verticillata^*	facw+	0	0	0	0	0	0	0	0	0	10	0	0
	Kalmia angustifolia	fac	0	0	0	0	5	5	0	0	0	0	0	0
	Trientalis borealis	fac	0	0	6	0	0	8	0	3	0	0	0	0
	*Trillium undulatum^*	fac	0	0	0	0	8	0	0	0	0	0	0	0
Shrub	*Alnus incana*	facw	12	0	0	0	0	0	50	60	60	0	0	0
	*Abies balsamea^*	fac	30	0	0	50	0	0	0	0	0	0	0	0
	Ilex verticillata	facw+	0	0	0	0	0	0	0	0	0	30	30	30
	Viburnum nudum	fac	6	0	0	0	0	0	0	10	10	0	0	0

Note: B=Baseline, Q = Quadrat ID, % = Percentage vegetation cover, PCM = Post Construction Monitoring

[1] Quadrat 5 was added in 2018 to replaced Quadrat 1 that was removed

^ Denotes a species previously recorded during the baseline (2016) or Year 3 (2019) assessments that was not observed during the Year 4 (2020) assessment.

Table D6: Vegetation Transect Data for Wetland 22, Transect 1.

Transect 1, Wetland 22														
Stratum	**Species**	**WL Indicator Status**	**Q1**			**Q2**			**Q3**			**Q4**		
			B: 2016 %	**PCM 2019 %**	**PCM 2020 %**	**B: 2016 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2016 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2016 %**	**PCM 2019 %**	**PCM 2020 %**
Herb	*Linnaea borealis*	fac	0	0	0	1	0	0	3	0	0	4	4	4
	Coptis trifolia	fac	0	0	0	0	0	0	0	12	12	1	4	4
	Mitella nuda^	facw	1	0	0	0	0	0	12	0	0	1	0	0
	Rubus hispidus	facw	0	5	5	3	18	18	1	10	10	0	0	0
	Dryopteris cristata	facw	2	0	0	0	28	45	25	20	20	0	0	0
	Solidago rugosa	fac	0	5	15	2	4	4	0	7	7	0	0	0
	Carex trisperma	obl	20	0	0	20	10	5	0	15	5	0	10	10
	Prunella vulgaris^	fac	1	0	0	0	0	0	0	0	0	0	0	0
	Acer rubrum	fac	0	0	0	0	0	0	0	0	0	0	1	1
	Abies balsamea	fac	0	0	0	0	0	0	0	0	0	0	1	1
	Trientalis borealis^	fac	0	0	0	0	0	0	0	3	0	0	5	0
	Impatiens capensis	fac	0	18	18	0	22	15	0	3	6	0	0	0
	Glyceria striata	facw	50	60	60	1	10	5	0	0	1	0	0	0
	Galium palustre	facw+	0	5	5	0	0	0	0	4	10	0	0	0
	*Oclemena nemoralis**	obl	0	0	8	0	0	0	0	0	0	0	0	0
	Onoclea sensibilis	fac	0	7	7	0	10	5	0	6	60	0	0	0
	Maianthemum canadense^	fac	0	0	0	0	0	0	0	0	0	0	3	0
Shrub	*Alnus incana*	facw	30	75	75	0	75	75	7	0	0	0	0	0

Note: B=Baseline, Q = Quadrat ID, % = Percentage vegetation cover, PCM = Post Construction Monitoring

* Denotes a new species recorded in the transect during the Year 4 (2020) assessment that was not present in baseline (2016) or Year 3 (2019) assessments.

^ Denotes a species previously recorded during the baseline (2016) or Year 3 (2019) assessments that was not observed during the Year 4 (2020) assessment.

Table D7: Vegetation Transect Data for Wetland 22, Transect 2.

Transect 2, Wetland 22														
Stratum	**Species**	**WL Indicator Status**	**Q1**			**Q2**			**Q3**			**Q4**		
			B: 2016 %	**PCM 2019 %**	**PCM 2020 %**	**B: 2016 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2016 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2016 %**	**PCM 2019 %**	**PCM 2020 %**
Herb	*Carex stricta*	obl	15	20	30	65	45	45	90	60	40	90	60	10
	*Carex folliculata**	obl	0	0	5	0	0	0	0	0	0	0	0	0
	Thalictrum pubescens^	facw	0	0	0	0	0	0	2	0	0	1	0	0
	Solidago rugosa	fac	6	6	0	0	0	0	35	4	4	15	5	5
	Oclemena acuminata	facu	1	0	0	0	0	5	0	0	0	0	0	0
	Typha latifolia^	obl	1	0	0	0	0	0	0	0	0	0	0	0
	Rubus pubescens^	fac	1	0	0	0	0	0	0	0	0	0	0	0
	Rubus hispidus	facw	2	8	8	0	0	0	0	0	0	0	0	0
	Calamagrostis canadensis	facw	0	25	15	0	0	0	0	0	0	0	0	0
	*Onoclea sensibilis**	facw	0	0	0	0	0	0	0	5	5	0	0	0
	Rubus allegheniensis	facu	1	40	40	0	0	10	25	40	60	35	50	30
Shrub	*Alnus incana*	facw	0	10	10	50	75	75	0	10	10	0	0	0

Note: B=Baseline, Q = Quadrat ID, % = Percentage vegetation cover, PCM = Post Construction Monitoring

* Denotes a new species recorded in the transect during the Year 4 (2020) assessment that was not present in baseline (2016) or Year 3 (2019) assessments.

^ Denotes a species previously recorded during the baseline (2016) or Year 3 (2019) assessments that was not observed during the Year 4 (2020) assessment.

Table D8: Vegetation Transect Data for Wetland 32, Transect 1.

Transect 1, Wetland 32														
			Q1			Q2			Q3			Q4		
	Species	WL Indicator Status	B: 2016 %	PCM 2019 %	PCM 2020 %	B: 2016 %	PCM 2019 %	PCM 2020 %	B: 2016 %	PCM 2019 %	PCM 2020 %	B: 2016 %	PCM 2019 %	PCM 2020 %
Stratum	*Cornus canadensis*	fac	2	25	25	0	0	0	0	0	0	0	0	0
	Trientalis borealis	fac	1	10	10	0	0	2	0	0	0	1	0	0
	Maianthemum canadense	fac	1	8	0	0	6	10	1	0	0	3	2	2
	Carex trisperma	obl	2	8	4	8	8	8	20	10	10	8	6	6
	Vaccinium myrtilloides	fac	1	0	6	0	0	0	1	0	0	1	4	4
	Picea rubens^	fac	5	0	0	0	0	0	0	0	0	0	0	0
	Rubus hispidus	facw	0	0	0	3	10	10	0	15	35	0	14	20
	Gaultheria hispidula	fac	0	0	0	6	0	7	0	12	0	4	0	0
	Rubus pubescens	fac	0	0	0	1	0	0	5	0	0	0	7	7
	Osmunda cinnamomea	fac	0	0	0	4	15	15	10	20	30	8	25	15
	Larix laricina^	fac	0	0	0	0	0	0	1	0	0	0	0	0
	Carex brunnescens	fac	0	0	0	0	0	6	0	10	40	0	0	0
	Kalmia angustifolia	fac	0	0	0	0	8	3	0	0	0	2	8	8
	Acer rubrum	fac	0	0	0	0	0	0	0	2	2	0	6	6
	*Phegopteris connectilis**	fac	0	0	0	0	0	10	0	0	0	0	0	0
	*Solidago canadensis**	fac	0	0	0	0	0	0	0	0	5	0	0	0
	Carex crinita^	obl	0	0	0	0	0	0	0	6	0	0	0	0
Shrub	*Alnus incana*	facw	0	0	0	0	0	0	1	0	8	0	0	0
	Abies balsamea	fac	20	12	22	10	0	7	0	5	0	0	0	0
Tree	*Abies balsamea*	fac	0	0	0	0	0	0	0	0	0	50	40	40

Note: B=Baseline, Q = Quadrat ID, % = Percentage vegetation cover, PCM = Post Construction Monitoring

* Denotes a new species recorded in the transect during the Year 4 (2020) assessment that was not present in baseline (2016) or Year 3 (2019) assessments.

^ Denotes a species previously recorded during the baseline (2016) or Year 3 (2019) assessments that was not observed during the Year 4 (2020) assessment.

Table D9: Vegetation Transect Data for Wetland 40, Transect 1.

Transect 1, Wetland 40														
			Q1			Q2			Q3			Q4		
	Species	WL Indicator Status	B: 2016 %	PCM 2019 %	PCM 2020 %	B: 2016 %	PCM 2019 %	PCM 2020 %	B: 2016 %	PCM 2019 %	PCM 2020 %	B: 2016 %	PCM 2019 %	PCM 2020 %
Stratum	*Thalictrum pubescens*	facw	12	35	35	8	12	12	10	30	20	1	18	20
	Carex trisperma	obl	10	12	12	10	25	25	13	15	25	0	35	15
	Solidago canadensis	fac	14	0	0	4	0	0	6	12	15	0	0	0
	Rubus hispidus	facw	10	0	10	16	0	8	3	0	7	1	0	18
	Abies balsamea^	fac	4	0	0	0	0	0	0	0	0	0	0	0
	Phegopteris connectilis^	fac	0	0	0	0	0	0	6	0	0	0	0	0
	Osmunda cinnamomea	fac	0	20	20	8	8	8	8	5	5	4	20	20
	Maianthemum trifolium^	fac	0	0	0	0	8	0	4	0	0	25	0	0
	Lonicera villosa	facw	0	0	5	0	0	0	6	0	0	20	0	19
	Triadenum virginicum^	obl	0	0	0	0	0	0	0	0	0	1	0	0
	Dryopteris intermedia^	fac	0	0	0	0	0	0	0	0	0	2	0	0
	Calamagrostis canadensis	facw	0	0	0	0	0	0	5	0	0	0	15	35
	*Glyceria canadensis**	obl	0	0	15	0	0	5	0	0	2	0	0	0
	*Rhododendron canadensis**	fac	0	0	0	0	0	0	0	0	0	0	0	10
	*Chelone glabra**	facw+	0	0	0	0	0	0	0	0	5	0	0	8
	Carex lurida	obl	0	10	10	0	0	10	0	0	5	0	0	0
Shrub	*Alnus incana*	facw	50	15	15	35	30	30	60	40	40	25	20	20
	Viburnum nudum	fac	0	10	10	0	0	0	0	0	0	0	10	10
	Abies balsamea^	fac	0	0	0	5	0	0	0	0	0	0	0	0

Note: B=Baseline, Q = Quadrat ID, % = Percentage vegetation cover, PCM = Post Construction Monitoring

* Denotes a new species recorded in the transect during the Year 4 (2020) assessment that was not present in baseline (2016) or Year 3 (2019) assessments.

^ Denotes a species previously recorded during the baseline (2016) or Year 3 (2019) assessments that was not observed during the Year 4 (2020) assessment.

Table D10: Vegetation Transect Data for Wetland 40, Transect 2.

Transect 2, Wetland 40														
Stratum	**Species**	**WL Indicator Status**	**Q1**			**Q2**			**Q3**			**Q4**		
			B: 2016 %	**PCM 2019 %**	**PCM 2020 %**	**B: 2016 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2016 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2016 %**	**PCM 2019 %**	**PCM 2020 %**
Herbs	*Osmunda cinnamomea*	fac	45	65	55	5	20	70	0	0	0	60	90	90
	Cornus canadensis	fac	25	10	10	2	6	6	15	25	25	20	12	12
	Kalmia angustifolia	fac	2	6	6	4	6	6	2	10	10	8	15	15
	Gaultheria hispidula	fac	4	8	8	1	8	8	12	6	10	10	2	6
	Abies balsamea	fac	6	10	10	0	0	0	26	30	30	4	0	0
	Trientalis borealis	fac	1	0	0	0	2	4	0	0	0	1	4	4
	Carex trisperma	obl	8	20	20	15	0	0	20	20	20	0	0	0
	Maianthemum canadense^	fac	4	0	0	3	3	0	0	0	0	0	0	0
	Oxalis montana	fac	0	0	0	1	5	5	0	0	0	0	4	0
	*Solidago canadensis**	fac	0	0	3	0	0	0	0	0	0	0	0	0
	Linnaea borealis	fac	0	0	0	0	0	0	0	0	0	0	6	6
Shrubs	*Acer rubrum*^	fac	0	0	0	0	0	0	10	0	0	0	0	0
	Ilex mucronata	fac	0	0	0	30	30	30	0	0	0	0	0	0
	Abies balsamea	fac	0	0	0	0	40	40	60	40	40	0	30	30

Note: B=Baseline, Q = Quadrat ID, % = Percentage vegetation cover, PCM = Post Construction Monitoring

* Denotes a new species recorded in the transect during the Year 4 (2020) assessment that was not present in baseline (2016) or Year 3 (2019) assessments.

^ Denotes a species previously recorded during the baseline (2016) or Year 3 (2019) assessments that was not observed during the Year 4 (2020) assessment.

Table D11: Vegetation Transect Data for Wetland 6, Transect 3.

Transect 3, Wetland 6														
Stratum	**Species**	**WL Indicator Status**	**Q1**			**Q2**			**Q3**			**Q4**		
			B: 2018 %	**PCM 2019 %**	**PCM 2020 %**	**B: 2018 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2018 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2018 %**	**PCM 2019 %**	**PCM 2020 %**
Herbs	*Carex trisperma*	obl	0	0	0	0	0	0	12	8	8	12	10	10
	*Kalmia angustifolia^*	fac	0	0	0	0	0	0	0	0	0	8	0	0
	*Gaultheria hispidula**	fac	0	0	0	0	0	0	0	0	2	0	0	0
	Linnaea borealis	fac	0	0	0	0	0	0	0	0	0	4	6	7
	Cornus canadensis	fac	0	0	0	0	0	0	6	6	6	6	10	10
	Osmunda cinnamomea	fac	0	0	0	0	0	0	40	40	40	0	0	0
	*Maianthemum canadense^*	fac	0	0	0	0	0	0	5	0	0	0	0	0
	Vaccinium myrtilloides	fac	0	0	0	0	0	0	10	8	4	0	6	3
	Rhododendron canadense	fac	0	0	0	20	25	30	0	0	0	0	0	0
	Chamaedaphne calyculata	obl	35	45	25	20	20	20	0	0	0	0	0	0
	Carex stricta	obl	20	15	15	50	50	50	0	0	0	0	0	0
	Coptis trifolia	fac	0	0	0	0	0	0	0	2	2	0	0	0
	*Spiraea alba**	fac	0	0	5	0	0	0	0	0	0	0	0	0
	Trientalis borealis	fac	0	0	0	0	0	0	0	4	4	0	0	0
Shrubs	*Ilex mucronata*	fac	0	0	0	0	0	0	25	25	25	0	0	0
	Abies balsamea	fac	0	0	0	25	25	25	0	0	0	0	0	0
	Larix laricina	fac	0	5	5	0	0	0	0	0	0	0	0	0
	Picea rubens	fac	0	0	0	0	0	0	0	0	0	0	5	5
	Myrica gale	obl	20	15	25	15	10	10	0	0	0	0	0	0

Note: B = Baseline, Q = Quadrat ID, % = Percentage vegetation cover, PCM = Post Construction Monitoring

* Denotes a new species recorded in the transect during the Year 4 (2020) assessment that was not present in baseline (2016) or Year 3 (2019) assessments.

^ Denotes a species previously recorded during the baseline (2016) or Year 3 (2019) assessments that was not observed during the Year 4 (2020) assessment.

Table D12: Vegetation Transect Data for Wetland 6, Transect 4.

Transect 4, Wetland 6														
Stratum	**Species**	**WL Indicator Status**	**Q1**			**Q2**			**Q3**			**Q4**		
			B: 2018 %	**PCM 2019 %**	**PCM 2020 %**	**B: 2018 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2018 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2018 %**	**PCM 2019 %**	**PCM 2020 %**
Herbs	*Rhododendron canadense*	fac	30	30	25	30	30	20	15	15	15	20	20	20
	Rhododendron groenlandicum	facw+	30	20	10	18	15	5	10	6	6	0	2	4
	Chamaedaphne calyculata	obl	30	25	30	10	10	15	12	25	15	25	25	25
	Picea mariana	facw	0	3	3	15	12	12	0	0	0	20	20	20
	Kalmia polifolia	obl	0	0	5	0	0	0	4	6	6	0	4	4
	Kalmia angustifolia	fac	30	10	5	6	10	15	10	15	25	0	0	0
	Empetrum nigrum	fac	0	0	0	0	0	0	1	6	10	0	0	0
	Vaccinium myrtilloides	fac	0	0	0	0	0	0	4	6	6	8	6	6
	Juncus tenuis^	fac	0	0	0	0	0	0	4	0	0	0	0	0
	Eriophorum vaginatum	obl	0	0	0	0	0	0	0	9	14	0	0	0
	*Lysimachia terrestris**	facw+	0	0	0	0	0	0	0	0	2	0	0	0
	*Larix laricina**	fac	0	0	0	0	0	0	0	0	2	0	0	0

Note: B = Baseline, Q = Quadrat ID, % = Percentage vegetation cover, PCM = Post Construction Monitoring

* Denotes a new species recorded in the transect during the Year 4 (2020) assessment that was not present in baseline (2016) or Year 3 (2019) assessments.

^ Denotes a species previously recorded during the baseline (2016) or Year 3 (2019) assessments that was not observed during the Year 4 (2020) assessment.

Table D13: Vegetation Transect Data for Wetland 22, Transect 3.

Transect 3, Wetland 22														
Stratum	**Species**	**WL Indicator Status**	**Q1**			**Q2[1]**			**Q3**			**Q4**		
			B: 2018 %	**PCM 2019 %**	**PCM 2020 %**	**B: 2018 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2018 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2018 %**	**PCM 2019 %**	**PCM 2020 %**
Herbs	*Carex stricta*	Obl	35	25	25	0	0	0	50	50	50	65	70	70
	Rubus allegheniensis	Facu	0	10	10	0	0	0	10	22	22	35	35	35
	Juncus effusus^	facw	0	0	0	0	0	0	15	0	0	0	0	0
	Osmunda cinnamomea	fac	0	0	0	0	0	0	30	20	20	0	0	0
	Solidago rugosa	fac	10	15	25	8	8	0	6	8	8	0	0	0
	Onoclea sensibilis	facw	20	30	20	40	28	8	0	0	0	0	0	0
	Thalictrum pubescens	facw	0	5	0	20	13	13	0	0	0	0	0	0
	Rubus hispidus	facw	10	10	10	8	7	7	0	0	0	0	0	0
	*Oclemena nemoralis**	obl	0	0	10	0	0	0	0	0	0	0	0	0
	Carex trisperma	obl	0	0	0	5	4	2	0	0	0	0	0	0
Shrubs	*Alnus incana*	facw	45	50	50	0	0	0	0	0	20	30	30	30

Note: B=Baseline, Q = Quadrat ID, % = Percentage vegetation cover, PCM = Post Construction Monitoring

[1] Larch Tree fell over on Q2 prior to assessment being completed in 2020, causing difficulty in aerial cover assessments.

* Denotes a new species recorded in the transect during the Year 4 (2020) assessment that was not present in baseline (2016) or Year 3 (2019) assessments.

^ Denotes a species previously recorded during the baseline (2016) or Year 3 (2019) assessments that was not observed during the Year 4 (2020) assessment.

Table D14: Vegetation Transect Data for Wetland 22, Transect 4.

Transect 4, Wetland 22											
Stratum	**Species**	**WL Indicator Status**	**Q1**			**Q2**			**Q3**		
			B: 2018 %	**PCM 2019 %**	**PCM 2020 %**	**B: 2018 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2018 %**	**PCM 2019 %**	**PCM 2020 %**
Herbs	*Carex stricta*	obl	0	0	0	0	0	0	75	75	75
	Rubus allegheniensis	facu	0	6	6	0	0	0	35	35	35
	Onoclea sensibilis	facw	0	0	0	40	40	40	0	0	0
	Cornus canadensis	fac	6	15	15	0	0	0	0	0	0
	Rubus hispidus	facw	20	35	45	0	0	0	0	0	0
	Carex folliculata	obl	8	18	28	0	0	0	0	0	0
	Maianthemum canadense^	fac	10	10	0	0	0	0	0	0	0
	Thelypteris palustris^	obl	0	0	0	0	0	0	0	5	0
	Oclemena nemoralis	obl	2	3	6	0	0	0	0	0	0
Shrubs	*Alnus incana*	facw	55	0	0	40	45	45	0	0	0

Note: B = Baseline, Q = Quadrat ID, % = Percentage vegetation cover, PCM = Post Construction Monitoring

*Denotes a new species in Year 3 to the study quadrat

^ Denotes a species previously recorded during the baseline (2016) or Year 3 (2019) assessments that was not observed during the Year 4 (2020) assessment.

Table D15: Vegetation Transect Data for Wetland 22, Transect 5.

Transect 5, Wetland 22														
Stratum	**Species**	**WL Indicator Status**	**Q1**			**Q2**			**Q3**			**Q4**		
			B: 2018 %	**PCM 2019 %**	**PCM 2020 %**	**B: 2018 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2018 %**	**PCM 2019 %**	**PCM 2020 %**	**B: 2018 %**	**PCM 2019 %**	**PCM 2020 %**
Herbs	*Carex stricta*	obl	0	0	0	0	0	0	0	0	0	95	90	90
	Galium palustre	facw+	0	0	0	0	0	0	0	0	0	6	5	5
	Onoclea sensibilis	facw	0	0	0	25	35	35	0	0	0	12	0	0
	Thalictrum pubescens	facw	0	0	0	0	0	0	10	15	10	0	0	0
	Cornus canadensis	fac	0	0	0	0	0	0	6	6	6	0	0	0
	Rubus hispidus^	facw	0	0	0	0	0	0	16	0	0	0	0	0
	Carex folliculata	obl	0	0	0	5	5	5	15	8	4	0	0	0
	Carex trisperma	obl	0	3	3	15	15	10	20	10	10	0	0	0
	Glyceria canadensis	obl	0	0	0	0	0	0	0	12	12	0	0	0
	Calamagrostis canadensis	facw	0	0	0	0	0	0	12	6	6	0	15	15
	Solidago canadensis	fac	0	0	0	4	10	8	15	10	20	0	5	5
	Abies balsamea	fac	0	0	0	0	5	5	6	1	2	0	0	0
	Trientalis borealis	fac	6	6	10	3	5	5	0	0	0	0	0	0
	Oclemena nemoralis	obl	0	0	0	2	0	5	0	0	0	0	0	0
	Rubus pubescens^	fac	0	0	0	1	0	0	0	0	0	0	0	0
	Acer rubrum^	fac	1	1	0	0	0	0	0	0	0	0	0	0
	Maianthemum canadense	fac	3	3	3	0	0	0	0	0	0	0	0	0

Note: B = Baseline, Q = Quadrat ID, % = Percentage vegetation cover, PCM = Post Construction Monitoring

^ Denotes a species previously recorded during the baseline (2016) or Year 3 (2019) assessments that was not observed during the Year 4 (2020) assessment.

APPENDIX E: DETAILED VEGETATION VISUAL ASSESSMENT RESULTS

Appendix E: Detailed Vegetation Transect Visual Observation Results

Detailed Vegetation Transect Dominant Species

Dominant species identified during each monitoring event are provided in Tables E1-6 below.

Table E1: Dominant plant species of Wetland 1.

Transect 1 – Wetland 1					
Stratum	**Baseline (May 2016)**	**Year 1 (July 2017)**	**Year 2 (July 2018)**	**Year 3 (August 2019)**	**Year 4 (August 2020)**
Herbs	*Rhododendron groenlandicum*	*Rhododendron groenlandicum*	*Kalmia angustifolia*	*Kalmia angustifolia*	*Rhododendron groenlandicum*
	Kalmia angustifolia	*Osmunda cinnamomea*			*Kalmia angustifolia*
Shrubs	*Picea mariana*	*Picea mariana*	*Picea mariana*	*Picea mariana*	*Picea mariana*
	Ilex mucronata	*Ilex mucronata*	*Ilex mucronata*	*Ilex mucronata*	*Ilex mucronata*

Table E2: Dominant plant species of Wetland 6.

Transect 1 – Wetland 6					
Stratum	**Baseline (May 2016)**	**Year 1 (July 2017)**	**Year 2 (July 2018)**	**Year 3 (August 2019)**	**Year 4 (August 2020)**
Herbs	*Kalmia angustifolia*	*Kalmia angustifolia*	*Chamaedaphne calyculata*	*Chamaedaphne calyculata*	*Chamaedaphne calyculata*
	Chamaedaphne calyculata	*Chamaedaphne calyculata*			
Transect 2 – Wetland 6					
Herbs	*Carex stricta*	*Carex stricta*	*Carex stricta*	*Carex stricta*	*Carex stricta*
		Kalmia polifolia	*Chamaedaphne calyculata*	*Chamaedaphne calyculata*	*Kalmia polifolia*
Shrubs	*Viburnum nudum*	*Larix laricina*	*Larix laricina*	*Larix laricina*	*Larix laricina*
		Viburnum nudum			
Trees	*Larix laricina*	None	None	None	None

Transect 3 – Wetland 6			
Stratum	**Baseline (July 2018)**	**Year 1 (August 2019)**	**Year 2 (August 2020)**
Herbs	*Carex stricta*	*Carex stricta*	*Carex stricta*
	Chamaedaphne calyculata	*Chamaedaphne calyculata*	
Shrubs	*Ilex mucronata*	*Ilex mucronata*	*Ilex mucronata*
	Abies balsamea	*Abies balsamea*	*Abies balsamea*
	Myrica gale	*Myrica gale*	*Myrica gale*
Transect 4 – Wetland 6			
Herbs	*Rhododendron canadense*	*Rhododendron canadense*	*Rhododendron canadense*
	Chamaedaphne calyculata	*Chamaedaphne calyculata*	*Chamaedaphne calyculata*

Table E3: Dominant plant species of Wetland 15.

Transect 1 – Wetland 15					
Stratum	**Baseline (May 2016)**	**Year 1 (July 2017)**	**Year 2 (July 2018)**	**Year 3 (July 2019)**	**Year 4 (August 2020)**
Herbs	*Carex trisperma*	*Kalmia angustifolia*	*Kalmia angustifolia*	*Kalmia angustifolia*	*Kalmia angustifolia*
Shrubs	*Acer rubrum*	*Viburnum nudum*	*Alnus incana*	*Alnus incana*	*Alnus incana*
	Viburnum nudum	*Alnus incana*			
	Alnus incana				
Trees	*Picea mariana*	*Picea mariana*	None	*Picea mariana*	None
Transect 2 – Wetland 15					
Herbs	*Viburnum nudum*	*Viburnum nudum*	None	*Rubus pubescens*	*Rubus pubescens*
Shrubs	*Alnus incana*	*Alnus incana*	*Alnus incana*	*Alnus incana*	*Alnus incana*
	Abies balsamea	*Abies balsamea*	*Abies balsamea*	*Ilex verticillata*	*Ilex verticillata*

Table E4: Dominant plant species of Wetland 22.

Transect 1 – Wetland 22					
Stratum	**Baseline (May 2016)**	**Year 1 (July 2017)**	**Year 2 (July 2018)**	**Year 3 (July 2019)**	**Year 4 (August 2020)**
Herbs	*Glyceria striata*	*Glyceria striata*	*Glyceria striata*	*Glyceria striata*	*Glyceria striata*
	Carex trisperma				*Dryopteris cristata*
Shrubs	*Alnus incana*	*Alnus incana*	*Alnus incana*	*Alnus incana*	*Alnus incana*
Transect 2 – Wetland 22					
Herbs	*Carex stricta*	*Carex stricta*	*Carex stricta*	*Carex stricta*	*Carex stricta*
		Rubus allegheniensis	*Rubus allegheniensis*	*Rubus allegheniensis*	*Rubus allegheniensis*
Shrubs	*Alnus incana*	*Alnus incana*	*Alnus incana*	*Alnus incana*	*Alnus incana*
Transect 3 – Wetland 22					
Stratum	**Baseline (July 2018)**		**Year 1 (July 2019)**		**Year 2 (August 2020)**
Herbs	*Carex stricta*		*Carex stricta*		*Carex stricta*
					Rubus allegheniensis
Shrubs	*Alnus incana*		*Alnus incana*		*Alnus incana*
Transect 4 – Wetland 22					
Herbs	*Carex stricta*		*Carex stricta*		*Carex stricta*
Shrubs	*Alnus incana*		*Alnus incana*		*Alnus incana*
Transect 5 – Wetland 22					
Herbs	*Carex stricta*		*Carex stricta*		*Carex stricta*

Table E5: Dominant plant species of Wetland 32.

Transect 1 – Wetland 32					
Stratum	**Baseline (May 2016)**	**Year 1 (July 2017)**	**Year 2 (July 2018)**	**Year 3 (July 2019)**	**Year 4 (August 2020)**
Herbs	*Osmunda cinnamomea*	*Osmunda cinnamomea*	*Osmunda cinnamomea*	*Osmunda cinnamomea*	*Osmunda cinnamomea*
	Carex trisperma		*Carex trisperma*		*Rubus hispidus*
Shrubs	*Abies balsamea*	*Viburnum nudum*	None	None	*Alnus incana*
					Abies balsamea
Trees	*Abies balsamea*	*Abies balsamea*	*Abies balsamea*	*Abies balsamea*	*Abies balsamea*

Table E6: Dominant plant species of Wetland 40.

Transect 1 – Wetland 40					
Stratum	**Baseline (May 2016)**	**Year 1 (July 2017)**	**Year 2 (July 2018)**	**Year 3 (July 2019)**	**Year 4 (August 2020)**
Herbs	None	*Thalictrum pubescens* *Osmunda cinnamomea*	*Thalictrum pubescens* *Osmunda cinnamomea*	*Thalictrum pubescens* *Carex trisperma*	*Thalictrum pubescens*
Shrubs	*Alnus incana*	*Alnus incana*	*Alnus incana*	*Alnus incana*	*Alnus incana*
Transect 2 – Wetland 40					
Herbs	*Osmunda cinnamomea* *Cornus canadensis*	*Osmunda cinnamomea*	*Osmunda cinnamomea*	*Osmunda cinnamomea*	*Osmunda cinnamomea*
Shrubs	*Ilex mucronata*	*Ilex mucronata*	*Ilex mucronata*	*Ilex mucronata*	*Ilex mucronata*
	Abies balsamea	*Abies balsamea*	*Abies balsamea*	*Abies balsamea*	*Abies balsamea*

Substrate and Topography Evaluation

Details related to the substrate characteristics at each quadrat location during baseline, Year 1, 2 and 3 PCM are provided in Tables E7-12.

Table E7: Substrate Characteristics per Quadrat – Wetland 1.

Topography				**Transect 1 – Wetland 1**															
B: 2016	**PCM: 2018**	**PCM: 2019**	**PCM: 2020**	**Q1**				**Q2**				**Q3**				**Q4**			
concave	concave	concave	concave	**B: 2016**	**PCM: 2018**	**PCM: 2019**	**PCM: 2020**	**B: 2016**	**PCM: 2018**	**PCM: 2019**	**PCM: 2020**	**B: 2016**	**PCM: 2018**	**PCM: 2019**	**PCM: 2020**	**B: 2016**	**PCM: 2018**	**PCM: 2019**	**PCM: 2020**
Water (%)				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Muck (%)				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Moss (%)				100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
% Stone, rock, exposed mineral				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: B=Baseline, Q = Quadrat ID, PCM = Post Construction Monitoring

Table E8: Substrate Characteristics per Quadrat – Wetland 6.

Topography				Transect 1 – Wetland 6														
B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	Q2				Q3				Q4				Q5[1]		
concave	concave	concave	concave	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	PCM: 2018	PCM: 2019	PCM: 2020
Water (%)				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Muck (%)				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Moss (%)				100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
% Stone, rock, exposed mineral				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Topography				Transect 2 – Wetland 6										
B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	Q3				Q4				Q5[2]		
concave	concave	concave	concave	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	PCM: 2018	PCM: 2019	PCM: 2020
Water (%)				60	0	0	0	25	0	0	0	0	0	0
Muck (%)				0	60	0	0	0	10	0	0	0	0	0
Moss (%)				40	40	100	100	75	90	100	100	100	100	100
% Stone, rock, exposed mineral				0	0	0	0	0	0	0	0	0	0	0

Topography			Transect 3[3] – Wetland 6											
B: 2018	PCM: 2019	PCM: 2020	Q1			Q2			Q3			Q4		
concave	concave	concave	B: 2018	PCM: 2019	PCM: 2020	B: 2018	PCM: 2019	PCM: 2020	B: 2018	PCM: 2019	PCM: 2020	B: 2018	PCM: 2019	PCM: 2020
Water (%)			0	0	0	0	0	0	0	0	0	0	0	0
Muck (%)			0	0	0	0	0	0	0	0	0	0	0	0
Moss (%)			100	100	100	100	100	100	100	100	100	100	100	100
% Stone, rock, exposed mineral			0	0	0	0	0	0	0	0	0	0	0	0

Topography			Transect 4[3] – Wetland 6											
B: 2018	PCM: 2019	PCM: 2020	Q1			Q2			Q3			Q4		
concave	concave	concave	B: 2018	PCM: 2019	PCM: 2020	B: 2018	PCM: 2019	PCM: 2020	B: 2018	PCM: 2019	PCM: 2020	B: 2018	PCM: 2019	PCM: 2020
Water (%)			0	0	0	0	0	0	0	0	0	0	0	0
Muck (%)			0	0	0	0	0	0	0	0	0	0	0	0
Moss (%)			100	100	100	100	100	100	100	100	100	100	100	100
% Stone, rock, exposed mineral			0	0	0	0	0	0	0	0	0	0	0	0

Note: B=Baseline, Q = Quadrat ID, PCM = Post Construction Monitoring

[1] Quadrat 5 was added in 2018 to replaced Quadrat 1 that was destroyed.

[2] Quadrat 5 was added in 2018 to replaced Quadrats 1 and 2 that were destroyed.

[3] Transects 3 and 4 were added in 2018; hence the baseline data were collected in July 2018.

Table E9: Substrate Characteristics per Quadrat – Wetland 15.

Topography				Transect 1 – Wetland 15														
B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	Q2				Q3				Q4				Q5[1]		
concave	concave	concave	concave	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2018	PCM: 2019	PCM: 2020
Water (%)				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Muck (%)				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Moss (%)				100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
% Stone, rock, exposed mineral				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Topography				**Transect 2 – Wetland 15**														
B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	Q2				Q3				Q4				Q5[1]		
concave	concave	concave	concave	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2018	PCM 2019	PCM: 2020
Water (%)				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Muck (%)				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Moss (%)				100	100	95	95	100	100	100	100	100	100	100	85	30	30	30
% Stone, rock, exposed mineral				0	0	5	5	0	0	0	0	0	0	0	15	70	70	70

Note: B=Baseline, Q = Quadrat ID, PCM: Post Construction Monitoring

[1] Quadrat 5 was added in 2018 to replaced Quadrat 1 that was removed

Table E10: Substrate Characteristics per Quadrat – Wetland 22.

Topography				Transect 1 – Wetland 22															
B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	Q1				Q2				Q3				Q4			
concave	concave	concave	concave	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020
Water (%)				2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Muck (%)				30	0	0	0	35	5	0	0	1	1	0	0	0	0	0	0
Moss (%)				68	100	100	100	65	95	100	100	99	99	100	100	100	100	100	100
% Stone, rock, exposed mineral				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Topography				**Transect 2 – Wetland 22**															
B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	Q1				Q2				Q3				Q4			
sloped	sloped	sloped	sloped	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020
Water (%)				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Muck (%)				0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0
Moss (%)				100	100	100	100	90	100	100	100	100	100	100	100	100	100	100	100
% Stone, rock, exposed mineral				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Topography				**Transect 3[1] – Wetland 22**															
PCM: 2018	PCM: 2019	PCM: 2020		Q1				Q2				Q3				Q4			
concave	concave	concave		B: 2018	PCM: 2019	PCM: 2020		B: 2018	PCM: 2019	PCM: 2020		B: 2018	PCM: 2019	PCM: 2020		B: 2018	PCM: 2019	PCM: 2020	
Water (%)				0	0	0		0	0	0		0	0	0		0	0	0	
Muck (%)				0	0	0		0	0	0		0	0	0		0	0	0	
Moss (%)				100	100	100		100	100	100		100	100	100		100	100	100	
% Stone, rock, exposed mineral				0	0	0		0	0	0		0	0	0		0	0	0	
Topography				**Transect 4[1] – Wetland 22**															
PCM: 2018	PCM: 2019	PCM: 2020		Q1				Q2				Q3							
concave	concave	concave		B: 2018	PCM: 2019	PCM: 2020		B: 2018	PCM: 2019	PCM: 2020		B: 2018	PCM: 2019	PCM: 2020					
Water (%)				0	0	0		0	0	0		0	0	0					
Muck (%)				0	0	0		0	0	0		0	0	0					
Moss (%)				100	95	95		100	80	50		100	100	100					
% Stone, rock, exposed mineral				0	5	5		0	20	50		0	0	0					
Topography				**Transect 5[1] – Wetland 22**															
B: 2018	PCM: 2019	PCM: 2020		Q1				Q2				Q3				Q4			
concave	concave	concave		B: 2018	PCM: 2019	PCM: 2020		B: 2018	PCM: 2019	PCM: 2020		B: 2018	PCM: 2019	PCM: 2020		B: 2018	PCM: 2019	PCM: 2020	
Water (%)				0	0	0		0	0	0		0	0	0		0	0	0	
Muck (%)				0	0	0		0	0	0		0	0	0		0	0	0	
Moss (%)				100	100	100		100	100	100		100	100	100		100	100	100	
% Stone, rock, exposed mineral				0	0	0		0	0	0		0	0	0		0	0	0	

Note: B=Baseline, Q = Quadrat ID, PCM = Post Construction Monitoring, [1] Transect 3, 4 and 5 were added in 2018; hence the baseline data were collected in July 2018.

Table E11: Substrate Characteristics per Quadrat – Wetland 32.

Topography				Transect 1 – Wetland 32															
B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	Q1				Q2				Q3				Q4			
concave	concave	concave	concave	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020
Water (%)				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Muck (%)				0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Moss (%)				89	95	85	85	94	85	90	90	93	90	90	90	100	100	100	100
% Stone, rock, exposed mineral				11	5	15	15	6	15	10	10	5	10	10	10	0	0	0	0

Note: B=Baseline, Q = Quadrat ID, PCM = Post Construction Monitoring

Table E12: Substrate Characteristics per Quadrat – Wetland 40.

Topography				Transect 1 – Wetland 40															
B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	Q1				Q2				Q3				Q4			
concave	concave	concave	concave	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020	B: 2016	PCM: 2018	PCM: 2019	PCM: 2020
Water (%)				50	30	10	5	20	30	15	0	40	30	20	10	0	0	0	0
Muck (%)				0	20	40	45	10	15	30	45	20	40	30	40	10	0	0	0
Moss (%)				50	50	50	50	70	55	55	55	40	30	50	50	90	100	100	100
% Stone, rock, exposed mineral				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Topography				**Transect 2 – Wetland 40**															
B: 2016	**PCM: 2018**	**PCM: 2019**	**PCM: 2020**	**Q1**				**Q2**				**Q3**				**Q4**			
concave	concave	concave	concave	**B: 2016**	**PCM: 2018**	**PCM: 2019**	**PCM: 2020**	**B: 2016**	**PCM: 2018**	**PCM: 2019**	**PCM: 2020**	**B: 2016**	**PCM: 2018**	**PCM: 2019**	**PCM: 2020**	**B: 2016**	**PCM: 2018**	**PCM: 2019**	**PCM: 2020**
Water (%)				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Muck (%)				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Moss (%)				100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
% Stone, rock, exposed mineral				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: B=Baseline, Q = Quadrat ID, PCM = Post Construction Monitoring

Photographic Documentation

Representative wetland habitat along detailed vegetation transects are provide in Photos E1-45 below.

Photo E1: Representative Wetland Habitat in WL1, T1 During Baseline Monitoring (2016)

Photo E2: Representative Wetland Habitat in WL1, T1 During Year 3 PCM (2019)

Photo E3: Representative Wetland Habitat in WL1, T1 During Year 4 PCM (2020)

Photo E4: Representative Wetland Habitat in WL6, T1 During Baseline Monitoring (2016)

Photo E5: Representative Wetland Habitat in WL 6, T1 During Year 3 PCM (2019)

Photo E6: Representative Wetland Habitat in WL 6, T1 During Year 4 PCM (2020)

Photo E7: Representative Wetland Habitat in WL6, T2 During Baseline Monitoring (2016)

Photo E8: Representative Wetland Habitat in WL6, T2 During Year 3 PCM (2019)

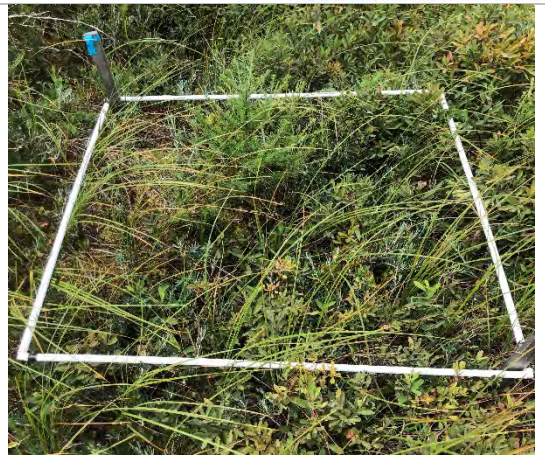


Photo E9: Representative Wetland Habitat in WL 6, T2 During Year 4 PCM (2020)

Photo E10: Representative Wetland Habitat in WL6, T3 During Baseline Monitoring (2018)

Photo E11: Representative Wetland Habitat in WL6, T3 During Year 1 PCM (2019)

Photo E12: Representative Wetland Habitat in WL 6, T3 During Year 2 PCM (2020)

Photo E13: Representative Wetland Habitat in WL6, T4 During Baseline Monitoring (2018)

Photo E14: Representative Wetland Habitat in WL 6, T4 During Year 1 PCM (2019)

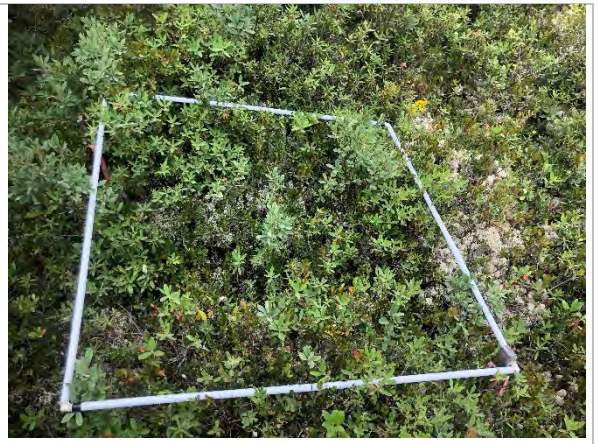


Photo E15: Representative Wetland Habitat in WL 6, T4 During Year 2 PCM (2020)

Photo E16: Representative Wetland Habitat in WL15, T1 During Baseline Monitoring (2016)

Photo E17: Representative Wetland Habitat in WL15, T1 During Year 3 PCM (2019)

Photo E18: Representative Wetland Habitat in WL 15, T1 During Year 4 PCM (2020)

Photo E19: Representative Wetland Habitat in WL 15, T2 During Baseline Monitoring (2016)

Photo E20: Representative Wetland Habitat in WL15, T2 During Year 3 PCM (2019)

Photo E21: Representative Wetland Habitat in WL 15, T2 During Year 4 PCM (2020)

Photo E22: Representative Wetland Habitat in WL22, T1 During Baseline Monitoring (2016)

Photo E23: Representative Wetland Habitat in WL22, T1 During Year 3 PCM (2019)

Photo E24: Representative Wetland Habitat in WL22, T1 During Year 4 PCM (2020)

Photo E25: Representative Wetland Habitat in WL22, T2 During Baseline Monitoring (2016)

Photo E26: Representative Wetland Habitat in WL22, T2 During Year 3 PCM (2019)

Photo E27: Representative Wetland Habitat in WL22, T2 During Year 4 PCM (2020)

Photo E28: Representative Wetland Habitat in WL22, T3 During Baseline Monitoring (2018)

Photo E29: Representative Wetland Habitat in WL22, T3 During Year 1 PCM (2019)

Photo E30: Representative Wetland Habitat in WL22, T3 During Year 2 PCM (2020)

Photo E31: Representative Wetland Habitat in WL22, T4 During Baseline Monitoring (2018)

Photo E32: Representative Wetland Habitat in WL22, T4 During Year 1 PCM (2019)

Photo E33: Representative Wetland Habitat in WL22, T4 During Year 2 PCM (2020)

Photo E34: Representative Wetland Habitat in WL22, T5 During Baseline Monitoring (2018)

Photo E35: Representative Wetland Habitat in WL22, T5 During Year 1 PCM (2019)

Photo E36: Representative Wetland Habitat in WL22, T5 During Year 2 PCM (2020)

Photo E37: Representative Wetland Habitat in WL32, T1 During Baseline Monitoring (2016)

Photo E38: Representative Wetland Habitat in WL 32, T1 During Year 3 PCM (2019)

Photo E39: Representative Wetland Habitat in WL 32, T1 During Year 4 PCM (2020)

Photo E40: Representative Wetland Habitat in WL40, T1 During Baseline Monitoring (2016)

Photo E41: Representative Wetland Habitat in WL 40, T1 During Year 3 PCM (2019)

Photo E42: Representative Wetland Habitat in WL 40, T1 During Year 4 PCM (2020)

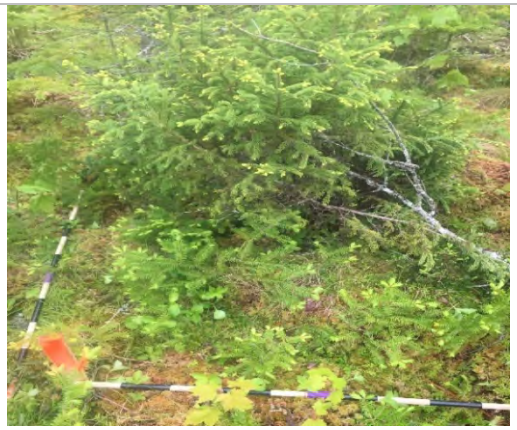


Photo E43: Representative Wetland Habitat in WL40, T2 During Baseline Monitoring (2016)

Photo E44: Representative Wetland Habitat in WL 40, T2 During Year 3 PCM (2019)

Photo E45: Representative Wetland Habitat in WL 40, T2 During Year 4 PCM (2020)

APPENDIX F: DETAILED HYDROLOGY RESULTS

Appendix F: Detailed Hydrology Monitoring Results

Appendix F provides relative ground water depths recorded in 2016 baseline monitoring, and post construction monitoring from 2017 to 2020. Water level data collected by Solinst Leveloggers within monitoring wells are provided in Figures F1 – F8. Two additional monitoring wells (MW6.2 and MW 22.3) were added to the monitoring program during the 2018 Year 2 PCM. Water level data collected by Solinst Leveloggers within these wells are provided in Figures F9 and F10.

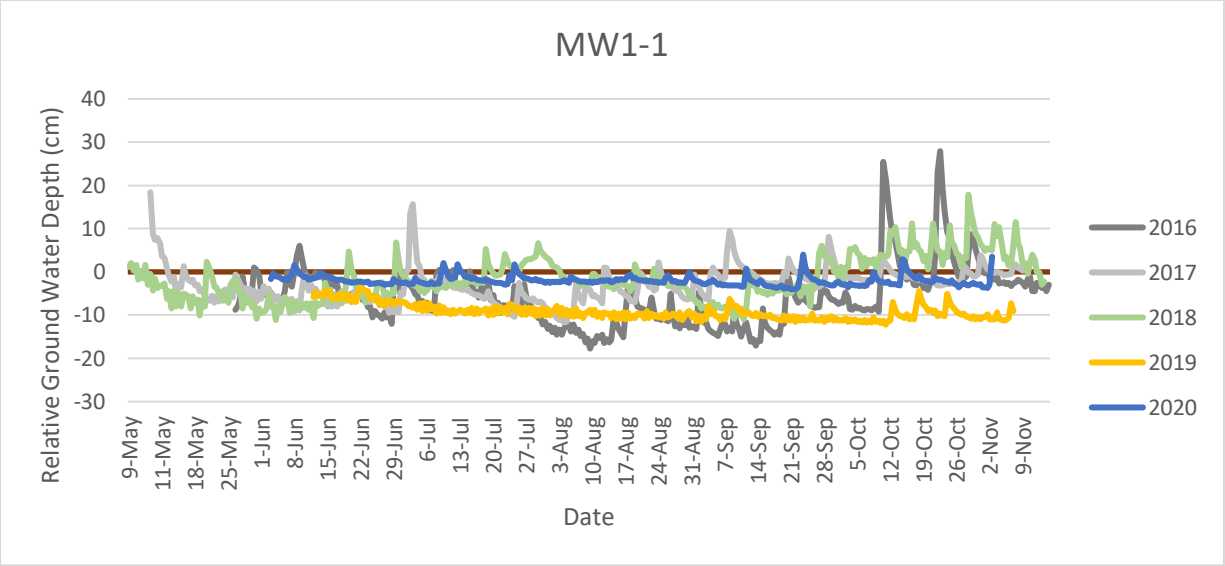


Figure F1: 2016 to 2020 water level data collected in Wetland 1, MW 1 from May 4 – November 14.

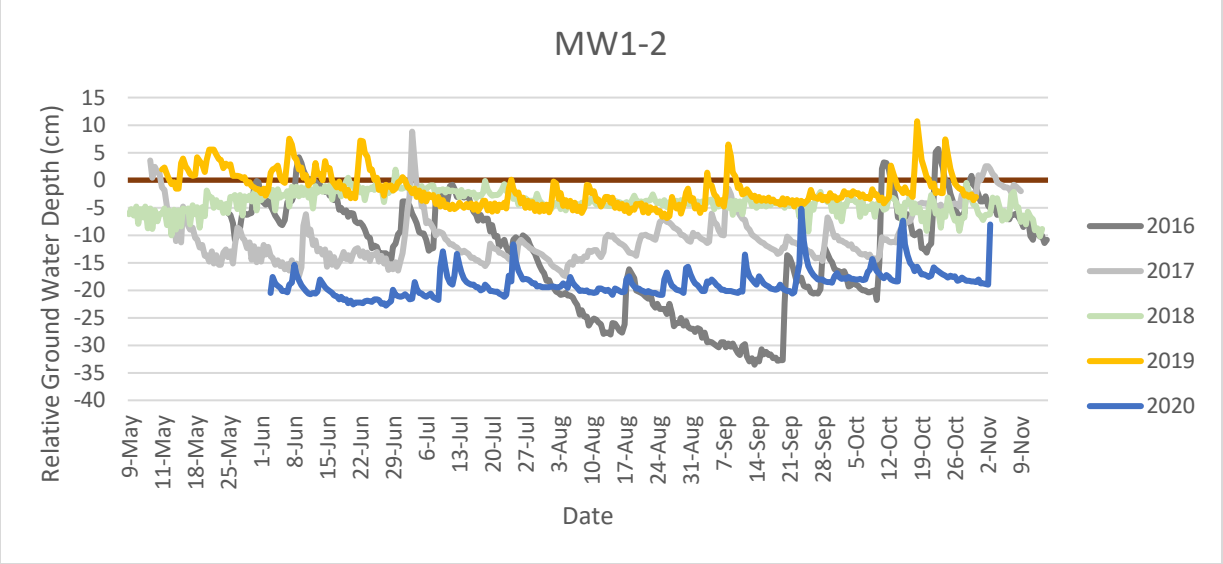


Figure F2: 2016 to 2020 water level data collected in Wetland 1, MW 2 from May 4 to November 14.

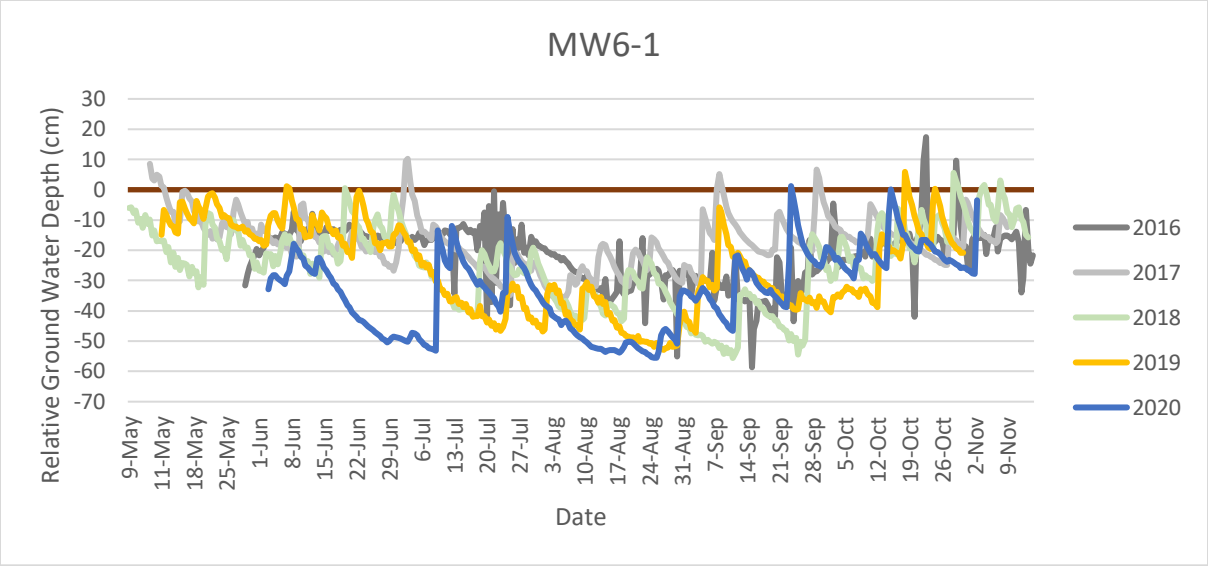


Figure F3: 2016 to 2020 water level data collected in Wetland 6, MW 1 from May 4 to November 14.

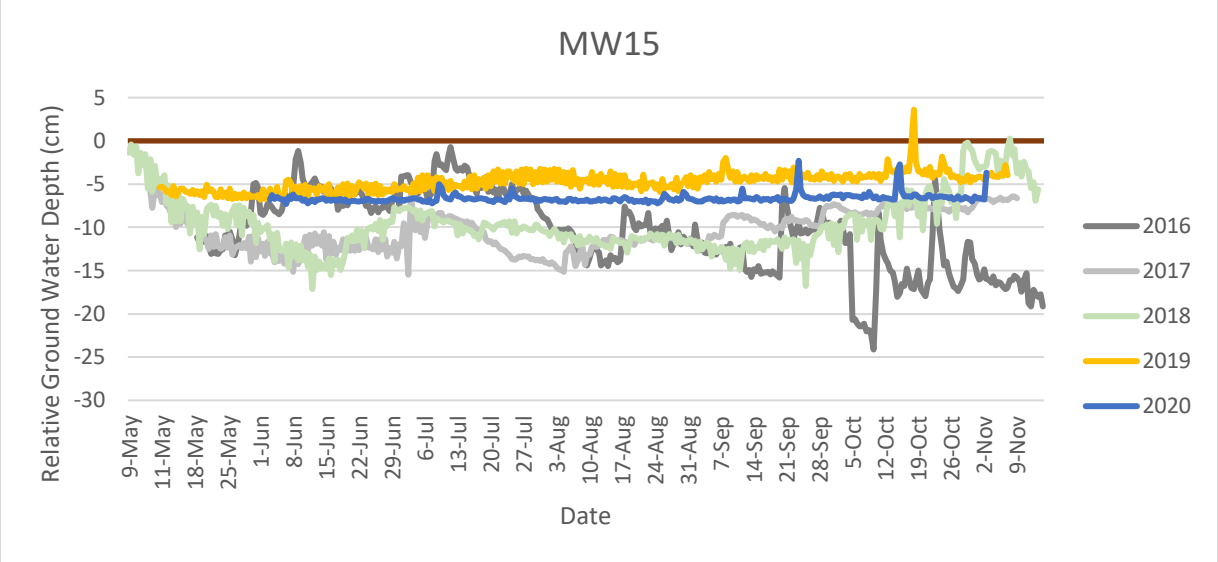


Figure F4: 2016 to 2020 water level data collected in Wetland 15 from May 4 to November 14.

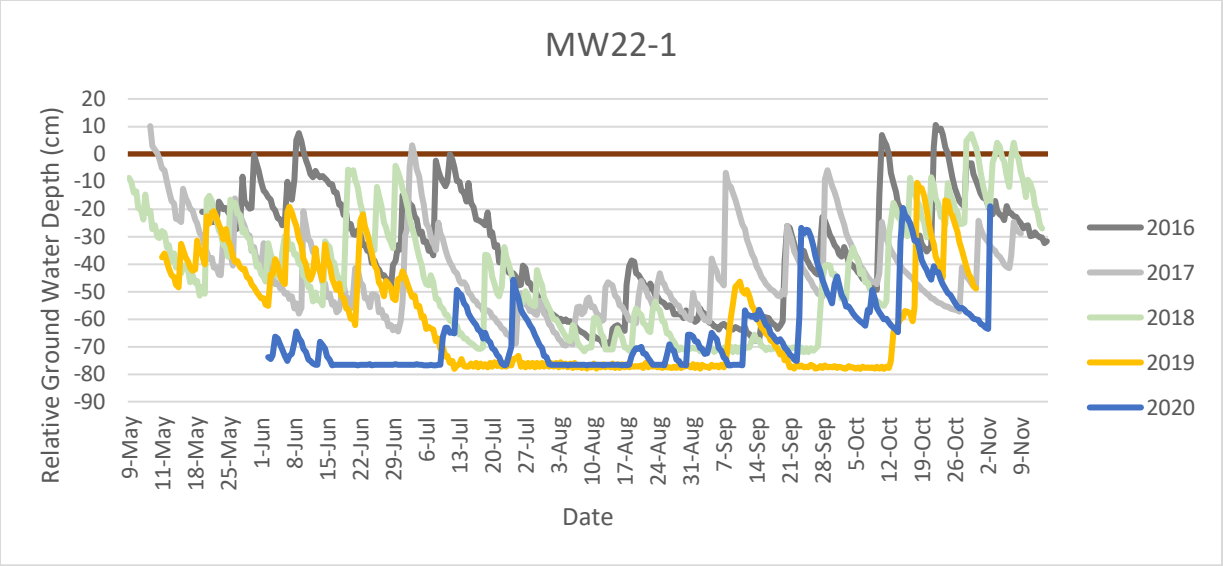


Figure F5: 2016 to 2020 water level data collected in Wetland 22, MW 1 from May 4 to November 14.

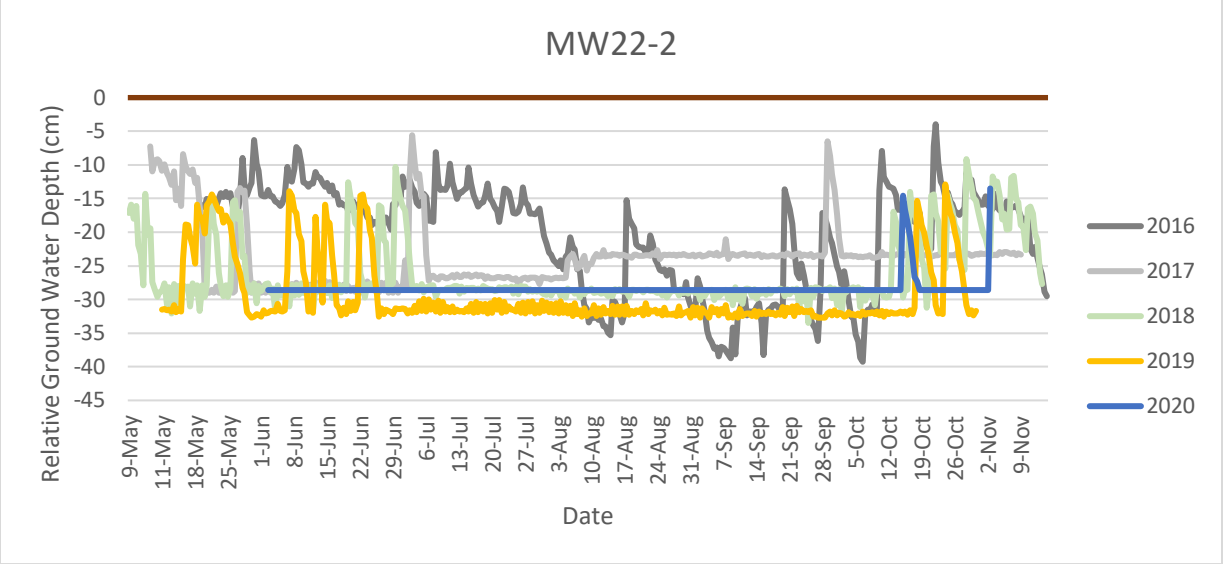


Figure F6: 2016 to 2020 water level data collected in Wetland 22, MW 2 from May 4 to November 14.

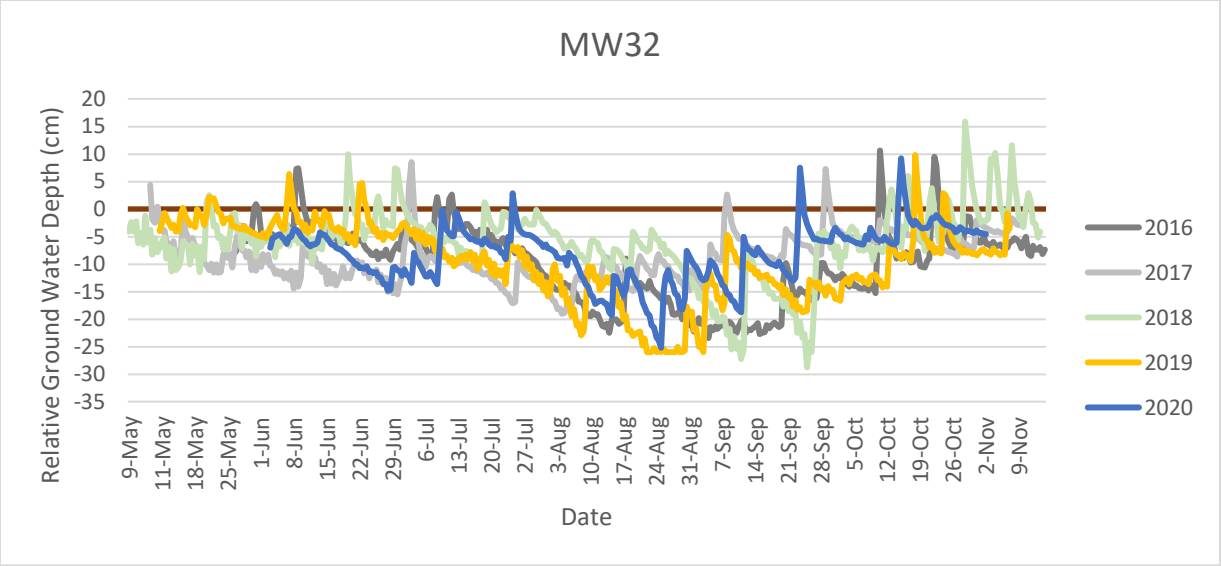


Figure F7: 2016 to 2020 water level data collected in Wetland 32 from May 4 to November 14.

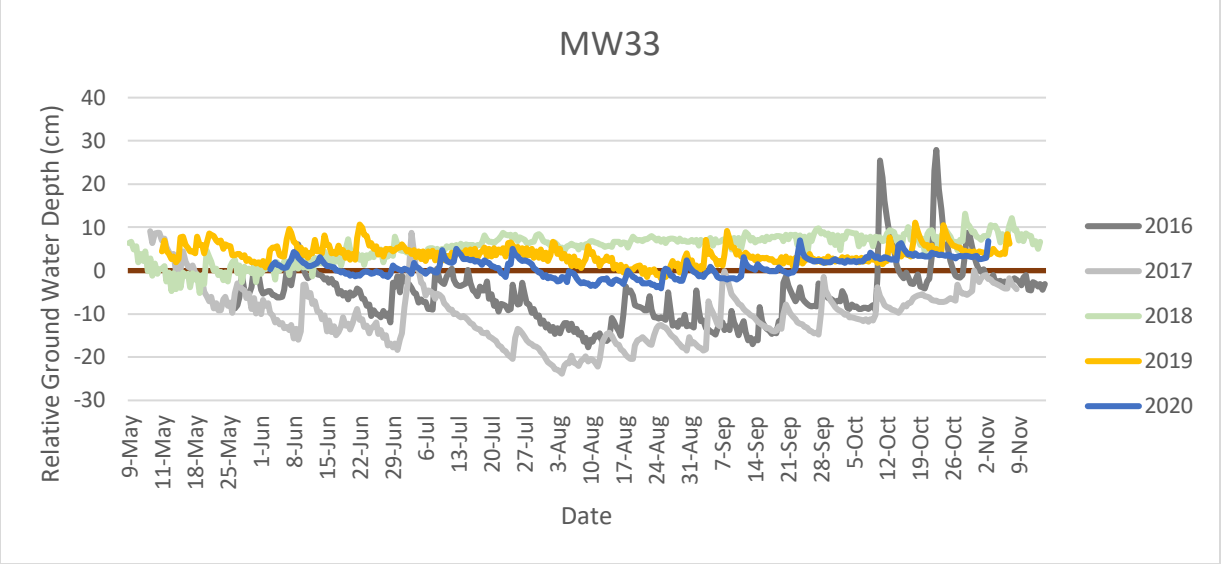


Figure F8: 2016 to 2020 water level data collected in Wetland 33 from May 4 to November 14.

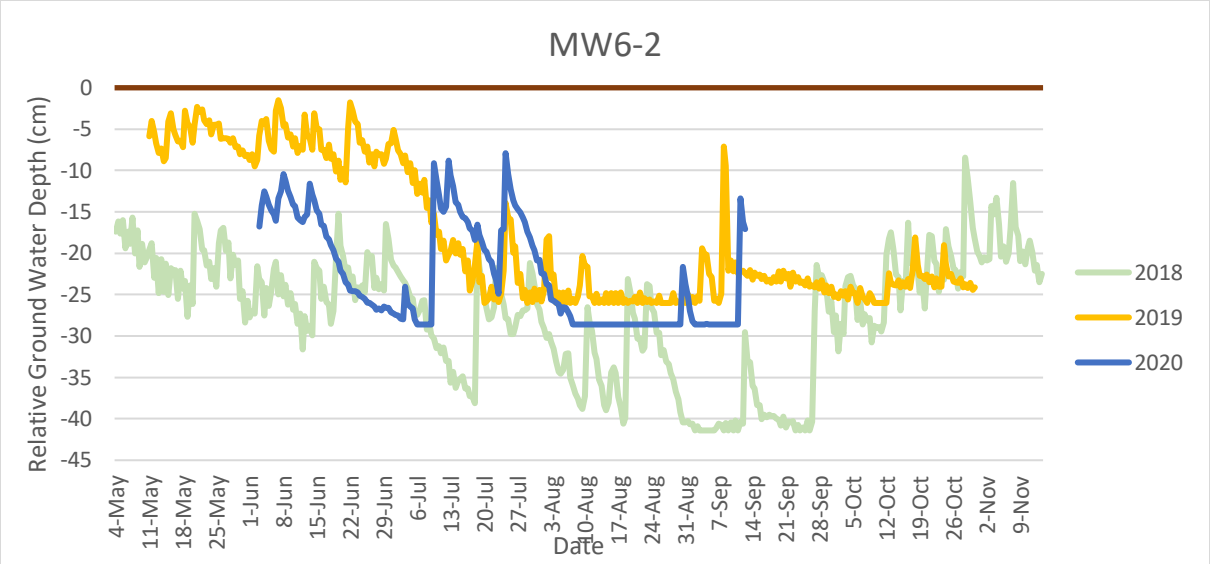


Figure F9: 2018 to 2020 water level data collected in Wetland 6, MW 2 from May 4 to November 14.

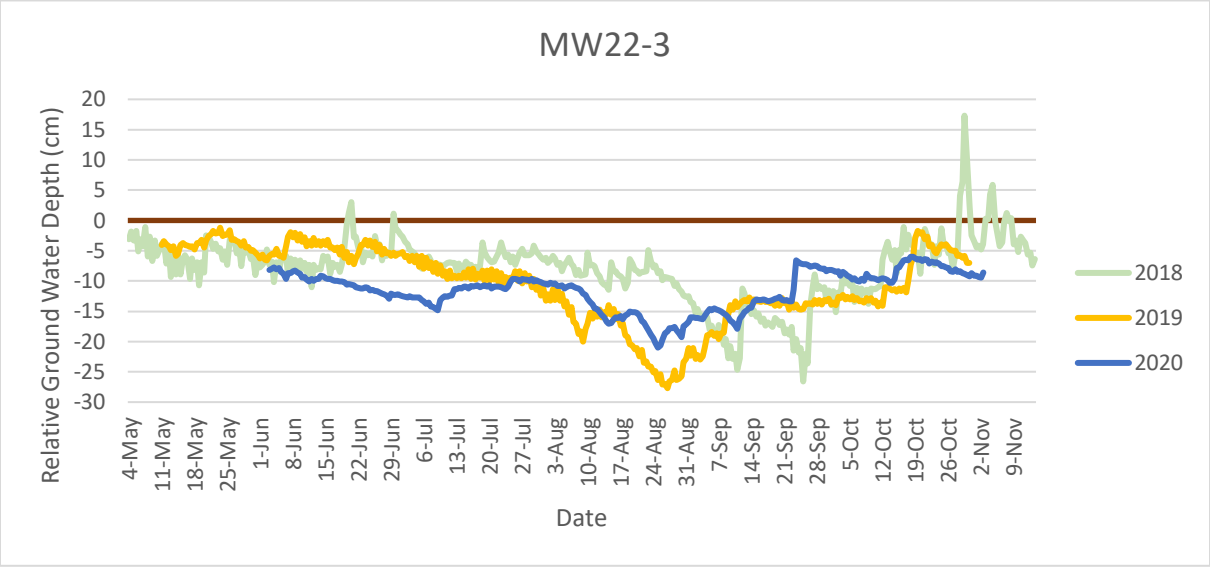


Figure F10: 2018 to 2020 water level data collected in Wetland 22, MW 3 from May 4 to November 14.