P.O. Box 1749
Halifax, Nova Scotia
B3J 3A5 Canada

Item No. 1
North West Community Council
October 26, 2015

TO: Chair and Members of North West Community Council

SUBMITTED BY: Original Signed

Bob Bjerke, Chief Planner and Director, Planning & Development

DATE: October 14, 2015

SUBJECT: **Bedford West Seasonal Water Quality Reports, Spring & Summer 2015**

INFORMATION REPORT

ORIGIN

Bedford Municipal Planning Strategy, Bedford West Secondary Planning Strategy, Policies BW-3, BW-4, and BW-5.

Development Agreements between Halifax Regional Municipality and West Bedford Holdings Ltd, and between Halifax Regional Municipality and Cresco Ltd.

LEGISLATIVE AUTHORITY

The Halifax Regional Municipality Charter, Part VIII, Planning and Development, Section 240, Development Agreements.

BACKGROUND

The Bedford West Secondary Planning Strategy, Policy BW-3, requires that a water quality monitoring program be undertaken for the Paper Mill Lake watershed to track the eutrophication process. The terms of the program are specified within Development Agreements that have been negotiated in consultation with the Bedford Watershed Advisory Board[1] until its dissolution in 2013, and the Regional Watersheds Advisory Board since 2013.

All such agreements require that the municipality designates a member of staff to submit test results to the Developer, the Community Council, and RWAB within three months of being received from the consultant, or immediately if total phosphorus (TP) or bacterial results exceed management thresholds identified therein.

1 RWAB assumed the functions previously performed by BWAB respecting Bedford West SPS once it began conducting meetings in July 2013.

DISCUSSION

This report presents the results of three water quality monitoring events that occurred in spring, summer, and late summer 2015 pursuant to the monitoring program for Bedford West. Monitoring reports issued pursuant to these events are provided as Attachments A, B, and C, respectively.

The late summer (September) event was conducted pursuant to the findings of the primary (August) event, in which Total Phosphorus (TP) results exceeded the management threshold of 10µg/L on several occasions. The September event monitored only TP concentrations, at each of the 11 standard stations, as well as an additional seven (7) stations located upstream of selected standard stations. These seven additional stations, all located upstream of standard stations, were identified and monitored to determine if substantial differences in parameter concentrations could be detected, as a means to identify areas that serve as high phosphorus loading sources to the lakes.

All monitoring events are conducted on behalf of the Halifax Regional Municipality by consulting professionals. The spring 2015 event was conducted by SLR Consulting Ltd., and the summer and late summer monitoring events were conducted by SNC Lavalin Inc.

The findings for the three events are different from one another. In spring 2015, only two stations had results that reached or exceeded the management threshold. In August, six results exceeded the threshold, and in September, all results exceeded the threshold – including results from both the standard and additional stations. TP results from all sampling events from summer 2013 to present are included as Attachment D.

Municipal staff is developing a plan to address high Total Phosphorous levels. As first steps, staff had the levels retested during summer 2015 to ensure they were accurate (see Attachment C), and then hired a consulting firm to perform a statistical analysis of all the water quality data for this watershed from 2006 to present (see Attachment E). Staff also submitted an access to information request for water quality monitoring of quarry operations located upstream of Kearney Lake, and is pursuing additional data for provincial projects associated with the Larry Uteck Boulevard interchange with Highway 102. Staff also received and has reviewed a memorandum prepared by Stantec on behalf of its client, West Bedford Holdings Ltd., regarding phosphorus levels in the watershed (see Attachment F).

Staff requires professional, independent advice to assist in the following considerations:

- Possible revision of the maximum concentration of Total Phosphorus to be considered the threshold for management action;
- Potential modifications to the water quality monitoring program to sharpen its focus on the effects of subdivision development activities on the Papermill Lake watershed; and
- Available methods to test if developments are phosphorous neutral.

Staff anticipates delivering a further update to the North West Community Council as part of the presentation of results from the fall 2015 water quality monitoring event. The next report is anticipated to reach Community Council in January or February 2016.

In addition to Total Phosphorus, several other parameters exceeded the guideline values during one or more monitoring event. Parameters with exceedances are as follows:

Parameter	# Sites Exceeded		
	Spring	August	September
Total Phosphorus	2	6	18
E. coli	0	0	--
Turbidity	0	2	--
Dissolved oxygen	4	0	--
pH	2	0	--
Dissolved Chloride	3	2	--
Aluminum	11	--	--
Cadmium	11	--	--
Copper	2	2	--
Iron	1	7	--
Manganese	0	2	--
Zinc	0	2	--

Table 1. Summary of parameters with guideline value exceedances. Values of '--' indicate that the parameter was not measured in the respective monitoring event.

FINANCIAL IMPLICATIONS

There are no financial implications of this report.

COMMUNITY ENGAGEMENT

No community engagement was required for this report.

ATTACHMENTS

Attachment A Final Report: Water Quality Monitoring Program, Bedford West – Spring 2015 Sampling Event, SLR Consulting Ltd.

Attachment B Final Report: Water Quality Monitoring Program, Bedford West – Summer 2015 Sampling Event, SNC-Lavalin Inc.

Attachment C Final Report: Total Phosphorous Follow-up Sampling, Water Quality Monitoring Program, Bedford West, SNC-Lavalin Inc.

Attachment D Summary of Total Phosphorus Measurements, Summer 2013 – Summer 2015, Bedford West

Attachment E Paper Mill Lake Watershed, Total Phosphorus Characterization Project, Final Report, CBCL Limited, September 2015

Attachment F Memorandum, Phosphorus Levels in the Paper Mill Lake Watershed, Stantec Consulting Ltd., August 12, 2015

A copy of this report can be obtained online at http://www.halifax.ca/commcoun/index.php then choose the appropriate Community Council and meeting date, or by contacting the Office of the Municipal Clerk at 902.490.4210, or Fax 902.490.4208.

Report Prepared by: Cameron Deacoff, Environmental Performance Officer, 902.490.1926

Report Approved by: Original Signed
Shannon Miedema, Acting Manager, Energy & Environment, 902.490.3665

Attachment A

23 June 2015

Halifax Regional Municipality
Planning and Development
Energy & Environment
P.O. Box 1749, Halifax, Nova Scotia
B3J 3A5

Attention: Mr. Cameron Deacoff

RE: FINAL REPORT Halifax Water Quality Monitoring – Bedford West Monitoring Results – Spring, 2015
HRM RFP Ref: 14-338

Dear Mr. Deacoff:

SLR Consulting (Canada) Ltd. is pleased to submit one electronic copy of the Final Letter Report describing the results of the spring, 2015 sampling event for the Bedford West Water Quality Monitoring Program (Bedford, Nova Scotia).

Please do not hesitate to contact the undersigned should you have any questions.

Sincerely,

SLR Consulting (Canada) Ltd.

Original Signed

Russell Dmytriw, M.Sc., P. Geo
Project Manager

SLR Consulting (Canada) Ltd. 115 Joseph Zatzman Drive, Dartmouth, NS B3B 1N3
T: 902 420 0040 F: 902 420 9703
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Table of Contents

1. INTRODUCTION

SLR Consulting (Canada) Ltd. has prepared this report to provide the Halifax Regional Municipality (HRM) with water quality data at eleven (11) surface water locations throughout the Bedford West development area.

SLR was retained by HRM to complete water quality monitoring and sampling each spring, summer and fall for two years beginning in 2015. The results of the spring 2015 monitoring program are detailed herein.

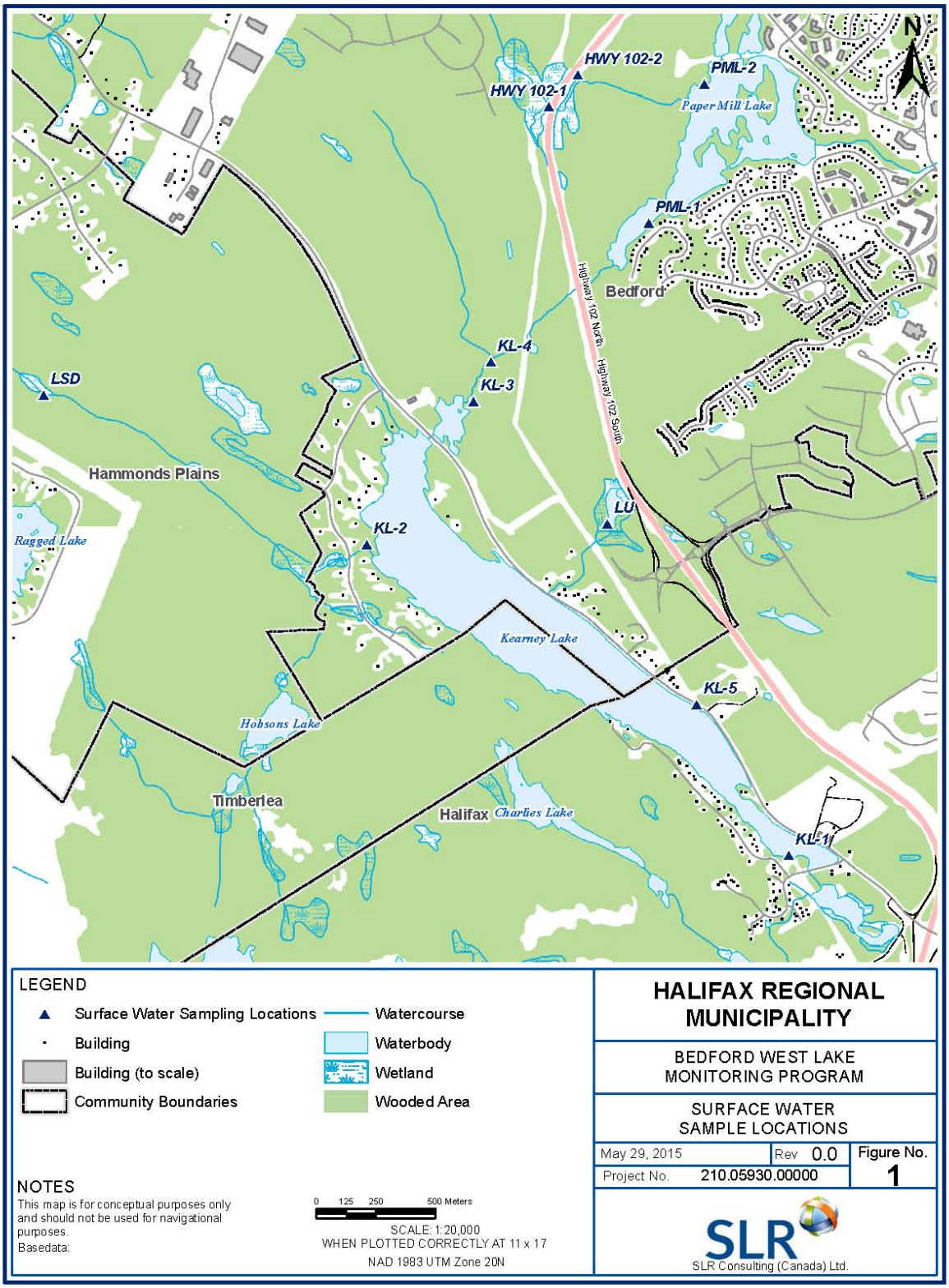
The overall purpose of the program is to conduct water quality sampling and testing prior to and during construction activities in order to detect any impacts on and/or changes to water quality. Through this monitoring program, HRM will build upon monitoring data collected by SNC Lavalin Inc. at the same locations between 2009 – 2014.

The program consists of collecting surface water samples from eleven (11) specified test locations as follows (See Drawing 1 - Sample Locations):

- Kearney Lake (KL1, KL2, KL5);
- Kearney Lake Run (KL3, KL4);
- Highway 102 (HWY 102-1);
- Highway 102 (Location: HWY 102-2)
- Lake Shore Drive (Location: LSD);
- Larry Uteck Boulevard (LU);
- Paper Mill Lake (PML1); and
- Paper Mill Lake (PLM2).

Table 1: Bedford West Sampling Locations

Water Course	Sample Name	Coordinates (UTM NAD 83)	
		Easting	Northing
Kearney Lake	KL-1	445718	4948496
Kearney Lake	KL-2	443942	4949803
Kearney Run	KL-3	444390	4950406
Kearney Run	KL-4	444463	4950571
Kearney Lake	KL-5	445329	4949131
Creek Above Highway	HWY 102-1	444708	4951644
Creek Below Highway	HWY 102-2	444829	4951778
Lake Shore Drive	LSD	442583	4950431
Larry Uteck Off Ramp	LU	444954	4949891
Paper Mill Lake	PML-1	445129	4951154
Paper Mill Lake	PML-2	445363	4951740


N
HWY 102-2
HWY 102-1
PML-2
Paper Mill Lake
PML-1
Bedford
Highway 102 North
Highway 102 South
KL-4
KL-3
LSD
Hammonds Plains
KL-2
LU
Ragged Lake
Kearney Lake
KL-5
Hobsons Lake
Timberlea
Halifax
Charlies Lake
KL-1
LEGEND
Surface Water Sampling Locations
Building
Building (to scale)
Community Boundaries
Watercourse
Waterbody
Wetland
Wooded Area
NOTES
This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata:
0 125 250 500 Meters
SCALE: 1:20,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N
HALIFAX REGIONAL MUNICIPALITY
BEDFORD WEST LAKE MONITORING PROGRAM
SURFACE WATER SAMPLE LOCATIONS
May 29, 2015
Rev 0.0
Figure No. 1
Project No. 210.05930.00000
SLR
SLR Consulting (Canada) Ltd.
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2. METHODOLOGY

The spring program consisted of one surface water sampling event and laboratory analyses of:

Group A – Field Parameters

Group B – Inorganics

Group C – Calculated Parameters

Group D – Standard Elements

Group E – Microbiologicals

Group F – Additional Metals

Table A summarizes the parameters measured in the field or analyzed by the laboratory in each Group.

Table A: Constituents of the Analytical Parameter Groups

Field Parameters (A)	Inorganics (B)	Calculated Parameters (C)	
• pH • TDS • Dissolved Oxygen (%, mg/L) Temperature • Secchi Depth Conductance • Air Temperature • Cloud Cover • Incidental Wildlife Sightings	• Total Alkalinity (as CaCO3) • (Dissolved) Chloride • Colour • Total Kjeldahl Nitrogen • Nitrate + Nitrite • Nitrate • Nitrite • Nitrogen (as NH4) • Total Organic Carbon • Orthophosphate (P) • pH • Total Phosphorus (low detection limit (0.002mg/l) • Reactive Silica • Total Suspended Solids • Dissolved Sulphate • Turbidity • Conductivity	• Anion Sum • Cation Sum • Ion Balance • Bicarbonate Alkalinity (as CaCO3) • Carbonate Alkalinity (as CaCO3) • Hardness • Total Dissolved Solids • Saturation pH (@4^{o}C & 20^{o}C) • Langelier Index (@4^{o}C & 20^{o}C)	
Standard Metals (D)	**Microbiologicals (E)**	**Additional Metals (F)**	
• Calcium • Copper • Iron • Magnesium • Manganese • Potassium • Sodium • Zinc	• Chlorophyll A • *E. coli* (Most Probable Number (MPN) or CFU per 100mL)	• Aluminum • Antimony • Arsenic • Barium • Bismuth • Boron • Cadmium • Chromium • Cobalt • Lead	• Molybdenum • Nickel • Selenium • Silver • Strontium • Thallium • Tin • Titanium • Uranium • Vanadium

The water samples and field parameter readings were collected from 1.0 m below surface whenever possible. Site conditions (weather, air temperature, cloud cover, and site accessibility) and field parameters for each sampling location were recorded on a field report sheet.

A new pair of latex gloves was used at each sample location. Surface water samples were collected and placed in clean laboratory-supplied jars and stored in a chilled container together with a chain of custody record for transport to the laboratory. All surface water samples collected were submitted to Maxxam Laboratories in Bedford, NS. No Secchi depth measurements were taken due to the shallowness of the sample stations.

All water samples and associated field parameters were collected within three consecutive days on the week of May 18th – 22nd, 2015. Samples were collected from the shore at all sample stations.

Field-based parameters were recorded at each station before water samples were collected. Field data consisting of pH, Dissolved Oxygen, Specific Conductivity, and water temperature were measured using a Horiba U-22 multi-meter and probe. Data was recorded in a field book once parameters had stabilized. The equipment was calibrated prior to each sampling event and was recalibrated at the start of each field day.

Air temperature was measured at each station using a hand held thermometer. Cloud cover and incidental wildlife sightings were also recorded. Finally, each sample station was photographed during the sample event, with the exception of KL-2 (the photo was blurred and unusable).

Water sampling followed the procedure outlined in the reference document *The Inspector's Field Sampling Manual* (Environment Canada 2005).

2.1 Assessment Standards

Certain results (i.e., pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity) were compared to:

- The Canadian Council of Ministers of the Environment (CCME) guidelines for the Protection of Aquatic Life – Freshwater (PAL-F). For TSS and Turbidity, the CCME Narrative Total Particulate Matter – Table 1 Suspended Sediments and Turbidity, High Flow Conditions, updated 2002 were used.

  For TSS, the guideline value is equal to a maximum increase of 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L. When background is greater than 250 mg/L, the concentration should not increase more than 10% of background levels.

Other results (i.e., *E. Coli*) were compared to:

- The Health Canada guidelines for Canadian Recreational Water Quality (2012, Third Edition). For turbidity, the guidelines indicate a limit of 50 Nephelometric Turbidity Units (NTU).

All inorganic parameters were compared to:

- Nova Scotia Environment Environmental Quality Standards for Surface Water (Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table A2, Reference for Pathway Specific Standards for Surface Water (ug/L) – Fresh Water.

3. WATER QUALITY RESULTS – SPRING 2015

3.1 Field Observations

Sample locations are shown on Table 1, attached. Data collected since 2009, along with recent data during the spring sampling event are presented on Tables 2a and 2b at the end of this report. Site conditions were recorded at all eleven sampling locations and are included in the attached field data sheets. Information recorded included weather, cloud cover, air temperature, wildlife sightings and site accessibility. Field data sheets and associated photographs are included in Appendix B and Appendix C, respectively.

3.2 Field Measurements

As noed, field measurements and laboratory analytical results are presented in Tables 2a and 2b, attached. Field information was recorded on a field data sheet and included: date and time the sample was collected, sample depth, pH, Dissolved Oxygen (DO), Secchi depth (if applicable), Water Temperature and Conductivity.

The **dissolved oxygen** readings collected on May 20th, 2015 were outside the range recommended in CCME PAL-F guidelines at the following stations:

- KL-1: 9.55 mg/L (recommended range 5.5 – 9.5 mg/L)
- KL-4: 9.81 mg/L (recommended range 5.5 – 9.5 mg/L
- HWY102-1: 4.27 mg/L (recommended range 5.5 – 9.5 mg/L)
- HWY102-2: 4.24 mg/L (recommended range 5.5 – 9.5 mg/L)

3.3 Laboratory Analytical Results

3.3.1 General Chemistry

Reported **pH** below minimum CCME PAL-F guidelines of 6.5 - 9.0 were as follows:

- KL-2: 6.32
- HWY102-2: 6.12

Reported **dissolved chloride** above the maximum CCME PAL-F guidelines of 120 mg/L were as follows:

- HWY102-1: 130 mg/L
- HWY102-2: 260 mg/L
- LU: 210 mg/L

3.3.2 Metals

The analytical parameter of **aluminium** exceeded the applicable NSE EQS guideline of 5 ug/L at the following stations (the CCME PAL-F limit is 100 ug/L):

- KL-1: 100 ug/L
- KL-2: 180 ug/L
- KL-3: 180 ug/L
- KL-4: 160 ug/L
- KL-5: 180 ug/L
- HWY102-1: 51 ug/L
- HWY102-2: 100 ug/L
- LSD: 120 ug/L
- LU: 59 ug/L
- PML-1: 140 ug/L
- PML-2: 130 ug/L

The analytical parameter of **cadmium** exceeded the applicable NSE EQS guideline of 0.01 ug/L at the following stations (the CCME PAL-F limit is 0.017 ug/L):

- KL-1: 0.031 ug/L
- KL-2: 0.014 ug/L
- KL-3: 0.033 ug/L
- KL-4: 0.033 ug/L
- KL-5: 0.035 ug/L
- HWY102-1: 0.024 ug/L
- HWY102-2: 0.100 ug/L
- LSD: 0.011 ug/L
- LU: 0.150 ug/L
- PML-1: 0.025 ug/L
- PML-2: 0.023 ug/L

The analytical parameter of **copper** exceeded the applicable NSE EQS guideline of 2 ug/L at the following stations (the CCME PAL-F limit is 2.0 – 4.0 ug/L):

- KL-4: 6.8 ug/L
- LU: 2.1 ug/L

The analytical parameter of **iron** exceeded the applicable NSE EQS guideline and the CCME PAL-F guideline of 300 ug/L at the following stations:

- HWY102-2: 960 ug/L

Microbiological

Eleven *E-coli* samples were collected during the spring 2015 sampling program. *E-coli* did not exceed the Heath Canada Guidelines of 400 CFU /100mL in any of the samples collected. *E. coli* was detected at low levels in the following locations:

- KL-1: 60 CFU/100mL
- KL-2: 30 CFU/100mL
- HWY102-1: 20 CFU/100mL

Total Phosphorous

The following stations contained total phosphorus results that met or exceeded the 10 ug/L objective listed in RFP 14-338:

- LSD: 11 ug/L or 0.011 mg/L
- HWY102-2: 10 ug/L or 0.01 mg/L

3.4 Statistical Presentation

Table B provides a summary example of the seasonal statistics of key water quality parameters from 2009 to 2015. A similar summary table is presented for each station at the end of this report, following the compiled data tables.

Table B: Water Quality Statistical Summary – Spring 2015

Station KL-1	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Chloride (mg/L)	60	60	81	66	69.7
pH	6.62	6.52	6.94	6.72	6.74
Total Phosphorus (mg/L)	0.008	0.007	0.037	0.0085	0.013
Total Suspended Solids (mg/L)	<10	1	4	2	2.3

Conductivity (uS/cm)	220	220	310	259	265
Chlorophyll a* (ug/L)	0.64	0.40	1.73	0.64	0.84

*Acidification method

4. CONCLUSION

The spring 2015 monitoring and sampling program included the collection of surface water samples from eleven (11) locations for the analysis of general chemistry, total metals, total phosphorus, TSS, *E.coli*, and chlorophyll-a. Additionally, field parameters collected at each station included pH, water temperature, dissolved oxygen, conductivity, secchi depth (if applicable), air temperature, cloud cover and wildlife sightings.

Based on the spring 2015 monitoring and sampling results (field measurements and laboratory analytical data), and their comparison with applicable guidelines, the following list summarizes the results:

The **dissolved oxygen** readings were outside the range recommended in CCME PAL-F guidelines at four stations: KL-1: 9.55 mg/L; KL-4: 9.81 mg/L; HWY102-1: 4.27 mg/L; and HWY102-2: 4.24 mg/L

With respect to **general chemistry**, reported **pH** below minimum CCME PAL-F guidelines of 6.5 - 9.0 were recorded at two stations: KL-2: 6.32 and HWY102-2: 6.12, while **dissolved chloride** above the maximum CCME PAL-F guidelines of 120 mg/L were recorded at three stations: HWY102-1: 130 mg/L; HWY102-2: 260 mg/L; and LU: 210 mg/L

With respect to **metals, aluminium** exceeded the applicable NSE EQS guideline of 5 ug/L at seven stations (the CCME PAL-F limit is 100 ug/L): KL-1: 100 ug/L; KL-2: 180 ug/L; KL-3: 180 ug/L; KL-4: 160 ug/L; KL-5: 180 ug/L; HWY102-1: 51 ug/L; HWY102-2: 100 ug/L; LSD: 120 ug/L; LU: 59 ug/L; PML-1: 140 ug/L; and PML-2: 130 ug/L.

Cadmium exceeded the applicable NSE EQS guideline of 0.01 ug/L at all eleven stations (the CCME PAL-F limit is 0.017 ug/L).

Copper exceeded the applicable NSE EQS guideline of 2 ug/L at two stations (the CCME PAL-F limit is 2.0 – 4.0 ug/L): KL-4: 6.8 ug/L and LU: 2.1 ug/L

Iron exceeded the applicable NSE EQS guideline and the CCME PAL-F guideline of 300 ug/L at one stations HWY102-2: 960 ug/L.

The next monitoring event is scheduled for August 2015 where samples will be collected from the same sample locations during the spring event.

No **E. Coli** samples exceeded Health Canada Guidelines. **Total phosphorous** was below 10 ug/L at all stations except LSD at 11 ug/L and HWY102-2 at 10 ug/L.

REFERENCES

CCME: The Canadian Council of Ministers of the Environment (CCME) guidelines for the Protection of Aquatic Life – Freshwater (FWAL). For TSS and turbidity, the CCME Narrative Total Particulate Matter – Table 1 Suspended Sediments and Turbidity, High Flow Conditions, updated 2002 were used.

EC: Environment Canada (2005). The Inspector's field sampling manual. Second Edition. Retrieved on March 6, 2015 from http://publications.gc.ca/collections/Collection-R/En40-498-2005-1E.pdf

HC: The Health Canada guidelines for Canadian Recreational Water Quality (2012, Third Edition). For turbidity, the guidelines indicate a limit of 50 Nephelometric Turbidity Units (NTU).

NSE: Nova Scotia Environment Environmental Quality Standards for Surface Water (Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table A2 Reference for Pathway Specific Standards for Surface Water (ug/L) – Fresh Water.

6.0 STATEMENT OF LIMITATIONS

This report has been prepared and the work referred to in this report has been undertaken by SLR Consulting (Canada) Ltd. (SLR) for Halifax Regional Municipality (HRM), hereafter referred to as the "Client". It is intended for the sole and exclusive use of Halifax Regional Municipality. The report has been prepared in accordance with the Scope of Work and agreement between SLR and the Client. Other than by the Client and as set out herein, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of SLR.

This report has been prepared in a manner generally accepted by professional consulting principles and practices for the same locality and under similar conditions. No other representations or warranties, expressed or implied, are made.

Opinions and recommendations contained in this report are based on conditions that existed at the time the services were performed and are intended only for the client, purposes, locations, time frames and project parameters as outlined in the Scope or Work and agreement between SLR and the Client. The data reported, findings, observations and conclusions expressed are limited by the Scope of Work. SLR is not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. SLR does not warranty the accuracy of information provided by third party sources.

TABLES

Bedford West Monitoring Results - Spring 2015
Bedford, NS
SLR Project No.: 210.05930.00000

TABLE 1: BEDFORD WEST SAMPLING PROGRAM

May 2015	Units	RDL	NSE ESQs for Surface Water (Applied)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	Kearney Lake																		
Sample Sites						KL1																		
Sampling Date	yyyy-mm-dd	--				2009/06/29	8/13/2009	10/1/2009	5/31/2010	8/24/2010	11/1/2010	5/13/2011	8/14/2011	10/16/2011	5/1/2012	8/14/2012	10/10/2012	5/15/2013	8/16/2013	10/16/2013	5/14/2014	8/14/2014	10/27/2014	5/20/2015
Sampling Time	hh:mm	--				08:00	11:45	08:30	11:00	13:10	12:00	11:00	14:30	14:00	8:30	11:20	9:50	10:20	11:10	13:30	10:30	14:15	14:55	08:30
FIELD DATA																								
Secchi Depth	Meters	--	--	1.2	--	4.1	4.2	5.0	N/A	5.0	4.9	2.4	3.2	2.4	2.35	5.36	N/A	2.50	2.03	2.90	2.36	2.70	2.54	NCC
Water Temp	Celsius	0.1	--	--	--	14.0	22.2	16.7	12.9	23.3	8.8	11.5	25.6	15.9	8.9	23.3	15.4	13.2	22.2	14.1	12.7	23.2	12.2	14.12
Dissolved Oxygen	mg/L	0.01	--	--	5.5-9.5	10.77	8.20	7.00	9.13	7.86	10.48	10.69	8.22	9.22	8.98	7.93	8.72	9.76	8.57	8.30	15.29	7.22	8.12	9.55
pH	pH	N/A	--	--	--	6.20	6.76	6.67	7.23	7.32	6.61	6.60	6.16	6.04	8.67	6.91	6.32	6.32	8.24	6.35	6.74	7.46	6.44	8.33
Specific Conductance	uS/cm	1	--	--	--	263	299	261	248	242	219	288	179	146	277	279	198.1	243	216.5	217.9	547.0	341.0	223.0	0.182
INORGANICS																								
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--	6	8	8	7	8	6	<5	9	7	24	7	<5	<5	<5	8	30	14	<5	5.2
Dissolved Chloride (Cl)	mg/L	1	--	--	120	81	74	64	62	60	55	73	45	33	66	70	50	66	59	48	80	76	46	60
Colour	TCU	30	--	--	--	18	18	16	26	8	21	28	40	45	50	11	20	11	37	20	13	8	23	37
Nitrite + Nitrate	mg/L	0.05	--	--	--	0.18	0.09	0.12	0.21	0.16	0.23	0.2	0.11	0.13	0.20	0.09	0.10	0.18	0.14	0.19	0.11	0.11	0.08	0.15
Nitrate (N)	mg/L	0.05	--	--	13000	0.18	--	--	0.21	0.16	--	0.2	--	--	0.20	0.09	0.10	0.18	0.14	0.19	0.11	0.11	0.08	0.15
Nitrite (N)	mg/L	0.05	--	--	60	<0.01	--	--	<0.01	<0.01	--	<0.01	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.04	0.03	<0.03	0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.050
Total Organic Carbon	mg/L	0.5	--	--	--	2.4	2.9	4.7	3.3	3.2	3.1	3.4	5.9	5.5	5.4	2.9	5.2	4.4	4.1	4.3	4.6	2.4	4.4	3.0
Orthophosphate (as P)	mg/L	0.01	--	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010
pH (Lab)	pH	N/A	--	5.0-9.0	6.5-9	6.94	6.65	6.68	6.91	7.00	6.79	6.52	6.51	6.52	6.7	7.2	6.9	6.78	6.93	6.85	6.72	7.06	6.53	6.62
Total Calcium (Ca)	mg/L	0.1	--	--	--	9.2	8.5	7.2	7.72	8.66	8.30	7.65	4.82	5.31	6.8	8.4	6.3	7.5	6.6	6.5	8.1	11	6.0	6400
Total Magnesium (Mg)	mg/L	0.1	--	--	--	1.5	1.4	1.2	1.42	1.36	1.30	1.29	0.86	1.06	1.1	1.5	1.5	1.1	1.2	1.2	1.6	1.6	0.9	920
Total Phosphorus (1M depth)	mg/L	0.006	--	--	--	<0.02	<0.02	<0.002	0.009	0.007	0.005	0.008	0.012	0.009	0.037	0.043	0.007	0.007	0.011	0.008	0.011	0.026	0.01	0.008
Total Potassium (K)	mg/L	0.1	--	--	--	1.1	0.9	1.3	0.876	0.888	0.901	0.788	0.773	0.871	0.7	0.9	0.9	0.8	0.7	1.1	0.9	1.6	0.7	680
Total Sodium (Na)	mg/L	0.1	--	--	--	51	46	37	31.8	35.2	33.8	43.7	22.8	19.8	40.1	42.0	29.8	35.8	26.2	31.6	50.2	54.2	37.6	33000
Reactive Silica (SiO2)	mg/L	0.5	--	--	--	2.6	2.2	2.3	2.9	2.7	2.9	2.8	1.9	2.3	2.4	1.3	2.2	2.5	1.8	2.2	2.0	1.5	1.8	2.5
Total Suspended Solids	mg/L	5	--	--	--	1	1	<1	4	17	3	2	2	3	<5	<5	<5	<5	<5	5	<5	<5	<5	<1.0
Dissolved Sulphate (SO4)	mg/L	2	--	--	--	14	13	12	11	11	11	12	10	8	8	9	9	11	9	9	12	11	7	8.7
Turbidity (NTU)	NTU	0.1	--	50	--	0.7	0.8	1.0	1.3	0.6	1	1	1	0.9	2.4	0.8	1.3	1.6	3.3	0.5	2.9	0.7	1.9	0.81
Conductivity (uS/cm)	µS/cm	1	--	--	--	310	290	250	240	240	230	290	180	140	246	274	196	259	241	212	290	339	235	220
Calculated Parameters																								
Anion Sum	me/L	N/A	--	--	--	2.72	2.52	2.23	2.12	2.08	1.91	2.33	1.66	1.27	2.52	2.31	1.60	2.10	1.86	1.71	3.11	2.66	1.45	1.98
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--	6	8	8	7	8	6	<1	9	7	24	7	<5	<5	<5	8	30	14.00	<5	5.2
Calculated TDS	mg/L	1	--	--	--	166	151	131	123	125	118	143	92	77	139	137	98	124	104	103	172	165.00	99	120
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<1.0
Cation Sum	me/L	N/A	--	--	--	2.85	2.57	2.12	1.92	2.10	2.02	2.42	1.33	1.25	2.24	2.41	1.79	2.08	1.61	1.84	2.77	3.09	2.05	1.84
Hardness (CaCO3)	mg/L	1	--	--	--	29	27	23	25	27	26	24	16	18	21.5	27.2	21.9	23.3	21.4	21.2	26.8	34.10	18.7	20.0
Ion Balance (% Difference)	%	N/A	--	--	--	2.33	0.98	2.53	4.95	0.48	2.80	1.89	11.00	0.79	5.9	2.1	5.3	0.7	7.3	3.4	5.8	7.50	17.2	3.66
Langelier Index (@ 20C)	N/A	N/A	--	--	--	-2.68	-2.87	-2.94	-2.72	-2.51	-2.87	NC	-3.18	-3.21	-2.69	-2.63	-3.19	-3.24	-3.14	-3.02	-2.51	-2.36	-3.76	-3.21
Langelier Index (@ 4C)	N/A	N/A	--	--	--	-2.93	-3.12	-3.19	-2.97	-2.76	-3.12	NC	-3.43	-3.46	-3.01	-2.95	-3.51	-3.56	-3.46	-3.34	-2.83	-2.68	-4.08	-3.46
Saturation pH (@ 20C)	N/A	N/A	--	--	--	9.62	9.52	9.62	9.63	9.51	9.66	NC	9.69	9.73	9.39	9.83	10.10	10.0	10.1	9.87	9.23	9.42	10.1	9.83
Saturation pH (@ 4C)	N/A	N/A	--	--	--	9.87	9.77	9.87	9.88	9.76	9.91	NC	9.94	9.98	9.71	10.2	10.4	10.3	10.4	10.2	9.55	9.74	10.4	10.1
Metals (ICP-MS)																								
Total Aluminum (Al)	µg/L	5	5	--	5-100	230	--	--	289	47.8	--	338	--	--	321	43	168	191	120	56	229	42	155	100
Total Antimony (Sb)	µg/L	2	20	--	--	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Arsenic (As)	µg/L	2	5.0	--	5	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Barium (Ba)	µg/L	5	1000	--	--	16	--	--	18.5	15.9	--	13	--	--	12	15	9	12	7	16	14	20	9	16
Total Beryllium (Be)	µg/L	2	5.3	--	--	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Bismuth (Bi)	µg/L	2	--	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Boron (B)	µg/L	5	1200	--	1500	8	--	--	11.4	9.1	--	<50	--	--	<5	11	33	6	10	9	7	22	10	<50
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017	<0.3	--	--	0.053	<0.017	--	0.056	--	--	0.032	0.027	0.021	0.020	<0.017	0.017	0.037	<0.017	0.025	0.021
Total Chromium (Cr)	µg/L	1	---	--	1	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	<1	<1	<1	<1	6	<1	<1	<1.0
Total Cobalt (Co)	µg/L	1	10	--	--	1	--	--	0.54	<0.40	--	0.79	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.40
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0	<2	--	--	5.8	<2.0	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<1	1	1	<1	1	<2.0
Total Iron (Fe)	µg/L	50	300	--	300	130	--	--	313	62	125	177	162	384	229	137	195	207	132	92	147	124	168	110
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0	<0.5	--	--	10.3	<0.50	--	<0.50	--	--	<0.5	<0.5	1.9	<0.5	<0.5	<0.5	5.1	<0.5	<0.5	<0.50
Total Manganese (Mn)	µg/L	2	820	--	--	100	--	--	79.2	57.1	59	78.4	52.3	55.8	48	65	68	73	48	24	48	115	42	39
Total Molybdenum (Mo)	µg/L	2	73	--	73	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Nickel (Ni)	µg/L	2	25	--	25-150	5	--	--	3.2	<2.0	--	3.2	--	--	<2	<2	2	2	<2	<2	3	<2	3	<2.0
Total Selenium (Se)	µg/L	1	1.0	--	1	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1.0
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1	<0.5	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Total Strontium (Sr)	µg/L	5	21000	--	--	46	--	--	39.1	37.7	--	36	--	--	32	41	32	37	33	30	40	45	26	29
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8	<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Total Tin (Sn)	µg/L	2	--	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Titanium (Ti)	µg/L	2	--	--	--	11	--	--	6.4	<2.0	--	5.4	--	--	8	<2	3	4	2	<2	2	<2	5	2.3
Total Uranium (U)	µg/L	0.1	300	--	15	0.1	--	--	0.11	<0.10	--	0.12	--	--	0.1	<0.1	0.1	0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.10
Total Vanadium (V)	µg/L	2	6	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Zinc (Zn)	µg/L	5	30	--	30	27	--	--	14.4	7.5	11.1	12.1	13.3	9.7	5	<5	11	11	6	5	14	<5	9	13
MICROBIOLOGICAL																								
Total Coliform	MPN/100mL	1	--	--	--	200	65	--	>250	63	>250	91	>250	--	2420	>2420	1120	1200	866	488	525	1550	>2420	---
E. coli	MPN/100mL	1	--	400	--	39	24	--	9	15	37	8	>250	<100	41	11	17	48	2	7	<1	15	28	60
Fecal Coliform	MPN/ml	--	--	400	--	--	--	<1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--	0.53	0.79	1.11	1.73	1.47	0.99	0.76	1.44	1.36	0.62	2.3	1.54	1.22	1.40	1.19	0.40	0.41	0.84	0.64
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--	0.48	0.69	1.17	1.61	1.42	0.81	0.69	1.15	1.14	0.63	2.3	2.16	1.40	1.40	1.19	1.32	0.36	0.8	0.62
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--	--	--	--	--	--	--	--	--	--	0.9	3.1	0.4	--	0.7	<0.4	1.1	<0.4	0.4	0.22

Notes:

NA - Not Applicable; NC - Not Calcuable; NCC - Not Collected
RDL = Recordable Detection Limit (represents most recent sampling event RDL)
" - -- " = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guidelines (updated 2011)
CCME FWAL Guidelines for Aluminum, Lead, Copper and Nickel vary based on reported pH and water hardness (CCME FWAL calculation equations). The largest guideline value for each respective element range was always used.
Health Canada Guideline for Recreational Water Quality = Health Canada Guidelines for Canadian Recreational Water Quality - Draft (September 2009)
Nova Scotia Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table A2 Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water
Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics, Metals)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

TABLE 1: BEDFORD WEST SAMPLING PROGRAM

May 2015	Units	RDL	NSE ESQs for Surface Water (Applied)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	Kearney Lake																		
Sample Sites						KL2																		
Sampling Date	yyyy-mm-dd	--				2009/06/29	8/13/2009	10/1/2009	5/31/2010	8/24/2010	11/1/2010	5/13/2011	8/14/2011	10/16/2011	5/1/2012	8/14/2012	10/10/2012	5/15/2013	8/15/2013	10/16/2013	5/14/2014	8/14/2014	10/27/2014	5/20/2015
Sampling Time	hh:mm	--				11:00	10:30	10:45	10:15	12:25	10:50	09:30	14:00	13:15	9:50	10:30	10:20	09:10	16:10	14:30	10:45	9:20	14:04	09:15
FIELD DATA																								
Secchi Depth	Meters	--	--	1.2	--	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NCC
Water Temp	Celsius	0.1	--	--	--	16.8	18.2	15.4	13.5	20.4	8.0	9.9	19.1	14.1	7.6	21.8	12.3	10.1	22.9	9.7	11.7	21.1	10.8	13.13
Dissolved Oxygen	mg/L	0.01	--	--	5.5-9.5	10.16	8.50	5.70	6.28	4.65	9.58	9.66	7.06	8.43	6.47	5.82	7.63	9.37	6.38	7.40	14.80	6.95	7.7	8.41
pH	pH	N/A	--	--	--	6.33	6.35	6.19	6.61	6.96	6.25	6.77	5.90	5.62	7.72	6.41	6.29	5.75	7.47	5.57	6.60	7.22	5.79	6.36
Specific Conductance	uS/cm	1	--	--	--	46	106	89	199	104	75	80	67	54	58	96.6	61.1	77.9	65.3	64.5	188.0	266.0	63.0	0.053
INORGANICS																								
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--	8	8	8	8	7	<5	<5	7	<5	20	<5	8	<5	<5	<5	29	7	28	<5.0
Dissolved Chloride (Cl)	mg/L	1	--	--	120	48	48	48	48	25	17	19	14	10	16	20	12	19	21	14	20	17	12	15
Colour	TCU	30	--	--	--	20	20	20	20	63	95	80	110	120	52	60	94	37	90	71	25	44	168	50
Nitrite + Nitrate	mg/L	0.05	--	--	--	0.19	0.19	0.19	0.19	0.07	0.06	0.12	0.07	<0.05	0.11	0.08	<0.05	0.12	<0.05	<0.05	0.08	<0.05	<0.05	0.059
Nitrate (N)	mg/L	0.05	--	--	13000	0.19	0.19	0.19	0.19	0.07	--	0.12	--	--	0.11	0.08	<0.05	0.12	<0.05	<0.05	0.08	<0.05	<0.05	0.059
Nitrite (N)	mg/L	0.05	--	--	60	<0.05	<0.05	<0.05	<0.05	<0.01	--	<0.01	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19	<0.03	<0.03	<0.03	<0.03	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	<0.03	<0.03	0.04	<0.03	<0.03	0.04	<0.03	<0.050
Total Organic Carbon	mg/L	0.5	--	--	--	4.3	4.3	4.3	4.3	6.6	9.7	6.5	10	12	8.1	7.1	10.9	7.5	11.1	10.9	6.2	6.6	12.9	4.0
Orthophosphate (as P)	mg/L	0.01	--	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010
pH (Lab)	pH	N/A	--	5.0-9.0	6.5-9	6.85	6.85	6.85	6.85	6.78	6.11	6.27	6.4	6.05	6.5	6.7	6.5	6.37	6.62	6.34	6.53	6.87	6.04	6.82
Total Calcium (Ca)	mg/L	0.1	--	--	--	6.5	6.5	6.5	6.5	4.08	3.55	2.51	2.48	2.21	2.4	3.6	2.9	2.7	2.5	2.4	3.4	4.0	2.4	2600
Total Magnesium (Mg)	mg/L	0.1	--	--	--	1.2	1.2	1.2	1.2	0.98	0.84	0.63	0.64	0.36	0.7	1.0	1.0	0.7	0.5	0.8	1.1	1.0	0.6	640
Total Phosphorus (1M depth)	mg/L	0.006	--	--	--	0.02	0.02	0.02	0.02	0.009	0.009	0.009	0.008	0.013	0.021	0.059	0.013	0.010	0.020	0.029	0.013	0.039	0.03	0.008
Total Potassium (K)	mg/L	0.1	--	--	--	1.1	1.1	1.1	1.1	0.634	0.826	0.534	0.497	0.734	0.5	0.7	0.8	0.5	0.5	0.7	0.7	0.9	0.7	540
Total Sodium (Na)	mg/L	0.1	--	--	--	31.6	31.6	31.6	31.6	14.7	10.6	11.1	7.8	6.9	9.8	14.2	9.5	8.9	7.0	7.9	17.5	14.0	7.6	8400
Reactive Silica (SiO2)	mg/L	0.5	--	--	--	2.2	2.2	2.2	2.2	4.2	4.7	2.7	4.3	4	2.6	4.0	4.9	2.8	4.4	4.9	2.4	3.3	4.6	2.0
Total Suspended Solids	mg/L	5	--	--	--	103	103	103	103	7	<1	<1	<2	<1	<5	<5	<5	<5	135	<5	<5	<5	<5	<1.0
Dissolved Sulphate (SO4)	mg/L	2	--	--	--	9	9	9	9	<2	<2	<2	<2	<2	3	3	2	4	5	4	4	2	3	2.8
Turbidity (NTU)	NTU	0.1	--	50	--	0.5	0.5	0.5	0.5	1.0	1.0	0.4	0.7	0.6	0.5	1.1	1.0	1.9	2.2	1.0	0.9	0.8	1.2	<1.0
Conductivity (uS/cm)	µS/cm	1	--	--	--	212	212	212	212	100	97	79	66	54	71	91	61	83	69	62	87	94	66	64
Calculated Parameters																								
Anion Sum	me/L	N/A	--	--	--	0.49	0.82	0.45	0.77	0.85	0.49	0.53	0.53	0.28	0.92	0.63	0.54	0.63	0.70	0.48	1.23	0.66	0.96	0.48
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--	<1	8	<1	5	7	<1	<1	7	<1	20	<5	8	<5	<5	<5	29	7	28	<1.0
Calculated TDS	mg/L	1	--	--	--	36	55	35	46	55	38	37	34	25	45	44	34	37	37	31	65	44	44	32
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<1.0
Cation Sum	me/L	N/A	--	--	--	0.71	0.99	0.67	0.74	0.95	0.74	0.68	0.55	0.49	0.65	0.94	0.73	0.63	0.54	0.60	1.07	0.97	0.57	0.57
Hardness (CaCO3)	mg/L	1	--	--	--	10	15	10	12	14	12	9	9	8	8.9	13.1	11.4	9.6	8.3	9.3	13.0	14.1	8.5	9.1
Ion Balance (% Difference)	%	N/A	--	--	--	18.30	9.39	19.60	1.99	5.56	20.30	12.40	1.85	27.30	17.6	19.7	15.1	0.3	12.9	11.0	7.1	19.1	25.7	8.57
Langelier Index (@ 20C)	N/A	N/A	--	--	--	NC	-3.20	NC	-3.44	-3.05	NC	NC	-3.66	NC	-3.37	-3.60	-3.68	-4.05	-3.83	-4.12	-3.04	-3.23	-3.66	NC
Langelier Index (@ 4C)	N/A	N/A	--	--	--	NC	-3.45	NC	-3.70	-3.30	NC	NC	-3.91	NC	-3.69	-3.92	-4.00	-4.37	-4.15	-4.44	-3.36	-3.55	-3.98	NC
Saturation pH (@ 20C)	N/A	N/A	--	--	--	NC	9.78	NC	10.00	9.83	NC	NC	10.10	NC	9.87	10.3	10.2	10.4	10.5	10.5	9.57	10.1	9.72	NC
Saturation pH (@ 4C)	N/A	N/A	--	--	--	NC	10.00	NC	10.30	10.10	NC	NC	10.30	NC	10.2	10.6	10.5	10.7	10.8	10.8	9.89	10.4	10.0	NC
Metals (ICP-MS)																								
Total Aluminum (Al)	µg/L	5	5	--	5-100	290	--	--	175	151	--	271	--	--	209	205	338	256	270	259	205	236	340	***180***
Total Antimony (Sb)	µg/L	2	20	--	--	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Arsenic (As)	µg/L	2	5.0	--	5	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Barium (Ba)	µg/L	5	1000	--	--	9	--	--	11.7	14.3	--	9.5	--	--	9	11	10	8	<5	13	13	18	9	9.2
Total Beryllium (Be)	µg/L	2	5.3	--	--	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Bismuth (Bi)	µg/L	2	--	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Boron (B)	µg/L	5	1200	--	1500	8	--	--	14.7	12.7	--	<50	--	--	6	14	22	6	11	9	11	12	12	<50
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017	<0.3	--	--	0.018	<0.017	--	<0.017	--	--	<0.017	<0.017	<0.017	<0.017	<0.017	0.019	<0.017	<0.017	0.018	***0.014***
Total Chromium (Cr)	µg/L	1	---	--	1	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	<1	<1	<1	<1	9	<1	<1	<1.0
Total Cobalt (Co)	µg/L	1	10	--	--	<1	--	--	<0.40	<0.40	--	<0.40	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.40
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0	<2	--	--	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<1	2	<1	<1	4	<2.0
Total Iron (Fe)	µg/L	50	300	--	300	250	--	--	227	403	238	202	418	358	154	541	813	269	528	523	174	723	305	250
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0	<0.5	--	--	1.01	<0.50	--	<0.50	--	--	<0.5	<0.5	1.1	<0.5	0.5	<0.5	5.8	<0.5	0.5	<0.50
Total Manganese (Mn)	µg/L	2	820	--	--	26	--	--	43.2	83.3	34.7	12.1	68.4	22.6	17	90	114	24	67	53	33	146	25	47
Total Molybdenum (Mo)	µg/L	2	73	--	73	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Nickel (Ni)	µg/L	2	25	--	25-150	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Selenium (Se)	µg/L	1	1.0	--	1	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	1	<1	<1	<1	<1	<1	<1	<1.0
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1	<0.5	--	--	0.42	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Total Strontium (Sr)	µg/L	5	21000	--	--	14	--	--	17.8	19.5	--	11.9	--	--	10	18	15	12	9	12	16	17	12	12
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8	<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Total Tin (Sn)	µg/L	2	--	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	3	<2	<2	<2	<2	<2	<2	<2.0
Total Titanium (Ti)	µg/L	2	--	--	--	2	--	--	<2.0	<2.0	--	2.8	--	--	<2	2	3	4	<2	2	2	<2	3	2.5
Total Uranium (U)	µg/L	0.1	300	--	15	<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Total Vanadium (V)	µg/L	2	6	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Zinc (Zn)	µg/L	5	30	--	30	8	--	--	5.4	5.3	6.5	<5.0	<5.0	<5.0	<5	<5	7	<5	<5	<5	<5	<5	<5	<5.0
MICROBIOLOGICAL																								
Total Coliform	MPN/100mL	1	--	--	--	1800	170	--	>250	11	>250	59	>250	--	>2420	1986	>2420	>2420	>2420	>2420	525	>2420	>2420	---
E. coli	MPN/100mL	1	--	400	--	1500	100	--	>250	6	6	2	>250	<100	3	7	3	12	6	2	<1	18	11	30
Fecal Coliform	MPN/ml	--	--	400	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--	0.82	6.05	1.97	0.73	0.55	0.22	0.44	0.89	0.97	0.53	2.2	0.07	0.62	1.00	0.73	0.13	0.83	0.41	0.34
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--	0.87	5.97	1.95	0.66	0.54	0.21	0.42	0.73	0.82	0.56	2.2	0.12	0.72	1.00	0.74	0.14	0.86	0.41	---
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--	--	--	--	--	--	--	--	--	--	<0.4	2.2	0.7	--	1.1	<0.4	<0.4	0.4	<0.4	0.4

Notes:

NC - Not Calculable
RDL = Recordable Detection Limit (regresents most recent sampling event RDL)
" -- " = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guideline for the protection of the environment and ecological receptors (last updated 2011)
CCME FWAL Guidelines for Aluminum, Lead, Copper and Nickel vary based on reported pH and water hardness (CCME FWAL calculation equations). The lowest guideline value for each respective element range was always used.
Health Canada Guideline for Recreational Water Quality = Health Canada Guidelines for Canadian Recreational Water Quality - Draft (September 2009) (Referenced)
Nova Scotia Environment Environmental Quality Standards for Surface Water (Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table
A2 Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water
Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics, Metals)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

TABLE 1: BEDFORD WEST SAMPLING PROGRAM

May 2015	Units	RDL	NSE ESQs for Surface Water (Applied)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	Kearney Lake																		
Sample Sites						KL3																		
Sampling Date	yyyy-mm-dd	--				2009/06/29	8/13/2009	10/1/2009	5/31/2010	8/24/2010	11/1/2010	5/13/2011	8/14/2011	10/16/2011	5/1/2012	8/14/2012	10/10/2012	5/15/2013	8/16/2013	10/16/2013	5/14/2014	8/14/2014	10/27/2014	5/20/2015
Sampling Time	hh:mm	--				09:00	11:00	09:30	11:30	14:12	11:40	10:30	12:20	12:00	10:26	12:20	11:20	9:50	10:00	14:00	11:00	11:50	14:25	10:35
FIELD DATA																								
Secchi Depth	Meters	--	--	1.2	--	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NCC
Water Temp	Celsius	0.1	--	--	--	14.0	21.6	17.3	14.7	23.1	9.9	10.3	21.1	15.5	9	24.5	15.6	11.7	21.5	13.6	11.0	22.7	12.8	14.73
Dissolved Oxygen	mg/L	0.01	--	--	5.5-9.5	10.79	8.00	8.00	9.26	7.83	10.35	11.06	8.42	9.60	8.89	8.17	7.72	10.20	9.20	8.90	5.90	7.87	8.12	8.02
pH	pH	N/A	--	--	--	7.27	6.74	6.97	7.27	7.33	6.76	6.83	6.96	6.30	7.68	6.85	6.51	5.86	7.25	6.49	6.55	7.37	6.67	6.84
Specific Conductance	uS/cm	1	--	--	--	95	282	246	220	228	199	220	175	161	204	225	177.2	207.3	194.4	210.6	405.0	252.0	208.0	0.185
INORGANICS																								
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--	<5	7	7	6	7	7	6	7	7	23	6	5	<5	5	7	15	5	6	<5.0
Dissolved Chloride (Cl)	mg/L	1	--	--	120	66	63	60	55	55	53	56	43	37	50	57	46	54	40	46	58	46	45	60
Colour	TCU	30	--	--	--	22	20	20	28	12	20	31	38	40	57	15	31	19	23	20	16	13	20	34
Nitrite + Nitrate	mg/L	0.05	--	--	--	0.14	0.12	0.14	0.24	0.15	0.22	0.24	0.15	0.16	0.19	0.09	0.09	0.21	0.11	<0.05	0.17	0.13	0.13	0.16
Nitrate (N)	mg/L	0.05	--	--	13000	0.14	--	--	0.24	0.15	--	0.24	--	--	0.19	0.09	0.09	0.21	0.11	<0.05	0.17	0.13	0.13	0.16
Nitrite (N)	mg/L	0.05	--	--	60	<0.01	--	--	<0.01	<0.01	--	<0.01	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19	<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	0.04	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.050
Total Organic Carbon	mg/L	0.5	--	--	--	2.6	3.9	4.3	3.6	3.1	3.3	3.8	5.1	5	5.9	3.4	4.9	4.3	4.4	4.6	4.6	2.8	4.5	3.4
Orthophosphate (as P)	mg/L	0.01	--	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010
pH (Lab)	pH	N/A	--	5.0-9.0	6.5-9	6.58	6.67	6.82	6.82	6.99	6.87	6.52	6.5	6.33	6.7	7.1	6.9	6.68	6.96	6.86	6.68	6.87	6.59	6.54
Total Calcium (Ca)	mg/L	0.1	--	--	--	6.7	7.1	6.8	6.81	7.98	8.29	7.09	4.73	5.63	5.7	6.9	6.0	7.0	5.3	6.8	6.4	7.9	6.8	6600
Total Magnesium (Mg)	mg/L	0.1	--	--	--	1.2	1.2	1.11	1.22	1.28	1.27	1.21	0.83	1.01	1.0	1.2	1.3	1.0	0.9	1.3	1.4	1.2	1.0	940
Total Phosphorus (1M depth)	mg/L	0.006	--	--	--	<0.02	<0.02	0.005	0.005	<0.002	0.003	0.008	0.003	0.012	0.019	0.045	0.007	0.006	0.006	0.012	0.009	0.023	0.15	0.004
Total Potassium (K)	mg/L	0.1	--	--	--	0.9	1.1	0.9	0.791	0.837	0.990	0.879	0.681	0.921	0.7	0.9	0.9	0.8	0.6	1.2	0.8	1.1	0.9	770
Total Sodium (Na)	mg/L	0.1	--	--	--	38	38	35	28.3	33.1	33.0	33.0	20.8	21.3	31.2	34.5	26.37	35.1	20.1	32.1	36.4	39.0	35.3	34000
Reactive Silica (SiO2)	mg/L	0.5	--	--	--	2.7	2.6	2.6	3.2	2.9	3.2	2.9	2.5	2.6	2.6	2.0	2.6	2.9	2.6	2.7	2.6	1.9	2.4	2.5
Total Suspended Solids	mg/L	5	--	--	--	<1	1	1	2	<2	<1	<1	<1	<1	<5	<5	<5	<5	<5	<5	<5	<5	<5	2.8
Dissolved Sulphate (SO4)	mg/L	2	--	--	--	11	12	12	10	10	10	9	10	8	7	8	7	7	7	8	9	7	7	7.9
Turbidity (NTU)	NTU	0.1	--	50	--	0.7	1.4	0.6	0.3	0.5	0.6	0.6	0.6	0.4	0.8	0.7	1	0.7	2.4	0.4	0.4	0.3	0.9	0.7
Conductivity (uS/cm)	µS/cm	1	--	--	--	250	250	240	220	220	220	220	170	160	197	222	182	219	216	204	218	243	216	220
Calculated Parameters																								
Anion Sum	me/L	N/A	--	--	--	2.11	2.17	2.08	1.90	1.93	1.87	1.90	1.58	1.36	2.03	1.90	1.55	1.68	1.38	1.60	2.14	1.55	1.54	1.87
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--	<1	7	7	6	7	7	6	7	7	23	6	5	<5	5	7	15	5	6	<1.0
Calculated TDS	mg/L	1	--	--	--	128	130	123	110	117	116	115	88	82	111	113	91	106	78	100	122	106	100	110
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<1.0
Cation Sum	me/L	N/A	--	--	--	2.12	2.16	1.99	1.69	1.97	1.98	1.92	1.23	1.32	1.77	1.98	1.60	2.00	1.24	1.89	2.07	2.23	2.00	1.89
Hardness (CaCO3)	mg/L	1	--	--	--	22	23	22	22	25	26	23	15	18	18.4	22.2	20.3	21.6	16.9	22.3	21.7	24.7	21.1	20
Ion Balance (% Difference)	%	N/A	--	--	--	0.24	0.23	2.21	5.85	1.03	2.86	0.52	12.50	1.49	6.8	2.1	1.5	8.6	5.5	8.3	1.5	17.9	12.8	0.53
Langelier Index (@ 20C)	N/A	N/A	--	--	--	NC	-3.00	-2.89	-2.92	-2.60	-2.73	-3.23	-3.33	-3.35	-2.77	-2.88	-3.21	-3.37	-3.19	-3.05	-2.93	-3.12	-3.39	NC
Langelier Index (@ 4C)	N/A	N/A	--	--	--	NC	-3.25	-3.14	-3.17	-2.85	-2.99	-3.49	-3.58	-3.60	-3.09	-3.20	-3.53	-3.69	-3.51	-3.37	-3.25	-3.44	-3.71	NC
Saturation pH (@ 20C)	N/A	N/A	--	--	--	NC	9.67	9.71	9.74	9.59	9.60	9.75	9.83	9.73	9.47	9.98	10.10	10.0	10.2	9.91	9.61	9.99	9.98	NC
Saturation pH (@ 4C)	N/A	N/A	--	--	--	NC	9.92	9.96	9.99	9.84	9.86	10.00	10.10	9.98	9.79	10.3	10.4	10.4	10.5	10.2	9.93	10.3	10.3	NC
Metals (ICP-MS)																								
Total Aluminum (Al)	µg/L	5	5	--	5-100	259	259	--	124	53.5	--	266	--	--	199	54	153	140	65	100	260	52	105	***180***
Total Antimony (Sb)	µg/L	2	20	--	--	<2	<2	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Arsenic (As)	µg/L	2	5.0	--	5	<2	<2	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Barium (Ba)	µg/L	5	1000	--	--	13	13	--	15.7	13.2	--	19.1	--	--	18	17	15	19	9	18	17	17	16	19
Total Beryllium (Be)	µg/L	2	5.3	--	--	<2	<2	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Bismuth (Bi)	µg/L	2	--	--	--	<2	<2	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Boron (B)	µg/L	5	1200	--	1500	9	9	--	7.8	8.7	--	<50	--	--	5	9	17	7	7	10	8	10	12	<50
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017	0.019	0.019	--	0.030	<0.017	--	0.046	--	--	0.019	0.021	0.027	0.028	<0.017	<0.017	0.038	<0.017	0.017	***0.023***
Total Chromium (Cr)	µg/L	1	---	--	1	<1	<1	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	<1	<1	<1	<1	7	<1	<1	<1.0
Total Cobalt (Co)	µg/L	1	10	--	--	<1	<1	--	<0.40	<0.40	--	<0.40	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.40
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0	2	2	--	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<1	1	1	<1	2	<2.0
Total Iron (Fe)	µg/L	50	300	--	300	523	523	--	73	133	58	136	104	154	137	136	119	131	71	172	137	96	118	120
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0	<0.5	<0.5	--	0.60	<0.50	--	<0.50	--	--	<0.5	<0.5	0.7	<0.5	<0.5	0.9	3.6	<0.5	<0.5	<0.50
Total Manganese (Mn)	µg/L	2	820	--	--	53	53	--	36.8	67.1	32.1	41.5	33.1	32.5	25	47	46	37	20	92	41	45	27	36
Total Molybdenum (Mo)	µg/L	2	73	--	73	<2	<2	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Nickel (Ni)	µg/L	2	25	--	25-150	<2	<2	--	2.0	<2.0	--	2.3	--	--	<2	<2	<2	<2	<2	<2	2	<2	<2	<2.0
Total Selenium (Se)	µg/L	1	1.0	--	1	<1	<1	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1.0
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1	<0.1	<0.1	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Total Strontium (Sr)	µg/L	5	21000	--	--	12	12	--	33.5	35.9	--	33.2	--	--	25	33	29	33	18	32	31	32	29	29
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8	<0.1	<0.1	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Total Tin (Sn)	µg/L	2	--	--	--	<2	<2	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Titanium (Ti)	µg/L	2	--	--	--	2	2	--	<2.0	<2.0	--	4.9	--	--	<2	<2	<2	<2	<2	2	3	<2	2	2.7
Total Uranium (U)	µg/L	0.1	300	--	15	<0.1	<0.1	--	<0.10	<0.10	--	0.11	--	--	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1
Total Vanadium (V)	µg/L	2	6	--	--	<2	<2	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Zinc (Zn)	µg/L	5	30	--	30	<5	<5	--	9.7	6.9	6.4	9.3	6.6	9.2	<5	<5	8	10	5	7	10	<5	6	8.7
MICROBIOLOGICAL																								
Total Coliform	MPN/100mL	1	--	--	--	120	24	--	190	16	58	72	110	--	291	1553	178	345	2420	1300	86	1730	>2420	---
E. coli	MPN/100mL	1	--	400	--	1	17	--	2	<1	8	5	37	<100	2	<1	3	8	21	<1	<1	<1	13	<0.10
Fecal Coliform	MPN/ml	--	--	400	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--	1.04	1.11	1.18	1.30	1.14	0.51	0.78	1.26	1.24	0.52	1.3	0.81	1.44	2.00	0.65	0.76	0.59	1.23	0.72
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--	0.94	0.97	1.21	1.09	1.19	0.42	0.67	0.98	1.01	0.55	1.2	1.14	1.62	2.30	0.61	0.69	0.51	1.12	0.68
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--	--	--	--	--	--	--	--	--	--	<0.4	2.8	<0.4	--	1.3	<0.4	0.6	0.4	0.4	0.15

Notes:

NC - Not Calculable
RDL = Recordable Detection Limit (represents most recent sampling event RDL)
" -- " = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guideline for the protection of the environment and ecological receptors (last updated 2011)
CCME FWAL Guidelines for Aluminum, Lead, Copper and Nickel vary based on reported pH and water hardness (CCME FWAL calculation equations). The
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Nova Scotia Environment Environmental Quality Standards for Surface Water (Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table
A2 Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water
Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics, Metals)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

TABLE 1: BEDFORD WEST SAMPLING PROGRAM

May 2015	Units	RDL	NSE ESQs for Surface Water (Applied)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	Kearney Lake																
Sample Sites						KL4																
Sampling Date	yyyy-mm-dd	--				2009/06/29	8/13/2009	10/1/2009	5/31/2010	8/24/2010	11/1/2010	5/13/2011	8/14/2011	10/16/2011	5/1/2012	8/14/2012	10/10/2012	5/15/2013	8/16/2013	10/16/2013	5/14/2014	8/14/2014	10/27/2014	5/20/2015
Sampling Time	hh:mm	--				10:00	11:30	10:00	11:20	13:50	11:15	10:10	11:40	11:40	10:16	12:00	11:40	9:41	10:30	14:20	11:15	11:35	14:35	10:25
FIELD DATA																								
Secchi Depth	Meters	--	--	1.2	--	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NCC
Water Temp	Celsius	0.1	--	--		13.4	21.9	17.3	14.5	21.9	9.8	10.1	21.2	15.3	9.0	24.4	15.7	11.7	20.4	13.5	11.0	21.8	12.5	14.75
Dissolved Oxygen	mg/L	0.01	--	--	5.5-9.5	10.87	8.10	8.30	9.01	6.27	10.89	10.98	8.50	9.65	8.70	7.32	8.87	10.08	8.89	9.60	14.50	5.92	7.52	9.81
pH	pH	N/A	--	--	--	8.00	6.71	6.94	7.19	6.98	6.07	6.49	6.43	6.02	9.0	6.71	6.77	5.72	7.08	6.41	6.30	7.25	6.55	6.64
Specific Conductance	uS/cm	1	--	--	--	771	262	247	224	226	215	218	172	126	206	225	185.9	207.1	196.2	209.0	273.0	251.0	208.0	0.188
INORGANICS																								
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--	5	7	7	6	8	7	5	8	7	22	8	<5	<5	<5	<5	30	5	29	<5.0
Dissolved Chloride (Cl)	mg/L	1	--	--	120	67	65	60	56	56	53	56	44	37	51	57	46	54	41	47	59	47	48	61
Colour	TCU	30	--	--	--	22	18	20	27	11	20	32	38	43	48	11	20	17	21	20	13	11	28	33
Nitrite + Nitrate	mg/L	0.05	--	--	--	0.15	0.12	0.14	0.23	0.19	0.21	0.23	0.15	0.17	0.19	0.11	0.09	0.20	0.11	0.17	0.25	0.17	0.16	0.16
Nitrate (N)	mg/L	0.05	--	--	13000	0.15	--	--	0.23	0.19	--	0.23	--	--	0.19	0.11	0.09	0.20	0.11	0.17	0.25	0.17	0.16	0.16
Nitrite (N)	mg/L	0.05	--	--	60	<0.01	--	--	<0.01	<0.01	--	<0.01	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	0.05	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.1
Total Organic Carbon	mg/L	0.5	--	--	--	2.5	2.6	4.0	3.3	2.6	3.1	3.7	6	5.4	7.5	3.2	4.8	4.2	4.5	4.3	4.4	2.1	4.4	2.8
Orthophosphate (as P)	mg/L	0.01	--	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010
pH (Lab)	pH	N/A	--	5.0-9.0	6.5-9	6.61	6.75	6.83	6.83	6.93	6.83	6.57	6.57	6.43	6.7	7.0	6.9	6.69	6.96	6.85	6.69	6.91	6.85	6.59
Total Calcium (Ca)	mg/L	0.1	--	--	--	6.8	7.7	7.0	6.81	8.00	8.45	6.84	4.93	5.24	5.7	6.8	5.8	6.8	5.1	6.8	6.4	7.9	6.8	6500
Total Magnesium (Mg)	mg/L	0.1	--	--	--	1.2	1.3	1.2	1.22	1.24	1.31	1.19	0.86	0.99	1.0	1.2	1.2	1.0	0.8	1.2	1.3	1.2	1.0	920
Total Phosphorus (1M depth)	mg/L	0.006	--	--	--	<0.02	<0.02	<0.002	0.004	<0.002	<0.002	0.007	0.003	0.026	0.022	0.043	0.007	0.006	2.39	0.016	0.022	0.031	0.015	0.006
Total Potassium (K)	mg/L	0.1	--	--	--	1	1	1	0.807	0.905	0.968	0.826	0.733	1.130	0.7	1.0	0.9	0.8	0.6	1.2	0.8	1.1	0.9	760
Total Sodium (Na)	mg/L	0.1	--	--	--	39	41	37	28.5	34.3	33.9	32.1	21.5	21.1	31.5	34.5	25.2	31.6	20.1	30.7	35.9	38.6	34.1	34000
Reactive Silica (SiO2)	mg/L	0.5	--	--	--	2.7	2.6	2.6	3.1	2.9	3.1	2.9	2.5	2.7	2.7	2.2	2.6	3.0	2.6	2.5	2.6	2.1	2.5	2.5
Total Suspended Solids	mg/L	5	--	--	--	<1	1	<1	<2	<2	<1	2	<1	<2	<5	<5	<5	<5	<5	<5	<5	<5	<5	<1.0
Dissolved Sulphate (SO4)	mg/L	2	--	--	--	11	12	11	10	10	10	9	10	8	7	8	7	7	7	9	9	8	8	7.7
Turbidity (NTU)	NTU	0.1	--	50	--	0.5	1.0	0.3	0.3	0.2	0.8	0.7	0.7	0.4	0.7	0.4	0.8	0.7	2.6	2.1	1.1	0.6	0.8	0.61
Conductivity (uS/cm)	µS/cm	1	--	--	--	260	250	230	220	230	250	210	170	160	200	224	183	218	218	204	219	241	218	220
Calculated Parameters																								
Anion Sum	me/L	N/A	--	--	--	2.23	2.22	2.09	1.91	1.94	1.85	1.88	1.62	1.36	2.04	1.94	1.45	1.68	1.31	1.53	2.47	1.60	2.11	1.88
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--	5	7	7	6	8	7	5	8	7	22	8	<5	<5	<5	<5	30	5	29	<1.0
Calculated TDS	mg/L	1	--	--	--	132	135	125	111	118	116	113	90	81	111	114	87	103	75	97	132	108	117	110
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<1.0
Cation Sum	me/L	N/A	--	--	--	2.16	2.32	2.07	1.70	2.02	2.03	1.86	1.28	1.3	1.78	1.97	1.53	1.84	1.23	1.84	2.04	2.21	1.94	1.91
Hardness (CaCO3)	mg/L	1	--	--	--	22	25	22	22	25	27	22	16	17	18.4	21.9	19.4	21.1	16.0	21.9	21.3	24.7	21.1	20
Ion Balance (% Difference)	%	N/A	--	--	--	1.59	2.20	0.48	5.82	2.02	4.64	0.53	11.70	2.26	6.6	0.8	2.8	4.5	3.2	9.2	9.5	15.8	4.2	0.79
Langelier Index (@ 20C)	N/A	N/A	--	--	--	-3.21	-2.89	-2.84	-2.92	-2.64	-2.75	-3.22	-3.18	-3.31	-2.79	-2.86	-3.22	-3.37	-3.21	-3.21	-2.63	-3.08	-2.45	NC
Langelier Index (@ 4C)	N/A	N/A	--	--	--	-3.46	-3.14	-3.09	-3.17	-2.89	-3.00	-3.47	-3.43	-3.56	-3.11	-3.18	-3.54	-3.69	-3.53	-3.53	-2.95	-3.40	-2.77	NC
Saturation pH (@ 20C)	N/A	N/A	--	--	--	9.82	9.64	9.67	9.75	9.57	9.58	9.79	9.75	9.77	9.49	9.86	10.10	10.1	10.2	10.1	9.32	9.99	9.30	NC
Saturation pH (@ 4C)	N/A	N/A	--	--	--	10.1	9.9	9.9	10.0	9.8	9.8	10.0	10.0	10.0	9.8	10.2	10.4	10.4	10.5	10.4	9.64	10.3	9.62	NC
Metals (ICP-MS)																								
Total Aluminum (Al)	µg/L	5	5	--	5-100	150	--	--	125	29.2	--	231	--	--	188	48	149	141	106	159	236	46	93	160
Total Antimony (Sb)	µg/L	2	20	--	--	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Arsenic (As)	µg/L	2	5.0	--	5	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Barium (Ba)	µg/L	5	1000	--	--	16	--	--	16.6	17.8	--	18.2	--	--	18	17	16	18	10	19	17	19	16	20
Total Beryllium (Be)	µg/L	2	5.3	--	--	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Bismuth (Bi)	µg/L	2	--	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Boron (B)	µg/L	5	1200	--	1500	6	--	--	8.6	9.1	--	<50	--	--	6	9	16	7	6	9	8	11	11	<50
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017	<0.3	--	--	0.031	<0.017	--	0.035	--	--	0.021	<0.017	0.027	0.027	0.017	0.050	0.027	<0.017	<0.017	0.033
Total Chromium (Cr)	µg/L	1	---	--	1	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	6	<1	<1	<1	6	<1	<1	<1.0
Total Cobalt (Co)	µg/L	1	10	--	--	<1	--	--	<0.40	<0.40	--	<0.40	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.40
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0	<2	--	--	<2.0	2.4	<2.0	2.3	<2.0	<2.0	<2	<2	4	9	<1	1	<1	<1	2	6.8
Total Iron (Fe)	µg/L	50	300	--	300	86	--	--	82	51	55	119	109	138	129	118	133	213	144	248	129	55	104	100
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0	<0.5	--	--	3.23	<0.50	--	<0.50	--	--	<0.5	<0.5	0.8	0.9	<0.5	<0.5	2.6	<0.5	<0.5	<0.50
Total Manganese (Mn)	µg/L	2	820	--	--	51	--	--	34.5	63.5	29.4	38.5	27.2	29.7	23	34	38	34	77	130	34	29	24	25
Total Molybdenum (Mo)	µg/L	2	73	--	73	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Nickel (Ni)	µg/L	2	25	--	25-150	3	--	--	2.0	<2.0	--	<2.0	--	--	<2	<2	5	<2	<2	<2	<2	<2	<2	<2.0
Total Selenium (Se)	µg/L	1	1.0	--	1	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1.0
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1	<0.5	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Total Strontium (Sr)	µg/L	5	21000	--	--	34	--	--	33.1	36.7	--	32.7	--	--	25	32	28	32	17	31	31	31	29	30
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8	<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Total Tin (Sn)	µg/L	2	--	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	5	<2	<2	<2	<2	<2	<2.0
Total Titanium (Ti)	µg/L	2	--	--	--	<2	--	--	<2.0	<2.0	--	4.2	--	--	<2	<2	<2	<2	<2	3	2	<2	<2	<2.0
Total Uranium (U)	µg/L	0.1	300	--	15	<0.1	--	--	<0.10	<0.10	--	0.1	--	--	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Total Vanadium (V)	µg/L	2	6	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Zinc (Zn)	µg/L	5	30	--	30	14	--	--	10.4	6.9	7	11.3	7.4	7	<5	<5	68	21	<5	9	9	<5	<5	9.6
MICROBIOLOGICAL																								
Total Coliform	MPN/100mL	1	--	--	--	28	58	--	100	16	75	83	95	--	345	>2420	921	548	>2420	770	308	1550	>2420	---
E. coli	MPN/100mL	1	--	400	--	4	33	--	1	<1	2	5	39	<100	4	<1	4	6	38	<1	<1	1	8	<10
Fecal Coliform	MPN/ml	--	--	400	--	--	--	<1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--	0.78	1.11	1.06	0.92	0.07	0.50	0.60	1.04	1.31	0.52	0.7	0.55	1.34	1.50	0.40	0.44	0.50	1.03	0.55
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--	0.69	0.96	1.11	0.77	0.07	0.41	0.55	0.82	1.07	0.55	0.7	0.74	1.48	1.70	0.39	0.40	0.57	0.95	0.51
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--	--	--	--	--	--	--	--	--	--	0.5	<0.4	0.7	--	1.8	1.1	<0.4	<0.4	<0.4	0.21

Notes:

NC - Not Calculable
RDL = Recordable Detection Limit (represents most recent sampling event RDL)
" -- " = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guideline for the protection of the environment and ecological receptors (last updated
CCME FWAL Guidelines for Aluminum, Lead, Copper and Nickel vary based on reported pH and water hardness (CCME FWAL calculation equations).
The lowest guideline value for each parameter element range was always used.
Health Canada Guideline for Recreational Water Quality = Health Canada Guidelines for Canadian Recreational Water Quality - Draft (September 2009) (Referenced)
Nova Scotia Environment Environmental Quality Standards for Surface Water (Environmental Quality Standards (EQS) for Contaminated Sites (NSE
2014) Table A2 Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water
Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics, Metals)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

TABLE 1: BEDFORD WEST SAMPLING PROGRAM

May 2015	Units	RDL	NSE ESQs for Surface Water (Applied)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	Kearney Lake										
Sample Sites						KL5										
Sampling Date	yyyy-mm-dd	--				2011/10/17	5/1/2012	8/14/2012	10/10/2012	5/15/2013	8/16/2013	10/16/2013	5/14/2014	8/14/2014	10/27/2014	5/20/2015
Sampling Time	hh:mm	--				9:40	10:52	13:10	12:10	10:03	10:50	13:45	11:30	13:55	10:45	09:00
FIELD DATA																
Secchi Depth	Meters	--	--	1.2	--	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NCC
Water Temp	Celsius	0.1	--	--	--	14.7	10.5	26.1	16.6	13.3	22.7	14.7	13.7	22.9	12.8	14.06
Dissolved Oxygen	mg/L	0.01	--	--	5.5-9.5	9.38	7.88	7.90	8.16	9.67	8.89	8.60	10.82	7.64	7.91	8.32
pH	pH	N/A	--	--	--	6.52	7.76	6.69	6.72	6.20	8.57	6.51	6.79	7.86	6.60	7.82
Specific Conductance	uS/cm	1	--	--	--	112	230	229	189.0	219.5	202.1	212.9	472.0	251.0	211.0	0.184
INORGANICS																
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--	9	21	8	<5	<5	6	5	32	<5	<5	5.4
Dissolved Chloride (Cl)	mg/L	1	--	--	120	37	55	57	48	58	44	46	61	47	47	59
Colour	TCU	30	--	--	--	35	43	10	27	10	22	18	14	11	22	35
Nitrite + Nitrate	mg/L	0.05	--	--	--	0.17	0.19	0.15	0.83	0.21	0.21	0.25	0.16	0.10	0.16	0.16
Nitrate (N)	mg/L	0.05	--	--	13000	--	0.19	0.15	0.83	0.21	0.21	0.20	0.16	0.10	0.16	0.16
Nitrite (N)	mg/L	0.05	--	--	60	--	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19	<0.05	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.06	<0.050
Total Organic Carbon	mg/L	0.5	--	--	--	4.8	5.8	3.4	4.7	4.0	4.6	7.0	4.3	2.7	4.5	3.1
Orthophosphate (as P)	mg/L	0.01	--	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010
pH (Lab)	pH	N/A	--	5.0-9.0	6.5-9	6.57	6.7	7.1	6.5	6.71	6.93	6.89	6.64	6.84	6.63	6.56
Total Calcium (Ca)	mg/L	0.1	--	--	--	5.79	6.1	6.6	5.9	7.1	5.7	6.4	6.5	7.6	7.0	6500
Total Magnesium (Mg)	mg/L	0.1	--	--	--	1.05	1.0	1.1	1.2	1.0	1.0	1.1	1.4	1.2	1.0	930
Total Phosphorus (1M depth)	mg/L	0.006	--	--	--	0.009	0.018	0.040	0.006	0.005	0.013	0.010	0.010	0.026	0.14	0.005
Total Potassium (K)	mg/L	0.1	--	--	--	0.858	0.7	0.9	0.8	0.8	0.7	1.1	0.8	1.1	0.9	720
Total Sodium (Na)	mg/L	0.1	--	--	--	22.0	34.6	32.0	27.7	33.6	19.2	31.3	37.5	40.3	38.3	33000
Reactive Silica (SiO2)	mg/L	0.5	--	--	--	2.5	2.7	2.0	2.4	2.7	2.5	2.5	2.7	2.1	2.5	3.3
Total Suspended Solids	mg/L	5	--	--	--	1	<5	<5	<5	<5	<5	<5	<5	<5	<5	<1.0
Dissolved Sulphate (SO4)	mg/L	2	--	--	--	9	7	8	8	8	7	8	9	8	8	8
Turbidity (NTU)	NTU	0.1	--	50	--	0.9	1.1	0.7	0.9	0.7	0.8	0.4	1.1	0.4	0.8	0.71
Conductivity (uS/cm)	µS/cm	1	--	--	--	160	215	226	189	232	223	204	228	246	225	220
Calculated Parameters																
Anion Sum	me/L	N/A	--	--	--	1.42	2.13	1.95	1.58	1.82	1.52	1.58	2.56	1.50	1.50	1.94
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--	9	21	8	<5	<5	6	5	32	<5	<5	5.4
Calculated TDS	mg/L	1	--	--	--	84	118	111	96	110	82	98	136	106	103	120
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--	<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<1.0
Cation Sum	me/L	N/A	--	--	--	1.36	1.94	1.85	1.64	1.94	1.23	1.81	2.12	2.27	2.14	1.87
Hardness (CaCO3)	mg/L	1	--	--	--	19	19.3	21.0	19.7	21.8	18.4	20.5	22.0	23.9	21.6	20.0
Ion Balance (% Difference)	%	N/A	--	--	--	2.16	4.7	2.6	2.0	3.2	10.6	6.7	9.4	20.3	17.5	1.8
Langelier Index (@ 20C)	N/A	N/A	--	--	--	-3.06	-2.79	-2.77	-3.62	-3.33	-3.11	-3.19	-2.64	-3.17	-3.42	-3.24
Langelier Index (@ 4C)	N/A	N/A	--	--	--	-3.31	-3.11	-3.09	-3.94	-3.65	-3.43	-3.51	-2.96	-3.49	-3.74	-3.50
Saturation pH (@ 20C)	N/A	N/A	--	--	--	9.63	9.49	9.87	10.1	10.0	10.0	10.1	9.28	10.0	10.0	9.8
Saturation pH (@ 4C)	N/A	N/A	--	--	--	9.88	9.81	10.2	10.4	10.4	10.4	10.4	9.60	10.3	10.4	10.1
Metals (ICP-MS)																
Total Aluminum (Al)	µg/L	5	5	--	5-100	--	**222**	52	**154**	**136**	58	61	**224**	53	**108**	***180***
Total Antimony (Sb)	µg/L	2	20	--	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Arsenic (As)	µg/L	2	5.0	--	5	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Barium (Ba)	µg/L	5	1000	--	--	--	18	16	15	19	9	16	16	17	17	17
Total Beryllium (Be)	µg/L	2	5.3	--	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Bismuth (Bi)	µg/L	2	--	--	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Boron (B)	µg/L	5	1200	--	1500	--	6	9	15	7	7	9	7	6	10	<50
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017	--	**0.022**	**0.027**	**0.029**	**0.024**	<0.017	**0.034**	**0.036**	<0.017	**0.024**	***0.035***
Total Chromium (Cr)	µg/L	1	---	--	1	--	<1	<1	5	<1	<1	<1	6	<1	<1	<1.0
Total Cobalt (Co)	µg/L	1	10	--	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.40
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0	<2.0	<2	<2	<2	<2	<1	1	<1	<1	5	<2.0
Total Iron (Fe)	µg/L	50	300	--	300	175	160	78	120	111	70	79	111	<50	119	100
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0	--	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	1.9	<0.5	0.5	<0.5
Total Manganese (Mn)	µg/L	2	820	--	--	35.9	30	14	37	35	13	12	40	18	25	34
Total Molybdenum (Mo)	µg/L	2	73	--	73	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Nickel (Ni)	µg/L	2	25	--	25-150	--	<2	<2	5	<2	<2	<2	2	<2	<2	<2.0
Total Selenium (Se)	µg/L	1	1.0	--	1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1.0
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Total Strontium (Sr)	µg/L	5	21000	--	--	--	27	31	29	31	18	31	31	30	30	29
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Total Tin (Sn)	µg/L	2	--	--	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Titanium (Ti)	µg/L	2	--	--	--	--	3	<2	<2	<2	<2	<2	<2	<2	2	2.3
Total Uranium (U)	µg/L	0.1	300	--	15	--	0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1
Total Vanadium (V)	µg/L	2	6	--	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Zinc (Zn)	µg/L	5	30	--	30	9.3	5	<5	**64**	11	7	5	10	<5	10	14
MICROBIOLOGICAL																
Total Coliform	MPN/100mL	1	--	--	--	--	461	613	93	461	308	461	42	629	>2470	---
E. coli	MPN/100mL	1	--	400	--	100	14	2	6	6	6	4	<1	1	17	<10
Fecal Coliform	MPN/ml	--	--	400	--	--	--	--	--	--	--	--	--	--	--	---
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--	0.91	0.30	1.2	1.09	1.44	2.20	0.64	0.20	0.61	0.9	0.48
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--	0.85	0.33	1.0	1.41	1.59	2.40	0.62	0.20	0.54	0.84	---
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--	--	<0.4	2.3	1.0	--	0.6	1.1	<0.4	0.5	1.1	0.31

Notes:

NC - Not Calculable
RDL = Recordable Detection Limit (represents most recent sampling event RDL)
" -- " = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guideline for the protection of the environment and ecological receptors (last updated
CCME FWAL Guidelines for Aluminum, Lead, Copper and Nickel vary based on reported pH and water hardness (CCME FWAL calculation equations).
The lowest guideline value for each respective element range was always used.
Health Canada Guideline for Recreational Water Quality = Health Canada Guidelines for Canadian Recreational Water Quality - Draft (September 2009) (Referenced)
Nova Scotia Environment Environmental Quality Standards for Surface Water (Environmental Quality Standards (EQS) for Contaminated Sites (NSE
2014) Table A2 Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water
Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics, Metals)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

TABLE 1: BEDFORD WEST SAMPLING PROGRAM

May 2015	Units	RDL	NSE ESQs for Surface Water (Reference)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	Highway 102																	
Sample Sites						HWY102-1																	
Sampling Date	yyyy-mm-dd	--				6/29/2009	8/13/2009	10/1/2009	5/31/2010	8/24/2010	11/1/2010	5/13/2011	8/14/2011	10/16/2011	5/1/2012	8/15/2012	10/11/2012	5/15/2013	2013/08/15	10/16/2013	5/14/2014	8/14/2014	10/27/2014	5/20/2015
Sampling Time	hh:mm	--				07:00	12:45	08:00	13:00	10:20	09:00	13:40	11:00	11:00	14:50	11:00	9:50	14:15	12:22	12:30	12:00	10:10	9:30	13:15
FIELD DATA																							
Secchi Depth	Meters	--	--	1.2	--	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Water Temp	Celsius	0.1	--	--	--	11.8	18.8	15.7	14.9	19.6	7.4	11.4	17.8	14.6	10.7	21.8	13.6	11.7	19.5	8.9	12.1	19.6	10.2	14.29
Dissolved Oxygen	mg/L	0.01	--	--	5.5-9.5	11.44	5.80	4.34	8.18	4.25	6.05	8.15	3.88	5.34	5.65	1.03	3.83	7.55	3.32	3.10	12.03	2.09	4.54	4.27
pH	pH	N/A	--	--	--	7.98	5.35	5.25	6.31	5.26	5.62	5.75	5.77	5.99	8.76	5.73	6.38	6.19	7.10	6.79	6.02	6.63	5.12	6.35
Specific Conductance	uS/cm	1	--	--	--	194	153	104	135	106	109	114	108	89	288	225	155.5	226	173.2	234.0	880.0	337	109	0.393
INORGANICS																							
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--	<5	<5	<5	<5	<5	<5	5	11	8	22	25	15	9	23	20	31	28	30	16
Dissolved Chloride (Cl)	mg/L	1	--	--	120	24	38	24	32	25	22	24	19	12	58	48	28	53	31	40	65	57	19	130
Colour	TCU	30	--	--	--	67	68	57	37	89	53	39	65	79	24	65	40	9	65	25	11	31	93	22
Nitrite + Nitrate	mg/L	0.05	--	--	--	<0.05	<0.05	<0.05	0.69	<0.05	1.2	0.69	0.25	1.2	2.61	0.06	0.43	0.51	<0.05	<0.05	<0.05	<0.05	0.53	<0.050
Nitrate (N)	mg/L	0.05	--	--	13000	<0.05	--	--	0.69	<0.05	--	0.69	--	--	2.61	0.06	0.43	0.51	<0.05	<0.05	<0.05	<0.05	0.53	<0.050
Nitrite (N)	mg/L	0.05	--	--	60	<0.01	--	--	<0.01	<0.01	--	<0.01	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19	<0.05	0.29	<0.05	<0.05	<0.05	<0.05	0.05	0.1	0.07	0.31	0.19	0.04	<0.03	0.05	0.06	<0.03	0.04	0.03	<0.050
Total Organic Carbon	mg/L	0.5	--	--	--	6.5	10	7.7	4.7	11	6.3	4.5	7.2	7.4	5.5	10.0	7.0	5.1	10.1	17.7	4.1	7.7	9.0	2.7
Orthophosphate (as P)	mg/L	0.01	--	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010
pH (units)	pH	N/A	--	5.0-9.0	6.5-9	4.54	5.24	5.40	5.48	6.24	7.31	6.42	6.55	6.28	6.4	6.9	6.8	6.86	6.87	6.73	6.56	7.49	5.90	6.61
Total Calcium (Ca)	mg/L	0.1	--	--	--	1.7	1.8	1.6	4.93	3.34	5.09	4.9	5.21	5.55	12.5	11.7	7.5	11.1	10.5	13.9	7.2	23.3	2.2	18000
Total Magnesium (Mg)	mg/L	0.1	--	--	--	0.3	0.5	0.5	1.08	0.79	1.09	0.91	0.92	1.19	1.7	2.0	1.4	1.4	1.5	2.3	1.6	3.2	0.6	2400
Total Phosphorus (1M depth)	mg/L	0.006	--	--	--	0.07	0.14	0.020	0.006	0.007	0.011	0.009	0.012	0.010	0.019	0.039	0.02	0.006	0.021	0.022	0.013	0.038	0.03	0.007
Total Potassium (K)	mg/L	0.1	--	--	--	0.5	1.2	0.7	1.140	1.630	1.310	1.100	1.500	1.880	1.6	2.5	1.5	1.3	1.7	2.4	1.2	2.5	0.7	2000
Total Sodium (Na)	mg/L	0.1	--	--	--	15	25	13	15.9	14.5	14.6	14.8	10.2	8.26	36.3	27.7	14.6	30.8	15.0	20.5	39.1	38.7	18.6	64000
Reactive Silica (SiO2)	mg/L	0.5	--	--	--	2.5	2.2	2.0	1.1	3.8	5.1	2.8	5.2	4.6	4.1	6.1	5.1	3.1	5.1	5.8	1.7	7.1	4.7	2.1
Total Suspended Solids	mg/L	5	--	--	--	7	80	2	<2	11	<2	<1	1	<1	9	6	<5	<5	<5	<5	6	<5	<5	<1.0
Dissolved Sulphate (SO4)	mg/L	2	--	--	--	5	3	3	8	<2	8	10	8	10	14	8	9	12	8	12	10	7	6	13
Turbidity (NTU)	NTU	0.1	--	50	--	14.0	35	0.9	1.4	1.2	0.6	0.4	0.6	1.1	0.9	1.9	0.9	0.5	1.6	0.5	0.7	1.6	0.9	0.59
Conductivity (uS/cm)	µS/cm	1	--	--	--	100	140	92	130	100	110	110	100	88	263	231	143	243	188	218	252	338	112	470
Calculated Parameters																							
Anion Sum	me/L	N/A	--	--	--	0.77	1.12	0.73	1.11	0.71	0.88	1.03	0.95	0.80	2.55	2.02	1.31	1.96	1.50	1.78	2.66	2.31	1.30	4.20
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--	<1	<1	<1	<1	<1	<1	5	11	8	22	25	15	9	23	20	31	28	30	16
Calculated TDS	mg/L	1	--	--	--	50	73	45	67	50	63	65	58	54	150	117	73	117	83	104	143	150	68	240
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<1.0
Cation Sum	me/L	N/A	--	--	--	0.84	1.32	0.74	1.06	0.93	1.02	1.00	0.83	0.80	2.43	6.04	1.19	2.06	1.40	1.87	2.25	3.22	1.04	3.94
Hardness (CaCO3)	mg/L	1	--	--	--	6	6	6	17	12	17	16	17	19	38.2	37.5	24.5	33.5	32.4	44.2	24.6	71.4	8.0	55.0
Ion Balance (% Difference)	%	N/A	--	--	--	4.35	8.20	0.68	2.30	13.40	7.37	1.48	6.74	0.00	2.6	1.9	4.6	2.4	3.5	2.6	8.4	16.4	11.2	3.19
Langelier Index (@ 20C)	N/A	N/A	--	--	--	NC	NC	NC	NC	NC	NC	-3.50	-2.99	-3.36	-2.77	-2.23	-2.72	-2.73	-2.33	-2.41	-2.69	-1.30	-3.85	-2.32
Langelier Index (@ 4C)	N/A	N/A	--	--	--	NC	NC	NC	NC	NC	NC	-3.75	-3.25	-3.61	-3.09	-2.55	-3.04	-3.05	-2.65	-2.73	-3.01	-1.62	-4.17	-2.57
Saturation pH (@ 20C)	N/A	N/A	--	--	--	NC	NC	NC	NC	NC	NC	9.92	9.54	9.64	9.17	9.13	9.52	9.59	9.20	9.14	9.25	8.79	9.75	8.93
Saturation pH (@ 4C)	N/A	N/A	--	--	--	NC	NC	NC	NC	NC	NC	10.20	9.80	9.89	9.49	9.45	9.84	9.91	9.52	9.46	9.57	9.11	10.1	9.18
Metals (ICP-MS)																							
Total Aluminum (Al)	µg/L	5	5	--	5-100	510	--	--	169	192	--	205	--	--	134	183	146	86	145	150	187	83	310	51
Total Antimony (Sb)	µg/L	2	20	--	--	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Arsenic (As)	µg/L	2	5.0	--	5	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Barium (Ba)	µg/L	5	1000	--	--	22	--	--	52.9	36.9	--	37.3	--	--	58	284	42	57	57	80	46	142	17	130
Total Beryllium (Be)	µg/L	2	5.3	--	--	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Bismuth (Bi)	µg/L	2	--	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Boron (B)	µg/L	5	1200	--	1500	<5	--	--	11.4	10.9	--	<50	--	--	12	18	13	10	10	11	9	14	11	<50
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017	<0.3	--	--	0.043	<0.017	--	0.023	--	--	0.034	0.021	<0.017	<0.017	<0.017	0.040	0.022	<0.017	0.022	0.024
Total Chromium (Cr)	µg/L	1	1.0	--	1	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	<1	<1	<1	<1	8	<1	<1	<1.0
Total Cobalt (Co)	µg/L	1	10	--	--	<1	--	--	0.50	0.46	--	<0.40	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.40
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0	2	--	--	3.4	<2.0	<2.0	<2.0	<2.0	<2.0	<2	<2	3	<2	<1	2	<1	<1	2	<2.0
Total Iron (Fe)	µg/L	50	300	--	300	720	--	--	146	637	150	107	209	219	102	1380	255	111	938	446	147	820	290	140
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0	1.6	--	--	2.37	0.56	--	<0.50	--	--	<0.5	0.7	<0.5	<0.5	<0.5	0.6	2.6	<0.5	0.6	<0.50
Total Manganese (Mn)	µg/L	2	820	--	--	40	--	--	55.3	39.0	67.0	28.1	21.0	31.3	34	79	28	23	45	31	56	122	61	28
Total Molybdenum (Mo)	µg/L	2	73	--	73	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Nickel (Ni)	µg/L	2	25	--	25-150	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Selenium (Se)	µg/L	1	1.0	--	1	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1.0
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1	<0.5	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Total Strontium (Sr)	µg/L	5	21000	--	--	11	--	--	29.1	19.7	--	24.3	--	--	48	58	36	52	47	62	38	103	13	85
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8	<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Total Tin (Sn)	µg/L	2	--	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Titanium (Ti)	µg/L	2	--	--	--	6	--	--	<2.0	<2.0	--	3.5	--	--	<2	3	<2	<2	<2	4	2	<2	<2	<2.0
Total Uranium (U)	µg/L	0.1	300	--	15	<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Total Vanadium (V)	µg/L	2	6	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Zinc (Zn)	µg/L	5	30	--	30	21	--	--	16.4	6.9	6.9	<5.0	<5.0	6.9	<5	6	<5	<5	<5	10	10	<5	7	11
MICROBIOLOGICAL																							
Total Coliform	MPN/100mL	1	--	--	--	84	>250	--	>250	>250	180	120	180	--	687	>2420	>2420	1550	>2420	1553	120	>2420	>2420	---
E. coli	MPN/100mL	1	--	400	--	54	>250	--	12	17	5	1	78	<100	3	68	145	4	9	5	3	179	3	20
Fecal Coliform	MPN/ml	--	--	400	--	--	--	<1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--	15.40	19.29	0.70	18.12	1.61	8.45	0.93	0.58	0.69	0.53	2.59	0.81	1.27	14.70	1.99	0.25	1.10	1.22	0.5
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--	17.50	19.60	0.84	17.62	1.68	7.52	0.84	0.56	0.65	0.59	2.89	1.05	1.45	15.80	2.20	0.82	1.11	1.38	0.55
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--	--	--	--	--	--	--	--	--	--	1.1	1.3	0.6	--	0.6	0.6	0.7	0.6	<0.4	0.34

Notes:

NA - Not Applicable; NC - Not Calculable; NCC - Not Collected
RDL = Recordable Detection Limit (represents most recent sampling event)
" -- " = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guideline for the protection of the environment and ecological receptors (last updated 2011)
CCME FWAL Guidelines for Aluminum, Lead, Copper and Nickel vary based on reported pH and water hardness (CCME FWAL calculation equations). The largest guideline value for each respective element range was always used.
Health Canada Guideline for Recreational Water Quality = Health Canada Guidelines for Canadian Recreational Water Quality - Draft (September 2009)
Nova Scotia Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table A2 Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water

Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics, Metals)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

TABLE 1: BEDFORD WEST SAMPLING PROGRAM

May 2015	Units	RDL	NSE ESQs for Surface Water (Reference)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	Highway 102																	
Sample Sites						HWY102-2																	
Sampling Date	yyyy-mm-dd	--				2009/06/29	8/13/2009	10/1/2009	5/31/2010	8/24/2010	11/1/2010	5/13/2011	8/14/2011	10/16/2011	5/1/2012	8/15/2012	10/11/2012	5/15/2013	8/15/2013	10/16/2013	5/14/2014	8/14/2014	10/27/2014	5/20/2015
Sampling Time	hh:mm	--				12:30	12:15	12:30	12:40	09:30	12:30	11:20	15:00	15:30	11:20	12:20	10:35	10:40	10:00	10:22	12:15	14:25	10:07	11:00
FIELD DATA																							
Secchi Depth	Meters	--	--	1.2	--	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	N/A	NCC
Water Temp	Celsius	0.1	--	--	--	16.7	19.2	16.4	17.2	17.0	10.8	24.2	15.1	7.8	23.7	14.3	11.5	22.0	10.7	11.4	--	10.4	12.7
Dissolved Oxygen	mg/L	0.01	--	--	5.5-9.5	10.01	5.90	4.80	4.91	2.45	2.99	6.92	7.03	5.09	3.73	13.1	3.28	6.30	1.57	4.20	10.50	--	9.25	4.24
pH	pH	N/A	--	--	--	6.57	5.71	5.40	6.33	5.86	5.64	6.22	5.89	5.29	7.3	6.37	6.72	6.01	6.92	5.40	5.40	--	5.85	6.45
Specific Conductance	uS/cm	1	--	--	--	37	457	162	415	167	101.2	92.2	123.1	96	225	226	159.1	288	188.5	204.4	204.4	--	174	0.411
INORGANICS																							
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--	<5	<5	7	6	5	<5	<5	5	<5	17	7	<5	6	14	7	30	--	8	7.5
Dissolved Chloride (Cl)	mg/L	1	--	--	120	21	82	83	170	41	18	21	21	17	63	109	45	71	50	52	113	--	34	260
Colour	TCU	30	--	--	--	120	190	91	96	160	68	65	98	77	32	100	70	11	61	36	13	--	85	17
Nitrite + Nitrate	mg/L	0.05	--	--	--	<0.05	<0.05	<0.05	0.10	<0.05	0.62	0.26	1.8	3.2	1.54	<0.05	0.14	0.17	<0.05	<0.05	<0.05	--	0.12	<0.050
Nitrate (N)	mg/L	0.05	--	--	13000	<0.05	--	--	0.10	<0.05	--	0.26	--	--	1.54	<0.05	0.14	0.17	<0.05	<0.05	<0.05	--	0.12	<0.050
Nitrite (N)	mg/L	0.05	--	--	60	<0.01	--	--	<0.01	<0.01	--	<0.01	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	<0.05	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19	<0.05	0.06	<0.05	<0.05	0.20	<0.05	<0.05	0.30	0.08	0.09	<0.03	<0.03	<0.03	0.17	0.09	<0.03	--	<0.03	0.056
Total Organic Carbon	mg/L	0.5	--	--	--	8.5	13	13	7.2	14	7.4	5.7	9.2	8.4	7.0	15.8	11.2	6.1	10.6	5.1	17.4	--	8.0	3.0
Orthophosphate (as P)	mg/L	0.01	--	--	--	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	<0.01	<0.010
pH (units)	pH	N/A	--	5.0-9.0	6.5-9	5.43	5.96	6.30	6.05	6.32	5.47	5.93	6.18	5.92	5.9	6.7	6.8	6.61	6.59	6.74	7.20	--	6.40	6.12
Total Calcium (Ca)	mg/L	0.1	--	--	--	1.6	4.0	4.8	7.44	3.84	4.01	3.07	2.22	3.80	7.0	8.4	5.6	7.6	8.5	8.2	14.1	--	9.5	20000
Total Magnesium (Mg)	mg/L	0.1	--	--	--	0.4	0.7	0.9	0.96	0.59	1.00	0.68	0.68	1.38	1.2	1.4	1.2	1.2	1.3	2.2	3.1	--	1.8	2500
Total Phosphorus (1M depth)	mg/L	0.006	--	--	--	<0.02	0.04	0.034	0.010	0.028	0.003	0.009	0.019	0.041	0.021	0.054	0.03	0.014	0.028	0.199	0.028	--	0.20	0.01
Total Potassium (K)	mg/L	0.1	--	--	--	0.5	0.8	1.1	0.984	0.956	1.390	0.844	1.310	1.880	1.2	1.7	1.6	1.3	1.5	2.5	2.9	--	1.7	1900
Total Sodium (Na)	mg/L	0.1	--	--	--	15	51	55	83.7	32.0	12.1	13.3	13.1	13.3	41.5	63.6	20.4	39.0	19.1	34.5	69.6	--	24.0	150000
Reactive Silica (SiO2)	mg/L	0.5	--	--	--	2.2	4.4	4.0	3.0	6.4	5.4	2.5	6.5	6.7	4.1	6.9	5.8	1.6	6.2	6.6	1.6	--	5.9	2.3
Total Suspended Solids	mg/L	5	--	--	--	<2	58	62	34	27	3	<1	10	14	<5	39	<5	<5	<5	194	34	--	<5	2
Dissolved Sulphate (SO4)	mg/L	2	--	--	--	<2	3	8	11	<2	7	5	5	8	12	6	10	10	9	10	12	--	8	15
Turbidity (NTU)	NTU	0.1	--	50	--	0.7	3.8	4.2	2.6	3.1	0.5	0.4	1.2 (1)	3.9	0.6	10.8	2	1.5	3.3	144	1.1	--	1.1	1.2
Conductivity (uS/cm)	µS/cm	1	--	--	--	85	290	310	590	160	94	91	100	110	263	403	179	295	203	223	433	--	194	920
Calculated Parameters																							
Anion Sum	me/L	N/A	--	--	--	0.60	2.37	2.62	5.13	1.27	0.70	0.73	0.91	0.86	2.48	3.34	1.49	2.34	1.88	1.81	4.04	--	1.29	7.88
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--	<1	<1	7	6	5	<1	<1	5	<1	17	7	<5	6	14	7	30	--	8	7.5
Calculated TDS	mg/L	1	--	--	--	42	150	165	282	93	52	48	62	67	143	200	86	135	100	145	235	--	85	460
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<10	<10	<10	<10	--	<10	<1.0
Cation Sum	me/L	N/A	--	--	--	0.81	2.65	2.89	4.17	1.81	0.86	0.82	0.83	0.97	2.32	2.10	1.40	2.24	1.50	3.50	4.17	--	1.76	7.87
Hardness (CaCO3)	mg/L	1	--	--	--	6	13	16	23	12	14	11	8	15	22.4	26.7	18.9	23.9	26.6	29.5	48.0	--	31.1	59.0
Ion Balance (% Difference)	%	N/A	--	--	--	14.90	5.58	4.90	10.30	17.50	10.30	5.81	4.60	6.01	3.3	3.6	3.1	2.3	11.3	31.7	1.6	--	15.1	0.0600
Langelier Index (@ 20C)	N/A	N/A	--	--	--	NC	NC	-3.57	-3.72	-3.70	NC	NC	-4.07	NC	-3.63	-3.15	-3.34	-3.33	-2.92	-3.50	-1.80	--	-3.30	-3.18
Langelier Index (@ 4C)	N/A	N/A	--	--	--	NC	NC	-3.82	-3.97	-3.95	NC	NC	-4.32	NC	-3.95	-3.47	-3.66	-3.65	-3.24	-3.82	-2.12	--	-3.62	-3.42
Saturation pH (@ 20C)	N/A	N/A	--	--	--	NC	NC	9.87	9.77	10.00	NC	NC	10.30	NC	9.53	9.85	10.10	9.94	9.51	9.84	9.00	--	9.70	9.29
Saturation pH (@ 4C)	N/A	N/A	--	--	--	NC	NC	10.10	10.00	10.30	NC	NC	10.50	NC	9.85	10.2	10.5	10.3	9.83	10.2	9.32	--	10.0	9.54
Metals (ICP-MS)																							
Total Aluminum (Al)	µg/L	5	5	--	5-100	270	--	--	189	368	--	260	--	--	145	466	259	130	138	2760	400	--	216	100
Total Antimony (Sb)	µg/L	2	20	--	--	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	--	<2	<1.0
Total Arsenic (As)	µg/L	2	5.0	--	5	<2	--	--	<1.0	2.1	--	<1.0	--	--	<2	<2	<2	<2	<2	6	<2	--	<2	<1.0
Total Barium (Ba)	µg/L	5	1000	--	--	20	--	--	53.1	27.7	--	26.6	--	--	49	74	33	44	43	213	381	--	63	140
Total Beryllium (Be)	µg/L	2	5.3	--	--	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	--	<2	<1.0
Total Bismuth (Bi)	µg/L	2	--	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	--	<2	<2.0
Total Boron (B)	µg/L	5	1200	--	1500	<5	--	--	7.9	7.8	--	<50	--	--	10	17	15	9	10	13	11	--	12	<50
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017	<0.3	--	--	0.051	<0.017	--	<0.017	--	--	0.037	0.031	0.032	0.019	<0.017	0.096	0.051	--	0.019	0.100
Total Chromium (Cr)	µg/L	1	1.0	--	1	<2	--	--	<1.0	1.0	--	<1.0	--	--	<1	<1	<1	<1	1	9	2	--	<1	<1.0
Total Cobalt (Co)	µg/L	1	10	--	--	<1	--	--	0.66	0.77	--	<0.40	--	--	<1	1	1	<1	1	3	1	--	<1	1.8
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0	2	--	--	2.0	<2.0	<2.0	<2.0	2.5	2.8	<2	3	3	<2	1	12	4	--	2	<2.0
Total Iron (Fe)	µg/L	50	300	--	300	880	--	--	1380	3950	303	229	897	1110	214	5210	1550	383	1720	28400	1660	--	485	960
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0	1.9	--	--	1.61	2.70	--	0.59	--	--	<0.5	5.2	2.1	0.6	0.7	19.4	3.5	--	1.0	<0.50
Total Manganese (Mn)	µg/L	2	820	--	--	110	--	--	387	135	52.9	40.5	106	176	78	219	207	83	173	327	212	--	93	470
Total Molybdenum (Mo)	µg/L	2	73	--	73	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	--	<2	<2.0
Total Nickel (Ni)	µg/L	2	25	--	25-150	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	4	2	--	<2	<2.0
Total Selenium (Se)	µg/L	1	1.0	--	1	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	<1	<1	<1	<1	<1	--	<1	<1.0
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1	<0.5	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	--	<0.1	<0.10
Total Strontium (Sr)	µg/L	5	21000	--	--	11	--	--	37.4	21.1	--	16.9	--	--	33	45	31	39	40	45	75	--	43	96
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8	<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	--	<0.1	<0.10
Total Tin (Sn)	µg/L	2	--	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	--	<2	<2.0
Total Titanium (Ti)	µg/L	2	--	--	--	4	--	--	<2.0	6.4	--	4.9	--	--	<2	10	4	4	<2	60	9	--	6	<2.0
Total Uranium (U)	µg/L	0.1	300	--	15	<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	--	<0.1	<0.10
Total Vanadium (V)	µg/L	2	6	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	2	<2	<2	<2	11	<2	--	<2	<2.0
Total Zinc (Zn)	µg/L	5	30	--	30	12	--	--	13.6	12.3	9.3	5.5	9	12.5	<5	7	12	12	<5	46	36	--	17	27
MICROBIOLOGICAL																							
Total Coliform	MPN/100mL	1	--	--	--	28	>250	--	>250	75	41	110	>250	--	1553	>2420	>2420	2420	1990	>2420	687	--	>2420	--
E. coli	MPN/100mL	1	--	400	--	4	230	--	9	5	<1	7	>250	<100	<1	16	50	111	9	4	<1	--	<1	<10
Fecal Coliform	MPN/ml	--	--	400	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--	0.90	82.63	48.17	0.85	16.36	0.25	0.97	4.91	1.9	2.07	21.03	0.33	2.41	1.10	21.62	10.34	--	0.46	0.53
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--	0.91	81.20	52.50	0.85	17.35	0.23	0.87	4.49	2.15	2.27	17.26	0.50	3.02	1.30	27.02	11.09	--	0.55	0.58
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--	--	--	--	--	--	--	--	--	--	0.6	1.1	0.5	--	0.7	2.0	15.3	--	<0.4	0.33

Notes:

NA - Not Applicable; NC - Not Calculable; NCC - Not Collected
RDL = Recordable Detection Limit (represents most recent sampling event)
" -- " = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guideline for the protection of the environment and ecological receptors (last updated 2011)

CCME FWAL Guidelines for Aluminum, Lead, Copper and Nickel vary based on reported pH and water hardness (CCME FWAL calculation equations). The largest guideline value for each respective element range was always used.

Health Canada Guideline for Recreational Water Quality = Health Canada Guidelines for Canadian Recreational Water Quality - Draft (September 2009)
Nova Scotia Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table A2 Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water

Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics, Metals)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

TABLE 1: BEDFORD WEST SAMPLING PROGRAM

May 2015	Units	RDL	NSE ESQs for Surface Water (Reference)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	Lake Shore Drive																	
Sample Sites						LSD																	
Sampling Date	yyyy-mm-dd	--				2009/06/29	8/13/2009	10/1/2009	5/31/2010	8/24/2010	11/1/2010	5/13/2011	8/14/2011	10/17/2011	5/1/2012	8/15/2012	10/11/2012	5/15/2013	8/15/2013	10/16/2013	5/15/2014	8/14/2014	10/27/2014	5/20/2015
Sampling Time	hh:mm	--				12:00	09:30	11:45	09:00	11:28	10:00	08:45	13:20	9:00	9:15	13:00	9:10	08:40	15:30	11:55	9:30	12:45	13:30	09:50
FIELD DATA																							
Secchi Depth	Meters	--	--	1.2	--	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	N/A	NCC
Water Temp	Celsius	0.1	--	--	--	13.1	16.7	15.3	13.4	21.3	7.3	10.2	21.0	12.0	5.7	25.7	13.4	7.7	20.2	8.8	8.9	--	10.48	12.52
Dissolved Oxygen	mg/L	0.01	--	--	5.5-9.5	10.84	5.70	5.50	8.60	5.41	8.47	9.44	7.87	8.16	4.06	2.69	7.58	8.77	7.26	7.60	14.78	--	7.22	6.26
pH	pH	N/A	--	--	--	7.88	6.74	6.34	6.42	6.64	6.17	7.09	6.88	6.63	8.22	7.16	6.92	5.19	7.28	6.23	7.02	--	6.31	6.88
Specific Conductance	uS/cm	1	--	--	--	723	210	168	218	203	110	146	126	112	62	177.5	116.7	123.6	132.5	147.8	180.0	--	111	0.119
INORGANICS																							
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--	13	16	12	13	21	9	9	15	12	21	14	11	8	20	11	35	--	10	11
Dissolved Chloride (Cl)	mg/L	1	--	--	120	41	34	31	49	45	25	38	27	22	22	33	23	39	32	23	29	--	23	32
Colour	TCU	30	--	--	--	32	27	37	20	26	33	32	41	49	13	20	40	10	21	25	9	--	31	20
Nitrite + Nitrate	mg/L	0.05	--	--	--	0.14	0.14	0.06	0.23	0.10	0.12	0.25	0.17	0.09	0.13	0.80	<0.05	0.18	0.20	<0.05	0.09	--	0.11	0.15
Nitrate (N)	mg/L	0.05	--	--	13000	0.14	--	--	0.23	0.10	--	0.25	--	--	0.13	0.80	<0.05	0.18	0.20	<0.05	0.09	--	0.11	0.15
Nitrite (N)	mg/L	0.05	--	--	60	<0.01	--	--	<0.01	<0.01	--	<0.01	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	<0.05	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19	<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	0.06	0.03	<0.03	<0.03	<0.03	0.03	0.03	0.04	--	<0.03	<0.050
Total Organic Carbon	mg/L	0.5	--	--	--	5.0	3.8	6.8	3.7	6.0	5.3	4.7	7.1	7.5	3.1	8.0	7.7	4.7	6.3	6.9	5.2	--	8.1	3.2
Orthophosphate (as P)	mg/L	0.01	--	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	<0.01	<0.010
pH (units)	pH	N/A	--	5.0-9.0	6.5-9	6.69	6.69	6.83	7.10	7.30	6.67	6.72	6.79	6.49	6.2	6.9	6.9	6.94	6.95	6.43	6.47	--	6.72	7.02
Total Calcium (Ca)	mg/L	0.1	--	--	--	6.5	6.9	5.4	7.99	10.5	5.29	5.9	5.14	5.04	2.6	18.1	5.1	6.4	6.0	5.6	5.4	--	5.1	6100
Total Magnesium (Mg)	mg/L	0.1	--	--	--	1.4	1.6	1.3	1.99	2.14	1.15	1.25	1.19	1.23	0.7	3.3	1.4	1.2	1.4	1.6	1.5	--	1.1	1300
Total Phosphorus (1M depth)	mg/L	0.006	--	--	--	and 400	0.03	0.009	0.018	0.100	0.009	0.018	0.028	0.014	0.022	0.063	0.003	0.007	0.015	0.078	0.100	--	0.03	0.011
Total Potassium (K)	mg/L	0.1	--	--	--	1.2	1.1	1.3	1.180	1.210	1.030	1.070	0.960	1.240	0.6	1.9	1.3	1.2	1.1	1.4	1.1	--	1.1	1100
Total Sodium (Na)	mg/L	0.1	--	--	--	24	21	18	24.8	26.9	15.2	23.2	14.3	13.8	11.3	18.6	15.2	21.9	26.6	14.6	23.4	--	18.1	19000
Reactive Silica (SiO2)	mg/L	0.5	--	--	--	3.1	4.2	4.0	3.2	3.4	4.3	2.6	3.9	3.8	3.1	2.9	4.9	2.6	3.9	5.0	2.9	--	4.2	2.4
Total Suspended Solids	mg/L	5	--	--	--	16	98	5	6	110	7	4	77	5	<5	16	19	<5	17	9	51	--	8	4.6
Dissolved Sulphate (SO4)	mg/L	2	--	--	--	6	4	5	7	3	4	6	4	4	5	5	5	6	7	5	5	--	4	4.8
Turbidity (NTU)	NTU	0.1	--	50	--	0.6	12	2.5	12	6.2	1	0.6	2.5	1.7	6.7	263	2.1	1.1	31.6	82.6	6.6	--	1.4	1.2
Conductivity (uS/cm)	µS/cm	1	--	--	--	170	150	140	200	200	110	150	130	110	96	161	110	168	136	105	122	--	125	140
Calculated Parameters																							
Anion Sum	me/L	N/A	--	--	--	1.56	0.82	1.22	1.80	1.77	0.97	1.39	1.14	0.96	1.15	1.37	0.97	1.40	1.46	0.97	1.63	--	0.94	1.22
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--	13	8	12	13	21	9	9	15	12	21	14	11	8	20	11	35	--	10	11
Calculated TDS	mg/L	1	--	--	--	92	55	74	104	107	62	84	66	60	56	163	58	82	87	66	88	--	59	74
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<10	<10	<10	<10	--	<10	<1.0
Cation Sum	me/L	N/A	--	--	--	1.53	0.99	1.20	1.69	1.94	1.05	1.44	1.02	1.00	0.76	3.59	1.10	1.43	1.62	1.62	1.52	--	1.19	1.28
Hardness (CaCO3)	mg/L	1	--	--	--	22	15	19	28	35	18	20	18	18	9.4	58.8	18.5	20.9	20.7	20.6	19.7	--	17.3	21.0
Ion Balance (% Difference)	%	N/A	--	--	--	0.97	9.39	0.83	3.15	4.58	3.96	1.77	5.56	2.04	20.7	63.0	6.1	1.0	5.2	25.0	3.4	--	11.8	2.4
Langelier Index (@ 20C)	N/A	N/A	--	--	--	-2.74	-3.20	-2.60	-2.22	-1.71	-2.99	-2.88	-2.64	-3.05	-3.62	-2.30	-2.91	-2.93	-2.55	-3.29	-2.84	--	-3.14	-2.50
Langelier Index (@ 4C)	N/A	N/A	--	--	--	-2.99	-3.45	-2.85	-2.47	-1.96	-3.24	-3.13	-2.89	-3.31	-3.94	-2.62	-3.23	-3.25	-2.87	-3.61	-3.16	--	-3.46	-2.75
Saturation pH (@ 20C)	N/A	N/A	--	--	--	9.43	9.78	9.53	9.32	9.01	9.66	9.60	9.43	9.54	9.82	9.20	9.81	9.87	9.50	9.78	9.31	--	9.86	9.51
Saturation pH (@ 4C)	N/A	N/A	--	--	--	9.68	10.00	9.78	9.57	9.26	9.91	9.85	9.68	9.80	10.10	9.52	10.10	10.20	9.82	10.1	9.63	--	10.2	9.77
Metals (ICP-MS)																							
Total Aluminum (Al)	µg/L	5	5	--	5-100	99	--	--	349	189	--	217	--	--	490	19200	186	131	93	3420	487	--	141	120
Total Antimony (Sb)	µg/L	2	20	--	--	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	--	<2	<1.0
Total Arsenic (As)	µg/L	2	5.0	--	5	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	8	<2	<2	<2	<2	<2	--	<2	<1.0
Total Barium (Ba)	µg/L	5	1000	--	--	14	--	--	15.3	19.2	--	13.9	--	--	11	86	12	12	7	24	15	--	11	12
Total Beryllium (Be)	µg/L	2	5.3	--	--	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	2	<2	<2	<2	<2	<2	--	<2	<1.0
Total Bismuth (Bi)	µg/L	2	--	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	--	<2	<2.0
Total Boron (B)	µg/L	5	1200	--	1500	13	--	--	41.4	21.6	--	<50	--	--	6	24	16	10	15	15	14	--	16	<50
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017	<0.3	--	--	0.018	<0.017	--	<0.017	--	--	0.029	1.050	0.023	<0.017	<0.017	0.073	0.032	--	<0.017	0.011
Total Chromium (Cr)	µg/L	1	1.0	--	1	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	11	<1	<1	<1	2	<1	--	<1	<1.0
Total Cobalt (Co)	µg/L	1	10	--	--	<1	--	--	<0.40	0.88	--	<0.40	--	--	<1	34	<1	<1	<1	1	<1	--	<1	<0.40
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0	<2	--	--	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2	22	2	<2	1	12	2	--	3	<2.0
Total Iron (Fe)	µg/L	50	300	--	300	180	--	--	554	965	120	211	388	384	161	38900	312	236	254	4200	593	--	363	230
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0	<0.5	--	--	3.02	0.54	--	<0.50	--	--	0.6	922	<0.5	<0.5	<0.5	5.2	0.5	--	<0.5	<0.50
Total Manganese (Mn)	µg/L	2	820	--	--	51	--	--	113	632	22.8	30.2	53.4	38.5	26	13200	67	71	81	124	140	--	60	130
Total Molybdenum (Mo)	µg/L	2	73	--	73	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	--	<2	<2.0
Total Nickel (Ni)	µg/L	2	25	--	25-150	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	13	<2	<2	<2	2	<2	--	<2	<2.0
Total Selenium (Se)	µg/L	1	1.0	--	1	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	2	<1	<1	<1	<1	<1	--	<1	<1.0
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1	<0.5	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	--	<0.1	<0.10
Total Strontium (Sr)	µg/L	5	21000	--	--	30	--	--	36.3	42.1	--	24.4	--	--	12	82	22	24	24	25	26	--	19	25
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8	<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	--	<0.1	<0.10
Total Tin (Sn)	µg/L	2	--	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	--	<2	<2.0
Total Titanium (Ti)	µg/L	2	--	--	--	<2	--	--	7.2	4.1	--	5.3	--	--	3	405	4	<2	2	36	6	--	3	3.3
Total Uranium (U)	µg/L	0.1	300	--	15	<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	1.6	<0.1	<0.1	<0.1	0.1	<0.1	--	<0.1	<0.10
Total Vanadium (V)	µg/L	2	6	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	30	<2	<2	<2	2	<2	--	<2	<2.0
Total Zinc (Zn)	µg/L	5	30	--	30	7	--	--	7.2	6.7	<5.0	<5.0	<5.0	5	<5	110	7	6	<5	15	<5	--	<5	<5.0
MICROBIOLOGICAL																							
Total Coliform	MPN/100mL	1	--	--	--	53	>250	--	>250	>250	280	85	>250	--	1414	>2420	>2420	1990	>2420	>2420	1203	--	8	--
E. coli	MPN/100mL	1	--	400	--	22	24	--	4	45	6	10	>250	<100	2	26	10	10	20	2	<1	--	>2420	<10
Fecal Coliform	MPN/ml	--	--	400	--	--	--	<1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--	1.46	10.70	4.68	1.21	6.64	0.21	1.19	1.93	1.41	1.88	6.62	0.13	<0.50	1.6	2.02	1.91	--	0.32	1.02
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--	1.85	11.10	5.62	1.32	7.71	0.19	1.07	1.73	1.18	2.28	7.58	0.22	<0.50	2	2.98	1.91	--	0.33	1.07
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--	--	--	--	--	--	--	--	--	--	0.5	3.5	0.5	--	0.7	3.0	1.0	--	<0.4	0.29

Notes:

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RDL = Recordable Detection Limit (represents most recent sampling event)
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Fresh Water

Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
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Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

TABLE 1: BEDFORD WEST SAMPLING PROGRAM

May 2015	Units	RDL	NSE ESQs for Surface Water (Reference)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	Larry Uteck Blvd										
Sample Sites						LU										
Sampling Date	yyyy-mm-dd	--				10/17/2011	5/1/2012	8/15/2012	10/11/2012	5/15/2013	8/15/2013	10/16/2013	5/15/2014	8/14/2014	10/27/2014	5/20/2015
Sampling Time	hh:mm	--				10:30	15:20	11:30	10:10	14:30	14:30	13:00	11:45	10:45	9:54	13:45
FIELD DATA																
Secchi Depth	Meters	--	--	1.2	--	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NCC
Water Temp	Celsius	0.1	--	--	--	11.3	12.8	27.3	14.6	13.9	18.3	10.9	15.0	22.8	10.2	16.06
Dissolved Oxygen	mg/L	0.01	--	--	5.5-9.5	**4.24**	6.17	8.2	9.04	**10.15**	8.29	**4.50**	**11.96**	8.08	7.55	7.28
pH	pH	N/A	--	--	--	6.07	7.82	6.65	6.78	6.39	7.49	5.45	6.50	7.23	6.17	6.57
Specific Conductance	uS/cm	1	--	--	--	203	955	480	262	670	320	845.0	999.0	611.0	371.0	0.646
INORGANICS																
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--	12	14	14	14	6	22	7	30	21	<5	13
Dissolved Chloride (Cl)	mg/L	1	--	--	120	34	**224**	116	52	**190**	99	**258**	**243**	104	70	**210**
Colour	TCU	30	--	--	--	94	18	14	18	7	7	19	6	8	18	8.4
Nitrite + Nitrate	mg/L	0.05	--	--	--	0.61	1.00	0.64	1.89	1.11	2.57	0.34	1.22	0.47	1.97	0.53
Nitrate (N)	mg/L	0.05	--	--	13000	--	1.00	0.64	1.89	1.11	2.57	0.34	1.22	0.47	1.97	0.53
Nitrite (N)	mg/L	0.05	--	--	60	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19	0.06	0.04	0.16	<0.03	<0.03	0.04	0.04	0.05	<0.03	<0.03	<0.050
Total Organic Carbon	mg/L	0.5	--	--	--	11.0	3.7	22.8	4.8	3.1	4.5	2.9	6.9	4.7	4.7	2.2
Orthophosphate (as P)	mg/L	0.01	--	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010
pH (units)	pH	N/A	--	5.0-9.0	6.5-9	**6.43**	6.7	7.2	7.2	6.92	7.11	**6.49**	**6.42**	7.42	**6.41**	6.95
Total Calcium (Ca)	mg/L	0.1	--	--	--	7.63	30.7	22.1	14.5	22.0	17.6	21.8	23.9	27.6	12.6	27000
Total Magnesium (Mg)	mg/L	0.1	--	--	--	2.34	4.2	3.6	2.2	2.8	2.7	4.0	4.2	3.8	2.2	3800
Total Phosphorus (1M depth)	mg/L	0.006	--	--	--	0.034	0.043	0.036	0.030	0.006	0.027	0.046	0.260	0.028	0.04	0.007
Total Potassium (K)	mg/L	0.1	--	--	--	2.110	3.2	3.6	2.5	2.6	2.8	2.9	3.1	3.7	3.0	3300
Total Sodium (Na)	mg/L	0.1	--	--	--	22.7	124	62.2	32.3	95.1	51.7	170	147	88.1	62.7	110000
Reactive Silica (SiO2)	mg/L	0.5	--	--	--	6.9	4.9	0.7	6.3	5.1	8.6	7.0	2.1	2.5	6.9	3.6
Total Suspended Solids	mg/L	5	--	--	--	13	5	165	<5	<5	<5	<5	626	<5	<5	<1.0
Dissolved Sulphate (SO4)	mg/L	2	--	--	--	21	26	25	23	26	29	33	29	20	27	27
Turbidity (NTU)	NTU	0.1	--	50	--	3.3	4.1	23.0	2.3	1.8	1.6	0.7	42.7	10.1	1.6	0.3
Conductivity (uS/cm)	µS/cm	1	--	--	--	190	813	482	255	732	433	840	819	605	394	790
Calculated Parameters																
Anion Sum	me/L	N/A	--	--	--	1.69	7.21	4.12	2.36	6.10	4.02	8.13	8.15	3.80	2.68	6.77
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--	12	14	14	14	6	22	7	30	21	<5	13
Calculated TDS	mg/L	1	--	--	--	109	426	246	144	347	229	496	477	262	187	400
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--	<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<1.0
Cation Sum	me/L	N/A	--	--	--	1.70	7.40	4.30	2.43	5.55	3.51	8.90	8.24	5.64	3.64	6.69
Hardness (CaCO3)	mg/L	1	--	--	--	29	94.0	70.0	45.3	66.5	55.1	70.9	77.0	84.6	40.5	84
Ion Balance (% Difference)	%	N/A	--	--	--	0.29	1.3	2.2	1.4	4.7	6.8	4.5	0.6	19.4	15.2	0.59
Langelier Index (@ 20C)	N/A	N/A	--	--	--	-2.95	-2.32	-1.94	-2.10	-2.60	-1.93	-2.98	-2.38	-1.45	-3.41	-1.95
Langelier Index (@ 4C)	N/A	N/A	--	--	--	-3.20	-2.64	-2.26	-2.42	-2.92	-2.25	-3.30	-2.70	-1.77	-3.73	-2.20
Saturation pH (@ 20C)	N/A	N/A	--	--	--	9.38	9.02	9.14	9.30	9.52	9.04	9.47	8.80	8.87	9.82	8.90
Saturation pH (@ 4C)	N/A	N/A	--	--	--	9.63	9.34	9.46	9.62	9.84	9.36	9.79	9.12	9.19	10.1	9.15
Metals (ICP-MS)																
Total Aluminum (Al)	µg/L	5	5	--	5-100	--	218	**227**	**252**	**107**	**447**	31	**1400**	46	**109**	***59***
Total Antimony (Sb)	µg/L	2	20	--	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Arsenic (As)	µg/L	2	5.0	--	5	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Barium (Ba)	µg/L	5	1000	--	--	--	225	201	116	133	134	119	185	157	80	150
Total Beryllium (Be)	µg/L	2	5.3	--	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Bismuth (Bi)	µg/L	2	--	--	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Boron (B)	µg/L	5	1200	--	1500	--	11	17	22	10	22	18	22	20	21	<50
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017	--	0.538	**0.171**	**0.168**	**0.300**	**0.236**	**0.148**	**0.171**	**0.031**	**0.079**	***0.150***
Total Chromium (Cr)	µg/L	1	1.0	--	1	--	<1	<1	<1	<1	1	<1	<1	<1	<1	<1.0
Total Cobalt (Co)	µg/L	1	10	--	--	--	<1	1	<1	<1	<1	<1	<1	<1	<1	<0.40
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0	2.9	<2	3	16	2	**6**	2	2	<1	4	***2.1***
Total Iron (Fe)	µg/L	50	300	--	300	**2150**	**347**	**1320**	**500**	194	**890**	157	**2000**	207	229	170
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0	--	0.8	0.7	1.0	<0.5	1.4	<0.5	1.8	<0.5	<0.5	<0.50
Total Manganese (Mn)	µg/L	2	820	--	--	129	182	485	120	87	89	26	71	182	36	110
Total Molybdenum (Mo)	µg/L	2	73	--	73	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Nickel (Ni)	µg/L	2	25	--	25-150	--	<2	<2	<2	<2	<2	<2	3	<2	<2	<2.0
Total Selenium (Se)	µg/L	1	1.0	--	1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1.0
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Total Strontium (Sr)	µg/L	5	21000	--	--	--	112	94	60	93	90	96	116	111	54	120
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Total Tin (Sn)	µg/L	2	--	--	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Titanium (Ti)	µg/L	2	--	--	--	--	4	3	7	3	11	2	22	<2	3	<2.0
Total Uranium (U)	µg/L	0.1	300	--	15	--	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Total Vanadium (V)	µg/L	2	6	--	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Zinc (Zn)	µg/L	5	30	--	30	9	**79**	**92**	**39**	**57**	**49**	26	17	8	23	27
MICROBIOLOGICAL																
Total Coliform	MPN/100mL	1	--	--	--	--	>2420	>2420	2420	866	>2420	866	>2420	961	>2420	---
E. coli	MPN/100mL	1	--	400	--	<100	<1	2	19	3	86	<1	<1	7	**1730**	<10
Fecal Coliform	MPN/ml	--	--	400	--	--	--	--	--	--	--	--	--	--	--	---
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--	1.99	2.44	32.52	1.80	1.54	2.30	0.12	99.13	2.54	0.96	0.69
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--	2.08	2.71	31.31	2.15	1.77	2.50	0.11	98.00	2.51	0.96	0.68
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--	---	0.4	4.2	0.7	--	0.5	<0.4	1.2	1.7	<0.4	0.3

Notes:

NA - Not Applicable; NC - Not Calculable; NCC Not Collected
RDL = Recordable Detection Limit (represents most recent sampling event RDL)
" -- " = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guideline for the protection of the environment and ecological receptors (last updated 2011)

CCME FWAL Guidelines for Aluminum, Lead, Copper and Nickel vary based on reported pH and water hardness (CCME FWAL calculation equations). The largest guideline value for each respective element range was always used.

Health Canada Guideline for Recreational Water Quality = Health Canada Guidelines for Canadian Recreational Water Quality - Draft (September 2009)
Nova Scotia Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table A2 Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water

Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics, Metals)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

TABLE 1: BEDFORD WEST SAMPLING PROGRAM

May 2015	Units	RDL	NSE ESQs for Surface Water (Reference)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	Paper Mill Lake																	
Sample Sites						PML1																	
Sampling Date	yyyy-mm-dd	--				2009/06/29	8/13/2009	10/1/2009	5/31/2010	8/24/2010	11/1/2010	5/13/2011	8/14/2011	10/16/2011	5/1/2012	8/15/2012	10/11/2012	5/15/2013	8/15/2013	10/16/2013	5/15/2014	8/14/2014	10/27/2014	5/20/2015
Sampling Time	hh:mm	--				13:45	13:00	13:00	13:35	15:15	13:00	13:00	16:50	17:00	12:50	--	10:55	10:51	11:35	10:45	10:30	14:45	12:35	12:45
FIELD DATA																							
Secchi Depth	Meters	--	--	1.2	--	3.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NCC
Water Temp	Celsius	0.1	--	--	--	15.7	17.1	16.2	13.2	22.7	9.1	10.3	22.1	13.6	8.3	--	14.9	11.6	22.5	12.3	12.1	23.6	12.4	15.13
Dissolved Oxygen	mg/L	0.01	--	--	5.5-9.5	10.56	8.10	6.90	8.76	7.83	10.43	10.39	8.17	9.54	8.41	--	8.60	9.98	7.65	9.90	12.08	7.49	8.06	7.16
pH	pH	N/A	--	--	--	7.39	6.57	6.64	7.06	7.35	5.89	6.28	6.20	6.11	7.58	--	6.63	6.39	7.20	6.32	6.60	7.42	6.60	6.90
Specific Conductance	uS/cm	1	--	--	--	561	279	223	265	234	125	177	174	106	366	--	186.4	215.1	199.0	250.5	431.0	263.0	210.0	0.197
INORGANICS																							
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--	6	7	7	7	9	5	6	7	7	20	--	<5	<5	6	7	31	7	7	5.2
Dissolved Chloride (Cl)	mg/L	1	--	--	120	39	64	58	67	61	24	44	43	18	55	--	45	57	57	48	63	50	46	65
Colour	TCU	30	--	--	--	54	15	21	19	12	57	32	38	65	38	--	29	8	15	11	17	10	30	31
Nitrite + Nitrate	mg/L	0.05	--	--	--	0.49	0.10	0.17	0.42	0.27	0.66	0.55	0.15	0.62	0.22	--	0.14	0.21	0.18	0.18	0.22	0.24	0.18	0.18
Nitrate (N)	mg/L	0.05	--	--	13000	0.49	--	--	0.42	0.27	--	0.55	--	--	0.22	--	0.14	0.21	0.18	0.18	0.22	0.24	0.18	0.18
Nitrite (N)	mg/L	0.05	--	--	60	<0.01	--	--	<0.01	<0.01	--	<0.01	--	--	<0.05	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	0.06	--	<0.03	<0.03	0.04	<0.03	0.04	<0.03	<0.03	<0.050
Total Organic Carbon	mg/L	0.5	--	--	--	6.5	3.6	4.7	0.7	3.3	6.7	4.6	5	8.3	5.7	--	5.3	4.2	4.1	5.1	4.0	2.0	4.4	2.7
Orthophosphate (as P)	mg/L	0.01	--	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010
pH (units)	pH	N/A	--	5.0-9.0	6.5-9	6.36	6.75	6.79	6.63	7.04	6.58	6.54	6.83	6.67	6.6	--	6.8	6.71	6.92	6.88	6.66	7.00	6.64	6.67
Total Calcium (Ca)	mg/L	0.1	--	--	--	4.5	6.9	6.4	8.37	9.02	5.90	6.02	4.99	4.64	6.0	--	6.0	6.8	6.6	6.9	6.9	9.1	7.0	6900
Total Magnesium (Mg)	mg/L	0.1	--	--	--	0.6	1.1	1.0	1.25	1.22	0.82	0.98	0.89	0.85	1.0	--	1.1	1.0	0.9	1.5	1.3	1.4	1.0	970
Total Phosphorus (1M depth)	mg/L	0.006	--	--	--	<0.02	<0.02	0.002	0.018	0.002	<0.002	0.014	0.011	0.030	0.019	--	0.03	0.006	0.007	0.047	0.012	0.030	0.02	0.005
Total Potassium (K)	mg/L	0.1	--	--	--	0.9	0.9	0.9	1.160	1.060	1.340	1.230	0.771	1.430	0.8	--	1.0	0.8	1.0	1.5	0.9	1.3	0.9	800
Total Sodium (Na)	mg/L	0.1	--	--	--	25	38	34	35.2	40.2	18.4	26.8	22.8	13.7	33.6	--	29.8	35.3	28.5	32.2	38.1	41.6	33.7	35000
Reactive Silica (SiO2)	mg/L	0.5	--	--	--	4.5	2.6	2.8	3.8	3.4	5.9	3.7	2.6	5.4	2.9	--	3.2	2.8	2.6	2.6	2.5	2.3	2.7	2.4
Total Suspended Solids	mg/L	5	--	--	--	<2	3	9	7	<2	<1	1	<2	5	9	--	6	<5	<5	23	6	<5	<5	1
Dissolved Sulphate (SO4)	mg/L	2	--	--	--	13	11	11	13	12	12	12	10	12	7	--	10	8	10	10	10	8	8	7.8
Turbidity (NTU)	NTU	0.1	--	50	--	0.4	0.5	0.6	8.2	0.9	0.5	0.6	1	1.2	0.7	--	1	0.7	1.1	19.2	1.4	0.9	1.5	0.45
Conductivity (uS/cm)	µS/cm	1	--	--	--	170	250	230	260	250	130	180	170	100	214	--	179	227	218	209	230	261	224	240
Calculated Parameters																							
Anion Sum	me/L	N/A	--	--	--	1.51	2.18	1.99	2.34	2.15	1.09	1.62	1.56	0.92	2.11	--	1.49	1.79	1.95	1.71	2.62	1.73	1.62	2.11
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--	6	7	7	7	9	5	6	7	7	20	--	<5	<5	6	7	31	7	7	5.2
Calculated TDS	mg/L	1	--	--	--	93	129	118	137	134	75	100	90	63	117	--	95	110	109	115	140	117	102	120
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	--	<10	<10	<10	<10	<10	<10	<10	<1.0
Cation Sum	me/L	N/A	--	--	--	1.40	2.11	1.89	2.11	2.33	1.20	1.58	1.35	0.95	1.89	--	1.78	2.00	1.69	2.56	2.18	2.45	1.94	1.98
Hardness (CaCO3)	mg/L	1	--	--	--	14	22	20	26	28	18	19	16	15	19.1	--	19.5	21.1	20.2	23.4	22.6	28.5	21.6	21.0
Ion Balance (% Difference)	%	N/A	--	--	--	3.78	1.63	2.58	5.17	4.02	4.80	1.25	7.22	1.60	5.5	--	9.0	5.5	7.0	19.8	9.2	17.0	9.2	3.2
Langelier Index (@ 20C)	N/A	N/A	--	--	--	-3.57	-2.90	-2.94	-2.96	-2.43	-3.25	-3.27	-2.94	-3.13	-2.91	--	-3.31	-3.35	-3.07	-3.03	-2.61	-2.79	-3.26	-3.13
Langelier Index (@ 4C)	N/A	N/A	--	--	--	-3.82	-3.15	-3.19	-3.21	-2.68	-3.50	-3.53	-3.19	-3.38	-3.23	--	-3.63	-3.67	-3.39	-3.35	-2.93	-3.11	-3.58	-3.38
Saturation pH (@ 20C)	N/A	N/A	--	--	--	9.93	9.65	9.73	9.59	9.47	9.83	9.81	9.77	9.80	9.51	--	10.10	10.1	9.99	9.91	9.27	9.79	9.90	9.80
Saturation pH (@ 4C)	N/A	N/A	--	--	--	10.20	9.90	9.98	9.84	9.72	10.10	10.10	10.00	10.10	9.83	--	10.40	10.4	10.3	10.2	9.59	10.1	10.2	10.1
Metals (ICP-MS)																							
Total Aluminum (Al)	µg/L	5	5	--	5-100	260	--	--	665	45.9	--	233	--	--	177	--	306	141	103	3920	305	129	142	140
Total Antimony (Sb)	µg/L	2	20	--	--	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	--	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Arsenic (As)	µg/L	2	5.0	--	5	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	--	<2	<2	<2	2	<2	<2	<2	<1.0
Total Barium (Ba)	µg/L	5	1000	--	--	23	--	--	35.3	24.4	--	26.6	--	--	22	--	19	20	12	40	23	23	18	21
Total Beryllium (Be)	µg/L	2	5.3	--	--	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	--	<2	<2	<2	<2	<2	<2	<2	<1.0
Total Bismuth (Bi)	µg/L	2	--	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	--	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Boron (B)	µg/L	5	1200	--	1500	8	--	--	11.3	8.6	--	<50	--	--	6	--	9	6	8	9	8	13	11	<50
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017	<0.3	--	--	0.032	<0.017	--	<0.017	--	--	<0.017	--	0.066	0.021	0.018	0.430	<0.017	0.020	<0.017	0.025
Total Chromium (Cr)	µg/L	1	1.0	--	1	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	--	<1	<1	<1	3	<1	<1	<1	<1.0
Total Cobalt (Co)	µg/L	1	10	--	--	<1	--	--	0.96	<0.40	--	<0.40	--	--	<1	--	2	<1	<1	9	<1	<1	<1	<0.40
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0	<2	--	--	2.0	<2.0	<2.0	4.0	<2.0	2.3	<2	--	<2	<2	1	6	1	<1	2	<2.0
Total Iron (Fe)	µg/L	50	300	--	300	140	--	--	837	89	161	141	315	528	137	--	742	130	205	5300	239	296	182	93
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0	<0.5	--	--	1.73	<0.50	--	<0.50	--	--	<0.5	--	0.9	<0.5	<0.5	11.5	0.9	<0.5	<0.5	<0.50
Total Manganese (Mn)	µg/L	2	820	--	--	17	--	--	142	68.9	41.3	14.4	128	62.4	48	--	214	33	58	693	54	260	49	34
Total Molybdenum (Mo)	µg/L	2	73	--	73	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	--	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Nickel (Ni)	µg/L	2	25	--	25-150	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	--	2	<2	<2	9	<2	<2	<2	<2.0
Total Selenium (Se)	µg/L	1	1.0	--	1	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	--	<1	<1	<1	<1	<1	<1	<1	<1.0
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1	<0.5	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Total Strontium (Sr)	µg/L	5	21000	--	--	18	--	--	36.3	27.1	--	25	--	--	26	--	30	31	25	34	35	37	30	32
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8	<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Total Tin (Sn)	µg/L	2	--	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	--	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Titanium (Ti)	µg/L	2	--	--	--	<2	--	--	7.8	<2.0	--	3.9	--	--	<2	--	4	<2	<2	65	4	<2	3	<2.0
Total Uranium (U)	µg/L	0.1	300	--	15	<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	0.1	--	<0.1	<0.1	<0.1	0.6	<0.1	<0.1	<0.1	<0.10
Total Vanadium (V)	µg/L	2	6	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	--	<2	<2	<2	10	<2	<2	<2	<2.0
Total Zinc (Zn)	µg/L	5	30	--	30	8	--	--	10.0	5.4	5.7	6.3	6.2	5.4	<5	--	13	8	<5	62	<5	<5	6	11
MICROBIOLOGICAL																							
Total Coliform	MPN/100mL	1	--	--	--	200	73	--	>250	>250	>250	85	>250	--	411	--	2420	866	1730	1011	613	2420	>2420	
E. coli	MPN/100mL	1	--	400	--	33	45	--	19	>250	2	2	34	<100	2	--	20	12	4	6	6	10	10	<10
Fecal Coliform	MPN/ml	--	--	400	--	--	--	<1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--	0.62	2.31	0.57	0.82	1.12	0.07	2.85	0.86	0.15	1.03	--	0.69	1.17	1.10	5.07	0.67	0.64	0.91	0.57
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--	0.64	2.21	0.64	0.74	1.04	0.06	2.75	0.76	0.15	1.10	--	0.91	1.37	1.10	6.39	0.65	0.65	0.87	0.54
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--	--	--	--	--	--	--	--	--	--	<0.4	--	0.4	--	0.4	0.8	0.4	0.4	<5	0.49

Notes:

NA - Not Applicable; NC - Not Calculable; NCC Not Collected
RDL = Recordable Detection Limit (represents most recent sampling event)
" -- " = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guideline for the protection of the environment and ecological receptors (last updated 2011)

CCME FWAL Guidelines for Aluminum, Lead, Copper and Nickel vary based on reported pH and water hardness (CCME FWAL calculation equations). The largest guideline value for each respective element range was always used.

Health Canada Guideline for Recreational Water Quality = Health Canada Guidelines for Canadian Recreational Water Quality - Draft (September 2009) (Referenced)
Nova Scotia Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table A2 Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water

Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics, Metals)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

TABLE 1: BEDFORD WEST SAMPLING PROGRAM

May 2015	Units	RDL	NSE ESQs for Surface Water (Reference)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	Paper Mill Lake																
Sample Sites						PML2																
Sampling Date	yyyy-mm-dd	--				2009/06/29	8/13/2009	10/1/2009	5/31/2010	8/24/2010	11/1/2010	5/13/2011	8/14/2011	10/16/2011	5/1/2012	8/15/2012	10/11/2012	5/15/2013	8/15/2013	10/16/2013	5/15/2014	8/14/2014	10/27/2014	5/20/2015
Sampling Time	hh:mm	--				13:15	13:40	13:45	14:30	16:20	13:00	12:40	16:20	16:15	13:16	--	--	13:40	10:45	11:20	11:00	9:20	8:30	11:30
FIELD DATA																								
Secchi Depth	Meters	--	--	1.2	--	2.8	2.2	2.3	N/A	3.0	2.0	2.2	2.3	2.2	2.35	--	--	3.20	--	N/A	N/A	N/A	3.1	NCC
Water Temp	Celsius	0.1	--	--	--	14.8	24.2	19.7	17.8	25.3	10.1	10.9	23.1	15.2	11.6	--	--	14.8	--	12.6	14.4	21.1	12.1	15.09
Dissolved Oxygen	mg/L	0.01	--	--	5.5-9.5	10.20	8.30	8.40	8.78	8.09	10.58	9.88	8.7	8.94	7.75	--	--	9.26	--	8.90	12.44	6.95	7.92	8.06
pH	pH	N/A	--	--	--	6.36	6.82	6.84	7.09	7.39	6.53	6.31	6.67	6.13	8.61	--	--	6.49	--	6.13	6.50	7.22	5.92	6.56
Specific Conductance	uS/cm	1	--	--	--	267	264	241	237	234	201	159	173	156	231	--	--	234	--	250.5	966.0	266.0	215.0	0.214
INORGANICS																								
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--	5	7	7	6	8	7	<5	8	7	21	--	--	<5	--	8	32	10	26	<5.0
Dissolved Chloride (Cl)	mg/L	1	--	--	120	63	63	58	62	58	50	44	43	34	55	--	--	63	--	64	245	50	42	69
Colour	TCU	30	--	--	--	22	17	19	20	13	23	35	38	48	39	--	--	18	--	8	6	7	31	26
Nitrite + Nitrate	mg/L	0.05	--	--	--	0.14	0.07	0.09	0.19	0.11	0.23	0.33	0.14	0.22	0.24	--	--	0.22	--	<0.05	0.13	0.18	0.18	0.11
Nitrate (N)	mg/L	0.05	--	--	13000	0.14	--	--	0.19	0.11	--	0.33	--	--	0.24	--	--	0.22	--	<0.05	0.13	0.18	0.18	0.11
Nitrite (N)	mg/L	0.05	--	--	60	<0.01	--	--	<0.01	<0.01	--	<0.01	--	--	<0.05	--	--	<0.05	--	<0.05	<0.05	<0.05	<0.05	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	--	--	0.03	--	0.23	0.05	0.03	<0.03	<0.050
Total Organic Carbon	mg/L	0.5	--	--	--	3.6	2.6	4.5	3.2	3.4	3.6	4	6	5.6	5.9	--	--	4.4	--	4.0	2.7	2.4	5.8	2.8
Orthophosphate (as P)	mg/L	0.01	--	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	--	<0.01	--	<0.01	<0.01	<0.01	<0.01	<0.010
pH (units)	pH	N/A	--	5.0-9.0	6.5-9	6.50	6.81	6.82	6.66	7.02	6.83	6.17	6.60	6.60	6.6	--	--	6.68	--	6.73	7.13	7.04	6.77	6.64
Total Calcium (Ca)	mg/L	0.1	--	--	--	6.1	7.1	6.1	7.17	7.69	7.96	5.30	4.76	5.04	6.1	--	--	6.7	--	7.7	19.2	8.8	6.9	7300
Total Magnesium (Mg)	mg/L	0.1	--	--	--	1.1	1.1	1.1	1.25	1.17	1.20	0.93	0.86	0.90	1.0	--	--	1.0	--	1.4	1.7	1.4	1.0	1000
Total Phosphorus (1M depth)	mg/L	0.006	--	--	--	<0.02	<0.02	0.002	0.010	0.002	<0.002	0.009	0.009	0.007	0.025	--	--	0.006	--	0.026	0.011	0.026	0.02	0.008
Total Potassium (K)	mg/L	0.1	--	--	--	0.9	1.0	0.9	0.984	0.900	1.020	0.861	0.801	0.968	0.8	--	--	0.8	--	1.3	1.4	1.2	1.1	830
Total Sodium (Na)	mg/L	0.1	--	--	--	35	40	34	31.1	35.1	30.8	25.7	21.3	20.9	34.6	--	--	37.5	--	42.0	133	42.6	33.9	38000
Reactive Silica (SiO2)	mg/L	0.5	--	--	--	2.6	2.5	2.3	2.6	2.3	3.3	2.9	2.5	3	2.8	--	--	2.7	--	4.2	2.4	2.3	2.9	1.9
Total Suspended Solids	mg/L	5	--	--	--	2	3	<1	15	<2	11	<1	8	<1	<5	--	--	<5	--	<5	16	<5	<5	1
Dissolved Sulphate (SO4)	mg/L	2	--	--	--	11	11	11	10	10	10	9	10	9	7	--	--	9	--	11	27	7	7	8
Turbidity (NTU)	NTU	0.1	--	50	--	0.8	0.7	0.6	1.0	0.8	0.4	0.4	3.4	0.5	0.7	--	--	1	--	3.3	2.6	0.7	1	0.88
Conductivity (uS/cm)	µS/cm	1	--	--	--	240	250	230	230	230	210	170	170	150	213	--	--	254	--	277	777	273	212	260
Calculated Parameters																								
Anion Sum	me/L	N/A	--	--	--	2.11	2.17	1.99	2.07	2.01	1.77	1.46	1.58	1.30	2.13	--	--	1.98	--	2.19	8.12	1.77	1.86	2.13
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--	5	7	7	6	8	7	<1	8	7	21	--	--	<5	--	8	32	10	26	<1.0
Calculated TDS	mg/L	1	--	--	--	123	131	117	120	120	110	91	89	79	119	--	--	119	--	137	448	118	109	130
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	--	--	<10	--	<10	<10	<10	<10	<1.0
Cation Sum	me/L	N/A	--	--	--	1.94	2.23	1.88	1.88	2.03	1.86	1.48	1.28	1.27	1.94	--	--	2.09	--	2.55	6.96	2.47	1.95	2.14
Hardness (CaCO3)	mg/L	1	--	--	--	20	22	20	23	24	25	17	15	16	19.3	--	--	20.8	--	25.0	54.9	27.7	21.3	23.0
Ion Balance (% Difference)	%	N/A	--	--	--	4.20	1.36	2.84	4.81	0.50	2.48	0.68	10.50	1.17	4.8	--	--	2.8	--	7.5	7.7	16.5	2.2	0.23
Langelier Index (@ 20C)	N/A	N/A	--	--	--	-3.33	-2.83	-2.93	-3.06	-2.55	-2.80	NC	-3.18	-3.17	-2.89	--	--	-3.39	--	-3.08	-1.73	-2.61	-2.57	NC
Langelier Index (@ 4C)	N/A	N/A	--	--	--	-3.59	-3.08	-3.18	-3.31	-2.80	-3.05	NC	-3.43	-3.42	-3.21	--	--	-3.71	--	-3.40	-2.05	-2.93	-2.89	NC
Saturation pH (@ 20C)	N/A	N/A	--	--	--	9.83	9.64	9.75	9.72	9.57	9.63	NC	9.78	9.77	9.49	--	--	10.1	--	9.81	8.86	9.65	9.34	NC
Saturation pH (@ 4C)	N/A	N/A	--	--	--	10.10	9.89	10.00	9.97	9.82	9.88	NC	10.00	10.00	9.81	--	--	10.4	--	10.1	9.18	9.97	9.66	NC
Metals (ICP-MS)																								
Total Aluminum (Al)	µg/L	5	5	--	5-100	130	--	--	1030	55.8	--	202	--	--	189	--	--	131	--	107	181	52	122	130
Total Antimony (Sb)	µg/L	2	20	--	--	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	--	--	<2	--	<2	<2	<2	<2	<1.0
Total Arsenic (As)	µg/L	2	5.0	--	5	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	--	--	<2	--	<2	<2	<2	<2	<1.0
Total Barium (Ba)	µg/L	5	1000	--	--	16	--	--	23.0	12.2	--	23	--	--	22	--	--	22	--	37	50	27	19	25
Total Beryllium (Be)	µg/L	2	5.3	--	--	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	--	--	<2	--	<2	<2	<2	<2	<1.0
Total Bismuth (Bi)	µg/L	2	--	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	--	--	<2	--	<2	<2	<2	<2	<2.0
Total Boron (B)	µg/L	5	1200	--	1500	5	--	--	8.2	8.8	--	<50	--	--	6	--	--	6	--	9	7	13	11	<50
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017	<0.3	--	--	0.037	<0.017	--	0.021	--	--	0.023	--	--	0.039	--	0.060	0.062	0.019	0.018	0.022
Total Chromium (Cr)	µg/L	1	1.0	--	1	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	--	--	<1	--	<1	<1	<1	<1	<1.0
Total Cobalt (Co)	µg/L	1	10	--	--	<1	--	--	0.65	<0.40	--	<0.40	--	--	<1	--	--	<1	--	2	<1	<1	<1	<0.40
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0	<2	--	--	3.3	<2.0	<2.0	<2.0	<2.0	<2.0	<2	--	--	<2	--	1380	1	<1	2	<2.0
Total Iron (Fe)	µg/L	50	300	--	300	100	--	--	1090	151	76	143	699	181	178	--	--	181	--	1760	264	316	134	170
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0	<0.5	--	--	2.39	<0.50	--	<0.50	--	--	<0.5	--	--	<0.5	--	48.7	0.7	<0.5	<0.5	<0.50
Total Manganese (Mn)	µg/L	2	820	--	--	58	--	--	159	81.0	28.0	23	88.6	30.6	22	--	--	87	--	866	206	278	24	43
Total Molybdenum (Mo)	µg/L	2	73	--	73	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	--	--	<2	--	<2	<2	<2	<2	<2.0
Total Nickel (Ni)	µg/L	2	25	--	25-150	2	--	--	2.2	<2.0	--	<2.0	--	--	<2	--	--	<2	--	3	<2	<2	<2	<2.0
Total Selenium (Se)	µg/L	1	1.0	--	1	<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	--	--	<1	--	<1	<1	<1	<1	<1.0
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1	<0.5	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	--	--	<0.1	--	0.1	<0.1	<0.1	<0.1	<0.10
Total Strontium (Sr)	µg/L	5	21000	--	--	30	--	--	34.7	32.8	--	25.7	--	--	27	--	--	35	--	31	68	37	29	34
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8	<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	--	--	<0.1	--	<0.1	<0.1	<0.1	<0.1	<0.10
Total Tin (Sn)	µg/L	2	--	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	--	--	<2	--	3	<2	<2	<2	<2.0
Total Titanium (Ti)	µg/L	2	--	--	--	<2	--	--	21.3	<2.0	--	3.6	--	--	<2	--	--	<2	--	2	3	<2	<2	2.1
Total Uranium (U)	µg/L	0.1	300	--	15	<0.1	--	--	0.10	<0.10	--	<0.10	--	--	0.1	--	--	<0.1	--	<0.1	<0.1	<0.1	<0.1	<0.10
Total Vanadium (V)	µg/L	2	6	--	--	<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	--	--	<2	--	<2	<2	<2	<2	<2.0
Total Zinc (Zn)	µg/L	5	30	--	30	12	--	--	18.3	<5.0	5.8	6.6	7.5	10	8	--	--	11	--	762	<5	<5	5	14
MICROBIOLOGICAL																								
Total Coliform	MPN/100mL	1	--	--	--	49	40	--	>250	46	97	64	>250	--	261	--	--	1410	--	411	291	517	>2420	--
E. coli	MPN/100mL	1	--	400	--	10	11	--	69	<1	6	17	>250	<100	1	--	--	12	--	2	<1	3	16	<0.10
Fecal Coliform	MPN/ml	--	--	400	--	--	--	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--	1.15	1.36	0.59	3.50	1.54	0.53	0.55	2.48	1.33	0.76	--	--	1.18	--	0.25	0.99	0.48	0.72	1.67
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--	1.22	1.33	0.66	3.39	1.51	0.42	0.51	2.26	1.13	0.76	--	--	1.34	--	0.27	1.13	0.44	0.7	1.56
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--	--	--	--	--	--	--	--	--	--	<0.4	--	--	--	--	1.7	<0.4	0.4	<5	0.23

Notes:

NA - Not Applicable; NC - Not Calculable; NCC Not Collected
RDL = Recordable Detection Limit (represents most recent sampling event)
" -- " = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guideline for the protection of the environment and ecological receptors (last updated 2011)
CCME FWAL Guidelines for Aluminum, Lead, Copper and Nickel vary based on reported pH and water hardness (CCME FWAL calculation equations). The largest guideline value for each respective element range was always used.
Health Canada Guideline for Recreational Water Quality = Health Canada Guidelines for Canadian Recreational Water Quality - Draft (September 2009)
Nova Scotia Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table A2 Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water

Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

Table 3: Statistical Presentation of Key Water Quality Parameters

Station 1

Station KL-1	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phosphorus (mg/L)	0.008	0.007	0.037	0.0085	0.013
Chloride (mg/L)	60	60	81	66	69.7
pH	6.62	6.52	6.94	6.72	6.74
Total Suspended Solids (mg/L)	<10	1	4	2	2.3
Conductivity (uS/cm)	220	220	310	259	265
Chlorophyll a* (µg/L)	0.64	0.40	1.73	0.64	0.84

Number of samples (n) = 7

*Acidification method

Station 2

Station KL2	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phosphorus (mg/L)	0.008	0.008	0.021	0.013	0.014
Chloride (mg/L)	15	15	48	19	26.4
pH	6.32	6.27	6.85	6.50	6.53
Total Suspended Solids (mg/L)	<1.0	<1.0	103	**	**
Conductivity (uS/cm)	64	64	212	83	115.4
Chlorophyll a* (µg/L)	0.34	0.13	0.82	0.53	0.52

Number of samples (n) = 7

*Acidification method

**Result is not representative

Station 3

Station KL3	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phosphorus (mg/L)	0.004	0.004	0.19	0.007	0.009
Chloride (mg/L)	60	50	66	56	57
pH	6.54	6.38	6.82	6.68	6.62
Total Suspended Solids (mg/L)	2.8	2	2.8	2.4	2.4
Conductivity (uS/cm)	220	197	250	220	220.6
Chlorophyll a* (µg/L)	0.72	0.52	1.44	0.78	0.94

Number of samples (n) = 7

*Acidification method

Station 4

Station KL4	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phosphorus (mg/L)	0.006	0.004	0.22	0.007	0.011
Chloride (mg/L)	61	51	67	56	57.7
pH	6.59	6.57	6.83	6.69	6.67
Total Suspended Solids (mg/L)	<1.0	2	2	2	2
Conductivity (uS/cm)	220	200	260	219	221
Chlorophyll a* (µg/L)	0.55	0.440	1.34	0.600	0.736

Number of samples (n) = 7

*Acidification method

Station 5

Station KL5	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phosphorus (mg/L)	0.005	0.005	0.018	0.008	0.010
Chloride (mg/L)	59	55	61	58.5	58.3
pH	6.56	6.56	6.71	6.67	6.65
Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
Conductivity (uS/cm)	220	215	232	224	223.8
Chlorophyll a* (µg/L)	0.46	0.20	1.44	0.39	0.61

Number of samples (n) = 4

*Acidification method

Station 6

Station HWY102-1	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phosphorus (mg/L)	0.007	0.006	0.070	0.009	0.019
Chloride (mg/L)	130	24	130	53	55
pH	6.61	4.54	6.86	6.42	6.12
Total Suspended Solids (mg/L)	<1.0	<1.0	9	7	7.3
Conductivity (uS/cm)	470	100	470	243	224
Chlorophyll a* (µg/L)	0.5	0.25	18.12	0.93	5.29

Number of samples (n) = 7

*Acidification method

Station 7

Station HWY102-2	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phosphorus (mg/L)	0.01	0.009	0.028	0.012	0.015
Chloride (mg/L)	260	21	260	71	102.7
pH	6.12	5.43	7.20	6.05	6.12
Total Suspended Solids (mg/L)	2	2	34	34	23.3
Conductivity (uS/cm)	920	85	920	295	382.4
Chlorophyll a* (µg/L)	0.53	0.53	10.34	0.97	2.58

Number of samples (n) = 7

*Acidification method

Station 8

Station LSD	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phosphorus (mg/L)	0.011	0.007	0.100	0.018	0.029
Chloride (mg/L)	32	22	49	38	35.7
pH	7.02	6.20	7.10	6.72	6.73
Total Suspended Solids (mg/L)	4.6	4	51	6	16.3
Conductivity (uS/cm)	140	96	200	150	149.4
Chlorophyll a* (µg/L)	1.02	1.02	1.91	1.34	1.45

Number of samples (n) = 7

*Acidification method

Station 9

Station LU	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phosphorus (mg/L)	0.007	0.006	0.260	0.025	0.079
Chloride (mg/L)	210	190	243	217	216.8
pH	6.95	6.42	6.95	6.81	6.75
Total Suspended Solids (mg/L)	<1.0	<1.0	626**	**	**
Conductivity (uS/cm)	790	732	819	801	788.5
Chlorophyll a* (µg/L)	0.69	0.690	99.13	1.99	25.95

Number of samples (n) = 4

*Acidification method

**not representative - TSS result collected on May 15, 2015 (626 mg/L) is approximately 100 times greater than the remainder of the spring sampling events.

Station 10

Station PML1	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phosphorus (mg/L)	0.005	0.005	0.019	0.013	0.012
Chloride (mg/L)	65	39	67	57	55.7
pH	6.67	6.36	6.71	6.63	6.59
Total Suspended Solids (mg/L)	1	1	9	6	4.8
Conductivity (uS/cm)	240	170	260	227	217.3
Chlorophyll a* (µg/L)	0.57	0.570	2.850	0.820	1.104

Number of samples (n) = 7

*Acidification method

Station 11

Station PML2	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phosphorus (mg/L)	0.008	0.006	0.025	0.010	0.012
Chloride (mg/L)	69	44	245	63	85.86
pH	6.64	6.37	7.13	6.64	6.65
Total Suspended Solids (mg/L)	1	1	16	8.5	8.5
Conductivity (uS/cm)	260	170	777	240	306.3
Chlorophyll a* (µg/L)	1.67	0.550	3.500	1.150	1.400

Number of samples (n) = 7

*Acidification method

APPENDIX A
Laboratory Certificates of Analysis

Bedford West Monitoring Results - Spring 2015
Bedford, NS
SLR Project No.: 210.05930.00000

Your P.O. #: HAL2427
Your Project #: 210.05930.00000
Site Location: BEDFORD WEST WQM
Your C.O.C. #: 513385-01-01

Attention:Ashley Gould

SLR Consulting (Canada) Ltd
115 Joseph Zatzman Drive
Dartmouth, NS
CANADA B3B 1N3

Report Date: 2015/06/01
Report #: R3449042
Version: 2 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B593678
Received: 2015/05/20, 16:28

Sample Matrix: Water
Samples Received: 11

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Carbonate, Bicarbonate and Hydroxide	11	N/A	2015/05/29	N/A	SM 22 4500-CO2 D
Alkalinity	11	N/A	2015/05/27	ATL SOP 00013	EPA 310.2 R1974 m
Chloride	11	N/A	2015/05/28	ATL SOP 00014	SM 22 4500-Cl- E m
E.coli in water (CFU/100mL)	1	N/A	2015/05/20	ATL SOP 00097	MOEE 3371/APHA 9222B
E.coli in water (CFU/100mL)	10	N/A	2015/05/21	ATL SOP 00097	MOEE 3371/APHA 9222B
Colour	11	N/A	2015/05/29	ATL SOP 00020	SM 22 2120C m
Conductance - water	11	N/A	2015/05/28	ATL SOP 00004	SM 22 2510B m
Hardness (calculated as CaCO3)	6	N/A	2015/05/27	ATL SOP 00048	SM 22 2340 B
Hardness (calculated as CaCO3)	5	N/A	2015/05/28	ATL SOP 00048	SM 22 2340 B
Metals Water Total MS	6	2015/05/25	2015/05/27	ATL SOP 00058	EPA 6020A R1 m
Metals Water Total MS	5	2015/05/27	2015/05/28	ATL SOP 00058	EPA 6020A R1 m
Ion Balance (% Difference)	11	N/A	2015/05/29		Auto Calc.
Anion and Cation Sum	11	N/A	2015/05/29		Auto Calc.
Nitrogen Ammonia - water	10	N/A	2015/05/27	ATL SOP 00015	EPA 350.1 R2 m
Nitrogen Ammonia - water	1	N/A	2015/05/28	ATL SOP 00015	EPA 350.1 R2 m
Nitrogen - Nitrate + Nitrite	11	N/A	2015/05/28	ATL SOP 00016	USGS SOPINCF0452.2 m
Nitrogen - Nitrite	11	N/A	2015/05/27	ATL SOP 00017	SM 22 4500-NO2- B m
Nitrogen - Nitrate (as N)	11	N/A	2015/05/29	ATL SOP 00018	ASTM D3867
pH (2)	11	N/A	2015/05/28	ATL SOP 00003	SM 22 4500-H+ B m
Phosphorus - ortho	11	N/A	2015/05/27	ATL SOP 00021	EPA 365.2 m
Sat. pH and Langelier Index (@ 20C)	11	N/A	2015/05/29	ATL SOP 00049	Auto Calc.
Sat. pH and Langelier Index (@ 4C)	11	N/A	2015/05/29	ATL SOP 00049	Auto Calc.
Reactive Silica	11	N/A	2015/05/28	ATL SOP 00022	EPA 366.0 m
Sulphate	11	N/A	2015/05/28	ATL SOP 00023	EPA 375.4 R1978 m
Total Dissolved Solids (TDS calc)	11	N/A	2015/05/29		Auto Calc.
Nitrogen TKN - water (as N)	11	2015/05/26	2015/05/26	ATL SOP 00019	EPA 351.2 R2 m
Organic carbon - Total (TOC) (3)	9	N/A	2015/05/22	ATL SOP 00037	SM 22 5310C m
Organic carbon - Total (TOC) (3)	2	N/A	2015/05/26	ATL SOP 00037	SM 22 5310C m
Total Phosphorus (Colourimetric) (1)	11	2015/05/28	2015/05/29	CAM SOP-00407	SM 4500 P B H m
Total Suspended Solids	11	N/A	2015/06/01	ATL SOP 00007	SM 22 2540D m

Your P.O. #: HAL2427
Your Project #: 210.05930.00000
Site Location: BEDFORD WEST WQM
Your C.O.C. #: 513385-01-01

Attention:Ashley Gould

SLR Consulting (Canada) Ltd
115 Joseph Zatzman Drive
Dartmouth, NS
CANADA B3B 1N3

Report Date: 2015/06/01
Report #: R3449042
Version: 2 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B593678
Received: 2015/05/20, 16:28

Sample Matrix: Water
Samples Received: 11

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Turbidity	1	N/A	2015/05/25	ATL SOP 00011	EPA 180.1 R2 m
Turbidity	9	N/A	2015/05/29	ATL SOP 00011	EPA 180.1 R2 m
Turbidity	1	N/A	2015/06/01	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.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Maxxam Analytics Mississauga
(2) 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.
(3) TOC / DOC present in the sample should be considered as non-purgeable TOC / DOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Michelle Hill, Project Manager
Email: MHill@maxxam.ca
Phone# (902)420-0203 Ext:289

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel: 902-420-0203 Toll-free: 800-565-7227 Fax: 902-420-8612 www.maxxamanalytics.com

Maxxam Job #: B593678
Report Date: 2015/06/01

SLR Consulting (Canada) Ltd
Client Project #: 210.05930.00000
Site Location: BEDFORD WEST WQM
Your P.O. #: HAL2427
Sampler Initials: AG

RESULTS OF ANALYSES OF WATER

Maxxam ID		AHM592		AHM593	AHM593	AHM594	AHM594		
Sampling Date		2015/05/20 10:35		2015/05/20 10:25	2015/05/20 10:25	2015/05/20 13:15	2015/05/20 13:15		
COC Number		513385-01-01		513385-01-01	513385-01-01	513385-01-01	513385-01-01		
	Units	KL3	QC Batch	KL4	KL4 Lab-Dup	HWY 102-1	HWY 102-1 Lab-Dup	RDL	QC Batch
Calculated Parameters									
Anion Sum	me/L	1.87	4030814	1.88		4.20		N/A	4030814
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	4030810	<1.0		16		1.0	4030810
Calculated TDS	mg/L	110	4030820	110		240		1.0	4030820
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	4030810	<1.0		<1.0		1.0	4030810
Cation Sum	me/L	1.89	4030814	1.91		3.94		N/A	4030814
Hardness (CaCO3)	mg/L	20	4030812	20		55		1.0	4030812
Ion Balance (% Difference)	%	0.530	4030813	0.790		3.19		N/A	4030813
Langelier Index (@ 20C)	N/A	NC	4030818	NC		-2.32			4030818
Langelier Index (@ 4C)	N/A	NC	4030819	NC		-2.57			4030819
Nitrate (N)	mg/L	0.16	4030815	0.16		<0.050		0.050	4030815
Saturation pH (@ 20C)	N/A	NC	4030818	NC		8.93			4030818
Saturation pH (@ 4C)	N/A	NC	4030819	NC		9.18			4030819
Inorganics									
Total Alkalinity (Total as CaCO3)	mg/L	<5.0	4038972	<5.0		16		5.0	4038972
Dissolved Chloride (Cl)	mg/L	60	4038974	61		130		1.0	4038974
Colour	TCU	34	4038979	33		22		5.0	4038979
Nitrate + Nitrite	mg/L	0.16	4038982	0.16		<0.050		0.050	4038982
Nitrite (N)	mg/L	<0.010	4038986	<0.010		<0.010		0.010	4038986
Nitrogen (Ammonia Nitrogen)	mg/L	<0.050	4039485	0.10		<0.050		0.050	4039485
Total Organic Carbon (C)	mg/L	3.4	4035538	2.8		2.7		0.50	4032928
Orthophosphate (P)	mg/L	<0.010	4038981	<0.010		<0.010		0.010	4038981
pH	pH	6.54	4042554	6.59		6.61	6.60	N/A	4042554
Total Phosphorus	mg/L	0.004	4041401	0.006		0.007		0.004	4041401
Reactive Silica (SiO2)	mg/L	2.5	4038978	2.5		2.1		0.50	4038978
Total Suspended Solids	mg/L	2.8	4039254	<1.0		<1.0		1.0	4039254
Dissolved Sulphate (SO4)	mg/L	7.9	4038977	7.7		13		2.0	4038977
Total Kjeldahl Nitrogen	mg/L	0.15	4037097	0.21	0.18	0.34		0.10	4037097
Turbidity	NTU	0.70	4043355	0.61		0.59		0.10	4043355
Conductivity	uS/cm	220	4042556	220		470	470	1.0	4042556

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

Maxxam Analytics International Corporation o/a Maxxam Analytics 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel: 902-420-0203 Toll-free: 800-565-7227 Fax: 902-420-8612 www.maxxamanalytics.com

Maxxam Job #: B593678
Report Date: 2015/06/01

SLR Consulting (Canada) Ltd
Client Project #: 210.05930.00000
Site Location: BEDFORD WEST WQM
Your P.O. #: HAL2427
Sampler Initials: AG

RESULTS OF ANALYSES OF WATER

Maxxam ID		AHM595	AHM595			AHM596	AHM596		
Sampling Date		2015/05/20 11:00	2015/05/20 11:00			2015/05/20 09:50	2015/05/20 09:50		
COC Number		513385-01-01	513385-01-01			513385-01-01	513385-01-01		
	Units	HWY 102-2	HWY 102-2 Lab-Dup	RDL	QC Batch	LSD	LSD Lab-Dup	RDL	QC Batch
Calculated Parameters									
Anion Sum	me/L	7.88		N/A	4030814	1.22		N/A	4030814
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	7.5		1.0	4030810	11		1.0	4030810
Calculated TDS	mg/L	460		1.0	4030820	74		1.0	4030820
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0		1.0	4030810	<1.0		1.0	4030810
Cation Sum	me/L	7.87		N/A	4030814	1.28		N/A	4030814
Hardness (CaCO3)	mg/L	59		1.0	4030812	21		1.0	4030812
Ion Balance (% Difference)	%	0.0600		N/A	4030813	2.40		N/A	4030813
Langelier Index (@ 20C)	N/A	-3.18			4030818	-2.50			4030818
Langelier Index (@ 4C)	N/A	-3.42			4030819	-2.75			4030819
Nitrate (N)	mg/L	<0.050		0.050	4030815	0.15		0.050	4030815
Saturation pH (@ 20C)	N/A	9.29			4030818	9.51			4030818
Saturation pH (@ 4C)	N/A	9.54			4030819	9.77			4030819
Inorganics									
Total Alkalinity (Total as CaCO3)	mg/L	7.5		5.0	4038972	11		5.0	4038972
Dissolved Chloride (Cl)	mg/L	260		5.0	4038974	32		1.0	4038974
Colour	TCU	17		5.0	4038979	20		5.0	4038979
Nitrate + Nitrite	mg/L	<0.050		0.050	4038982	0.15		0.050	4038982
Nitrite (N)	mg/L	<0.010		0.010	4038986	<0.010		0.010	4038986
Nitrogen (Ammonia Nitrogen)	mg/L	0.056		0.050	4039485	<0.050		0.050	4039485
Total Organic Carbon (C)	mg/L	3.0	3.0	0.50	4035538	3.2	3.3	0.50	4032928
Orthophosphate (P)	mg/L	<0.010		0.010	4038981	<0.010		0.010	4038981
pH	pH	6.12		N/A	4042554	7.02		N/A	4042554
Total Phosphorus	mg/L	0.010		0.004	4041401	0.011		0.004	4041401
Reactive Silica (SiO2)	mg/L	2.3		0.50	4038978	2.4		0.50	4038978
Total Suspended Solids	mg/L	2.0		1.0	4039254	4.6		1.0	4039254
Dissolved Sulphate (SO4)	mg/L	15		2.0	4038977	4.8		2.0	4038977
Total Kjeldahl Nitrogen	mg/L	0.33		0.10	4037097	0.29		0.10	4037097
Turbidity	NTU	1.2		0.10	4043355	1.2		0.10	4043355
Conductivity	uS/cm	920		1.0	4042556	140		1.0	4042556

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

Maxxam Analytics International Corporation o/a Maxxam Analytics 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel: 902-420-0203 Toll-free: 800-565-7227 Fax: 902-420-8612 www.maxxamanalytics.com

Maxxam Job #: B593678
Report Date: 2015/06/01

SLR Consulting (Canada) Ltd
Client Project #: 210.05930.00000
Site Location: BEDFORD WEST WQM
Your P.O. #: HAL2427
Sampler Initials: AG

RESULTS OF ANALYSES OF WATER

Maxxam ID		AHM597	AHM597			AHM598		AHM599		
Sampling Date		2015/05/20 13:45	2015/05/20 13:45			2015/05/20 12:45		2015/05/20 11:30		
COC Number		513385-01-01	513385-01-01			513385-01-01		513385-01-01		
	Units	LU	LU Lab-Dup	RDL	QC Batch	PML-1	QC Batch	PML-2	RDL	QC Batch
Calculated Parameters										
Anion Sum	me/L	6.77		N/A	4030814	2.11	4030814	2.13	N/A	4030814
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	13		1.0	4030810	5.2	4030810	<1.0	1.0	4030810
Calculated TDS	mg/L	400		1.0	4030820	120	4030820	130	1.0	4030820
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0		1.0	4030810	<1.0	4030810	<1.0	1.0	4030810
Cation Sum	me/L	6.69		N/A	4030814	1.98	4030814	2.14	N/A	4030814
Hardness (CaCO3)	mg/L	84		1.0	4030812	21	4030812	23	1.0	4030812
Ion Balance (% Difference)	%	0.590		N/A	4030813	3.18	4030813	0.230	N/A	4030813
Langelier Index (@ 20C)	N/A	-1.95			4030818	-3.13	4030818	NC		4030818
Langelier Index (@ 4C)	N/A	-2.20			4030819	-3.38	4030819	NC		4030819
Nitrate (N)	mg/L	0.53		0.050	4030815	0.18	4030815	0.11	0.050	4030815
Saturation pH (@ 20C)	N/A	8.90			4030818	9.80	4030818	NC		4030818
Saturation pH (@ 4C)	N/A	9.15			4030819	10.1	4030819	NC		4030819
Inorganics										
Total Alkalinity (Total as CaCO3)	mg/L	13		5.0	4038972	5.2	4038972	<5.0	5.0	4038972
Dissolved Chloride (Cl)	mg/L	210		5.0	4038974	65	4038974	69	1.0	4038974
Colour	TCU	8.4		5.0	4038979	31	4038979	26	5.0	4038979
Nitrate + Nitrite	mg/L	0.53		0.050	4038982	0.18	4038982	0.11	0.050	4038982
Nitrite (N)	mg/L	<0.010		0.010	4038986	<0.010	4038986	<0.010	0.010	4038986
Nitrogen (Ammonia Nitrogen)	mg/L	<0.050		0.050	4039485	<0.050	4039485	<0.050	0.050	4039485
Total Organic Carbon (C)	mg/L	2.2		0.50	4032928	2.7	4032928	2.8	0.50	4032928
Orthophosphate (P)	mg/L	<0.010		0.010	4038981	<0.010	4038981	<0.010	0.010	4038981
pH	pH	6.95		N/A	4042554	6.67	4042554	6.64	N/A	4042554
Total Phosphorus	mg/L	0.007		0.004	4041401	0.005	4041401	0.008	0.004	4041401
Reactive Silica (SiO2)	mg/L	3.6		0.50	4038978	2.4	4038978	1.9	0.50	4038978
Total Suspended Solids	mg/L	<1.0		1.0	4039254	1.0	4039254	1.0	1.0	4039737
Dissolved Sulphate (SO4)	mg/L	27		2.0	4038977	7.8	4038977	8.0	2.0	4038977
Total Kjeldahl Nitrogen	mg/L	0.30		0.10	4037097	0.49	4037114	0.23	0.10	4037114
Turbidity	NTU	0.30	0.31	0.10	4036070	0.45	4043355	0.88	0.10	4043355
Conductivity	uS/cm	790		1.0	4042556	240	4042556	260	1.0	4042556

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B593678
Report Date: 2015/06/01

SLR Consulting (Canada) Ltd
Client Project #: 210.05930.00000
Site Location: BEDFORD WEST WQM
Your P.O. #: HAL2427
Sampler Initials: AG

RESULTS OF ANALYSES OF WATER

Maxxam ID		AHM599	AHM784		AHM785			AHM786		
Sampling Date		2015/05/20 11:30	2015/05/20 08:30		2015/05/20 09:15			2015/05/20 09:00		
COC Number		513385-01-01	513385-01-01		513385-01-01			513385-01-01		
	Units	PML-2 Lab-Dup	KL1	RDL	KL2	RDL	QC Batch	KL5	RDL	QC Batch
Calculated Parameters										
Anion Sum	me/L		1.98	N/A	0.480	N/A	4030814	1.94	N/A	4030814
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		5.2	1.0	<1.0	1.0	4030810	5.4	1.0	4030810
Calculated TDS	mg/L		120	1.0	32	1.0	4030820	120	1.0	4030820
Carb. Alkalinity (calc. as CaCO3)	mg/L		<1.0	1.0	<1.0	1.0	4030810	<1.0	1.0	4030810
Cation Sum	me/L		1.84	N/A	0.570	N/A	4030814	1.87	N/A	4030814
Hardness (CaCO3)	mg/L		20	1.0	9.1	1.0	4030812	20	1.0	4030812
Ion Balance (% Difference)	%		3.66	N/A	8.57	N/A	4030813	1.84	N/A	4030813
Langelier Index (@ 20C)	N/A		-3.21		NC		4030818	-3.24		4030818
Langelier Index (@ 4C)	N/A		-3.46		NC		4030819	-3.50		4030819
Nitrate (N)	mg/L		0.15	0.050	0.059	0.050	4030815	0.16	0.050	4030815
Saturation pH (@ 20C)	N/A		9.83		NC		4030818	9.81		4030818
Saturation pH (@ 4C)	N/A		10.1		NC		4030819	10.1		4030819
Inorganics										
Total Alkalinity (Total as CaCO3)	mg/L	5.4	5.2	5.0	<5.0	5.0	4038972	5.4	5.0	4038972
Dissolved Chloride (Cl)	mg/L	69	60	1.0	15	1.0	4038974	59	1.0	4038974
Colour	TCU	26	37	5.0	50	10	4038979	35	5.0	4038979
Nitrate + Nitrite	mg/L	0.10	0.15	0.050	0.059	0.050	4038982	0.16	0.050	4038982
Nitrite (N)	mg/L	<0.010	<0.010	0.010	<0.010	0.010	4038986	<0.010	0.010	4038986
Nitrogen (Ammonia Nitrogen)	mg/L		<0.050	0.050	<0.050	0.050	4039485	<0.050	0.050	4039485
Total Organic Carbon (C)	mg/L		3.0	0.50	4.0	0.50	4032928	3.1	0.50	4032928
Orthophosphate (P)	mg/L	<0.010	<0.010	0.010	<0.010	0.010	4038981	<0.010	0.010	4038981
pH	pH		6.62	N/A	6.32	N/A	4042554	6.56	N/A	4042554
Total Phosphorus	mg/L		0.008	0.004	0.008	0.004	4041401	0.005	0.004	4041401
Reactive Silica (SiO2)	mg/L	1.9	2.5	0.50	2.0	0.50	4038978	3.3	0.50	4038978
Total Suspended Solids	mg/L		<1.0	1.0	<1.0	1.0	4039737	<1.0	1.0	4039737
Dissolved Sulphate (SO4)	mg/L	8.5	8.7	2.0	2.8	2.0	4038977	8.0	2.0	4038977
Total Kjeldahl Nitrogen	mg/L		0.22	0.10	0.40	0.10	4037114	0.31	0.10	4037114
Turbidity	NTU		0.81	0.10	1.2	0.10	4043355	0.71	0.10	4045764
Conductivity	uS/cm		220	1.0	64	1.0	4042556	220	1.0	4042556

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B593678
Report Date: 2015/06/01

SLR Consulting (Canada) Ltd
Client Project #: 210.05930.00000
Site Location: BEDFORD WEST WQM
Your P.O. #: HAL2427
Sampler Initials: AG

RESULTS OF ANALYSES OF WATER

Maxxam ID		AHM786		
Sampling Date		2015/05/20 09:00		
COC Number		513385-01-01		
	Units	**KL5 Lab-Dup**	**RDL**	**QC Batch**
Inorganics				
Nitrogen (Ammonia Nitrogen)	mg/L	<0.050	0.050	4039485

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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Sampler Initials: AG

ELEMENTS BY ICP/MS (WATER)

Maxxam ID		AHM592	AHM593	AHM594	AHM595	AHM596	AHM597		
Sampling Date		2015/05/20 10:35	2015/05/20 10:25	2015/05/20 13:15	2015/05/20 11:00	2015/05/20 09:50	2015/05/20 13:45		
COC Number		513385-01-01	513385-01-01	513385-01-01	513385-01-01	513385-01-01	513385-01-01		
	Units	KL3	KL4	HWY 102-1	HWY 102-2	LSD	LU	RDL	QC Batch
Metals									
Total Aluminum (Al)	ug/L	180	160	51	100	120	59	5.0	4035321
Total Antimony (Sb)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	4035321
Total Arsenic (As)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	4035321
Total Barium (Ba)	ug/L	19	20	130	140	12	150	1.0	4035321
Total Beryllium (Be)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	4035321
Total Bismuth (Bi)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	4035321
Total Boron (B)	ug/L	<50	<50	<50	<50	<50	<50	50	4035321
Total Cadmium (Cd)	ug/L	0.033	0.033	0.024	0.10	0.011	0.15	0.010	4035321
Total Calcium (Ca)	ug/L	6600	6500	18000	20000	6100	27000	100	4035321
Total Chromium (Cr)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	4035321
Total Cobalt (Co)	ug/L	<0.40	<0.40	<0.40	1.8	<0.40	<0.40	0.40	4035321
Total Copper (Cu)	ug/L	<2.0	6.8	<2.0	<2.0	<2.0	2.1	2.0	4035321
Total Iron (Fe)	ug/L	120	100	140	960	230	170	50	4035321
Total Lead (Pb)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	4035321
Total Magnesium (Mg)	ug/L	940	920	2400	2500	1300	3800	100	4035321
Total Manganese (Mn)	ug/L	36	25	28	470	130	110	2.0	4035321
Total Molybdenum (Mo)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	4035321
Total Nickel (Ni)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	4035321
Total Phosphorus (P)	ug/L	<100	<100	<100	<100	<100	<100	100	4035321
Total Potassium (K)	ug/L	770	760	2000	1900	1100	3300	100	4035321
Total Selenium (Se)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	4035321
Total Silver (Ag)	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	4035321
Total Sodium (Na)	ug/L	34000	34000	64000	150000	19000	110000	100	4035321
Total Strontium (Sr)	ug/L	29	30	85	96	25	120	2.0	4035321
Total Thallium (Tl)	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	4035321
Total Tin (Sn)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	4035321
Total Titanium (Ti)	ug/L	2.7	<2.0	<2.0	<2.0	3.3	<2.0	2.0	4035321
Total Uranium (U)	ug/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	4035321
Total Vanadium (V)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	4035321
Total Zinc (Zn)	ug/L	8.7	9.6	11	27	<5.0	27	5.0	4035321

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B593678
Report Date: 2015/06/01

SLR Consulting (Canada) Ltd
Client Project #: 210.05930.00000
Site Location: BEDFORD WEST WQM
Your P.O. #: HAL2427
Sampler Initials: AG

ELEMENTS BY ICP/MS (WATER)

Maxxam ID		AHM598	AHM599	AHM784	AHM785	AHM786		
Sampling Date		2015/05/20 12:45	2015/05/20 11:30	2015/05/20 08:30	2015/05/20 09:15	2015/05/20 09:00		
COC Number		513385-01-01	513385-01-01	513385-01-01	513385-01-01	513385-01-01		
	Units	PML-1	PML-2	KL1	KL2	KL5	RDL	QC Batch
Metals								
Total Aluminum (Al)	ug/L	140	130	180	180	180	5.0	4037042
Total Antimony (Sb)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	4037042
Total Arsenic (As)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	4037042
Total Barium (Ba)	ug/L	21	25	16	9.2	17	1.0	4037042
Total Beryllium (Be)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	4037042
Total Bismuth (Bi)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	4037042
Total Boron (B)	ug/L	<50	<50	<50	<50	<50	50	4037042
Total Cadmium (Cd)	ug/L	0.025	0.023	0.031	0.014	0.035	0.010	4037042
Total Calcium (Ca)	ug/L	6900	7300	6400	2600	6500	100	4037042
Total Chromium (Cr)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	4037042
Total Cobalt (Co)	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	4037042
Total Copper (Cu)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	4037042
Total Iron (Fe)	ug/L	93	170	110	250	100	50	4037042
Total Lead (Pb)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	4037042
Total Magnesium (Mg)	ug/L	970	1000	920	640	930	100	4037042
Total Manganese (Mn)	ug/L	34	43	39	47	34	2.0	4037042
Total Molybdenum (Mo)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	4037042
Total Nickel (Ni)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	4037042
Total Phosphorus (P)	ug/L	<100	<100	<100	<100	<100	100	4037042
Total Potassium (K)	ug/L	800	830	680	540	720	100	4037042
Total Selenium (Se)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	4037042
Total Silver (Ag)	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	4037042
Total Sodium (Na)	ug/L	35000	38000	33000	8400	33000	100	4037042
Total Strontium (Sr)	ug/L	32	34	29	12	29	2.0	4037042
Total Thallium (Tl)	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	4037042
Total Tin (Sn)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	4037042
Total Titanium (Ti)	ug/L	<2.0	2.1	2.3	2.5	2.3	2.0	4037042
Total Uranium (U)	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	0.10	4037042
Total Vanadium (V)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	4037042
Total Zinc (Zn)	ug/L	11	14	13	<5.0	14	5.0	4037042

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B593678
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Client Project #: 210.05930.00000
Site Location: BEDFORD WEST WQM
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Sampler Initials: AG

MICROBIOLOGY (WATER)

Maxxam ID		AHM592	AHM593	AHM594	AHM595	AHM596	AHM597		
Sampling Date		2015/05/20 10:35	2015/05/20 10:25	2015/05/20 13:15	2015/05/20 11:00	2015/05/20 09:50	2015/05/20 13:45		
COC Number		513385-01-01	513385-01-01	513385-01-01	513385-01-01	513385-01-01	513385-01-01		
	Units	KL3	KL4	HWY 102-1	HWY 102-2	LSD	LU	RDL	QC Batch
Microbiological									
Escherichia coli	CFU/100mL	<10	<10	20	<10	<10	<10	10	4030941

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		AHM598	AHM599		AHM784		AHM785		
Sampling Date		2015/05/20 12:45	2015/05/20 11:30		2015/05/20 08:30		2015/05/20 09:15		
COC Number		513385-01-01	513385-01-01		513385-01-01		513385-01-01		
	Units	PML-1	PML-2	QC Batch	KL1	QC Batch	KL2	RDL	QC Batch
Microbiological									
Escherichia coli	CFU/100mL	<10	<10	4030941	60	4030943	30	10	4030940

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		AHM786		
Sampling Date		2015/05/20 09:00		
COC Number		513385-01-01		
	Units	KL5	RDL	QC Batch
Microbiological				
Escherichia coli	CFU/100mL	<10	10	4030940

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: B593678
Report Date: 2015/06/01

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Site Location: BEDFORD WEST WQM
Your P.O. #: HAL2427
Sampler Initials: AG

GENERAL COMMENTS

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

Package 1	2.7°C
Package 2	1.0°C

Sample AHM785-01 : RCAp Ion Balance acceptable. Anion/cation agreement within 0.2 meq/L.

Results relate only to the items tested.

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Report Date: 2015/06/01

QUALITY ASSURANCE REPORT

SLR Consulting (Canada) Ltd
Client Project #: 210.05930.00000
Site Location: BEDFORD WEST WQM
Your P.O. #: HAL2427
Sampler Initials: AG

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
4030940	Escherichia coli	2015/05/21					<1.0	CFU/100 mL				
4030941	Escherichia coli	2015/05/21					<1.0	CFU/100 mL				
4030943	Escherichia coli	2015/05/20					<1.0	CFU/100 mL				
4032928	Total Organic Carbon (C)	2015/05/22	102	80 - 120	98	80 - 120	<0.50	mg/L	4.2	20		
4035321	Total Aluminum (Al)	2015/05/27	105	80 - 120	106	80 - 120	<5.0	ug/L	NC	20		
4035321	Total Antimony (Sb)	2015/05/27	113	80 - 120	110	80 - 120	<1.0	ug/L	NC	20		
4035321	Total Arsenic (As)	2015/05/27	100	80 - 120	99	80 - 120	<1.0	ug/L	NC	20		
4035321	Total Barium (Ba)	2015/05/27	NC	80 - 120	106	80 - 120	<1.0	ug/L	0.45	20		
4035321	Total Beryllium (Be)	2015/05/27	102	80 - 120	103	80 - 120	<1.0	ug/L	NC	20		
4035321	Total Bismuth (Bi)	2015/05/27	108	80 - 120	108	80 - 120	<2.0	ug/L	NC	20		
4035321	Total Boron (B)	2015/05/27	119	80 - 120	118	80 - 120	<50	ug/L	NC	20		
4035321	Total Cadmium (Cd)	2015/05/27	104	80 - 120	102	80 - 120	<0.010	ug/L	NC	20		
4035321	Total Calcium (Ca)	2015/05/27	NC	80 - 120	104	80 - 120	<100	ug/L	1.6	20		
4035321	Total Chromium (Cr)	2015/05/27	99	80 - 120	99	80 - 120	<1.0	ug/L	NC	20		
4035321	Total Cobalt (Co)	2015/05/27	99	80 - 120	99	80 - 120	<0.40	ug/L	NC	20		
4035321	Total Copper (Cu)	2015/05/27	96	80 - 120	95	80 - 120	<2.0	ug/L	NC	20		
4035321	Total Iron (Fe)	2015/05/27	NC	80 - 120	103	80 - 120	<50	ug/L	NC	20		
4035321	Total Lead (Pb)	2015/05/27	108	80 - 120	105	80 - 120	<0.50	ug/L	NC	20		
4035321	Total Magnesium (Mg)	2015/05/27	105	80 - 120	103	80 - 120	<100	ug/L	1.8	20		
4035321	Total Manganese (Mn)	2015/05/27	NC	80 - 120	103	80 - 120	<2.0	ug/L	1.2	20		
4035321	Total Molybdenum (Mo)	2015/05/27	109	80 - 120	106	80 - 120	<2.0	ug/L	NC	20		
4035321	Total Nickel (Ni)	2015/05/27	99	80 - 120	96	80 - 120	<2.0	ug/L	NC	20		
4035321	Total Phosphorus (P)	2015/05/27	106	80 - 120	105	80 - 120	<100	ug/L	NC	20		
4035321	Total Potassium (K)	2015/05/27	109	80 - 120	108	80 - 120	<100	ug/L	0.21	20		
4035321	Total Selenium (Se)	2015/05/27	99	80 - 120	98	80 - 120	<1.0	ug/L	NC	20		
4035321	Total Silver (Ag)	2015/05/27	106	80 - 120	106	80 - 120	<0.10	ug/L	NC	20		
4035321	Total Sodium (Na)	2015/05/27	107	80 - 120	104	80 - 120	<100	ug/L	0.14	20		
4035321	Total Strontium (Sr)	2015/05/27	NC	80 - 120	104	80 - 120	<2.0	ug/L	0.0073	20		

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Maxxam Job #: B593678
Report Date: 2015/06/01

QUALITY ASSURANCE REPORT(CONT'D)

SLR Consulting (Canada) Ltd
Client Project #: 210.05930.00000
Site Location: BEDFORD WEST WQM
Your P.O. #: HAL2427
Sampler Initials: AG

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
4035321	Total Thallium (Tl)	2015/05/27	109	80 - 120	107	80 - 120	<0.10	ug/L	NC	20		
4035321	Total Tin (Sn)	2015/05/27	112	80 - 120	107	80 - 120	<2.0	ug/L	NC	20		
4035321	Total Titanium (Ti)	2015/05/27	103	80 - 120	105	80 - 120	<2.0	ug/L	NC	20		
4035321	Total Uranium (U)	2015/05/27	112	80 - 120	107	80 - 120	<0.10	ug/L	NC	20		
4035321	Total Vanadium (V)	2015/05/27	103	80 - 120	102	80 - 120	<2.0	ug/L	NC	20		
4035321	Total Zinc (Zn)	2015/05/27	102	80 - 120	100	80 - 120	<5.0	ug/L	NC	20		
4035538	Total Organic Carbon (C)	2015/05/26	94	80 - 120	97	80 - 120	<0.50	mg/L	2.7	20		
4036070	Turbidity	2015/05/25					<0.10	NTU	NC	25	93	80 - 120
4037042	Total Aluminum (Al)	2015/05/28	108	80 - 120	105	80 - 120	<5.0	ug/L				
4037042	Total Antimony (Sb)	2015/05/28	115	80 - 120	113	80 - 120	<1.0	ug/L				
4037042	Total Arsenic (As)	2015/05/28	105	80 - 120	101	80 - 120	<1.0	ug/L	NC	20		
4037042	Total Barium (Ba)	2015/05/28	NC	80 - 120	103	80 - 120	<1.0	ug/L				
4037042	Total Beryllium (Be)	2015/05/28	106	80 - 120	101	80 - 120	<1.0	ug/L				
4037042	Total Bismuth (Bi)	2015/05/28	107	80 - 120	109	80 - 120	<2.0	ug/L				
4037042	Total Boron (B)	2015/05/28	115	80 - 120	112	80 - 120	<50	ug/L				
4037042	Total Cadmium (Cd)	2015/05/28	105	80 - 120	102	80 - 120	<0.010	ug/L				
4037042	Total Calcium (Ca)	2015/05/28	NC	80 - 120	104	80 - 120	<100	ug/L				
4037042	Total Chromium (Cr)	2015/05/28	101	80 - 120	100	80 - 120	<1.0	ug/L				
4037042	Total Cobalt (Co)	2015/05/28	101	80 - 120	100	80 - 120	<0.40	ug/L				
4037042	Total Copper (Cu)	2015/05/28	97	80 - 120	98	80 - 120	<2.0	ug/L				
4037042	Total Iron (Fe)	2015/05/28	104	80 - 120	105	80 - 120	<50	ug/L				
4037042	Total Lead (Pb)	2015/05/28	107	80 - 120	106	80 - 120	<0.50	ug/L				
4037042	Total Magnesium (Mg)	2015/05/28	NC	80 - 120	104	80 - 120	<100	ug/L				
4037042	Total Manganese (Mn)	2015/05/28	NC	80 - 120	105	80 - 120	<2.0	ug/L				
4037042	Total Molybdenum (Mo)	2015/05/28	109	80 - 120	104	80 - 120	<2.0	ug/L				
4037042	Total Nickel (Ni)	2015/05/28	100	80 - 120	101	80 - 120	<2.0	ug/L				
4037042	Total Phosphorus (P)	2015/05/28	110	80 - 120	106	80 - 120	<100	ug/L				
4037042	Total Potassium (K)	2015/05/28	107	80 - 120	106	80 - 120	<100	ug/L				
4037042	Total Selenium (Se)	2015/05/28	99	80 - 120	98	80 - 120	<1.0	ug/L				
4037042	Total Silver (Ag)	2015/05/28	108	80 - 120	106	80 - 120	<0.10	ug/L				

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Maxxam Job #: B593678
Report Date: 2015/06/01

QUALITY ASSURANCE REPORT(CONT'D)

SLR Consulting (Canada) Ltd
Client Project #: 210.05930.00000
Site Location: BEDFORD WEST WQM
Your P.O. #: HAL2427
Sampler Initials: AG

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
4037042	Total Sodium (Na)	2015/05/28	104	80 - 120	104	80 - 120	<100	ug/L				
4037042	Total Strontium (Sr)	2015/05/28	NC	80 - 120	106	80 - 120	<2.0	ug/L				
4037042	Total Thallium (Tl)	2015/05/28	109	80 - 120	107	80 - 120	<0.10	ug/L				
4037042	Total Tin (Sn)	2015/05/28	113	80 - 120	111	80 - 120	<2.0	ug/L				
4037042	Total Titanium (Ti)	2015/05/28	109	80 - 120	107	80 - 120	<2.0	ug/L				
4037042	Total Uranium (U)	2015/05/28	112	80 - 120	110	80 - 120	<0.10	ug/L				
4037042	Total Vanadium (V)	2015/05/28	104	80 - 120	103	80 - 120	<2.0	ug/L				
4037042	Total Zinc (Zn)	2015/05/28	100	80 - 120	102	80 - 120	<5.0	ug/L				
4037097	Total Kjeldahl Nitrogen	2015/05/26	119	80 - 120	107	80 - 120	<0.10	mg/L	NC	25		
4037114	Total Kjeldahl Nitrogen	2015/05/26	87	80 - 120	104	80 - 120	<0.10	mg/L	14	25		
4038972	Total Alkalinity (Total as CaCO3)	2015/05/27	102	80 - 120	97	80 - 120	<5.0	mg/L	NC	25		
4038974	Dissolved Chloride (Cl)	2015/05/28	NC	80 - 120	100	80 - 120	<1.0	mg/L	0.64	25	106	80 - 120
4038977	Dissolved Sulphate (SO4)	2015/05/28	107	80 - 120	91	80 - 120	<2.0	mg/L	NC	25		
4038978	Reactive Silica (SiO2)	2015/05/28	99	80 - 120	97	80 - 120	<0.50	mg/L	NC	25		
4038979	Colour	2015/05/29			102	80 - 120	<5.0	TCU	1.2	25		
4038981	Orthophosphate (P)	2015/05/27	98	80 - 120	104	80 - 120	<0.010	mg/L	NC	25		
4038982	Nitrate + Nitrite	2015/05/28	99	80 - 120	102	80 - 120	<0.050	mg/L	NC	25		
4038986	Nitrite (N)	2015/05/27	98	80 - 120	101	80 - 120	<0.010	mg/L	NC	25		
4039254	Total Suspended Solids	2015/06/01					<1.0	mg/L	9.5	25	97	80 - 120
4039485	Nitrogen (Ammonia Nitrogen)	2015/05/28	99	80 - 120	100	80 - 120	0.053, RDL=0.050	mg/L	NC	25		
4039737	Total Suspended Solids	2015/06/01					<1.0	mg/L	12	25	97	80 - 120
4041401	Total Phosphorus	2015/05/29	102	80 - 120	100	80 - 120	<0.004	mg/L	NC	20	106	80 - 120
4042554	pH	2015/05/28			100	N/A	1.40	pH	0.15	N/A		
4042556	Conductivity	2015/05/28			106	80 - 120	1.4, RDL=1.0	uS/cm	0.22	25		
4043355	Turbidity	2015/05/29					<0.10	NTU	4.4	25	98	80 - 120

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Maxxam Job #: B593678
Report Date: 2015/06/01

QUALITY ASSURANCE REPORT(CONT'D)

SLR Consulting (Canada) Ltd
Client Project #: 210.05930.00000
Site Location: BEDFORD WEST WQM
Your P.O. #: HAL2427
Sampler Initials: AG

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
4045764	Turbidity	2015/06/01					<0.10	NTU	3.7	25	102	80 - 120

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

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Maxxam Job #: B593678
Report Date: 2015/06/01

SLR Consulting (Canada) Ltd
Client Project #: 210.05930.00000
Site Location: BEDFORD WEST WQM
Your P.O. #: HAL2427
Sampler Initials: AG

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Original Signed

Andrew VanWychen, Bedford Micro

Original Signed

Cristina Carriere, Scientific Services

Original Signed

Mike MacGillivray, Scientific Specialist (Inorganics)

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Chain Of Custody Record

INVOICE TO:		Report Information		Project Information		Laboratory Use Only	
Company Name	#21542 SLR Consulting (Canada) Ltd	Company Name		Quotation #	B53522	Maxxam Job #	Bottle Order #:
Contact Name	Ashley Gould	Contact Name		P.O. #	HAL-242-F	B593678	513385
Address	115 Joseph Zatzman Drive Dartmouth NS B3B 1N3	Address		Project #	210.05930.00000	Chain Of Custody Record	Project Manager
Phone	(902) 420-0040 Fax: (902) 420-9703	Phone	Fax:	Project Name	Bedford West WQM	C#513385-01-01	Michelle Hill
Email	agould@slrconsulting.com, analytical@slrconsulting.com	Email		Site #			
				Sampled By	AG/MM		

Original Signed

Regulatory Criteria:

Special Instructions

** Specify Matrix: Surface/Ground/Tapwater/Sewage/Effluent/Seawater Potable/Non-potable/Tissue/Soil/Sludge/Metal

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

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

Turnaround Time (TAT) Required:

Please provide advance notice for rush projects

Regular (Standard) TAT:
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests..
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: Time Required:

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered & Preserved	Lab Filtration Required	E.coli in water (CFU/100mL)	Total Phosphorus (Low Level TOTPLOW-W)	Nitrogen TKN - water (as N)	Total Suspended Solids	Chlorophyll A (Maxxam Burnaby)	RCAp-MS Total Metals	# of Bottles	Comments / Hazards / Other Required Analysis
1	SID#284631	KL1	May 20 2015	830am	SW			X	X	X	X	X	X	9	
2	SID#284632	KL2		915 AM	SW			X	X	X	X	X	X		
3	SID#284633	KL3		1035am	SW			X	X	X	X	X	X		
4	SID#284634	KL4		1025am	SW			X	X	X	X	X	X		
5	SID#284635	KL5		900am	SW			X	X	X	X	X	X		
6	SID#284636	HWY 102-1		115PM	SW			X	X	X	X	X	X		
7	SID#284637	HWY 102-2		11:00AM	SW			X	X	X	X	X	X		
8	SID#284638	LSD		950AM	SW			X	X	X	X	X	X		
9	SID#284639	LU		145PM	SW			X	X	X	X	X	X		
10	SID#284640	PML-1		1245PM	SW			X	X	X	X	X	X		

B593678

2015 MAY 29 16:28

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
Original Signed	15/20/15		Original Signed			

Lab Use Only

Time Sensitive	Temperature (°C) on Receipt	Custody Seal Intact on Cooler?
☐	2,1,2 0,0,3	☐ Yes ☐ No

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

White: Maxxam Yellow: Client

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Chain Of Custody Record

INVOICE TO:		Report Information		Project Information		Laboratory Use Only	
Company Name	#21542 SLR Consulting (Canada) Ltd	Company Name		Quotation #	B53522	Maxxam Job #	Bottle Order #:
Contact Name	Ashley Gould	Contact Name		P.O. #	HAL2427	B593078	513385
Address	115 Joseph Zatzman Drive Dartmouth NS B3B 1N3	Address		Project #	210.05930.00000	Chain Of Custody Record	Project Manager
Phone	(902) 420-0040 Fax: (902) 420-9703	Phone	Fax:	Project Name	Bedford West WQM	C#513385-02-01	Michelle Hill
Email	agould@slrconsulting.com, analytical@slrconsulting.com	Email		Site #			
				Sampled By	AG/MM		

Original Signed

Regulatory Criteria:

Special Instructions

** Specify Matrix: Surface/Ground/Tapwater/Sewage/Effluent/Seawater
Potable/Nonpotable/Tissue/Soil/Sludge/Metal

SAMPLES MUST BE KEPT COOL (< 10ºC) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

Turnaround Time (TAT) Required:

Please provide advance notice for rush projects

Regular (Standard) TAT:
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests..
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: Time Required:

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered & Preserved	Lab Filtration Required	E.coli in water (CFU/100mL)	Total Phosphorus (Low Level TOTPLOW-W)	Nitrogen TKN - water (as N)	Total Suspended Solids	Chlorophyll A (Maxxam Burnaby)	RCAp-MS Total Metals	# of Bottles	Comments / Hazards / Other Required Analysis
1	SID#284641	PML-2	May 20 2015	1130am	SW			X	X	X	X	X	X	9	
2															
3															
4															
5															
6															
7															
8															
9															
10															

* * RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Lab Use Only		
Original Signed	15/20/15		Original Signed				Time Sensitive ☐	Temperature (ºC) on Receipt 2,1,2 0,0,3	Custody Seal Intact on Cooler? ☐ Yes ☐ No

2015 MAY 21 16:28

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

White: Maxxam Yellow: Client

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APPENDIX B
Field Reports

Bedford West Monitoring Results - Spring 2015
Bedford, NS
SLR Project No.: 210.05930.00000

Bedford West Water Quality Monitoring
FIELD REPORT

Site Address:	Kearney Lake (On Hamshaw Drive)		**Report Date:**	June 10th, 2015	
Field Personnel:	Mike McKenzie		**Sample ID's:**	KL-1	
GPS Coordinates:	20T 0445718 E, 4948496 N (UTM, NAD 83)		**Monitoring date(s):**	May 20th, 2015	
Project number:	210.05930.00000				
Watercourse (Circle One)	Lake	River	Outlet	Inlet	Other:

Site Conditions

Weather	Cloudy, Light Drizzle
Air Temperature	10 ^{o}C
Cloud Cover	100%
Wildlife Sightings	Crows and other birds
Accessibility	Park Entrance, Directly On Beach

Site Description:

Sandy beach, minimal leaf litter, clear appearance, kayaks present on water.

Field Parameter Data:

Date & Time	May 20th, 2015 @ 8:30am
Sample Depth	0.5m
pH	8.33
Dissolved Oxygen (mg/L)	9.55
Dissolved Oxygen (%)	95.5
Secchi Depth (m)	N/A
Water Temperature	14.12 Celcius
Conductivity (mS/cm)	0.182 mS/cm

Additional Comments, Sketches, Notes, Logger Installation Information:

Field parameter data and water samples were collected from this location on May 20th, 2015. Secchi disk information was not collected as it does not apply in this case as the total depth of the water column was <1m.

Bedford West Water Quality Monitoring
FIELD REPORT

Site Address:	Kearney Lake		**Report Date:**	June 10th, 2015	
Field Personnel:	Mike McKenzie		**Sample ID's:**	KL-2	
GPS Coordinates:	20T 0443942 E, 4949803 N (UTM, NAD 83)		**Monitoring date(s):**	May 20th, 2015	
Project number:	210.05930.00000				
Watercourse (Circle One)	Lake	River	Outlet	Inlet	Other:

Site Conditions

Weather	Cloudy, Light Breeze
Air Temperature	10.9 ^{o}C
Cloud Cover	100%
Wildlife Sightings	Birds - Chickadees and Crows
Accessibility	Collins Road

Site Description:

Adjacent to Collins Road. Water sample taken adjacent the culvert below the road (next to residential properties). Brown (tanin) colour to water.

Field Parameter Data:

Date & Time	May 20th, 2015 @ 9:15am
Sample Depth	Surface (water was approximately 0.2m deep)
pH	6.36
Dissolved Oxygen (mg/L)	8.41
Dissolved Oxygen (%)	82.9
Secchi Depth (m)	N/A
Water Temperature	13.13
Conductivity (mS/cm)	0.053 mS/cm

Additional Comments, Sketches, Notes, Logger Installation Information:

Field parameter data and water samples were collected from this location on May 20th, 2015. Secchi disk information was not collected as it does not apply in this case as the total depth of the water column was <1m.

Bedford West Water Quality Monitoring
FIELD REPORT

Site Address:	Kearney Lake Run		**Report date:**	June 10th, 2015	
Field Personnel:	Mike McKenzie		**Sample ID's:**	KL-3	
GPS Coordinates:	20 T 0444390 E, 4950406 N (UTM, NAD 83)		**Monitoring date(s):**	May 20th, 2015	
Project number:	210.05930.00000				
Watercourse (Circle One)	Lake	River	Outlet	Inlet	Other:

Site Conditions

Weather	Cloudy, No Rain
Air Temperature	11.1 ^{o}C
Cloud Cover	100%
Wildlife Sightings	Birds
Accessibility	Walking path; same as KL-4

Site Description:

Downstream of Kearney Lake Dam. ~50-75 m distance away. Rocky bottom, moss present with some leaf litter.

Field Parameter Data:

Date & Time	May 20th, 2015 @ 10:35am
Sample Depth	0.3m (shallow water column)
pH	6.84
Dissolved Oxygen (mg/L)	8.02
Dissolved Oxygen (%)	91.5
Secchi Depth (m)	N/A
Water Temperature	14.73
Conductivity (mS/cm)	0.185 mS/cm

Additional Comments, Sketches, Notes, Logger Installation Information:

Field parameter data and water samples were collected from this location on May 20th, 2015. Secchi disk information was not collected as it does not apply in this case as the total depth of the water column was <1m.

Bedford West Water Quality Monitoring
FIELD REPORT

Site Address:	Kearney Lake Run		**Report date:**	June 10th, 2015	
Field Personnel:	Mike McKenzie		**Sample ID's:**	KL-4	
GPS Coordinates:	20 T 0444463 E, 4950571 N (UTM, NAD 83)		**Monitoring date(s):**	May 20th, 2015	
Project number:	210.05930.00000				
Watercourse (Circle One)	Lake	River	Outlet	Inlet	Other:

Site Conditions

Weather	Cloudy, Light Breeze
Air Temperature	11.1 ^{o}C
Cloud Cover	100%
Wildlife Sightings	Birds
Accessibility	Walking Path, Orange Flagging Tape

Site Description:

Rocky stream bed, moss, muddy, moderate flow speeds into woods adjacent to walking path.

Field Parameter Data:

Date & Time	May 20th, 2015 @ 10:25am
Sample Depth	0.1m
pH	6.64
Dissolved Oxygen (mg/L)	9.81
Dissolved Oxygen (%)	100.2
Secchi Depth (m)	N/A
Water Temperature	14.75
Conductivity (mS/cm)	188

Additional Comments, Sketches, Notes, Logger Installation Information:

Field parameter data and water samples were collected from this location on May 20th, 2015. Secchi disk information was not collected as it does not apply in this case as the total depth of the water column was <1m.

Bedford West Water Quality Monitoring
FIELD REPORT

Site Address:	Kearney Lake Road		**Report date:**	June 10th, 2015	
Field Personnel:	Mike McKenzie		**Sample ID's:**	KL-5	
GPS Coordinates:	20T 0445329 E 4949131 N (UTM, NAD 83)		**Monitoring date(s):**	May 20th, 2015	
Project number:	210.05930.00000				
Watercourse (Circle One)	Lake	River	Outlet	Inlet	Other:

Site Conditions

Weather	Cloudy, Light Drizzle, Light Breeze
Air Temperature	10.9 °C
Cloud Cover	100%
Wildlife Sightings	Birds
Accessibility	Side Of Kearney Lake Road, Next To Two Power Poles

Site Description:

Rocky bottom, slight brown colour to the water.

Field Parameter Data:

Date & Time	May 20th, 2015 @ 9am
Sample Depth	0.4m
pH	7.82
Dissolved Oxygen (mg/L)	8.32
Dissolved Oxygen (%)	86.9
Secchi Depth (m)	N/A
Water Temperature	14.06 Celcius
Conductivity (mS/cm)	0.184 mS/cm

Additional Comments, Sketches, Notes, Logger Installation Information:

Field parameter data and water samples were collected from this location on May 20th, 2015. Secchi disk information was not collected as it does not apply in this case as the total depth of the water column was <1m.

Bedford West Water Quality Monitoring
FIELD REPORT

Site Address:	Paper Mill Lake		**Report date:**	June 10th, 2015	
Field Personnel:	Mike McKenzie		**Sample ID's:**	PML-1	
GPS Coordinates:	20T 0445129 E, 4951154 N (UTM, NAD83)		**Monitoring date(s):**	May 20th, 2015	
Project number:	210.05930.00000				
Watercourse (Circle One)	Lake	River	Outlet	Inlet	Other:

Site Conditions

Weather	Cloudy
Air Temperature	11.7 °C
Cloud Cover	100%
Wildlife Sightings	Birds (Crows)
Accessibility	Ahmadi Crescent (Entrance off this street)

Site Description:

Lake, wooded area, leaf litter, a few boat launches present, residential area, rocky bottom.

Field Parameter Data:

Date & Time	May 20th, 2015 @ 12:45pm
Sample Depth	1.0m
pH	6.9
Dissolved Oxygen (mg/L)	7.16
Dissolved Oxygen (%)	73.8
Secchi Depth (m)	N/A
Water Temperature	15.13
Conductivity (mS/cm)	0.197

Additional Comments, Sketches, Notes, Logger Installation Information:

Field parameter data and water samples were collected from this location on May 20th, 2015. Secchi disk information was not collected as it does not apply in this case as the total depth of the water column was <1m.

Bedford West Water Quality Monitoring
FIELD REPORT

Site Address:	Paper Mill Lake		**Report date:**	June 10th, 2015	
Field Personnel:	Mike McKenzie		**Sample ID's:**	PML-2	
GPS Coordinates:	20T 0445363 E, 4951740 N (UTM, NAD83)		**Monitoring date(s):**	May 20th, 2015	
Project number:	210.05930.00000				
Watercourse (Circle One)	Lake	River	Outlet	Inlet	Other:

Site Conditions

Weather	Cloudy
Air Temperature	11.6 °C
Cloud Cover	100%
Wildlife Sightings	Birds, Beaver Dam Present
Accessibility	5 Minute Walk Down Trail Off Lake Drive

Site Description:

Flagging tape from previous site visits. Rocky bottom in lake, heavy leaf litter and canopy cover.

Field Parameter Data:

Date & Time	May 20th, 2015 @ 11:30am
Sample Depth	0.4m
pH	6.56
Dissolved Oxygen (mg/L)	8.06
Dissolved Oxygen (%)	83.6
Secchi Depth (m)	N/A
Water Temperature	15.09
Conductivity (mS/cm)	0.214

Additional Comments, Sketches, Notes, Logger Installation Information:

Field parameter data and water samples were collected from this location on May 20th, 2015. Secchi disk information was not collected as it does not apply in this case as the total depth of the water column was <1m.

Bedford West Water Quality Monitoring
FIELD REPORT

Site Address:	Lake Shore Drive (Marsh)		**Report date:**	June 10th, 2015	
Field Personnel:	Mike McKenzie		**Sample ID's:**	LSD	
GPS Coordinates:	20T 0442583 E, 4950431 N (UTM, NAD83)		**Monitoring date(s):**	May 20th, 2015	
Project number:	210.05930.00000				
Watercourse (Circle One)	Lake	River	Outlet	Inlet	Other: Stream

Site Conditions

Weather	Cloudy
Air Temperature	11 ^{o}C
Cloud Cover	100%
Wildlife Sightings	Birds, Frogs, Mosquitoes
Accessibility	Lake Shore Drive, Trail (5 minute walk)

Site Description:

Wid shallow stream (along water, leaf litter, sandy bottom, wooded area).

Field Parameter Data:

Date & Time	May 20th, 2015 @ 9:50am
Sample Depth	0.4m
pH	6.88
Dissolved Oxygen (mg/L)	6.26
Dissolved Oxygen (%)	60.17
Secchi Depth (m)	N/A
Water Temperature	12.52
Conductivity (mS/cm)	0.119

Additional Comments, Sketches, Notes, Logger Installation Information:

Field parameter data and water samples were collected from this location on May 20th, 2015. Secchi disk information was not collected as it does not apply in this case as the total depth of the water column was <1m.

Bedford West Water Quality Monitoring
FIELD REPORT

Site Address:	Larry Uteck Blvd.		**Report date:**	June 10th, 2015	
Field Personnel:	Mike McKenzie		**Sample ID's:**	LU	
GPS Coordinates:	20T 0444954 4949891 (UTM, NAD83)		**Monitoring date(s):**	May 20th, 2015	
Project number:	210.05930.00000				
Watercourse (Circle One)	Lake	River	Outlet	Inlet	Other: Pond

Site Conditions

Weather	Cloudy, Light Breeze
Air Temperature	11.7 ^{o}C
Cloud Cover	100%
Wildlife Sightings	Birds, Insects
Accessibility	Poor; 30-40m Wood/Bog Area

Site Description:

Bog/fen ~ 40m to watercourse, soft watercourse bottom with leaf litter. Clear with a slight brown colour to sample.

Field Parameter Data:

Date & Time	May 20th, 2015 @ 1:45pm
Sample Depth	1.0m
pH	6.57
Dissolved Oxygen (mg/L)	7.28
Dissolved Oxygen (%)	76.3
Secchi Depth (m)	N/A
Water Temperature	16.06
Conductivity (mS/cm)	0.646

Additional Comments, Sketches, Notes, Logger Installation Information:

Field parameter data and water samples were collected from this location on May 20th, 2015. Secchi disk information was not collected as it does not apply in this case as the total depth of the water column was <1m.

Bedford West Water Quality Monitoring
FIELD REPORT

Site Address:	Highway 102		**Report date:**	June 10th, 2015	
Field Personnel:	Mike McKenzie		**Sample ID's:**	HWY 102-1	
GPS Coordinates:	20T 0444708 E, 4951644 N (UTM, NAD83)		**Monitoring date(s):**	May 20th, 2015	
Project number:	210.05930.00000				
Watercourse (Circle One)	Lake	River	Outlet	Inlet	Other:

Site Conditions

Weather	Cloudy, Light Drizzle & Breeze
Air Temperature	11.8 ^{o}C
Cloud Cover	100%
Wildlife Sightings	Birds, Frogs
Accessibility	Hwy 102

Site Description:

Boggy, marsh area. Leaf litter, soft bottom, rocks, garbage and debris. Sample collected near culvert.

Field Parameter Data:

Date & Time	May 20th, 2015 @ 1:15pm
Sample Depth	0.20m
pH	6.35
Dissolved Oxygen (mg/L)	4.27
Dissolved Oxygen (%)	43.1
Secchi Depth (m)	N/A
Water Temperature	14.29
Conductivity (mS/cm)	0.393

Additional Comments, Sketches, Notes, Logger Installation Information:

Field parameter data and water samples were collected from this location on May 20th, 2015. Secchi disk information was not collected as it does not apply in this case as the total depth of the water column was <1m.

Bedford West Water Quality Monitoring
FIELD REPORT

Site Address:	Highway 102		**Report date:**	June 10th, 2015	
Field Personnel:	Mike McKenzie		**Sample ID's:**	Hwy 102-2	
GPS Coordinates:	20T 0444829 E, 4951778 N (UTM, NAD83)		**Monitoring date(s):**	May 20th, 2015	
Project number:	210.05930.00000				
Watercourse (Circle One)	Lake	River	Outlet	Inlet	Other:

Site Conditions

Weather	Cloudy
Air Temperature	11.7 °C
Cloud Cover	100%
Wildlife Sightings	None
Accessibility	Adjacent Highway 102

Site Description:

Sample collected adjacent to culvert near highway. Brown/opaque appearance. Algae (green). Rocky stream + grass/moss.

Field Parameter Data:

Date & Time	May 20th, 2015 @ 11am
Sample Depth	0.5m
pH	6.45
Dissolved Oxygen (mg/L)	4.84
Dissolved Oxygen (%)	48.7
Secchi Depth (m)	N/A
Water Temperature	12.7
Conductivity (mS/cm)	0.411

Additional Comments, Sketches, Notes, Logger Installation Information:

Field parameter data and water samples were collected from this location on May 20th, 2015. Secchi disk information was not collected as it does not apply in this case as the total depth of the water column was <1m.

APPENDIX C
Photolog

Bedford West Monitoring Results - Spring 2015
Bedford, NS
SLR Project No.: 210.05930.00000

Photo 1: KL-1: Kearney Lake Sample Location

Photo 2: KL-2: Kearney Lake Sample Location (Photo Taken By SNC Lavalin (Actual sample location on opposite side of Collins Road).

Photo 3: KL-3: Kearney Lake Sample Location

Photo 4: KL-4: Kearney Lake Sample Location

Photo 5: KL-5: Kearney Lake Sample Location

Photo 6: HWY 102-1: Highway 102 Sample Location

Photo 7: HWY 102-2: Highway 102 Sample Location

Photo 8: LSD: Lakeshore Drive Sample Location

Photo 9: LU: Larry Uteck Sample Location

Photo 10: PML-1: Paper Mill Lake Sample Location

Photo 11: PML-2: Paper Mill Lake Sample Location

Attachment B

SNC-Lavalin Inc.
Suite 200, Park Lane Terraces
5657 Spring Garden Road
Halifax, Nova Scotia, Canada, B3J 3R4
902.492.4544 902.492.4540

September 28, 2015

Halifax Regional Municipality
Energy and Environment
PO Box 1749
Halifax, Nova Scotia
B3J 3A5

Attention: Mr. Cameron Deacoff

Dear Mr. Deacoff:

RE: Final Report: Water Quality Monitoring Program
Bedford West, Bedford, Nova Scotia – Summer 2015 Sampling Event

SNC-Lavalin Inc. (SLI) is pleased to submit one electronic copy of the Final Report presenting the results of the summer 2015 surface water sampling event for the Bedford West Water Quality Monitoring Program in Bedford, Nova Scotia.

If you have any questions or require clarification, please contact the undersigned at 902-492-4544.

Yours truly,

SNC♦LAVALIN INC.

Original Signed

Crysta Cumming, P. Eng
Environmental Department Manager

CC/mg

631477-0001-T-4E-REP-000-0001_C01.docx

EXECUTIVE SUMMARY

On August 25th, 2015 SNC-Lavalin (Inc.) completed the Bedford West Summer 2015 water quality monitoring sampling event on behalf of Halifax Regional Municipality (HRM). The sampling program consisted of collecting surface water samples from eleven (11) sample stations. Water quality sampling consisted of recording field parameters and collecting surface water samples for the laboratory analyses of inorganics, calculated parameters, standard metals, and microbiological.

Applicable water quality criteria included:

- Canadian Council of Ministers of the Environment (CCME) guidelines for the Protection of Aquatic Life – Freshwater (PAL-F).
- Health Canada guidelines for Canadian Recreational Water Quality (2012, Third Edition).
- Nova Scotia Environment (NSE) Environmental Quality Standards (EQS) for Surface Water (EQS for Contaminated Sites (NSE 2014) Table A2, Reference for Pathway Specific Standards for Surface Water (ug/L) – Fresh Water.

The following tested parameters exceeded the recommended water quality criteria. Details of sample stations and sample results are outlined in the report.

1. Total Phosphorous
2. Dissolved Oxygen (Field Parameter)
3. pH
4. Dissolved Chloride
5. Turbidity
6. Standard Metals (Total Iron, Total Copper, Total Manganese and Total Zinc)

A follow-up monitoring event was ordered by HRM pursuant to the Secondary Planning Strategy policy BW-5 due to Total Phosphorus results exceeding the management threshold of 10 µg/L at several water quality stations during the summer event (August 25th, 2015).

The follow-up monitoring event was conducted on September 15th and 16th, 2015 and included surface water quality re-sampling at the eleven (11) water quality sampling stations, as well as seven (7) novel stations (i.e. upstream) to determine potential sources of TP. In addition, physical parameters were recorded at all sampling stations mention above.

A summary letter report (Reference No. 631477-0001-T-4E P-000-0002) was submitted to HRM on September 18th, 2015 to document the findings of the follow-up monitoring event.

TABLE OF CONTENTS

List of Tables

List of Figures

Appendices

1 INTRODUCTION AND BACKGROUND

SNC-Lavalin Inc. (SLI) has prepared this report to provide Halifax Regional Municipality (HRM) with water quality data at eleven (11) surface water stations throughout the Bedford West development area.

SLI was retained by HRM to complete water quality monitoring program each spring, summer and fall for two years beginning in 2015. The results of the summer 2015 monitoring program are detailed herein.

The overall purpose of the program is to conduct water quality sampling and testing prior to and during construction activities of the development project in order to detect any impacts on and/or changes to water quality.

SLI conducted the program at same sampling stations between 2009 and 2014. SLR Consulting Ltd. provided the monitoring services for spring 2015 event. The summer 2015 program consists of collecting surface water samples from eleven (11) specified test stations. Sampling locations are summarized in Table 1 and shown in Figure 1.

Table 1: Bedford West Sampling Stations

Water Course	Sample Location Name	Updated Coordinates (UTM NAD 83)	
		Easting	Northing
Kearney Lake	KL-1	20T445718E	4948496N
Kearney Lake	KL-2	20T0443859	4949738N
Kearney Run	KL-3	20T444390E	4950406N
Kearney Run	KL-4	20T444463E	4950571N
Kearney Lake	KL-5	20T4949142E	445280N
Creek Above Highway	HWY 102-1	20T444708E	4951644N
Creek Below Highway	HWY 102-2	20T444829E	4951778N
Lake Shore Drive	LSD	20T442583E	4950431N
Larry Uteck Off Ramp	LU	20T444954E	4949891N
Paper Mill Lake	PML-1	20T445129E	4951154N
Paper Mill Lake	PML-2	20T445363E	4951740N

Figure 1: Bedford West Water Quality Sampling Stations

N

HWY102-2

HWY102-1

PML2

PAPER MILL LAKE

PML1

KL4

KL3

LSD

KL2

LU

KEARNEY LAKE

KL5

KL1

Legend

- Water Quality Monitoring Test Locations/Sample Identification

0 200 400 800 1,200 1,600

Meters

SNC•LAVALIN

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Halifax, Nova Scotia, Canada
Telephone: (902) 492-4544
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Member of the SNC•LAVALIN Group

Certified ISO 9001

HALIFAX REGIONAL MUNICIPALITY

PROJECT: WATER QUALITY MONITORING WITHIN BEDFORD WEST

TITLE: WATER QUALITY MONITORING TEST LOCATIONS

DESIGNED:	CH
DRAWN:	CH
CHECKED:	DH
SCALE:	AS SHOWN
DATE:	21-09-2015
PROJECT #:	631477-0001
DRAWING #:	1

2 METHODOLOGY

The summer 2015 water quality sampling event consisted of collection of Field Parameters (Group A) and surface water for the laboratory analyses of:

- Inorganics (Group B)
- Calculated Parameters (Group C)
- Standard Metals (Group D)
- Microbiologicals (Group E)

Table 2 below summarizes the parameters measured in the field or analyzed by the laboratory in each Group.

Table 2: Analytical Parameter Groups

Field Parameters (A)	Inorganic (B)	Calculated Parameters (C)
▪ pH ▪ TDS ▪ Dissolved Oxygen ▪ Temperature ▪ Secchi Depth ▪ Conductance ▪ Air Temperature ▪ Cloud Cover ▪ Incidental Wildlife Sightings	▪ Total Alkalinity (as $CaCO_3$) ▪ (Dissolved) Chloride ▪ Colour ▪ Total Kjeldahl Nitrogen ▪ Nitrate + Nitrite ▪ Nitrate ▪ Nitrite ▪ Nitrogen (as NH4) ▪ Total Organic Carbon ▪ Orthophosphate (P) ▪ pH ▪ Total Phosphorus (low detection limit (0.002 mg/L) ▪ Reactive Silica ▪ Total Suspended Solids ▪ Dissolved Sulphate ▪ Turbidity ▪ Conductivity	▪ Anion Sum ▪ Cation Sum ▪ Ion Balance ▪ Bicarbonate Alkalinity(as $CaCO_3$) ▪ Carbonate Alkalinity (as $CaCO_3$) ▪ Hardness ▪ Total Dissolved Solids ▪ Saturation pH (@4°C & 20°C) ▪ Langelier Index (@4°C & 20°C)
Standard Metals (D		**Microbiologicals (E)**
▪ Calcium ▪ Copper ▪ Iron ▪ Magnesium ▪ Manganese ▪ Potassium ▪ Sodium ▪ Zinc		▪ Chlorophyll A ▪ E. coli ▪ (Most Probable Number (MPN) or CFU per 100 mL)

All water samples and associated field parameters were collected on August 25th, 2015.

Field parameters were recorded at each station before water samples were collected. Field data consisting of pH, Dissolved Oxygen, Specific Conductivity, water temperature and air temperature were measured using a YSI Professional plus Water Quality Instrument (6050000) / PromComm (605604).

Data was recorded in a field book once parameters had stabilized. The equipment is calibrated annually by the manufacturer. No Secchi depth measurements were taken during the Summer 2015 event due to limited water depth at the sample stations. Site conditions (i.e. weather, air temperature, cloud cover, site accessibility, wildlife sitings) and field parameters for each sampling location were recorded on a field report sheet. Each sample station was photographed during the sample event.

The water samples and field parameter readings were collected within a depth of 1.0 m below surface. Water samples were collected from the shore at all sample stations. Water sampling followed the SNC-Lavalin Inc.'s Standard Operating Procedures (SOP) for surface water sampling. A new pair of latex gloves were used at each sample location. Surface water samples were collected and placed in clean laboratory-supplied jars and stored in a chilled container together with a chain of custody record for transport to the laboratory. All surface water samples were submitted to AGAT Laboratories in Dartmouth, NS.

3 ASSESSMENT STANDARDS

There is currently no national environmental quality guideline for phosphorus in freshwater aquatic environments. In the Canadian framework, trigger ranges are based on the trophic classification of the baseline condition. A trigger range is a desired concentration range for phosphorus; if the upper limit of the range is exceeded, it indicates potential for quality environmental issues, and therefore, "triggers" further investigations. For this water quality monitoring program, HRM defined the water quality limit for Total Phosphorous as 10 µg/L. According to CCME phosphorus trigger ranges, 10 µg/L is the threshold between oligotrophic and mesotrophic trophic classifications.

pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity were compared to:

- The Canadian Council of Ministers of the Environment (CCME) guidelines for the Protection of Aquatic Life – Freshwater (PAL-F). For Total Suspended Solids (TSS) and Turbidity, the CCME Narrative Total Particulate Matter – Table 1 Suspended Sediments and Turbidity, High Flow Conditions, updated 2002 were used.

  For TSS, the guideline value is equal to a maximum increase of 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L. When background is greater than 250 mg/L, the concentration should not increase more than 10% of background levels.

E.coli, Secchi Depth, and Turbidity were compared to:

- The Health Canada guidelines for Canadian :reational Water Quality (2012, Third Edition). The Canadian Recreational Water Quality guidelines indicate that the clarity of the water should be sufficiently clear such that a Secchi disk is visible at a minimum of 1.2 metres. For turbidity, the guidelines indicate a limit of 50 Nephelometric Turbidity Units (NTU).

All inorganic parameters were compared to:

- Nova Scotia Environment (NSE) Environmental Quality Standards (EQS) for Surface Water (EQS for Contaminated Sites (NSE 2014) Table A2, Reference for Pathway Specific Standards for Surface Water (µg/L) – Fresh Water.

4 WATER QUALITY RESULTS SUMMER 2015

Laboratory Certificates of Analysis are enclosed in **Appendix A**.

4.1 FIELD OBSERVATIONS

Results of the Summer 2015 sampling of the eleven (11) sample stations are presented along with historic data in Table 3. Table 3 is attached at the end of this report.

Site conditions were recorded for all sampling stations and are included in the field data sheets in **Appendix B**. Site condition observations include weather, cloud cover, air temperature, wildlife sightings and site accessibility. Photographs are included in **Appendix C**.

4.2 FIELD MEASUREMENTS

Field measurements are presented in **Table 3** attached at the end of this report. Field measurements were recorded on field data sheets (**Appendix B**) and included: date and time of sample collection, sample depth, pH, Dissolved Oxygen (DO), Secchi depth (if applicable), water temperature and conductivity.

On August 25th, 2015, the following stations had **dissolved oxygen** readings outside of the range of 5.5-9.5 mg/L recommended in the CCME PAL-F guidelines:

- KL3: 9.91 mg/L
- HWY102-1: 3.82 mg/L
- PLM2: 9.76 mg/L

4.3 LABORATORY ANALYTICAL RESULTS

Laboratory analytical results are presented in Table 3, which is attached at the end of this report.

4.3.1 TOTAL PHOSPHOROUS

Total Phosphorus that met or exceeded the management threshold criteria of 10 µg/L (0.01 mg/L) listed in the HRM RFP 14-338 was reported at six (6) water quality monitoring stations as follows. Results are also presented in mg/L for comparison with Table 3.

- KL2: 12 µg/L (0.012 mg/L)
- HWY102-1: 20 µg/L (0.020 mg/L)
- HWY102-2: 1,506 µg/L (1.56 mg/L)
- LSD: 501 µg/L (0.501 mg/L)
- PLM1: 60 µg/L (0.060 mg/L)
- PLM2: 12 µg/L (0.012 mg/L)

4.3.2 GENERAL CHEMISTRY

pH was within the CCM-PAL-F guideline of 6.5-9 at all of the eleven (11) sample stations.

Dissolved chloride was above the maximum CCME PAL-F guidelines of 120 mg/L at the following sample stations:

- HWY102-2: 178 mg/L
- LU: 132 mg/L

Turbidity was above the Health Canada guideline for recreational water quality of 50 NTU at the following stations:

- HWY102-2: 1,490 NTU
- LSD: 4,430 NTU

4.3.3 STANDARD METALS

The analytical parameter of **Total Iron** exceeded the applicable NSE EQS guideline of 300 µg/L at the following stations. Note that the CCME PAL-F limit is also 300µg/L.

- KL2: 641 µg/L
- HWY102-1: 1,280 µg/L
- HWY102-2: 217,000 µg/L
- LSD: 176,000 µg/L

- LU: 671 µg/L
- PML1: 4,460 µg/L
- PLM2: 334 µg/L

Total Copper exceeded the applicable NSE EQS guideline of 2µg/L at the following stations. Note that the the CCME PAL-F limit is 2.0 – 4.0 µg/L.

- HWY102-2: 404 µg/L
- LSD: 183 µg/L

Total Manganese exceeded the applicable NSE EQS guideline of 820 µg/L at the following stations:

- HWY 102-2: 2,800 µg/L
- LSD: 13,800 µg/L

Total Zinc exceeded the applicable NSE EQS guideline of 30µg/L at the following stations. Note that the CCME PAL-F limit is 30 µg/L

- HWY102-2: 1,210 µg/L
- LSD: 799 µg/L

4.3.4 MICROBIOLOGICAL

Eleven (11) *E.coli* samples were collected during the spring 2015 sampling program. *E-coli* did not exceed the Heath Canada Guidelines of 400 CFU /100mL in any of the samples collected.

5 STATISTICAL PRESENTATION

Table 4, which is attached at the end of this report, provides a summary of the seasonal statistics from 2009-2015 for each of the eleven (11) stations for six (6) key water quality parameters: Total Phosphorous, Chloride, laboratory measured pH, Total Suspended Solids, Conductivity and Chlorophyll-A.

6 GRAPHS

Appendix C encloses graphs that show concentrations from 2009 to 20015 of six (6) key water quality parameters such as dissolved chloride (mg/L), pH, total phosphorus (mg/L), total suspended solids (mg/L), conductivity (µS/cm) and chlorophyll A (µg/L) at each of the eleven (11) water quality monitoring sites. Graphs allow for comparison between sites and identification of concentration increases (i.e. above applicable CCME guidelines).

7 CONCLUSIONS

The Summer 2015 water quality monitoring program included collection of surface water samples from eleven (11) sample stations for the analysis of general chemistry, total metals, total phosphorus, total suspended solids, *E.coli*, and chlorophyll-*a*. Additionally, field parameters collected at each station included pH, water temperature, dissolved oxygen, conductivity, secchi depth (if applicable), air temperature, cloud cover and wildlife sightings.

Based on the summer 2015 monitoring results and their comparison with applicable guidelines, the following list summarizes the results:

- **Total Phosphorous** was above the management threshold criteria of 10 µg/L at six (6) stations as follows: KL2: 2 µg/L; HWY102-1: 20 µg/L; HWY102-2: 1,560 µg/L; LSD: 501 µg/L; PLM1: 60 µg/L; and PLM2: 12 µg/L.

  A follow-up monitoring event was ordered by the Halifax Municipality pursuant to Secondary Planning Strategy policy BW-5 due to Total Phosphorus results exceeding the management threshold of 10 µg/L at several water quality stations during the summer event (August 25th, 2015). A summary letter report (Reference No. 631477-0001-T-4E-REP-000-0002) was submitted to HRM on September 18th, 2015 to document the findings of the follow-up monitoring event.

- **Dissolved Oxygen** readings outside of the CCME PAL-F guideline range of 5.5-9.5 mg/L were as follows: KL3: 9.91 mg/L; HWY102-1: 3.82 mg/L; and PLM2: 9.76 mg/L.

General Chemistry

- All reported **pH** data were within the CCME PAL-F guideline of 6.5 - 9.
- Reported **dissolved chloride** above the maximum CCME PAL-F guidelines of 120 mg/L was recorded at: HWY102-2: 178 mg/L, and LU: 132 mg/L.
- Reported **turbidity** above the Health Canada guideline for recreational water quality of 50 NTU was recorded at stations HWY102-2: 1490 NTU, and LSD: 4430 NTU

Standard Metals

- **Total Copper** exceeded the applicable NSE EQS guideline of 2 µg/L at two stations as follows: HWY102-2: 404 µg/L, and LSD: 183 µg/L.
- **Total Iron** exceeded the applicable NSE EQS guideline and the CCME PAL-F guideline of 300 µg/L at seven stations as follows: KL2: 641 µg/L; HWY102-1: 1280 µg/L; HWY102-2: 217000 µg/L; LSD: 176000 µg/L; LU: 671 µg/L; PML1: 4460 µg/L; and PLM2: 334 µg/L.
- **Total Manganese** exceeded the applicable NSE EQS guideline of 820 µg/L at two stations as follows HWY102-2: 2800 µg/L, and LSD: 13800 µg/L.

- **Total Zinc** exceeded the applicable NSE EQS guideline and the CCME PAL-F guideline of 30 µg/L at two stations: HWY102-2: 1210 µg/L, and LSD: 799 µg/L.

Microbiological

- **E.coli** analytical results did not exceed the Heath Canada Guidelines of 400 CFU /100 mL in any of the eleven (11) sample stations.

8 REFERENCES

The Canadian Council of Ministers of the Environment (CCME) guidelines for the Protection of Aquatic Life – Freshwater (FWAL). For TSS and turbidity, the CCME Narrative Total Particulate Matter – Table 1 Suspended Sediments and Turbidity, High Flow Conditions, updated 2002 were used.

Environment Canada (EC), 2005, The Inspector's field sampling manual. Second Edition. Retrieved on March 6, 2015 from http://publications.gc.ca/collections/Collection-R/En40-498-2005-1E.pdf

Canadian Environmental Quality Guidelines for the Protection of Aquatic Life, 2004, "Phosphorous: Canadian Guidance Framework for the Management of Freshwater Systems".

The Health Canada guidelines for Canadian Recreational Water Quality (2012, Third Edition). For turbidity, the guidelines indicate a limit of 50 Nephelometric Turbidity Units (NTU).

Nova Scotia Environment (NSE), Environmental Quality Standards for Surface Water (Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table A2 Reference for Pathway Specific Standards for Surface Water (ug/L) – Fresh Water

9 LIMITATIONS

This report has been prepared and the work referred to in this report has been undertaken by SNC-Lavalin Inc (SLI) for Halifax Regional Municipality (HRM), hereafter referred to as the "Client". It is intended for the sole and exclusive use of Halifax Regional Municipality.

The report has been prepared in accordance with the Scope of Work and agreement between SLI and the Client. Other than by the Client and as set out herein, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of SLI.

This report has been prepared in a manner generally accepted by professional consulting principles and practices for the same locality and under similar conditions. No other representations or warranties, expressed or implied, are made.

Opinions and recommendations contained in this report are based on conditions that existed at the time the services were performed and are intended only for the client, purposes, stations, time frames and project parameters as outlined in the Scope or Work and agreement between SLI and the Client. The data reported, findings, observations and conclusions expressed are limited by the Scope of Work. SLI is not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. SLI does not warranty the accuracy of information provided by third party sources.

Table 3: Water Quality Monitoring Results

TABLE 3: Bedford West Water Quality Sampling Program

August 2015	Units	RDL (August 2015)	NSE ESQs for Surface Water (Applied)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	CCME Phosphorus Trigger Range (Applied)	Kearney Lake																			
Sample Sites							KL1																			
Sampling Date	yyyy-mm-dd	--					2009/06/29	2009/08/13	2009/10/01	2010/05/31	2010/08/24	2010/11/01	2011/05/13	2011/08/14	2011/10/16	2012/05/01	2012/08/14	2012/10/10	2013/05/15	2013/08/16	2013/10/16	2014/05/14	2014/08/14	2014/10/27	2015/05/20	2015/08/25
Sampling Time	hh:mm	--					08:00	11:45	08:30	11:00	13:10	12:00	11:00	14:30	14:00	8:30	11:20	9:50	10:20	11:10	13:30	10:30	14:15	14:55	08:30	14:54
FIELD DATA																										
Secchi Depth	Meters	--	--	1.2	--		4.1	4.2	5.0	N/A	5.0	4.9	2.4	3.2	2.4	2.35	5.36	N/A	2.50	2.03	2.90	2.36	2.70	2.54	NCC	N/A
Water Temp	Celsius	0.1	--	--	--		14.0	22.2	16.7	12.9	23.3	8.8	11.5	25.6	15.9	8.9	23.3	15.4	13.2	22.2	14.1	12.7	23.2	12.2	14.12	26.1
Dissolved Oxygen	mg/L	0.01	--	--	5.5 - 9.5		10.77	8.20	7.00	9.13	7.86	10.48	10.69	8.22	9.22	8.98	7.93	8.72	9.76	8.57	8.30	15.29	7.22	8.12	9.55	8.13
pH	pH	N/A	--	--	--		6.20	6.76	6.67	7.23	7.32	6.61	6.60	6.16	6.04	8.67	6.91	6.32	6.32	8.24	6.35	6.74	7.46	6.44	8.33	6.95
Specific Conductance	uS/cm	1	--	--	--		263	299	261	248	242	219	288	179	146	277	279	198.1	243	216.5	217.9	547.0	341.0	223.0	0.182	298.3
INORGANICS																										
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--		6	8	8	7	8	6	<5	9	7	24	7	<5	<5	<5	8	30	14	<5	5.2	6
Dissolved Chloride (Cl)	mg/L	1	--	--	120		81	74	64	62	60	55	73	45	33	66	70	50	66	59	48	80	76	46	60	62
Colour	TCU	30	--	--	--		18	18	16	26	8	21	28	40	45	50	11	20	11	37	20	13	8	23	37	8
Nitrite + Nitrate	mg/L	0.05	--	--	--		0.18	0.09	0.12	0.21	0.16	0.23	0.2	0.11	0.13	0.20	0.09	0.10	0.18	0.14	0.19	0.11	0.11	0.08	0.15	0.15
Nitrate (N)	mg/L	0.05	--	--	13000		0.18	--	--	0.21	0.16	--	0.2	--	--	0.20	0.09	0.10	0.18	0.14	0.19	0.11	0.11	0.08	0.15	0.15
Nitrite (N)	mg/L	0.05	--	--	60		<0.01	--	--	<0.01	<0.01	--	<0.01	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010	<0.05
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.04	0.03	<0.03	0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.050	<0.03
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--		--	--	--	--	--	--	--	--	--	0.9	3.1	0.4	--	--	0.7	<0.4	1.1	<0.4	0.4	0.22	4.5
Total Organic Carbon	mg/L	0.5	--	--	--		2.4	2.9	4.7	3.3	3.2	3.1	3.4	5.9	5.5	5.4	2.9	5.2	4.4	4.1	4.3	4.6	2.4	4.4	3.0	5.3
Orthophosphate (as P)	mg/L	0.01	--	--	--		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.01
pH (Lab)	pH	N/A	--	5.0-9.0	6.5-9		6.94	6.65	6.68	6.91	7.00	6.79	6.52	6.51	6.52	6.7	7.2	6.9	6.78	6.93	6.85	6.72	7.06	6.35	6.62	6.95
Total Calcium (Ca)	mg/L	0.1	--	--	--		9.2	8.5	7.2	7.72	8.66	8.30	7.65	4.82	5.31	6.8	8.4	6.3	7.5	6.6	6.5	8.1	11	6.0	6400	7.9
Total Magnesium (Mg)	mg/L	0.1	--	--	--		1.5	1.4	1.2	1.42	1.36	1.30	1.29	0.86	1.06	1.1	1.5	1.5	1.1	1.2	1.2	1.6	1.6	0.9	920	1.3
Total Phosphorus (1M depth)	mg/L	0.002	--	--	--	0.01	<0.02	<0.02	<0.002	0.009	0.007	0.005	0.008	0.012	0.009	0.037	0.043	0.007	0.007	0.011	0.008	0.011	0.026	0.01	0.008	0.002
Total Potassium (K)	mg/L	0.1	--	--	--		1.1	0.9	1.3	0.876	0.888	0.901	0.788	0.773	0.871	0.7	0.9	0.9	0.8	0.7	1.1	0.9	1.6	0.7	680	0.9
Total Sodium (Na)	mg/L	0.1	--	--	--		51	46	37	31.8	35.2	33.8	43.7	22.8	19.8	40.1	42.0	29.8	35.8	26.2	31.6	50.2	54.2	37.6	33	43.3
Reactive Silica (SiO2)	mg/L	0.5	--	--	--		2.6	2.2	2.3	2.9	2.7	2.9	2.8	1.9	2.3	2.4	1.3	2.2	2.5	1.8	2.2	2.0	1.5	1.8	2.5	1.8
Total Suspended Solids	mg/L	5	--	--	--		1	1	<1	4	17	3	2	2	3	<5	<5	<5	<5	<5	5	<5	<5	<5	<1.0	<5
Dissolved Sulphate (SO4)	mg/L	2	--	--	--		14	13	12	11	11	11	12	10	8	8	9	9	11	9	9	12	11	7	8.7	10
Turbidity (NTU)	NTU	0.1	--	50	--		0.7	0.8	1.0	1.3	0.6	1	1	1	0.9	2.4	0.8	1.3	1.6	3.3	0.5	2.9	0.7	1.9	0.81	1.9
Conductivity (uS/cm)	µS/cm	1	--	--	--		310	290	250	240	240	230	290	180	140	246	274	196	259	241	212	290	339	235	220	257
Calculated Parameters																										
Anion Sum	me/L	N/A	--	--	--		2.72	2.52	2.23	2.12	2.08	1.91	2.33	1.66	1.27	2.52	2.31	1.60	2.10	1.86	1.71	3.11	2.66	1.45	1.98	2.09
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--		6	8	8	7	8	6	<1	9	7	24	7	<5	<5	<5	8	30	14.00	<5	5.2	6
Calculated TDS	mg/L	1	--	--	--		166	151	131	123	125	118	143	92	77	139	137	98	124	104	103	172	165.00	99	120	130
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--		<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<1.0	<10
Cation Sum	me/L	N/A	--	--	--		2.85	2.57	2.12	1.92	2.10	2.02	2.42	1.33	1.25	2.24	2.41	1.79	2.08	1.61	1.84	2.77	3.09	2.05	1.84	2.43
Hardness (CaCO3)	mg/L	1	--	--	--		29	27	23	25	27	26	24	16	18	21.5	27.2	21.9	23.3	21.4	21.2	26.8	34.10	18.7	20.0	25.1
Ion Balance (% Difference)	%	N/A	--	--	--		2.33	0.98	2.53	4.95	0.48	2.80	1.89	11.00	0.79	5.9	2.1	5.3	0.7	7.3	3.4	5.8	7.50	17.2	3.66	7.5
Langelier Index (@ 20C)	N/A	N/A	--	--	--		-2.68	-2.87	-2.94	-2.72	-2.51	-2.87	NC	-3.18	-3.21	-2.69	-2.63	-3.19	-3.24	-3.14	-3.02	-2.51	-2.36	-3.76	-3.21	-2.97
Langelier Index (@ 4C)	N/A	N/A	--	--	--		-2.93	-3.12	-3.19	-2.97	-2.76	-3.12	NC	-3.43	-3.46	-3.01	-2.95	-3.51	-3.56	-3.46	-3.34	-2.83	-2.68	-4.08	-3.46	-3.29
Saturation pH (@ 20C)	N/A	N/A	--	--	--		9.62	9.52	9.62	9.63	9.51	9.66	NC	9.69	9.73	9.39	9.83	10.10	10.0	10.1	9.87	9.23	9.42	10.1	9.83	9.92
Saturation pH (@ 4C)	N/A	N/A	--	--	--		9.87	9.77	9.87	9.88	9.76	9.91	NC	9.94	9.98	9.71	10.2	10.4	10.3	10.4	10.2	9.55	9.74	10.4	10.1	10.2
Metals (ICP-MS)																										
Total Aluminum (Al)	µg/L	5	5	--	5-100		230	--	--	289	47.8	--	338	--	--	321	43	168	191	120	56	229	42	155		--
Total Antimony (Sb)	µg/L	2	20	--	--		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	--
Total Arsenic (As)	µg/L	2	5.0	--	5		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	--
Total Barium (Ba)	µg/L	5	1000	--	--		16	--	--	18.5	15.9	--	13	--	--	12	15	9	12	7	16	14	20	9	16	--
Total Beryllium (Be)	µg/L	2	5.3	--	--		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	--
Total Bismuth (Bi)	µg/L	2	--	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Boron (B)	µg/L	5	1200	--	1500		8	--	--	11.4	9.1	--	<50	--	--	<5	11	33	6	10	9	7	22	10	<50	--
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017		<0.3	--	--	0.053	<0.017	--	0.056	--	--	0.032	0.027	0.021	0.020	<0.017	0.017	0.037	<0.017	0.025		--
Total Chromium (Cr)	µg/L	1	--	--	1		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	<1	<1	<1	<1	6	<1	<1	<1.0	--
Total Cobalt (Co)	µg/L	1	10	--	--		1	--	--	0.54	<0.40	--	0.79	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.40	--
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0		<2	--	--	5.8	<2.0	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<1	1	1	<1	1	<2.0	<1
Total Iron (Fe)	µg/L	50	300	--	300		130	--	--	313	62	125	177	162	384	229	137	195	207	132	92	147	124	168	110	157
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0		<0.5	--	--	10.3	<0.50	--	<0.50	--	--	<0.5	<0.5	1.9	<0.5	<0.5	<0.5	5.1	<0.5	<0.5	<0.50	--
Total Manganese (Mn)	µg/L	2	820	--	--		100	--	--	79.2	57.1	59	78.4	52.3	55.8	48	65	68	73	48	24	48	115	42	39	41
Total Molybdenum (Mo)	µg/L	2	73	--	73		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Nickel (Ni)	µg/L	2	25	--	25-150		5	--	--	3.2	<2.0	--	3.2	--	--	<2	<2	2	2	<2	<2	3	<2	3	<2.0	--
Total Selenium (Se)	µg/L	1	1.0	--	1		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1.0	--
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1		<0.5	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	--
Total Strontium (Sr)	µg/L	5	21000	--	--		46	--	--	39.1	37.7	--	36	--	--	32	41	32	37	33	30	40	45	26	29	--
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8		<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	--
Total Tin (Sn)	µg/L	2	--	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Titanium (Ti)	µg/L	2	--	--	--		11	--	--	6.4	<2.0	--	5.4	--	--	8	<2	3	4	2	<2	2	<2	5	2.3	--
Total Uranium (U)	µg/L	0.1	300	--	15		0.1	--	--	0.11	<0.10	--	0.12	--	--	0.1	<0.1	0.1	0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.10	--
Total Vanadium (V)	µg/L	2	6	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Zinc (Zn)	µg/L	5	30	--	30		27	--	--	14.4	7.5	11.1	12.1	13.3	9.7	5	<5	11	11	6	5	14	<5	9	13	8
MICROBIOLOGICAL																										
Total Coliform	MPN/100mL	1	--	--	--		200	65	--	>250	63	>250	91	>250	--	2420	>2420	1120	1200	866	488	525	1550	>2420	---	980
E. coli	MPN/100mL	1	--	400	--		39	24	--	9	15	37	8	>250	<100	41	11	17	48	2	7	<1	15	28	60	24
Fecal Coliform	MPN/ml	--	--	400	--		--	--	<1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---	--
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--		0.53	0.79	1.11	1.73	1.47	0.99	0.76	1.44	1.36	0.62	2.3	1.54	1.22	1.40	1.19	0.40	0.41	0.84	0.64	1.14
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--		0.48	0.69	1.17	1.61	1.42	0.81	0.69	1.15	1.14	0.63	2.3	2.16	1.40	1.40	1.19	1.32	0.36	0.8	0.62	1.11

Notes:

NA - Not Applicable; NC - Not Calcuable; NCC - Not Collected
RDL = Recordable Detection Limit (represents most recent sampling event RDL)
" -- " = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guidelines (updated 2011)
CCME FWAL Guidelines for Aluminum, Lead, Copper and Nickel vary based on reported pH and water hardness (CCME FWAL calculation equations). The largest guideline value for each respective element range was always used.
Health Canada Guideline for Recreational Water Quality = Health Canada Guidelines for Canadian Recreational Water Quality - Draft (September 2009)
Nova Scotia Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table A2 Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water

Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics, Metals)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

TABLE 3: Bedford West Water Quality Sampling Program

August 2015	Units	RDL (August 2015)	NSE ESQs for Surface Water (Applied)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	CCME Phosphorus Trigger Range (Applied)	Kearney Lake																			
Sample Sites							KL2																			
Sampling Date	yyyy-mm-dd	--					2009/06/29	2009/08/13	2009/10/01	2010/05/31	2010/08/24	2010/11/01	2011/05/13	2011/08/14	2011/10/16	2012/05/01	2012/08/14	2012/10/10	2013/05/15	2013/08/15	2013/10/16	2014/05/14	2014/08/14	2014/10/27	2015/05/20	2015/08/25
Sampling Time	hh:mm	--					11:00	10:30	10:45	10:15	12:25	10:50	09:30	14:00	13:15	9:50	10:30	10:20	09:10	16:10	14:30	10:45	9:20	14:04	09:15	13:29
FIELD DATA																										
Secchi Depth	Meters	--	--	1.2	--		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NCC	N/A
Water Temp	Celsius	0.1	--	--	--		16.8	18.2	15.4	13.5	20.4	8.0	9.9	19.1	14.1	7.6	21.8	12.3	10.1	22.9	9.7	11.7	21.1	10.8	13.13	24.7
Dissolved Oxygen	mg/L	0.01	--	--	5.5 - 9.5		**10.16**	8.50	5.70	6.28	**4.66**	**9.58**	**9.66**	7.06	8.43	6.47	5.82	7.63	9.37	6.38	7.40	**14.90**	6.95	7.7	8.41	7.28
pH	pH	N/A	--	--	--		6.33	6.35	6.19	6.61	6.96	6.25	6.77	5.90	5.62	7.72	6.41	6.29	5.75	7.47	5.57	6.60	7.22	5.79	6.36	5.88
Specific Conductance	uS/cm	1	--	--	--		46	106	89	199	104	75	80	67	54	58	96.6	61.1	77.9	65.3	64.5	188.0	266.0	63.0	0.053	107.9
INORGANICS																										
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--		8	8	8	8	7	<5	<5	7	<5	20	<5	8	<5	<5	<5	29	7	28	<5.0	7
Dissolved Chloride (Cl)	mg/L	1	--	--	120		48	48	48	48	25	17	19	14	10	16	20	12	19	21	14	20	17	12	15	14
Colour	TCU	30	--	--	--		20	20	20	20	63	95	80	110	120	52	60	94	37	90	71	25	44	168	50	63
Nitrite + Nitrate	mg/L	0.05	--	--	--		0.19	0.19	0.19	0.19	0.07	0.06	0.12	0.07	<0.05	0.11	0.08	<0.05	0.12	<0.05	<0.05	0.08	<0.05	<0.05	0.059	0.08
Nitrate (N)	mg/L	0.05	--	--	13000		0.19	0.19	0.19	0.19	0.07	--	0.12	--	--	0.11	0.08	<0.05	0.12	<0.05	<0.05	0.08	<0.05	<0.05	0.059	0.08
Nitrite (N)	mg/L	0.05	--	--	60		<0.05	<0.05	<0.05	<0.05	<0.01	--	<0.01	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010	<0.05
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19		<0.03	<0.03	<0.03	<0.03	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<0.03	<0.03	<0.03	0.04	<0.03	<0.03	0.04	<0.03	<0.050	<0.03
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--		--	--	--	--	--	--	--	--	--	<0.4	2.2	0.7	--	1.1	<0.4	<0.4	0.4	<0.4	0.4	0.8
Total Organic Carbon	mg/L	0.5	--	--	--		4.3	4.3	4.3	4.3	6.6	9.7	6.5	10	12	8.1	7.1	10.9	7.5	11.1	10.9	6.2	6.6	12.9	4.0	13.3
Orthophosphate (as P)	mg/L	0.01	--	--	--		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.01
pH (Lab)	pH	N/A	--	5.0-9.0	6.5-9		6.85	6.85	6.85	6.85	6.78	**6.11**	**6.27**	**6.4**	**6.05**	6.5	6.7	6.5	**6.37**	6.62	**6.34**	6.53	6.87	**6.06**	**6.32**	6.99
Total Calcium (Ca)	mg/L	0.1	--	--	--		6.5	6.5	6.5	6.5	4.08	3.55	2.51	2.48	2.21	2.4	3.6	2.9	2.7	2.5	2.4	3.4	4.0	2.4	2600	3.4
Total Magnesium (Mg)	mg/L	0.1	--	--	--		1.2	1.2	1.2	1.2	0.98	0.84	0.63	0.64	0.36	0.7	1.0	1.0	0.7	0.5	0.8	1.1	1.0	0.6	640	0.9
Total Phosphorus (1M depth)	mg/L	0.002	--	--	--	0.01	0.02	0.02	0.02	0.02	0.009	0.009	0.009	0.008	0.013	0.021	0.099	0.013	0.010	0.020	0.029	0.013	0.039	0.03	0.008	**0.012**
Total Potassium (K)	mg/L	0.1	--	--	--		1.1	1.1	1.1	1.1	0.634	0.826	0.534	0.497	0.734	0.5	0.7	0.8	0.5	0.5	0.7	0.7	0.9	0.7	540	0.7
Total Sodium (Na)	mg/L	0.1	--	--	--		31.6	31.6	31.6	31.6	14.7	10.6	11.1	7.8	6.9	9.8	14.2	9.5	8.9	7.0	7.9	17.5	14.0	7.6	8.4	11.5
Reactive Silica (SiO2)	mg/L	0.5	--	--	--		2.2	2.2	2.2	2.2	4.2	4.7	2.7	4.3	4	2.6	4.0	4.9	2.8	4.4	4.9	2.4	3.3	4.6	2.0	3.7
Total Suspended Solids	mg/L	5	--	--	--		103	103	103	103	7	<1	<1	<2	<1	<5	<5	<5	<5	135	<5	<5	<5	<5	<1.0	<5
Dissolved Sulphate (SO4)	mg/L	2	--	--	--		9	9	9	9	<2	<2	<2	<2	<2	3	3	2	4	5	4	4	2	3	2.8	<2
Turbidity (NTU)	NTU	0.1	--	50	--		0.5	0.5	0.5	0.5	1.0	1.0	0.4	0.7	0.6	0.5	1.1	1.0	1.9	2.2	1.0	0.9	0.8	1.2	<1.0	1.6
Conductivity (uS/cm)	µS/cm	1	--	--	--		212	212	212	212	100	97	79	66	54	71	91	61	83	69	62	87	94	66	64	81
Calculated Parameters																										
Anion Sum	me/L	N/A	--	--	--		0.49	0.82	0.45	0.77	0.85	0.49	0.53	0.53	0.28	0.92	0.63	0.54	0.63	0.70	0.48	1.23	0.66	0.96	0.48	0.54
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--		<1	8	<1	5	7	<1	<1	7	<1	20	<5	8	<5	<5	<5	29	7	28	<1.0	7
Calculated TDS	mg/L	1	--	--	--		36	55	35	46	55	38	37	34	25	45	44	34	37	37	31	65	44	44	32	36
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--		<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<1.0	<10
Cation Sum	me/L	N/A	--	--	--		0.71	0.99	0.67	0.74	0.95	0.74	0.68	0.55	0.49	0.65	0.94	0.73	0.63	0.54	0.60	1.07	0.97	0.57	0.57	0.82
Hardness (CaCO3)	mg/L	1	--	--	--		10	15	10	12	14	12	9	9	8	8.9	13.1	11.4	9.6	8.3	9.3	13.0	14.1	8.5	9.1	12.2
Ion Balance (% Difference)	%	N/A	--	--	--		18.30	9.39	19.60	1.99	5.56	20.30	12.40	1.85	27.30	17.6	19.7	15.1	0.3	12.9	11.0	7.1	19.1	25.7	8.57	20.5
Langelier Index (@ 20C)	N/A	N/A	--	--	--		NC	-3.20	NC	-3.44	-3.05	NC	NC	-3.66	NC	-3.37	-3.60	-3.68	-4.05	-3.83	-4.12	-3.04	-3.23	-3.66	NC	-3.18
Langelier Index (@ 4C)	N/A	N/A	--	--	--		NC	-3.45	NC	-3.70	-3.30	NC	NC	-3.91	NC	-3.69	-3.92	-4.00	-4.37	-4.15	-4.44	-3.36	-3.55	-3.98	NC	-3.50
Saturation pH (@ 20C)	N/A	N/A	--	--	--		NC	9.78	NC	10.00	9.83	NC	NC	10.10	NC	9.87	10.3	10.2	10.4	10.5	10.5	9.57	10.1	9.72	NC	10.20
Saturation pH (@ 4C)	N/A	N/A	--	--	--		NC	10.00	NC	10.30	10.10	NC	NC	10.30	NC	10.2	10.6	10.5	10.7	10.8	10.8	9.89	10.4	10.0	NC	10.5
Metals (ICP-MS)																										
Total Aluminum (Al)	µg/L	5	5	--	5-100		**290**	--	--	**175**	**151**	--	**271**	--	--	**209**	**205**	**338**	**256**	**270**	**259**	**205**	**236**	**340**	***180***	--
Total Antimony (Sb)	µg/L	2	20	--	--		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	--
Total Arsenic (As)	µg/L	2	5.0	--	5		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	--
Total Barium (Ba)	µg/L	5	1000	--	--		9	--	--	11.7	14.3	--	9.5	--	--	9	11	10	8	<5	13	13	18	9	9.2	--
Total Beryllium (Be)	µg/L	2	5.3	--	--		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	--
Total Bismuth (Bi)	µg/L	2	--	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Boron (B)	µg/L	5	1200	--	1500		8	--	--	14.7	12.7	--	<50	--	--	6	14	22	6	11	9	11	12	12	<50	--
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017		<0.3	--	--	**0.018**	<0.017	--	<0.017	--	--	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	**0.019**	<0.017	<0.017	**0.018**	***0.014***	--
Total Chromium (Cr)	µg/L	1	--	--	1		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	<1	<1	<1	<1	**3**	<1	<1	<1.0	--
Total Cobalt (Co)	µg/L	1	10	--	--		<1	--	--	<0.40	<0.40	--	<0.40	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.40	--
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0		<2	--	--	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<1	2	<1	<1	4	<2.0	<1
Total Iron (Fe)	µg/L	50	300	--	300		250	--	--	227	**403**	238	202	**418**	**358**	154	**541**	**813**	269	**528**	**523**	174	**723**	**305**	250	**641**
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0		<0.5	--	--	1.01	<0.50	--	<0.50	--	--	<0.5	<0.5	1.1	<0.5	0.5	<0.5	5.8	<0.5	0.5	<0.50	--
Total Manganese (Mn)	µg/L	2	820	--	--		26	--	--	43.2	83.3	34.7	12.1	68.4	22.6	17	90	114	24	67	53	33	146	25	47	120
Total Molybdenum (Mo)	µg/L	2	73	--	73		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Nickel (Ni)	µg/L	2	25	--	25-150		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Selenium (Se)	µg/L	1	1.0	--	1		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	1	<1	<1	<1	<1	<1	<1	<1.0	--
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1		<0.5	--	--	**0.42**	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	--
Total Strontium (Sr)	µg/L	5	21000	--	--		14	--	--	17.8	19.5	--	11.9	--	--	10	18	15	12	9	12	16	17	12	12	--
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8		<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	--
Total Tin (Sn)	µg/L	2	--	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	3	<2	<2	<2	<2	<2	<2	<2.0	--
Total Titanium (Ti)	µg/L	2	--	--	--		2	--	--	<2.0	<2.0	--	2.8	--	--	<2	2	3	4	<2	2	2	<2	3	2.5	--
Total Uranium (U)	µg/L	0.1	300	--	15		<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	--
Total Vanadium (V)	µg/L	2	6	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Zinc (Zn)	µg/L	5	30	--	30		8	--	--	5.4	5.3	6.5	<5.0	<5.0	<5.0	<5	<5	7	<5	<5	<5	<5	<5	<5	<5.0	<5
MICROBIOLOGICAL																										
Total Coliform	MPN/100mL	1	--	--	--		1800	170	--	>250	11	>250	59	>250	--	>2420	1986	>2420	>2420	>2420	>2420	525	>2420	>2420	---	>2420
E. coli	MPN/100mL	1	--	400	--		**1500**	100	--	**>250**	6	6	2	**>250**	<100	3	7	3	12	6	2	<1	18	11	30	11
Fecal Coliform	MPN/ml	--	--	400	--		--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---	--
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--		0.82	6.05	1.97	0.73	0.55	0.22	0.44	0.89	0.97	0.53	2.2	0.07	0.62	1.00	0.73	0.13	0.83	0.41	0.34	0.96
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--		0.87	5.97	1.95	0.66	0.54	0.21	0.42	0.73	0.82	0.56	2.2	0.12	0.72	1.00	0.74	0.14	0.86	0.41	---	1.26

Notes:

NC - Not Calculable
RDL = Recordable Detection Limit (represents most recent sampling event RDL)
" -- " = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guideline for the protection of the environment and ecological receptors (last updated 2011)
CCME FWAL Guidelines for Aluminum, Lead, Copper and Nickel vary based on reported pH and water hardness (CCME FWAL calculation equations). The largest guideline value for each respective element range was always
Health Canada Guideline for Recreational Water Quality = Health Canada Guidelines for Canadian Recreational Water Quality - Draft (September 2009) (Referenced)
Nova Scotia Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table A2 Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water

Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics, Metals)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

TABLE 3: Bedford West Water Quality Sampling Program

August 2015	Units	RDL (August 2015)	NSE ESQs for Surface Water (Applied)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	CCME Phosphorus Trigger Range (Applied)	Kearney Lake																			
Sample Sites							KL3																			
Sampling Date	yyyy-mm-dd	--					2009/06/29	2009/08/13	2009/10/01	2010/05/31	2010/08/24	2010/11/01	2011/05/13	2011/08/14	2011/10/16	2012/05/01	2012/08/14	2012/10/10	2013/05/15	2013/08/16	2013/10/16	2014/05/14	2014/08/14	2014/10/27	2015/05/20	2015/08/25
Sampling Time	hh:mm	--					09:00	11:00	09:30	11:30	14:12	11:40	10:30	12:20	12:00	10:26	12:20	11:20	9:50	10:00	14:00	11:00	11:50	14:25	10:35	11:45
FIELD DATA																										
Secchi Depth	Meters	--	--	1.2	--		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NCC	N/A
Water Temp	Celsius	0.1	--	--	--		14.0	21.6	17.3	14.7	23.1	9.9	10.3	21.1	15.5	9	24.5	15.6	11.7	21.5	13.6	11.0	22.7	12.8	14.73	25.0
Dissolved Oxygen	mg/L	0.01	--	--	5.5 - 9.5		10.79	8.00	8.00	9.26	7.83	10.35	11.06	8.42	9.60	8.89	8.17	7.72	10.20	9.20	8.90	5.90	7.87	8.12	8.02	9.91
pH	pH	N/A	--	--	--		7.27	6.74	6.97	7.27	7.33	6.76	6.83	6.96	6.30	7.68	6.85	6.51	5.86	7.25	6.49	6.55	7.37	6.67	6.84	6.87
Specific Conductance	uS/cm	1	--	--	--		95	282	246	220	228	199	220	175	161	204	225	177.2	207.3	194.4	210.6	405.0	252.0	208.0	0.185	245.1
INORGANICS																										
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--		<5	7	7	6	7	7	6	7	7	23	6	5	<5	5	7	15	5	6	<5.0	6
Dissolved Chloride (Cl)	mg/L	1	--	--	120		66	63	60	55	55	53	56	43	37	50	57	46	54	40	46	58	46	45	60	56
Colour	TCU	30	--	--	--		22	20	20	28	12	20	31	38	40	57	15	31	19	23	20	16	13	20	34	13
Nitrite + Nitrate	mg/L	0.05	--	--	--		0.14	0.12	0.14	0.24	0.15	0.22	0.24	0.15	0.16	0.19	0.09	0.09	0.21	0.11	<0.05	0.17	0.13	0.13	0.16	0.12
Nitrate (N)	mg/L	0.05	--	--	13000		0.14	--	--	0.24	0.15	--	0.24	--	--	0.19	0.09	0.09	0.21	0.11	<0.05	0.17	0.13	0.13	0.16	0.12
Nitrite (N)	mg/L	0.05	--	--	60		<0.01	--	--	<0.01	<0.01	--	<0.01	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010	<0.05
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19		<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	0.04	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.050	<0.03
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--		--	--	--	--	--	--	--	--	--	<0.4	2.8	<0.4	--	1.3	<0.4	0.6	0.4	0.4	0.15	1.2
Total Organic Carbon	mg/L	0.5	--	--	--		2.6	3.9	4.3	3.6	3.1	3.3	3.8	5.1	5	5.9	3.4	4.9	4.3	4.4	4.6	4.6	2.8	4.5	3.4	5.7
Orthophosphate (as P)	mg/L	0.01	--	--	--		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.01
pH (Lab)	pH	N/A	--	5.0-9.0	6.5-9		6.38	6.67	6.82	6.82	6.99	6.87	6.52	6.5	6.38	6.7	7.1	6.9	6.68	6.96	6.86	6.68	6.87	6.59	6.54	6.92
Total Calcium (Ca)	mg/L	0.1	--	--	--		6.7	7.1	6.8	6.81	7.98	8.29	7.09	4.73	5.63	5.7	6.9	6.0	7.0	5.3	6.8	6.4	7.9	6.8	6600	7.8
Total Magnesium (Mg)	mg/L	0.1	--	--	--		1.2	1.2	1.11	1.22	1.28	1.27	1.21	0.83	1.01	1.0	1.2	1.3	1.0	0.9	1.3	1.4	1.2	1.0	940	1.2
Total Phosphorus (1M depth)	mg/L	0.002	--	--	--	0.01	<0.02	<0.02	0.005	0.005	<0.002	0.003	0.008	0.003	0.012	0.019	0.045	0.007	0.006	0.006	0.012	0.009	0.023	0.15	0.004	0.004
Total Potassium (K)	mg/L	0.1	--	--	--		0.9	1.1	0.9	0.791	0.837	0.990	0.879	0.681	0.921	0.7	0.9	0.9	0.8	0.6	1.2	0.8	1.1	0.9	770	0.9
Total Sodium (Na)	mg/L	0.1	--	--	--		38	38	35	28.3	33.1	33.0	33.0	20.8	21.3	31.2	34.5	26.37	35.1	20.1	32.1	36.4	39.0	35.3	34	40.0
Reactive Silica (SiO2)	mg/L	0.5	--	--	--		2.7	2.6	2.6	3.2	2.9	3.2	2.9	2.5	2.6	2.7	2.0	2.6	2.9	2.6	2.7	2.6	1.9	2.4	2.5	2.4
Total Suspended Solids	mg/L	5	--	--	--		<1	1	1	2	<2	<1	<1	<1	<1	<5	<5	<5	<5	<5	<5	<5	<5	<5	2.8	<5
Dissolved Sulphate (SO4)	mg/L	2	--	--	--		11	12	12	10	10	10	9	10	8	7	8	7	7	7	8	9	7	7	7.9	9
Turbidity (NTU)	NTU	0.1	--	50	--		0.7	1.4	0.6	0.3	0.5	0.6	0.6	0.6	0.4	0.8	0.7	1	0.7	2.4	0.4	0.4	0.3	0.9	0.7	0.5
Conductivity (uS/cm)	µS/cm	1	--	--	--		250	250	240	220	220	220	220	170	160	197	222	182	219	216	204	218	243	216	220	242
Calculated Parameters																										
Anion Sum	me/L	N/A	--	--	--		2.11	2.17	2.08	1.90	1.93	1.87	1.90	1.58	1.36	2.03	1.90	1.55	1.68	1.38	1.60	2.14	1.55	1.54	1.87	1.90
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--		<1	7	7	6	7	7	6	7	7	23	6	5	<5	5	7	15	5	6	<1.0	6.0
Calculated TDS	mg/L	1	--	--	--		128	130	123	110	117	116	115	88	82	111	113	91	106	78	100	122	106	100	110	119
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--		<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<1.0	<10
Cation Sum	me/L	N/A	--	--	--		2.12	2.16	1.99	1.69	1.97	1.98	1.92	1.23	1.32	1.77	1.98	1.60	2.00	1.24	1.89	2.07	2.23	2.00	1.89	2.27
Hardness (CaCO3)	mg/L	1	--	--	--		22	23	22	22	25	26	23	15	18	18.4	22.2	20.3	21.6	16.9	22.3	21.7	24.7	21.1	20	24.4
Ion Balance (% Difference)	%	N/A	--	--	--		0.24	0.23	2.21	5.85	1.03	2.86	0.52	12.50	1.49	6.8	2.1	1.6	8.6	5.5	8.3	1.5	17.9	12.8	0.53	9.0
Langelier Index (@ 20C)	N/A	N/A	--	--	--		NC	-3.00	-2.89	-2.92	-2.60	-2.73	-3.23	-3.33	-3.35	-2.77	-2.88	-3.21	-3.37	-3.19	-3.05	-2.93	-3.12	-3.39	NC	-3.00
Langelier Index (@ 4C)	N/A	N/A	--	--	--		NC	-3.25	-3.14	-3.17	-2.85	-2.99	-3.49	-3.58	-3.60	-3.09	-3.20	-3.53	-3.69	-3.51	-3.37	-3.25	-3.44	-3.71	NC	-3.32
Saturation pH (@ 20C)	N/A	N/A	--	--	--		NC	9.67	9.71	9.74	9.59	9.60	9.75	9.83	9.73	9.47	9.98	10.10	10.0	10.2	9.91	9.61	9.99	9.98	NC	9.92
Saturation pH (@ 4C)	N/A	N/A	--	--	--		NC	9.92	9.96	9.99	9.84	9.86	10.00	10.10	9.98	9.79	10.3	10.4	10.4	10.5	10.2	9.93	10.3	10.3	NC	10.2
Metals (ICP-MS)																										
Total Aluminum (Al)	µg/L	5	5	--	5-100		259	259	--	124	53.5	--	266	--	--	199	54	153	140	65	100	260	52	105	180	--
Total Antimony (Sb)	µg/L	2	20	--	--		<2	<2	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	--
Total Arsenic (As)	µg/L	2	5.0	--	5		<2	<2	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	--
Total Barium (Ba)	µg/L	5	1000	--	--		13	13	--	15.7	13.2	--	19.1	--	--	18	17	15	19	9	18	17	17	16	19	--
Total Beryllium (Be)	µg/L	2	5.3	--	--		<2	<2	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	--
Total Bismuth (Bi)	µg/L	2	--	--	--		<2	<2	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Boron (B)	µg/L	5	1200	--	1500		9	9	--	7.8	8.7	--	<50	--	--	5	9	17	7	7	10	8	10	12	<50	--
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017		0.019	0.019	--	0.039	<0.017	--	0.046	--	--	0.019	0.021	0.027	0.028	<0.017	<0.017	0.038	<0.017	0.017	0.023	--
Total Chromium (Cr)	µg/L	1	--	--	1		<1	<1	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	<1	<1	<1	<1	7	<1	<1	<1.0	--
Total Cobalt (Co)	µg/L	1	10	--	--		<1	<1	--	<0.40	<0.40	--	<0.40	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.40	--
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0		2	2	--	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<1	1	1	<1	2	<2.0	1.0
Total Iron (Fe)	µg/L	50	300	--	300		523	523	--	73	133	58	136	104	154	137	136	119	131	71	172	137	96	118	120	165
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0		<0.5	<0.5	--	0.60	<0.50	--	<0.50	--	--	<0.5	<0.5	0.7	<0.5	<0.5	0.9	3.6	<0.5	<0.5	<0.50	--
Total Manganese (Mn)	µg/L	2	820	--	--		53	53	--	36.8	67.1	32.1	41.5	33.1	32.5	25	47	46	37	20	92	41	45	27	36	48
Total Molybdenum (Mo)	µg/L	2	73	--	73		<2	<2	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Nickel (Ni)	µg/L	2	25	--	25-150		<2	<2	--	2.0	<2.0	--	2.3	--	--	<2	<2	<2	<2	<2	<2	2	<2	<2	<2.0	--
Total Selenium (Se)	µg/L	1	1.0	--	1		<1	<1	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1.0	--
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1		<0.1	<0.1	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	--
Total Strontium (Sr)	µg/L	5	21000	--	--		12	12	--	33.5	35.9	--	33.2	--	--	25	33	29	33	18	32	31	32	29	29	--
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8		<0.1	<0.1	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	--
Total Tin (Sn)	µg/L	2	--	--	--		<2	<2	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Titanium (Ti)	µg/L	2	--	--	--		2	2	--	<2.0	<2.0	--	4.9	--	--	<2	<2	<2	<2	<2	2	3	<2	2	2.7	--
Total Uranium (U)	µg/L	0.1	300	--	15		<0.1	<0.1	--	<0.10	<0.10	--	0.11	--	--	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	--
Total Vanadium (V)	µg/L	2	6	--	--		<2	<2	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Zinc (Zn)	µg/L	5	30	--	30		<5	<5	--	9.7	6.9	6.4	9.3	6.6	9.2	<5	<5	8	10	5	7	10	<5	6	8.7	7
MICROBIOLOGICAL																										
Total Coliform	MPN/100mL	1	--	--	--		120	24	--	190	16	58	72	110	--	291	1553	178	345	2420	1300	86	1730	>2420	---	2420
E. coli	MPN/100mL	1	--	400	--		1	17	--	2	<1	8	5	37	<100	2	<1	3	8	21	<1	<1	<1	13	<0.10	7
Fecal Coliform	MPN/ml	--	--	400	--		--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---	--
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--		1.04	1.11	1.18	1.30	1.14	0.51	0.78	1.26	1.24	0.52	1.3	0.81	1.44	2.00	0.65	0.76	0.59	1.23	0.72	1.27
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--		0.94	0.97	1.21	1.09	1.19	0.42	0.67	0.98	1.01	0.55	1.2	1.14	1.62	2.30	0.61	0.69	0.51	1.12	0.68	1.34

Notes:

NC - Not Calculable
RDL = Recordable Detection Limit (represents most recent sampling event RDL)
" -- " = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guideline for the protection of the environment and ecological receptors (last updated 2011)
CCME FWAL Guidelines for Aluminum, Lead, Copper and Nickel vary based on reported pH and water hardness (CCME FWAL calculation equations). The largest
Health Canada Guideline for Recreational Water Quality = Health Canada Guidelines for Canadian Recreational Water Quality - Draft (September 2009) (Referenced)
Nova Scotia Environment Environmental Quality Standards for Surface Water (Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table A2
Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water
Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics, Metals)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

TABLE 3: Bedford West Water Quality Sampling Program

August 2015	Units	RDL (August 2015)	NSE ESQs for Surface Water (Applied)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	CCME Phosphorus Trigger Range (Applied)	Kearney Lake																					
Sample Sites							KL4																					
Sampling Date	yyyy-mm-dd	--					2009/06/29	2009/08/13	2009/10/01	2010/05/31	2010/08/24	2010/11/01	2011/05/13	2011/08/14	2011/10/16	2012/05/01	2012/08/14	2012/10/10	2013/05/15	2013/08/16	2013/10/16	2014/05/14	2014/08/14	2014/10/27	2015/05/20	2015/08/25
Sampling Time	hh:mm	--					10:00	11:30	10:00	11:20	13:50	11:15	10:10	11:40	11:40	10:16	12:00	11:40	9:41	10:30	14:20	11:15	11:35	14:35	10:25	11:02
FIELD DATA																												
Secchi Depth	Meters	--	--	1.2	--		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NCC	N/A
Water Temp	Celsius	0.1	--	--	--		13.4	21.9	17.3	14.5	21.9	9.8	10.1	21.2	15.3	9.0	24.4	15.7	11.7	20.4	13.5	11.0	21.8	12.5	14.75	24.7
Dissolved Oxygen	mg/L	0.01	--	--	5.5 - 9.5		10.87	8.10	8.30	9.01	6.27	10.89	10.99	8.55	9.65	8.70	7.32	8.87	10.09	8.89	9.60	14.50	5.92	7.52	9.81	9.09
pH	pH	N/A	--	--	--		8.00	6.71	6.94	7.19	6.98	6.07	6.49	6.43	6.02	9.0	6.71	6.77	5.72	7.08	6.41	6.30	7.25	6.55	6.64	6.81
Specific Conductance	uS/cm	1	--	--	--		771	262	247	224	226	215	218	172	126	206	225	185.9	207.1	196.2	209.0	273.0	251.0	208.0	0.188	243.5
INORGANICS																												
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--		5	7	7	6	8	7	5	8	7	22	8	<5	<5	<5	<5	30	5	29	<5.0	6
Dissolved Chloride (Cl)	mg/L	1	--	--	120		67	65	60	56	56	53	56	44	37	51	57	46	54	41	47	59	47	48	61	56
Colour	TCU	30	--	--	--		22	18	20	27	11	20	32	38	43	48	11	20	17	21	20	13	11	28	33	10
Nitrite + Nitrate	mg/L	0.05	--	--	--		0.15	0.12	0.14	0.23	0.19	0.21	0.23	0.15	0.17	0.19	0.11	0.09	0.20	0.11	0.17	0.25	0.17	0.16	0.16	0.14
Nitrate (N)	mg/L	0.05	--	--	13000		0.15	--	--	0.23	0.19	--	0.23	--	--	0.19	0.11	0.09	0.20	0.11	0.17	0.25	0.17	0.16	0.16	0.14
Nitrite (N)	mg/L	0.05	--	--	60		<0.01	--	--	<0.01	<0.01	--	<0.01	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010	<0.05
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	0.05	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.1	<0.03
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--		--	--	--	--	--	--	--	--	--	0.5	<0.4	0.7	--	1.8	1.1	<0.4	<0.4	<0.4	0.21	0.4
Total Organic Carbon	mg/L	0.5	--	--	--		2.5	2.6	4.0	3.3	2.6	3.1	3.7	6	5.4	7.5	3.2	4.8	4.2	4.5	4.3	4.4	2.1	4.4	2.8	5.2
Orthophosphate (as P)	mg/L	0.01	--	--	--		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.01
pH (Lab)	pH	N/A	--	5.0-9.0	6.5-9		6.61	6.75	6.83	6.83	6.93	6.83	6.57	6.57	6.46	6.7	7.0	6.9	6.69	6.96	6.85	6.69	6.91	6.85	6.59	6.94
Total Calcium (Ca)	mg/L	0.1	--	--	--		6.8	7.7	7.0	6.81	8.00	8.45	6.84	4.93	5.24	5.7	6.8	5.8	6.8	5.1	6.8	6.4	7.9	6.8	6500	7.9
Total Magnesium (Mg)	mg/L	0.1	--	--	--		1.2	1.3	1.2	1.22	1.24	1.31	1.19	0.86	0.99	1.0	1.2	1.2	1.0	0.8	1.2	1.3	1.2	1.0	920	1.3
Total Phosphorus (1M depth)	mg/L	0.002	--	--	--	0.01	<0.02	<0.02	<0.002	0.004	<0.002	<0.002	0.007	0.003	0.026	0.022	0.043	0.007	0.006	2.39	0.016	0.022	0.031	0.015	0.006	0.007
Total Potassium (K)	mg/L	0.1	--	--	--		1	1	1	0.807	0.905	0.968	0.826	0.733	1.130	0.7	1.0	0.9	0.8	0.6	1.2	0.8	1.1	0.9	760	0.9
Total Sodium (Na)	mg/L	0.1	--	--	--		39	41	37	28.5	34.3	33.9	32.1	21.5	21.1	31.5	34.5	25.2	31.6	20.1	30.7	35.9	38.6	34.1	34	40.0
Reactive Silica (SiO2)	mg/L	0.5	--	--	--		2.7	2.6	2.6	3.1	2.9	3.1	2.9	2.5	2.7	2.7	2.2	2.6	3.0	2.6	2.5	2.6	2.1	2.5	2.5	2.6
Total Suspended Solids	mg/L	5	--	--	--		<1	1	<1	<2	<2	<1	2	<1	<2	<5	<5	<5	<5	<5	<5	<5	<5	<5	<1.0	7.0
Dissolved Sulphate (SO4)	mg/L	2	--	--	--		11	12	11	10	10	10	9	10	8	7	8	7	7	7	9	9	8	8	7.7	9.0
Turbidity (NTU)	NTU	0.1	--	50	--		0.5	1.0	0.3	0.3	0.2	0.8	0.7	0.7	0.4	0.7	0.4	0.8	0.7	2.6	2.1	1.1	0.6	0.8	0.61	0.7
Conductivity (uS/cm)	µS/cm	1	--	--	--		260	250	230	220	230	250	210	170	160	200	224	183	218	218	204	219	241	218	220	241
Calculated Parameters																												
Anion Sum	me/L	N/A	--	--	--		2.23	2.22	2.09	1.91	1.94	1.85	1.88	1.62	1.36	2.04	1.94	1.45	1.68	1.31	1.53	2.47	1.60	2.11	1.88	1.90
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--		5	7	7	6	8	7	5	8	7	22	8	<5	<5	<5	<5	30	5	29	<1.0	6.0
Calculated TDS	mg/L	1	--	--	--		132	135	125	111	118	116	113	90	81	111	114	87	103	75	97	132	108	117	110	121
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--		<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<1.0	<10
Cation Sum	me/L	N/A	--	--	--		2.16	2.32	2.07	1.70	2.02	2.03	1.86	1.28	1.3	1.78	1.97	1.53	1.84	1.23	1.84	2.04	2.21	1.94	1.91	2.35
Hardness (CaCO3)	mg/L	1	--	--	--		22	25	22	22	25	27	22	16	17	18.4	21.9	19.4	21.1	16.0	21.9	21.3	24.7	21.1	20	25.1
Ion Balance (% Difference)	%	N/A	--	--	--		1.59	2.20	0.48	5.82	2.02	4.64	0.53	11.70	2.26	6.6	0.8	2.8	4.5	3.2	9.2	9.5	15.8	4.2	0.79	10.7
Langelier Index (@ 20C)	N/A	N/A	--	--	--		-3.21	-2.89	-2.84	-2.92	-2.64	-2.75	-3.22	-3.18	-3.31	-2.79	-2.86	-3.22	-3.37	-3.21	-3.21	-2.63	-3.08	-2.45	NC	-2.98
Langelier Index (@ 4C)	N/A	N/A	--	--	--		-3.46	-3.14	-3.09	-3.17	-2.89	-3.00	-3.47	-3.43	-3.56	-3.11	-3.18	-3.54	-3.69	-3.53	-3.53	-2.95	-3.40	-2.77	NC	-3.30
Saturation pH (@ 20C)	N/A	N/A	--	--	--		9.82	9.64	9.67	9.75	9.57	9.58	9.79	9.75	9.77	9.49	9.86	10.10	10.1	10.2	10.1	9.32	9.99	9.30	NC	9.92
Saturation pH (@ 4C)	N/A	N/A	--	--	--		10.1	9.9	9.9	10.0	9.8	9.8	10.0	10.0	10.0	9.8	10.2	10.4	10.4	10.5	10.4	9.64	10.3	9.62	NC	10.2
Metals (ICP-MS)																												
Total Aluminum (Al)	µg/L	5	5	--	5-100		150	--	--	125	29.2	--	231	--	--	188	48	149	141	106	159	236	46	93	260	--
Total Antimony (Sb)	µg/L	2	20	--	--		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	--
Total Arsenic (As)	µg/L	2	5.0	--	5		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	--
Total Barium (Ba)	µg/L	5	1000	--	--		16	--	--	16.6	17.8	--	18.2	--	--	18	17	16	18	10	19	17	19	16	20	--
Total Beryllium (Be)	µg/L	2	5.3	--	--		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	--
Total Bismuth (Bi)	µg/L	2	--	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Boron (B)	µg/L	5	1200	--	1500		6	--	--	8.6	9.1	--	<50	--	--	6	9	16	7	6	9	8	11	11	<50	--
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017		<0.3	--	--	0.031	<0.017	--	0.035	--	--	0.021	<0.017	0.027	0.027	0.017	0.050	0.027	<0.017	<0.017	0.033	--
Total Chromium (Cr)	µg/L	1	----	--	1		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	6	<1	<1	<1	9	<1	<1	<1.0	--
Total Cobalt (Co)	µg/L	1	10	--	--		<1	--	--	<0.40	<0.40	--	<0.40	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.40	--
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0		<2	--	--	<2.0	2.4	<2.0	2.3	<2.0	<2.0	<2	<2	4	9	<1	1	<1	<1	2	6.8	1
Total Iron (Fe)	µg/L	50	300	--	300		86	--	--	82	51	55	119	109	138	129	118	133	213	144	248	129	55	104	100	217
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0		<0.5	--	--	3.23	<0.50	--	<0.50	--	--	<0.5	<0.5	0.8	0.9	<0.5	<0.5	2.6	<0.5	<0.5	<0.50	--
Total Manganese (Mn)	µg/L	2	820	--	--		51	--	--	34.5	63.5	29.4	38.5	27.2	29.7	23	34	38	34	77	130	34	29	24	25	78
Total Molybdenum (Mo)	µg/L	2	73	--	73		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Nickel (Ni)	µg/L	2	25	--	25-150		3	--	--	2.0	<2.0	--	<2.0	--	--	<2	<2	5	<2	<2	<2	<2	<2	<2	<2.0	--
Total Selenium (Se)	µg/L	1	1.0	--	1		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1.0	--
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1		<0.5	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	--
Total Strontium (Sr)	µg/L	5	21000	--	--		34	--	--	33.1	36.7	--	32.7	--	--	25	32	28	32	17	31	31	31	29	30	--
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8		<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	--
Total Tin (Sn)	µg/L	2	--	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	5	<2	<2	<2	<2	<2	<2.0	--
Total Titanium (Ti)	µg/L	2	--	--	--		<2	--	--	<2.0	<2.0	--	4.2	--	--	<2	<2	<2	<2	<2	3	2	<2	<2	<2.0	--
Total Uranium (U)	µg/L	0.1	300	--	15		<0.1	--	--	<0.10	<0.10	--	0.1	--	--	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	--
Total Vanadium (V)	µg/L	2	6	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Zinc (Zn)	µg/L	5	30	--	30		14	--	--	10.4	6.9	7	11.3	7.4	7	<5	<5	68	21	<5	9	9	<5	<5	9.6	8
MICROBIOLOGICAL																												
Total Coliform	MPN/100mL	1	--	--	--		28	58	--	100	16	75	83	95	--	345	>2420	921	548	>2420	770	308	1550	>2420	---	>2420
E. coli	MPN/100mL	1	--	400	--		4	33	--	1	<1	2	5	39	<100	4	<1	4	6	38	<1	<1	1	8	<10	5
Fecal Coliform	MPN/ml	--	--	400	--		--	--	<1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---	--
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--		0.78	1.11	1.06	0.92	0.07	0.50	0.60	1.04	1.31	0.52	0.7	0.55	1.34	1.50	0.40	0.44	0.50	1.03	0.55	0.26
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--		0.69	0.96	1.11	0.77	0.07	0.41	0.55	0.82	1.07	0.55	0.7	0.74	1.48	1.70	0.39	0.40	0.57	0.95	0.51	0.31

Notes:

NC - Not Calculable
RDL = Recordable Detection Limit (represents most recent sampling event RDL)
" -- " = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guideline for the protection of the environment and ecological receptors (last updated 2011)
CCME FWAL Guidelines for Aluminum, Lead, Copper and Nickel vary based on reported pH and water hardness (CCME FWAL calculation equations).
Health Canada Guideline for Recreational Water Quality = Health Canada Guidelines for Canadian Recreational Water Quality - Draft (September 2009) (Referenced)
Nova Scotia Environment Environmental Quality Standards for Surface Water (Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table A2 Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water
Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics, Metals)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

TABLE 3: Bedford West Water Quality Sampling Program

August 2015	Units	RDL (August 2015)	NSE ESQs for Surface Water (Applied)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	CCME Phosphorus Trigger Range (Applied)	Kearney Lake											
Sample Sites							KL5											
Sampling Date	yyyy-mm-dd	--					2011/10/17	2012/05/01	2012/08/14	2012/10/10	2013/05/15	2013/08/16	2013/10/16	2014/05/14	2014/08/14	2014/10/27	2015/05/20	2015/08/25
Sampling Time	hh:mm	--					9:40	10:52	13:10	12:10	10:03	10:50	13:45	11:30	13:55	10:45	09:00	12:04
FIELD DATA																		
Secchi Depth	Meters	--	--	1.2	--		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NCC	N/A
Water Temp	Celsius	0.1	--	--	--		14.7	10.5	26.1	16.6	13.3	22.7	14.7	13.7	22.9	12.8	14.06	25.4
Dissolved Oxygen	mg/L	0.01	--	--	5.5 - 9.5		9.38	7.88	7.90	8.16	**9.67**	8.89	8.60	**15.83**	7.64	7.91	8.32	8.75
pH	pH	N/A	--	--	--		6.52	7.76	6.69	6.72	6.20	8.57	6.51	6.79	7.86	6.60	7.82	6.77
Specific Conductance	uS/cm	1	--	--	--		112	230	229	189.0	219.5	202.1	212.9	472.0	251.0	211.0	0.184	249.8
INORGANICS																		
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--		9	21	8	<5	<5	6	5	32	<5	<5	5.4	6
Dissolved Chloride (Cl)	mg/L	1	--	--	120		37	55	57	48	58	44	46	61	47	47	59	58
Colour	TCU	30	--	--	--		35	43	10	27	10	22	18	14	11	22	35	8
Nitrite + Nitrate	mg/L	0.05	--	--	--		0.17	0.19	0.15	0.83	0.21	0.21	0.25	0.16	0.10	0.16	0.16	0.12
Nitrate (N)	mg/L	0.05	--	--	13000		--	0.19	0.15	0.83	0.21	0.21	0.20	0.16	0.10	0.16	0.16	0.12
Nitrite (N)	mg/L	0.05	--	--	60		--	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.010	<0.05
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19		<0.05	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.06	<0.050	<0.03
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--		--	<0.4	2.3	1.0	--	0.6	1.1	<0.4	0.5	1.1	0.31	<0.4
Total Organic Carbon	mg/L	0.5	--	--	--		4.8	5.8	3.4	4.7	4.0	4.6	7.0	4.3	2.7	4.5	3.1	5.3
Orthophosphate (as P)	mg/L	0.01	--	--	--		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.01
pH (Lab)	pH	N/A	--	5.0-9.0	6.5-9		6.57	6.7	7.1	6.5	6.71	6.93	6.89	6.64	6.84	6.63	6.56	6.90
Total Calcium (Ca)	mg/L	0.1	--	--	--		5.79	6.1	6.6	5.9	7.1	5.7	6.4	6.5	7.6	7.0	6500	8.0
Total Magnesium (Mg)	mg/L	0.1	--	--	--		1.05	1.0	1.1	1.2	1.0	1.0	1.1	1.4	1.2	1.0	930	1.3
Total Phosphorus (1M depth)	mg/L	0.002	--	--	--	0.01	0.009	0.018	0.040	0.006	0.005	0.013	0.010	0.010	0.026	0.14	0.005	0.005
Total Potassium (K)	mg/L	0.1	--	--	--		0.858	0.7	0.9	0.8	0.8	0.7	1.1	0.8	1.1	0.9	720	0.09
Total Sodium (Na)	mg/L	0.1	--	--	--		22.0	34.6	32.0	27.7	33.6	19.2	31.3	37.5	40.3	38.3	33	42.6
Reactive Silica (SiO2)	mg/L	0.5	--	--	--		2.5	2.7	2.0	2.4	2.7	2.5	2.5	2.7	2.1	2.5	3.3	1.9
Total Suspended Solids	mg/L	5	--	--	--		1	<5	<5	<5	<5	<5	<5	<5	<5	<5	<1.0	<5
Dissolved Sulphate (SO4)	mg/L	2	--	--	--		9	7	8	8	8	7	8	9	8	8	8	9
Turbidity (NTU)	NTU	0.1	--	50	--		0.9	1.1	0.7	0.9	0.7	0.8	0.4	1.1	0.4	0.8	0.71	1.0
Conductivity (uS/cm)	µS/cm	1	--	--	--		160	215	226	189	232	223	204	228	246	225	220	248
Calculated Parameters																		
Anion Sum	me/L	N/A	--	--	--		1.42	2.13	1.95	1.58	1.82	1.52	1.58	2.56	1.50	1.50	1.94	1.95
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--		9	21	8	<5	<5	6	5	32	<5	<5	5.4	6
Calculated TDS	mg/L	1	--	--	--		84	118	111	96	110	82	98	136	106	103	120	124
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--		<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<1.0	<10
Cation Sum	me/L	N/A	--	--	--		1.36	1.94	1.85	1.64	1.94	1.23	1.81	2.12	2.27	2.14	1.87	2.40
Hardness (CaCO3)	mg/L	1	--	--	--		19	19.3	21.0	19.7	21.8	18.4	20.5	22.0	23.9	21.6	20.0	25.3
Ion Balance (% Difference)	%	N/A	--	--	--		2.16	4.7	2.6	2.0	3.2	10.6	6.7	9.4	20.3	17.5	1.8	10.2
Langelier Index (@ 20C)	N/A	N/A	--	--	--		-3.06	-2.79	-2.77	-3.62	-3.33	-3.11	-3.19	-2.64	-3.17	-3.42	-3.24	-3.20
Langelier Index (@ 4C)	N/A	N/A	--	--	--		-3.31	-3.11	-3.09	-3.94	-3.65	-3.43	-3.51	-2.96	-3.49	-3.74	-3.50	-3.34
Saturation pH (@ 20C)	N/A	N/A	--	--	--		9.63	9.49	9.87	10.1	10.0	10.0	10.1	9.28	10.0	10.0	9.8	9.9
Saturation pH (@ 4C)	N/A	N/A	--	--	--		9.88	9.81	10.2	10.4	10.4	10.4	10.4	9.60	10.3	10.4	10.1	10.2
Metals (ICP-MS)																		
Total Aluminum (Al)	µg/L	5	5	--	5-100		--	**222**	52	**154**	**136**	58	61	**224**	53	**108**	***139***	---
Total Antimony (Sb)	µg/L	2	20	--	--		--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	---
Total Arsenic (As)	µg/L	2	5.0	--	5		--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	---
Total Barium (Ba)	µg/L	5	1000	--	--		--	18	16	15	19	9	16	16	17	17	17	---
Total Beryllium (Be)	µg/L	2	5.3	--	--		--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	---
Total Bismuth (Bi)	µg/L	2	--	--	--		--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	---
Total Boron (B)	µg/L	5	1200	--	1500		--	6	9	15	7	7	9	7	6	10	<50	---
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017		--	**0.022**	**0.027**	**0.029**	**0.024**	<0.017	**0.034**	**0.036**	<0.017	**0.024**	***0.025***	---
Total Chromium (Cr)	µg/L	1	--	--	1		--	<1	<1	5	<1	<1	<1	**9**	<1	<1	<1.0	---
Total Cobalt (Co)	µg/L	1	10	--	--		--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.40	---
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0		<2.0	<2	<2	<2	<2	<1	1	<1	<1	5	<2.0	1
Total Iron (Fe)	µg/L	50	300	--	300		175	160	78	120	111	70	79	111	<50	119	100	123
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0		--	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	1.9	<0.5	0.5	<0.5	---
Total Manganese (Mn)	µg/L	2	820	--	--		35.9	30	14	37	35	13	12	40	18	25	34	24
Total Molybdenum (Mo)	µg/L	2	73	--	73		--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	---
Total Nickel (Ni)	µg/L	2	25	--	25-150		--	<2	<2	5	<2	<2	<2	2	<2	<2	<2.0	---
Total Selenium (Se)	µg/L	1	1.0	--	1		--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1.0	---
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1		--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	---
Total Strontium (Sr)	µg/L	5	21000	--	--		--	27	31	29	31	18	31	31	30	30	29	---
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8		--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	---
Total Tin (Sn)	µg/L	2	--	--	--		--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	---
Total Titanium (Ti)	µg/L	2	--	--	--		--	3	<2	<2	<2	<2	<2	<2	<2	2	2.3	---
Total Uranium (U)	µg/L	0.1	300	--	15		--	0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	---
Total Vanadium (V)	µg/L	2	6	--	--		--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	---
Total Zinc (Zn)	µg/L	5	30	--	30		9.3	5	<5	**64**	11	7	5	10	<5	10	14	6
MICROBIOLOGICAL																		
Total Coliform	MPN/100mL	1	--	--	--		--	461	613	93	461	308	461	42	629	>2470	---	356
E. coli	MPN/100mL	1	--	400	--		100	14	2	6	6	6	4	<1	1	17	<10	1
Fecal Coliform	MPN/ml	--	--	400	--		--	--	--	--	--	--	--	--	--	--	---	---
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--		0.91	0.30	1.2	1.09	1.44	2.20	0.64	0.20	0.61	0.9	0.48	1.22
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--		0.85	0.33	1.0	1.41	1.59	2.40	0.62	0.20	0.54	0.84	---	1.26

Notes:

NC - Not Calculable
RDL = Recordable Detection Limit (represents most recent sampling event RDL)
"--" = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guideline for the protection of the environment and ecological receptors (last updated 2011)
CCME FWAL Guidelines for Aluminum, Lead, Copper and Nickel vary based on reported pH and water hardness (CCME FWAL calculation equations). The largest
Health Canada Guideline for Recreational Water Quality = Health Canada Guidelines for Canadian Recreational Water Quality - Draft (September 2009) (Referenced)
Nova Scotia Environment Environmental Quality Standards for Surface Water (Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table A2
Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water
Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics, Metals)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

TABLE 3: Bedford West Water Quality Sampling Program

August 2015	Units	RDL	NSE ESQs for Surface Water (Reference)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	CCME Phosphorus Trigger Range (Applied)	Highway 102																		
Sample Sites							HWY102-1																		
Sampling Date	yyy-mm-dd	--					2009/06/29	2009/08/13	2009/10/01	2010/05/31	2010/08/24	2010/11/01	2011/05/13	2011/08/14	2011/10/16	2012/05/01	2012/08/15	2012/10/11	2013/05/15	2013/08/15	2013/10/16	2014/05/14	2014/08/14	2014/10/27	2015/05/20	2015/08/25
Sampling Time	hh:mm	--					07:00	12:45	08:00	13:00	10:20	09:00	13:40	11:00	11:00	14:50	11:00	9:50	14:15	12:22	12:30	12:00	10:10	9:30	13:15	09:20
FIELD DATA																										
Secchi Depth	Meters	--	--	1.2	--		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Water Temp	Celsius	0.1	--	--	--		11.8	18.8	15.7	14.9	19.6	7.4	11.4	17.8	14.6	10.7	21.8	13.6	11.7	19.5	8.9	12.1	19.6	10.2	14.29	20.70
Dissolved Oxygen	mg/L	0.01	--	--	5.5-9.5		11.44	5.80	4.34	8.18	4.25	6.05	8.15	3.88	5.34	5.65	1.03	3.83	7.55	3.32	3.10	12.03	2.09	4.54	4.27	3.82
pH	pH	N/A	--	--	--		7.98	5.35	5.25	6.31	5.26	5.62	5.75	5.77	5.99	8.76	5.73	6.38	6.19	7.10	6.79	6.02	6.63	5.12	6.35	6.24
Specific Conductance	uS/cm	1	--	--	--		194	153	104	135	106	109	114	108	89	288	225	155.5	226	173.2	234.0	880.0	337	109	0.393	335.8
INORGANICS																										
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--		<5	<5	<5	<5	<5	<5	5	11	8	22	25	15	9	23	20	31	28	30	16	21
Dissolved Chloride (Cl)	mg/L	1	--	--	120		24	38	24	32	25	22	24	19	12	58	48	28	53	31	40	65	57	19	130	67
Colour	TCU	30	--	--	--		67	68	57	37	89	53	39	65	79	24	65	40	9	65	25	11	31	93	22	27
Nitrite + Nitrate	mg/L	0.05	--	--	--		<0.05	<0.05	<0.05	0.69	<0.05	1.2	0.69	0.25	1.2	2.61	0.06	0.43	0.51	<0.05	<0.05	<0.05	<0.05	0.53	<0.050	<0.05
Nitrate (N)	mg/L	0.05	--	--	13000		<0.05	--	--	0.69	<0.05	--	0.69	--	--	2.61	0.06	0.43	0.51	<0.05	<0.05	<0.05	<0.05	0.53	<0.050	<0.05
Nitrite (N)	mg/L	0.05	--	--	60		<0.01	--	--	<0.01	<0.01	--	<0.01	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010	<0.05
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19		<0.05	0.29	<0.05	<0.05	<0.05	<0.05	0.05	0.1	0.07	0.31	0.19	0.04	<0.03	0.05	0.06	<0.03	0.04	0.03	<0.050	<0.03
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--		--	--	--	--	--	--	--	--	--	1.1	1.3	0.6	--	0.6	0.6	0.7	0.6	<0.4	0.34	0.50
Total Organic Carbon	mg/L	0.5	--	--	--		6.5	10	7.7	4.7	11	6.3	4.5	7.2	7.4	5.5	10.0	7.0	5.1	10.1	17.7	4.1	7.7	9.0	2.7	14.6
Orthophosphate (as P)	mg/L	0.01	--	--	--		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.01
pH (units)	pH	N/A	--	5.0-9.0	6.5-9		4.54	5.24	5.40	5.48	6.24	5.31	6.42	6.55	6.28	6.4	6.9	6.8	6.86	6.87	6.73	6.56	7.49	5.50	6.61	7.46
Total Calcium (Ca)	mg/L	0.1	--	--	--		1.7	1.8	1.6	4.93	3.34	5.09	4.9	5.21	5.55	12.5	11.7	7.5	11.1	10.5	13.9	7.2	23.3	2.2	18000	18.0
Total Magnesium (Mg)	mg/L	0.1	--	--	--		0.3	0.5	0.5	1.08	0.79	1.09	0.91	0.92	1.19	1.7	2.0	1.4	1.4	1.5	2.3	1.6	3.2	0.6	2400	2.7
Total Phosphorus (1M depth)	mg/L	0.002	--	--	--	0.01	0.07	0.14	0.020	0.006	0.007	0.011	0.009	0.012	0.010	0.019	0.039	0.02	0.006	0.021	0.022	0.013	0.038	0.03	0.007	0.020
Total Potassium (K)	mg/L	0.1	--	--	--		0.5	1.2	0.7	1.140	1.630	1.310	1.100	1.500	1.880	1.6	2.5	1.5	1.3	1.7	2.4	1.2	2.5	0.7	2000	2.1
Total Sodium (Na)	mg/L	0.1	--	--	--		15	25	13	15.9	14.5	14.6	14.8	10.2	8.26	36.3	27.7	14.6	30.8	15.0	20.5	39.1	38.7	18.6	64	37.7
Reactive Silica (SiO2)	mg/L	0.5	--	--	--		2.5	2.2	2.0	1.1	3.8	5.1	2.8	5.2	4.6	4.1	6.1	5.1	3.1	5.1	5.8	1.7	7.1	4.7	2.1	4.9
Total Suspended Solids	mg/L	5	--	--	--		7	80	2	<2	11	<2	<1	1	<1	9	6	<5	<5	<5	<5	6	<5	<5	<1.0	<5
Dissolved Sulphate (SO4)	mg/L	2	--	--	--		5	3	3	8	<2	8	10	8	10	14	8	9	12	8	12	10	7	6	13	9
Turbidity (NTU)	NTU	0.1	--	50	--		14.0	35	0.9	1.4	1.2	0.6	0.4	0.6	1.1	0.9	1.9	0.9	0.5	1.6	0.5	0.7	1.6	0.9	0.59	0.9
Conductivity (uS/cm)	µS/cm	1	--	--	--		100	140	92	130	100	110	110	100	88	263	231	143	243	188	218	252	338	112	470	324
Calculated Parameters																										
Anion Sum	me/L	N/A	--	--	--		0.77	1.12	0.73	1.11	0.71	0.88	1.03	0.95	0.80	2.55	2.02	1.31	1.96	1.50	1.78	2.66	2.31	1.30	4.20	2.50
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--		<1	<1	<1	<1	<1	<1	5	11	8	22	25	15	9	23	20	31	28	30	16	21
Calculated TDS	mg/L	1	--	--	--		50	73	45	67	50	63	65	58	54	150	117	73	117	83	104	143	150	68	240	151
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--		<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<1.0	<10
Cation Sum	me/L	N/A	--	--	--		0.84	1.32	0.74	1.06	0.93	1.02	1.00	0.83	0.80	2.43	6.04	1.19	2.06	1.40	1.87	2.25	3.22	1.04	3.94	2.88
Hardness (CaCO3)	mg/L	1	--	--	--		6	6	6	17	12	17	16	17	19	38.2	37.5	24.5	33.5	32.4	44.2	24.6	71.4	8.0	55.0	56.1
Ion Balance (% Difference)	%	N/A	--	--	--		4.35	8.20	0.68	2.30	13.40	7.37	1.48	6.74	0.00	2.6	1.9	4.6	2.4	3.5	2.6	8.4	16.4	11.2	3.19	7.1
Langelier Index (@ 20C)	N/A	N/A	--	--	--		NC	NC	NC	NC	NC	NC	-3.50	-2.99	-3.36	-2.77	-2.23	-2.72	-2.73	-2.33	-2.41	-2.69	-1.30	-3.85	-2.32	-1.57
Langelier Index (@ 4C)	N/A	N/A	--	--	--		NC	NC	NC	NC	NC	NC	-3.75	-3.25	-3.61	-3.09	-2.55	-3.04	-3.05	-2.65	-2.73	-3.01	-1.62	-4.17	-2.57	-1.89
Saturation pH (@ 20C)	N/A	N/A	--	--	--		NC	NC	NC	NC	NC	NC	9.92	9.54	9.64	9.17	9.13	9.52	9.59	9.20	9.14	9.25	8.79	9.75	8.93	9.03
Saturation pH (@ 4C)	N/A	N/A	--	--	--		NC	NC	NC	NC	NC	NC	10.20	9.80	9.89	9.49	9.45	9.84	9.91	9.52	9.46	9.57	9.11	10.1	9.18	9.35
Metals (ICP-MS)																										
Total Aluminum (Al)	µg/L	5	5	--	5-100		510	--	--	169	192	--	205	--	--	134	183	146	86	145	150	187	83	310	51	--
Total Antimony (Sb)	µg/L	2	20	--	--		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	--
Total Arsenic (As)	µg/L	2	5.0	--	5		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	--
Total Barium (Ba)	µg/L	5	1000	--	--		22	--	--	52.9	36.9	--	37.3	--	--	58	284	42	57	57	80	46	142	17	130	--
Total Beryllium (Be)	µg/L	2	5.3	--	--		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	--
Total Bismuth (Bi)	µg/L	2	--	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Boron (B)	µg/L	5	1200	--	1500		<5	--	--	11.4	10.9	--	<50	--	--	12	18	13	10	<5	10	11	9	14	11	<50	--
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017		<0.3	--	--	0.043	<0.017	--	0.023	--	--	0.034	0.021	<0.017	<0.017	<0.017	0.040	0.022	<0.017	0.022	0.024	--
Total Chromium (Cr)	µg/L	1	1.0	--	1		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	<1	<1	<1	<1	8	<1	<1	<1.0	--
Total Cobalt (Co)	µg/L	1	10	--	--		<1	--	--	0.50	0.46	--	<0.40	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.40	--
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0		2	--	--	3.4	<2.0	<2.0	<2.0	<2.0	<2.0	<2	<2	3	<2	<1	2	<1	<1	2	<2.0	<1
Total Iron (Fe)	µg/L	50	300	--	300		720	--	--	146	637	150	107	209	219	102	1380	255	111	638	449	147	629	290	140	1280
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0		1.6	--	--	2.37	0.56	--	<0.50	--	--	<0.5	0.7	<0.5	<0.5	<0.5	0.6	2.6	<0.5	0.6	<0.50	--
Total Manganese (Mn)	µg/L	2	820	--	--		40	--	--	55.3	39.0	67.0	28.1	21.0	31.3	34	79	28	23	45	31	56	122	61	28	95
Total Molybdenum (Mo)	µg/L	2	73	--	73		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Nickel (Ni)	µg/L	2	25	--	25-150		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Selenium (Se)	µg/L	1	1.0	--	1		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1.0	--
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1		<0.5	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	--
Total Strontium (Sr)	µg/L	5	21000	--	--		11	--	--	29.1	19.7	--	24.3	--	--	48	58	36	52	47	62	38	103	13	85	--
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8		<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	--
Total Tin (Sn)	µg/L	2	--	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Titanium (Ti)	µg/L	2	--	--	--		6	--	--	<2.0	<2.0	--	3.5	--	--	<2	3	<2	<2	<2	4	2	<2	<2	<2.0	--
Total Uranium (U)	µg/L	0.1	300	--	15		<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	--
Total Vanadium (V)	µg/L	2	6	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Zinc (Zn)	µg/L	5	30	--	30		21	--	--	16.4	6.9	6.9	<5.0	<5.0	6.9	<5	6	<5	<5	<5	10	10	<5	7	11	<5
MICROBIOLOGICAL																										
Total Coliform	MPN/100mL	1	--	--	--		84	>250	--	>250	>250	180	120	180	--	687	>2420	>2420	1550	>2420	1553	120	>2420	>2420	---	>2420
E. coli	MPN/100mL	1	--	400	--		54	>250	--	12	17	5	1	78	<100	3	68	145	4	9	5	3	179	3	20	25
Fecal Coliform	MPN/ml	--	--	400	--		--	--	<1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---	--
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--		15.40	19.29	0.70	18.12	1.61	8.45	0.93	0.58	0.69	0.53	2.59	0.81	1.27	14.70	1.99	0.25	1.10	1.22	0.5	7.27
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--		17.50	19.60	0.84	17.62	1.68	7.52	0.84	0.56	0.65	0.59	2.89	1.05	1.45	15.80	2.20	0.82	1.11	1.38	0.55	6.79

Notes:

NA - Not Applicable; NC - Not Calculable; NCC - Not Collected
RDL = Recordable Detection Limit (represents most recent sampling event)
" -- " = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guideline for the protection of the environment and ecological receptors (last updated 2011)
CCME FWAL Guidelines for Aluminum, Lead, Copper and Nickel vary based on reported pH and water hardness (CCME FWAL calculation equations). The largest guideline value for each respective element range was always used.
Health Canada Guideline for Recreational Water Quality = Health Canada Guidelines for Canadian Recreational Water Quality - Draft (September 2009)
Nova Scotia Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table A2 Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water

Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics, Metals)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

TABLE 3: Bedford West Water Quality Sampling Program

August 2015	Units	RDL	NSE ESQs for Surface Water (Reference)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	CCME Phosphorus Trigger Range (Applied)	Highway 102																				
Sample Sites							HWY102-2																				
Sampling Date	yyy-mm-dd	--					2009/06/29	2009/08/13	2009/10/01	2010/05/31	2010/08/24	2010/11/01	2011/05/13	2011/08/14	2011/10/16	2012/05/01	2012/08/15	2012/10/11	2013/05/15	2013/08/15	2013/10/16	2014/05/14	2014/08/14	2014/10/27	2015/05/20	2015/08/25
Sampling Time	hh:mm	--					12:30	12:15	12:30	12:40	09:30	12:30	11:20	15:00	15:30	11:20	12:20	10:35	10:40	10:00	10:22	12:15	14:25	10:07	11:00	12:58
FIELD DATA																											
Secchi Depth	Meters	--	--	1.2	--		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	N/A	NCC	N/A	
Water Temp	Celsius	0.1	--	--	--		16.7	19.2	16.4	17.2	17.0	8.7	10.8	24.2	15.1	7.8	23.7	14.3	11.5	22.0	10.7	11.4	--	10.4	12.7	23.7	
Dissolved Oxygen	mg/L	0.01	--	--	5.5-9.5		10.01	5.90	4.80	4.91	2.45	2.99	6.92	7.03	5.09	3.73	13.1	3.28	6.30	1.57	4.20	10.50	--	9.25	4.24	6.11	
pH	pH	N/A	--	--	--		6.57	5.71	5.40	6.33	5.86	5.64	6.22	5.89	5.29	7.3	6.37	6.72	6.01	6.92	5.40	5.40	--	5.85	6.45	6.04	
Specific Conductance	uS/cm	1	--	--	--		37	457	162	415	167	101.2	92.2	123.1	96	225	226	159.1	288	188.5	204.4	204.4	--	174	0.411	699	
INORGANICS																											
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--		<5	<5	7	6	5	<5	<5	5	<5	17	7	<5	6	14	7	30	--	8	7.5	5	
Dissolved Chloride (Cl)	mg/L	1	--	--	120		21	82	83	170	41	18	21	21	17	63	109	45	71	50	52	113	--	34	260	178	
Colour	TCU	30	--	--	--		120	190	91	96	160	68	65	98	77	32	100	70	11	61	36	13	--	85	17	9	
Nitrite + Nitrate	mg/L	0.05	--	--	--		<0.05	<0.05	<0.05	0.10	<0.05	0.62	0.26	1.8	3.2	1.54	<0.05	0.14	0.17	<0.05	<0.05	<0.05	--	0.12	<0.050	<0.05	
Nitrate (N)	mg/L	0.05	--	--	13000		<0.05	--	--	0.10	<0.05	--	0.26	--	--	1.54	<0.05	0.14	0.17	<0.05	<0.05	<0.05	--	0.12	<0.050	<0.05	
Nitrite (N)	mg/L	0.05	--	--	60		<0.01	--	--	<0.01	<0.01	--	<0.01	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	<0.05	<0.010	<0.05	
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19		<0.05	0.06	<0.05	<0.05	0.20	<0.05	<0.05	0.30	0.08	0.09	<0.03	<0.03	<0.03	0.17	0.09	<0.03	--	<0.03	0.056	0.19	
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--		--	--	--	--	--	--	--	--	--	0.6	1.1	0.5	--	0.7	2.0	15.3	--	<0.4	0.33	62.6	
Total Organic Carbon	mg/L	0.5	--	--	--		8.5	13	13	7.2	14	7.4	5.7	9.2	8.4	7.0	15.8	11.2	6.1	10.6	5.1	17.4	--	8.0	3.0	29.0	
Orthophosphate (as P)	mg/L	0.01	--	--	--		<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	<0.01	<0.010	<0.01	
pH (units)	pH	N/A	--	5.0-9.0	6.5-9		5.43	5.96	6.30	6.05	6.32	5.47	5.92	6.18	5.92	5.9	--	--	--	6.7	6.8	6.61	6.59	6.34	7.20	--	6.40	6.12	6.64	
Total Calcium (Ca)	mg/L	0.1	--	--	--		1.6	4.0	4.8	7.44	3.84	4.01	3.07	2.22	3.80	7.0	8.4	5.6	7.6	8.5	8.2	14.1	--	9.5	20000	33.3	
Total Magnesium (Mg)	mg/L	0.1	--	--	--		0.4	0.7	0.9	0.96	0.59	1.00	0.68	0.68	1.38	1.2	1.4	1.2	1.2	1.3	2.2	3.1	--	1.8	2500	32.7	
Total Phosphorus (1M depth)	mg/L	0.002	--	--	--	0.01	<0.02	0.04	0.034	0.010	0.028	0.003	0.009	0.019	0.041	0.021	0.054	0.03	0.014	0.028	0.199	0.028	--	0.20	0.01	1.56	
Total Potassium (K)	mg/L	0.1	--	--	--		0.5	0.8	1.1	0.984	0.956	1.390	0.844	1.310	1.880	1.2	1.7	1.6	1.3	1.5	2.5	2.9	--	1.7	1900	12.5	
Total Sodium (Na)	mg/L	0.1	--	--	--		15	51	55	83.7	32.0	12.1	13.3	13.1	13.3	41.5	63.6	20.4	39.0	19.1	34.5	69.6	--	24.0	150	124	
Reactive Silica (SiO2)	mg/L	0.5	--	--	--		2.2	4.4	4.0	3.0	6.4	5.4	2.5	6.5	6.7	4.1	6.9	5.8	1.6	6.2	6.6	1.6	--	5.9	2.3	7.2	
Total Suspended Solids	mg/L	5	--	--	--		<2	58	62	34	27	3	<1	10	14	<5	39	<5	<5	<5	194	34	--	<5	2	3000	
Dissolved Sulphate (SO4)	mg/L	2	--	--	--		<2	3	8	11	<2	7	5	5	8	12	6	10	10	9	10	12	--	8	15	7	
Turbidity (NTU)	NTU	0.1	--	50	--		0.7	3.8	4.2	2.6	3.1	0.5	0.4	1.2 (1)	3.9	0.6	10.8	2	1.5	3.3	144	1.1	--	1.1	1.2	1490	
Conductivity (uS/cm)	µS/cm	1	--	--	--		85	290	310	590	160	94	91	100	110	263	403	179	295	203	223	433	--	194	920	662	
Calculated Parameters																											
Anion Sum	me/L	N/A	--	--	--		0.60	2.37	2.62	5.13	1.27	0.70	0.73	0.91	0.86	2.48	3.34	1.49	2.34	1.88	1.81	4.04	--	1.29	7.88	5.27	
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--		<1	<1	7	6	5	<1	<1	5	<1	17	7	<5	6	14	7	30	--	8	7.5	5	
Calculated TDS	mg/L	1	--	--	--		42	150	165	282	93	52	48	62	67	143	200	86	135	100	145	235	--	85	460	712	
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--		<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<10	<10	<10	<10	--	<10	<1.0	<10	
Cation Sum	me/L	N/A	--	--	--		0.81	2.65	2.89	4.17	1.81	0.86	0.82	0.83	0.97	2.32	2.10	1.40	2.24	1.50	3.50	4.17	--	1.76	7.87	29.1	
Hardness (CaCO3)	mg/L	1	--	--	--		6	13	16	23	12	14	11	8	15	22.4	26.7	18.9	23.9	26.6	29.5	48.0	--	31.1	59.0	218	
Ion Balance (% Difference)	%	N/A	--	--	--		14.90	5.58	4.90	10.30	17.50	10.30	5.81	4.60	6.01	3.3	3.6	3.1	2.3	11.3	31.7	1.6	--	15.1	0.0600	69.4	
Langelier Index (@ 20C)	N/A	N/A	--	--	--		NC	NC	-3.57	-3.72	-3.70	NC	NC	-4.07	NC	-3.63	-3.15	-3.34	-3.33	-2.92	-3.50	-1.80	--	-3.30	-3.18	-2.81	
Langelier Index (@ 4C)	N/A	N/A	--	--	--		NC	NC	-3.82	-3.97	-3.95	NC	NC	-4.32	NC	-3.95	-3.47	-3.66	-3.65	-3.24	-3.82	-2.12	--	-3.62	-3.42	-3.13	
Saturation pH (@ 20C)	N/A	N/A	--	--	--		NC	NC	9.87	9.77	10.00	NC	NC	10.30	NC	9.53	9.85	10.10	9.94	9.51	9.84	9.00	--	9.70	9.29	9.45	
Saturation pH (@ 4C)	N/A	N/A	--	--	--		NC	NC	10.10	10.00	10.30	NC	NC	10.50	NC	9.85	10.2	10.5	10.3	9.83	10.2	9.32	--	10.0	9.54	9.77	
Metals (ICP-MS)																											
Total Aluminum (Al)	µg/L	5	5	--	5-100		270	--	--	189	368	--	260	--	--	145	466	259	130	138	2760	400	--	216	100	--	
Total Antimony (Sb)	µg/L	2	20	--	--		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	--	<2	<1.0	--	
Total Arsenic (As)	µg/L	2	5.0	--	5		<2	--	--	<1.0	2.1	--	<1.0	--	--	<2	<2	<2	<2	<2	6	<2	--	<2	<1.0	--	
Total Barium (Ba)	µg/L	5	1000	--	--		20	--	--	53.1	27.7	--	26.6	--	--	49	74	33	44	43	213	381	--	63	140	--	
Total Beryllium (Be)	µg/L	2	5.3	--	--		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	--	<2	<1.0	--	
Total Bismuth (Bi)	µg/L	2	--	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	--	<2	<2.0	--	
Total Boron (B)	µg/L	5	1200	--	1500		<5	--	--	7.9	7.8	--	<50	--	--	10	17	15	9	10	13	11	--	12	<50	--	
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017		<0.3	--	--	0.051	<0.017	--	<0.017	--	--	0.037	0.031	0.022	0.019	<0.017	0.096	0.051	--	0.019	0.100	--	
Total Chromium (Cr)	µg/L	1	1.0	--	1		<2	--	--	<1.0	1.0	--	<1.0	--	--	<1	<1	<1	<1	1	9	2	--	<1	<1.0	--	
Total Cobalt (Co)	µg/L	1	10	--	--		<1	--	--	0.66	0.77	--	<0.40	--	--	<1	1	1	<1	1	3	1	--	<1	1.8	--	
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0		2	--	--	2.0	<2.0	<2.0	<2.0	2.5	2.8	<2	3	3	<2	1	12	4	--	2	<2.0	404	
Total Iron (Fe)	µg/L	50	300	--	300		880	--	--	1380	3820	303	229	897	1110	214	521.0	1550	383	1720	29400	1660	--	405	562	217000	
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0		1.9	--	--	1.61	2.70	--	0.59	--	--	<0.5	5.2	2.1	0.6	0.7	19.4	3.5	--	1.0	<0.50	--	
Total Manganese (Mn)	µg/L	2	820	--	--		110	--	--	387	135	52.9	40.5	106	176	78	219	207	83	173	327	212	--	93	470	2800	
Total Molybdenum (Mo)	µg/L	2	73	--	73		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	--	<2	<2.0	--	
Total Nickel (Ni)	µg/L	2	25	--	25-150		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	4	2	--	<2	<2.0	--	
Total Selenium (Se)	µg/L	1	1.0	--	1		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	<1	<1	<1	<1	<1	<1	--	<1	<1.0	--	
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1		<0.5	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	--	<0.1	<0.10	--	
Total Strontium (Sr)	µg/L	5	21000	--	--		11	--	--	37.4	21.1	--	16.9	--	--	33	45	31	39	40	45	75	--	43	96	--	
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8		<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	--	<0.1	<0.10	--	
Total Tin (Sn)	µg/L	2	--	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	--	<2	<2.0	--	
Total Titanium (Ti)	µg/L	2	--	--	--		4	--	--	<2.0	6.4	--	4.9	--	--	<2	10	4	4	<2	60	9	--	6	<2.0	--	
Total Uranium (U)	µg/L	0.1	300	--	15		<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	--	<0.1	<0.10	--	
Total Vanadium (V)	µg/L	2	6	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	2	<2	<2	<2	11	<2	--	<2	<2.0	--	
Total Zinc (Zn)	µg/L	5	30	--	30		12	--	--	13.6	12.3	9.3	5.5	9	12.5	<5	7	12	12	<5	46	36	--	17	27	1210	
MICROBIOLOGICAL																											
Total Coliform	MPN/100mL	1	--	--	--		28	>250	--	>250	75	41	110	>250	--	1553	>2420	>2420	2420	1990	>2420	687	--	>2420	---	>2420	
E. coli	MPN/100mL	1	--	400	--		4	230	--	9	5	<1	7	>250	<100	<1	16	50	111	9	4	<1	--	<1	<10	201	
Fecal Coliform	MPN/ml	--	--	400	--		--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---	--	
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--		0.90	82.63	48.17	0.85	16.36	0.25	0.97	4.91	1.9	2.07	21.03	0.33	2.41	1.10	21.62	10.34	--	0.46	0.53	119.14	
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--		0.91	81.20	52.50	0.85	17.35	0.23	0.87	4.49	2.15	2.27	17.26	0.50	3.02	1.30	27.02	11.09	--	0.55	0.58	129.77	

Notes:

NA - Not Applicable; NC - Not Calculable; NCC - Not Collected
RDL = Recordable Detection Limit (represents most recent sampling event)
" -- " = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guideline for the protection of the environment and ecological receptors (last updated 2011)
CCME FWAL Guidelines for Aluminum, Lead, Copper and Nickel vary based on reported pH and water hardness (CCME FWAL calculation equations). The largest guideline value for each respective element range was always used.
Health Canada Guideline for Recreational Water Quality = Health Canada Guidelines for Canadian Recreational Water Quality - Draft (September 2009)
Nova Scotia Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table A2 Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water

Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics, Metals)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

TABLE 3: Bedford West Water Quality Sampling Program

August 2015	Units	RDL	NSE ESQs for Surface Water (Reference)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	CCME Phosphorus Trigger Range (Applied)	Lake Shore Drive																		
Sample Sites																									LSD
Sampling Date	yyyy-mm-dd	--					2009/06/29	2009/08/13	2009/10/01	2010/05/31	2010/08/24	2010/11/01	2011/05/13	2011/08/14	2011/10/17	2012/05/01	2012/08/15	2012/10/11	2013/05/15	2013/08/15	2013/10/16	2014/05/15	2014/08/14	2014/10/27	2015/05/20	2015/08/25
Sampling Time	hh:mm	--					12:00	09:30	11:45	09:00	11:28	10:00	08:45	13:20	9:00	9:15	13:00	9:10	08:40	15:30	11:55	9:30	12:45	13:30	09:50	16:02
FIELD DATA																									
Secchi Depth	Meters	--	--	1.2	--		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	N/A	NCC	N/A
Water Temp	Celsius	0.1	--	--	--		13.1	16.7	15.3	13.4	21.3	7.3	10.2	21.0	12.0	5.7	25.7	13.4	7.7	20.2	8.8	8.9	--	10.48	12.52	24.3
Dissolved Oxygen	mg/L	0.01	--	--	5.5-9.5		10.84	5.70	5.50	8.60	5.41	8.47	9.44	7.87	8.16	4.06	2.69	7.58	8.77	7.26	7.60	14.78	--	7.22	6.26	7.25
pH	pH	N/A	--	--	--		7.88	6.74	6.34	6.42	6.64	6.17	7.09	6.88	6.63	8.22	7.16	6.92	5.19	7.28	6.23	7.02	--	6.31	6.88	6.34
Specific Conductance	uS/cm	1	--	--	--		723	210	168	218	203	110	146	126	112	62	177.5	116.7	123.6	132.5	147.8	180.0	--	111	0.119	155.3
INORGANICS																									
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--		13	16	12	13	21	9	9	15	12	21	14	11	8	20	11	35	--	10	11	7
Dissolved Chloride (Cl)	mg/L	1	--	--	120		41	34	31	49	45	25	38	27	22	22	33	23	39	32	23	29	--	23	32	27
Colour	TCU	30	--	--	--		32	27	37	20	26	33	32	41	49	13	20	40	10	21	25	9	--	31	20	11
Nitrite + Nitrate	mg/L	0.05	--	--	--		0.14	0.14	0.06	0.23	0.10	0.12	0.25	0.17	0.09	0.13	0.80	<0.05	0.18	0.20	<0.05	0.09	--	0.11	0.15	0.25
Nitrate (N)	mg/L	0.05	--	--	13000		0.14	--	--	0.23	0.10	--	0.25	--	--	0.13	0.80	<0.05	0.18	0.20	<0.05	0.09	--	0.11	0.15	0.16
Nitrite (N)	mg/L	0.05	--	--	60		<0.01	--	--	<0.01	<0.01	--	<0.01	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	<0.05	<0.010	0.09
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19		<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	0.06	0.03	<0.03	<0.03	<0.03	0.03	0.03	0.04	--	<0.03	<0.050	0.11
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--		--	--	--	--	--	--	--	--	--	0.5	3.5	0.5	--	0.7	3.0	1.0	--	<0.4	0.29	77.4
Total Organic Carbon	mg/L	0.5	--	--	--		5.0	3.8	6.8	3.7	6.0	5.3	4.7	7.1	7.5	3.1	8.0	7.7	4.7	6.3	6.9	5.2	--	8.1	3.2	14.1
Orthophosphate (as P)	mg/L	0.01	--	--	--		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	<0.01	<0.010	<0.01
pH (units)	pH	N/A	--	5.0-9.0	6.5-9		6.69	6.69	6.93	7.10	7.30	6.67	6.72	6.79	6.49	6.2	6.9	6.9	6.94	6.95	6.49	6.47	--	6.72	7.02	6.59
Total Calcium (Ca)	mg/L	0.1	--	--	--		6.5	6.9	5.4	7.99	10.5	5.29	5.9	5.14	5.04	2.6	18.1	5.1	6.4	6.0	5.6	5.4	--	5.1	6100	52.2
Total Magnesium (Mg)	mg/L	0.1	--	--	--		1.4	1.6	1.3	1.99	2.14	1.15	1.25	1.19	1.23	0.7	3.3	1.4	1.2	1.4	1.6	1.5	--	1.1	1300	23.0
Total Phosphorus (1M depth)	mg/L	0.002	--	--	--	0.01	<0.02	0.03	0.009	0.018	0.100	0.009	0.018	0.028	0.014	0.022	0.063	0.003	0.007	0.015	0.078	0.100	--	0.03	0.011	0.501
Total Potassium (K)	mg/L	0.1	--	--	--		1.2	1.1	1.3	1.180	1.210	1.030	1.070	0.960	1.240	0.6	1.9	1.3	1.2	1.1	1.4	1.1	--	1.1	1100	9.7
Total Sodium (Na)	mg/L	0.1	--	--	--		24	21	18	24.8	26.9	15.2	23.2	14.3	13.8	11.3	18.6	15.2	21.9	26.6	14.6	23.4	--	18.1	19	24.4
Reactive Silica (SiO2)	mg/L	0.5	--	--	--		3.1	4.2	4.0	3.2	3.4	4.3	2.6	3.9	3.8	3.1	2.9	4.9	2.6	3.9	5.0	2.9	--	4.2	2.4	4.2
Total Suspended Solids	mg/L	5	--	--	--		16	98	5	6	110	7	4	77	5	<5	16	19	<5	17	9	51	--	8	4.6	719
Dissolved Sulphate (SO4)	mg/L	2	--	--	--		6	4	5	7	3	4	6	4	4	5	5	5	6	7	5	5	--	4	4.8	<2
Turbidity (NTU)	NTU	0.1	--	50	--		0.6	12	2.5	12	6.2	1	0.6	2.5	1.7	6.7	283	2.1	1.1	31.6	82.6	6.6	--	1.4	1.2	4430
Conductivity (uS/cm)	µS/cm	1	--	--	--		170	150	140	200	200	110	150	130	110	96	161	110	168	136	105	122	--	125	140	129
Calculated Parameters																									
Anion Sum	me/L	N/A	--	--	--		1.56	0.82	1.22	1.80	1.77	0.97	1.39	1.14	0.96	1.15	1.37	0.97	1.40	1.46	0.97	1.63	--	0.94	1.22	0.92
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--		13	8	12	13	21	9	9	15	12	21	14	11	8	20	11	35	--	10	11	7
Calculated TDS	mg/L	1	--	--	--		92	55	74	104	107	62	84	66	60	56	163	58	82	87	66	88	--	59	74	498
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--		<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<10	<10	<10	<10	--	<10	<1.0	<10
Cation Sum	me/L	N/A	--	--	--		1.53	0.99	1.20	1.69	1.94	1.05	1.44	1.02	1.00	0.76	3.59	1.10	1.43	1.62	1.62	1.52	--	1.19	1.28	31.0
Hardness (CaCO3)	mg/L	1	--	--	--		22	15	19	28	35	18	20	18	18	9.4	58.8	18.5	20.9	20.7	20.6	19.7	--	17.3	21.0	225
Ion Balance (% Difference)	%	N/A	--	--	--		0.97	9.39	0.83	3.15	4.58	3.96	1.77	5.56	2.04	20.7	63.0	6.1	1.0	5.2	25.0	3.4	--	11.8	2.4	94.2
Langelier Index (@ 20C)	N/A	N/A	--	--	--		-2.74	-3.20	-2.60	-2.22	-1.71	-2.99	-2.88	-2.64	-3.05	-3.62	-2.30	-2.91	-2.93	-2.55	-3.29	-2.84	--	-3.14	-2.50	-2.50
Langelier Index (@ 4C)	N/A	N/A	--	--	--		-2.99	-3.45	-2.85	-2.47	-1.96	-3.24	-3.13	-2.89	-3.31	-3.94	-2.62	-3.23	-3.25	-2.87	-3.61	-3.16	--	-3.46	-2.75	-2.82
Saturation pH (@ 20C)	N/A	N/A	--	--	--		9.43	9.78	9.53	9.32	9.01	9.66	9.60	9.43	9.54	9.82	9.20	9.81	9.87	9.50	9.78	9.31	--	9.86	9.51	9.09
Saturation pH (@ 4C)	N/A	N/A	--	--	--		9.68	10.00	9.78	9.57	9.26	9.91	9.85	9.68	9.80	10.10	9.52	10.10	10.20	9.82	10.1	9.63	--	10.2	9.77	9.41
Metals (ICP-MS)																									
Total Aluminum (Al)	µg/L	5	5	--	5-100		99	--	--	349	189	--	217	--	--	490	19200	186	131	93	3420	487	--	141	120	--
Total Antimony (Sb)	µg/L	2	20	--	--		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	<2	<2	<2	<2	<2	<2	--	<2	<1.0	--
Total Arsenic (As)	µg/L	2	5.0	--	5		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	8	<2	<2	<2	<2	<2	--	<2	<1.0	--
Total Barium (Ba)	µg/L	5	1000	--	--		14	--	--	15.3	19.2	--	13.9	--	--	11	86	12	12	7	24	15	--	11	12	--
Total Beryllium (Be)	µg/L	2	5.3	--	--		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	2	<2	<2	<2	<2	<2	--	<2	<1.0	--
Total Bismuth (Bi)	µg/L	2	--	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	--	<2	<2.0	--
Total Boron (B)	µg/L	5	1200	--	1500		13	--	--	41.4	21.6	--	<50	--	--	6	24	16	10	15	15	14	--	16	<50	16
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017		<0.3	--	--	0.018	<0.017	--	<0.017	--	--	0.029	1.050	0.023	<0.017	<0.017	0.072	0.032	--	<0.017	0.011	--
Total Chromium (Cr)	µg/L	1	1.0	--	1		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	11	<1	<1	<1	2	<1	--	<1	<1.0	--
Total Cobalt (Co)	µg/L	1	10	--	--		<1	--	--	<0.40	0.88	--	<0.40	--	--	<1	34	<1	<1	<1	1	<1	--	<1	<0.40	--
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0		<2	--	--	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2	22	2	<2	1	12	2	--	3	<2.0	183
Total Iron (Fe)	µg/L	50	300	--	300		180	--	--	554	903	120	211	388	384	161	38800	312	236	254	4200	593	--	363	230	176000
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0		<0.5	--	--	3.02	0.54	--	<0.50	--	--	0.6	82.4	<0.5	<0.5	<0.5	5.2	0.5	--	<0.5	<0.50	--
Total Manganese (Mn)	µg/L	2	820	--	--		51	--	--	113	632	22.8	30.2	53.4	38.5	26	13200	67	71	81	124	140	--	60	130	13800
Total Molybdenum (Mo)	µg/L	2	73	--	73		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	--	<2	<2.0	--
Total Nickel (Ni)	µg/L	2	25	--	25-150		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	13	<2	<2	<2	2	<2	--	<2	<2.0	--
Total Selenium (Se)	µg/L	1	1.0	--	1		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	2	<1	<1	<1	<1	<1	--	<1	<1.0	--
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1		<0.5	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	--	<0.1	<0.10	--
Total Strontium (Sr)	µg/L	5	21000	--	--		30	--	--	38.3	42.1	--	24.4	--	--	12	82	22	24	24	25	26	--	19	25	--
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8		<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	--	<0.1	<0.10	--
Total Tin (Sn)	µg/L	2	--	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	<2	<2	<2	<2	<2	<2	--	<2	<2.0	--
Total Titanium (Ti)	µg/L	2	--	--	--		<2	--	--	7.2	4.1	--	5.3	--	--	3	405	4	<2	2	36	6	--	3	3.3	--
Total Uranium (U)	µg/L	0.1	300	--	15		<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	1.6	<0.1	<0.1	<0.1	0.1	<0.1	--	<0.1	<0.10	--
Total Vanadium (V)	µg/L	2	6	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	30	<2	<2	<2	2	<2	--	<2	<2.0	--
Total Zinc (Zn)	µg/L	5	30	--	30		7	--	--	7.2	6.7	<5.0	<5.0	<5.0	5	<5	110	7	6	<5	15	<5	--	<5	<5.0	799
MICROBIOLOGICAL																									
Total Coliform	MPN/100mL	1	--	--	--		53	>250	--	>250	>250	280	85	>250	--	1414	>2420	>2420	1990	>2420	>2420	1203	--	8	---	>2420
E. coli	MPN/100mL	1	--	400	--		22	24	--	4	45	6	10	>250	<100	2	26	10	10	20	2	<1	--	>2420	<10	16
Fecal Coliform	MPN/ml	--	--	400	--		--	--	<1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---	--
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--		1.46	10.70	4.68	1.21	6.64	0.21	1.19	1.93	1.41	1.88	6.62	0.13	<0.50	1.6	2.02	1.91	--	0.32	1.02	90.33
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--		1.85	11.10	5.62	1.32	7.71	0.19	1.07	1.73	1.18	2.28	7.58	0.22	<0.50	2	2.98	1.91	--	0.33	1.07	121.83

Notes:

NA - Not Applicable; NC - Not Calculable; NCC Not Collected
RDL = Recordable Detection Limit (represents most recent sampling event)
" -- " = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guideline for the protection of the environment and ecological receptors (last updated 2011)
CCME FWAL Guidelines for Aluminum, Lead, Copper and Nickel vary based on reported pH and water hardness (CCME FWAL calculation equations). The largest guideline value for each respective element range was always used.
Health Canada Guideline for Recreational Water Quality = Health Canada Guidelines for Canadian Recreational Water Quality - Draft (September 2009)
Nova Scotia Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table A2 Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water

Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics, Metals)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

TABLE 3: Bedford West Water Quality Sampling Program

August 2015	Units	RDL	NSE ESQs for Surface Water (Reference)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	CCME Phosphorus Trigger Range (Applied)	Larry Uteck Blvd											
Sample Sites							LU											
Sampling Date	yyyy-mm-dd	--					2011/10/17	2012/05/01	2012/08/15	2012/10/11	2013/05/15	2013/08/15	2013/10/16	2014/05/15	2014/08/14	2014/10/27	2015/05/20	2015/08/25
Sampling Time	hh:mm	--					10:30	15:20	11:30	10:10	14:30	14:30	13:00	11:45	10:45	9:54	13:45	10:23
FIELD DATA																		
Secchi Depth	Meters	--	--	1.2	--		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NCC	N/A
Water Temp	Celsius	0.1	--	--	--		11.3	12.8	27.3	14.6	13.9	18.3	10.9	15.0	22.8	10.2	16.06	23.40
Dissolved Oxygen	mg/L	0.01	--	--	5.5-9.5		4.24	6.17	8.2	9.04	10.15	8.29	4.50	11.96	8.08	7.55	7.28	9.49
pH	pH	N/A	--	--	--		6.07	7.82	6.65	6.78	6.39	7.49	5.45	6.50	7.23	6.17	6.57	6.80
Specific Conductance	uS/cm	1	--	--	--		203	955	480	262	670	320	845.0	999.0	611.0	371.0	0.646	569
INORGANICS																		
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--		12	14	14	14	6	22	7	30	21	<5	13	16
Dissolved Chloride (Cl)	mg/L	1	--	--	120		34	224	116	52	190	99	258	243	104	70	210	132
Colour	TCU	30	--	--	--		94	18	14	18	7	7	19	6	8	18	8.4	8
Nitrite + Nitrate	mg/L	0.05	--	--	--		0.61	1.00	0.64	1.89	1.11	2.57	0.34	1.22	0.47	1.97	0.53	0.59
Nitrate (N)	mg/L	0.05	--	--	13000		--	1.00	0.64	1.89	1.11	2.57	0.34	1.22	0.47	1.97	0.53	0.59
Nitrite (N)	mg/L	0.05	--	--	60		--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010	<0.05
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19		0.06	0.04	0.16	<0.03	<0.03	0.04	0.04	0.05	<0.03	<0.03	<0.050	0.05
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--		--	0.4	4.2	0.7	--	0.5	<0.4	1.2	1.7	<0.4	0.3	8.0
Total Organic Carbon	mg/L	0.5	--	--	--		11.0	3.7	22.8	4.8	3.1	4.5	2.9	6.9	4.7	4.7	2.2	7.6
Orthophosphate (as P)	mg/L	0.01	--	--	--		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.01
pH (units)	pH	N/A	--	5.0-9.0	6.5-9		6.43	6.7	7.2	7.2	6.92	7.11	6.49	6.42	7.42	6.41	6.95	7.30
Total Calcium (Ca)	mg/L	0.1	--	--	--		7.63	30.7	22.1	14.5	22.0	17.6	21.8	23.9	27.6	12.6	27000	20.3
Total Magnesium (Mg)	mg/L	0.1	--	--	--		2.34	4.2	3.6	2.2	2.8	2.7	4.0	4.2	3.8	2.2	3800	3.4
Total Phosphorus (1M depth)	mg/L	0.002	--	--	--	0.01	0.034	0.043	0.036	0.030	0.006	0.027	0.046	0.260	0.028	0.04	0.007	0.009
Total Potassium (K)	mg/L	0.1	--	--	--		2.110	3.2	3.6	2.5	2.6	2.8	2.9	3.1	3.7	3.0	3300	2.8
Total Sodium (Na)	mg/L	0.1	--	--	--		22.7	124	62.2	32.3	95.1	51.7	170	147	88.1	62.7	110	102
Reactive Silica (SiO2)	mg/L	0.5	--	--	--		6.9	4.9	0.7	6.3	5.1	8.6	7.0	2.1	2.5	6.9	3.6	4.9
Total Suspended Solids	mg/L	5	--	--	--		13	5	165	<5	<5	<5	<5	626	<5	<5	<1.0	<5
Dissolved Sulphate (SO4)	mg/L	2	--	--	--		21	26	25	23	26	29	33	29	20	27	27	31
Turbidity (NTU)	NTU	0.1	--	50	--		3.3	4.1	23.0	2.3	1.8	1.6	0.7	42.7	10.1	1.6	0.3	2.8
Conductivity (uS/cm)	µS/cm	1	--	--	--		190	813	482	255	732	433	840	819	605	394	790	575
Calculated Parameters																		
Anion Sum	me/L	N/A	--	--	--		1.69	7.21	4.12	2.36	6.10	4.02	8.13	8.15	3.80	2.68	6.77	4.73
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--		12	14	14	14	6	22	7	30	21	<5	13	16
Calculated TDS	mg/L	1	--	--	--		109	426	246	144	347	229	496	477	262	187	400	305
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--		<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<1.0	<10
Cation Sum	me/L	N/A	--	--	--		1.70	7.40	4.30	2.43	5.55	3.51	8.90	8.24	5.64	3.64	6.69	5.86
Hardness (CaCO3)	mg/L	1	--	--	--		29	94.0	70.0	45.3	66.5	55.1	70.9	77.0	84.6	40.5	84	64.7
Ion Balance (% Difference)	%	N/A	--	--	--		0.29	1.3	2.2	1.4	4.7	6.8	4.5	0.6	19.4	15.2	0.59	10.6
Langelier Index (@ 20C)	N/A	N/A	--	--	--		-2.95	-2.32	-1.94	-2.10	-2.60	-1.93	-2.98	-2.38	-1.45	-3.41	-1.95	-1.82
Langelier Index (@ 4C)	N/A	N/A	--	--	--		-3.20	-2.64	-2.26	-2.42	-2.92	-2.25	-3.30	-2.70	-1.77	-3.73	-2.20	-2.14
Saturation pH (@ 20C)	N/A	N/A	--	--	--		9.38	9.02	9.14	9.30	9.52	9.04	9.47	8.80	8.87	9.82	8.90	9.12
Saturation pH (@ 4C)	N/A	N/A	--	--	--		9.63	9.34	9.46	9.62	9.84	9.36	9.79	9.12	9.19	10.1	9.15	9.44
Metals (ICP-MS)																		
Total Aluminum (Al)	µg/L	5	5	--	5-100		--	218	227	252	107	447	31	1400	46	109	59	--
Total Antimony (Sb)	µg/L	2	20	--	--		--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	--
Total Arsenic (As)	µg/L	2	5.0	--	5		--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	--
Total Barium (Ba)	µg/L	5	1000	--	--		--	225	201	116	133	134	119	185	157	80	150	--
Total Beryllium (Be)	µg/L	2	5.3	--	--		--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	--
Total Bismuth (Bi)	µg/L	2	--	--	--		--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Boron (B)	µg/L	5	1200	--	1500		--	11	17	22	10	22	18	22	20	21	<50	--
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017		--	0.538	0.171	0.168	0.300	0.236	0.148	0.171	0.031	0.079	0.150	--
Total Chromium (Cr)	µg/L	1	1.0	--	1		--	<1	<1	<1	<1	1	<1	<1	<1	<1	<1.0	--
Total Cobalt (Co)	µg/L	1	10	--	--		--	<1	1	<1	<1	<1	<1	<1	<1	<1	<0.40	--
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0		2.9	<2	3	16	2	6	2	2	<1	4	2.1	3
Total Iron (Fe)	µg/L	50	300	--	300		2150	347	1320	500	194	890	157	2000	207	229	170	671
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0		--	0.8	0.7	1.0	<0.5	1.4	<0.5	1.8	<0.5	<0.5	<0.50	--
Total Manganese (Mn)	µg/L	2	820	--	--		129	182	485	120	87	89	26	71	182	36	110	371
Total Molybdenum (Mo)	µg/L	2	73	--	73		--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Nickel (Ni)	µg/L	2	25	--	25-150		--	<2	<2	<2	<2	<2	<2	3	<2	<2	<2.0	--
Total Selenium (Se)	µg/L	1	1.0	--	1		--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1.0	--
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1		--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	--
Total Strontium (Sr)	µg/L	5	21000	--	--		--	112	94	60	93	90	96	116	111	54	120	--
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8		--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	--
Total Tin (Sn)	µg/L	2	--	--	--		--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Titanium (Ti)	µg/L	2	--	--	--		--	4	3	7	3	11	2	22	<2	3	<2.0	--
Total Uranium (U)	µg/L	0.1	300	--	15		--	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.10	--
Total Vanadium (V)	µg/L	2	6	--	--		--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Zinc (Zn)	µg/L	5	30	--	30		9	79	92	39	57	49	26	17	8	23	27	17
MICROBIOLOGICAL																		
Total Coliform	MPN/100mL	1	--	--	--		--	>2420	>2420	2420	866	>2420	866	>2420	961	>2420	---	>2420
E. coli	MPN/100mL	1	--	400	--		<100	<1	2	19	3	86	<1	<1	7	1720	<10	19
Fecal Coliform	MPN/ml	--	--	400	--		--	--	--	--	--	--	--	--	--	--	---	--
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--		1.99	2.44	32.52	1.80	1.54	2.30	0.12	99.13	2.54	0.96	0.69	3.14
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--		2.08	2.71	31.31	2.15	1.77	2.50	0.11	98.00	2.51	0.96	0.68	3.10

Notes:

NA - Not Applicable; NC - Not Calculable; NCC Not Collected
RDL = Recordable Detection Limit (represents most recent sampling event RDL)
" -- " = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guideline for the protection of the environment and ecological receptors (last updated 2011)
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Health Canada Guideline for Recreational Water Quality = Health Canada Guidelines for Canadian Recreational Water Quality - Draft (September 2009)
Nova Scotia Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table A2 Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water

Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics, Metals)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

TABLE 3: Bedford West Water Quality Sampling Program

August 2015	Units	RDL	NSE ESQs for Surface Water (Reference)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	CCME Phosphorus Trigger Range (Applied)	Paper Mill Lake																				
Sample Sites							PML1																				
Sampling Date	yyyy-mm-dd	--					2009/06/29	2009/08/13	2009/10/01	2010/05/31	2010/08/24	2010/11/01	2011/05/13	2011/08/14	2011/10/16	2012/05/01	2012/08/15	2012/10/11	2013/05/15	2013/08/15	2013/10/16	2014/05/15	2014/08/14	2014/10/27	2015/05/20	2015/08/25
Sampling Time	hh:mm	--					13:45	13:00	13:00	13:35	15:15	13:00	13:00	16:50	17:00	12:50	--	10:55	10:51	11:35	10:45	10:30	14:45	12:35	12:45	08:45
FIELD DATA																											
Secchi Depth	Meters	--	--	1.2	--		3.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	--	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NCC	N/A
Water Temp	Celsius	0.1	--	--	--		15.7	17.1	16.2	13.2	22.7	9.1	10.3	22.1	13.6	8.3	--	14.9	11.6	22.5	12.3	12.1	23.6	12.4	15.13	24.0
Dissolved Oxygen	mg/L	0.01	--	--	5.5-9.5		10.56	8.10	6.90	8.76	7.83	10.43	10.39	8.17	9.54	8.41	--	8.60	9.98	7.65	9.90	12.08	7.49	8.06	7.16	8.04
pH	pH	N/A	--	--	--		7.39	6.57	6.64	7.06	7.35	5.89	6.28	6.20	6.11	7.58	--	6.63	6.39	7.20	6.32	6.60	7.42	6.60	6.90	6.34
Specific Conductance	uS/cm	1	--	--	--		561	279	223	265	234	125	177	174	106	366	--	186.4	215.1	199.0	250.5	431.0	263.0	210.0	0.197	432.1
INORGANICS																											
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--		6	7	7	7	9	5	6	7	7	20	--	<5	<5	6	7	31	7	7	5.2	6
Dissolved Chloride (Cl)	mg/L	1	--	--	120		39	64	58	67	61	24	44	43	18	55	--	45	57	57	48	63	50	46	65	57
Colour	TCU	30	--	--	--		54	15	21	19	12	57	32	38	65	38	--	29	8	15	11	17	10	30	31	7
Nitrite + Nitrate	mg/L	0.05	--	--	--		0.49	0.10	0.17	0.42	0.27	0.66	0.55	0.15	0.62	0.22	--	0.14	0.21	0.18	0.18	0.22	0.24	0.18	0.18	0.14
Nitrate (N)	mg/L	0.05	--	--	13000		0.49	--	--	0.42	0.27	--	0.55	--	--	0.22	--	0.14	0.21	0.18	0.18	0.22	0.24	0.18	0.18	0.14
Nitrite (N)	mg/L	0.05	--	--	60		<0.01	--	--	<0.01	<0.01	--	<0.01	--	--	<0.05	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010	<0.05
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	0.06	--	<0.03	<0.03	0.04	<0.03	0.04	<0.03	<0.03	<0.050	<0.03
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--		--	--	--	--	--	--	--	--	--	<0.4	--	0.4	--	0.4	0.8	0.4	0.4	<5	0.49	1.20
Total Organic Carbon	mg/L	0.5	--	--	--		6.5	3.6	4.7	0.7	3.3	6.7	4.6	5	8.3	5.7	--	5.3	4.2	4.1	5.1	4.0	2.0	4.4	2.7	5.4
Orthophosphate (as P)	mg/L	0.01	--	--	--		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.01
pH (units)	N/A	N/A	--	5.0-9.0	6.5-9		6.36	6.75	6.79	6.63	7.04	6.58	6.54	6.83	6.67	6.6	--	6.8	6.71	6.92	6.88	6.66	7.00	6.64	6.67	6.95
Total Calcium (Ca)	mg/L	0.1	--	--	--		4.5	6.9	6.4	8.37	9.02	5.90	6.02	4.99	4.64	6.0	--	6.0	6.8	6.6	6.9	6.9	9.1	7.0	6900	7.8
Total Magnesium (Mg)	mg/L	0.1	--	--	--		0.6	1.1	1.0	1.25	1.22	0.82	0.98	0.89	0.85	1.0	--	1.1	1.0	0.9	1.5	1.3	1.4	1.0	970	1.4
Total Phosphorus (1M depth)	mg/L	0.002	--	--	--	0.01	<0.02	<0.02	0.002	0.018	0.002	<0.002	0.014	0.011	0.030	0.019	--	0.03	0.006	0.007	0.047	0.012	0.030	0.02	0.005	0.060
Total Potassium (K)	mg/L	0.1	--	--	--		0.9	0.9	0.9	1.160	1.060	1.340	1.230	0.771	1.430	0.8	--	1.0	0.8	1.0	1.5	0.9	1.3	0.9	800	1.0
Total Sodium (Na)	mg/L	0.1	--	--	--		25	38	34	35.2	40.2	18.4	26.8	22.8	13.7	33.6	--	29.8	35.3	28.5	32.2	38.1	41.6	33.7	35	38.6
Reactive Silica (SiO2)	mg/L	0.5	--	--	--		4.5	2.6	2.8	3.8	3.4	5.9	3.7	2.6	5.4	2.9	--	3.2	2.8	2.6	2.6	2.5	2.3	2.7	2.4	2.4
Total Suspended Solids	mg/L	5	--	--	--		<2	3	9	7	<2	<1	1	<2	5	9	--	6	<5	<5	23	6	<5	<5	1	149
Dissolved Sulphate (SO4)	mg/L	2	--	--	--		13	11	11	13	12	12	12	10	12	7	--	10	8	10	10	10	8	8	7.8	9
Turbidity (NTU)	NTU	0.1	--	50	--		0.4	0.5	0.6	8.2	0.9	0.5	0.6	1	1.2	0.7	--	1	0.7	1.1	19.2	1.4	0.9	1.5	0.45	3.8
Conductivity (uS/cm)	uS/cm	1	--	--	--		170	250	230	260	250	130	180	170	100	214	--	179	227	218	209	230	261	224	240	246
Calculated Parameters																											
Anion Sum	me/L	N/A	--	--	--		1.51	2.18	1.99	2.34	2.15	1.09	1.62	1.56	0.92	2.11	--	1.49	1.79	1.95	1.71	2.62	1.73	1.62	2.11	1.93
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--		6	7	7	7	9	5	6	7	7	20	--	<5	<5	6	7	31	7	7	5.2	6
Calculated TDS	mg/L	1	--	--	--		93	129	118	137	134	75	100	90	63	117	--	95	110	109	115	140	117	102	120	126
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--		<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	--	<10	<10	<10	<10	<10	<10	<10	<1.0	<10
Cation Sum	me/L	N/A	--	--	--		1.40	2.11	1.89	2.11	2.33	1.20	1.58	1.35	0.95	1.89	--	1.78	2.00	1.69	2.56	2.18	2.45	1.94	1.98	2.61
Hardness (CaCO3)	mg/L	1	--	--	--		14	22	20	26	28	18	19	16	15	19.1	--	19.5	21.1	20.2	23.4	22.6	28.5	21.6	21.0	25.2
Ion Balance (% Difference)	%	N/A	--	--	--		3.78	1.63	2.58	5.17	4.02	4.80	1.25	7.22	1.60	5.5	--	9.0	5.5	7.0	19.8	9.2	17.0	9.2	3.2	15.2
Langelier Index (@ 20C)	N/A	N/A	--	--	--		-3.57	-2.90	-2.94	-2.96	-2.43	-3.25	-3.27	-2.94	-3.13	-2.91	--	-3.31	-3.35	-3.07	-3.03	-2.61	-2.79	-3.26	-3.13	-2.98
Langelier Index (@ 4C)	N/A	N/A	--	--	--		-3.82	-3.15	-3.19	-3.21	-2.68	-3.50	-3.53	-3.19	-3.38	-3.23	--	-3.63	-3.67	-3.39	-3.35	-2.93	-3.11	-3.58	-3.38	-3.30
Saturation pH (@ 20C)	N/A	N/A	--	--	--		9.93	9.65	9.73	9.59	9.47	9.83	9.81	9.77	9.80	9.51	--	10.10	10.1	9.99	9.91	9.27	9.79	9.90	9.80	9.93
Saturation pH (@ 4C)	N/A	N/A	--	--	--		10.20	9.90	9.98	9.84	9.72	10.10	10.10	10.00	10.10	9.83	--	10.40	10.4	10.3	10.2	9.59	10.1	10.2	10.1	10.2
Metals (ICP-MS)																											
Total Aluminum (Al)	µg/L	5	5	--	5-100		260	--	--	665	45.9	--	233	--	--	177	--	306	141	103	3920	305	129	142	140	--
Total Antimony (Sb)	µg/L	2	20	--	--		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	--	<2	<2	<2	<2	<2	<2	<2	<1.0	--
Total Arsenic (As)	µg/L	2	5.0	--	5		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	--	<2	<2	<2	2	<2	<2	<2	<1.0	--
Total Barium (Ba)	µg/L	5	1000	--	--		23	--	--	35.3	24.4	--	26.6	--	--	22	--	19	20	12	40	23	23	18	21	--
Total Beryllium (Be)	µg/L	2	5.3	--	--		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	--	<2	<2	<2	<2	<2	<2	<2	<1.0	--
Total Bismuth (Bi)	µg/L	2	--	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	--	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Boron (B)	µg/L	5	1200	--	1500		8	--	--	11.3	8.6	--	<50	--	--	6	--	9	6	8	9	8	13	11	<50	--
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017		<0.3	--	--	0.032	<0.017	--	<0.017	--	--	<0.017	--	0.066	0.021	0.018	0.430	<0.017	0.020	<0.017	0.025	--
Total Chromium (Cr)	µg/L	1	1.0	--	1		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	--	<1	<1	<1	3	<1	<1	<1	<1.0	--
Total Cobalt (Co)	µg/L	1	10	--	--		<1	--	--	0.96	<0.40	--	<0.40	--	--	<1	--	2	<1	<1	9	<1	<1	<1	<0.40	--
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0		<2	--	--	2.0	<2.0	<2.0	4.0	<2.0	2.3	<2	--	<2	<2	1	6	1	<1	2	<2.0	3
Total Iron (Fe)	µg/L	50	300	--	300		140	--	--	687	89	161	141	315	528	137	--	742	130	205	5300	239	296	182	93	4460
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0		<0.5	--	--	1.73	<0.50	--	<0.50	--	--	<0.5	--	0.9	<0.5	<0.5	13.5	0.9	<0.5	<0.5	<0.50	--
Total Manganese (Mn)	µg/L	2	820	--	--		17	--	--	142	68.9	41.3	14.4	128	62.4	48	--	214	33	58	693	54	260	49	34	296
Total Molybdenum (Mo)	µg/L	2	73	--	73		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	--	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Nickel (Ni)	µg/L	2	25	--	25-150		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	--	2	<2	<2	9	<2	<2	<2	<2.0	--
Total Selenium (Se)	µg/L	1	1.0	--	1		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	--	<1	<1	<1	<1	<1	<1	<1	<1.0	--
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1		<0.5	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	--
Total Strontium (Sr)	µg/L	5	21000	--	--		18	--	--	36.3	37.1	--	25	--	--	26	--	30	31	25	34	35	37	30	32	--
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8		<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	--
Total Tin (Sn)	µg/L	2	--	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	--	<2	<2	<2	<2	<2	<2	<2	<2.0	--
Total Titanium (Ti)	µg/L	2	--	--	--		<2	--	--	7.8	<2.0	--	3.9	--	--	<2	--	4	<2	<2	65	4	<2	3	<2.0	--
Total Uranium (U)	µg/L	0.1	300	--	15		<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	0.1	--	<0.1	<0.1	<0.1	0.6	<0.1	<0.1	<0.1	<0.10	--
Total Vanadium (V)	µg/L	2	6	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	--	<2	<2	<2	10	<2	<2	<2	<2.0	--
Total Zinc (Zn)	µg/L	5	30	--	30		8	--	--	10.0	5.4	5.7	6.3	6.2	5.4	<5	--	13	8	<5	62	<5	<5	6	11	13
MICROBIOLOGICAL																											
Total Coliform	MPN/100mL	1	--	--	--		200	73	--	>250	>250	>250	85	>250	--	411	--	2420	866	1730	1011	613	2420	>2420	---	>2420
E. coli	MPN/100mL	1	--	400	--		33	45	--	19	>200	2	2	34	<100	2	--	20	12	4	6	6	10	10	<10	3
Fecal Coliform	MPN/ml	--	--	400	--		--	--	<1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---	--
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--		0.62	2.31	0.57	0.82	1.12	0.07	2.85	0.86	0.15	1.03	--	0.69	1.17	1.10	5.07	0.67	0.64	0.91	0.57	8.84
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--		0.64	2.21	0.64	0.74	1.04	0.06	2.75	0.76	0.15	1.10	--	0.91	1.37	1.10	6.39	0.65	0.65	0.87	0.54	9.54

Notes:

NA - Not Applicable; NC - Not Calculable; NCC Not Collected
RDL = Recordable Detection Limit (represents most recent sampling event)
" -- " = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guideline for the protection of the environment and ecological receptors (last updated 2011)
CCME FWAL Guidelines for Aluminum, Lead, Copper and Nickel vary based on reported pH and water hardness (CCME FWAL calculation equations). The largest guideline value for each respective element range was always used.
Health Canada Guideline for Recreational Water Quality = Health Canada Guidelines for Canadian Recreational Water Quality - Draft (September 2009) (Referenced)
Nova Scotia Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table A2 Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water

Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics, Metals)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

TABLE 3: Bedford West Water Quality Sampling Program

August 2015	Units	RDL	NSE ESQs for Surface Water (Reference)	Health Canada Guideline for Recreational Water Quality (Reference)	CCME Guideline FWAL (Applied)	CCME Phosphorus Trigger Range (Applied)	Paper Mill Lake																	
Sample Sites							PML2																	
Sampling Date	yyyy-mm-dd	--					2009/06/29	2009/08/13	2009/10/01	2010/05/31	2010/08/24	2010/11/01	2011/05/13	2011/08/14	2011/10/16	2012/05/01	2012/08/15	2012/10/11	2013/05/15	2013/08/15	2013/10/16	2014/05/15	2014/08/14	2014/10/27	2015/05/20	2015/08/25
Sampling Time	hh:mm	--					13:15	13:40	13:45	14:30	16:20	13:00	12:40	16:20	16:15	13:16	--	--	13:40	10:45	11:20	11:00	9:20	8:30	11:30	13:45
FIELD DATA																								
Secchi Depth	Meters	--	--	1.2	--		2.8	2.2	2.3	N/A	3.0	2.0	2.2	2.3	2.2	2.35	--	--	3.20	--	N/A	N/A	N/A	3.1	NCC	N/A
Water Temp	Celsius	0.1	--	--	--		14.8	24.2	19.7	17.8	25.3	10.1	10.9	23.1	15.2	11.6	--	--	14.8	--	12.6	14.4	21.1	12.1	15.09	27.0
Dissolved Oxygen	mg/L	0.01	--	--	5.5-9.5		10.20	8.30	8.40	8.78	8.09	10.58	9.88	8.7	8.94	7.75	--	--	9.26	--	8.90	12.44	6.95	7.92	8.06	9.76
pH	pH	N/A	--	--	--		6.36	6.82	6.84	7.09	7.39	6.53	6.31	6.67	6.13	8.61	--	--	6.49	--	6.13	6.50	7.22	5.92	6.56	6.76
Specific Conductance	uS/cm	1	--	--	--		267	264	241	237	234	201	159	173	156	231	--	--	234	--	250.5	966.0	266.0	215.0	0.214	255.6
INORGANICS																								
Total Alkalinity (as CaCO3)	mg/L	5	--	--	--		5	7	7	6	8	7	<5	8	7	21	--	--	<5	--	8	32	10	26	<5.0	5
Dissolved Chloride (Cl)	mg/L	1	--	--	120		63	63	58	62	58	50	44	43	34	55	--	--	63	--	64	245	50	42	69	59
Colour	TCU	30	--	--	--		22	17	19	20	13	23	35	38	48	39	--	--	18	--	8	6	7	31	26	10
Nitrite + Nitrate	mg/L	0.05	--	--	--		0.14	0.07	0.09	0.19	0.11	0.23	0.33	0.14	0.22	0.24	--	--	0.22	--	<0.05	0.13	0.18	0.18	0.11	0.32
Nitrate (N)	mg/L	0.05	--	--	13000		0.14	--	--	0.19	0.11	--	0.33	--	--	0.24	--	--	0.22	--	<0.05	0.13	0.18	0.18	0.11	0.17
Nitrite (N)	mg/L	0.05	--	--	60		<0.01	--	--	<0.01	<0.01	--	<0.01	--	--	<0.05	--	--	<0.05	--	<0.05	<0.05	<0.05	<0.05	<0.010	0.15
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	--	--	19		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	--	--	0.03	--	0.23	0.05	0.03	<0.03	<0.050	<0.03
Total Kjeldahl Nitrogen as N	mg/L	0.4	--	--	--		--	--	--	--	--	--	--	--	--	<0.4	--	--	--	--	1.7	<0.4	0.4	<5	0.23	1.20
Total Organic Carbon	mg/L	0.5	--	--	--		3.6	2.6	4.5	3.2	3.4	3.6	4	6	5.6	5.9	--	--	4.4	--	4.0	2.7	2.4	5.8	2.8	6.0
Orthophosphate (as P)	mg/L	0.01	--	--	--		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	--	<0.01	--	<0.01	<0.01	<0.01	<0.01	<0.010	<0.01
pH (units)	pH	N/A	--	5.0-9.0	6.5-9		6.50	6.81	6.82	6.66	7.02	6.83	6.37	6.60	6.60	6.6	--	--	6.68	--	6.73	7.13	7.04	6.77	6.64	6.98
Total Calcium (Ca)	mg/L	0.1	--	--	--		6.1	7.1	6.1	7.17	7.69	7.96	5.30	4.76	5.04	6.1	--	--	6.7	--	7.7	19.2	8.8	6.9	7300	8.2
Total Magnesium (Mg)	mg/L	0.1	--	--	--		1.1	1.1	1.1	1.25	1.17	1.20	0.93	0.86	0.90	1.0	--	--	1.0	--	1.4	1.7	1.4	1.0	1000	1.3
Total Phosphorus (1M depth)	mg/L	0.002	--	--	--	0.01	<0.02	<0.02	0.002	0.010	0.002	<0.002	0.009	0.009	0.007	0.025	--	--	0.006	--	0.026	0.011	0.026	0.02	0.006	0.012
Total Potassium (K)	mg/L	0.1	--	--	--		0.9	1.0	0.9	0.984	0.900	1.020	0.861	0.801	0.968	0.8	--	--	0.8	--	1.3	1.4	1.2	1.1	830	1.0
Total Sodium (Na)	mg/L	0.1	--	--	--		35	40	34	31.1	35.1	30.8	25.7	21.3	20.9	34.6	--	--	37.5	--	42.0	133	42.6	33.9	38	43.3
Reactive Silica (SiO2)	mg/L	0.5	--	--	--		2.6	2.5	2.3	2.6	2.3	3.3	2.9	2.5	3	2.8	--	--	2.7	--	4.2	2.4	2.3	2.9	1.9	1.8
Total Suspended Solids	mg/L	5	--	--	--		2	3	<1	15	<2	11	<1	8	<1	<5	--	--	<5	--	<5	16	<5	<5	1	<5
Dissolved Sulphate (SO4)	mg/L	2	--	--	--		11	11	11	10	10	10	9	10	9	7	--	--	9	--	11	27	7	7	8	9
Turbidity (NTU)	NTU	0.1	--	50	--		0.8	0.7	0.6	1.0	0.8	0.4	0.4	3.4	0.5	0.7	--	--	1	--	3.3	2.6	0.7	1	0.88	1.9
Conductivity (uS/cm)	µS/cm	1	--	--	--		240	250	230	230	230	210	170	170	150	213	--	--	254	--	277	777	273	212	260	251
Calculated Parameters																								
Anion Sum	me/L	N/A	--	--	--		2.11	2.17	1.99	2.07	2.01	1.77	1.46	1.58	1.30	2.13	--	--	1.98	--	2.19	8.12	1.77	1.86	2.13	1.97
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	5	--	--	--		5	7	7	6	8	7	<1	8	7	21	--	--	<5	--	8	32	10	26	<1.0	5
Calculated TDS	mg/L	1	--	--	--		123	131	117	120	120	110	91	89	79	119	--	--	119	--	137	448	118	109	130	127
Carb. Alkalinity (calc. as CaCO3)	mg/L	10	--	--	--		<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	--	--	<10	--	<10	<10	<10	<10	<1.0	<10
Cation Sum	me/L	N/A	--	--	--		1.94	2.23	1.88	1.88	2.03	1.86	1.48	1.28	1.27	1.94	--	--	2.09	--	2.55	6.96	2.47	1.95	2.14	2.44
Hardness (CaCO3)	mg/L	1	--	--	--		20	22	20	23	24	25	17	15	16	19.3	--	--	20.8	--	25.0	54.9	27.7	21.3	23.0	25.8
Ion Balance (% Difference)	%	N/A	--	--	--		4.20	1.36	2.84	4.81	0.50	2.48	0.68	10.50	1.17	4.8	--	--	2.8	--	7.5	7.7	16.5	2.2	0.23	10.6
Langelier Index (@ 20C)	N/A	N/A	--	--	--		-3.33	-2.83	-2.93	-3.06	-2.55	-2.80	NC	-3.18	-3.17	-2.89	--	--	-3.39	--	-3.08	-1.73	-2.61	-2.57	NC	-3.00
Langelier Index (@ 4C)	N/A	N/A	--	--	--		-3.59	-3.08	-3.18	-3.31	-2.80	-3.05	NC	-3.43	-3.42	-3.21	--	--	-3.71	--	-3.40	-2.05	-2.93	-2.89	NC	-3.32
Saturation pH (@ 20C)	N/A	N/A	--	--	--		9.83	9.64	9.75	9.72	9.57	9.83	NC	9.78	9.77	9.49	--	--	10.1	--	9.81	8.86	9.65	9.34	NC	9.98
Saturation pH (@ 4C)	N/A	N/A	--	--	--		10.10	9.89	10.00	9.97	9.82	9.88	NC	10.00	10.00	9.81	--	--	10.4	--	10.1	9.18	9.97	9.66	NC	10.3
Metals (ICP-MS)																								
Total Aluminum (Al)	µg/L	5	5	--	5-100		130	--	--	1030	55.8	--	202	--	--	189	--	--	131	--	107	181	52	122	130	--
Total Antimony (Sb)	µg/L	2	20	--	--		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	--	--	<2	--	<2	<2	<2	<2	<1.0	--
Total Arsenic (As)	µg/L	2	5.0	--	5		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	--	--	<2	--	<2	<2	<2	<2	<1.0	--
Total Barium (Ba)	µg/L	5	1000	--	--		16	--	--	23.0	12.2	--	23	--	--	22	--	--	22	--	37	50	27	19	25	--
Total Beryllium (Be)	µg/L	2	5.3	--	--		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<2	--	--	<2	--	<2	<2	<2	<2	<1.0	--
Total Bismuth (Bi)	µg/L	2	--	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	--	--	<2	--	<2	<2	<2	<2	<2.0	--
Total Boron (B)	µg/L	5	1200	--	1500		5	--	--	8.2	8.8	--	<50	--	--	6	--	--	6	--	9	7	13	11	<50	--
Total Cadmium (Cd)	µg/L	0.017	0.01	--	0.017		<0.3	--	--	0.037	<0.017	--	0.025	--	--	0.023	--	--	0.039	--	0.060	0.062	0.019	0.018	0.023	--
Total Chromium (Cr)	µg/L	1	1.0	--	1		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	--	--	<1	--	<1	<1	<1	<1	<1.0	--
Total Cobalt (Co)	µg/L	1	10	--	--		<1	--	--	0.65	<0.40	--	<0.40	--	--	<1	--	--	<1	--	2	<1	<1	<1	<0.40	--
Total Copper (Cu)	µg/L	1	2	--	2.0-4.0		<2	--	--	3.3	<2.0	<2.0	<2.0	<2.0	<2.0	<2	--	--	<2	--	1380	1	<1	2	<2.0	2
Total Iron (Fe)	µg/L	50	300	--	300		100	--	--	1090	151	76	143	699	181	178	--	--	181	--	1760	264	318	134	170	334
Total Lead (Pb)	µg/L	0.5	1	--	1.0-7.0		<0.5	--	--	2.39	<0.50	--	<0.50	--	--	<0.5	--	--	<0.5	--	49.7	0.7	<0.5	<0.5	<0.50	--
Total Manganese (Mn)	µg/L	2	820	--	--		58	--	--	159	81.0	28.0	33.8	88.6	30.6	22	--	--	87	--	866	206	278	24	43	67
Total Molybdenum (Mo)	µg/L	2	73	--	73		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	--	--	<2	--	<2	<2	<2	<2	<2.0	--
Total Nickel (Ni)	µg/L	2	25	--	25-150		2	--	--	2.2	<2.0	--	<2.0	--	--	<2	--	--	<2	--	3	<2	<2	<2	<2.0	--
Total Selenium (Se)	µg/L	1	1.0	--	1		<2	--	--	<1.0	<1.0	--	<1.0	--	--	<1	--	--	<1	--	<1	<1	<1	<1	<1.0	--
Total Silver (Ag)	µg/L	0.1	0.1	--	0.1		<0.5	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	--	--	<0.1	--	0.1	<0.1	<0.1	<0.1	<0.10	--
Total Strontium (Sr)	µg/L	5	21000	--	--		30	--	--	34.7	32.8	--	25.7	--	--	27	--	--	31	--	35	68	37	29	34	--
Total Thallium (Tl)	µg/L	0.1	0.8	--	0.8		<0.1	--	--	<0.10	<0.10	--	<0.10	--	--	<0.1	--	--	<0.1	--	<0.1	<0.1	<0.1	<0.1	<0.10	--
Total Tin (Sn)	µg/L	2	--	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	--	--	<2	--	3	<2	<2	<2	<2.0	--
Total Titanium (Ti)	µg/L	2	--	--	--		<2	--	--	21.3	<2.0	--	3.6	--	--	<2	--	--	<2	--	2	3	<2	<2	2.1	--
Total Uranium (U)	µg/L	0.1	300	--	15		<0.1	--	--	0.10	<0.10	--	<0.10	--	--	0.1	--	--	<0.1	--	<0.1	<0.1	<0.1	<0.1	<0.10	--
Total Vanadium (V)	µg/L	2	6	--	--		<2	--	--	<2.0	<2.0	--	<2.0	--	--	<2	--	--	<2	--	<2	<2	<2	<2	<2.0	--
Total Zinc (Zn)	µg/L	5	30	--	30		12	--	--	18.3	<5.0	5.8	6.6	7.5	10	8	--	--	11	--	762	<5	<5	5	14	<5
MICROBIOLOGICAL																								
Total Coliform	MPN/100mL	1	--	--	--		49	40	--	>250	46	97	64	>250	--	261	--	--	1410	--	411	291	517	>2420	---	>2420
E. coli	MPN/100mL	1	--	400	--		10	31	--	69	<1	6	17	>200	<100	1	--	--	12	--	2	<1	3	16	<0.10	5
Fecal Coliform	MPN/ml	--	--	400	--		--	--	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---	--
Chlorophyll A - Acidification method	µg/L	0.05	--	--	--		1.15	1.36	0.59	3.50	1.54	0.53	0.55	2.48	1.33	0.76	--	--	1.18	--	0.25	0.99	0.48	0.72	1.67	4.79
Chlorophyll A - Welschmeyer method	µg/L	0.05	--	--	--		1.22	1.33	0.66	3.39	1.51	0.42	0.51	2.26	1.13	0.76	--	--	1.34	--	0.27	1.13	0.44	0.7	1.56	4.59

Notes:

NA - Not Applicable; NC - Not Calculable; NCC Not Collected
RDL = Recordable Detection Limit (represents most recent sampling event)
" -- " = no guideline available / Not Tested.
CCME FWAL = Canadian Council of Ministers of the Environment Freshwater Aquatic Life Guideline for the protection of the environment and ecological receptors (last updated 2011)
CCME FWAL Guidelines for Aluminum, Lead, Copper and Nickel vary based on reported pH and water hardness (CCME FWAL calculation equations). The largest guideline value for each respective element range was always used.
Health Canada Guideline for Recreational Water Quality = Health Canada Guidelines for Canadian Recreational Water Quality - Draft (September 2009)
Nova Scotia Environmental Quality Standards (EQS) for Contaminated Sites (NSE 2014) Table A2 Reference for Pathway Specific Standards for Surface Water (ug/L) - Fresh Water

Bold = Parameter concentration exceeds CCME FWAL Guideline - Present Result (pH, Dissolved Oxygen, Dissolved Chloride, Total Suspended Solids and Turbidity)
Bold = Parameter concentration exceeds NSE EQS Contaminated Sites Regulations - Present Result (Inorganics)
Bold = Parameter concentration exceeds CCME FWAL Guideline - Previous Result (SNC Lavalin)

Table 4: Statistical Presentation of Key Water Quality Parameters

TABLE 4: Statistical Presentation of Key Water Quality Parameters - Bedford West Water Quality Sampling Program

Station 1					
KL-1	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phospophorous (µg/L)	5	5	43	7.5	20
Chloride (mg/L)	62	45	76	48	63.71
Lab pH	6.95	6.51	7.2	6.68	6.90
Total Suspended Solids (mg/L)	<5	<5	17	3	6.67
Conductivity (uS/cm)	257	180	339	212	260.14
Chloropylla-A (µg/L)	1.14	0.41	2.3	1.11	1.28

Number of Samples = 7

Station 2					
KL-2	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phospophorous (µg/L)	12	8	59	20	27.60
Chloride (mg/L)	14	14	21	17	17.20
pH	6.99	6.4	6.99	6.7	6.72
Total Suspended Solids (mg/L)	<5	<5	135	135	135.00
Conductivity (uS/cm)	81	66	94	81	80.20
Chloropylla-A (µg/L)	0.96	0.83	2.2	0.96	1.18

Number of Samples = 7

Station 3					
KL-3	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phospophorous (µg/L)	4	3	45	6	16.2
Chloride (mg/L)	56	40.00	57.00	46.00	48.40
pH	6.92	6.50	7.10	6.92	6.87
Total Suspended Solids (mg/L)	<5	<1	<5	**	**
Conductivity (uS/cm)	242	170.00	243.00	222.00	218.60
Chloropylla-A (µg/L)	1.27	0.59	2.00	1.27	1.28

** Results is not representative

Number of Samples = 7

Station 4					
KL-4	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phospophorous (µg/L)	7	<2	2390	31	494.8
Chloride (mg/L)	56	41.0	65.0	56.0	52.29
pH	6.94	6.57	7.00	6.93	6.87
Total Suspended Solids (mg/L)	7.0	<1	7.00	4.00	4.00
Conductivity (uS/cm)	241	170	250	230	225
Chloropylla-A (µg/L)	0.26	0.07	1.50	0.70	0.74

Number of Samples = 7

TABLE 4: Statistical Presentation of Key Water Quality Parameters - Bedford West Water Quality Sampling Program

Station 5					
KL-5	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phospophorous (µg/L)	5	5	40	19.5	21
Chloride (mg/L)	58	44	58	52	51.5
pH	6.90	6.84	7.1	6.915	6.9425
Total Suspended Solids (mg/L)	<5	<5	<5	**	**
Conductivity (uS/cm)	248	223	248	236	235.75
Chloropylla-A (µg/L)	1.22				

** Results is not representative

Number of Samples = 4

Station 6					
HWY102-1	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phospophorous (µg/L)	20	7	140	21	39.57
Chloride (mg/L)	67	19	67	38	40.71
pH	7.46	5.24	7.49	6.87	6.68
Total Suspended Solids (mg/L)	<5	1	80	8.5	24.50
Conductivity (uS/cm)	324	100	338	188	203.00
Chloropylla-A (µg/L)	7.27	0.58	19.29	2.59	6.73

Number of Samples = 7

Station 7					
HWY102-2	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phospophorous (µg/L)	1560	19	1560	34	288.17
Chloride (mg/L)	7.27	7.27	109	45.5	51.71
pH	6.64	5.96	6.7	6.455	6.40
Total Suspended Solids (mg/L)	3000	10	3000	39	626.80
Conductivity (uS/cm)	662	100	662	246.5	303.00
Chloropylla-A (µg/L)	119.14	1.1	119.14	18.695	40.86

Number of Samples = 7

Station 8					
LSD	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phospophorous (µg/L)	501	15	501	78	141.40
Chloride (mg/L)	27	27	45	27	32.80
pH	6.59	6.59	7.3	6.9	6.91
Total Suspended Solids (mg/L)	719	16	719	19	187.80
Conductivity (uS/cm)	129	129	200	129	151.20
Chloropylla-A (µg/L)	90.33	1.6	90.33	2.02	21.42

Number of Samples = 7

TABLE 4: Statistical Presentation of Key Water Quality Parameters - Bedford West Water Quality Sampling Program

Station 9					
LU	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phospophorous (µg/L)	9	9	36	27.5	25
Chloride (mg/L)	132	99	132	110	112.75
pH	7.30	7.11	7.42	7.25	7.2575
Total Suspended Solids (mg/L)	<5	165	165	165	165
Conductivity (uS/cm)	575	433	605	528.5	523.75
Chloropylla-A (µg/L)	3.14	2.3	32.52	2.84	10.125

Number of Samples = 4

Station 10					
PML1	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phospophorous (µg/L)	60	2	60	11	22.00
Chloride (mg/L)	57	43	64	57	55.33
pH	6.95	6.75	7.04	6.935	6.92
Total Suspended Solids (mg/L)	149	3	149	76	76.00
Conductivity (uS/cm)	246	170	261	248	232.50
Chloropylla-A (µg/L)	8.84	0.64	8.84	1.11	2.48

Number of Samples = 7

Station 11					
PLM2	Seasonal Results	Seasonal Minimum	Seasonal Maximum	Seasonal Median	Seasonal Mean
Total Phospophorous (µg/L)	12	2	26	10.5	12.25
Chloride (mg/L)	59	43	63	58	54.6
pH	6.98	6.6	7.04	6.98	6.89
Total Suspended Solids (mg/L)	<5	<2	8	5.5	5.5
Conductivity (uS/cm)	251	170	273	250	234.8
Chloropylla-A (µg/L)	4.79	0.48	4.79	1.54	2.13

Number of Samples = 7

SNC·LAVALIN

Appendix A

Laboratory Certificate of Analysis

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

CLIENT NAME: SNC-LAVALIN
5657 SPRING GARDEN RD, SUITE 200
HALIFAX , NS B3J3R4
(902) 492-4544

ATTENTION TO: Crysta Cumming

PROJECT: 631477

AGAT WORK ORDER: 15X011351

MICROBIOLOGY ANALYSIS REVIEWED BY: Jason Coughtrey, Inorganics Supervisor

WATER ANALYSIS REVIEWED BY: Jason Coughtrey, Inorganics Supervisor

DATE REPORTED: Sep 11, 2015

PAGES (INCLUDING COVER): 13

VERSION*: 2

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718

*NOTES
VERSION 2:Version 2.0 supersedes version 1.0, issued September 4, 2015.

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 15X011351

PROJECT: 631477

CLIENT NAME: SNC-LAVALIN

ATTENTION TO: Crysta Cumming

SAMPLING SITE:

SAMPLED BY:

Total Coliforms and E.coli (MPN)

DATE RECEIVED: 2015-08-25

DATE REPORTED: 2015-09-11

		SAMPLE DESCRIPTION:		KL1	KL2	KL3	KL4	KL5	HWY-102-1	HWY-102-2	LSD
		SAMPLE TYPE:		Water	Water	Water	Water	Water	Water	Water	Water
		DATE SAMPLED:		8/25/2015	8/25/2015	8/25/2015	8/25/2015	8/25/2015	8/25/2015	8/25/2015	8/25/2015
Parameter	Unit	G / S	RDL	6897474	6897477	6897482	6897487	6897493	6897499	6897504	6897509
E. Coli (MPN)	MPN/100 mL		1	24	11	7	5	1	25	201	16
Total Coliforms (MPN)	MPN/100 mL		1	980	>2420	2420	>2420	356	>2420	>2420	>2420

		SAMPLE DESCRIPTION:		LU	PML-1	PML-2
		SAMPLE TYPE:		Water	Water	Water
		DATE SAMPLED:		8/25/2015	8/25/2015	8/25/2015
Parameter	Unit	G / S	RDL	6897519	6897530	6897535
E. Coli (MPN)	MPN/100 mL		1	19	3	5
Total Coliforms (MPN)	MPN/100 mL		1	>2420	>2420	>2420

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

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Certificate of Analysis

AGAT WORK ORDER: 15X011351

PROJECT: 631477

CLIENT NAME: SNC-LAVALIN

ATTENTION TO: Crysta Cumming

SAMPLING SITE:

SAMPLED BY:

Standard Water Analysis (Total)

DATE RECEIVED: 2015-08-25

DATE REPORTED: 2015-09-11

SAMPLE DESCRIPTION:				KL1	KL2	KL3	KL4	KL5	HWY-102-1		HWY-102-2
SAMPLE TYPE:				Water	Water	Water	Water	Water	Water		Water
DATE SAMPLED:				8/25/2015	8/25/2015	8/25/2015	8/25/2015	8/25/2015	8/25/2015		8/25/2015
Parameter	Unit	G / S	RDL	6897474	6897477	6897482	6897487	6897493	6897499	RDL	6897504
pH				6.95	6.99	6.92	6.94	6.90	7.46		6.64
Reactive Silica as SiO2	mg/L		0.5	1.8	3.7	2.4	2.6	1.9	4.9	0.5	7.2
Chloride	mg/L		1	62	14	56	56	58	67	1	178
Fluoride	mg/L		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1
Sulphate	mg/L		2	10	<2	9	9	9	9	2	7
Alkalinity	mg/L		5	6	7	6	6	6	21	5	5
True Color	TCU		5	8	63	13	10	8	27	5	9
Turbidity	NTU		0.1	1.9	1.6	0.5	0.7	1.0	0.9	0.1	1490
Electrical Conductivity	umho/cm		1	257	81	242	241	248	324	1	662
Nitrate + Nitrite as N	mg/L		0.05	0.15	0.08	0.12	0.14	0.12	<0.05	0.05	<0.05
Nitrate as N	mg/L		0.05	0.15	0.08	0.12	0.14	0.12	<0.05	0.05	<0.05
Nitrite as N	mg/L		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	<0.05
Ammonia as N	mg/L		0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	0.19
Total Organic Carbon	mg/L		0.5	5.3	13.3	5.7	5.2	5.3	14.6	0.5	29.0
Ortho-Phosphate as P	mg/L		0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
Total Sodium	mg/L		0.1	43.3	11.5	40.0	41.5	42.6	37.7	5.0	124
Total Potassium	mg/L		0.1	0.9	0.7	0.9	0.9	0.9	2.1	5.0	12.5
Total Calcium	mg/L		0.1	7.9	3.4	7.8	7.9	8.0	18.0	5.0	33.3
Total Magnesium	mg/L		0.1	1.3	0.9	1.2	1.3	1.3	2.7	5.0	32.7
Total Phosphorous	mg/L		0.02	0.13	0.15	0.14	0.16	0.17	0.14	1.00	5.07
Bicarb. Alkalinity (as CaCO3)	mg/L		5	6	7	6	6	6	21	5	5
Carb. Alkalinity (as CaCO3)	mg/L		10	<10	<10	<10	<10	<10	<10	10	<10
Hydroxide	mg/L		5	<5	<5	<5	<5	<5	<5	5	<5
Calculated TDS	mg/L		1	130	36	119	121	124	151	1	712
Hardness	mg/L			25.1	12.2	24.4	25.1	25.3	56.1		218
Langelier Index (@20C)	NA			-2.97	-3.18	-3.00	-2.98	-3.02	-1.57		-2.81
Langelier Index (@ 4C)	NA			-3.29	-3.50	-3.32	-3.30	-3.34	-1.89		-3.13
Saturation pH (@ 20C)	NA			9.92	10.2	9.92	9.92	9.92	9.03		9.45
Saturation pH (@ 4C)	NA			10.2	10.5	10.2	10.2	10.2	9.35		9.77
Anion Sum	me/L			2.09	0.54	1.90	1.90	1.95	2.50		5.27

Original Signed

Certified By:

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Certificate of Analysis

AGAT WORK ORDER: 15X011351

PROJECT: 631477

CLIENT NAME: SNC-LAVALIN

ATTENTION TO: Crysta Cumming

SAMPLING SITE:

SAMPLED BY:

Standard Water Analysis (Total)

DATE RECEIVED: 2015-08-25

DATE REPORTED: 2015-09-11

SAMPLE DESCRIPTION:				KL1	KL2	KL3	KL4	KL5	HWY-102-1		HWY-102-2
SAMPLE TYPE:				Water	Water	Water	Water	Water	Water		Water
DATE SAMPLED:				8/25/2015	8/25/2015	8/25/2015	8/25/2015	8/25/2015	8/25/2015		8/25/2015
Parameter	Unit	G / S	RDL	6897474	6897477	6897482	6897487	6897493	6897499	RDL	6897504
Cation sum	me/L			2.43	0.82	2.27	2.35	2.40	2.88		29.1
% Difference/ Ion Balance (NS)	%			7.5	20.5	9.0	10.7	10.2	7.1		69.4
Total Copper	ug/L		1	<1	<1	1	1	1	<1	50	404
Total Iron	ug/L		50	157	641	165	217	123	1280	2500	217000
Total Manganese	ug/L		2	41	120	48	78	24	95	100	2800
Total Zinc	ug/L		5	8	<5	7	8	6	<5	250	1210

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Certificate of Analysis

AGAT WORK ORDER: 15X011351

PROJECT: 631477

CLIENT NAME: SNC-LAVALIN

ATTENTION TO: Crysta Cumming

SAMPLING SITE:

SAMPLED BY:

Standard Water Analysis (Total)

DATE RECEIVED: 2015-08-25

DATE REPORTED: 2015-09-11

		SAMPLE DESCRIPTION:		LSD		LU	PML-1	PML-2
		SAMPLE TYPE:		Water		Water	Water	Water
		DATE SAMPLED:		8/25/2015		8/25/2015	8/25/2015	8/25/2015
Parameter	Unit	G / S	RDL	6897509	RDL	6897519	6897530	6897535
pH				6.59		7.30	6.95	6.98
Reactive Silica as SiO2	mg/L		0.5	4.2	0.5	4.9	2.4	1.8
Chloride	mg/L		1	27	1	132	57	59
Fluoride	mg/L		0.1	<0.1	0.1	<0.1	<0.1	<0.1
Sulphate	mg/L		2	<2	2	31	9	9
Alkalinity	mg/L		5	7	5	16	6	5
True Color	TCU		5	11	5	8	7	10
Turbidity	NTU		0.1	4430	0.1	2.8	3.8	1.9
Electrical Conductivity	umho/cm		1	129	1	575	246	251
Nitrate + Nitrite as N	mg/L		0.05	0.25	0.05	0.59	0.14	0.32
Nitrate as N	mg/L		0.05	0.16	0.05	0.59	0.14	0.17
Nitrite as N	mg/L		0.05	0.09	0.05	<0.05	<0.05	0.15
Ammonia as N	mg/L		0.03	0.11	0.03	0.05	<0.03	<0.03
Total Organic Carbon	mg/L		0.5	14.1	0.5	7.6	5.4	6.0
Ortho-Phosphate as P	mg/L		0.01	<0.01	0.01	<0.01	<0.01	<0.01
Total Sodium	mg/L		5.0	24.4	0.1	102	38.6	43.3
Total Potassium	mg/L		5.0	9.7	0.1	2.8	1.0	1.0
Total Calcium	mg/L		5.0	52.2	0.1	20.3	7.8	8.2
Total Magnesium	mg/L		5.0	23.0	0.1	3.4	1.4	1.3
Total Phosphorous	mg/L		1.00	5.88	0.02	0.12	0.19	0.14
Bicarb. Alkalinity (as CaCO3)	mg/L		5	7	5	16	6	5
Carb. Alkalinity (as CaCO3)	mg/L		10	<10	10	<10	<10	<10
Hydroxide	mg/L		5	<5	5	<5	<5	<5
Calculated TDS	mg/L		1	498	1	305	126	127
Hardness	mg/L			225		64.7	25.2	25.8
Langelier Index (@20C)	NA			-2.50		-1.82	-2.98	-3.00
Langelier Index (@ 4C)	NA			-2.82		-2.14	-3.30	-3.32
Saturation pH (@ 20C)	NA			9.09		9.12	9.93	9.98
Saturation pH (@ 4C)	NA			9.41		9.44	10.2	10.3
Anion Sum	me/L			0.92		4.73	1.93	1.97

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Certificate of Analysis

AGAT WORK ORDER: 15X011351

PROJECT: 631477

CLIENT NAME: SNC-LAVALIN

ATTENTION TO: Crysta Cumming

SAMPLING SITE:

SAMPLED BY:

Standard Water Analysis (Total)

DATE RECEIVED: 2015-08-25

DATE REPORTED: 2015-09-11

		SAMPLE DESCRIPTION:		LSD		LU	PML-1	PML-2
		SAMPLE TYPE:		Water		Water	Water	Water
		DATE SAMPLED:		8/25/2015		8/25/2015	8/25/2015	8/25/2015
Parameter	Unit	G / S	RDL	6897509	RDL	6897519	6897530	6897535
Cation sum	me/L			31.0		5.86	2.61	2.44
% Difference/ Ion Balance (NS)	%			94.2		10.6	15.2	10.6
Total Copper	ug/L		50	183	1	3	3	2
Total Iron	ug/L		2500	176000	50	671	4460	334
Total Manganese	ug/L		100	13800	2	371	296	67
Total Zinc	ug/L		250	799	5	17	13	<5

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

6897477 When the cation and anion sums are below 1 me/L, the acceptable criteria is less than 0.3me/L

6897487 Ion Balance is greater than 10% due to the fact that samples are digested for total metals and any particulates in the water could be increasing the concentrations of certain elements.

6897504-6897509 Ion Balance is greater than 10% due to the fact that samples are digested for total metals and any particulates in the water could be increasing the concentrations of certain elements.

6897530 Ion Balance is greater than 10% due to the fact that samples are digested for total metals and any particulates in the water could be increasing the concentrations of certain elements.

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AGAT WORK ORDER: 15X011351

PROJECT: 631477

CLIENT NAME: SNC-LAVALIN

ATTENTION TO: Crysta Cumming

SAMPLING SITE:

SAMPLED BY:

Subcontracted Data Received-Dal Chlorophyll A

DATE RECEIVED: 2015-08-25

DATE REPORTED: 2015-09-11

		SAMPLE DESCRIPTION:		KL1	KL2	KL3	KL4	KL5	HWY-102-1	HWY-102-2	LSD
		SAMPLE TYPE:		Water	Water	Water	Water	Water	Water	Water	Water
		DATE SAMPLED:		8/25/2015	8/25/2015	8/25/2015	8/25/2015	8/25/2015	8/25/2015	8/25/2015	8/25/2015
Parameter	Unit	G / S	RDL	6897474	6897477	6897482	6897487	6897493	6897499	6897504	6897509
Subcontracted Data				Y	Y	Y	Y	Y	Y	Y	Y

		SAMPLE DESCRIPTION:		LU	PML-1	PML-2
		SAMPLE TYPE:		Water	Water	Water
		DATE SAMPLED:		8/25/2015	8/25/2015	8/25/2015
Parameter	Unit	G / S	RDL	6897519	6897530	6897535
Subcontracted Data				Y	Y	Y

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

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Certificate of Analysis

AGAT WORK ORDER: 15X011351

PROJECT: 631477

CLIENT NAME: SNC-LAVALIN

ATTENTION TO: Crysta Cumming

SAMPLING SITE:

SAMPLED BY:

TP (Water)

DATE RECEIVED: 2015-08-25

DATE REPORTED: 2015-09-11

		SAMPLE DESCRIPTION:		KL1	KL2	KL3	KL4	KL5	HWY-102-1		HWY-102-2
		SAMPLE TYPE:		Water	Water	Water	Water	Water	Water		Water
		DATE SAMPLED:		8/25/2015	8/25/2015	8/25/2015	8/25/2015	8/25/2015	8/25/2015		8/25/2015
Parameter	Unit	G / S	RDL	6897474	6897477	6897482	6897487	6897493	6897499	RDL	6897504
Total Phosphorus	mg/L		0.002	0.005	0.012	0.004	0.007	0.005	0.020	0.020	1.56

		SAMPLE DESCRIPTION:		LSD		LU	PML-1	PML-2
		SAMPLE TYPE:		Water		Water	Water	Water
		DATE SAMPLED:		8/25/2015		8/25/2015	8/25/2015	8/25/2015
Parameter	Unit	G / S	RDL	6897509	RDL	6897519	6897530	6897535
Total Phosphorus	mg/L		0.010	0.501	0.002	0.009	0.060	0.012

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

6897474-6897535 Revision, 2015/09/10
TP Low Level Analysis: The RDLs and TP values have been corrected to comply with the required regulatory standards.

Elevated RDLs indicate the degree of sample dilutions prior to analyses to keep analyte within the calibration range, reduce matrix interference and/or to avoid contaminating the instrument.

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Certificate of Analysis

AGAT WORK ORDER: 15X011351

PROJECT: 631477

CLIENT NAME: SNC-LAVALIN

ATTENTION TO: Crysta Cumming

SAMPLING SITE:

SAMPLED BY:

TSS, TKN

DATE RECEIVED: 2015-08-25

DATE REPORTED: 2015-09-11

Parameter	Unit	G / S	RDL	SAMPLE DESCRIPTION: KL1	KL2	KL3	KL4	KL5	HWY-102-1	HWY-102-2	LSD
				SAMPLE TYPE: Water	Water	Water	Water	Water	Water	Water	Water
				DATE SAMPLED: 8/25/2015	8/25/2015	8/25/2015	8/25/2015	8/25/2015	8/25/2015	8/25/2015	8/25/2015
				6897474	6897477	6897482	6897487	6897493	6897499	6897504	6897509
Total Suspended Solids	mg/L		5	<5	<5	<5	7	<5	<5	3000	719
Total Kjeldahl Nitrogen as N	mg/L		0.4	4.5	0.8	1.2	0.4	<0.4	0.5	62.6	77.4
TKN Digest				Y	Y	Y	Y	Y	Y	Y	Y

Parameter	Unit	G / S	RDL	SAMPLE DESCRIPTION: LU	PML-1	PML-2
				SAMPLE TYPE: Water	Water	Water
				DATE SAMPLED: 8/25/2015	8/25/2015	8/25/2015
				6897519	6897530	6897535
Total Suspended Solids	mg/L		5	<5	149	<5
Total Kjeldahl Nitrogen as N	mg/L		0.4	0.8	1.2	1.2
TKN Digest				Y	Y	Y

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

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Quality Assurance

CLIENT NAME: SNC-LAVALIN

AGAT WORK ORDER: 15X011351

PROJECT: 631477

ATTENTION TO: Crysta Cumming

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Sep 11, 2015			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Standard Water Analysis (Total)															
pH	6897079		7.7	8.1	5.1%	<	100%	80%	120%		80%	120%		80%	120%
Reactive Silica as SiO2	1	6897119	11.2	11.6	3.5%	< 0.5	101%	80%	120%		80%	120%	80%	80%	120%
Chloride	6897474	6897474	62	62	1.2%	< 1	100%	80%	120%	NA	80%	120%	NA	80%	120%
Fluoride	6897474	6897474	<0.1	<0.1	0.0%	< 0.1	109%	80%	120%	NA	80%	120%	83%	80%	120%
Sulphate	6897474	6897474	10	10	0.0%	< 2	108%	80%	120%	NA	80%	120%	89%	80%	120%
Alkalinity	6897079		96	93	3.2%	< 5	87%	80%	120%		80%	120%		80%	120%
True Color	1	6897530	7	6	15.4%	< 5	120%	80%	120%		80%	120%		80%	120%
Turbidity	1	6897499	0.906	0.929	2.5%	< 0.1	93%	80%	120%		80%	120%		80%	120%
Electrical Conductivity	6897079		383	378	1.3%	< 1	103%	80%	120%		80%	120%		80%	120%
Nitrate as N	6897474	6897474	0.15	0.14	0.0%	< 0.05	108%	80%	120%	NA	80%	120%	97%	80%	120%
Nitrite as N	6897474	6897474	<0.05	<0.05	0.0%	< 0.05	102%	80%	120%	NA	80%	120%	97%	80%	120%
Ammonia as N	1	6893789	0.05	0.05	0.0%	< 0.03	99%	80%	120%		80%	120%	90%	80%	120%
Total Organic Carbon	1	6898734	6.9	6.6	4.4%	< 0.5	112%	80%	120%		80%	120%	101%	80%	120%
Ortho-Phosphate as P	1	6897119	<0.01	<0.01	0.0%	< 0.01	91%	80%	120%		80%	120%	120%	80%	120%
Total Sodium	8272015		26.4	26.7	1.1%	< 0.1	107%	80%	120%	107%	80%	120%	96%	70%	130%
Total Potassium	8272015		0.5	0.5	0.0%	< 0.1	111%	80%	120%	110%	80%	120%	83%	70%	130%
Total Calcium	8272015		45.1	44.4	1.6%	< 0.1	114%	80%	120%	112%	80%	120%	109%	70%	130%
Total Magnesium	8272015		9.60	9.76	1.7%	< 0.1	107%	80%	120%	107%	80%	120%	70%	70%	130%
Total Phosphorous	8272015		0.09	0.09	0.0%	< 0.02	112%	80%	120%	112%	80%	120%	95%	70%	130%
Total Copper	8272015		18	18	0.0%	< 1	113%	80%	120%	113%	80%	120%	77%	70%	130%
Total Iron	8272015		< 50	< 50	0.0%	< 50	111%	80%	120%	115%	80%	120%	82%	70%	130%
Total Manganese	8272015		151	152	0.7%	< 2	116%	80%	120%	109%	80%	120%	97%	70%	130%
Total Zinc	8272015		6	6	0.0%	< 5	107%	80%	120%	107%	80%	120%	72%	70%	130%
TSS, TKN															
Total Suspended Solids	1	0072	< 5	< 5	0.0%	< 5	103%	80%	120%		120%	120%	97%	80%	120%
Total Kjeldahl Nitrogen as N	1	6895894	0.5	0.5	0.0%	< 0.4	95%	80%	120%		80%	120%	93%	80%	120%
TP (Water)															
Total Phosphorus	6897474	6897474	0.005	0.006	18.2%	< 0.002	100%	90%	110%	106%	90%	110%	105%	80%	120%

Original Signed

Certified By:

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Method Summary

CLIENT NAME: SNC-LAVALIN

AGAT WORK ORDER: 15X011351

PROJECT: 631477

ATTENTION TO: Crysta Cumming

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Microbiology Analysis			
E. Coli (MPN)	MIC-121-7000	Based on SM 9223B	INCUBATOR
Total Coliforms (MPN)	MIC-121-7000	Based on SM 9223B	INCUBATOR

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Method Summary

CLIENT NAME: SNC-LAVALIN

AGAT WORK ORDER: 15X011351

PROJECT: 631477

ATTENTION TO: Crysta Cumming

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
pH	INOR-121-6001	SM 4500 H+B	PC-TITRATE
Reactive Silica as SiO2	INORG-121-6028	SM 4110 B	COLORIMETER
Chloride	INORG-121-6005	SM 4110 B	IC
Fluoride	INORG-121-6005	SM 4110 B	IC
Sulphate	INORG-121-6005	SM 4110 B	IC
Alkalinity	INORG-121-6001	SM 2320 B	PC-TITRATE
True Color	INORG-121-6014	EPA 110.2	NEPHELOMETER
Turbidity	INORG-121-6022	SM 2130 B	NEPHELOMETER
Electrical Conductivity	INOR-121-6001	SM 2510 B	PC-TITRATE
Nitrate + Nitrite as N	INORG-121-6005	SM 4110 B	IC
Nitrate as N	INORG-121-6005	SM 4110 B	IC
Nitrite as N	INORG-121-6005	SM 4110 B	IC
Ammonia as N	INORG-121-6003	SM 4500-NH3 G	COLORIMETER
Total Organic Carbon	INORG-121-6026	SM 5310 B	TOC ANALYZER
Ortho-Phosphate as P	INORG-121-6005	SM 4110 B	COLORIMETER
Total Sodium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Potassium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Calcium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Magnesium	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Phosphorous	MET-121-6104 & MET-121-6105	SM 3125	ICP/MS
Bicarb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC-TITRATE
Carb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC-TITRATE
Hydroxide	INORG-121-6001	SM 2320 B	PC-TITRATE
Calculated TDS		SM 1030E	CALCULATION
Hardness		SM 2340B	CALCULATION
Langelier Index (@20C)			CALCULATION
Langelier Index (@ 4C)			CALCULATION
Saturation pH (@ 20C)			CALCULATION
Saturation pH (@ 4C)			CALCULATION
Anion Sum		SM 1030E	CALCULATION
Cation sum		SM 1030E	CALCULATION
% Difference/ Ion Balance (NS)		SM 1030E	CALCULATION
Total Copper	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Iron	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Manganese	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Total Zinc	MET121-6104 & MET-121-6105	SM 3125	ICP/MS
Subcontracted Data			
Total Phosphorus	INOR-93-6022	SM 4500-P B & E	SPECTROPHOTOMETER
Total Suspended Solids	INOR-121-6024, 6025	SM 2540C, D	GRAVIMETRIC
Total Kjeldahl Nitrogen as N	INOR-121-6020	SM 4500 NORG D	COLORIMETER
TKN Digest			COLORIMETER

AGAT Laboratories

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Dartmouth, Nova Scotia
B3B 1M2
http://webearth.agatlabs.com

Phone: 902-468-8718
Fax: 902-468-8924
www.agatlabs.com

Laboratory use Only
Arrival Condition: 20° ☐ Good ☐ Poor (complete 'notes') 15X011351
Arrival Temperature: AGAT Job Number:
Notes:

Drinking Water Sample (y/n): Reg. No.
Waterworks Number:

Report To:
Company: SNC Lavalin
Contact: Maria Gutierrez
Address: 5657 Spring Garden Road
Halifax, NS B3J 3R4
Phone: 902-492-4544 FAX:
PO#:
AGAT Quotation: 15-1718
Client Project #: Bedford West

Invoice to: Same (Y/N) - Circle
Company: SNC Lavalin
Contact: payables@snclavalin.com
Address:
Phone: Fax:
PO#/Credit Card #:

Report Information
1. Name:
Email:
2. Name:
Email:

Regulatory Requirements (Check):
☐ List Guidelines on Report ☐ Do Not List Guidelines on Report
☐ PIRI Site Info (check all that apply):
☐ Teir 1 ☐ Res. ☐ Pot. ☐ Coarse
☐ Teir 2 ☐ Com ☐ N/Pot. ☐ Fine
☐ Gas ☐ Fuel ☐ Lube
☐ CCME ☐ CDWQ
☐ Ind ☐ NSDFOSP
☐ Com ☐ HRM 101
☐ Res/P Storm Water
☐ Ag ☐ HRM 101
☐ FWAL Waste Water
☐ Sediment
☐ Other

Report Format
☐ Single PDF sample per page
☐ Multiple PDF samples per page
☐ Excel Format Included

Turnaround Time (TAT) Business Days
Regular TAT:
■ 5 - 7 days
Rush TAT:
☐ 1 day ☐ 2 days
☐ 3 - 4 days
Date Required:
Time Required:

SAMPLE IDENTIFICATION	DATE / TIME SAMPLED	SAMPLE MATRIX	# OF CONTAINERS	COMMENTS - Site/Sample Info, Sample Containment	Field Filtered/ Preserved	Standard Water Analysis	Metals (Spring Quarterly Only)	(circle-Total, Diss or Available)	Mercury	BOD	pH	TSS	TKN, TP (Low Level)	Anions	Total Phosphorus	Phenols	TPH/BTEX (PIRI) Teir 1	TPH/BTEX-Fractionation Teir 2	VOC	THM	PAH	Chlorophyll A (Sub to DAL)	TC & EC by MPN	Hazardous (Y/N)	Lab Sample #
KL1		water	5			X						X	X									X	X		
KL2		water	5			X						X	X									X	X		
KL3		water	5			X						X	X									X	X		
KL4		water	5			X						X	X									X	X		
KL5		water	5			X						X	X									X	X		
HWY-102-1		water	5			X						X	X									X	X		
HWY-102-2		water	5			X						X	X									X	X		
LSD		water	5			X						X	X									X	X		
LU		water	5			X						X	X									X	X		
PML-1		water	5			X						X	X									X	X		
PML-2		water	5			X						X	X									X	X		

Sample Relinquished By (print name & sign)	Date/Time	Samples Received By (print name and sign)	Date/Time
		Original Signed	Aug 25/15
Sample Relinquished By (print name & sign)	Date/Time	Samples Received By (print name and sign)	Date/Time
Original Signed	Aug 25/15 5:00 PM	Original Signed	17:00

Special Instructions

Page of

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Appendix B

Field Reports Summer 2015

FIELD REPORT – SUMMER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Kearney Lake	**Site ID: KL1**	
Watercourse: Kearney Lake	**Location:** Kearney Lake Road	
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	20T 0445718E, 4948496N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster / Ryan Flinn	

Site Conditions

Weather:	Sun and Cloud
Air Temperature:	24.9°C
Cloud Cover :	30%
Wildlife Sightings:	Kids Swimming
Site Accessibility: Yes, Accessible	Off Kearney Lake Road
Site Access Detail:	Sample taken off the end of dock at Kearney Lake beach. Parked in public parking of Hamshaw Dr. and walked down to beach area.

Field Parameter Data

	Remarks
Date (d.m.y):	24.08.15
Time (hh:mm):	2:54pm
Sample Depth (m):	0.4m
pH:	6.68
Dissolved Oxygen (mg/L):	8.13
Secchi Depth (m):	__-----__meters (depth to bottom 1.3 m – visible from surface)
Water Temperature (degrees Celsius):	26.1
Conductivity (µs/cm):	298.3

Additional Comments / Notes

Total Dissolved Solids: 0.1677
C (ms/cm): 0.264

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FIELD REPORT – SUMMER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Kearney Lake		**Site ID: KL2**
Watercourse: Kearney Lake		**Location:** Kearney Lake Road
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	20T 0443859E, 4949738N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster / Ryan Flinn	

Site Conditions

Weather:	Sunny with cloudy periods
Air Temperature:	25.3°C
Cloud Cover:	50%
Wildlife Sightings:	Dragon fly, Birds
Site Accessibility: Yes, Accessible	Off Colin's Rd.
Site Access Detail:	Sample taken on the lake side of the culvert between residential buildings 20 and 28. Walked down rock to left of culvert. Note: Sample when standing downstream of bottle.

Field Parameter Data

	Remarks
Date (d.m.y):	24.08.15
Time (hh:mm):	3:29pm
Sample Depth (m):	0.2m
pH:	5.88
Dissolved Oxygen (mg/L):	7.28
Secchi Depth (m):	**N/A**
Water Temperature (degrees Celsius):	24.7
Conductivity (µs/cm):	107.9

Additional Comments / Notes

Total Dissolved Solids: 0.0689
C (ms/cm): 0.107

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FIELD REPORT – SUMMER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Kearney Lake Run		**Site ID: KL3**
Watercourse: Kearney Lake Run		**Location:** Kearney Lake Road
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	20T 0444390E, 4950406N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster / Ryan Flinn	

Site Conditions

Weather:	Sun and Cloud
Air Temperature:	23.1°C
Cloud Cover:	25%
Wildlife Sightings:	Birds, Insects
Site Accessibility: Yes, Accessible	Off walking trail from Amesbury Gate Rd.
Site Access Detail:	Access to site is via a walking path clearly evident off of Amesbury Gate Rd. (off Larry Uteck Blvd.) roughly 205m down road on left. Walk down path, follow gravel walkway downhill and take sample at the low point facing the dam. Look for large rock outcrop on right.

Field Parameter Data

	Remarks
Date (d.m.y):	24.08.15
Time (hh:mm):	11:45am
Sample Depth (m):	0.4m-0.5m
pH:	6.87
Dissolved Oxygen (mg/L):	9.91
Secchi Depth (m):	**N/A**
Water Temperature (degrees Celsius):	25.0
Conductivity (µs/cm):	245. 1

Additional Comments / Notes

Total Dissolved Solids: 0.1592
C (ms/cm): 0.245

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FIELD REPORT – SUMMER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Kearney Lake Run		**Site ID: KL4**
Watercourse: Kearney Lake Run		**Location:** Kearney Lake Road
Monitoring Well ☐Pumping Well ☐Surface Water ☐Spring/Seep ☐Discharge Pipe ☒**Other:**		
GPS Coordinates:	20T 0444463E, 4950571N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster / Ryan Flinn	

Site Conditions

Weather:	Sun and Cloud
Air Temperature:	22.3°C
Cloud Cover:	40%
Wildlife Sightings:	Insects on water, Birds
Site Accessibility: Yes, Accessible	Via the extended road at the end of Weybridge Ln. or walking path off Abbington Ave. (roughly 360m down road on right).
Site Access Detail:	If Weybridge, go to end of extended road on right and walk and take sample above the rocky area at the base of the wider, slow moving section of the river.

Field Parameter Data

	Remarks
Date (d.m.y):	24.08.15
Time (hh:mm):	11:02
Sample Depth (m):	0.4m-0.5m
pH:	6.81
Dissolved Oxygen (mg/L):	9.09
Secchi Depth (m):	**N/A**
Water Temperature (degrees Celsius):	24.7
Conductivity (µs/cm):	243.5

Additional Comments / Notes

Sample taken upstream of rocky section near lower end of slow moving river pool.

Total Dissolved Solids: 0.1586
C (ms/cm): 0.242

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FIELD REPORT – SUMMER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 9
Client:	Halifax Regional Municipality	
Site: Kearney Lake		**Site ID: KL5**
Watercourse: Kearney Lake		**Location:** Kearney Lake Road
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	20T 4949142E, 445280N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster / Ryan Flinn	

Site Conditions

Weather:	Sun and Cloud
Air Temperature:	24.4°C
Cloud Cover:	25%
Wildlife Sightings:	N/A
Site Accessibility: Yes, Accessible	Along Kearney Lake Road
Site Access Detail:	Easily accessible, sample location is directly off the Kearney Lake Road on a rocky outcrop supporting a power line pole (two pole structure). Slow truck down carefully, turn hazard lights on. Samples were taken on left front of outcrop facing lake.

Field Parameter Data

	Remarks
Date (d.m.y):	24.08.15
Time (hh:mm):	12:04
Sample Depth (m):	0.4m
pH:	6.77
Dissolved Oxygen (mg/L):	8.75
Secchi Depth (m):	**N/A**
Water Temperature (degrees Celsius):	25.4
Conductivity (µs/cm):	249.8

Additional Comments / Notes

Total Dissolved Solids: 0.1625
C (ms/cm): 0.253

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FIELD REPORT – SUMMER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Highway 102	**Site ID: HWY 102-1**	
Watercourse: Marsh area	**Location:** Highway 102, south of exit 3	
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	20T 0444708E, 4951644N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster / Ryan Flinn	

Site Conditions

Weather:	Mostly Cloudy
Air Temperature:	21°C
Cloud Cover:	80%
Wildlife Sightings:	Dead turtle on shoulder of road. Insects on water.
Site Accessibility: Yes, Accessible	Off Highway 102 Park before guardrail.
Site Access Detail:	Carefully slow truck down while pulling off highway 102. Park truck with hazard lights on before the start of the guardrail. Walk along outside of guardrail (for approximately 150m). Site is on right fed by a swampy bog area. Samples were taken in front of culvert. There is a concrete pad to step on to take samples. Sample while standing downstream.

Field Parameter Data

	Remarks
Date (d.m.y):	24.08.15
Time (hh:mm):	9:20am
Sample Depth (m):	0.3m-0.4m
pH:	6.24
Dissolved Oxygen (mg/L):	3.82
Secchi Depth (m):	**N/A**
Water Temperature (degrees Celsius):	20.7
Conductivity (µs/cm):	335.8

Additional Comments / Notes

Sample taken adjacent to the culvert algae floating.

Total Dissolved Solids: 0.2184
C (ms/cm): 0.309

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FIELD REPORT – SUMMER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Highway 102		**Site ID: HWY 102-2**
Watercourse: Marsh area		**Location:** HWY 102, south of exit 3
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	20T 0444829E, 4951778N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster / Ryan Flinn	

Site Conditions

Weather:	Sun and Cloud
Air Temperature:	23.8°C
Cloud Cover:	60%
Wildlife Sightings:	Frog
Site Accessibility: Yes, Accessible	Off Highway 102 (Small gravel drive way- *Back in
Site Access Detail:	Travel along Highway 102 toward Bedford NS. Site is on right easily to identify based on swamp/bog. Carefully slow truck down with hazard lights flashing. There is a small driveway to park truck. Pull a head of driveway and when lanes are clear back truck down into spot. Take samples in water body in front of culvert.

Field Parameter Data

	Remarks
Date (d.m.y):	24.08.15
Time (hh:mm):	12:58pm
Sample Depth (m):	0.3m
pH:	6.04
Dissolved Oxygen (mg/L):	6.11
Secchi Depth (m):	**N/A**
Water Temperature (degrees Celsius):	23.7
Conductivity (µs/cm):	699

Additional Comments / Notes

Algae covering the surface of the sample location.

Total Dissolved Solids: 0.4550
C (ms/cm): 0.680

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FIELD REPORT – SUMMER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Lake Shore Drive		**Site ID: LSD**
Watercourse: Marsh @ Lakeshore Dr.		**Location:** Kingswood Subdivision
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	20T 0442583E, 4950431N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster / Ryan Flinn	

Site Conditions

Weather:	Sun and Cloud
Air Temperature:	24.3°C
Cloud Cover:	70%
Wildlife Sightings:	Frogs, Horse Flies, Mosquitoes
Site Accessibility: Yes, Accessible	Via Lakeshore Drive in Kingswood Subdivision
Site Access Detail:	Take Kingswood Drive off Hammonds Plains Road. Travel down to Diana Drive on left go to end and take a left on Lakeshore drive. Travel approximately 1.0 km. There will be a clearing on left down to power lines. Drive truck (4X4) down until larger clearing is reached and park. Continue (walk) down hill to ATV pathway on left. Follow pathway for approximately 250m. Sample location is on right (river with a lot of vegetation throughout)

Field Parameter Data

	Remarks
Date (d.m.y):	24.08.15
Time (hh:mm):	4:02pm
Sample Depth (m):	0.3m-0.4m
pH:	6.34
Dissolved Oxygen (mg/L):	7.25
Secchi Depth (m):	**N/A**
Water Temperature (degrees Celsius):	24.3
Conductivity (µs/cm):	155.3

Additional Comments / Notes

Total Dissolved Solids: 0.1008
C (ms/cm): 0.153

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FIELD REPORT – SUMMER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 9
Client:	Halifax Regional Municipality	
Site: Larry Uteck Blvd.		**Site ID: LU**
Watercourse: Pond		**Location:** Larry Uteck off-ramp
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	20T 4949816E, 445042N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster / Ryan Flinn	

Site Conditions

Weather:	Sunny with some cloud
Air Temperature:	22.2 °C
Cloud Cover:	30%
Wildlife Sightings:	Insects, Birds
Site Accessibility:	Difficult (30m-40m through woods and bog From Larry Uteck Blvd.
Site Access Detail:	Take Larry Uteck off ramp and continue down Larry Uteck Blvd. for approximately 320m. Park truck safely on grassy clearing on left. Sample location is at shore line of lake across road. Take walking pathway to wooded area and travel approximately 80m to lake shore. Avoid walking through the bog area on right.

Field Parameter Data

	Remarks
Date (d.m.y):	24.08.15
Time (hh:mm):	10:23am
Sample Depth (m):	0.3m-0.4m
pH:	6.80
Dissolved Oxygen (mg/L):	9.49
Secchi Depth (m):	**N/A**
Water Temperature (degrees Celsius):	23.4
Conductivity (µs/cm):	569

Additional Comments / Notes

GPS locations have been changed to meet SLR sampling site off Larry Uteck Blvd.
HRM-BW Project Manager to advise if site coordinates should be revised to 20T 0444954, 4949891 for consistency of water quality sampling events collected in previous years (2009 to 2014)

Total Dissolved Solids: 0.3705
C (ms/cm): 0.550

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FIELD REPORT – SUMMER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Paper Mill Lake		**Site ID: PML1**
Watercourse: Paper Mill Lake		**Location:** Moirs Mill Subdivision
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	20T 0445129E, 4951154N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster / Ryan Flinn	

Site Conditions

Weather:	Sun and Cloud
Air Temperature:	21.5 ^{o}C
Cloud Cover:	30%
Wildlife Sightings:	Birds
Site Accessibility: Yes, Accessible	Via Ahmadi Crescent in Moirs Mill Subdivision
Site Access Detail:	Travel down Ahmadi Cr. approximately 340m (around second bend in road). Park truck in front of Halifax Water station and carefully walk down rock wall on left. At the bottom locate the small stream and continue along the left and side facing lake. Sample location is a small clearing to the left at the mouth of the river.

Field Parameter Data

	Remarks
Date (d.m.y):	24.08.15
Time (hh:mm):	8:48am
Sample Depth (m):	0.3m-0.4m
pH:	6.34
Dissolved Oxygen (mg/L):	8.04
Secchi Depth (m):	N/A
Water Temperature (degrees Celsius):	24.0
Conductivity (µs/cm):	432.1

Additional Comments / Notes

-More appropriate access site is via Ahmadi Crescent.
-Water column was less than 1.0m.

Total Dissolved Solids: 0.2808
C (ms/cm): 0.421

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FIELD REPORT – SUMMER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Paper Mill Lake		**Site ID: PML2**
Watercourse: Paper Mill Lake		**Location:** Moirs Mill Subdivision
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	20T 0445363E, 4951740N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster / Ryan Flinn	

Site Conditions

Weather:	Sun and Cloud
Air Temperature:	23.8 °C
Cloud Cover:	70%
Wildlife Sightings:	Insects, Birds
Site Accessibility: Yes, Accessible	Via Lake Dr., off Hammonds Plains Rd.
Site Access Detail:	Drive down Lake Dr. approximately 85m and locate walking trail on right. Park truck with hazard lights on at trail opening. Take trail for roughly 175m and then walk left toward lake shore. Follow lake shore out and around point. Sample location is on west side (far side).

Field Parameter Data

	Remarks
Date (d.m.y):	24.08.15
Time (hh:mm):	1:45pm
Sample Depth (m):	0.4m-0.5m
pH:	6.76
Dissolved Oxygen (mg/L):	9.76
Secchi Depth (m):	_-----_ meters
Water Temperature (degrees Celsius):	27.0
Conductivity (µs/cm):	255.6

Additional Comments / Notes

Expected to use secchi disk however, water column was less than 1.0m. Total depth was measured at 0.6m. Depending on the season (particularly spring) water levels may be higher and the sechhi disk might be required at the GPS location.

Total Dissolved Solids: 0.1664
C (ms/cm): 0.266

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Appendix C

Site Photographs Summer 2015

Photo 1: PML-1 Paper Mill Lake Sample Location

Photo 2: HWY 102-1 Sample Location

Photo 3: LU Larry Uteck Sample Location

Photo 4: KL4 Kearney Lake Sample Location

Photo 5: KL3 Kearney Lake Sample Location

Photo 6: KL5 Kearney Lake Sample Location

Photo 7: HWY102-2 Sample Location

Photo 8: KL1 Kearney Lake Sample Location

Photo 9: KL2 Kearney Lake Sample Location (lake side of culvert)

Photo 10: LSD Lake Shore Drive Sample Location

Photo 11: PML-2 Paper Mill Lake Sample Location

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Additional Photographs – Reference

Ref. Photo: HWY 102-1 Sample Location

Ref. Photo: Incorrect GPS coordinates at LU Sample Location

Ref. Photo: HWY 102-2 Sample Location

Ref. Photo: KL2 Sample Location

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Appendix D

Graphics

Graphs were created showing concentrations from 2009 to 2015 for six (6) water quality parameters; dissolved chloride (mg/L), pH, total phosphorus (mg/L), total suspended solids (mg/L), conductivity (µS/cm) and chlorophyll A (µg/L) at each of the standard eleven (11) sample sites. This was done to allow for comparison between sites and identification of concentration increases.

As many parameters show seasonal concentration fluctuations, the data was also graphed showing only the concentrations for a given season (i.e. summertime sampling events in this case).

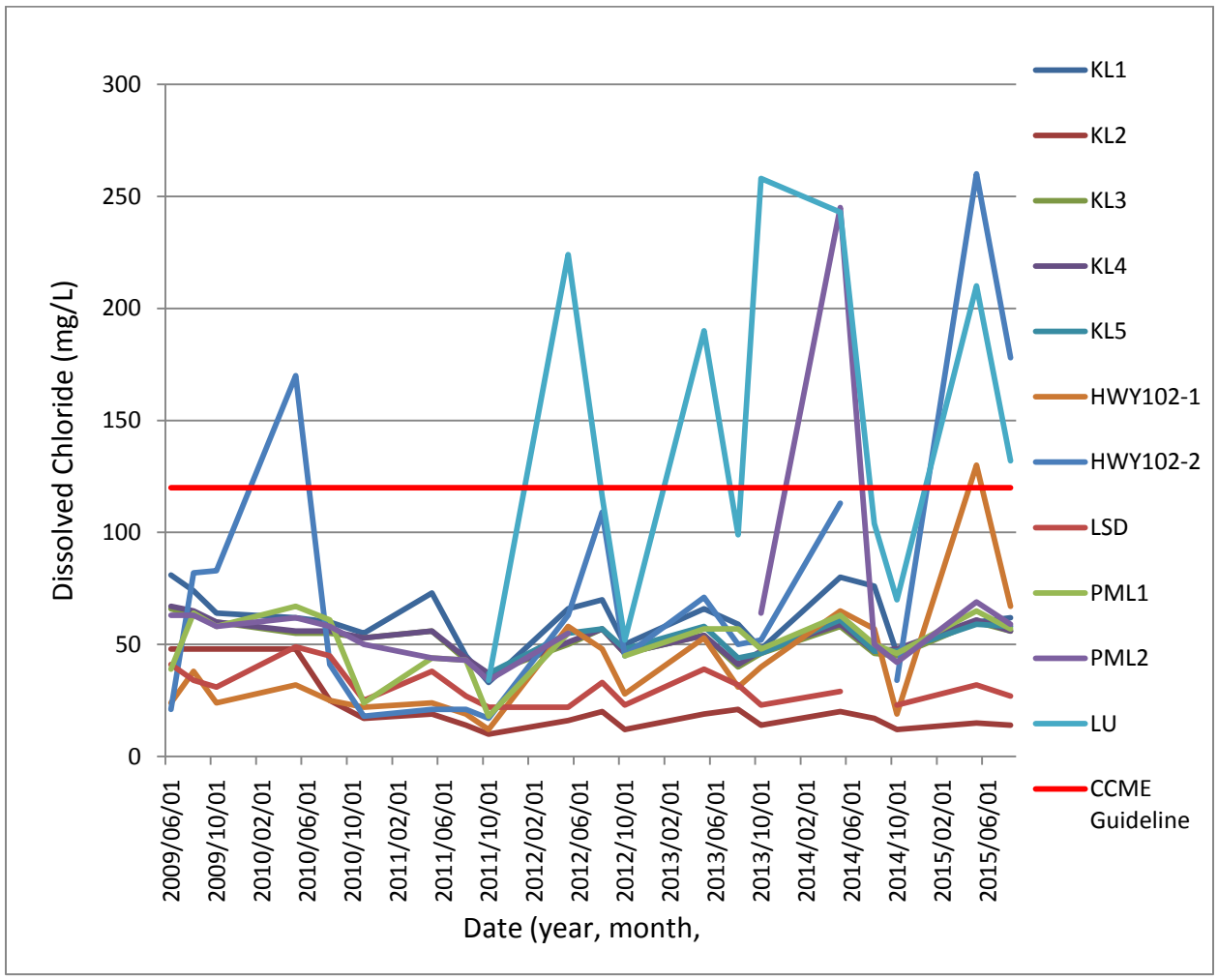


Figure 1 - Dissolved chloride concentrations.

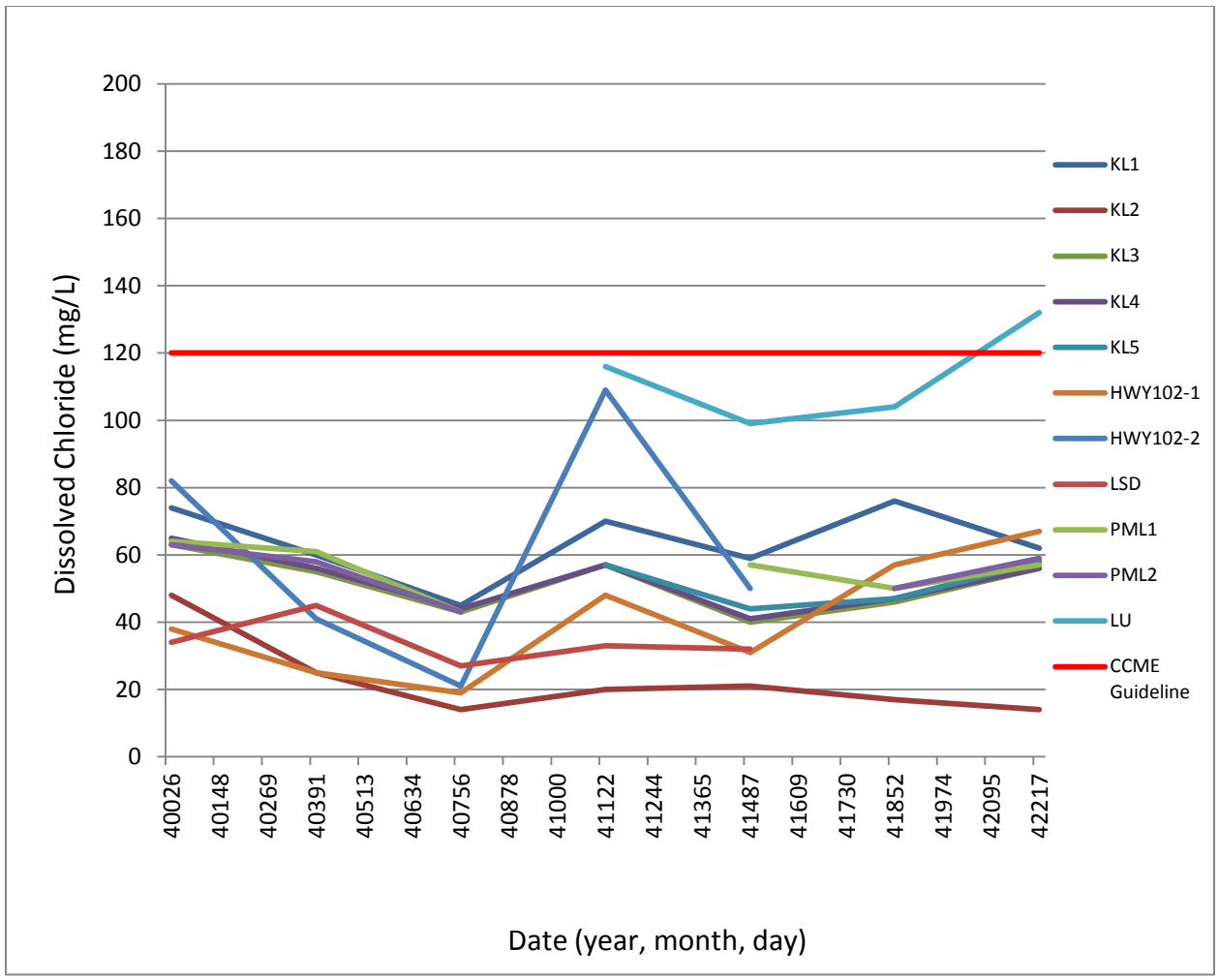


Figure 2 – Seasonal dissolved chloride concentrations.

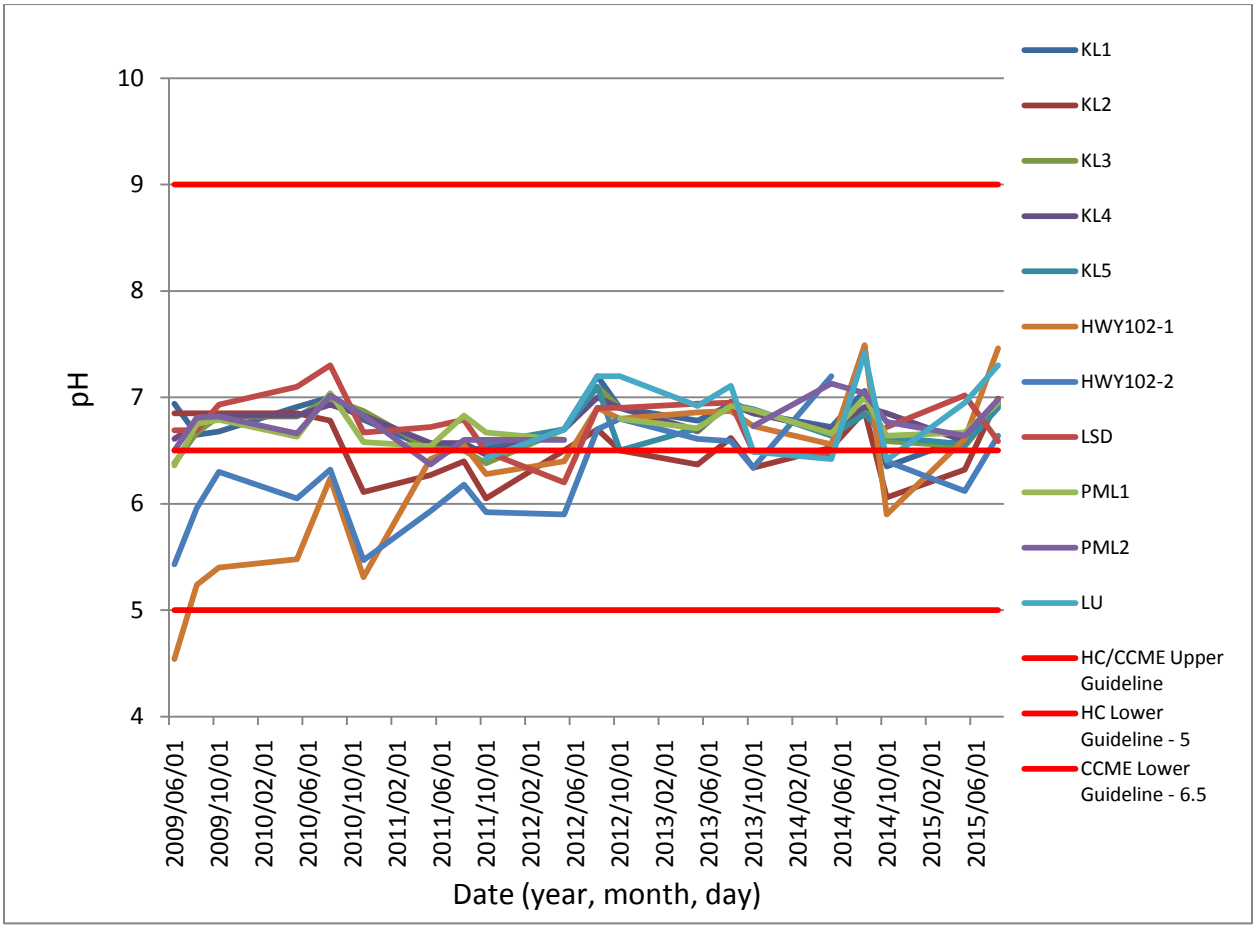


Figure 3 – pH.

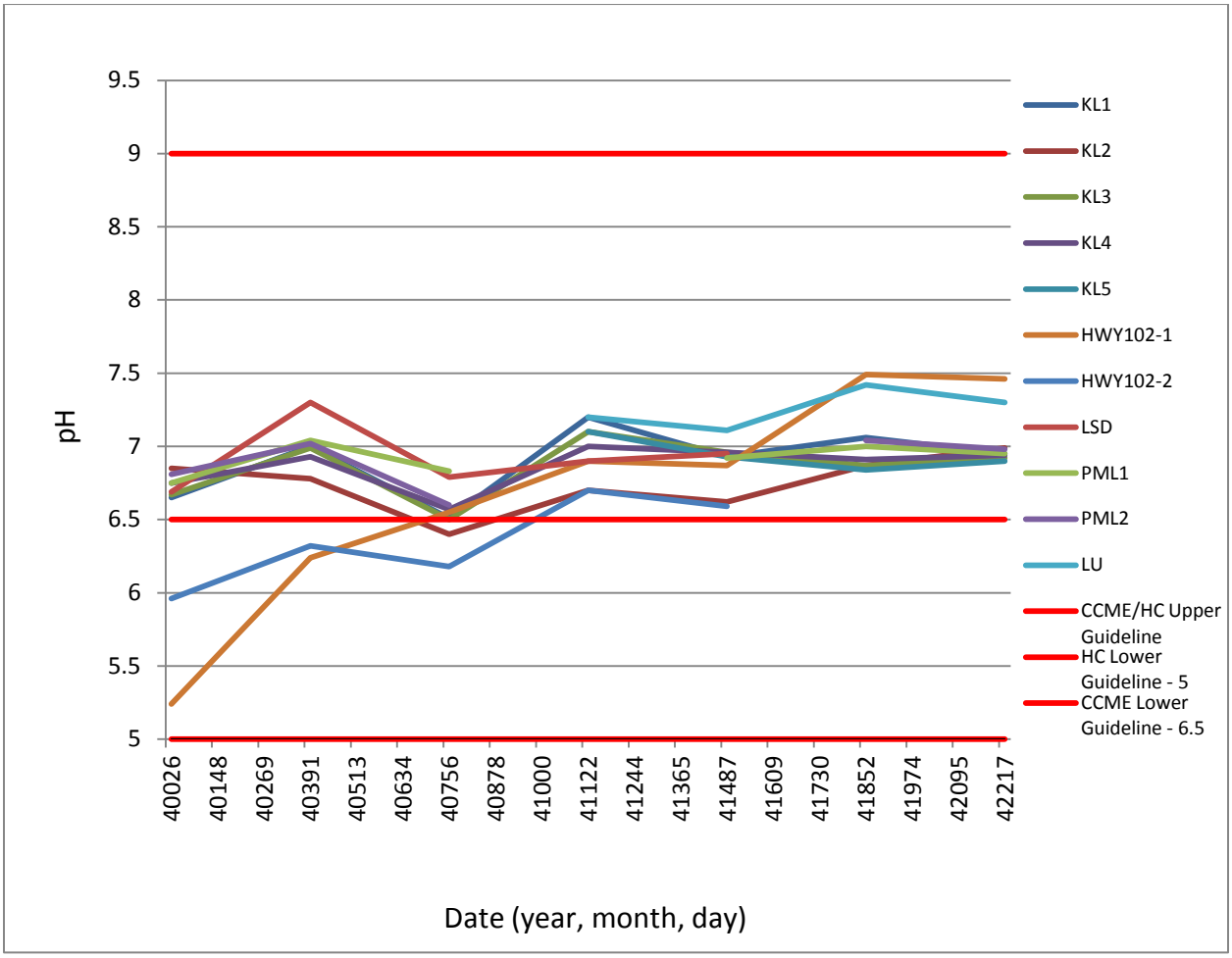


Figure 4 – Seasonal pH.

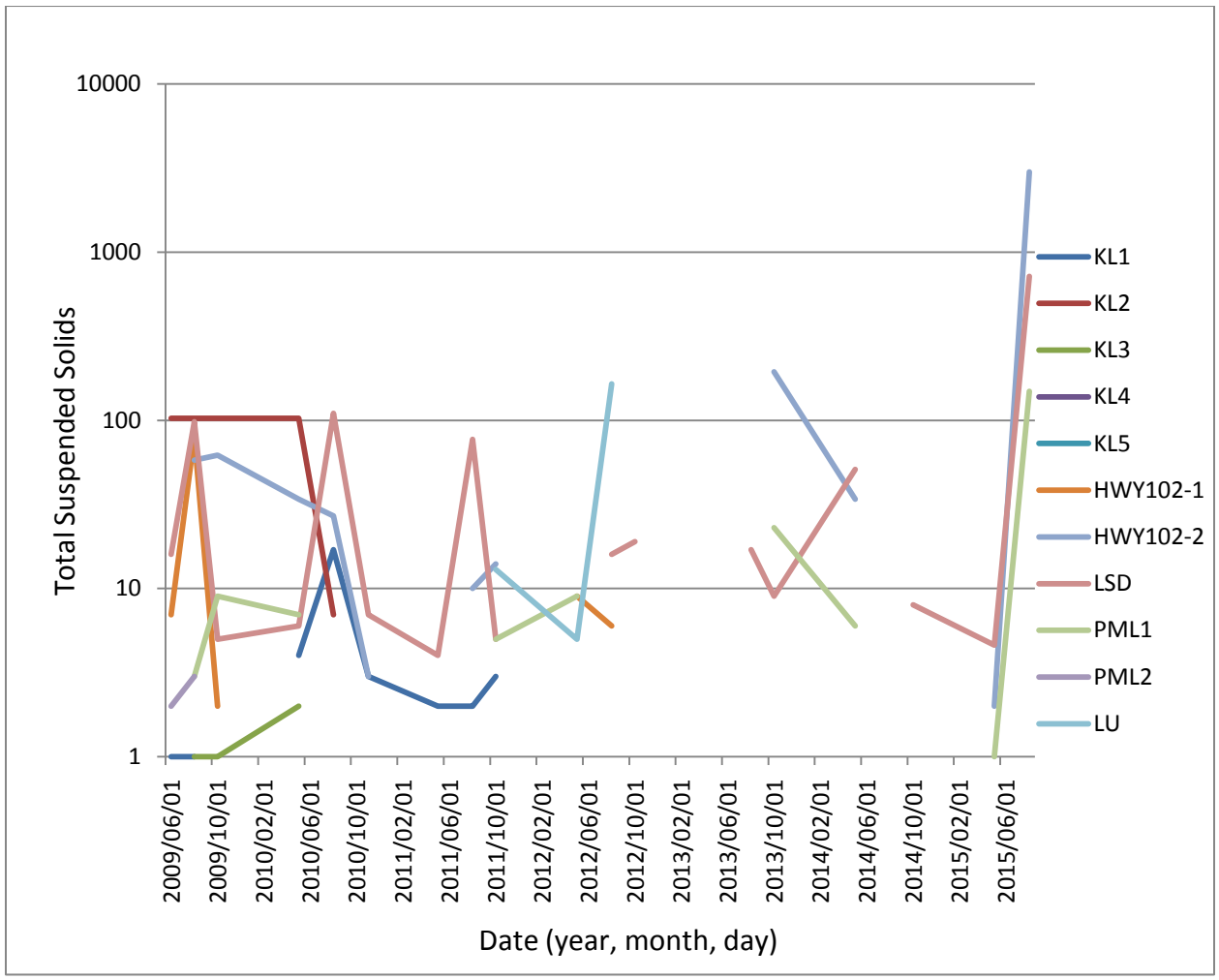


Figure 5 – Total suspended solids concentrations (logarithmic scale).

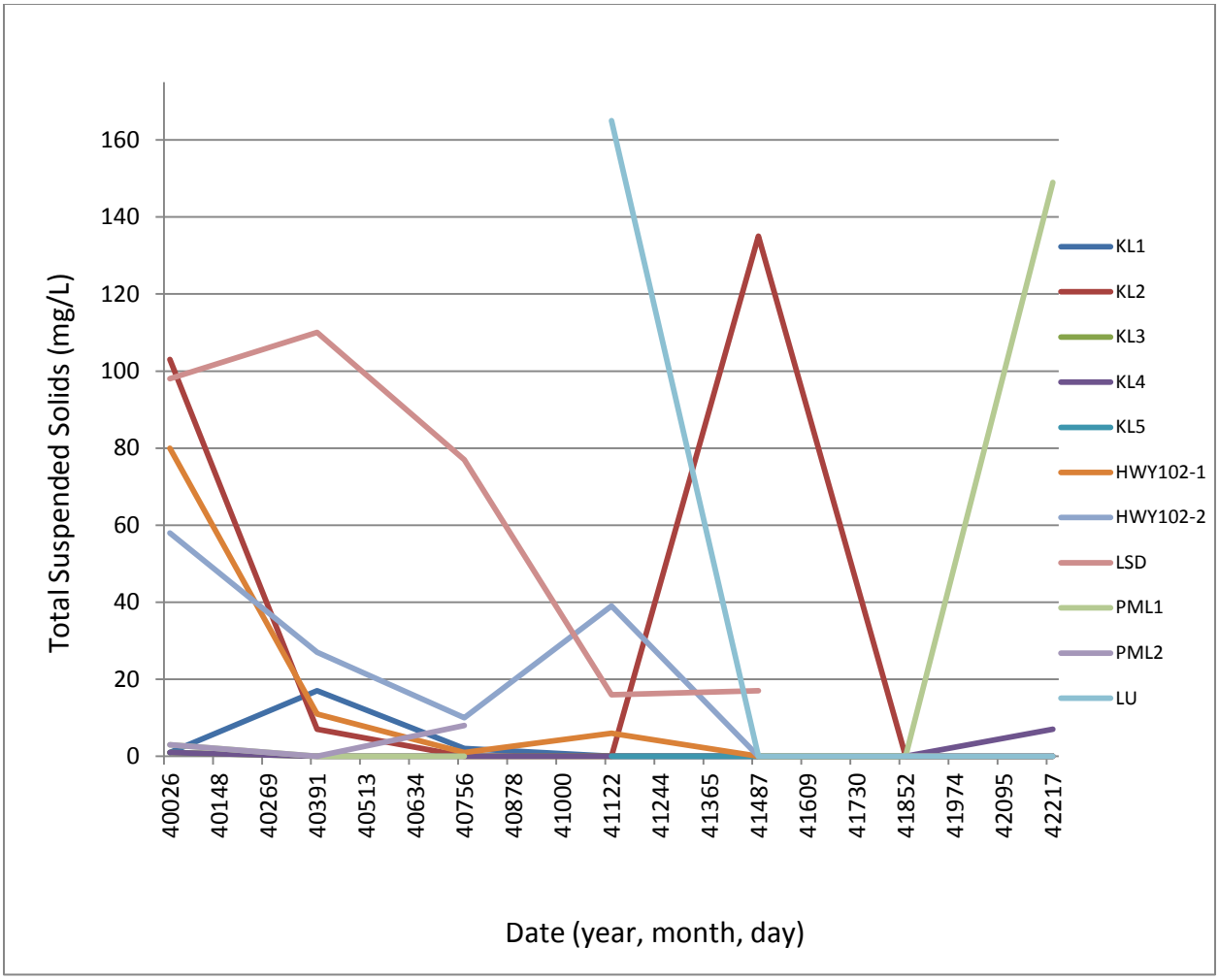


Figure 6 – Seasonal total suspended solids concentrations.

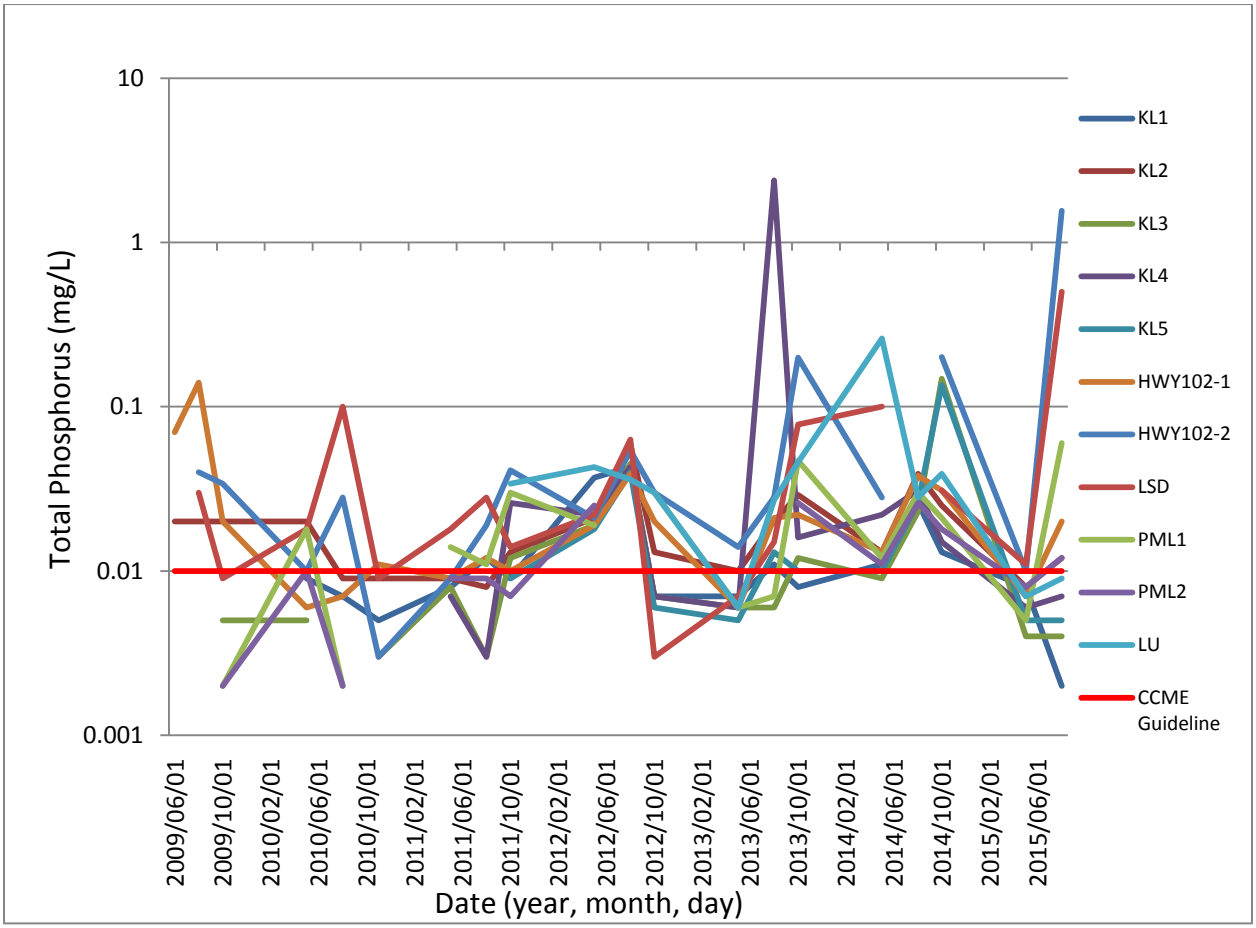


Figure 7 – Total phosphorus concentrations (logarithmic scale).

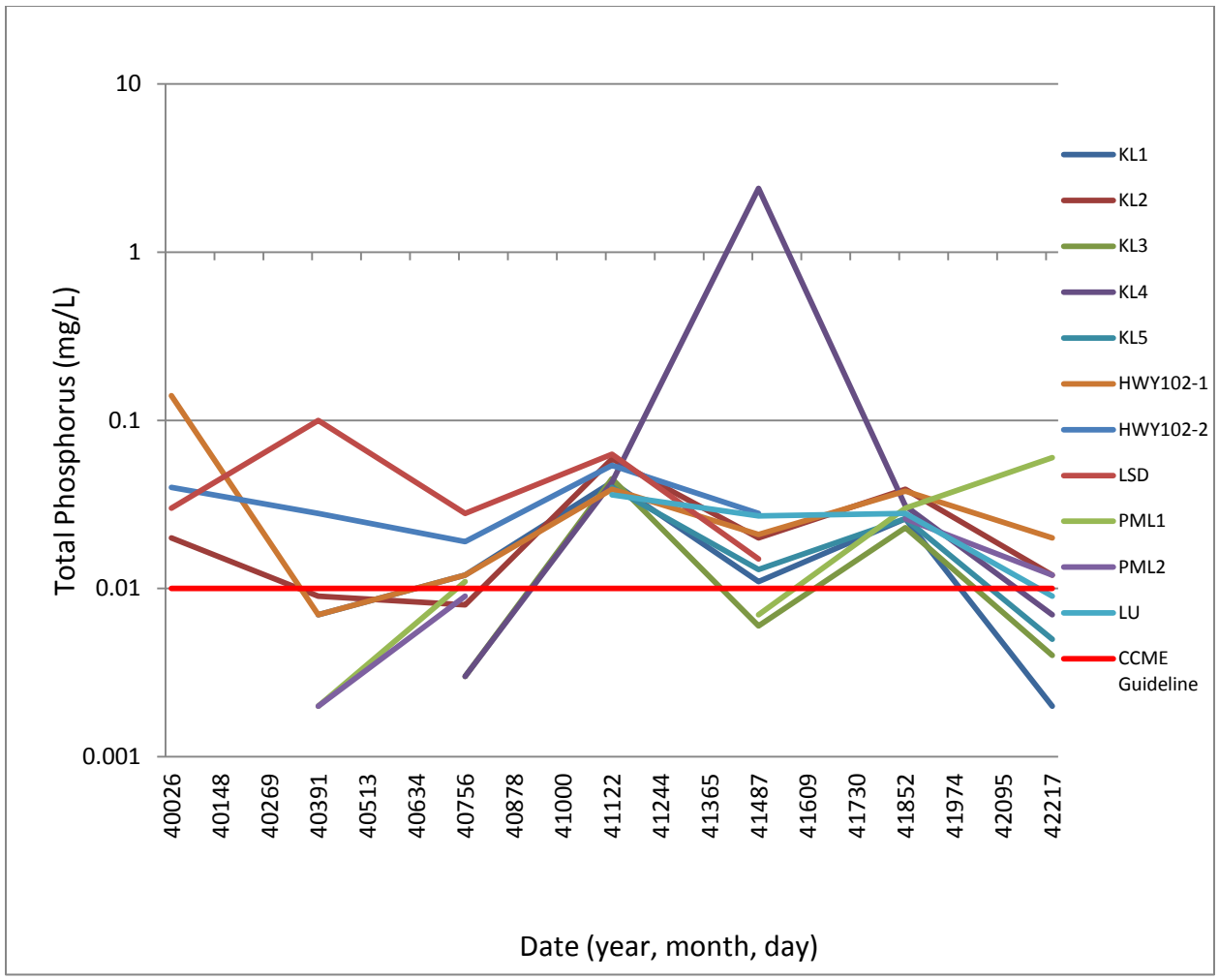


Figure 8 – Seasonal total phosphorus concentrations (logarithmic scale).

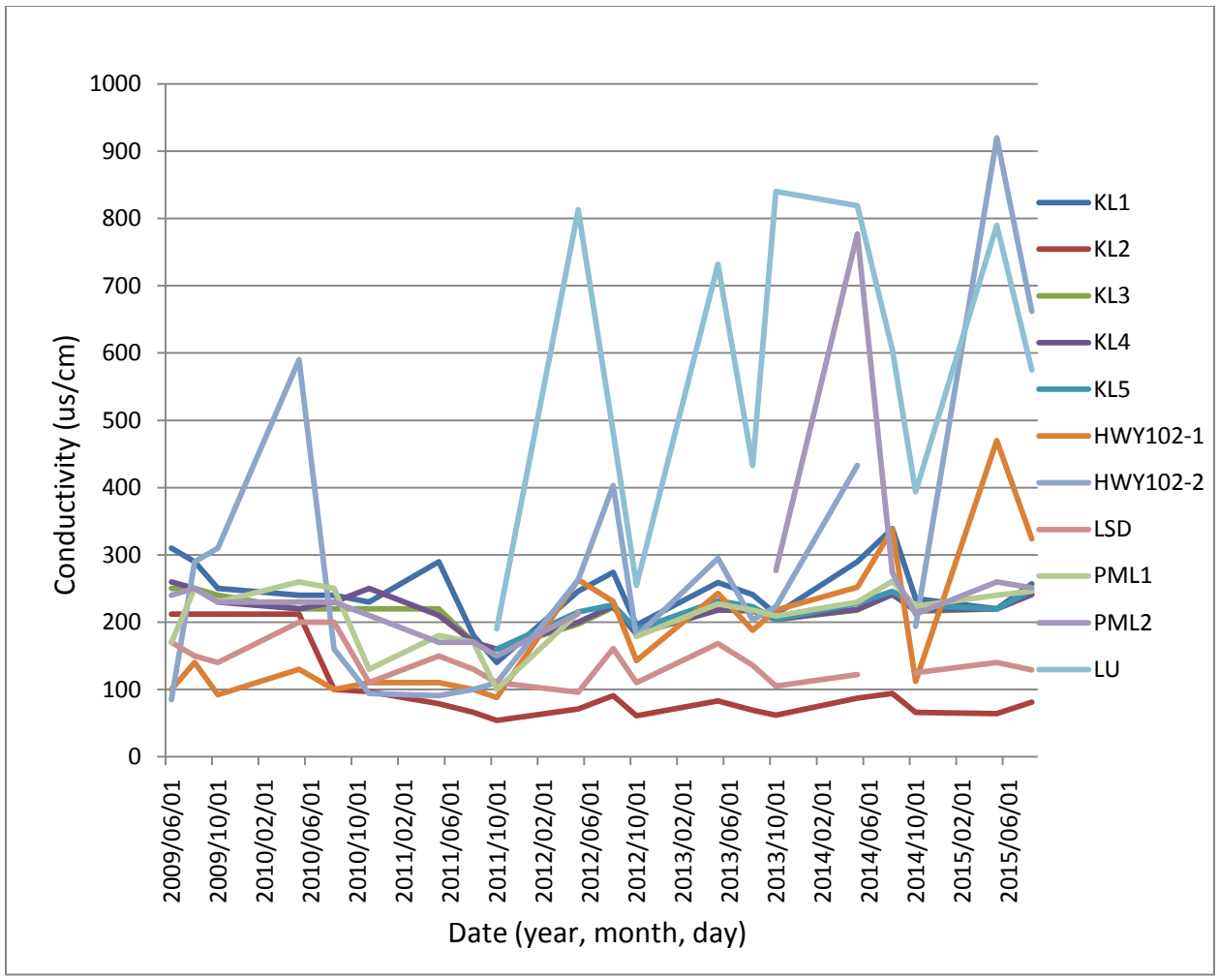


Figure 9 – Conductivity.

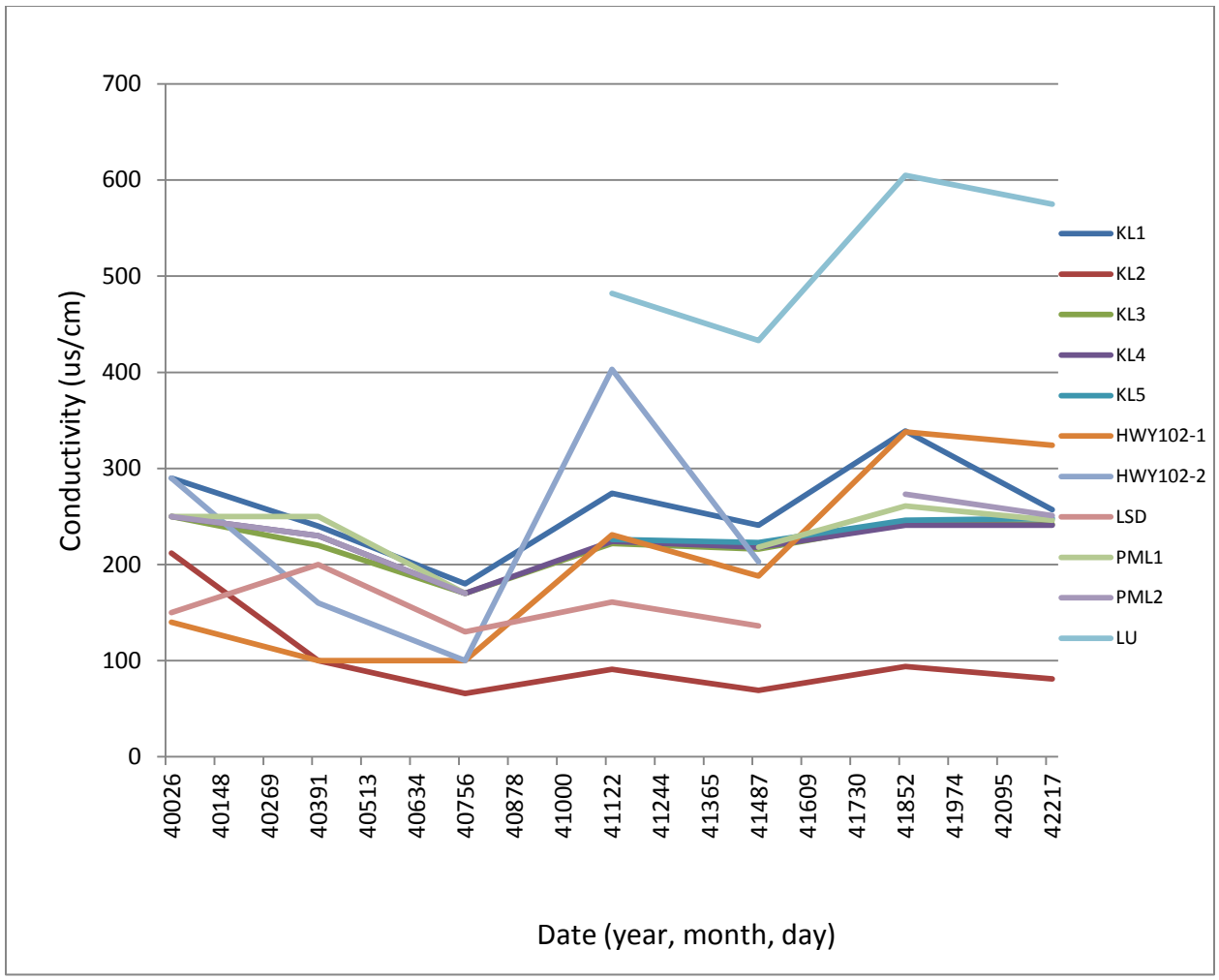


Figure 10 – Seasonal conductivity.

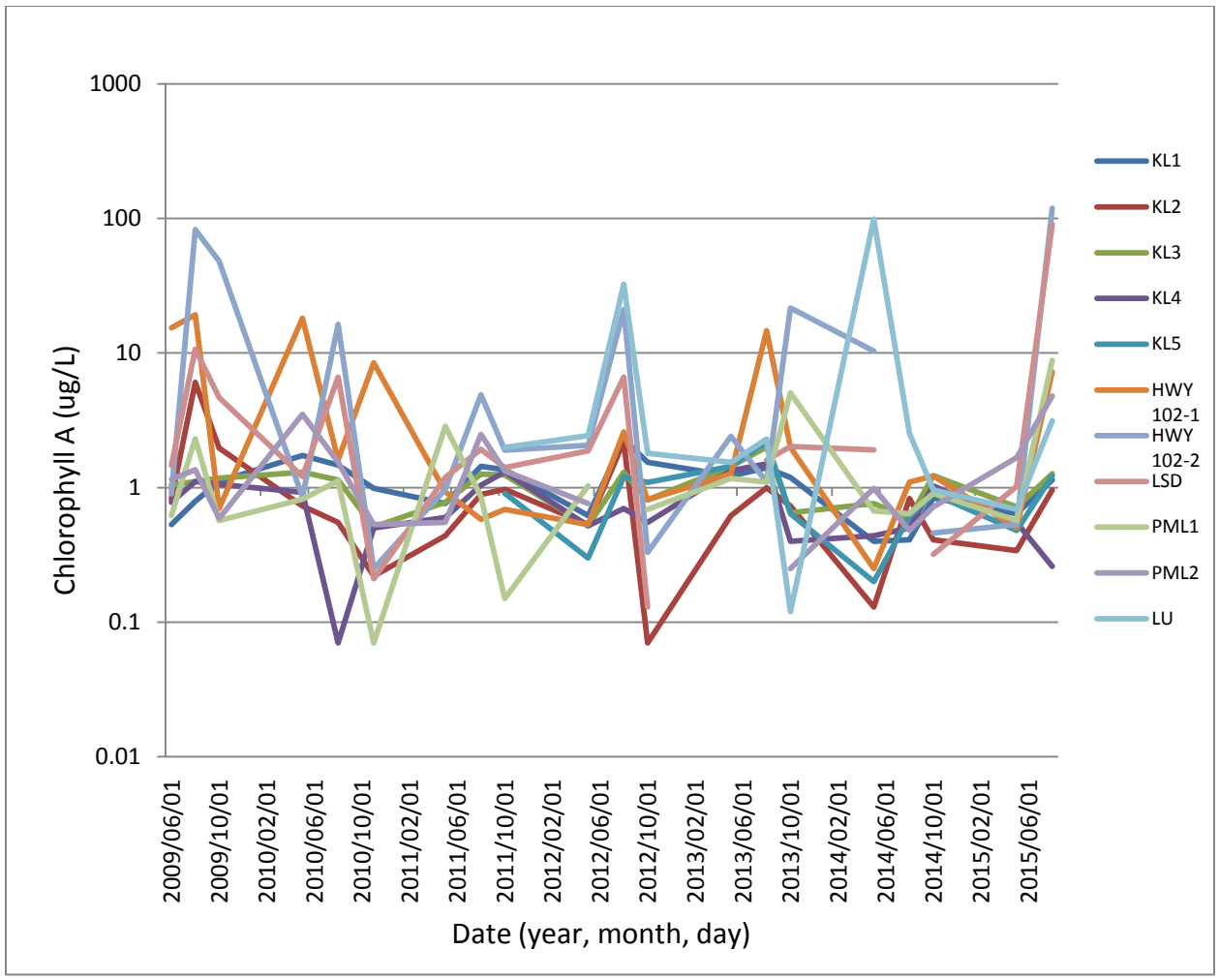


Figure 11 – Chlorophyll A concentrations (logarithmic scale).

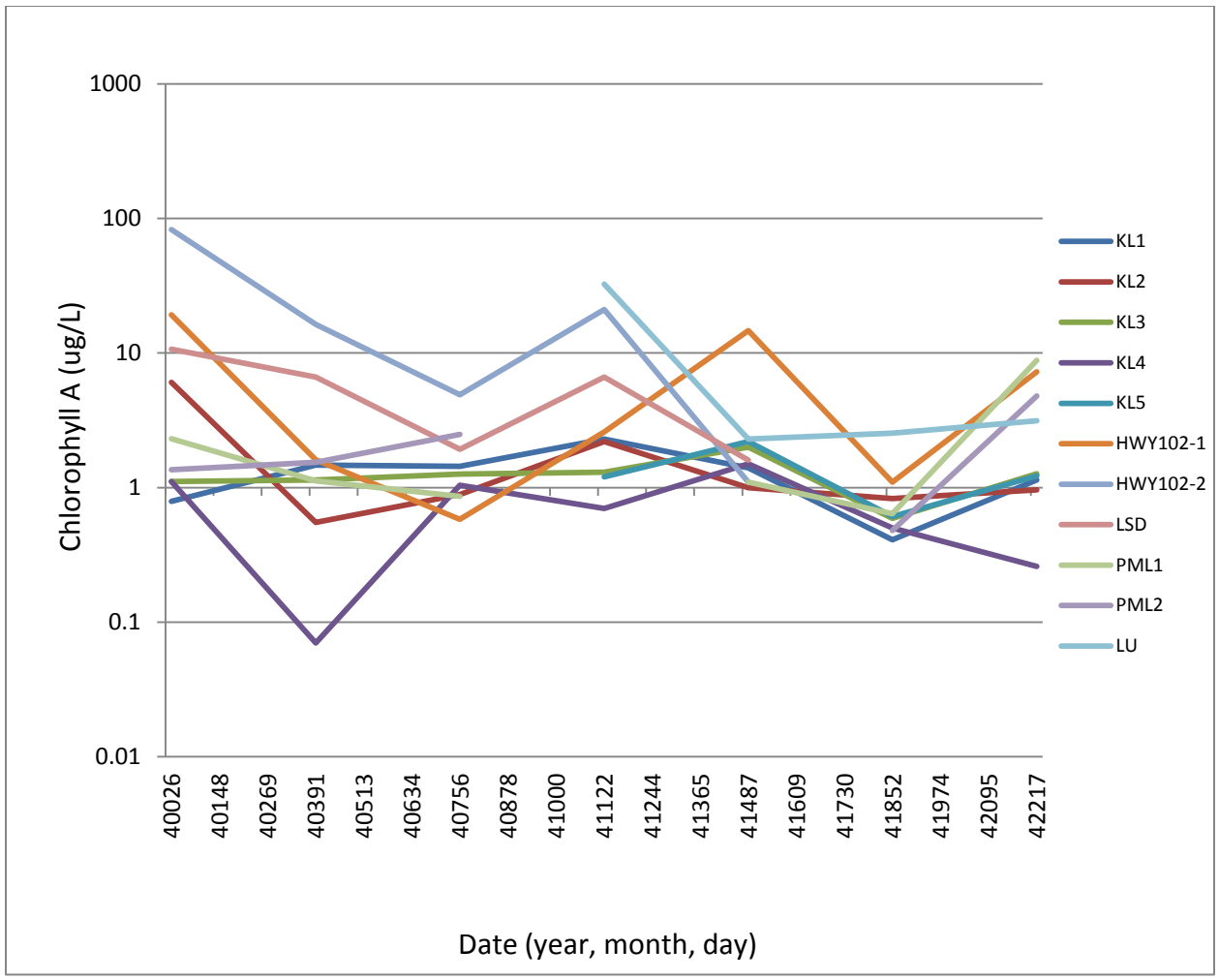


Figure 12 – Seasonal chlorophyll A concentrations (logarithmic scale).

Attachment C

SNC-Lavalin Inc.
Suite 200, Park Lane Terraces
5657 Spring Garden Road
Halifax, Nova Scotia, Canada, B3J 3R4
902.492.4544 902.492.4540

September 28, 2015

Halifax Regional Municipality
Energy and Environment
PO Box 1749
Halifax, Nova Scotia
B3J 3A5

Attention: Mr. Cameron Deacoff

Dear Mr. Deacoff:

RE: Final Report: Total Phosphorous Follow-up Sampling
Water Quality Monitoring Program Bedford West, Bedford, Nova Scotia

SNC-Lavalin Inc. (SLI) is pleased to submit one electronic copy of the final summary letter report presenting the results of the Low Level Total Phosphorous Follow-up Sampling Event conducted as part of the summer 2015 Bedford West Water Quality Monitoring Program in Bedford, Nova Scotia.

If you have any questions or require clarification, please contact the undersigned at 902-492-4544.

Yours truly,

SNC♦LAVALIN INC.

Original Signed

Crysta Cumming, P. Eng
Environmental Department Manager

CC/mg

631477-0001-T-4E-REP-000-0002 _ C01.docx

TABLE OF CONTENTS

List of Tables

List of Figures

Appendices

Appendix A Laboratory Certificates of Analysis
Appendix B Field Reports (18 Sampling Locations)

1 INTRODUCTION

SNC-Lavalin Inc. (SLI) is pleased to submit one electronic copy of the summary letter report describing the results of the Total Phosphorous Follow-up Sampling Event conducted as part of the Bedford West Water Quality Monitoring Program.

This follow-up monitoring event was ordered by the Halifax Municipality pursuant to Secondary Planning Strategy policy BW-5 due to Total Phosphorus results exceeding the management threshold of 10 µg/L at several water quality stations during the summer event (August 25th, 2015).

This follow-up sampling event was completed on September 15th and 16th, 2015. Table below summaries the timing and magnitudes of precipitation experienced in the Halifax Regional Municipality (HRM) area in the period (i.e. five days) immediately prior to the follow-up monitoring event.

Table 1: Historical Local Precipitation

September (Day)	Total Rain (mm)
10	31.8
11	31.4
12	2.4
13	0.2
14	2.6
15*	0.5
16*	0.0

Source: Government of Canada, Climate, Halifax, Daily Data Report for September 2015
(*): Water Quality Sampling Date

2 METHODOLOGY

To determine potential sources of TP, the follow-up sampling event included collection of **(i)** physical parameters and **(ii)** water quality re-sampling at the eleven (11) standard sampling stations as well as seven (7) novel sampling stations as follows:

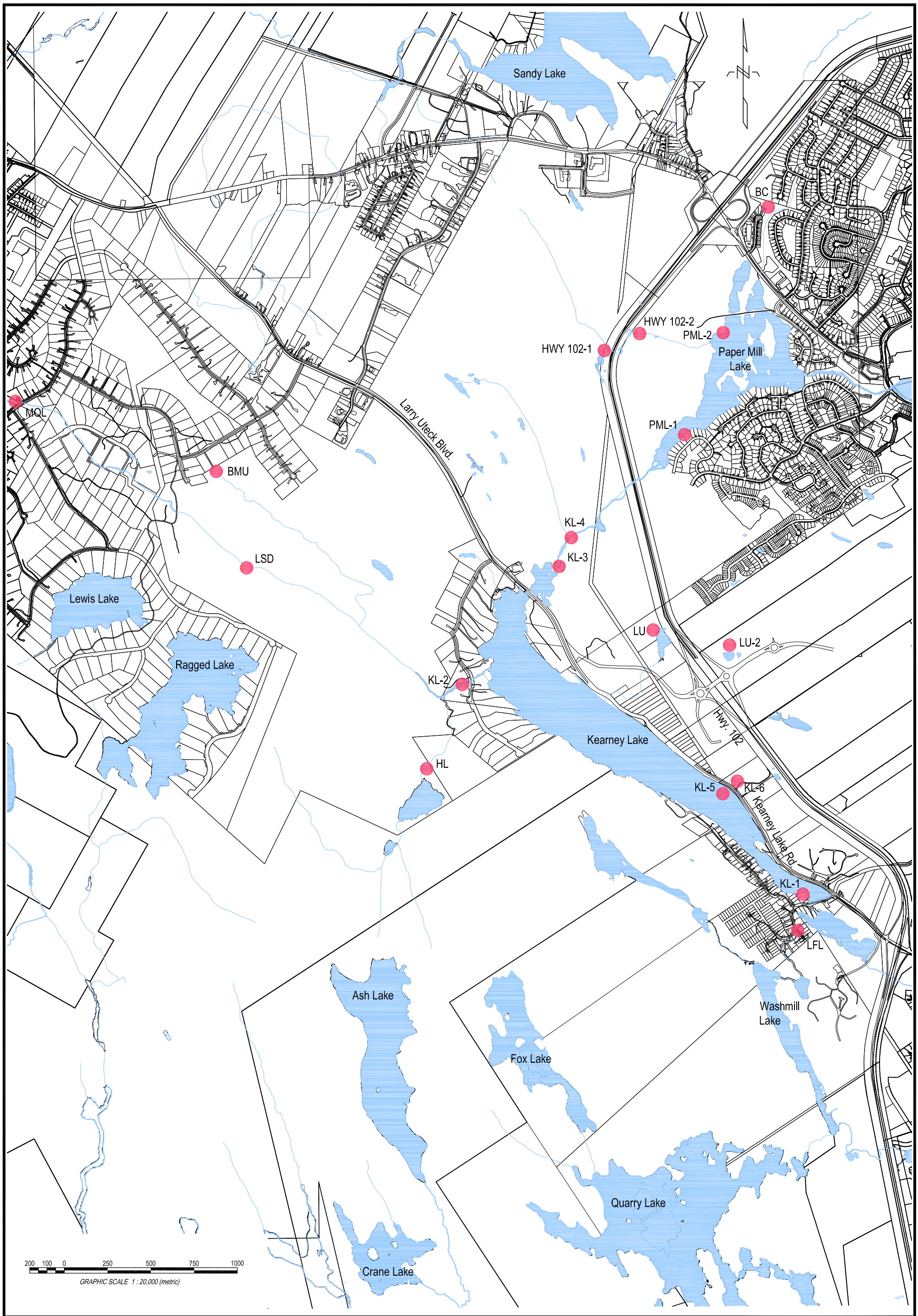
Table 2: Bedford West – Standard Sampling Stations

Water Course	Sample Location ID	Updated Coordinates (UTM NAD 83)	
		Easting	Northing
Kearney Lake	KL-1	20T445718E	4948496N
Kearney Lake	KL-2	20T0443859	4949738N
Kearney Run	KL-3	20T444390E	4950406N
Kearney Run	KL-4	20T444463E	4950571N
Kearney Lake	KL-5	20T4949142E	445280N
Creek Above Highway	HWY 102-1	20T444708E	4951644N
Creek Below Highway	HWY 102-2	20T444829E	4951778N
Lake Shore Drive	LSD	20T442583E	4950431N
Larry Uteck Off Ramp	LU	20T444954E	4949891N
Paper Mill Lake	PML-1	20T445129E	4951154N
Paper Mill Lake	PML-2	20T445363E	4951740N

Table 3: Bedford West –Additional Sampling Locations

Additional Station Locations and Relationship with Standard stations	Sample Location ID	Coordinates (UTM NAD 83)	
		Easting	Northing
Second Larry Uteck Drive, Upstream from LU.	LU2	20T 0445325	4949886
Unnamed stream near Blue Mountain Drive, Upstream from KL2	BMU	20T 0442418	4950992
McQuade Lake, Upstream from LSD, BMU, and KL2	MQL	20T 0441264	4951418
Hobson Lake, Upstream from KL2	HL	20T 0443603	4949250
Brookshire Court, Upstream from PML2	BC	20T 0445637	4952462
Little Fox Lane, Upstream from KL1	LFL	20T 0445730	4948275
Across Kearney Lake Road; approx. 10 meters upstream for the culvert, Upstream from KL5.	KL-6	20T 0445391	4949129

Figure 1: Bedford West Water Quality Sampling Stations and Follow-up Total Phosphorous Sampling Stations



SNC•LAVALIN
SNC • LAVALIN Inc.
Halifax, Nova Scotia, Canada
Member of the SNC•LAVALIN Group
Certified ISO 9001

HALIFAX

PROJECT:	WATER QUALITY MONITORING WITHIN BEDFORD WEST
TITLE:	WATER QUALITY MONITORING TEST LOCATIONS
DESIGNED:	C.C.
DRAWN:	D.B.
SCALE:	AS SHOWN
DATE:	2015/SEP/23
PROJECT NO.	631477-0001
DRAWING:	1

3 RESULTS

Analytical results show that Total Phosphorous was above the **10 µg/L** (0.01 mg/L) water quality criteria at all eighteen (18) sample locations. See Table 1 below. Laboratory Certificates of Analysis are included in **Appendix A**.

Table 4: Analytical Results for Follow-up Total Phosphorous Sampling

Sample ID	Total Phosphorus (mg/L)
KL1	0.021
KL2	0.028
KL3	0.020
KL4	0.021
KL5	0.021
HWY-102-1	0.028
HWY-102-2	0.035
LSD	0.032
LU	0.032
PML-1	0.023
PML-2	0.023
LU2	0.073
BMU	0.032
MQL	0.025
HL	0.025
BC	0.037
LFL	0.023
KL-6	0.022

Note: Laboratory RDL = 0.002 mg/L

Physical parameters for each of the sample locations are shown in the Field Report Forms which are enclosed in **Appendix B**. A photo-log of the sample locations will be included

4 REFERENCES

Canadian Environmental Quality Guidelines for the Protection of Aquatic Life, 2004, “Phosphorous: Canadian Guidance Framework for the Management of Freshwater Systems”.

5 LIMITATIONS

This report has been prepared and the work referred to in this report has been undertaken by SNC-Lavalin Inc (SLI) for Halifax Regional Municipality (HRM), hereafter referred to as the "Client". It is intended for the sole and exclusive use of Halifax Regional Municipality.

The report has been prepared in accordance with the Scope of Work and agreement between SLI and the Client. Other than by the Client and as set out herein, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of SLI.

This report has been prepared in a manner generally accepted by professional consulting principles and practices for the same locality and under similar conditions. No other representations or warranties, expressed or implied, are made.

Opinions and recommendations contained in this report are based on conditions that existed at the time the services were performed and are intended only for the client, purposes, locations, time frames and project parameters as outlined in the Scope or Work and agreement between SLI and the Client. The data reported, findings, observations and conclusions expressed are limited by the Scope of Work. SLI is not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. SLI does not warranty the accuracy of information provided by third party sources.

SNC·LAVALIN

Appendix A

Laboratory Certificate of Analysis

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

CLIENT NAME: SNC Lavalin Inc.
5657 SPRING GARDEN RD, SUITE 200
HALIFAX , NS B3J3R4
(902) 492-4544

ATTENTION TO: Crysta Cumming

PROJECT: 631477

AGAT WORK ORDER: 15X019190

WATER ANALYSIS REVIEWED BY: Jason Coughtrey, Inorganics Supervisor

DATE REPORTED: Sep 18, 2015

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 15X019190

PROJECT: 631477

CLIENT NAME: SNC Lavalin Inc.

ATTENTION TO: Crysta Cumming

SAMPLING SITE:

SAMPLED BY:

TP (Water)

DATE RECEIVED: 2015-09-15

DATE REPORTED: 2015-09-18

		SAMPLE DESCRIPTION:		KL1	KL2	KL3	KL4	KL5	HWY-102-2	LSD	BMU
		SAMPLE TYPE:		Water	Water	Water	Water	Water	Water	Water	Water
		DATE SAMPLED:		9/15/2015	9/15/2015	9/15/2015	9/15/2015	9/15/2015	9/15/2015	9/15/2015	9/15/2015
Parameter	Unit	G / S	RDL	6969320	6969321	6969322	6969323	6969324	6969325	6969326	6969327
Total Phosphorus	mg/L		0.002	0.021	0.028	0.020	0.021	0.021	0.035	0.032	0.032

		SAMPLE DESCRIPTION:		MQL	HL	BC	LFL
		SAMPLE TYPE:		Water	Water	Water	Water
		DATE SAMPLED:		9/15/2015	9/15/2015	9/15/2015	9/15/2015
Parameter	Unit	G / S	RDL	6969328	6969329	6969330	6969331
Total Phosphorus	mg/L		0.002	0.025	0.025	0.037	0.023

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Original Signed

Certified By:

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: SNC Lavalin Inc.

AGAT WORK ORDER: 15X019190

PROJECT: 631477

ATTENTION TO: Crysta Cumming

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Sep 18, 2015			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
TP (Water)															
Total Phosphorus	6969320	6969320	0.021	0.021	0.0%	< 0.006	95%	90%	110%	107%	90%	110%	102%	80%	120%

Original Signed

Certified By:

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

Method Summary

CLIENT NAME: SNC Lavalin Inc.

AGAT WORK ORDER: 15X019190

PROJECT: 631477

ATTENTION TO: Crysta Cumming

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Phosphorus	INOR-93-6022	SM 4500-P B & E	SPECTROPHOTOMETER

AGAT Laboratories

Unit 122 - 11 Morris Dr.
Dartmouth, Nova Scotia
B3B 1M2
http://webearth.agatlabs.com

Phone: 902-468-8718
Fax: 902-468-8924
www.agatlabs.com

Laboratory use Only
Arrival Condition: ☐ Good ☐ Poor (complete 'notes')
Arrival Temperature: 10°
AGAT Job Number: 15x019190
Notes:

Drinking Water Sample (y/n): _____ Reg. No. _____
Waterworks Number: _____

Report To:
Company: SNC Lavalin
Contact: Crysta Cumming
Address: 5657 Spring Garden Road
Halifax, NS B3J 3R4
Phone: 902-492-4544 FAX:
PO#:
AGAT Quotation: 15-1718
Client Project #: 631477

Invoice to: Same (Y/N) - Circle
Company: SNC Lavalin
Contact: payables@snclavalin.com
Address:
Phone: Fax:
PO#/Credit Card #:

Report Information
1. Name: Crysta Cumming
Email:
2. Name: Ryan Flinn/Maria Gutierrez
Email:

Regulatory Requirements (Check):
☐ List Guidelines on Report ☐ Do Not List Guidelines on Report
☐ PIRI Site Info (check all that apply):
☐ Teir 1 ☐ Res. ☐ Pot. ☐ Coarse
☐ Teir 2 ☐ Com ☐ N/Pot. ☐ Fine
☐ Gas ☐ Fuel ☐ Lube
☐ CCME ☐ CDWQ
☐ Ind ☐ NSDFOSP
☐ Com ☐ HRM 101
☐ Res/P Storm Water
☐ Ag ☐ HRM 101
☐ FWAL Waste Water
☐ Sediment
☐ Other

Report Format
☐ Single PDF sample per page
☐ Multiple PDF samples per page
☐ Excel Format Included

Turnaround Time (TAT) Business Days
PUSH!
Regular TAT:
☐ 5 - 7 days
Rush TAT:
☐ 1 day ☐ 2 days
☐ 3 - 4 days
Date Required: September 17th, 2015
Time Required: End of day

SAMPLE IDENTIFICATION	DATE / TIME SAMPLED	SAMPLE MATRIX	# OF CONTAINERS	COMMENTS - Site/Sample Info, Sample Containment	Field Filtered/ Preserved	Standard Water Analysis	Metals (Spring Quarterly Only)	(circle-Total, Diss or Available)	Mercury	BOD	pH	TSS	TP- Low Level (Mississauga)	Anions	Total Phosphorus	Phenols	TPH/BTEX (PIRI) Teir 1	TPH/BTEX-Fractionation Teir 2	VOC	THM	PAH	Chlorophyll A (Sub to DAL)	TC & EC by MPN	Hazardous (Y/N)	Lab Sample #
KL1	Sept 15	water	1										X												
KL2	Sept 15	water	1										X												
KL3	Sept 15	water	1										X												
KL4	Sept 15	water	1										X												
KL5	Sept 15	water	1										X												
~~HWY-102-1~~		water	1										X												
HWY-102-2	Sept 15	water	1										X												
LSD	Sept 15	water	1										X												
LU		water	1										X												
~~PML-1~~		water	1										X												
~~PML-2~~		water	1										X												
~~LU2 - Second Larry Uteck Dr location~~		water	1										X												
BMU ~~- unnamed stream near Blue Mou~~	Sept 15	water	1										X												
MQL ~~- MacQuade Lake~~	Sept 15	water	1										X												
HL ~~- Hobson Lake~~	Sept 15	water	1										X												
BC - ~~Brookside Ct~~	Sept 15	water	1										X												
LFL ~~- Little Fox Ln~~	Sept 15	water	1										X												
No.7		water	1										X												
~~No.8~~		water	1										X												
No.9		water	1										X												

Sample Relinquished By (print name & sign)	Date/Time	Samples Received By (print name and sign)	Date/Time	Special Instructions
Original Signed	15/4:45	Original Signed	Sept 15	Request rdL of 0.002 mg/L
Sample Relinquished By (print name & sign)	Date/Time	Samples Received By (print name and sign)	Date/Time	Page 1 of 1
			16:45	

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

CLIENT NAME: SNC-LAVALIN
5657 SPRING GARDEN RD, SUITE 200
HALIFAX , NS B3J3R4
(902) 492-4544

ATTENTION TO: Crysta Cumming

PROJECT: 631477

AGAT WORK ORDER: 15X019578

WATER ANALYSIS REVIEWED BY: Jason Coughtrey, Inorganics Supervisor

DATE REPORTED: Sep 18, 2015

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 15X019578

PROJECT: 631477

CLIENT NAME: SNC-LAVALIN

ATTENTION TO: Crysta Cumming

SAMPLING SITE:

SAMPLED BY:

TP (Water)

DATE RECEIVED: 2015-09-16

DATE REPORTED: 2015-09-18

SAMPLE DESCRIPTION:				HWY-102-1	LU	PML-1	PML-2	LU2 - second Larr Uteck Dr location	KL6
SAMPLE TYPE:				Water	Water	Water	Water	Water	Water
DATE SAMPLED:				9/16/2015	9/16/2015	9/16/2015	9/16/2015	9/16/2015	9/16/2015
Parameter	Unit	G / S	RDL	6974081	6974082	6974083	6974086	6974087	6974088
Total Phosphorus	mg/L		0.002	0.028	0.032	0.023	0.023	0.073	0.022

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Original Signed

Certified By:

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: SNC-LAVALIN

AGAT WORK ORDER: 15X019578

PROJECT: 631477

ATTENTION TO: Crysta Cumming

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Sep 18, 2015			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
TP (Water)															
Total Phosphorus	6969320		0.021	0.021	0.0%	< 0.006	95%	90%	110%	107%	90%	110%	102%	80%	120%

Original Signed

Certified By: _____

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

Method Summary

CLIENT NAME: SNC-LAVALIN

AGAT WORK ORDER: 15X019578

PROJECT: 631477

ATTENTION TO: Crysta Cumming

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Phosphorus	INOR-93-6022	SM 4500-P B & E	SPECTROPHOTOMETER

AGAT Laboratories

Unit 122 - 11 Morris Dr.
Dartmouth, Nova Scotia
B3B 1M2
http://webearth.agatlabs.com

Phone: 902-468-8718
Fax: 902-468-8924
www.agatlabs.com

Laboratory use Only
Arrival Condition: ☐ Good ☐ Poor (complete 'notes')
Arrival Temperature: 4° AGAT Job Number: 15X019578
Notes:

Drinking Water Sample (y/n): _____ Reg. No. _____
Waterworks Number: _____

Report To:
Company: SNC Lavalin
Contact: Crysta Cumming
Address: 5657 Spring Garden Road
Halifax, NS B3J 3R4
Phone: 902-492-4544 FAX:
PO#:
AGAT Quotation: 15-1718
Client Project #: 631477

Invoice to: Same (Y/N) - Circle
Company: SNC Lavalin
Contact: payables@snclavalin.com
Address:
Phone: Fax:
PO#/Credit Card #:

Report Information
1. Name: Crysta Cumming
Email:
2. Name: Ryan Flinn/Maria Gutierrez
Email:

Regulatory Requirements (Check):
☐ List Guidelines on Report ☐ Do Not List Guidelines on Report
☐ PIRI Site Info (check all that apply):
☐ Teir 1 ☐ Res ☐ Pot ☐ Coarse
☐ Teir 2 ☐ Com ☐ N/Pot ☐ Fine
☐ Gas ☐ Fuel ☐ Lube
☐ CCME ☐ CDWQ
☐ Ind ☐ NSDFOSP
☐ Com ☐ HRM 101
☐ Res/P Storm Water
☐ Ag ☐ HRM 101
☐ FWAL Waste Water
☐ Sediment
☐ Other

Report Format
☐ Single PDF sample per page
☐ Multiple PDF samples per page
☐ Excel Format Included

Turnaround Time (TAT) Business Days
RUSH!
Regular TAT: ☐ 5 - 7 days
Rush TAT: ☐ 1 day ☐ 2 days ☐ 3 - 4 days
Date Required: Sept 18th, 2015
Time Required: End of day

SAMPLE IDENTIFICATION	DATE / TIME SAMPLED	SAMPLE MATRIX	# OF CONTAINERS	COMMENTS - Site/Sample Info, Sample Containment	Field Filtered/ Preserved	Standard Water Analysis	Metals (Spring Quarterly Only)	(circle-Total, Diss or Available)	Mercury	BOD	pH	TSS	TP- Low Level (Mississauga)	Anions	Total Phosphorus	Phenols	TPH/BTEX (PIRI) Teir 1	TPH/BTEX-Fractionation Teir 2	VOC	THM	PAH	Chlorophyll A (Sub to DAL)	TC & EC by MPN	Hazardous (Y/N)	Lab Sample #
~~KL1~~		water	1										X												
~~KL2~~		water	1										X												
~~KL3~~		water	1										X												
~~KL4~~		water	1										X												
~~KL5~~		water	1										X												
HWY-102-1	Sept. 16	water	1										X												
~~HWY-102-2~~		water	1										X												
~~LSD~~		water	1										X												
LU	Sept. 16	water	1										X												
PML-1	Sept. 16	water	1										X												
PML-2	Sept. 16	water	1										X												
LU2 - second Larry Uteck Dr location	Sept. 16	water	1										X												
~~BMU - unnamed stream near Blue Mou~~		water	1										X												
~~MQL - McQuade Lake~~		water	1										X												
~~HL - Hobson Lake~~		water	1										X												
~~BC - Brookshire Ct~~		water	1										X												
LFL - Little Fox Ln		water	1										X												
~~No.7~~ KLG	Sept. 16	water	1										X												
~~No.8~~		water	1										X												
~~No.9~~		water	1										X												

Sample Relinquished By (print name & sign)	Date/Time	Samples Received By (print name and sign)	Date/Time	Special Instructions
Original Signed		Original Signed	Sept 16	Request RDL of 0.002 mg/L
Sample Relinquished By (print name & sign)	Date/Time	Samples Received By (print name and sign)	Date/Time 15:20	Page 1 of 1

SNC·LAVALIN

Appendix B

Field Reports September 2015

FIELD REPORT – SEPTEMBER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Kearney Lake	**Site ID: KL1**	
Watercourse: Kearney Lake	**Location:** Kearney Lake Road	
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	20T 0445718E, 4948496N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster and Alex Hayes	

Site Conditions

Weather:	Cloudy
Air Temperature:	18.4 ^{o}C
Cloud Cover :	100%
Wildlife Sightings:	No
Site Accessibility: Yes, Accessible	Off Kearney Lake Road
Site Access Detail:	Sample taken off the end of dock at Kearney Lake beach. Parked in public parking of Hamshaw Dr. and walked down to beach area.

Field Parameter Data

	Remarks
Date (d.m.y):	15 / 09 / 2015
Time (hh:mm):	3:10 pm
Sample Depth (m):	100 cm
pH:	6.73
Dissolved Oxygen (mg/L):	37.91
Secchi Depth (m): 12:50 pm	2.72 meters
Water Temperature (degrees Celsius):	20.7
Conductivity (µs/cm):	288.2

Additional Comments / Notes

Secchi Depth was measured on Sep 16th, 2015 at 12:50 pm.
Secchi Depth Coordinates: 0445635, 4948582

FIELD REPORT – SEPTEMBER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5	
Client:	Halifax Regional Municipality		
Site: Kearney Lake		**Site ID: KL2**	
Watercourse: Kearney Lake		**Location:** Kearney Lake Road	
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:			
GPS Coordinates:	20T 0443859E, 4949738N (UTM, NAD83)		
SNC Field Personnel:	Jeff MacMaster, Alex Hayes		

Site Conditions

Weather:	Overcast
Air Temperature:	19.4 ^{0}C
Cloud Cover:	75%
Wildlife Sightings:	No
Site Accessibility: Yes, Accessible	Off Colin's Rd.
Site Access Detail:	Sample taken on the lake side of the culvert between residential buildings 20 and 28. Upstream of roadway. Note: Sample when standing downstream of bottle.

Field Parameter Data

	Remarks
Date (d.m.y):	15/ 09 / 2015
Time (hh:mm):	1:45 pm
Sample Depth (m):	0.3 meters
pH:	6.56
Dissolved Oxygen (mg/L):	5.65
Secchi Depth (m):	2.6 meters
Water Temperature (degrees Celsius):	18.6
Conductivity (µs/cm):	85.5

Additional Comments / Notes

Secchi Depth was measured on Sep 16th, 2015 at 1:23 pm.
Secchi Depth Coordinates: 0443844, 4949739

FIELD REPORT – SEPTEMBER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Kearney Lake Run	**Site ID: KL3**	
Watercourse: Kearney Lake Run	**Location:** Kearney Lake Road	
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	20T 0444390E, 4950406N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster, Alex Hayes	

Site Conditions

Weather:	Overcast
Air Temperature:	17.4 ^{0}C
Cloud Cover:	90%
Wildlife Sightings:	No
Site Accessibility: Yes, Accessible	Off walking trail from Amesbury Gate Rd.
Site Access Detail:	Access to site is via a walking path clearly evident off of Amesbury Gate Rd. (off Larry Uteck Blvd.) roughly 205m down road on left. Walk down path, follow gravel walkway downhill and take sample at the low point facing the dam. Look for large rock outcrop on right.

Field Parameter Data

	Remarks
Date (d.m.y):	15/09/2015
Time (hh:mm):	13:10
Sample Depth (m):	0.30 meters
pH:	7.27
Dissolved Oxygen (mg/L):	5.75
Secchi Depth (m):	**N/A**
Water Temperature (degrees Celsius):	20.6
Conductivity (µs/cm):	253.4

Additional Comments / Notes

FIELD REPORT – SEPTEMBER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Kearney Lake Run	**Site ID: KL4**	
Watercourse: Kearney Lake Run	**Location:** Kearney Lake Road	
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	20T 0444463E, 4950571N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster, Alex Hayes	

Site Conditions

Weather:	Overcast
Air Temperature:	17.4
Cloud Cover:	100%
Wildlife Sightings:	No
Site Accessibility: Yes, Accessible	Via the extended road at the end of Weybridge Ln.
Site Access Detail:	If Weybridge, go to end of extended road on right and walk and take sample above the rocky area at the base of the wider, slow moving section of the river.

Field Parameter Data

	Remarks
Date (d.m.y):	15/09/2015
Time (hh:mm):	13:20
Sample Depth (m):	0.3
pH:	7.27
Dissolved Oxygen (mg/L):	5.81
Secchi Depth (m):	**N/A**
Water Temperature (degrees Celsius):	20.5
Conductivity (µs/cm):	248.3

Additional Comments / Notes

FIELD REPORT – SEPTEMBER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 9
Client:	Halifax Regional Municipality	
Site: Kearney Lake	**Site ID: KL5**	
Watercourse: Kearney Lake	**Location:** Kearney Lake Road	
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	20T 4949142E, 445280N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster, Alex Hayes	

Site Conditions

Weather:	Cloudy
Air Temperature:	18.4 ^{0}C
Cloud Cover:	75%
Wildlife Sightings:	No
Site Accessibility: Yes, Accessible	Along Kearney Lake Road
Site Access Detail:	Easily accessible, sample location is directly off the Kearney Lake Road on a rocky outcrop supporting a power line pole (two pole structures). Slow truck down carefully, turn hazard lights on. Samples were taken on left front of outcrop facing lake.

Field Parameter Data

	Remarks
Date (d.m.y):	15/09/2015
Time (hh:mm):	2:51 pm
Sample Depth (m):	50 cm
pH:	6.55
Dissolved Oxygen (mg/L):	6.70
Secchi Depth (m):	4.26 meters
Water Temperature (degrees Celsius):	21.4 ^{0}C
Conductivity (µs/cm):	250.3

Additional Comments / Notes

Secchi Depth was measured on Sep 16th, 2015 at 1:02 pm.
Secchi Depth Coordinates: 0445324, 4949071

FIELD REPORT – SEPTEMBER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Highway 102	**Site ID: HWY 102-1**	
Watercourse: Marsh area	**Location:** Highway 102, south of exit 3	
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	20T 0444708E, 4951644N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster, Alex Hayes	

Site Conditions

Weather:	Clear
Air Temperature:	19.6 ^{0}C
Cloud Cover:	0 %
Wildlife Sightings:	Dead Turtle, side of highway.
Site Accessibility: Yes, Accessible	Off Highway 102 Park before guardrail.
Site Access Detail:	Carefully slow truck down while pulling off highway 102. Park truck with hazard lights on before the start of the guardrail. Walk along outside of guardrail (for approximately 150m). Site is on right fed by a swampy bog area. Samples were taken in front of culvert. There is a concrete pad to step on to take samples. Sample while standing downstream.

Field Parameter Data

	Remarks
Date (d.m.y):	16 / 09/ 2015
Time (hh:mm):	9:40 am
Sample Depth (m):	40 cm
pH:	6.60
Dissolved Oxygen (mg/L):	10.14
Secchi Depth (m):	**N/A**
Water Temperature (degrees Celsius):	16.9
Conductivity (µs/cm):	245.5

Additional Comments / Notes

FIELD REPORT – SEPTEMBER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Highway 102	**Site ID: HWY 102-2**	
Watercourse: Marsh area	**Location:** HWY 102, south of exit 3	
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	20T 0444829E, 4951778N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster, Alex Hayes	

Site Conditions

Weather:	Cloudy
Air Temperature:	19.2 ^{0}C
Cloud Cover:	90%
Wildlife Sightings:	Flies (water bugs)
Site Accessibility: Yes, Accessible	Off Highway 102 (Small gravel drive way- *Back in)
Site Access Detail:	Travel along Highway 102 toward Bedford NS. Site is on right easily to identify based on swamp/bog. Carefully slow truck down with hazard lights flashing. There is a small driveway to park truck. Pull a head of driveway and when lanes are clear back truck down into spot. Take samples in water body in front of culvert.

Field Parameter Data

	Remarks
Date (d.m.y):	15/09/2015
Time (hh:mm):	4:00 pm
Sample Depth (m):	10 cm
pH:	6.29
Dissolved Oxygen (mg/L):	2.45
Secchi Depth (m):	**N/A**
Water Temperature (degrees Celsius):	19.0
Conductivity (µs/cm):	370.5

Additional Comments / Notes

FIELD REPORT – SEPTEMBER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Lake Shore Drive		**Site ID: LSD**
Watercourse: Marsh @ Lakeshore Dr.		**Location:** Kingswood Subdivision
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	20T 0442583E, 4950431N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster, Alex Hayes	

Site Conditions

Weather:	Overcast, Showers
Air Temperature:	17.4%
Cloud Cover:	Overcast, 100%
Wildlife Sightings:	No
Site Accessibility: Yes, Accessible	Via Lakeshore Drive in Kingswood Subdivision
Site Access Detail:	Take Kingswood Drive off Hammonds Plains Road. Travel down to Diana Drive on left go to end and take a left on Lakeshore drive. Travel approximately 1.0 km. There will be a clearing on left down to power lines. Drive truck (4X4) down until larger clearing is reached and park. Continue (walk) downhill to ATV pathway on left. Follow pathway for approximately 250m. Sample location is on right (river with a lot of vegetation throughout)

Field Parameter Data

	Remarks
Date (d.m.y):	15/09/2015
Time (hh:mm):	11:24
Sample Depth (m):	Surface, 40 cm
pH:	7.10
Dissolved Oxygen (mg/L):	4.94
Secchi Depth (m):	N/A
Water Temperature (degrees Celsius):	17.2
Conductivity (µs/cm):	137.5

Additional Comments / Notes

FIELD REPORT – SEPTEMBER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 9
Client:	Halifax Regional Municipality	
Site: Larry Uteck Blvd.		**Site ID: LU**
Watercourse: Pond		**Location:** Larry Uteck off-ramp
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	20T 0444954E, 4949891N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster, Alex Hayes	

Site Conditions

Weather:	Clear
Air Temperature:	21.2^{0}C
Cloud Cover:	0%
Wildlife Sightings:	Dragon Flies
Site Accessibility: Yes, Accessible	From Larry Uteck Blvd.
Site Access Detail:	Take Larry Uteck off ramp and continue down Larry Uteck Blvd. for approximately 320m. Park truck safely on grassy clearing on left. Sample location is at shore line of lake across road. Take walking pathway to wooded area and travel approximately 80m to lake shore. Avoid walking through the bog area on right.

Field Parameter Data

	Remarks
Date (d.m.y):	16/09/2015
Time (hh:mm):	10:26 am
Sample Depth (m):	20 cm
pH:	6.82
Dissolved Oxygen (mg/L):	41.30
Secchi Depth (m):	N/A
Water Temperature (degrees Celsius):	19.7
Conductivity (µs/cm):	484.4

Additional Comments / Notes

FIELD REPORT – SEPTEMBER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Paper Mill Lake	**Site ID: PML1**	
Watercourse: Paper Mill Lake	**Location:** Moirs Mill Subdivision	
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	20T 0445129E, 4951154N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster, Alex Hayes	

Site Conditions

Weather:	Clear
Air Temperature:	20.3 ^{0}C
Cloud Cover:	20%
Wildlife Sightings:	No
Site Accessibility: Yes, Accessible	Via Ahmadi Crescent in Moirs Mill Subdivision

Field Parameter Data

	Remarks
Date (d.m.y):	Sep 16th, 2015
Time (hh:mm):	1:45 pm
Sample Depth (m):	20 cm
pH:	7.6
Dissolved Oxygen (mg/L):	32.63
Secchi Depth (m):	4.28 meters
Water Temperature (degrees Celsius):	21.0
Conductivity (µs/cm):	264.4

Additional Comments / Notes

Secchi Depth was measured on Sep 16th, 2015 at 2:01 pm.
Secchi Depth Coordinates: 0445152, 4951218.
Note: Secchi depth collected from white buoy. For safety access, watch for roots/holes while hiking to lake.

FIELD REPORT – SEPTEMBER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Paper Mill Lake	**Site ID: PML2**	
Watercourse: Paper Mill Lake	**Location:** Moirs Mill Subdivision	
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	20T 0445363E, 4951740N (UTM, NAD83)	
SNC Field Personnel:	Jeff MacMaster, Alex Hayes	

Site Conditions

Weather:	Clear
Air Temperature:	26.6 ^{0}C
Cloud Cover:	10%
Wildlife Sightings:	No
Site Accessibility:	Yes, Accessible
Site Access Detail:	Via Lake Dr., off Hammonds Plains Rd.

Field Parameter Data

	Remarks
Date (d.m.y):	16/09/2015
Time (hh:mm):	2:35 pm
Sample Depth (m):	35 cm
pH:	7.20
Dissolved Oxygen (mg/L):	22.99
Secchi Depth (m):	2.46 meters
Water Temperature (degrees Celsius):	24.4
Conductivity (µs/cm):	264.3

Additional Comments / Notes

Secchi Depth was measured on Sep 16th, 2015.
Secchi Depth Coordinates: 0445435, 4951718.
Note: Secchi depth is equal at bottom.

FIELD REPORT – SEPTEMBER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Larry Uteck Blvd.	**Site ID: LU2**	
Watercourse:	**Location:**	
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	0445325 4949886	
SNC Field Personnel:	Jeff MacMaster, Alex Hayes	

Site Conditions

Weather:	Clear
Air Temperature:	20.6 ^{o}C
Cloud Cover:	0%
Wildlife Sightings:	Birds (chickadees)
Site Accessibility:	Requires Halifax Water access.
Site Access Detail:	Walk down gill to stream by the culvers.

Field Parameter Data

	Remarks
Date (d.m.y):	16/09/2015
Time (hh:mm):	11:10 am
Sample Depth (m):	10 cm
pH:	7.17
Dissolved Oxygen (mg/L):	340 mg/L (30.4 %)
Secchi Depth (m):	N/A
Water Temperature (degrees Celsius):	18.3
Conductivity (µs/cm):	528.4

Additional Comments / Notes

LU2 - second Larry Uteck Drive Location; upstream from LU

FIELD REPORT – SEPTEMBER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Blue Mountain Unnamed	**Site ID:** Blue Mountain Unnamed **(BMU)**	
Watercourse: McQuade Lake River	**Location: Blue Mountain Rd.**	
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	0442418 4950992	
SNC Field Personnel:	Jeff MacMaster, Alex Hayes	

Site Conditions

Weather:	Overcast, showers
Air Temperature:	17.1 ^{o}C
Cloud Cover:	Overcast, 100%
Wildlife Sightings:	Frogs in stream
Site Accessibility:	Accessible
Site Access Detail:	Walk along slow steam into the woods.

Field Parameter Data

	Remarks
Date (d.m.y):	15/09/2015
Time (hh:mm):	12:00
Sample Depth (m):	Surface, 15 cm
pH:	6.88
Dissolved Oxygen (mg/L):	4.09
Secchi Depth (m):	N/A
Water Temperature (degrees Celsius):	17^{o}C
Conductivity (µs/cm):	167.3

Additional Comments / Notes

BMU - unnamed stream near Blue Mountain Drive; upstream from KL2

FIELD REPORT – SEPTEMBER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: McQuade Lake	**Site ID: MQL**	
Watercourse: McQuade Lake	**Location:** Stream	
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	0441264 4951418	
SNC Field Personnel:	Jeff MacMaster, Alex Hayes	

Site Conditions

Weather:	Overcast, showers
Air Temperature:	17.3 ^{0}C
Cloud Cover:	Overcast, 100%
Wildlife Sightings:	No
Site Accessibility:	Accessible
Site Access Detail:	Walk into woods by stream

Field Parameter Data

	Remarks
Date (d.m.y):	15/09/2015
Time (hh:mm):	10:50 am
Sample Depth (m):	Surface, 30 cm.
pH:	7.74
Dissolved Oxygen (mg/L):	61.0
Secchi Depth (m):	N/A
Water Temperature (degrees Celsius):	19.4 ^{o}C
Conductivity (µs/cm):	208.7

Additional Comments / Notes

MQL - McQuade Lake; upstream from LSD, BMU, and KL2.

FIELD REPORT – SEPTEMBER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Hobson Lake	**Site ID: HL**	
Watercourse: Hobson Lake	**Location:** Collins Rd.	
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	0443603 4949250	
SNC Field Personnel:	Jeff MacMaster, Alex Hayes	

Site Conditions

Weather:	Cloudy
Air Temperature:	18.9 ^{o}C
Cloud Cover:	100%
Wildlife Sightings:	Water bugs
Site Accessibility:	Accessible
Site Access Detail:	Walk trail until sampler reach the lake.

Field Parameter Data

	Remarks
Date (d.m.y):	15/09/2015
Time (hh:mm):	2:12 pm
Sample Depth (m):	Surface, 50 cm.
pH:	6.08
Dissolved Oxygen (mg/L):	56.1 mg/L (5.50%)
Secchi Depth (m):	N/A
Water Temperature (degrees Celsius):	20.5 ^{0}C
Conductivity (µs/cm):	35.5

Additional Comments / Notes

HL - Hobson Lake; upstream from KL2

FIELD REPORT – SEPTEMBER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Brookshire	**Site ID: BC**	
Watercourse:	**Location:** Brookshire Court	
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	0445637 4952462	
SNC Field Personnel:	Jeff MacMaster, Alex Hayes	

Site Conditions

Weather:	Cloudy
Air Temperature:	18.2^0C
Cloud Cover:	90%
Wildlife Sightings:	Flies
Site Accessibility:	Accessible
Site Access Detail:	Off path at end of Brookshire Court.

Field Parameter Data

	Remarks
Date (d.m.y):	15/09/2015
Time (hh:mm):	5:15 pm
Sample Depth (m):	Surface, 15 cm.
pH:	6.79
Dissolved Oxygen (mg/L):	47.56 mg/L (4.9%)
Secchi Depth (m):	N/A
Water Temperature (degrees Celsius):	16.8
Conductivity (µs/cm):	191.7

Additional Comments / Notes

BC - Brookshire Court; upstream from PML2

FIELD REPORT – SEPTEMBER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Little Fox Lane	**Site ID: LFL**	
Watercourse: River	**Location:** Little Fox Lane	
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	0445730 4948275	
SNC Field Personnel:	Jeff MacMaster, Alex Hayes	

Site Conditions

Weather:	Overcast, Misting
Air Temperature:	17.8 ^{o}C
Cloud Cover:	100%
Wildlife Sightings:	No
Site Accessibility:	Accessable
Site Access Detail:	Culvert off Little Fox Lane

Field Parameter Data

	Remarks
Date (d.m.y):	15/09/2015
Time (hh:mm):	3:30
Sample Depth (m):	85 cm
pH:	6.78
Dissolved Oxygen (mg/L):	50.07 mg/L (5.0%)
Secchi Depth (m):	N/A
Water Temperature (degrees Celsius):	20.6
Conductivity (µs/cm):	271.5

Additional Comments / Notes

LFL - Little Fox Lane; upstream from KL1

FIELD REPORT – SEPTEMBER 2015

Project:	Water Quality Monitoring - Bedford West	**Sub-Area(s):** 2, 3, 4, 5
Client:	Halifax Regional Municipality	
Site: Kearney Lake	**Site ID: KL6**	
Watercourse: Kearly Lake	**Location:** Inflow river to KL5	
Monitoring Well ☐Pumping Well ☒ Surface Water ☐Spring/Seep ☐Discharge Pipe ☐Other:		
GPS Coordinates:	0445391 4949129	
SNC Field Personnel:	Jeff MacMaster, Alex Hayes	

Site Conditions

Weather:	Clear
Air Temperature:	24.9
Cloud Cover:	0%
Wildlife Sightings:	No
Site Accessibility:	Accessible
Site Access Detail:	Walk around fence by culver, continue upstream.

Field Parameter Data

	Remarks
Date (d.m.y):	16/09/2015
Time (hh:mm):	10:55 am
Sample Depth (m):	Surface 10 cm.
pH:	7.29
Dissolved Oxygen (mg/L):	34.61
Secchi Depth (m):	N/A
Water Temperature (degrees Celsius):	18.6
Conductivity (µs/cm):	502.7

Additional Comments / Notes

KL6 - across Kearney Lake Road for KL5; approx. 10 meters upstream for the culvert. Upstream from KL5

Attachment D.

Summary of Total Phosphorus Measurements, Summer 2013 – Summer 2015, Bedford West

Sites	2013 Summer	2013 Fall	2014 Spring	2014 Summer	2014 Fall	2015 Spring	2015 August	2015 September
KL1	11	8	11	26	13	8	2	21
KL2	20	29	13	39	25	8	12	28
KL3	6	12	9	23	148	4	4	20
KL4	2390	16	22	31	15	6	7	21
KL5	13	10	10	26	135	5	5	21
HWY102-1	21	22	13	38	31	7	20	28
HWY102-2	28	199	28	--	201	10	1560	35
LSD	15	78	100	--	31	11	501	32
LU	27	46	260	28	39	7	9	32
PML1	7	47	12	30	21	5	60	23
PML2	--	26	11	26	18	8	12	23
LU2	--	--	--	--	--	--	--	73
BMU	--	--	--	--	--	--	--	32
MQL	--	--	--	--	--	--	--	25
HL	--	--	--	--	--	--	--	25
BC	--	--	--	--	--	--	--	37
LFL	--	--	--	--	--	--	--	23
KL-6								22
Seasonal Summary: # Exceedances	8	9	9	9	11	2	6	18
Seasonal Summary: % total	80%	82%	82%	100%	100%	18%	55%	100%

Notes

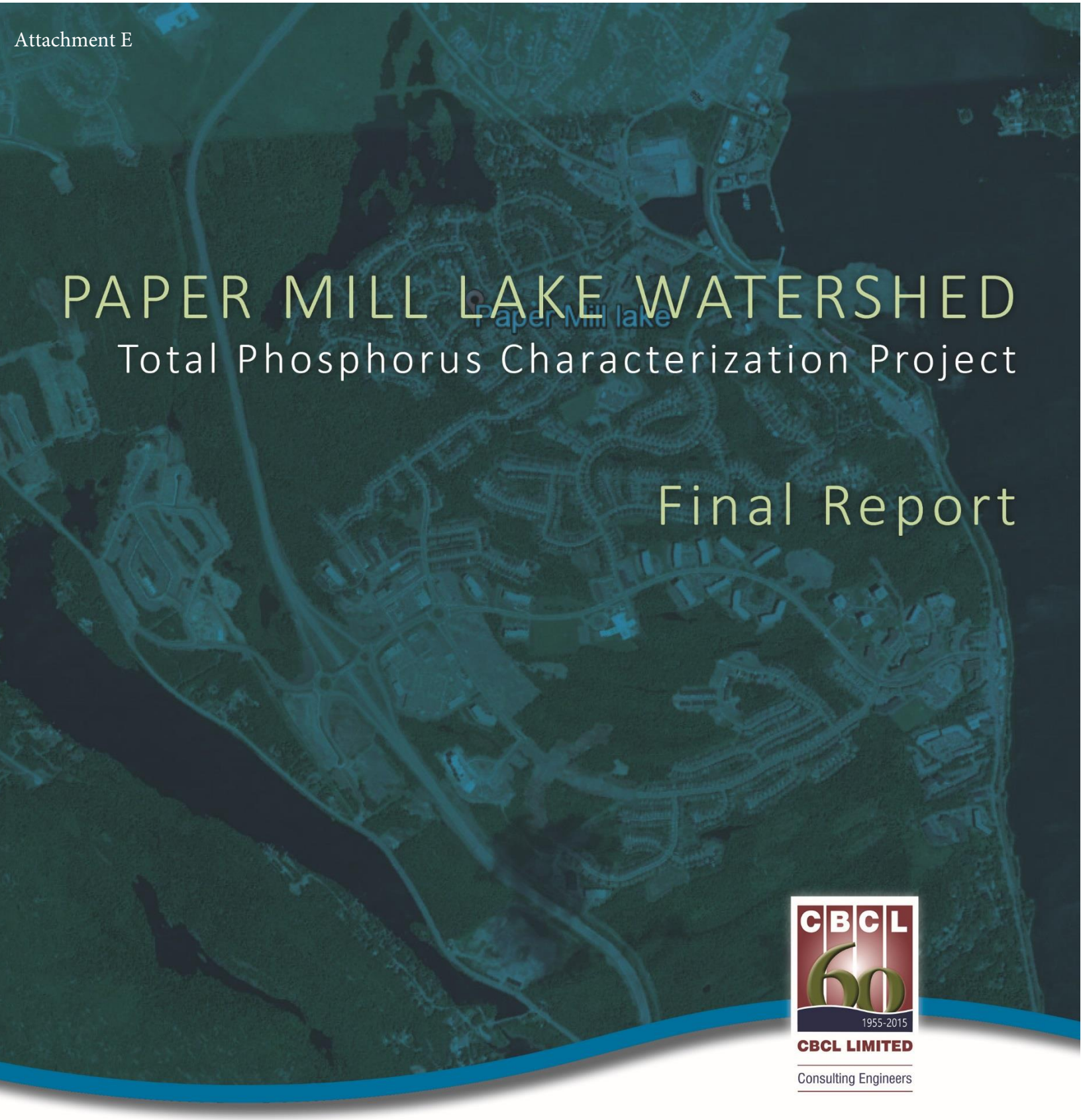
1. Cells marked in grey indicate that measured Total Phosphorus results exceeded 10mg/L during the corresponding monitoring event.

2. Cells marked '--' indicate that the corresponding site was not monitored during the season.

Legend

	oligotrophic (0-9 µg/100mL): lowest trophic status, below notification threshold
	mesotrophic (10-20 µg/100mL): one trophic status above threshold
	meso-eutrophic (20-35 µg/100mL): trophic status two steps above threshold
	eutrophic (35-100 µg/100mL): trophic status three steps above threshold
	hypereutrophic (≥100 µg/100mL): highest trophic status, four steps above threshold

Attachment E



PAPER MILL LAKE WATERSHED

Total Phosphorus Characterization Project

Final Report

CBCL 60 1955-2015
CBCL LIMITED
Consulting Engineers

Prepared for

HALIFAX

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Final Report	Original Signed	09/18/2015	Original Signed
Draft Report	A. Wilson	09/14/2015	L. Braschi
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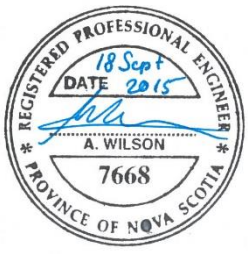
CBCL LIMITED
Consulting Engineers



EXECUTIVE SUMMARY

In spring of 2009, monitoring was initiated in Bedford West according to a plan jointly developed by the Bedford Watershed Advisory Board and the Halifax Regional Municipality (HRM) staff. It was determined that, if water quality levels for Paper Mill Lake reached a total phosphorus (TP) threshold of 0.010 mg/L, the municipality should conduct an assessment. Recent indications suggest that TP concentrations in the Kearney and Paper Mill Lakes rose above the established threshold several times since at least 2012 (they have exceeded the "early warning" threshold). HRM has therefore commissioned CBCL to characterize these recent increases in TP levels.

The purpose of this Phase I study is to identify when and where the TP threshold has been exceeded in the Kearney and Paper Mill Lakes and adjacent watercourses. In this report, the 2006-2011 conditions are first established based on a statistical analysis of HRM's former Water Quality Monitoring Program. Then, the variation in TP measurements from those conditions is visually and statistically compared based on the Bedford West Monitoring Plan (2009-2014).

- Measured TP levels in both lakes during the 2006-2011 period displayed little variation, with levels in the oligotrophic range (<0.010 mg/L).
- There are indications that TP is increasing in Kearney and Paper Mill Lakes.
    - Average TP values from the 2009-2014 data set are higher than averages from the 2006-2011 data set.
    - For three sites, there were statistically significant linear increases in TP over time.
    - The "early warning" threshold of 0.010 mg/L was exceeded several times in the 2009-2014 data set, with levels moving into the mesotrophic range, and on some occasions, into the eutrophic range (> 0.035 mg/L).
- TP displayed increased variation during the 2009-2014 phase. A pattern of higher variation in TP is to be expected in oligotrophic lakes such as Kearney and Paper Mill Lakes, as they become initially more enriched. This is particularly the case in lakes that are in transition from oligotrophic to mesotrophic, and where levels are close to the limits of analytical detection. The variation could also be explained by a chance in sampling methodology.

However, the two data sets are not directly comparable because they were obtained from samples taken at different locations; this discrepancy is evident from the period of overlap (2009-2011) between the two sampling programs, because they yield different results. Also, duration of sampling and sample size is insufficient to statistically characterize spatial and temporal variability in TP measurements. In order to more closely compare 2006-2011 conditions to 2009-2014 conditions, it may be worthwhile to consider renewed sampling at the 2006-2011 data set sampling locations.

Contents

Appendices

List of Tables

List of Figures

CHAPTER 1 INTRODUCTION

In spring of 2009, monitoring was initiated in Bedford West according to a plan jointly developed by the Bedford Watershed Advisory Board and the Halifax Regional Municipality (HRM) staff. It was determined that, if water quality levels for Paper Mill Lake reached a total phosphorus (TP) threshold of 0.010 mg/L, the municipality should conduct an assessment. Recent indications suggest that TP concentrations in the Kearney and Paper Mill Lakes rose above the established threshold several times since at least 2012 (they have exceeded the "early warning" threshold). HRM has therefore commissioned CBCL Limited to characterize these recent increases in TP levels.

Elevated TP concentrations in waterbodies can contribute to an increase in primary productivity, which can lead to plant growth and depleted oxygen levels (when decaying organic material decomposes). This may also cause a decrease in biodiversity and changes in the dominant biota. Excessive plant growth can also include certain species of cyanobacteria that cause increased risk to human health (CCME 2004). TP is the main predictor of trophic status recommended by the Canadian Environmental Quality Guidelines (Table 1.1; CCME 2004). TP concentrations are particularly critical for Kearney and Paper Mill Lakes, because both lakes are strongly limited in phosphorus (AECOM 2013).

Table 1.1: Trophic Statuses Based on TP, According to the Canadian Environmental Quality Guidelines (CCME 2004)

Trophic Status	Total Phosphorus
Ultra-oligotrophic	<4 µg/L
Oligotrophic	4 – 10 µg/L
Mesotrophic	10 – 20 µg/L
Meso-eutrophic	20 – 35 µg/L
Eutrophic	35 – 100 µg/L
Hyper-eutrophic	>100 µg/L

The purpose of this Phase I study is to identify when and where the TP threshold is exceeded in the Kearney and Paper Mill Lakes and adjacent watercourses. In this report, the 2006-2011 conditions are first established based on a statistical analysis of HRM's former Water Quality Monitoring Program. Then, the variation in TP measurements from those conditions is visually and statistically compared based on the Bedford West Monitoring Plan (2009-2014). Both monitoring programs were ongoing

during 2009-2011; thus, there is a period of overlap of two years. The HRM Water Quality Monitoring Program includes two measurement locations in each of the Kearney and Paper Mill Lakes, monitored three times annually (Appendix A). The Bedford West Monitoring Plan started with nine stations and expanded to eleven stations in 2012, also monitored three times annually (Appendix A). These two data sets will be hereinafter referred to as "2006-2011 Data Set" and "2009-2014 Data Set" respectively. Phase II of the project will investigate potential causes of the TP observations and trends.

1.1 2006-2011 Data Set

Average conditions were first quantified for the 2006-2011 data set. This data set provides up to three measurements in both Kearney and Paper Mill Lakes for each year, annual means were calculated for each lake and identified the corresponding annual trophic statuses (Table 1.2). Annual means are a good statistic for this data set in the sense that there are no apparent patterns in seasonal variability that would have been lost by the averaging process (Appendix B). However, for a sampling regime of only three samples, missing values render annual means statistically meaningless (e.g., only one measurement available). Table 1.2 shows that TP in both Kearney and Paper Mill Lakes during 2006-2011 was generally < 0.010 mg/L, and that the lakes were therefore oligotrophic for much of the 2006-2011 time period. Individual TP measurements and annual TP means are shown together in Figure 1.1. Three-year running means are discussed and reported in Appendix F.

Table 1.2: Kearney and Paper Mill Lakes 2006-2011 TP Annual Means and Trophic Statuses

	Kearney Lake 2006-2011		Paper Mill Lake 2006-2011	
	Mean TP (mg/L)	**Trophic status**	**Mean TP (mg/L)**	**Trophic Status**
2006	0.006 ± 0.002 (1 σ)	Oligotrophic	0.007 ± 0.002 (1 σ)	Oligotrophic
2007	0.007 ± 0.002 (1 σ)	Oligotrophic	0.004 ± 0.001 (1 σ)	Oligotrophic
2008	0.009 ± 0.003 (1 σ)	Oligotrophic	0.009 ± 0.003 (1 σ)	Oligotrophic
2009	0.006 ± 0.002 (1 σ)	Oligotrophic	0.008 ± 0.003 (1 σ)	Oligotrophic
2010	0.007 ± 0.002 (1 σ)	Oligotrophic	0.010 ± 0.004 (1 σ)	Oligo- Mesotrophic
2011	0.011 ± 0.004 (1 σ)	Oligo-Mesotrophic	0.008 ± 0.003 (1 σ)	Oligotrophic

In both Table 1.2 and Figure 1.1, the error on each annual mean is the standard deviation (σ), as reported by AGAT laboratories (35%). The standard deviation is a measure used to quantify the amount of variation or dispersion of measurements compared to the mean. This uncertainty results from natural TP variability of as well as measurement error (due to limits on instrumental precision).

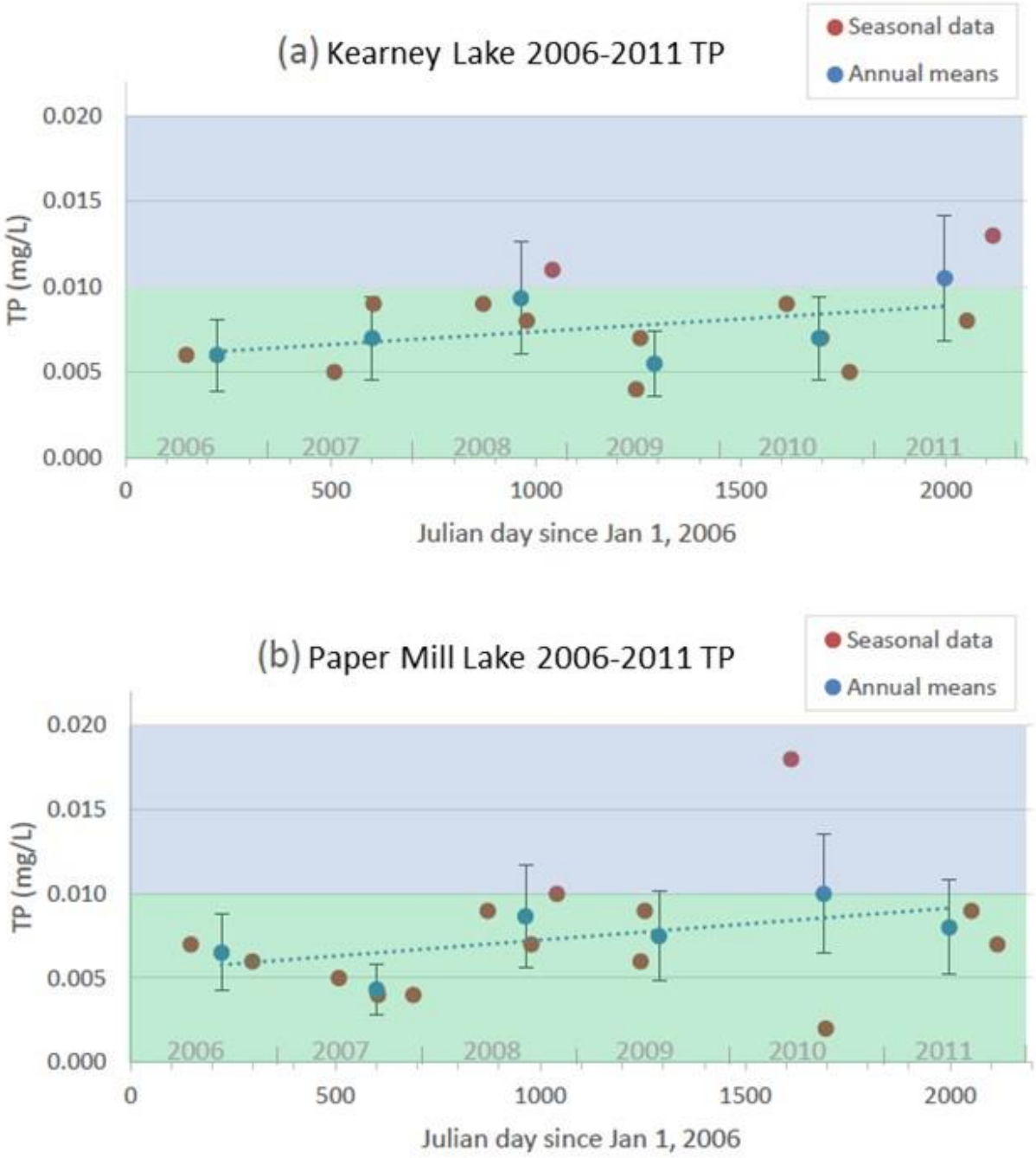


Figure 1.1: Kearney and Paper Mill 2006-2011 Time Series of TP Measurements

A slight trend is visually apparent in the 2006-2011 data of both lakes (Figure 1.1). However, based on regression analysis (Appendix C), the trend is not statistically significant. This confirms the Stantec (2012) and AECOM (2013) preliminary results (based on visual analyses) that the TP was stable in both Kearney and Paper Mill Lakes from 2006-2011. Hence, it can be considered that TP was unchanged in both lakes throughout the 2006-2011 time period. The means of the TP measurements from each lake were therefore calculated, thus obtaining an average TP value representative of the entire sampling

period from 2006-2011 (Table 1.3). The standard deviation (σ) provides a measure of the variability from this 2006-2011 average.

Table 1.3: Kearney and Paper Mill Lakes 2006-2011 TP Means and Trophic Statuses for the Entire Sampling Period

	Kearney Lake 2006-2011		Paper Mill Lake 2006-2011	
	Mean TP (mg/L)	Trophic Status	Mean TP (mg/L)	Trophic Status
2006-2011	0.008 ± 0.003 (1 σ)	Oligotrophic	0.007 ± 0.004 (1 σ)	Oligotrophic

The standard deviation (1 σ error) includes variability within years, between years, and due to measurement error.

Next, it was necessary to determine whether the difference in the TP averages between the two lakes was significant. Using a 2-sample t-test, it was found that the two means are statistically indistinguishable (Appendix D). Therefore, the TP measurements for both lakes can be pooled. In other words, the 2006-2011 data set shows no statistically significant spatial differences in TP. The pooled average and pooled error is reported in Table 1.4.

Table 1.4: Pooled Kearney and Paper Mill Lakes 2006-2011 TP and Trophic Status. The Pooled Standard Deviation is from the Analysis of Variance (ANOVA; Appendix D)

	Pooled Kearney and Paper Mill Lakes 2006-2011	
	Mean TP (mg/L)	Trophic status
2006-2011	0.008 ± 0.003 (1 σ)	Oligotrophic

In summary, there are no apparent seasonal patterns in the TP measurements during the 2006-2011 period, the TP measurements did not change significantly over time, and the TP levels between Kearney and Paper Mill Lakes cannot be statistically distinguished. A 2006-2011 average was obtained as well as a measure of the variability in TP (the amount by which measurements tend to vary from the average). The trophic status classification of both lakes during the 2006-2011 period was oligotrophic.

In both Table 1.2 and Figure 1.1, the error on each annual mean is the standard deviation (σ; 35%). This uncertainty on the mean value results from natural TP variability of as well as measurement error (due to limits on instrumental precision). The Julian day convention is explained in Appendix A. The oligotrophic range is shown in green and the mesotrophic range is shown in blue.

1.2 2009-2014 Data Set

This section describes and characterizes TP during 2009-2014, in comparison to the established 2006-2011. The 2009-2014 TP data set shows two main differences from the 2006-2011 data set. Firstly, there are occasional, abnormally high TP measurements, which are considerably higher than other measurements. This type of observation was absent from the 2006-2011 data set. Secondly, there is a statistically significant linear increase over time in TP measurements at certain locations. This contrasts with the demonstrated stability of the 2006-2011 TP measurements.

The abnormally high TP measurements (Figure 1.2), which only occur at one to three stations on any given sampling date, cannot be definitively attributed to measurement error, seasonal conditions, weather events, or concerns with particular sampling locations. Each of these potential factors is addressed in Appendix E. The investigations were therefore focused on the bulk of the measurements (see Appendix E for excluded data points). Regressions which include the abnormally high measurements were found to be less meaningful because of the disproportionate influence of single measurements, due to small sample sizes (Appendix E). This is apparent in Figure 1.2, where a linear regression is shown through annual averages, but this is skewed by abnormally high values.

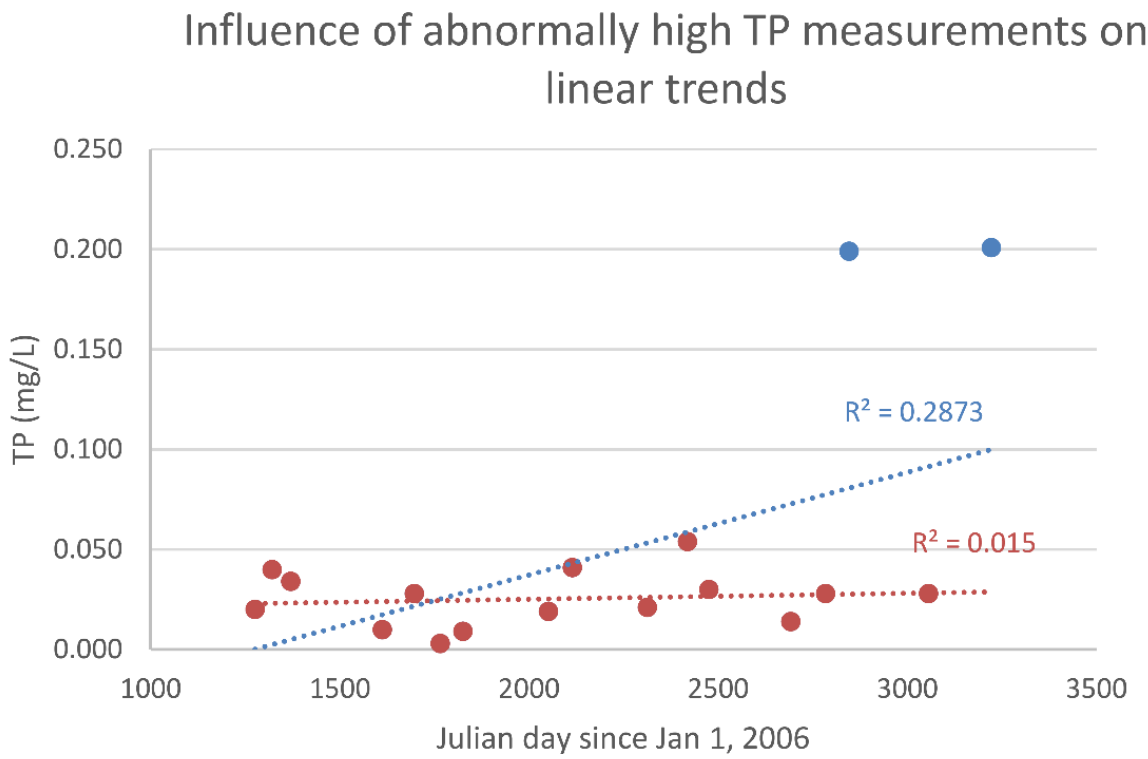


Figure 1.2: 2009-2014 TP at Highway-102 Site 2

The blue measurements represent abnormally high values. The blue trend line is calculated on all measurements, including the abnormally high values (both the red and blue points). The red trend line is calculated without the abnormally high values (only the red points).

The remaining 2009-2014 data set shows increasing TP over time in some locations; in some locations, the TP measurements cross from the oligotrophic range (green) into the mesotrophic range (blue; Figure 1.3). According to a regression analysis (Appendix C), these linear trends are statistically significant at three sites: the Highway 102 Site 1 (HWY 102-01, Figure 1.3b), Paper Mill Lake Site 2 (PML2, Figure 1.3f), and Kearny Lake Site 3 (KL3, Figure 1.3i).

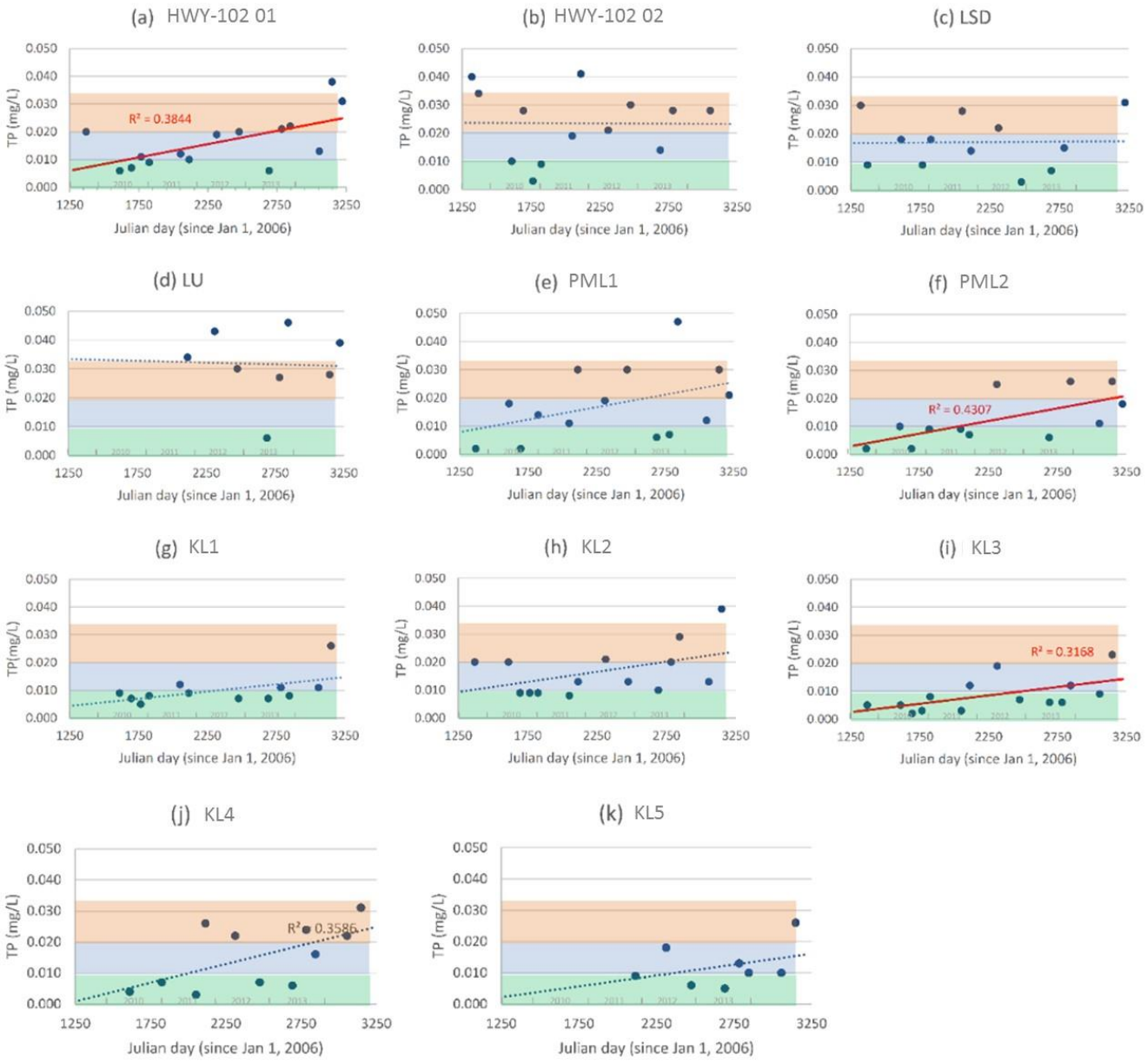


Figure 1.3: Bedford West 2009-2014 TP Background Trends

Statistically significant trend lines are shown in red. The oligotrophic range is shown in green, the mesotrophic in blue, and meso-eutrophic in orange.

For the sampling locations without statistically significant trends (all locations except Highway-102 Site 01, Paper Mill Lake Site 2, and Kearney Lake Site 2), means of the TP measurements were calculated and average TP values representative of the entire sampling period from 2009-2014 were obtained (Table 1.5). The Kearney Lake measurements were pooled, since they were not statistically different based on an ANOVA analysis (Appendix D). AECOM (2013) came to the same conclusion during the Birch Cove Lake Study and suggested that the TP measurements for KL1, KL3 and KL4 should be pooled.

Table 1.5: 2009-2014 TP Values for Sampling Locations without Linear Trends

Sampling Station	TP and Trophic Status (2009-2011)	
	Mean TP (mg/L)	Trophic Status
HWY 102-02	0.023 ± 0.012 (1 σ)	Meso-eutrophic
LSD	0.017 ± 0.009 (1 σ)	Mesotrophic
LU	0.032 ± 0.012 (1 σ)	Meso-eutrophic
PML1	0.018 ± 0.013 (1 σ)	Meso-eutrophic
KL1	0.010 ± 0.005 (1 σ)	Mesotrophic
KL2	0.017 ± 0.009 (1 σ)	Mesotrophic
KL4	0.015 ± 0.010 (1 σ)	Mesotrophic
KL5	0.012 ± 0.007 (1 σ)	Mesotrophic
KL1, KL2, KL4, KL5 average	0.018 ± 0.008 (1 σ)	Mesotrophic

The 2009-2014 TP means are generally higher than the 2006-2011 TP mean, and they correspond to mesotrophic or meso-eutrophic rather than oligotrophic conditions. However, the interpretation of this result requires a careful comparison of the 2006-2011 and 2009-2014 data sets where they overlap (2009-2011). Figure 1.4 shows that the 2009-2014 data has more variability and a higher average than the 2006-2011 data set during those two years. Regardless of the reason for this discrepancy, comparison of 2009-2014 data to 2006-2011 data overestimates the change in TP over time, since the 2009-2014 data set has higher TP values.

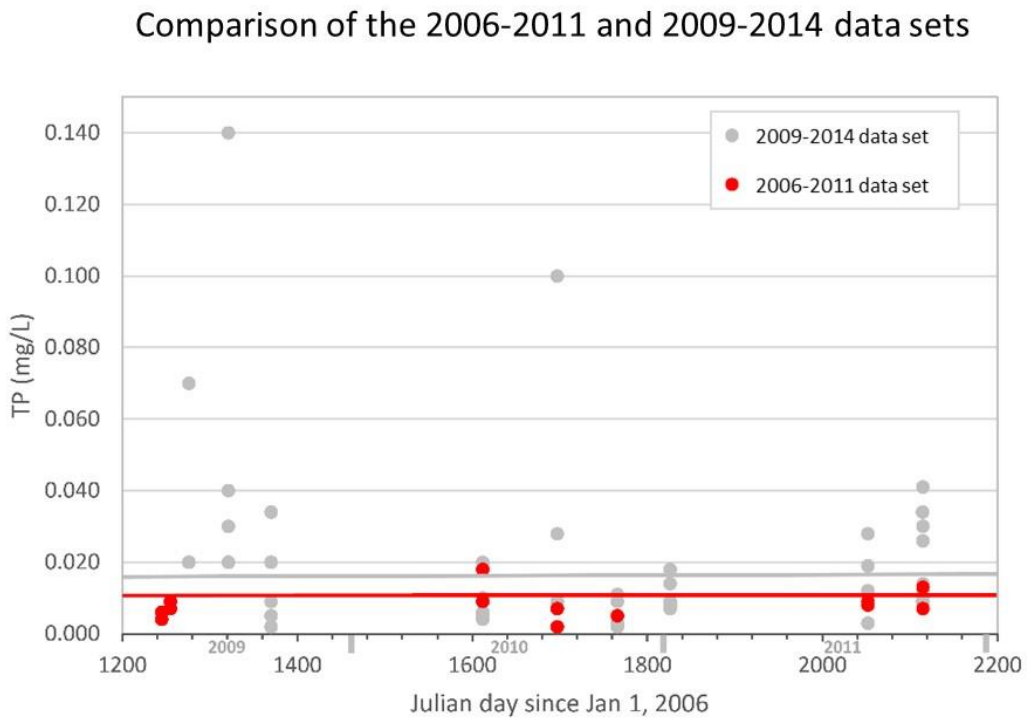


Figure 1.4: Comparison of 2006-2011 and 2009-2014 TP Data Sets

The 2006-2011 data set is shown in red and the 2009-2014 data set is shown in grey. Average values are shown in the solid lines (in red and grey respectively).

The discrepancy may be caused by a difference in the sampling locations. The 2006-2011 data were obtained from the outlet of Kearney and Paper Mill Lakes, unlike the 2009-2014 samples (see discussion Appendix E). Both sampling programs obtained samples at 1 m depth whenever possible and analysed TP using spectrophotometry.

It is important to note that some of the sampling locations had fewer TP measurements. These small sample sizes were further reduced by the removal of abnormally high values. Small sample sizes reduce the statistical power of tests such as linear regressions and ANOVAs. The statistical term 'power' is the probability of rejecting the null hypothesis (hypothesis of no difference) when it is false. A small sample size makes it much harder to detect differences (trends in the case of regression, and differences between groups in the case of ANOVA): the power is low. This is particularly applicable if natural variability is high. Thus, data limitations may be part of the reason why distinct trends over time and patterns over space could not be discerned from the data.

CHAPTER 2 COMPARISON TO MODEL RESULTS

AECOM (2013) investigated the potential effects of future land use changes on the trophic state and phosphorus concentrations in various lakes using two models: a Lake Capacity Model (LCM) and a stormwater management model (SWMM). Four scenarios were tested:

1. Modelling Scenario 1: Existing Conditions.
2. Modelling Scenario 2: Approved and Planned Development Commitments (build-out of Bedford West and Bedford South).
3. Modelling Scenario 3: Scenario 2 plus full build-out of the Highway 102 West Corridor Lands.
4. Modelling Scenario 4: Scenario 3 minus Highway 102 West Corridor Lands within the Conceptual Park.

For Paper Mill Lake, both LCM and SWMM predicted that Modelling Scenario 1 (existing conditions) would not result in any changes in the lake's trophic status. However, Scenarios 2-4 would result in a shift to mesotrophic conditions. Modelling results were the same for Kearney Lake, except that the SWMM model predicted no change in the trophic status for Scenario 2.

CWRS (2004) used a refined version of the Dillon-Rigler (1975) phosphorus loading model to predict that future development would cause TP concentrations to increase by 0.0035 mg/L in Kearney Lake and 0.0063 mg/L in Paper Mill Lake. The observed changes in TP measurements (identified from comparison of the 2006-2011 and 2009-2014 data sets) from oligotrophic to mesotrophic concentrations agree with the modelled predictions of AECOM (2013) and CWRS (2004).

CHAPTER 3 CONCLUSIONS AND RECOMMENDATIONS

The 2006-2011 and 2009-2014 data sets are not directly comparable because different sites were used for sampling; this discrepancy is evident from the period of overlap (2009-2011) between the two sampling programs. Also, sample size is insufficient to properly characterize potential spatial variability in TP measurements. Nonetheless, the following conclusions can be made:

- Measured TP levels in Kearney and Paper Mill Lakes during the 2006-2011 period displayed little variation, with levels within the oligotrophic range (<0.10 mg/L);
- TP does appear to be increasing in Kearney and Paper Mill Lakes. Average TP values from the 2009-2014 data set are higher than those of the 2006-2011 data set. The "early warning" threshold of 0.010 mg/L was exceeded several times in the 2009-2014 data set, with TP levels therefore moving into the mesotrophic range. On some occasions, TP levels in the eutrophic range (>0.35mg/L) were recorded. For some sites there was an indication of a linear increase in TP over time;
- TP levels during the 2009-2014 phase displayed an increased variation in both lakes. In particular, there is an occurrence of abnormally high values in this data set; and
- A pattern of higher variation in TP levels is to be expected in oligotrophic lakes such as Kearney and Paper Mill Lakes as they become initially more enriched. This is particularly the case in lakes that are in transition from oligotrophic to mesotrophic, and where levels are close to the limits of analytical detection.

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APPENDIX A

Data Used

Two data sets were relevant for this study (Table A1). The first data set was the HRM Lakes Water Quality Monitoring Program (2006-2011), which has one sampling location in each of Kearney and Paper Mill Lakes. The only missing data are for summer 2006 and fall 2009 in both locations, in addition to fall 2006 and 2007 in Kearney Lake. AECOM (2013) conducted a watershed study on behalf of HRM entitled "Birch Cove Lakes Watershed Study", which used the HRM Lakes Water Quality Monitoring Program (2006-2011) data set. AECOM supplemented the HRM data by collecting data on four occasions during 2011-2012. Since these additional locations were geographically removed from the Kearney and Paper Mill Lakes, they were not analysed in this study. The AECOM data compilation also includes data collected by the Nova Scotia Department of Environment and the Nova Scotia Department of Fisheries and Aquaculture as a part of the Nova Scotia Lakes Inventory Program (initiated in 1940). The more recent HRM Lakes Water Quality Monitoring Program Data was deemed more representative of pre-development conditions in Bedford West, and was therefore the focus of these analyses. This HRM Lakes Water Quality Monitoring Program Data is referred to as the "2006-2011" data set in this report.

The second data set was the Bedford West Monitoring Program. The data referenced are from Spring 2009 onward, collected 3 times each year. During 2009-2012, nine stations were monitored, and during 2012-2014, an additional 2 stations (11 in total) were monitored. Sampling could not be consistently conducted in Paper Mill Lake in 2012 and 2013 due to safety considerations (AECOM 2013). This data set is referred to as the "2009-2014" data set in this report.

In the spreadsheets obtained by CBCL from HRM, data points below the detection limits were indicated by the "<" sign and the detection limit. Any data point presented as < 0.02 mg/L was removed, since the actual TP concentration could be an order of magnitude less than the detection limit. These data points were found to be overly influential on the regression analyses. It is noted that a detection limit of 0.02 mg/L is not suitable for determining whether a lake is changing from oligotrophic to mesotrophic conditions. Deep water TP could not be used in the regression analysis due to the scarcity of the data (see Appendix H)

In order for the date of sampling to be analysed as a continuous variable (and thus to enable regression analyses), the sampling dates needed to be converted from calendar dates to Julian dates. Although Julian days are usually calculated since January 1, 4713 BCE, for the purpose of this study, January 1, 2006 was selected as a simplified starting date.

Table A1: **TP Data Used in this Report. Abbreviations: HWY 102-01 (Highway 102 Site 1), HWY 102-02 (Highway-102 Site 2), LSD (Lake Shore Drive), LU (Larry Uteck), PM (Paper Mill Lake), KL (Kearney Lake)**

	2006-2011 Data Set			2009-2014 Data Set											
	Julian day	Kearney	Paper Mill	Julian Day	HWY 102-01	HWY 102-02	LSD	LU	PML1	PML2	KL1	KL2	KL3	KL4	KL5
Spring 2006	147	0.006	0.007												
Fall 2006	298	ND	0.006												
Spring 2007	509	0.005	0.005												
Summer 2007	604	0.009	0.004												
Fall 2007	690	ND	0.004												
Spring 2008	872	0.009	0.009												
Summer 2008	978	0.008	0.007												
Fall 2008	1041	0.011	0.010												
Spring 2009	1245	0.004	0.006	1276	0.070	<0.020	ND		<0.020	<0.020	<0.02	0.020	<0.020	<0.020	
Summer 2009	1255	0.007	0.009	1321	0.140	0.040	0.030		<0.020	<0.020	<0.02	0.020	<0.020	<0.020	
Fall 2009	1370	ND	ND	1370	0.020	0.034	0.009		0.002	0.002	<0.002	0.020	0.005	<0.002	
Spring 2010	1612	0.009	0.018	1612	0.006	0.010	0.018		0.018	0.010	0.009	0.020	0.005	0.004	
Summer 2010	1697	0.007	0.002	1697	0.007	0.028	0.100		0.002	0.002	0.007	0.009	<0.002	<0.002	
Fall 2010	1766	0.005		1766	0.011	0.003	0.009		<0.002	<0.002	0.005	0.009	0.003	<0.002	
Spring 2011	1826	ND	ND	1826	0.009	0.009	0.018		0.014	0.009	0.008	0.009	0.008	0.007	
Summer 2011	2052	0.008	0.009	2052	0.012	0.019	0.028		0.011	0.009	0.012	0.008	0.003	0.003	
Fall 2011	2115	0.013	0.007	2115	0.010	0.041	0.014	0.034	0.030	0.007	0.009	0.013	0.012	0.026	0.009
Spring 2012				2313	0.019	0.021	0.022	0.043	0.019	0.025	0.037	0.021	0.019	0.022	0.018
Summer 2012				2419	0.039	0.054	0.063	0.036	ND	ND	0.043	0.059	0.045	0.043	0.040
Fall 2012				2476	0.020	0.030	0.003	0.030	0.030	ND	0.007	0.013	0.007	0.007	0.006
Spring 2013				2692	0.006	0.014	0.007	0.006	0.006	0.006	0.007	0.010	0.006	0.006	0.005
Summer 2013				2784	0.021	0.028	0.015	0.027	0.007	ND	0.011	0.020	0.006	0.024	0.013
Fall 2013				2846	0.022	0.199	0.078	0.046	0.047	0.026	0.008	0.029	0.012	0.016	0.010
Spring 2014				3056	0.013	0.028	0.100	0.260	0.012	0.011	0.011	0.013	0.009	0.022	0.010
Summer 2014				3148	0.038			0.028	0.030	0.026	0.026	0.039	0.023	0.031	0.026
Fall 2014				3222	0.031	0.201	0.031	0.039	0.021	0.018	0.013	0.025	0.148	0.015	0.135

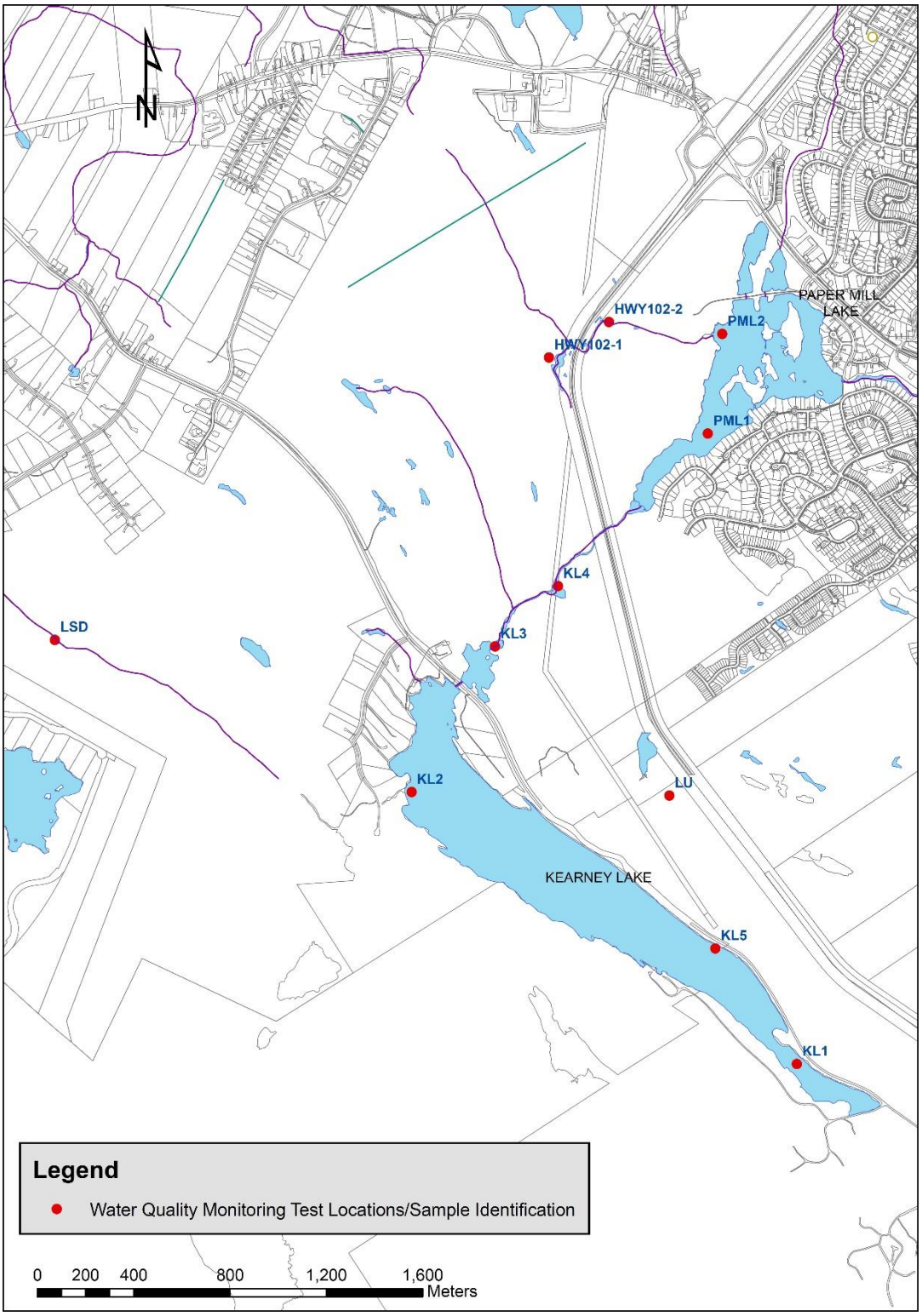

Figure A1: **Map of Sampling Locations for the Bedford West Water Quality Monitoring Program. Map Modified from SNC Lavalin (2014).**

APPENDIX B

Seasonal Patterns in 2006-2011 TP

It was of interest to investigate whether there were any consistent differences in the TP measured in the spring, summer, and fall, since these would have been lost by the annual averaging. TP can display seasonal variation due to the annual cycle of growth and biological production in lakes, and due to the thermal stratification of most deep lakes. For example, the TP measured in spring may differ from the ice-free season average by being influenced by the contribution of TP accumulated under ice and the resuspension of sediment at spring turnover (Dillon et al. 1986). Phosphorus is commonly lost during stratification due to the settling of algal cells (Dillon et al. 1986).

It appears from Figure A1 that there are no patterns in seasonal variation. The absence of seasonal patterns in TP measurements suggests that Kearney and Paper Mill Lakes may not show significant stratification during the ice-free season (perhaps because of their small size). Annual standard deviations of TP were also calculated and plotted, but no patterns could be discerned. This is concordant with the finding by AECOM (2013) that “differences in spring, summer and fall epilimnetic [surface] phosphorus concentrations were negligible”. Furthermore, samples collected 1 m below the thermocline for TP were relatively low and comparable to epilimnetic (surface) TP measurements.

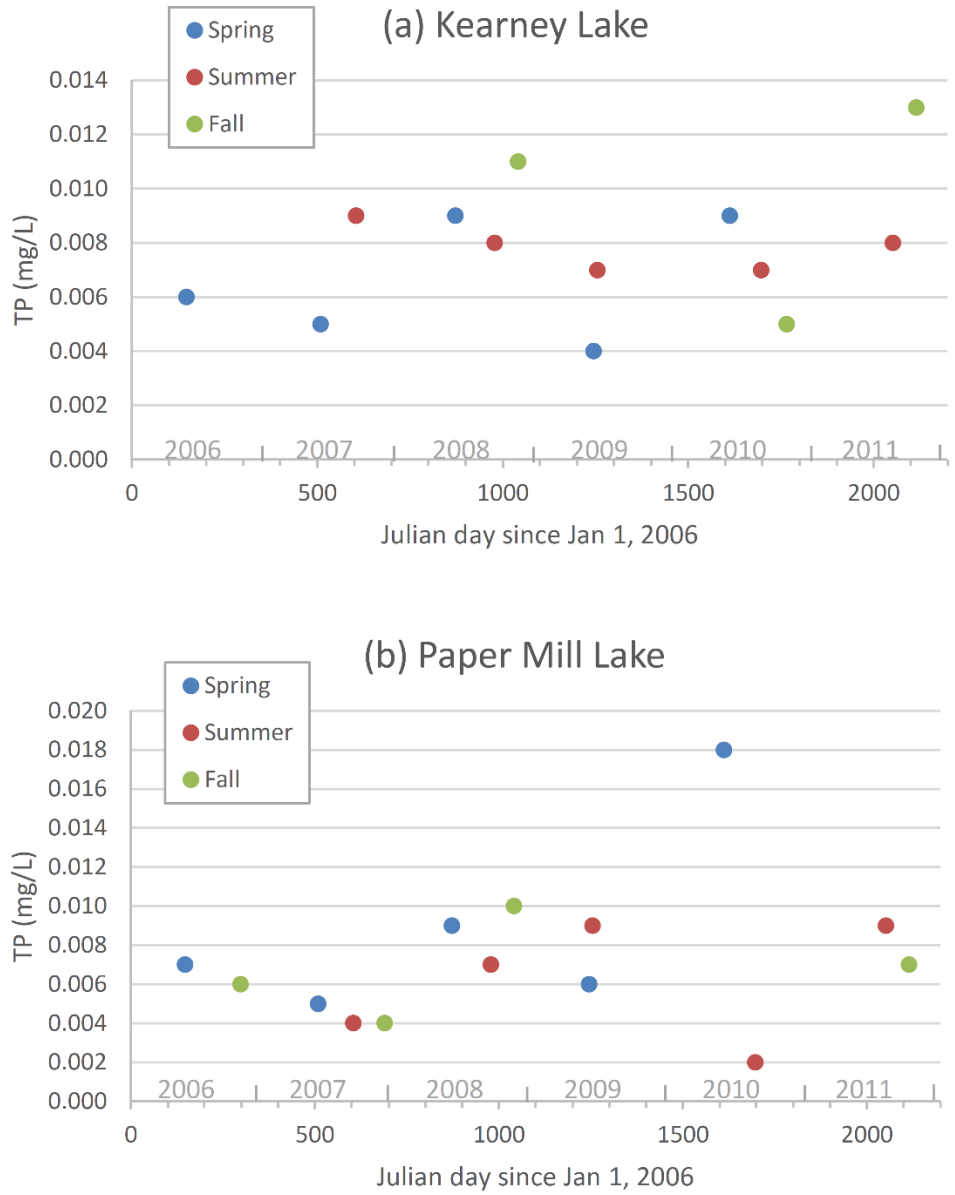

Figure B1: Effect of Seasonal Variation on 2006-2011 TP Measurements

APPENDIX C

Regression Analyses

i. 2006-2011 Data Set: Kearney and Paper Mill Lake

Kearney and Paper Mill Lakes appear to have increasing trends of TP over time (Figure C1). However, using $\alpha = 0.05$, regression analysis reveals that neither lake's trend is statistically significant. This means that the null hypothesis that the measurements were produced by random variability cannot be rejected. The regression was repeated using both geometric means and 3-year running averages, and the same result was obtained. The regression was also performed on all data points (without taking annual means first), but the trend was also insignificant. This regression analysis does not factor the error on the measurements (which would make the trend even more likely to be caused by random variation).

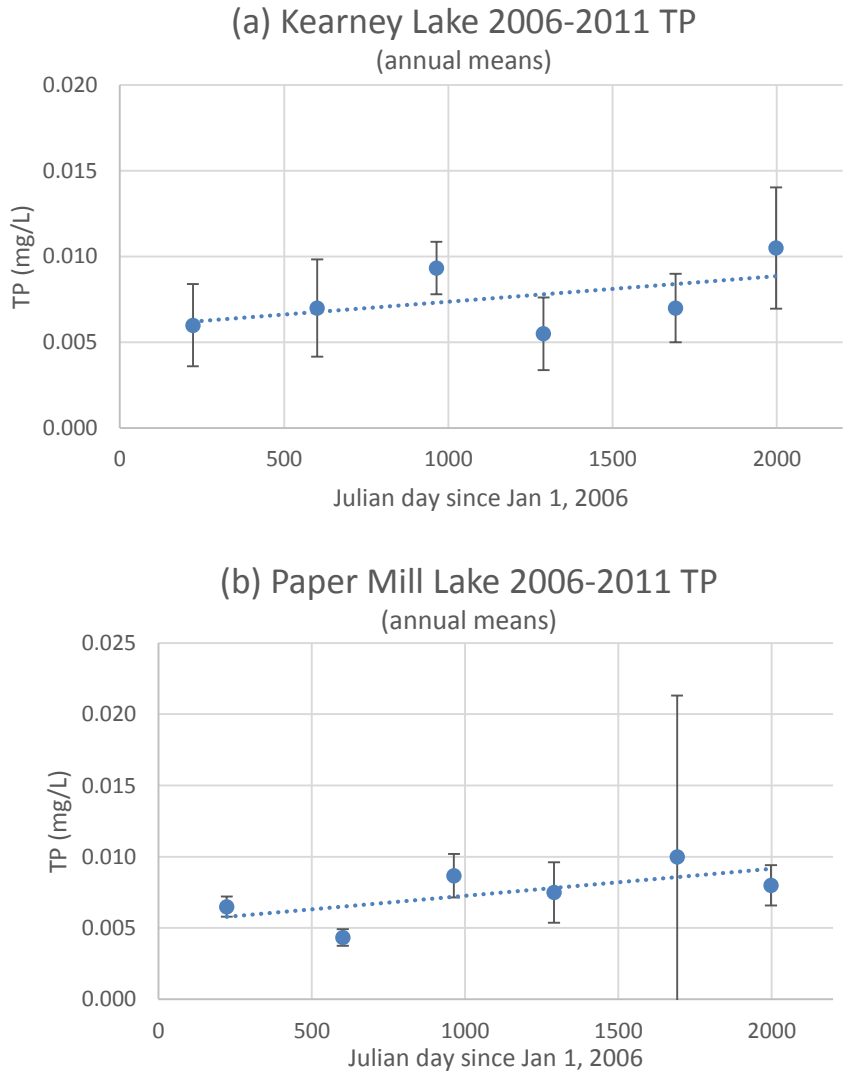

Figure C1: Kearney and Paper Mill Lake 2006-2011 TP Linear Trends. The error on each annual mean is the standard deviation (σ) of the three measurements obtained during that year.

Minitab regression analysis results for Kearney Lake:

```
The regression equation is: Kearney_TP = 0.006276 + 0.000001*Julian_day

S = 0.00251735   R-Sq = 8.6%   R-Sq(adj) = 0.3%

Analysis of Variance:
Source      DF         SS         MS     F      P
Regression   1  0.0000066  0.0000066  1.04  0.329
Error       11  0.0000697  0.0000063
Total       12  0.0000763
```

Minitab regression analysis results for Paper Mill Lake:

```
The regression equation is: Paper Mill_TP = 0.005430 + 0.000002*Julian_day

S = 0.00380081   R-Sq = 8.4%   R-Sq(adj) = 0.7%

Analysis of Variance:
Source      DF         SS         MS     F      P
Regression   1  0.0000159  0.0000159  1.10  0.315
Error       12  0.0001734  0.0000144
Total       13  0.0001892
```

ii. 2009-2014 Data Set: TP Time Series at Each Sampling Location

The 2009-2014 TP time series for each location was tested for trends (α = 0.05), following removal of abnormally high measurements (Appendix E). Samples sizes (n = 8-15) were not large enough to provide a very precise estimate of the strength of the relationship.

Table C1: Linear Regression Results for 2009-2014 Sampling Locations

Sampling Location	Is Linear Regression Significant at α = 0.05?	p	% of the Variation can be Explained by Linear Regression	R
HWY102-01	Yes	0.014	38.44	0.62
HWY102-02	No	0.974		
LSD	No	0.948		
LU	No	0.929		
PML1	No	0.138		
PML2	Yes	0.020	43.07%	0.66
KL1	No	0.074		
KL2	No	0.094		
KL3	Yes	0.036	31.68%	0.56
KL4	No	0.052		
KL5	No	0.383		

APPENDIX D

Analyses of Variance (ANOVAs)

i. 2006-2011 Data Set: Kearney vs. Paper Mill Lake

A 2-sample t-test was performed to identify whether a statistical difference between the two lakes can be discerned. A 2-sample t-test is equivalent to a one-way ANOVA with only 2 groups. Both lakes passed the test for normality (Ryan-Joiner/ Shapiro-Wilk test; p >0.1 for both lakes) as well as for test for homogeneity of variance (Levenes test; p=0.394). This is consistent with visual analysis of the data sets. The t-test was then performed, and the null hypothesis of no difference could not be rejected ($\alpha = 0.05$). The 2006-2011 data sets for both lakes were therefore pooled to create a regional 2006-2011 average (see main text).

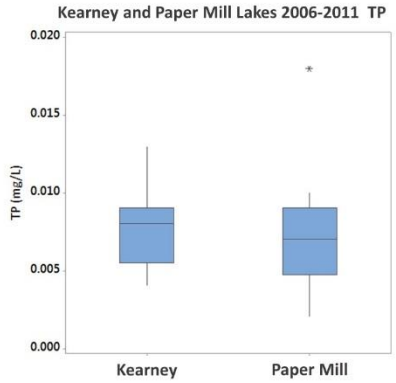

Figure D1: Boxplot of the Kearney and Paper Mill 2006-2011 TP data sets. The boxes show the distribution of values for each sampling location. The horizontal black line in each box is the median TP for that location. The upper and lower limits of the box represent the first and third quartiles. The first quartile splits the lowest 25% of the data, whereas the third quartile splits the upper 75% of the data. The vertical lines (or "whiskers") extend to the minimum and maximum data points (excluding outliers). The asterisk represents an outlier in the Paper Mill Lake data set.

Minitab two-sample equivalence test:

```
Test mean of Paper Mill = mean of Kearney
Equal variances were not assumed for the analysis.

Descriptive Statistics:

Variable    N       Mean      StDev     SE Mean
Kearney    13  0.0077692  0.0025217  0.00069939
Paper Mill  14  0.0073571  0.0038151   0.0010196


Difference: Mean (Kearney) - Mean (Paper Mill)
Difference         SE 95% Lower Bound Lower Limit
0.00041209 0.0012364       -0.0017111            0

Lower bound is not greater than 0. Cannot claim Mean (Kearney) > Mean (Paper
Mill).

Test
```

```
Null hypothesis:          Mean (Kearney) - Mean (Paper Mill) ≤ 0
Alternative hypothesis:   Mean (Kearney) - Mean (Paper Mill) > 0
α level:                  0.05

DF  T-Value  P-Value
22  0.33329    0.371

P-Value > 0.05. Cannot claim Mean (Kearney) > Mean (Paper Mill).
```

ii. 2009-2014 Data Set: Sampling Locations without Statistically Significant Trends

A 1-way ANOVA was performed to test whether a statistical difference between the Kearney 2009-2014 data sets which do not have statistically significant trends (KL1, KL2, KL4, KL5) can be discerned. All Kearney sampling locations passed the test for normality (Ryan-Joiner/ Shapiro-Wilk). However, the test for homogeneity of variance (Levenes) failed. Figure D2 shows that the KL1 sampling location has much lower variance in TP measurements. The consequence of heterogeneity of variance is to reduce the power of the ANOVA (lower likelihood of rejecting the null hypothesis if it is false). An ANOVA was conducted and the null hypothesis was not rejected (α = 0.05). However, heterogeneity of variance could have weakened the test and contributed to the rejection of the null hypothesis.

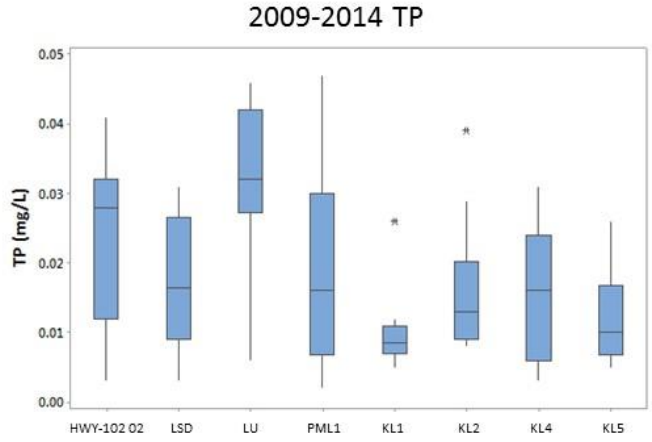

Figure D2: Boxplot for the sampling locations of the 2009-2014 TP data set which show no linear trends. The boxes show the distribution of values for each sampling location. The horizontal black line in each box is the median TP for that location. The upper and lower limits of the box represent the first and third quartiles. The first quartile splits the lowest 25% of the data, whereas the third quartile splits the upper 75% of the data. The vertical lines (or "whiskers") extend to the minimum and maximum data points (excluding outliers). The asterisks represents outliers.

Minitab ANOVA results:

```
Null hypothesis         All means are equal
Alternative hypothesis  At least one mean is different
Significance level      α = 0.05
Rows unused             27

Factor Information:
Factor  Levels  Values
Factor       4  KL1, KL2, KL4, KL5

Analysis of Variance:
Source  DF    Adj SS    Adj MS  F-Value  P-Value
Factor   3  0.000332  0.000111     1.67    0.189
```

```
Error    41  0.002727  0.000067
Total    44  0.003059

Model Summary
        S    R-sq  R-sq(adj)  R-sq(pred)
0.0081548  10.86%      4.34%       0.00%

Means
Factor   N     Mean    StDev         95% CI
KL1      12  0.01000  0.00543  (0.00525, 0.01475)
KL2      14  0.01664  0.00894  (0.01224, 0.02104)
KL4      11  0.01526  0.01014  (0.01030, 0.02023)
KL5       8  0.01212  0.00692  (0.00630, 0.01795)

Pooled StDev = 0.00815481
```

iii. 2009-2014 data set: Event of Summer 2012

Figure D3 shows that Summer 2012 has higher measurements of TP than do other events. It would have been ideal to determine whether this is a statistically distinct event by performing an ANOVA (to determine whether the Summer 2012 TP measurements are part of the same population as TP measurements on other days). However, an ANOVA could not be performed because of the disparate variances (even if the outliers are removed, the variances are still too heterogeneous). Therefore, it was not possible to confirm whether Summer 2012 is a statistically distinct "event".

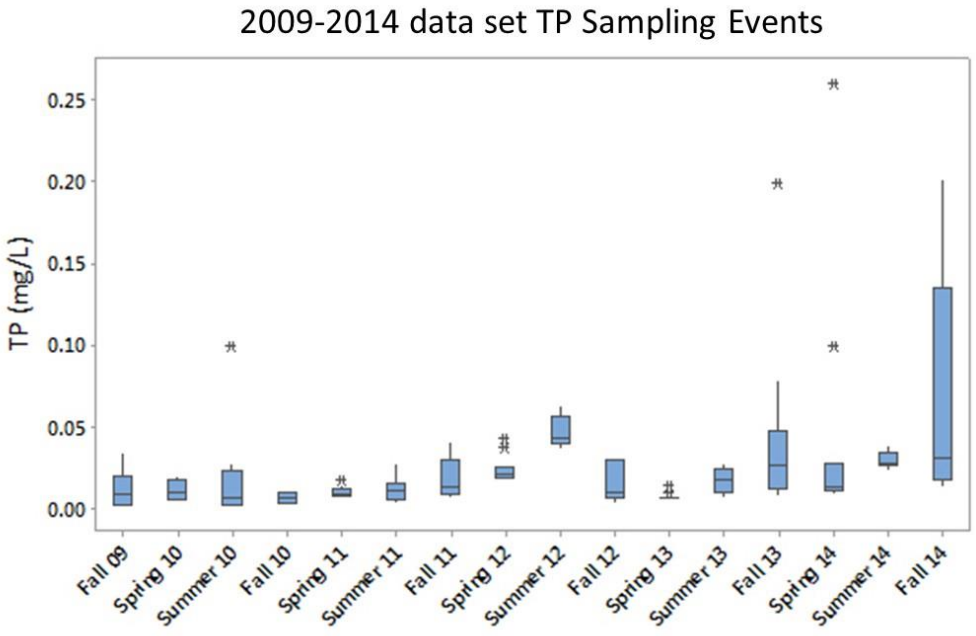

Figure D3: Boxplot of 2009-2014 TP Sampling Events. The horizontal black line in each box is the median TP for that location. The upper and lower limits of the box represent the first and third quartiles. The first quartile splits the lowest 25% of the data, whereas the third quartile splits the upper 75% of the data. The vertical lines (or "whiskers") extend to the minimum and maximum data points (excluding outliers). The asterisk represents an outlier in the Paper Mill Lake data set.

APPENDIX E

Abnormally High TP Measurements

The 2009-2014 data set contains high, isolated measurements, some of which are statistical outliers (> 2 σ from the mean; Figure 2). This means that the oligotrophic-mesotrophic threshold is exceeded more in the 2009-2014 data set than in the 2006-2011 data set (Table E1).

Table E1: Percentage of Measurements that Exceed the Oligotrophic-mesotrophic Threshold of 0.010 mg/L (CCME 2004)

Monitoring Program	Year	Total Number of Measurements	Number of Times that the Threshold is Exceeded	Percentage of Measurements that Exceed the Threshold
HRM Water Quality Monitoring Program	2006-2011	27	3	11
Bedford West Monitoring Plan	2009	12	8	67
	2010	23	6	26
	2011	29	14	48
	2012	30	25	83
	2013	32	18	56
	2014	31	29	94

Some of the hypothesised causes of these abnormally high measurements include:

- **Problematic locations?** Abnormally high measurements do not always occur at the same sampling stations, and therefore are harder to attribute to point sources, edge effects, or other spatial considerations;
- **Problematic sampling days?** During some sampling events, the abnormally high measurements occur only in one location. During other events, they are present in up to 3 locations. Usually, the sampling locations without the abnormality(ies) are not particularly elevated in TP. Therefore, it was not possible to isolate unusual "events" (e.g., caused by problematic weather conditions). AECOM (2013) reports that the high TP concentration measured on October 16, 2011, followed a 21.6 mm rain event on October 14, 2011 and wet weather the first two weeks in October. However, high TP measurements were only observed at one location on this date (Highway-102 Site 02). Summer 2012 was the only sampling date where TP measurements were elevated across several sampling locations, ANOVA could not be used to show that the difference in TP measurements was statistically significant (Appendix C);
- **Problematic seasonal variation?** Although TP is known to vary with seasonal conditions (e.g., snowmelt, low flow conditions in waterways, lake stratification), there is no correspondence in the 2009-2014 data set of abnormally high values with the time of year. This is consistent with the lack of seasonality in the 2006-2011 data set (Appendix B); and
- **Measurement errors?** The abnormally high values consistently fall within a certain range, suggesting that they cannot be data entry errors. Some measurements are > 0.1 mg/L, but others are only > 0.06 mg/L. There is no basis for excluding the abnormal measurements based on measurement error.

Nothing atypical was recorded in field reports, and both sampling programs use spectrophotometry to analyse for TP in the laboratory. Problems can arise during the transfer of sample from the sampling container to the analytical vessel, as bacteria containing phosphorous and algae adhere strongly to the container wall. However, the result is a consistent underestimate of the TP in the sample. Could this have been a problem with the 2006-2011 data set? Although AECOM (2013) report that surface water samples were collected and placed in clean laboratory-supplied jars and stored in a chilled container, it is unclear whether this sampling protocol was used for both data sets.

As mentioned in the main text of this report, there is a discrepancy when the 2006-2011 and 2009-2014 data sets overlap (2009-2011). This may be because the 2006-2011 and 2009-2014 data set TP measurements were not obtained at the same locations. In particular, the 2006-2011 TP measurements for Kearney Lake were obtained from the center of the lake, whereas KL1 is from near the inflow, KL2 is from the northwestern portion of the lake in Black Duck Brook, and KL3 and KL4 are from the outflow of Kearney Lake into Paper Mill Lake. Similarly, the 2006-2011 TP measurements for Paper Mill Lake were obtained from the outlet, whereas the 2009-2014 TP measurements were sampled from the inflow (PML1) and the northwestern basin of the lake (PML2). Nearshore areas or isolated embayments may not display values that are typical of whole lake values even though the lake is considered 'theoretically' to be mixed. In any case, the 2006-2011 and 2009-2014 data sets are difficult to compare because the sampling locations are different.

Note that this discrepancy between the data sets is likely the cause for the apparent shift in variability. A shift to higher TP values, from the 2006-2011 TP, seems to have occurred around late 2011, but since this coincides with a shift in the data set, it cannot be ruled out that the change in variability is due to a change in methodology (e.g., location). It is also possible that the overall range (or variability) of concentrations during recent years has increased compared to during 2006-2011. Increases in TP are accompanied by increases in TP variability, since TP often enters waterbodies at point sources; however, this cannot be determined with the available data.

Table E2: Abnormally high TP Values in the 2009-2014 data set. The Bolded values were excluded from analysis. Measurements > 0.1 mg/L are highlighted in pink.

Sampling Date	HWY 102-01	HWY 102-02	LSD	LU	PML1	PML2	KL1	KL2	KL3	KL4	KL5
29/06/2009	**0.070**	0.020									
13/08/2009	**0.140**	0.040	0.030								
01/10/2009	0.020	0.034	0.009		0.002	0.002		0.020	0.005		
31/05/2010	0.006	0.010	0.018		0.018	0.010	0.009	0.020	0.005	0.004	
24/08/2010	0.007	0.028	**0.100**		0.002	0.002	0.007	0.009	0.002		
01/11/2010	0.011	0.003	0.009				0.005	0.009	0.003		
13/05/2011	0.009	0.009	0.018		0.014	0.009	0.008	0.009	0.008	0.007	
14/08/2011	0.012	0.019	0.028		0.011	0.009	0.012	0.008	0.003	0.003	
16/10/2011	0.010	0.041	0.014	0.034	0.030	0.007	0.009	0.013	0.012	0.026	0.009
01/05/2012	0.019	0.021	0.022	0.043	0.019	0.025	**0.037**	0.021	0.019	0.022	0.018
15/08/2012	0.039	0.054	**0.063**	0.036			**0.043**	**0.059**	**0.045**	0.043	**0.040**
11/10/2012	0.020	0.030	0.003	0.030	0.030		0.007	0.013	0.007	0.007	0.006
15/05/2013	0.006	0.014	0.007	0.006	0.006	0.006	0.007	0.010	0.006	0.006	0.005
15/08/2013	0.021	0.028	0.015	0.027	0.007		0.011	0.020	0.006	0.024	0.013
16/10/2013	0.022	**0.199**	**0.078**	0.046	0.047	0.026	0.008	0.029	0.012	0.016	0.010
14/05/2014	0.013	0.028	**0.100**	**0.260**	0.012	0.011	0.011	0.013	0.009	0.022	0.010
14/08/2014	**0.038**			0.028	0.030	0.026	0.026	0.039	0.023	0.031	0.026
27/10/2014	0.031	**0.201**	0.031	0.039	0.021	0.018	0.013	0.025	**0.148**	0.015	**0.135**

APPENDIX F

Three-year Running Means

Three-year running means were calculated for both 2006-2011 and 2009-2014 data sets and are reported in Table F1 and Figure F1. The error reported in Table F1 is at one standard deviation (1 σ), and represents the variation between all measurements taken during the three-year periods. The averages in Figure F1 are plotted according to the middle year of the three-year average. These results show a TP increase in some locations, as well as an increase in the overall variability of TP, as reported and discussed in the main text.

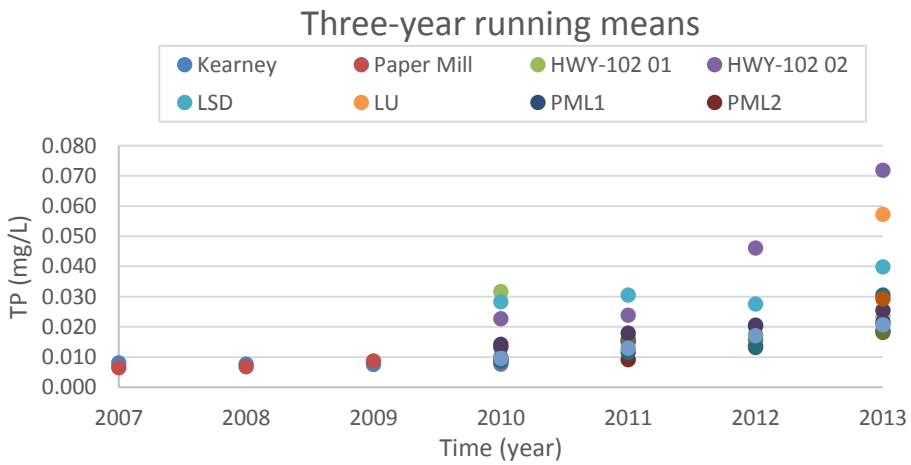

Figure F1: Three-year Running Means

Table F1: Three-year Running Means

	2006-2011 Data Set		2009-2014 Data Set										
	Kearney	Paper Mill	HWY 102-01	HWY 102-02	LSD	LU	PML1	PML2	KL1	KL2	KL3	KL4	KL5
2006-2008	0.008±0.002	0.007 ±0.002											
2007-2009	0.008±0.002	0.007 ±0.002											
2008-2010	0.008±0.002	0.009 ±0.005											
2009-2011	0.008±0.003	0.009 ±0.005	0.032 ±0.045	0.023 ±0.014	0.028 ±0.030		0.013 ±0.010	0.009 ±0.007	0.010 ±0.006	0.014 ±0.006	0.009 ±0.007	0.010 ±0.010	
2010-2012			0.015 ±0.010	0.024 ±0.016	0.031 ±0.031		0.016 ±0.011	0.009 ±0.008	0.015 ±0.014	0.018 ±0.016	0.012 ±0.014	0.013 ±0.014	
2011-2013			0.018 ±0.010	0.046 ±0.059	0.028 ±0.026		0.021 ±0.014	0.014 ±0.009	0.016 ±0.014	0.020 ±0.016	0.013 ±0.013	0.017 ±0.013	
2012-2014			0.023 ±0.011	0.072 ±0.080	0.040 ±0.036	0.057 ±0.077	0.022 ±0.014	0.019 ±0.009	0.018 ±0.014	0.025 ±0.015	0.031 ±0.043	0.021 ±0.010	0.029 ±0.041

APPENDIX G

Comparison of TP to Rainfall

One characteristic of the 2009-2014 data set is the occurrence of occasional, abnormally high TP measurements, which are considerably higher than other measurements. Figure 4 illustrates how these measurements are more prevalent in the post-development data set, and Figure 2 shows how they strongly influence linear trends. The measurements considered to be abnormally high are summarized in Table E1. Refer to Appendix E for a list of their possible causes.

One plausible cause is the flushing of nutrients into the lake during high rainfall events. This possibility was explored by plotting measured TP measurements against Environment Canada daily rainfall data (Figure G.1; rainfall data available until 2012). No correlation between TP and rainfall could be identified.

The abnormally high measurements are not associated with a strong temporal pattern. During some sampling events, the abnormally high measurements occur only in one location. During other events, they are present in up to 3 locations. Usually, the sampling locations without the abnormality(ies) are not particularly elevated in TP. For example, although AECOM (2013) report that the high TP concentration measured on October 16, 2011 followed a 21.6 mm rain event on October 14, 2011 and wet weather the first two weeks in October, high TP measurements were only observed at one location on this date (Highway-102 Site 02). August 15, 2012 was the only sampling date where TP measurements were elevated across several sampling locations (Figure G.1), but ANOVA could not be used to show that the difference in TP measurements was statistically significant (Appendix D).

The discrepancy between the 2006-2011 and 2009-2014 data sets during the period of overlap (2009-2011) may provide clues as to the cause of the abnormally high measurements. During 2009-2011, unusually high measurements occur in the 2009-2014 data set but are generally absent from the 2006-2011 data set (Figure 4). Hence, what is causing the abnormally high measurements is affecting the 2009-2014 data set but not the 2006-2011 data set. For example, differences in location or methodology could be causing the occurrence of abnormally high measurements in one sampling program but not the other (see discussion in Appendix E).

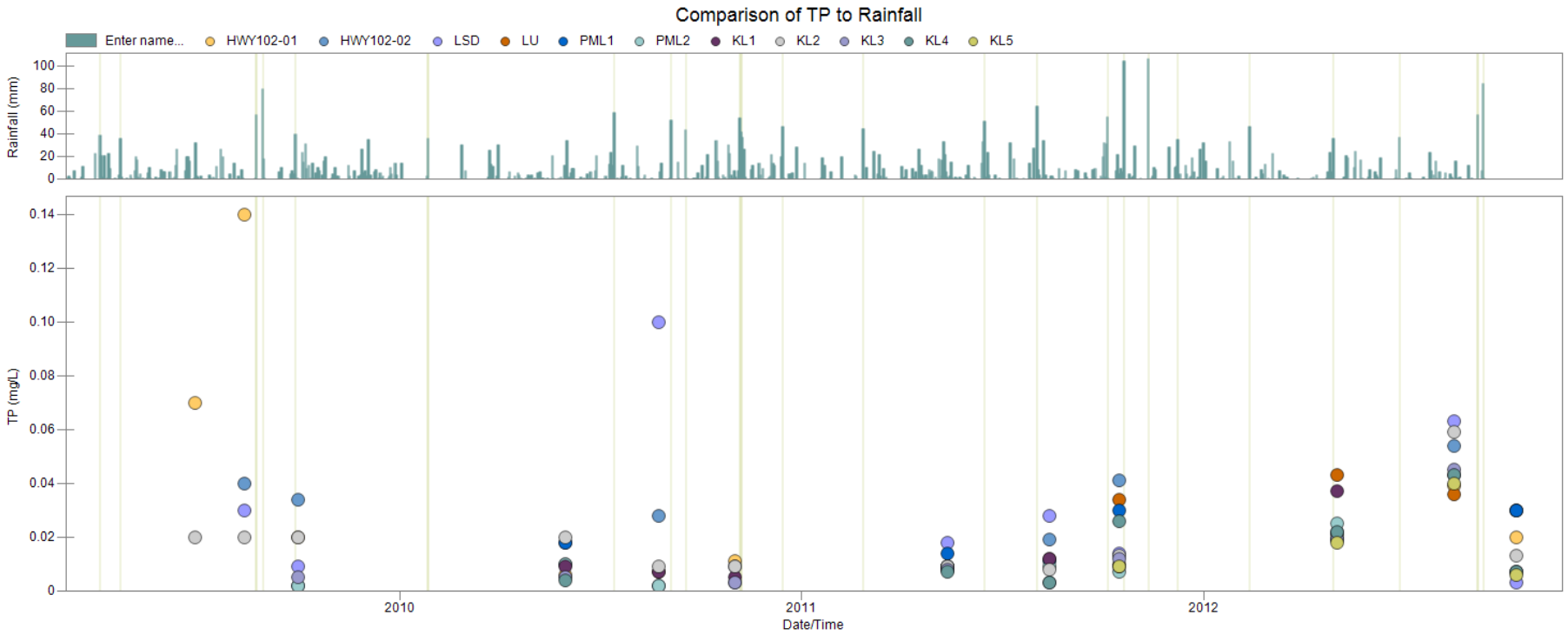

Figure G1: Comparison of TP to Rainfall. Rainfall data obtained from Environment Canada.

APPENDIX H

Considerations for trophic status monitoring

The type and resolution of monitoring should be designed to address the water quality management objectives. This appendix presents several considerations for sampling which must be viewed in light of management objectives. These sampling considerations also require careful evaluation of site-specific characteristics.

i. Sampling locations: management goals

Water quality management objectives have an important bearing on sampling location. Lake-based and inflow-based sampling programs are two approaches which meet different water monitoring objectives. If the objective is to establish the state of the lake and the health of the ecosystem, a lake-based approach is more appropriate. Sampling within the lake shows how the lake is responding to nutrient inputs. However, if the objective is to monitor inflows into the lake, an inflow-based approach is more appropriate. Sampling at the inflows into the lake (e.g., outflows from development areas) will help identify causes of lake enrichment. Whereas sampling within the lake gives an indication of average conditions, sampling at the inflows is more likely to capture spikes in concentrations. The disadvantage of an inflow-based approach is that it does not show how the lake system is responding as a whole (i.e., through increased biological productivity, decreased oxygen levels, etc.).

ii. Sampling locations: long-term consistency

Long-term monitoring enables a better characterization of inter-annual variability. Therefore, it is important for earlier data to be comparable to more recent data. In this report, it was identified that the 2006-2011 and 2009-2014 data set TP measurements were not obtained at the same locations. In particular, the 2006-2011 TP measurements for Paper Mill Lake were obtained from the outlet, whereas the 2009-2014 TP measurements were sampled from the inflow (PML1) and the northwestern basin of the lake (PML2). The 2006-2011 TP measurements for Kearney Lake were obtained from the center of the lake, whereas KL1 is from near the inflow, KL2 is from the northwestern portion of the lake in Black Duck Brook, and KL3 and KL4 are from the outflow of Kearney Lake into Paper Mill Lake.

Figure H2 shows these differences in station location in Kearney Lake in context of the location of outfalls into the lake. For instance, the figure shows that KL2 is at the outlet of Black Duck Brook. It it therefore likely highly influenced by the brook and less representative of average lake conditions. KL1, near the inflow, is in the narrow southeastern portion of the lake. Nearshore areas or isolated embayments may not display values that are typical of whole lake values even though the lake is considered 'theoretically' to be mixed.

For these reasons, the 2006-2011 and 2009-2014 data sets are difficult to compare because the sampling locations are different. It the goal is to compare new measurements to the 2006-2011 data set, it is highly recommended that the original 2006-2011 station locations be re-instated in the future (and supplemented by other station locations).

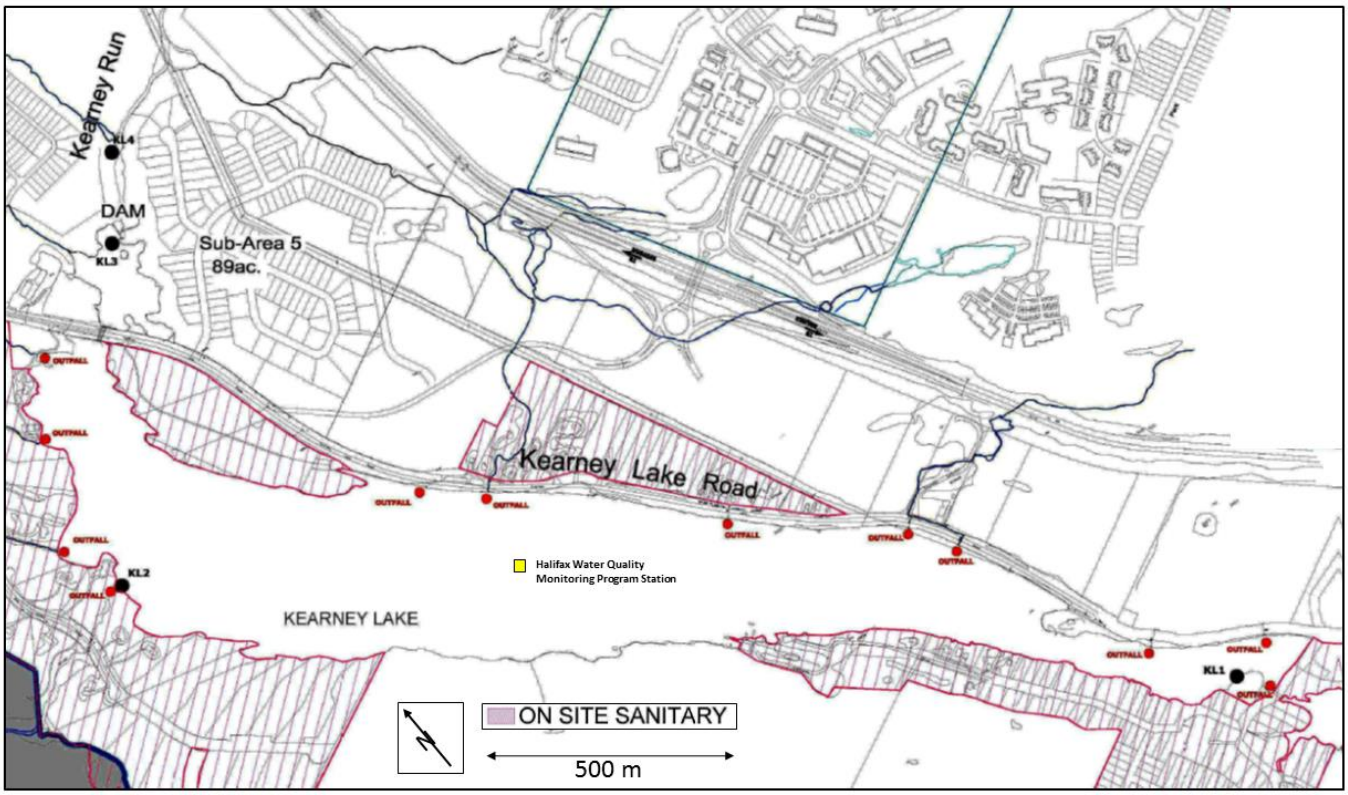

Figure H1: Change of sampling station locations (map modified from Stantec, 2015).

iii. Choosing trophic status indicators

Although TP is the most commonly measured indicator for monitoring changes in trophic status, several other water quality indicators are also habitually used. Indicators of eutrophication can either be biological (measures of biomass) or chemical (measures of compounds essential to the growth and survival of living organisms). For instance, chlorophyll a, bottom water oxygen, and nitrogen are three indicators of eutrophication (Table H1). Chlorophyll a is a measure of phytoplankton production in the lake. The maximum chlorophyll value, which occurs during spring turnover, reflects the biological phytoplankton response of the lake to nutrient enrichment. The deficit in bottom water oxygen shows how the lake's chemistry is responding to biological productivity. Total Nitrogen indicates whether there are inputs of fertilizer or sewage to the lake.

The relevance of different water quality indicators for assessing trends in the eutrophication of a given lake depends on the local characteristics of the site. For example, a lake rich in pondweed, which tends to be abundant in lakes dominated by shallow water, will likely show increases in pondweed when exposed to increases in nutrient loading. Changes in pondweed in such a lake are therefore a good indicator of changes in eutrophication. In contrast, a lake poor in pondweed is likely to show greater changes in the concentration of chlorophyll a, because the nutrients are primarily being used for algae growth.

Since several water quality parameters have been monitored as part of the Halifax Water Quality Monitoring Program, it could be useful to consider them in addition to TP when assessing trends in the eutrophication of Kearney and Paper Mill Lakes. Several indices have been developed to combine different water quality indicators and provide a more comprehensive reflection of the lake system (e.g., Carlson 1977, Cheng and Li 2006). Carlson's index is one of the more commonly used trophic indices and is used by the US Environmental Protection Agency.

Table H1: Trophic status indicators.

Indicator	Sampling Requirements	Usefulness
Maximum chlorophyll	Must be sampled during lake turnover	Reflects biological phytoplankton response of the lake to enrichment in addition to any potential water quality problems.
Mean chlorophyll		Gives an average response of the lake to enrichment.
Bottom water oxygen deficit	Deep sampling	Shows how the lake's chemistry is responding to biological productivity. Gives a measure of the health of the lake as an ecosystem.
Secchi depth	-	Measures the water transparency and is only a very rough indicator of the trophic status of the lake.
Nitrogen (NO_3^- or Total Nitrogen)	-	Gives insight as to whether there are inputs of fertilizer and/or sewage. Provides a measure of an important nutrient for plant growth, in addition to phosphorus.
Conductivity	-	Indicates increased mineralization and only provides limited information about trophic status.

The relevance of different water quality indicators for assessing trends in the eutrophication of a given lake depends on the local characteristics of the site. For example, a lake rich in pondweed, which tends to dominate in lakes with lots of shallow water, will likely show increases in pondweed when exposed to increases in nutrient loading. Changes in pondweed in such a lake are therefore a good indicator of changes in eutrophication. In contrast, a lake poor in pondweed is likely to show greater changes in the concentration of chlorophyll a, because the nutrients are primarily being used for algae growth.

Since several water quality parameters have been monitored as part of the Halifax Water Quality Monitoring Program, it could be useful to consider them in addition to TP when assessing trends in the eutrophication of Kearney and Paper Mill Lakes. Several indices have been developed to combine different water quality indicators and provide a more comprehensive reflection of the lake system (e.g., Carlson 1977, Cheng and Li 2006). Carlson's index is one of the more commonly used trophic indices and is used by the US Environmental Protection Agency.

iv. Sampling at different depths and during different seasons

The stratification cycle of lakes has a major influence on nutrient concentrations. As the sun warms the surface of deeper lakes, the temperature difference between the upper and lower layers increases (Figure H1). The temperature difference eventually creates a physical force (i.e., difference in density) strong enough to resist the mixing force of the wind. The stratification continues until fall when surface waters cool and begin to sink. The surface waters can cut off the exchange of oxygen with the atmosphere from deeper layers, which in turn affects the solubility of nutrients from the bottom sediments (e.g., phosphorus is more soluble in anoxic bottom water).

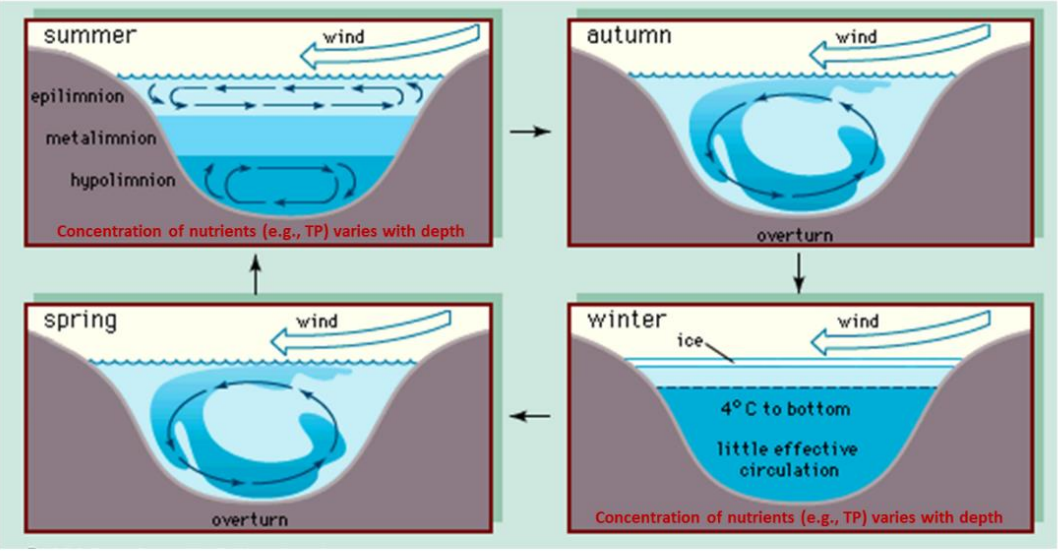

Figure H2: Seasonal lake stratification (image from Encyclopedia Britannica, Inc., 1996).

Therefore, the timing of sampling (i.e., degree of stratification) dictates whether the measurement represents average lake conditions or the conditions of a sublayer. For example, sampling a stratified lake during spring overturning conditions will capture the peak in TP. A good strategy is to focus monitoring efforts at this time, and to track maximum TP concentrations. However, the stability of stratification varies from lake to lake, depending on factors such as the lake's depth, shape, size, orientation to the wind, and inflows and outflows. Thus, Kearney and Paper Mill Lakes may not stratify to the same extent, or at the same time. Hence, the selection of how TP (and other water quality indicators) should be monitored in Kearney and Paper Mill Lakes requires careful consideration of the respective local characteristics of these lakes. Seasonality was investigated for Kearney and Paper Mill Lakes in Appendix B, but no strong patterns were identified (possibly due to insufficient data paired with high variability).

The Halifax Water Quality Monitoring Program (2006-2011) had "deep water TP" sampling stations (Table H2). However, as stated in Stantec's 2012 review of the program, "data from deep water TP stations were not consistently available". Stantec identified this as one of several limitations with the water quality data. Over the course of 2006-2011, only 19% of measurements for deep water TP in Kearney Lake were successful (1 in the spring and 3 in the fall, and therefore none during potentially stratified summer conditions). No deep TP data was recorded for Paper Mill Lake. This may be because both lakes are shallow, Paper Mill Lake being more shallow than Kearney Lake. However, data from other lakes in the sampling program is also sparse. The lack of data may thus be due to challenges associated with obtaining deep measurements. The cause for missing data should be investigated.

Table H2: Kearney and Paper Mill Lakes Deep Phosphorus Data.

		2006			2007			2008			2009			2010			2011		
		Sumer	Fall	Fall	Spring	Sumer	Fall	Spring	Sumer	Fall	Spring	Sumer	Fall	Spring	Sumer	Fall	Spring	Sumer	Fall
Kearney	1m depth	0.006	--	ND	0.005	0.009	ND	0.009	0.008	0.011	0.004	0.007	--	0.009	0.007	0.005	--	0.008	0.013
	deep		--			0.008			0.01			0.003					--	N/A	
Paper Mill	1m depth	0.007	--	0.006	0.005	0.004	0.004	0.009	0.007	0.01	0.006	0.009	--	0.018	0.002	ND	--	0.009	0.007
	deep		--			N/A			--			N/A			--		--	N/A	

v. Sampling resolution

Lastly, water quality management objectives also determine the level of uncertainty that is acceptable. For example, if a given trend must be statistically significant at α=0.05 in order for a action to be taken, then the temporal resolution, spatial resolution, consistency of monitoring, and total time of monitoring must be sufficient to characterize the trend at that level of significance (this will also depend on how much natural and human-induced variability is present).

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Memo

To:	Mr. Cameron Deacoff, Environmental Performance Officer Planning & Development Department Halifax Regional Municipality PO Box 1749 Halifax, NS B3J 3A5	From:	Darek Moreau, Senior Aquatic Scientist Stantec Consulting Ltd. 845 Prospect Street Fredericton, NB E3B 2T7
File:	Phosphorous Levels in the Paper Mill Lake Watershed	Date:	August 12, 2015

Reference: Phosphorous Levels in the Paper Mill Lake Watershed

This memo presents a review conducted by Stantec Consulting Ltd. (Stantec) on past reports and studies associated with the trophic status of the Paper Mill Lake watershed. Specifically, this memo contains the following:

1. A review of past phosphorous (P) modelling results predicting the trophic status of Paper Mill Lake watershed with and without urban development;
2. A commentary on the utilization of past information in the establishment of regional water quality objectives; specifically, the management threshold of 10 µg P/L;
3. A summary of P data from 2009 to 2014 for Paper Mill and Kearney Lakes;
4. A review of the Birch Cove Lakes watershed study;
5. West Bedford Sub-areas 7 and 8 within the watershed; and,
6. Water quality management recommendations.

INTRODUCTION

The Halifax Regional Municipality (HRM) has designated the Bedford West area as one of the primary locations for urban development over the next 25 years. The Bedford West Secondary Planning Strategy (BWSPS) identified 12 sub-areas for potential development and outlined a development agreement process through which negotiations could proceed.

The Paper Mill Lake watershed is the primary watershed in the Bedford West area. Paper Mill Lake is a water body with a surface area of 31.6 ha in a 3,185 ha immediate drainage watershed that receives inflow from the Birch Cove Lakes system. Paper Mill Lake eventually discharges into the Bedford Basin. Kearney Lake is upstream of Paper Mill Lake and has a 61.5 ha surface area and an immediate drainage area of 2,960 ha (Jacques Whitford 2004). West Bedford Sub-area's 7 and 8 is bounded by Belle Street to the South, Larry Uteck Boulevard to the East, Blue Mountian Road to the North and Lake Shore Drive to the West. Black Duck Brook bisects the site, which is the only drainage channel for McQuade Lake into Kearney Lake. AECOM (2012) identified the dominant land uses in the Birch Cove Lakes watershed, which include Kearney Lake and Paper Mill Lake, as forested uplands (53%), residential (12%), roads (8%) and industrial/commercial (4%). Water flows out of Kearney and Paper Mill Lakes are regulated with dam structures owned and operated by Annapolis Group Inc.

Reference: Phosphorous Levels in the Paper Mill Lake Watershed

The BWSPS includes an environmental protection policy, which stipulates goals that include determining the water quality of watersheds impacted by Bedford West area development. Among the water quality concerns is the potential for changes in the trophic status of waterbodies in the area. The Canadian Council of Ministers of the Environment (CCME) defines trophic status in terms of P concentrations in surface water (CCME 2004; Table 1).

Table 1 Total phosphorous trigger ranges for Canadian lakes and rivers. Source: CCME (2004).

Trophic Status	Canadian Trigger Ranges Total phosphorus ($\mu g \cdot L^{-1}$)
Ultra-oligotrophic	< 4
Oligotrophic	4-10
Mesotrophic	10-20
Meso-eutrophic	20-35
Eutrophic	35-100
Hyper-eutrophic	> 100

The Halifax Regional Municipality (HRM) has developed P management objectives for Kearney Lake and Paper Mill Lake related to the relatively low P concentration oligotrophic trophic state (4 – 10 µg P/L) (CCME 2004). The threshold objective accepted by HRM for initiating further management measures within the Paper Mill Lake watershed has been established at 10 µg P/L (Blouin 2007; HRM 2012).

REVIEW OF PAST PHOSPHOROUS MODELLING PREDICTIONS

Prior to the approval of the BWSPS in 2006, two studies were commissioned by Annapolis Group Inc. to investigate total phosphorous (TP) management in the Paper Mill Lake watershed: Scott and Hart (2004) and Jacques Whitford (2004). Scott and Hart (2004) developed a refined Dillon-Rigler P loading model (Dillon and Rigler 1975) estimating P concentration of surface waters in the Paper Mill Lake watershed under existing and predicted development scenarios. The model predicted that the total P (TP) concentrations in both Kearney and Paper Mill Lakes would increase above 10 µg P/L, which would change the status of the lakes from oligotrophic to mesotrophic (CCME 2004). Specifically, TP levels were projected to range between 12.1-16.7 µg P/L, and 16.2-19.7 µg P/L for Kearney and Paper Mill Lakes, respectively (Table 2; Figure 1; Scott and Hart 2004; Jacques Whitford 2004). The lower range of these predictions (12.1 µg P/L for Kearney Lake and 16.2 µg P/L for Paper Mill Lake) was within the mesotrophic classification range and expected regardless of any future development from 2004 onward in the watershed. The upper range of these predictions (16.7 µg P/L for Kearney Lake and 19.7 µg P/L for Paper Mill Lake) were within the upper limits of the mesotrophic range. Moreover, the upper range predictions are considered a 'worst case scenario' as it was assumed that no phosphorous reduction strategies would be implemented for future developments and no remediation of past developments would occur.

Reference: Phosphorous Levels in the Paper Mill Lake Watershed

Table 2 Predicted phosphorous concentrations based on 2004 development (present day), future development serviced by central sewer (future) and modelled on-site wastewater system contributions (on-site ultimate). Source: Scott and Hart (2004).

Lake	Present-Day		Future		Sub-Total		On-Site Ultimate		Total
Kearney	8.5	+	3.6	=	12.1	+	4.6	=	16.7
Papermill	9.9	+	6.3	=	16.2	+	3.5	=	19.7

The main inputs of P within the Paper Mill Lake watershed were identified as existing on-site wastewater systems and surface runoff from urban development (Scott and Hart 2004; Jacques Whitford 2004). On-site wastewater systems in existing developments within the McQuade Lake watershed in 2004 were identified as a major contributor of phosphorous to the Kearney and Paper Mill Lakes watershed (Table 2; Figure 1; Scott and Hart 2004). Further, it was predicted that future developments from 2004 onward that used centralized wastewater treatment infrastructure discharging outside of the Kearney and Paper Mill Lake watersheds, would contribute less P than existing developments.

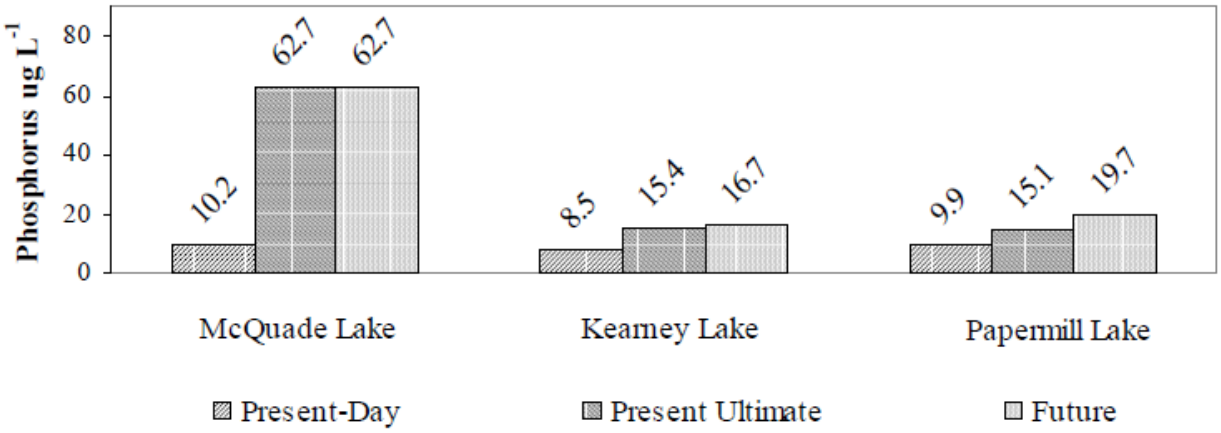


Figure 1 Model predictions of lake phosphorous concentrations from upstream on-site waste water systems. Source: Scott and Hart (2004).

REGIONAL WATER QUALITY OBJECTIVE ESTABLISHMENT

Under the terms of the BWSPS, HRM set out to determine water quality objectives for the Kearney and Paper Mill Lakes in 2007. At the time, it appears as though precedence for setting HRM

management objectives was to maintain the current trophic status of the system in question. In a memo from HRM to the Bedford Watershed Advisory Board (BWAB), Blouin (2007) states,

"*If the management objective for these lakes is to maintain the current trophic status, and based on the likely reference conditions, the phosphorous threshold value would be 10 µg P/L. If the management objective is to prevent progression to meso-eutrophic conditions, then the phosphorous threshold would be 20 µg P/L.*"

Further, in reference to the Scott and Hart (2004) study, Blouin (2007) states,

"*In setting a threshold level, consideration must be given to practical considerations. Progression to mesotrophic conditions seems likely for both Kearney and Paper Mill Lakes with significant further development within their watersheds.*"

Ultimately, HRM presented the following two water quality management options to the BWAB (Blouin 2007):

1. Recommended: Maintain current oligotrophic state of Kearney and Paper Mill Lakes with a TP threshold level of 10 µg P/L; or
2. Alternative: Prevent the progression of Kearney and Paper Mill Lakes to meso-eutrophic trophic state conditions with, and set the TP threshold levels at, the mid-range of the mesotrophic range (15 µg P/L), or at the upper end of the mesotrophic range (20 µg P/L).

Although Blouin (2007) referenced the Scott and Hart (2004) study, which stated that P loads from the existing developments within the Paper Mill Lake watershed were expected to cause mesotrophic state conditions, Blouin recommended the oligotrophic TP threshold level. The BWAB supported the oligotrophic threshold and it was subsequently adopted as the management objective for the Paper Mill Lake watershed (HRM 2012).

The Scott and Hart (2004) study predicted that Kearney and Paper Mill Lakes would change from oligotrophic to mesotrophic state conditions based on the existing land use scenario with no further development. In Stantec's professional opinion without implementing mitigation and management practices to reduce TP loads from existing land uses in the Kearney and Paper Mill Lake watersheds the 10 µg P/L threshold is too stringent to allow for land use changes and development within the watershed. Preventing TP concentrations from entering the meso-eutrophic trophic state condition (20 - 35 µg P/L) would have been a more realistic approach based on the expected changes in water quality for the existing TP concentrations in Kearney and Paper Mill Lakes.

SUMMARY OF TOTAL PHOSPHORUS DATA, 2009-2014

Contracted by HRM, SNC Lavalin Group Inc. conducted water quality monitoring for the West Bedford area between 2009-2014 (SNC Lavalin 2014). The annual and final reports did not include an analysis of the current trophic state of the lake system based on the TP results.

Analysis of this dataset by Stantec determined the trophic states of both Kearney and Paper Mill Lakes are progressing into mesotrophic classification (Table 3). Specifically, the results of the SNC monitoring program include median annual TP values of 10.5 µg P/L and 11 µg P/L for Kearney and

Paper Mill Lakes, respectively. These data indicate that TP concentrations have routinely exceeded the 10 µg P/L threshold in the spring, summer and fall since 2009.

Table 3 Total Phosphorous (TP; µg P/L) Summary Statistics for Kearney and Paper Mill Lakes, 2009-2014

TP Concentration Statistics[a]	Kearney Lake[b]				Paper Mill Lake[c]			
	Spring	Summer	Fall	Combined	Spring	Summer	Fall	Combined
Sample Number	23	23	28	74	10	7	11	28
Minimum	4.0	<2.0[d]	<2.0[d]	<2.0[d]	6.0	<2.0[d]	<2.0[d]	<2.0[d]
Maximum	37.0	2390.0[e]	148.0	2390.0[e]	25.0	30.0	47.0	47.0
Median	9.0	20.0	9.5	10.5	11.5	9.0	18.0	11.0
Mean	12.4	124.4	20.3	50.2	13.0	12.4	17.0	14.4
Standard Deviation	8.0	494.2	35.0	276.8	6.1	11.2	15.3	11.5

Notes:

[a] Data collected for the spring and summer of 2009 were measured to a detection limit of 20 µg P/L of TP. These data were not included in the statistics presented unless they exceeded the detection limit.

[b] Kearney Lake currently has five sampling stations (KL1, KL, KL3, KL4 and KL5). However, the fifth station (KL5) was added in the fall of 2011. Sampling occurs at each station once in the spring, summer and fall. All TP measurements occurred at a depth of 1 m below the surface.

[c] Paper Mill Lake has two sampling stations (PML1 and PML2). Sampling occurs at each station once in the spring, summer and fall. All TP measurements occurred at a depth of 1 m below the surface.

[d] 2.0 µg P/L represents the minimum detection limit of TP. Values below 2.0 µg P/L were entered in as 2.0 µg P/L for the summary statistics presented.

[e] Uncharacteristically large value observed at KL4.

REVIEW OF THE BIRCH COVE LAKES WATERSHED STUDY

In August 2011, HRM contracted AECOM to complete the Birch Cove Lakes Watershed Study (AECOM 2013). A part of the study assessed the existing trophic state and TP concentrations in the Paper Mill Lake watershed. The assessment utilized surface water quality data collected between 2006 and 2011 (AECOM, 2013). Taken in concert with the SNC Lavalin (2014) data summarized above, it appears as though Kearney and Papermill Lakes have experienced a continued progression to a mesotrophic state (Table 3; Table 4).

Reference: Phosphorous Levels in the Paper Mill Lake Watershed

Table 4 Total phosphorous data of selected waterbodies within the Paper Mill Lakes watershed. Source: AECOM (2013).

	Kearney Lake	Paper Mill Lake	Washmill Lake	Black Duck Brook
Number of Samples	37	30	9	9
Min	<2	<2	<2	8
Max	26	30	12	40
Median	7	7	8	9
Mean	7	8	8	15
Standard Deviation	5	6	3	12

In addition to summarizing existing P data, AECOM (2013) used two models to assess the trophic status of lakes within the Paper Mill Lakes watershed for different urban-residential development scenarios, including the implementation of different management practices. The Lake Capacity Model (LCM) estimated TP loading to each lake and predicted the resulting lake responses (Table 5). The other model, the Storm Water Management Model (SWMM), was used to predict future TP concentrations and assess changes in hydrology and sediment loading from development activities (Table 6). The SWMM model did not consider septic system inputs. The SWMM specifically predicted the mitigative contribution of storm water management systems (SWM).

Table 5 Lake Capacity Model predictions under different development scenarios with and without on-site wastewater (OWS) removal. Source: AECOM (2013).

Lake	Measured TP	Scenario 1: Existing Conditions	Scenario 2: Approved and Planned Developments		Scenario 3: Scenario 2 + Hwy. 2 West Corridor Lands		Scenario 4: Scenario 3 Minus Lands within Park Boundary	
			With OWS	OWS Removed	With OWS	OWS Removed	With OWS	OWS Removed
Paper Mill	8	9	16	14	17	15	17	15
Kearney	7	8	12	7	15	10	14	9
McQuade	12	14	78	14	80	14	78	14

Table 6 The Storm Water Management (SWM) Model predictions under different development scenarios with and without storm water management systems. Source: AECOM (2013).

Lake	Measured TP	Scenario 1: Existing Conditions	Scenario 2: Approved and Planned Developments		Scenario 3: Scenario 2 + Hwy. 2 West Corridor Lands		Scenario 4: Scenario 3 Minus Lands within Park Boundary	
			NO SWM	SWM	NO SWM	SWM	NO SWM	SWM
Paper Mill	7	7	10	9	13	10	11	9
Kearney	8	8	9	9	13	10	11	9
McQuade	12	6	6	--	6	--	6	--

Collectively, the AECOM (2013) modelling results suggest that, in absence of costly septic system remediation and storm water management in the area, Kearney and Paper Mill Lakes will become mesotrophic for all development scenarios simulated. Similar to Scott and Hart (2004), septic removal is suggested to have the largest impact on TP concentrations in the watershed.

WEST BEDFORD SUB-AREAS 7 AND 8 WITHIN THE WATERSHED

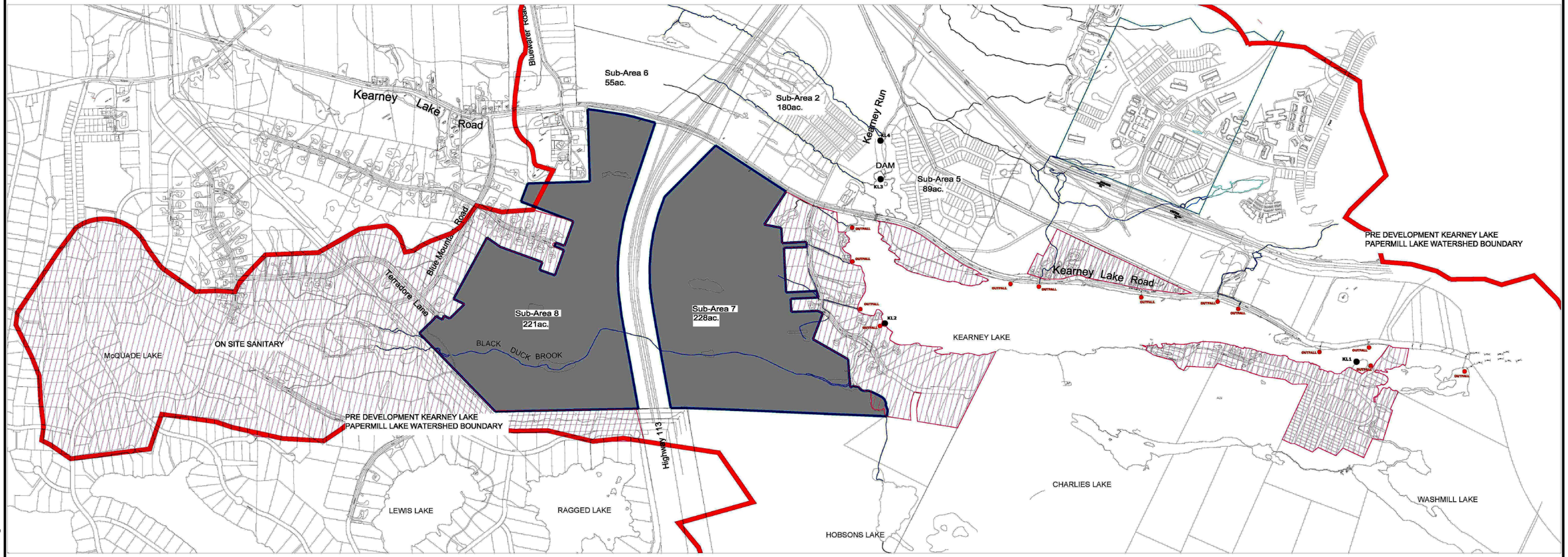
McQuade Lake is a small headwater lake of 7.1 ha with a catchment area of about 57 ha. Black Duck Brook is about 3.5 km long flowing from McQuade Lake and intersects with the outlet stream of Hobsons Lake before discharging into Kearney Lake (Jacques Whitford 2004). Black Duck Brook acts as the only watercourse connecting McQuade Lake to Kearney Lake. This watercourse bisects West Bedford Sub-Area 7 and 8.

The existing developments within the Black Duck Brook watershed, which contains McQuade Lake, contain septic fields and open storm sewer systems (Figure 2). The surrounding residential and industrial land uses do not use any type of storm sewer detention or quality enhancement Best Management Practices (Jacques Whitford 2004). AECOM (2013) calculated a 2006 to 2012 mean observed TP concentration for Black Duck Brook of 15 µg P/L and a median TP concentration of 9 µg P/L, which approaches the mesotrophic trophic state range. AECOM (2013) identified that as Black Duck Brook drains McQuade Lake that the McQuade Lake was also mesotrophic. Moreover, both AECOM (2013) and Scott and Hart (2004) predict increasing TP input into McQuade Lake and Black Duck Brook as a result of the existing sanitation and storm water management systems.

In total, Kearney Lake has approximately 15 direct storm sewer outfalls into the lake; four of which are located on developed lands adjacent to Sub-Areas 7 and 8. These outfalls vary from roadway culverts from existing drainage channels to natural watercourses, including the Black Duck Brook outflow (Figure 2). At 128 Kearney Lake Road Halifax Water has operated a wastewater pump station with an overflow into Kearney Lake. The pump station will be removed in 2015 with the commissioning of a new Kearney Lake Trunk Sewer (AECOM 2013b).

The Master Storm Water Management Plan for West Bedford Sub-areas 7 and 8 was approved by the HRM Regional Watershed Advisory Board on February 12th, 2014 (LVM Maritime Testing 2013). The approximately 182 ha site has not been developed and remains as a forested land use area. An empirical TP loading modeling approach predicted existing annual TP loads from the existing land

uses to be 0.61 kg. Following stormwater management Best Management Practices (BMPs), the Master Storm Water Management Plan for West Bedford Sub-areas 7 and 8 the annual TP load is expected to be 0.60 kg, which equates to be a no net increase in annual TP loading from the developed areas compared to the existing forest land use condition.



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THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

Reference:

WEST BEDFORD HOLDINGS LTD., JACQUES WHITFORD (2004)

CURRENT OUTFALLS AND ONSITE SANITARY (SEPTIC) SYSTEMS THAT MAY INFLUENCE THE WATER QUALITY OF KEARNEY LAKE

Client: CLAYTON DEVELOPMENTS LTD.

Job No.:	121413579
Scale:	N.T.S.
Date:	11-AUG-2015
Dwn. By:	MA
App'd By:	DM

Fig. No.: 2

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CONCLUSIONS AND RECOMMENDATIONS

Previous studies estimating TP concentrations and loading within the Kearney and Paper Mill Lake systems under different development scenarios, including no further development identified the trophic state shifting from oligotrophic to mesotrophic. Based on the information provided to Stantec and used in this review, the trophic status of Kearney and Paper Mill Lakes was in a mesotrophic state for the 2009 to 2014 time period with median ice-free condition TP concentrations of 10.5 and 11 µg P/L, respectively. The recommended threshold TP concentration of 10 µg P/L by HRM (2012) has been exceeded during this time period for both lake systems. Importantly, this progression to mesotrophic conditions has occurred without any post-development P contributions from the West Bedford sub-areas 7 and 8.

As the threshold TP concentration has been exceeded for the Kearney and Paper Mill Lake watersheds, best management practices (BMPs) should be applied to reduce TP loads into the lake systems. Potential options for reducing TP loads from OWS include installing replacements of existing disposal field filter media with high P removal media (e.g., iron-enriched sands), initiating OWS maintenance programs (e.g., scheduled septic tank pumping and inspections), increasing disposal field setbacks from water bodies and removing OWS and switching to municipal sewer connections (Sinclair, 2014). Switching homeowners to municipal sewer connections from OWS would have the largest P reductions of the recommended BMPs by removing the TP source from the watershed. Stormwater runoff P loads from existing residential and commercial developments within the Kearney and Paper Mill Lake watersheds would potentially be reduced by improving infiltration of surface runoff through infiltration basins and trenches, permeable pavements, grassed swales and SWM Ponds and/or stormwater wetlands with high P removal filter media. Combinations of various surface runoff BMPs for different developments and areas potentially would provide the highest P reduction levels.

The alternative threshold TP concentration value of 20 µg P/L recommended by Blouin (2007) would be potentially more appropriate for managing the Kearney and Paper Mill Lake systems based on results of past studies and most recent observed TP concentrations. A revised threshold would allow opportunities to work with existing landowners and developments to initiate BMPs for urban runoff and OWS to reduce existing loads. The revised threshold would also allow for HRM to work with future developments to include BMPs in the design phase to minimize TP loads from urban runoff and OWSs. This threshold level would accommodate the existing mesotrophic conditions and allow the flexibility to balance both developmental commitments and the maintenance of achievable water quality targets.

CLOSURE

This report was undertaken exclusively for the purpose outlined herein and was limited to the scope and purpose specifically expressed in this report and the referenced documents. 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. Any use of this report by a third party, or any reliance on decisions made based upon it, are the responsibility of such third parties. Stantec accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

Reference: Phosphorous Levels in the Paper Mill Lake Watershed

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 used in the preparation of this report were assumed by Stantec to be accurate. Conclusions presented in this report should not be construed as legal advice.

This report represents the best professional judgment of Stantec personnel available at the time of its preparation. Stantec reserves the right to modify the contents of this report, in whole or in part, to reflect any new information that becomes available. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

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