

Real-Time Water Quality Deployment Report

Paddy's Pond at Outlet

July 6, 2021 to September 8, 2021



Government of Newfoundland & Labrador
Department of Environment and Climate Change
Water Resources Management Division
St. John's, NL, A1B 4J6 Canada

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General

The Department of Environment and Climate Change, Water Quality Management Division staff monitors the real-time water quality at Paddy's Pond at outlet to Three Arm Pond (47.488129N, 52.893809W).



Figure 1: Paddy's Pond at Outlet Real-Time Water Quality Station location

Maintenance and Calibration of Instrument

As part of the Quality Assurance and Quality Control protocol (QAQC), an assessment of the reliability of data recorded by an instrument is made at the beginning and end of the deployment period. The procedure is based on the approach used by the United States Geological Survey.

Upon deployment, a QA/QC Sonde is temporarily deployed *in situ*, adjacent to the Field Sonde. Depending on the degree of difference between each parameter from the Field and QAQC sondes a qualitative rank is assigned (See Table 1). The possible ranks, from most to least desirable, are: Excellent, Good, Fair, Marginal, and Poor. A grab sample is also taken for additional confirmation of conditions at deployment and to allow for future modelling studies.

Table 1: Ranking classifications for deployment and removal

Parameter	Rank				
	Excellent	Good	Fair	Marginal	Poor
Temperature (°C)	<=+/-0.2	>+/-0.2 to 0.5	>+/-0.5 to 0.8	>+/-0.8 to 1	<+/-1
pH (unit)	<=+/-0.2	>+/-0.2 to 0.5	>+/-0.5 to 0.8	>+/-0.8 to 1	>+/-1
Sp. Conductance (µS/cm)	<=+/-3	>+/-3 to 10	>+/-10 to 15	>+/-15 to 20	>+/-20
Sp. Conductance > 35 µS/cm (%)	<=+/-3	>+/-3 to 10	>+/-10 to 15	>+/-15 to 20	>+/-20
Dissolved Oxygen (mg/L) (% Sat)	<=+/-0.3	>+/-0.3 to 0.5	>+/-0.5 to 0.8	>+/-0.8 to 1	>+/-1
Turbidity <40 NTU (NTU)	<=+/-2	>+/-2 to 5	>+/-5 to 8	>+/-8 to 10	>+/-10
Turbidity > 40 NTU (%)	<=+/-5	>+/-5 to 10	>+/-10 to 15	>+/-15 to 20	>+/-20

At the end of a deployment period, a freshly cleaned and calibrated QA/QC Sonde is placed *in situ*, adjacent to the Field Sonde. Deployment and removal comparison rankings for the station at Paddy's Pond deployed between July 6, 2021 and September 8, 2021 are summarized in Table 2.

Table 2: Qualitative QA/QC comparison rankings for Paddy's Pond at outlet station July 6, 2021 through September 8, 2021.

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Paddy's Pond at Outlet	2021-07-06	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
	2021-07-06	Grab Sample #1825	N/A	Excellent	Excellent	N/A	Excellent
	2021-09-08	Removal	Fair	Fair	Excellent	Good	Excellent
	2021-09-08	Grab Sample #1834	N/A	Good	Good	N/A	Excellent

- On July 6, 2021, a real-time water quality monitoring instrument was deployed at the station Paddy's Pond at Outlet. The instrument was deployed for a period of 65 days and was removed on September 8, 2021.
- Upon deployment, all parameters ranked 'Excellent' against the QA/QC sonde.
- The grab sample (#2021-1825-SP-SI) results collected during the deployment of sonde, ranked 'Excellent' against the field sonde values.
- At removal of the instrument, parameter rankings varied between 'Excellent' and 'Fair', against the QA/QC sonde. The grab sample (#2021-1834-SP-SI) results collected during the removal of sonde, ranked 'Excellent' and 'Good' against the field sonde values supporting

the conclusion that the QA/QC sonde may not have adequately stabilized prior to taking measurements at time of removal.

- Other potential causes for less than desirable QA/QC rankings to be obtained include, the placement of the QA/QC sonde in relation to the field sonde and deteriorating performance of one of the sensors either from sensor failure or biofouling.

DATA INTERPRETATION

The following graphs and discussion illustrate water quality data obtained hourly from July 6, 2021 through September 8, 2021 at Paddy's Pond at outlet to Three Arm Pond, St. John's, NL.

Stage is not monitored at this station and as such cannot be discussed with respect to other monitored water quality parameters. All data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol.

Mean daily temperature and total precipitation data was obtained from the ECCC St. John's West station historical weather data at https://climate.weather.gc.ca/historical_data/search_historic_data_e.html and can be found illustrated in Appendix A. Gaps in available daily data were removed for graphing purposes.

Water Temperature

- Water Temperature is a major factor used to describe water quality. Temperature has major implications on both the ecology and chemistry of a water body, governing processes such as the metabolic rate of aquatic plants and animals and the degree of dissolved oxygen saturation.
- It should be noted that the temperature sensor on any sonde is the most important. All other parameters can be broken down into three groups: temperature dependent, temperature compensated and temperature independent. Because the temperature sensor is not isolated from the rest of the sonde the entire sonde must be at the same temperature before the sensor will stabilize. The values may take some time to climb to the appropriate reading; if a reading is taken too soon it may not accurately portray the water body.

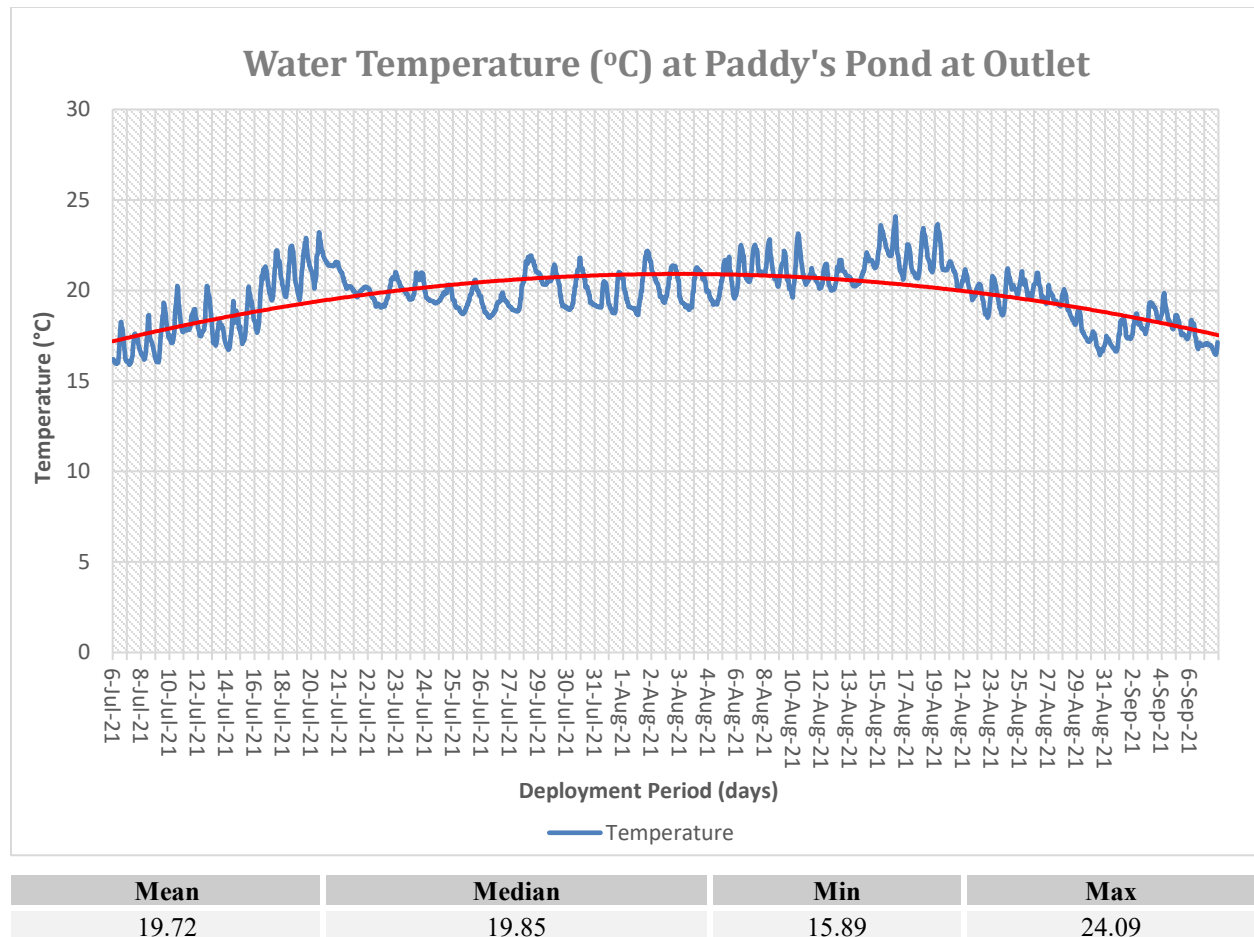


Figure 2: Water temperature (°C) values at Paddy's Pond at Outlet

- Over the 65-day deployment period, water temperature began to increase in correlation with increasing natural seasonal air temperatures (Figure 2). In late July, water temperature decreased suddenly due to a significant precipitation event (July 20, 2021) where a total rainfall of 46.9 mm was observed (see Appendix A – Figure 7). Water temperature trend then began to steadily increase until mid-August before decreasing for the rest of the deployment period naturally as the cooler fall season neared. Maximum water temperature of 24.09°C decreased to a minimum temperature of 15.89°C observed in late October.
- The mean temperature was 19.72°C with a median temperature of 19.85°C.
- A natural diurnal temperature pattern with temperatures increasing during the day and decreasing overnight was observed. The diurnal variation pattern began to decrease near the end of the deployment period in mid-August. The magnitude of variation is in correlation to the smaller daily water temperature range and length of days as expected at this time of the year.

pH

- pH is used to give an indication of the acidity or basicity of a solution. A pH of seven (7) denotes a neutral solution while lower values are acidic and higher values are basic. Technically, the pH of a solution indicates the availability of protons to react with molecules dissolved in water. Such reactions can affect how molecules function chemically and metabolically.
- pH values are temperature dependant as well as influenced by photosynthesis and respiration by aquatic organisms. The concentration of dissolved carbon dioxide in the water throughout the day, especially overnight when oxygen production is reduced relative to carbon dioxide levels. Carbon dioxide dissolved in water yields a slightly acidic solution.

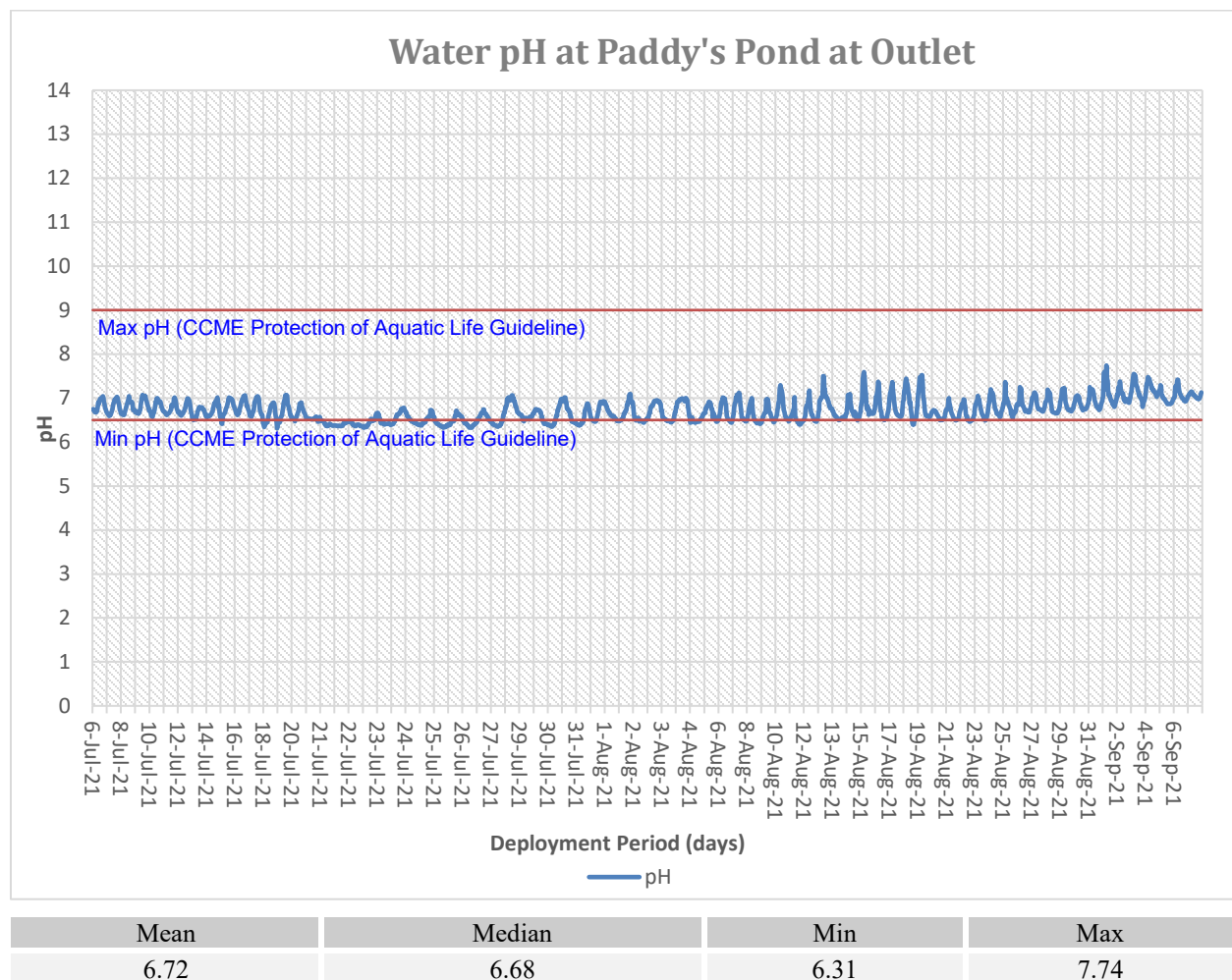


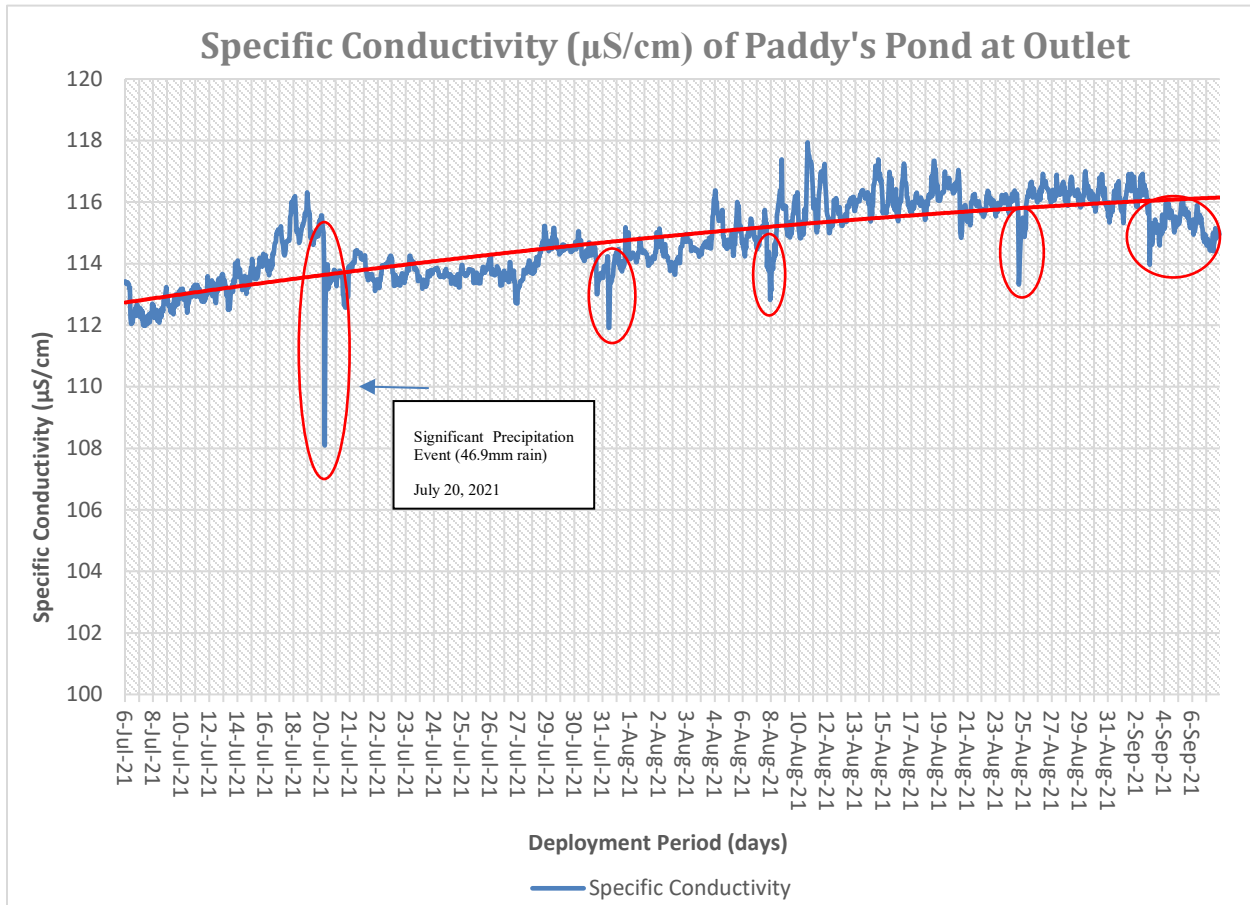
Figure 3: pH (pH units) at Paddy's Pond at outlet from July 6, 2021 through September 8, 2021.

- Throughout the deployment period, pH values ranged from 6.31 to 7.74 pH units, with a mean unit value of 6.72 and median of 6.68 units (Figure 3).

- The CCME guideline for the protection of aquatic life states the requirement of a minimum pH value of 6.5 and max value of 9.0. This guideline provides a basis for the overall health of the waterbody. Paddy's Pond at Outlet pH values decreased below the minimum guideline multiple times throughout the deployment period. This is likely the result of an increase in temperature and multiple precipitation events. On July 20, 2021, a significant drop in pH was observed (see Figure 3) due to a significant rainfall event of 46.9 mm. After the event, pH value slowly increased above the minimum pH CCME guideline. A continuous increase above the baseline pH values for Paddy's Pond was observed near the end of the deployment period as air and water temperatures began to seasonally cool.
- Diurnal variation was visible from July through the beginning of September. The magnitude of variation was significantly influenced by the precipitation event on July 20, 2021 and was observed to have decreased for approximately four days between July 20-24, 2021. Diurnal variation then began to increase in correlation with an increase in air/water temperature as expected and was relatively consistent in late August.

Specific Conductivity

- Conductivity relates to the ease of passing an electric charge – or resistance – through a solution. Conductivity is highly influenced by the concentration of dissolved ions in solution: distilled water has zero conductivity (infinite resistance) while salty solutions have high conductivity (low resistance). Specific Conductivity is corrected to 25°C to allow comparison across variable temperatures.



Mean	Median	Min	Max
114.8	114.7	108.1	117.9

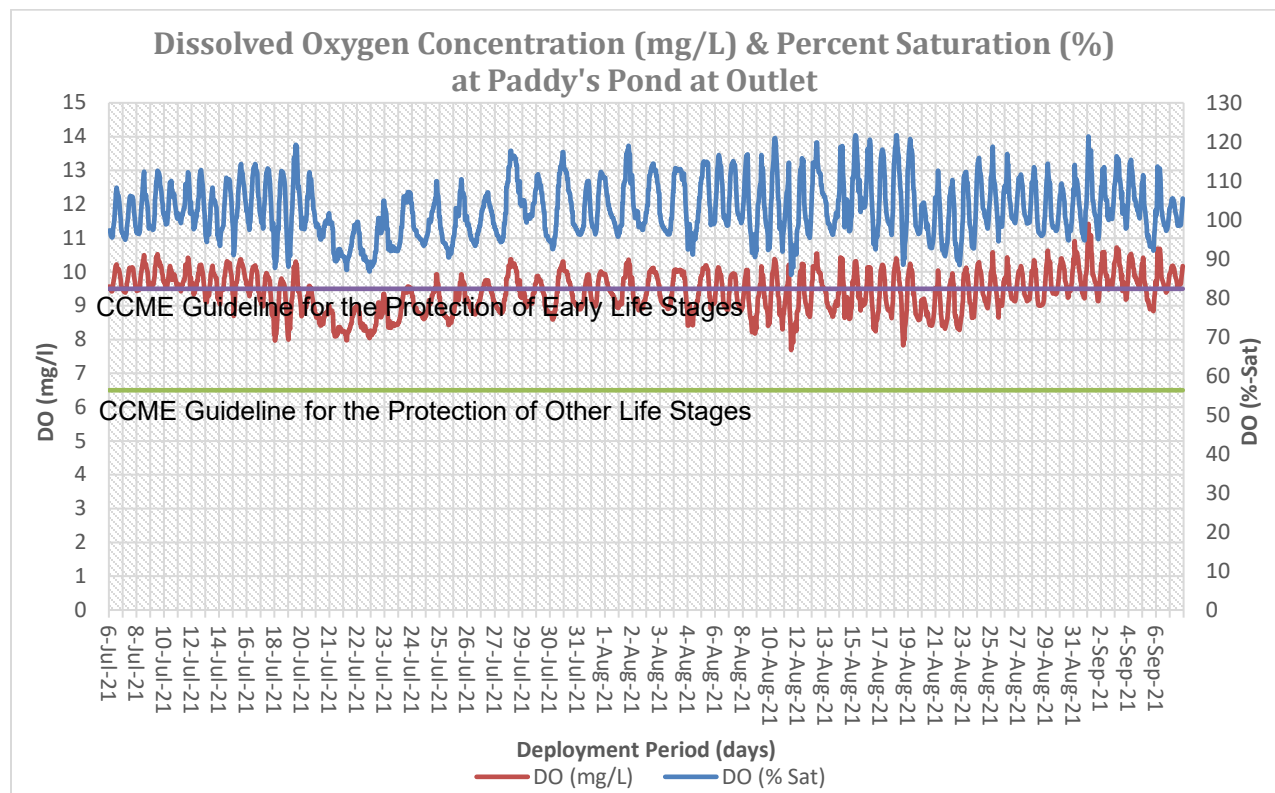
Figure 4: Specific conductivity (µS/cm) values at Paddy's Pond at Outlet.

- Specific Conductivity trend increased steadily throughout the deployment period and was within 108.1 µS/cm and 117.9 µS/cm (Figure 4). Mean conductivity value was 114.8 µS/cm with a median conductivity value of 114.7 µS/cm. Conductivity began to decrease slightly early September onwards.
- Slight decreases in specific conductivity (identified in red in Figure 4) throughout the deployment period were likely the result of a precipitation events (Figure 6 – Appendix 1).

- A significant decrease in conductivity, to a minimum of 108.1 $\mu\text{S}/\text{cm}$, was observed on July 20, 2021. This decrease correlated with a precipitation event with a total of 46.9 mm of rainfall received on that day. This can be expected after rainfall: as the amount of water increases, solids concentration is reduced in the system, decreasing conductivity.
- Given the isolated station location, sources of disturbances that may affect conductivity are considered minimal.

Dissolved Oxygen

- Dissolved oxygen is a metabolic requirement of aquatic plants and animals. The concentration of oxygen in water depends on many factors, especially temperature – the saturation of oxygen in water is inversely proportional to water temperature. Oxygen concentrations also tend to be higher in flowing water compared to still, lake environments. Low oxygen concentrations can give an indication of excessive decomposition of organic matter or the presence of oxidizing materials.



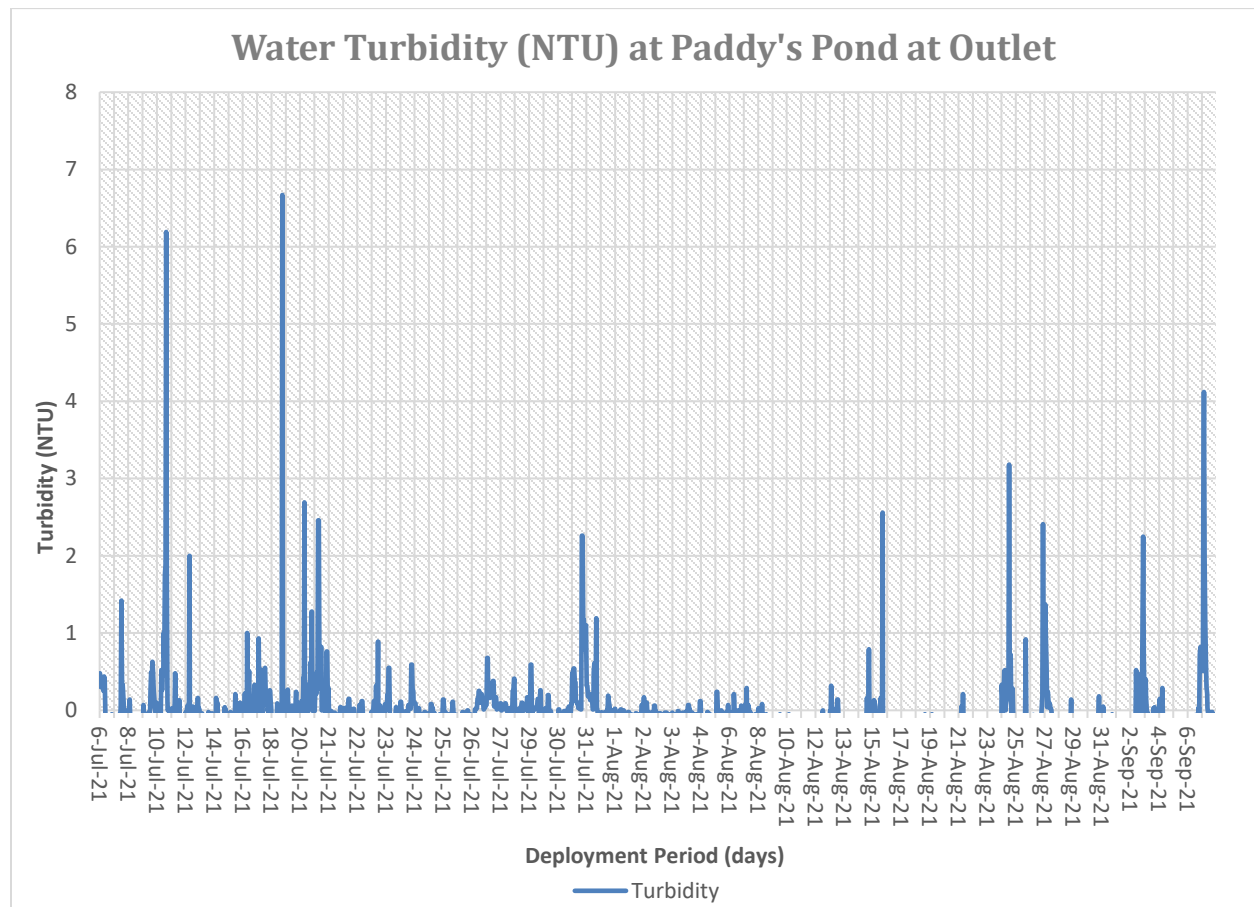
Parameter	Mean	Median	Min	Max
DO (mg/L)	9.39	9.42	7.69	11.42
DO (% Sat)	102.8	101.8	85.9	121.7

Figure 5: Dissolved Oxygen (mg/L & Percent (%) Saturation) values at Paddy's Pond at Outlet.

- Dissolved oxygen concentrations remained relatively stable from July 6, 2021 through September 8, 2021. The saturation of dissolved oxygen (%DO) ranged from 85.9 mg/L to 121.7 mg/L, with a mean %DO of 102.8. A range of 7.69 mg/L to 11.42 mg/L was observed for the concentration of dissolved oxygen with a mean of 9.39 mg/L and median of 9.42 mg/L.
- A decrease in dissolved oxygen was observed (see Figure 5) after a significant rainfall event of 46.9 mm was received on July 20, 2021. After the event, dissolved oxygen slowly increased to baseline values as observed before the event.
- All values were above the minimum CCME Guideline for the Protection of Other Life Stages of 6.5 mg/l. Indicated in green in Figure 5.
- Diurnal variation was visible throughout the deployment period. The magnitude of variation decreased immediately after the July 20th rainfall event, before increasing shortly after due to an increase in range of daily air and water temperatures.

Turbidity

- Turbidity is typically caused by fine suspended solids such as silt, clay, or organic material. Consistently high levels of turbidity tend to block sunlight penetration into a waterbody, discouraging plant growth. High turbidity can also damage the delicate respiratory organs of aquatic animals and cover spawning areas.



Mean	Median	Min	Max
0.0	-0.1	-0.3	6.7

Figure 6: Water turbidity (NTU) values at Paddy's Pond at Outlet during deployment period July 6, 2021 through September 8, 2021.

- Turbidity values range from -0.3 NTU to 6.7 NTU, with a mean of 0.0 and a median value of -0.1 NTU as seen in Figure 6.
- Turbidity levels were generally low during this deployment period. Occasional events above baseline such as July 11, 2021 (6.19 NTU) and July 18, 2021 (6.67 NTU), are likely influenced by debris, suspended algae, siltation due to wave action and precipitation events.

- Turbidity measurements throughout the deployment period often indicated negative turbidity values. This situation is most likely to happen when measuring low-level turbidity. Natural variations in all measurements, instrument and non-instrument related, can lead to a negative result. Some other turbidimeters are designed to round up a negative number to 0.00 NTU, since a result of less than 0.00 NTU is theoretically impossible. However, in practice, these results are actually quite meaningful. The problem could be operator technique or sonde error. It could also indicate a problem with the low turbidity/turbidity-free water used for a blank or a problem with the calibration. If the meter rounds the negative result to 0.00 NTU, the user will not be alerted to a potential problem.

APPENDIX A : MEAN DAILY TEMPERATURE AND TOTAL PRECIPITATION

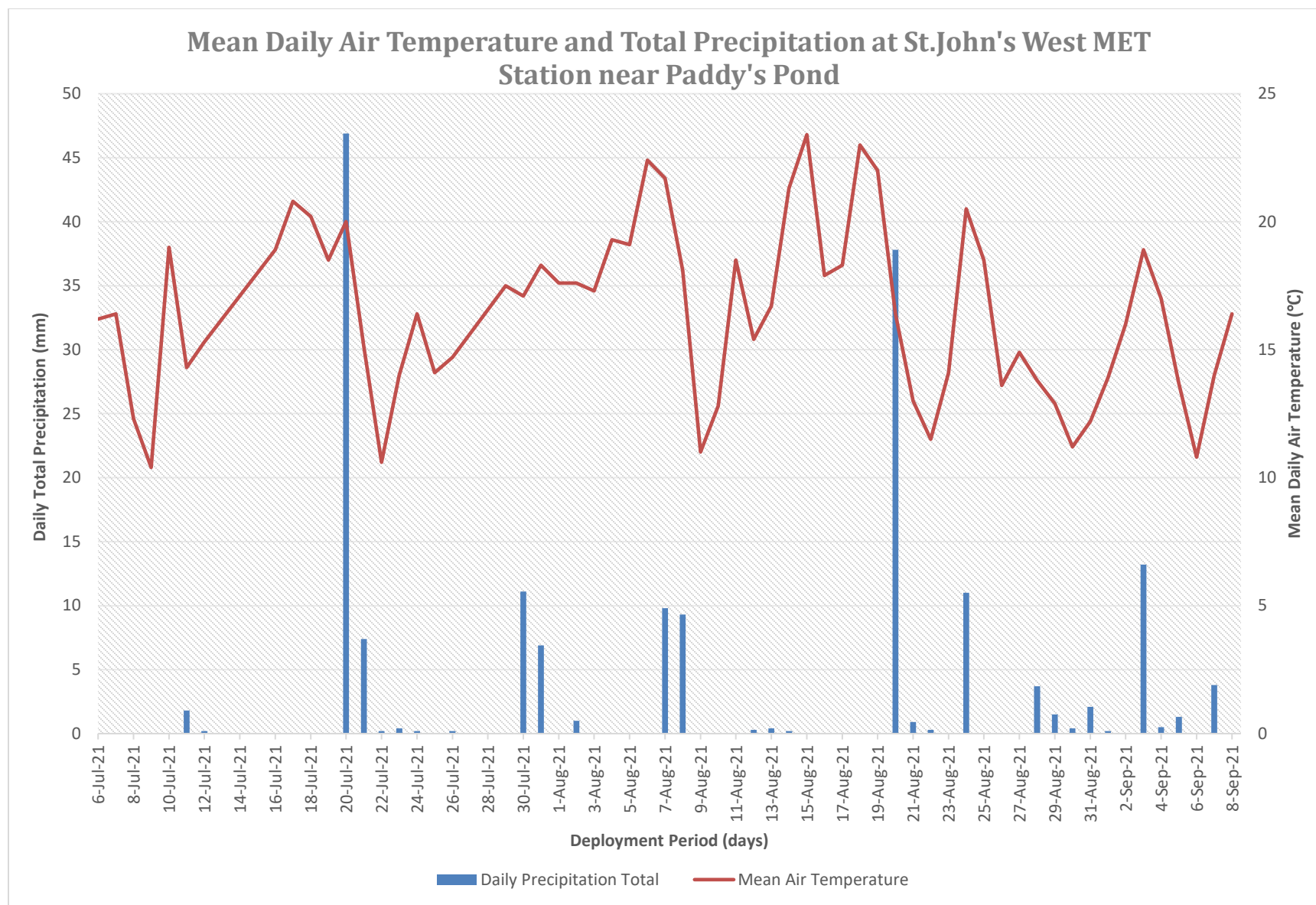


Figure 6: Mean daily air temperature and total precipitation at St. John's West near Paddy's Pond between July 6, 2021 and September 8, 2021

APPENDIX B : QA/QC GRAB SAMPLE FIELD RESULTS



Your P.O. #: 220028978-5
 Site Location: N/A
 Your C.O.C. #: N/A, 2021-1825-00-SI-SP

Attention: Robert Richard Harvey

NL Department of Environment, Climate Change and Municipalities
 Water Resources
 PO Box 8700
 St. John's, NL
 CANADA A1B 4J6

Report Date: 2021/07/22
 Report #: R6731209
 Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C118521

Received: 2021/07/07, 09:26

Sample Matrix: Water
 # Samples Received: 1

Analyses	Quantity	Date		Laboratory Method	Analytical Method
		Extracted	Analyzed		
Alkalinity	1	N/A	2021/07/14	ATL SOP 00013	EPA 310.2 R1974 m
Anions (1)	1	N/A	2021/07/14	CAM SOP-00435	SM 23 4110 B m
Colour	1	N/A	2021/07/14	ATL SOP 00020	SM 23 2120C m
Organic carbon - Diss (DOC) (2)	1	N/A	2021/07/13	ATL SOP 00203	SM 23 5310B m
Conductance - water	1	N/A	2021/07/12	ATL SOP 00004	SM 23 2510B m
Fluoride	1	N/A	2021/07/12	ATL SOP 00043	SM 23 4500-F- C m
Hardness (calculated as CaCO3)	1	N/A	2021/07/13	ATL SOP 00048	Auto Calc
Mercury - Total (CVAA,LL)	1	2021/07/09	2021/07/09	ATL SOP 00026	EPA 245.1 R3 m
Metals Water Total MS	1	2021/07/08	2021/07/12	ATL SOP 00058	EPA 6020B R2 m
Nitrogen Ammonia - water	1	N/A	2021/07/13	ATL SOP 00015	EPA 350.1 R2 m
Nitrogen - Nitrate + Nitrite	1	N/A	2021/07/14	ATL SOP 00016	USGS I-2547-11m
Nitrogen - Nitrite	1	N/A	2021/07/14	ATL SOP 00017	SM 23 4500-NO2- B m
Nitrogen - Nitrate (as N)	1	N/A	2021/07/15	ATL SOP 00018	ASTM D3867-16
pH (3)	1	N/A	2021/07/12	ATL SOP 00003	SM 23 4500-H+ B m
Calculated TDS (DW Pkg)	1	N/A	2021/07/12	N/A	Auto Calc
Total Kjeldahl Nitrogen in Water (1)	1	2021/07/12	2021/07/13	CAM SOP-00938	OMOE E3516 m
Organic carbon - Total (TOC) (2)	1	N/A	2021/07/14	ATL SOP 00203	SM 23 5310B m
Total Phosphorus (Colourimetric) (1)	1	2021/07/14	2021/07/14	CAM SOP-00407	SM 23 4500 P B H m
Total Suspended Solids	1	2021/07/12	2021/07/14	ATL SOP 00007	SM 23 2540D m
Turbidity	1	N/A	2021/07/12	ATL SOP 00011	EPA 180.1 R2 m

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

(1) This test was performed by Bureau Veritas Mississauga

(2) TOC / DOC present in the sample should be considered as non-purgeable TOC / DOC.

(3) The APHA Standard Method require pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the APHA Standard Method holding time.



Your P.O. #: 220028978-5
Site Location: N/A
Your C.O.C. #: N/A, 2021-1825-00-SI-SP

Attention: Robert Richard Harvey

NL Department of Environment, Climate Change and Municipalities
Water Resources
PO Box 8700
St. John's, NL
CANADA A1B 4J6

Report Date: 2021/07/22
Report #: R6731209
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1I8521
Received: 2021/07/07, 09:26

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
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BV Labs Job #: C118521
Report Date: 2021/07/22

NL Department of Environment, Climate Change and
Municipalities

Site Location: N/A

Your P.O. #: 220028978-5

Sampler Initials: LH

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
QAQ506 PADDYS POND								
Sampling Date		2021/07/06						
Matrix		W						
Sample #		2021-1825-00-SI-SP						
Registration #		WS-S-0000						
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	8.6	1.0	mg/L	N/A	2021/07/13		7450666
Nitrate (N)	-	ND	0.050	mg/L	N/A	2021/07/15		7450670
Total dissolved solids (calc., EC)	-	61	1.0	mg/L	N/A	2021/07/12		7451360
Inorganics								
Conductivity	-	110	1.0	uS/cm	N/A	2021/07/12	SHW	7456551
Chloride (Cl-)	-	26	1.0	mg/L	N/A	2021/07/14	FD	7461469
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2021/07/14	FD	7461469
Sulphate (SO4)	-	3.0	1.0	mg/L	N/A	2021/07/14	FD	7461469
Total Alkalinity (Total as CaCO3)	-	7.4	5.0	mg/L	N/A	2021/07/14	MCN	7462092
Colour	-	21	5.0	TCU	N/A	2021/07/14	MCN	7462118
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2021/07/12	SHW	7456559
Total Kjeldahl Nitrogen (TKN)	-	0.16	0.10	mg/L	2021/07/12	2021/07/13	RTY	7457711
Nitrate + Nitrite (N)	-	ND	0.050	mg/L	N/A	2021/07/14	MCN	7462127
Nitrite (N)	-	ND	0.010	mg/L	N/A	2021/07/14	MCN	7462129
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2021/07/13	MCN	7459567
Dissolved Organic Carbon (C)	-	4.2	0.50	mg/L	N/A	2021/07/13	NGI	7458811
Total Organic Carbon (C)	-	4.2	0.50	mg/L	N/A	2021/07/14	NGI	7461302
pH	-	6.84		pH	N/A	2021/07/12	SHW	7456556
Total Phosphorus	-	0.010	0.004	mg/L	2021/07/14	2021/07/14	SSV	7461718
Total Suspended Solids	-	3.4	1.0	mg/L	2021/07/12	2021/07/14	BBD	7456529
Turbidity	-	0.56	0.10	NTU	N/A	2021/07/12	SHW	7456628
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2021/07/09	2021/07/09	NHU	7451428
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.052	0.0050	mg/L	2021/07/08	2021/07/12	BAN	7451625
Total Antimony (Sb)	-	ND	0.0010	mg/L	2021/07/08	2021/07/12	BAN	7451625
Total Arsenic (As)	-	ND	0.0010	mg/L	2021/07/08	2021/07/12	BAN	7451625
Total Barium (Ba)	-	0.0028	0.0010	mg/L	2021/07/08	2021/07/12	BAN	7451625
Total Boron (B)	-	ND	0.050	mg/L	2021/07/08	2021/07/12	BAN	7451625
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2021/07/08	2021/07/12	BAN	7451625
Total Calcium (Ca)	-	2.4	0.10	mg/L	2021/07/08	2021/07/12	BAN	7451625
Total Chromium (Cr)	-	ND	0.0010	mg/L	2021/07/08	2021/07/12	BAN	7451625
Total Copper (Cu)	-	ND	0.00050	mg/L	2021/07/08	2021/07/12	BAN	7451625
Total Iron (Fe)	-	0.12	0.050	mg/L	2021/07/08	2021/07/12	BAN	7451625
Total Lead (Pb)	-	ND	0.00050	mg/L	2021/07/08	2021/07/12	BAN	7451625
Total Magnesium (Mg)	-	0.63	0.10	mg/L	2021/07/08	2021/07/12	BAN	7451625



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BV Labs Job #: C118521
Report Date: 2021/07/22

NL Department of Environment, Climate Change and
Municipalities
Site Location: N/A
Your P.O. #: 220028978-5
Sampler Initials: LH

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
QAQ506 PADDYS POND								
Sampling Date 2021/07/06								
Matrix W								
Sample # 2021-1825-00-SI-SP								
Registration # WS-S-0000								
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Manganese (Mn)	-	0.026	0.0020	mg/L	2021/07/08	2021/07/12	BAN	7451625
Total Nickel (Ni)	-	ND	0.0020	mg/L	2021/07/08	2021/07/12	BAN	7451625
Total Phosphorus (P)	-	ND	0.10	mg/L	2021/07/08	2021/07/12	BAN	7451625
Total Selenium (Se)	-	ND	0.00050	mg/L	2021/07/08	2021/07/12	BAN	7451625
Total Sodium (Na)	-	16	0.10	mg/L	2021/07/08	2021/07/12	BAN	7451625
Total Strontium (Sr)	-	0.0075	0.0020	mg/L	2021/07/08	2021/07/12	BAN	7451625
Total Uranium (U)	-	ND	0.00010	mg/L	2021/07/08	2021/07/12	BAN	7451625
Total Zinc (Zn)	-	ND	0.0050	mg/L	2021/07/08	2021/07/12	BAN	7451625



GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	3.3°C
Package 2	1.7°C
Package 3	3.7°C
Package 4	3.0°C
Package 5	0.0°C
Package 6	0.3°C
Package 7	2.0°C
Package 8	1.3°C

Results relate only to the items tested.



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BV Labs Job #: C118521
Report Date: 2021/07/22

NL Department of Environment, Climate Change and
Municipalities
Site Location: N/A
Your P.O. #: 220028978-5
Sampler Initials: LH

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Colleen Acker, B.Sc, Scientific Service Specialist

Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

Mike MacGillivray, Scientific Specialist (Inorganics)

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Your P.O. #: 220028978-5
 Your C.O.C. #: N/A, 2021-1834-00-SI-SP

Attention: Robert Richard Harvey

NL Department of Environment, Climate Change and Municipalities
 Water Resources
 PO Box 8700
 St. John's, NL
 CANADA A1B 4J6

Report Date: 2021/09/20
 Report #: R6818974
 Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1Q3046
Received: 2021/09/09, 11:01

Sample Matrix: Water
 # Samples Received: 1

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Alkalinity	1	N/A	2021/09/16	ATL SOP 00013	EPA 310.2 R1974 m
Anions (1)	1	N/A	2021/09/16	CAM SOP-00435	SM 23 4110 B m
Colour	1	N/A	2021/09/16	ATL SOP 00020	SM 23 2120C m
Organic carbon - Diss (DOC) (2)	1	N/A	2021/09/16	ATL SOP 00203	SM 23 5310B m
Conductance - water	1	N/A	2021/09/16	ATL SOP 00004	SM 23 2510B m
Fluoride	1	N/A	2021/09/16	ATL SOP 00043	SM 23 4500-F- C m
Hardness (calculated as CaCO3)	1	N/A	2021/09/16	ATL SOP 00048	Auto Calc
Mercury - Total (CVAA,LL)	1	2021/09/16	2021/09/16	ATL SOP 00026	EPA 245.1 R3 m
Metals Water Total MS	1	2021/09/14	2021/09/15	ATL SOP 00058	EPA 6020B R2 m
Nitrogen Ammonia - water	1	N/A	2021/09/15	ATL SOP 00015	EPA 350.1 R2 m
Nitrogen - Nitrate + Nitrite	1	N/A	2021/09/16	ATL SOP 00016	USGS I-2547-11m
Nitrogen - Nitrite	1	N/A	2021/09/16	ATL SOP 00017	SM 23 4500-NO2- B m
Nitrogen - Nitrate (as N)	1	N/A	2021/09/17	ATL SOP 00018	ASTM D3867-16
pH (3)	1	N/A	2021/09/16	ATL SOP 00003	SM 23 4500-H+ B m
Calculated TDS (DW Pkg)	1	N/A	2021/09/16	N/A	Auto Calc
Total Kjeldahl Nitrogen in Water (1)	1	2021/09/16	2021/09/17	CAM SOP-00938	OMOE E3516 m
Organic carbon - Total (TOC) (2)	1	N/A	2021/09/17	ATL SOP 00203	SM 23 5310B m
Total Phosphorus (Colourimetric) (1)	1	2021/09/16	2021/09/17	CAM SOP-00407	SM 23 4500 P B H m
Total Suspended Solids	1	2021/09/15	2021/09/16	ATL SOP 00007	SM 23 2540D m
Turbidity	1	N/A	2021/09/16	ATL SOP 00011	EPA 180.1 R2 m

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

(1) This test was performed by Bureau Veritas Mississauga, 6740 Campobello Rd , Mississauga, ON, L5N 2L8

(2) TOC / DOC present in the sample should be considered as non-purgeable TOC / DOC.

(3) The APHA Standard Method require pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the APHA Standard Method holding time.



Your P.O. #: 220028978-5
Your C.O.C. #: N/A, 2021-1834-00-SI-SP

Attention: Robert Richard Harvey

NL Department of Environment, Climate Change and Municipalities
Water Resources
PO Box 8700
St. John's, NL
CANADA A1B 4J6

Report Date: 2021/09/20
Report #: R6818974
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1Q3046
Received: 2021/09/09, 11:01

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Maryann Comeau, Customer Experience Supervisor/PM

Email: Maryann.COMEAU@bureauveritas.com

Phone# (902)420-0203 Ext:298

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BV Labs Job #: C1Q3046
Report Date: 2021/09/20

NL Department of Environment, Climate Change and
Municipalities
Your P.O. #: 220028978-5
Sampler Initials: LH

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
QQG183 PADDYS POND								
Sampling Date		2021/09/08						
Matrix		W						
Sample #		2021-1834-00-SI-SP						
Registration #		WS-S-0000						
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	8.8	1.0	mg/L	N/A	2021/09/16		7575341
Nitrate (N)	-	ND	0.050	mg/L	N/A	2021/09/17		7575348
Total dissolved solids (calc., EC)	-	61	1.0	mg/L	N/A	2021/09/16		7575560
Inorganics								
Conductivity	-	110	1.0	uS/cm	N/A	2021/09/16	SHW	7580528
Chloride (Cl-)	-	27	1.0	mg/L	N/A	2021/09/16	FD	7580093
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2021/09/16	FD	7580093
Sulphate (SO4)	-	2.6	1.0	mg/L	N/A	2021/09/16	FD	7580093
Total Alkalinity (Total as CaCO3)	-	6.3	5.0	mg/L	N/A	2021/09/16	EMT	7580605
Colour	-	14	5.0	TCU	N/A	2021/09/16	EMT	7580610
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2021/09/16	SHW	7580530
Total Kjeldahl Nitrogen (TKN)	-	0.13	0.10	mg/L	2021/09/16	2021/09/17	RTY	7581179
Nitrate + Nitrite (N)	-	ND	0.050	mg/L	N/A	2021/09/16	EMT	7580612
Nitrite (N)	-	ND	0.010	mg/L	N/A	2021/09/16	EMT	7580613
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2021/09/15	EMT	7577990
Dissolved Organic Carbon (C)	-	3.6	0.50	mg/L	N/A	2021/09/16	NGI	7578333
Total Organic Carbon (C)	-	3.6	0.50	mg/L	N/A	2021/09/17	NGI	7580550
pH	-	6.82		pH	N/A	2021/09/16	SHW	7580529
Total Phosphorus	-	0.007	0.004	mg/L	2021/09/16	2021/09/17	SSV	7582240
Total Suspended Solids	-	2.0	1.0	mg/L	2021/09/15	2021/09/16	MKX	7578834
Turbidity	-	0.56	0.10	NTU	N/A	2021/09/16	SHW	7580639
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2021/09/16	2021/09/16	NHU	7578208
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.031	0.0050	mg/L	2021/09/14	2021/09/15	MLB	7576152
Total Antimony (Sb)	-	ND	0.0010	mg/L	2021/09/14	2021/09/15	MLB	7576152
Total Arsenic (As)	-	ND	0.0010	mg/L	2021/09/14	2021/09/15	MLB	7576152
Total Barium (Ba)	-	0.0017	0.0010	mg/L	2021/09/14	2021/09/15	MLB	7576152
Total Boron (B)	-	ND	0.050	mg/L	2021/09/14	2021/09/15	MLB	7576152
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2021/09/14	2021/09/15	MLB	7576152
Total Calcium (Ca)	-	2.5	0.10	mg/L	2021/09/14	2021/09/15	MLB	7576152
Total Chromium (Cr)	-	ND	0.0010	mg/L	2021/09/14	2021/09/15	MLB	7576152
Total Copper (Cu)	-	ND	0.00050	mg/L	2021/09/14	2021/09/15	MLB	7576152
Total Iron (Fe)	-	0.10	0.050	mg/L	2021/09/14	2021/09/15	MLB	7576152
Total Lead (Pb)	-	ND	0.00050	mg/L	2021/09/14	2021/09/15	MLB	7576152
Total Magnesium (Mg)	-	0.63	0.10	mg/L	2021/09/14	2021/09/15	MLB	7576152
Total Manganese (Mn)	-	0.032	0.0020	mg/L	2021/09/14	2021/09/15	MLB	7576152



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BV Labs Job #: C1Q3046
Report Date: 2021/09/20

NL Department of Environment, Climate Change and
Municipalities
Your P.O. #: 220028978-5
Sampler Initials: LH

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
QQG183 PADDYS POND								
Sampling Date		2021/09/08						
Matrix		W						
Sample #		2021-1834-00-SI-SP						
Registration #		WS-S-0000						
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Nickel (Ni)	-	ND	0.0020	mg/L	2021/09/14	2021/09/15	MLB	7576152
Total Phosphorus (P)	-	ND	0.10	mg/L	2021/09/14	2021/09/15	MLB	7576152
Total Potassium (K)	-	0.49	0.10	mg/L	2021/09/14	2021/09/15	MLB	7576152
Total Selenium (Se)	-	ND	0.00050	mg/L	2021/09/14	2021/09/15	MLB	7576152
Total Sodium (Na)	-	16	0.10	mg/L	2021/09/14	2021/09/15	MLB	7576152
Total Strontium (Sr)	-	0.0080	0.0020	mg/L	2021/09/14	2021/09/15	MLB	7576152
Total Uranium (U)	-	ND	0.00010	mg/L	2021/09/14	2021/09/15	MLB	7576152
Total Zinc (Zn)	-	ND	0.0050	mg/L	2021/09/14	2021/09/15	MLB	7576152



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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	13.4°C
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Results relate only to the items tested.



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NL Department of Environment, Climate Change and
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VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Ewa Pranjic


Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

Mike Mac Gillivray

Mike MacGillivray, Scientific Specialist (Inorganics)

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