

Appendix A

2021 NPNS Baseline Ambient Air Monitoring



**Summary of Fence Line Ambient
Air Quality Monitoring at Northern
Pulp, New Glasgow, Nova Scotia**

Final Report

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SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

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1.0 BACKGROUND

Stantec Consulting Ltd. (“Stantec”) was retained by Northern Pulp Nova Scotia Corporation (Northern Pulp) to conduct fence line ambient air quality monitoring at the Northern Pulp Mill, located in New Glasgow, Nova Scotia. The results of this ambient air quality monitoring program will support the development of the Environmental Assessment Report for the replacement Effluent Treatment Facility (ETF).

The fence line ambient air quality monitoring at Northern Pulp was completed over a 24-hour sampling period once every six days following the National Air Pollution Surveillance (NAPS) schedule for a total of 5 sampling days during the spring of 2021. The meteorological data to support the air quality monitoring was acquired from the closest Environment and Climate Change Canada (ECCC) weather station located at Caribou Point, which is approximately 9 km away from the Mill. Monitoring at Northern Pulp was conducted for total suspended particulate (TSP), particulate matter with aerodynamic diameter less than or equal to 2.5 microns (PM_{2.5}), metals, polycyclic aromatic hydrocarbons (PAHs), dioxin and furans, speciated volatile organic compounds (VOCs), combustion gases (SO₂, NO_x, H₂S), aldehydes and ammonia.

This fence line ambient air quality monitoring memo presents the results of the meteorological data and fence line monitoring that took place on March 11, 17, 23, 29, and April 4, 2021.

2.0 SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING PROGRAM

The data presented for the fence line ambient air quality monitoring include: i) meteorological data acquired from the ECCC weather station at Caribou Point; and ii) the fence line ambient air quality data collected at Northern Pulp on March 11, 17, 23, 29, and April 4, 2021. The laboratory analysis reports are included in Appendix A. The air contaminant analysis was conducted by AGAT Laboratories Ltd. with the exception of PAHs and dioxins and furans, which were subcontracted to ALS due to an equipment failure at AGAT Laboratories.

2.1 METEOROLOGICAL DATA

A summary of the meteorological conditions during each sampling event on March 11, 17, 23, 29, and April 4, 2021 is presented in Table 1.



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

Table 1 Summary of Meteorological Conditions during each Sampling Event

Sampling Date	March 11, 2021	March 17, 2021	March 23, 2021	March 29, 2021	April 4, 2021
Wind Direction (blowing from)	Frequency (%)				
North	0	0	4	0	29
North – Northeast	0	0	0	0	13
Northeast	0	0	0	0	21
East – Northeast	0	0	0	0	21
East	0	0	0	0	0
East – Southeast	0	0	0	0	0
Southeast	0	0	0	0	0
South – Southeast	0	0	0	13	0
South	8	0	0	21	0
South – Southwest	38	21	46	13	0
Southwest	29	33	21	4	0
West – Southwest	21	29	21	21	0
West	0	4	8	4	0
West – Northwest	0	8	0	25	0
Northwest	0	0	0	0	0
North – Northwest	0	4	0	0	17
Meteorological Variable	Value				
Average Wind Speed m/s (km/hr)	4.31 (15.5)	11.24 (40.5)	4.68 (16.8)	6.83 (24.6)	4.94 (17.8)
Average Temperature (°C)	4.3	-7.2	-4.8	-5.4	-3.7
Minimum Temperature (°C)	-0.2	-11	-8.1	-6.6	-11.5
Maximum Temperature (°C)	11.5	-5.2	-2.9	-4.3	3.0
Relative Humidity (%)	94.5	69.89	74.4	76.4	61.7
Note: (ECCC 2021)					

Wind roses showing the direction and speed of wind at the Caribou Point Meteorological Station for each individual sampling day on March 11, 17, 23, 29, and April 4, 2021 are presented in Appendix B. A wind rose representing the direction and speed of the wind for the entire sampling event is also presented in Appendix B.

2.2 TOTAL SUSPENDED PARTICULATE (TSP)

Total suspended particulate (TSP) was sampled using a Tisch Environmental TE-5170 mass-flow high-volume sampler and with re-weighed 8" x 10" quartz filter paper. The equipment was calibrated prior to deployment of samples and calibration sheets can be found in Appendix C.

Total suspended particulate (TSP) matter was sampled following the methodology outlined in the United States Environmental Protection Agency (US EPA) National Primary and Secondary Ambient Air Quality Standards, Appendix B – Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere (High-Volume Method).



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

A summary of the results for TSP for the sampling program is presented in Table 2, along with corresponding regulatory criteria.

Table 2 Fence Line Ambient Air Monitoring Results for TSP

Air Contaminant	Units	Regulatory Criteria for the 24-hour Time Averaging Period				Sampling Date				
		Nova Scotia Air Quality Regulations	Canadian Ambient Air Quality Standards (CAAQS)	Ontario's Ambient Air Quality Criteria (AAQC)	Ontario's Air Contaminant Benchmark List (ACB List), B1 Value	March 11, 2021	March 17, 2021	March 23, 2021	March 29, 2021	April 4, 2021
Total Suspended Particulate	µg/m ³	120	-	--	-	19	9	8	5	7
Notes: B1 (Benchmark 1) – Standards and guidelines "-" no applicable regulatory criteria										

During the sampling events, concentrations of TSP ranged from 5 to 19 µg/m³. The results of the ambient air monitoring for TSP during the sampling events were therefore below the *Nova Scotia Air Quality Regulation* of 120 µg/m³. A blank sample was collected on March 17, 2021 and the results were below the laboratory detection limits.

2.2.1 Metals

Metals were sampled using the same filter as analyzed for TSP, following US EPA National Primary and Secondary Ambient Air Quality Standards, Appendix B - Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere (High-Volume Method) and were analyzed according to National Institute for Occupational Safety & Health (NIOSH) 6009/7303 and Standard Methods (SM) 3125.

A summary of the results for metals for the sampling program is presented in Table 3 along with corresponding regulatory criteria.



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

Table 3 Fence Line Ambient Air Monitoring Results for Metals

Air Contaminant	Units	Regulatory Criteria for the 24-hour Time Averaging Period				Sampling Date				
		Nova Scotia Air Quality Regulations	Canadian Ambient Air Quality Standards (CAAQS)	Ontario's Ambient Air Quality Criteria (AAQC)	Ontario's Air Contaminant Benchmark List (ACB List), B1 Value	March 11, 2021	March 17, 2021	March 23, 2021	March 29, 2021	April 4, 2021
Aluminum	µg/m ³	-	-	-	-	0.167	0.074	0.111	0.029	0.048
Antimony	µg/m ³	-	-	25	25	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	µg/m ³	-	-	0.3	0.3	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	µg/m ³	-	-	10	10	0.002	<0.001	0.002	<0.001	<0.001
Beryllium	µg/m ³	-	-	0.01	0.01	<0.001	<0.001	<0.001	<0.001	<0.001
Boron	µg/m ³	-	-	120	120	<0.001	0.014	0.043	0.009	0.026
Cadmium	µg/m ³	-	-	0.025	0.025	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	µg/m ³	-	-	0.5	0.5	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	µg/m ³	-	-	0.1	0.1	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	µg/m ³	-	-	50	50	0.070	0.039	0.055	0.036	0.076
Iron	µg/m ³	-	-	4	4	0.147	0.078	0.102	0.022	0.014
Lead	µg/m ³	-	-	0.5	0.5	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	µg/m ³	-	-	0.4	0.4	0.007	0.004	0.004	0.001	0.002
Mercury	µg/m ³	-	-	2	2	<0.001	<0.001	<0.001	<0.001	<0.001
Molybdenum	µg/m ³	-	-	120	120	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	µg/m ³	-	-	0.2	-	<0.001	<0.001	<0.001	<0.001	<0.001
Silver	µg/m ³	-	-	1	1	<0.001	<0.001	<0.001	<0.001	<0.001
Strontium	µg/m ³	-	-	120	120	<0.001	<0.001	<0.001	<0.001	<0.001
Thallium	µg/m ³	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001
Tin	µg/m ³	-	-	10	10	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium	µg/m ³	-	-	120	120	0.004	0.004	0.005	<0.001	<0.001
Uranium	µg/m ³	-	-	0.3	-	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	µg/m ³	-	-	2	2	<0.001	<0.001	<0.001	<0.001	0.004
Zinc	µg/m ³	-	-	120	120	0.01	0.006	0.008	<0.001	0.002
Notes:										
B1 (Benchmark 1) – Standards and guidelines; “-” no applicable regulatory criteria										



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

The results of the ambient air monitoring for metals during the sampling program were below Ontario Ambient Air Quality Criteria and the Ontario Air Contaminant Benchmark List, B1 Values. One blank sample was collected on March 17, 2021 and a majority of the results were below the laboratory detection limits.

2.3 PARTICULATE MATTER SMALLER THAN 2.5 MICRONS (PM_{2.5})

The particulate matter less than 2.5 microns in diameter (PM_{2.5}) was sampled using a BGI/Mesa Labs PQ 200 Ambient Air Particulate Sampler and with a pre-weighed 37 mm glass fiber filter. The equipment was calibrated prior to deployment of samples and calibration sheets can be found in Appendix C.

The results for particulate matter less than 2.5 microns in diameter (PM_{2.5}) are presented in Table 4 along with the corresponding regulatory criteria. The PM_{2.5} samples were collected following the US EPA Manual Reference Method Designation: EPA RFPS-0498-116.

A summary of the results for PM_{2.5} for the sampling program is presented in Table 4 along with corresponding regulatory criteria.

Table 4 Fence Line Ambient Air Monitoring Results for PM_{2.5}

Air Contaminant	Units	Regulatory Criteria for the 24-hour Time Averaging Period				Sampling Date				
		Nova Scotia Air Quality Regulations	Canadian Ambient Air Quality Standards (CAAQS)	Ontario's Ambient Air Quality Criteria (AAQC)	Ontario's Air Contaminant Benchmark List (ACB List), B1 Value	March 11, 2021	March 17, 2021	March 23, 2021	March 29, 2021	April 4, 2021
Particulate Matter less than 2.5 Microns	µg/m ³	-	27 (2020 standard) ¹	30 ²	-	6.5	3.7	4.9	2.5	2.9
Notes: ¹ Based on a 3-year average of the annual 98th percentile of the daily 24-hour average concentrations. As three years of data have not yet been collected, a direct comparison to the 24-hour CAAQS of each individual value sampled for PM _{2.5} while not strictly valid, will be made for context. ² This value is based on the Canada Wide Standard for PM _{2.5} , which has been replaced with the CAAQS for PM _{2.5} . B1 (Benchmark 1) – Standards and guidelines “-” no applicable regulatory criteria										

During the sampling program, the measured concentrations of PM_{2.5} ranged from 2.5 to 6.5 µg/m³. The results of the ambient air monitoring for PM_{2.5} were therefore below the threshold limits in the Canadian Ambient Air Quality Standards (CAAQS) (27 µg/m³) and Ontario's Ambient Air Quality Criteria (30 µg/m³). One blank sample was collected on March 17, 2021 and the results were below the laboratory detection limits.



2.4 POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)

The polycyclic aromatic hydrocarbon (PAHs) were sampled using a Tisch Environmental TE-1000 mass-flow high volume air sampler with a dual chambered sampling module and a Teflon coated glass fiber filter and a Poly-Urethane Foam (PUF) cartridge. The equipment was calibrated prior to deployment of samples and calibration sheets can be found in Appendix C.

The PAHs samples were collected in combination with dioxins and furans following the methodology outlined in the US EPA Compendium Method TO-9, Determination of Polychlorinated Dibenzo-p-Dioxins (PCDDs) in Ambient Air Using High-Resolution Gas Chromatography/ High Resolution Mass Spectrometry (HRGC/HRMS). The PAH samples were analyzed in combination with dioxins and furans.

A summary of the results for PAHs for the sampling program is presented in Table 5 along with corresponding regulatory criteria.



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Table 5 Fence Line Ambient Air Monitoring Results for PAHs

Air Contaminant	Units	Regulatory Criteria for the 24-hour Time Averaging Period				Sampling Date				
		Nova Scotia <i>Air Quality Regulations</i>	Canadian Ambient Air Quality Standards (CAAQS)	Ontario's Ambient Air Quality Criteria (AAQC)	Ontario's Air Contaminant Benchmark List (ACB List), B1 Value	11-Mar-21	17-Mar-21	23-Mar-21	29-Mar-21	4-Apr-21
1,3-Dimethylnaphthalene ²	ng/m ³	-	-	-	-	<0.01	<0.01	0.07	<0.02	<0.01
1-Chloronaphthalene	ng/m ³	-	-	-	-	<0.01	<0.01	<0.01	<0.02	<0.01
1-Methylnaphthalene ¹	ng/m ³	-	-	-	-	0.23	0.54	0.75	0.46	0.45
1,4,6,7-Tetramethylnaphthalene	ng/m ³	-	-	-	-	<0.01	<0.01	0.07	<0.02	<0.01
2,3,5-Trimethylnaphthalene	ng/m ³	-	-	-	-	0.04	0.32	0.19	0.31	0.17
2,3,6-Trimethylnaphthalene	ng/m ³	-	-	-	-	0.11	0.08	0.10	0.13	0.1
2,6-Dimethylnaphthalene	ng/m ³	-	-	-	-	0.16	0.22	0.36	0.29	0.21
2-Chloronaphthalene	ng/m ³	-	-	-	-	<0.01	<0.01	<0.01	<0.02	<0.01
2-Methylfluoranthene ³	ng/m ³	-	-	-	-	<0.01	0.01	<0.01	<0.02	0.01
2-Methylnaphthalene	ng/m ³	-	-	-	-	0.35	0.72	1.14	0.63	0.55
3-Methylfluoranthene/Benzo(a)fluor ene	ng/m ³	-	-	-	-	<0.01	<0.01	<0.01	<0.02	<0.01
7,12-Dimethylbenzanthracene ⁶	ng/m ³	-	-	-	-	<0.01	<0.01	<0.01	<0.02	<0.01
7H-Dibenzo(c,g)carbazole	ng/m ³	-	-	-	-	<0.01	<0.01	<0.01	<0.02	<0.01
Acenaphthene	ng/m ³	-	-	-	-	<0.01	0.08	0.23	0.17	0.13
Acenaphthylene	ng/m ³	-	-	-	-	0.01	0.04	0.03	0.05	0.06
Anthanthrene	ng/m ³	-	-	-	-	<0.01	<0.01	<0.01	<0.02	<0.01
Anthracene	ng/m ³	-	-	-	-	<0.01	<0.01	0.01	0.66	0.02



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

Table 5 Fence Line Ambient Air Monitoring Results for PAHs

Air Contaminant	Units	Regulatory Criteria for the 24-hour Time Averaging Period				Sampling Date				
		Nova Scotia Air Quality Regulations	Canadian Ambient Air Quality Standards (CAAQS)	Ontario's Ambient Air Quality Criteria (AAQC)	Ontario's Air Contaminant Benchmark List (ACB List), B1 Value	11-Mar-21	17-Mar-21	23-Mar-21	29-Mar-21	4-Apr-21
Benzo(b+j)fluoranthene ⁷	ng/m ³	-	-	-	-	Benzo (b)flour- anthene <0.01	Benzo (b)floura -nthene 0.02	Benzo (b)flour- anthene <0.01	Benzo (b)flour- anthene <0.02	Benzo (b)flour- anthene <0.01
Benzo(c)phenanthrene	ng/m ³	-	-	-	-	<0.01	0.02	0.01	<0.02	<0.01
Benzo(e)pyrene	ng/m ³	-	-	-	-	<0.01	0.020	<0.01	<0.02	<0.01
Benzo[a]Anthracene	ng/m ³	-	-	-	-	<0.01	0.01	<0.01	<0.02	<0.01
Benzo[a]Pyrene	ng/m ³	-	-	0.05 ¹	-	<0.0025	0.01	<0.0025	<0.0025	<0.0025
Benzo[g,h,i]Perylene	ng/m ³	-	-	-	-	<0.01	<0.01	<0.01	<0.02	<0.01
Benzo[k]Fluoranthene	ng/m ³	-	-	-	-	<0.01	0.03	<0.01	<0.02	<0.01
Biphenyl	ng/m ³	-	-	-	-	0.13	0.49	0.43	0.55	0.34
Chrysene ⁵	ng/m ³	-	-	-	-	<0.01	0.03	0.01	<0.02	0.01
Dibenzo(a,h)acridine	ng/m ³	-	-	-	-	<0.01	<0.01	<0.01	<0.02	<0.01
Dibenzo(a,j)anthracene	ng/m ³	-	-	-	-	<0.01	<0.01	<0.01	<0.02	<0.01
Dibenzo[a,h]Anthracene ⁸	ng/m ³	-	-	-	-	<0.01	<0.01	<0.01	<0.02	<0.01
Fluorene	ng/m ³	-	-	-	-	0.03	0.1	0.09	0.09	0.08
Fluoroanthene ⁴	ng/m ³	-	-	-	-	0.13	0.17	0.41	0.28	0.27
Indeno[1,2,3,c-d]Pyrene	ng/m ³	-	-	-	-	<0.01	<0.01	<0.01	<0.02	<0.01
Naphthalene	ng/m ³	-	-	22,500	22,500	0.78	3.44	3.54	2.08	2.51



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

Table 5 Fence Line Ambient Air Monitoring Results for PAHs

Air Contaminant	Units	Regulatory Criteria for the 24-hour Time Averaging Period				Sampling Date				
		Nova Scotia <i>Air Quality Regulations</i>	Canadian Ambient Air Quality Standards (CAAQS)	Ontario's Ambient Air Quality Criteria (AAQC)	Ontario's Air Contaminant Benchmark List (ACB List), B1 Value	11-Mar-21	17-Mar-21	23-Mar-21	29-Mar-21	4-Apr-21
Perylene	ng/m ³	-	-	-	-	<0.01	<0.01	<0.01	<0.02	<0.01
Phenanthrene	ng/m ³	-	-	-	-	0.17	0.41	0.66	0.64	0.54
Pyrene	ng/m ³	-	-	-	-	0.01	0.06	0.05	0.05	0.05
Quinoline	ng/m ³	-	-	-	-	<0.01	<0.01	<0.01	<0.02	<0.01
Notes: 1 Spelled "1-Methylnaphthalene" in the lab reports 2 These results are reported as 2,6/1,3-Dimethylnaphthalene 3 1,3-Dimethylnaphthalene results are not available, the data was reported as 1,2-Dimethylnaphthalene 4 These results are reported as 3-Methylfluoranthene/Benzo(a)fluorene 5 Spelled as "Fluoranthene" on lab reports 6 This lab result is for Chrysene/Triphenylene 7 These results are reported as 7,12-Dimethylbenz(a)anthracene in the lab reports 8 Isomers reported differently (Benzo(b)fluoranthene and Benzo(k)fluoranthene)										



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

The results of the ambient air monitoring for PAHS during the sampling program were below Ontario Ambient Air Quality Criteria and the Ontario Air Contaminant Benchmark List, B1 Values. One blank sample was collected on March 29, 2021 the majority of the results were below the laboratory detection limits.

2.5 DIOXINS AND FURANS

Dioxins and Furans were sampled using the same sample media as the PAHs. Dioxins and furans were collected following the methodology outlined in the US EPA Compendium Method TO9, Determination of Polychlorinated Dibenzo-p-Dioxins (PCDDs) in Ambient Air Using High-Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS).

A summary of the results for Dioxins and Furans for the sampling program is presented in Table 6 along with corresponding regulatory criteria.



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

Table 6 Fence Line Ambient Air Monitoring Results for Dioxins and Furans

Air Contaminant	Units	Regulatory Criteria for the 24-hour Time Averaging Period				Sampling Date and Results				
		Nova Scotia Air Quality Regulations	Canadian Ambient Air Quality Standards (CAAQS)	Ontario's Ambient Air Quality Criteria (AAQC)	Ontario's Air Contaminant Benchmark List (ACB List), B1 Value	11-Mar-21	17-Mar-21	23-Mar-21	29-Mar-21	4-Apr-21
2,3,7,8-Tetra CDD	pg/m ³	-	-	-	-	<0.0043	<0.0025	<0.0076	<0.0052	<0.0028
1,2,3,7,8-Penta CDD	pg/m ³	-	-	-	-	<0.0040	<0.0016	0.0136	<0.0032	<0.0018
1,2,3,4,7,8-Hexa CDD	pg/m ³	-	-	-	-	<0.0054	<0.0015	<0.016	<0.0042	<0.0035
1,2,3,6,7,8-Hexa CDD	pg/m ³	-	-	-	-	<0.0039	<0.0014	<0.0073	<0.0030	<0.0042
1,2,3,7,8,9-Hexa CDD	pg/m ³	-	-	-	-	<0.0044	<0.0014	<0.020	<0.0034	0.00867
1,2,3,4,6,7,8-Hepta CDD	pg/m ³	-	-	-	-	0.0184	0.0209	<0.0083	<0.0074	0.111
Octa CDD	pg/m ³	-	-	-	-	0.107	<0.068	<0.11	<0.019	1.35
2,3,7,8-Tetra CDF	pg/m ³	-	-	-	-	<0.0031	<0.0024	<0.0066	<0.0039	<0.0030
1,2,3,7,8-Penta CDF	pg/m ³	-	-	-	-	<0.0038	0.00256	0.0134	<0.0025	<0.0029
2,3,4,7,8-Penta CDF	pg/m ³	-	-	-	-	<0.0027	<0.0021	0.0108	<0.0023	<0.0027
1,2,3,4,7,8-Hexa CDF	pg/m ³	-	-	-	-	<0.0037	<0.0020	0.0129	<0.0030	0.00346
1,2,3,6,7,8-Hexa CDF	pg/m ³	-	-	-	-	0.00305	<0.0020	<0.0084	<0.0024	<0.0026
2,3,4,6,7,8-Hexa CDF	pg/m ³	-	-	-	-	<0.0035	<0.0022	<0.015	<0.0028	<0.0031
1,2,3,7,8,9-Hexa CDF	pg/m ³	-	-	-	-	<0.0059	0.00531	0.0198	<0.0046	<0.0071
1,2,3,4,6,7,8-Hepta CDF	pg/m ³	-	-	-	-	<0.0082	<0.0052	0.0278	<0.0028	0.0219
1,2,3,4,7,8,9-Hepta CDF	pg/m ³	-	-	-	-	<0.0030	<0.0030	0.0265	<0.0038	<0.0032
Octa CDF	pg/m ³	-	-	-	-	<0.0078	<0.0051	0.0552	<0.0074	<0.063
Total Tetrachlorodibenzodioxins	pg/m ³	-	-	-	-	<0.0043	<0.0025	<0.0076	<0.0052	<0.0028
Total Pentachlorodibenzodioxins	pg/m ³	-	-	-	-	<0.0040	<0.0016	0.0136	<0.0032	<0.0018
Total Hexachlorodibenzodioxins	pg/m ³	-	-	-	-	<0.0054	0.00345	<0.0085	<0.0042	0.00867



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

Table 6 Fence Line Ambient Air Monitoring Results for Dioxins and Furans

Air Contaminant	Units	Regulatory Criteria for the 24-hour Time Averaging Period				Sampling Date and Results				
		Nova Scotia <i>Air Quality Regulations</i>	Canadian Ambient Air Quality Standards (CAAQS)	Ontario's Ambient Air Quality Criteria (AAQC)	Ontario's Air Contaminant Benchmark List (ACB List), B1 Value	11-Mar-21	17-Mar-21	23-Mar-21	29-Mar-21	4-Apr-21
Total Heptachlorodibenzodioxins	pg/m³	-	-	-	-	0.0184	0.0388	0.0254	<0.0042	0.244
Total PCDDs	pg/m³	-	-	-	-	N/A	N/A	N/A	N/A	N/A
Total Tetrachlorodibenzofurans	pg/m³	-	-	-	-	<0.0031	<0.0024	<0.0066	<0.0039	<0.0030
Total Pentachlorodibenzofurans	pg/m³	-	-	-	-	<0.0029	0.00256	0.0242	<0.0025	<0.0029
Total Hexachlorodibenzofurans	pg/m³	-	-	-	-	<0.0044	0.0123	0.0328	<0.0035	0.00656
Total Heptachlorodibenzofurans	pg/m³	-	-	-	-	<0.0030	<0.0030	0.0543	<0.0038	0.0296
Total PCDFs	pg/m³	-	-	-	-	N/A	N/A	N/A	N/A	N/A
Total PCDDs and PCDFs (TEQ)*	Lower bound pg TEQ/m³	-	-	0.1	0.1	0.000521	0.000817	0.0211	0.00	0.00295
	Mid Point pg TEQ/m³					0.00708	0.00392	0.0319	0.00629	0.00776
	Upper Bound pg TEQ/m³					0.0128	0.00694	0.0361	0.0120	0.0108
Notes: B1 (Benchmark 1) – Standards and guidelines N/A – Not Available “-“ no applicable regulatory criteria *This value is not a direct summation of the concentrations of dioxins and furans in the table; it is a weighted value.										



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

The concentrations of dioxins and furans measured during sampling events were below the Ontario Ambient Air Quality Criteria and the Ontario Air Contaminant Benchmark List, B1 Values.

A blank sample was collected on March 29, 2021 and the quantities of dioxins and furans in the field blank were below the laboratory detection limits.

2.6 SPECIATED VOLATILE ORGANIC COMPOUNDS (VOCS)

Speciated volatile organic compounds (VOC) were sampled using Summa Canister with a 24-hour regulator and timer.

The VOCs were collected following the methodology outlined in the US EPA Compendium Method TO-15, Determination of Volatile Organic Compounds (VOCs) in Ambient Air using Specially Prepared Canisters with Subsequent Analysis by Gas Chromatography.

A summary of the ambient air monitoring results for VOCs for February 2021 is presented in Table 7 along with corresponding regulatory criteria.



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

Table 7 Ambient Air Monitoring Results for VOCs – March 2021

Air Contaminant	Units	Regulatory Criteria for the 24-hour Time Averaging Period				Sampling Date and Results				
		Nova Scotia Air Quality Regulations	Canadian Ambient Air Quality Standards (CAAQS)	Ontario's Ambient Air Quality Criteria (AAQC)	Ontario's Air Contaminant Benchmark List (ACB List), B1 Value	11-Mar-21	17-Mar-21	23-Mar-21	29-Mar-21	4-Apr-21
1,1,1-Trichloroethane	µg/m ³	-	-	115,000	115,000	< 1.6	<1.6	<1.6	<1.6	<1.6
1,1,2,2-Tetrachloroethane	µg/m ³	-	-	-	-	< 1.5	<1.5	<1.5	<1.5	<1.5
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/m ³	-	-	-	-	< 1.5	<1.5	<1.5	<1.5	<1.5
1,1,2-Trichloroethane	µg/m ³	-	-	-	-	< 1.6	<1.6	<1.6	<1.6	<1.6
1,1-Dichloroethane	µg/m ³	-	-	165	165	< 1.2	<1.2	<1.2	<1.2	<1.2
1,1-Dichloroethene	µg/m ³	-	-	10	-	< 1.0	<1.0	<1.0	<1.0	<1.0
1,2,4-Trichlorobenzene	µg/m ³	-	-	400	400	< 3.5	<3.5	<3.5	<3.5	<3.5
1,2,4-Trimethylbenzene	µg/m ³	-	-	220	220	< 2.5	<2.5	<2.5	<2.5	<2.5
1,2-Dibromoethane	µg/m ³	-	-	-	-	< 1.5	<1.5	<1.5	<1.5	<1.5
1,2-Dichlorobenzene	µg/m ³	-	-	-	-	< 2.5	<2.5	<2.5	<2.5	<2.5
1,2-Dichloroethane	µg/m ³	-	-	-	-	< 0.30	<0.30	<0.30	<0.30	<0.30
1,2-Dichloropropane	µg/m ³	-	-	-	-	< 2.0	<2.0	<2.0	<2.0	<2.0
1,2-Dichlorotetrafluoroethane	µg/m ³	-	-	-	-	< 1.4	<1.4	<1.4	<1.4	<1.4
1,3,5-Trimethylbenzene	µg/m ³	-	-	220	220	< 2.5	<2.5	<2.5	<2.5	<2.5
1,3-Butadiene	µg/m ³	-	-	10	-	< 0.20	<0.20	<0.20	<0.20	<0.20
1,3-Dichlorobenzene	µg/m ³	-	-	-	-	< 2.5	<2.5	<2.5	<2.5	<2.5
1,4-Dichlorobenzene	µg/m ³	-	-	95	95	< 2.5	<2.5	<2.5	<2.5	<2.5
1,4-Dioxane	µg/m ³	-	-	3,500	3,500	< 2.0	<2.0	<2.0	<2.0	<2.0
1-Ethyl-4-Methylbenzene	µg/m ³	-	-	-	-	<2.5	<2.5	<2.5	<2.5	<2.5



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

Table 7 Ambient Air Monitoring Results for VOCs – March 2021

Air Contaminant	Units	Regulatory Criteria for the 24-hour Time Averaging Period				Sampling Date and Results				
		Nova Scotia Air Quality Regulations	Canadian Ambient Air Quality Standards (CAAQS)	Ontario's Ambient Air Quality Criteria (AAQC)	Ontario's Air Contaminant Benchmark List (ACB List), B1 Value	11-Mar-21	17-Mar-21	23-Mar-21	29-Mar-21	4-Apr-21
2,2,4-Trimethylpentane (Iso octane)	µg/m ³	-	-	-	-	< 2.3	<2.3	<2.3	<2.3	<2.3
2-Hexanone	µg/m ³	-	-	-	-	< 2.0	<2.0	<2.0	<2.0	<2.0
Acetone	µg/m ³	-	-	11,880	11,880	12.6	11.0	11.1	6.6	15.6
Benzene	µg/m ³	-	-	2.3	-	0.29	0.29	0.22	0.35	0.32
Benzyl Chloride	µg/m ³	-	-	-	-	< 2.5	<2.5	<2.5	<2.5	<2.5
Bromodichloromethane	µg/m ³	-	-	-	-	< 1.3	<1.3	<1.3	<1.3	<1.3
Bromoform	µg/m ³	-	-	55	55	< 2.0	<2.0	<2.0	<2.0	<2.0
Bromomethane	µg/m ³	-	-	-	-	< 1.9	<1.9	<1.9	<1.9	<1.9
Carbon Disulfide	µg/m ³	-	-	330	330	< 1.5	<1.5	<1.5	<1.5	<1.5
Carbon Tetrachloride	µg/m ³	-	-	2.4	2.4	< 2.0	<2.0	<2.0	<2.0	<2.0
Chlorobenzene	µg/m ³	-	-	-	-	< 1.0	<1.0	<1.0	<1.0	<1.0
Chloroethane	µg/m ³	-	-	5,600	5,600	< 1.0	<1.0	<1.0	<1.0	<1.0
Chloroform	µg/m ³	-	-	1	1	< 0.20	<0.20	<0.20	<0.20	<0.20
Chloromethane	µg/m ³	-	-	320	320	1.6	1.6	1.2	1.7	1.3
cis-1,2-Dichloroethene	µg/m ³	-	-	-	-	< 0.80	<0.80	<0.80	<0.80	<0.80
cis-1,3-Dichloropropene	µg/m ³	-	-	-	-	< 1.0	<1.0	<1.0	<1.0	<1.0
Cyclohexane	µg/m ³	-	-	6,100	6,100	< 0.70	<0.70	<0.70	<0.70	<0.70
Dibromochloromethane	µg/m ³	-	-	-	-	< 2.0	<2.0	<2.0	<2.0	<2.0
Dichlorodifluoromethane	µg/m ³	-	-	500,000	-	2.9	2.7	2.5	2.8	2.1
Ethanol	µg/m ³	-	-	-	-	9.2	8.3	10.8	1.4	13.6



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

Table 7 Ambient Air Monitoring Results for VOCs – March 2021

Air Contaminant	Units	Regulatory Criteria for the 24-hour Time Averaging Period				Sampling Date and Results				
		Nova Scotia Air Quality Regulations	Canadian Ambient Air Quality Standards (CAAQS)	Ontario's Ambient Air Quality Criteria (AAQC)	Ontario's Air Contaminant Benchmark List (ACB List), B1 Value	11-Mar-21	17-Mar-21	23-Mar-21	29-Mar-21	4-Apr-21
Ethyl acetate	µg/m ³	-	-	-	-	2.8	2.9	7.1	10.9	18.7
Ethylbenzene	µg/m ³	-	-	1,000	-	< 0.9	<1.8	<1.8	<1.8	2.7
Hexachlorobutadiene	µg/m ³	-	-	-	-	< 5.0	<0.90	<0.90	<0.90	<0.90
Iso-propanol	µg/m ³	-	-	7,300	7,300	9.4	<5.0	<5.0	<5.0	<5.0
m&p-Xylene	µg/m ³	-	-	730	730	< 1.5	9.2	7.6	5.6	9.7
Methyl Ethyl Ketone	µg/m ³	-	-	1,000	1,000	< 1.5	<1.5	<1.5	<1.5	<1.5
Methyl Isobutyl Ketone (MIBK)	µg/m ³	-	-	1,200	1,200	< 2.0	<1.5	<1.5	<1.5	<1.5
Methyl methacrylate	µg/m ³	-	-	860	860	< 2.0	<2.0	<2.0	<2.0	<2.0
Methyl tert-Butyl ether (MTBE)	µg/m ³	-	-	7,000	7,000	< 0.8	<2.0	<2.0	<2.0	<2.0
Methylene Chloride	µg/m ³	-	-	220	220	4.6	<0.80	<0.80	<0.80	<0.80
Naphthalene	µg/m ³	-	-	22.5	22.5	< 5.0	<5.0	<5.0	<5.0	<5.0
n-Heptane	µg/m ³	-	-	11,000	11,000	< 1.2	<1.2	<1.2	<1.2	<1.2
n-Hexane	µg/m ³	-	-	2,500	2,500	< 1.1	<1.1	14.1	<1.1	9.3
o-Xylene	µg/m ³	-	-	730	730	< 0.90	<0.90	<0.90	<0.90	<0.90
Propylene	µg/m ³	-	-	4,000	4,000	< 0.50	<0.50	<0.50	<0.50	<0.50
Styrene	µg/m ³	-	-	400	400	< 1.0	<1.0	<1.0	<1.0	1.2
Tetrachloroethene	µg/m ³	-	-	-	-	< 1.0	<1.0	<1.0	<1.0	<1.0
Tetrahydrofuran	µg/m ³	-	-	93,000	93,000	< 1.2	<1.2	<1.2	<1.2	<1.2
Toluene	µg/m ³	-	-	2,000	2,000	< 0.80	<0.80	<0.80	<0.80	1.5
Total Xylenes	µg/m ³	-	-	730	730	< 2.0	<2.0	<2.0	<2.0	<2.0



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

Table 7 Ambient Air Monitoring Results for VOCs – March 2021

Air Contaminant	Units	Regulatory Criteria for the 24-hour Time Averaging Period				Sampling Date and Results				
		Nova Scotia Air Quality Regulations	Canadian Ambient Air Quality Standards (CAAQS)	Ontario's Ambient Air Quality Criteria (AAQC)	Ontario's Air Contaminant Benchmark List (ACB List), B1 Value	11-Mar-21	17-Mar-21	23-Mar-21	29-Mar-21	4-Apr-21
trans-1,2-Dichloroethene	µg/m ³	-	-	-	-	< 0.80	<0.80	<0.80	<0.80	<0.80
trans-1,3-Dichloropropene	µg/m ³	-	-	-	-	< 1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethene	µg/m ³	-	-	-	-	< 0.50	<0.50	<0.50	<0.50	<0.50
Trichlorofluoromethane	µg/m ³	-	-	6,000	6,000	< 2.3	<2.3	<2.3	<2.3	<2.3
Vinyl Acetate	µg/m ³	-	-	-	-	< 1.8	<1.8	<1.8	<1.8	<1.8
Vinyl Bromide	µg/m ³	-	-	-	-	< 0.80	<0.80	<0.80	<0.80	<0.80
Vinyl Chloride	µg/m ³	-	-	1	1	< 0.20	<0.20	<0.20	<0.20	<0.20
Notes: B1 (Benchmark 1) – Standards and guidelines "-" indicates no applicable criteria										



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

The concentrations of the speciated VOCs measured during the month of March 2021 were below the Ontario Ambient Air Quality Criteria and the Ontario Air Contaminant Benchmark List, B1 Values. A blank sample was collected on March 17, 2021 and all air contaminants were below the laboratory detection limits.

2.7 AMMONIA, ACETALDEHYDE AND FORMALDEHYDE

The ambient concentrations for ammonia, acetaldehyde, and formaldehyde were measured using passive air sampling devices.

A summary of the ambient air monitoring results for ammonia, acetaldehyde, and formaldehyde for the monitoring events is presented in Table 8 along with corresponding regulatory criteria.

Table 8 Ambient Air Monitoring Results for Ammonia, Acetaldehyde, and Formaldehyde – March 2021

Air Contaminant	Units	Regulatory Criteria for the 24-hour Time Averaging Period				Sampling Date	
		Nova Scotia Air Quality Regulations	Canadian Ambient Air Quality Standards (CAAQS)	Ontario's Ambient Air Quality Criteria (AAQC)	Ontario's Air Contaminant Benchmark List (ACB List), B1 Value	17-Mar-2021	23-Mar-2021
Ammonia	µg/m ³	-	-	100	100	<1.0	<1.0
Acetaldehyde	µg/m ³	-	-	500	500	1.2	NS
Formaldehyde	µg/m ³	-	-	65	65	1.1	NS
Notes: B1 (Benchmark 1) – Standards and guidelines “-” indicates no applicable criteria NS- No Sample							

The results of the March 2021 ambient air monitoring for ammonia, acetaldehyde, and formaldehyde were below the Ontario Ambient Air Quality Criteria and the Ontario Air Contaminant Benchmark List, B1 Values. A blank sample was collected on March 17, 2021 and all air contaminants were below the laboratory detection limits. The sample for acetaldehyde and formaldehyde on March 23, 2021 was lost due to a laboratory error.

There are no regulatory values for ammonia, acetaldehyde and formaldehyde in NS, therefore air quality criteria from other jurisdictions are being used to provide context to the results. Ammonia, acetaldehyde and formaldehyde are measured over approximately a 6-day period and compared to the available Ontario 24-hour regulatory criteria to determine if there are any potential exposure issues. As the 6-day average sample was well below the 24-hour criteria, it is not likely that the 24-hour criteria would have been exceeded during the sample period.



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

2.8 COMBUSTION GASES

The ambient concentrations for hydrogen sulfide, sulfur dioxide, and nitrogen dioxide were measured using passive air sampling devices.

A summary of the ambient air monitoring results for hydrogen sulfide, sulfur dioxide, and nitrogen dioxide for the monitoring events is presented in Table 9 along with corresponding regulatory criteria.

Table 9 Table Ambient Air Monitoring Results for Hydrogen Sulfide, Sulfur Dioxide, and Nitrogen Dioxide

Air Contaminant	Units	Regulatory Criteria for the 24-hour Time Averaging Period				Sampling Date
		Nova Scotia Air Quality Regulations	Canadian Ambient Air Quality Standards (CAAQS)	Ontario's Ambient Air Quality Criteria (AAQC)	Ontario's Air Contaminant Benchmark List (ACB List), B1 Value	
Hydrogen Sulfide	µg/m ³	8	-	7	7	0.06
Sulfur Dioxide	µg/m ³	300	-	10.6*	275	0.81
Nitrogen Dioxide	µg/m ³	100*	-	200	200	1.75
Notes: B1 (Benchmark 1) – Standards and guidelines “-” indicates no applicable criteria *- Annual averaging period						

These samples were collected from March 10, 2021 to April 6, 2021. A blank sample was collected, and hydrogen sulfide was below the laboratory detection limit while sulfur dioxide and nitrogen dioxide were not. While the blanks may have detectable concentrations and some may not, this is typical for the blank sample media. The lab prepares the treated filters and there is always a little bit of background concentration from the filter treatment process and handling. All samples have the field blank subtracted from the results. When comparing the 24-hour time averaging period to the period that the samples were set out (approximately 27 days), it is not likely that the 24-hour criteria would have been exceeded during the sample period.



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

3.0 CLOSING

This memo has been prepared for the sole benefit of Northern Pulp. This report may not be relied upon by any other person or entity without the express written consent of Stantec and Northern Pulp. Any use of this report by a third party, or any reliance on decisions made based upon this report, are the responsibility of the third party. Stantec accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Stantec makes no representation or warranty with respect to this report, other than the work was undertaken by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time the work was performed. Any information or facts provided by others and referred to or utilized in the preparation of this report was assumed by Stantec to be accurate.

This study was undertaken exclusively for the purpose outlined herein and was limited to those details specifically referenced in this report. This report cannot be used or applied under any circumstances to another location or situation or for any other purpose without further evaluation of the data and related limitations.

This report was written by Mohammad Abdulrahman, EIT, and reviewed by Jennifer McPhail, P.Eng. If you have any questions regarding the contents of this report, or require any additional information, please do not hesitate to contact the undersigned.

STANTEC CONSULTING LTD.

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APPENDIX A

Lab Certificates

Laboratory certificates excised to reduce file size.
Available on request

APPENDIX B

Wind Roses

SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

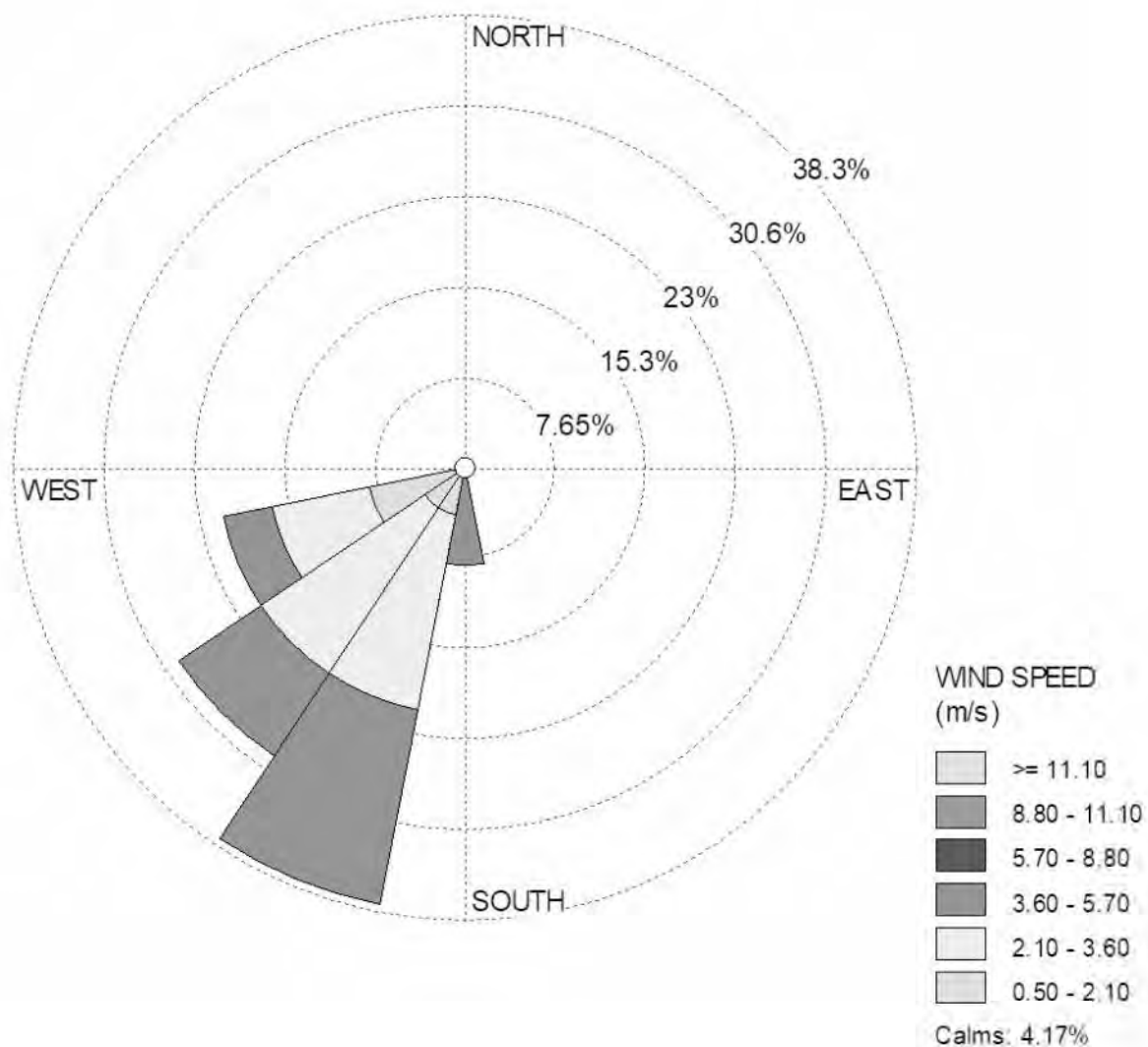


Figure B1 Wind Rose for the March 11, 2021 Monitoring Event – Caribou Point (blowing from southwest)



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

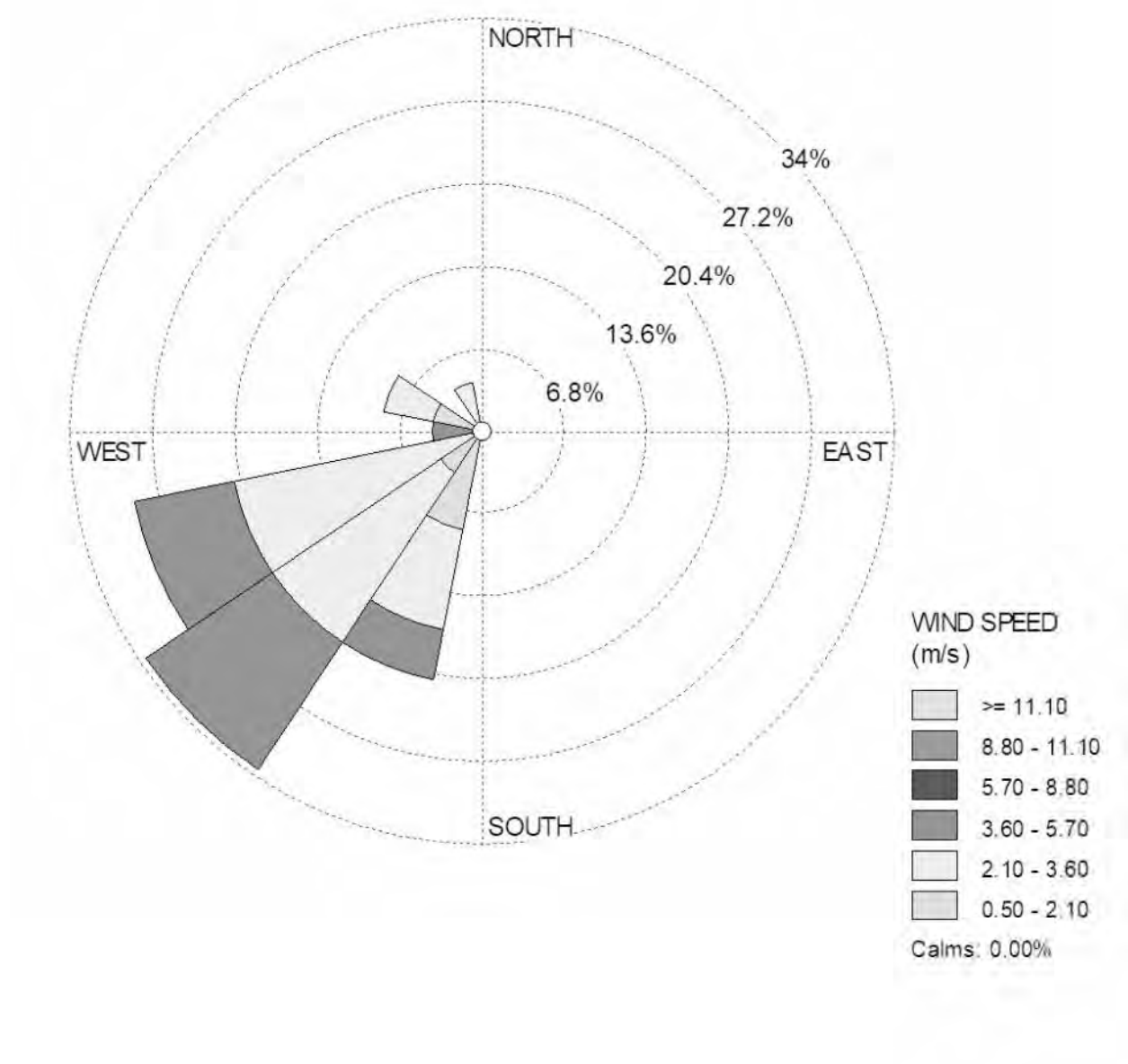


Figure B2 Wind Rose for the March 17, 2021 Monitoring Event – Caribou Point (blowing from southwest)



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

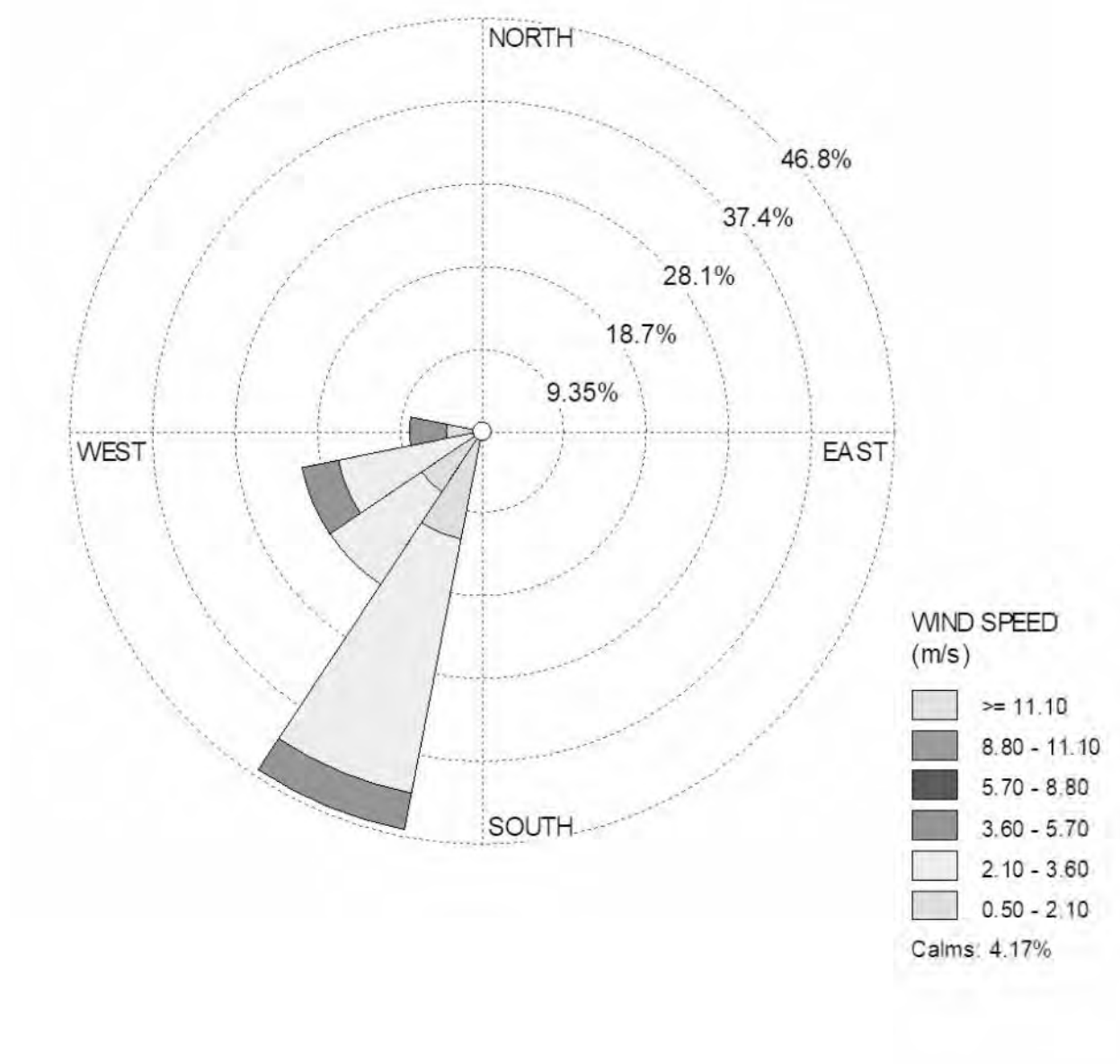


Figure B3 Wind Rose for the March 23, 2021 Monitoring Event – Caribou Point (blowing from southwest)



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

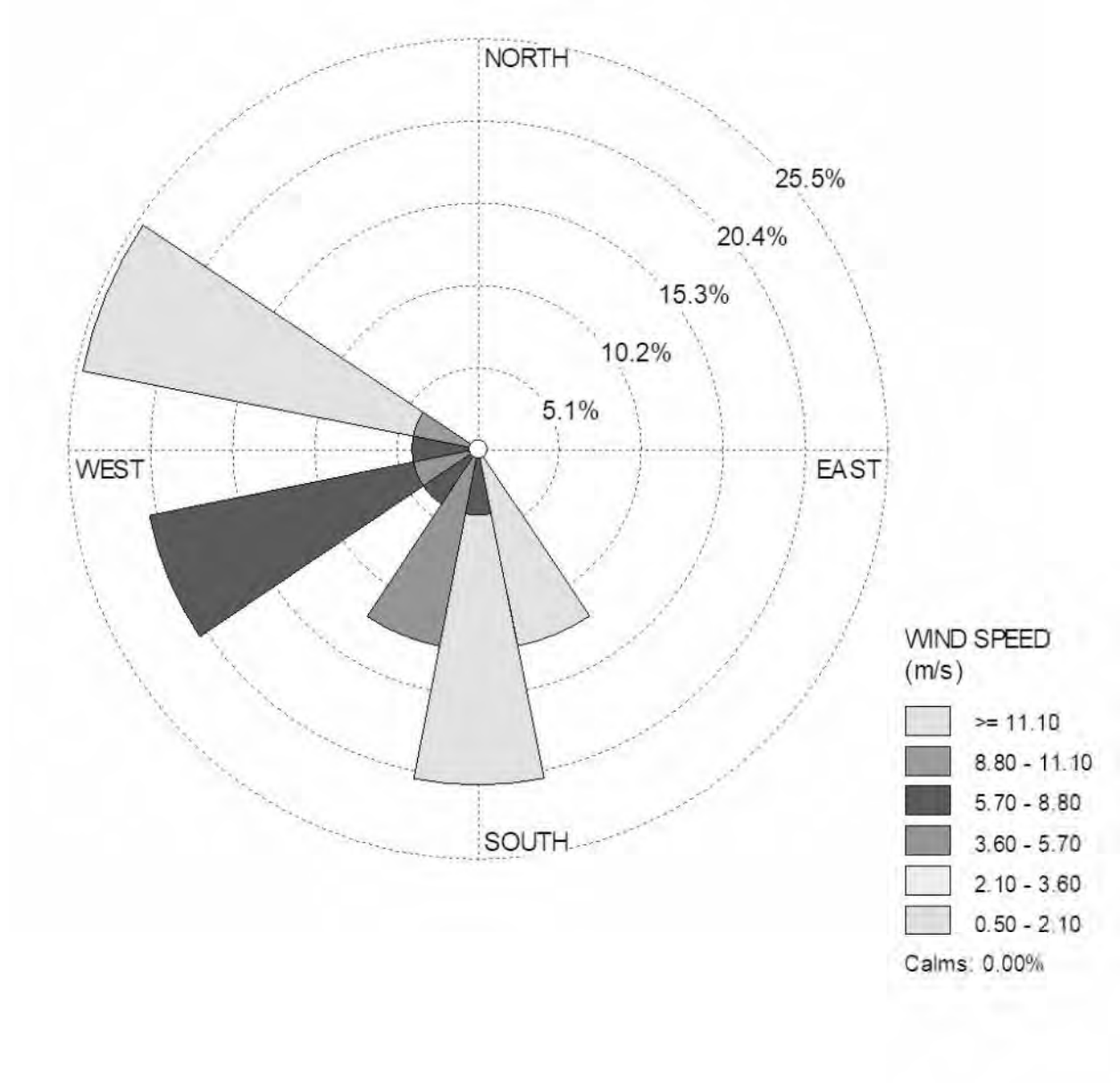


Figure B4 Wind Rose for the March 29, 2021 Monitoring Event – Caribou Point (blowing from northwest)



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

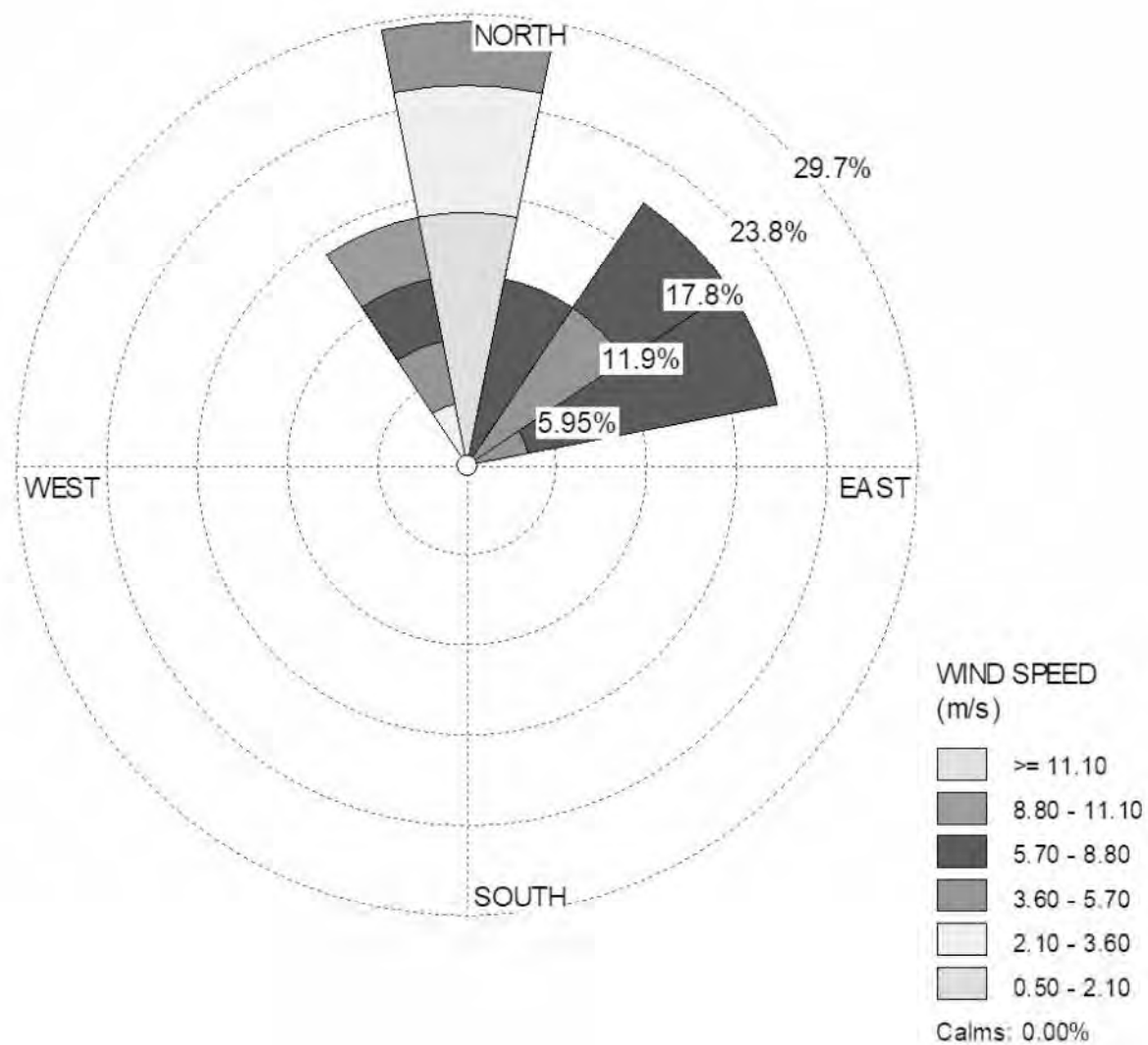


Figure B5 Wind Rose for the April 4, 2021 Monitoring Event– Caribou Point (blowing from north)



SUMMARY OF FENCE LINE AMBIENT AIR QUALITY MONITORING AT NORTHERN PULP, NEW GLASGOW, NOVA SCOTIA

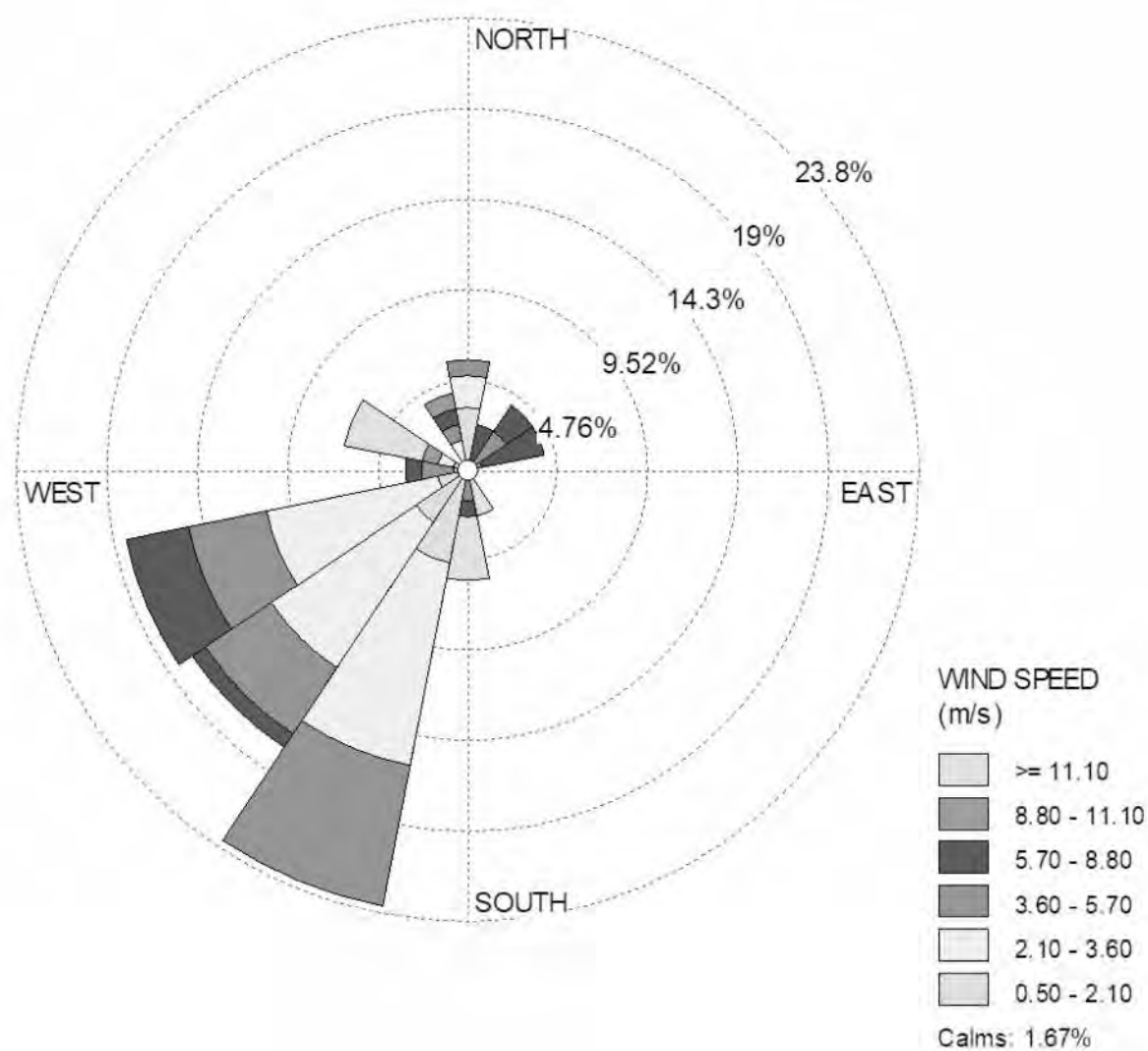


Figure B6 Wind Rose for the all of the Monitoring Events– Caribou Point (blowing from southwest)



APPENDIX C

Calibration Certificates



Certificate of Calibration

Calibration Certification Information

Cal. Date: April 21, 2020

Rootsmeter S/N: 438320

Ta: 294

°K

Operator: Jim Tisch

Pa: 748.0

mm Hg

Calibration Model #: TE-5040A

Calibrator S/N: 1490

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	6.976	3.60	2.00
2	3	4	1	4.238	10.00	5.50
3	5	6	1	3.377	15.50	8.50
4	7	8	1	2.892	21.00	11.50
5	9	10	1	2.57	26.50	14.50
6	11	12	1	2.403	30.20	16.50

Data Tabulation

Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9928	0.1423	1.4125	0.9952	0.1427	0.8866
0.9843	0.2323	2.3424	0.9866	0.2328	1.4703
0.9770	0.2893	2.9120	0.9793	0.2900	1.8278
0.9696	0.3353	3.3872	0.9719	0.3361	2.1260
0.9623	0.3744	3.8034	0.9646	0.3753	2.3873
0.9574	0.3984	4.0572	0.9596	0.3993	2.5466
QSTD	m=	10.30176	QA	m=	6.45079
	b=	-0.05665		b=	-0.03556
	r=	0.99996		r=	0.99996

Calculations

Vstd = $\Delta Vol \left(\frac{Pa - \Delta P}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)$	Va = $\Delta Vol \left(\frac{Pa - \Delta P}{Pa} \right)$
Qstd = $Vstd / \Delta Time$	Qa = $Va / \Delta Time$
For subsequent flow rate calculations:	
Qstd = $1/m \left(\left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} \right) - b \right)$	Qa = $1/m \left(\left(\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)} \right) - b \right)$

Standard Conditions

Tstd: 298.15 °K

Pstd: 760 mm Hg

Key

ΔH: calibrator manometer reading (in H2O)

ΔP: rootsmeter manometer reading (mm Hg)

Ta: actual absolute temperature (°K)

Pa: actual barometric pressure (mm Hg)

b: intercept

m: slope

RECALIBRATION

US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30



Certificate of Calibration

Calibration Certification Information

Cal. Date: January 21, 2021 Rootsmeter S/N: 438320 Ta: 295 °K
Operator: Jim Tisch Pa: 744.22 mm Hg
Calibration Model #: TE-5028A Calibrator S/N: 1149

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.2610	4.4	1.50
2	3	4	1	0.9770	7.1	2.50
3	5	6	1	0.8930	8.4	3.00
4	7	8	1	0.8260	9.9	3.50
5	9	10	1	0.6250	17.0	6.00

Data Tabulation

Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9833	0.7798	1.2181	0.9941	0.7883	0.7711
0.9798	1.0028	1.5726	0.9905	1.0138	0.9955
0.9780	1.0952	1.7227	0.9887	1.1072	1.0905
0.9760	1.1816	1.8607	0.9867	1.1945	1.1779
0.9666	1.5466	2.4362	0.9772	1.5635	1.5422
QSTD	m=	1.58913	QA	m=	0.99509
	b=	-0.01970		b=	-0.01247
	r=	0.99999		r=	0.99999

Calculations

Vstd=	$\Delta Vol((Pa-\Delta P)/Pstd)(Tstd/Ta)$	Va=	$\Delta Vol((Pa-\Delta P)/Pa)$
Qstd=	Vstd/ΔTime	Qa=	Va/ΔTime
For subsequent flow rate calculations:			
Qstd=	$1/m \left(\left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} \right) - b \right)$	Qa=	$1/m \left(\left(\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)} \right) - b \right)$

Standard Conditions

Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH: calibrator manometer reading (in H2O)	
ΔP: rootsmeter manometer reading (mm Hg)	
Ta: actual absolute temperature (°K)	
Pa: actual barometric pressure (mm Hg)	
b: intercept	
m: slope	

RECALIBRATION

US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30.



TE-1000 PUF Calibration Worksheet

Site Information

Location: Boat Harbor **Site ID:** Northern I **Date:** 10-Mar-21
Sampler: TE-1000 **Serial No:** PUF 001 **Tech:** MA

Site Conditions

Barometric Pressure (in Hg):	30.44	Corrected Pressure (mm Hg):	773.2
Temperature (deg F):	37	Temperature (deg K):	275.9
Average Pressure (in Hg):	29.91	Corrected Average Pressure (mm Hg):	759.7
Average Temperature (deg F):	27	Average Temperature (deg K):	270.2

Calibration Orifice

Make: Tisch	Qstd Slope: 10.30176
Model: TE-5040A	Qstd Intercept: -0.05665
Serial#: 1490	Calibration Due Date: 21-Apr-21

Calibration Information

Plate or Test #	Pressure (in H ₂ O)	Qstd (m ³ /min)	Flow (magn)	Flow (corrected)	Linear Regression
1	8.60	0.304	70.0	8.77	Slope: 30.9082
2	7.80	0.290	60.0	8.12	Intercept: -0.7449
3	6.60	0.267	50.0	7.41	Corr. Coeff: 0.9971
4	5.20	0.238	40.0	6.63	
5	4.00	0.209	30.0	5.74	

of Observations: 5

Calculations

$Qstd = 1/m[\text{Sqrt}((H_2O)(Pa/760)(298/Ta))-b]$
 $\text{Flow (corrected)} = \text{Sqrt}((\text{magn})(Pa/Pstd)(Tstd/Ta))$

Qstd = standard flow rate
Flow (magn) = reading from magnehelic gauge
Flow (corrected) = corrected flow rate

m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K
Pstd = 760 mm Hg

For subsequent calculation of sampler flow:
 $Qstd = 1/m[\text{Sqrt}((H_2O)(Pa/760)(298/Ta))-b]$

m = sampler slope
b = sampler intercept
(magn) = magnehelic reading
Tav = daily average temperature
Pav = daily average pressure

Average Flow (magn):	35.0
	0.225063
Enter Total Time (hrs):	24.0
Total Flow Over Sample (m3)	324.0903816
Total Flow Over Sample (liters)	324090.3816

NOTE: Ensure calibration orifice has been certified within 12 months of use



TE-5170V Sampler Calibration Worksheet (Using G-Factor)

Site and Calibration Information

<u>Site</u>	<u>Calibration Orifice</u>
Location: Northern Pulp	Make: Tisch Environmental
Date: Mar10, 2021	Model: TE-5028A
Tech.: Mohammad A	Serial: 2806
Sampler: TE-5170V	Qa Slope (m): 0.99509
Serial #: P8644 TSP	Qa Int (b): -0.01247
VFC G-Factor: 0.0873745900	Calibration due date: 01/21/22

Ambient Conditions

Temp (deg F): 31.6	Barometric Press (in Hg): 30.50
Ta (deg K): 273	Pa (mm Hg): 774.7
Ta (deg C): -0.2	

Calibration Information

<u>Run Number</u>	<u>Orifice "H2O</u>	<u>Qa m3/min</u>	<u>Sampler "H2O</u>	<u>Pf mm Hg</u>	<u>Po/Pa</u>	<u>Calculated m3/min</u>	<u>% of Diff</u>
1	4.30	1.249	6.40	11.944	0.985	1.236	-1.12
2	4.20	1.235	7.50	13.997	0.982	1.232	-0.24
3	4.20	1.235	7.80	14.557	0.981	1.231	-0.24
4	4.20	1.235	8.60	16.050	0.979	1.229	-0.49
5	4.10	1.220	10.00	18.663	0.976	1.224	0.33

Calculate Total Air Volume Using G-Factor

Enter Average Temperature During Sampling Duration (Deg F)	37.00
Average Temperature During Sampling Duration (Deg K)	275.78
Enter Average Barometric Pressure During Sampling Duration (In Hg)	30.44
Average Barometric Pressure During Sampling (mm Hg)	773.18
Enter Clean Filter Sampler Inches of Water	12.60
Enter Dirty Filter Sampler Inches of Water	16.00
Average Filter Sampler (mm Hg)	26.69
Enter Total Runtime in Hours (xx.xx)	23.90
	Po/Pa : 0.965
	Calculated Flow Rate (m3/min): 1.216
	Total Flow (m3): 1744.27

Calculations

$$\text{Calibrator Flow (Qa)} = 1/\text{Slope} * (\text{SQRT}(\text{H2O} * (\text{Ta}/\text{Pa})) - \text{Intercept})$$

$$\text{Pressure Ratio (Po/Pa)} = 1 - \text{Pf}/\text{Pa}$$

$$\% \text{ Difference} = (\text{Look Up Flow} - \text{Calibrator Flow}) / \text{Calibrator Flow} * 100$$

NOTE: Ensure calibration orifice has been certified within 12 months of use

PQ200 Calibration Sheet

Date:	<u>04-Mar-21</u>	PQ200 Serial Number:
Site Name:	<u>VES Shop Calibration</u>	2505
Site Location:	<u>Newmarket, Ontario</u>	PQ200 Configuration:
Calibrator Make:	<u>TetraCal</u>	PM2.5
Calibrator Serial Number:	<u>275</u>	Auditor: <u>Nik Zelinski</u>
NIST Certificate Expiry Date:	<u>26-Jun-21</u>	Signature: 

Ambient Temperature (°C)

PQ200 Rdg.:	<u>20.5</u>
Actual Rdg.:	<u>20.1</u>
% Difference:	<u>2.0</u>
Reset:	<u>no</u>

Filter Temperature (°C)

PQ200 Rdg.:	<u>20.9</u>
Actual Rdg.:	<u>20.4</u>
% Difference:	<u>2.5</u>
Reset:	<u>no</u>

Flow Check (LPM)

Target Q Setpoint:	<u>16.7</u>
Measured Flow:	<u>16.7</u>
% Difference:	<u>0.0</u>
Flow Reset (Yes or No):	<u>no</u>
Target Q Setpoint:	<u>18.4</u>
Measured Flow:	<u>18.4</u>
% Difference:	<u>0.0</u>
Target Q Setpoint:	<u>15.0</u>
Measured Flow:	<u>15.0</u>
% Difference:	<u>0.0</u>

Leak Test

Initial SP (cm):	<u>105</u>
Final SP (cm):	<u>104</u>
Pass or Fail:	<u>Pass</u>

Barometric Pressure (mmHg)

PQ200 Rdg.:	<u>757.0</u>
Actual Rdg.:	<u>757.5</u>
% Difference:	<u>-0.1</u>
Reset:	<u>no</u>

System Clock Time

PQ200 Time (EST):	<u>13:00</u>
Actual Time (EST):	<u>13:00</u>
PQ200 Date:	<u>04-Mar-21</u>
Actual Date:	<u>04-Mar-21</u>

Inspection of Inlet / Seals / Filter

Inlet Type:	<u>PM10</u>
Cleanliness of inlet:	<u>ok</u>
Glass Jar :	<u>ok</u>
Glass Jar Gasket:	<u>ok</u>
PM2.5 VSCC inlet:	<u>ok</u>
Filter Holder:	<u>ok</u>
Filter Holder Seals:	<u>ok</u>
Filter Tensioner:	<u>ok</u>
Cleanliness of fan filter:	<u>ok</u>

Accumulated Pump Hours:	<u>814.19</u>
Fan Function Test:	<u>Pass</u>
Download Function Test:	<u>Pass</u>
Logger Interval Setting:	<u>5 Min</u>
No Load Battery %:	<u>99.0</u>
Charge Status:	<u>Charged</u>

Comments and or Recommendations:

<u>1 Paired Temperature Sensor</u>	<u>Equipment Rental Includes; 3 PQ 200 Legs,</u>
<u>1 Paired Power Supply</u>	<u>3 Pegs, 3 Lags, 2 Filter Cassette Cases,</u>
<u>1 PM2.5 Cutter SN139949</u>	<u>PQ200 Manual and Software CD, Downstem,</u>
<u>1 PM10 Inlet SN150813</u>	<u>USB to DB9 Converter Cable with Adapter.</u>
<u>2 Filter Cassettes (47 mm)</u>	

PQ200 Manual and Software also available for download at <https://bgi.mesalabs.com/>

Valley Environmental 160 Pony Dr., Newmarket, Ontario, L3Y 7B6. Phone 905 830 0136.

Appendix B

Surface Water Quality Data

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-1					
				29-Oct-12	06-Apr-13	03-Jul-13	23-Oct-13	17-Dec-13	15-May-14
Sodium (Na)	mg/L	0.1	**	138	77	151	64	F R O Z E N	130
Potassium (K)	mg/L	0.1	**	2.8	1.6	2.1	2.4		2.1
Calcium (Ca)	mg/L	0.1	**	100	56	95	59		82
Magnesium (Mg)	mg/L	0.1	**	7.3	3.5	7.1	4.2		5.6
Alkalinity (CaCO3)	mg/L	5	**	230	100	230	140		150
Hardness (CaCO3)	mg/L	1	**	280	150	270	170		230
Bicarbonate (as CaCO3)	mg/L	1	**	220	99	230	140		150
Carbonate (as CaCO3)	mg/L	1	**	2.8	<1	3.1	<1		2.0
TDS (calculated)	mg/L	1	**	683	382	682	370		590
Sulfate (SO4)	mg/L	10	**	76	67	76	49		85
Chloride (Cl)	mg/L	10	120 (1)	210	110	200	97		190
Fluoride (F)	mg/L	0.1	0.12	0.10	<0.1	0.11	<0.1		<0.1
Silica (SiO2)	mg/L	0.5	**	9.6	3.5	7.7	6.0		2.1
Ortho-phosphorus (P)	mg/L	0.01	**	<0.01	<0.01	<0.01	<0.01		<0.01
Phosphorus	mg/L	0.1	**	<0.1	<0.1	<0.1	<0.1		<0.1
Nitrite	mg/L	0.01	0.06	<0.01	<0.01	<0.01	<0.01		<0.01
Nitrate	mg/L	0.05	2.935 (2)	0.06	<0.05	0.06	<0.05		<0.05
Nitrate+Nitrite (N)	mg/L	0.05	**	0.06	<0.05	0.06	<0.05		<0.05
Ammonia (N)	mg/L	0.05	see Note (3)	<0.05	<0.05	0.052	0.051		0.062
Colour	T.C.U.	5	**	10	8.6	11	15		9.8
Turbidity	N.T.U.	0.1	**	0.6	0.3	<0.1	1.1		0.4
Conductivity	umho/cm	1	**	1200	680	1200	660		1100
pH	unit	N/A	6.5 - 9.0	8.13	8.02	8.16	7.83		8.2
Total Organic Carbon (TOC)	mg/L	50	**	2.9	3.0	2.8	5.2		2.5
Carbonaceous BOD	mg/L	5	**	<5	<5	<5	<5		<2
Total Chemical Oxygen Demand	mg/L	5	**	9.0	10	24	36		8
Cation Sum	me/L	N/A	**	11.7	6.46	12.0	6.18		10.3
Anion Sum	me/L	N/A	**	12.1	6.60	12.0	6.54		10.3
Ion Balance	%	N/A	**	2.02	1.07	0.130	2.83		0.0500
Saturation pH (4°C)	N/A	N/A	**	7.40	7.94	7.41	7.77		7.64
Saturation pH (20°C)	N/A	N/A	**	7.15	7.70	7.16	7.52		7.39
Langelier Index (4°C)	N/A	N/A	**	0.730	0.0760	0.749	0.0610		0.511
Langelier Index (20°C)	N/A	N/A	**	0.977	0.324	0.996	0.310		0.758
Total Suspended Solids	mg/L	1	50 (4)	<1	<1	1.4	2.6		<1
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)	0.069	0.020	0.016	0.083		0.018
Antimony (Sb)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001		<0.001
Arsenic (As)	mg/L	0.001	0.005	<0.001	<0.001	<0.001	0.0011		<0.001
Barium (Ba)	mg/L	0.001	**	0.148	0.056	0.103	0.070		0.083
Beryllium (Be)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001		<0.001
Bismuth (Bi)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002		<0.002
Boron (B)	mg/L	0.05	1.5 (6)	<0.05	<0.05	<0.05	<0.05		<0.05
Cadmium - ICP	mg/L	0.000017	see Note (7)	<0.000017	<0.000017	<0.000017	0.000016		0.000020
Chromium (Cr)	mg/L	0.001	see Note (8)	<0.001	<0.001	<0.001	<0.001		<0.001
Trivalent Chromium	mg/L	0.001	0.0089	<0.005	-	<0.001	<0.001		<0.001
Hexavalent Chromium	mg/L	0.001	0.001	0.0013	-	0.00080	0.0010		<0.0005
Cobalt (Co)	mg/L	0.0004	**	<0.0004	<0.0004	<0.0004	<0.0004		<0.0004
Copper (Cu)	mg/L	0.002	see Note (9)	<0.002	<0.002	<0.002	<0.002		<0.002
Iron (Fe)	mg/L	0.05	0.3	0.098	<0.05	<0.05	0.100		<0.05
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)	<0.0005	<0.0005	<0.0005	<0.0005		<0.0005
Manganese (Mn)	mg/L	0.002	See Note (15)	0.055	0.13	0.035	0.15		0.073
Molybdenum (Mo)	mg/L	0.002	0.073	<0.002	<0.002	<0.002	<0.002		<0.002
Nickel (Ni)	mg/L	0.002	see Note (11)	<0.002	<0.002	<0.002	<0.002		<0.002
Selenium (Se)	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001		<0.001
Silver (Ag)	mg/L	0.0001	0.00025 (12)	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001
Strontium (Sr)	mg/L	0.002	**	0.29	0.18	0.28	0.17		0.26
Thallium (Tl)	mg/L	0.0001	0.0008	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001
Tin (Sn)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002		<0.002
Titanium (Ti)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002		<0.002
Uranium (U)	mg/L	0.0001	0.015 (13)	0.00077	0.00032	0.00089	0.00042		0.00089
Vanadium (V)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002		<0.002
Zinc (Zn)	mg/L	0.005	0.007 (14)	0.0054	<0.005	<0.005	0.0051		<0.005
Mercury (Hg)	ug/L	0.013	0.026	0.020	-	-	0.068		-
Dissolved Organic Carbon	mg/L	0.5	**	-	-	-	-		-
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)	-	-	-	-		-
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)	-	-	-	-		-

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-1					
				02-Jul-14	24-Sep-14	15-Dec-14	06-May-15	14-Jul-15	21-Oct-15
Sodium (Na)	mg/L	0.1	**	590	1700	67	44	91	84.9
Potassium (K)	mg/L	0.1	**	3.2	4.6	1.5	1.3	1.7	2.2
Calcium (Ca)	mg/L	0.1	**	3.6	33	40	38	47	14.1
Magnesium (Mg)	mg/L	0.1	**	0.3	1.5	2.3	1.9	2.7	4.4
Alkalinity (CaCO3)	mg/L	5	**	980	3900	100	62	122	157
Hardness (CaCO3)	mg/L	1	**	10	88	109	102	128	53.3
Bicarbonate (as CaCO3)	mg/L	1	**	12	3	79	62	122	137
Carbonate (as CaCO3)	mg/L	1	**	670	1500	21	<10	<10	20
TDS (calculated)	mg/L	1	**	1500	4300	260	191	307	319
Sulfate (SO4)	mg/L	10	**	69	11	49	29	32	46
Chloride (Cl)	mg/L	10	120 (1)	210	190	39	39	57	67
Fluoride (F)	mg/L	0.1	0.12	0.14	0.27	0.10	0.2	0.2	0.9
Silica (SiO2)	mg/L	0.5	**	15	24	6.4	3.0	6.0	8.0
Ortho-phosphorus (P)	mg/L	0.01	**	0.043	0.20	0.02	<0.01	0.02	0.01
Phosphorus	mg/L	0.1	**	0.120	0.340	0.06	0.05	0.27	0.02
Nitrite	mg/L	0.01	0.06	0.017	<0.01	0.06	<0.05	0.22	0.45
Nitrate	mg/L	0.05	2.935 (2)	0.098	0.40	0.05	0.09	0.27	0.51
Nitrate+Nitrite (N)	mg/L	0.05	**	0.11	0.40	0.11	0.09	0.49	0.96
Ammonia (N)	mg/L	0.05	see Note (3)	0.17	0.80	0.06	<0.03	<0.03	<0.03
Colour	T.C.U.	5	**	23	98	27	13	19	35
Turbidity	N.T.U.	0.1	**	1.4	8.7	7.9	2.2	4.2	6.1
Conductivity	umho/cm	1	**	3400	13000	507	374	506	635
pH	unit	N/A	6.5 - 9.0	11.8	12.7	8.9	7.9	7.99	8.76
Total Organic Carbon (TOC)	mg/L	50	**	4.3	14	8.1	4.1	<0.5	4.8
Carbonaceous BOD	mg/L	5	**	<5	7	<2	<2	<2	<2
Total Chemical Oxygen Demand	mg/L	5	**	33	69	19	6	9	17
Cation Sum	me/L	N/A	**	25.9	76.0	5.2	4.01	6.61	4.9
Anion Sum	me/L	N/A	**	27.0	84.0	4.1	2.95	4.75	6.06
Ion Balance	%	N/A	**	2.23	4.99	11.5	15.2	16.4	10.6
Saturation pH (4°C)	N/A	N/A	**	10.2	10.0	8.35	8.57	8.20	8.61
Saturation pH (20°C)	N/A	N/A	**	9.98	9.75	8.03	8.25	7.88	8.29
Langelier Index (4°C)	N/A	N/A	**	1.56	2.70	0.56	-0.67	-0.21	0.15
Langelier Index (20°C)	N/A	N/A	**	1.80	2.94	0.88	-0.35	0.11	0.47
Total Suspended Solids	mg/L	1	50 (4)	10	28	<5	<5	6	8
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)	0.280	2.50	0.555	0.102	0.176	0.389
Antimony (Sb)	mg/L	0.001	**	<0.001	0.002	<0.002	<0.002	<0.002	<0.002
Arsenic (As)	mg/L	0.001	0.005	0.011	0.054	0.002	<0.002	0.004	0.007
Barium (Ba)	mg/L	0.001	**	0.0099	0.120	0.038	0.041	0.064	0.071
Beryllium (Be)	mg/L	0.001	**	<0.001	<0.001	<0.002	<0.002	<0.002	<0.002
Bismuth (Bi)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Boron (B)	mg/L	0.05	1.5 (6)	<0.05	<0.05	0.015	0.014	0.018	0.018
Cadmium - ICP	mg/L	0.000017	see Note (7)	0.000055	0.000230	0.000050	0.000019	0.000065	0.000255
Chromium (Cr)	mg/L	0.001	see Note (8)	<0.001	0.003	0.005	<0.001	<0.001	0.001
Trivalent Chromium	mg/L	0.001	0.0089	<0.001	0.002	0.005	<0.001	<0.001	0.001
Hexavalent Chromium	mg/L	0.001	0.001	<0.0005	0.00071	<0.001	<0.001	<0.001	<0.001
Cobalt (Co)	mg/L	0.0004	**	<0.0004	0.0011	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	mg/L	0.002	see Note (9)	0.0021	0.0087	0.003	0.001	0.002	0.002
Iron (Fe)	mg/L	0.05	0.3	0.140	0.400	0.477	0.155	0.25	0.469
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)	0.00064	0.0026	0.0012	<0.0005	0.0008	0.001
Manganese (Mn)	mg/L	0.002	See Note (15)	0.150	0.190	0.058	0.069	0.082	0.661
Molybdenum (Mo)	mg/L	0.002	0.073	<0.002	0.010	<0.002	<0.002	0.003	<0.002
Nickel (Ni)	mg/L	0.002	see Note (11)	<0.002	0.0059	<0.002	<0.002	<0.002	<0.002
Selenium (Se)	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001
Silver (Ag)	mg/L	0.0001	0.00025 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Strontium (Sr)	mg/L	0.002	**	0.023	0.120	0.141	0.103	0.107	0.067
Thallium (Tl)	mg/L	0.0001	0.0008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Titanium (Ti)	mg/L	0.002	**	0.0027	0.0083	0.014	0.003	0.006	0.005
Uranium (U)	mg/L	0.0001	0.015 (13)	0.00052	0.00150	0.0004	0.0002	0.0006	0.0007
Vanadium (V)	mg/L	0.002	**	0.018	0.048	0.002	<0.002	<0.002	0.004
Zinc (Zn)	mg/L	0.005	0.007 (14)	0.0057	0.023	0.009	0.007	0.006	<0.005
Mercury (Hg)	ug/L	0.013	0.026	-	6.1	-	<0.026	-	0.251
Dissolved Organic Carbon	mg/L	0.5	**	-	-	-	-	-	-
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)	-	-	-	-	-	-
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)	-	-	-	-	-	-

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-1					
				09-Dec-15	12-Apr-16	02-Jun-16	07-Oct-16	19-Dec-16	12-Apr-17
Sodium (Na)	mg/L	0.1	**	91.1	39.0	91	230	30	49
Potassium (K)	mg/L	0.1	**	1.9	1.2	1.9	4.9	1.4	1.3
Calcium (Ca)	mg/L	0.1	**	73.7	44.0	40	6.3	36	43
Magnesium (Mg)	mg/L	0.1	**	4.1	2.3	3.1	2.9	2.1	2.6
Alkalinity (CaCO3)	mg/L	5	**	119	83	170	260	74	91
Hardness (CaCO3)	mg/L	1	**	201	120	110	28	99	120
Bicarbonate (as CaCO3)	mg/L	1	**	119	83	170	150	74	91
Carbonate (as CaCO3)	mg/L	1	**	<10	<1	3.9	100	<1	<1
TDS (calculated)	mg/L	1	**	411	250	360	660	210	280
Sulfate (SO4)	mg/L	10	**	82	51	54	100	42	41
Chloride (Cl)	mg/L	10	120 (1)	85	52	56	140	47	80
Fluoride (F)	mg/L	0.1	0.12	<0.12	<0.1	0.11	<0.1	<0.1	<0.1
Silica (SiO2)	mg/L	0.5	**	5.3	3.9	5.7	17	4.8	3.2
Ortho-phosphorus (P)	mg/L	0.01	**	0.01	<0.01	0.037	0.044	0.011	<0.01
Phosphorus	mg/L	0.1	**	0.11	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrite	mg/L	0.01	0.06	0.09	<0.01	<0.01	0.012	<0.01	<0.01
Nitrate	mg/L	0.05	2.935 (2)	0.08	0.05	0.062	0.072	0.16	<0.05
Nitrate+Nitrite (N)	mg/L	0.05	**	0.17	0.05	0.062	0.083	0.16	<0.05
Ammonia (N)	mg/L	0.05	see Note (3)	0.07	<0.05	0.28	0.66	1.3	0.71
Colour	T.C.U.	5	**	6	14	31	19	19	12
Turbidity	N.T.U.	0.1	**	4.7	3.2	4.2	5.6	3.9	1.3
Conductivity	umho/cm	1	**	752	430	580	1100	340	490
pH	unit	N/A	6.5 - 9.0	7.92	7.86	8.39	9.87	7.85	7.79
Total Organic Carbon (TOC)	mg/L	50	**	2.9	2.9	3.4	2.9	4.2	2.7
Carbonaceous BOD	mg/L	5	**	<2	<5	15	<5	<5	<5
Total Chemical Oxygen Demand	mg/L	5	**	18	7.9	22	11	15	9.2
Cation Sum	me/L	N/A	**	8.09	4.13	6.27	10.9	3.42	4.53
Anion Sum	me/L	N/A	**	6.50	4.21	6.13	11.3	3.72	4.95
Ion Balance	%	N/A	**	10.9	1.0	1.13	1.99	4.2	4.43
Saturation pH (4°C)	N/A	N/A	**	8.03	-0.23	7.86	8.77	8.21	8.07
Saturation pH (20°C)	N/A	N/A	**	7.71	0.02	7.62	8.52	7.96	7.83
Langelier Index (4°C)	N/A	N/A	**	-0.11	8.09	0.527	1.09	-0.361	-0.283
Langelier Index (20°C)	N/A	N/A	**	0.21	7.84	0.775	1.34	-0.111	-0.034
Total Suspended Solids	mg/L	1	50 (4)	<5	<1	1.4	2.6	5.4	1
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)	0.267	0.13	0.48	0.14	0.16	0.044
Antimony (Sb)	mg/L	0.001	**	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (As)	mg/L	0.001	0.005	<0.002	<0.001	0.016	0.012	<0.001	<0.001
Barium (Ba)	mg/L	0.001	**	0.075	0.051	0.05	0.02	0.046	0.052
Beryllium (Be)	mg/L	0.001	**	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001
Bismuth (Bi)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Boron (B)	mg/L	0.05	1.5 (6)	0.015	<0.050	<0.05	<0.05	<0.05	<0.05
Cadmium - ICP	mg/L	0.000017	see Note (7)	0.000029	0.000036	0.000093	0.000018	0.000024	0.000012
Chromium (Cr)	mg/L	0.001	see Note (8)	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Trivalent Chromium	mg/L	0.001	0.0089	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Hexavalent Chromium	mg/L	0.001	0.001	<0.005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt (Co)	mg/L	0.0004	**	<0.001	<0.0004	0.0013	<0.0004	<0.0004	<0.0004
Copper (Cu)	mg/L	0.002	see Note (9)	0.001	<0.002	0.0041	<0.002	<0.002	<0.002
Iron (Fe)	mg/L	0.05	0.3	0.243	0.2	0.35	0.16	0.16	<0.05
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)	0.0060	0.0006	0.0015	<0.0005	<0.0005	<0.0005
Manganese (Mn)	mg/L	0.002	See Note (15)	0.344	0.15	0.23	0.14	0.065	0.044
Molybdenum (Mo)	mg/L	0.002	0.073	<0.002	<0.002	0.0025	0.0032	<0.002	<0.002
Nickel (Ni)	mg/L	0.002	see Note (11)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Selenium (Se)	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silver (Ag)	mg/L	0.0001	0.00025 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Strontium (Sr)	mg/L	0.002	**	0.202	0.13	0.098	0.033	0.094	0.12
Thallium (Tl)	mg/L	0.0001	0.0008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Titanium (Ti)	mg/L	0.002	**	0.004	0.012	0.0069	<0.002	0.0052	<0.002
Uranium (U)	mg/L	0.0001	0.015 (13)	0.0004	0.0002	0.00095	0.00037	0.00018	0.00026
Vanadium (V)	mg/L	0.002	**	<0.002	<0.002	0.0077	0.013	<0.002	<0.002
Zinc (Zn)	mg/L	0.005	0.007 (14)	0.006	<0.005	0.0075	<0.005	<0.005	<0.005
Mercury (Hg)	ug/L	0.013	0.026	-	-	-	0.17	0.1	-
Dissolved Organic Carbon	mg/L	0.5	**	-	-	-	-	-	-
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)	-	-	-	-	-	-
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)	-	-	-	-	-	-

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-1					
				21-Jun-17	13-Sep-17	06-Dec-17	23-Apr-18	02-Aug-18	10-Oct-18
Sodium (Na)	mg/L	0.1	**	78	78	38	69	150	150
Potassium (K)	mg/L	0.1	**	1.5	1.9	1.6	1.6	2.2	3.0
Calcium (Ca)	mg/L	0.1	**	68	49	33	63	75	74
Magnesium (Mg)	mg/L	0.1	**	4.9	4.4	2.6	3.8	5.8	6.1
Alkalinity (CaCO3)	mg/L	5	**	170	150	81	110	210	210
Hardness (CaCO3)	mg/L	1	**	190	140	93	170	210	210
Bicarbonate (as CaCO3)	mg/L	1	**	170	150	80	110	210	210
Carbonate (as CaCO3)	mg/L	1	**	2.1	1.8	<1	<1	1.7	1.9
TDS (calculated)	mg/L	1	**	430	380	220	390	650	610
Sulfate (SO4)	mg/L	10	**	43	40	37	64	88	73
Chloride (Cl)	mg/L	10	120 (1)	120	95	50	110	200	160
Fluoride (F)	mg/L	0.1	0.12	<0.1	<0.1	<0.1	<0.1	0.12	<0.1
Silica (SiO2)	mg/L	0.5	**	5.7	8.6	5.0	2.9	9.7	9.5
Ortho-phosphorus (P)	mg/L	0.01	**	<0.01	<0.01	<0.01	<0.01	0.022	0.020
Phosphorus	mg/L	0.1	**	<0.1	0.21	<0.1	<0.1	<0.1	<0.1
Nitrite	mg/L	0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate	mg/L	0.05	2.935 (2)	<0.05	<0.05	<0.05	0.055	0.069	<0.05
Nitrate+Nitrite (N)	mg/L	0.05	**	<0.05	<0.05	<0.05	0.055	0.069	<0.05
Ammonia (N)	mg/L	0.05	see Note (3)	0.09	0.62	<0.05	0.057	0.22	0.10
Colour	T.C.U.	5	**	6.7	10	8.5	9	16	9.6
Turbidity	N.T.U.	0.1	**	0.44	0.25	2.1	0.32	0.94	1.7
Conductivity	umho/cm	1	**	730	620	370	690	1200	1000
pH	unit	N/A	6.5 - 9.0	8.11	8.09	7.88	7.93	7.92	7.99
Total Organic Carbon (TOC)	mg/L	50	**	2.4	2.5	2.7	3.8	3.6	3.5
Carbonaceous BOD	mg/L	5	**	<5	<5	<5	<5	<5	<5
Total Chemical Oxygen Demand	mg/L	5	**	22	7.9	20	9.4	25	9.7
Cation Sum	me/L	N/A	**	7.23	6.4	3.56	6.48	10.7	10.7
Anion Sum	me/L	N/A	**	7.79	6.59	3.78	6.77	11.7	10.4
Ion Balance	%	N/A	**	3.73	1.46	3.00	2.19	4.39	1.33
Saturation pH (4°C)	N/A	N/A	**	7.63	7.82	8.22	7.85	7.55	7.54
Saturation pH (20°C)	N/A	N/A	**	7.39	7.57	7.97	7.6	7.30	7.30
Langelier Index (4°C)	N/A	N/A	**	0.476	0.273	-0.344	0.081	0.375	0.446
Langelier Index (20°C)	N/A	N/A	**	0.724	0.522	-0.095	0.33	0.622	0.693
Total Suspended Solids	mg/L	1	50 (4)	2.2	2	2	<1	4.2	<1
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)	0.15	1.5	0.068	0.016	0.021	0.013
Antimony (Sb)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (As)	mg/L	0.001	0.005	<0.001	0.0049	<0.001	<0.001	0.0013	0.0028
Barium (Ba)	mg/L	0.001	**	0.11	0.19	0.049	0.067	0.11	0.11
Beryllium (Be)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bismuth (Bi)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Boron (B)	mg/L	0.05	1.5 (6)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium - ICP	mg/L	0.000017	see Note (7)	0.000022	0.00025	0.000015	0.000014	<0.00001	<0.00001
Chromium (Cr)	mg/L	0.001	see Note (8)	<0.001	0.0032	<0.001	<0.001	<0.001	<0.001
Trivalent Chromium	mg/L	0.001	0.0089	<0.001	0.003	<0.001	<0.001	<0.001	<0.001
Hexavalent Chromium	mg/L	0.001	0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt (Co)	mg/L	0.0004	**	<0.0004	0.0019	<0.0004	<0.0004	<0.0004	<0.0004
Copper (Cu)	mg/L	0.002	see Note (9)	<0.002	0.0051	<0.002	<0.002	<0.002	<0.002
Iron (Fe)	mg/L	0.05	0.3	0.2	2.7	0.11	<0.05	<0.05	<0.05
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)	<0.0005	0.0057	<0.0005	<0.0005	<0.0005	<0.0005
Manganese (Mn)	mg/L	0.002	See Note (15)	0.18	3.3	0.060	0.067	0.13	0.076
Molybdenum (Mo)	mg/L	0.002	0.073	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L	0.002	see Note (11)	<0.002	0.0038	<0.002	<0.002	<0.002	<0.002
Selenium (Se)	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silver (Ag)	mg/L	0.0001	0.00025 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Strontium (Sr)	mg/L	0.002	**	0.17	0.12	0.075	0.18	0.20	0.18
Thallium (Tl)	mg/L	0.0001	0.0008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Titanium (Ti)	mg/L	0.002	**	0.0023	0.018	<0.002	<0.002	<0.002	<0.002
Uranium (U)	mg/L	0.0001	0.015 (13)	0.00056	0.00049	0.00019	0.00041	0.00093	0.00083
Vanadium (V)	mg/L	0.002	**	<0.002	0.0054	<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	0.005	0.007 (14)	<0.005	0.04	<0.005	<0.005	<0.005	<0.005
Mercury (Hg)	ug/L	0.013	0.026	-	0.06	-	-	-	0.022
Dissolved Organic Carbon	mg/L	0.5	**	-	-	-	-	-	-
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)	-	-	-	-	-	-
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)	-	-	-	-	-	-

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-1					
				12-Dec-18	02-May-19	11-Jul-19	24-Sep-19	18-Dec-19	06-Apr-20
Sodium (Na)	mg/L	0.1	**	55	68	140	180	51	37
Potassium (K)	mg/L	0.1	**	1.2	1.6	1.8	2.7	1.2	1.1
Calcium (Ca)	mg/L	0.1	**	58	61	94	92	56	36
Magnesium (Mg)	mg/L	0.1	**	3.5	3.6	6.9	7.1	3.3	2.2
Alkalinity (CaCO ₃)	mg/L	5	**	110	120	240	290	110	89
Hardness (CaCO ₃)	mg/L	1	**	160	170	260	260	150	100
Bicarbonate (as CaCO ₃)	mg/L	1	**	110	110	230	290	110	89
Carbonate (as CaCO ₃)	mg/L	1	**	<1	1.2	3.5	3.2	<1	<1
TDS (calculated)	mg/L	1	**	330	380	670	760	330	230
Sulfate (SO ₄)	mg/L	10	**	60	61	86	96	62	31
Chloride (Cl)	mg/L	10	120 (1)	82	110	190	200	75	58
Fluoride (F)	mg/L	0.1	0.12	<0.1	<0.1	<0.10	0.1	<0.1	<0.1
Silica (SiO ₂)	mg/L	0.5	**	5.3	3.1	9.8	12	5.5	4.1
Ortho-phosphorus (P)	mg/L	0.01	**	<0.01	0.043	<0.01	0.020	0.010	<0.01
Phosphorus	mg/L	0.1	**	<0.1	<0.1	<0.10	<0.1	<0.1	<0.1
Nitrite	mg/L	0.01	0.06	<0.01	<0.01	<0.01	<0.01	0.012	<0.01
Nitrate	mg/L	0.05	2.935 (2)	0.12	0.058	<0.05	<0.05	0.11	0.094
Nitrate+Nitrite (N)	mg/L	0.05	**	0.12	0.058	<0.05	<0.05	0.12	0.094
Ammonia (N)	mg/L	0.05	see Note (3)	0.13	0.16	0.097	0.23	7.0	0.18
Colour	T.C.U.	5	**	5.9	6.3	12	15	8.1	10
Turbidity	N.T.U.	0.1	**	0.18	1.4	0.83	0.89	0.71	0.94
Conductivity	umho/cm	1	**	590	620	1200	1300	580	420
pH	unit	N/A	6.5 - 9.0	7.79	8.06	8.21	8.07	7.86	7.96
Total Organic Carbon (TOC)	mg/L	50	**	2.7	3.1	3.0	4.0	3.0	3.2
Carbonaceous BOD	mg/L	5	**	<5	<10	<5	<5	<10	<10
Total Chemical Oxygen Demand	mg/L	5	**	<20	27	<20	28	20	<20
Cation Sum	me/L	N/A	**	5.63	6.36	11.3	13.2	5.84	3.81
Anion Sum	me/L	N/A	**	5.72	6.69	11.9	13.3	5.53	4.08
Ion Balance	%	N/A	**	0.79	2.53	2.55	0.38	2.73	3.42
Saturation pH (4°C)	N/A	N/A	**	7.88	7.85	7.41	7.34	7.90	8.15
Saturation pH (20°C)	N/A	N/A	**	7.63	7.6	7.16	7.09	7.65	7.90
Langelier Index (4°C)	N/A	N/A	**	-0.0920	0.214	0.801	0.731	-0.038	-0.193
Langelier Index (20°C)	N/A	N/A	**	0.157	0.462	1.05	0.977	0.211	0.0570
Total Suspended Solids	mg/L	1	50 (4)	<1	2.2	<1	<1	1.0	1.6
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)	0.011	0.031	0.011	0.01	0.018	0.031
Antimony (Sb)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (As)	mg/L	0.001	0.005	<0.001	<0.001	0.001	0.0015	<0.001	<0.001
Barium (Ba)	mg/L	0.001	**	0.066	0.08	0.13	0.14	0.065	0.046
Beryllium (Be)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bismuth (Bi)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Boron (B)	mg/L	0.05	1.5 (6)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium - ICP	mg/L	0.000017	see Note (7)	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chromium (Cr)	mg/L	0.001	see Note (8)	<0.001	<0.001	0.0011	<0.001	<0.001	<0.001
Trivalent Chromium	mg/L	0.001	0.0089	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
Hexavalent Chromium	mg/L	0.001	0.001	<0.0005	<0.0005	<0.0005	0.0005	0.00077	0.00080
Cobalt (Co)	mg/L	0.0004	**	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Copper (Cu)	mg/L	0.002	see Note (9)	<0.002	0.00071	0.0044	0.00052	<0.0005	0.00063
Iron (Fe)	mg/L	0.05	0.3	<0.05	0.058	<0.05	<0.05	<0.05	0.062
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Manganese (Mn)	mg/L	0.002	See Note (15)	0.020	0.087	0.11	0.099	0.022	0.010
Molybdenum (Mo)	mg/L	0.002	0.073	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L	0.002	see Note (11)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Selenium (Se)	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005	<0.0005
Silver (Ag)	mg/L	0.0001	0.00025 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Strontium (Sr)	mg/L	0.002	**	0.16	0.16	0.25	0.24	0.14	0.078
Thallium (Tl)	mg/L	0.0001	0.0008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Titanium (Ti)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Uranium (U)	mg/L	0.0001	0.015 (13)	0.00041	0.00043	0.00085	0.001	0.00032	0.00020
Vanadium (V)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	0.005	0.007 (14)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Mercury (Hg)	ug/L	0.013	0.026	-	-	-	0.013	-	-
Dissolved Organic Carbon	mg/L	0.5	**	-	-	-	-	-	3.5
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)	-	-	-	-	-	0.0059
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)	-	-	-	-	-	<0.005

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-1		
				16-Jun-20	13-Oct-20	15-Dec-20
Sodium (Na)	mg/L	0.1	**	110	290	55
Potassium (K)	mg/L	0.1	**	1.8	3.8	1.7
Calcium (Ca)	mg/L	0.1	**	90	86	59
Magnesium (Mg)	mg/L	0.1	**	6.4	7.4	3.9
Alkalinity (CaCO ₃)	mg/L	5	**	240	300	140
Hardness (CaCO ₃)	mg/L	1	**	250	260	170
Bicarbonate (as CaCO ₃)	mg/L	1	**	230	300	130
Carbonate (as CaCO ₃)	mg/L	1	**	3.6	4.2	1.4
TDS (calculated)	mg/L	1	**	570	1200	340
Sulfate (SO ₄)	mg/L	10	**	63	230	59
Chloride (Cl)	mg/L	10	120 (1)	150	350	72
Fluoride (F)	mg/L	0.1	0.12	<0.1	<0.1	<0.1
Silica (SiO ₂)	mg/L	0.5	**	10	11	6.9
Ortho-phosphorus (P)	mg/L	0.01	**	0.019	0.019	0.013
Phosphorus	mg/L	0.1	**	<0.1	<0.1	<0.1
Nitrite	mg/L	0.01	0.06	<0.01	<0.01	<0.01
Nitrate	mg/L	0.05	2.935 (2)	0.12	0.080	0.098
Nitrate+Nitrite (N)	mg/L	0.05	**	0.12	0.080	0.098
Ammonia (N)	mg/L	0.05	see Note (3)	0.097	3.8	<0.05
Colour	T.C.U.	5	**	17	18	10
Turbidity	N.T.U.	0.1	**	1.2	1.1	0.64
Conductivity	umho/cm	1	**	1000	2100	600
pH	unit	N/A	6.5 - 9.0	8.22	8.18	8.05
Total Organic Carbon (TOC)	mg/L	50	**	3.5	4.3	3.9
Carbonaceous BOD	mg/L	5	**	<5	<5	<5
Total Chemical Oxygen Demand	mg/L	5	**	<20	22	<20
Cation Sum	me/L	N/A	**	9.76	19.5	5.89
Anion Sum	me/L	N/A	**	10.3	20.5	5.99
Ion Balance	%	N/A	**	2.89	2.60	0.840
Saturation pH (4°C)	N/A	N/A	**	7.41	7.39	7.78
Saturation pH (20°C)	N/A	N/A	**	7.16	7.15	7.53
Langelier Index (4°C)	N/A	N/A	**	0.809	0.784	0.269
Langelier Index (20°C)	N/A	N/A	**	1.06	1.03	0.518
Total Suspended Solids	mg/L	1	50 (4)	1.4	1.4	1.6
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)	0.0092	0.013	0.020
Antimony (Sb)	mg/L	0.001	**	<0.001	<0.001	<0.001
Arsenic (As)	mg/L	0.001	0.005	0.0013	0.0012	0.0011
Barium (Ba)	mg/L	0.001	**	0.11	0.091	0.063
Beryllium (Be)	mg/L	0.001	**	<0.001	<0.001	<0.001
Bismuth (Bi)	mg/L	0.002	**	<0.002	<0.002	<0.002
Boron (B)	mg/L	0.05	1.5 (6)	<0.05	<0.05	<0.05
Cadmium - ICP	mg/L	0.000017	see Note (7)	<0.00001	<0.00001	<0.00001
Chromium (Cr)	mg/L	0.001	see Note (8)	<0.001	<0.001	<0.001
Trivalent Chromium	mg/L	0.001	0.0089	<0.001	<0.001	<0.001
Hexavalent Chromium	mg/L	0.001	0.001	0.00070	0.00075	0.00051
Cobalt (Co)	mg/L	0.0004	**	<0.0004	<0.0004	<0.0004
Copper (Cu)	mg/L	0.002	see Note (9)	0.00059	<0.0005	0.00071
Iron (Fe)	mg/L	0.05	0.3	<0.05	<0.05	<0.05
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)	<0.0005	<0.0005	<0.0005
Manganese (Mn)	mg/L	0.002	See Note (15)	0.053	0.044	0.017
Molybdenum (Mo)	mg/L	0.002	0.073	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L	0.002	see Note (11)	<0.002	<0.002	<0.002
Selenium (Se)	mg/L	0.001	0.001	<0.0005	<0.0005	<0.0005
Silver (Ag)	mg/L	0.0001	0.00025 (12)	<0.0001	<0.0001	<0.0001
Strontium (Sr)	mg/L	0.002	**	0.23	0.23	0.13
Thallium (Tl)	mg/L	0.0001	0.0008	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.002	**	<0.002	<0.002	<0.002
Titanium (Ti)	mg/L	0.002	**	<0.002	<0.002	<0.002
Uranium (U)	mg/L	0.0001	0.015 (13)	0.00086	0.0014	0.00050
Vanadium (V)	mg/L	0.002	**	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	0.005	0.007 (14)	<0.005	<0.005	<0.005
Mercury (Hg)	ug/L	0.013	0.026	-	<0.013	-
Dissolved Organic Carbon	mg/L	0.5	**	6.1	5.9	4.7
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)	0.047	0.22	0.011
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)	<0.005	<0.005	<0.005

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-2				
				29-Oct-12	06-Apr-13	03-Jul-13	23-Oct-13	23-Oct-13 F/D
Sodium (Na)	mg/L	0.1	**	130	77	148	66	68
Potassium (K)	mg/L	0.1	**	2.8	1.7	2.1	2.5	2.5
Calcium (Ca)	mg/L	0.1	**	95	57	95	62	61
Magnesium (Mg)	mg/L	0.1	**	7.0	3.6	7.1	4.4	4.3
Alkalinity (CaCO3)	mg/L	5	**	230	110	230	140	140
Hardness (CaCO3)	mg/L	1	**	270	160	270	170	170
Bicarbonate (as CaCO3)	mg/L	1	**	230	100	230	140	140
Carbonate (as CaCO3)	mg/L	1	**	3.9	1.2	4.5	1.0	1.0
TDS (calculated)	mg/L	1	**	662	381	659	380	380
Sulfate (SO4)	mg/L	10	**	72	62	72	49	50
Chloride (Cl)	mg/L	10	120 (1)	200	110	190	100	100
Fluoride (F)	mg/L	0.1	0.12	0.10	<0.1	0.11	<0.1	<0.1
Silica (SiO2)	mg/L	0.5	**	9.6	3.2	6.3	6.1	6.6
Ortho-phosphorus (P)	mg/L	0.01	**	0.012	<0.01	<0.01	<0.01	<0.01
Phosphorus	mg/L	0.1	**	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrite	mg/L	0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate	mg/L	0.05	2.935 (2)	<0.05	<0.05	<0.05	<0.05	<0.05
Nitrate+Nitrite (N)	mg/L	0.05	**	<0.05	<0.05	<0.05	<0.05	<0.05
Ammonia (N)	mg/L	0.05	see Note (3)	<0.05	<0.05	0.054	0.093	0.070
Colour	T.C.U.	5	**	10	12	8.0	14	19
Turbidity	N.T.U.	0.1	**	0.4	0.5	0.2	1.2	1.5
Conductivity	umho/cm	1	**	1100	670	1200	670	670
pH	unit	N/A	6.5 - 9.0	8.25	8.09	8.33	7.90	7.89
Total Organic Carbon (TOC)	mg/L	50	**	2.7	2.7	3.1	5.2	5.3
Carbonaceous BOD	mg/L	5	**	<5	<5	<5	<5	-
Total Chemical Oxygen Demand	mg/L	5	**	8.1	12	10	31	-
Cation Sum	me/L	N/A	**	11.0	6.51	11.8	6.42	6.43
Anion Sum	me/L	N/A	**	12.0	6.59	11.5	6.64	6.72
Ion Balance	%	N/A	**	4.05	0.610	1.59	1.68	2.21
Saturation pH (4°C)	N/A	N/A	**	7.41	7.92	7.41	7.75	7.76
Saturation pH (20°C)	N/A	N/A	**	7.16	7.67	7.17	7.51	7.51
Langelier Index (4°C)	N/A	N/A	**	0.843	0.172	0.917	0.146	0.127
Langelier Index (20°C)	N/A	N/A	**	1.09	0.420	1.16	0.395	0.376
Total Suspended Solids	mg/L	1	50 (4)	<1	1	1.8	2.6	-
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)	0.013	0.043	0.023	0.12	0.085
Antimony (Sb)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (As)	mg/L	0.001	0.005	<0.001	<0.001	<0.001	0.0011	0.0010
Barium (Ba)	mg/L	0.001	**	0.133	0.056	0.101	0.075	0.073
Beryllium (Be)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.001
Bismuth (Bi)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002
Boron (B)	mg/L	0.05	1.5 (6)	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium - ICP	mg/L	0.000017	see Note (7)	<0.000017	<0.000017	<0.000017	0.000019	0.000019
Chromium (Cr)	mg/L	0.001	see Note (8)	<0.001	<0.001	<0.001	<0.001	<0.001
Trivalent Chromium	mg/L	0.001	0.0089	<0.005	-	<0.001	<0.001	-
Hexavalent Chromium	mg/L	0.001	0.001	<0.001	-	<0.0005	0.00096	-
Cobalt (Co)	mg/L	0.0004	**	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Copper (Cu)	mg/L	0.002	see Note (9)	<0.002	<0.002	<0.002	<0.002	<0.002
Iron (Fe)	mg/L	0.05	0.3	<0.05	0.059	<0.05	0.120	0.110
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Manganese (Mn)	mg/L	0.002	See Note (15)	0.076	0.088	0.11	0.11	0.12
Molybdenum (Mo)	mg/L	0.002	0.073	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L	0.002	see Note (11)	<0.002	<0.002	<0.002	<0.002	<0.002
Selenium (Se)	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silver (Ag)	mg/L	0.0001	0.00025 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Strontium (Sr)	mg/L	0.002	**	0.28	0.18	0.28	0.17	0.18
Thallium (Tl)	mg/L	0.0001	0.0008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002
Titanium (Ti)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	0.0025
Uranium (U)	mg/L	0.0001	0.015 (13)	0.00084	0.00035	0.00094	0.00045	0.00044
Vanadium (V)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	0.005	0.007 (14)	0.0060	<0.005	<0.005	<0.005	0.0065
Mercury (Hg)	ug/L	0.013	0.026	0.019	-	-	0.080	-
Dissolved Organic Carbon	mg/L	0.5	**	-	-	-	-	-
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)	-	-	-	-	-
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)	-	-	-	-	-

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-2					
				17-Dec-13	15-May-14	02-Jul-14	24-Sep-14	15-Dec-14	06-May-15
Sodium (Na)	mg/L	0.1	**	130	120	530	1700	66	45
Potassium (K)	mg/L	0.1	**	4.6	2.0	3.0	4.6	1.5	1.3
Calcium (Ca)	mg/L	0.1	**	87	79	6.6	32	40	38
Magnesium (Mg)	mg/L	0.1	**	6.1	5.4	0.44	1.0	2.3	1.9
Alkalinity (CaCO3)	mg/L	5	**	220	160	900	3600	107	69
Hardness (CaCO3)	mg/L	1	**	240	220	18	85	109	101
Bicarbonate (as CaCO3)	mg/L	1	**	220	150	18	4	80	69
Carbonate (as CaCO3)	mg/L	1	**	2.5	2.0	680	1600	27	<10
TDS (calculated)	mg/L	1	**	670	560	1400	4200	258	196
Sulfate (SO4)	mg/L	10	**	110	78	74	6	48	29
Chloride (Cl)	mg/L	10	120 (1)	190	180	190	180	35	39
Fluoride (F)	mg/L	0.1	0.12	<0.1	<0.1	0.15	0.27	<0.1	<0.1
Silica (SiO2)	mg/L	0.5	**	14	2.4	15	24	6.5	2.9
Ortho-phosphorus (P)	mg/L	0.01	**	0.023	<0.01	0.077	0.18	0.02	<0.01
Phosphorus	mg/L	0.1	**	<0.1	<0.1	180	0.37	0.06	0.05
Nitrite	mg/L	0.01	0.06	0.012	<0.01	0.018	<0.01	0.06	<0.05
Nitrate	mg/L	0.05	2.935 (2)	0.13	<0.05	0.093	0.54	0.06	<0.05
Nitrate+Nitrite (N)	mg/L	0.05	**	0.14	<0.05	0.11	0.54	0.12	<0.05
Ammonia (N)	mg/L	0.05	see Note (3)	0.13	<0.05	0.29	1.2	<0.03	<0.03
Colour	T.C.U.	5	**	11	10	42	140	38	16
Turbidity	N.T.U.	0.1	**	7.5	0.7	3.5	7.3	9.6	2.7
Conductivity	umho/cm	1	**	1200	1000	2800	12000	509	392
pH	unit	N/A	6.5 - 9.0	8.09	8.2	11.6	12.6	9.0	7.92
Total Organic Carbon (TOC)	mg/L	50	**	3.0	2.6	5.1	17	8.4	4.4
Carbonaceous BOD	mg/L	5	**	<5	<2	<5	13	<2	<2
Total Chemical Oxygen Demand	mg/L	5	**	11	10	40	86	20	13
Cation Sum	me/L	N/A	**	10.7	9.73	23.4	76.7	5.2	4.06
Anion Sum	me/L	N/A	**	11.9	9.84	25.0	77.9	4.1	3.08
Ion Balance	%	N/A	**	5.12	0.560	3.27	0.74	11.1	13.6
Saturation pH (4°C)	N/A	N/A	**	7.47	7.65	9.77	9.87	8.32	8.52
Saturation pH (20°C)	N/A	N/A	**	7.22	7.40	9.53	9.63	8.00	8.2
Langelier Index (4°C)	N/A	N/A	**	0.622	0.506	1.84	2.74	0.70	-0.6
Langelier Index (20°C)	N/A	N/A	**	0.869	0.753	2.09	2.98	1.02	-0.28
Total Suspended Solids	mg/L	1	50 (4)	17	1.2	3.7	24	6	<5
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)	0.27	0.027	0.420	2.70	0.633	0.137
Antimony (Sb)	mg/L	0.001	**	<0.001	<0.001	<0.001	0.002	<0.002	<0.002
Arsenic (As)	mg/L	0.001	0.005	0.0020	<0.001	0.012	0.057	0.003	<0.002
Barium (Ba)	mg/L	0.001	**	0.089	0.086	0.014	0.110	0.039	0.042
Beryllium (Be)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002
Bismuth (Bi)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Boron (B)	mg/L	0.05	1.5 (6)	<0.05	<0.05	<0.05	<0.05	0.014	0.014
Cadmium - ICP	mg/L	0.000017	see Note (7)	0.000035	0.000019	0.000090	0.000290	0.000038	0.000026
Chromium (Cr)	mg/L	0.001	see Note (8)	<0.001	<0.001	<0.001	0.003	0.005	<0.001
Trivalent Chromium	mg/L	0.001	0.0089	<0.001	<0.001	<0.001	0.002	0.005	<0.001
Hexavalent Chromium	mg/L	0.001	0.001	0.00090	<0.0005	<0.0005	0.00085	<0.001	<0.001
Cobalt (Co)	mg/L	0.0004	**	<0.0004	<0.0004	0.00048	0.0014	<0.001	<0.001
Copper (Cu)	mg/L	0.002	see Note (9)	<0.002	<0.002	0.004	0.010	0.003	0.002
Iron (Fe)	mg/L	0.05	0.3	0.280	<0.05	0.24	0.43	0.53	0.169
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)	0.0007	<0.0005	0.0013	0.0035	0.0013	<0.0005
Manganese (Mn)	mg/L	0.002	See Note (15)	0.30	0.11	0.17	0.16	0.058	0.059
Molybdenum (Mo)	mg/L	0.002	0.073	0.0038	<0.002	0.0022	0.011	<0.002	<0.002
Nickel (Ni)	mg/L	0.002	see Note (11)	<0.002	<0.002	<0.002	0.0065	<0.002	<0.002
Selenium (Se)	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silver (Ag)	mg/L	0.0001	0.00025 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Strontium (Sr)	mg/L	0.002	**	0.35	0.25	0.027	0.11	0.14	0.100
Thallium (Tl)	mg/L	0.0001	0.0008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Titanium (Ti)	mg/L	0.002	**	0.0066	<0.002	0.0039	0.0077	0.014	0.004
Uranium (U)	mg/L	0.0001	0.015 (13)	0.0011	0.00086	0.00055	0.0013	0.0004	0.0002
Vanadium (V)	mg/L	0.002	**	0.0023	<0.002	0.018	0.051	0.002	<0.002
Zinc (Zn)	mg/L	0.005	0.007 (14)	0.0083	0.0058	0.0067	0.022	0.009	0.011
Mercury (Hg)	ug/L	0.013	0.026	-	-	-	7.0	-	<0.026
Dissolved Organic Carbon	mg/L	0.5	**	-	-	-	-	-	-
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)	-	-	-	-	-	-
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)	-	-	-	-	-	-

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-2				
				6-May-15 F/D	14-Jul-15	21-Oct-15	09-Dec-15	12-Apr-16
Sodium (Na)	mg/L	0.1	**	46	91	102	88.6	38.0
Potassium (K)	mg/L	0.1	**	1.2	1.6	2.3	1.9	1.4
Calcium (Ca)	mg/L	0.1	**	37	47	30.6	70.3	44.0
Magnesium (Mg)	mg/L	0.1	**	1.8	2.8	4.7	4.1	2.5
Alkalinity (CaCO ₃)	mg/L	5	**	68	129	164	124	85
Hardness (CaCO ₃)	mg/L	1	**	101	130	95.8	192	120
Bicarbonate (as CaCO ₃)	mg/L	1	**	68	129	153	124	84
Carbonate (as CaCO ₃)	mg/L	1	**	<10	<10	12	<10	<1
TDS (calculated)	mg/L	1	**	217	313	351	404	240
Sulfate (SO ₄)	mg/L	10	**	35	33	45	80	45
Chloride (Cl)	mg/L	10	120 (1)	51	58	67	83	52
Fluoride (F)	mg/L	0.1	0.12	0.2	0.1	0.2	<0.12	<0.1
Silica (SiO ₂)	mg/L	0.5	**	3	6	8.2	5.3	4.0
Ortho-phosphorus (P)	mg/L	0.01	**	<0.01	0.02	<0.01	0.02	<0.01
Phosphorus	mg/L	0.1	**	0.06	0.29	0.1	0.11	<0.1
Nitrite	mg/L	0.01	0.06	<0.05	0.23	<0.05	0.08	0.01
Nitrate	mg/L	0.05	2.935 (2)	0.75	0.27	0.13	0.08	0.08
Nitrate+Nitrite (N)	mg/L	0.05	**	0.75	0.50	0.13	0.16	0.09
Ammonia (N)	mg/L	0.05	see Note (3)	<0.03	<0.03	0.04	0.06	<0.05
Colour	T.C.U.	5	**	21	11	13	19	15
Turbidity	N.T.U.	0.1	**	3.1	3.6	3.3	5.5	31.0
Conductivity	umho/cm	1	**	384	519	650	753	420
pH	unit	N/A	6.5 - 9.0	8.00	8.13	8.55	8.00	7.91
Total Organic Carbon (TOC)	mg/L	50	**	4.7	<0.5	4.7	2.8	3.0
Carbonaceous BOD	mg/L	5	**	-	3	<2	<2	<5
Total Chemical Oxygen Demand	mg/L	5	**	-	<3	13	52	10
Cation Sum	me/L	N/A	**	4.06	6.60	6.46	7.80	4.14
Anion Sum	me/L	N/A	**	3.58	4.94	6.12	6.50	4.10
Ion Balance	%	N/A	**	6.3	14.4	2.7	9.1	0.5
Saturation pH (4°C)	N/A	N/A	**	8.54	8.17	8.26	8.03	-0.17
Saturation pH (20°C)	N/A	N/A	**	8.22	7.85	7.94	7.71	0.08
Langelier Index (4°C)	N/A	N/A	**	-0.54	-0.04	0.29	-0.03	8.08
Langelier Index (20°C)	N/A	N/A	**	-0.22	0.28	0.61	0.29	7.83
Total Suspended Solids	mg/L	1	50 (4)	-	<5	<5	9	12
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)	0.140	0.142	0.257	0.224	0.56
Antimony (Sb)	mg/L	0.001	**	<0.002	<0.002	<0.002	<0.002	<0.001
Arsenic (As)	mg/L	0.001	0.005	<0.002	0.004	0.006	<0.002	<0.001
Barium (Ba)	mg/L	0.001	**	0.042	0.062	0.057	0.075	0.057
Beryllium (Be)	mg/L	0.001	**	<0.002	<0.002	<0.002	<0.002	<0.001
Bismuth (Bi)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002
Boron (B)	mg/L	0.05	1.5 (6)	0.012	0.016	0.018	0.016	<0.050
Cadmium - ICP	mg/L	0.000017	see Note (7)	0.000032	0.000060	0.000069	0.000027	0.000054
Chromium (Cr)	mg/L	0.001	see Note (8)	<0.001	<0.001	<0.001	<0.001	0.001
Trivalent Chromium	mg/L	0.001	0.0089	-	<0.001	<0.001	<0.001	0.001
Hexavalent Chromium	mg/L	0.001	0.001	-	<0.001	<0.001	<0.005	<0.0005
Cobalt (Co)	mg/L	0.0004	**	<0.001	<0.001	<0.001	<0.001	0.00044
Copper (Cu)	mg/L	0.002	see Note (9)	0.001	0.002	0.002	0.001	0.0025
Iron (Fe)	mg/L	0.05	0.3	0.168	0.192	0.316	0.215	0.68
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)	<0.0005	0.0008	0.0007	<0.0005	0.0014
Manganese (Mn)	mg/L	0.002	See Note (15)	0.058	0.036	0.192	0.215	0.1
Molybdenum (Mo)	mg/L	0.002	0.073	<0.002	0.002	0.002	<0.002	<0.002
Nickel (Ni)	mg/L	0.002	see Note (11)	<0.002	<0.002	<0.002	<0.002	<0.002
Selenium (Se)	mg/L	0.001	0.001	<0.001	0.001	<0.001	<0.001	<0.001
Silver (Ag)	mg/L	0.0001	0.00025 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Strontium (Sr)	mg/L	0.002	**	0.098	0.112	0.069	0.199	0.12
Thallium (Tl)	mg/L	0.0001	0.0008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002
Titanium (Ti)	mg/L	0.002	**	0.004	0.006	<0.002	0.004	0.0077
Uranium (U)	mg/L	0.0001	0.015 (13)	0.0002	0.0006	0.0007	0.0005	0.0002
Vanadium (V)	mg/L	0.002	**	<0.002	<0.002	0.007	<0.002	<0.002
Zinc (Zn)	mg/L	0.005	0.007 (14)	0.007	0.015	0.006	0.005	0.019
Mercury (Hg)	ug/L	0.013	0.026	<0.026	-	0.172	-	-
Dissolved Organic Carbon	mg/L	0.5	**	-	-	-	-	-
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)	-	-	-	-	-
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)	-	-	-	-	-

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-2				
				02-Jun-16	07-Oct-16	19-Dec-16	12-Apr-17	21-Jun-17
Sodium (Na)	mg/L	0.1	**	90	230	31	52	76
Potassium (K)	mg/L	0.1	**	1.8	4.4	1.5	1.3	1.6
Calcium (Ca)	mg/L	0.1	**	39	8.6	38	43	66
Magnesium (Mg)	mg/L	0.1	**	3.1	2.8	2.1	2.8	4.9
Alkalinity (CaCO ₃)	mg/L	5	**	170	280	78	92	180
Hardness (CaCO ₃)	mg/L	1	**	110	33	100	120	190
Bicarbonate (as CaCO ₃)	mg/L	1	**	170	180	78	90	180
Carbonate (as CaCO ₃)	mg/L	1	**	3.6	92	<1	1.8	2.8
TDS (calculated)	mg/L	1	**	350	680	210	280	420
Sulfate (SO ₄)	mg/L	10	**	53	110	41	41	41
Chloride (Cl)	mg/L	10	120 (1)	56	130	48	79	120
Fluoride (F)	mg/L	0.1	0.12	<0.1	<0.1	<0.1	<0.1	<0.1
Silica (SiO ₂)	mg/L	0.5	**	5.6	18	4.9	3.1	4.1
Ortho-phosphorus (P)	mg/L	0.01	**	0.026	0.06	0.012	<0.01	<0.01
Phosphorus	mg/L	0.1	**	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrite	mg/L	0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate	mg/L	0.05	2.935 (2)	<0.05	0.15	0.18	<0.05	0.059
Nitrate+Nitrite (N)	mg/L	0.05	**	<0.05	0.15	0.18	<0.05	0.059
Ammonia (N)	mg/L	0.05	see Note (3)	<0.05	0.096	0.41	0.22	0.09
Colour	T.C.U.	5	**	26	24	17	13	8.5
Turbidity	N.T.U.	0.1	**	4.2	1.3	3.4	0.66	0.95
Conductivity	umho/cm	1	**	590	1100	330	480	730
pH	unit	N/A	6.5 - 9.0	8.36	9.74	7.63	8.33	8.22
Total Organic Carbon (TOC)	mg/L	50	**	3.3	2.9	4.2	2.7	2.8
Carbonaceous BOD	mg/L	5	**	<2	<5	<5	<5	<5
Total Chemical Oxygen Demand	mg/L	5	**	13	12	12	10	25
Cation Sum	me/L	N/A	**	6.15	11	3.46	4.65	7.08
Anion Sum	me/L	N/A	**	6.11	11.5	3.78	4.93	7.84
Ion Balance	%	N/A	**	0.33	2.54	4.42	2.92	5.09
Saturation pH (4°C)	N/A	N/A	**	7.87	8.56	8.18	8.08	7.62
Saturation pH (20°C)	N/A	N/A	**	7.62	8.31	7.93	7.83	7.38
Langelier Index (4°C)	N/A	N/A	**	0.492	1.18	-0.543	0.256	0.594
Langelier Index (20°C)	N/A	N/A	**	0.741	1.43	-0.294	0.505	0.843
Total Suspended Solids	mg/L	1	50 (4)	<1	1	1.6	1.6	2.2
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)	0.37	0.10	0.18	0.050	0.036
Antimony (Sb)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (As)	mg/L	0.001	0.005	0.014	0.012	<0.001	<0.001	<0.001
Barium (Ba)	mg/L	0.001	**	0.044	0.017	0.049	0.056	0.1
Beryllium (Be)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.001
Bismuth (Bi)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002
Boron (B)	mg/L	0.05	1.5 (6)	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium - ICP	mg/L	0.000017	see Note (7)	0.000087	0.000026	0.000024	0.000011	0.000011
Chromium (Cr)	mg/L	0.001	see Note (8)	<0.001	<0.001	<0.001	<0.001	<0.001
Trivalent Chromium	mg/L	0.001	0.0089	<0.001	<0.001	<0.001	<0.001	<0.001
Hexavalent Chromium	mg/L	0.001	0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt (Co)	mg/L	0.0004	**	0.001	<0.0004	<0.0004	<0.0004	<0.0004
Copper (Cu)	mg/L	0.002	see Note (9)	0.0036	<0.002	<0.002	<0.002	<0.002
Iron (Fe)	mg/L	0.05	0.3	0.23	0.13	0.21	0.069	<0.05
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)	0.0011	<0.0005	<0.0005	<0.0005	<0.0005
Manganese (Mn)	mg/L	0.002	See Note (15)	0.12	0.087	0.063	0.044	0.22
Molybdenum (Mo)	mg/L	0.002	0.073	0.0023	0.0035	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L	0.002	see Note (11)	<0.002	<0.002	<0.002	<0.002	<0.002
Selenium (Se)	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silver (Ag)	mg/L	0.0001	0.00025 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Strontium (Sr)	mg/L	0.002	**	0.099	0.037	0.098	0.12	0.17
Thallium (Tl)	mg/L	0.0001	0.0008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002
Titanium (Ti)	mg/L	0.002	**	0.004	0.002	0.003	<0.002	<0.002
Uranium (U)	mg/L	0.0001	0.015 (13)	0.0009	0.00048	0.00019	0.00027	0.0006
Vanadium (V)	mg/L	0.002	**	0.0069	0.013	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	0.005	0.007 (14)	0.0054	<0.005	<0.005	<0.005	<0.005
Mercury (Hg)	ug/L	0.013	0.026	-	0.15	0.1	-	-
Dissolved Organic Carbon	mg/L	0.5	**	-	-	-	-	-
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)	-	-	-	-	-
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)	-	-	-	-	-

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-2					
				13-Sep-17	06-Dec-17	23-Apr-18	02-Aug-18	2-Aug-18 F/D	10-Oct-18
Sodium (Na)	mg/L	0.1	**	77	40	69	150	150	140
Potassium (K)	mg/L	0.1	**	1.8	1.7	1.7	2.1	2.1	2.9
Calcium (Ca)	mg/L	0.1	**	49	34	63	78	79	74
Magnesium (Mg)	mg/L	0.1	**	4.0	2.8	4.0	6.1	6.0	6.5
Alkalinity (CaCO ₃)	mg/L	5	**	160	82	120	230	220	230
Hardness (CaCO ₃)	mg/L	1	**	140	97	170	220	220	210
Bicarbonate (as CaCO ₃)	mg/L	1	**	160	82	110	220	220	220
Carbonate (as CaCO ₃)	mg/L	1	**	1.6	<1	1.2	2.7	2.2	2.3
TDS (calculated)	mg/L	1	**	370	230	380	660	650	580
Sulfate (SO ₄)	mg/L	10	**	39	37	61	84	83	67
Chloride (Cl)	mg/L	10	120 (1)	93	56	110	190	190	150
Fluoride (F)	mg/L	0.1	0.12	<0.1	<0.1	<0.1	0.12	0.12	<0.1
Silica (SiO ₂)	mg/L	0.5	**	7.8	4.7	3.5	10	9.8	9.6
Ortho-phosphorus (P)	mg/L	0.01	**	0.015	<0.01	<0.01	0.020	0.020	0.020
Phosphorus	mg/L	0.1	**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrite	mg/L	0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate	mg/L	0.05	2.935 (2)	<0.05	<0.05	0.063	<0.05	<0.05	<0.05
Nitrate+Nitrite (N)	mg/L	0.05	**	<0.05	<0.05	0.063	<0.05	<0.05	<0.05
Ammonia (N)	mg/L	0.05	see Note (3)	0.39	0.38	0.34	0.11	0.24	<0.05
Colour	T.C.U.	5	**	10	9	9.4	12	12	8.8
Turbidity	N.T.U.	0.1	**	0.39	14	2.1	0.26	0.34	0.12
Conductivity	umho/cm	1	**	630	390	690	1200	1200	1000
pH	unit	N/A	6.5 - 9.0	8.03	7.88	8.03	8.10	8.03	8.04
Total Organic Carbon (TOC)	mg/L	50	**	2.5	3.2	4.2	3.5	3.5	3.3
Carbonaceous BOD	mg/L	5	**	<5	<5	<5	<5	<5	<5
Total Chemical Oxygen Demand	mg/L	5	**	6.4	11	11	9.5	9.1	7.8
Cation Sum	me/L	N/A	**	6.2	3.77	6.56	10.9	10.8	10.4
Anion Sum	me/L	N/A	**	6.68	3.99	6.72	11.7	11.6	10.1
Ion Balance	%	N/A	**	3.73	2.84	1.20	3.81	3.34	1.56
Saturation pH (4°C)	N/A	N/A	**	7.79	8.2	7.84	7.50	7.51	7.51
Saturation pH (20°C)	N/A	N/A	**	7.54	7.95	7.59	7.25	7.26	7.27
Langelier Index (4°C)	N/A	N/A	**	0.244	-0.324	0.196	0.602	0.526	0.527
Langelier Index (20°C)	N/A	N/A	**	0.493	-0.075	0.445	0.849	0.773	0.774
Total Suspended Solids	mg/L	1	50 (4)	<1	16	3.2	<1	1	1
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)	0.029	0.33	0.15	0.014	0.012	0.0091
Antimony (Sb)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (As)	mg/L	0.001	0.005	0.0021	<0.001	<0.001	0.0012	0.0013	0.0020
Barium (Ba)	mg/L	0.001	**	0.066	0.054	0.073	0.12	0.12	0.11
Beryllium (Be)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bismuth (Bi)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Boron (B)	mg/L	0.05	1.5 (6)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium - ICP	mg/L	0.000017	see Note (7)	<0.00001	0.000022	0.000019	0.000014	<0.00001	<0.00001
Chromium (Cr)	mg/L	0.001	see Note (8)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Trivalent Chromium	mg/L	0.001	0.0089	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Hexavalent Chromium	mg/L	0.001	0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt (Co)	mg/L	0.0004	**	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Copper (Cu)	mg/L	0.002	see Note (9)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Iron (Fe)	mg/L	0.05	0.3	0.051	0.41	0.23	0.052	0.051	<0.05
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)	<0.0005	0.00071	<0.0005	<0.0005	<0.0005	<0.0005
Manganese (Mn)	mg/L	0.002	See Note (15)	0.063	0.091	0.15	0.16	0.15	0.13
Molybdenum (Mo)	mg/L	0.002	0.073	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L	0.002	see Note (11)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Selenium (Se)	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silver (Ag)	mg/L	0.0001	0.00025 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Strontium (Sr)	mg/L	0.002	**	0.12	0.077	0.18	0.22	0.21	0.18
Thallium (Tl)	mg/L	0.0001	0.0008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Titanium (Ti)	mg/L	0.002	**	<0.002	0.0066	0.0022	<0.002	<0.002	<0.002
Uranium (U)	mg/L	0.0001	0.015 (13)	0.00041	0.00022	0.00049	0.0010	0.0010	0.00086
Vanadium (V)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	0.005	0.007 (14)	<0.005	0.011	0.005	<0.005	<0.005	<0.005
Mercury (Hg)	ug/L	0.013	0.026	0.017	-	-	-	-	0.018
Dissolved Organic Carbon	mg/L	0.5	**	-	-	-	-	-	-
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)	-	-	-	-	-	-
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)	-	-	-	-	-	-

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-2					
				12-Dec-18	02-May-19	2-May-19 F/D	11-Jul-19	24-Sep-19	18-Dec-19
Sodium (Na)	mg/L	0.1	**	56	68	68	140	180	51
Potassium (K)	mg/L	0.1	**	1.3	1.7	1.6	1.8	2.9	1.2
Calcium (Ca)	mg/L	0.1	**	58	62	61	97	94	56
Magnesium (Mg)	mg/L	0.1	**	3.6	3.7	3.7	7	7.5	3.4
Alkalinity (CaCO3)	mg/L	5	**	110 (110)	120	130	230	300	110
Hardness (CaCO3)	mg/L	1	**	160	170	170	270	270	150
Bicarbonate (as CaCO3)	mg/L	1	**	110	120	120	230	290	110
Carbonate (as CaCO3)	mg/L	1	**	<1	1.4	1.6	4.1	5.4	<1
TDS (calculated)	mg/L	1	**	330	380	380	650	760	330
Sulfate (SO4)	mg/L	10	**	59 (58)	61	61	82	93	62
Chloride (Cl)	mg/L	10	120 (1)	81 (79)	110	110	180	190	75
Fluoride (F)	mg/L	0.1	0.12	<0.1	<0.1	<0.1	<0.10	<0.1	<0.1
Silica (SiO2)	mg/L	0.5	**	5.2 (5.3)	2.9	2.9	9.1	11	5.9
Ortho-phosphorus (P)	mg/L	0.01	**	<0.01 (<0.01)	<0.01	<0.01	0.010	0.016	0.010
Phosphorus	mg/L	0.1	**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrite	mg/L	0.01	0.06	<0.01 (<0.01)	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate	mg/L	0.05	2.935 (2)	0.11	0.052	0.053	0.06	<0.05	0.12
Nitrate+Nitrite (N)	mg/L	0.05	**	0.11 (0.12)	0.052	0.053	0.06	<0.05	0.12
Ammonia (N)	mg/L	0.05	see Note (3)	0.072	<0.05	0.12	0.11	5.6	3.9
Colour	T.C.U.	5	**	6.2 (6.7)	6.2	6.2	8.7	12	5.3
Turbidity	N.T.U.	0.1	**	0.26	0.24	0.33	0.27	1.1	0.98
Conductivity	umho/cm	1	**	600	620	620	1100	1300	580
pH	unit	N/A	6.5 - 9.0	7.91	8.08	8.13	8.28	8.29	7.92
Total Organic Carbon (TOC)	mg/L	50	**	2.7	3.1	3.1	3.2	3.7	2.9
Carbonaceous BOD	mg/L	5	**	<5	<10	<10	<5	<5	<10
Total Chemical Oxygen Demand	mg/L	5	**	<20	25	100	21	21	<20
Cation Sum	me/L	N/A	**	5.68	6.44	6.37	11.4	13.6	5.60
Anion Sum	me/L	N/A	**	5.75	6.79	6.82	11.5	13.2	5.65
Ion Balance	%	N/A	**	0.610	2.65	3.41	0.480	1.46	0.440
Saturation pH (4°C)	N/A	N/A	**	7.87	7.81	7.81	7.4	7.32	7.88
Saturation pH (20°C)	N/A	N/A	**	7.62	7.56	7.56	7.15	7.08	7.63
Langelier Index (4°C)	N/A	N/A	**	0.0440	0.266	0.319	0.882	0.970	0.0470
Langelier Index (20°C)	N/A	N/A	**	0.293	0.514	0.568	1.13	1.22	0.295
Total Suspended Solids	mg/L	1	50 (4)	<1.9	1.6	<1	<1	1.0	1.4
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)	0.014	0.024	0.021	0.0093	0.0092	0.016
Antimony (Sb)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (As)	mg/L	0.001	0.005	<0.001	<0.001	<0.001	<0.001	0.0013	<0.001
Barium (Ba)	mg/L	0.001	**	0.068	0.08	0.078	0.13	0.16	0.066
Beryllium (Be)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bismuth (Bi)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Boron (B)	mg/L	0.05	1.5 (6)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium - ICP	mg/L	0.000017	see Note (7)	<0.00001	<0.00001	<0.00001	0.000011	<0.00001	0.000014
Chromium (Cr)	mg/L	0.001	see Note (8)	<0.001	<0.001	0.0011	<0.001	<0.001	<0.001
Trivalent Chromium	mg/L	0.001	0.0089	<0.001	<0.001	-	<0.001	<0.001	<0.001
Hexavalent Chromium	mg/L	0.001	0.001	<0.0005	<0.0005	-	<0.0005	<0.0005	0.00061
Cobalt (Co)	mg/L	0.0004	**	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Copper (Cu)	mg/L	0.002	see Note (9)	<0.002	0.00064	0.00065	0.00078	0.00089	<0.0005
Iron (Fe)	mg/L	0.05	0.3	<0.05	<0.05	<0.05	<0.05	0.057	<0.05
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Manganese (Mn)	mg/L	0.002	See Note (15)	0.072	0.061	0.062	0.12	0.14	0.034
Molybdenum (Mo)	mg/L	0.002	0.073	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L	0.002	see Note (11)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Selenium (Se)	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005
Silver (Ag)	mg/L	0.0001	0.00025 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Strontium (Sr)	mg/L	0.002	**	0.16	0.16	0.16	0.26	0.25	0.13
Thallium (Tl)	mg/L	0.0001	0.0008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Titanium (Ti)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Uranium (U)	mg/L	0.0001	0.015 (13)	0.00045	0.00051	0.00049	0.0011	0.001	0.00038
Vanadium (V)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	0.005	0.007 (14)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Mercury (Hg)	ug/L	0.013	0.026	-	-	-	-	0.013	-
Dissolved Organic Carbon	mg/L	0.5	**	-	-	-	-	-	-
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)	-	-	-	-	-	-
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)	-	-	-	-	-	-

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-2			
				06-Apr-20	16-Jun-20	13-Oct-20	15-Dec-20
Sodium (Na)	mg/L	0.1	**	39	110	220	120
Potassium (K)	mg/L	0.1	**	1.2	2.5	13	12
Calcium (Ca)	mg/L	0.1	**	39	80	67	40
Magnesium (Mg)	mg/L	0.1	**	2.4	6.0	4.5	3.0
Alkalinity (CaCO ₃)	mg/L	5	**	96	250	330	230
Hardness (CaCO ₃)	mg/L	1	**	110	220	180	110
Bicarbonate (as CaCO ₃)	mg/L	1	**	94	240	320	230
Carbonate (as CaCO ₃)	mg/L	1	**	1.4	4.9	6.1	3.7
TDS (calculated)	mg/L	1	**	240	550	860	480
Sulfate (SO ₄)	mg/L	10	**	32	61	180	83
Chloride (Cl)	mg/L	10	120 (1)	60	130	160	57
Fluoride (F)	mg/L	0.1	0.12	<0.1	<0.1	<0.1	<0.1
Silica (SiO ₂)	mg/L	0.5	**	3.8	13	13	14
Ortho-phosphorus (P)	mg/L	0.01	**	<0.01	0.020	0.022	0.11
Phosphorus	mg/L	0.1	**	<0.1	<0.1	<0.1	0.19
Nitrite	mg/L	0.01	0.06	<0.01	<0.01	<0.01	0.034
Nitrate	mg/L	0.05	2.935 (2)	0.14	0.088	0.057	0.11
Nitrate+Nitrite (N)	mg/L	0.05	**	0.14	0.088	0.057	0.15
Ammonia (N)	mg/L	0.05	see Note (3)	0.059	0.090	21	<0.05
Colour	T.C.U.	5	**	11	12	35	71
Turbidity	N.T.U.	0.1	**	1.6	1.5	1.3	23
Conductivity	umho/cm	1	**	440	980	1400	760
pH	unit	N/A	6.5 - 9.0	8.21	8.33	8.30	8.23
Total Organic Carbon (TOC)	mg/L	50	**	3.1	3.9	7.5	9.9
Carbonaceous BOD	mg/L	5	**	<10	<5	<5	<5
Total Chemical Oxygen Demand	mg/L	5	**	<20	<20	<20	33
Cation Sum	me/L	N/A	**	4.00	9.27	14.5	7.90
Anion Sum	me/L	N/A	**	4.26	9.89	14.8	8.07
Ion Balance	%	N/A	**	3.15	3.24	0.960	1.06
Saturation pH (4°C)	N/A	N/A	**	8.09	7.44	7.46	7.75
Saturation pH (20°C)	N/A	N/A	**	7.84	7.19	7.21	7.50
Langelier Index (4°C)	N/A	N/A	**	0.122	0.896	0.843	0.486
Langelier Index (20°C)	N/A	N/A	**	0.371	1.14	1.09	0.734
Total Suspended Solids	mg/L	1	50 (4)	1.8	1.6	1.4	8.8
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)	0.038	0.023	0.027	0.80
Antimony (Sb)	mg/L	0.001	**	<0.001	<0.001	<0.001	0.0013
Arsenic (As)	mg/L	0.001	0.005	<0.001	0.0019	0.0016	0.0046
Barium (Ba)	mg/L	0.001	**	0.050	0.11	0.14	0.072
Beryllium (Be)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001
Bismuth (Bi)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002
Boron (B)	mg/L	0.05	1.5 (6)	<0.05	<0.05	0.076	0.070
Cadmium - ICP	mg/L	0.000017	see Note (7)	<0.00001	0.000014	0.000012	0.000065
Chromium (Cr)	mg/L	0.001	see Note (8)	<0.001	<0.001	<0.001	0.0018
Trivalent Chromium	mg/L	0.001	0.0089	<0.001	<0.001	<0.001	<0.001
Hexavalent Chromium	mg/L	0.001	0.001	0.00068	0.00077	0.00087	0.00094
Cobalt (Co)	mg/L	0.0004	**	<0.0004	<0.0004	<0.0004	0.00043
Copper (Cu)	mg/L	0.002	see Note (9)	0.00054	0.0011	0.0013	0.0045
Iron (Fe)	mg/L	0.05	0.3	<0.05	0.074	0.084	0.73
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)	<0.0005	<0.0005	<0.0005	0.0014
Manganese (Mn)	mg/L	0.002	See Note (15)	0.022	0.18	0.27	0.096
Molybdenum (Mo)	mg/L	0.002	0.073	<0.002	<0.002	0.0022	0.0039
Nickel (Ni)	mg/L	0.002	see Note (11)	<0.002	<0.002	<0.002	<0.002
Selenium (Se)	mg/L	0.001	0.001	<0.0005	<0.0005	<0.0005	<0.0005
Silver (Ag)	mg/L	0.0001	0.00025 (12)	<0.0001	<0.0001	<0.0001	<0.0001
Strontium (Sr)	mg/L	0.002	**	0.088	0.21	0.14	0.085
Thallium (Tl)	mg/L	0.0001	0.0008	<0.0001	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002
Titanium (Ti)	mg/L	0.002	**	<0.002	<0.002	<0.002	0.0087
Uranium (U)	mg/L	0.0001	0.015 (13)	0.00028	0.00088	0.00091	0.00067
Vanadium (V)	mg/L	0.002	**	<0.002	<0.002	<0.002	0.010
Zinc (Zn)	mg/L	0.005	0.007 (14)	<0.005	<0.005	<0.005	0.0086
Mercury (Hg)	ug/L	0.013	0.026	-	-	<0.013	-
Dissolved Organic Carbon	mg/L	0.5	**	3.3	4.2	7.2	7.8
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)	0.018	0.15	0.26	0.035
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)	<0.005	0.0055	<0.005	<0.005

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-3					
				29-Oct-12	06-Apr-13	03-Jul-13	23-Oct-13	17-Dec-13	15-May-14
Sodium (Na)	mg/L	0.1	**	17	218	101	77	64	120
Potassium (K)	mg/L	0.1	**	1.0	5.9	2.8	2.5	1.9	2.5
Calcium (Ca)	mg/L	0.1	**	11	85	55	50	42	58
Magnesium (Mg)	mg/L	0.1	**	2.4	9.9	7.3	6.3	6.2	7.1
Alkalinity (CaCO ₃)	mg/L	5	**	37	250	170	190	150	150
Hardness (CaCO ₃)	mg/L	1	**	37	250	170	150	130	170
Bicarbonate (as CaCO ₃)	mg/L	1	**	37	250	170	190	150	150
Carbonate (as CaCO ₃)	mg/L	1	**	<1	3.0	1.7	1.3	<1	1.9
TDS (calculated)	mg/L	1	**	91	860	447	370	330	510
Sulfate (SO ₄)	mg/L	10	**	9.8	100	41	39	40	48
Chloride (Cl)	mg/L	10	120 (1)	22	280	130	77	83	170
Fluoride (F)	mg/L	0.1	0.12	<0.1	0.10	<0.1	<0.1	<0.1	<0.1
Silica (SiO ₂)	mg/L	0.5	**	4.8	6.5	6.1	7.2	5.7	6.0
Ortho-phosphorus (P)	mg/L	0.01	**	0.022	0.011	0.017	0.018	0.014	0.011
Phosphorus	mg/L	0.1	**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrite	mg/L	0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate	mg/L	0.05	2.935 (2)	0.16	<0.05	0.06	<0.05	0.13	0.082
Nitrate+Nitrite (N)	mg/L	0.05	**	0.16	<0.05	0.06	<0.05	0.13	0.082
Ammonia (N)	mg/L	0.05	see Note (3)	<0.05	<0.05	0.062	0.053	<0.05	<0.05
Colour	T.C.U.	5	**	45	8.9	12	17	14	11
Turbidity	N.T.U.	0.1	**	7	0.6	0.5	2.0	2.4	0.4
Conductivity	umho/cm	1	**	150	1600	790	650	590	940
pH	unit	N/A	6.5 - 9.0	7.72	8.11	8.02	7.86	7.82	8.12
Total Organic Carbon (TOC)	mg/L	50	**	5.5	2.5	3.4	4.1	3.1	2.5
Carbonaceous BOD	mg/L	5	**	<5	<5	<5	<5	<5	<2
Total Chemical Oxygen Demand	mg/L	5	**	22	22	12	29	26	11
Cation Sum	me/L	N/A	**	1.50	14.7	7.83	6.44	5.44	8.87
Anion Sum	me/L	N/A	**	1.58	15.1	7.97	6.82	6.20	8.98
Ion Balance	%	N/A	**	2.60	1.21	0.890	2.87	6.53	0.620
Saturation pH (4°C)	N/A	N/A	**	8.99	7.46	7.73	7.71	7.88	7.78
Saturation pH (20°C)	N/A	N/A	**	8.74	7.21	7.48	7.46	7.63	7.53
Langelier Index (4°C)	N/A	N/A	**	-1.27	0.655	0.292	0.148	-0.058	0.343
Langelier Index (20°C)	N/A	N/A	**	-1.02	0.901	0.540	0.397	0.191	0.591
Total Suspended Solids	mg/L	1	50 (4)	9.6	1.6	1.8	<1	3.2	1.4
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)	0.28	0.035	0.051	0.096	0.19	0.050
Antimony (Sb)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (As)	mg/L	0.001	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium (Ba)	mg/L	0.001	**	0.040	0.17	0.13	0.10	0.090	0.11
Beryllium (Be)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bismuth (Bi)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Boron (B)	mg/L	0.05	1.5 (6)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium - ICP	mg/L	0.000017	see Note (7)	0.000023	0.000215	0.000045	0.000033	0.000034	0.000021
Chromium (Cr)	mg/L	0.001	see Note (8)	0.0012	<0.001	0.0012	<0.001	<0.001	<0.001
Trivalent Chromium	mg/L	0.001	0.0089	<0.005	-	<0.001	<0.001	<0.001	<0.001
Hexavalent Chromium	mg/L	0.001	0.001	0.0017	-	0.00091	0.0010	0.00096	<0.0005
Cobalt (Co)	mg/L	0.0004	**	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Copper (Cu)	mg/L	0.002	see Note (9)	0.0061	0.0028	0.0042	0.0038	0.0027	0.0024
Iron (Fe)	mg/L	0.05	0.3	0.530	0.093	0.139	0.180	0.250	0.11
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)	0.00065	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Manganese (Mn)	mg/L	0.002	See Note (15)	0.10	0.20	0.30	0.31	0.11	0.078
Molybdenum (Mo)	mg/L	0.002	0.073	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L	0.002	see Note (11)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Selenium (Se)	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silver (Ag)	mg/L	0.0001	0.00025 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Strontium (Sr)	mg/L	0.002	**	0.040	0.22	0.15	0.13	0.12	0.15
Thallium (Tl)	mg/L	0.0001	0.0008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Titanium (Ti)	mg/L	0.002	**	0.0069	0.0024	<0.002	0.0031	0.0032	<0.002
Uranium (U)	mg/L	0.0001	0.015 (13)	<0.0001	0.0012	0.00064	0.00057	0.00055	0.00057
Vanadium (V)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	0.005	0.007 (14)	0.012	0.0055	<0.005	0.0064	<0.005	0.0055
Mercury (Hg)	ug/L	0.013	0.026	<0.013	-	-	<0.013	-	-
Dissolved Organic Carbon	mg/L	0.5	**	-	-	-	-	-	-
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)	-	-	-	-	-	-
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)	-	-	-	-	-	-

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-3				
				02-Jul-14	2-Jul-14 F/D	24-Sep-14	24-Sep-14 F/D	15-Dec-14
Sodium (Na)	mg/L	0.1	**	93	95	29	29	81
Potassium (K)	mg/L	0.1	**	2.4	2.5	1.3	1.3	3.4
Calcium (Ca)	mg/L	0.1	**	56	57	16	16	54
Magnesium (Mg)	mg/L	0.1	**	7.4	7.5	3.5	3.5	6.2
Alkalinity (CaCO3)	mg/L	5	**	180	170	55	55	173
Hardness (CaCO3)	mg/L	1	**	170	170	55	56	160
Bicarbonate (as CaCO3)	mg/L	1	**	170	170	54	55	173
Carbonate (as CaCO3)	mg/L	1	**	2.2	2.0	<1	<1	<10
TDS (calculated)	mg/L	1	**	440	450	140	140	338
Sulfate (SO4)	mg/L	10	**	29	38	14	15	32
Chloride (Cl)	mg/L	10	120 (1)	130	130	40	40	56
Fluoride (F)	mg/L	0.1	0.12	0.10	-	<0.1	<0.1	0.1
Silica (SiO2)	mg/L	0.5	**	6.1	6.1	2.4	2.4	7.0
Ortho-phosphorus (P)	mg/L	0.01	**	0.010	0.015	0.012	<0.01	0.02
Phosphorus	mg/L	0.1	**	<0.1	<0.1	0.12	<0.1	0.07
Nitrite	mg/L	0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.05
Nitrate	mg/L	0.05	2.935 (2)	<0.05	<0.05	0.11	0.12	0.05
Nitrate+Nitrite (N)	mg/L	0.05	**	<0.05	<0.05	0.11	0.12	0.05
Ammonia (N)	mg/L	0.05	see Note (3)	2.0	0.10	1.2	0.27	<0.03
Colour	T.C.U.	5	**	9.0	9.8	16	19	8
Turbidity	N.T.U.	0.1	**	1.4	0.86	5.5	5.2	8.3
Conductivity	umho/cm	1	**	800	800	260	260	680
pH	unit	N/A	6.5 - 9.0	8.12	8.09	8.22	7.85	8.10
Total Organic Carbon (TOC)	mg/L	50	**	3.1	3.2	4.6	4.7	6.9
Carbonaceous BOD	mg/L	5	**	<5	-	<5.6	-	<2
Total Chemical Oxygen Demand	mg/L	5	**	28	-	33	-	12
Cation Sum	me/L	N/A	**	7.70	7.67	2.49	2.42	6.87
Anion Sum	me/L	N/A	**	7.91	8.04	2.52	2.57	5.71
Ion Balance	%	N/A	**	1.35	2.36	0.600	3.01	9.20
Saturation pH (4°C)	N/A	N/A	**	7.71	7.72	8.68	8.66	7.99
Saturation pH (20°C)	N/A	N/A	**	7.46	7.47	8.43	8.41	7.67
Langelier Index (4°C)	N/A	N/A	**	0.410	0.368	-0.454	-0.809	0.11
Langelier Index (20°C)	N/A	N/A	**	0.658	0.616	-0.203	-0.559	0.43
Total Suspended Solids	mg/L	1	50 (4)	3	-	11	-	<5
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)	0.080	0.081	0.34	0.29	0.18
Antimony (Sb)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.002
Arsenic (As)	mg/L	0.001	0.005	<0.001	<0.001	<0.001	<0.001	<0.002
Barium (Ba)	mg/L	0.001	**	0.12	0.12	0.048	0.048	0.094
Beryllium (Be)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.002
Bismuth (Bi)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002
Boron (B)	mg/L	0.05	1.5 (6)	<0.05	<0.05	<0.05	<0.05	0.033
Cadmium - ICP	mg/L	0.000017	see Note (7)	0.000029	0.000032	0.00002	0.000022	0.000031
Chromium (Cr)	mg/L	0.001	see Note (8)	<0.001	<0.001	0.0013	0.0013	<0.001
Trivalent Chromium	mg/L	0.001	0.0089	<0.001	-	<0.001	-	<0.001
Hexavalent Chromium	mg/L	0.001	0.001	0.00051	-	0.00082	-	<0.001
Cobalt (Co)	mg/L	0.0004	**	<0.0004	<0.0004	<0.0004	<0.0004	<0.001
Copper (Cu)	mg/L	0.002	see Note (9)	0.0050	0.0051	0.0063	0.0062	0.002
Iron (Fe)	mg/L	0.05	0.3	0.16	0.14	0.42	0.37	0.26
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)	<0.0005	<0.0005	0.00059	0.00058	<0.0005
Manganese (Mn)	mg/L	0.002	See Note (15)	0.28	0.24	0.16	0.15	0.26
Molybdenum (Mo)	mg/L	0.002	0.073	<0.0002	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L	0.002	see Note (11)	<0.002	<0.002	<0.002	<0.002	<0.002
Selenium (Se)	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silver (Ag)	mg/L	0.0001	0.00025 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Strontium (Sr)	mg/L	0.002	**	0.15	0.15	0.064	0.065	0.14
Thallium (Tl)	mg/L	0.0001	0.0008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002
Titanium (Ti)	mg/L	0.002	**	0.0026	0.0028	0.0084	0.0063	0.005
Uranium (U)	mg/L	0.0001	0.015 (13)	0.00054	0.00055	0.00011	0.00012	0.0007
Vanadium (V)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	0.002
Zinc (Zn)	mg/L	0.005	0.007 (14)	0.0062	<0.005	0.0088	0.0081	0.006
Mercury (Hg)	ug/L	0.013	0.026	-	-	<0.013	-	-
Dissolved Organic Carbon	mg/L	0.5	**	-	-	-	-	-
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)	-	-	-	-	-
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)	-	-	-	-	-

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-3					
				06-May-15	14-Jul-15	21-Oct-15	09-Dec-15	12-Apr-16	02-Jun-16
Sodium (Na)	mg/L	0.1	**	244	27	37.8	163	95	37
Potassium (K)	mg/L	0.1	**	4.4	1.0	1.3	4.6	2.7	1.2
Calcium (Ca)	mg/L	0.1	**	91	9.8	28.5	105	45	23
Magnesium (Mg)	mg/L	0.1	**	8	2.2	4.4	13.6	4.9	3.3
Alkalinity (CaCO ₃)	mg/L	5	**	168	32	96	269	160	76
Hardness (CaCO ₃)	mg/L	1	**	259	34	89.3	318	130	72
Bicarbonate (as CaCO ₃)	mg/L	1	**	168	32	96	269	160	75
Carbonate (as CaCO ₃)	mg/L	1	**	<10	<10	<10	<10	1.7	<1
TDS (calculated)	mg/L	1	**	888	94	215	683	400	180
Sulfate (SO ₄)	mg/L	10	**	59	11	20	80	38	19
Chloride (Cl)	mg/L	10	120 (1)	379	22	63	154	110	43
Fluoride (F)	mg/L	0.1	0.12	0.1	<0.1	1.0	<0.12	<0.1	<0.1
Silica (SiO ₂)	mg/L	0.5	**	4.9	2.3	4.2	8.2	6.1	2.2
Ortho-phosphorus (P)	mg/L	0.01	**	<0.01	<0.01	<0.01	0.01	0.02	0.01
Phosphorus	mg/L	0.1	**	0.04	0.42	0.03	0.10	<0.1	<0.1
Nitrite	mg/L	0.01	0.06	<0.05	0.12	<0.05	<0.05	<0.01	<0.01
Nitrate	mg/L	0.05	2.935 (2)	0.23	0.15	<0.05	0.07	0.06	0.054
Nitrate+Nitrite (N)	mg/L	0.05	**	0.23	0.27	<0.05	0.07	0.06	0.054
Ammonia (N)	mg/L	0.05	see Note (3)	<0.03	<0.03	0.04	0.06	0.08	<0.05
Colour	T.C.U.	5	**	11	12	6	<5	11	15
Turbidity	N.T.U.	0.1	**	2	4.5	11.2	1.3	3.5	1.6
Conductivity	umho/cm	1	**	1540	169	457	1180	730	310
pH	unit	N/A	6.5 - 9.0	8.18	7.60	8.07	8.10	8.06	7.99
Total Organic Carbon (TOC)	mg/L	50	**	4	3.9	5	1.5	2.3	3.8
Carbonaceous BOD	mg/L	5	**	<2	<2	<2	<2	<5	3.3
Total Chemical Oxygen Demand	mg/L	5	**	3	10	8	16	23	24
Cation Sum	me/L	N/A	**	15.9	1.91	3.55	13.6	6.9	3.08
Anion Sum	me/L	N/A	**	15.3	1.51	4.11	11.4	7.1	3.14
Ion Balance	%	N/A	**	2.10	11.8	7.4	8.9	1.9	0.96
Saturation pH (4°C)	N/A	N/A	**	7.82	9.41	8.5	7.54	0.21	8.38
Saturation pH (20°C)	N/A	N/A	**	7.50	9.09	8.18	7.22	0.46	8.13
Langelier Index (4°C)	N/A	N/A	**	0.36	-1.81	-0.43	0.56	7.85	-0.389
Langelier Index (20°C)	N/A	N/A	**	0.68	-1.49	-0.11	0.88	7.60	-0.139
Total Suspended Solids	mg/L	1	50 (4)	<5	<5	22	8	1.6	4
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)	0.041	0.178	0.188	0.041	0.1	0.14
Antimony (Sb)	mg/L	0.001	**	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001
Arsenic (As)	mg/L	0.001	0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001
Barium (Ba)	mg/L	0.001	**	0.171	0.036	0.104	0.166	0.082	0.053
Beryllium (Be)	mg/L	0.001	**	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001
Bismuth (Bi)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Boron (B)	mg/L	0.05	1.5 (6)	0.039	0.016	0.022	0.046	<0.050	<0.05
Cadmium - ICP	mg/L	0.000017	see Note (7)	0.000038	0.000018	0.000155	0.000025	0.000018	0.000035
Chromium (Cr)	mg/L	0.001	see Note (8)	<0.001	<0.001	0.002	<0.001	<0.001	<0.001
Trivalent Chromium	mg/L	0.001	0.0089	<0.001	<0.001	0.002	<0.001	<0.001	<0.001
Hexavalent Chromium	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.005	<0.0005	<0.0005
Cobalt (Co)	mg/L	0.0004	**	<0.001	<0.001	<0.001	<0.001	<0.0004	<0.0004
Copper (Cu)	mg/L	0.002	see Note (9)	0.003	0.005	0.004	0.001	0.0022	0.0047
Iron (Fe)	mg/L	0.05	0.3	0.123	0.327	0.509	0.188	0.14	0.23
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)	<0.0005	<0.0005	0.0008	<0.0005	<0.0005	<0.0005
Manganese (Mn)	mg/L	0.002	See Note (15)	0.702	0.079	1.16	0.997	0.2	0.091
Molybdenum (Mo)	mg/L	0.002	0.073	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L	0.002	see Note (11)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Selenium (Se)	mg/L	0.001	0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001
Silver (Ag)	mg/L	0.0001	0.00025 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Strontium (Sr)	mg/L	0.002	**	0.206	0.039	0.078	0.21	0.11	0.066
Thallium (Tl)	mg/L	0.0001	0.0008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Titanium (Ti)	mg/L	0.002	**	0.003	0.005	<0.002	<0.002	0.0023	0.007
Uranium (U)	mg/L	0.0001	0.015 (13)	0.0008	<0.0001	0.0003	0.0009	0.0005	0.00022
Vanadium (V)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	0.005	0.007 (14)	0.058	0.007	0.009	0.005	<0.005	0.0077
Mercury (Hg)	ug/L	0.013	0.026	-	-	<0.026	-	-	-
Dissolved Organic Carbon	mg/L	0.5	**	-	-	-	-	-	-
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)	-	-	-	-	-	-
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)	-	-	-	-	-	-

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-3				
				07-Oct-16	19-Dec-16	12-Apr-17	21-Jun-17	21-Jun-17 F/D
Sodium (Na)	mg/L	0.1	**	S A M P L E L O C A T I O N D R Y	14	16	15	16
Potassium (K)	mg/L	0.1	**		0.76	0.76	0.71	0.74
Calcium (Ca)	mg/L	0.1	**		7.9	6.6	7.5	7.7
Magnesium (Mg)	mg/L	0.1	**		2.4	1.7	1.8	1.9
Alkalinity (CaCO3)	mg/L	5	**		24	17	25	25
Hardness (CaCO3)	mg/L	1	**		30	24	26	27
Bicarbonate (as CaCO3)	mg/L	1	**		23	17	25	25
Carbonate (as CaCO3)	mg/L	1	**		<1	<1	<1	<1
TDS (calculated)	mg/L	1	**		79	77	76	77
Sulfate (SO4)	mg/L	10	**		13	7.7	7.5	7.6
Chloride (Cl)	mg/L	10	120 (1)	S A M P L E L O C A T I O N D R Y	20	29	24	24
Fluoride (F)	mg/L	0.1	0.12		<0.1	<0.1	<0.1	<0.1
Silica (SiO2)	mg/L	0.5	**		3.9	2.5	2.7	3.2
Ortho-phosphorus (P)	mg/L	0.01	**		0.011	<0.01	<0.01	<0.01
Phosphorus	mg/L	0.1	**		<0.1	<0.1	<0.1	<0.1
Nitrite	mg/L	0.01	0.06		<0.01	<0.01	<0.01	<0.01
Nitrate	mg/L	0.05	2.935 (2)		0.27	0.20	0.096	0.097
Nitrate+Nitrite (N)	mg/L	0.05	**		0.27	0.20	0.096	0.097
Ammonia (N)	mg/L	0.05	see Note (3)		0.62	0.90	0.073	<0.05
Colour	T.C.U.	5	**		30	23	15	23
Turbidity	N.T.U.	0.1	**	S A M P L E L O C A T I O N D R Y	11	14	3.8	4.9
Conductivity	umho/cm	1	**		130	140	130	130
pH	unit	N/A	6.5 - 9.0		7.95	7.23	7.96	7.52
Total Organic Carbon (TOC)	mg/L	50	**		4.8	2.6	3.4	3.3
Carbonaceous BOD	mg/L	5	**		<5	<5	<5	<5
Total Chemical Oxygen Demand	mg/L	5	**		14	7.8	22	9.2
Cation Sum	me/L	N/A	**		1.3	1.29	1.23	1.24
Anion Sum	me/L	N/A	**		1.33	1.33	1.35	1.35
Ion Balance	%	N/A	**		1.14	1.53	4.65	4.25
Saturation pH (4°C)	N/A	N/A	**		9.31	9.54	9.3	9.29
Saturation pH (20°C)	N/A	N/A	**	S A M P L E L O C A T I O N D R Y	9.06	9.29	9.05	9.04
Langelier Index (4°C)	N/A	N/A	**		-1.37	-2.31	-1.34	-1.77
Langelier Index (20°C)	N/A	N/A	**		-1.12	-2.06	-1.09	-1.52
Total Suspended Solids	mg/L	1	50 (4)		7.4	17	3.6	4.2
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)		0.35	0.73	0.16	0.18
Antimony (Sb)	mg/L	0.001	**		<0.001	<0.001	<0.001	<0.001
Arsenic (As)	mg/L	0.001	0.005		<0.001	<0.001	<0.001	<0.001
Barium (Ba)	mg/L	0.001	**		0.035	0.034	0.033	0.035
Beryllium (Be)	mg/L	0.001	**		<0.001	<0.001	<0.001	<0.001
Bismuth (Bi)	mg/L	0.002	**		<0.002	<0.002	<0.002	<0.002
Boron (B)	mg/L	0.05	1.5 (6)	S A M P L E L O C A T I O N D R Y	<0.05	<0.05	<0.05	<0.05
Cadmium - ICP	mg/L	0.000017	see Note (7)		0.000011	0.000013	0.000011	0.000015
Chromium (Cr)	mg/L	0.001	see Note (8)		<0.001	<0.001	<0.001	<0.001
Trivalent Chromium	mg/L	0.001	0.0089		<0.001	<0.001	<0.001	<0.001
Hexavalent Chromium	mg/L	0.001	0.001		<0.0005	<0.0005	<0.0005	<0.0005
Cobalt (Co)	mg/L	0.0004	**		<0.0004	<0.0004	<0.0004	<0.0004
Copper (Cu)	mg/L	0.002	see Note (9)		0.0035	0.0041	0.0041	0.0041
Iron (Fe)	mg/L	0.05	0.3		0.46	0.77	0.26	0.28
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)		<0.0005	0.00068	<0.0005	<0.0005
Manganese (Mn)	mg/L	0.002	See Note (15)		0.063	0.069	0.064	0.073
Molybdenum (Mo)	mg/L	0.002	0.073	S A M P L E L O C A T I O N D R Y	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L	0.002	see Note (11)		<0.002	<0.002	<0.002	<0.002
Selenium (Se)	mg/L	0.001	0.001		<0.001	<0.001	<0.001	<0.001
Silver (Ag)	mg/L	0.0001	0.00025 (12)		<0.0001	<0.0001	<0.0001	<0.0001
Strontium (Sr)	mg/L	0.002	**		0.039	0.028	0.032	0.033
Thallium (Tl)	mg/L	0.0001	0.0008		<0.0001	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.002	**		<0.002	<0.002	<0.002	<0.002
Titanium (Ti)	mg/L	0.002	**		0.0064	0.0097	0.0026	0.0026
Uranium (U)	mg/L	0.0001	0.015 (13)		<0.0001	<0.0001	<0.00010	<0.00010
Vanadium (V)	mg/L	0.002	**		<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	0.005	0.007 (14)	S A M P L E L O C A T I O N D R Y	<0.005	0.0062	<0.005	<0.005
Mercury (Hg)	ug/L	0.013	0.026		<0.013	-	-	-
Dissolved Organic Carbon	mg/L	0.5	**		-	-	-	-
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)		-	-	-	-
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)		-	-	-	-

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-3					
				13-Sep-17	06-Dec-17	6-Dec-17 F/D	23-Apr-18	02-Aug-18	10-Oct-18
Sodium (Na)	mg/L	0.1	**	48	26	25	180	210	38
Potassium (K)	mg/L	0.1	**	1.9	1.9	1.7	6.2	7.4	2.1
Calcium (Ca)	mg/L	0.1	**	25	13	12	80	86	21
Magnesium (Mg)	mg/L	0.1	**	3.5	3.4	3.3	9.9	12	5.0
Alkalinity (CaCO3)	mg/L	5	**	90	34	34	210	320	81
Hardness (CaCO3)	mg/L	1	**	76	47	44	240	270	73
Bicarbonate (as CaCO3)	mg/L	1	**	89	34	34	210	320	81
Carbonate (as CaCO3)	mg/L	1	**	<1	<1	<1	2.7	4.4	<1
TDS (calculated)	mg/L	1	**	230	120	110	730	870	180
Sulfate (SO4)	mg/L	10	**	24	12	12	54	66	14
Chloride (Cl)	mg/L	10	120 (1)	66	34	34	260	260	45
Fluoride (F)	mg/L	0.1	0.12	<0.1	<0.1	<0.1	0.11	0.15	<0.1
Silica (SiO2)	mg/L	0.5	**	4.8	3.5	3.5	7	13	5.3
Ortho-phosphorus (P)	mg/L	0.01	**	<0.01	0.035	0.036	0.061	0.12	0.077
Phosphorus	mg/L	0.1	**	<0.1	0.23	0.15	0.13	0.18	0.16
Nitrite	mg/L	0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate	mg/L	0.05	2.935 (2)	0.27	<0.05	<0.05	<0.05	<0.05	<0.05
Nitrate+Nitrite (N)	mg/L	0.05	**	0.27	<0.05	<0.05	<0.05	<0.05	<0.05
Ammonia (N)	mg/L	0.05	see Note (3)	1.5	<0.05	0.22	0.13	0.27	0.17
Colour	T.C.U.	5	**	9.9	16	16	7.6	9.6	8.5
Turbidity	N.T.U.	0.1	**	2.2	7.2	7.2	1.2	1.1	1.2
Conductivity	umho/cm	1	**	400	210	210	1300	1500	320
pH	unit	N/A	6.5 - 9.0	7.79	8	7.84	8.13	8.17	7.88
Total Organic Carbon (TOC)	mg/L	50	**	3	3.9	3.9	3.5	4.5	3.9
Carbonaceous BOD	mg/L	5	**	<5	<5	<5	<5	<5	<5
Total Chemical Oxygen Demand	mg/L	5	**	7.7	23	25	24	23	24
Cation Sum	me/L	N/A	**	3.78	2.14	2.07	12.8	14.6	3.20
Anion Sum	me/L	N/A	**	4.17	1.88	1.89	12.8	15.8	3.19
Ion Balance	%	N/A	**	4.91	6.47	4.55	0.08	4.15	0.160
Saturation pH (4°C)	N/A	N/A	**	8.3	8.95	8.98	7.53	7.34	8.40
Saturation pH (20°C)	N/A	N/A	**	8.05	8.7	8.73	7.29	7.09	8.15
Langelier Index (4°C)	N/A	N/A	**	-0.515	-0.952	-1.14	0.600	0.825	-0.522
Langelier Index (20°C)	N/A	N/A	**	-0.266	-0.701	-0.885	0.847	1.07	-0.272
Total Suspended Solids	mg/L	1	50 (4)	2.4	16	19	1.8	3.8	2.4
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)	0.066	0.90	0.62	0.032	0.055	0.060
Antimony (Sb)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (As)	mg/L	0.001	0.005	<0.001	<0.001	<0.001	<0.001	0.0012	<0.001
Barium (Ba)	mg/L	0.001	**	0.068	0.10	0.081	0.16	0.23	0.078
Beryllium (Be)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bismuth (Bi)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Boron (B)	mg/L	0.05	1.5 (6)	<0.05	<0.05	<0.05	0.058	0.087	<0.05
Cadmium - ICP	mg/L	0.000017	see Note (7)	0.000014	0.00012	0.000097	0.000034	0.000021	0.000019
Chromium (Cr)	mg/L	0.001	see Note (8)	<0.001	0.0011	<0.001	<0.001	<0.001	<0.001
Trivalent Chromium	mg/L	0.001	0.0089	<0.001	0.001	<0.001	<0.001	<0.001	<0.001
Hexavalent Chromium	mg/L	0.001	0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt (Co)	mg/L	0.0004	**	<0.0004	0.00042	<0.0004	<0.0004	<0.0004	<0.0004
Copper (Cu)	mg/L	0.002	see Note (9)	0.0024	0.0043	0.0038	<0.002	<0.002	0.0027
Iron (Fe)	mg/L	0.05	0.3	0.42	0.80	0.59	0.27	0.12	0.17
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)	<0.0005	0.0007	0.00055	<0.0005	<0.0005	<0.0005
Manganese (Mn)	mg/L	0.002	See Note (15)	0.27	0.4	0.29	0.68	0.32	0.24
Molybdenum (Mo)	mg/L	0.002	0.073	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L	0.002	see Note (11)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Selenium (Se)	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silver (Ag)	mg/L	0.0001	0.00025 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Strontium (Sr)	mg/L	0.002	**	0.076	0.068	0.063	0.22	0.27	0.095
Thallium (Tl)	mg/L	0.0001	0.0008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Titanium (Ti)	mg/L	0.002	**	<0.002	0.045	0.025	<0.002	<0.002	<0.002
Uranium (U)	mg/L	0.0001	0.015 (13)	0.00017	<0.0001	<0.0001	0.00085	0.00094	0.00012
Vanadium (V)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	0.005	0.007 (14)	<0.005	0.013	0.01	<0.005	<0.005	<0.005
Mercury (Hg)	ug/L	0.013	0.026	<0.013	-	-	-	-	<0.013
Dissolved Organic Carbon	mg/L	0.5	**	-	-	-	-	-	-
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)	-	-	-	-	-	-
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)	-	-	-	-	-	-

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-3				
				12-Dec-18	02-May-19	11-Jul-19	11-Jul-19 F/D	24-Sep-19
Sodium (Na)	mg/L	0.1	**	160	190	200	210	190
Potassium (K)	mg/L	0.1	**	5.2	5.8	6.9	7.1	5.8
Calcium (Ca)	mg/L	0.1	**	81	100	100	110	88
Magnesium (Mg)	mg/L	0.1	**	11	12	13	13	12
Alkalinity (CaCO3)	mg/L	5	**	280	240	310	310	320
Hardness (CaCO3)	mg/L	1	**	250	300	310	320	270
Bicarbonate (as CaCO3)	mg/L	1	**	270	240	310	310	320
Carbonate (as CaCO3)	mg/L	1	**	2.2	2.5	3.5	4.3	2.3
TDS (calculated)	mg/L	1	**	700	830	870	880	820
Sulfate (SO4)	mg/L	10	**	74	65	60	62	80
Chloride (Cl)	mg/L	10	120 (1)	200	300	290	290	240
Fluoride (F)	mg/L	0.1	0.12	0.13	<0.1	0.11	0.11	0.12
Silica (SiO2)	mg/L	0.5	**	9.6	7.3	11	9.6	12
Ortho-phosphorus (P)	mg/L	0.01	**	0.017	0.014	<0.01	0.012	0.015
Phosphorus	mg/L	0.1	**	<0.1	<0.1	<0.10	<0.10	0.11
Nitrite	mg/L	0.01	0.06	0.012	<0.01	<0.01	<0.01	<0.01
Nitrate	mg/L	0.05	2.935 (2)	0.086	<0.05	<0.05	<0.05	<0.05
Nitrate+Nitrite (N)	mg/L	0.05	**	0.098	<0.05	<0.05	<0.05	<0.05
Ammonia (N)	mg/L	0.05	see Note (3)	<0.05 (<0.05)	0.14	0.062	0.098	0.31
Colour	T.C.U.	5	**	5.5	<5	7.9	9.4	7.6
Turbidity	N.T.U.	0.1	**	0.93	2	3.4	3.1	1.6
Conductivity	umho/cm	1	**	1300	1400	1500	1500	1500
pH	unit	N/A	6.5 - 9.0	7.94	8.04	8.08	8.17	7.88
Total Organic Carbon (TOC)	mg/L	50	**	2.9	3.5	3.6	3.7	4.2
Carbonaceous BOD	mg/L	5	**	<5	<10	<5	<5	<5
Total Chemical Oxygen Demand	mg/L	5	**	23	37	23	23	24
Cation Sum	me/L	N/A	**	12.1	14.5	15.2	15.7	13.8
Anion Sum	me/L	N/A	**	12.6	14.6	15.5	15.7	14.8
Ion Balance	%	N/A	**	2.11	0.170	0.980	0	3.60
Saturation pH (4°C)	N/A	N/A	**	7.41	7.40	7.28	7.27	7.32
Saturation pH (20°C)	N/A	N/A	**	7.16	7.15	7.04	7.02	7.07
Langelier Index (4°C)	N/A	N/A	**	0.530	0.645	0.795	0.903	0.561
Langelier Index (20°C)	N/A	N/A	**	0.777	0.892	1.04	1.15	0.807
Total Suspended Solids	mg/L	1	50 (4)	<1	4.0	3.4	2.0	1.2
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)	0.0092	0.025	0.012	0.012	0.0079
Antimony (Sb)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (As)	mg/L	0.001	0.005	<0.001	<0.001	<0.001	<0.001	<0.001
Barium (Ba)	mg/L	0.001	**	0.18	0.28	0.39	0.40	0.29
Beryllium (Be)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.001
Bismuth (Bi)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002
Boron (B)	mg/L	0.05	1.5 (6)	0.059	<0.05	0.063	0.065	0.065
Cadmium - ICP	mg/L	0.000017	see Note (7)	0.000026	0.000034	0.000018	0.000021	<0.00001
Chromium (Cr)	mg/L	0.001	see Note (8)	<0.001	<0.001	0.001	0.0011	<0.001
Trivalent Chromium	mg/L	0.001	0.0089	<0.001	<0.001	0.001	0.001	<0.001
Hexavalent Chromium	mg/L	0.001	0.001	<0.0005 (<0.0005)	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt (Co)	mg/L	0.0004	**	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Copper (Cu)	mg/L	0.002	see Note (9)	<0.002	0.0012	0.00081	0.00077	0.00073
Iron (Fe)	mg/L	0.05	0.3	0.34	0.63	0.69	0.70	0.36
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Manganese (Mn)	mg/L	0.002	See Note (15)	0.98	0.95	1.5	1.6	0.30
Molybdenum (Mo)	mg/L	0.002	0.073	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/L	0.002	see Note (11)	<0.002	<0.002	<0.002	<0.002	<0.002
Selenium (Se)	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
Silver (Ag)	mg/L	0.0001	0.00025 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Strontium (Sr)	mg/L	0.002	**	0.22	0.27	0.30	0.31	0.25
Thallium (Tl)	mg/L	0.0001	0.0008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002
Titanium (Ti)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002
Uranium (U)	mg/L	0.0001	0.015 (13)	0.00074	0.0011	0.00089	0.00097	0.0007
Vanadium (V)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	0.005	0.007 (14)	<0.005	<0.005	<0.005	<0.005	<0.005
Mercury (Hg)	ug/L	0.013	0.026	-	-	-	-	<0.013
Dissolved Organic Carbon	mg/L	0.5	**	-	-	-	-	-
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)	-	-	-	-	-
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)	-	-	-	-	-

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-3				
				18-Dec-19	06-Apr-20	16-Jun-20	13-Oct-20	15-Dec-20
Sodium (Na)	mg/L	0.1	**	110	200	210	180	140
Potassium (K)	mg/L	0.1	**	4.1	4.2	6.8	5.7	4.7
Calcium (Ca)	mg/L	0.1	**	78	99	98	88	71
Magnesium (Mg)	mg/L	0.1	**	9.0	11	12	12	8.7
Alkalinity (CaCO3)	mg/L	5	**	240	190	260	290	240
Hardness (CaCO3)	mg/L	1	**	230	290	310	270	220
Bicarbonate (as CaCO3)	mg/L	1	**	240	190	260	290	240
Carbonate (as CaCO3)	mg/L	1	**	1.7	2.3	2.4	2.1	2.1
TDS (calculated)	mg/L	1	**	560	800	920	800	610
Sulfate (SO4)	mg/L	10	**	64	74	85	84	68
Chloride (Cl)	mg/L	10	120 (1)	140	290	330	240	170
Fluoride (F)	mg/L	0.1	0.12	0.11	<0.1	<0.1	<0.1	<0.1
Silica (SiO2)	mg/L	0.5	**	8.5	3.7	11	10	8.1
Ortho-phosphorus (P)	mg/L	0.01	**	0.015	<0.01	0.027	<0.01	0.024
Phosphorus	mg/L	0.1	**	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrite	mg/L	0.01	0.06	<0.01	<0.01	<0.01	<0.01	0.014
Nitrate	mg/L	0.05	2.935 (2)	<0.05	<0.05	<0.05	<0.05	0.094
Nitrate+Nitrite (N)	mg/L	0.05	**	<0.05	<0.05	<0.05	<0.05	0.11
Ammonia (N)	mg/L	0.05	see Note (3)	0.68	0.12	0.11	0.19	<0.05
Colour	T.C.U.	5	**	<5	5.7	20	8.5	12
Turbidity	N.T.U.	0.1	**	2.1	0.41	1.7	2.8	0.72
Conductivity	umho/cm	1	**	960	1700	1700	1500	1100
pH	unit	N/A	6.5 - 9.0	7.89	8.12	8.00	7.88	7.98
Total Organic Carbon (TOC)	mg/L	50	**	2.6	2.4	5.8	3.6	3.2
Carbonaceous BOD	mg/L	5	**	<10	<10	<5	<5	<5
Total Chemical Oxygen Demand	mg/L	5	**	<20	22	29	<20	<20
Cation Sum	me/L	N/A	**	9.71	14.9	15.7	13.6	10.4
Anion Sum	me/L	N/A	**	10.0	13.4	16.2	14.3	11.0
Ion Balance	%	N/A	**	1.62	5.51	1.69	2.47	3.04
Saturation pH (4°C)	N/A	N/A	**	7.46	7.50	7.38	7.37	7.51
Saturation pH (20°C)	N/A	N/A	**	7.22	7.25	7.13	7.12	7.26
Langelier Index (4°C)	N/A	N/A	**	0.426	0.618	0.619	0.513	0.473
Langelier Index (20°C)	N/A	N/A	**	0.674	0.865	0.865	0.759	0.721
Total Suspended Solids	mg/L	1	50 (4)	2.2	<1	1.8	2.8	1.2
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)	0.0080	0.0089	0.014	0.0058	0.014
Antimony (Sb)	mg/L	0.001	**	<0.001	<0.001	0.0015	<0.001	<0.001
Arsenic (As)	mg/L	0.001	0.005	<0.001	<0.001	<0.001	<0.001	<0.001
Barium (Ba)	mg/L	0.001	**	0.16	0.19	0.26	0.23	0.14
Beryllium (Be)	mg/L	0.001	**	<0.001	<0.001	<0.001	<0.001	<0.001
Bismuth (Bi)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002
Boron (B)	mg/L	0.05	1.5 (6)	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium - ICP	mg/L	0.000017	see Note (7)	<0.00001	0.000015	0.000013	<0.00001	0.000011
Chromium (Cr)	mg/L	0.001	see Note (8)	<0.001	<0.001	<0.001	<0.001	<0.001
Trivalent Chromium	mg/L	0.001	0.0089	<0.001	<0.001	<0.001	<0.001	<0.001
Hexavalent Chromium	mg/L	0.001	0.001	<0.0005	0.00054	0.00094	<0.0005	<0.0005
Cobalt (Co)	mg/L	0.0004	**	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Copper (Cu)	mg/L	0.002	see Note (9)	0.00075	0.0015	0.0020	0.00078	0.0011
Iron (Fe)	mg/L	0.05	0.3	0.12	0.092	0.11	0.30	0.16
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Manganese (Mn)	mg/L	0.002	See Note (15)	0.19	0.14	0.33	0.87	0.30
Molybdenum (Mo)	mg/L	0.002	0.073	<0.002	<0.002	0.0027	<0.002	<0.002
Nickel (Ni)	mg/L	0.002	see Note (11)	<0.002	<0.002	<0.002	<0.002	<0.002
Selenium (Se)	mg/L	0.001	0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Silver (Ag)	mg/L	0.0001	0.00025 (12)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Strontium (Sr)	mg/L	0.002	**	0.19	0.24	0.28	0.25	0.19
Thallium (Tl)	mg/L	0.0001	0.0008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002
Titanium (Ti)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002
Uranium (U)	mg/L	0.0001	0.015 (13)	0.00077	0.00088	0.0011	0.00070	0.00079
Vanadium (V)	mg/L	0.002	**	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/L	0.005	0.007 (14)	<0.005	<0.005	<0.005	<0.005	<0.005
Mercury (Hg)	ug/L	0.013	0.026	-	-	-	<0.013	-
Dissolved Organic Carbon	mg/L	0.5	**	-	2.9	8.7	5.2	3.1
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)	-	0.082	0.39	0.49	0.22
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)	-	<0.005	<0.005	<0.005	<0.005

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Mill Site
Surface Water Analytical Results - General Inorganic Chemistry & Metals

PARAMETER	UNIT	RDL	RECOMMENDED LIMIT FWAL	SW12-3 15-Dec-20 F/D
Sodium (Na)	mg/L	0.1	**	140
Potassium (K)	mg/L	0.1	**	4.8
Calcium (Ca)	mg/L	0.1	**	72
Magnesium (Mg)	mg/L	0.1	**	8.9
Alkalinity (CaCO ₃)	mg/L	5	**	250
Hardness (CaCO ₃)	mg/L	1	**	220
Bicarbonate (as CaCO ₃)	mg/L	1	**	240
Carbonate (as CaCO ₃)	mg/L	1	**	2.2
TDS (calculated)	mg/L	1	**	620
Sulfate (SO ₄)	mg/L	10	**	68
Chloride (Cl)	mg/L	10	120 (1)	170
Fluoride (F)	mg/L	0.1	0.12	<0.1
Silica (SiO ₂)	mg/L	0.5	**	8.7
Ortho-phosphorus (P)	mg/L	0.01	**	0.024
Phosphorus	mg/L	0.1	**	<0.1
Nitrite	mg/L	0.01	0.06	<0.01
Nitrate	mg/L	0.05	2.935 (2)	0.12
Nitrate+Nitrite (N)	mg/L	0.05	**	0.12
Ammonia (N)	mg/L	0.05	see Note (3)	<0.05
Colour	T.C.U.	5	**	9.0
Turbidity	N.T.U.	0.1	**	0.83
Conductivity	umho/cm	1	**	1100
pH	unit	N/A	6.5 - 9.0	7.97
Total Organic Carbon (TOC)	mg/L	50	**	3.2
Carbonaceous BOD	mg/L	5	**	<5
Total Chemical Oxygen Demand	mg/L	5	**	<20
Cation Sum	me/L	N/A	**	10.3
Anion Sum	me/L	N/A	**	11.1
Ion Balance	%	N/A	**	3.82
Saturation pH (4°C)	N/A	N/A	**	7.50
Saturation pH (20°C)	N/A	N/A	**	7.25
Langelier Index (4°C)	N/A	N/A	**	0.478
Langelier Index (20°C)	N/A	N/A	**	0.726
Total Suspended Solids	mg/L	1	50 (4)	1.6
Aluminum (Al)	mg/L	0.005	0.005-0.1 (5)	0.014
Antimony (Sb)	mg/L	0.001	**	<0.001
Arsenic (As)	mg/L	0.001	0.005	<0.001
Barium (Ba)	mg/L	0.001	**	0.14
Beryllium (Be)	mg/L	0.001	**	<0.001
Bismuth (Bi)	mg/L	0.002	**	<0.002
Boron (B)	mg/L	0.05	1.5 (6)	<0.05
Cadmium - ICP	mg/L	0.000017	see Note (7)	0.000013
Chromium (Cr)	mg/L	0.001	see Note (8)	<0.001
Trivalent Chromium	mg/L	0.001	0.0089	<0.001
Hexavalent Chromium	mg/L	0.001	0.001	<0.0005
Cobalt (Co)	mg/L	0.0004	**	<0.0004
Copper (Cu)	mg/L	0.002	see Note (9)	0.0010
Iron (Fe)	mg/L	0.05	0.3	0.16
Lead (Pb)	mg/L	0.0005	0.001-0.007 (10)	<0.0005
Manganese (Mn)	mg/L	0.002	See Note (15)	0.31
Molybdenum (Mo)	mg/L	0.002	0.073	<0.002
Nickel (Ni)	mg/L	0.002	see Note (11)	<0.002
Selenium (Se)	mg/L	0.001	0.001	<0.0005
Silver (Ag)	mg/L	0.0001	0.00025 (12)	<0.0001
Strontium (Sr)	mg/L	0.002	**	0.19
Thallium (Tl)	mg/L	0.0001	0.0008	<0.0001
Tin (Sn)	mg/L	0.002	**	<0.002
Titanium (Ti)	mg/L	0.002	**	<0.002
Uranium (U)	mg/L	0.0001	0.015 (13)	0.00079
Vanadium (V)	mg/L	0.002	**	<0.002
Zinc (Zn)	mg/L	0.005	0.007 (14)	<0.005
Mercury (Hg)	ug/L	0.013	0.026	-
Dissolved Organic Carbon	mg/L	0.5	**	3.7
Dissolved Manganese (Mn)	mg/L	0.002	see Note (15)	0.20
Dissolved Zinc (Zn)	mg/L	0.005	see Note (14)	<0.005

FWAL - Freshwater Aquatic Life Guidelines

Shade indicates concentration above the recommended guideline

(1) to (15) - see Legend Notes; Surface Water Chemistry

** There is no recommended limit according to the guidelines.

Surface Water - General Inorganic and Metals Chemistry

Legend Notes

- 1) The guideline for **chloride** is based on long-term exposure.
- 2) The guideline for **nitrate** of 13 mg-nitrate/L is equivalent to 2.935 mg nitrate-nitrogen/L (CCME Summary Table - updates). The lab reports mg nitrate-nitrogen/L.
- 3) The guideline for **ammonia** is dependent on pH and temperature (see factsheet Table 2, FWAL 2001).
- 4) The guideline for **TSS** is from NSE standards for a grab sample.
- 5) The **aluminum** guideline varies from 0.005 mg/L for pH <6.5 units to 0.1 mg/L for pH >6.5 units.
- 6) The guideline for **boron** is based on long-term exposure.
- 10) The guideline for **cadmium** was updated by CCME in January 2014 and is dependent on hardness. Based on a long term exposure scenario, the guideline is 0.04 ug/L for hardness of 0 to <17 mg/L and 0.37 ug/L for hardness >280 mg/L. For hardness between 17 and 280 mg/L, Cd guideline (ug/L) = $10^{\{0.83 [\log (\text{hardness in mg/L})] - 2.46\}}$; see also Table 1, CCME factsheet. Prior to 2014, the guideline for cadmium was calculated as:
Cd guideline (ug/L) = $10^{\{0.86 [\log (\text{hardness in mg/L})] - 3.2\}}$.
- 8) Evaluation of **chromium** concentrations in surface water are typically based on total **chromium** concentrations, while the CCME Canadian Environmental Guidelines for the Protection of Aquatic Life (Freshwater) evaluate Trivalent Chromium (0.0089 mg/L) and Hexavalent Chromium (0.0010 mg/L). Total chromium in surface water samples is, therefore, compared to the more stringent 0.0010 mg/L guideline, unless chromium speciation is requested (i.e., trivalent and hexavalent concentrations are reported).
- 9) The guideline for **copper** is dependent on hardness: Cu guideline (ug/L) = $e^{0.8545[\ln(\text{hardness in mg/L CaCO}_3)] - 1.465} \times 0.2$, with the minimum guideline being 2 ug/L or 0.002 mg/L.
- 10) The guideline for **lead** is calculated as: Pb guideline (ug/L) = $e^{1.273[\ln(\text{hardness in mg/L CaCO}_3)] - 4.705}$. The guideline varies from 1 ug/L (or 0.001 mg/L) for hardness 0 to 60 mg/L CaCO₃ to 7 ug/L (or 0.007 mg/L) for hardness >180 mg/L CaCO₃.
- 11) The guideline for **nickel** is dependent on hardness: Ni guideline (ug/L) = $e^{0.76[\ln(\text{hardness})] + 1.06}$, with the minimum guideline being 25 ug/L or 0.025 mg/L.
- 12) The CCME guideline for **silver** in freshwater was updated in 2015 to 0.00025 mg/L and is based on long term exposure. Prior to this, the guideline, which came into effect in January 2011, was 0.0001 mg/L.
- 13) The guideline for **uranium** is based on long-term exposure.
- 14) The guideline shown is for **dissolved zinc**. The zinc guideline was updated in September 2018, is based on long term exposure, and a 7 ug/L (or 0.007 mg/L) guideline is for surface water of 50 mg/L hardness, pH of 7.5 and 0.5 mg/L DOC. The dissolved zinc guideline is calculated using the following equation:
Zn guideline (ug/L) = $\exp(0.947[\ln(\text{hardness mg} \cdot \text{L}^{-1})] - 0.815[\text{pH}] + 0.398[\ln(\text{DOC mg} \cdot \text{L}^{-1})] + 4.625)$. Please see Guideline Technical Document for conversion information. Prior to September 2018, the FWAL guideline for zinc (i.e., total) was 0.03 mg/L.
- 15) The guideline is for **dissolved manganese** and came into effect in November or December 2019. The long-term guideline is found using the look-up table (see Table 5 of CCME factsheet) or the CWQG and benchmark calculator in Appendix B of CCME (2019, found online). The CWQG table is valid between hardness 25 and 670 mg/L and pH 5.8 and 8.4.

Mill Site
Surface Water Analytical Results - Total Petroleum Hydrocarbons

Sample Location	Sample Date	BTEX Concentration (mg/L)				Petroleum Hydrocarbons (mg/L)						Reached Baseline at C32	Resemblance
		Benzene	Toluene	E. Benzene	Xylenes	C6 - C10	>C10 - C16	>C16 - C21	>C21 - C32	Total			
SW12-1	29-Oct-12	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA	
	6-Apr-13	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA	
	3-Jul-13	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA	
	23-Oct-13	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA	
	17-Dec-13	Frozen											
	15-May-14	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA	
	2-Jul-14	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA	
	24-Sep-14	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA	
	15-Dec-14	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	Yes	NA	
	6-May-15	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	Yes	NA	
	14-Jul-15	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	Yes	NA	
	21-Oct-15	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	Yes	NA	
	9-Dec-15	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	Yes	NR	
	12-Apr-16	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA	
	2-Jun-16	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA	
	7-Oct-16	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA	
	19-Dec-16	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA	
	12-Apr-17	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA	
	21-Jun-17	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA	
	13-Sep-17	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA	
	6-Dec-17	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA	
	23-Apr-18	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA	
	2-Aug-18	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA	
	10-Oct-18	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA	
	12-Dec-18	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA	
	2-May-19	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA	
	11-Jul-19	<0.001	<0.001	<0.001	<0.002	<0.1	<0.05	<0.05	<0.1	<0.1	NA	NA	
	24-Sep-19	<0.001	<0.001	<0.001	<0.002	<0.1	<0.05	<0.05	<0.1	<0.1	NA	NA	
	18-Dec-19	<0.001	<0.001	<0.001	<0.002	<0.1	<0.05	<0.05	<0.1	<0.1	NA	NA	
	6-Apr-20	<0.001	<0.001	<0.001	<0.002	<0.09	<0.05	<0.05	<0.09	<0.09	NA	NA	
	16-Jun-20	<0.001	<0.001	<0.001	<0.002	<0.09	<0.05	<0.05	<0.09	<0.09	NA	NA	
	13-Oct-20	<0.001	<0.001	<0.001	<0.002	<0.09	<0.05	<0.05	<0.09	<0.09	NA	NA	
	15-Dec-20	<0.001	<0.001	<0.001	<0.002	<0.09	<0.05	<0.05	<0.09	<0.09	NA	NA	

Mill Site
Surface Water Analytical Results - Total Petroleum Hydrocarbons

Sample Location	Sample Date	BTEX Concentration (mg/L)				Petroleum Hydrocarbons (mg/L)					Reached Baseline at C32	Resemblance
		Benzene	Toluene	E. Benzene	Xylenes	C6 - C10	>C10 - C16	>C16 - C21	>C21 - C32	Total		
SW12-2	29-Oct-12	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	6-Apr-13	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	3-Jul-13	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	23-Oct-13	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	17-Dec-13	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	15-May-14	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	2-Jul-14	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	24-Sep-14	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	15-Dec-14	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	Yes	NA
	6-May-15	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	Yes	NA
	14-Jul-15	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	Yes	NA
	21-Oct-15	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	Yes	NA
	9-Dec-15	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	Yes	NR
	13-Apr-16	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	2-Jun-16	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	7-Oct-16	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	19-Dec-16	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	12-Apr-17	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	21-Jun-17	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	13-Sep-17	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	6-Dec-17	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	23-Apr-18	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	2-Aug-18	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	2-Aug-18 F/D	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	10-Oct-18	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	12-Dec-18	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	2-May-19	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	2-May-19 F/D	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	11-Jul-19	<0.001	<0.001	<0.001	<0.002	<0.1	<0.05	<0.05	<0.1	<0.1	NA	NA
	24-Sep-19	<0.001	<0.001	<0.001	<0.002	<0.1	<0.05	<0.05	<0.1	<0.1	NA	NA
	18-Dec-19	<0.001	<0.001	<0.001	<0.002	<0.1	<0.05	<0.05	<0.1	<0.1	NA	NA
	6-Apr-20	<0.001	<0.001	<0.001	<0.002	<0.09	<0.05	<0.05	<0.09	<0.09	NA	NA
	16-Jun-20	<0.001	<0.001	<0.001	<0.002	<0.09	<0.05	<0.05	<0.09	<0.09	NA	NA
	13-Oct-20	<0.001	<0.001	<0.001	<0.002	<0.09	<0.05	<0.05	<0.09	<0.09	NA	NA
	15-Dec-20	<0.001	<0.001	<0.001	<0.002	<0.09	<0.05	<0.05	<0.09	<0.09	NA	NA

Mill Site
Surface Water Analytical Results - Total Petroleum Hydrocarbons

Sample Location	Sample Date	BTEX Concentration (mg/L)				Petroleum Hydrocarbons (mg/L)					Reached Baseline at C32	Resemblance
		Benzene	Toluene	E. Benzene	Xylenes	C6 - C10	>C10 - C16	>C16 - C21	>C21 - C32	Total		
SW12-3	29-Oct-12	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	6-Apr-13	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	0.071	0.10	0.17	Yes	F, L
	3-Jul-13	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	23-Oct-13	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	17-Dec-13	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	15-May-14	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	2-Jul-14	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	24-Sep-14	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	0.11	0.11	Yes	L
	15-Dec-14	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	Yes	NA
	6-May-15	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	Yes	NA
	14-Jul-15	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	Yes	NA
	21-Oct-15	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	Yes	NA
	9-Dec-15	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	Yes	NR
	12-Apr-16	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	2-Jun-16	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	7-Oct-16	Sample Location Dry										
	19-Dec-16	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	12-Apr-17	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	21-Jun-17	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	21-Jun-27 FD	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	13-Sep-17	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	6-Dec-17	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	6-Dec-17 FD	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	23-Apr-18	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	2-Aug-18	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	10-Oct-18	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	12-Dec-18	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	2-May-19	<0.001	<0.001	<0.001	<0.002	<0.01	<0.05	<0.05	<0.1	<0.1	NA	NA
	11-Jul-19	<0.001	<0.001	<0.001	<0.002	<0.1	<0.05	<0.05	<0.1	<0.1	NA	NA
	11-Jul-19 FD	<0.001	<0.001	<0.001	<0.002	<0.1	<0.05	<0.05	<0.1	<0.1	NA	NA
	24-Sep-19	<0.001	<0.001	<0.001	<0.002	<0.1	<0.05	<0.05	<0.1	<0.1	NA	NA
	18-Dec-19	<0.001	<0.001	<0.001	<0.002	<0.1	<0.05	<0.05	<0.1	<0.1	NA	NA
	6-Apr-20	<0.001	<0.001	<0.001	<0.002	<0.09	<0.05	<0.05	<0.09	<0.09	NA	NA
	16-Jun-20	<0.001	<0.001	<0.001	<0.002	<0.09	<0.05	<0.05	<0.09	<0.09	NA	NA
	13-Oct-20	<0.001	<0.001	<0.001	<0.002	<0.09	<0.05	<0.05	<0.09	<0.09	NA	NA
	15-Dec-20	<0.001	<0.001	<0.001	<0.002	<0.09	<0.05	<0.05	<0.09	<0.09	NA	NA
	15-Dec-20 FD	<0.001	<0.001	<0.001	<0.002	<0.09	<0.05	<0.05	<0.09	<0.09	NA	NA

Mill Site
Surface Water Analytical Results - Total Petroleum Hydrocarbons

Sample Location	Sample Date	BTEX Concentration (mg/L)				Petroleum Hydrocarbons (mg/L)					Reached Baseline at C32	Resemblance
		Benzene	Toluene	E. Benzene	Xylenes	C6 - C10	>C10 - C16	>C16 - C21	>C21 - C32	Total		
FWAL Guidelines		0.37	0.002	0.09	**	**	**	**	**	**		
Estimated Quantitation Limit		0.001	0.001	0.001	0.002	0.01	0.05	0.05	0.1	0.1	-	-

FWAL Freshwater Aquatic Life Guidelines

SHADE indicates concentration above the recommended guideline

** no applicable guideline

FD denotes field duplicate sample

NA denotes not applicable

G - gas; F - fuel oil; L - lube oil

NR denotes no resemblance

Mill Site
Surface Water Analytical Results - Volatile Organic Compounds (VOCs)

Parameter	RDL	Units	FWAL	SW12-1	SW12-2	SW12-3
				29-Oct-12	29-Oct-12	29-Oct-12
Chloromethane	8	µg/L	**	ND	ND	ND
Vinyl Chloride	0.5	µg/L	**	ND	ND	ND
Bromomethane	3	µg/L	**	ND	ND	ND
Chloroethane	8	µg/L	**	ND	ND	ND
Trichlorofluoromethane	8	µg/L	**	ND	ND	ND
1,1-Dichloroethylene	0.5	µg/L	**	ND	ND	ND
Methylene chloride	3	µg/L	98.1	ND	ND	ND
trans-1,2- Dichloroethylene	2	µg/L	**	ND	ND	ND
1,1-Dichloroethane	2	µg/L	**	ND	ND	ND
cis-1,2 Dichloroethylene	2	µg/L	**	ND	ND	ND
Chloroform	1	µg/L	1.8	ND	ND	ND
1,1,1-Trichloroethane	1	µg/L	**	ND	ND	ND
1,2-Dichloroethane	1	µg/L	100	ND	ND	ND
Carbon tetrachloride	1	µg/L	13.3	ND	ND	ND
Benzene	1	µg/L	370	ND	ND	ND
1,2-Dichloropropane	1	µg/L	**	ND	ND	ND
Trichloroethylene	1	µg/L	21	ND	ND	ND
Bromodichloromethane	1	µg/L	**	ND	ND	ND
cis-1,3-Dichloropropylene	2	µg/L	**	ND	ND	ND
trans-1,3-Dichloropropylene	1	µg/L	**	ND	ND	ND
Toluene	1	µg/L	2	ND	ND	ND
1,1,2-Trichloroethane	1	µg/L	**	ND	ND	ND
Dibromochloromethane	1	µg/L	**	ND	ND	ND
Ethylene Dibromide	1	µg/L	**	ND	ND	ND
Tetrachloroethylene	1	µg/L	110	ND	ND	ND
Chlorobenzene	1	µg/L	1.3	ND	ND	ND
Ethyl Benzene	1	µg/L	90	ND	ND	ND
m&p-Xylene	2	µg/L	**	ND	ND	ND
Bromoform	1	µg/L	**	ND	ND	ND
Styrene	1	µg/L	72	ND	ND	ND
o-Xylene	1	µg/L	**	ND	ND	ND
1,1,2,2-Tetrachloroethane	1	µg/L	**	ND	ND	ND
1,2-Dichlorobenzene	0.5	µg/L	0.7	ND	ND	ND
1,3-Dichlorobenzene	1	µg/L	150	ND	ND	ND
1,4-Dichlorobenzene	1	µg/L	26	ND	ND	ND

FWAL - Freshwater Aquatic Life Guidelines

SHADE indicates concentration above the recommended guideline

RDL - Reportable Detection Limit

** No recommended guideline

The maximum concentration for trihalomethanes (chloroform, bromodichloromethane, dibromochloromethane and bromoform) is 100 ug/L.

Mill Site
Surface Water Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs)

Parameter	Units	RDL	FWAL	SW12-1	SW12-2	SW12-3	SW12-3
				29-Oct-12	29-Oct-12	29-Oct-12	06-May-15
1-Methylnaphthalene	ug/L	0.05	**	ND	ND	ND	-
2-Methylnaphthalene	ug/L	0.05	**	ND	ND	ND	-
Acenaphthene	ug/L	0.01	5.8	ND	ND	ND	-
Acenaphthylene	ug/L	0.01	**	ND	ND	ND	-
Anthracene	ug/L	0.01	0.012	ND	ND	ND	-
Benzo(a)anthracene	ug/L	0.01	0.018	ND	ND	ND	-
Benzo(a)pyrene	ug/L	0.01	0.015	ND	ND	ND	-
Benzo(b)fluoranthene	ug/L	0.01	**	ND	ND	ND	-
Benzo(ghi)perylene	ug/L	0.01	**	ND	ND	ND	-
Benzo(j)fluoranthene	ug/L	0.01	**	ND	ND	ND	-
Benzo(k)fluoranthene	ug/L	0.01	**	ND	ND	ND	-
Chrysene	ug/L	0.01	**	ND	ND	ND	-
Dibenzo(a,h)anthracene	ug/L	0.01	**	ND	ND	ND	-
Fluoranthene	ug/L	0.01	0.04	ND	ND	ND	-
Fluorene	ug/L	0.01	3	ND	ND	ND	-
Indeno(1,2,3-cd)pyrene	ug/L	0.01	**	ND	ND	ND	-
Naphthalene	ug/L	0.2	1.1	ND	ND	ND	-
Perylene	ug/L	0.01	**	ND	ND	ND	-
Phenanthrene	ug/L	0.01	0.4	ND	ND	0.011	<0.01
Pyrene	ug/L	0.01	0.025	ND	ND	ND	-

FWAL Freshwater Aquatic Life Guidelines

SHADE indicates concentration above the recommended guideline

RDL - Reportable Detection Limit

** No recommended guideline

ND = not detected

Appendix C

Vegetation Data

Complete Plant List for Site by Habitat

ETF Site - Full Plant List		S Rank	Urban Disturbed	Wetland/Drainage Channel Spp	Upland Field/Roadside Spp	Upland Forested Spp	Coastal Beach
<i>Acer negundo</i>	Box Elder	SE	x				
<i>Acer platanoides</i>	Norway Maple	SE	x				
<i>Acer rubrum</i>	Red Maple	S5				x	
<i>Achillea millefolium</i>	Common Yarrow	SE			x		
<i>Alnus incana</i>	Speckled Alder	S5		x			
<i>Ammophila breviligulata</i>	American Beachgrass	S5					x
<i>Aralia nudicaulis</i>	Wild Sarsaparilla	S5				x	
<i>Arctium tomentosum</i>	Woolly Burdock	SE	x				
<i>Artemisia absinthium</i>	Common Wormwood	SE			x		x
<i>Athyrium filix-femina</i>	Lady-Fern	S5				x	
<i>Betula papyrifera</i>	Paper Birch	S5				x	
<i>Betula populifolia</i>	Gray Birch	S5				x	
<i>Bidens frondosa</i>	Devil's Beggar-Ticks	S5		x			
<i>Calamagrostis canadensis</i>	Blue-Joint Reedgrass	S5			x		
<i>Carex intumescens</i>	Bladder Sedge	S5				x	
<i>Carex scoparia</i>	Pointed Broom Sedge	S5		x			
<i>Cirsium arvense</i>	Creeping Thistle	SE	x		x		
<i>Conyza canadensis</i>	Canada Horseweed	SE			x		
<i>Crataegus sp</i>	Hawthorn	not a sp at risk			x		
<i>Daucus carota</i>	Wild Carrot	SE			x		
<i>Doellingeria umbellata</i>	Parasol White-Top	S5			x	x	
<i>Dryopteris carthusiana</i>	Spinulose Shield Fern	S5				x	
<i>Epilobium ciliatum</i>	Hairy Willow-Herb	S5		x			
<i>Epipactis helleborine</i>	Eastern Helleborine	SE				x	
<i>Equisetum arvense</i>	Field Horsetail	S5	x				x
<i>Eupatorium maculatum</i>	Spotted Joe-Pye Weed	S5		x			
<i>Eupatorium perfoliatum</i>	Common Boneset	S5		x			
<i>Euthamia graminifolia</i>	Flat-Top Fragrant-Golden-Rod	S5	x	x	x		
<i>Fragaria virginiana</i>	Virginia Strawberry	S5				x	

ETF Site - Full Plant List		S Rank	Urban Disturbed	Wetland/Drainage Channel Spp	Upland Field/Roadside Spp	Upland Forested Spp	Coastal Beach
<i>Fraxinus americana</i>	White Ash	S5				x	
<i>Galeopsis tetrahit</i>	Brittle-Stem Hempnettle	SE					x
<i>Galium asprellum</i>	Rough Bedstraw	S5			x		
<i>Galium palustre</i>	Marsh Bedstraw	S5		x			
<i>Hieracium pilosella</i>	Mouseear	SE				x	
<i>Honckenya peploides</i>	Sea-Beach Sandwort	S5					x
<i>Hypericum perforatum</i>	A St. John's-Wort	SE			x		
<i>Impatiens capensis</i>	Spotted Jewel-Weed	S5		x			
<i>Iris versicolor</i>	Blueflag	S5		x			
<i>Juncus effusus</i>	Soft Rush	S5		x			
<i>Leontodon autumnalis</i>	Autumn Hawkbit	SE			x		
<i>Lilium lancifolium</i>	Lance-Leaf Tiger Lily	SE				x	
<i>Linaria vulgaris</i>	Butter-And-Eggs	SE			x		x
<i>Linnaea borealis</i>	Twinflower	S5				x	
<i>Lotus corniculatus</i>	Birds-Foot Trefoil	SE			x		
<i>Lycopus americanus</i>	American Bugleweed	S5		x			
<i>Myosotis laxa</i>	Small Forget-Me-Not	S5		x			
<i>Myrica pensylvanica</i>	Northern Bayberry	S5	x			x	
<i>Onoclea sensibilis</i>	Sensitive Fern	S5		x		x	
<i>Osmunda cinnamomea</i>	Cinnamon Fern	S5		x			
<i>Oxalis stricta</i>	Upright Yellow Wood-Sorrel	S5				x	
<i>Pastinaca sativa</i>	Wild Parsnip	SE	x	x			
<i>Phalaris arundinacea</i>	Reed Canary Grass	S5	x	x			
<i>Phragmites australis</i>	Common Reed	S5					x
<i>Picea glauca</i>	White Spruce	S5			x	x	
<i>Plantago major</i>	Nipple-Seed Plantain	SE			x		
<i>Polygonum hydropiper</i>	Marshpepper Smartweed	SE		x			
<i>Populus tremuloides</i>	Quaking Aspen	S5			x	x	
<i>Prunella vulgaris</i>	Self-Heal	S5					x
<i>Prunus virginiana</i>	Choke Cherry	S5	x	x		x	
<i>Ranunculus acris</i>	Tall Butter-Cup	SE		x		x	
<i>Rhamnus cathartica</i>	Buckthorn	SE		x		x	

ETF Site - Full Plant List		S Rank	Urban Disturbed	Wetland/Drainage Channel Spp	Upland Field/Roadside Spp	Upland Forested Spp	Coastal Beach
<i>Rosa multiflora</i>	Rambler Rose	SE		x			
<i>Rubus idaeus</i>	Red Raspberry	S5		x	x	x	
<i>Rubus pubescens</i>	Dwarf Red Raspberry	S5				x	
<i>Rumex crispus</i>	Curly Dock	SE		x	x		
<i>Salix bebbiana</i>	Bebb's Willow	S5		x			
<i>Scirpus cyperinus</i>	Cottongrass Bulrush	S5		x			
<i>Senecio vulgaris</i>	Old-Man-In-The-Spring	SE					x
<i>Solanum dulcamara</i>	Climbing Nightshade	S5	x				
<i>Solidago canadensis</i>	Canada Goldenrod	S5	x		x		
<i>Solidago rugosa</i>	Rough-Leaf Goldenrod	S5				x	
<i>Sonchus arvensis</i>	Field Sowthistle	SE	x				x
<i>Spartina pectinata</i>	Fresh Water Cordgrass	S5		x			x
<i>Symphyotrichum ciliatum</i>	Alkali American-Aster	S5				x	
<i>Symphyotrichum lateriflorum</i>	Farewell-Summer	S5				x	
<i>Symphyotrichum novi-belgii</i>	New Belgium American-Aster	S5	x	x			
<i>Taraxacum officinale</i>	Common Dandelion	SE	x				
<i>Tragopogon pratensis</i>	Meadow Goat's-Beard	SE		x			
<i>Trifolium campestre</i>	Low Hop Clover	SE			x		
<i>Trifolium pratense</i>	Red Clover	SE			x		
<i>Tussalago farfara</i>	Coltsfoot	SE	x		x	x	x
<i>Typha latifolia</i>	Broad-Leaf Cattail	S5		x			
<i>Ulmus americanus</i>	American Elm	S4	x				
<i>Veronica officinalis</i>	Gypsy-Weed	S5				x	
<i>Viburnum opulus</i>	Guelder-Rose Viburnum	S5				x	
<i>Vicia cracca</i>	Tufted Vetch	SE	x				
<i>Viola cucullata</i>	Marsh Blue Violet	S5				x	

*Exotic species are indicated with shading

Appendix D

AC CDC Report 2018

DATA REPORT 6252: Pictou, NS

Prepared 15 November 2018
by J. Churchill, Data Manager

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Map 1. A 100 km buffer around the study area

1.0 PREFACE

The Atlantic Canada Conservation Data Centre (AC CDC; www.accdc.com) is part of a network of NatureServe data centres and heritage programs serving 50 states in the U.S.A, 10 provinces and 1 territory in Canada, plus several Central and South American countries. The NatureServe network is more than 30 years old and shares a common conservation data methodology. The AC CDC was founded in 1997, and maintains data for the jurisdictions of New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador. Although a non-governmental agency, the AC CDC is supported by 6 federal agencies and 4 provincial governments, as well as through outside grants and data processing fees.

Upon request and for a fee, the AC CDC queries its database and produces customized reports of the rare and endangered flora and fauna known to occur in or near a specified study area. As a supplement to that data, the AC CDC includes locations of managed areas with some level of protection, and known sites of ecological interest or sensitivity.

1.1 DATA LIST

Included datasets:

Filename	Contents
PictouNS_6252ob.xls	All Rare and legally protected <i>Flora and Fauna</i> in your study area
PictouNS_6252ob100km.xls	A list of Rare and legally protected <i>Flora and Fauna</i> within 100 km of your study area
PictouNS_6252ma.xls	All <i>Managed Areas</i> in your study area
PictouNS_6252sa.xls	All <i>Significant Natural Areas</i> in your study area
PictouNS_6252wf.xls	Rare and common <i>Waterfowl</i> in your study area (CWS database)
PictouNS_6252bc.xls	Rare and common <i>Colonial Birds</i> in your study area

1.2 RESTRICTIONS

The AC CDC makes a strong effort to verify the accuracy of all the data that it manages, but it shall not be held responsible for any inaccuracies in data that it provides. By accepting AC CDC data, recipients assent to the following limits of use:

- a) Data is restricted to use by trained personnel who are sensitive to landowner interests and to potential threats to rare and/or endangered flora and fauna posed by the information provided.
- b) Data is restricted to use by the specified Data User; any third party requiring data must make its own data request.
- c) The AC CDC requires Data Users to cease using and delete data 12 months after receipt, and to make a new request for updated data if necessary at that time.
- d) AC CDC data responses are restricted to the data in our Data System at the time of the data request.
- e) Each record has an estimate of locational uncertainty, which must be referenced in order to understand the record's relevance to a particular location. Please see attached Data Dictionary for details.
- f) AC CDC data responses are not to be construed as exhaustive inventories of taxa in an area.
- g) The absence of a taxon cannot be inferred by its absence in an AC CDC data response.

1.3 ADDITIONAL INFORMATION

The accompanying Data Dictionary provides metadata for the data provided.

Please direct any additional questions about AC CDC data to the following individuals:

Plants, Lichens, Ranking Methods, All other Inquiries

Sean Blaney, Senior Scientist, Executive Director

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Animals (Fauna)

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Billing

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Questions on the biology of Federal Species at Risk can be directed to AC CDC: (506) 364-2658, with questions on Species at Risk regulations to: Samara Eaton, Canadian Wildlife Service (NB and PE): (506) 364-5060 or Julie McKnight, Canadian Wildlife Service (NS): (902) 426-4196.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in New Brunswick, please contact Hubert Askanas, Energy and Resource Development: (506) 453-5873.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in Nova Scotia, please contact Donna Hurlburt, NS DLF: (902) 679-6886. To determine if location-sensitive species (section 4.3) occur near your study site please contact a NS DLF Regional Biologist:

Western: Duncan Bayne
(902) 648-3536
Duncan.Bayne@novascotia.ca

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For provincial information about rare taxa and protected areas, or information about game animals, fish habitat etc., in Prince Edward Island, please contact Garry Gregory, PEI Dept. of Communities, Land and Environment: (902) 569-7595.

2.0 RARE AND ENDANGERED SPECIES

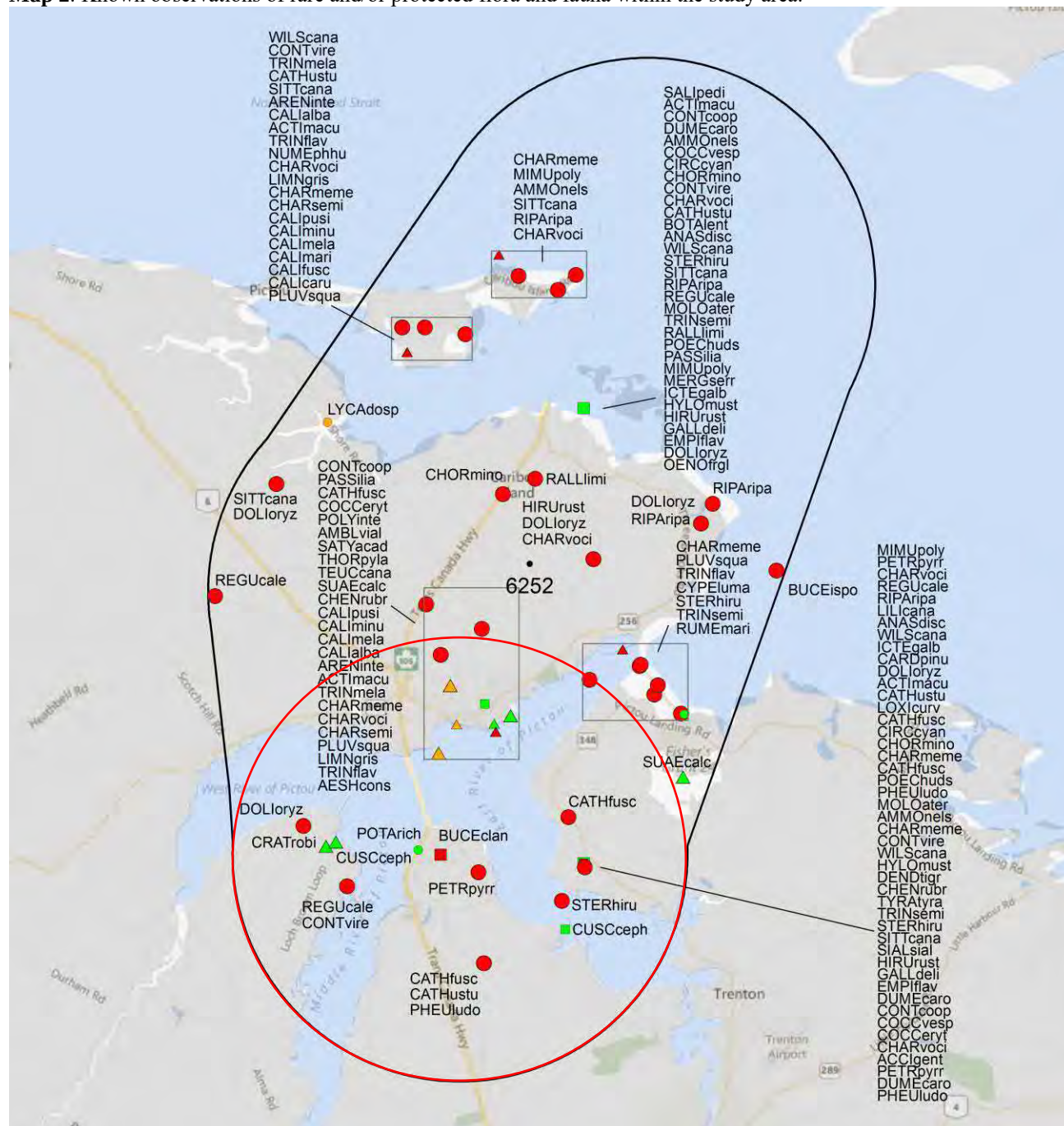
2.1 FLORA

The study area contains 15 records of 11 vascular, no records of nonvascular flora (Map 2 and attached: *ob.xls).

2.2 FAUNA

The study area contains 381 records of 57 vertebrate, 12 records of 6 invertebrate fauna (Map 2 and attached data files - see 1.1 Data List). Please see section 4.3 to determine if 'location-sensitive' species occur near your study site.

Map 2: Known observations of rare and/or protected flora and fauna within the study area.



RESOLUTION

- 4.7 within 50s of kilometers
- 4.0 within 10s of kilometers
- 3.7 within 5s of kilometers
- △ 3.0 within kilometers
- △ 2.7 within 500s of meters
- △ 2.0 within 100s of meters
- △ 1.7 within 10s of meters

HIGHER TAXON

- vertebrate fauna
- invertebrate fauna
- vascular flora
- nonvascular flora

3.0 SPECIAL AREAS

3.1 MANAGED AREAS

The GIS scan identified 14 managed areas in the vicinity of the study area (Map 3 and attached file: *ma*.xls).

3.2 SIGNIFICANT AREAS

The GIS scan identified 2 biologically significant sites in the vicinity of the study area (Map 3 and attached file: *sa*.xls).

Map 3: Boundaries and/or locations of known Managed and Significant Areas within the study area.



MANAGED AREAS SIGNIFICANT AREAS



4.0 RARE SPECIES LISTS

Rare and/or endangered taxa (excluding “location-sensitive” species, section 4.3) within the study area listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation ($\pm$ the precision, in km, of the record). [P] = vascular plant, [N] = nonvascular plant, [A] = vertebrate animal, [I] = invertebrate animal, [C] = community. Note: records are from attached files *ob.xls/*ob.shp only.

4.1 FLORA

	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
P	<i>Cyperus lupulinus ssp. macilentus</i>	Hop Flatsedge				S1	2 May Be At Risk	2	3.3 $\pm$ 0.0
P	<i>Crataegus robinsonii</i>	Robinson's Hawthorn				S1?	5 Undetermined	1	7.7 $\pm$ 1.0
P	<i>Chenopodium rubrum</i>	Red Pigweed				S2	2 May Be At Risk	2	3.6 $\pm$ 0.0
P	<i>Oenothera fruticosa ssp. glauca</i>	Narrow-leaved Evening Primrose				S2	5 Undetermined	1	3.6 $\pm$ 7.0
P	<i>Salix pedicellaris</i>	Bog Willow				S2	3 Sensitive	1	3.6 $\pm$ 7.0
P	<i>Lilium canadense</i>	Canada Lily				S2	2 May Be At Risk	1	6.7 $\pm$ 7.0
P	<i>Potamogeton richardsonii</i>	Richardson's Pondweed				S2	2 May Be At Risk	1	6.8 $\pm$ 0.0
P	<i>Cuscuta cephalanthi</i>	Buttonbush Dodder				S2?	5 Undetermined	2	7.5 $\pm$ 1.0
P	<i>Teucrium canadense</i>	Canada Germander				S3	3 Sensitive	1	3.2 $\pm$ 5.0
P	<i>Suaeda calceoliformis</i>	Horned Sea-blite				S3S4	4 Secure	2	3.4 $\pm$ 4.0
P	<i>Rumex maritimus</i>	Sea-Side Dock				S3S4		1	4.7 $\pm$ 0.0

4.2 FAUNA

	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	<i>Charadrius melodus melodus</i>	Piping Plover melodus ssp	Endangered	Endangered	Endangered	S1B	1 At Risk	39	2.8 $\pm$ 0.0
A	<i>Calidris canutus rufa</i>	Red Knot rufa ssp	Endangered		Endangered	S2M	1 At Risk	2	5.4 $\pm$ 0.0
A	<i>Riparia riparia</i>	Bank Swallow	Threatened	Threatened	Endangered	S2S3B	2 May Be At Risk	5	3.6 $\pm$ 7.0
A	<i>Hirundo rustica</i>	Barn Swallow	Threatened	Threatened	Endangered	S2S3B	1 At Risk	7	1.4 $\pm$ 0.0
A	<i>Wilsonia canadensis</i>	Canada Warbler	Threatened	Threatened	Endangered	S3B	1 At Risk	4	3.6 $\pm$ 7.0
A	<i>Dolichonyx oryzivorus</i>	Bobolink	Threatened	Threatened	Vulnerable	S3S4B	3 Sensitive	9	1.4 $\pm$ 0.0
A	<i>Hylocichla mustelina</i>	Wood Thrush	Threatened	Threatened		SUB	5 Undetermined	2	3.6 $\pm$ 7.0
A	<i>Bucephala islandica (Eastern pop.)</i>	Barrow's Goldeneye - Eastern pop.	Special Concern	Special Concern		S1N	1 At Risk	1	5.4 $\pm$ 0.0
A	<i>Chordeiles minor</i>	Common Nighthawk	Special Concern	Threatened	Threatened	S2B	1 At Risk	4	1.6 $\pm$ 0.0
A	<i>Contopus cooperi</i>	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S2B	1 At Risk	5	2.5 $\pm$ 0.0
A	<i>Contopus virens</i>	Eastern Wood-Pewee	Special Concern	Special Concern	Vulnerable	S3S4B	3 Sensitive	9	3.6 $\pm$ 7.0
A	<i>Coccothraustes vespertinus</i>	Evening Grosbeak	Special Concern		Vulnerable	S3S4B,S3N	4 Secure	2	3.6 $\pm$ 7.0
A	<i>Sterna hirundo</i>	Common Tern	Not At Risk			S3B	3 Sensitive	17	2.9 $\pm$ 0.0
A	<i>Sialia sialis</i>	Eastern Bluebird	Not At Risk			S3B	3 Sensitive	1	6.7 $\pm$ 7.0
A	<i>Accipiter gentilis</i>	Northern Goshawk	Not At Risk			S3S4	4 Secure	1	6.7 $\pm$ 7.0
A	<i>Circus cyaneus</i>	Northern Harrier	Not At Risk			S3S4B	4 Secure	2	3.6 $\pm$ 7.0
A	<i>Ammodramus nelsoni</i>	Nelson's Sparrow	Not At Risk			S3S4B	4 Secure	3	3.6 $\pm$ 7.0
A	<i>Mimus polyglottos</i>	Northern Mockingbird				S1B	4 Secure	3	3.6 $\pm$ 7.0
A	<i>Calidris minutilla</i>	Least Sandpiper				S1B,S3M	4 Secure	15	3.8 $\pm$ 0.0
A	<i>Charadrius semipalmatus</i>	Semipalmated Plover				S1B,S3S4M	4 Secure	23	3.8 $\pm$ 0.0
A	<i>Dendroica tigrina</i>	Cape May Warbler				S2B	3 Sensitive	1	6.7 $\pm$ 7.0
A	<i>Molothrus ater</i>	Brown-headed Cowbird				S2B	4 Secure	2	3.6 $\pm$ 7.0
A	<i>Bucephala clangula</i>	Common Goldeneye				S2B,S5N	4 Secure	5	6.7 $\pm$ 13.0
A	<i>Carduelis pinus</i>	Pine Siskin				S2S3	3 Sensitive	1	6.7 $\pm$ 7.0
A	<i>Rallus limicola</i>	Virginia Rail				S2S3B	5 Undetermined	2	1.9 $\pm$ 0.0
A	<i>Tringa semipalmata</i>	Willet				S2S3B	2 May Be At Risk	7	3.6 $\pm$ 7.0
A	<i>Petrochelidon pyrrhonota</i>	Cliff Swallow				S2S3B	2 May Be At Risk	3	6.7 $\pm$ 7.0
A	<i>Pheucticus ludovicianus</i>	Rose-breasted Grosbeak				S2S3B	3 Sensitive	4	6.7 $\pm$ 7.0
A	<i>Icterus galbula</i>	Baltimore Oriole				S2S3B	2 May Be At Risk	5	3.6 $\pm$ 7.0
A	<i>Numenius phaeopus hudsonicus</i>	Hudsonian Whimbrel				S2S3M	3 Sensitive	1	5.4 $\pm$ 0.0

	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)
A	<i>Calidris melanotos</i>	Pectoral Sandpiper				S2S3M	4 Secure	2	3.8 ± 0.0
A	<i>Poecile hudsonica</i>	Boreal Chickadee				S3	3 Sensitive	2	3.6 ± 7.0
A	<i>Sitta canadensis</i>	Red-breasted Nuthatch				S3	4 Secure	9	3.6 ± 7.0
A	<i>Calidris maritima</i>	Purple Sandpiper				S3?N	3 Sensitive	1	5.4 ± 0.0
A	<i>Charadrius vociferus</i>	Killdeer				S3B	3 Sensitive	13	1.4 ± 0.0
A	<i>Gallinago delicata</i>	Wilson's Snipe				S3B	3 Sensitive	4	3.6 ± 7.0
A	<i>Coccyzus erythrophthalmus</i>	Black-billed Cuckoo				S3B	2 May Be At Risk	2	2.8 ± 0.0
A	<i>Tyrannus tyrannus</i>	Eastern Kingbird				S3B	3 Sensitive	1	6.7 ± 7.0
A	<i>Dumetella carolinensis</i>	Gray Catbird				S3B	2 May Be At Risk	6	3.6 ± 7.0
A	<i>Tringa melanoleuca</i>	Greater Yellowlegs				S3B,S3S4M	3 Sensitive	21	3.8 ± 0.0
A	<i>Pluvialis squatarola</i>	Black-bellied Plover				S3M	4 Secure	17	2.8 ± 0.0
A	<i>Tringa flavipes</i>	Lesser Yellowlegs				S3M	4 Secure	8	2.8 ± 0.0
A	<i>Arenaria interpres</i>	Ruddy Turnstone				S3M	4 Secure	14	3.8 ± 0.0
A	<i>Calidris pusilla</i>	Semipalmated Sandpiper				S3M	3 Sensitive	26	3.8 ± 0.0
A	<i>Calidris fuscicollis</i>	White-rumped Sandpiper				S3M	4 Secure	1	5.4 ± 0.0
A	<i>Limnodromus griseus</i>	Short-billed Dowitcher				S3M	4 Secure	5	3.8 ± 0.0
A	<i>Calidris alba</i>	Sanderling				S3M,S2N	4 Secure	16	3.8 ± 0.0
A	<i>Loxia curvirostra</i>	Red Crossbill				S3S4	4 Secure	1	6.7 ± 7.0
A	<i>Botaurus lentiginosus</i>	American Bittern				S3S4B	3 Sensitive	3	3.6 ± 7.0
A	<i>Anas discors</i>	Blue-winged Teal				S3S4B	2 May Be At Risk	4	3.6 ± 7.0
A	<i>Actitis macularius</i>	Spotted Sandpiper				S3S4B	3 Sensitive	13	3.6 ± 7.0
A	<i>Empidonax flaviventris</i>	Yellow-bellied Flycatcher				S3S4B	3 Sensitive	3	3.6 ± 7.0
A	<i>Regulus calendula</i>	Ruby-crowned Kinglet				S3S4B	3 Sensitive	8	3.6 ± 7.0
A	<i>Catharus fuscescens</i>	Veery				S3S4B	4 Secure	7	2.8 ± 0.0
A	<i>Catharus ustulatus</i>	Swainson's Thrush				S3S4B	4 Secure	4	3.6 ± 7.0
A	<i>Passerella iliaca</i>	Fox Sparrow				S3S4B	4 Secure	3	1.8 ± 0.0
A	<i>Mergus serrator</i>	Red-breasted Merganser				S3S4B,S5N	4 Secure	2	3.6 ± 7.0
I	<i>Satyrus acadica</i>	Acadian Hairstreak				S1	5 Undetermined	5	3.2 ± 1.0
I	<i>Lycaena dospassosi</i>	Salt Marsh Copper				S2	1 At Risk	1	5.4 ± 0.0
I	<i>Thorybes pylades</i>	Northern Cloudywing				S2S3	3 Sensitive	1	3.2 ± 1.0
I	<i>Aeshna constricta</i>	Lance-Tipped Darner				S3	4 Secure	1	4.6 ± 1.0
I	<i>Polygonia interrogationis</i>	Question Mark				S3B	4 Secure	3	3.2 ± 1.0
I	<i>Amblyscirtes vialis</i>	Common Roadside-Skipper				S3S4	4 Secure	1	3.2 ± 1.0

4.3 LOCATION SENSITIVE SPECIES

The Department of Natural Resources in each Maritimes province considers a number of species “location sensitive”. Concern about exploitation of location-sensitive species precludes inclusion of precise coordinates in this report. Those intersecting your study area are indicated below with “YES”.

Nova Scotia

Scientific Name	Common Name	SARA	Prov Legal Prot	Known within the Study Site?
<i>Fraxinus nigra</i>	Black Ash		Threatened	YES
<i>Emydoidea blandingii</i>	Blanding's Turtle - Nova Scotia pop.	Endangered	Vulnerable	No
<i>Glyptemys insculpta</i>	Wood Turtle	Threatened	Threatened	No
<i>Falco peregrinus</i> pop. 1	Peregrine Falcon - anatum/tundrius pop.	Special Concern	Vulnerable	No
<i>Bat Hibernaculum</i>		[Endangered] ¹	[Endangered] ¹	No

¹ *Myotis lucifugus* (Little Brown Myotis), *Myotis septentrionalis* (Long-eared Myotis), and *Perimyotis subflavus* (Tri-colored Bat or Eastern Pipistrelle) are all Endangered under the Federal Species at Risk Act and the NS Endangered Species Act.

4.4 SOURCE BIBLIOGRAPHY

The recipient of these data shall acknowledge the AC CDC and the data sources listed below in any documents, reports, publications or presentations, in which this dataset makes a significant contribution.

# recs	CITATION
169	Morrison, Guy. 2011. Maritime Shorebird Survey (MSS) database. Canadian Wildlife Service, Ottawa, 15939 surveys. 86171 recs.
155	Lepage, D. 2014. Maritime Breeding Bird Atlas Database. Bird Studies Canada, Sackville NB, 407,838 recs.
20	Amirault, D.L. & Stewart, J. 2007. Piping Plover Database 1894-2006. Canadian Wildlife Service, Sackville, 3344 recs, 1228 new.
13	Benjamin, L.K. (compiler). 2012. Significant Habitat & Species Database. Nova Scotia Dept Natural Resources, 4965 recs.
13	Erschine, A.J. 1992. Maritime Breeding Bird Atlas Database. NS Museum & Nimbus Publ., Halifax, 82,125 recs.
11	Staff, DNR 2007. Restricted & Limited Use Land Database (RLUL).
11	Wilhelm, S.I. et al. 2011. Colonial Waterbird Database.
9	Layberry, R.A. & Hall, P.W., LaFontaine, J.D. 1998. The Butterflies of Canada. University of Toronto Press. 280 pp+plates.
5	Hicks, Andrew. 2009. Coastal Waterfowl Surveys Database, 2000-08. Canadian Wildlife Service, Sackville, 46488 recs (11149 non-zero).
4	Roland, A.E. & Smith, E.C. 1969. The Flora of Nova Scotia, 1st Ed. Nova Scotia Museum, Halifax, 743pp.
3	Canadian Wildlife Service, Dartmouth. 2010. Piping Plover censuses 2007-09, 304 recs.
3	Pronych, G. & Wilson, A. 1993. Atlas of Rare Vascular Plants in Nova Scotia. Nova Scotia Museum, Halifax NS, I:1-168, II:169-331. 1446 recs.
2	Amirault, D.L. & McKnight, J. 2003. Piping Plover Database 1991-2003. Canadian Wildlife Service, Sackville, unpublished data. 7 recs.
2	Benjamin, L.K. (compiler) 2012. Significant Habitat & Species Database. NS Dept of Natural Resources.
2	Klymko, J.J.D. 2014. Maritimes Butterfly Atlas, 2012 submissions. Atlantic Canada Conservation Data Centre, 8552 records.
2	Munro, Marian K. Nova Scotia Provincial Museum of Natural History Herbarium Database. Nova Scotia Provincial Museum of Natural History, Halifax, Nova Scotia. 2013.
2	Newell, R.E. 2005. E.C. Smith Digital Herbarium. E.C. Smith Herbarium, Irving Biodiversity Collection, Acadia University, Web site: http://luxor.acadiu.ca/library/Herbarium/project/ . 582 recs.
2	NSDNR website
1	Benjamin, L.K. (compiler). 2007. Significant Habitat & Species Database. Nova Scotia Dept Natural Resources, 8439 recs.
1	Blaney, C.S.; Mazerolle, D.M.; Oberndorfer, E. 2007. Fieldwork 2007. Atlantic Canada Conservation Data Centre. Sackville NB, 13770 recs.
1	Blaney, C.S.; Spicer, C.D.; Rothfels, C. 2004. Fieldwork 2004. Atlantic Canada Conservation Data Centre. Sackville NB, 1343 recs.
1	Brunelle, P.-M. (compiler). 2009. ADIP/MDDS Odonata Database: data to 2006 inclusive. Atlantic Dragonfly Inventory Program (ADIP), 24200 recs.
1	Daur, R.W. & Bateman, M.C. 1996. The Barrow's Goldeneye (<i>Bucephala islandica</i>) in the Atlantic Provinces and Maine. Canadian Wildlife Service, Sackville, 47pp.
1	NCC Atlantic Canada, 2000
1	Zinck, M. & Roland, A.E. 1998. Roland's Flora of Nova Scotia. Nova Scotia Museum, 3rd ed., rev. M. Zinck; 2 Vol., 1297 pp.

5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 32207 records of 138 vertebrate and 790 records of 55 invertebrate fauna; 4264 records of 270 vascular, 1318 records of 61 nonvascular flora (attached: *ob100km.xls).

Taxa within 100 km of the study site that are rare and/or endangered in the province in which the study site occurs (including "location-sensitive" species). All ranks correspond to the province in which the study site falls, even for out-of-province records. Taxa are listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation ($\pm$ the precision, in km, of the record).

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	<i>Myotis lucifugus</i>	Little Brown Myotis	Endangered	Endangered	Endangered	S1	1 At Risk	65	21.8 $\pm$ 0.0	NS
A	<i>Myotis septentrionalis</i>	Northern Long-eared Myotis	Endangered	Endangered	Endangered	S1	1 At Risk	97	34.9 $\pm$ 1.0	PE
A	<i>Perimyotis subflavus</i>	Eastern Pipistrelle	Endangered	Endangered	Endangered	S1	1 At Risk	4	81.8 $\pm$ 5.0	NS
A	<i>Salmo salar</i> pop. 1	Atlantic Salmon - Inner Bay of Fundy pop.	Endangered	Endangered		S1	2 May Be At Risk	14	39.0 $\pm$ 0.0	NS
A	<i>Charadrius melodus melodus</i>	Piping Plover melodus ssp	Endangered	Endangered	Endangered	S1B	1 At Risk	2352	2.8 $\pm$ 0.0	NS
A	<i>Sterna dougallii</i>	Roseate Tern	Endangered	Endangered	Endangered	S1B	1 At Risk	18	91.1 $\pm$ 0.0	NS
A	<i>Morone saxatilis</i> pop. 2	Striped Bass- Bay of Fundy pop.	Endangered			S1B	2 May Be At Risk	1	97.4 $\pm$ 0.0	NS
A	<i>Calidris canutus rufa</i>	Red Knot rufa ssp	Endangered		Endangered	S2M	1 At Risk	232	5.4 $\pm$ 0.0	NS
A	<i>Caprimulgus vociferus</i>	Whip-Poor-Will	Threatened	Threatened	Threatened	S1?B	1 At Risk	7	51.6 $\pm$ 7.0	NS
A	<i>Catharus bicknelli</i>	Bicknell's Thrush	Threatened	Special Concern	Endangered	S1S2B	1 At Risk	1	91.9 $\pm$ 7.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	<i>Glyptemys insculpta</i>	Wood Turtle	Threatened	Threatened	Threatened	S2	3 Sensitive	220	13.1 ± 5.0	NS
A	<i>Acipenser oxyrinchus</i>	Atlantic Sturgeon	Threatened			S2	2 May Be At Risk	2	84.7 ± 0.0	NS
A	<i>Anguilla rostrata</i>	American Eel	Threatened			S2	4 Secure	5	76.5 ± 0.0	NS
A	<i>Chaetura pelagica</i>	Chimney Swift	Threatened	Threatened	Endangered	S2B,S1M	1 At Risk	190	11.0 ± 7.0	NS
A	<i>Riparia riparia</i>	Bank Swallow	Threatened	Threatened	Endangered	S2S3B	2 May Be At Risk	513	3.6 ± 7.0	NS
A	<i>Hirundo rustica</i>	Barn Swallow	Threatened	Threatened	Endangered	S2S3B	1 At Risk	884	1.4 ± 0.0	NS
A	<i>Wilsonia canadensis</i>	Canada Warbler	Threatened	Threatened	Endangered	S3B	1 At Risk	743	3.6 ± 7.0	NS
A	<i>Dolichonyx oryzivorus</i>	Bobolink	Threatened	Threatened	Vulnerable	S3S4B	3 Sensitive	679	1.4 ± 0.0	NS
A	<i>Hylocichla mustelina</i>	Wood Thrush	Threatened	Threatened		SUB	5 Undetermined	30	3.6 ± 7.0	NS
A	<i>Passerculus sandwichensis princeps</i>	Savannah Sparrow princeps ssp	Special Concern	Special Concern		S1B	3 Sensitive	1	97.5 ± 7.0	NS
A	<i>Falco peregrinus pop. 1</i>	Peregrine Falcon - anatum/tundrius	Special Concern	Special Concern	Vulnerable	S1B,SNAM	3 Sensitive	4	67.8 ± 0.0	PE
A	<i>Bucephala islandica</i> (Eastern pop.)	Barrow's Goldeneye - Eastern pop.	Special Concern	Special Concern		S1N	1 At Risk	5	5.4 ± 0.0	NS
A	<i>Asio flammeus</i>	Short-eared Owl	Special Concern	Special Concern		S1S2B	2 May Be At Risk	12	16.6 ± 7.0	NS
A	<i>Euphagus carolinus</i>	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2B	2 May Be At Risk	231	20.0 ± 7.0	NS
A	<i>Chordeiles minor</i>	Common Nighthawk	Special Concern	Threatened	Threatened	S2B	1 At Risk	285	1.6 ± 0.0	NS
A	<i>Contopus cooperi</i>	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S2B	1 At Risk	868	2.5 ± 0.0	NS
A	<i>Histrionicus histrionicus pop. 1</i>	Harlequin Duck - Eastern pop.	Special Concern	Special Concern	Endangered	S2N	1 At Risk	12	92.4 ± 2.0	NS
A	<i>Phalaropus lobatus</i>	Red-necked Phalarope	Special Concern			S2S3M	3 Sensitive	6	75.5 ± 0.0	NS
A	<i>Morone saxatilis pop. 1</i>	Striped Bass- Southern Gulf of St Lawrence pop.	Special Concern			S2S3N	2 May Be At Risk	1	60.8 ± 1.0	NS
A	<i>Chelydra serpentina</i>	Snapping Turtle	Special Concern	Special Concern	Vulnerable	S3	3 Sensitive	37	17.1 ± 0.0	NS
A	<i>Contopus virens</i>	Eastern Wood-Pewee	Special Concern	Special Concern	Vulnerable	S3S4B	3 Sensitive	664	3.6 ± 7.0	NS
A	<i>Coccothraustes vespertinus</i>	Evening Grosbeak	Special Concern		Vulnerable	S3S4B,S3N	4 Secure	385	3.6 ± 7.0	NS
A	<i>Phocoena phocoena</i> (NW Atlantic pop.)	Harbour Porpoise - Northwest Atlantic pop.	Special Concern	Threatened		S4		1	70.5 ± 5.0	PE
A	<i>Podiceps auritus</i>	Horned Grebe	Special Concern			S4N	4 Secure	5	96.2 ± 1.0	NB
A	<i>Accipiter cooperii</i>	Cooper's Hawk	Not At Risk			S1?B	5 Undetermined	2	18.3 ± 0.0	NS
A	<i>Fulica americana</i>	American Coot	Not At Risk			S1B	5 Undetermined	19	16.9 ± 7.0	NS
A	<i>Sorex dispar</i>	Long-tailed Shrew	Not At Risk	Special Concern		S2	3 Sensitive	2	84.4 ± 5.0	NS
A	<i>Aegolius funereus</i>	Boreal Owl	Not At Risk			S2?B	5 Undetermined	19	29.5 ± 0.0	NS
A	<i>Globicephala melas</i>	Long-finned Pilot Whale	Not At Risk			S2S3		1	82.2 ± 100.0	NS
A	<i>Hemidactylium scutatum</i>	Four-toed Salamander	Not At Risk			S3	4 Secure	6	43.5 ± 0.0	NS
A	<i>Sterna hirundo</i>	Common Tern	Not At Risk			S3B	3 Sensitive	455	2.9 ± 0.0	NS
A	<i>Sialia sialis</i>	Eastern Bluebird	Not At Risk			S3B	3 Sensitive	45	6.7 ± 7.0	NS
A	<i>Buteo lagopus</i>	Rough-legged Hawk	Not At Risk			S3N	4 Secure	3	92.7 ± 4.0	NS
A	<i>Accipiter gentilis</i>	Northern Goshawk	Not At Risk			S3S4	4 Secure	102	6.7 ± 7.0	NS
A	<i>Lagenorhynchus acutus</i>	Atlantic White-sided Dolphin	Not At Risk			S3S4		1	83.3 ± 1.0	PE
A	<i>Circus cyaneus</i>	Northern Harrier	Not At Risk			S3S4B	4 Secure	450	3.6 ± 7.0	NS
A	<i>Ammodramus nelsoni</i>	Nelson's Sparrow	Not At Risk			S3S4B	4 Secure	197	3.6 ± 7.0	NS
A	<i>Alces americanus</i>	Moose			Endangered	S1	1 At Risk	60	26.6 ± 0.0	NS
A	<i>Salmo salar</i>	Atlantic Salmon				S1	2 May Be At Risk	78	18.5 ± 0.0	NS
A	<i>Picoides dorsalis</i>	American Three-toed Woodpecker				S1?	5 Undetermined	12	78.9 ± 7.0	PE
A	<i>Passerina cyanea</i>	Indigo Bunting				S1?B	5 Undetermined	16	39.7 ± 0.0	PE
A	<i>Nycticorax nycticorax</i>	Black-crowned Night-heron				S1B	2 May Be At Risk	1	61.3 ± 7.0	NS
A	<i>Anas acuta</i>	Northern Pintail				S1B	2 May Be At Risk	50	35.9 ± 14.0	PE
A	<i>Oxyura jamaicensis</i>	Ruddy Duck				S1B	4 Secure	6	53.0 ± 0.0	NS
A	<i>Gallinula chloropus</i>	Common Moorhen				S1B	5 Undetermined	11	29.6 ± 7.0	NS
A	<i>Myiarchus crinitus</i>	Great Crested Flycatcher				S1B	2 May Be At Risk	12	18.8 ± 7.0	NS
A	<i>Cistothorus palustris</i>	Marsh Wren				S1B	5 Undetermined	1	96.8 ± 3.0	NB
A	<i>Mimus polyglottos</i>	Northern Mockingbird				S1B	4 Secure	32	3.6 ± 7.0	NS
A	<i>Toxostoma rufum</i>	Brown Thrasher				S1B	5 Undetermined	10	16.6 ± 7.0	NS
A	<i>Vireo gilvus</i>	Warbling Vireo				S1B	5 Undetermined	14	29.0 ± 7.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
A	<i>Dendroica pinus</i>	Pine Warbler				S1B	5 Undetermined	8	18.8 ± 7.0	NS
A	<i>Calidris minutilla</i>	Least Sandpiper				S1B,S3M	4 Secure	490	3.8 ± 0.0	NS
A	<i>Charadrius semipalmatus</i>	Semipalmated Plover				S1B,S3S4M	4 Secure	967	3.8 ± 0.0	NS
A	<i>Lasiurus cinereus</i>	Hoary Bat				S1S2B, S1M	2 May Be At Risk	2	67.6 ± 1.0	PE
A	<i>Pluvialis dominica</i>	American Golden-Plover				S1S2M	3 Sensitive	82	17.7 ± 0.0	NS
A	<i>Limosa haemastica</i>	Hudsonian Godwit				S1S2M	3 Sensitive	272	60.9 ± 0.0	NS
A	<i>Vireo philadelphicus</i>	Philadelphia Vireo				S2?B	5 Undetermined	50	36.6 ± 0.0	PE
A	<i>Anas clypeata</i>	Northern Shoveler				S2B	2 May Be At Risk	30	66.0 ± 7.0	PE
A	<i>Anas strepera</i>	Gadwall				S2B	2 May Be At Risk	73	46.2 ± 0.0	NS
A	<i>Empidonax traillii</i>	Willow Flycatcher				S2B	3 Sensitive	13	39.4 ± 7.0	NS
A	<i>Dendroica tigrina</i>	Cape May Warbler				S2B	3 Sensitive	161	6.7 ± 7.0	NS
A	<i>Piranga olivacea</i>	Scarlet Tanager				S2B	5 Undetermined	14	11.0 ± 7.0	NS
A	<i>Pooecetes gramineus</i>	Vesper Sparrow				S2B	2 May Be At Risk	41	17.5 ± 7.0	NS
A	<i>Molothrus ater</i>	Brown-headed Cowbird				S2B	4 Secure	139	3.6 ± 7.0	NS
A	<i>Bucephala clangula</i>	Common Goldeneye				S2B,S5N	4 Secure	159	6.7 ± 13.0	NS
A	<i>Branta bernicla</i>	Brant				S2M	3 Sensitive	2	89.0 ± 0.0	NS
A	<i>Phalacrocorax carbo</i>	Great Cormorant				S2S3	3 Sensitive	185	25.0 ± 7.0	PE
A	<i>Asio otus</i>	Long-eared Owl				S2S3	2 May Be At Risk	34	33.2 ± 0.0	NS
A	<i>Carduelis pinus</i>	Pine Siskin				S2S3	3 Sensitive	303	6.7 ± 7.0	NS
A	<i>Cathartes aura</i>	Turkey Vulture				S2S3B	3 Sensitive	5	65.7 ± 0.0	PE
A	<i>Rallus limicola</i>	Virginia Rail				S2S3B	5 Undetermined	43	1.9 ± 0.0	NS
A	<i>Tringa semipalmata</i>	Willet				S2S3B	2 May Be At Risk	1141	3.6 ± 7.0	NS
A	<i>Petrochelidon pyrrhonota</i>	Cliff Swallow				S2S3B	2 May Be At Risk	227	6.7 ± 7.0	NS
A	<i>Pheucticus ludovicianus</i>	Rose-breasted Grosbeak				S2S3B	3 Sensitive	498	6.7 ± 7.0	NS
A	<i>Icterus galbula</i>	Baltimore Oriole				S2S3B	2 May Be At Risk	52	3.6 ± 7.0	NS
A	<i>Pinicola enucleator</i>	Pine Grosbeak				S2S3B,S5N	2 May Be At Risk	82	11.0 ± 7.0	NS
A	<i>Numenius phaeopus hudsonicus</i>	Hudsonian Whimbrel				S2S3M	3 Sensitive	140	5.4 ± 0.0	NS
A	<i>Calidris melanotos</i>	Pectoral Sandpiper				S2S3M	4 Secure	115	3.8 ± 0.0	NS
A	<i>Perisoreus canadensis</i>	Gray Jay				S3	3 Sensitive	402	9.5 ± 7.0	NS
A	<i>Poecile hudsonica</i>	Boreal Chickadee				S3	3 Sensitive	704	3.6 ± 7.0	NS
A	<i>Sitta canadensis</i>	Red-breasted Nuthatch				S3	4 Secure	731	3.6 ± 7.0	NS
A	<i>Alosa pseudoharengus</i>	Alewife				S3	3 Sensitive	17	18.5 ± 0.0	NS
A	<i>Salvelinus fontinalis</i>	Brook Trout				S3	3 Sensitive	28	18.5 ± 0.0	NS
A	<i>Salvelinus namaycush</i>	Lake Trout				S3	3 Sensitive	1	56.4 ± 0.0	NS
A	<i>Calidris maritima</i>	Purple Sandpiper				S3?N	3 Sensitive	15	5.4 ± 0.0	NS
A	<i>Calcarius lapponicus</i>	Lapland Longspur				S3?N	4 Secure	2	96.9 ± 0.0	NB
A	<i>Falco sparverius</i>	American Kestrel				S3B	4 Secure	468	8.2 ± 0.0	NS
A	<i>Charadrius vociferus</i>	Killdeer				S3B	3 Sensitive	558	1.4 ± 0.0	NS
A	<i>Gallinago delicata</i>	Wilson's Snipe				S3B	3 Sensitive	582	3.6 ± 7.0	NS
A	<i>Sterna paradisaea</i>	Arctic Tern				S3B	2 May Be At Risk	48	56.8 ± 7.0	NS
A	<i>Coccyzus erythrophthalmus</i>	Black-billed Cuckoo				S3B	2 May Be At Risk	102	2.8 ± 0.0	NS
A	<i>Tyrannus tyrannus</i>	Eastern Kingbird				S3B	3 Sensitive	310	6.7 ± 7.0	NS
A	<i>Dumetella carolinensis</i>	Gray Catbird				S3B	2 May Be At Risk	347	3.6 ± 7.0	NS
A	<i>Wilsonia pusilla</i>	Wilson's Warbler				S3B	3 Sensitive	64	13.0 ± 7.0	NS
A	<i>Tringa melanoleuca</i>	Greater Yellowlegs				S3B,S3S4M	3 Sensitive	1263	3.8 ± 0.0	NS
A	<i>Oceanodroma leucorhoa</i>	Leach's Storm-Petrel				S3B,S5M	4 Secure	26	92.0 ± 7.0	NS
A	<i>Rissa tridactyla</i>	Black-legged Kittiwake				S3B,S5N	3 Sensitive	1	49.6 ± 0.0	NS
A	<i>Fratercula arctica</i>	Atlantic Puffin				S3B,S5N	3 Sensitive	2	92.0 ± 7.0	NS
A	<i>Pluvialis squatarola</i>	Black-bellied Plover				S3M	4 Secure	1155	2.8 ± 0.0	NS
A	<i>Tringa flavipes</i>	Lesser Yellowlegs				S3M	4 Secure	650	2.8 ± 0.0	NS
A	<i>Arenaria interpres</i>	Ruddy Turnstone				S3M	4 Secure	503	3.8 ± 0.0	NS
A	<i>Calidris pusilla</i>	Semipalmated Sandpiper				S3M	3 Sensitive	912	3.8 ± 0.0	NS
A	<i>Calidris fuscicollis</i>	White-rumped Sandpiper				S3M	4 Secure	203	5.4 ± 0.0	NS
A	<i>Limnodromus griseus</i>	Short-billed Dowitcher				S3M	4 Secure	515	3.8 ± 0.0	NS
A	<i>Calidris alba</i>	Sanderling				S3M,S2N	4 Secure	595	3.8 ± 0.0	NS
A	<i>Chroicocephalus ridibundus</i>	Black-headed Gull				S3N	4 Secure	4	92.4 ± 0.0	NB

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A	<i>Somateria mollissima</i>	Common Eider				S3S4	4 Secure	269	11.5 ± 9.0	NS
A	<i>Picoides arcticus</i>	Black-backed Woodpecker				S3S4	3 Sensitive	147	11.0 ± 7.0	NS
A	<i>Loxia curvirostra</i>	Red Crossbill				S3S4	4 Secure	92	6.7 ± 7.0	NS
A	<i>Sorex palustris</i>	American Water Shrew				S3S4	4 Secure	4	46.2 ± 0.0	PE
A	<i>Botaurus lentiginosus</i>	American Bittern				S3S4B	3 Sensitive	293	3.6 ± 7.0	NS
A	<i>Anas discors</i>	Blue-winged Teal				S3S4B	2 May Be At Risk	322	3.6 ± 7.0	NS
A	<i>Actitis macularius</i>	Spotted Sandpiper				S3S4B	3 Sensitive	682	3.6 ± 7.0	NS
A	<i>Empidonax flaviventris</i>	Yellow-bellied Flycatcher				S3S4B	3 Sensitive	558	3.6 ± 7.0	NS
A	<i>Regulus calendula</i>	Ruby-crowned Kinglet				S3S4B	3 Sensitive	1454	3.6 ± 7.0	NS
A	<i>Catharus fuscescens</i>	Veery				S3S4B	4 Secure	434	2.8 ± 0.0	NS
A	<i>Catharus ustulatus</i>	Swainson's Thrush				S3S4B	4 Secure	1221	3.6 ± 7.0	NS
A	<i>Vermivora peregrina</i>	Tennessee Warbler				S3S4B	3 Sensitive	288	9.5 ± 7.0	NS
A	<i>Dendroica castanea</i>	Bay-breasted Warbler				S3S4B	3 Sensitive	433	9.5 ± 7.0	NS
A	<i>Dendroica striata</i>	Blackpoll Warbler				S3S4B	3 Sensitive	84	9.5 ± 7.0	NS
A	<i>Passerella iliaca</i>	Fox Sparrow				S3S4B	4 Secure	56	1.8 ± 0.0	NS
A	<i>Mergus serrator</i>	Red-breasted Merganser				S3S4B,S5N	4 Secure	86	3.6 ± 7.0	NS
A	<i>Bucephala albeola</i>	Bufflehead				S3S4N	4 Secure	17	41.5 ± 9.0	NS
A	<i>Leucophaeus atricilla</i>	Laughing Gull				SHB	4 Secure	1	96.9 ± 0.0	NB
A	<i>Progne subis</i>	Purple Martin				SHB	2 May Be At Risk	5	88.9 ± 7.0	NS
A	<i>Eremophila alpestris</i>	Horned Lark				SHB,S4S5N	4 Secure	6	44.3 ± 7.0	PE
A	<i>Morus bassanus</i>	Northern Gannet				SHB,S5M	4 Secure	39	29.1 ± 13.0	PE
A	<i>Aythya americana</i>	Redhead				SHB,SNAM	4 Secure	1	100.0 ± 0.0	PE
I	<i>Danaus plexippus</i>	Monarch	Endangered	Special Concern	Endangered	S2B	3 Sensitive	29	14.4 ± 0.0	NS
I	<i>Barnea truncata</i>	Atlantic Mud-piddock	Threatened			S1	1 At Risk	1	91.6 ± 1.0	NS
I	<i>Alasmodonta varicosa</i>	Brook Floater	Special Concern		Threatened	S1S2	3 Sensitive	17	45.0 ± 0.0	NS
I	<i>Bombus terricola</i>	Yellow-banded Bumblebee	Special Concern		Vulnerable	S3	3 Sensitive	3	65.8 ± 0.0	PE
I	<i>Satyrium acadica</i>	Acadian Hairstreak				S1	5 Undetermined	10	3.2 ± 1.0	NS
I	<i>Erora laeta</i>	Early Hairstreak				S1	2 May Be At Risk	1	74.8 ± 0.0	PE
I	<i>Neurocordulia michaeli</i>	Broadtailed Shadowdragon				S1		26	47.5 ± 0.0	NS
I	<i>Strophitus undulatus</i>	Creeper				S1	2 May Be At Risk	6	93.2 ± 1.0	NS
I	<i>Polygonia satyrus</i>	Satyr Comma				S1?	3 Sensitive	6	60.5 ± 0.0	PE
I	<i>Nymphalis l-album</i>	Compton Tortoiseshell				S1S2	4 Secure	6	58.6 ± 1.0	NS
I	<i>Somatochlora kennedyi</i>	Kennedy's Emerald				S1S2	2 May Be At Risk	2	65.9 ± 1.0	PE
I	<i>Coenagrion resolutum</i>	Taiga Bluet				S1S2	2 May Be At Risk	51	31.9 ± 1.0	PE
I	<i>Stylurus scudderi</i>	Zebra Clubtail				S1S2	2 May Be At Risk	2	96.5 ± 0.0	NS
I	<i>Lycaena hyllus</i>	Bronze Copper				S2	4 Secure	10	28.8 ± 0.0	PE
I	<i>Lycaena dospassosi</i>	Salt Marsh Copper				S2	1 At Risk	51	5.4 ± 0.0	NS
I	<i>Satyrium calanus falacer</i>	Banded Hairstreak				S2	1 At Risk	2	67.5 ± 1.0	NS
I	<i>Boloria chariclea grandis</i>	Purple Lesser Fritillary				S2	3 Sensitive	2	51.7 ± 1.0	NS
I	<i>Aglais milberti milberti</i>	Milbert's Tortoise Shell				S2	4 Secure	14	62.7 ± 0.0	NS
I	<i>Epithea princeps</i>	Prince Baskettail				S2	3 Sensitive	9	64.7 ± 0.0	NS
I	<i>Somatochlora williamsoni</i>	Williamson's Emerald				S2	2 May Be At Risk	12	74.9 ± 0.0	PE
I	<i>Williamsonia fletcheri</i>	Ebony Boghaunter				S2	2 May Be At Risk	4	64.5 ± 0.0	NS
I	<i>Enallagma signatum</i>	Orange Bluet				S2	2 May Be At Risk	1	70.2 ± 0.0	NS
I	<i>Margaritifera margaritifera</i>	Eastern Pearlshell				S2	3 Sensitive	143	13.6 ± 0.0	NS
I	<i>Pantala hymenaea</i>	Spot-Winged Glider				S2?B	3 Sensitive	1	73.7 ± 1.0	NS
I	<i>Thorybes pylades</i>	Northern Cloudywing				S2S3	3 Sensitive	14	3.2 ± 1.0	NS
I	<i>Amblyscirtes hegou</i>	Pepper and Salt Skipper				S2S3	4 Secure	3	59.6 ± 0.0	NS
I	<i>Satyrium liparops strigosum</i>	Striped Hairstreak				S2S3	3 Sensitive	4	66.0 ± 1.0	NS
I	<i>Euphydryas phaeton</i>	Baltimore Checkerspot				S2S3	4 Secure	29	8.3 ± 1.0	NS
I	<i>Gomphus desertus</i>	Harpoon Clubtail				S2S3	3 Sensitive	4	74.5 ± 1.0	NS
I	<i>Ophiogomphus aspersus</i>	Brook Snaketail				S2S3	2 May Be At Risk	1	91.3 ± 0.0	NS
I	<i>Ophiogomphus mainensis</i>	Maine Snaketail				S2S3	2 May Be At Risk	14	45.3 ± 0.0	NS
I	<i>Ophiogomphus rupinsulensis</i>	Rusty Snaketail				S2S3	2 May Be At Risk	38	52.8 ± 0.0	NS
I	<i>Somatochlora forcipata</i>	Forcipate Emerald				S2S3	2 May Be At Risk	3	60.7 ± 1.0	PE
I	<i>Somatochlora franklini</i>	Delicate Emerald				S2S3	3 Sensitive	6	60.5 ± 0.0	PE
I	<i>Alasmodonta undulata</i>	Triangle Floater				S2S3	4 Secure	15	58.0 ± 1.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
I	<i>Callophrys henrici</i>	Henry's Elfin				S3	4 Secure	3	60.7 ± 0.0	NS
I	<i>Callophrys lanoraieensis</i>	Bog Elfin				S3	2 May Be At Risk	4	52.7 ± 0.0	NS
I	<i>Speyeria aphrodite</i>	Aphrodite Fritillary				S3	4 Secure	12	19.2 ± 100.0	NS
I	<i>Polygonia faunus</i>	Green Comma				S3	4 Secure	15	37.7 ± 0.0	NS
I	<i>Megisto cymela</i>	Little Wood-satyr				S3	4 Secure	9	66.5 ± 0.0	PE
I	<i>Oeneis jutta</i>	Jutta Arctic				S3	2 May Be At Risk	7	32.6 ± 0.0	PE
I	<i>Aeshna clepsydra</i>	Mottled Darner				S3	4 Secure	3	89.4 ± 1.0	NS
I	<i>Aeshna constricta</i>	Lance-Tipped Darner				S3	4 Secure	26	4.6 ± 1.0	NS
I	<i>Boyeria grafiana</i>	Ocellated Darner				S3	3 Sensitive	11	59.2 ± 0.0	NS
I	<i>Gomphaeschna furcillata</i>	Harlequin Darner				S3	3 Sensitive	1	60.8 ± 0.0	PE
I	<i>Somatochlora tenebrosa</i>	Clamp-Tipped Emerald				S3	4 Secure	1	83.9 ± 1.0	PE
I	<i>Sympetrum danae</i>	Black Meadowhawk				S3	3 Sensitive	9	60.6 ± 1.0	PE
I	<i>Enallagma vernale</i>	Vernal Bluet				S3	5 Undetermined	3	60.5 ± 0.0	PE
I	<i>Amphiagron saucium</i>	Eastern Red Damsel				S3	4 Secure	2	43.1 ± 0.0	NS
I	<i>Polygonia interrogationis</i>	Question Mark				S3B	4 Secure	46	3.2 ± 1.0	NS
I	<i>Erynnis juvenalis</i>	Juvenal's Duskywing				S3S4	4 Secure	2	58.3 ± 1.0	NS
I	<i>Amblyscirtes vialis</i>	Common Roadside-Skipper				S3S4	4 Secure	4	3.2 ± 1.0	NS
I	<i>Polygonia progne</i>	Grey Comma				S3S4	4 Secure	22	7.0 ± 1.0	NS
I	<i>Lanthus parvulus</i>	Northern Pygmy Clubtail				S3S4	4 Secure	14	43.8 ± 1.0	NS
I	<i>Lampsilis radiata</i>	Eastern Lampmussel				S3S4	3 Sensitive	56	23.2 ± 0.0	NS
N	<i>Erioderma pedicellatum</i> (Atlantic pop.)	Boreal Felt Lichen - Atlantic pop.	Endangered	Endangered	Endangered	S1	1 At Risk	433	60.1 ± 0.0	NS
N	<i>Erioderma mollissimum</i>	Graceful Felt Lichen	Endangered		Endangered	S1S2	2 May Be At Risk	14	80.5 ± 0.0	NS
N	<i>Peltigera hydrothyria</i>	Eastern Waterfan	Threatened		Threatened	S1	2 May Be At Risk	2	72.6 ± 0.0	NS
N	<i>Pannaria lurida</i>	Veined Shingle Lichen	Threatened		Threatened	S1S2	2 May Be At Risk	11	94.5 ± 0.0	NS
N	<i>Anzia colpodes</i>	Black-foam Lichen	Threatened		Threatened	S3	3 Sensitive	2	85.2 ± 0.0	NS
N	<i>Sclerophora peronella</i> (Nova Scotia pop.)	Frosted Glass-whiskers Lichen - Nova Scotia pop.	Special Concern	Special Concern		S1?		11	71.4 ± 0.0	NS
N	<i>Degelia plumbea</i>	BluDegelia plumbeae Felt Lichen	Special Concern	Special Concern	Vulnerable	S3	4 Secure	49	36.9 ± 0.0	NS
N	<i>Pseudevernia cladonia</i>	Ghost Antler Lichen	Not At Risk			S2S3	3 Sensitive	1	81.2 ± 0.0	NS
N	<i>Cladonia brevis</i>	Short Peg Lichen				S1		1	89.5 ± 4.0	PE
N	<i>Aloina rigida</i>	Aloe-Like Rigid Screw Moss				S1?	2 May Be At Risk	1	67.2 ± 0.0	NS
N	<i>Brachythecium erythrorrhizon</i>	Taiga Ragged Moss				S1?		2	83.3 ± 0.0	PE
N	<i>Campylostelium saxicola</i>	a Moss				S1?	3 Sensitive	3	74.5 ± 0.0	PE
N	<i>Tortula obtusifolia</i>	a Moss				S1?	5 Undetermined	2	57.2 ± 2.0	NS
N	<i>Parmeliella parvula</i>	Poor-man's Shingles Lichen				S1?	2 May Be At Risk	1	98.6 ± 0.0	NS
N	<i>Tetradontium brownianum</i>	Little Georgia				S1S2	3 Sensitive	1	88.2 ± 0.0	PE
N	<i>Timmia megapolitana</i>	Metropolitan Timmia Moss				S1S2	3 Sensitive	1	68.0 ± 0.0	NS
N	<i>Cyrtio-hypnum minutulum</i>	Tiny Cedar Moss				S1S2	3 Sensitive	1	61.0 ± 0.0	NS
N	<i>Bryohaplocladium microphyllum</i>	Tiny-leaved Haplocladium Moss				S1S2		1	76.3 ± 5.0	NS
N	<i>Anomodon viticulosus</i>	a Moss				S2?	3 Sensitive	1	66.5 ± 5.0	NS
N	<i>Atrichum angustatum</i>	Lesser Smoothcap Moss				S2?	3 Sensitive	3	51.4 ± 2.0	NS
N	<i>Campyllum polygamum</i>	a Moss				S2?	5 Undetermined	1	78.9 ± 0.0	PE
N	<i>Dicranum condensatum</i>	Condensed Broom Moss				S2?	5 Undetermined	1	87.7 ± 0.0	PE
N	<i>Ditrichum rhynchostegium</i>	a Moss				S2?	3 Sensitive	1	36.3 ± 0.0	PE
N	<i>Philonotis marchica</i>	a Moss				S2?	5 Undetermined	2	50.3 ± 0.0	NS
N	<i>Saelania glaucescens</i>	Blue Dew Moss				S2?	3 Sensitive	1	44.1 ± 0.0	NS
N	<i>Cyrtomnium hymenophylloides</i>	Short-pointed Lantern Moss				S2?	3 Sensitive	1	44.1 ± 0.0	NS
N	<i>Leptogium teretiusculum</i>	Beaded Jellyskin Lichen				S2?	3 Sensitive	2	32.3 ± 0.0	NS
N	<i>Peltigera collina</i>	Tree Pelt Lichen				S2?	3 Sensitive	3	75.1 ± 5.0	NS
N	<i>Ephemerum serratum</i>	a Moss				S2S3	3 Sensitive	1	17.0 ± 3.0	NS
N	<i>Eurhynchium hians</i>	Light Beaked Moss				S2S3	3 Sensitive	1	87.0 ± 25.0	NS
N	<i>Platydictya subtilis</i>	Bark Willow Moss				S2S3	3 Sensitive	2	74.5 ± 0.0	PE
N	<i>Tortula truncata</i>	a Moss				S2S3	3 Sensitive	1	72.5 ± 300.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
N	<i>Usnocetraria oakesiana</i>	Yellow Band Lichen				S2S3	2 May Be At Risk	1	85.7 ± 0.0	PE
N	<i>Fuscopannaria leucosticta</i>	Rimmed Shingles Lichen				S2S3	2 May Be At Risk	5	72.9 ± 0.0	NS
N	<i>Leptogium tenuissimum</i>	Birdnest Jellyskin Lichen				S2S3	6 Not Assessed	1	95.1 ± 0.0	NS
N	<i>Parmeliopsis ambigua</i>	Green Starburst Lichen				S2S3	3 Sensitive	1	89.5 ± 4.0	PE
N	<i>Ramalina thrausta</i>	Angelhair Ramalina Lichen				S3	3 Sensitive	1	72.1 ± 0.0	PE
N	<i>Collema nigrescens</i>	Blistered Tarpaper Lichen				S3	3 Sensitive	6	72.2 ± 0.0	NS
N	<i>Sticta fuliginosa</i>	Peppered Moon Lichen				S3	3 Sensitive	12	29.5 ± 2.0	NS
N	<i>Leptogium subtile</i>	Appressed Jellyskin Lichen				S3	3 Sensitive	2	74.8 ± 0.0	NS
N	<i>Fuscopannaria ahlneri</i>	Corrugated Shingles Lichen				S3	4 Secure	33	60.5 ± 0.0	NS
N	<i>Heterodermia speciosa</i>	Powdered Fringe Lichen				S3	4 Secure	5	37.0 ± 0.0	NS
N	<i>Leptogium corticola</i>	Blistered Jellyskin Lichen				S3	3 Sensitive	25	60.5 ± 0.0	NS
N	<i>Nephroma bellum</i>	Naked Kidney Lichen				S3	3 Sensitive	2	45.7 ± 0.0	NS
N	<i>Moelleropsis nebulosa</i>	Blue-gray Moss Shingle Lichen				S3	4 Secure	37	70.7 ± 0.0	NS
N	<i>Calliergon giganteum</i>	Giant Spear Moss				S3?	3 Sensitive	1	64.4 ± 2.0	PE
N	<i>Helodium blandowii</i>	Wetland-plume Moss				S3?	4 Secure	1	24.2 ± 3.0	NS
N	<i>Cladina stygia</i>	Black-footed Reindeer Lichen				S3?	3 Sensitive	2	89.4 ± 0.0	NS
N	<i>Dicranum leioneuron</i>	a Dicranum Moss				S3S4	4 Secure	1	92.7 ± 1.0	PE
N	<i>Encalypta procera</i>	Slender Extinguisher Moss				S3S4	4 Secure	2	59.8 ± 0.0	NS
N	<i>Myurella julacea</i>	Small Mouse-tail Moss				S3S4	3 Sensitive	1	44.1 ± 0.0	NS
N	<i>Schistidium agassizii</i>	Elf Bloom Moss				S3S4	4 Secure	1	83.8 ± 3.0	NS
N	<i>Hypogymnia vittata</i>	Slender Monk's Hood Lichen				S3S4	4 Secure	51	79.1 ± 0.0	NS
N	<i>Leptogium acadense</i>	Acadian Jellyskin Lichen				S3S4		1	32.3 ± 0.0	NS
N	<i>Parmeliopsis hyperopta</i>	Gray Starburst Lichen				S3S4	5 Undetermined	2	21.2 ± 1.0	NS
N	<i>Physconia detorsa</i>	Bottlebrush Frost Lichen				S3S4	3 Sensitive	3	84.3 ± 0.0	PE
N	<i>Coccocarpia palmicola</i>	Salted Shell Lichen				S3S4	4 Secure	520	68.5 ± 0.0	NS
N	<i>Anaptychia palmulata</i>	Shaggy Fringed Lichen				S3S4	4 Secure	14	53.4 ± 0.0	NS
N	<i>Bryoria capillaris</i>	Gray Horsehair Lichen				S3S4	5 Undetermined	11	67.6 ± 0.0	PE
N	<i>Evernia prunastri</i>	Valley Oakmoss Lichen				S3S4	3 Sensitive	3	56.2 ± 0.0	PE
N	<i>Heterodermia neglecta</i>	Fringe Lichen				S3S4	4 Secure	15	73.4 ± 0.0	NS
P	<i>Bartonia paniculata</i> ssp. <i>paniculata</i>	Branched Bartonia	Threatened	Threatened		SNA		1	57.3 ± 10.0	NS
P	<i>Lilaeopsis chinensis</i>	Eastern Lilaeopsis	Special Concern	Special Concern	Vulnerable	S2	3 Sensitive	16	84.1 ± 0.0	NS
P	<i>Isoetes prototypus</i>	Prototype Quillwort	Special Concern	Special Concern	Vulnerable	S2	3 Sensitive	13	79.5 ± 0.0	NS
P	<i>Floerkea proserpinacoides</i>	False Mermaidweed	Not At Risk			S2	3 Sensitive	3	53.3 ± 7.0	NS
P	<i>Cypripedium arietinum</i>	Ram's-Head Lady's-Slipper			Endangered	S1	1 At Risk	8	64.3 ± 0.0	NS
P	<i>Thuja occidentalis</i>	Eastern White Cedar			Vulnerable	S1	1 At Risk	42	51.6 ± 7.0	NS
P	<i>Acer saccharinum</i>	Silver Maple				S1	5 Undetermined	1	91.0 ± 20.0	PE
P	<i>Sanicula odorata</i>	Clustered Sanicle				S1	2 May Be At Risk	4	11.0 ± 7.0	NS
P	<i>Zizia aurea</i>	Golden Alexanders				S1	2 May Be At Risk	43	41.8 ± 1.0	NS
P	<i>Antennaria parlinii</i>	a Pussytoes				S1	2 May Be At Risk	1	24.4 ± 0.0	NS
P	<i>Bidens hyperborea</i>	Estuary Beggarticks				S1	2 May Be At Risk	3	61.0 ± 1.0	NS
P	<i>Prenanthes racemosa</i>	Glaucous Rattlesnakeroot				S1	2 May Be At Risk	1	91.0 ± 20.0	PE
P	<i>Ageratina altissima</i>	White Snakeroot				S1	2 May Be At Risk	2	60.6 ± 1.0	NS
P	<i>Barbarea orthoceras</i>	American Yellow Rocket				S1	2 May Be At Risk	5	61.5 ± 0.0	NS
P	<i>Cochlearia tridactylites</i>	Limestone Scurvy-grass				S1	2 May Be At Risk	1	97.8 ± 0.0	NS
P	<i>Lobelia spicata</i>	Pale-Spiked Lobelia				S1	2 May Be At Risk	6	60.3 ± 7.0	NS
P	<i>Stellaria crassifolia</i>	Fleshy Stitchwort				S1	2 May Be At Risk	2	78.9 ± 5.0	PE
P	<i>Suaeda maritima</i> ssp. <i>richii</i>	White Sea-blite				S1	5 Undetermined	3	61.3 ± 7.0	NS
P	<i>Hudsonia tomentosa</i>	Woolly Beach-heath				S1	2 May Be At Risk	54	13.0 ± 7.0	NS
P	<i>Elatine americana</i>	American Waterwort				S1	2 May Be At Risk	1	91.3 ± 0.0	NS
P	<i>Desmodium canadense</i>	Canada Tick-trefoil				S1	2 May Be At Risk	20	19.4 ± 0.0	NS
P	<i>Ribes americanum</i>	Wild Black Currant				S1	5 Undetermined	2	59.3 ± 5.0	NS
P	<i>Fraxinus pennsylvanica</i>	Red Ash				S1	2 May Be At Risk	3	53.9 ± 0.0	PE
P	<i>Polygonum careyi</i>	Carey's Smartweed				S1	5 Undetermined	1	71.8 ± 3.0	NS
P	<i>Ranunculus pensylvanicus</i>	Pennsylvania Buttercup				S1	2 May Be At Risk	25	69.9 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
P	<i>Salix myrtillofolia</i>	Blueberry Willow				S1	2 May Be At Risk	1	87.1 ± 0.0	NS
P	<i>Salix serissima</i>	Autumn Willow				S1	2 May Be At Risk	2	87.1 ± 0.0	NS
P	<i>Agalinis paupercula</i> var. <i>borealis</i>	Small-flowered Agalinis				S1		1	12.0 ± 0.0	NS
P	<i>Scrophularia lanceolata</i>	Lance-leaved Figwort				S1	5 Undetermined	1	97.9 ± 1.0	NS
P	<i>Dirca palustris</i>	Eastern Leatherwood				S1	2 May Be At Risk	5	88.8 ± 7.0	NS
P	<i>Boehmeria cylindrica</i>	Small-spike False-nettle				S1	2 May Be At Risk	2	98.6 ± 0.0	NS
P	<i>Pilea pumila</i>	Dwarf Clearweed				S1	2 May Be At Risk	25	25.5 ± 6.0	NS
P	<i>Carex alopecoidea</i>	Foxtail Sedge				S1	2 May Be At Risk	2	71.2 ± 0.0	NS
P	<i>Carex chordorrhiza</i>	Creeping Sedge				S1	2 May Be At Risk	1	78.2 ± 1.0	PE
P	<i>Carex garberi</i>	Garber's Sedge				S1	2 May Be At Risk	4	42.8 ± 0.0	NS
P	<i>Carex gynocrates</i>	Northern Bog Sedge				S1	2 May Be At Risk	2	87.1 ± 0.0	NS
P	<i>Carex haydenii</i>	Hayden's Sedge				S1	2 May Be At Risk	3	40.1 ± 5.0	NS
P	<i>Carex pellita</i>	Woolly Sedge				S1	2 May Be At Risk	12	19.3 ± 0.0	NS
P	<i>Carex plantaginea</i>	Plantain-Leaved Sedge				S1	2 May Be At Risk	3	47.0 ± 0.0	NS
P	<i>Carex prairea</i>	Prairie Sedge				S1	2 May Be At Risk	1	74.8 ± 0.0	PE
P	<i>Carex tinctoria</i>	Tinged Sedge				S1	2 May Be At Risk	3	71.2 ± 1.0	NS
P	<i>Carex grisea</i>	Inflated Narrow-leaved Sedge				S1	2 May Be At Risk	6	61.8 ± 0.0	NS
P	<i>Cyperus lupulinus</i>	Hop Flatsedge				S1	2 May Be At Risk	5	69.7 ± 0.0	NS
P	<i>Cyperus lupulinus</i> ssp. <i>macilentus</i>	Hop Flatsedge				S1	2 May Be At Risk	10	3.3 ± 0.0	NS
P	<i>Blysmus rufus</i>	Red Bulrush				S1	2 May Be At Risk	3	87.4 ± 5.0	PE
P	<i>Iris prismatica</i>	Slender Blue Flag				S1	2 May Be At Risk	2	66.1 ± 1.0	NS
P	<i>Juncus vaseyi</i>	Vasey Rush				S1	2 May Be At Risk	3	47.5 ± 0.0	NS
P	<i>Allium tricoccum</i>	Wild Leek				S1	2 May Be At Risk	8	39.0 ± 0.0	NS
P	<i>Malaxis brachypoda</i>	White Adder's-Mouth				S1	2 May Be At Risk	2	83.8 ± 0.0	PE
P	<i>Bromus latiglumis</i>	Broad-Glumed Brome				S1	2 May Be At Risk	31	50.1 ± 0.0	NS
P	<i>Elymus wiegandii</i>	Wiegand's Wild Rye				S1	2 May Be At Risk	21	14.8 ± 1.0	NS
P	<i>Elymus hystrix</i> var. <i>bigeloviana</i>	Spreading Wild Rye				S1	2 May Be At Risk	4	32.4 ± 1.0	NS
P	<i>Potamogeton nodosus</i>	Long-leaved Pondweed				S1	2 May Be At Risk	1	95.6 ± 5.0	NS
P	<i>Adiantum pedatum</i>	Northern Maidenhair Fern				S1	2 May Be At Risk	1	60.4 ± 1.0	NS
P	<i>Solidago hispida</i>	Hairy Goldenrod				S1?	2 May Be At Risk	1	57.7 ± 7.0	NS
P	<i>Crataegus robinsonii</i>	Robinson's Hawthorn				S1?	5 Undetermined	3	7.7 ± 1.0	NS
P	<i>Carex pennsylvanica</i>	Pennsylvania Sedge				S1?	2 May Be At Risk	1	77.7 ± 0.0	NS
P	<i>Carex rostrata</i>	Narrow-leaved Beaked Sedge				S1?	2 May Be At Risk	1	79.6 ± 5.0	PE
P	<i>Schoenoplectus robustus</i>	Sturdy Bulrush				S1?	5 Undetermined	2	60.3 ± 7.0	NS
P	<i>Dichanthelium acuminatum</i> var. <i>lindheimeri</i>	Woolly Panic Grass				S1?	5 Undetermined	1	16.4 ± 0.0	NS
P	<i>Fraxinus nigra</i>	Black Ash			Threatened	S1S2	1 At Risk	168	7.1 ± 0.0	NS
P	<i>Rudbeckia laciniata</i>	Cut-Leaved Coneflower				S1S2	2 May Be At Risk	24	39.1 ± 0.0	NS
P	<i>Proserpinaca intermedia</i>	Intermediate Mermaidweed				S1S2	2 May Be At Risk	1	92.0 ± 0.0	NS
P	<i>Anemone virginiana</i> var. <i>alba</i>	Virginia Anemone				S1S2	3 Sensitive	5	50.9 ± 5.0	NS
P	<i>Hepatica nobilis</i> var. <i>obtusata</i>	Round-lobed Hepatica				S1S2	2 May Be At Risk	23	26.1 ± 0.0	NS
P	<i>Parnassia palustris</i> var. <i>parviflora</i>	Marsh Grass-of-Parnassus				S1S2	2 May Be At Risk	1	41.5 ± 1.0	NS
P	<i>Gratiola neglecta</i>	Clammy Hedge-Hyssop				S1S2	3 Sensitive	5	63.9 ± 0.0	NS
P	<i>Carex livida</i> var. <i>radiculis</i>	Livid Sedge				S1S2	2 May Be At Risk	12	67.4 ± 0.0	NS
P	<i>Juncus greenii</i>	Greene's Rush				S1S2	2 May Be At Risk	4	69.2 ± 1.0	NS
P	<i>Juncus alpinoarticulatus</i> ssp. <i>nodulosus</i>	Richardson's Rush				S1S2	2 May Be At Risk	6	82.1 ± 3.0	PE
P	<i>Platanthera huronensis</i>	Fragrant Green Orchid				S1S2	5 Undetermined	3	44.4 ± 10.0	NS
P	<i>Calamagrostis stricta</i> ssp. <i>stricta</i>	Slim-stemmed Reed Grass				S1S2	3 Sensitive	1	88.4 ± 2.0	PE
P	<i>Cinna arundinacea</i>	Sweet Wood Reed Grass				S1S2	2 May Be At Risk	19	60.3 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
P	<i>Festuca subverticillata</i>	Nodding Fescue				S1S2	2 May Be At Risk	3	89.3 ± 1.0	NS
P	<i>Cryptogramma stelleri</i>	Steller's Rockbrake				S1S2	2 May Be At Risk	1	100.0 ± 0.0	NS
P	<i>Carex vacillans</i>	Estuarine Sedge				S1S3	5 Undetermined	2	71.2 ± 0.0	NS
P	<i>Conioselinum chinense</i>	Chinese Hemlock-parsley				S2	3 Sensitive	1	25.1 ± 5.0	NS
P	<i>Osmorhiza longistylis</i>	Smooth Sweet Cicely				S2	2 May Be At Risk	20	17.3 ± 0.0	NS
P	<i>Erigeron philadelphicus</i>	Philadelphia Fleabane				S2	3 Sensitive	4	51.6 ± 7.0	NS
P	<i>Lactuca hirsuta</i> var. <i>sanguinea</i>	Hairy Lettuce				S2	3 Sensitive	2	65.9 ± 5.0	PE
P	<i>Symphotrichum ciliolatum</i>	Fringed Blue Aster				S2	3 Sensitive	18	20.4 ± 0.0	NS
P	<i>Impatiens pallida</i>	Pale Jewelweed				S2	3 Sensitive	2	61.3 ± 7.0	NS
P	<i>Caulophyllum thalictroides</i>	Blue Cohosh				S2	2 May Be At Risk	48	13.6 ± 1.0	NS
P	<i>Arabis drummondii</i>	Drummond's Rockcress				S2	3 Sensitive	6	48.4 ± 0.0	NS
P	<i>Stellaria humifusa</i>	Saltmarsh Starwort				S2	3 Sensitive	8	65.2 ± 1.0	PE
P	<i>Stellaria longifolia</i>	Long-leaved Starwort				S2	3 Sensitive	11	33.5 ± 0.0	NS
P	<i>Chenopodium rubrum</i>	Red Pigweed				S2	2 May Be At Risk	7	3.6 ± 0.0	NS
P	<i>Hudsonia ericoides</i>	Pinebarren Golden Heather				S2	3 Sensitive	12	82.1 ± 25.0	PE
P	<i>Hypericum majus</i>	Large St John's-wort				S2	3 Sensitive	6	75.0 ± 0.0	PE
P	<i>Crassula aquatica</i>	Water Pygmyweed				S2	3 Sensitive	6	74.5 ± 5.0	PE
P	<i>Myriophyllum farwellii</i>	Farwell's Water Milfoil				S2	3 Sensitive	10	44.3 ± 1.0	NS
P	<i>Myriophyllum verticillatum</i>	Whorled Water Milfoil				S2	3 Sensitive	1	59.7 ± 0.0	NS
P	<i>Oenothera fruticosa</i> ssp. <i>glauca</i>	Narrow-leaved Evening Primrose				S2	5 Undetermined	3	3.6 ± 7.0	NS
P	<i>Polygonum arifolium</i>	Halberd-leaved Tearthumb				S2	3 Sensitive	16	29.3 ± 1.0	PE
P	<i>Rumex salicifolius</i> var. <i>mexicanus</i>	Triangular-valve Dock				S2	3 Sensitive	4	74.8 ± 0.0	NS
P	<i>Primula mistassinica</i>	Mistassini Primrose				S2	3 Sensitive	16	50.1 ± 0.0	NS
P	<i>Anemone canadensis</i>	Canada Anemone				S2	2 May Be At Risk	2	88.0 ± 1.0	NS
P	<i>Anemone quinquefolia</i>	Wood Anemone				S2	3 Sensitive	17	58.7 ± 0.0	NS
P	<i>Anemone virginiana</i>	Virginia Anemone				S2	3 Sensitive	21	20.8 ± 1.0	NS
P	<i>Anemone virginiana</i> var. <i>virginiana</i>	Virginia Anemone				S2	3 Sensitive	1	67.5 ± 7.0	NS
P	<i>Caltha palustris</i>	Yellow Marsh Marigold				S2	3 Sensitive	36	19.3 ± 0.0	NS
P	<i>Galium boreale</i>	Northern Bedstraw				S2	2 May Be At Risk	2	78.6 ± 5.0	NS
P	<i>Galium labradoricum</i>	Labrador Bedstraw				S2	3 Sensitive	96	58.5 ± 0.0	NS
P	<i>Salix pedicellaris</i>	Bog Willow				S2	3 Sensitive	46	3.6 ± 7.0	NS
P	<i>Comandra umbellata</i>	Bastard's Toadflax				S2	2 May Be At Risk	42	67.4 ± 5.0	NS
P	<i>Tiarella cordifolia</i>	Heart-leaved Foamflower				S2	3 Sensitive	217	29.6 ± 7.0	NS
P	<i>Viola nephrophylla</i>	Northern Bog Violet				S2	3 Sensitive	9	21.3 ± 0.0	NS
P	<i>Carex bebbii</i>	Bebb's Sedge				S2	3 Sensitive	20	32.8 ± 0.0	PE
P	<i>Carex castanea</i>	Chestnut Sedge				S2	2 May Be At Risk	22	86.7 ± 0.0	NS
P	<i>Carex comosa</i>	Bearded Sedge				S2	3 Sensitive	3	50.5 ± 0.0	PE
P	<i>Carex hystericina</i>	Porcupine Sedge				S2	2 May Be At Risk	5	27.3 ± 0.0	NS
P	<i>Carex tenera</i>	Tender Sedge				S2	3 Sensitive	8	24.2 ± 1.0	NS
P	<i>Carex tuckermanii</i>	Tuckerman's Sedge				S2	3 Sensitive	6	15.3 ± 0.0	NS
P	<i>Eleocharis quinqueflora</i>	Few-flowered Spikerush				S2	3 Sensitive	1	82.9 ± 3.0	PE
P	<i>Vallisneria americana</i>	Wild Celery				S2	2 May Be At Risk	2	72.9 ± 1.0	NS
P	<i>Allium schoenoprasum</i>	Wild Chives				S2	2 May Be At Risk	1	95.8 ± 0.0	PE
P	<i>Allium schoenoprasum</i> var. <i>sibiricum</i>	Wild Chives				S2	2 May Be At Risk	1	61.0 ± 7.0	NS
P	<i>Lilium canadense</i>	Canada Lily				S2	2 May Be At Risk	85	6.7 ± 7.0	NS
P	<i>Cypripedium parviflorum</i> var. <i>pubescens</i>	Yellow Lady's-slipper				S2	3 Sensitive	7	9.5 ± 7.0	NS
P	<i>Cypripedium reginae</i>	Showy Lady's-Slipper				S2	2 May Be At Risk	74	9.8 ± 0.0	NS
P	<i>Goodyera pubescens</i>	Downy Rattlesnake-Plantain				S2	3 Sensitive	1	93.9 ± 1.0	NS
P	<i>Platanthera flava</i> var. <i>herbiola</i>	Pale Green Orchid				S2	5 Undetermined	8	27.4 ± 0.0	NS
P	<i>Platanthera macrophylla</i>	Large Round-Leaved Orchid				S2	3 Sensitive	12	27.3 ± 5.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
P	<i>Spiranthes lucida</i>	Shining Ladies'-Tresses				S2	2 May Be At Risk	21	18.9 ± 1.0	NS
P	<i>Calamagrostis stricta</i>	Slim-stemmed Reed Grass				S2	3 Sensitive	16	60.8 ± 0.0	PE
P	<i>Dichanthelium linearifolium</i>	Narrow-leaved Panic Grass				S2	3 Sensitive	4	16.6 ± 7.0	NS
P	<i>Piptatherum canadense</i>	Canada Rice Grass				S2	3 Sensitive	6	65.9 ± 1.0	NS
P	<i>Potamogeton friesii</i>	Fries' Pondweed				S2	2 May Be At Risk	23	34.0 ± 0.0	PE
P	<i>Potamogeton richardsonii</i>	Richardson's Pondweed				S2	2 May Be At Risk	5	6.8 ± 0.0	NS
P	<i>Dryopteris fragrans</i> var. <i>remotiuscula</i>	Fragrant Wood Fern				S2	3 Sensitive	4	47.0 ± 7.0	NS
P	<i>Woodsia glabella</i>	Smooth Cliff Fern				S2	3 Sensitive	1	75.7 ± 1.0	NS
P	<i>Symphyotrichum boreale</i>	Boreal Aster				S2?	3 Sensitive	24	61.0 ± 7.0	NS
P	<i>Cuscuta cephalanthi</i>	Buttonbush Dodder				S2?	5 Undetermined	5	7.5 ± 1.0	NS
P	<i>Epilobium coloratum</i>	Purple-veined Willowherb				S2?	3 Sensitive	3	10.6 ± 1.0	NS
P	<i>Rumex maritimus</i> var. <i>persicarioides</i>	Peach-leaved Dock				S2?	2 May Be At Risk	6	62.9 ± 5.0	PE
P	<i>Crataegus submollis</i>	Quebec Hawthorn				S2?	5 Undetermined	4	31.9 ± 7.0	NS
P	<i>Carex peckii</i>	White-Tinged Sedge				S2?	2 May Be At Risk	3	55.1 ± 0.0	NS
P	<i>Eleocharis ovata</i>	Ovate Spikerush				S2?	3 Sensitive	6	37.8 ± 0.0	NS
P	<i>Scirpus pedicellatus</i>	Stalked Bulrush				S2?	3 Sensitive	9	60.2 ± 0.0	NS
P	<i>Potamogeton pulcher</i>	Spotted Pondweed			Vulnerable	S2S3	3 Sensitive	3	67.5 ± 2.0	NS
P	<i>Hieracium robinsonii</i>	Robinson's Hawkweed				S2S3	3 Sensitive	3	33.0 ± 7.0	NS
P	<i>Senecio pseudoarnica</i>	Seabeach Ragwort				S2S3	3 Sensitive	2	61.0 ± 7.0	NS
P	<i>Betula michauxii</i>	Michaux's Dwarf Birch				S2S3	3 Sensitive	15	72.0 ± 0.0	NS
P	<i>Sagina nodosa</i>	Knotted Pearlwort				S2S3	4 Secure	3	80.6 ± 0.0	PE
P	<i>Sagina nodosa</i> ssp. <i>borealis</i>	Knotted Pearlwort				S2S3	4 Secure	5	81.0 ± 5.0	PE
P	<i>Ceratophyllum echinatum</i>	Prickly Hornwort				S2S3	3 Sensitive	8	60.2 ± 0.0	NS
P	<i>Hypericum dissimulatum</i>	Disguised St John's-wort				S2S3	3 Sensitive	2	80.0 ± 1.0	NS
P	<i>Triosteum aurantiacum</i>	Orange-fruited Tinker's Weed				S2S3	3 Sensitive	75	13.6 ± 1.0	NS
P	<i>Shepherdia canadensis</i>	Soapberry				S2S3	3 Sensitive	2	97.0 ± 0.0	NS
P	<i>Empetrum eamesii</i> ssp. <i>atropurpureum</i>	Pink Crowberry				S2S3	3 Sensitive	6	82.4 ± 5.0	PE
P	<i>Empetrum eamesii</i> ssp. <i>eamesii</i>	Pink Crowberry				S2S3	3 Sensitive	2	66.0 ± 5.0	PE
P	<i>Chamaesyce polygonifolia</i>	Seaside Spurge				S2S3	3 Sensitive	14	25.9 ± 2.0	NS
P	<i>Halenia deflexa</i>	Spurred Gentian				S2S3	3 Sensitive	2	82.7 ± 1.0	NS
P	<i>Hedeoma pulegioides</i>	American False Pennyroyal				S2S3	3 Sensitive	6	13.3 ± 5.0	NS
P	<i>Polygonum buxiforme</i>	Small's Knotweed				S2S3	5 Undetermined	3	12.1 ± 0.0	NS
P	<i>Polygonum raii</i>	Sharp-fruited Knotweed				S2S3	5 Undetermined	8	81.7 ± 5.0	PE
P	<i>Amelanchier fernaldii</i>	Fernald's Serviceberry				S2S3	5 Undetermined	4	82.0 ± 0.0	PE
P	<i>Potentilla canadensis</i>	Canada Cinquefoil				S2S3	3 Sensitive	1	79.1 ± 5.0	NS
P	<i>Galium aparine</i>	Common Bedstraw				S2S3	3 Sensitive	5	22.1 ± 4.0	NS
P	<i>Salix pellita</i>	Satiny Willow				S2S3	3 Sensitive	5	63.8 ± 0.0	NS
P	<i>Veronica serpyllifolia</i> ssp. <i>humifusa</i>	Thyme-Leaved Speedwell				S2S3	3 Sensitive	1	55.9 ± 0.0	NS
P	<i>Carex adusta</i>	Lesser Brown Sedge				S2S3	3 Sensitive	6	59.7 ± 0.0	NS
P	<i>Carex hirtifolia</i>	Pubescent Sedge				S2S3	3 Sensitive	43	15.9 ± 0.0	NS
P	<i>Carex houghtoniana</i>	Houghton's Sedge				S2S3	3 Sensitive	4	74.6 ± 1.0	NS
P	<i>Eleocharis olivacea</i>	Yellow Spikerush				S2S3	3 Sensitive	7	56.0 ± 5.0	NS
P	<i>Eriophorum gracile</i>	Slender Cottongrass				S2S3	3 Sensitive	12	59.1 ± 10.0	NS
P	<i>Coeloglossum viride</i> var. <i>virescens</i>	Long-bracted Frog Orchid				S2S3	2 May Be At Risk	1	84.0 ± 0.0	NS
P	<i>Cypripedium parviflorum</i>	Yellow Lady's-slipper				S2S3	3 Sensitive	20	9.9 ± 0.0	NS
P	<i>Stuckenia filiformis</i>	Thread-leaved Pondweed				S2S3	3 Sensitive	4	67.1 ± 0.0	PE
P	<i>Stuckenia filiformis</i> ssp. <i>alpina</i>	Thread-leaved Pondweed				S2S3	3 Sensitive	4	78.2 ± 1.0	PE
P	<i>Botrychium lanceolatum</i> var. <i>angustisegmentum</i>	Lance-Leaf Grape-Fern				S2S3	3 Sensitive	12	19.3 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
P	<i>Botrychium simplex</i>	Least Moonwort				S2S3	3 Sensitive	3	23.5 ± 0.0	NS
P	<i>Ophioglossum pusillum</i>	Northern Adder's-tongue				S2S3	3 Sensitive	7	30.7 ± 0.0	NS
P	<i>Angelica atropurpurea</i>	Purple-stemmed Angelica				S3	4 Secure	8	31.5 ± 1.0	PE
P	<i>Erigeron hyssopifolius</i>	Hyssop-leaved Fleabane				S3	3 Sensitive	19	49.0 ± 0.0	NS
P	<i>Hieracium paniculatum</i>	Panicled Hawkweed				S3	4 Secure	6	30.9 ± 0.0	NS
P	<i>Megalodonta beckii</i>	Water Beggarticks				S3	4 Secure	10	29.5 ± 0.0	NS
P	<i>Packera paupercula</i>	Balsam Groundsel				S3	4 Secure	52	19.6 ± 0.0	NS
P	<i>Betula pumila</i>	Bog Birch				S3	3 Sensitive	21	59.6 ± 0.0	PE
P	<i>Campanula aparinoides</i>	Marsh Bellflower				S3	3 Sensitive	32	15.3 ± 0.0	NS
P	<i>Viburnum edule</i>	Squashberry				S3	3 Sensitive	2	26.0 ± 0.0	NS
P	<i>Empetrum eamesii</i>	Pink Crowberry				S3	3 Sensitive	13	82.0 ± 0.0	PE
P	<i>Vaccinium boreale</i>	Northern Blueberry				S3	3 Sensitive	2	93.5 ± 1.0	NS
P	<i>Vaccinium caespitosum</i>	Dwarf Bilberry				S3	4 Secure	53	44.2 ± 0.0	NS
P	<i>Geranium bicknellii</i>	Bicknell's Crane's-bill				S3	4 Secure	3	64.5 ± 2.0	NS
P	<i>Proserpinaca palustris</i>	Marsh Mermaidweed				S3	4 Secure	14	59.8 ± 0.0	NS
P	<i>Proserpinaca palustris</i> var. <i>crebra</i>	Marsh Mermaidweed				S3	4 Secure	14	58.4 ± 0.0	NS
P	<i>Proserpinaca pectinata</i>	Comb-leaved Mermaidweed				S3	4 Secure	2	51.8 ± 1.0	NS
P	<i>Teucrium canadense</i>	Canada Germander				S3	3 Sensitive	22	3.2 ± 5.0	NS
P	<i>Decodon verticillatus</i>	Swamp Loosestrife				S3	4 Secure	1	78.7 ± 0.0	PE
P	<i>Epilobium strictum</i>	Downy Willowherb				S3	3 Sensitive	30	58.9 ± 5.0	NS
P	<i>Polygala sanguinea</i>	Blood Milkwort				S3	3 Sensitive	13	13.4 ± 1.0	NS
P	<i>Polygonum pensylvanicum</i>	Pennsylvania Smartweed				S3	4 Secure	13	15.1 ± 0.0	NS
P	<i>Polygonum scandens</i>	Climbing False Buckwheat				S3	3 Sensitive	45	15.8 ± 0.0	NS
P	<i>Plantago rugelii</i>	Rugel's Plantain				S3	4 Secure	5	16.4 ± 0.0	NS
P	<i>Samolus valerandi</i> ssp. <i>parviflorus</i>	Seaside Brookweed				S3	3 Sensitive	17	56.7 ± 1.0	NS
P	<i>Pyrola asarifolia</i>	Pink Pyrola				S3	4 Secure	16	43.7 ± 0.0	NS
P	<i>Pyrola minor</i>	Lesser Pyrola				S3	3 Sensitive	2	30.6 ± 0.0	NS
P	<i>Ranunculus gmelinii</i>	Gmelin's Water Buttercup				S3	4 Secure	64	29.4 ± 5.0	PE
P	<i>Rhamnus alnifolia</i>	Alder-leaved Buckthorn				S3	4 Secure	153	48.4 ± 5.0	PE
P	<i>Agrimonia gryposepala</i>	Hooked Agrimony				S3	4 Secure	110	19.5 ± 0.0	NS
P	<i>Amelanchier stolonifera</i>	Running Serviceberry				S3	4 Secure	14	12.2 ± 2.0	NS
P	<i>Geocaulon lividum</i>	Northern Comandra				S3	4 Secure	5	68.7 ± 0.0	NS
P	<i>Limosella australis</i>	Southern Mudwort				S3	4 Secure	44	34.8 ± 1.0	PE
P	<i>Lindernia dubia</i>	Yellow-seeded False Pimperel				S3	4 Secure	24	15.4 ± 0.0	NS
P	<i>Laportea canadensis</i>	Canada Wood Nettle				S3	3 Sensitive	38	16.8 ± 0.0	NS
P	<i>Verbena hastata</i>	Blue Vervain				S3	4 Secure	106	15.8 ± 0.0	NS
P	<i>Carex cryptolepis</i>	Hidden-scaled Sedge				S3	4 Secure	10	58.9 ± 10.0	NS
P	<i>Carex eburnea</i>	Bristle-leaved Sedge				S3	3 Sensitive	27	49.1 ± 0.0	NS
P	<i>Carex lupulina</i>	Hop Sedge				S3	4 Secure	25	15.1 ± 0.0	NS
P	<i>Carex rosea</i>	Rosy Sedge				S3	4 Secure	16	16.6 ± 0.0	NS
P	<i>Carex tribuloides</i>	Blunt Broom Sedge				S3	4 Secure	9	26.8 ± 2.0	NS
P	<i>Carex wiedgandii</i>	Wiegand's Sedge				S3	3 Sensitive	5	34.9 ± 5.0	PE
P	<i>Carex foenea</i>	Fernald's Hay Sedge				S3	4 Secure	15	35.1 ± 0.0	NS
P	<i>Elodea canadensis</i>	Canada Waterweed				S3	4 Secure	6	37.8 ± 0.0	NS
P	<i>Juncus subcaudatus</i> var. <i>planisepalus</i>	Woods-Rush				S3	3 Sensitive	7	11.1 ± 5.0	NS
P	<i>Juncus dudleyi</i>	Dudley's Rush				S3	4 Secure	39	19.4 ± 0.0	NS
P	<i>Goodyera oblongifolia</i>	Menzies' Rattlesnake-plantain				S3	3 Sensitive	1	84.6 ± 0.0	PE
P	<i>Goodyera repens</i>	Lesser Rattlesnake-plantain				S3	3 Sensitive	19	30.0 ± 1.0	PE
P	<i>Listera australis</i>	Southern Twayblade				S3	4 Secure	13	47.8 ± 0.0	NS
P	<i>Platanthera grandiflora</i>	Large Purple Fringed Orchid				S3	4 Secure	95	29.6 ± 0.0	NS
P	<i>Platanthera hookeri</i>	Hooker's Orchid				S3	4 Secure	5	54.6 ± 0.0	NS
P	<i>Platanthera orbiculata</i>	Small Round-leaved Orchid				S3	4 Secure	40	19.4 ± 0.0	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	Prov GS Rank	# recs	Distance (km)	Prov
P	<i>Spiranthes ochroleuca</i>	Yellow Ladies'-tresses				S3	4 Secure	7	44.6 ± 0.0	NS
P	<i>Alopecurus aequalis</i>	Short-awned Foxtail				S3	4 Secure	21	47.2 ± 1.0	NS
P	<i>Dichanthelium clandestinum</i>	Deer-tongue Panic Grass				S3	4 Secure	83	57.5 ± 0.0	NS
P	<i>Potamogeton obtusifolius</i>	Blunt-leaved Pondweed				S3	4 Secure	11	51.0 ± 0.0	NS
P	<i>Potamogeton praelongus</i>	White-stemmed Pondweed				S3	3 Sensitive	40	23.5 ± 5.0	NS
P	<i>Potamogeton zosteriformis</i>	Flat-stemmed Pondweed				S3	3 Sensitive	11	61.1 ± 0.0	NS
P	<i>Sparganium natans</i>	Small Burreed				S3	4 Secure	16	43.0 ± 1.0	NS
P	<i>Asplenium trichomanes-ramosum</i>	Green Spleenwort				S3	3 Sensitive	1	80.5 ± 7.0	NS
P	<i>Equisetum pratense</i>	Meadow Horsetail				S3	3 Sensitive	10	50.8 ± 0.0	NS
P	<i>Equisetum variegatum</i>	Variegated Horsetail				S3	4 Secure	20	19.4 ± 0.0	NS
P	<i>Isoetes acadensis</i>	Acadian Quillwort				S3	3 Sensitive	2	69.1 ± 1.0	NS
P	<i>Lycopodium sitchense</i>	Sitka Clubmoss				S3	4 Secure	7	52.6 ± 5.0	NS
P	<i>Huperzia appalachiana</i>	Appalachian Fir-Clubmoss				S3	3 Sensitive	6	51.3 ± 5.0	NS
P	<i>Botrychium dissectum</i>	Cut-leaved Moonwort				S3	4 Secure	5	27.9 ± 5.0	NS
P	<i>Polypodium appalachianum</i>	Appalachian Polypody				S3	5 Undetermined	10	32.7 ± 0.0	NS
P	<i>Asclepias incarnata</i> ssp. <i>pulchra</i>	Swamp Milkweed				S3?	5 Undetermined	43	67.1 ± 0.0	NS
P	<i>Polygonum amphibium</i> var. <i>emersum</i>	Water Smartweed				S3?	5 Undetermined	1	97.5 ± 0.0	NS
P	<i>Lycopodium sabinifolium</i>	Ground-Fir				S3?	4 Secure	11	40.8 ± 1.0	NS
P	<i>Atriplex franktonii</i>	Frankton's Saltbush				S3S4	4 Secure	8	33.1 ± 2.0	NS
P	<i>Suaeda calceoliformis</i>	Horned Sea-blite				S3S4	4 Secure	9	3.4 ± 4.0	NS
P	<i>Vaccinium corymbosum</i>	Highbush Blueberry				S3S4	4 Secure	1	82.3 ± 3.0	PE
P	<i>Myriophyllum sibiricum</i>	Siberian Water Milfoil				S3S4	4 Secure	32	45.7 ± 0.0	PE
P	<i>Nuphar lutea</i> ssp. <i>pumila</i>	Small Yellow Pond-lily				S3S4	4 Secure	3	17.3 ± 2.0	NS
P	<i>Sanguinaria canadensis</i>	Bloodroot				S3S4	4 Secure	107	16.8 ± 0.0	NS
P	<i>Polygonum fowleri</i>	Fowler's Knotweed				S3S4	4 Secure	4	61.6 ± 0.0	NS
P	<i>Rumex maritimus</i>	Sea-Side Dock				S3S4		38	4.7 ± 0.0	NS
P	<i>Rumex maritimus</i> var. <i>fueginus</i>	Tierra del Fuego Dock				S3S4	4 Secure	6	66.7 ± 5.0	PE
P	<i>Crataegus succulenta</i>	Fleshy Hawthorn				S3S4	5 Undetermined	5	74.3 ± 5.0	PE
P	<i>Fragaria vesca</i> ssp. <i>americana</i>	Woodland Strawberry				S3S4	4 Secure	59	43.3 ± 1.0	NS
P	<i>Salix petiolaris</i>	Meadow Willow				S3S4	4 Secure	22	26.3 ± 0.0	NS
P	<i>Agalinis neoscotica</i>	Nova Scotia Agalinis				S3S4	4 Secure	2	95.9 ± 0.0	NS
P	<i>Viola sagittata</i> var. <i>ovata</i>	Arrow-Leaved Violet				S3S4	4 Secure	3	65.6 ± 1.0	PE
P	<i>Carex argyrantha</i>	Silvery-flowered Sedge				S3S4	4 Secure	1	40.2 ± 5.0	PE
P	<i>Eriophorum russeolum</i>	Russet Cottongrass				S3S4	4 Secure	14	33.3 ± 5.0	NS
P	<i>Triglochin gaspensis</i>	Gasp Arrowgrass				S3S4	5 Undetermined	7	79.2 ± 5.0	PE
P	<i>Juncus acuminatus</i>	Sharp-Fruit Rush				S3S4	4 Secure	2	91.3 ± 2.0	NS
P	<i>Luzula parviflora</i>	Small-flowered Woodrush				S3S4	4 Secure	3	56.4 ± 0.0	NS
P	<i>Liparis loeselii</i>	Loesel's Twayblade				S3S4	4 Secure	18	29.2 ± 5.0	PE
P	<i>Panicum tuckermanii</i>	Tuckerman's Panic Grass				S3S4	4 Secure	11	68.7 ± 0.0	NS
P	<i>Trisetum spicatum</i>	Narrow False Oats				S3S4	4 Secure	9	22.1 ± 0.0	NS
P	<i>Cystopteris bulbifera</i>	Bulblet Bladder Fern				S3S4	4 Secure	123	49.1 ± 0.0	NS
P	<i>Equisetum hyemale</i> var. <i>affine</i>	Common Scouring-rush				S3S4	4 Secure	22	50.0 ± 0.0	NS
P	<i>Equisetum scirpoides</i>	Dwarf Scouring-Rush				S3S4	4 Secure	37	50.6 ± 0.0	NS
P	<i>Lycopodium complanatum</i>	Northern Clubmoss				S3S4	4 Secure	7	36.6 ± 0.0	PE
P	<i>Schizaea pusilla</i>	Little Curlygrass Fern				S3S4	4 Secure	2	81.5 ± 0.0	NS
P	<i>Solidago simplex</i> var. <i>randii</i>	Sticky Goldenrod				SH	0.1 Extirpated	1	92.9 ± 1.0	NS
P	<i>Viola canadensis</i>	Canada Violet				SH	0.1 Extirpated	1	53.3 ± 7.0	NS

5.1 SOURCE BIBLIOGRAPHY (100 km)

The recipient of these data shall acknowledge the AC CDC and the data sources listed below in any documents, reports, publications or presentations, in which this dataset makes a significant contribution.

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172	Belliveau, A.G. 2018. Atlantic Canada Conservation Data Centre Fieldwork 2017. Atlantic Canada Conservation Data Centre.
170	Bryson, I. 2013. Nova Scotia rare plant records. CBCL Ltd., 180 records.
148	Brunelle, P.-M. (compiler). 2009. ADIP/MDDS Odonata Database: data to 2006 inclusive. Atlantic Dragonfly Inventory Program (ADIP), 24200 recs.
147	Amirault, D.L. & McKnight, J. 2003. Piping Plover Database 1991-2003. Canadian Wildlife Service, Sackville, unpublished data. 7 recs.
122	Pronych, G. & Wilson, A. 1993. Atlas of Rare Vascular Plants in Nova Scotia. Nova Scotia Museum, Halifax NS, I:1-168, II:169-331. 1446 recs.
121	LaPaix, R.W.; Crowell, M.J.; MacDonald, M. 2011. Stantec rare plant records, 2010-11. Stantec Consulting, 334 recs.
120	Scott, F.W. 2002. Nova Scotia Herpetofauna Atlas Database. Acadia University, Wolfville NS, 8856 recs.
116	Pepper, C. 2013. 2013 rare bird and plant observations in Nova Scotia. , 181 records.
111	Burns, L. 2013. Personal communication concerning bat occurrence on PEI. Winter 2013. Pers. comm.
110	Canadian Wildlife Service, Dartmouth. 2010. Piping Plover censuses 2007-09, 304 recs.
102	Klymko, J.J.D. 2014. Maritimes Butterfly Atlas, 2012 submissions. Atlantic Canada Conservation Data Centre, 8552 records.
97	Klymko, J.J.D. 2012. Insect fieldwork & submissions, 2011. Atlantic Canada Conservation Data Centre. Sackville NB, 760 recs.
93	Blaney, C.S.; Mazerolle, D.M. 2008. Fieldwork 2008. Atlantic Canada Conservation Data Centre. Sackville NB, 13343 recs.
93	eBird. 2014. eBird Basic Dataset. Version: EBD_relNov-2014. Ithaca, New York. Nov 2014. Cornell Lab of Ornithology, 25036 recs.
85	Cameron, R.P. 2011. Lichen observations, 2011. Nova Scotia Environment & Labour, 731 recs.
78	Blaney, C.S.; Mazerolle, D.M.; Belliveau, A.B. 2013. Atlantic Canada Conservation Data Centre Fieldwork 2013. Atlantic Canada Conservation Data Centre, 9000+ recs.
78	Cameron, R.P. 2009. Cyanolichen database. Nova Scotia Environment & Labour, 1724 recs.
75	Blaney, C.S.; Spicer, C.D. 2001. Fieldwork 2001. Atlantic Canada Conservation Data Centre. Sackville NB, 981 recs.
67	Munro, Marian K. Nova Scotia Provincial Museum of Natural History Herbarium Database. Nova Scotia Provincial Museum of Natural History, Halifax, Nova Scotia. 2013.
63	Layberry, R.A. & Hall, P.W., LaFontaine, J.D. 1998. The Butterflies of Canada. University of Toronto Press. 280 pp+plates.
62	Blaney, C.S.; Mazerolle, D.M.; Oberndorfer, E. 2007. Fieldwork 2007. Atlantic Canada Conservation Data Centre. Sackville NB, 13770 recs.
62	Manthorne, A. 2014. MaritimesSwiftwatch Project database 2013-2014. Bird Studies Canada, Sackville NB, 326 recs.
60	Blaney, C.S. 2000. Fieldwork 2000. Atlantic Canada Conservation Data Centre. Sackville NB, 1265 recs.
59	Ayles, P. 2006. Prince Edward Island National Park Digital Database. Parks Canada, 179 recs.
57	Blaney, C.S.; Spicer, C.D.; Popma, T.M.; Hanel, C. 2002. Fieldwork 2002. Atlantic Canada Conservation Data Centre. Sackville NB, 2252 recs.
56	Pulsifer, M.D. 2002. NS Freshwater Mussel Fieldwork. Nova Scotia Dept Natural Resources, 369 recs.
52	Roland, A.E. & Smith, E.C. 1969. The Flora of Nova Scotia, 1st Ed. Nova Scotia Museum, Halifax, 743pp.
50	Cameron, R.P. 2009. Erioderma pedicellatum database, 1979-2008. Dept Environment & Labour, 103 recs.
49	Curley, F.R. 2005. PEF&W Collection 2003-04. PEI Fish & Wildlife Div., 716 recs.
48	Neily, T.H. & Pepper, C.; Toms, B. 2015. Nova Scotia lichen location database [as of 2015-02-15]. Mersey Tobeatic Research Institute, 1691 records.
46	Blaney, C.S.; Mazerolle, D.M.; Klymko, J.; Spicer, C.D. 2006. Fieldwork 2006. Atlantic Canada Conservation Data Centre. Sackville NB, 8399 recs.
46	Blaney, C.S.; Spicer, C.D.; Mazerolle, D.M. 2005. Fieldwork 2005. Atlantic Canada Conservation Data Centre. Sackville NB, 2333 recs.

# recs	CITATION
45	Blaney, C.S.; Spicer, C.D.; Rothfels, C. 2004. Fieldwork 2004. Atlantic Canada Conservation Data Centre. Sackville NB, 1343 recs.
45	Hall, R.A. 2001. S. NS Freshwater Mussel Fieldwork. Nova Scotia Dept Natural Resources, 178 recs.
45	Hall, R.A. 2003. NS Freshwater Mussel Fieldwork. Nova Scotia Dept Natural Resources, 189 recs.
44	Erskine, D. 1960. The plants of Prince Edward Island, 1st Ed. Research Branch, Agriculture Canada, Ottawa., Publication 1088. 1238 recs.
44	Klymko, J.J.D. 2012. Maritimes Butterfly Atlas, 2010 and 2011 records. Atlantic Canada Conservation Data Centre, 6318 recs.
44	Zinck, M. & Roland, A.E. 1998. Roland's Flora of Nova Scotia. Nova Scotia Museum, 3rd ed., rev. M. Zinck; 2 Vol., 1297 pp.
43	Benjamin, L.K. 2012. NSDNR fieldwork & consultant reports 2008-2012. Nova Scotia Dept Natural Resources, 196 recs.
38	Mazerolle, D.M. 2017. Atlantic Canada Conservation Data Centre Fieldwork 2017. Atlantic Canada Conservation Data Centre.
36	MacDonald, M. 2008. PEI Power Corridor Floral Surveys, 2004-08. Jacques Whitford Ltd, 2238 recs (979 rare).
31	Belliveau, A.G. 2016. Atlantic Canada Conservation Data Centre Fieldwork 2016. Atlantic Canada Conservation Data Centre, 10695 recs.
31	Popma, T.M. 2003. Fieldwork 2003. Atlantic Canada Conservation Data Centre. Sackville NB, 113 recs.
28	Sharkie, R., MacQuarrie, K., Fraser, M. 2003. A Floral Inventory of the Western Section of Prince Edward Island National Park and adjacent Crown lands. Parks Canada Agency, v + 106 pp.
28	Sollows, M.C.. 2008. NBM Science Collections databases: mammals. New Brunswick Museum, Saint John NB, download Jan. 2008, 4983 recs.
28	Tims, J. & Craig, N. 1995. Environmentally Significant Areas in New Brunswick (NBESA). NB Dept of Environment & Nature Trust of New Brunswick Inc, 6042 recs.
27	MacQuarrie, K.E., H. Schaefer, and K. Schoenrank. 1999. A Floral inventory of the Western Area, Greenwich, Prince Edward Island National Park. Parks Canada Agency, Parks Canada Technical Reports in Ecosystem Science, No 021.
26	Blaney, C.S. 2003. Fieldwork 2003. Atlantic Canada Conservation Data Centre. Sackville NB, 1042 recs.
26	Neily, T.H. 2010. Erioderma Pedicellatum records 2005-09. Mersey Tobiotic Research Institute, 67 recs.
25	Archibald, D.R. 2003. NS Freshwater Mussel Fieldwork. Nova Scotia Dept Natural Resources, 213 recs.
25	Benjamin, L.K. (compiler). 2001. Significant Habitat & Species Database. Nova Scotia Dept of Natural Resources, 15 spp, 224 recs.
25	Tranquilla, L. 2015. Maritimes Marsh Monitoring Project 2015 data. Bird Studies Canada, Sackville NB, 5062 recs.
23	Pepper, Chris. 2012. Observations of breeding Canada Warbler's along the Eastern Shore, NS. Pers. comm. to S. Blaney, Jan. 20, 28 recs.
21	Powell, B.C. 1967. Female sexual cycles of <i>Chrysemy spicta</i> & <i>Clemmys insculpta</i> in Nova Scotia. Can. Field-Nat., 81:134-139. 26 recs.
19	Cameron, R.P. 2013. 2013 rare species field data. Nova Scotia Department of Environment, 71 recs.
19	Porter, C.J.M. 2014. Field work data 2007-2014. Nova Scotia Nature Trust, 96 recs.
18	Cameron, R.P. 2014. 2013-14 rare species field data. Nova Scotia Department of Environment, 35 recs.
18	McMullin, R.T. 2015. Prince Edward Island's lichen biodiversity and proposed conservation status in a report prepared for the province of PEI. Biodiversity Institute of Ontario Herbarium, University of Guelph, 776 records.
18	Neily, T.H. 2012. 2012 Erioderma pedicellatum records in Nova Scotia.
16	Canadian Wildlife Service, Atlantic Region. 2010. Piping Plover censuses 2006-09. , 35 recs.
16	Gilhen, J. 1984. Amphibians & Reptiles of Nova Scotia, 1st Ed. Nova Scotia Museum, 164pp.
15	Adams, J. & Herman, T.B. 1998. Thesis, Unpublished map of C. insculpta sightings. Acadia University, Wolfville NS, 88 recs.
15	Chaput, G. 2002. Atlantic Salmon: Maritime Provinces Overview for 2001. Dept of Fisheries & Oceans, Atlantic Region, Science Stock Status Report D3-14. 39 recs.
15	Plissner, J.H. & Haig, S.M. 1997. 1996 International piping plover census. US Geological Survey, Corvallis OR, 231 pp.
14	Belland, R.J. Maritimes moss records from various herbarium databases. 2014.
14	Grandtner, M.M. 1971. Ecological Study of the Interior Dunes of West Brackley Beach, Prince Edward Island National Park. Parks Canada, 1: 70. 41 recs.
14	Munro, Marian K. Nova Scotia Provincial Museum of Natural History Herbarium Database. Nova Scotia Provincial Museum of Natural History, Halifax, Nova Scotia. 2014.
14	NS DNR. 2017. Black Ash records from NS DNR Permanent Sample Plots (PSPs), 1965-2016. NS Dept of Natural Resources.
14	Robinson, S.L. 2011. 2011 ND dune survey field data. Atlantic Canada Conservation Data Centre, 2715 recs.
14	Spicer, C.D. 2002. Fieldwork 2002. Atlantic Canada Conservation Data Centre. Sackville NB, 211 recs.
13	McNeil, J.A. 2016. Blandings Turtle (<i>Emydoidea blandingii</i>), Eastern Ribbonsnake (<i>Thamnophis sauritus</i>), Wood Turtle (<i>Glyptemys insculpta</i>), and Snapping Turtle (<i>Chelydra serpentina</i>) sightings, 2016. Mersey Tobeatic Research Institute, 774 records.
12	Blaney, C.S.; Mazerolle, D.M. 2011. Fieldwork 2011. Atlantic Canada Conservation Data Centre. Sackville NB.
12	Cameron, R.P. 2012. Rob Cameron 2012 vascular plant data. NS Department of Environment, 30 recs.
12	Doucet, D.A. 2009. Census of Globally Rare, Endemic Butterflies of Nova Scotia Gulf of St Lawrence Salt Marshes. Nova Scotia Dept of Natural Resources, Species at Risk, 155 recs.
11	Downes, C. 1998-2000. Breeding Bird Survey Data. Canadian Wildlife Service, Ottawa, 111 recs.
11	Goltz, J.P. & Bishop, G. 2005. Confidential supplement to Status Report on Prototype Quillwort (<i>Isoetes prototypus</i>). Committee on the Status of Endangered Wildlife in Canada, 111 recs.
11	Harding, R.W. 2008. Harding Personal Insect Collection 1999-2007. R.W. Harding, 309 recs.
11	Klymko, J.J.D. 2016. 2015 field data. Atlantic Canada Conservation Data Centre.
10	Basquill, S.P. 2003. Fieldwork 2003. Atlantic Canada Conservation Data Centre, Sackville NB, 69 recs.
10	Basquill, S.P. 2010. Plant data from Prince Edward Island National Park Forest Community Plots. Atlantic Canada Conservation Data Centre, 150 records.
10	Belland, R.J. 2012. PEI moss records from Devonian Botanical Garden. DBG Cryptogam Database, Web site: https://secure.devonian.ualberta.ca/bryo_search.php 748 recs.
10	Curley, F.R. 2007. PEF&W Collection. PEI Fish & Wildlife Div., 199 recs.
10	Klymko, J.J.D.; Robinson, S.L. 2012. 2012 field data. Atlantic Canada Conservation Data Centre, 447 recs.
9	Benjamin, L.K. 2011. NSDNR fieldwork & consultant reports 1997, 2009-10. Nova Scotia Dept Natural Resources, 85 recs.
9	Cameron, R.P. 2005. Erioderma pedicellatum unpublished data. NS Dept of Environment, 9 recs.
9	Doucet, D.A. 2007. Lepidopteran Records, 1988-2006. Doucet, 700 recs.
9	Kelly, G. 2005. <i>Fraxinus nigra</i> . Dept of Agriculture, Fisheries, Aquaculture & Forestry. Pers. comm. to C.S. Blaney, Mar. 2, 11 recs.
9	O'Neil, S. 1998. Atlantic Salmon: Northumberland Strait Nova Scotia part of SFA 18. Dept of Fisheries & Oceans, Atlantic Region, Science. Stock Status Report D3-08. 9 recs.

# recs	CITATION
8	Benjamin, L.K. 2009. Boreal Felt Lichen, Mountain Avens, Orchid and other recent records. Nova Scotia Dept Natural Resources, 105 recs.
8	Giberson, D. 2008. UPEI Insect Collection. University of Prince Edward Island, 157 recs.
8	Oldham, M.J. 2000. Oldham database records from Maritime provinces. Oldham, M.J.; ONHIC, 487 recs.
7	Amirault, D.L. 1997-2000. Unpublished files. Canadian Wildlife Service, Sackville, 470 recs.
7	Cameron, B. 2006. Hepatica americana Survey at Scotia Mine Site in Gays River, and Discovery of Three Yellow-listed Species. Conestoga-Rovers and Associates, (a consulting firm), october 25. 7 recs.
7	Dibblee, R.L. 1999. PEI Cormorant Survey. Prince Edward Island Fisheries, Aquaculture & Environment, 1p. 21 recs.
7	Layberry, R.A. 2012. Lepidopteran records for the Maritimes, 1974-2008. Layberry Collection, 1060 recs.
7	MacArthur, M.E.L. 1976. An Ecological Study of the Greenwich Sand Dune System, M.Sc. Thesis. Department of Biology, Acadia University, Wolfville NS, 98 recs.
7	MacQuarrie, K.E., H. Schaefer, and K. Schoenrank. 2001. A Floral inventory of the Central and Schooner Pond Areas of Greenwich, Prince Edward Island National Park. Parks Canada Agency, Parks Canada Technical Reports in Ecosystem Science, No 030.
7	Nova Scotia Nature Trust. 2013. Nova Scotia Nature Trust 2013 Species records. Nova Scotia Nature Trust, 95 recs.
7	Smith, M.E.M. 2008. AgCan Collection. Agriculture Canada, Charlottetown PE, 44 recs.
6	Basquill, S.P. 2012. 2012 rare vascular plant field data. Nova Scotia Department of Natural Resources, 37 recs.
6	Clayden, S.R. 2007. NBM Science Collections databases: vascular plants. New Brunswick Museum, Saint John NB, download Mar. 2007, 6914 recs.
6	Edsall, J. 2007. Personal Butterfly Collection: specimens collected in the Canadian Maritimes, 1961-2007. J. Edsall, unpubl. report, 137 recs.
6	Hall, R. 2008. Rare plant records in old fieldbook notes from Truro area. Pers. comm. to C.S. Blaney. 6 recs, 6 recs.
6	Hill, N.M. 1994. Status report on the Long's bulrush Scirpus longii in Canada. Committee on the Status of Endangered Wildlife in Canada, 7 recs.
6	Klymko, J.J.D. 2018. 2017 field data. Atlantic Canada Conservation Data Centre.
6	Sabine, D.L. 2013. Dwaine Sabine butterfly records, 2009 and earlier.
6	Stevens, C. 1999. Cam Stevens field data from PEI vegetation plots. Sent along with specimens to C.S. Blaney. UNB masters research project, 732 recs.
5	Bredin, K.A. 2002. NS Freshwater Mussel Fieldwork. Atlantic Canada Conservation Data Centre, 30 recs.
5	Daury, R.W. & Bateman, M.C. 1996. The Barrow's Goldeneye (Bucephala islandica) in the Atlantic Provinces and Maine. Canadian Wildlife Service, Sackville, 47pp.
5	MacQuarrie, K. 1991-1999. Site survey files, maps. Island Nature Trust, Charlottetown PE, 60 recs.
5	Majka, C.G. 2008. Lepidoptera at St Patricks, 1993-2007. Pers. comm. to R. Curley, 8 Jan. 29 recs, 29 recs.
5	Olsen, R. Herbarium Specimens. Nova Scotia Agricultural College, Truro. 2003.
5	Towell, C. 2014. 2014 Northern Goshawk and Common Nighthawk email reports, NS. NS Department of Natural Resources.
4	Belliveau, A. 2013. Rare species records from Nova Scotia. Mersey Tobateic Research Institute, 296 records. 296 recs.
4	Blaney, C.S. 2016. Atlantic Canada Conservation Data Centre Fieldwork 2016. Atlantic Canada Conservation Data Centre, 6719 recs.
4	Blaney, C.S. 2017. Atlantic Canada Conservation Data Centre Fieldwork 2017. Atlantic Canada Conservation Data Centre.
4	Clayden, S.R. 1998. NBM Science Collections databases: vascular plants. New Brunswick Museum, Saint John NB, 19759 recs.
4	Erskine, A.J. 1999. Maritime Nest Records Scheme (MNRS) 1937-1999. Canadian Wildlife Service, Sackville, 313 recs.
4	Gagnon, J. 2004. Specimen data from 2002 visit to Prince Edward Island. , 104 recs.
4	O'Neil, S. 1998. Atlantic Salmon: Eastern Shore Nova Scotia SFA 20. Dept of Fisheries & Oceans, Atlantic Region, Science. Stock Status Report D3-10. 4 recs.
4	Prince Edward Island National Park. 2014. Prince Edward Island National Park Herbarium. Parks Canada Agency, PEINP, 39 recs.
4	Robinson, S.L. 2014. 2013 Field Data. Atlantic Canada Conservation Data Centre.
4	Sollows, M.C.. 2009. NBM Science Collections databases: molluscs. New Brunswick Museum, Saint John NB, download Jan. 2009, 6951 recs (2957 in Atlantic Canada).
4	Speers, L. 2001. Butterflies of Canada database. Agriculture & Agri-Food Canada, Biological Resources Program, Ottawa, 190 recs.
4	Spicer, C.D. 2004. Specimens from CWS Herbarium, Mount Allison Herbarium Database. Mount Allison University, 5939 recs.
3	Basquill, S.P. 2012. 2012 Bryophyte specimen data. Nova Scotia Department of Natural Resources, 37 recs.
3	Benjamin, L.K. 2006. Cyripedium arietinum. Pers. comm. to D. Mazerolle. 9 recs, 9 recs.
3	Blaney, C.S. Miscellaneous specimens received by ACCDC (botany). Various persons. 2001-08.
3	Boyne, A.W. & Grecian, V.D. 1999. Tern Surveys. Canadian Wildlife Service, Sackville, unpublished data. 23 recs.
3	Churchill, J.L.; Walker, J. 2017. Species at Risk Surveys at Correctional Services Canada Properties in Nova Scotia and New Brunswick. Atlantic Canada Conservation Data Centre.
3	Kelly, Glen 2004. Botanical records from 2004 PEI Forestry fieldwork. Dept of Environment, Energy & Forestry, 71 recs.
2	Bagnell, B.A. 2001. New Brunswick Bryophyte Occurrences. B&B Botanical, Sussex, 478 recs.
2	Belliveau, A.G. 2014. Plant Records from Southern and Central Nova Scotia. Atlantic Canada Conservation Data Centre, 919 recs.
2	Benedict, B. Connell Herbarium Specimens (Data) . University New Brunswick, Fredericton. 2003.
2	Brunelle, P.-M. (compiler). 2010. ADIP/MDDS Odonata Database: NB, NS Update 1900-09. Atlantic Dragonfly Inventory Program (ADIP), 935 recs.
2	Cameron, B. 2005. C. palmicola, E. pedicellatum records from Sixth Lake. Pers. comm. to C.S. Blaney. 3 recs, 3 recs.
2	Cameron, R.P. 2006. Erioderma pedicellatum 2006 field data. NS Dept of Environment, 9 recs.
2	Cameron, R.P. 2009. Nova Scotia nonvascular plant observations, 1995-2007. Nova Scotia Dept Natural Resources, 27 recs.
2	Curley, F.R. 2003. Glen Kelly records for Betula pumila & Asclepias syriaca on PEI. , Pers. comm. to C.S. Blaney. 9 recs.
2	Frittaion, C. 2012. NSNT 2012 Field Observations. Nova Scotia Nature Trust, Pers comm. to S. Blaney Feb. 7, 34 recs.
2	Giroux, P. 2013. Personal communication concerning species at risk in and around PEI NP, PE. Winter 2013. Pers. comm.
2	Guignion, M; Ristau, C.; Lemon, D. 1995. The distribution & abundance of the Gulf of St. Lawrence Aster, Aster laurentianus in Prince Edward Island National Park. Can. Field-Nat, 109:462-464. 10 recs.
2	Hill, N. 2003. Floerkea proserpinacoides at Heatherdale, Antigonish Co. 2002. , Pers. comm. to C.S. Blaney. 2 recs.
2	Hinds, H.R. 1989. Greenwich, Blooming Point plant collections in Plant locations. Pers. Comm. to Robin Day (Ag. Can). 2pp, 8 recs, 8 recs.
2	Klymko, J.J.D.; Robinson, S.L. 2014. 2013 field data. Atlantic Canada Conservation Data Centre.

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2	Macaulay, M. Notes on newly discovered <i>Hepatica nobilis</i> var. <i>obtusa</i> population in Cumberland Co. NS. Pers. comm. to S. Blaney, 1 rec.
2	Macaulay, M. 2008. Email to Sean Blaney regarding rich hardwood floodplain site at Howards Pool, Wallace River, NS.
2	McAlpine, D.F. 1998. NBM Science Collections databases to 1998. New Brunswick Museum, Saint John NB, 241 recs.
2	Parks Canada. 2010. Specimens in or near National Parks in Atlantic Canada. Canadian National Museum, 3925 recs.
2	Standley, L.A. 2002. <i>Carex haydenii</i> in Nova Scotia. , Pers. comm. to C.S. Blaney. 4 recs.
2	Thomas, H.H., Jones, G.S. & Diblee, R.L. 1980. <i>Sorex palustris</i> on Prince Edward Island. Can. Field Nat., vol 94:329-331. 2 recs.
2	Webster, R.P. & Edsall, J. 2007. 2005 New Brunswick Rare Butterfly Survey. Environmental Trust Fund, unpublished report, 232 recs.
2	Whittam, R.M. 1999. Status Report on the Roseate Tern (update) in Canada. Committee on the Status of Endangered Wildlife in Canada, 36 recs.
2	Williams, M. Cape Breton University Digital Herbarium. Cape Breton University Digital Herbarium. 2013.
1	Amirault, D.L. 2003. 2003 Peregrine Falcon Survey. Canadian Wildlife Service, Sackville, unpublished data. 7 recs.
1	Amiro, Peter G. 1998. Atlantic Salmon: Inner Bay of Fundy SFA 22 & part of SFA 23. Dept of Fisheries & Oceans, Atlantic Region, Science Stock Status Report D3-12. 4 recs.
1	Bateman, M.C. & Prescott, W.H. 1984. The Mammals of Prince Edward Island National Park. Canadian Wildlife Service, vol 2:5. 3 recs.
1	Bateman, M.C. 2001. Coastal Waterfowl Surveys Database, 1965-2001. Canadian Wildlife Service, Sackville, 667 recs.
1	Belland, R.J. 2012. PEI moss records from New York Botanical Garden. NYBG Virtual Herbarium, Web site: http://sciweb.nybg.org/science2/vii2.asp 135 recs.
1	Benedict, B. Connell Herbarium Specimens, Digital photos. University New Brunswick, Fredericton. 2005.
1	Benjamin, L.K. 2009. NSDNR Fieldwork & Consultants Reports. Nova Scotia Dept Natural Resources, 143 recs.
1	Blaney, C.S. & Whittam, R.M. 2003. Botanical & freshwater mussel observations at Lake Killarney, Cumberland Co., NS - Sept. 27, 2003. Atlantic Canada Conservation Data Centre, 3 recs.
1	Bridgehouse, D. Email communication (July 3, 2014) to John Klymko regarding hairstreak butterfly observations made Nova Scotia. 2014.
1	Cairns, D. 1998. Atlantic Salmon: Prince Edward Island SFA 17. Dept of Fisheries & Oceans, Atlantic Region, Science. Stock Status Report D3-07. 1 rec.
1	Cameron, R.P. 2012. Additional rare plant records, 2009. , 7 recs.
1	Doucet, D.A. 2007. PEI National Park Odonata Survey. Parks Canada, PEI National Park, 1 rec.
1	Doucet, D.A. ACCDC Reference Collection. Atlantic Canada Conservation Data Centre, Sackville NB. 2008.
1	Edsall, J. 2001. Lepidopteran records in New Brunswick, 1997-99. , Pers. comm. to K.A. Bredin. 91 recs.
1	Gagnon, J. 2003. Prince Edward Island plant records. Societe de la faune et des parcs Quebec, 13 recs.
1	Gillis, J. 2015. Rare plant records from Cape Breton gypsum sites. Pers. comm., 25 rare plant records.
1	Glen, W. 1991. 1991 Prince Edward Island Forest Biomass Inventory Data. PEI Dept of Energy and Forestry, 10059 recs.
1	Harling, L. & Silva, M. 2004. Abundance & species richness of shrews within forested habitats on PEI. Am. Midl. Nat., 151:399-407. 2 recs.
1	Haughian, S.R. 2018. Description of <i>Fuscopannaria leucosticta</i> field work in 2017 . New Brunswick Museum, 314 recs.
1	Klymko, J.J.D. 2010. Miscellaneous observations reported to ACCDC (zoology). Pers. comm. from various persons, 3 recs.
1	MacPhail, V. Bee and syrphid specimens from MSc research. Pers. comm., J. Klymko. 2006.
1	MacQuarrie, K. and R. Sharkie. 2004. Plant lists for selected areas at Brackley and Dalvay, Prince Edward Island National Park. Island Nature Trust, 168 recs.
1	Neily, P.D. Plant Specimens. Nova Scotia Dept Natural Resources, Truro. 2006.
1	Neily, T.H. 2013. Email communication to Sean Blaney regarding <i>Agalinis paupercula</i> observations made in 2013 in Nova Scotia. , 1 rec.
1	New York Botanical Garden. 2006. Virtual Plant Herbarium - Vascular Plant Types Catalog. Sylva, S.; Kallunki, J. (ed.) International Plant Science Centre, Web site: http://sciweb.nybg.org/science2/vii2.asp . 4 recs.
1	Newell, R.B.; Sam, D. 2014. 2014 Bloodroot personal communication report, Antigonish, NS. NS Department of Natural Resources.
1	Quigley, E.J. 2006. Plant records, Mabou & Port Hood. Pers. comm. to S.P. Basquill, Jun. 12. 4 recs, 4 recs.
1	Robinson, C.B. 1907. Early interval flora of eastern Nova Scotia. Transactions of the Nova Scotia Institute of Science, 10:502-506. 1 rec.
1	Sabine, D.L. 2012. Bronze Copper records, 2003-06. New Brunswick Dept of Natural Resources, 5 recs.
1	Speers, L. 2008. Butterflies of Canada database: New Brunswick 1897-1999. Agriculture & Agri-Food Canada, Biological Resources Program, Ottawa, 2048 recs.
1	Spicer, C.D. & Harries, H. 2001. Mount Allison Herbarium Specimens. Mount Allison University, 128 recs.
1	Stewart, J.I. 2010. Peregrine Falcon Surveys in New Brunswick, 2002-09. Canadian Wildlife Service, Sackville, 58 recs.
1	te Raa, J. 2016. Island Naturalist. Nature PEI, 219.
1	Wilson, G. 2013. 2013 Snapping Turtle email report, Wentworth, NS. Pers. comm.

DATA DICTIONARY:

revised December 18, 2017

I. Observation Records

The following fields of data may be included (and may or may not be populated) in occurrence records.
Text fields are 255 char max. (and may truncate text).

TAXONOMY	<i>type</i>	<i>definition</i>
MCODE	TXT	8 character 'Museum Code' (1 to 4 = genus, 5 to 8 = sp+ssp)
ELCODE	TXT	Unique Identifier of taxon ¹
SCINAME	TXT	Global Scientific Name of taxon ¹
COMNAME	TXT	English Common Name of taxon ¹
NOMCOMMUN	TXT	French Common Name

LOCATION

SURVEYSITE	TXT	General locality of occurrence (not necessarily protected)
DIRECTIONS	TXT	Specific locality: e.g. bearings and distance from enduring landmark
SUBNAT	TXT	Province/State: 2 character ISO code
COCODE	TXT	County Code (2 chars for province + 4 chars for county name)
MAPCODE	TXT	Map number: NTS identifier in Canada
UTME20	NUM	Easting in UTM Zone 20
UTMN20	NUM	Northing in UTM Zone 20
LONDEC	DEC	Decimal Longitude (5 decimal places, negative for west of Greenwich)
LATDEC	DEC	Decimal Latitude (5 decimal places)
LOCUNCN	NUM	Horizontal precision in metres
PREC	DEC	Precision in metres by power of 10 (e.g. 3 = 10 to the 3rd = 1000 m = 1 km)

<i>prec</i>	<i>common speech</i>	<i>example</i>	<i>unit size</i>	<i>literal range (m)</i>
6.0	within province	province	1000.0 km	562.3 - 1778.3
5.7	in part of province	'NW NB'	500.0 km	281.2 - 889.1
5.0	within in county	county	100.0 km	56.2 - 177.8
4.7	within 50s of kilometres		50.0 km	28.1 - 88.9
4.0	within 10s of kilometres	BBA grid	10.0 km	5.6 - 17.8
3.7	within 5s of kilometres		5.0 km	2.8 - 8.9
3.0	within kilometres	topo grid	1.0 km	0.6 - 1.8
2.7	within 500s of metres		500.0 m	281.2 - 889.1
2.0	within 100s of metres	ball field	100.0 m	56.2 - 177.8
1.7	within 50s of metres		50.0 m	28.1 - 88.9
1.0	within 10s of metres	boxcar	10.0 m	5.6 - 17.8
0.7	within 5s of metres		5.0 m	2.8 - 8.9
0.0	within metres NOT USED	pace	1.0 m	0.6 - 1.8
-1.0	within 10s of centimetres	fingernail	0.1 m	0.1 - 0.2

RARITY STATUS

NRANK	TXT	National Rarity Rank of taxon (in Canada) ¹
NPROT	TXT	National Protection Status of taxon (= COSEWIC in Canada)
NPROTSAR	TXT	National Protection Status of taxon (= SARA in Canada)

code rank and short definition

X	Extinct in Canada and elsewhere
XT	Extirpated in Canada but surviving elsewhere
E	Endangered in Canada
T	Threatened in Canada
V	Vulnerable in Canada
SC	Special Concern in Canada
DD	Data Deficient: data inadequate for assessment
NAR	Not At Risk in Canada

SRANK**	TXT	Subnational (Provincial) Rarity Rank of taxon ¹
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code rank and short definition

SX	Extinct or extirpated in province
SH	Historically occurring but currently undetected in province
S1	Extremely rare in province
S2	Rare in province
S3	Uncommon in province
S4	Widespread, common and apparently secure in province
S5	Widespread, abundant and demonstrably secure in province
SE	Exotic in province
SA	Accidental, infrequent and outside of range within province
SNA	Ranking not applicable in province
SNR	Not yet assessed in province

SPROT**	TXT	Provincial rank/status of taxon; cf provincial websites
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SGSRANK	TXT	Provincial General Status Rank
IUCN	TXT	International Union of Conservation Naturalists rarity rank; cf IUCN website <i>code rank and short definition</i>

EX	Extinct: no individuals remaining
EW	Extinct in the Wild: only captive or naturalised survivors
CR	Critically Endangered: extreme risk of extinction in wild
EN	Endangered: high risk of extinction in wild
VU	Vulnerable: high risk of endangerment in wild
NT	Near Threatened: likely to become endangered soon
LC	Least Concern: lowest risk, widespread and abundant
DD	Data Deficient: data inadequate for assessment
NE	Not Evaluated, not yet assessed against criteria

OBSERVATION

OBSERVER	TXT	Person or persons collecting specimen, in bibliographic form
OBDATE	TXT	Date of specimen collection as YYYY MM DD
OBDATA	TXT	Concatenation of fields below, relating to specimen (OBEVID, OBCOUNT etc)
OBEVID	TXT	Type of evidence (specimen, photo etc)
OBCOUNT	TXT	Number of individuals at location
OBABUN	TXT	Relative rarity of taxon at location, e.g. 'common', 'scattered'
OBSIZE	TXT	Size of specimen
SIZE	TXT	Size of occurrence 'patch' (in m2, ha or acres)
OBDESC	TXT	Details of specimen appearance
OBPHEN	TXT	Lifestage of specimen (bud, flowering etc)
OBSEX	TXT	Male/female if relevant
OBACTIV	TXT	Activity of taxon when observed (nesting, crossing road etc)
OBASSP	TXT	Other taxa associated with specimen
NOTETAX	TXT	Identifier's note on taxonomic issues
GENDESC	TXT	Concatenation of fields below, relating to site (HABITAT, ECOL etc)
HABITAT	TXT	Habitat characterization of location
ECODIST	NUM	National Ecological Framework EcoDistrict identifier
WSCORE	TXT	Quaternary Watershed identifier
GENCOM	TXT	General Comments: concatenation of Notes (NOTE1, NOTE2, NOTE3)

COLLECTION

CITATION	TXT	Primary source of data
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DATA MANAGEMENT

IDNUM	TXT	Field Office Number: Internal ACCDC record reference (not the EONUM)
EDITION	TXT	Last editor's initials and date as YYYY MM DD

Notes:

¹ Methodology of NatureServe, Arlington, VA

** Field name followed by 2-character ISO provincial abbreviation.

II. Managed or Special Areas

The following fields of data may be included (and may or may not be populated) for Protected Areas and Ecologically Significant Areas.

IDENTITY

MACODE	TXT	Unique identifier for Managed Area ¹ with some level of protection
SACODE	TXT	Unique identifier for Ecologically Special Area ¹ with or without protection
MANAME	TXT	Name of Protected Area containing occurrence
SANAME	TXT	Name of Ecologically Special Area containing occurrence
SITECODE	TXT	External agency site identity code

JURISDICTION / OWNERSHIP

LOCALJURIS	TXT	Abbreviation for mandated agency
OWNER	TXT	Short name or category of title holder
OWNERCOM	TXT	Short detail of multiparty arrangements
OWNERCODE	TXT	Canadian Conservation Area DB ownercodes (modified)

<i>group</i>	<i>code</i>	<i>designation</i>
Owner	GN	government, national (federal)
	GS	government, subnational (prov., state)
	GM	government, municipal
	IN	international
	NG	non-governmental organisation
	OR	organisational
	CO	corporate
	PR	private

CLASSIFICATION

PROTSTAT	TXT	Activities permitted or restricted (when known)
LEGALACT	TXT	Short title of enabling legislation
LEGALDATE	TXT	Year of enabling legislation
ESTABDATE	TXT	Year of site designation
IBP	TXT	International Biological Program identity number (Y=unknown)
IBPSTATUS	TXT	International Biological Program status: proposed or declared
IUCN	TXT	IUCN protection level, e.g. I very restricted, VI few restrictions
LEVEL1	TXT	Canadian Conservation Area DB type
LEVEL2	TXT	Canadian Conservation Area DB subtype(s)

<i>group</i>	<i>code</i>	<i>designation</i>
Conservation	CEP	Conservation Easement Property
	ESA	Environmentally Sensitive Area
	NAC	Nature Conservancy
	NAT	Natural Area
	NCA	NCC Conservation Land
	PCA	Private Conservation Area
	PRA	Protected Area
	PRB	Protected Beach
	RER	Representative Area Ecological Reserve
Heritage	TRA	Nature Trail
	ARS	Archaeological Site
	HEA	Heritage Area or Park
	HEC	Heritage Canal
	HEP	Heritage Park
	HER	Heritage River
	HIA	Historic Area or Park
	NHP	National Historic Park
	NHS	National Historic Site
	PEP	Provincial Heritage Property
Parks	PHP	Provincial Historic/Heritage Park
	PHS	Provincial Heritage Site
	WHS	World Heritage Site
	CMG	Campground
	CMP	Community Park
	DUP	Day Use Park
	MUP	Municipal Park
	NAP	National Park
	NEP	Natural Environment Park
	NTP	Nature Park
	PKW	Parkway
	PNS	Picnic Site
	PPR	Provincial Park Reserve
	PVP	Provincial Park
	WAP	Wayside Park

<i>group</i>	<i>code</i>	<i>designation</i>
Wilderness	ECR NTA NTR SES WDA WDR	Ecological Reserve Nature Trust Area Nature Reserve Significant Ecological Area Wilderness Area Wilderness Reserve
Wildlife	BSR EHJ GAS MBS NWA PWA SBS WHR WLP WLR WLS WMA WPA WRF	Bird Sanctuary Eastern Habitat Joint Venture Game Sanctuary Migratory Bird Sanctuary National Wildlife Area Provincial Wildlife Area Sea Bird Sanctuary Western Hemispheric Shorebird Reserve Wildlife Park Wildlife Reserve Wildlife Sanctuary Wildlife Management Area Wildlife Protection Area Wildlife Refuge
Other	AGF ASI DUN EDA FCP IBP NCC NSA PLS PSL RAM RTA	Agreement Forest Area of Scientific Interest Ducks Unlimited Canada Education Area Federal Community Pasture International Biological Program National Capital Commission Natural Scenic Area Palaeontological Site Public Safety Lands: watershed protection Ramsar Wetland Site Research and Teaching Area
NS SigHab	380 381 382 383	wetland habitat saltmarsh habitat deer/moose wintering other significant habitats

Appendix E

Avian Fauna Data

Desktop Analyses

Table 1: Bird Species Potentially Occurring in the Area Based on the AC CDC search (from Dillon 2019a)

Common Name	Scientific Name	Status ¹	Breeding or Migratory Habitat (whichever is most applicable)	Detected or Observed during Field Work?	Possible Habitat Type in the local assessment area
American Bittern	<i>Botaurus lentiginosus</i>	Provincial S3S4B - Sensitive	Breeding - Nests in freshwater wetlands and occasionally in salt marshes.	No	Open wetlands.
American Coot	<i>Fulica americana</i>	Provincial S1B - Undetermined	Breeding - found in aquatic habitats year around and during migration.	No	Open wetlands.
American Golden-Plover	<i>Pluvialis dominica</i>	Provincial S1S2M - Sensitive	Migratory - during fall migration prefers open grass areas, less often on mudflats and beaches.	No	Agricultural lands, fields and shorelines.
American Kestrel	<i>Falco sparverius</i>	Provincial S3B - Secure	Breeding – cavity-nester in trees or structures. Prefer open areas, such as agriculture and open woodland.	No	Agricultural lands, fields and open wetlands.
American Three-toed Woodpecker	<i>Picoides dorsalis</i>	Provincial S1? - Undetermined	Breeding - nest in conifer forests and montane regions, often black spruce near bogs.	No	Wetlands, especially peatlands.
Arctic Tern	<i>Sterna paradisaea</i>	Provincial S3B - May be at Risk	Breeding - Nest on coastal islands or gravel beaches with little to no vegetation. Migratory - May occur in coastal areas during spring/fall migration.	No	Pictou and Caribou Harbours, but no known nearby breeding colony exists.
Baltimore Oriole	<i>Icterus galbula</i>	Provincial S2S3B - May be at risk	Breeding – Nests in open, deciduous forest often along watercourse, but will also nests in urban areas.	No	Developed or cleared areas.
Bank Swallow	<i>Riparia riparia</i>	COSEWIC/SARA Threatened Sched. 1; NS ESA Endangered Provincial S2S3B May be at risk	Breeding – Nests in sandy banks and cliffs around coastlines and watercourse. Will also use human-made habitats such as gravels pits and road cuts.	No	Steep shorelines, such as Abercrombie point.

Common Name	Scientific Name	Status ¹	Breeding or Migratory Habitat (whichever is most applicable)	Detected or Observed during Field Work?	Possible Habitat Type in the local assessment area
Barn Swallow	<i>Hirundo rustica</i>	COSEWIC/SARA Threatened Sched. 1 NS ESA Endangered Provincial S2S3B/At risk	Breeding – shows a tendency to construct its nest on human-made structures such as barns, bridges, cottages or any structure with a shelf, vertical surface or overhang.	Yes, ETF Site facing northeast (May 2018).	NPNS facility, the Pictou Causeway and other built structures.
Barrow's Goldeneye – Eastern pop.	<i>Bucephala islandica</i>	COSEWIC/SARA Special Concern Sched. 1 Provincial S1N- At Risk	Migratory - Winters in coastal waters and rivers during winter months.	Yes, west of Site along Highway 106 (Jan. 2018).	Pictou and Caribou Harbours. No Critical Habitat identified within the PFA.
Bay-breasted Warbler	<i>Dendroica castanea</i>	Provincial S3S4B/ Sensitive	Breeding - Nests in mid-aged to mature conifer forests, including managed stands, preferring spruce, fir or hemlock.	No	Conifer-dominated forest adjacent Highway 106.
Bicknell's Thrush	<i>Catharus bicknelli</i>	COSEWIC Threatened, SARA Special Concern Sched. 1, NS ESA Endangered, Provincial S1S2B - At Risk	Breeding - Nests in early successional fir and spruce at high elevations.	No	None – no high elevation forest. No Critical Habitat identified within the PFA.
Black-backed Woodpecker	<i>Picoides arcticus</i>	Provincial S3S4 - Sensitive	Breeding - Nests in mature softwood stands and burnt areas with dead, standing trees. Occasionally in peatlands.	No	Wetlands, especially peatlands.
Black-bellied Plover	<i>Pluvialis squatarola</i>	Provincial S3M - Secure	Migratory - Winters on coastal beaches and estuaries.	No	Shorelines within the Pictou and Caribou Harbours.

Common Name	Scientific Name	Status ¹	Breeding or Migratory Habitat (whichever is most applicable)	Detected or Observed during Field Work?	Possible Habitat Type in the local assessment area
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	Provincial S3B - May be at Risk	Breeding - Nests in forest edges and tall shrub thickets, showing an association for young deciduous trees, often near water.	No	Developed or cleared areas, riparian corridors and wetlands.
Black-crowned Night-heron	<i>Nycticorax nycticorax</i>	Provincial S1B - May Be At Risk	Breeding – Colony nester in trees, often near the coast or on coastal islands. Rare ground nester.	No	Shorelines within the Pictou and Caribou Harbours, but no known nearby colony exists.
Black-headed Gull	<i>Chroicocephalus ridibundus</i>	Provincial S3N - Secure	Migratory/Vagrant – Some individuals winter along the Atlantic Coastline in estuaries and sheltered bays.	No	Pictou and Caribou Harbours
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Provincial S3B,S5N - Sensitive	Breeding - Colony cliff nester of steep, offshore islands and coastal cliffs.	No	None – no known nearby colony.
Blackpoll Warbler	<i>Dendroica striata</i>	Provincial S3S4B - Sensitive	Breeding - Nests in young fir or spruce, often in high elevation or coastal areas.	No	Peatlands
Blue-winged Teal	<i>Anas discors</i>	Provincial S3S4B - May be at Risk	Breeding - Nests in cattail marshes and other open water wetlands.	No	Open wetlands.
Bobolink	<i>Dolichonyx oryzivorus</i>	COSEWIC/SARA Threatened Sched. 1 NS ESA Vulnerable Provincial S3S4B - Sensitive	Breeding – Shows a strong affinity for cultivated grasslands, but also nests in fens, and other graminoid dominated environments.	No	Agricultural lands and unmanaged grasslands
Boreal Chickadee	<i>Poecile hudsonica</i>	Provincial S3 - Sensitive	Breeding - Nest in mature coniferous forests, typically at higher elevations.	No	Conifer-dominated forest adjacent Highway 106.

Common Name	Scientific Name	Status ¹	Breeding or Migratory Habitat (whichever is most applicable)	Detected or Observed during Field Work?	Possible Habitat Type in the local assessment area
Boreal Owl	<i>Aegolius funereus</i>	Provincial S2?B - Undetermined	Breeding – Often will nest in old woodpecker holes and other tree cavities in mature coniferous forest.	No	Conifer-dominated forest adjacent Highway 106.
Brown Thrasher	<i>Toxostoma rufum</i>	Provincial S1B - Undetermined	Breeding - Nest in shrubby environments, such as thickets, swales and edge habitats.	No	Wetlands.
Brown-headed Cowbird	<i>Molothrus ater</i>	Provincial S2B - Secure	Breeding - Parasitic nester, closely associated with agricultural grassland and livestock farming.	No	Agricultural lands, developed areas and other cleared land.
Bufflehead	<i>Bucephala albeola</i>	Provincial S3S4N - Secure	Migratory - Winters along the coast, using sheltered coves, harbours, and estuaries.	Yes, ETF Site facing northeast Dec. 2017, Jan. and March 2018).	Pictou and Caribou Harbours.
Canada Warbler	<i>Wilsonia Canadensis</i>	COSEWIC/SARA Threatened Sched. 1 NS ESA Endangered Provincial S3B - At risk	Breeding – Nests in forested wetlands with dense understories.	No	Wetlands. No Critical Habitat identified within the PFA.
Cape May Warbler	<i>Dendroica tigrina</i>	Provincial S2B - Sensitive	Nests in mature coniferous forests, typically black spruce.	No	Conifer-dominated forest adjacent Highway 106.
Chimney Swift	<i>Chaetura pelagica</i>	COSEWIC/SARA Threatened Sched. 1 NS ESA Endangered Provincial S2B,S1M - At Risk	Breeding – Typically forms nesting colonies in vertical, and often, human-made chimneys. Will also nest in large, standing dead trees that have hollowed out.	No	Possible in wetlands. No known nearby chimney roosting site exists.

Common Name	Scientific Name	Status ¹	Breeding or Migratory Habitat (whichever is most applicable)	Detected or Observed during Field Work?	Possible Habitat Type in the local assessment area
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	Provincial S2S3B - May be at Risk	Breeding – Colonial nester, creates nests on buildings and other human-made structures using available mud and their saliva.	Yes, west of Site along Hwy 106 (June 2018).	NPNS facility, the Pictou Causeway and other built structures.
Common Eider	<i>Somateria mollissima</i>	Provincial S3S4 - Secure	Breeding – Colony nester of offshore islands. Migratory – Winters along rocky coastlines	No	Pictou and Caribou Harbours.
Common Goldeneye	<i>Bucephala clangula</i>	Provincial S2B, S5N - Secure	Breeding - Nests in large trees with cavities near freshwater wetlands, ponds, lakes and rivers. Migratory – Winters in shallow coastal bays, harbours and estuaries.	Yes, ETF Site facing northeast (Dec 2017, Jan. & March 2018). Observed from shoreline site, 350 m north-east from Hwy 106 causeway (Jan. & March 2018).	Breeding: Open wetlands. Migratory: Pictou and Caribou Harbours.
Common Moorhen	<i>Gallinula chloropus (Gallinula galeata)*</i>	Provincial S1B - Undetermined	Breeding - Nest in cattail marshes, and other waterbodies with dense emergent vegetation.	No	Open wetlands.
Common Nighthawk	<i>Chordeiles minor</i>	COSEWIC/SARA Threatened Sched. 1 NS ESA Threatened Provincial S2B - At risk	Breeding - Nests on the ground in open to semi-open habitats such as scrub barrens, headlands, rocky outcroppings, clear cut areas, burns and even gravelled rooftops and parking lots.	No	Open wetlands, disturbed areas and other cleared land. ⁵ No Critical Habitat identified within the PFA.

Common Name	Scientific Name	Status ¹	Breeding or Migratory Habitat (whichever is most applicable)	Detected or Observed during Field Work?	Possible Habitat Type in the local assessment area
Common Tern	<i>Sterna hirundo</i>	COSEWIC Not at risk Provincial S3B - Sensitive	Breeding - Nests on coastal islands, sand spits and barrier beaches, occasionally will use derelict piers or even dredge spoils.	Yes, ETF Site facing northeast and west of site along Hwy 106 in May 2018. Yes, observed from shoreline site, 350 m northeast of Hwy 106 causeway (May 2018).	Pictou Bar and Ballast Island; Pictou and Caribou Harbours.
Cooper's Hawk	<i>Accipiter cooperii</i>	Provincial S1?B - Undetermined	Breeding – Nests in a wide variety of forest types, but shows an association with mature hardwood forests or mature Mixedwood forests.	No	Forested areas adjacent Highway 106.
Eastern Bluebird	<i>Sialia sialis</i>	COSEWIC Not at risk Provincial S3B - Sensitive	Breeding – Cavity nester preferring open habitats, such as bogs or fens, but often associated with agricultural lands.	No	Open wetlands and agricultural areas.
Eastern Kingbird	<i>Tyrannus tyrannus</i>	Provincial S3B - Sensitive	Breeding - Nests in open, scrubby habitats along woodland edges, wetlands and watercourses.	No	Wetlands.
Eastern Whip-Poor-Will	<i>Caprimulgus vociferus</i>	COSEWIC/SARA Threatened Sched. 1 NS ESA Threatened Provincial S1?B - At Risk	Breeding – Nests on the ground in deciduous and Mixedwood forests with little to no understory.	No	Forested areas adjacent Highway 106.

Common Name	Scientific Name	Status ¹	Breeding or Migratory Habitat (whichever is most applicable)	Detected or Observed during Field Work?	Possible Habitat Type in the local assessment area
Eastern Wood-Pewee	<i>Contopus virens</i>	COSEWIC/SARA Special Concern Sched. 1 NS ESA Vulnerable Provincial S3BS4B - Sensitive	Breeding – Nests in mature deciduous or mixed wood forest, often in forest clearings and in edge habitat.	No	Forested areas adjacent Highway 106.
Evening Grosbeak	<i>Coccothraustes vespertinus</i>	COSEWIC Special Concern Provincial S3S4B, S3N - Secure	Breeding – Nests in mature coniferous to mixedwood forests, but can tolerate a wide variety of forested habitats	No	Forested areas adjacent Highway 106.
Fox Sparrow	<i>Passerella iliaca</i>	Provincial S3S4B - Secure	Breeding - Nests in higher elevation coniferous forest, often stunted spruce or fir. Will also use regenerating forests after cutting and conifer plantations.	No	Forested areas adjacent Highway 106.
Gadwall	<i>Anas strepera</i>	Provincial S2B - May Be At Risk	Breeding - Nest in cattail marshes, and other waterbodies with dense emergent vegetation.	No	Open wetlands.
Gray Catbird	<i>Dumetella carolinensis</i>	Provincial S3B - May be at risk	Breeding – Nests in shrubby thickets, early successional and edge habitats.	Yes, observed from shoreline site, 350 m northeast from Hwy 106 causeway facing S and E (June 2018).	Wetlands.
Gray Jay	<i>Perisoreus canadensis</i>	Provincial S3 - Sensitive	Breeding – Nests in old-growth coniferous forest, often comprised of spruce and fir.	No	Conifer-dominated forest adjacent Highway 106.

Common Name	Scientific Name	Status ¹	Breeding or Migratory Habitat (whichever is most applicable)	Detected or Observed during Field Work?	Possible Habitat Type in the local assessment area
Great Cormorant	<i>Phalacrocorax carbo</i>	Provincial S2S3 - Sensitive	Breeding – Nests in colonies on steep coastal cliffs and offshore islands. Migratory – Winters in coastal areas in bays, harbours and coves.	Yes, overwintering survey (December 2017)	Breeding: May nest amongst double-crested colony on Pictou Causeway. Migratory: Pictou and Caribou Harbours.
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	Provincial S1B/May be at risk	Breeding - Nest in holes/cavities in deciduous forests, particularly along lakes, watercourse and wetlands.	No	Open wetlands.
Greater Yellowlegs	<i>Tringa melanoleuca</i>	Provincial S3B,S3S4M - Sensitive	Breeding – Nests in bogs, fens and other sparsely wooded wetlands. Migratory – Winters along shorelines, saltmarshes, mudflats and other ice-free waterbodies.	No	Breeding: Peatlands. Migratory: Pictou and Caribou Harbours
Harlequin Duck - Eastern pop.	<i>Histrionicus histrionicus pop. 1</i>	COSEWIC/SARA Special Concern Sched. 1 NS ESA Endangered Provincial S2N - At Risk	Migratory – Winters along coasts, mostly in turbulent waters near submerged reefs.	No	None. No Critical Habitat identified within the PFA.
Hudsonian Godwit	<i>Limosa haemastica</i>	Provincial S1S2M - Sensitive	Migratory - Migrants use marshes, beaches, flooded fields and mudflats.	No	Open wetlands and the Pictou and Caribou Harbours.
Hudsonian Whimbrel	<i>Numenius phaeopus hudsonicus</i>	Provincial S2S3M - Sensitive	Migratory – Migrants use marshes, beaches, flooded fields, mudflats and saltmarshes.	No	Open wetlands and the Pictou and Caribou Harbours.

Common Name	Scientific Name	Status ¹	Breeding or Migratory Habitat (whichever is most applicable)	Detected or Observed during Field Work?	Possible Habitat Type in the local assessment area
Indigo Bunting	<i>Passerina cyanea</i>	Provincial S1?B - Undetermined	Breeding – Nests in shrubby areas, typically early successional or edge habitats.	No	Agricultural lands, developed areas and other cleared land.
Killdeer	<i>Charadrius vociferus</i>	Provincial S3B - Sensitive	Breeding – Nest on open ground in disturbed areas such as borrow pits, agricultural land and gravelled areas.	Yes, observed from shoreline site, 350 m northeast from Hwy 106 causeway facing south and east (May 2018).	Agricultural lands, developed areas and other cleared land.
Lapland Longspur	<i>Calcarius lapponicus</i>	Provincial S3?N - Secure	Migratory - During spring and fall migration, found on plowed fields, grassland, and other open, graminoid dominated environments	No	Agricultural lands, developed areas and other cleared land.
Least Sandpiper	<i>Calidris minutilla</i>	Provincial S1B, S3M - Secure	Breeding – Nests in coastal heathlands and sand dunes. Migratory – Winters on coastal mudflats, wet meadows and the mucky edges of waterbodies.	No	Breeding: None. Migratory: Pictou and Caribou Harbours
Lesser Yellowlegs	<i>Tringa flavipes</i>	Provincial S3M - Secure	Migratory - Winter in coastal estuaries, marshes, edges of lakes and ponds.	No	Open wetlands and the Pictou and Caribou Harbours.
Long-eared Owl	<i>Asio otus</i>	Provincial S2S3 - May Be At Risk	Breeding – Typically selects an abandoned hawk or corvid stick nest in a wide variety of forest types, but often near wetlands such as fens, bogs or beaver ponds.	No	Wetlands.
Marsh Wren	<i>Cistothorus palustris</i>	Provincial S1B - Undetermined	Breeding – Nests in either fresh or saltwater marshes with abundant emergent vegetation.	No	Open wetlands.

Common Name	Scientific Name	Status ¹	Breeding or Migratory Habitat (whichever is most applicable)	Detected or Observed during Field Work?	Possible Habitat Type in the local assessment area
Nelson's Sparrow	<i>Ammodramus nelsoni</i>	Provincial S3S4B - Secure	Breeding - Nests in saltmarshes and along tidal sections of large rivers.	No	Pictou and Caribou Harbours.
Northern Goshawk	<i>Accipiter gentilis</i>	COSEWIC Not at risk Provincial S3S4 - Secure	Breeding – Nests in mature forests with low density understory and a high percentage of canopy closure.	No	Forested areas adjacent Highway 106
Northern Harrier	<i>Circus cyaneus</i>	COSEWIC Not at risk Provincial S3S4B - Secure	Breeding – Nests on the ground in cultivated grassland, scrubland, bogs, and in open habitats around the coast.	No	Open wetlands and agricultural lands.
Northern Mockingbird	<i>Mimus polyglottos</i>	Provincial S1B - Secure	Breeding – Nests in open, shrubby habitats, often near human developed and landscaping.	No	Agricultural lands, developed areas and other cleared land.
Northern Shoveler	<i>Anas clypeata</i>	Provincial S2B - May Be At Risk	Breeding – Nests in fresh or brackish marshes.	No	Open wetlands.
Olive-sided Flycatcher	<i>Contopus cooperi</i>	SARA Threatened Sched. 1 NS ESA Threatened Provincial S2B - At risk	Breeding – Typically nests in coniferous forest or treed wetlands, often near water.	No	Wetlands. No Critical Habitat identified within the PFA.
Pectoral Sandpiper	<i>Calidris melanotos</i>	Provincial S2S3M - Secure	Migratory – During migration uses open wetlands, mudflats and the shorelines.	No	Wetlands and the Pictou and Caribou Harbours.
Peregrine Falcon - anatum/ tundrius	<i>Falco peregrinus pop. 1</i>	SARA Special Concern Sched. 1 NS ESA Vulnerable Provincial S1B SNAM - Sensitive	Breeding - Nests on shoreline cliffs, mostly around the Bay of Fundy.	No	None.
Pine Grosbeak	<i>Pinicola enucleator</i>	Provincial S2S3B,S5N - May Be At Risk	Breeding - Nests in open coniferous forest.	No	Conifer-dominated forest adjacent Highway 106.

Common Name	Scientific Name	Status ¹	Breeding or Migratory Habitat (whichever is most applicable)	Detected or Observed during Field Work?	Possible Habitat Type in the local assessment area
Pine Siskin	<i>Carduelis pinus</i>	Provincial S2S3 - Sensitive	Breeding - Nests in conifer-dominated forests.	No	Conifer-dominated forest adjacent Highway 106.
Pine Warbler	<i>Dendroica pinus</i>	Provincial S1B - Undetermined	Breeding – Nests in mature red or white pines.	No	Abercrombie Point and forested areas adjacent Highway 106.
Piping Plover <i>melodus</i> ssp.	<i>Charadrius melodus melodus</i>	SARA Endangered Sched. 1 NS ESA Endangered Provincial S1B - At Risk	Breeding – Nests on shallow sloping, sparsely vegetated sandy beaches.	No	Pictou Bar and other sandy beaches within the Pictou and Caribou Harbours. No Critical Habitat identified within the PFA. However, number of nearby beaches within the LAA are considered Critical Habitat.
Purple Martin	<i>Progne subis</i>	Provincial SHB/ May Be At Risk	Breeding - Nest in open areas in cavities (natural and human-made) always near water.	No	Agricultural lands and open wetlands.
Purple Sandpiper	<i>Calidris maritima</i>	Provincial S3?N - Sensitive	Migratory - Winters along turbulent, rocky coastlines and sometimes human-made jetties.	No	Pictou and Caribou Harbours.

Common Name	Scientific Name	Status ¹	Breeding or Migratory Habitat (whichever is most applicable)	Detected or Observed during Field Work?	Possible Habitat Type in the local assessment area
Red-breasted Merganser	<i>Mergus serrator</i>	Provincial S3S4B,S5N - Secure	Breeding – Often nests in association with gull or terns colonies, using dunes, barrier beaches and offshore islands. Will also nest inland around lakes and rivers. Migratory - Winters on coastal waters in May-August	Yes, ETF Site facing northeast in Dec. 2017, Jan., March & May 2018; west of site along Hwy 106 (March & May 2018). Yes, observed from shoreline site, 350 m northeast from Hwy 106 causeway (March 2018).	Breeding: Pictou Bar; other locations within Pictou and Caribou Harbours Migratory: Pictou and Caribou Harbours.
Red-breasted Nuthatch	<i>Sitta canadensis</i>	Provincial S3 - Secure	Breeding - Nests in cavities in dead trees, often in conifer-dominated forests.	No	Wetlands and conifer-dominated forest adjacent Highway 106.
Red Crossbill	<i>Loxia curvirostra</i>	Provincial S3S4 - Secure	Breeding - Nests in conifer-dominated forests, especially those with older spruce, balsam fir and pine.	No	Conifer-dominated forest adjacent Highway 106. No Critical Habitat identified within the PFA.
Red Knot rufa ssp	<i>Calidris canutus rufa</i>	SARA Endangered Sched. 1, NS ESA Endangered Provincial S2M - At risk	Migratory - During migration may be found on coastal mudflats and tidal zones, sometimes on open sandy beaches.	No	Pictou and Caribou Harbours. No Critical Habitat identified within the PFA.
Red-necked Phalarope	<i>Phalaropus lobatus</i>	COSEWIC Special Concern Provincial S2S3M - Sensitive	Migratory – typically overwinter offshore and in coastal areas, in migration can found along the coast.	No	Pictou and Caribou Harbours.

Common Name	Scientific Name	Status ¹	Breeding or Migratory Habitat (whichever is most applicable)	Detected or Observed during Field Work?	Possible Habitat Type in the local assessment area
Roseate Tern	<i>Sterna dougallii</i>	COSEWIC /SARA Endangered Sched. 1 NS ESA Endangered Provincial S1B - At Risk	Breeding – Nests on rocky, offshore islands linked to colonies of arctic and common terns. Migratory – Winters offshore and along coasts.	No	None - There is no known record of a Roseate Tern colony along the Northumberland Strait. ¹¹ No Critical Habitat identified within the PFA.
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	Provincial S2S3B - Sensitive	Breeding - Nests in open deciduous forest with a well-developed shrub understory, often near waterbodies or wetlands.	No	Forested areas adjacent Highway 106.
Rough-legged Hawk	<i>Buteo lagopus</i>	Provincial S3N - Secure	Migratory - Overwinters in open habitats such as grasslands, open wetlands and other clearings	No	Open wetlands and agricultural lands.
Ruby-crowned Kinglet	<i>Regulus calendula</i>	Provincial S3S4B - Sensitive	Breeding - Nest in a variety of forest types both young and old.	No	Forested areas adjacent Highway 106.
Ruddy Duck	<i>Oxyura jamaicensis</i>	Provincial S1B - Secure	Breeding – Nesting habitats not well-understood in the Maritimes, but is associated with lagoons, impounded wetlands and bogs.	No	Open wetlands.
Ruddy Turnstone	<i>Arenaria interpres</i>	Provincial S3M - Secure	Migratory – In migration and winter can be found near rocky shorelines and beaches with ample sea wrack.	No	Pictou and Caribou Harbours.

Common Name	Scientific Name	Status ¹	Breeding or Migratory Habitat (whichever is most applicable)	Detected or Observed during Field Work?	Possible Habitat Type in the local assessment area
Rusty Blackbird	<i>Euphagus carolinus</i>	COESWIC/SARA Special Concern Sched. 1 NS ESA Endangered Provincial S2S3B - May be at risk	Breeding - Nests around treed wetlands and beaver ponds.	No	Wetlands.
Sanderling	<i>Calidris alba</i>	Provincial S3M,S2N - Secure	Migratory – During migration will use hard-packed sand beaches, tidal mudflats, rocky coastlines, and inland bodies of water, including ponds, streams, and wetlands, near coastal beaches.	No	Pictou and Caribou Harbours.
Savannah Sparrow princeps ssp	<i>Passerculus sandwichensis princeps</i>	COSEWIC/SARA Special Concern Sched. 1 NS ESA Endangered Provincial S1B - Sensitive	Migratory – This subspecies nests exclusively on Sable Island. Some birds may winter on beaches on mainland NS on dunes and coastal grassland.	No	Pictou Bar
Scarlet Tanager	<i>Piranga olivacea</i>	Provincial S2B - Undetermined	Breeding - Nests in mature, shade-tolerant hardwood forests.	No	Forested areas adjacent Highway 106.
Semipalmated Plover	<i>Charadrius semipalmatus</i>	Provincial S1B,S3S4M - Secure	Breeding - Nests on gravel beaches Migratory – beaches and coastlines	No	Breeding: Gravel beaches with Pictou and Caribou Harbours. Migratory: Pictou and Caribou Harbours.
Semi-palmated Sandpiper	<i>Calidris pusilla</i>	Provincial S3M - Sensitive	Migratory – In migration is found on mudflats, open wetlands, shallow estuaries and sandy beaches.	No	Open wetlands and the Pictou and Caribou Harbours.

Common Name	Scientific Name	Status ¹	Breeding or Migratory Habitat (whichever is most applicable)	Detected or Observed during Field Work?	Possible Habitat Type in the local assessment area
Short-billed Dowitcher	<i>Limnodromus griseus</i>	Provincial S3M - Secure	Migratory - In migration is found in coastal areas such as tidal flats, estuaries and bays, marshes, sandy beaches.	No	Pictou and Caribou Harbours.
Short-eared Owl	<i>Asio flammeus</i>	COSEWIC/SARA Special Concern Sched. 1 Provincial S1S2B - May Be At Risk	Breeding - Nest on dry ground, often on raised hummocks in grasslands, barren headlands and uncultivated grasslands, often near the coast.	No	Wetlands. No Critical Habitat identified within the PFA.
Spotted Sandpiper	<i>Actitis macularius</i>	Provincial S3S4B - Sensitive	Breeding – Typically nests along the shoreline of major rivers, but are associated with almost any type of aquatic habitat.	No	Wetlands, riparian corridors and shorelines with the Pictou and Caribou Harbours
Swainson's Thrush	<i>Catharus ustulatus</i>	Provincial S3S4B - Secure	Breeding – Nests in a wide variety of forested habitats, but shows a preference for mature, closed canopy forests away from human habitation.	No	Forested areas adjacent Highway 106.
Tennessee Warbler	<i>Vermivora peregrina</i>	Provincial S3S4B - Sensitive	Breeding – Typically nests in thickets of deciduous shrubs within conifer-dominated forest.	No	Forested areas adjacent Highway 106.
Tree Swallow	<i>Tachycineta bicolor</i>	Provincial S4B - Sensitive	Breeding - Nests in cavities, either natural or human-made, near lakes and other waterbodies.	Yes, site ETF Site facing northeast in May 2018. Yes, observed from shoreline site, 350 m northeast from Hwy 106 causeway facing south and east (May 2018).	Open wetlands.

Common Name	Scientific Name	Status ¹	Breeding or Migratory Habitat (whichever is most applicable)	Detected or Observed during Field Work?	Possible Habitat Type in the local assessment area
Turkey Vulture	<i>Cathartes aura</i>	Provincial S2S3B - Sensitive	Breeding – Nests on steep, rocky cliffs where they use sheltered crevices/caves, occasionally will nest inside hollow trees, logs or man-made structures.	No	Wetlands.
Veery	<i>Catharus fuscescens</i>	Provincial S3S4B - Secure	Breeding - Nests in wet areas with dense shrub cover, such as shrub or treed swamps.	No	Wetlands.
Vesper Sparrow	<i>Pooecetes gramineus</i>	Provincial S2B - May be at risk	Breeding – Nests in a variety of grassland-type habitats such as barren headlands and cultivated blueberry fields.	No	Wetlands and agricultural lands.
Virginia Rail	<i>Rallus limicola</i>	Provincial S2S3B - Undetermined	Breeding - Nests in marshes or lakeshores with abundant emergent vegetation.	No	Open wetlands.
Warbling Vireo	<i>Vireo gilvus</i>	Provincial S1B - Undetermined	Breeding - Breeds mature riparian forests	No	Wetlands and riparian corridors.
White-rumped Sandpiper	<i>Calidris fuscicollis</i>	Provincial S3M - Secure	Migratory - During migration is found in freshwater marshes, tidal flats, beaches and shorelines.	No	Open wetlands and the Pictou and Caribou Harbours.
Willet	<i>Tringa semipalmata</i>	Provincial S2S3B - May be at risk	Breeding – Nests in coastal marshes, barrier islands and beaches, and occasionally in upland wet meadows.	No	Open wetlands; Pictou Bar
Willow Flycatcher	<i>Empidonax traillii</i>	Provincial S2B - Sensitive	Breeding - Nests in thickets of deciduous trees and shrubs, willows when available, often along streams or near wetlands.	No	Wetlands and riparian corridors.
Wilson's Snipe	<i>Gallinago delicata</i>	Provincial S3B - Sensitive	Breeding - Nests in freshwater wetlands.	No	Wetlands.

Common Name	Scientific Name	Status ¹	Breeding or Migratory Habitat (whichever is most applicable)	Detected or Observed during Field Work?	Possible Habitat Type in the local assessment area
Wilson's Warbler	<i>Wilsonia pusilla</i>	Provincial S3B - Sensitive	Breeding – Nests in shrubby habitats, such as shrub swamps and regenerating clear-cut areas.	No	Wetlands.
Wood Thrush	<i>Hylocichla mustelina</i>	COSEWIC/SARA Threatened Sched. 1 Provincial SUB - Undetermined	Breeding - Nests in the shrubby understory of a variety of forest types, but shows a preference for mature hardwood forests.	No	Forested areas adjacent Highway 106.
Yellow-bellied Flycatcher	<i>Empidonax flaviventris</i>	Provincial S3S4B - Sensitive	Breeding - Nests on ground in mosses, often in younger coniferous forests near wetlands.	No	Wetlands.

¹ Status notes (as of December 2018) - S1: extremely rare in province; S2: rare in province; S3: uncommon in province; S4: widespread, common and apparently secure in province; S5: widespread, abundant and demonstrably secure in province, SU: unrankable (lack of info). The use of 'S#S#' is to denote a range in rank used to indicate any uncertainty about the status of the species or community. Qualifiers: B= Breeding (breeding population), N = Nonbreeding (nonbreeding population) ? = Inexact/Uncertain, H = Historic (possibly extirpated), M = Migrant and SNR = Not yet assessed in province.

Table 2: Historical Marine Bird Observations Recorded by the AC CDC (Dillon 2019a)

Common Name	Scientific Name	NS ESA Status	SARA Status (Schedule 1)	COSEWIC Status	AC CDC Rank ¹	Habitat Considerations
Seabirds						
Common Tern	<i>Sterna hirundo</i>	–	–	Not at Risk	S3B	Inhabits mainly coastal habitats
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	–	–	Not at Risk	S5B	Inhabits mainly coastal habitats
Waterfowl						
Barrow's Goldeneye (Eastern population)	<i>Bucephala islandica</i>	–	Special Concern	Special Concern	S1N	Overwinters in protected coastal waters
Blue-winged Teal	<i>Anas discors</i>	–	–	–	S3S4B	Migrates along coastal habitat
Common Goldeneye	<i>Bucephala clangula</i>	–	–	–	S2B, S5N	Overwinters in protected coastal waters
Common Loon	<i>Gavia immer</i>	–	–	Not at Risk	S3B, S4N	Overwinters in coastal waters
Red-breasted Merganser	<i>Mergus serrator</i>	–	–	–	S3S4B, S5N	Overwinters in coastal waters
Shorebirds						
Black-bellied Plover	<i>Pluvialis squatarola</i>	–	–	–	S3M	Coastal shorebird
Greater Yellowlegs	<i>Tringa melanoleuca</i>	–	–	–	S3B, S3S4M	Inhabits freshwater wetlands and can be found in coastal habitats during migration
Hudsonian Whimbrel	<i>Numenius phaeopus hudsonicus</i>	–	–	–	S2S3M	Coastal shorebird

Killdeer	<i>Charadrius vociferus</i>	–	–	–	S3B	Can be found in terrestrial or coastal habitats
Lesser Yellowlegs	<i>Tringa flavipes</i>	–	–	–	S3M	Inhabits freshwater wetlands and can be found in coastal habitats during migration
Pectoral Sandpiper	<i>Calidris melanotos</i>	–	–	–	S2S3M	Inhabits freshwater wetlands and can be found in coastal habitats during migration
Piping Plover (<i>melodus</i> subspecies)	<i>Charadrius melodus melodus</i>	Endangered	Endangered	Endangered	S1B	Coastal shorebird
Purple Sandpiper	<i>Calidris maritima</i>	–	–	–	S3?N	Coastal shorebird
Red Knot (<i>rufa</i> subspecies)	<i>Calidris canutus rufa</i>	Endangered	Endangered	Endangered	S2M	Coastal shorebird
Ruddy Turnstone	<i>Arenaria interpres</i>	–	–	–	S3M	Coastal shorebird
Sanderling	<i>Calidris alba</i>	–	–	–	S3M, S2N	Coastal shorebird
Semipalmated Plover	<i>Charadrius semipalmatus</i>	–	–	–	S1B, S3S4M	Coastal shorebird
Semipalmated Sandpiper	<i>Calidris pusilla</i>	–	–	–	S3M	Coastal shorebird
Short-billed Dowitcher	<i>Limnodromus griseus</i>	–	–	–	S3M	Inhabits freshwater wetlands and can be found in

						coastal habitats during migration
Spotted Sandpiper	<i>Actitis macularius</i>	–	–	–	S3S4B	Inhabits freshwater and coastal habitats
White-rumped Sandpiper	<i>Calidris fuscicollis</i>	–	–	–	S3M	Coastal shorebird
Willet	<i>Tringa semipalmata</i>	–	–	–	S2S3B	Coastal shorebird

¹ AC CDC rank (as of December 2018) - S1: extremely rare in province; S2: rare in province; S3: uncommon in province; S4: widespread, common and apparently secure in province; S5: widespread, abundant and demonstrably secure in province, SU: unrankable (lack of info). The use of 'S#S#' is to denote a range in rank used to indicate any uncertainty about the status of the species or community. Qualifiers: B= Breeding (breeding population), N = Nonbreeding (nonbreeding population) ? = Inexact/Uncertain, H = Historic (possibly extirpated), M = Migrant and SNR = Not yet assessed in province.

MBBA Data Summary for Square 20NR25



Square Summary (20NR25)

#species (1st atlas)				#species (2nd atlas)				#hours	#pc done
poss	prob	conf	total	poss	prob	conf	total	1st	2nd
46	9	34	89	24	46	39	109	16	81.2
								16	0

Region summary (#21: Cobequid)

#squares		#sq with data		#species		#pc done	target #pc
1st	2nd	1st	2nd	1st	2nd		
67	62	65	146	167	508	251	

Target number of point counts in this square: 14 road side, 1 off road (1 in Mature coniferous). Please try to ensure that each off-road station is located such that the entire 100m radius circle is within the prescribed habitat.

SPECIES		Code		%		SPECIES		Code		%		SPECIES		Code		%	
1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Canada Goose		FY		0	53	Northern Harrier		H		46	76	Short-eared Owl †					1
Wood Duck		P		20	52	Sharp-shinned Hawk				22	38	North Saw-whet Owl					11
Gadwall ‡				0	3	Northern Goshawk		H		12	20	Common Nighthawk †	H	D			29
Eurasian Wigeon ‡				0	0	Broad-winged Hawk		H	H	32	55	Chimney Swift †					32
American Wigeon		H		12	26	Red-tailed Hawk		H	H	46	72	Ruby-thr Hummingbird	H	H			61
American Black Duck		NE	FY	66	81	Virginia Rail †				6	9	Belted Kingfisher	ON	P			51
Mallard		H	T	9	60	Sora		FY		16	52	Yellow-bellied Sapsucker		T			50
<u>Blue-winged Teal</u>		P		27	26	Common Gallinule †				3	1	Downy Woodpecker	FL	A			48
Northern Shoveler ‡				3	4	American Coot †				4	0	Hairy Woodpecker	FL	FY			54
Northern Pintail				8	1	Semipalmated Plover †				6	0	Am Three-toed Woodpecker †					0
Green-winged Teal		H	T	24	56	Piping Plover †		NE	D	3	3	Black-back Woodpecker					20
Ring-necked Duck		P	FY	32	72	Killdeer		FL	FY	56	64	Northern Flicker	H	FS			80
Greater Scaup †				0	0	Spotted Sandpiper		H	FY	50	70	Pileated Woodpecker	H	P			45
Common Eider ‡§				0	1	Greater Yellowlegs †				0	3	<u>American Kestrel</u>	H				50
Hooded Merganser		P	FY	9	50	Willet			FY	14	24	Merlin		NY			16
Common Merganser		H	H	25	55	Wilson's Snipe		H	T	62	73	Olive-sided Flycatcher †		T			38
<u>Red-breast Merganser</u>		H		4	7	American Woodcock		H	D	22	81	Eastern Wood-Pewee	H	D			56
Gray Partridge				6	4	Ring-billed Gull ‡§				0	0	Yellow-bellied Flycatcher		T			30
Ring-necked Pheasant			S	20	69	Herring Gull §				8	10	Alder Flycatcher	H	T			79
Ruffed Grouse		FL	H	58	86	Great Black-backed Gull §				8	6	Willow Flycatcher †					1
Spruce Grouse				20	30	Common Tern §		H	NE	9	12	Least Flycatcher	H	T			59
Common Loon			H	29	35	Arctic Tern ‡§				1	0	<u>Eastern Phoebe</u>					12
Pied-billed Grebe			FY	24	30	Black Guillemot ‡§				0	3	Gr Crested Flycatcher					6
Double-crest Cormorant §		NY	NY	8	12	Rock Pigeon		H	AE	59	78	Eastern Kingbird	H	D			45
<u>American Bittern</u>				22	55	Mourning Dove		FL	FY	27	95	Blue-headed Vireo	H	CF			61
Great Blue Heron §		ON	H	29	13	Yellow-billed Cuckoo ‡			H	0	1	Philadelphia Vireo ‡					1
Turkey Vulture ‡¶				0	0	Black-billed Cuckoo			S	9	26	Red-eyed Vireo	FL	T			82
Osprey		ON	NY	22	50	<u>Great Horned Owl</u>				40	63	<u>Gray Jay</u>					45
Bald Eagle ¶		H	NY	27	83	Barred Owl			T	35	69	Blue Jay	FL	FY			70

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Maritimes Breeding Bird Atlas - Summary Sheet for Square 20NR25 (page 2 of 2)

SPECIES	Code		%		SPECIES	Code		%		SPECIES	Code		%	
	1st	2nd	1st	2nd		1st	2nd	1st	2nd		1st	2nd	1st	2nd
American Crow	AY	NY	87	100	Black-white Warbler	H	T	77	87	Dark-eyed Junco	A	T	70	92
Common Raven	H	T	69	100	<u>Tennessee Warbler</u>	H		75	43	Scarlet Tanager †			4	1
Horned Lark †			1	1	Nashville Warbler	H	T	48	86	Northern Cardinal ‡		FY	0	10
Tree Swallow	H	AE	80	93	Mourning Warbler			33	49	Rose-breast Grosbeak	H	T	69	56
Bank Swallow §		H	56	43	Common Yellowthroat	AY	CF	82	100	Indigo Bunting ‡			1	3
Cliff Swallow §	ON	NY	38	36	American Redstart	AY	CF	85	98	Bobolink	H	T	70	69
Barn Swallow	H	P	85	90	<u>Cape May Warbler</u>	AY		32	16	Red-wing Blackbird	FL	CF	67	84
Black-capp Chickadee	FL	CF	67	98	Northern Parula		T	72	96	Rusty Blackbird †			24	21
Boreal Chickadee	H	T	53	66	Magnolia Warbler	H	T	72	96	Common Grackle	AY	CF	75	96
Red-breast Nuthatch		T	70	81	<u>Bay-breasted Warbler</u>	H		40	49	Brown-head Cowbird	H	T	43	18
White-breast Nuthatch	P	H	11	15	Blackburnian Warbler	P	T	54	83	Orchard Oriole †		S	0	†
Brown Creeper		P	14	50	Yellow Warbler	AY	CF	74	92	<u>Baltimore Oriole</u>	AY		11	13
Winter Wren		S	38	80	Chestn-sided Warbler	H	T	61	86	Pine Grosbeak			29	4
Golden-crown Kinglet	H	T	69	87	Blackpoll Warbler			12	12	Purple Finch	H	T	67	93
Ruby-crown Kinglet	H	T	79	92	Black-thr Blue Warbler		S	8	43	House Finch †			1	4
Eastern Bluebird †		T	1	16	<u>Palm Warbler</u>			22	75	Red Crossbill †		T	17	15
Veery	A	T	54	61	Yellow-rumped Warbler	H	T	67	98	<u>White-winged Crossbill</u>			54	64
Bicknell's Thrush †			1	0	Black-thr Green Warbler	H	D	69	83	Pine Siskin		S	59	58
Swainson's Thrush	H	S	66	89	Canada Warbler †	AY	A	35	52	American Goldfinch	FL	S	82	100
Hermit Thrush	H	T	74	96	Wilson's Warbler			11	10	Evening Grosbeak	H	T	50	55
<u>Wood Thrush</u> †	T		4	9	Chipping Sparrow	FL	S	69	86	House Sparrow	FL	S	79	36
American Robin	AY	CF	90	100	Vesper Sparrow †			4	10					
Gray Catbird	AY	H	54	58	Savannah Sparrow	H	FY	74	86					
<u>Northern Mockingbird</u> †	NY		4	3	Nelson's Sh.-tail Sparrow		CF	16	21					
European Starling	FL	CF	77	93	Song Sparrow	FL	DD	87	100					
Bohemian Waxwing ‡			0	0	<u>Lincoln's Sparrow</u>	A		45	63					
Cedar Waxwing	H	FY	70	100	Swamp Sparrow	H	FY	51	95					
Ovenbird	NE	FY	70	93	White-throat Sparrow	NE	DD	77	100					
North Waterthrush		T	30	55	White-crown Sparrow ‡			0	1					

This list includes all species found during the Maritimes Breeding Bird Atlas (1st atlas: 1986-1990, 2nd atlas: 2006-2010) in the region #21 (Cobequid). Underlined species are those that you should try to add to this square (20NR25). They have not yet been reported during the 2nd atlas, but were found during the 1st atlas in this square or have been reported in more than 50% of the squares in this region during the 2nd atlas so far. "Code" is the code for the highest breeding evidence for that species in square 20NR25 during the 2nd and 1st atlas respectively. The % columns give the percentage of squares in that region where that species was reported during the 2nd and 1st atlas (this gives an idea of the expected chance of finding that species in region #21). Rare/Colonial Species Report Forms should be completed for species marked: § (Colonial), ‡ (regionally rare), † (rare in the Maritimes) or ‡ (rare in the Maritimes; documentation only required for confirmed records). Current as of 22/11/2018. An up-to-date version of this sheet is available from <http://www.mba-aom.ca/sp/summaryform.jsp?squareID=20NR25?lang=en>

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Field Surveys

Table 3: Overwintering Bird Survey Summary - December 7, 2017, January 26, 2018, and March 20, 2018

Common Name	Scientific Name	S-ranking*	Provincial NS ESA	Federal SARA	Total number detected
Greater Scaup	<i>Aythya marila</i>	S4N	-	-	1,427
Canada Goose	<i>Branta canadensis</i>	SNAB, S4N	-	-	762
Red-breasted Merganser	<i>Mergus serrator</i>	S3S4B, S5N	-	-	533
Herring Gull	<i>Larus argentatus</i>	S5	-	-	397
Common Goldeneye	<i>Bucephala clangula</i>	S2B, S5N	-	-	314
Bonaparte's Gull	<i>Chroicocephalus philadelphia</i>	S5M	-	-	213
Common Merganser	<i>Mergus merganser</i>	S5	-	-	187
Long-tailed Duck	<i>Clangula hyemalis</i>	S5N	-	-	75
Iceland Gull	<i>Larus glaucoides</i>	S4N	-	-	65
Rock Pigeon	<i>Columba livia</i>	SNA	-	-	58
Great Black-backed Gull	<i>Larus marinus</i>	S4S5	-	-	50
Ring-billed Gull	<i>Larus delawarensis</i>	SUB, S5N	-	-	39
American Black Duck	<i>Anas rubripes</i>	S5	-	-	21
Bufflehead	<i>Bucephala albeola</i>	S3S4N	-	-	17
Bald Eagle	<i>Haliaeetus leucocephalus</i>	S5	-	-	13
Barrow's Goldeneye	<i>Bucephala islandica</i>	S1N	-	Special Concern	6
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	S4B	-	-	6
Lesser Scaup	<i>Aythya affinis</i>	SNA	-	-	6
Hooded Merganser	<i>Lophodytes cucullatus</i>	S5B	-	-	4
Osprey	<i>Pandion haliaetus</i>	S4B	-	-	2
European Common Gull	<i>Larus canus</i>	SNA	-	-	1
Great Cormorant	<i>Phalacrocorax carbo</i>	S2S3	-	-	1
Red-throated Loon	<i>Gavia stellata</i>	S4N	-	-	1
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	S4B	-	-	1
Tufted Duck	<i>Aythya fuligula</i>	SNA	-	-	1

*S-rank - Status notes (as of December 2018) - S1: extremely rare in province; S2: rare in province; S3: uncommon in province; S4: widespread, common and apparently secure in province; S5: widespread, abundant and demonstrably secure in province, SU: unrankable (lack of info). The use of 'S#S#' is to denote a range in rank used to indicate any uncertainty about the status of the species or community. Qualifiers: B= Breeding (breeding population), N = Nonbreeding (nonbreeding population) ? = Inexact/Uncertain, H = Historic (possibly extirpated), M = Migrant and SNR = Not yet assessed in province. (ACCDC 2018a).

Bold indicates a species of conservation concern.

Table 4: Migratory Stop-Over Summary – May 14, 2018

Common Name	Scientific Name	S-ranking*	Provincial NS ESA	Federal SARA	Total number detected
Common Tern	<i>Sterna hirundo</i>	S3B	-	-	161
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	S4B	-	-	132
Bonaparte's Gull	<i>Chroicocephalus philadelphia</i>	S5M	-	-	100
European Starling	<i>Sturnus vulgaris</i>	SNA	-	-	48
Tree Swallow	<i>Tachycineta bicolor</i>	S4B	-	-	31
Song Sparrow	<i>Melospiza melodia</i>	S5B	-	-	17
American Crow	<i>Corvus brachyrhynchos</i>	S5	-	-	16
Canada Goose	<i>Branta canadensis</i>	SNAB, S4N	-	-	16
Rock Pigeon	<i>Columba livia</i>	SNA	-	-	15
Red-breasted Merganser	<i>Mergus serrator</i>	S3S4B, S5N	-	-	12
American Goldfinch	<i>Spinus tristis</i>	S5	-	-	11
American Robin	<i>Turdus migratorius</i>	S5B, S3N	-	-	8
Bald Eagle	<i>Haliaeetus leucocephalus</i>	S5	-	-	7
Barn Swallow	<i>Hirundo rustica</i>	S2S3B	Endangered	Threatened	4
Osprey	<i>Pandion haliaetus</i>	S4B	-	-	4
Black-capped Chickadee	<i>Poecile atricapillus</i>	S5	-	-	3
Ring-billed Gull	<i>Larus delawarensis</i>	SUB, S5N	-	-	3
Killdeer	<i>Charadrius vociferus</i>	S3B	-	-	2
Savannah Sparrow	<i>Passerculus sandwichensis</i>	S4S5B	-	-	2
Belted Kingfisher	<i>Megasceryle alcyon</i>	S5B	-	-	1
Common Grackle	<i>Quiscalus quiscula</i>	S5B	-	-	1
Common Raven	<i>Corvus corax</i>	S5	-	-	1
Hairy Woodpecker	<i>Picoides villosus</i>	S5	-	-	1
Mourning Dove	<i>Zenaida macroura</i>	S5	-	-	1
White-throated Sparrow	<i>Zonotrichia albicollis</i>	S5B	-	-	1

*S-rank - Status notes (as of December 2018) - S1: extremely rare in province; S2: rare in province; S3: uncommon in province; S4: widespread, common and apparently secure in province; S5: widespread, abundant and demonstrably secure in province, SU: unrankable (lack of info). The use of 'S#S#' is to denote a range in rank used to indicate any uncertainty about the status of the species or community. Qualifiers: B= Breeding (breeding population), N = Nonbreeding (nonbreeding population) ? = Inexact/Uncertain, H = Historic (possibly extirpated), M = Migrant and SNR = Not yet assessed in province. (ACCDC 2018a).

Bold indicates a species of conservation concern.

Table 5: Breeding Bird Survey Summary – June 16, 2018

Common Name	Scientific Name	S-ranking*	Provincial NS ESA	Federal SARA	Total number detected
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	S4B	-	-	204
European Starling	<i>Sturnus vulgaris</i>	SNA	-	-	137
Yellow Warbler	<i>Dendroica petechia</i>	S5B	-	-	49
Rock Pigeon	<i>Columba livia</i>	SNA	-	-	44
American Goldfinch	<i>Spinus tristis</i>	S5	-	-	39
Song Sparrow	<i>Melospiza melodia</i>	S5B	-	-	35
Cedar Waxwing	<i>Bombycilla cedrorum</i>	S5B	-	-	34
Red-eyed Vireo	<i>Vireo olivaceus</i>	S5B	-	-	33
Alder Flycatcher	<i>Empidonax alnorum</i>	S5B	-	-	28
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	S2S3B	-	-	26
Scoter spp.	<i>Melanitta spp.</i>	S4N	-	-	25
American Redstart	<i>Setophaga ruticilla</i>	S4S5B	-	-	24
American Crow	<i>Corvus brachyrhynchos</i>	S5	-	-	20
American Robin	<i>Turdus migratorius</i>	S5B, S3N	-	-	19
Savannah Sparrow	<i>Passerculus sandwichensis</i>	S4S5B	-	-	15
Black-capped Chickadee	<i>Poecile atricapillus</i>	S5	-	-	12
Common Grackle	<i>Quiscalus quiscula</i>	S5B	-	-	11
Great Blue Heron	<i>Ardea herodias</i>	S4B	-	-	6
Common Raven	<i>Corvus corax</i>	S5	-	-	5
Purple Finch	<i>Haemorhous purpureus</i>	S4S5B, S3S4N	-	-	5
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	S4B	-	-	5
Blue Jay	<i>Cyanocitta cristata</i>	S5	-	-	4
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	S5B	-	-	4
Mourning Dove	<i>Zenaidura macroura</i>	S5	-	-	4
Chipping Sparrow	<i>Spizella passerine</i>	S4B	-	-	3
Common Yellowthroat	<i>Geothlypis trichas</i>	S5B	-	-	3
Canada Goose	<i>Branta Canadensis</i>	SNAB, S4N	-	-	2
Gray Catbird	<i>Dumatella carolinensis</i>	S3B	-	-	2
Mallard	<i>Anas platyrhynchos</i>	S5	-	-	2
Northern Parula	<i>Setophaga americana</i>	S5B	-	-	2
Barn Swallow	<i>Hirundo rustica</i>	S2S3B	Endangered	Threatened	1
Belted Kingfisher	<i>Megasceryle alcyon</i>	S5B	-	-	1
Black-and-white Warbler	<i>Mniotilta varia</i>	S5B	-	-	1

Common Name	Scientific Name	S-ranking*	Provincial NS ESA	Federal SARA	Total number detected
Black-throated Green Warbler	<i>Dendroica virens</i>	S5B	-	-	1
Osprey	<i>Pandion haliaetus</i>	S4B	-	-	1
Ovenbird	<i>Seiurus aurocapilla</i>	S5B	-	-	1
Ruby-throated Hummingbird	<i>Phalacrocorax auritus</i>	S5B	-	-	1

*S-rank - Status notes (as of December 2018) - S1: extremely rare in province; S2: rare in province; S3: uncommon in province; S4: widespread, common and apparently secure in province; S5: widespread, abundant and demonstrably secure in province, SU: unrankable (lack of info). The use of 'S#S#' is to denote a range in rank used to indicate any uncertainty about the status of the species or community. Qualifiers: B= Breeding (breeding population), N = Nonbreeding (nonbreeding population) ? = Inexact/Uncertain, H = Historic (possibly extirpated), M = Migrant and SNR = Not yet assessed in province. (ACCDC 2018a).

Bold indicates a species of conservation concern

Table 6: Summary of Common Nighthawk, Double-Crested Cormorant and Raptor Survey Results

Species	# Birds Counted	Location ID
Common Nighthawk	1	Nighthawk #3
	2	Nighthawk #5
Double-crested Cormorant	1245	Double-crested Cormorant Colony
	2	Owl #3 (Barred Owl)
Owls	1	Owl #5 (Great Horned Owl)
	2	Owl #6 (American Woodcock)
Raptor Nests	2	Osprey Nests

Table 7: Bird Surveys Conducted May 9, 2019.

Scientific Name	Common Name	Number of individuals identified at Point Count Location														SARA Status	NSES Status	S-Rank	Sgs rank
		PC#1	PC#2	PC#3	PC#4	PC#5	PC#6	PC#7	PC#8	PC#9	PC#10	PC#11	PC#12	PC#13	PC#14				
Anas rubripes	American Black Duck					3										-	-	S5	4 Secure
Corvus brachyrhynchos	American Crow	3	2		2			1		3	2	1	4	2		-	-	S5	4 Secure
Carduelis tristis	American Goldfinch	2		2		1			1			2		1		-	-	S5	4 Secure
Turdus migratorius	American Robin	2		1	2	1				2	1	9				-	-	S5B,S3N	4 Secure
Haliaeetus leucocephalus	Bald Eagle	1				1						1	1			NAR	-	S5	4 Secure
Megaceryle alcyon	Belted Kingfisher			1												-	-	S5B	4 Secure
Poecile atricapilla	Black-capped Chickadee	2					2	1	1							-	-	S5	4 Secure
Cyanocitta cristata	Blue Jay	1				1						4				-	-	S5	4 Secure
Certhia americana	Brown Creeper									1						-	-	S5	4 Secure
Branta canadensis	Canada Goose								1							-	-	SNAB,S4N	4 Secure
Quiscalus quiscula	Common Grackle					1			1	2						-	-	S5B	4 Secure
Corvus corax	Common Raven			1	2				1	1	1			4		-	-	S5	4 Secure
Junco hyemalis	Dark-eyed Junco							1								-	-	S4S5	4 Secure
Phalacrocorax auritus	Double-crested Cormorant			11		1										NAR	-	S4B	4 Secure
Sturnus vulgaris	European Starling	2		4	2	1	1									-	-	SNA	7 Exotic
Regulus satrapa	Golden-crowned Kinglet										1					-	-	S5	3 Sensitive
Anas crecca	Green-winged Teal								3							-	-	S4S5B	4 Secure
Larus argentatus	Herring Gull												3			-	-	S5	4 Secure
Zenaidura macroura	Mourning Dove							1								-	-	S5	4 Secure
Vermivora ruficapilla	Nashville Warbler		1													-	-	S4S5B	4 Secure
Colaptes auratus	Northern Flicker					2	1			1						-	-	S5B	4 Secure
Pandion haliaetus	Osprey		1													-	-	S4B	4 Secure
Carpodacus purpureus	Purple Finch	2				1	1			3						-	-	S4S5B,S3S4	4 Secure
Mergus serrator	Red-breasted Merganser			6												-	-	S3S4B,S5N	4 Secure
Agelaius phoeniceus	Red-winged Blackbird					2	1		6							-	-	S4B	4 Secure
Phasianus colchicus	Ring-necked Pheasant			1			1	1								-	-	SNA	7 Exotic
Columba livia	Rock Pigeon		2										7			-	-	SNA	7 Exotic
Regulus calendula	Ruby-crowned Kinglet								1	2	1					-	-	S3S4B	3 Sensitive
Zonotrichia albicollis	White-throated Sparrow							3			2	1		2		-	-	S5B	4 Secure
Sphyrapicus varius	Yellow-bellied Sapsucker				1											-	-	S4S5B	4 Secure
Dendroica coronata	Yellow-rumped Warbler		2		1		2		2			2		1		-	-	S5B	4 Secure

Birder: CK

S-rank - Ranking by the Atlantic Canadian Conservation Data Centre and NatureServe. Status notes (as of November 2018): S1: Extremely rare in province; S2: Rare in the province; S3: Uncommon in province; S4: Widespread, common and apparently Secure in province; S5: Widespread, abundant and demonstrably secure in province; SNA: Not applicable; SNR: Not yet assessed in province. The use of 'S#S#' is to denote a range in rank used to indicate any uncertainty about the status of the species or community. Qualifiers: B= Breeding (breeding population), N = Nonbreeding (nonbreeding population) ? = Inexact/Uncertain, H = Historic (possibly extirpated), M = Migrant and SNR = Not yet assessed in province. (ACDC 2019).

Italicized S# - Species is ranked as S1-S3 by the AC CDC.

Bold: SARA status - Conservation status under the Species At Risk Act as of June 2019: Not at Risk (NAR), endangered (E), threatened (T), special concern (SC)

Bold: NSES Status - Conservation status under the Nova Scotia Endangered Species Act as of June 2019: Vulnerable (V)

PC - Point Count

Sgs Rank - Provincial ranks under the General Status of Wildlife Process

- not assessed by SARA or NSES

Table 8: Bird Surveys Conducted May 24, 2019.

Scientific Name	Common Name	Number of individuals identified at Point Count Location														SARA Status	NSES Status	S-Rank	Sgs rank
		PC#1	PC#2	PC#3	PC#4	PC#5	PC#6	PC#7	PC#8	PC#9	PC#10	PC#11	PC#12	PC#13	PC#14				
<i>Corvus brachyrhynchos</i>	American Crow		3	5		3	3		1	1		1	4			-	-	S5	4 Secure
<i>Carduelis tristis</i>	American Goldfinch		2	5	2	2	1	2	1					1	2	-	-	S5	4 Secure
<i>Setophaga ruticilla</i>	American Redstart								1							-	-	S4S5B	4 Secure
<i>Turdus migratorius</i>	American Robin	2		3	2	2			1	4	2	3	1		1	-	-	S5B,S3N	4 Secure
<i>Haliaeetus leucocephalus</i>	Bald Eagle					1					1	1	2			NAR	-	S5	4 Secure
<i>Mniotilta varia</i>	Black-and-White Warbler				1	1	1				1	1		1		-	-	S5B	4 Secure
<i>Dendroica fusca</i>	Blackburnian Warbler									1	1					-	-	S4B	4 Secure
<i>Poecile atricapilla</i>	Black-capped Chickadee	1		1	1			2		2		1			1	-	-	S5	4 Secure
<i>Dendroica virens</i>	Black-throated Green Warbler					1			2							-	-	S5B	4 Secure
<i>Cyanocitta cristata</i>	Blue Jay		1					1					1		1	-	-	S5	4 Secure
<i>Vireo solitarius</i>	Blue-headed Vireo			1	1				1	1				1		-	-	S5B	4 Secure
<i>Branta canadensis</i>	Canada Goose														1	-	-	SNAB,S4N	4 Secure
<i>Quiscalus quiscula</i>	Common Grackle					1	1									-	-	S5B	4 Secure
<i>Corvus corax</i>	Common Raven								1	3	1	1			1	-	-	S5	4 Secure
<i>Geothlypis trichas</i>	Common Yellowthroat							1	1					1		-	-	S5B	4 Secure
<i>Phalacrocorax auritus</i>	Double-crested Cormorant			3									5			NAR	-	S4B	4 Secure
<i>Picoides pubescens</i>	Downy Woodpecker											1				-	-	S5	4 Secure
<i>Sturnus vulgaris</i>	European Starling	2	11	1	6	1							2			-	-	SNA	7 Exotic
<i>Ardea herodias</i>	Great Blue Heron			3											1	-	-	S4B	4 Secure
<i>Tringa melanoleuca</i>	Greater Yellowlegs			1												-	-	S3B,S3S4M	3 Sensitive
<i>Catharus guttatus</i>	Hermit Thrush										2			1		-	-	S5B	4 Secure
<i>Charadrius vociferus</i>	Killdeer												1			-	-	S3B	3 Sensitive
<i>Colaptes auratus</i>	Northern Flicker			1		1										-	-	S5B	4 Secure
<i>Parula americana</i>	Northern Parula					1		2								-	-	S5B	4 Secure
<i>Pandion haliaetus</i>	Osprey		1													-	-	S4B	4 Secure
<i>Seiurus aurocapilla</i>	Ovenbird		1			1	1	2	1	3	1	1		2		-	-	S5B	4 Secure
<i>Dendroica palmarum</i>	Palm Warbler													1		-	-	S5B	4 Secure
<i>Carpodacus purpureus</i>	Purple Finch		1	1						1	1					-	-	S4S5B,S3S4N	4 Secure
<i>Sitta canadensis</i>	Red-breasted Nuthatch								1							-	-	S3	4 Secure
<i>Agelaius phoeniceus</i>	Red-winged Blackbird						1	1	6						1	-	-	S4B	4 Secure
<i>Aythya collaris</i>	Ring-necked Duck			1												-	-	S5B	4 Secure
<i>Columba livia</i>	Rock Pigeon		2										2			-	-	SNA	7 Exotic
<i>Regulus calendula</i>	Ruby-crowned Kinglet								1	1			1			-	-	S3S4B	3 Sensitive
<i>Melospiza melodia</i>	Song Sparrow		1	2		2	2		1							-	-	S5B	4 Secure
<i>Porzana carolina</i>	Sora								1							-	-	S5B	4 Secure
<i>Melospiza georgiana</i>	Swamp Sparrow								1							-	-	S5B	4 Secure
<i>Tachycineta bicolor</i>	Tree Swallow									1						-	-	S4B	3 Sensitive
<i>Zonotrichia albicollis</i>	White-throated Sparrow		1		1		1				1	1		1		-	-	S5B	4 Secure
<i>Wilsonia pusilla</i>	Wilson's Warbler	1														-	-	S3B	3 Sensitive
<i>Troglodytes troglodytes</i>	Winter Wren									1						-	-	S5B	4 Secure
<i>Dendroica petechia</i>	Yellow Warbler	1		4		2	1									-	-	S5B	4 Secure
<i>Sphyrapicus varius</i>	Yellow-bellied Sapsucker				1											-	-	S4S5B	4 Secure
<i>Dendroica coronata</i>	Yellow-rumped Warbler	1	2			1		1	4	3	2			1		-	-	S5B	4 Secure

Birder: CK

S-rank - Ranking by the Atlantic Canadian Conservation Data Centre and NatureServe. Status notes (as of November 2018): S1: Extremely rare in province; S2: Rare in the province; S3: Uncommon in province; S4: Widespread, common and apparently Secure in province; S5: Widespread, abundant and demonstrably secure in province; SNA: Not applicable; SNR: Not yet assessed in province. The use of 'S#S#' is to denote a range in rank used to indicate any uncertainty about the status of the species or community. Qualifiers: B= Breeding (breeding population), N = Nonbreeding (nonbreeding population) ? = Inexact/Uncertain, H = Historic (possibly extirpated), M =

Italicized S# - Species is ranked as S1-S3 by the AC CDC.

Bold: SARA status - Conservation status under the Species At Risk Act as of June 2019: Not at Risk (NAR), endangered (E), threatened (T), special concern (SC)

Bold: NSES Status - Conservation status under the Nova Scotia Endangered Species Act as of June 2019: Vulnerable (V)

PC - Point Count

Sgs Rank - Provincial ranks under the General Status of Wildlife Process

- not assessed by SARA or NSES

Table 9: Bird Surveys Conducted June 10, 2019.

Scientific Name	Common Name	Number of individuals identified at Point Count Location														SARA Status	NSES Status	S-Rank	Sgs rank
		PC#1	PC#2	PC#3	PC#4	PC#5	PC#6	PC#7	PC#8	PC#9	PC#10	PC#11	PC#12	PC#13	PC#14				
<i>Empidonax alnorum</i>	Alder Flycatcher			2	2	3	2		3			1			2	-	-	S5B	4 Secure
<i>Corvus brachyrhynchos</i>	American Crow		3	2	2		1			1	1	1	3	1		-	-	S5	4 Secure
<i>Carduelis tristis</i>	American Goldfinch	2	1		2				1		1	1			4	-	-	S5	4 Secure
<i>Setophaga ruticilla</i>	American Redstart	1		1	1	2			1			1	1		1	-	-	S4S5B	4 Secure
<i>Turdus migratorius</i>	American Robin	2	2	1	1	1		2			3	3		1	2	-	-	S5B, S3N	4 Secure
<i>Haliaeetus leucocephalus</i>	Bald Eagle								2			1	3			NAR	-	S5	4 Secure
<i>Mniotilta varia</i>	Black-and-White Warbler				1	2		2							1	-	-	S5B	4 Secure
<i>Dendroica fusca</i>	Blackburnian Warbler										1	1			1	-	-	S4B	4 Secure
<i>Poecile atricapilla</i>	Black-capped Chickadee	2			1	1	1		1	2		2				-	-	S5	4 Secure
<i>Dendroica virens</i>	Black-throated Green Warbler									1						-	-	S5B	4 Secure
<i>Cyanocitta cristata</i>	Blue Jay				1	4		2	1							-	-	S5	4 Secure
<i>Vireo solitarius</i>	Blue-headed Vireo			1								1				-	-	S5B	4 Secure
<i>Branta canadensis</i>	Canada Goose		2												1	-	-	SNAB, S4N	4 Secure
<i>Bombicilla cedrorum</i>	Cedar Waxwing		2		1		2	1				1				-	-	S5B	4 Secure
<i>Dendroica pensylvanica</i>	Chestnut-sided Warbler			1	2		2	1							1	-	-	S5B	4 Secure
<i>Quiscalus quiscula</i>	Common Grackle				1				3						1	-	-	S5B	4 Secure
<i>Corvus corax</i>	Common Raven										1					-	-	S5	4 Secure
<i>Geothlypis trichas</i>	Common Yellowthroat		1			1	1		2						2	-	-	S5B	4 Secure
<i>Phalacrocorax auritus</i>	Double-crested Cormorant												3			NAR	-	S4B	4 Secure
<i>Picoides pubescens</i>	Downy Woodpecker						1									-	-	S5	4 Secure
<i>Contopus virens</i>	Eastern Wood-Pewee					2										SC	V	S3S4B	3 Sensitive
<i>Sturnus vulgaris</i>	European Starling	2	9		3	3										-	-	SNA	7 Exotic
<i>Regulus satrapa</i>	Golden-crowned Kinglet										1					-	-	S5	3 Sensitive
<i>Ardea herodias</i>	Great Blue Heron			2												-	-	S4B	4 Secure
<i>Catharus guttatus</i>	Hermit Thrush														2	-	-	S5B	4 Secure
<i>Dendroica magnolia</i>	Magnolia Warbler						1		1	2	2	1			1	-	-	S5B	4 Secure
<i>Zenaidura macroura</i>	Mourning Dove			1												-	-	S5	4 Secure
<i>Colaptes auratus</i>	Northern Flicker						1									-	-	S5B	4 Secure
<i>Parula americana</i>	Northern Parula							1				2				-	-	S5B	4 Secure
<i>Pandion haliaetus</i>	Osprey		1													-	-	S4B	4 Secure
<i>Seiurus aurocapilla</i>	Ovenbird			1		1		2		4	2	1	1	1	1	-	-	S5B	4 Secure
<i>Dryocopus pileatus</i>	Pileated Woodpecker				1											-	-	S5	4 Secure
<i>Vireo olivaceus</i>	Red-eyed Vireo	1		3	1	1	3	1		1		2	1			-	-	S5B	4 Secure
<i>Agelaius phoeniceus</i>	Red-winged Blackbird					1		2	5							-	-	S4B	4 Secure
<i>Columba livia</i>	Rock Pigeon			1									9			-	-	SNA	7 Exotic
<i>Regulus calendula</i>	Ruby-crowned Kinglet									1						-	-	S3S4B	3 Sensitive
<i>Accipiter striatus</i>	Sharp-shinned Hawk				1											NAR	-	S5	4 Secure
<i>Melospiza melodia</i>	Song Sparrow		1	2	1	2	2		1				2			-	-	S5B	4 Secure
<i>Melospiza georgiana</i>	Swamp Sparrow								1						1	-	-	S5B	4 Secure
<i>Tachycineta bicolor</i>	Tree Swallow											1				-	-	S4B	3 Sensitive
<i>Catharus fuscescens</i>	Veery							1								-	-	S3S4B	4 Secure
<i>Zonotrichia albicollis</i>	White-throated Sparrow											1		1	2	-	-	S5B	4 Secure
<i>Dendroica petechia</i>	Yellow Warbler	2	1	3	1			1					2			-	-	S5B	4 Secure
<i>Sphyrapicus varius</i>	Yellow-bellied Sapsucker				1											-	-	S4S5B	4 Secure
<i>Dendroica coronata</i>	Yellow-rumped Warbler								1	1	1					-	-	S5B	4 Secure

Birder: CK

S-rank - Ranking by the Atlantic Canadian Conservation Data Centre and NatureServe. Status notes (as of November 2018): S1: Extremely rare in province; S2: Rare in the province; S3: Uncommon in province; S4: Widespread, common and apparently secure in province; S5: Widespread, abundant and demonstrably secure in province; SNA: Not applicable; SNR: Not yet assessed in province. The use of 'S#S#' is to denote a range in rank used to indicate any uncertainty about the status of the species or community. Qualifiers: B = Breeding (breeding population), N = Nonbreeding (nonbreeding population) ? = Inexact/Uncertain, H = Historic (possibly extirpated), M = Migrant and SNR = Not yet assessed in province. (ACCDC 2019).

Bold indicates a species of conservation concern.

Italicized S# - Species is ranked as S1-S3 by the AC CDC.

Bold: SARA status - Conservation status under the Species At Risk Act as of June 2019: Not at Risk (NAR), endangered (E), threatened (T), special concern (SC)

Bold: NSES Status - Conservation status under the Nova Scotia Endangered Species Act as of June 2019: Vulnerable (V)

PC - Point Count

Sgs Rank - Provincial ranks under the General Status of Wildlife Process

- not assessed by SARA or NSES

Table 10: Bird Surveys Conducted July 5, 2019.

Scientific Name	Common Name	Number of individuals identified at Point Count Location														SARA Status	NSES Status	S-Rank	Sgs rank
		PC#1	PC#2	PC#3	PC#4	PC#5	PC#6	PC#7	PC#8	PC#9	PC#10	PC#11	PC#12	PC#13	PC#14				
Empidonax alnorum	Alder Flycatcher			2					1						1	-	-	S5B	4 Secure
Corvus brachyrhynchos	American Crow	1	3	1	1				1		1		1	1	1	-	-	S5	4 Secure
Carduelis tristis	American Goldfinch	2	2	3			1	3	1			2		1	3	-	-	S5	4 Secure
Setophaga ruticilla	American Redstart	2		2						1	1	1				-	-	S4S5B	4 Secure
Turdus migratorius	American Robin	2		1				1	2	1		2	1			-	-	S5B,S3N	4 Secure
Mniotilta varia	Black-and-White Warbler					2	2					1		1	1	-	-	S5B	4 Secure
Poecile atricapilla	Black-capped Chickadee	1				1	1	1	1							-	-	S5	4 Secure
Cyanocitta cristata	Blue Jay			1								1		1		-	-	S5	4 Secure
Vireo solitarius	Blue-headed Vireo							2								-	-	S5B	4 Secure
Bombicilla cedrorum	Cedar Waxwing			2	1				7	2		2	5		1	-	-	S5B	4 Secure
Dendroica pensylvanica	Chestnut-sided Warbler	1			2	2	2				1	1	1			-	-	S5B	4 Secure
Petrochelidon pyrrhonota	Cliff Swallow		11													-	-	S2S3B	2 May Be At Risk
Quiscalus quiscula	Common Grackle					1										-	-	S5B	4 Secure
Corvus corax	Common Raven										1			2	1	-	-	S5	4 Secure
Sterna hirundo	Common Tern												1			NAR	-	S3B	3 Sensitive
Geothlypis trichas	Common Yellowthroat					1		1	1	1		1		2	2	-	-	S5B	4 Secure
Phalacrocorax auritus	Double-crested Cormorant			6			2	1				1	4			NAR	-	S4B	4 Secure
Sturnus vulgaris	European Starling		6	3			1									-	-	SNA	7 Exotic
Ardea herodias	Great Blue Heron			1			2									-	-	S4B	4 Secure
Catharus guttatus	Hermit Thrush									1	1					-	-	S5B	4 Secure
Larus argentatus	Herring Gull												4			-	-	S5	4 Secure
Zenaidura macroura	Mourning Dove			2								1				-	-	S5	4 Secure
Colaptes auratus	Northern Flicker					1										-	-	S5B	4 Secure
Parula americana	Northern Parula						1		2			1		1		-	-	S5B	4 Secure
Pandion haliaetus	Osprey		1													-	-	S4B	4 Secure
Seiurus aurocapilla	Ovenbird				1	1	1	2			2	1	1		1	-	-	S5B	4 Secure
Dendroica palmarum	Palm Warbler													1		-	-	S5B	4 Secure
Carpodacus purpureus	Purple Finch								1	1						-	-	S4S5B,S3S4N	4 Secure
Vireo olivaceus	Red-eyed Vireo	1			1	4		1	1	1	2	1	1			-	-	S5B	4 Secure
Agelaius phoeniceus	Red-winged Blackbird					1		2	4							-	-	S4B	4 Secure
Columba livia	Rock Pigeon		1										1			-	-	SNA	7 Exotic
Regulus calendula	Ruby-crowned Kinglet									1						-	-	S3S4B	3 Sensitive
Melospiza melodia	Song Sparrow	1	2	2	2	2	1		1				1			-	-	S5B	4 Secure
Catharus ustulatus	Swainson's Thrush														1	-	-	S3S4B	4 Secure
Melospiza georgiana	Swamp Sparrow								1						2	-	-	S5B	4 Secure
Tachycineta bicolor	Tree Swallow												1			-	-	S4B	3 Sensitive
Zonotrichia leucophrys	White-crowned Sparrow									2						-	-	SNA	4 Secure
Zonotrichia albicollis	White-throated Sparrow								1		1			1	1	-	-	S5B	4 Secure
Dendroica petechia	Yellow Warbler	1		1		1							2			-	-	S5B	4 Secure
Sphyrapicus varius	Yellow-bellied Sapsucker				1											-	-	S4S5B	4 Secure
Dendroica coronata	Yellow-rumped Warbler	1	1						2	1						-	-	S5B	4 Secure

Birder: CK

S-rank - Ranking by the Atlantic Canadian Conservation Data Centre and NatureServe. Status notes (as of November 2018): S1: Extremely rare in province; S2: Rare in the province; S3: Uncommon in province; S4: Widespread, common and apparently secure in province; S5: Widespread, abundant and demonstrably secure in province; SNA: Not applicable; SNR: Not yet assessed in province. The use of 'S#S#' is to denote a range in rank used to indicate any uncertainty about the status of the species or community. Qualifiers: B= Breeding (breeding population), N = Nonbreeding (nonbreeding population) ? = Inexact/Uncertain, H = Historic (possibly extirpated), M = Migrant and SNR = Not yet assessed in province. (ACCDC 2019).

Italicized S# - Species is ranked as S1-S3 by the AC CDC.

Bold: SARA status - Conservation status under the Species At Risk Act as of June 2019: Not at Risk (NAR), endangered (E), threatened (T), special concern (SC)

Bold: NSES Status - Conservation status under the Nova Scotia Endangered Species Act as of June 2019: Vulnerable (V)

PC - Point Count

Sgs Rank - Provincial ranks under the General Status of Wildlife Process

- not assessed by SARA or NSES

Table 11: Spring 2019 Bird Survey List.

Scientific Name	Common Name	Spring Total Individuals	SARA Status	NSESA Status	S-Rank	Sgs rank
<i>Anas rubripes</i>	American Black Duck	3	-	-	S5	4 Secure
<i>Corvus brachyrhynchos</i>	American Crow	41	-	-	S5	4 Secure
<i>Carduelis tristis</i>	American Goldfinch	27	-	-	S5	4 Secure
<i>Setophaga ruticilla</i>	American Redstart	1	-	-	S4S5B	4 Secure
<i>Turdus migratorius</i>	American Robin	39	-	-	S5B,S3N	4 Secure
<i>Haliaeetus leucocephalus</i>	Bald Eagle	9	NAR	-	S5	4 Secure
<i>Megaceryle alcyon</i>	Belted Kingfisher	1	-	-	S5B	4 Secure
<i>Mniotilta varia</i>	Black-and-White Warbler	6	-	-	S5B	4 Secure
<i>Dendroica fusca</i>	Blackburnian Warbler	2	-	-	S4B	4 Secure
<i>Poecile atricapilla</i>	Black-capped Chickadee	15	-	-	S5	4 Secure
<i>Dendroica virens</i>	Black-throated Green Warbler	3	-	-	S5B	4 Secure
<i>Cyanocitta cristata</i>	Blue Jay	10	-	-	S5	4 Secure
<i>Vireo solitarius</i>	Blue-headed Vireo	5	-	-	S5B	4 Secure
<i>Certhia americana</i>	Brown Creeper	1	-	-	S5	4 Secure
<i>Branta canadensis</i>	Canada Goose	2	-	-	SNAB,S4N	4 Secure
<i>Quiscalus quiscula</i>	Common Grackle	6	-	-	S5B	4 Secure
<i>Corvus corax</i>	Common Raven	17	-	-	S5	4 Secure
<i>Geothlypis trichas</i>	Common Yellowthroat	3	-	-	S5B	4 Secure
<i>Junco hyemalis</i>	Dark-eyed Junco	1	-	-	S4S5	4 Secure
<i>Phalacrocorax auritus</i>	Double-crested Cormorant	20	NAR	-	S4B	4 Secure
<i>Picoides pubescens</i>	Downy Woodpecker	1	-	-	S5	4 Secure
<i>Sturnus vulgaris</i>	European Starling	33	-	-	SNA	7 Exotic
<i>Regulus satrapa</i>	Golden-crowned Kinglet	1	-	-	S5	3 Sensitive
<i>Ardea herodias</i>	Great Blue Heron	4	-	-	S4B	4 Secure
<i>Tringa melanoleuca</i>	Greater Yellowlegs	1	-	-	S3B,S3S4M	3 Sensitive
<i>Anas crecca</i>	Green-winged Teal	3	-	-	S4S5B	4 Secure
<i>Catharus guttatus</i>	Hermit Thrush	3	-	-	S5B	4 Secure
<i>Larus argentatus</i>	Herring Gull	3	-	-	S5	4 Secure
<i>Charadrius vociferus</i>	Killdeer	1	-	-	S3B	3 Sensitive
<i>Zenaidura macroura</i>	Mourning Dove	1	-	-	S5	4 Secure
<i>Vermivora ruficapilla</i>	Nashville Warbler	1	-	-	S4S5B	4 Secure
<i>Colaptes auratus</i>	Northern Flicker	6	-	-	S5B	4 Secure
<i>Parula americana</i>	Northern Parula	3	-	-	S5B	4 Secure
<i>Pandion haliaetus</i>	Osprey	2	-	-	S4B	4 Secure
<i>Seiurus aurocapilla</i>	Ovenbird	13	-	-	S5B	4 Secure
<i>Dendroica palmarum</i>	Palm Warbler	1	-	-	S5B	4 Secure
<i>Carpodacus purpureus</i>	Purple Finch	11	-	-	S4S5B,S3S4N	4 Secure
<i>Mergus serrator</i>	Red-breasted Merganser	6	-	-	S3S4B,S5N	4 Secure
<i>Sitta canadensis</i>	Red-breasted Nuthatch	1	-	-	S3	4 Secure
<i>Agelaius phoeniceus</i>	Red-winged Blackbird	18	-	-	S4B	4 Secure
<i>Aythya collaris</i>	Ring-necked Duck	1	-	-	S5B	4 Secure
<i>Phasianus colchicus</i>	Ring-necked Pheasant	3	-	-	SNA	7 Exotic
<i>Columba livia</i>	Rock Pigeon	13	-	-	SNA	7 Exotic
<i>Regulus calendula</i>	Ruby-crowned Kinglet	7	-	-	S3S4B	3 Sensitive
<i>Melospiza melodia</i>	Song Sparrow	16	-	-	S5B	4 Secure
<i>Porzana carolina</i>	Sora	1	-	-	S5B	4 Secure
<i>Melospiza georgiana</i>	Swamp Sparrow	1	-	-	S5B	4 Secure
<i>Tachycineta bicolor</i>	Tree Swallow	1	-	-	S4B	3 Sensitive
<i>Zonotrichia albicollis</i>	White-throated Sparrow	14	-	-	S5B	4 Secure
<i>Wilsonia pusilla</i>	Wilson's Warbler	1	-	-	S3B	3 Sensitive
<i>Troglodytes troglodytes</i>	Winter Wren	1	-	-	S5B	4 Secure
<i>Dendroica petechia</i>	Yellow Warbler	8	-	-	S5B	4 Secure
<i>Sphyrapicus varius</i>	Yellow-bellied Sapsucker	2	-	-	S4S5B	4 Secure
<i>Dendroica coronata</i>	Yellow-rumped Warbler	25	-	-	S5B	4 Secure

Birder: CK

S-rank - Ranking by the Atlantic Canadian Conservation Data Centre and NatureServe. Status notes (as of November 2018): S1: Extremely rare in province; S2: Rare in the province; S3: Uncommon in province; S4: Widespread, common and apparently Secure in province; S5: Widespread, abundant and demonstrably secure in province; SNA: Not applicable; SNR: Not yet assessed in province. The use of 'S#S#' is to denote a range in rank used to indicate any uncertainty about the status of the species or community. Qualifiers: B= Breeding (breeding population), N = Nonbreeding (nonbreeding population) ? = Inexact/Uncertain, H = Historic (possibly extirpated), M = Migrant and SNR = Not yet assessed in province. (ACDC 2019).
 Italicized S# - Species is ranked as S1-S3 by the AC CDC.

Bold: SARA status - Conservation status under the Species At Risk Act as of June 2019: Not at Risk (NAR), endangered (E), threatened (T), special concern (SC)

Bold: NSESA Status - Conservation status under the Nova Scotia Endangered Species Act as of June 2019: Vulnerable (V)

Sgs Rank - Provincial ranks under the General Status of Wildlife Process, - not assessed by SARA or NSESA

Table 12: 2019 Breeding Bird List.

Scientific Name	Common Name	Breeding Total Individuals	SARA Status	NSESA Status	S-Rank	Sgs rank
<i>Empidonax alnorum</i>	Alder Flycatcher	19	-	-	S5B	4 Secure
<i>Corvus brachyrhynchos</i>	American Crow	26	-	-	S5	4 Secure
<i>Carduelis tristis</i>	American Goldfinch	30	-	-	S5	4 Secure
<i>Setophaga ruticilla</i>	American Redstart	16	-	-	S4S5B	4 Secure
<i>Turdus migratorius</i>	American Robin	28	-	-	S5B,S3N	4 Secure
<i>Haliaeetus leucocephalus</i>	Bald Eagle	6	NAR	-	S5	4 Secure
<i>Mniotilta varia</i>	Black-and-White Warbler	13	-	-	S5B	4 Secure
<i>Dendroica fusca</i>	Blackburnian Warbler	3	-	-	S4B	4 Secure
<i>Poecile atricapilla</i>	Black-capped Chickadee	15	-	-	S5	4 Secure
<i>Dendroica virens</i>	Black-throated Green Warbler	1	-	-	S5B	4 Secure
<i>Cyanocitta cristata</i>	Blue Jay	11	-	-	S5	4 Secure
<i>Vireo solitarius</i>	Blue-headed Vireo	4	-	-	S5B	4 Secure
<i>Branta canadensis</i>	Canada Goose	3	-	-	SNAB,S4N	4 Secure
<i>Bombicilla cedrorum</i>	Cedar Waxwing	27	-	-	S5B	4 Secure
<i>Dendroica pensylvanica</i>	Chestnut-sided Warbler	17	-	-	S5B	4 Secure
<i>Petrochelidon pyrrhonota</i>	Cliff Swallow	11	-	-	S2S3B	2 May Be At Risk
<i>Quiscalus quiscula</i>	Common Grackle	6	-	-	S5B	4 Secure
<i>Corvus corax</i>	Common Raven	5	-	-	S5	4 Secure
<i>Sterna hirundo</i>	Common Tern	1	NAR	-	S3B	3 Sensitive
<i>Geothlypis trichas</i>	Common Yellowthroat	16	-	-	S5B	4 Secure
<i>Phalacrocorax auritus</i>	Double-crested Cormorant	17	NAR	-	S4B	4 Secure
<i>Picoides pubescens</i>	Downy Woodpecker	1	-	-	S5	4 Secure
<i>Contopus virens</i>	Eastern Wood-Pewee	2	SC	V	S3S4B	3 Sensitive
<i>Sturnus vulgaris</i>	European Starling	27	-	-	SNA	7 Exotic
<i>Regulus satrapa</i>	Golden-crowned Kinglet	1	-	-	S5	3 Sensitive
<i>Ardea herodias</i>	Great Blue Heron	5	-	-	S4B	4 Secure
<i>Catharus guttatus</i>	Hermit Thrush	4	-	-	S5B	4 Secure
<i>Larus argentatus</i>	Herring Gull	4	-	-	S5	4 Secure
<i>Dendroica magnolia</i>	Magnolia Warbler	8	-	-	S5B	4 Secure
<i>Zenaidura macroura</i>	Mourning Dove	4	-	-	S5	4 Secure
<i>Colaptes auratus</i>	Northern Flicker	2	-	-	S5B	4 Secure
<i>Parula americana</i>	Northern Parula	8	-	-	S5B	4 Secure
<i>Pandion haliaetus</i>	Osprey	2	-	-	S4B	4 Secure
<i>Seiurus aurocapilla</i>	Ovenbird	24	-	-	S5B	4 Secure
<i>Dendroica palmarum</i>	Palm Warbler	1	-	-	S5B	4 Secure
<i>Dryocopus pileatus</i>	Pileated Woodpecker	1	-	-	S5	4 Secure
<i>Carpodacus purpureus</i>	Purple Finch	2	-	-	S4S5B,S3S4N	4 Secure
<i>Vireo olivaceus</i>	Red-eyed Vireo	28	-	-	S5B	4 Secure
<i>Agelaius phoeniceus</i>	Red-winged Blackbird	15	-	-	S4B	4 Secure
<i>Columba livia</i>	Rock Pigeon	12	-	-	SNA	7 Exotic
<i>Regulus calendula</i>	Ruby-crowned Kinglet	2	-	-	S3S4B	3 Sensitive
<i>Accipiter striatus</i>	Sharp-shinned Hawk	1	NAR	-	S5	4 Secure
<i>Melospiza melodia</i>	Song Sparrow	23	-	-	S5B	4 Secure
<i>Catharus ustulatus</i>	Swainson's Thrush	1	-	-	S3S4B	4 Secure
<i>Melospiza georgiana</i>	Swamp Sparrow	5	-	-	S5B	4 Secure
<i>Tachycineta bicolor</i>	Tree Swallow	2	-	-	S4B	3 Sensitive
<i>Catharus fuscescens</i>	Veery	1	-	-	S3S4B	4 Secure
<i>Zonotrichia leucophrys</i>	White-crowned Sparrow	2	-	-	SNA	4 Secure
<i>Zonotrichia albicollis</i>	White-throated Sparrow	8	-	-	S5B	4 Secure
<i>Dendroica petechia</i>	Yellow Warbler	15	-	-	S5B	4 Secure
<i>Sphyrapicus varius</i>	Yellow-bellied Sapsucker	2	-	-	S4S5B	4 Secure
<i>Dendroica coronata</i>	Yellow-rumped Warbler	8	-	-	S5B	4 Secure

Birder: CK

S-rank - Ranking by the Atlantic Canadian Conservation Data Centre and NatureServe. Status notes (as of November 2018): S1: Extremely rare in province; S2: Rare in the province; S3: Uncommon in province; S4: Widespread, common and apparently Secure in province; S5: Widespread, abundant and demonstrably secure in province; SNA: Not applicable; SNR: Not yet assessed in province. The use of 'S#S#' is to denote a range in rank used to indicate any uncertainty about the status of the species or community. Qualifiers: B= Breeding (breeding population), N = Nonbreeding (nonbreeding population) ? = Inexact/Uncertain, H = Historic (possibly extirpated), M = Migrant and SNR = Not yet assessed in province. (ACCDC 2019). Italicized S# - Species is ranked as S1-S3 by the AC CDC.

Bold: SARA status - Conservation status under the Species At Risk Act as of June 2019: Not at Risk (NAR), endangered (E), threatened (T), special concern (SC)

Bold: NSESA Status - Conservation status under the Nova Scotia Endangered Species Act as of June 2019: Vulnerable (V), Endangered (E), Threatened (T), Special Concern (SC)

Sgs Rank - Provincial ranks under the General Status of Wildlife Process, - not assessed by SARA or NSESA

Appendix F

Wetland Data

Wetlands in the Vicinity of the Project Footprint Area Photo Plate

		
Ponded area within WL-2. June 12, 2018.	View of WL-2 (left) from NPNS employee parking lot (facing NE). June 12, 2018.	Dense shrubs and rip-rap on the edge of WL-2 below employee parking lot. June 12, 2018.
		
Small stand of willow trees in WL-1. June 12, 2018.	Inundation and hummocky ground within WL-1. June 12, 2018.	Small outlet channel from WL-1 into a nearby ditch Oct. 12, 2018.

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Northern Pulp Municipality/County: Pictou Sampling Date: June 12, 2018
 Applicant/Owner: NPNS Sampling Point: WET1
 Investigator(s): C. Kennedy, T. Neilly, K. Regan Affiliation: Dillen
 Landform (hillslope, terrace, etc.): Basin Local relief (concave, convex, none):
 Slope (%): 5% Lat: 522064 m E Long: 5055745 m W Datum: NAD83
 Soil Map Unit Name/Type: Pugwash sandy to silty loam Wetland Type: Shrub Swamp
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
 Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐
 Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐	Is the Sampled Area within a Wetland? Yes ☒ No ☐ If yes, optional Wetland Site ID: <u>Wetland #1</u>
Hydric Soil Present?	Yes ☒	No ☐	
Wetland Hydrology Present?	Yes ☒	No ☐	
Remarks: (Explain alternative procedures here or in a separate report.)			

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: <u>10 m radius</u>)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>5</u> (A) Total Number of Dominant Species Across All Strata: <u>5</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100%</u> (A/B)
1. <u>Picea glauca</u>	<u>20</u>	☒	<u>FAC</u>	
2. <u>Sorbus americana</u>	<u>20</u>	☒	<u>FAC</u>	
3. <u>Acer rubrum</u>	<u>10</u>		<u>FAC</u>	
4. <u> </u>				
5. <u> </u>				
<u>50</u> = Total Cover				
Sapling/Shrub Stratum (Plot size: <u>5 m radius</u>)	Absolute % Cover	Dominant Species?	Indicator Status	Prevalence Index worksheet: Total % Cover of: <u> </u> Multiply by: <u> </u> OBL species <u> </u> x 1 = <u> </u> FACW species <u> </u> x 2 = <u> </u> FAC species <u> </u> x 3 = <u> </u> FACU species <u> </u> x 4 = <u> </u> UPL species <u> </u> x 5 = <u> </u> Column Totals: (A) <u> </u> (B) <u> </u> Prevalence Index = B/A = <u> </u>
1. <u>Alnus incana</u>	<u>20</u>	☒	<u>FACW</u>	
2. <u>Prunus virginiana</u>	<u>10</u>	☒	<u>FAC</u>	
3. <u>Ilex verticillata</u>	<u>30</u>	☒	<u>FACW+</u>	
4. <u> </u>				
5. <u> </u>				
<u>60</u> = Total Cover				
Herb Stratum (Plot size: <u>2 m radius</u>)	Absolute % Cover	Dominant Species?	Indicator Status	Hydrophytic Vegetation Indicators: ☐ Rapid Test for Hydrophytic Vegetation ☐ Dominance Test is >50% ☐ Prevalence Index is ≤3.0 ¹ ☐ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) ☐ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
1. <u>Scirpus cyperinus</u>	<u>10</u>		<u>FACW</u>	
2. <u>Osmunda cinnamomea</u>	<u>10</u>		<u>FAC</u>	
3. <u>Valerian officinalis</u>	<u>5</u>		<u>FAC</u>	
4. <u>Equisetum arvense</u>	<u>15</u>		<u>FAC</u>	
5. <u>Lathyrus spp.</u>	<u>10</u>		<u>FACU</u>	
6. <u>Galium palustre</u>	<u>5</u>		<u>FACW+</u>	
7. <u>Typha latifolia</u>	<u>20</u>	☒	<u>OBL</u>	
8. <u> </u>				
9. <u> </u>				
10. <u> </u>				
<u>75</u> = Total Cover				
Woody Vine Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	Hydrophytic Vegetation Present? Yes ☒ No ☐
1. <u> </u>				
2. <u> </u>				
<u> </u> = Total Cover				
Remarks: (Include photo numbers here or on a separate sheet.) <u>Pond chemistry pH: 5.95 Conductivity: 0.37 uS/cm</u> <u>Temp: 14.6°C</u>				

Sampling Point: Wet 1

HYDROLOGY

Adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011)

WETLAND DELINEATION DATA FORM – NOVA SCOTIA

Project/Site: Northern Pelop Municipality/County: Pictou Sampling Date: June 12, 2018
 Applicant/Owner: NPNS Sampling Point: WET2
 Investigator(s): C. Kennedy, T. Neilly, K. Regan Affiliation: Dillon
 Landform (hillslope, terrace, etc.): Basin Local relief (concave, convex, none): _____
 Slope (%): ✓ Lat: 522203 m E Long: 5055191 m W Datum: NAD 83
 Soil Map Unit Name/Type: Pugwash sandy to silty loam Wetland Type: Wet meadow (depression)
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)
 Are Vegetation Yes, Soil No, or Hydrology Yes significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____
 Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes <u>✓</u>	No _____	Is the Sampled Area within a Wetland?	Yes <u>✓</u>	No _____
Hydric Soil Present?	Yes <u>✓</u>	No _____		If yes, optional Wetland Site ID: <u>Wetland #2</u>	
Wetland Hydrology Present?	Yes <u>✓</u>	No _____			
Remarks: (Explain alternative procedures here or in a separate report.) <u>Likely was a small shrub swamp prior to clearing the area + ditching</u> <u>↳ naturalized now</u>					

VEGETATION – Use scientific names of plants.

Tree Stratum	(Plot size: <u>10 m radius</u>)	Absolute % Cover	Dominant Species?	Indicator Status
1.				
2.	<u>NONE</u>			
3.				
4.				
5.				
= Total Cover				
Sapling/Shrub Stratum	(Plot size: <u>5 m radius</u>)	Absolute % Cover	Dominant Species?	Indicator Status
1.	<u>Salix bebbiana</u>	<u>40</u>	<u>✓</u>	<u>FAC</u>
2.				
3.				
4.				
5.				
= Total Cover				
Herb Stratum	(Plot size: <u>2 m radius</u>)	Absolute % Cover	Dominant Species?	Indicator Status
1.	<u>Scirpus cyperinus</u>	<u>30</u>	<u>✓</u>	<u>FACW</u>
2.	<u>Galium palustre</u>	<u>15</u>		<u>FACW+</u>
3.	<u>Typha latifolia</u>	<u>10</u>		<u>OBL</u>
4.	<u>Drelingaria umbellata</u>	<u>10</u>		<u>FAC</u>
5.	<u>Equisetum arvense</u>	<u>20</u>	<u>✓</u>	<u>FAC</u>
6.				
7.				
8.				
9.				
10.				
= Total Cover				
Woody Vine Stratum	(Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.				
2.				
= Total Cover				
Remarks: (Include photo numbers here or on a separate sheet.)				

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____	(A) _____ (B) _____
Prevalence Index = B/A = _____	

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0¹

___ Morphological Adaptations¹ (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation¹ (Explain)

¹Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present?

Yes ✓ No _____

SOIL

Sampling Point: WET 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-12	7.5YR 4/2	100					Sandy Clay	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains.²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ☐ Histosol (A1)
☒ Histic Epipedon (A2)
☒ Black Histic (A3)
☒ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5)
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1)
☐ Sandy Gleyed Matrix (S4)

- ☐ Sandy Redox (S5)
☐ Polyvalue Below Surface (S8)
☐ Thin Dark Surface (S9)
☐ Loamy Gleyed Matrix (F2)
☐ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils³:

- ☐ Coast Prairie Redox (A16)
☐ 5 cm Mucky Peat or Peat (S3)
☐ Iron-Manganese Masses (F12)
☐ Piedmont Floodplain Soils (F19)
☐ Red Parent Material (TF2)
☐ Other (Explain in Remarks)

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Rock
 Depth (inches): @ ~ 12 inches

Hydric Soil Present? Yes ☒ No ☐

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☒ Surface Water (A1)
☒ High Water Table (A2)
☒ Saturation (A3)
☐ Water Marks (B1)
☐ Sediment Deposits (B2)
☐ Drift Deposits (B3)
☐ Algal Mat or Crust (B4)
☐ Iron Deposits (B5)
☐ Inundation Visible on Aerial Imagery (B7)
☒ Sparsely Vegetated Concave Surface (B8)

- ☐ Water-Stained Leaves (B9)
☒ Aquatic Fauna (B13)
☐ Marl Deposits (B15)
☒ Hydrogen Sulfide Odor (C1)
☐ Oxidized Rhizospheres on Living Roots (C3)
☐ Presence of Reduced Iron (C4)
☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Thin Muck Surface (C7)
☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☒ Surface Soil Cracks (B6)
☐ Drainage Patterns (B10)
☐ Moss Trim Lines (B16)
☐ Dry-Season Water Table (C2)
☒ Saturation Visible on Aerial Imagery (C9)
☒ Stunted or Stressed Plants (D1)
☐ Geomorphic Position (D2)
☐ Shallow Aquitard (D3)
☐ Microtopographic Relief (D4)
☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ☒ No ☐ Depth (inches): 1-2 inches
 Water Table Present? Yes ☒ No ☐ Depth (inches): 1-2 inches
 Saturation Present? Yes ☒ No ☐ Depth (inches): @ surface
 (includes capillary fringe)

Wetland Hydrology Present? Yes ☒ No ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WESP-AC Results for Wetland WL-1

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	3.63	Lower	10.00	Higher	4.66	5.06
Stream Flow Support (SFS)	1.97	Moderate	2.85	Moderate	1.58	1.86
Water Cooling (WC)	5.04	Higher	2.10	Moderate	3.36	1.12
Sediment Retention & Stabilisation (SR)	4.53	Moderate	10.00	Higher	5.73	10.00
Phosphorus Retention (PR)	1.38	Lower	10.00	Higher	4.61	10.00
Nitrate Removal & Retention (NR)	3.93	Moderate	10.00	Higher	5.68	10.00
Carbon Sequestration (CS)	3.26	Lower			6.74	
Organic Nutrient Export (OE)	6.35	Moderate			5.19	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	6.85	Higher	6.41	Higher	3.63	4.01
Aquatic Invertebrate Habitat (INV)	8.18	Higher	6.75	Higher	6.86	4.74
Amphibian & Turtle Habitat (AM)	6.99	Higher	4.95	Moderate	6.74	6.10
Waterbird Feeding Habitat (WBF)	7.88	Higher	5.00	Moderate	6.06	5.00
Waterbird Nesting Habitat (WBN)	6.59	Higher	5.00	Moderate	4.78	5.00
Songbird, Raptor, & Mammal Habitat (SBM)	8.42	Higher	5.00	Moderate	7.25	5.00
Pollinator Habitat (POL)	7.23	Moderate	0.00	Lower	5.99	0.00
Native Plant Habitat (PH)	2.38	Lower	4.42	Lower	4.86	4.42
Public Use & Recognition (PU)			2.77	Moderate		2.20
Wetland Sensitivity (Sens)			6.27	Higher		4.65
Wetland Ecological Condition (EC)			5.65	Moderate		7.92

WESP-AC Results for Wetland WL-1 (cont.)

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Wetland Stressors (STR) (higher score means more stress)			10.00	Higher		5.83
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	3.63	Lower	10.00	Higher	4.66	5.06
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	3.90	Lower	10.00	Higher	6.21	10.00
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	6.78	Higher	5.33	Higher	5.56	3.66
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	6.77	Higher	5.34	Moderate	5.49	5.06
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	7.21	Higher	4.07	Lower	6.64	4.07
WETLAND CONDITION (EC)			5.65	Moderate		7.92
WETLAND RISK (average of Sensitivity & Stressors)			8.14	Higher		5.24
NOTE: A score of 0 does not mean the function or benefit is absent from the wetland. It means only that this wetland has a capacity that is equal or less than the lowest-scoring one, for that function or benefit, from among all the NS calibration wetlands that were assessed previously.						

WESP-AC Results for Wetland WL-2

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	3.69	Lower	6.94	Higher	4.70	3.08
Stream Flow Support (SFS)	1.20	Lower	0.00	Lower	0.96	0.00
Water Cooling (WC)	0.00	Lower	0.00	Lower	0.00	0.00
Sediment Retention & Stabilisation (SR)	2.52	Lower	10.00	Higher	4.16	5.00
Phosphorus Retention (PR)	1.21	Lower	6.43	Higher	4.50	5.00
Nitrate Removal & Retention (NR)	3.51	Moderate	10.00	Higher	5.38	10.00
Carbon Sequestration (CS)	1.42	Lower			5.87	
Organic Nutrient Export (OE)	2.69	Lower			3.85	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	1.74	Lower	3.04	Moderate	4.26	2.84
Amphibian & Turtle Habitat (AM)	5.70	Moderate	1.99	Lower	6.06	3.82
Waterbird Feeding Habitat (WBF)	4.49	Moderate	2.50	Lower	3.45	2.50
Waterbird Nesting Habitat (WBN)	2.79	Moderate	2.50	Lower	2.02	2.50
Songbird, Raptor, & Mammal Habitat (SBM)	6.39	Moderate	2.50	Lower	5.50	2.50
Pollinator Habitat (POL)	7.48	Moderate	0.00	Lower	6.20	0.00
Native Plant Habitat (PH)	0.08	Lower	3.90	Lower	3.94	3.90

WESP-AC Results for Wetland WL-2 (cont.)

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Public Use & Recognition (PU)			2.75	Moderate		2.19
Wetland Sensitivity (Sens)			4.84	Moderate		4.21
Wetland Ecological Condition (EC)			1.59	Lower		5.97
Wetland Stressors (STR) (higher score means more stress)			10.00	Higher		5.21
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	3.69	Lower	6.94	Higher	4.70	3.08
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	2.96	Lower	9.40	Higher	5.42	8.33
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	2.05	Lower	2.03	Moderate	3.27	1.89
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	4.15	Moderate	1.95	Lower	4.19	2.79
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	6.07	Moderate	3.02	Lower	5.71	3.02
WETLAND CONDITION (EC)			1.59	Lower		5.97
WETLAND RISK (average of Sensitivity & Stressors)			7.42	Higher		4.71
NOTE: A score of 0 does not mean the function or benefit is absent from the wetland. It means only that this wetland has a capacity that is equal or less than the lowest-scoring one, for that function or benefit, from among all the NS calibration wetlands that were assessed previously.						

Appendix G

Freshwater and Marine Fish

Table 1: Fish Species Using Freshwater Habitats in General Area

Fish	Species	Priority Status+	Relevant Habitat Information**
Anadromous Fish			
Atlantic salmon*	<i>Salmo salar</i>	S. Gulf of St. Lawrence pop. COSEWIC Special Concern; provincial S1/-	Adults enter freshwater to spawn (usually fall). Spawn on gravel beds in shallow rapidly flowing water. Juveniles move downstream to brackish water in May-June.
Blueback Herring	<i>Alosa aestivalis</i>	provincial S4/Sensitive	Enter streams to spawn in June – lakes and quiet reaches. Adults return to sea. Eggs hatch and juveniles to brackish water in late Aug.-Sept.
Gaspereau*	<i>Alosa pseudoharengus</i>	provincial S3/Sensitive	Enter streams to spawn in June – lakes and quiet reaches. Adults return to sea. Eggs hatch and juveniles to brackish water in late Aug.-Sept.
Rainbow smelt	<i>Osmerus mordax</i>	provincial S5/Secure	Adults leave marine habitats in the fall to winter in estuaries/lakes. Following spring thaw move into shallow freshwater streams to spawn, then return to sea.
Striped bass*	<i>Morone saxatilis</i>	S. Gulf of St. Lawrence pop. COSEWIC Special Concern; provincial S2S3N/May be at risk	Adults leave seas to spawn and enter rivers above head of tide in June.
Catadromous Fish			
American eel *	<i>Anguilla rostrata</i>	COSEWIC Threatened; provincial S2/Secure	Adults (females) in lakes and streams, males in estuaries. Fall migration to marine spawning area.
“Freshwater” Fish			
Banded killifish	<i>Fundulus diaphanus</i>	provincial S5/Secure	Freshwater widely distributed. Spawns in weedy shallows in the summer.
Brook trout*	<i>Salvelinus fontinalis</i>	provincial S3/Sensitive	May be sea run. Spawn in fall in shallow gravel bottomed streams or other oxygenated areas. Adults in cool well-oxygenated lakes and streams.
Brown bullhead	<i>Ameiurus nebulosus</i>	provincial S5/Secure	Quiet weedy, mud-bottomed lakes and streams. Spawn in spring in sandy shallows.
Brown trout (introduced)	<i>Salmo trutta</i>	provincial SNA/Exotic	May be sea run. Spawn in fall in shallow gravel bottomed streams.
Chain pickerel	<i>Esox niger</i>	provincial SNA/Exotic	Invasive species of lakes and streams.
Common shiner	<i>Luxilus cornutus</i>	provincial S5/Secure	Occurs in streams and lakes. Spawns in shallow running water in the spring to early summer.
Creek chub	<i>Semotilus atromaculatus</i>	provincial S5/Secure	Occurs in streams and lakes. Spawns in streams in the spring.
Lake chub	<i>Couesius plumbeus</i>	provincial S5/Secure	Occurs in streams and lakes. Spawns in streams in the spring.
Northern redbelly dace	<i>Phoxinus eos</i>	provincial S5/Secure	Prefers acidic waters. Spawns among aquatic plants in summer.
Pearl dace*	<i>Margariscus margarita</i>	provincial S3/Sensitive	Inhabits boggy lakes and streams including in Pictou Co.

Smallmouth bass	<i>Micropterus dolomieu</i>	provincial SNA/Exotic	Prefer clear rocky lakes. Spawn in shallows in June to early July.
Stickleback (Three spine)	<i>Gasterosteus aculeatus</i>	provincial S5/Secure	Fresh and brackish habitats. Spawns in spring.
Stickleback (Four spine)	<i>Apeltes quadracus</i>	provincial S5/Sensitive	Marine and lakes and streams. Spawns late spring or early summer.
Stickleback (nine spine)	<i>Pungitius pungitius</i>	provincial S5/Secure	Widely distributed fresh and salt water. Spawns in summer.
White perch	<i>Morone americana</i>	provincial S5/Secure	Fresh and salt water. Spawns in shallows in June.
White sucker	<i>Catostomus commersonii</i>	provincial S5/Secure	Occurs in streams and lakes, preferring bottom areas in shallow water. Spawns in the spring in shallow areas where water flows swiftly over a gravel bottom.
Yellow perch	<i>Perca flavescens</i>	provincial S5/Secure	Lakes and quiet streams. Spawn in shallows in May.

**Data Sources: Stantec (2017) and Gilhen (1974).

*Priority fish species – see Section 8.6.2.4 below

+Status as of December 2018

S-ranks:

S1 Extremely rare in province; S2 Rare in the province; S3 Uncommon in the province; S4 Widespread, common and apparently secure in province; S5 Widespread, abundant and secure in the province.

General Status - “Sensitive” indicating they are potentially susceptible to human activities or natural events “May be at Risk” therefore considered here to be of high conservation concern within the province. “Undetermined” indicating that there is currently insufficient data, information, or knowledge available to evaluate its status.

Table 2: Seasonal Sensitivity of “Freshwater” Fish Species Potentially Occurring

Common Name	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
American Eel					1	1,2		2	2			
White Sucker												
Mummichog/ Killifish												
Various Minnow Species												
Yellow Perch/ White Perch												
Rainbow Smelt												
Gaspereau												
Atlantic Salmon (Gulf pop.)												
Brook Trout												
Brown Bullhead												

	Spawning
	Eggs/Sac fry or juvenile in substrate

Source: Gilhen (1974)

Notes: 1 = Juvenile elvers move shoreward with peak migration in late April to late June (COSEWIC 2012) 2. Spring seasonal downstream movements of adults or fall seasonal movements of adults upstream; and/or migrations to spawning areas

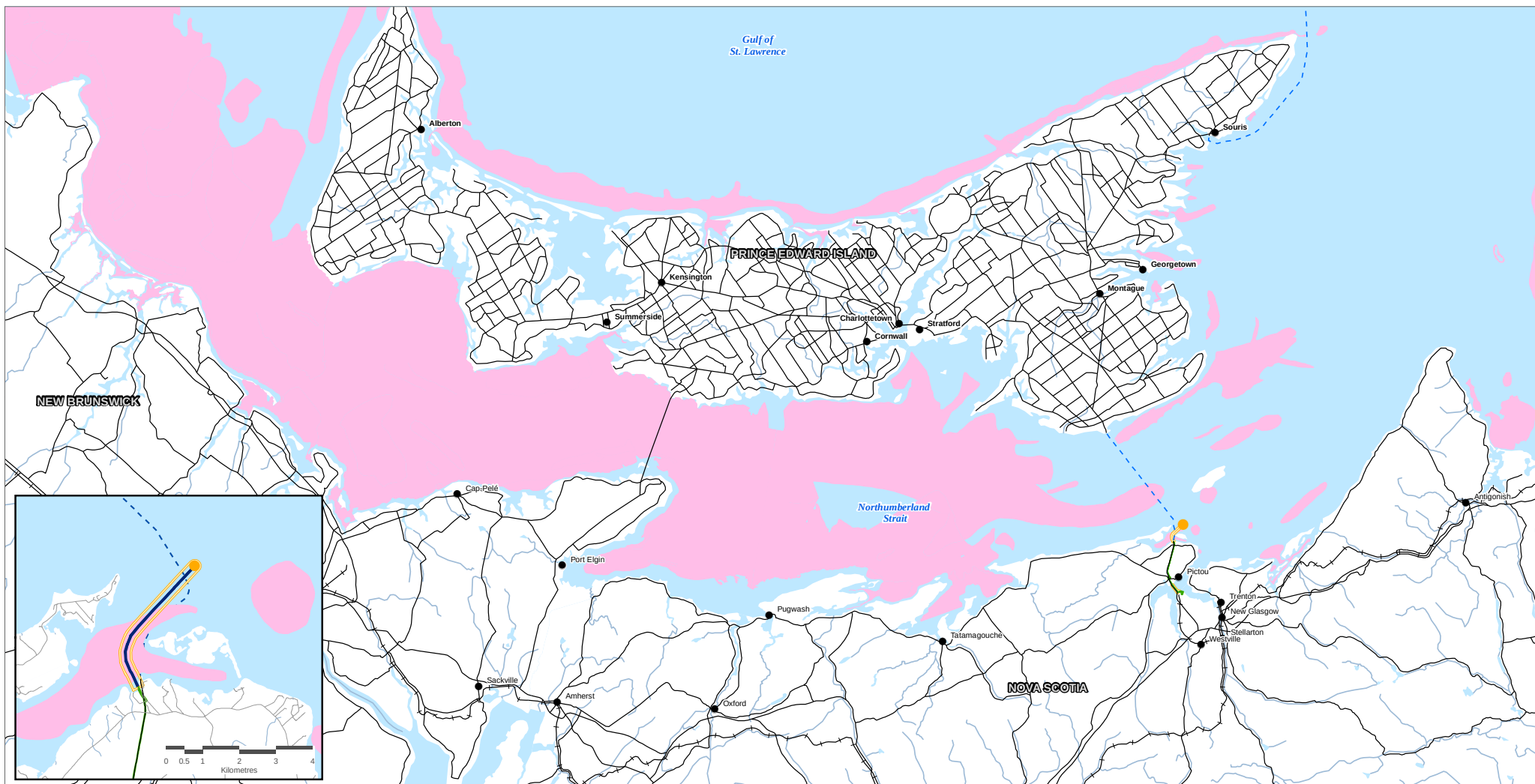
Table 3: Marine Fish Species with the Potential to Occur in Eastern Northumberland Strait

Common Name	Scientific Name	Occurrence
Secure Species		
Alligatorfish	<i>Aspidophoroides monopterygius</i>	Demersal
Arctic rockling	<i>Gaidropsarus argentatus</i>	Demersal
Atlantic halibut	<i>Hippoglossus hippoglossus</i>	Demersal
Atlantic herring	<i>Clupea harengus</i>	Pelagic
Atlantic mackerel	<i>Scomber scombrus</i>	Pelagic
Atlantic silverside	<i>Menidia menidia</i>	Coastal
Atlantic tomcod	<i>Microgadus tomcod</i>	Demersal
Banded killifish	<i>Fundulus diaphanous</i>	Coastal
Blackspotted stickleback	<i>Gasterosteus wheatlandi</i>	Coastal
Brook trout	<i>Salvelinus fontinalis</i>	Coastal
Butterfish	<i>Peprilus tricanthus</i>	Demersal
Capelin	<i>Mallotus villosus</i>	Pelagic
Common oceanpout	<i>Zoarces americanus</i>	Demersal
Cunner	<i>Tautoglabrus adspersus</i>	Coastal
Eelpout	<i>Lycodes</i> sp.	Demersal
Fourbeard rockling	<i>Enchelyopus cimbrius</i>	Demersal
Fourline snakeblenny	<i>Eumesogrammus praecisus</i>	Demersal
Fourspine stickleback	<i>Apeltes quadracus</i>	Coastal
Gaspereau/Alewife	<i>Alosa pseudoharengus</i>	Pelagic
Greenland cod	<i>Gadus ogac</i>	Demersal
Greenland halibut	<i>Reinhardtius hippoglossoides</i>	Demersal
Longhorn sculpin	<i>Myoxocephalus octodecemspinosus</i>	Demersal
Mailed sculpin	<i>Triglops murrayi</i>	Demersal
Mummichog	<i>Fundulus heteroclitus</i>	Pelagic
Northern sand lance	<i>Ammodytes dubius</i>	Demersal
Ninespine stickleback	<i>Pungitius pungitius</i>	Coastal
Northern pipefish	<i>Syngnathus fuscus</i>	Coastal
Rainbow smelt	<i>Osmerus mordax</i>	Coastal
Rainbow trout	<i>Salmo gairdneri</i>	Coastal
Sand lance	<i>Ammodytes americanus</i>	Demersal
Sea raven	<i>Hemitripterus americanus</i>	Demersal
Shorthorn sculpin	<i>Myoxocephalus scorpius</i>	Demersal
Silver hake	<i>Merluccius bilinearis</i>	Demersal
Snakeblenny	<i>Lumpenus lampretaeformis</i>	Demersal

Common Name	Scientific Name	Occurrence
Threespine stickleback	<i>Gasterosteus aculeatus</i>	Coastal
Windowpane	<i>Scophthalmus aquosus</i>	Demersal
Winter flounder	<i>Pseudopleuronectes americanus</i>	Demersal
Winter skate*	<i>Leucoraja ocellata</i>	Demersal
Wrymouth	<i>Cryptacanthodes maculatus</i>	Demersal
Yellowtail flounder	<i>Limanda ferruginea</i>	Demersal
Species of Conservation Concern		
American eel	<i>Anguilla rostrata</i>	Coastal - Catadromous
American plaice (Maritime population)	<i>Hippogloissoides platessoides</i>	Demersal
Atlantic bluefin tuna	<i>Thunnus thynnus</i>	Pelagic
Atlantic cod (Laurentian South population)	<i>Gadus morhua</i>	Demersal
Atlantic salmon (Gaspé-Southern Gulf of St. Lawrence population)	<i>Salmo salar</i>	Coastal - Anadromous
Lumpfish	<i>Cyclopterus lumpus</i>	Demersal
Porbeagle	<i>Lamna nasus</i>	Pelagic
Spiny dogfish (Atlantic population)	<i>Squalus acanthias</i>	Pelagic
Striped bass (Southern Gulf of St. Lawrence population)	<i>Morone saxatilis</i>	Coastal - Anadromous
White hake (Southern Gulf of St. Lawrence population)	<i>Urophycis tenuis</i>	Demersal
*Southern Gulf of St. Lawrence population is secure Sources: Benoit et al. (2003); AMEC (2007).		

Fisheries Maps

(from Dillon, 2019a)

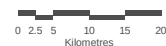


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**Rock Crab Fishing in the
Northumberland Strait**
Figure 8.12-3



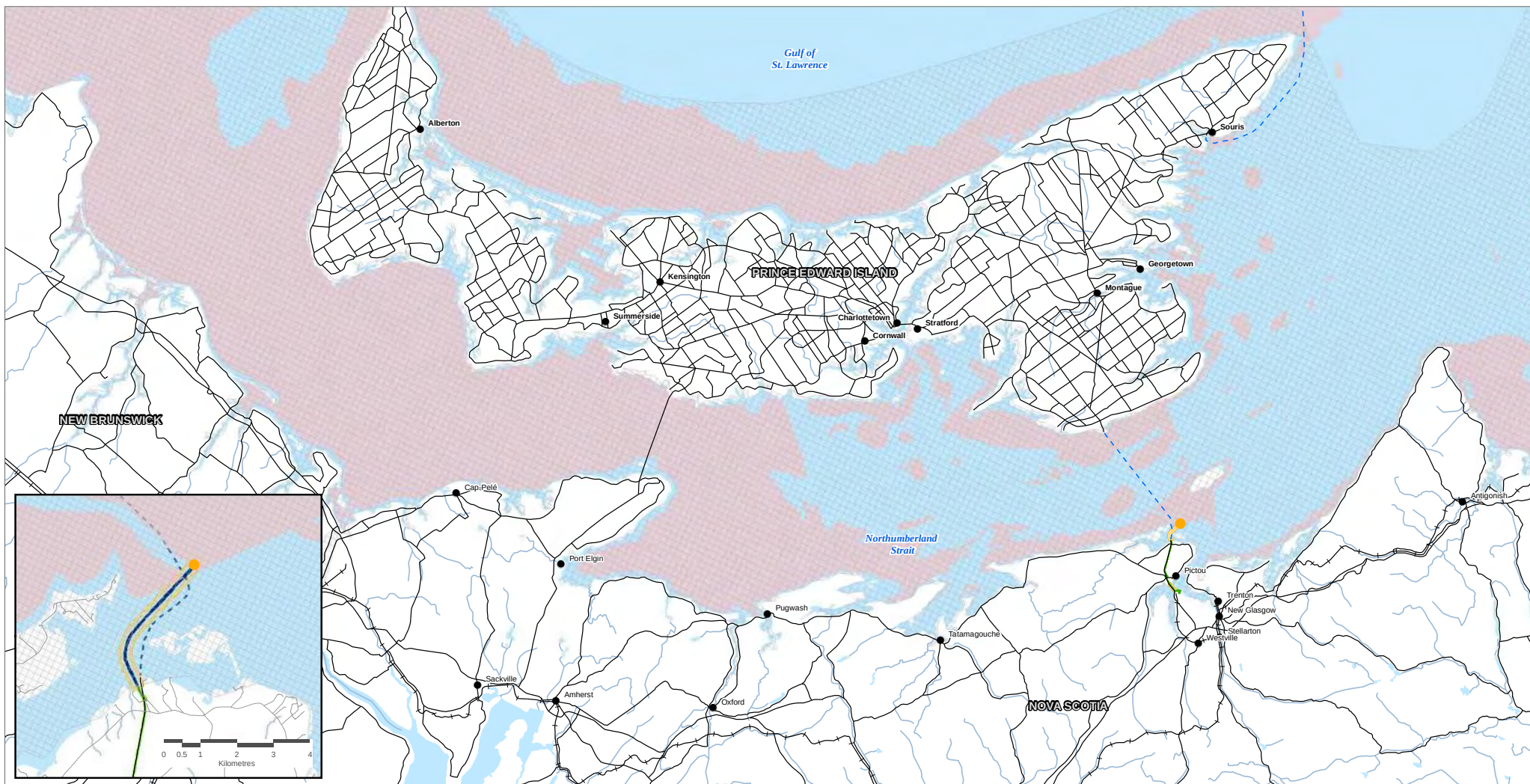
MAP CREATED BY: HW
MAP CHECKED BY: SS
MAP PROJECTION: NAD 1983 UTM Zone 20N



Sources:
1 JWEI (2001)
PROJECT: 17-6461

*Precise Project Footprint to be determined following completion of detailed design

Date: 1/24/2019



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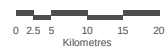
**Lobster Fishing and Distribution
in the Northumberland Strait**
Figure 8.12-4



- Outfall Diffuser Location
- Marine Local Assessment Area
- ▨ Lobster Distribution ¹
- Marine Project Footprint Area*
- Lobster Fishing Resource ¹
- Terrestrial Project Footprint Area*



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MAP PROJECTION: NAD 1983 UTM Zone 20N

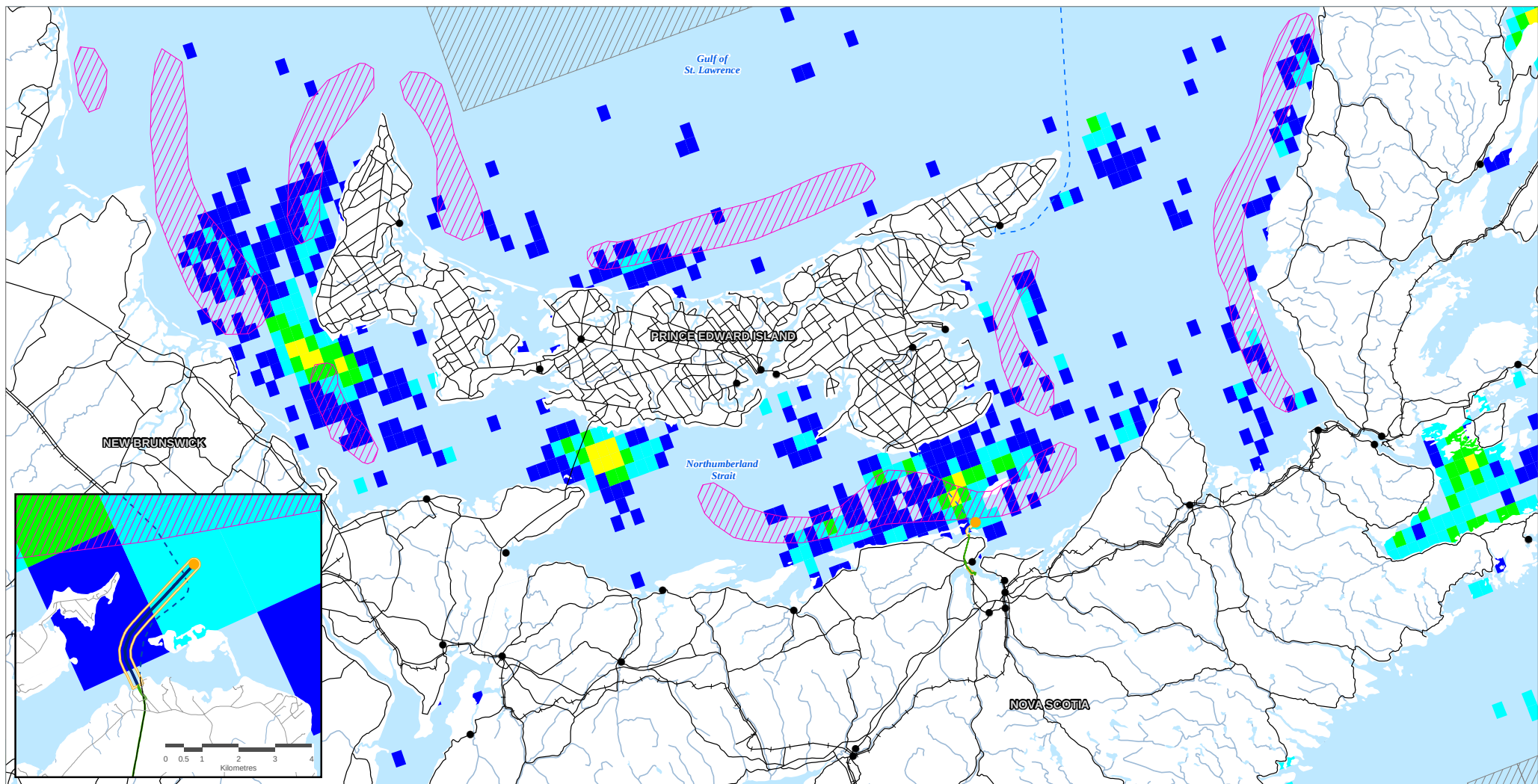


*Precise Project Footprint to be determined following completion of detailed design

Sources:
¹ JWEL (2001)

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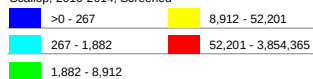


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**Scallop Catch Weight 2010-2014
and Distribution in the Northumberland Strait**
Figure 8.12-5



Scallop, 2010-2014, Screened ¹



Privacy Screened Area

Scallop Distribution ²

Outfall Diffuser Location

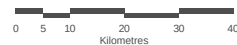
Marine Local Assessment Area

Marine Project Footprint Area*

Terrestrial Project Footprint Area*



MAP CREATED BY: HW
MAP CHECKED BY: SS
MAP PROJECTION: NAD 1983 UTM Zone 20N

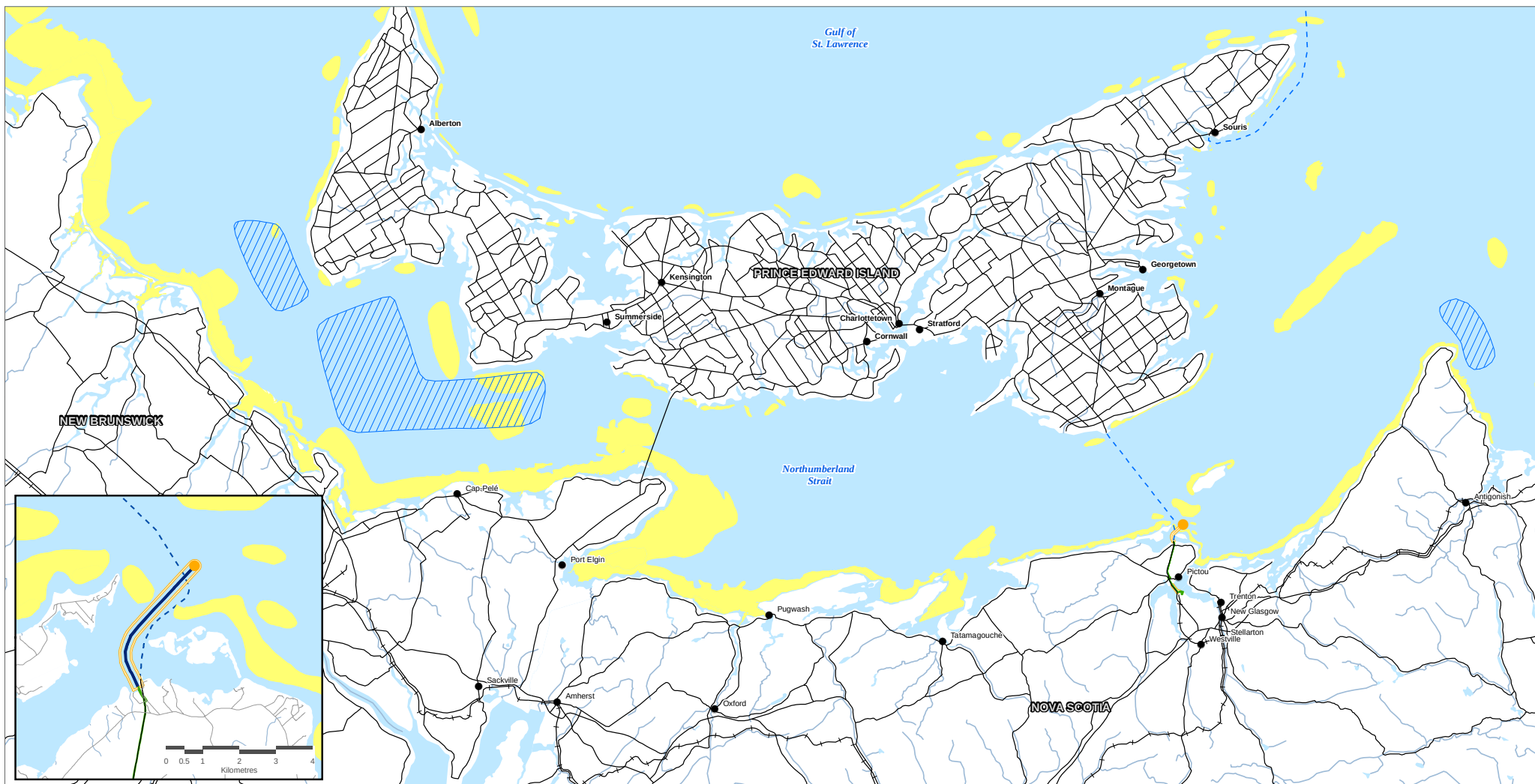


*Precise Project Footprint to be determined following completion of detailed design

Sources:
¹ Butler, S. and S. Coffin-Smout (2017)
² JWEL (2001)

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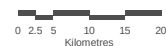
**Herring Fishing and Nursing Areas
in the Northumberland Strait**
Figure 8.12-6



- Outfall Diffuser Location
- Marine Local Assessment Area
- Herring Fishing Resource ¹
- Marine Project Footprint Area*
- Herring Nursery Area ¹
- Terrestrial Project Footprint Area*



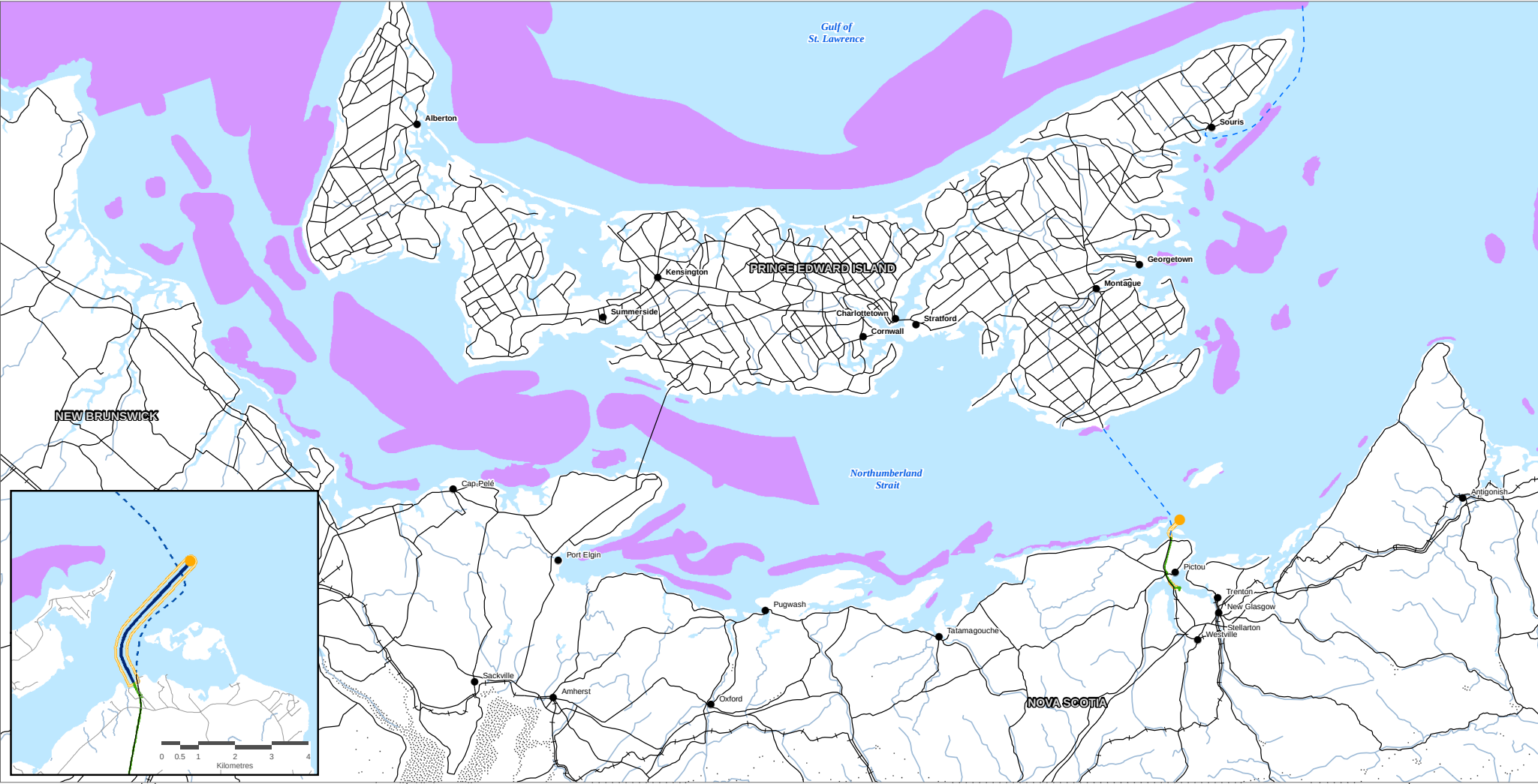
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MAP PROJECTION: NAD 1983 UTM Zone 20N



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Sources:
¹ JWEL (2001)
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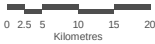
Mackerel Fishing in the Northumberland Strait
Figure 8.12-8



- Outfall Diffuser Location
- Marine Local Assessment Area
- Mackerel Fishing Resource
- Marine Project Footprint Area*
- Terrestrial Project Footprint Area*



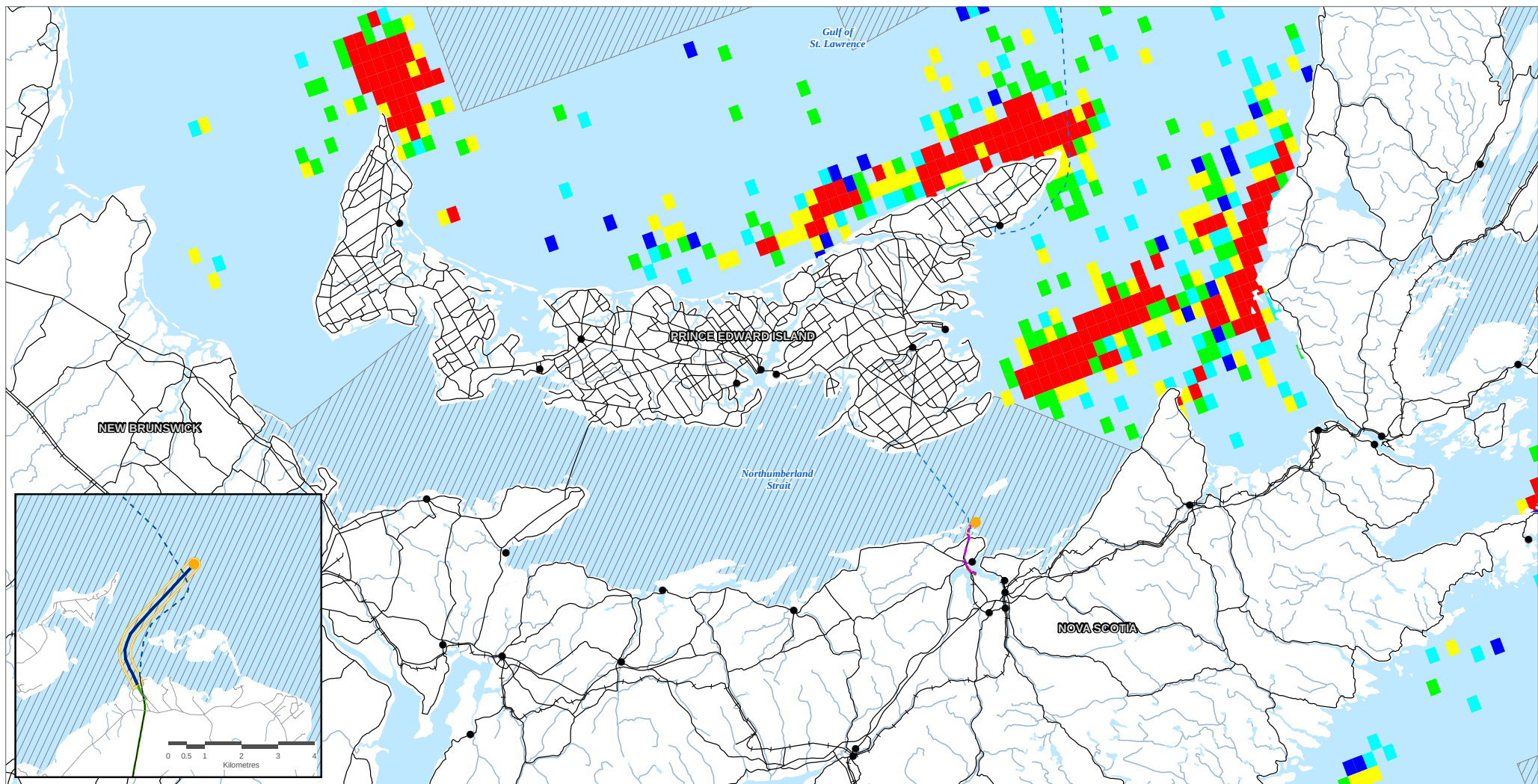
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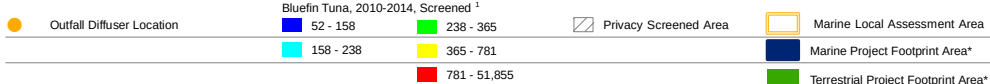
Sources:
1 JWEL (2001)
PROJECT: 17-6461

Date: 1/24/2019

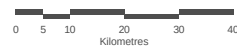


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**Bluefin Tuna Catch Weight 2010-2014
in the Northumberland Strait**
Figure 8.12-9



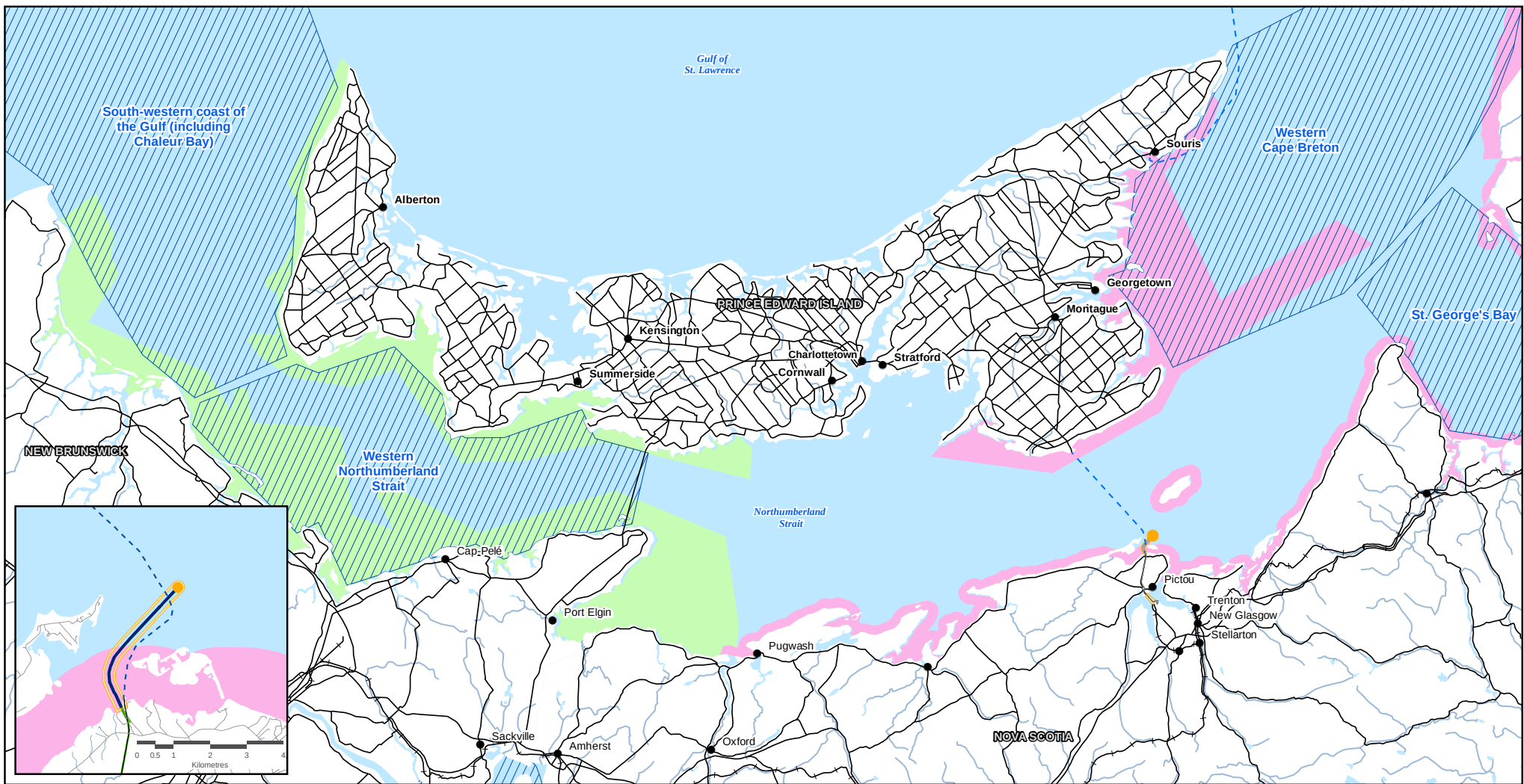
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MAP PROJECTION: NAD 1983 UTM Zone 20N



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Sources:
¹ Butler, S. and S. Coffin-Smout (2017)
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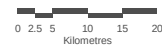


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Special Areas of Importance for Marine Fish and Fish
Habitat in and Around the Northumberland Strait
Figure 8.12-10



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MAP CHECKED BY: SS
MAP PROJECTION: NAD 1983 UTM Zone 20N



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