Real-Time Water Quality Deployment Report

Paddy's Pond at Outlet

November 3, 2021 to December 15, 2021

Newfoundland Labrador

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

CONTENTS

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

	Rank				
Parameter	**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 Nov. 3, 2021 and Dec. 15, 2021 are summarized in Table 2.

Table 2: Qualitative QA/QC comparison rankings for Paddy's Pond at outlet station Nov. 3, 2021 through Dec. 15, 2021.

Station	**Date**	**Action**	**Comparison Ranking**				
			Temperature	**pH**	**Conductivity**	**Dissolved Oxygen**	**Turbidity**
Paddy's Pond at Outlet	2021-11-03	Deployment	Good	Excellent	Poor	Excellent	Good
	2021-11-03	Grab Sample #2021-1841-00-SI-SP	N/A	Fair	Good	N/A	Excellent
	2021-12-15	Removal	Good	Fair	Excellent	Poor	Good
	2021-12-15	Grab Sample #2021-1850-00-SI-SP	N/A	Excellent	Fair	N/A	Good

- On November 3, 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 43 days and was removed on December 15, 2021.

- Upon deployment, all sensors ranked 'Excellent' and 'Good' against the calibrated QA/QC sonde with exception to conductivity, which ranked 'Poor". 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, the amount of time each sonde was given to stabilize before readings were recorded; and deteriorating performance of one of the sensors.

- Conductivity value comparison between the field sonde and the deployment grab sample (#2021-1841-00-SI-SP) ranked 'Good' indicating that the 'Poor' deployment ranking is likely the result of the QA/QC sonde. Grab sample lab results can be reviewed in Appendix B.

- Upon removal, measured field grab sample parameter sensors ranked 'Excellent', 'Good' and 'Fair' against the field sonde.

- At removal of the instrument, parameter rankings varied between 'Excellent', 'Good' and 'Fair', with the exception of dissolved oxygen which ranked 'Poor' against the QA/QC sonde. After examination of the instrument and data, it was determined the DO sensor had failed on November 5th, 2021. Data after this time is thus invalid.

DATA INTERPRETATION

The following graphs and discussion illustrate water quality data obtained hourly from November 3, 2021 through December 15, 2021 at Paddy's Pond at outlet to Three Arm Pond, St. John's, NL.

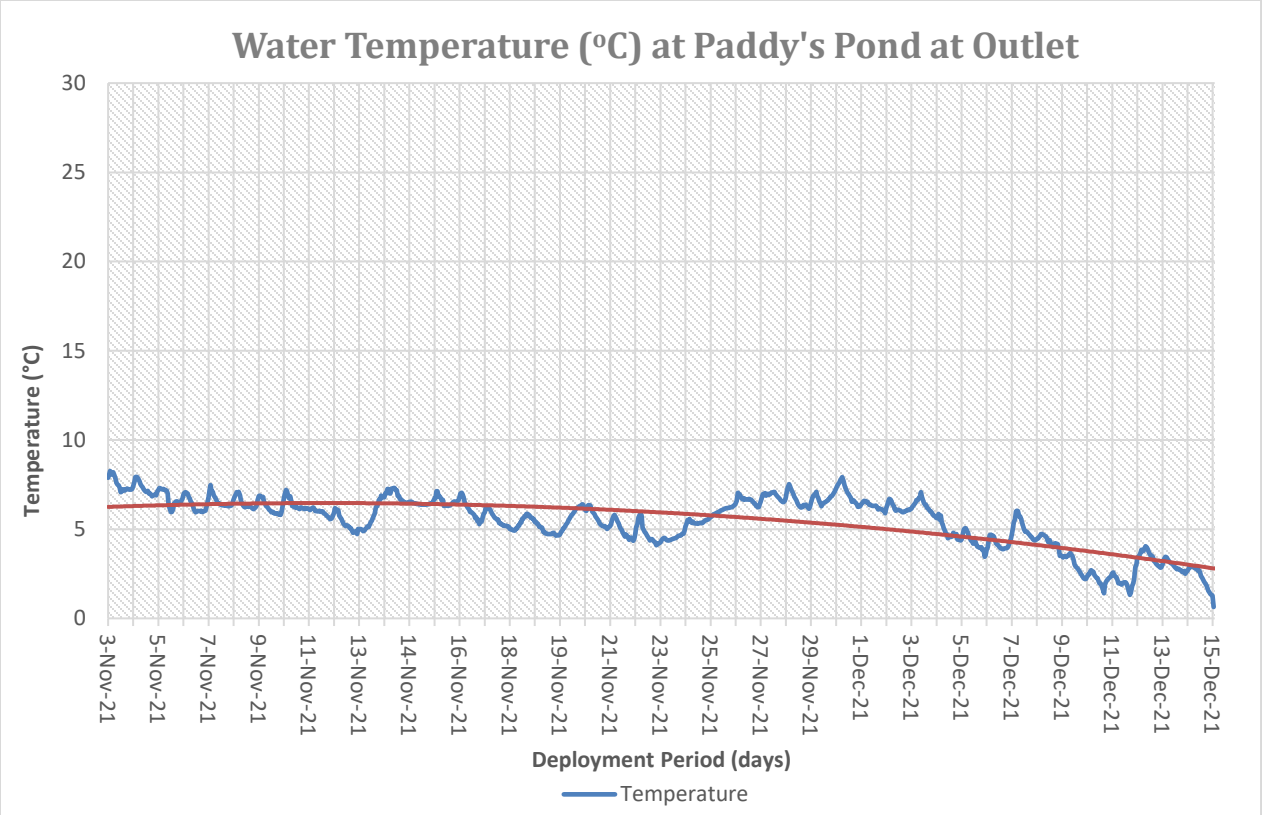
Stage is not monitored at this station and as such cannot be discussed with respect to other monitored water quality parameters. All data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol.

Mean daily temperature and total precipitation data was obtained from the ECCC 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.



Mean	Median	Min	Max
5.47	5.92	0.64	8.26

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

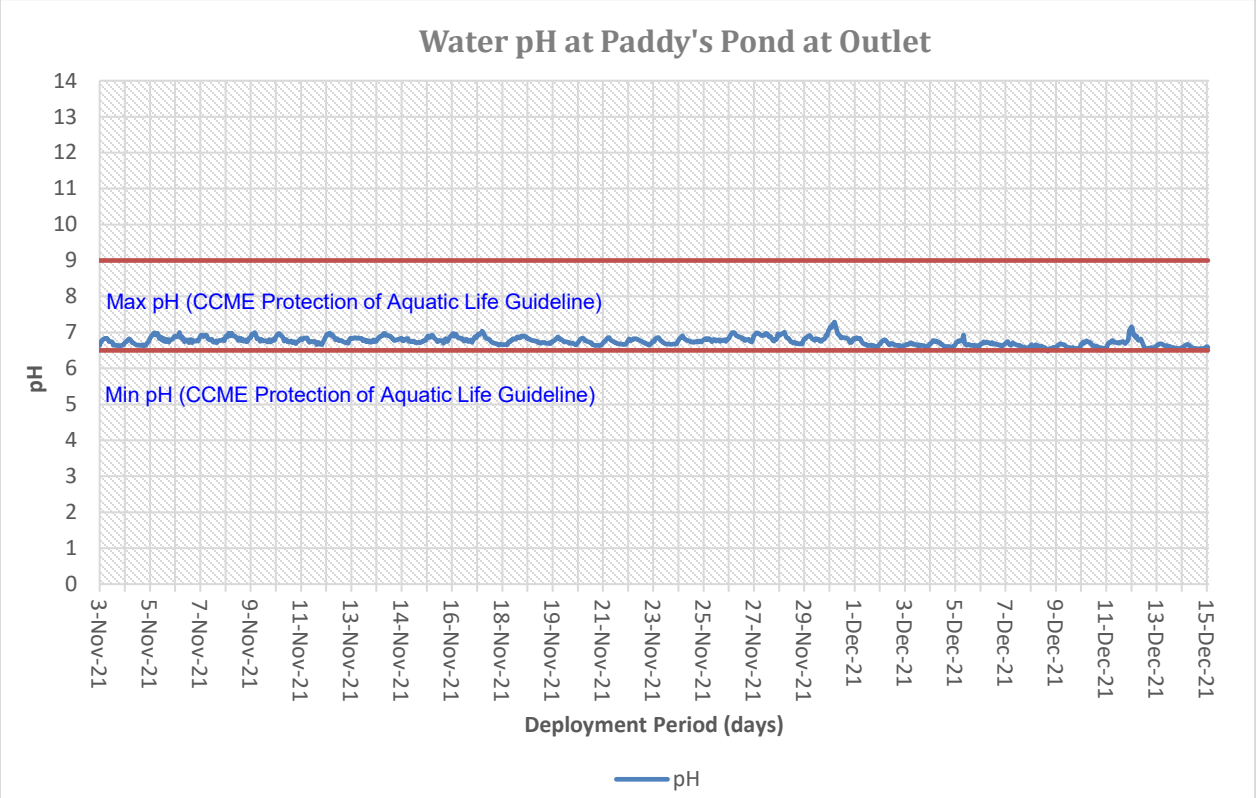
- Over the 43-day deployment period, water temperature remained steady with a mean temperature of 5.47°C and a median of 5.92°C. Water temperature began a natural decreasing trend after December 3, 2021 as air temperatures decreased (see Appendix A – Figure 7) and the shore water zone began to freeze for the winter season.

- Max water temperature of 8.26 °C decreased to a minimum temperature of 0.64°C observed in mid December. (Figure 2).

- A small diurnal temperature pattern with temperatures increasing during the day and decreasing overnight was observed due to low daily air temperature ranges and shortened length of daylight, which is expected during 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.



Mean	Median	Min	Max
6.75	6.75	6.48	7.29

Figure 3: pH (pH units) at Paddy's Pond at outlet from Nov. 3, 2021 through Dec. 15, 2021.

- Throughout the deployment period, pH values remained stable with a range from 6.48 to 7.29 pH units, with a mean unit value of 6.75 and median of 6.75 units (Figure 3).

- A slight decrease in pH was observed near the end of the deployment period and is most likely correlated to increased precipitation events indicated in Appendix A – Figure 7, but may also be the result of pH sensor calibration drift.

- 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 the waterbody. Paddy's Pond at Outlet pH values remained within these guidelines except for a

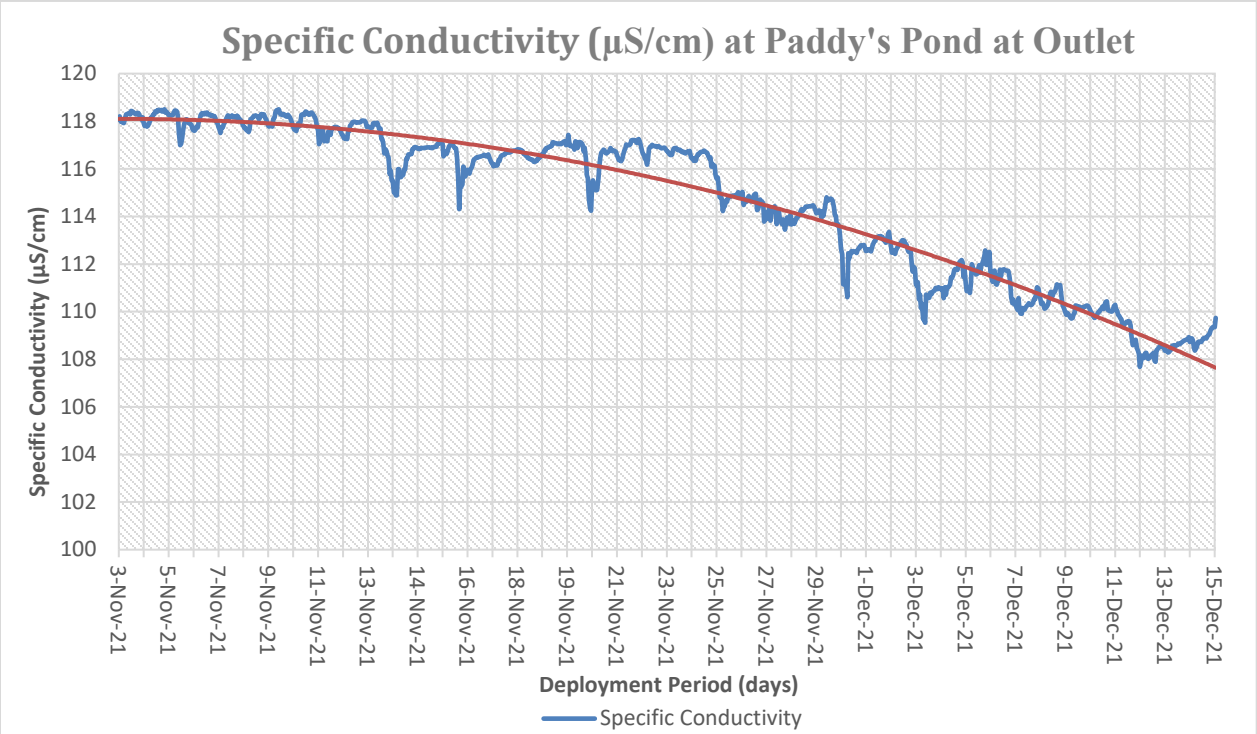
brief period on December 9, 2021 when the pH value was 6.48. This is likely a result of a precipitation event that occurred on this day. See Appendix A – Figure 7.

- 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.

- A small diurnal variation pattern was visible throughout the deployment period. 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.

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
114.6	116.1	107.7	118.5

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

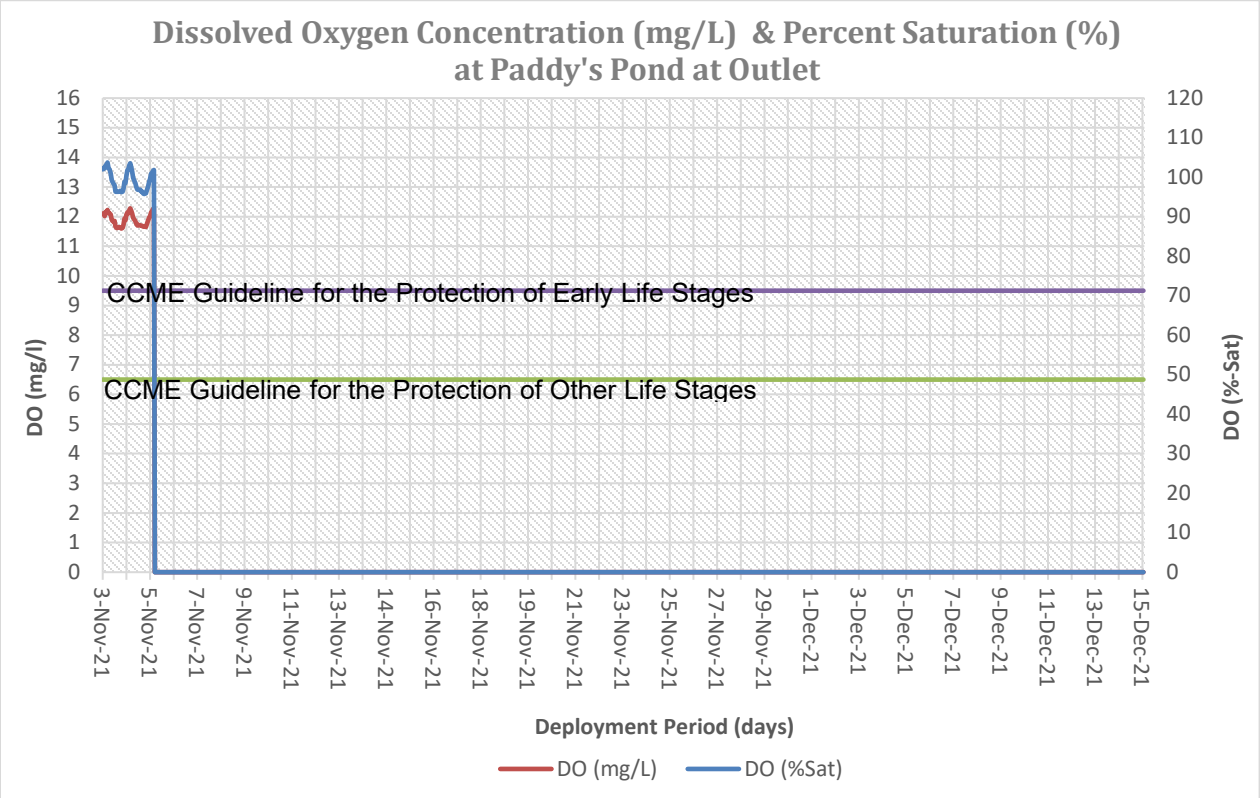
- Specific Conductivity levels declined throughout the deployment period with a maximum value of 118.5 µS/cm and a minimum value of 107.7 µS/cm (Figure 4). Mean conductivity value was 114.6 µS/cm with a median conductivity value of 116.1 µS/cm. This trend (indicated in red in Figure 4) is expected and correlates with decreasing water temperature.

- Variability in specific conductivity values throughout the deployment period is likely the result of temperature variations and precipitation events (Appendix A – Figure 7). A reduction conductivity can be expected after rainfall, as the amount of water increases solids concentration is reduced, 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)	0.60	0.00	0.00	12.28
DO (% Sat)	5.0	0.0	0.0	103.7

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

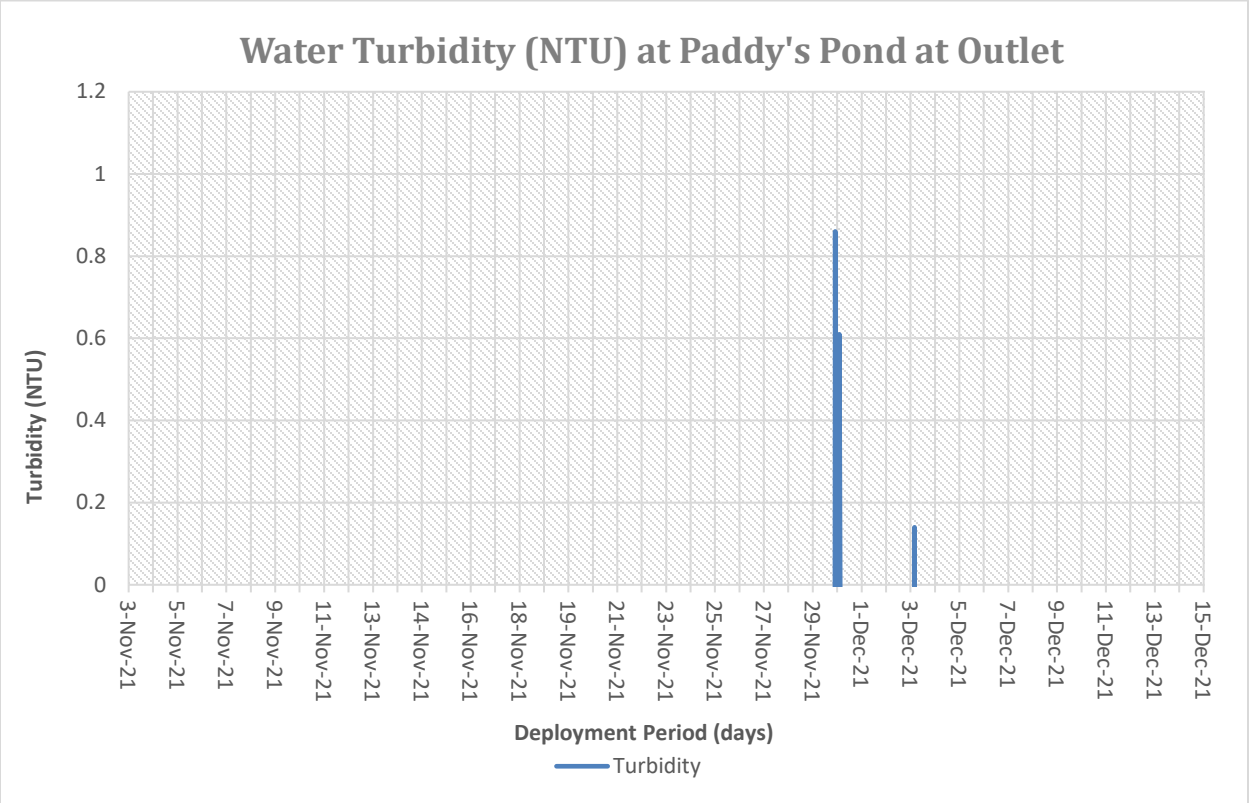
- The Dissolved Oxygen sensor failed during deployment (November 5, 2021) due to an electrical issue. Values indicated in the above table are erroneous and not indicative of historical dissolved oxygen concentrations at Paddy's Pond. This data will be removed from the dataset.

- During the first two (2) days of the deployment period, the maximum dissolved oxygen observed was 12.28 mg and 103.7% saturation. This is comparable to historical conductivity data for Paddy's Pond.

- Diurnal variation was observed on November 3-4, 2021 while the sensor was still functioning.

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
-3.2	-3.3	-3.8	0.9

Figure 6: Water turbidity (NTU) values at Paddy's Pond at Outlet during deployment period Nov. 3, 2021 through Dec. 15, 2021.

- Turbidity values range from -3.8 NTU to 0.9 NTU, with a mean of -3.2 and a median value of -3.3 NTU (Figure 6). Turbidity measurements over the majority of the deployment period 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.

- Turbidity levels were low during this deployment period, however events above baseline level as seen on November 3 and December 3, 2021, are likely influenced by debris, suspended algae, siltation due to wave action and precipitation events.

APPENDIX A : MEAN DAILY TEMPERATURE AND TOTAL PRECIPITATION

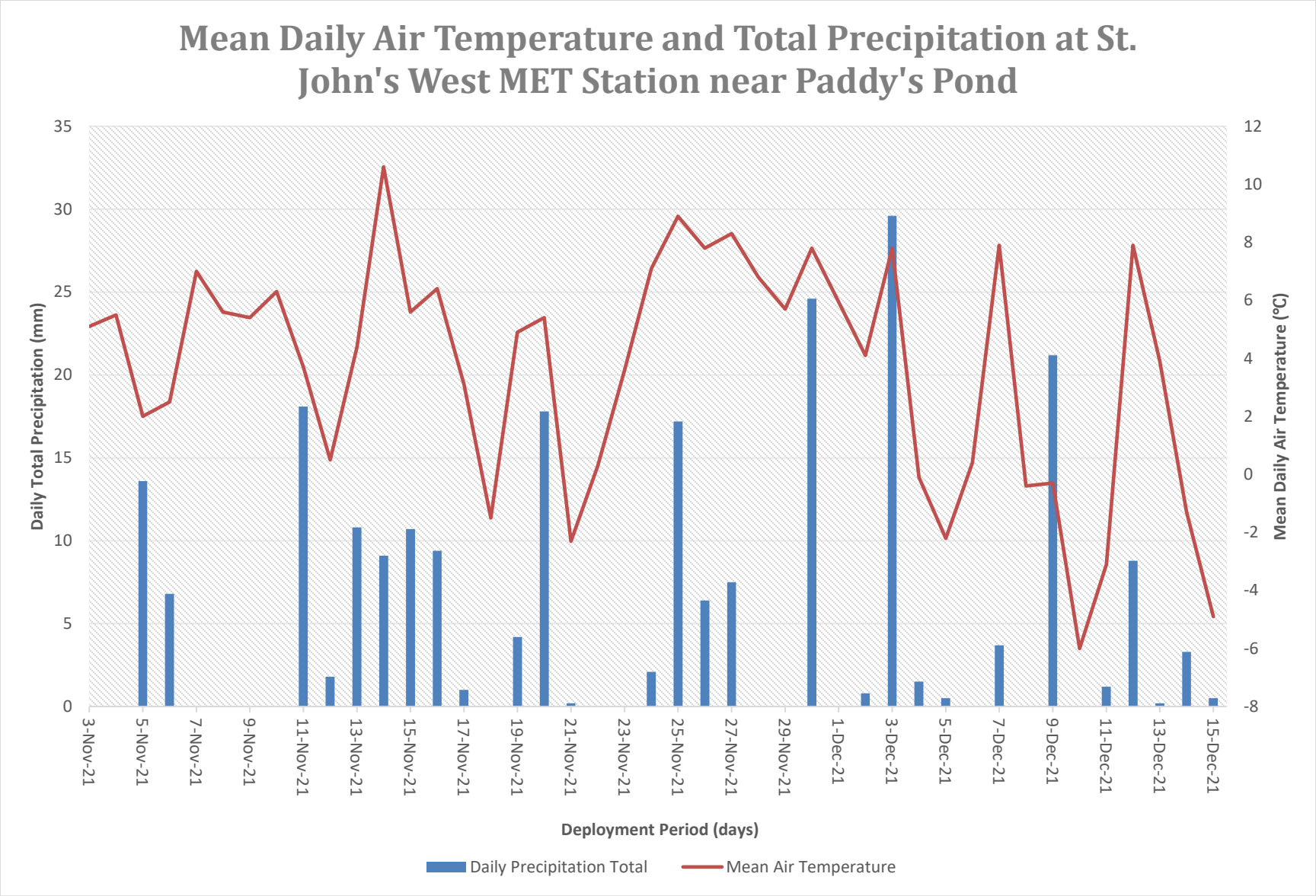


Figure 7: Mean daily air temperature and total precipitation at St. John's West near Paddy's Pond between Nov. 3, 2021 and Dec. 15, 2021

APPENDIX B : QA/QC GRAB SAMPLE FIELD RESULTS

Your P.O. #: 220028978-5
Your C.O.C. #: 2021-1841-00-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: 2021/11/17
Report #: R6905252
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1W7271
Received: 2021/11/05, 09:33

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	1	N/A	2021/11/10	ATL SOP 00013	EPA 310.2 R1974 m
Anions (1)	1	N/A	2021/11/11	CAM SOP-00435	SM 23 4110 B m
Colour	1	N/A	2021/11/10	ATL SOP 00020	SM 23 2120C m
Organic carbon - Diss (DOC) (2)	1	N/A	2021/11/10	ATL SOP 00203	SM 23 5310B m
Conductance - water	1	N/A	2021/11/09	ATL SOP 00004	SM 23 2510B m
Fluoride	1	N/A	2021/11/09	ATL SOP 00043	SM 23 4500-F- C m
Hardness (calculated as CaCO3)	1	N/A	2021/11/09	ATL SOP 00048	Auto Calc
Mercury - Total (CVAA,LL)	1	2021/11/15	2021/11/15	ATL SOP 00026	EPA 245.1 R3 m
Metals Water Total MS	1	2021/11/08	2021/11/08	ATL SOP 00058	EPA 6020B R2 m
Nitrogen Ammonia - water	1	N/A	2021/11/09	ATL SOP 00015	EPA 350.1 R2 m
Nitrogen - Nitrate + Nitrite	1	N/A	2021/11/17	ATL SOP 00016	USGS I-2547-11m
Nitrogen - Nitrite	1	N/A	2021/11/16	ATL SOP 00017	SM 23 4500-NO2- B m
Nitrogen - Nitrate (as N)	1	N/A	2021/11/17	ATL SOP 00018	ASTM D3867-16
pH (3)	1	N/A	2021/11/09	ATL SOP 00003	SM 23 4500-H+ B m
Calculated TDS (DW Pkg)	1	N/A	2021/11/09	N/A	Auto Calc
Total Kjeldahl Nitrogen in Water (1)	1	2021/11/10	2021/11/15	CAM SOP-00938	OMOE E3516 m
Organic carbon - Total (TOC) (2)	1	N/A	2021/11/09	ATL SOP 00203	SM 23 5310B m
Total Phosphorus (Colourimetric) (1)	1	2021/11/11	2021/11/11	CAM SOP-00407	SM 23 4500 P B H m
Total Suspended Solids	1	2021/11/10	2021/11/15	ATL SOP 00007	SM 23 2540D m
Turbidity	1	N/A	2021/11/09	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. #: 2021-1841-00-SI-SP

Attention: Robert Richard Harvey

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Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1W7271
Received: 2021/11/05, 09:33

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
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Bureau Veritas Job #: C1W7271
Report Date: 2021/11/17

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

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
RDZ173 PADDYS POND								
Sampling Date 2021/11/03								
Matrix W								
Sample # 2021-1841-00-SI-SP								
Registration # WS-S-0000								
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	9.8	1.0	mg/L	N/A	2021/11/09		7686253
Nitrate (N)	-	ND	0.050	mg/L	N/A	2021/11/17		7703504
Total dissolved solids (calc., EC)	-	63	1.0	mg/L	N/A	2021/11/09		7686273
Inorganics								
Conductivity	-	110	1.0	uS/cm	N/A	2021/11/09	SHW	7688555
Chloride (Cl-)	-	30	1.0	mg/L	N/A	2021/11/11	FD	7691631
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2021/11/11	FD	7691631
Sulphate (SO4)	-	3.6	1.0	mg/L	N/A	2021/11/11	FD	7691631
Total Alkalinity (Total as CaCO3)	-	75	5.0	mg/L	N/A	2021/11/10	EMT	7689035
Colour	-	11	5.0	TCU	N/A	2021/11/10	EMT	7691525
Dissolved Fluoride (F-)	-	ND	0.10	mg/L	N/A	2021/11/09	SHW	7688558
Total Kjeldahl Nitrogen (TKN)	-	0.16	0.10	mg/L	2021/11/10	2021/11/15	MJ1	7693210
Nitrate + Nitrite (N)	-	0.061	0.050	mg/L	N/A	2021/11/17	EMT	7702420
Nitrite (N)	-	0.024	0.010	mg/L	N/A	2021/11/16	EMT	7700513
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2021/11/09	MKY	7688801
Dissolved Organic Carbon (C)	-	3.6	0.50	mg/L	N/A	2021/11/10	NGI	7688649
Total Organic Carbon (C)	-	3.5	0.50	mg/L	N/A	2021/11/09	NGI	7688633
pH	-	6.77		pH	N/A	2021/11/09	SHW	7688557
Total Phosphorus	-	0.010	0.004	mg/L	2021/11/11	2021/11/11	SSV	7694343
Total Suspended Solids	-	1.0	1.0	mg/L	2021/11/10	2021/11/15	MKX	7691785
Turbidity	-	0.79	0.10	NTU	N/A	2021/11/09	SHW	7688650
MERCURY BY COLD VAPOUR AA (WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2021/11/15	2021/11/15	NHU	7691845
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	-	0.038	0.0050	mg/L	2021/11/08	2021/11/08	SJO	7686521
Total Antimony (Sb)	-	ND	0.0010	mg/L	2021/11/08	2021/11/08	SJO	7686521
Total Arsenic (As)	-	ND	0.0010	mg/L	2021/11/08	2021/11/08	SJO	7686521
Total Barium (Ba)	-	0.0025	0.0010	mg/L	2021/11/08	2021/11/08	SJO	7686521
Total Boron (B)	-	ND	0.050	mg/L	2021/11/08	2021/11/08	SJO	7686521
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2021/11/08	2021/11/08	SJO	7686521
Total Calcium (Ca)	-	2.7	0.10	mg/L	2021/11/08	2021/11/08	SJO	7686521
Total Chromium (Cr)	-	ND	0.0010	mg/L	2021/11/08	2021/11/08	SJO	7686521
Total Copper (Cu)	-	ND	0.00050	mg/L	2021/11/08	2021/11/08	SJO	7686521
Total Iron (Fe)	-	0.11	0.050	mg/L	2021/11/08	2021/11/08	SJO	7686521
Total Lead (Pb)	-	ND	0.00050	mg/L	2021/11/08	2021/11/08	SJO	7686521
Total Magnesium (Mg)	-	0.73	0.10	mg/L	2021/11/08	2021/11/08	SJO	7686521
Total Manganese (Mn)	-	0.021	0.0020	mg/L	2021/11/08	2021/11/08	SJO	7686521
Total Nickel (Ni)	-	ND	0.0020	mg/L	2021/11/08	2021/11/08	SJO	7686521

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Bureau Veritas Job #: C1W7271
Report Date: 2021/11/17

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

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
RDZ173 PADDYS POND Sampling Date 2021/11/03 Matrix W Sample # 2021-1841-00-SI-SP Registration # WS-S-0000								
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Phosphorus (P)	-	ND	0.10	mg/L	2021/11/08	2021/11/08	SJO	7686521
Total Potassium (K)	-	0.59	0.10	mg/L	2021/11/08	2021/11/08	SJO	7686521
Total Selenium (Se)	-	ND	0.00050	mg/L	2021/11/08	2021/11/08	SJO	7686521
Total Sodium (Na)	-	17	0.10	mg/L	2021/11/08	2021/11/08	SJO	7686521
Total Strontium (Sr)	-	0.0083	0.0020	mg/L	2021/11/08	2021/11/08	SJO	7686521
Total Uranium (U)	-	ND	0.00010	mg/L	2021/11/08	2021/11/08	SJO	7686521
Total Zinc (Zn)	-	ND	0.0050	mg/L	2021/11/08	2021/11/08	SJO	7686521

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GENERAL COMMENTS

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

Package 1	14.7°C

Sample RDZ173 [PADDYS POND] : NOX < NO2 : Both values fall within the method uncertainty for duplicates and are likely equivalent.

Results relate only to the items tested.

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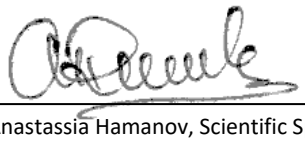
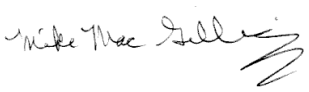
VALIDATION SIGNATURE PAGE

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



Anastassia Hamanov, Scientific Specialist

Colleen Acker, B.Sc, Scientific Service Specialist



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www.bvlabs.com E-mail: customerservicebedford@bvlabs.com

CHAIN OF CUSTODY RECORD

COC #:

Invoice Information		Report Information (if differs from invoice)		Project Information (where applicable)		Turnaround Time (TAT) Required
Company Name:	Environment, Climate Change and Municipalities	Company Name:		Quotation #:	INORGANICS & TSS	✓ Regular TAT (5 business days) Most analyses
Contact Name:	Robert Richard Harvey	Contact Name:		Purchase Order#:	220028978-5	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address:	PO Box 8700	Address:		Project #:		IF RUSH please specify date (Surcharges will be applied)
	St. John's NL A1B 4J6 PC:		PC:	Site Location:		DATE REQUIRED:
Phone:	(709) 729-7634	Phone:		Site Province:	NL	Early Results
Email:	rharvey@gov.nl.ca	Email:		Site #:		
Report Copies:	rharvey@gov.nl.ca	Report Copies:		Sampled By:		

Laboratory Use Only

CUSTODY SEAL Present	CUSTODY SEAL Intact	COOLER TEMPERATURES	COOLER TEMPERATURES
		12/16	

COOLING MEDIA PRESENT Y / N

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

Analysis Requested

	SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED & PRESERVED	LAB FILTRATION REQUIRED	Inorganics Package	TSS	HOLD- DO NOT ANALYZE	Regulatory Requirements (Specify) / COMMENTS Site Name
1	2021-1841-00-SI-SP	2021/11/03		water	8			x	x		Paddys Pond
2				water	8						
3				water	8						
4				water	8						
5				water	8						
6				water	8						
7				water	8						
8				water	8						
9				water	8						
10				water	8						

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	BV LABS JOB #
Leona Hyde	2021/11/03			NOV 03 2021	11 3	UN 7271

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Signing of this Chain of Custody document is acknowledgment and acceptance of our terms which are available for viewing at www.bvlabs.com

Your P.O. #: 220028978-5
Your C.O.C. #: N/A, 2021-1850-00-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: 2022/01/25
Report #: R6976141
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1Z7100
Received: 2021/12/16, 10:05

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	1	N/A	2022/01/06	ATL SOP 00013	EPA 310.2 R1974 m
Anions (1)	1	N/A	2021/12/22	CAM SOP-00435	SM 23 4110 B m
Colour	1	N/A	2022/01/06	ATL SOP 00020	SM 23 2120C m
Organic carbon - Diss (DOC) (2)	1	N/A	2021/12/23	ATL SOP 00203	SM 23 5310B m
Conductance - water	1	N/A	2022/01/06	ATL SOP 00004	SM 23 2510B m
Fluoride	1	N/A	2022/01/06	ATL SOP 00043	SM 23 4500-F- C m
Hardness (calculated as CaCO3)	1	N/A	2021/12/23	ATL SOP 00048	Auto Calc
Mercury (low level) (1)	1	2022/01/20	2022/01/24	CAM SOP-00453	EPA 7470 m
Metals Water Total MS	1	2021/12/20	2021/12/21	ATL SOP 00058	EPA 6020B R2 m
Nitrogen Ammonia - water	1	N/A	2021/12/23	ATL SOP 00015	EPA 350.1 R2 m
Nitrogen - Nitrate + Nitrite	1	N/A	2022/01/06	ATL SOP 00016	USGS I-2547-11m
Nitrogen - Nitrite	1	N/A	2022/01/06	ATL SOP 00017	SM 23 4500-NO2- B m
Nitrogen - Nitrate (as N)	1	N/A	2022/01/07	ATL SOP 00018	ASTM D3867-16
pH (3)	1	N/A	2022/01/06	ATL SOP 00003	SM 23 4500-H+ B m
Calculated TDS (DW Pkg)	1	N/A	2022/01/10	N/A	Auto Calc
Total Kjeldahl Nitrogen in Water (1)	1	2021/12/22	2021/12/31	CAM SOP-00938	OMOE E3516 m
Organic carbon - Total (TOC) (2)	1	N/A	2021/12/24	ATL SOP 00203	SM 23 5310B m
Total Phosphorus (Colourimetric) (1)	1	2021/12/22	2022/01/04	CAM SOP-00407	SM 23 4500 P B H m
Total Suspended Solids	1	2021/12/20	2021/12/22	ATL SOP 00007	SM 23 2540D m
Turbidity	1	N/A	2022/01/04	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, 2021-1850-00-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: 2022/01/25
Report #: R6976141
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1Z7100
Received: 2021/12/16, 10:05

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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Bureau Veritas Job #: C1Z7100
Report Date: 2022/01/25

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

Sample Details/Parameters	MAC	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
RKK648 PADDY'S POND								
Sampling Date 2021/12/15								
Matrix W								
Sample # 2021-1850-00-SI-SP								
Registration # WS-S-0000								
RESULTS OF ANALYSES OF WATER								
Calculated Parameters								
Hardness (CaCO3)	-	9.2	1.0	mg/L	N/A	2021/12/23		7738155
Nitrate (N)	**10**	ND	0.050	mg/L	N/A	2022/01/07		7738158
Total dissolved solids (calc., EC)	-	55	1.0	mg/L	N/A	2022/01/10		7738269
Inorganics								
Conductivity	-	98	1.0	uS/cm	N/A	2022/01/06	SHW	7765909
Chloride (Cl-)	-	30	1.0	mg/L	N/A	2021/12/22	FD	7746952
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2021/12/22	FD	7746952
Sulphate (SO4)	-	3.7	1.0	mg/L	N/A	2021/12/22	FD	7746952
Total Alkalinity (Total as CaCO3)	-	6.2	5.0	mg/L	N/A	2022/01/06	MCN	7765779
Colour	-	24	5.0	TCU	N/A	2022/01/06	MCN	7766082
Dissolved Fluoride (F-)	**1.5**	ND	0.10	mg/L	N/A	2022/01/06	SHW	7765914
Total Kjeldahl Nitrogen (TKN)	-	ND	0.10	mg/L	2021/12/22	2021/12/31	RTY	7749615
Nitrate + Nitrite (N)	-	ND	0.050	mg/L	N/A	2022/01/06	MCN	7766094
Nitrite (N)	**1**	ND	0.010	mg/L	N/A	2022/01/06	MCN	7766116
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2021/12/23	MCN	7750652
Dissolved Organic Carbon (C)	-	4.3	0.50	mg/L	N/A	2021/12/23	NGI	7750865
Total Organic Carbon (C)	-	4.5	0.50	mg/L	N/A	2021/12/24	NGI	7750842
pH		6.63		pH	N/A	2022/01/06	SHW	7765911
Total Phosphorus	-	0.019	0.004	mg/L	2021/12/22	2022/01/04	SSV	7748177
Total Suspended Solids	-	1.4	1.0	mg/L	2021/12/20	2021/12/22	MKX	7741650
Turbidity	-	1.5	0.10	NTU	N/A	2022/01/04	SHW	7762914

MAC: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, September 2020.

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If Screening Levels (SL) for gross alpha or gross beta are exceeded then concentration of the specific radionuclides of the CWQG should be analyzed.

Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
Note 2 Aluminum guideline value of 0.1 mg/L is for treatment plants using aluminum-based coagulants, 0.2mg/L applies to other types of treatment systems.

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Bureau Veritas Job #: C1Z7100
Report Date: 2022/01/25

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

Sample Details/Parameters	MAC	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
RKK648 PADDY'S POND								
Sampling Date 2021/12/15								
Matrix W								
Sample # 2021-1850-00-SI-SP								
Registration # WS-S-0000								
ELEMENTS BY ICP/MS (WATER)								
Metals								
Total Aluminum (Al)	**2.9**	0.090	0.0050	mg/L	2021/12/20	2021/12/21	BAN	7741635
Total Antimony (Sb)	**0.006**	ND	0.0010	mg/L	2021/12/20	2021/12/21	BAN	7741635
Total Arsenic (As)	**0.010**	ND	0.0010	mg/L	2021/12/20	2021/12/21	BAN	7741635
Total Barium (Ba)	**2.0**	0.0028	0.0010	mg/L	2021/12/20	2021/12/21	BAN	7741635
Total Boron (B)	**5**	ND	0.050	mg/L	2021/12/20	2021/12/21	BAN	7741635
Total Cadmium (Cd)	**0.007**	ND	0.000010	mg/L	2021/12/20	2021/12/21	BAN	7741635
Total Calcium (Ca)	-	2.5	0.10	mg/L	2021/12/20	2021/12/21	BAN	7741635
Total Chromium (Cr)	**0.05**	ND	0.0010	mg/L	2021/12/20	2021/12/21	BAN	7741635
Total Copper (Cu)	**2**	ND	0.00050	mg/L	2021/12/20	2021/12/21	BAN	7741635
Total Iron (Fe)	-	0.19	0.050	mg/L	2021/12/20	2021/12/21	BAN	7741635
Total Lead (Pb)	**0.005**	ND	0.00050	mg/L	2021/12/20	2021/12/21	BAN	7741635
Total Magnesium (Mg)	-	0.71	0.10	mg/L	2021/12/20	2021/12/21	BAN	7741635
Total Manganese (Mn)	**0.12**	0.025	0.0020	mg/L	2021/12/20	2021/12/21	BAN	7741635
Total Nickel (Ni)	-	ND	0.0020	mg/L	2021/12/20	2021/12/21	BAN	7741635
Total Phosphorus (P)	-	ND	0.10	mg/L	2021/12/20	2021/12/21	BAN	7741635
Total Potassium (K)	-	0.58	0.10	mg/L	2021/12/20	2021/12/21	BAN	7741635
Total Selenium (Se)	**0.05**	ND	0.00050	mg/L	2021/12/20	2021/12/21	BAN	7741635
Total Sodium (Na)	-	15	0.10	mg/L	2021/12/20	2021/12/21	BAN	7741635
Total Strontium (Sr)	**7.0**	0.0074	0.0020	mg/L	2021/12/20	2021/12/21	BAN	7741635
Total Uranium (U)	**0.02**	ND	0.00010	mg/L	2021/12/20	2021/12/21	BAN	7741635
Total Zinc (Zn)	-	ND	0.0050	mg/L	2021/12/20	2021/12/21	BAN	7741635

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RKK648 PADDY'S POND								
Sampling Date 2021/12/15								
Matrix W								
Sample # 2021-1850-00-SI-SP								
Registration # WS-S-0000								
ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)								
Metals								
Mercury (Hg)	**0.001**	ND	0.00001	mg/L	2022/01/20	2022/01/24	GR1	7790723

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GENERAL COMMENTS

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

Package 1	4.7°C

Sample RKK648 [PADDY'S POND] : Mercury analyzed past recommended hold time.

Results relate only to the items tested.

VALIDATION SIGNATURE PAGE

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

Brad Newman, B.Sc., C.Chem., Scientific Service Specialist

Colleen Acker, B.Sc, Scientific Service Specialist

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

Mike MacGillivray, Scientific Specialist (Inorganics)

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