Improving Water Quality in the Shediac and Scoudouc Rivers

Final Report

By:

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Acknowledgements

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Table of Contents

TABLE OF TABLES

TABLE OF FIGURES

1. INTRODUCTION

1.1 Description of the Shediac Bay Watershed Association

The Shediac Bay Watershed Association (SBWA) was founded in 1999 as a result of growing concerns from local community residents over the ecological health of Shediac Bay. In order to establish a long-term water quality-monitoring program, a community-based association was formed.
The Shediac Bay Watershed Association vision and mission statements are as follows:

Our Vision – Communities working together to foster a healthy ecosystem that will sustain the quality of water for future generations.

Our Mission – The SBWA will accomplish its vision through education and community stewardship.

The Board of Directors includes the following members:

Mr. Armand Robichaud, President	Mr. Gerry Dionne	Ms. Petrina Ferris
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The Shediac Bay Watershed Association gratefully receives guidance, donations and in-kind support from various organizations and interest groups. SBWA has a database of stakeholders consisting of business-owners, industry, foresters, farmers, local residents, cottage owners, recreation boaters and swimmers, conservation groups and community organizations within the Shediac Bay Watershed.

1.2 Overview of the Shediac Bay Watershed

The Shediac Bay Watershed covers 420 km^2 of land area and stretches along 36 km of coastline, from Cap Bimet to Cap de Cocagne (Fig. 1). The Shediac Bay Watershed is composed of two major river systems emptying into Shediac Bay: the Shediac River and the Scoudouc River. The Shediac and the Scoudouc Rivers are characterized by dendritic patterns of small tributaries covering a watershed of 201.8 and 143.3 km^2, respectively. The Shediac River is composed of two major water arms. The northern water arm is created by the convergence of the McQuade Brook, the Weisner and the Calhoun Brook. The southern large water arm of the Shediac River is the continuation of the Batemans Brook. Water velocity in both rivers is generally weak due to the gentle regional elevation. The watershed boundaries stretch into both Kent and Westmorland County and crosses into both Shediac and Moncton.

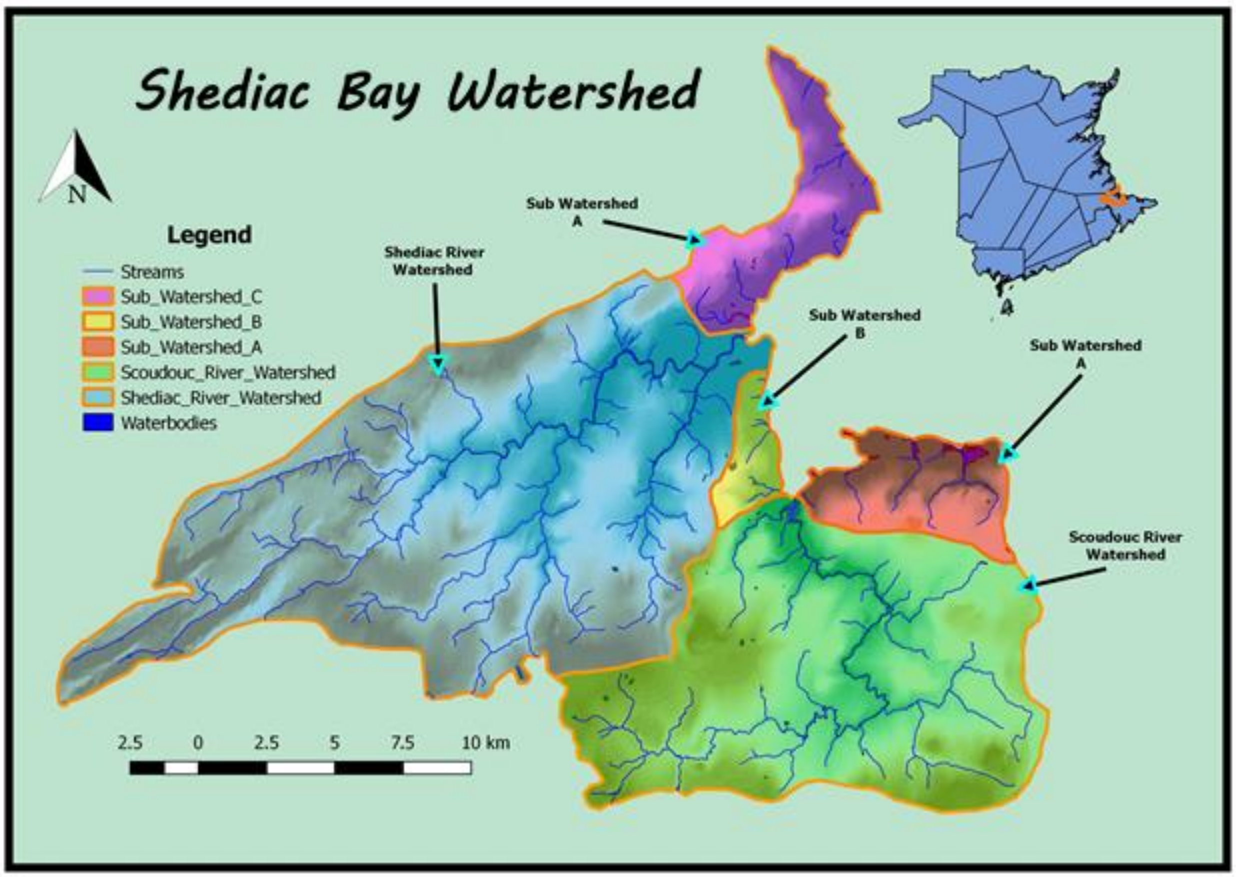


Figure 1: Map of Shediac Bay watershed boundaries and sub-watersheds

1.3 History of the Shediac Bay Watershed's Water Quality Monitoring

Water quality monitoring began in the Shediac Bay Watershed during the water classification program in 1999-2001. Basic physical measurements were then taken at the same 18 sites from 1999 - 2005. In 2007, the sampling was restarted with by analyzing *E. coli*, total coliforms, nitrate-nitrogen and phosphorus, with the help of the Peticodiac Watershed Alliance laboratory. With little available funding, the number of sites had to be cut by half. Only 9 water classification station was monitored until 2015, when new development in Irish Town brought the need to readopt the historical site nearby (ShdA).

The water quality monitoring program is used to support and detect the need for remediation actions and measures to help improve and protect water quality. It is also used to complete detailed sanitary surveys and establish the status of our rivers.

Such monitoring helps determine if changes to the water quality occur and if sections of the stream or river remain suitable for aquatic life. It is of outmost importance to have accurate and continuous data of water parameters for the watershed. This allows for effective management strategies and the creation of strategic plans.

The addition of biomonitoring through the use of macroinvertebrate sampling (CABIN) adds valuable data to our water quality monitoring. By creating a baseline data of macroinvertebrate ecosystems at various sites, we will be able to observe changes in the ecosystem if there are changes in water quality. The use of biomonitoring will help use determine the environmental impacts of climate change, and activities such as urban development, road works, one-time pollution events or long-term pollution impacts.

2. METHODOLOGY

2.1 Water Quality Sampling

Water quality monitoring was conducted once a month from June to October 2017, at 11 new sampling sites in small tributaries along the coast of the Shediac Bay. Water quality sampling was performed using the protocol developed by the New Brunswick Department of Environment. Water samples were not collected after heavy rainfall events.

Basic water quality parameters (DO, temperature, pH, conductivity and salinity) were measured using a new YSI- *Professional Plus* multi-parameter metre. Water samples were sent to *RPC Laboratory* for analysis of *E.coli* and inorganic elements.

The equipment needed to conduct the sampling and collect the habitat data includes; laboratory issued sample bottles, labels, latex or nitrile gloves, clipboard, waterproof paper for field sheets, pencils, waders or rubber boots, GPS, digital camera, YSI (water conditioning metre), metre stick and survey measuring tape.

2.2 Macroinvertebrates

The protocol used to conduct macroinvertebrate survey is the Canadian Aquatic Biomonitoring Network (CABIN) program. SBWA staff are well trained and certified under this national program by Environment and Climate Change Canada. The sampling originally began in 2014 with one single test site in the Weisner Brook (SHM-01). In 2015, the test sites in the Shediac River near Irish Town (SHA-01) and in the McQuade Brook (SHB-01) were added. In 2016, a suitable location was found in the Scoudouc River, and was added as the fourth test site (SCF-01). In 2017, the site in the McQuade Brook was impacted by flooding from a new beaver dam downstream. Therefore, 3 sites were sampled this year; Weisner Brook, Shediac River, and Scoudouc River. All the sampling data from the 4 years of the CABIN sampling have been added to the Environment and Climate Change Canada website. They are added in the study managed by the *Southern Gulf of St-Lawrence Coalition on Sustainability* (Coalition SGSL).

Sampling was done using a 400µm D-frame net (kick-net). Benthos was disturbed during a 3-minute period with the net facing upstream to allow collection of disturbed benthos and invertebrates in the kick-net. The invertebrates were fixed used 10% Formalin buffer, diluted 3:1. All specimens were stored and preserved using 70 % ethanol. Macroinvertebrates were sent to a certified biologist for identification. Water samples were sent to be analyzed at the RPC Laboratory in Moncton, methodology can be found in Appendix A. The data from field sheets, laboratory analysis, and site photos have been entered in the CABIN Data Management website, and the downloaded reports can also be found in Appendix B and C.

2.3 Site Information – Water Classification Stations

The following describes the sample site information for the 10 water classification monitoring stations established in 1999.

Table 1: Water Quality Monitoring Site Information

Site ID	Latitude	Longitude	Elevation (m) Google Earth	Location Description
Shd A	N46°12'13.42"	W64°47'53.01"	83	On route 115, Iristown Rd, in between junction with Ammon Rd and Scotch Settlement Rd, just upstream of culvert
Shd B	N46°13'55.17"	W64°44'35.81"	27	On Scotch Settlement Rd, North of junction with MacLean Crossroad Rd, just upstream of culvert
Shd C	N46°12'33.10"	W64°44'33.24"	27	On Cape Breton Rd, at junction with McLean Crossroad Rd, just upstream from bridge and downstream from tributary
Shd E	N46°14'43.24"	W64°39'52.21"	7	At the covered bridge of the Shediac River, upstream from covered bridge
Shd G	N46°12'53.56"	W64°40'29.74"	13	Weisner Brook, at bridge on St-Philippe Rd, upstream from bridge
Shd H	N46°13'50.95"	W64°37'15.89"	11	Bateman Brook, on Bateman's Mill Road, approx. 10 m upstream from bridge
Scd B	N46° 8'42.74"	W64°33'51.55"	24	Scoudouc River, downstream from bridge on Route 132, next to Wakin' Tail Inn and Dionne road
***Scd E-2**	N46° 9'57.12"	W64°31'58.13"	11	Scoudouc River, at 156 Scoudouc River Rd, take trail between garage and field, access is marked down the field
Scd F	N46°10'50.52"	W64°30'17.78"	13	Scoudouc River, on Pellerin Rd
****Scd H**	N46°12'12.32"	W64°34'55.49"	17	Cornwall Brook, take Harbour view drive, after Chevy Dealership to end of road then first left through field

*ScdE-2 formerly known as ScdE
**ScdH formerly known as ScdG

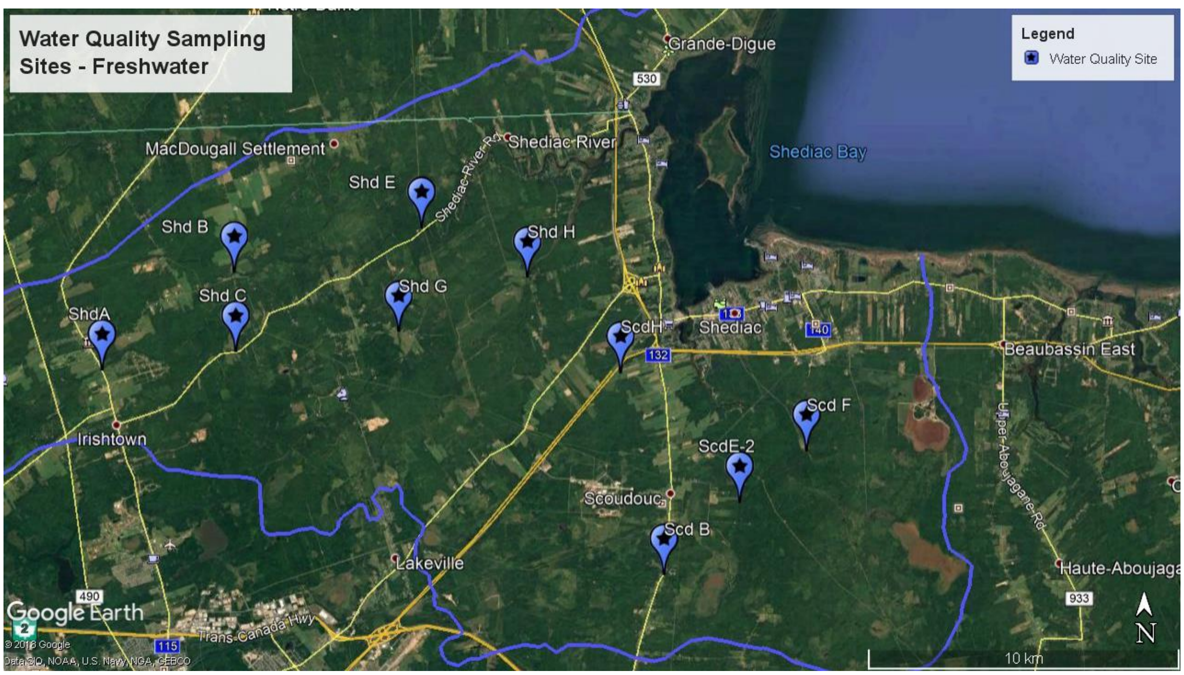


Figure 2: Water Quality Sampling Sites – Water Classification Stations

2.4 Water Quality Parameters

2.4.1 Water Temperature

Water temperature can fluctuate depending on the period of the day and during seasonal changes. Values are influenced by numerous factors such as the tree canopy providing shade, water velocity and depths, presence of cold springs, etc. It is considered that water above 25 or 29 degrees Celsius (°C) tends to be of poor quality because less oxygen can be dissolved. Therefore, water temperature directly influences the dissolved oxygen levels. Water temperatures above 22 °C is said to cause thermal stress to salmonid populations, causing them to stop feeding and search for thermal refugia.

2.4.2 Potential Hydrogen (pH)

The potential hydrogen (pH) level indicates if the water is acidity or basic. It affects how much other substances, such as metals, dissolve in the water. In facts, the pH affects the solubility and toxicity of chemicals and heavy metals in water. Many aquatic organisms are sensitive to changes in pH and may be adversely affected by the pH that is either too high or too low. The pH varies naturally depending on bedrock, climate and vegetation cover, but may also be affected by industrial or other effluents, the exposure of some type of rock (for example during road construction) or drainage from mining operations. According to the CCME's Canadian water quality guidelines, pH should be between 6.5 and 9, as pH levels move away from this range it can stress animal systems and reduce hatching and survival rates in the stream.

2.4.3 Dissolved Oxygen

Dissolved oxygen (DO) represents the concentration of oxygen in gaseous form in the dissolved in the water column. Most of the oxygen in the water comes from the surface atmosphere and is mixed in the water by turbulence and current. The measurement of the concentration of dissolved oxygen in surface waters is essential for measuring changes in water condition and evaluating water quality. It has a direct effect on aquatic life and can be influenced by stream habitat alteration. DO is essential for the survival of fish and many other forms of aquatic life. The temperature limits the amount of oxygen that can dissolve in water, dissolved oxygen varies with temperature and tends to be lower when the water temperature is high. However, temperature is not the only cause of low-oxygen, too many bacteria and an excess amount of biological oxygen demand from the oxygen consumption used by the microorganisms (aerobic bacteria) in the oxidation of organic matter also affects the dissolved oxygen concentrations. According to the Canadian Council of Ministers of the Environment (CCME) Canadian water quality guidelines, the lowest acceptable DO concentration for aquatic life in cold water is 9.5 mg/l for early life stages and 6.5 mg/l for other life stages.

2.4.4 Conductivity

Conductivity is the measurement of the ability of water to pass an electrical current. It is affected by the amount of inorganic dissolved solids (nitrate, chloride, sulfate, sodium, etc.) found in the water. The conductivity level may be influenced by rainwater, agricultural or urban runoff and the geology of the area. There are no set criteria for conductivity levels for water quality, but the US Environmental Protection Agency states that stream conductivity levels ranging between 0.15 and 0.5 mS/cm usually seem to support a good mixed fisheries. Consequently, a higher conductivity level may indicate a higher amount of dissolved material in the water and the presence of contaminants.

2.4.5 Nitrate-Nitrogen

Nitrogen is essential for plant growth, but the presence of excessive amounts in water presents a major pollution problem. Nitrogen compounds may enter water as nitrates or be converted to nitrates from agricultural fertilizers, sewage, industrial and packing house wastes, drainage from livestock feeding areas, farm manures and legumes. The acceptable amount of Nitrate-nitrogen for the protection of aquatic life in freshwater is set at 13 mg/l (NO3).

2.4.6 Phosphates

Phosphates exist in different forms: orthophosphate, metaphosphate and organically compound contains phosphorus. These forms of phosphate occur in living and decomposing plants and animals, as free ions, chemically bonded in aqueous system or mineralized compounds in sediments, soils and rocks. Large amount of phosphate coming from cleaning products (detergents), run off from agricultural and residential fertilizer components can lead to eutrophication. Soil erosion is a major contributor of phosphorus to stream. It is recommended by Environment Canada to apply the Canadian Framework for phosphorus. Trigger ranges are based on the range of phosphorus concentrations in water that define the reference trophic status for a site. Measured phosphorus concentrations should not exceed predefined trigger ranges and should not increase more than 50% over baseline (reference) levels. Total phosphorus levels should be under 0.025 mg/L to maintain its unaffected trophic state.

2.4.7 Escherichia Coli

Escherichia coli (E. coli) is one of many species of bacteria living in the lower intestines of mammals. The presence of E. coli in water is a common indicator of fecal contamination. The acceptable count of E.coli in water is set at 400 MPN/100 ml.

2.4.8 Aluminum

A high concentration of aluminum, due to non-point sources such as rain and snowmelt leaching from watershed soils, can pose a risk to fish in freshwater habitats. For example, ionoregulatory and osmoregulatory complications can develop in fish where aluminum concentrations exceed the CCME recommended guideline of 5 $\mu g \bullet L^{-1}$ when the pH is less than 6.5, and 100 $\mu g \bullet L^{-1}$ when the pH is greater than or equal to 6.5. Furthermore, respiratory problems can occur due to the precipitation of aluminum on the gills, as the positively charged aluminum ion (Al^{3+}) binds with the negatively charged epithelium of the gill.

Many of Atlantic Canada's freshwater habitats naturally contain aluminum concentrations that often exceed CCME guidelines for the protection of aquatic wildlife; however, various fish species are abundant in New Brunswick's rivers. This increased amount of aluminum and other metals is often accompanied by runoff organic carbon due to Atlantic Canada's relatively flat topography and impermeability (Dennis & Clair, 2012). The organic carbon possesses a negatively charged carboxylic functional group, which attracts and binds with the positively charged dissolved aluminum ion. This neutralizes the aluminum ion, rendering it inert and therefore unable to bind with the negatively charged epithelium of the fish gill. Despite this, aluminum ion levels in Atlantic Canada can still reach levels dangerous to fish (Dennis & Clair, 2012).

2.4.9 Iron

Iron enters freshwater habitats in a similar manner to aluminum. Rain and snowmelt leach iron from rocks and watershed soils, and the runoff enters rivers and streams. Anthropogenic sources, such as wastewater and storm water discharges, are also non-point sources of iron in freshwater habitats. A high concentration of iron may cause physiological and/or morphological changes in aquatic plant species (Xing & Liu, 2011).

2.4.10 Copper

Because copper is an essential metal, aquatic organisms have developed methods of copper regulation in the body. Despite this, however, copper toxicity is still possible at high concentrations.

2.4.11 Chloride

Chloride ions (Cl-) in a freshwater habitat are the result of dissolved salts from various sources, and can negatively impact aquatic wildlife sensitive to increased chloride concentration. Although a naturally contributing source of chloride is estuarine backflow from the ocean during rising tide, road salt runoff can also increase chloride concentrations. Since freshwater organisms are generally hyperosmotic, they depend on a low concentration of chloride for proper osmoregulation. A higher concentration of chloride may decrease the ability for freshwater organisms to osmoregulate, affecting endocrine balance, oxygen consumption following long-term exposure, and overall changes in physiological processes. Increased chloride levels may also increase the rigidity in spotted salamander eggs, lowering permeability and in turn, oxygen consumption (Canadian Council of Ministers of the Environment, 2011).

2.4.12 Boron

Boron (B) is ubiquitous in the environment, occurring naturally in the earth's crust and various minerals. Although boron is relatively non-toxic, it may cause sensitivities in some species of fish. Long-term exposure to boron has shown to cause sensitivities in amphibians and water fleas (Canadian Council of Ministers of the Environment, 2009).

2.4.13 Ammonia

Ammonia (NH_3) has many different point and non-point sources, including not only natural causes, but also anthropogenic (e.g. municipal, agricultural, and industrial) causes. Natural sources of ammonia include the decomposition of dead organic matter and waste, gas exchange with the atmosphere, forest fires, animal waste, human breath, discharge of ammonia by biota, and nitrogen fixation processes. Sewage treatment plants and waste burning are examples of municipal sources, whereas intensive farming, ammonia-rich fertilizer spills, and the decomposition of wastes from livestock are examples of agricultural sources. Finally, industrial sources include, but are not limited to, iron and steel mills, fertilizer plants, oil refineries, meat-processing plants, mining, and the fabrication of explosives.

High concentrations of unionized ammonia can result in adverse health effects in freshwater biota. Since unionized ammonia is neutral, it can diffuse across biological membranes more readily than ammonium ion (NH_4^+). A study done by Thurston and Russo (1984) showed that long-term exposure of rainbow trout to ammonia causes pathological lesion formation on the gills and tissue degradation in the kidneys (Canadian Council of Ministers of the Environment, 2010).

2.5 CCME - Canadian Environmental Quality Guidelines (CEQGs)

Table 2: Summary of the CCME Canadian Environmental Quality Guidelines

CCME RECOMMENDED GUIDELINES FOR THE PROTECTION OF AQUATIC LIFE (FRESHWATER) SUMMARY							
Parameter	Condition	Value (µg/L)	Condition	Value (µg/L)	Equation Between Conditions	Notes	
Ag	—	—	Long-Term	0.25	—	The following parameters did not have CCME recommended guidelines for the protection of aquatic life and were therefore omitted from the table:	
Al	pH<6.5	5	pH≥6.5	100	—		
As	—	—	Upper	5	—		
B	Short-Term	29,000	Long-Term	1,500	—		
Cd (Short-Term)	HARD<5.3	0.11	HARD>360	7.7	10^(1.016*LOG(HARD)-1.71)	ALK_T	Mg
Cd (Long-Term)	HARD<17	0.04	HARD>280	0.37	10^(0.83*LOG(HARD)-2.46)	Ba	Mn
Cl	Short-Term	640,000	Long-Term	120,000	—	Be	Na
CLRA	Narrative; refer to CCME website for more information.				—	HCO3	NOX
Cu	HARD<82	2	HARD>180	4	0.2*EXP(0.8545*LN(HARD)-1.465)	Bi	Rb
Fe	—	—	Upper	300	—	Br	pH (Sat)
Mo	—	—	Upper	73	—	Ca	Sb
NH3_T	Table; refer to CCME website for more information.				—	CO3	Sn
NH3_Un	—	—	Long-Term	19	—	Co	SO4
Ni	HARD≤60	25	HARD>180	150	EXP(0.76*LN(HARD)+1.06)	COND	Sr
NO2	—	—	Upper	197	—	Cr	TDS
NO3	Short-Term	550	Long-Term	13	—	F	Te
Pb	HARD≤60	1	HARD>180	7	EXP(1.273*LN(HARD)-4.705)	HARD	TKN
Se	—	—	Upper	1	—	K	TOC
Tl	—	—	Upper	0.8	—	Lang_Ind (20°C)	TURB
U	Short-Term	33	Long-Term	15	—	Li	V
Zn	—	—	Upper	30	—		

2.6 Health Canada - Guidelines for Canadian Recreational Water Quality

Table 3: Guidelines for Health Canada Recreational Water Quality: Summary Table

Guidelines		
Parameter	Considerations	Guideline
Escherichia coli (Primary-Contact Recreation)*	Geometric mean concentration (minimum 5 samples) Single sample maximum concentration	≤ 200 *E. coli* /100 mL ≤ 400 *E. coli* /100 mL
Enterococci (Primary-Contact Recreation)*	Geometric mean concentration (minimum 5 samples) Single sample maximum concentration	≤ 35 Enterococci /100 mL ≤ 70 Enterococci /100 mL

Source : https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-recreational-water-quality-third-edition/guidelines-canadian-recreational-water-quality-third-edition-page-9.html#a41

2.7 CCME Recommendation Guidelines for the Protection of Aquatic Life (Freshwater)

Table 4: CCME Recommendation Guidelines for the Protection of Aquatic Life (Freshwater)

CCME RECOMMENDED GUIDELINES FOR THE PROTECTION OF AQUATIC LIFE (FRESHWATER) SUMMARY OF OTHER PARAMETERS				
Parameter	Description	Value	Units	Notes
Dissolved O_2	Early life stages, cold water biota†	**9.5**	mg/L	† The guidelines for dissolved oxygen are divided into four different categories to accommodate the wide range of tolerances exhibited by freshwater species at various life stages, and with warmer or colder temperature preferences.
	Other life stages, cold water biota	**6.5**	mg/L	
	Early life stages, warm water biota	**6.0**	mg/L	
	Other life stages, warm water biota	5.5	mg/L	
pH	Lower long-term limit	**6.5**	—	‡ There is no limit for the protection of aquatic wildlife for E. coli. The limit of 400 MPN/100mL for the protection of environmental and human health is used instead.
	Upper long-term limit	**9.0**	—	
E. coli	Upper limit‡	**400**	MPN/100mL	

2.8 CCME Guidance framework for Phosphorus

Table 5: CCME Guidance framework for Phosphorus

CCME Guidance Framework for Phosphorus (TP-L)				
Parameter	Description	Value	Units	Notes
TP-L*	Hyper-eutrophic	**> 100**	µg/L	The CCME recommended guidelines for the protection of aquatic wildlife (freshwater) indicate the concentrations of total phosphorus at which each condition may occur. This does not suggest that a stream with hyper-eutrophic levels of total phosphorus will necessarily exhibit hyper-eutrophic properties, for example.
	Eutrophic	**35 – 100**	µg/L	
	Meso-eutrophic	**20 – 35**	µg/L	
	Mesotrophic	10 – 20	µg/L	
	Oligotrophic	4 – 10	µg/L	
	Ultra-oligotrophic	< 4	µg/L	* Total phosphorus level

2.9 Terms and Definitions

All data collected during the sampling season has been organized in 3 distinct tables: water chemistry data and E. coli results, nutrient results, and inorganics results. The following provides the terms and definitions of the acronyms used in the data tables.

Table 6: Terms and definitions for water chemistry and bacterial data tables

TERMS AND DEFINITIONS FOR FIELD DATA COLLECTED BY YSI AND LABORATORY SAMPLES		
Parameter	Unit	Definition
Temp	°C	Air and w ater temperature measured in degrees Celsius
SAL	ppt	Salinity measured in parts per thousand
Dissolved O_2	mg/L, %	Dissolved oxygen measured in milligrams per litre and percentage
E. coli	MPN/100mL	Escherichia coli concentration measured in most probable number per 100 millilitres
ALK_T	mg/L	Total alkalinity measured in milligrams per litre
CLRA	TCU	Water colour measured in true colour units
COND	µS/cm	Conductivity measured in microsiemens per centimetre in the field and laboratory
HARD	mg/L	Hardness measured in milligrams per litre
Lang_Ind (20°C)	—	Langlier index at 20 degrees Celsius
pH	—	Potential of hydrogen measured in the field and laboratory, and the saturation pH at 20 degrees Celsius
Sat (20°C)	—	The pH at w hich w ater at 20 degrees Celsius is saturated w ith calcium carbonate
TDS	mg/L	Total dissolved solids measured in milligrams per litre
TURB	NTU	Water turbidity measured in nephelometric turbidity units

Table 7: Terms and definitions for nutrients data tables

TERMS AND DEFINITIONS FOR NUTRIENT DATA					
Parameter	Unit	Definition	Parameter	Unit	Definition
HCO_3	mg/L	Bicarbonate measured in milligrams per litre	NH_3_Un	µg/L	Ammonia unionized at 20°C measured in micrograms per litre
Br	µg/L	Bromine measured in micrograms per litre	NO_2	µg/L	Nitrite measured in micrograms per litre
Ca	mg/L	Calcium measured in milligrams per litre	NO_3	µg/L	Nitrate measured in micrograms per litre
CO_3	µg/L	Carbonate measured in micrograms per litre	NO_X	µg/L	Nitrite + Nitrate measured in micrograms per litre
Cl	mg/L	Chloride measured in milligrams per litre	SO_4	mg/L	Sulphate measured in milligrams per litre
F	µg/L	Fluoride measured in micrograms per litre	TKN	mg/L	Total Kjedhal nitrogen measured in milligrams per litre
K	mg/L	Potassium measured in milligrams per litre	TN	mg/L	Total nitrogen calculated in milligrams per litre
Mg	mg/L	Magnesium measured in milligrams per litre	TOC	mg/L	Total organic carbon measured in milligrams per litre
Na	mg/L	Sodium measured in milligrams per litre	TP-L	µg/L	Total phosphorus measured in micrograms per litre
NH_3T	µg/L	Total ammonia measured in micrograms per litre	—	—	—

Table 8: Terms and definitions for inorganics data tables

TERMS AND DEFINITIONS FOR HEAVY METAL DATA					
Parameter	Unit	Definition	Parameter	Unit	Definition
Al	µg/L	Aluminum measured in micrograms per litre	Mn	µg/L	Manganese measured in micrograms per litre
As	µg/L	Arsenic measured in micrograms per litre	Mo	µg/L	Molybdenum measured in micrograms per litre
B	µg/L	Boron measured in micrograms per litre	Ni	µg/L	Nickel measured in micrograms per litre
Ba	µg/L	Baryium measured in micrograms per litre	Pb	µg/L	Lead measured in micrograms per litre
Cd	µg/L	Cadmium measured in micrograms per litre	Rb	µg/L	Rubidium measured in micrograms per litre
Co	µg/L	Cobalt measured in micrograms per litre	Sb	µg/L	Antimony measured in micrograms per litre
Cr	µg/L	Chromium measured in micrograms per litre	Sr	µg/L	Strontium measured in micrograms per litre
Cu	µg/L	Copper measured in micrograms per litre	U	µg/L	Uranium measured in micrograms per litre
Fe	µg/L	Iron measured in micrograms per litre	V	µg/L	Vanadium measured in micrograms per litre
Li	µg/L	Lithium measured in micrograms per litre	Zn	µg/L	Zinc measured in micrograms per litre

3. SAMPLING RESULTS

The follow section contains the results on all the data collected during the water quality monitoring for 2017. In recent years, the water samples had been analyzed at the Petitcodiac Watershed Alliance's in-house laboratory. However, the data could not be added to the *Department of Environment and local Government* database, as the lab was not accredited and did not have assigned field numbers. Therefore, all water samples, except for May 2017, are now being analyzed by RPC Laboratory. All water samples as of June was taken with a DELG field number, so that water quality results may be logged with the Province of New Brunswick database.

It was discovered this year that during the water classification sampling years (1999- 2003), the site ScdG was actually located in the higher reaches of the Scoudouc River, just above the Trans-Canada Highway. When the sampling program was restarted in 2005-2006, it is unknown why the station was changed to the Cornwall Brook but the site code remained the same. Therefore, the station ID was changed to ScdH, and all data taken since 2006 under the site ID ScdG will now be compared to the data under the site name ScdH.

A similar mistake was done in 2005-2006 at the site ScdE; in 1999-2003, the sample was taken approximately 1 km downstream of the current day location (Table 1). The original ScdE was located under the transmission power lines crossing the Scoudouc River, and was most likely reached using an ATV. In 2005-2006, it is believed that staff found a different way of getting close to the area by contacting landowners and gaining permission of access. Since it is not in the exact location, a decision was taken to rename the site ScdE-2.

3.1 Shediac River – ShdA

This water quality sampling site is located in the main branch of the Shediac River, off Route 115 in Irish Town. The sample is taken upstream of the culvert. The surrounding land uses includes; residential, agricultural fields, farmlands containing cattle, a mineral extraction pit and a golf course. It is important to note that there is intense development of new residential sectors and roads upstream of the sampling site (off NB-490). There has been a lot of changes in the land uses around this site in the last 2-3 years, therefore 2 maps were added to compare the surrounding areas between 2015 and 2017.

The farm fields on both sides of the river are used for the cultivation of hay and as cattle pastures. Intense tree planting was done with the help of the SBWA back in the early 2000's, to increase the buffer zones. There is cattle fencing along the river, but it does allow the cows to cross the river in one area upstream of the sample site. There is a section of the brook, 100 m in length in the cow crossing area, that only has a thin buffer zone (> 10 m) or none at all in some spots.

A new apple orchard field has been established in 2016-2017 less than 200 metres from the sampling site. Approximately 20 hectares was cleared of vegetation for the orchard and possibly for the cultivation of other products. There are no tree buffers that would prevent drainage from these fields from reaching the river when flowing down to NB-115 and following the ditch to the water. Near the top of the parcel of land, trees were cut and land was tilled up to 15 metres from the river. Depending of land elevations and drainage direction, this area may be high risk for the river.

Next to the orchard is another plot of land (20 ha) that was previously used for agriculture and possibly farm animals, but aerial imagery from 2017 demonstrates evidence of the land being sold, possibly for mineral extraction. The fields have been stripped of its vegetation, house and barn, and is now an empty field that contains a road and a gravel/mineral pit at the top of the field. The pit currently takes up 1 hectares of the parcel. The only trees visible are the ones outside of the property lines. These fields are located approximately 700 metres away from the sample site (distance measured along the road), continued monitoring is important to measure whether these activities will have an impact on the Shediac River.

The golf course is located to the right of the river (looking upstream) approximately 500 m away from the sample site (distance measured along the road), and it is unknown if any runoff from this location reaches the site by the ditch along NB-115. One of the cattle fields separate the river and the golf course. The sampling parameters used in this report may not include the detection of certain chemicals present in pesticides that are commonly used in golf courses. It is unknown whether or not the golf courses use pesticides and/or fertilizers on their lawns.

The water sampling results for the site ShdA, for 2017, meets or exceeds all the recommendations for the survival of freshwater aquatic life based on pH and dissolved oxygen. Total phosphorus levels for long-term eutrophic conditions, according to the *CCME Guidance framework for Phosphorus*, were in the mesotrophic (10 – 20 µg/L) to meso-eutrophic range (20 – 35 µg/L). Results did not exceed any of the recommended CCME water quality guidelines for inorganics (heavy metals and other elements). Bacterial levels did exceed the maximum concentration of E. coli from Health Canada recreational guideline (≥ 400 MPN/100 mL) for the sample taken in June; 980.4 MPN/100 mL, nearly 2.5 times the recommended limit.

Table 9: Water chemistry data and E. coli results for ShdA, 2017

SITE ShdA: FIELD DATA COLLECTED BY YSI AND LAB SAMPLES																			
Date (yy-mm-dd)	Temp (°C)		SAL (ppt)	Dissolved O_2		E. coli (MPN /100mL)	ALK_T (mg/L)	CLRA (TCU)	COND (µS/cm)		HARD (mg/L)	Lang_Ind (20°C)	pH (pH)			TDS (mg/L)		TURB (NTU)
	Air	Water		(mg/L)	%				Field	Lab			Field	Lab	Sat (20°C)	Field	Lab	
17-05-31	14	11.6	0.06	10.79	—	93.4	—	—	100	—	—	—	7.63	—	—	87.10	—	—
17-06-27	23	19.5	0.11	10.65	—	**980.4**	76	16	198	228	98.2	0.29	8.28	8.3	8.0	146.90	123	2.7
17-07-26	24	18.5	0.12	9.35	—	198.9	87	11	223	258	106	0.28	8.15	8.2	7.9	165.10	139	2.3
17-08-30	22	15.9	0.12	11.51	—	25	85	11	204	251	106	0.47	8.12	8.4	7.9	161.00	134	3.9
17-09-27	18	16.6	0.12	11.25	—	110.0	88	12	210	254	109	0.50	8.26	8.4	7.9	163.15	136	4.1
17-10-24	22	12.4	0.14	11.6	—	127	86	14	220	291	118	0.32	7.96	8.2	7.9	187.85	160	1.5

E. coli sample in June measured in CFU/100 mL

Table 10: Nutrient results for ShdA, 2017

SITE ShdA: NUTRIENT DATA																			
Date (yy-mm-dd)	HCO_3 (mg/L)	Br (µg/L)	Ca (mg/L)	CO_3 (µg/L)	Cl (mg/L)	F (µg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	NH_3T (µg/L)	NH_3_Un (µg/L)	NO_2 (µg/L)	NO_3 (µg/L)	NO_X (µg/L)	SO_4 (mg/L)	TKN (mg/L)	TN (mg/L)	TOC (mg/L)	TP-L (µg/L)
17-06-27	74.5	30	30.6	1400	10	150	0.99	5.30	8.40	<50	<1	<50	390	390	19	0.3	0.7	3.8	25
17-07-26	85.6	20	33.4	1280	10.6	160	0.69	5.42	6.64	<50	<1	<50	620	620	26	0.2	0.8	2.0	15
17-08-30	82.9	20	33.5	1960	10	140	0.77	5.37	6.53	<50	<1	<50	560	560	23	0.2	0.8	1.7	31
17-09-27	85.8	20	34.7	2030	10	150	0.87	5.32	6.59	<50	<1	<50	590	590	22	0.2	0.8	1.9	20
17-10-24	84.7	20	37.5	1260	15.1	140	1.00	6.04	8.33	<50	<1	<50	440	440	37	0.2	0.6	2.4	12

Table 11: Inorganics results for ShdA, 2017

SITE ShdA: HEAVY METALS AND OTHER ELEMENTS																					
Date (yy-mm-dd)	Al (µg/L)	As (µg/L)	B (µg/L)	Ba (µg/L)	Cd (µg/L)	Co (µg/L)	Cr (µg/L)	Cu (µg/L)	Fe (µg/L)	Li (µg/L)	Mn (µg/L)	Mo (µg/L)	Ni (µg/L)	Pb (µg/L)	Rb (µg/L)	Sb (µg/L)	Sr (µg/L)	U (µg/L)	U_STL (µg/L)	U_LTL (µg/L)	V (µg/L)	Zn (µg/L)
17-06-27	79	<1	29	53	0.01	0.1	<1	<1	280	2.1	60	1.9	<1	0.2	1.0	<0.1	581	1	33	15	<1	9
17-07-26	50	<1	32	55	<0.01	<0.1	<1	<1	190	2.1	42	2.5	<1	0.1	0.8	<0.1	572	1.7	33	15	<1	1
17-08-30	40	<1	31	47	<0.01	<0.1	<1	<1	190	2.2	40	2.8	<1	0.1	0.8	<0.1	505	1.8	33	15	<1	4
17-09-27	49	<1	34	51	<0.01	<0.1	<1	<1	180	2.4	38	3.3	<1	<0.1	0.9	0.1	516	1.8	33	15	<1	<1
17-10-24	42	<1	39	58	<0.01	<0.1	<1	<1	90	2.8	42	2	<1	<0.1	1.0	<0.1	770	1.6	33	15	<1	7

Figure 3: ShdA site location and surrounding land uses (imagery view of 2015)

Figure 4: ShdA site location and surrounding land uses (imagery view of 2017)

3.2 Shediac River – ShdB

This water quality sampling site is located in the McQuade Brook, off Scotch Settlement Road (175 after turning right off MacLean Crossroad rd). The sample is taken upstream of the culvert. The surrounding land uses includes; residences, agricultural fields, cattle farms, and a mineral extraction pit. It is important to note that beavers have moved back into the area, building a dam inside the culvert of Scotch Settlement rd. The sample protocol was not changed, and measurement and samples were taken in the beaver habitat. In the summer, the stagnant water became warm, low in dissolved oxygen, turbid, had a bad odour.

Most of the drainage providing from agricultural and cattle fields around the site would flow into other small tributaries of the McQuade Brook, converging at a lower points in the system. The gravel/mineral pit is close to the brook approximately 3 km upstream of the sampling site. There is a buffer zone between the riverbanks and the pit, ranging from 20 m to 100 m or more in density. Further upstream, the watercourse crosses transmission power lines. The McQuade Brook is made up of a lot of small tributaries from around McQuade and Scotch Settlement, which are places with several farms and clear cut lots from past logging activity.

The water sampling results for the site ShdB, for 2017, meet the recommendations for the survival of freshwater aquatic life based on pH, however, dissolved oxygen levels fell below 6 mg/L in the months of July, August, and September (5.38 mg/L, 5.71 mg/L and 5.1 mg/L respectively). Total phosphorus levels for long-term eutrophic conditions, according to the *CCME Guidance framework for Phosphorus*, were in the mesotrophic (10 – 20 µg/L) to eutrophic range (20 – 35 µg/L), with one sample exceeding the hyper-eutrophic range (> 100 µg/L). Aluminum exceeds the guidelines in the samples of July (311 µg/L), August (259 µg/L), and October (108 µg/L), when the recommendation is 100 µg/L when the pH value is ≥ 6.5. Iron exceeds the guideline (300 µg/L) in each sample except June. For the samples taken in July, August, September, and October, iron concentrations were 860 µg/L, 950 µg/L, 740 µg/L, and 650 µg/L, respectively. Bacterial levels did not exceed the maximum concentration of E. coli from the Health Canada recreational guideline (≥ 400 MPN/100 mL).

Table 12: Water chemistry data and E. coli results for ShdB, 2017

SITE ShdB: FIELD DATA COLLECTED BY YSI AND LAB SAMPLES																		
Date (yy-mm-dd)	Temp (°C)		SAL (ppt)	Dissolved O_2		E. coli (MPN /100mL)	ALK_T (mg/L)	CLRA (TCU)	COND (µS/cm)		HARD (mg/L)	Lang_Ind (20°C)	pH (pH)			TDS (mg/L)		TURB (NTU)
	Air	Water		(mg/L)	%				Field	Lab			Field	Lab	Sat (20°C)	Field	Lab	
17-05-31	13	10.6	0.04	10.61	—	9.8	—	—	59	—	—	—	7.56	—	—	52.65	—	—
17-06-27	23	16.3	0.08	9.52	—	195.6	63	18	139	169	63.0	-0.67	7.97	7.6	8.3	108.55	88	1.4
17-07-26	24	17.0	0.11	5.38	—	86.7	86	16	193	226	82.8	-0.23	7.74	7.8	8.0	148.85	118	14.5
17-08-30	22	15.0	0.11	5.71	—	73	100	18	188	241	89.1	-0.64	8.02	7.3	7.9	159.25	129	15.0
17-09-27	—	16.5	0.12	5.1	—	214.3	100	20	215	260	92.5	-0.52	7.52	7.4	7.9	167.05	142	5.6
17-10-24	—	9.1	0.12	9.95	—	42	96	20	179	259	88.9	-0.36	7.73	7.6	8.0	167.05	142	7.9

E. coli sample in June measured in CFU/100mL

Table 13: Nutrient results for ShdB, 2017

SITE ShdB: NUTRIENT DATA																		
Date (yy-mm-dd)	HCO_3 (mg/L)	Br (µg/L)	Ca (mg/L)	CO_3 (µg/L)	Cl (mg/L)	F (µg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	NH_3T (µg/L)	NH_3_Un (µg/L)	NO_2 (µg/L)	NO_3 (µg/L)	NO_X (µg/L)	SO_4 (mg/L)	TKN (mg/L)	TN (mg/L)	TOC (mg/L)	TP-L (µg/L)
17-06-27	62.7	40	18.7	235	12	150	1.02	3.95	9.47	<50	<1	<50	120	120	3	0.2	0.3	4.0	11
17-07-26	85.5	60	24.8	507	12.9	170	1.15	5.06	11.7	70	2	<50	70	70	7	0.5	0.6	3.2	109
17-08-30	99.8	60	26.8	187	11.3	130	0.33	5.38	12.6	100	<1	<50	<50	<50	8	0.5	0.5	3.0	92
17-09-27	99.8	60	28.1	236	17	150	1.35	5.43	15.4	<50	<1	<50	<50	<50	12	0.3	0.3	3.5	39
17-10-24	95.6	50	26.7	358	17.9	100	1.08	5.39	15.5	<50	<1	<50	<50	<50	15	0.2	0.2	3.0	36

Table 14: Inorganics results for ShdB, 2017

SITE ShdB: HEAVY METALS AND OTHER ELEMENTS																						
Date (yy-mm-dd)	Al (µg/L)	As (µg/L)	B (µg/L)	Ba (µg/L)	Cd (µg/L)	Co (µg/L)	Cr (µg/L)	Cu (µg/L)	Fe (µg/L)	Li (µg/L)	Mn (µg/L)	Mo (µg/L)	Ni (µg/L)	Pb (µg/L)	Rb (µg/L)	Sb (µg/L)	Sr (µg/L)	U (µg/L)	U_STL (µg/L)	U_LTL (µg/L)	V (µg/L)	Zn (µg/L)
17-06-27	37	<1	11	69	<0.01	0.1	<1	<1	280	1.0	180	0.7	<1	<0.1	1.0	<0.1	109	0.2	33	15	<1	3
17-07-26	311	2	12	127	0.04	0.9	<1	1	860	0.9	1230	0.7	<1	1.7	1.7	<0.1	160	0.4	33	15	1	10
17-08-30	259	2	12	125	0.03	0.8	<1	<1	950	0.7	1300	0.8	<1	1.4	1.8	<0.1	171	0.4	33	15	1	9
17-09-27	93	2	14	119	0.01	0.5	<1	<1	740	0.8	1220	1	<1	0.5	1.7	<0.1	188	0.4	33	15	<1	8
17-10-24	108	1	13	100	0.01	0.4	<1	<1	650	0.9	618	0.6	<1	0.5	1.1	<0.1	185	0.4	33	15	<1	9

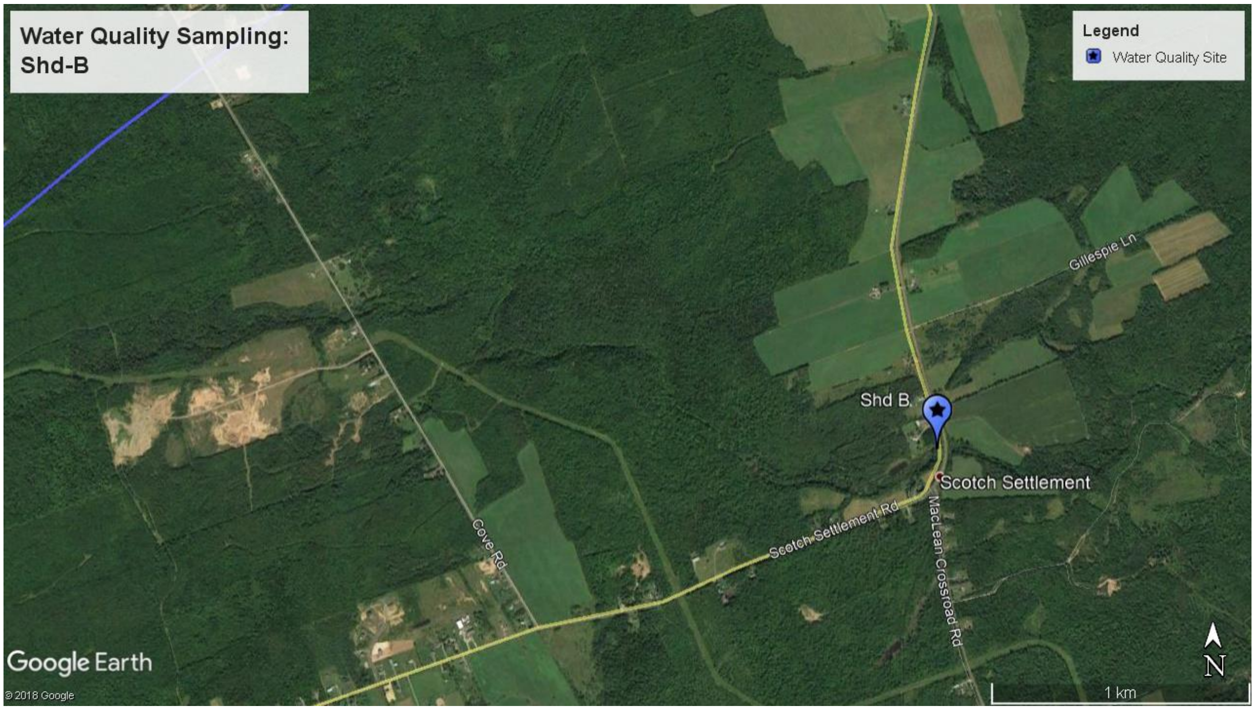


Figure 5: ShdB site location and surrounding land uses

3.3 Shediac River - ShdC

This water quality sampling site is located in the main branch of the Shediac River, at the bridge of MacLean Crossroad rd. (at the junction with Shediac River Road/Cape Breton Road). The sample is taken upstream of the bridge. The surrounding land uses is mainly residences and forested land. This site is located over 5.3 km downstream of the site ShdA, and there is little more than houses and cabins in regards to land use in between those two sites. From aerial imagery, there is evidence of an ATV crossing without a bridge approx. 1.6 km downstream of the site.

The water sampling results for the site ShdC, for 2017, meets or exceeds all the recommendations for the survival of freshwater aquatic life based on pH and dissolved oxygen. Total phosphorus levels for long-term eutrophic conditions, according to the CCME Guidance framework for Phosphorus, were in the oligotrophic (4 – 10 µg/L) to mesotrophic range (10 – 20 µg/L). Results did not exceed any of the recommended CCME water quality guidelines for inorganics (heavy metals and other elements). Bacterial levels did not exceed the maximum concentration of E. coli from the Health Canada recreational guideline (≥ 400 MPN/100 mL).

Table 15: Water chemistry data and E. coli results for ShdC, 2017

SITE ShdC: FIELD DATA COLLECTED BY YSI AND LAB SAMPLES																		
Date (yy-mm-dd)	Temp (°C)		SAL (ppt)	Dissolved O_2		E. coli (MPN /100mL)	ALK_T (mg/L)	CLRA (TCU)	COND (µS/cm)		HARD (mg/L)	Lang_Ind (20°C)	pH (pH)			TDS (mg/L)		TURB (NTU)
	Air	Water		(mg/L)	%				Field	Lab			Field	Lab	Sat (20°C)	Field	Lab	
17-05-31	13	11.2	0.06	11.55	—	64.4	—	—	89	—	—	—	7.49	—	—	79.30	—	—
17-06-27	23	17.6	0.10	11.91	—	24.1	68	15	184	206	78.6	0.04	8.13	8.2	8.2	139.10	108	0.6
17-07-26	23	17.4	0.12	11.43	—	88.2	81	10	213	251	95.7	0.19	8.12	8.2	8.0	162.50	129	0.9
17-08-30	20	15.4	0.12	12.75	—	38	97	8	207	259	109	0.71	8.42	8.6	7.9	155.60	143	1.0
17-09-27	—	16.0	0.12	10.52	—	33.1	96	8	216	267	110	0.32	7.96	8.2	7.9	169.65	143	1.2
17-10-24	20	12.5	0.12	11.41	—	13	94	15	197	268	106	0.10	7.70	8.0	7.9	168.35	146	0.7

E. coli sample in June measured in CFU/100 mL

Table 16: Nutrient results for ShdC, 2017

SITE ShdC: NUTRIENT DATA																			
Date (yy-mm-dd)	HCO_3 (mg/L)	Br (µg/L)	Ca (mg/L)	CO_3 (µg/L)	Cl (mg/L)	F (µg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	NH_3T (µg/L)	NH_3_Un (µg/L)	NO_2 (µg/L)	NO_3 (µg/L)	NO_X (µg/L)	SO_4 (mg/L)	TKN (mg/L)	TN (mg/L)	TOC (mg/L)	TP-L (µg/L)
17-06-27	66.9	30	23.8	997	12.9	140	1.21	4.65	10.0	<50	<1	<50	<50	<50	14	0.2	0.2	3.6	9
17-07-26	79.7	20	23.7	1190	13.4	120	1.19	5.83	9.65	<50	<1	<50	130	130	20	0.2	0.3	1.9	9
17-08-30	93.3	20	32.9	3490	11.1	140	1.22	6.52	8.34	<50	<1	<50	90	90	23	0.1	<0.2	1.4	6
17-09-27	94.5	20	33.5	1410	12	150	1.31	6.39	9.08	<50	<1	<50	160	160	21	0.2	0.4	1.8	9
17-10-24	93.1	20	31.9	875	14.9	120	1.22	6.43	9.18	<50	<1	<50	<50	<50	25	0.1	<0.2	2.1	13

Table 17: Inorganics results for ShdC, 2017

SITE ShdC: HEAVY METALS AND OTHER ELEMENTS																						
Date (yy-mm-dd)	Al (µg/L)	As (µg/L)	B (µg/L)	Ba (µg/L)	Cd (µg/L)	Co (µg/L)	Cr (µg/L)	Cu (µg/L)	Fe (µg/L)	Li (µg/L)	Mn (µg/L)	Mo (µg/L)	Ni (µg/L)	Pb (µg/L)	Rb (µg/L)	Sb (µg/L)	Sr (µg/L)	U (µg/L)	U_STL (µg/L)	U_LTL (µg/L)	V (µg/L)	Zn (µg/L)
17-06-27	26	<1	15	64	<0.01	<0.1	<1	<1	100	1.1	31	0.8	<1	<0.1	1.0	<0.1	249	0.5	33	15	<1	3
17-07-26	27	<1	20	78	<0.01	<0.1	<1	<1	60	1.0	41	1.2	<1	0.1	1.0	<0.1	642	0.9	33	15	<1	1
17-08-30	24	<1	21	73	<0.01	<0.1	<1	<1	50	1.1	47	1.5	<1	<0.1	0.9	<0.1	382	1	33	15	<1	4
17-09-27	30	<1	25	79	<0.01	<0.1	<1	<1	60	1.3	40	1.5	<1	<0.1	1.1	<0.1	403	1	33	15	<1	2
17-10-24	18	<1	17	83	<0.01	<0.1	<1	<1	50	1.2	47	0.8	<1	<0.1	0.9	<0.1	374	0.9	33	15	<1	4

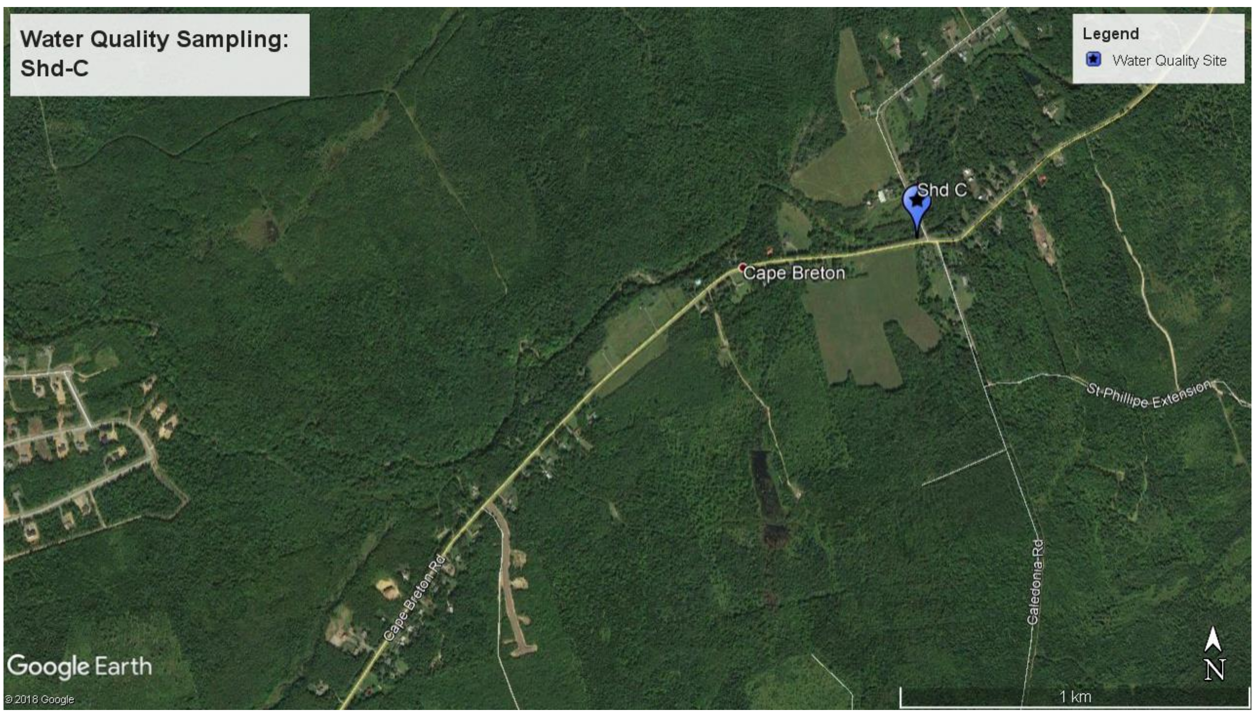


Figure 6: ShdC site location and surrounding land uses

3.4 Shediac River – ShdE

This water quality sampling site is located in the main branch of the Shediac River, at the old covered bridge. The sample is taken upstream of the covered bridge. The surrounding land uses is mainly residences, forested land, ATV trails, and transmission power lines crossing overhead of the site. There are some clear-cut lots along the river further upstream, and some buffer zone in these areas may be less than 10-15 m.

The water sampling results for the site ShdE, for 2017, meets or exceeds all the recommendations for the survival of freshwater aquatic life based on pH and dissolved oxygen. Total phosphorus levels for long-term eutrophic conditions, according to the *CCME Guidance framework for Phosphorus*, were in the oligotrophic (4 – 10 µg/L) to mesotrophic range (10 – 20 µg/L). Results did not exceed any of the recommended CCME water quality guidelines for inorganics (heavy metals and other elements). Bacterial levels did not exceed the maximum concentration of E. coli from the Health Canada recreational guideline (≥ 400 MPN/100 mL).

Table 18: Water chemistry data and E. coli results for ShdE, 2017

SITE ShdE: FIELD DATA COLLECTED BY YSI AND LAB SAMPLES																			
Date (yy-mm-dd)	Temp (°C)		SAL (ppt)	Dissolved O_2		E. coli (MPN /100mL)	ALK_T (mg/L)	CLRA (TCU)	COND (µS/cm)		HARD (mg/L)	Lang_Ind (20°C)	pH (pH)			TDS (mg/L)		TURB (NTU)
	Air	Water		(mg/L)	%				Field	Lab			Field	Lab	Sat (20°C)	Field	Lab	
17-05-31	11	11.1	0.04	11.15	—	62.4	—	—	63	—	—	—	7.40	—	—	55.90	—	—
17-06-27	24	18.3	0.08	10.6	—	19.9	61	19	145	168	63.9	-0.37	7.82	7.9	8.3	107.90	87	0.8
17-07-26	22	18.3	0.10	9.41	—	13.2	77	12	186	215	79.0	-0.09	7.83	8.0	8.1	139.10	110	0.6
17-08-30	20	15.5	0.11	9.42	—	0	86	10	182	225	89.6	0.11	7.71	8.1	8.0	144.30	118	0.9
17-09-27	—	17.0	0.11	9.75	—	16.0	92	9	195	233	91.0	0.05	7.65	8.0	8.0	149.50	125	1.1
17-10-24	19	10.4	0.11	10.45	—	6	85	18	170	233	89.0	-0.10	7.65	7.9	8.0	153.40	124	0.9

E. coli sample in June measured in CFU/100 mL

Table 19: Nutrient results for ShdE, 2017

SITE ShdE: NUTRIENT DATA																			
Date (yy-mm-dd)	HCO_3 (mg/L)	Br (µg/L)	Ca (mg/L)	CO_3 (µg/L)	Cl (mg/L)	F (µg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	NH_3T (µg/L)	NH_3_Un (µg/L)	NO_2 (µg/L)	NO_3 (µg/L)	NO_X (µg/L)	SO_4 (mg/L)	TKN (mg/L)	TN (mg/L)	TOC (mg/L)	TP-L (µg/L)
17-06-27	60.5	30	19.9	452	10.5	130	1.10	3.44	8.20	<50	<1	<50	<50	<50	6	0.2	0.2	4.3	10
17-07-26	76.2	30	24.4	716	12.2	160	1.14	4.40	9.34	<50	<1	<50	<50	<50	11	0.2	0.2	2.5	8
17-08-30	84.9	30	27.8	1000	10.1	120	1.20	4.90	9.01	<50	<1	<50	<50	<50	12	0.1	<0.2	1.9	7
17-09-27	91.1	30	28.3	856	11.8	140	1.28	4.95	9.67	<50	<1	<50	<50	<50	13	0.2	0.2	2.3	8
17-10-24	84.3	20	27.5	629	12.1	100	1.26	4.94	9.81	<50	<1	<50	<50	<50	16	0.2	0.2	2.7	10

Table 20: Inorganics results for ShdE, 2017

SITE ShdE: HEAVY METALS AND OTHER ELEMENTS																					
Date (yy-mm-dd)	Al (µg/L)	As (µg/L)	B (µg/L)	Ba (µg/L)	Cd (µg/L)	Co (µg/L)	Cr (µg/L)	Cu (µg/L)	Fe (µg/L)	Li (µg/L)	Mn (µg/L)	Mo (µg/L)	Ni (µg/L)	Pb (µg/L)	Rb (µg/L)	Sb (µg/L)	Sr (µg/L)	U (µg/L)	U_STL (µg/L)	U_LTL (µg/L)	V (µg/L)	Zn (µg/L)
17-06-27	27	<1	9	70	<0.01	<0.1	<1	<1	170	1.0	36	0.5	<1	0.7	1.0	<0.1	155	0.2	33	15	<1	3
17-07-26	14	<1	13	87	<0.01	<0.1	<1	<1	90	1.2	37	0.7	<1	0.1	1.1	<0.1	221	0.4	33	15	<1	<1
17-08-30	19	<1	13	86	<0.01	<0.1	<1	<1	100	1.3	33	0.8	<1	<0.1	1.0	<0.1	251	0.5	33	15	<1	20
17-09-27	28	<1	15	101	<0.01	<0.1	<1	<1	100	1.4	48	0.7	<1	<0.1	1.2	<0.1	267	0.5	33	15	<1	<1
17-10-24	30	<1	12	97	<0.01	<0.1	<1	2	110	1.4	49	0.5	<1	0.1	1.0	<0.1	260	0.5	33	15	<1	9

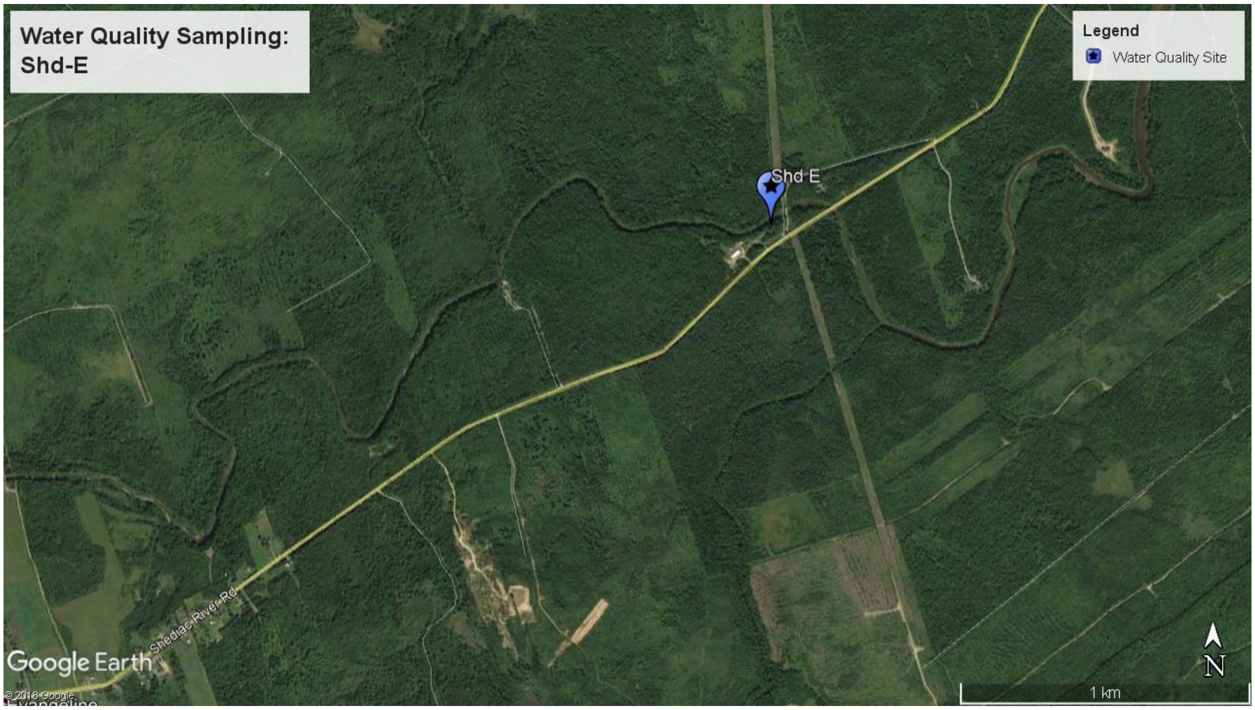


Figure 7: ShdE site location and surrounding land uses

3.5 Shediac River – ShdG

This water quality sampling site is located in the Weisner Brook, at the small bridge on St-Philippe Rd. The sample is taken downstream of the bridge, due to a large beaver dam spanning the length of the bridge, creating deep beaver habitat unfit for chest waders. The surrounding land uses includes; residences, large open fields with ATV activity, forested land, transmission power lines, mineral extraction pit and farmland.

A few areas along the brook, in the open fields, have thinner buffer zone (> 10 m) mostly made up of young shrubs, but there is no agriculture or farming. However, to the left of the sampling site (looking upstream) directly upstream of the bridge, is a newly cut parcel of land. This lot clearing has reached the riverbanks in several areas, and has left little vegetation in the riparian area spanning approx. 175 m. The mineral extraction pit is located in the upper reaches of the Weisner Brook, over 3.3 km upstream. There is a tree buffer between the pit and the brook (> 160 m). Further upstream from the pit are few farm fields and clear cut areas, also with good tree density separating the fields from the brook (> 150 m).

The water sampling results for the site ShdG, for 2017, meets or exceeds all the recommendations for the survival of freshwater aquatic life based on pH and dissolved oxygen. Total phosphorus levels for long-term eutrophic conditions, according to the CCME Guidance framework for Phosphorus, were in the mesotrophic (10 – 20 µg/L) to eutrophic range (35 - 100 µg/L). Concentrations of aluminum exceeded the CCME water quality guideline (100 µg/L for a pH of 6.5 or above) for the sample taken in August (176 µg/L). Concentrations of iron exceeded the

CCME water quality guideline (300 µg/L) for every sample taken in 2017 with the exception of the sample taken in September. For the samples taken in June, July, August, and October, iron concentrations were 530 µg/L, 360 µg/L, 570 µg/L, and 350 µg/L, respectively. Bacterial levels did not exceed the maximum concentration of E. coli from the Health Canada recreational guideline (≥ 400 MPN/100 mL).

Table 21: Water chemistry data and E. coli results for ShdG, 2017

SITE ShdG: FIELD DATA COLLECTED BY YSI AND LAB SAMPLES																		
Date (yy-mm-dd)	Temp (°C)		SAL (ppt)	Dissolved O_2		E. coli (MPN /100mL)	ALK_T (mg/L)	CLRA (TCU)	COND (µS/cm)		HARD (mg/L)	Lang_Ind (20°C)	pH (pH)			TDS (mg/L)		TURB (NTU)
	Air	Water		(mg/L)	%				Field	Lab			Field	Lab	Sat (20°C)	Field	Lab	
17-05-31	11	11.6	0.03	9.97	—	25.6	—	—	45	—	—	—	7.30	—	—	39.00	—	—
17-06-27	23	14.6	0.05	10.01	—	86	45	74	89	113	43.4	-1.11	7.74	7.5	8.6	72.15	56	1.5
17-07-26	20	14.6	0.07	8.49	—	151.5	58	18	118	150	57.8	-0.71	7.90	7.7	8.4	96.20	73	3.7
17-08-30	15	13.3	0.08	8.68	—	64	74	13	124	162	67.7	-0.64	7.84	7.6	8.2	105.30	86	4.8
17-09-27	15	14.9	0.07	7.95	—	98.8	69	19	128	160	65.0	-0.58	7.58	7.7	8.3	102.70	84	1.4
17-10-24	19	9.8	0.07	9.95	—	31	66	35	110	156	63.4	-0.71	7.69	7.6	8.3	100.75	79	2.7

◥ E. coli sample in June measured in CFU/100 mL

Table 22: Nutrient results for ShdG, 2017

SITE ShdG: NUTRIENT DATA																			
Date (yy-mm-dd)	HCO_3 (mg/L)	Br (µg/L)	Ca (mg/L)	CO_3 (µg/L)	Cl (mg/L)	F (µg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	NH_3T (µg/L)	NH_3_Un (µg/L)	NO_2 (µg/L)	NO_3 (µg/L)	NO_X (µg/L)	SO_4 (mg/L)	TKN (mg/L)	TN (mg/L)	TOC (mg/L)	TP-L (µg/L)
17-06-27	44.9	30	11.5	133	6.5	200	0.66	3.56	5.36	<50	<1	<50	80	80	<1	0.4	0.5	9.2	30
17-07-26	57.7	20	14.7	272	6.1	180	0.73	5.13	6.15	<50	<1	<50	<50	<50	4	0.2	0.2	2.6	34
17-08-30	73.7	20	17.4	276	5.2	130	0.85	5.88	6.17	<50	<1	<50	60	60	4	0.2	0.3	1.5	53
17-09-27	68.7	20	16.8	324	6.3	150	0.90	5.60	6.37	<50	<1	<50	<50	<50	5	0.2	0.2	3.8	14
17-10-24	65.7	20	16.3	246	6.7	120	0.90	5.5	6.47	<50	<1	<50	<50	<50	2	0.3	0.3	4.9	27

Table 23: Inorganics results for ShdG, 2017

SITE ShdG: HEAVY METALS AND OTHER ELEMENTS																						
Date (yy-mm-dd)	Al (µg/L)	As (µg/L)	B (µg/L)	Ba (µg/L)	Cd (µg/L)	Co (µg/L)	Cr (µg/L)	Cu (µg/L)	Fe (µg/L)	Li (µg/L)	Mn (µg/L)	Mo (µg/L)	Ni (µg/L)	Pb (µg/L)	Rb (µg/L)	Sb (µg/L)	Sr (µg/L)	U (µg/L)	U_STL (µg/L)	U_LTL (µg/L)	V (µg/L)	Zn (µg/L)
17-06-27	53	<1	15	53	<0.01	0.2	<1	<1	530	1.2	102	<0.1	<1	0.2	0.8	<0.1	71	<0.1	33	15	<1	2
17-07-26	82	<1	15	77	0.01	0.3	<1	<1	360	1.6	271	0.1	<1	0.3	0.9	<0.1	98	0.1	33	15	<1	1
17-08-30	176	<1	8	94	0.02	0.5	<1	<1	570	2.0	495	<0.1	<1	0.8	0.9	<0.1	111	0.2	33	15	<1	10
17-09-27	26	<1	18	84	<0.01	0.1	<1	<1	200	2.0	171	0.1	<1	<0.1	1.0	<0.1	116	0.1	33	15	<1	8
17-10-24	88	<1	9	89	0.01	0.3	<1	<1	350	2.1	326	<0.1	<1	0.4	0.9	<0.1	118	0.2	33	15	<1	24

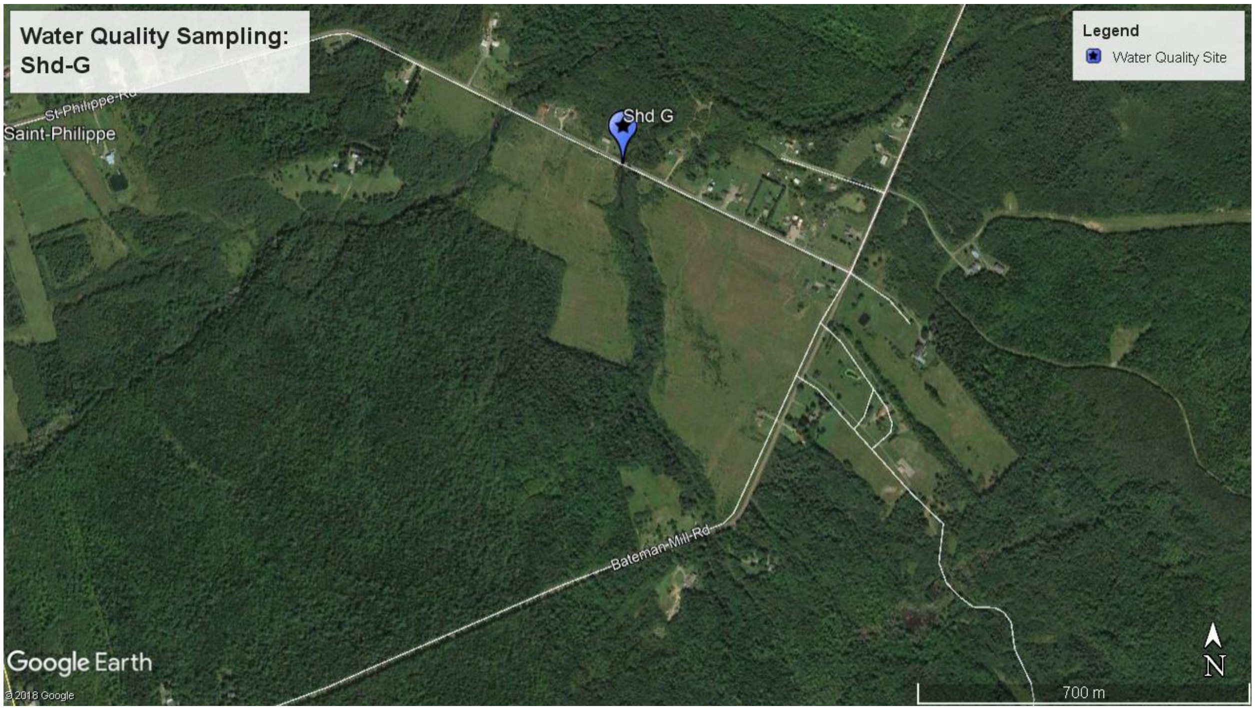


Figure 8: ShdG site location and surrounding land uses

3.6 Shediac River – ShdH

This water quality sampling site is located in the Bateman Brook, at the culvert on Bateman Mill Rd. The sample is taken upstream from the culvert. The surrounding land uses includes mainly residences and farm fields for both the cultivation of hay and cattle. The building of a pig farm with an adjoining settling pond is evident on aerial imagery, but it is unknown whether there is still any activity. Further upstream in the Bateman Brook system are several active and/or recently active logging fields.

The tree buffer between the cattle/cultivation fields and the sampling site is on average 15 -20 m in density. Upstream from these fields is logging activity, also with tree lines as little at 10 - 20 m. The forestry activity takes place in various areas of the tributaries and wetlands of the Bateman Brook. Some areas show little in terms of buffer between fields and water or wetlands. Woody debris can be seen in a wetland from aerial imagery.

The water sampling results for the site ShdH, for 2017, meets or exceeds all the recommendations for the survival of freshwater aquatic life based on pH and dissolved oxygen. Total phosphorus levels for long-term eutrophic conditions, according to the CCME Guidance framework for Phosphorus, were in the mesotrophic (10 – 20 µg/L) to meso-eutrophic range (20 – 35 µg/L). Concentrations of iron exceeded the CCME water quality guideline (300 µg/L) for every sample taken in 2017 with the exception of the sample taken in September. For the samples taken in June, July, August, and October, iron concentrations were 690 µg/L, 470 µg/L, 360 µg/L, and 400 µg/L, respectively. Bacterial levels did not exceed the maximum concentration of E. coli from the Health Canada recreational guideline (≥ 400 MPN/100 mL).

Table 24: Water chemistry data and E. coli results for ShdH, 2017

SITE ShdH: FIELD DATA COLLECTED BY YSI AND LAB SAMPLES																		
Date (yy-mm-dd)	Temp (°C)		SAL (ppt)	Dissolved O_2		E. coli (MPN /100mL)	ALK_T (mg/L)	CLRA (TCU)	COND (µS/cm)		HARD (mg/L)	Lang_Ind (20°C)	pH (pH)			TDS (mg/L)		TURB (NTU)
	Air	Water		(mg/L)	%				Field	Lab			Field	Lab	Sat (20°C)	Field	Lab	
17-05-31	10	11.7	0.04	10.3	—	62.4	—	—	67	—	—	—	7.31	—	—	57.85	—	—
17-06-27	21	16.8	0.07	8.8	—	48	48	59	133	159	52.0	-1.04	7.53	7.4	8.4	102.70	78	2.7
17-07-26	20	16.3	0.09	8.54	—	248.1	70	19	162	198	70.5	-0.46	7.51	7.7	8.2	26.10	95	2.6
17-08-30	18	14.9	0.11	7.63	—	51	91	15	182	229	87.3	-0.27	7.66	7.7	8.0	146.25	118	1.9
17-09-27	15	16.3	0.11	8.43	—	52.9	89	12	195	238	83.4	-0.10	7.39	7.9	8.0	152.10	123	1.4
17-10-24	18	9.6	0.11	11.24	—	17	77	18	166	229	79.2	-0.68	7.76	7.4	8.1	152.75	117	1.5

◥ E. coli sample in June measured in CFU/100 mL

Table 25: Nutrient results for ShdH, 2017

SITE ShdH: NUTRIENT DATA																		
Date (yy-mm-dd)	HCO_3 (mg/L)	Br (µg/L)	Ca (mg/L)	CO_3 (µg/L)	Cl (mg/L)	F (µg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	NH_3T (µg/L)	NH_3_Un (µg/L)	NO_2 (µg/L)	NO_3 (µg/L)	NO_X (µg/L)	SO_4 (mg/L)	TKN (mg/L)	TN (mg/L)	TOC (mg/L)	TP-L (µg/L)
17-06-27	47.9	40	16.3	113	15.1	150	0.84	2.74	10.8	<50	<1	<50	90	90	2	0.4	0.5	8.1	30
17-07-26	69.6	30	21.9	328	14.5	100	0.86	3.84	9.87	<50	<1	<50	60	60	<1	0.2	0.3	2.8	19
17-08-30	90.5	30	27.3	426	17.2	110	1.05	4.64	11.8	<50	<1	<50	<50	<50	<1	0.1	<0.2	2.2	14
17-09-27	88.3	30	26.2	659	22.3	130	1.05	4.36	13.4	<50	<1	<50	<50	<50	1	0.2	0.2	2.6	12
17-10-24	76.8	30	24.7	181	23.8	80	1.03	4.26	13.1	<50	<1	<50	<50	<50	2	0.2	0.2	2.6	14

Table 26: Inorganics results for ShdH, 2017

SITE ShdH: HEAVY METALS AND OTHER ELEMENTS																						
Date (yy-mm-dd)	Al (µg/L)	As (µg/L)	B (µg/L)	Ba (µg/L)	Cd (µg/L)	Co (µg/L)	Cr (µg/L)	Cu (µg/L)	Fe (µg/L)	Li (µg/L)	Mn (µg/L)	Mo (µg/L)	Ni (µg/L)	Pb (µg/L)	Rb (µg/L)	Sb (µg/L)	Sr (µg/L)	U (µg/L)	U_STL (µg/L)	U_LTL (µg/L)	V (µg/L)	Zn (µg/L)
17-06-27	70	<1	4	91	<0.01	0.2	<1	<1	690	1.0	151	<0.1	<1	0.2	1.1	<0.1	96	0.1	33	15	<1	19
17-07-26	24	<1	6	122	<0.01	0.1	<1	<1	470	1.5	136	0.1	<1	<0.1	1.0	<0.1	141	0.3	33	15	<1	2
17-08-30	28	<1	6	139	<0.01	<0.1	<1	<1	360	1.6	128	0.1	<1	0.1	1.1	<0.1	174	0.4	33	15	<1	12
17-09-27	19	<1	6	146	<0.01	<0.1	<1	<1	280	1.8	152	0.1	<1	<0.1	1.1	<0.1	170	0.3	33	15	<1	12
17-10-24	22	<1	5	135	<0.01	0.1	<1	<1	400	1.6	176	<0.1	<1	<0.1	1.1	<0.1	164	0.3	33	15	<1	11

Figure 9: ShdH site location and surrounding land uses

3.7 Scoudouc River – ScdB

This water quality sampling site is located in the main branch of the Scoudouc River, at the bridge on Route 132, next to the *Waggin' Tail Inn*. The sample is taken downstream of the bridge. The surrounding land uses includes; residences, the Greater Shediac Sewerage Commission's aeration lagoons, the Scoudouc Industrial Park, the Highway 15 (in the headwaters of the river) and forested land.

The sample site is upstream from the treated wastewater's discharge pipe. The property to the left of the sampling site (looking upstream) mows the lawn up to the riverbank, leaving only a few shrubs and grass on the riparian area. Another property upstream of the bridge, to the right, also has similar lawn mowing trends. Erosion is evident on the left bank. The industrial park has forested land between the edge of the property and the wetlands and drainage system (> 900 m in tree density).

The water sampling results for the site ScdB, for 2017, meet the recommendations for the survival of freshwater aquatic life based on pH, however, dissolved oxygen levels fell below 6 mg/L in the months of September (5.75 mg/L). Total phosphorus levels for long-term eutrophic conditions, according to the *CCME Guidance framework for Phosphorus*, were in the meso-eutrophic (20 – 35 µg/L) to eutrophic range (35 - 100 µg/L). Concentrations of aluminum exceeded the CCME water quality guideline (100 µg/L for a pH of 6.5 or above) for the sample taken in June (163 µg/L). Concentrations of iron exceeded the CCME water quality guideline (300 µg/L) for every sample taken in 2017: June (890 µg/L), July (660 µg/L), August (710 µg/L), September (610 µg/L), and October (460 µg/L).Bacterial levels did exceed the maximum concentration of E. coli from Health Canada recreational guideline (≥ 400 MPN/100 mL) in the sample of July; 488.4 MPN/100 mL.

Table 27: Water chemistry data and E. coli results for ScdB, 2017

SITE ScdB: FIELD DATA COLLECTED BY YSI AND LAB SAMPLES																		
Date (yy-mm-dd)	Temp (°C)		SAL (ppt)	Dissolved O_2		E. coli (MPN /100mL)	ALK_T (mg/L)	CLRA (TCU)	COND (µS/cm)		HARD (mg/L)	Lang_Ind (20°C)	pH (pH)			TDS (mg/L)		TURB (NTU)
	Air	Water		(mg/L)	%				Field	Lab			Field	Lab	Sat (20°C)	Field	Lab	
17-05-31	9	11.5	0.03	9.81	—	49.5	—	—	43	—	—	—	7.63	—	—	37.70	—	—
17-06-27	18	16.0	0.06	8.17	—	198.9	40	170	103	124	39.5	-1.42	7.81	7.2	8.6	80.60	69	4.2
17-07-26	16	15.6	0.12	6.2	—	488.4	93	37	210	259	89.4	-0.23	7.79	7.7	7.9	167.05	132	10.6
17-08-30	15	13.7	0.14	7.05	—	54	120	22	234	298	116	-0.11	7.86	7.6	7.7	194.35	159	12.0
17-09-27	14	16.1	0.13	5.75	—	387.3	96	45	219	261	89.2	-0.12	7.44	7.8	7.9	171.60	143	7.5
17-10-24	14	7.0	0.12	8.74	—	68	75	67	167	249	81.8	-0.66	8.16	7.4	8.1	165.10	129	7.4

E. coli sample in June measured in CFU/100 mL

Table 28: Nutrient results for ScdB, 2017

SITE ScdB: NUTRIENT DATA																			
Date (yy-mm-dd)	HCO_3 (mg/L)	Br (µg/L)	Ca (mg/L)	CO_3 (µg/L)	Cl (mg/L)	F (µg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	NH_3T (µg/L)	NH_3_Un (µg/L)	NO_2 (µg/L)	NO_3 (µg/L)	NO_X (µg/L)	SO_4 (mg/L)	TKN (mg/L)	TN (mg/L)	TOC (mg/L)	TP-L (µg/L)
17-06-27	39.9	60	12.9	59	18	270	0.57	1.78	10.4	<250	<1	<250	<250	<250	<5	0.7	0.7	18.8	36
17-07-26	92.5	90	29.6	436	19.8	230	0.79	3.77	13.9	<50	<1	<50	<50	<50	6	0.3	0.3	4.7	45
17-08-30	120	120	38.8	447	18.4	140	0.95	4.58	13.5	<50	<1	<50	<50	<50	8	0.2	0.2	2.7	46
17-09-27	95.4	100	29.7	566	24.8	190	0.99	3.64	16.3	<50	<1	<50	80	80	7	0.4	0.5	8.3	31
17-10-24	74.8	100	27.0	177	28.7	170	1.05	3.49	16.0	<50	<1	<50	<50	<50	6	0.4	0.4	9.1	42

Table 29: Inorganics results for ScdB, 2017

SITE ScdB: HEAVY METALS AND OTHER ELEMENTS																					
Date (yy-mm-dd)	Al (µg/L)	As (µg/L)	B (µg/L)	Ba (µg/L)	Cd (µg/L)	Co (µg/L)	Cr (µg/L)	Cu (µg/L)	Fe (µg/L)	Li (µg/L)	Mn (µg/L)	Mo (µg/L)	Ni (µg/L)	Pb (µg/L)	Rb (µg/L)	Sb (µg/L)	Sr (µg/L)	U (µg/L)	U_STL (µg/L)	U_LTL (µg/L)	V (µg/L)	Zn (µg/L)
17-06-27	**163**	<1	4	28	0.01	0.3	<1	<1	**890**	0.7	114	0.2	<1	0.4	1.0	<0.1	56	0.2	33	15	<1	16
17-07-26	87	<1	8	53	<0.01	0.3	<1	<1	**660**	1.3	311	0.5	<1	0.5	1.3	<0.1	125	0.9	33	15	<1	3
17-08-30	97	<1	8	56	0.01	0.3	<1	<1	**710**	1.5	393	0.5	<1	0.5	1.3	<0.1	145	1.4	33	15	<1	8
17-09-27	79	<1	15	53	<0.01	0.3	<1	<1	**610**	1.4	446	0.4	<1	0.4	1.5	<0.1	124	0.8	33	15	<1	8
17-10-24	97	<1	10	47	0.01	0.3	<1	<1	**460**	1.3	215	0.3	<1	0.5	1.3	<0.1	114	0.7	33	15	<1	12

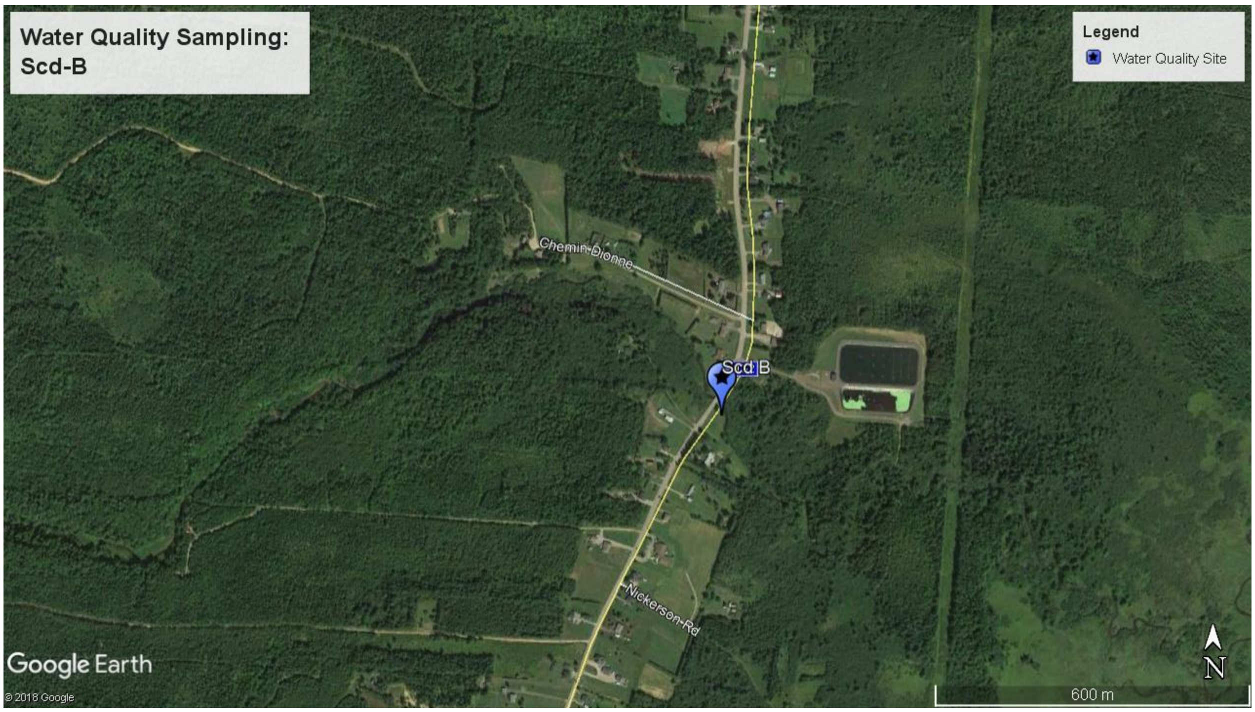


Figure 10: ScdB site location and surrounding land uses

3.1 Scoudouc River – ScdE-2

This water quality sampling site is located in the main branch of the Scoudouc River, and is accessed through a private property with landowner permission. Off Scoudouc River Rd, there is a large field that the staff uses to access a trail in the far right corner (1 km from the road). The path is marked with flagging tape and leads to the River. This site is located approx. 11 km downstream from the aeration lagoons. The surrounding land uses is mainly a few residences, forested land, wetlands, ATV trails, and one mineral extraction pit. The pit has a dense tree buffer between the outer limit and the beginning of the wetlands surrounding the river (> 350 m).

The water sampling results for the site ScdE-2, for 2017, meets or exceeds all the recommendations for the survival of freshwater aquatic life based on pH and dissolved oxygen. Total phosphorus levels for long-term eutrophic conditions, according to the CCME Guidance framework for Phosphorus, were in the meso-eutrophic (20 – 35 µg/L) to eutrophic range (35 – 100 µg/L).

Concentrations of aluminum exceeded the CCME water quality guideline (100 µg/L for a pH of 6.5 or above) for the sample taken in June (153 µg/L). Concentrations of iron exceeded the CCME water quality guideline (300 µg/L) for every sample taken in 2017: June (1110 µg/L), July (470 µg/L), August (530 µg/L), September (480 µg/L), and October (390 µg/L). Bacterial levels did not exceed the maximum concentration of E. coli from the Health Canada recreational guideline (≥ 400 MPN/100 mL).

Table 30: Water chemistry data and E. coli results for ScdE-2, 2017

SITE ScdE-2: FIELD DATA COLLECTED BY YSI AND LAB SAMPLES																		
Date (yy-mm-dd)	Temp (°C)		SAL (ppt)	Dissolved O_2		E. coli (MPN /100mL)	ALK_T (mg/L)	CLRA (TCU)	COND (µS/cm)		HARD (mg/L)	Lang_Ind (20°C)	pH (pH)			TDS (mg/L)		TURB (NTU)
	Air	Water		(mg/L)	%				Field	Lab			Field	Lab	Sat (20°C)	Field	Lab	
17-05-31	9	12.7	0.02	9.06	—	75.9	—	—	37	—	—	—	7.37	—	—	31.85	—	—
17-06-27	18	17.3	0.04	8.66	—	125.9	30	170	74	88	28.6	-1.67	7.52	7.2	8.9	56.55	51	2.5
17-07-26	17	16.7	0.06	8.3	—	52.9	37	68	108	130	37.0	-1.08	7.66	7.6	8.7	83.85	62	2.7
17-08-30	15	16.1	0.08	6.99	—	26	49	36	143	173	46.7	-0.97	7.78	7.5	8.5	111.80	88	9.7
17-09-27	14	16.7	0.07	8.5	—	22.8	41	79	124	148	42.0	-0.98	7.61	7.6	8.6	95.55	74	4.2
17-10-24	14	7.3	0.07	9.72	—	4	38	99	96	146	40.7	-1.34	7.95	7.3	8.6	94.90	72	3.2

E. coli sample in June measured in CFU/100 mL

Table 31: Nutrient results for ScdE-2, 2017

SITE ScdE-2: NUTRIENT DATA																			
Date (yy-mm-dd)	HCO_3 (mg/L)	Br (µg/L)	Ca (mg/L)	CO_3 (µg/L)	Cl (mg/L)	F (µg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	NH_3T (µg/L)	NH_3_Un (µg/L)	NO_2 (µg/L)	NO_3 (µg/L)	NO_X (µg/L)	SO_4 (mg/L)	TKN (mg/L)	TN (mg/L)	TOC (mg/L)	TP-L (µg/L)
17-06-27	29.9	50	9.24	45	13	240	0.48	1.34	7.27	<250	<1	<250	<250	<250	<5	0.7	0.7	18.1	37
17-07-26	36.8	80	12.0	138	14.2	230	0.46	1.70	10.7	<50	<1	<50	<50	<50	<1	0.4	0.4	9.0	20
17-08-30	48.8	120	15.2	145	23.6	150	0.62	2.12	16.1	<50	<1	<50	<50	<50	<1	0.4	0.4	5.8	51
17-09-27	40.8	80	13.7	153	19.4	200	0.71	1.90	12.9	<50	<1	<50	<50	<50	<1	0.5	0.5	12.3	24
17-10-24	37.9	80	13.1	71	19.2	170	0.85	1.95	12.7	<50	<1	<50	<50	<50	<1	0.5	0.5	14	20

Table 32: Inorganics results for ScdE-2, 2017

SITE ScdE-2: HEAVY METALS AND OTHER ELEMENTS																					
Date (yy-mm-dd)	Al (µg/L)	As (µg/L)	B (µg/L)	Ba (µg/L)	Cd (µg/L)	Co (µg/L)	Cr (µg/L)	Cu (µg/L)	Fe (µg/L)	Li (µg/L)	Mn (µg/L)	Mo (µg/L)	Ni (µg/L)	Pb (µg/L)	Rb (µg/L)	Sb (µg/L)	Sr (µg/L)	U (µg/L)	U_STL (µg/L)	U_LTL (µg/L)	V (µg/L)	Zn (µg/L)
17-06-27	153	<1	5	28	<0.01	0.2	<1	<1	1110	0.5	101	0.1	<1	0.4	1.0	<0.1	49	0.1	33	15	<1	5
17-07-26	42	<1	7	32	<0.01	0.2	<1	<1	470	0.7	91	0.1	<1	0.2	1.0	<0.1	81	<0.1	33	15	<1	4
17-08-30	96	<1	8	47	0.01	0.3	<1	<1	530	0.9	232	0.2	<1	0.3	1.2	<0.1	113	<0.1	33	15	<1	18
17-09-27	58	<1	8	47	<0.01	0.2	<1	<1	480	0.8	118	0.1	<1	0.3	1.4	<0.1	95	<0.1	33	15	<1	24
17-10-24	51	<1	9	40	<0.01	0.1	<1	<1	390	0.7	56	<0.1	<1	0.1	1.4	<0.1	85	<0.1	33	15	<1	13

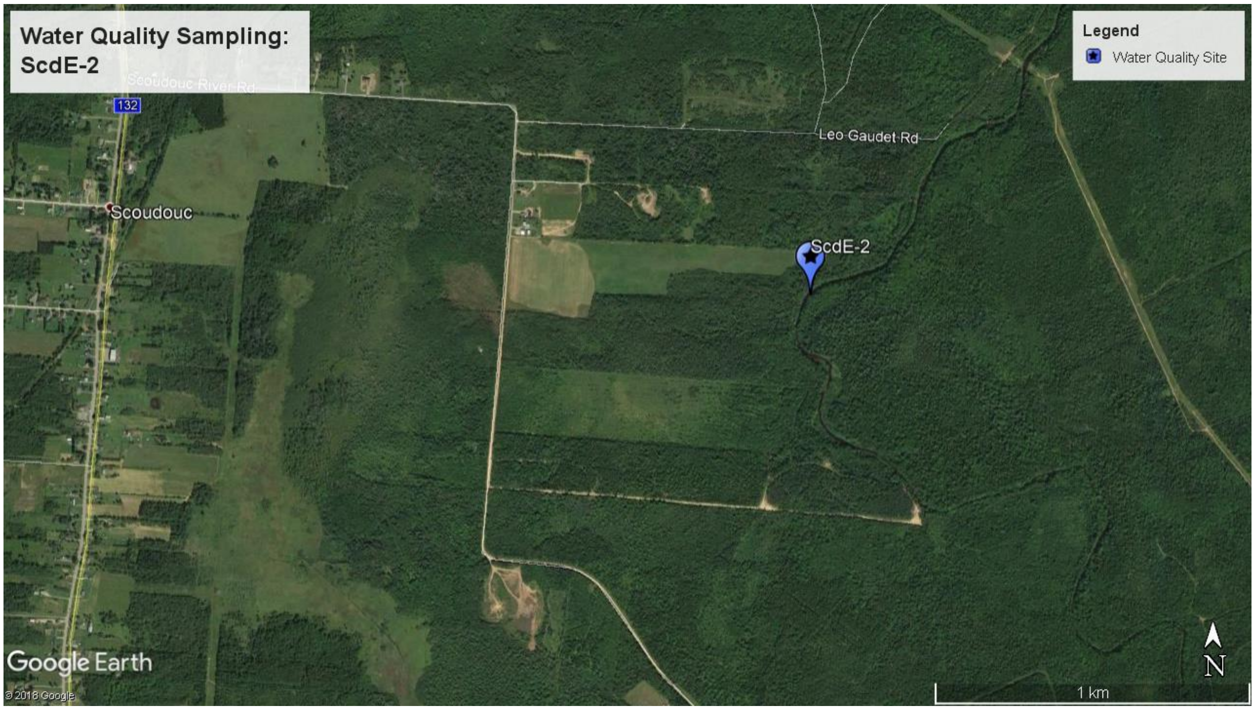


Figure 11: ScdE-2 site location and surrounding land uses

3.2 Scoudouc River – ScdF

This water quality sampling site is located in an unnamed tributary of the Scoudouc River, accessed by the public dirt road, Pellerin Rd, off Lino Road. On Google maps, the road shows up as Sackville Road. The sample is taken downstream of the road's culvert. The surrounding land uses in mainly cottages, forests, wetlands, ATV trails, and at the headwaters, a bog being exploited for peat moss. The peat moss extraction spans over 200 hectares as seen and measured on aerial imagery of 2017.

The water sampling results for the site ScdF, for 2017, meets or exceeds all the recommendations for the survival of freshwater aquatic life based on pH and dissolved oxygen. Total phosphorus levels for long-term eutrophic conditions, according to the CCME Guidance framework for Phosphorus, were in the meso-eutrophic (20 – 35 µg/L) to eutrophic range (35 – 100 µg/L). Concentrations of aluminum exceeded the CCME water quality guideline (100 µg/L for a pH of 6.5 or above) for the samples taken in June and October (332 µg/L and 155 µg/L, respectively). Concentrations of iron exceeded the CCME water quality guideline (300 µg/L) for every sample taken in 2017: June (1450 µg/L), July (1110 µg/L), August (660 µg/L), September (850 µg/L), and October (1000 µg/L). Bacterial levels did not exceed the maximum concentration of E. coli from the Health Canada recreational guideline (≥ 400 MPN/100 mL).

Table 33: Water chemistry data and E. coli results for ScdF, 2017

SITE ScdF: FIELD DATA COLLECTED BY YSI AND LAB SAMPLES																		
Date (yy-mm-dd)	Temp (°C)		SAL (ppt)	Dissolved O_2		E. coli (MPN /100mL)	ALK_T (mg/L)	CLRA (TCU)	COND (µS/cm)		HARD (mg/L)	Lang_Ind (20°C)	pH (pH)			TDS (mg/L)		TURB (NTU)
	Air	Water		(mg/L)	%				Field	Lab			Field	Lab	Sat (20°C)	Field	Lab	
17-06-27	11	15.8	0.03	8.72	—	135.4	23	290	52	62	26.5	-2.03	8.01	7.0	9.0	40.95	38	9.9
17-07-26	9	14.3	0.06	8.46	—	95.7	50	120	95	121	48.3	-0.75	8.09	7.7	8.5	79.00	61	7.8
17-08-30	9	13.3	0.07	9.03	—	51	72	40	121	158	64.7	-0.37	7.57	7.8	8.2	101.40	81	9.3
17-09-27	14	16.1	0.06	8.44	—	178.0	58	99	110	132	54.7	-0.73	7.85	7.6	8.3	85.80	69	8.2
17-10-24	12	6.8	0.06	10.08	—	24	53	120	80	124	50.4	-1.01	7.91	7.4	8.4	79.95	65	13.6

◥ E. coli sample in June measured in CFU/100 mL

Table 34: Nutrient results for ScdF, 2017

SITE ScdF: NUTRIENT DATA																		
Date (yy-mm-dd)	HCO_3 (mg/L)	Br (µg/L)	Ca (mg/L)	CO_3 (µg/L)	Cl (mg/L)	F (µg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	NH_3T (µg/L)	NH_3_Un (µg/L)	NO_2 (µg/L)	NO_3 (µg/L)	NO_X (µg/L)	SO_4 (mg/L)	TKN (mg/L)	TN (mg/L)	TOC (mg/L)	TP-L (µg/L)
17-06-27	23.0	50	8.25	22	7	310	0.71	1.43	3.33	<250	<1	<250	<250	<250	1	0.8	0.8	28	52
17-07-26	49.7	30	15.2	234	4	290	0.74	2.52	4.86	<250	<1	<250	<250	<250	2	0.4	0.4	11.4	39
17-08-30	71.5	30	20.6	424	5.1	120	0.76	3.23	6.02	<50	<1	<50	70	70	<1	0.2	0.3	4.2	29
17-09-27	57.8	30	17.3	216	6.1	180	0.90	2.80	5.33	50	<1	<50	<50	<50	<1	0.6	0.6	12.2	31
17-10-24	52.9	30	15.9	125	6.4	140	0.87	2.59	5.21	<50	<1	<50	<50	<50	<1	0.4	0.4	13	40

Table 35: Inorganics results for ScdF, 2017

SITE ScdF: HEAVY METALS AND OTHER ELEMENTS																						
Date (yy-mm-dd)	Al (µg/L)	As (µg/L)	B (µg/L)	Ba (µg/L)	Cd (µg/L)	Co (µg/L)	Cr (µg/L)	Cu (µg/L)	Fe (µg/L)	Li (µg/L)	Mn (µg/L)	Mo (µg/L)	Ni (µg/L)	Pb (µg/L)	Rb (µg/L)	Sb (µg/L)	Sr (µg/L)	U (µg/L)	U_STL (µg/L)	U_LTL (µg/L)	V (µg/L)	Zn (µg/L)
17-06-27	332	1	2	38	0.01	0.4	<1	<1	1450	0.6	143	0.1	<1	0.7	1.3	<0.1	53	0.2	33	15	1	7
17-07-26	95	1	5	47	<0.01	0.2	<1	<1	1110	0.7	87	0.2	<1	0.5	1.3	<0.1	98	0.2	33	15	<1	6
17-08-30	72	<1	4	50	<0.01	0.2	<1	<1	660	0.6	111	0.2	<1	0.3	1.2	<0.1	116	0.2	33	15	<1	10
17-09-27	80	<1	5	55	<0.01	0.2	<1	<1	850	0.8	116	0.2	<1	0.4	1.5	<0.1	114	0.2	33	15	<1	6
17-10-24	155	<1	5	51	<0.01	0.3	<1	<1	1000	1.0	109	0.1	<1	0.7	1.3	<0.1	104	0.2	33	15	<1	9

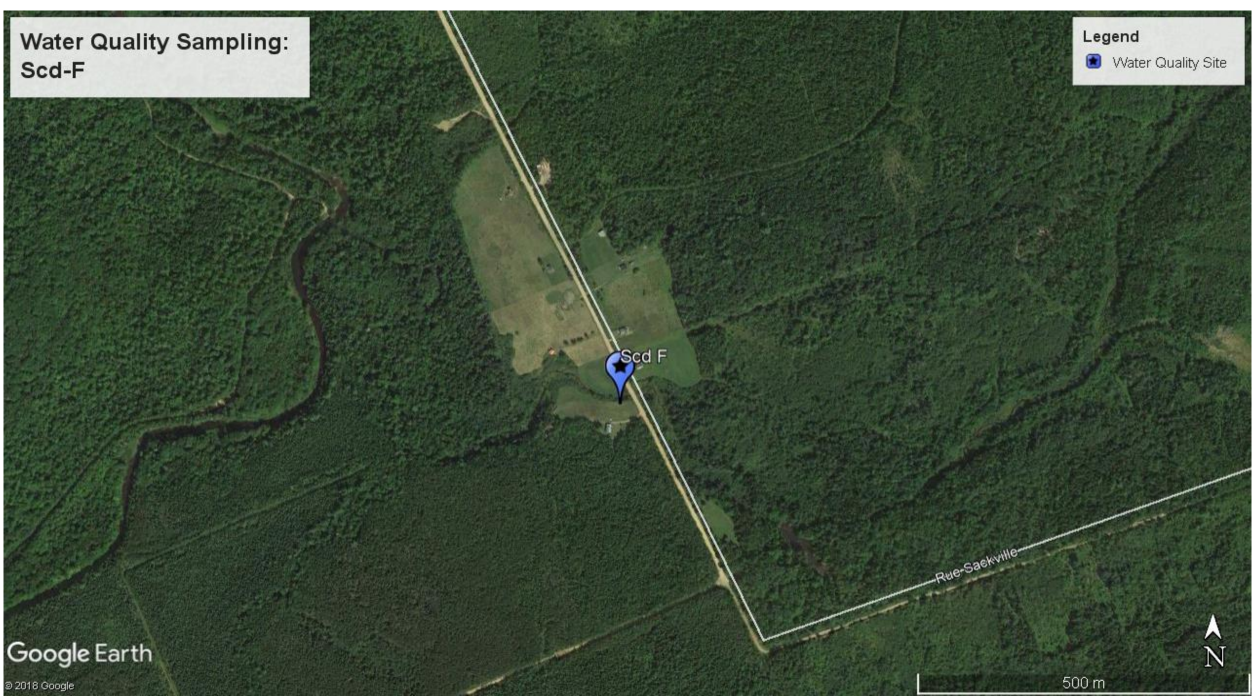


Figure 12: ScdF site location and surrounding land uses

3.3 Scoudouc River – ScdH

This water quality sampling site is located in the Cornwall Brook, accessed through a farmer's road, with permission. This small road is located passed the end of Promenade Harbour View, behind the *Seaside Chevrolet Dealership*. The surrounding land uses includes; residences, agricultural fields, cattle fields, Highway 15, a mineral extraction pit, transmission power lines and the Scoudouc Industrial Park.

The farm fields on both sides of the sampling site has buffer zones ranging from 10 -30 metres. There is a beaver dam directly above the sample site, and beaver activity has reduced the density of trees in the buffer zone. Other clear cut fields upstream now serve as cattle pastures, and seem to have buffer zones > 25 m. The mineral pit upstream (approx. 3 ha.) has a forested buffer over 400 m. However, there seems to be drainage near the pit that flows towards the brook. The headwaters of the Cornwall Brook is located near the industrial park. There is forested land between the industrial zone and the wetlands, and based on approximate land elevations, there does not appear to be drainage heading towards the brook.

The water sampling results for the site ScdH, for 2017, meets or exceeds all the recommendations for the survival of freshwater aquatic life based on pH and dissolved oxygen. Total phosphorus levels for long-term eutrophic conditions, according to the CCME Guidance framework for Phosphorus, were in the meso-eutrophic (20 – 35 µg/L) to eutrophic range (35 – 100 µg/L). Results slightly exceeded long term limits for chloride in freshwater in September (121 mg/L) and October (122 mg/L), when the recommendation is 120 mg/L. The short term limits for chloride in freshwater were not exceeded (640 mg/L). Concentrations of aluminum exceeded the CCME water quality guideline (100 µg/L for a pH of 6.5 or above) for the samples taken in July and August (111 µg/L and 288 µg/L, respectively). Concentrations of iron also exceeded the CCME water quality guideline (300 µg/L) for the samples taken in August and September (870 µg/L and 350 µg/L, respectively). Bacterial levels did not exceed the maximum concentration of E. coli from the Health Canada recreational guideline (≥ 400 MPN/100 mL).

Table 36: Water chemistry data and E. coli results for ScdH, 2017

SITE ScdH: FIELD DATA COLLECTED BY YSI AND LAB SAMPLES																		
Date (yy-mm-dd)	Temp (°C)		SAL (ppt)	Dissolved O_2		E. coli (MPN /100mL)	ALK_T (mg/L)	CLRA (TCU)	COND (µS/cm)		HARD (mg/L)	Lang_Ind (20°C)	pH (pH)			TDS (mg/L)		TURB (NTU)
	Air	Water		(mg/L)	%				Field	Lab			Field	Lab	Sat (20°C)	Field	Lab	
17-05-31	9	9.8	0.08	10.32	—	108.1	—	—	126	—	—	—	7.65	—	—	115.05	—	—
17-06-27	16	14.5	0.15	8.62	—	99	76	43	255	322	68.7	-0.64	7.52	7.5	8.1	8.620	166	1.6
17-07-26	15	15.5	0.27	7.26	—	178.5	120	27	457	577	92.7	0.05	7.76	7.9	7.8	362.70	297	1.7
17-08-30	9	14.9	0.33	7.99	—	23	150	20	540	683	111	0.21	7.51	7.9	7.7	435.50	355	4.1
17-09-27	14	17.0	0.35	6.62	—	111.9	160	23	600	716	117	0.26	7.56	7.9	7.6	461.50	384	3.1
17-10-24	14	8.0	0.48	9.69	—	114	160	42	660	982	120	0.14	7.54	7.8	7.7	630.50	550	1.1

E. coli sample in June measured in CFU/100 mL

Table 37: Nutrient results for ScdH, 2017

SITE ScdH: NUTRIENT DATA																			
Date (yy-mm-dd)	HCO_3 (mg/L)	Br (µg/L)	Ca (mg/L)	CO_3 (µg/L)	Cl (mg/L)	F (µg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	NH_3T (µg/L)	NH_3_Un (µg/L)	NO_2 (µg/L)	NO_3 (µg/L)	NO_X (µg/L)	SO_4 (mg/L)	TKN (mg/L)	TN (mg/L)	TOC (mg/L)	TP-L (µg/L)
17-06-27	75.8	80	22.8	225	47.2	210	1.27	2.86	40.9	<50	<1	<50	60	60	4	0.4	0.5	8.3	35
17-07-26	119	150	30.7	889	90.6	190	1.83	3.89	80.2	<50	<1	<50	<50	<50	16	0.4	0.4	6.3	32
17-08-30	149	200	36.5	1110	112	180	2.58	4.87	97.1	<50	<1	<50	<50	<50	8	0.4	0.4	<0.5	53
17-09-27	159	190	38.7	1190	121	210	3.20	4.85	104	<50	<1	<50	<50	<50	14	0.4	0.4	5.9	32
17-10-24	159	260	39.5	943	222	240	4.38	5.24	154	<50	<1	<50	<50	<50	27	0.4	0.4	7.2	31

Table 38: Inorganics results for ScdH, 2017

SITE ScdH: HEAVY METALS AND OTHER ELEMENTS																					
Date (yy-mm-dd)	Al (µg/L)	As (µg/L)	B (µg/L)	Ba (µg/L)	Cd (µg/L)	Co (µg/L)	Cr (µg/L)	Cu (µg/L)	Fe (µg/L)	Li (µg/L)	Mn (µg/L)	Mo (µg/L)	Ni (µg/L)	Pb (µg/L)	Rb (µg/L)	Sb (µg/L)	Sr (µg/L)	U (µg/L)	U_STL (µg/L)	U_LTL (µg/L)	V (µg/L)	Zn (µg/L)
17-06-27	60	<1	185	70	0.02	0.2	<1	<1	230	1.1	158	1.3	<1	0.1	0.9	<0.1	115	0.2	33	15	<1	5
17-07-26	111	<1	430	103	0.02	0.3	<1	<1	270	1.3	276	2.4	1	0.3	1.3	<0.1	183	0.5	33	15	1	4
17-08-30	288	1	407	152	0.04	0.7	<1	<1	870	1.4	1040	1.3	1	1	2.1	<0.1	234	0.8	33	15	2	12
17-09-27	81	<1	414	106	0.01	0.3	<1	<1	350	1.4	369	1.9	1	0.3	2.3	<0.1	252	0.7	33	15	1	6
17-10-24	26	<1	508	110	0.02	0.2	<1	<1	140	1.5	95	1.5	2	<0.1	2.5	<0.1	262	0.5	33	15	<1	7

Figure 13: ScdH site location and surrounding land uses

3.4 Bacterial Sampling Summary

The bacterial levels measured in the 2017 sampling of the Shediac and Scoudouc River are relatively very good.

For the Shediac River, there is only one sample that surpasses the 400 MPN/100 mL limits; the site ShdA in June (980.4 MPN/100 mL). There was no rainfall in the 24 hours prior to the sampling in June. The only occurrence of light rainfall (> 5 mm) in the 24-hour period prior to a sample was in the month of September.

For the Scoudouc River, there is only one sample that slightly surpasses the 400 MPN/100 mL limits; the site ScdB in July (488.4 MPN/100 mL).

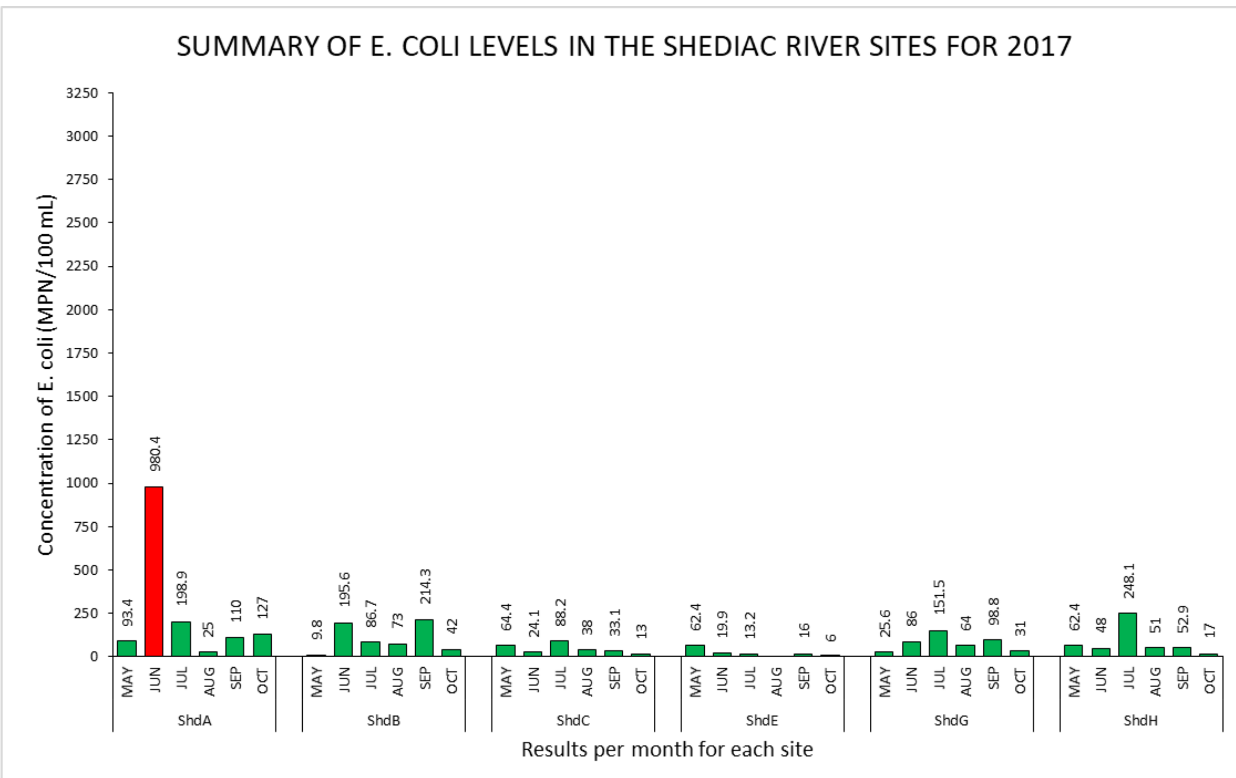


Figure 14: Summary of water quality results for E. coli, Shediac River sampling 2017

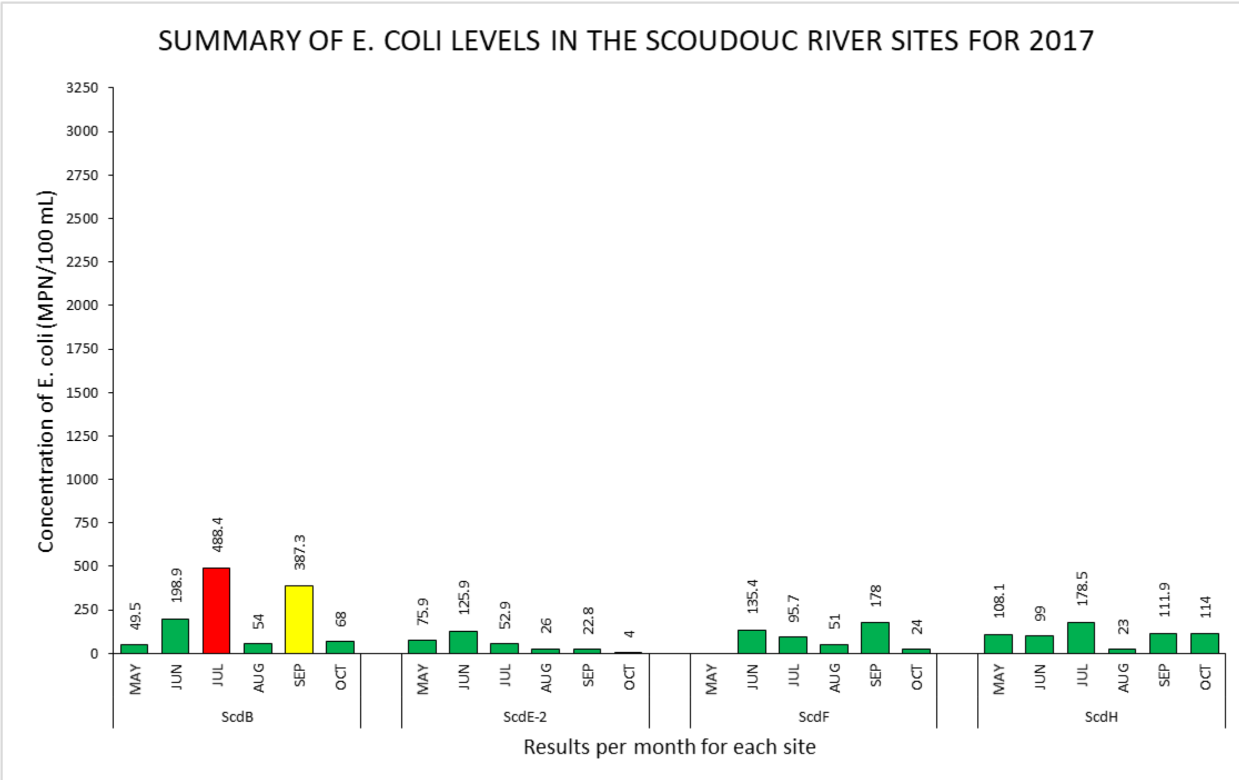


Figure 15: Summary of water quality results for E. coli, Scoudouc River sampling 2017

4. WATER TEMPERATURE MONITORING

This part of the project is done in partnership with the "*Institut national de la recherche scientifique*" (INRS) in the province of Quebec. In 2016, the SBWA received 3 loggers from INRS to be installed in major tributaries. In 2017, the SBWA purchased 4 additional loggers of the same type (HOBO light pendants), and placed them in strategic locations to monitor temperature fluctuations. Having a total of 7 loggers, the strategy was to monitor temperatures in areas determined to be high risk for thermal stress in juvenile salmonids, and to monitor areas that are determined to be cold zones suitable for thermal refugia.

The three sites established in 2016 are located in the McQuade brook (T-ShdB) near the electrofishing site (EShdB-02), the Weisner Brook (T-ShdM) near electrofishing site (EShdM-01), and in the mid-to-higher reaches of the Scoudouc River (T-ScdB). Two of the new sites of 2017 have been placed in the Shediac River; in the mid-reach near the covered bridge (T-ShdE) and in the upper-reaches in Irish Town (T-ShdA). The third was placed in the lowest reach of the Weisner Brook (T-ShdE-2A), near the convergence with the Shediac River, located 600 m downstream of the covered bridge. The Weisner Brook is considered to be a cold-water refuge for salmonids according to the *Department of Natural Resources of New Brunswick*. The area of the covered bridge is considered to be very warm, due to the lack of canopy coverage and wide shallow channel. It is assumed that in periods of high temperatures and thermal stress, salmonids and other fish would migrate downstream to seek the colder waters of the Weisner Brook. The fourth new logger was installed in the mid-to-lower reaches of the Scoudouc River, near the electrofishing site (EScdD-01) and the ATV restoration site.

Most temperature loggers were installed in the first week of June, except for the logger T-ScdD that was installed later in the month due to the inaccessibility of the site (poor conditions of the dirt road prior to spring maintenance). See Table 1 for details on installation and retrieval dates, as well as GPS coordinates of the placement of the loggers. The following section of this report is the thermograph data showing daily maximum temperatures recorded by the loggers. Unfortunately, the data from one logger (T-ShdE-2A) was lost during the transfer of data into the software. The recommended temperature limits indicate the threshold for thermal stress begins at 22.5°C for juvenile Atlantic salmon, and upper lethal limits are 25°C or greater (Crisp 1999).

Table 39: Thermograph monitoring site information, SBWA 2016

Monitoring station	Name of the river	Latitude	Longitude	Installation date	Date of retrieval
T-ShdM	**Weisner Brook**	**N46°12'26.50''**	**W64°40'20.30''**	06/07/2017	09/29/2017
T-ShdB	**McQuade Brook**	**N46°13'55.10''**	**W64°44'32.05''**	06/07/2017	09/29/2017
T-ScdB	**Scoudouc River**	**N46°08'39.20''**	**W64°33'36.60''**	06/07/2017	09/29/2017
T-ScdD	**Scoudouc River**	**N46°11'02.03''**	**W64°30'39.83''**	06/21/2017	10/02/2017
T-ShdE	**Shediac River**	**N46°14'41.50''**	**W64°39'56.30''**	06/01/2017	09/29/2017
T-ShdE-2A	**Weisner Brook**	**N46°14'28.90''**	**W64°39'39.00''**	06/01/2017	10/02/2017
T-ShdA	**Shediac River**	**N46°11'36.70''**	**W64°48'56.00''**	06/01/2017	09/29/2017

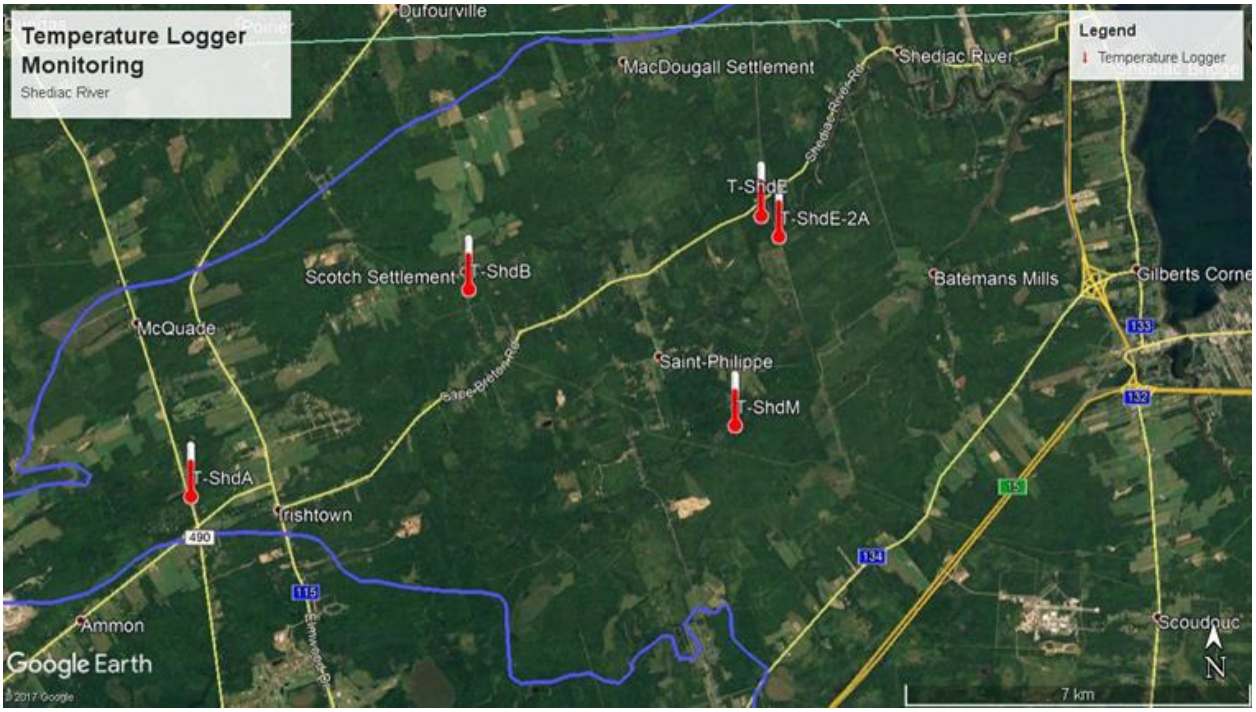


Figure 16: Map of temperature logger placement in the Shediac River, SBWA 2017

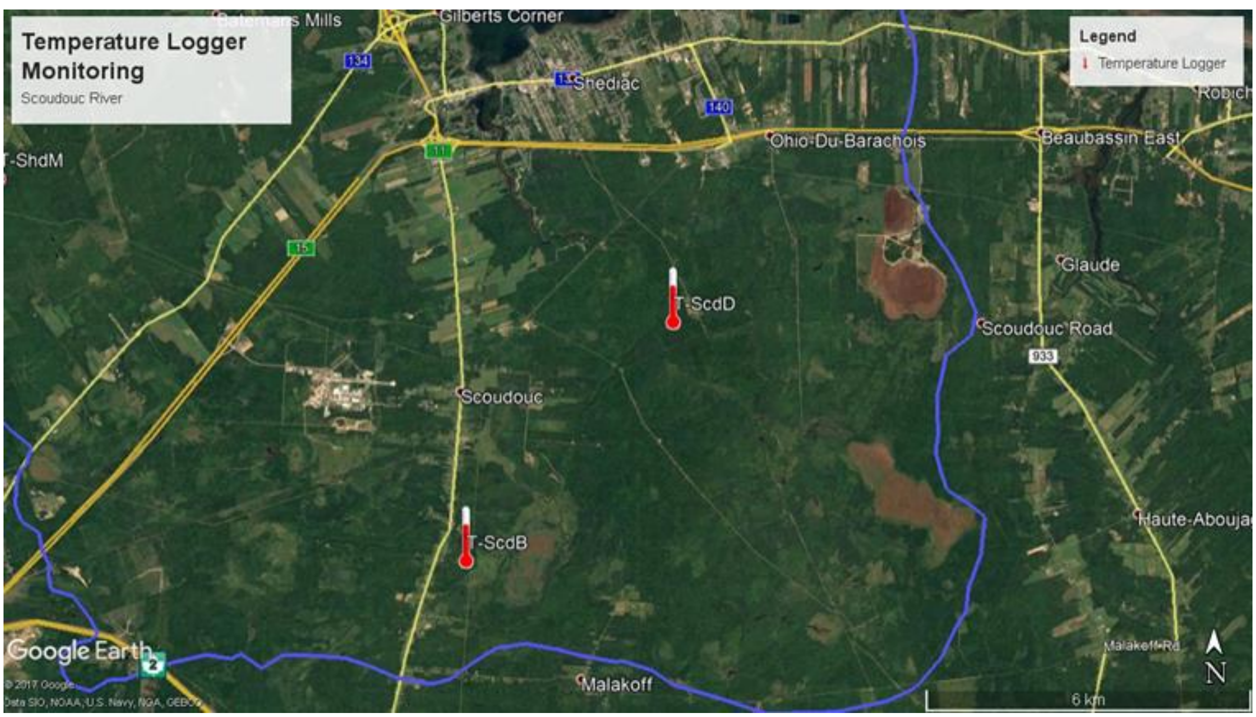


Figure 17: Map of temperature logger placement in the Scoudouc River, SBWA 2017

4.1 Thermograph monitoring station T-ShdA

This temperature logger is located in the main branch of the Shediac River, in the upper-reaches near Irish Town. This area was predicted to have lower temperatures due to the canopy coverage and narrow channel. However, the logger is placed in the same area where new development of a residential area is currently taking place. This logger is collecting baseline data of current water temperatures, and will be used to measure the impact of the deforestation taking place directly next to the site.

The thermograph shows the maximum daily temperatures between June 1st and September 30th. The maximum temperatures exceeded the thermal stress threshold on 25 occasions during the peak of the summer months. Temperatures exceeded the threshold for 7 consecutive days: from July 16 to July 22. The thermograph also shows that the maximum temperatures exceeded the lethal maximum on only one occasion, and was the highest temperature recorded (25.22°C) on July 19. The highest average daily temperature for this site was 22.80°C.

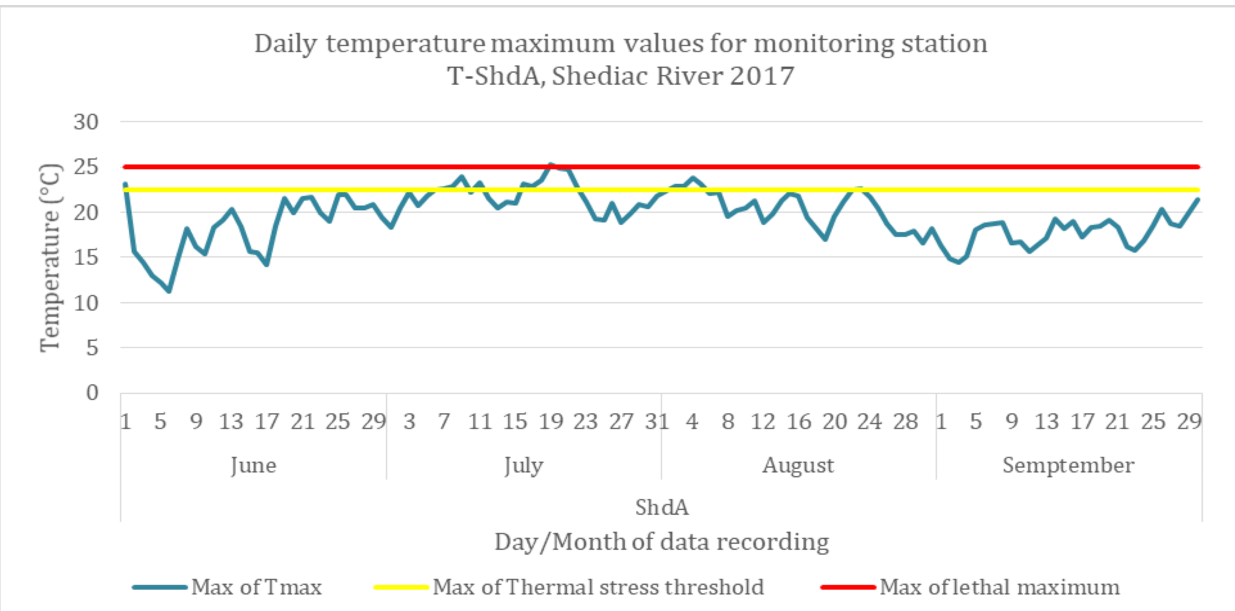


Figure 18: Thermograph data chart for monitoring station ID T-ShdA, Shediac River 2017

4.2 Thermograph monitoring station T-ShdB

This temperature logger was installed in the McQuade Brook, directly below the fish ladder and upstream of the electrofishing site EShdB-02. The thermograph shows the maximum daily temperature between June 8th and September 28th. The maximum temperatures exceeded the thermal stress threshold on 14 occasions during the peak of the summer months; 4 independent days, 6 consecutive days in July and 4 in August. The maximum daily temperatures exceeded the lethal maximum limit only once, this was 25.13 °C on July 20th. The highest daily average temperature for this site was 22.47 °C.

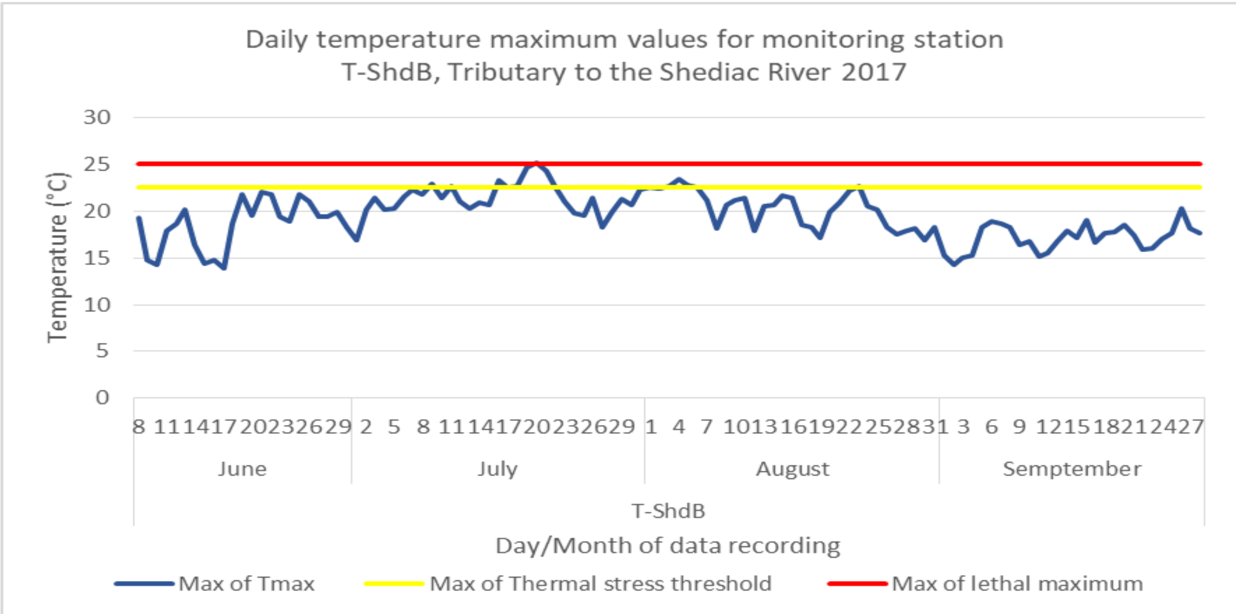


Figure 19: Thermograph data chart for monitoring station ID T-ShdB, Shediac River 2017

4.3 Thermograph monitoring station T-ShdE

This temperature logger is located in the main branch of the Shediac River, in the mid-lower reaches near the covered bridge. This area was predicted to have warmer waters due to the lack of canopy coverage, and its wide and shallow channel.

The thermograph shows the maximum daily temperature between June 1st and September 30th. The maximum temperatures exceeded the thermal stress threshold on 56 occasions during the peak of the summer months, 22 consecutive days in July. The thermograph also shows that the maximum temperatures exceeded the lethal maximum on 23 occasions; 16 times in July and 7 times in August. Twice, the maximum daily temperatures exceeded the lethal maximum limit for a stretch of seven consecutive days from July 16 to June 22 and again from July 30 to August 6. The Highest temperatures recorded within these time periods are 29.25°C and 29.05°C, which occurred for two consecutive days (July 19 and 20). The highest average temperature daily temperature for this site was 25.43°C.The high temperature recordings are a result of a very hot and dry summer which resulted water level for this river to be at its all-time low.

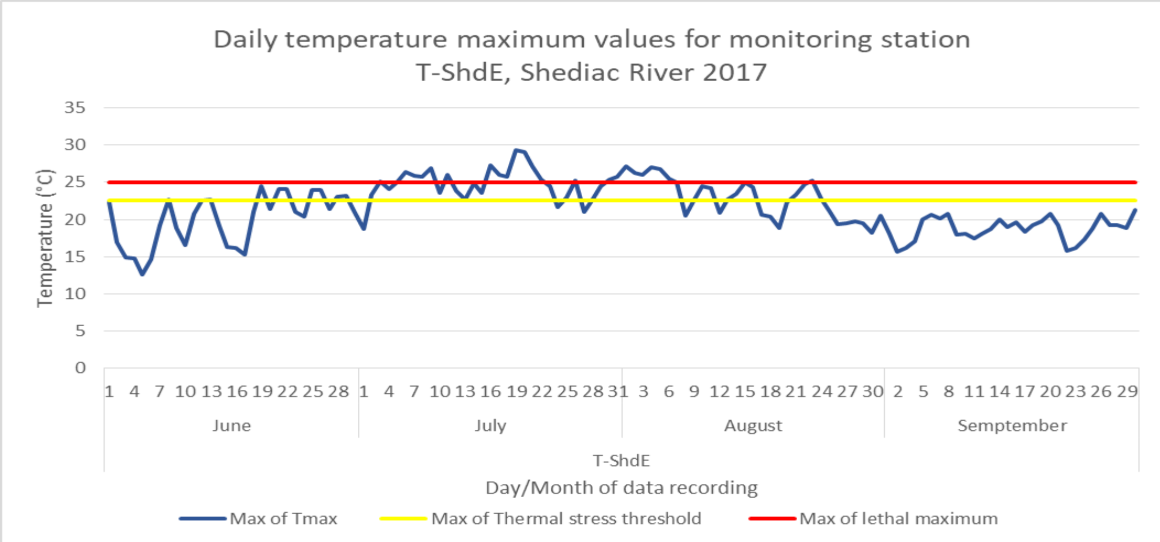


Figure 20: Thermograph data chart for monitoring station ID T-ShdE, Shediac River 2017

4.4 Thermograph monitoring station T-ShdM

This temperature logger was installed in the Weisner Brook, a tributary of the Shediac River. This logger was predicted to show cold temperatures, as the Weisner Brook is considered to be a summering area for mature brook trout by DNR. Thermographs show the maximum daily temperatures between June 9th and September 28th. During this time period, the daily maximum temperatures never exceeded the thermal stress threshold. The highest temperature recorded was 21.19 °C. The highest daily average temperature for this site was 18.97 °C. These excellent temperature readings are due to a good vegetation coverage over the stream and well-forested buffer zones.

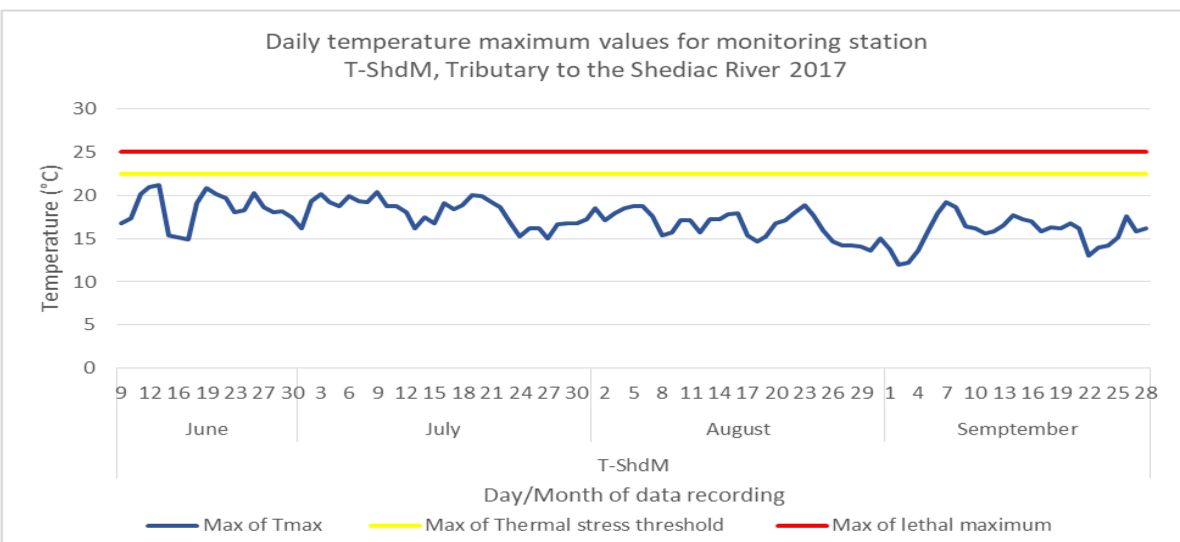


Figure 21: Thermograph data chart for monitoring station ID T-ShdM, Shediac River 2017

4.5 Thermograph monitoring station T-ScdB

This temperature logger was installed at a location of the main branch of the Scoudouc River. The thermograph shows the maximum daily temperatures between June 8th and September 30th. The maximum temperatures exceeded the thermal stress threshold on 5 occasions during the peak of the summer months; on June 19, July 9 and July 19 to 21. The highest temperature recorded during this time period was 23.39 for two consecutive days (July 19 and 20). The highest average temperature daily temperature for this site was 22.16 °C.

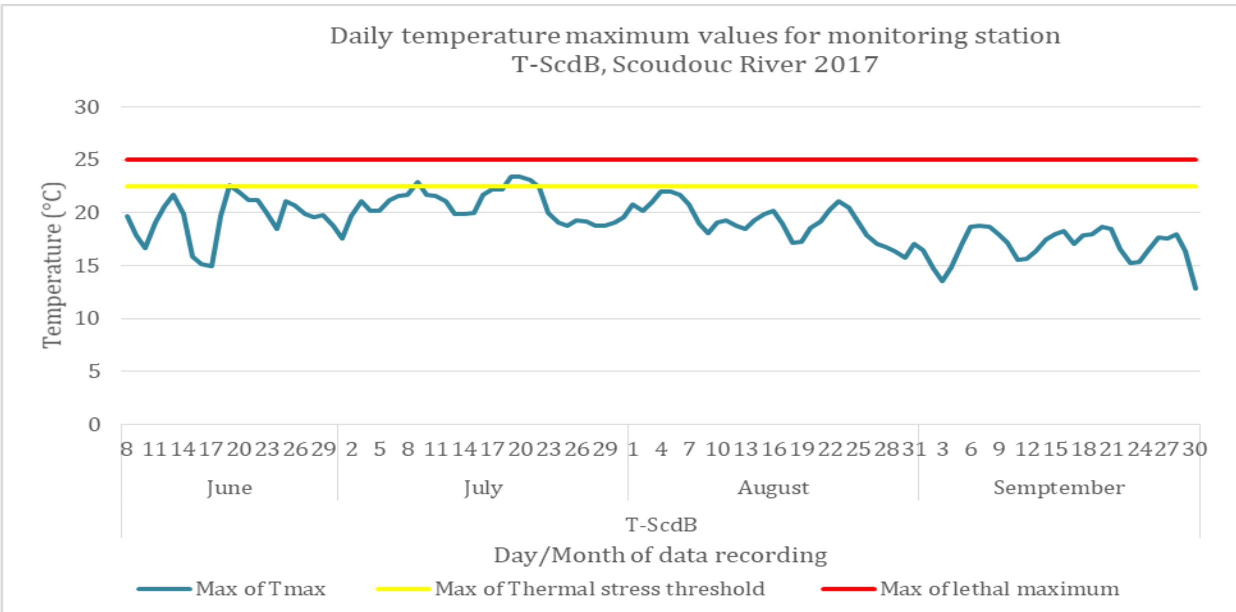


Figure 22: Thermograph data chart for monitoring station ID T-ScdB, Scoudouc River 2017

4.6 Thermograph monitoring station T-ScdD

This temperature logger was installed in the Scoudouc River. The thermograph shows the maximum daily temperatures between June 22nd and September 30th. The maximum temperatures exceeded the thermal stress threshold on 39 occasions during the peak of the summer months, in which on three occasions exceed the threshold for at least 7 consecutive days (July 5 to 11, July 16 to 22 and July 31 to August 7). The thermograph also shows that the maximum temperatures exceeded the lethal maximum on 9 occasions; 2 times in June, 5 times in July (3 times on consecutive days) and 2 times in August. The Highest temperature recorded within these time periods is 29.15°C (June 21). The highest average temperature daily temperature for this site was 23.69°C. The high temperature recordings are a result of a very hot and dry summer in which the water level of this river was at its all-time low.

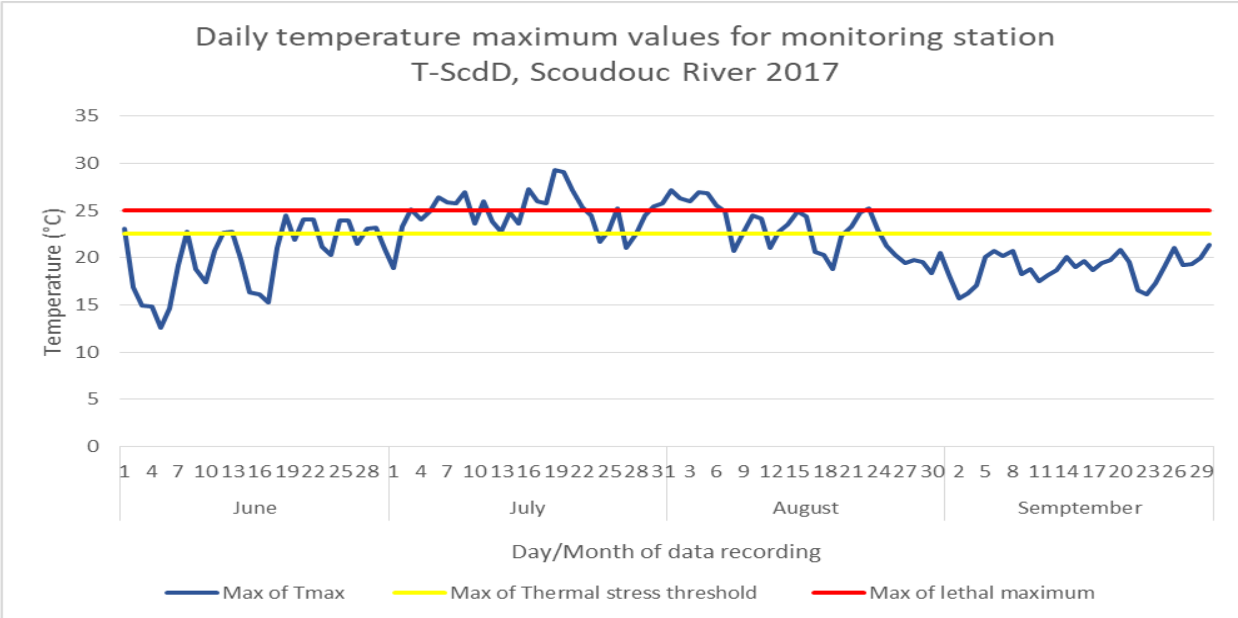


Figure 23: Thermograph data chart for monitoring station ID T-ScdD, Scoudouc River 2017

5. MACROINVERTEBRATE SURVEY

In 2017, 3 sites were sampled for macroinvertebrates using the CABIN protocol; the Weisner Brook (SHM-01), the Shediac River (SHA-01), and the Scoudouc River (SCF-01). The fourth established CABIN site, SHB-01 in the McQuade Brook, has been flooded by a beaver dam, disqualifying the site for sampling (no riffle).

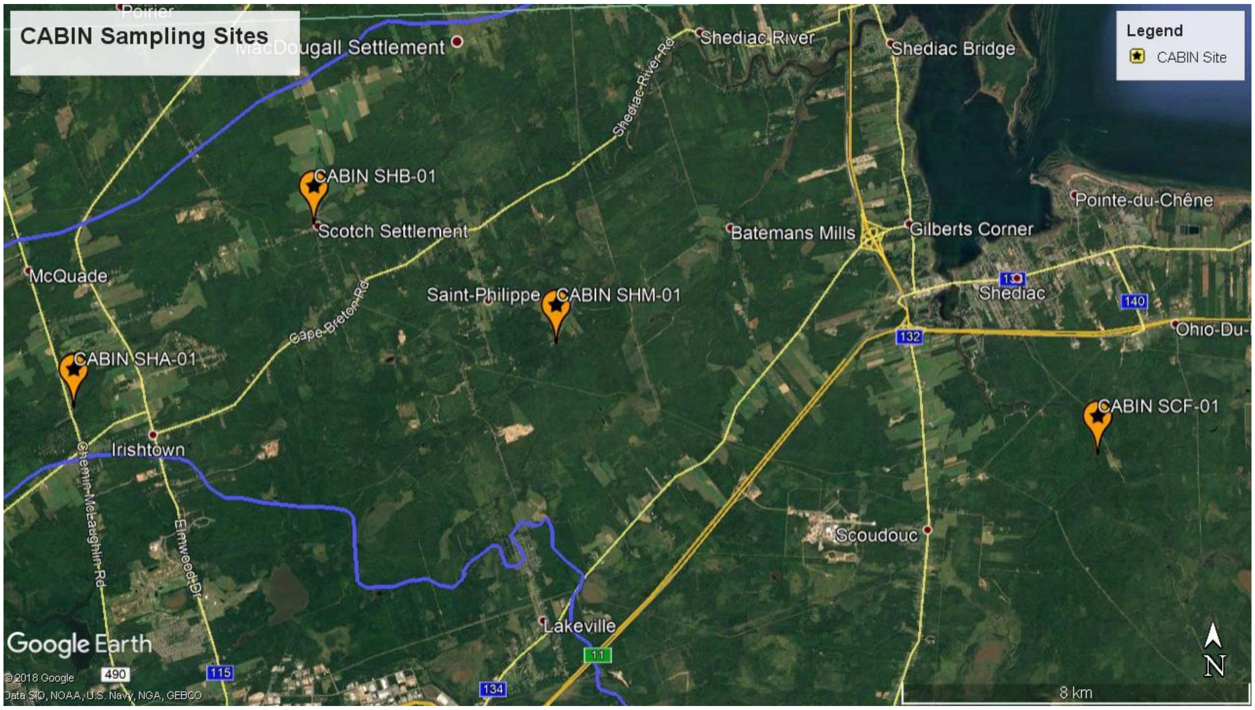


Figure 24: CABIN sampling sites

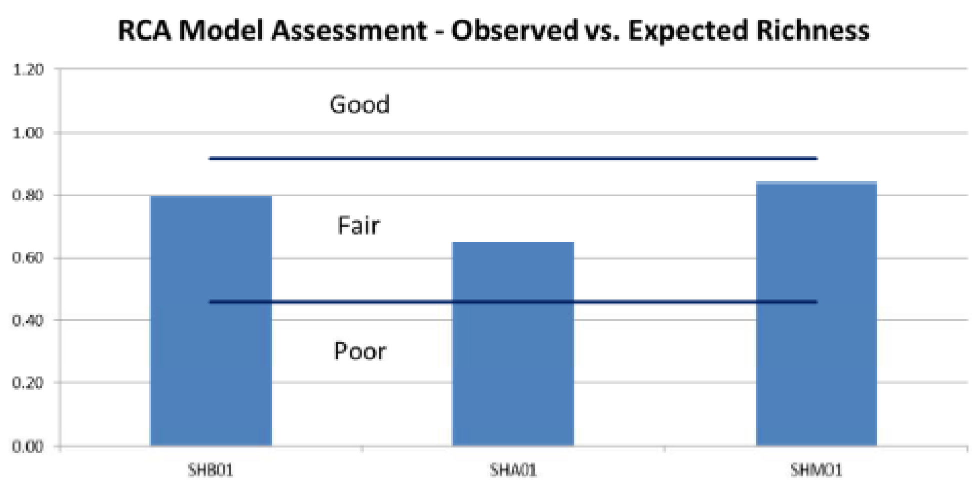
Table 40: CABIN Site information

Site ID	Latitude	Longitude	Elevation (m) Google Earth	Brook Name	Location Description
SHA-01	N46°11'36.80"	W 64°48'55.75"	115	Shediac River	Off NB-490, approx. 50 metres downstream from the culvert
SHB-01	N46°13'52.85"	W 64°44'40.20"	31	McQuade Brook	Off Scotch Settlement Road, approx. 130 metres upstream from the culvert
SHM-01	N46°12'24.77"	W 64°40'20.02"	21	Weisner Brook	Off Bateman Mill Road, approx. 90 metres upstream from culvert
SCF-01	N 46°11'1.97"	W 64°30'38.71"	8	Scoudouc River	Off Pellerin road (public dirt road), accessed by ATV Trail (250 metres from road), approx. 40 metres downstream from access point

All the sampling data has been added to the Environment and Climate Change Canada website. They are added in the study managed by the Southern Gulf of St-Lawrence Coalition on Sustainability (Coalition SGSL). The downloaded reports of the habitat data, water chemistry and invertebrate data can be found in Appendix B. In the 2016 water quality report, the invertebrate results were not yet received, they have been included in the Appendix C.

The data collected will serve in the CABIN analytical tool "Reference Condition Approach" (RCA) assessment, to assess the invertebrate data based on pristine reference sites. The tool is developed for the Western provinces and territories, but for our area, additional steps using GIS software must be done using datasets provided to the SBWA by Environment and Climate Change Canada. A step-by-step guide was also provided as a tool to do these first steps. SBWA staff received training by the *Canadian River's Institute* (CRI) in QGIS mapping software. The SBWA will be able to put the data from all CABIN samplings since 2014 next year, and complete the RCA assessments.

In the 2015, the sampling was done in partnership with the Miramichi River Environmental Assessment Committee (MREAC), as part of their project "The Atlantic Provinces Canadian Aquatic Biomonitoring Network Collaborative", funded by AEI (Atlantic Ecosystem Initiative). The RCA model assessment was done for the SBWA's site by MREAC staff (Figure 25).



Site_Ids	O/E Richness	O/E Berger_Parker	O/E Simpson	O/E Pielou	O/E Shannon
SHB01	0.80	1.52	1.26	1.31	1.30
SHA01	0.65	1.36	1.16	1.13	1.10
SHM01	0.84	1.33	1.17	1.11	1.13

Figure 25: RCA Model Assessment – Observed vs. Expected Richness, CABIN 2015

According to the RCA Model Assessment, all tree sites sampled in 2015 fall in the same category of fair. In order of best to worst; the Weisner Brook (SHM-01), the McQuade Brook (SHB-01) and the Main Branch of the Shediac River (SHA-01).

The area surrounding the site SHA-01 near Irish Town has been under development in the last 2-3 years; a new sub development of residences nearby and a new road requiring clear cutting along the river less than 100 metres away. The SBWA became aware of poor construction practises when heavy rains turned the Shediac River brown with fine sediments. The province was contacted and the Environmental inspector reported that no sediment control measures were put in place. A hydrologist was hired and sediment traps were installed. These sediment loads were flowing into the river by the trench of the road, Route 490, approximately 50 metres away from the sampling site.

The site in the McQuade Brook (SHB-01) is located within the restoration site that began in 2014. Once debris accumulations had been cleaned by the SBWA, heavy loads of sediment was flushed out, revealing clean gravel and new riffles. One on those riffles became the sampling site. Unfortunately, beavers moved back into the area and transformed the sampling site into a small lake.

The site with the best results, SHM-01 in the Weisner Brook, is mainly impacted by a few roads crossings, although far apart, residences, a crossing of transition power lines and a mineral extraction pit approximately 2 km upstream. Other than those factors, the site is mostly surrounded by dense mixed forest except for one side that has mowed grass up to the bank from the nearby house.

Figure 26: SBWA team doing CABIN surveys, 2016

6. DISCUSSION

The first disclaimer is that SBWA does not by any means proclaim to be water quality experts. The purpose of this project is to collect samples, organize the data, look at surrounding land uses and buffer zones, then pass on the information to experts. We can point out trends from our limited sampling results, but changes occur so quickly that general patterns are not always evident. Our sampling is simply a snapshot of the results on that collection day. It would be very expensive to monitor water quality changes on a daily or even weekly basis. As a non-profit environmental organization, we do not have the resources or capacity for this. Our goal is to look for gross abnormalities in general patterns and hope to identify possible causes.

Many of the flagged parameters above can have a wide range of negative impacts on various aquatic species when concentrations exceed their threshold of tolerance. This threshold varies depending on species, life stage, and sometimes concentrations of other parameters.

The concentrations for the following metals were below their respective detection limits for all samples at every site. These metals were not included in the above tables; Silver (Ag), Beryllium (Be), Bismuth (Bi), Selenium (Se), Tin (Sn), Tellurium (Te), Thallium (Tl).

Most sites were under the limits for E. coli based on Health Canada Recreational Guidelines, except for ShdA (1 sample at 980.4 MPN/100 mL) and ScdB (1 sample at 488.4 MPN/100 mL).

All pH levels were found to be within the guidelines; between 6.5 and 9. However, dissolved oxygen for ScdB and ShdB fell below the recommended 6 mg/L for the protection of aquatic early life stages.

Looking at total phosphorous levels, most of our site falls into mesotrophic to eutrophic range. Only two sites contained total phosphorous levels low enough to be classed in the oligotrophic range (4-10 µg/L) .

Inorganic's results that were over the CCME recommended water quality guideline were mainly iron and aluminum. The province of New Brunswick is known to have higher levels of naturally occurring aluminum. More investigation ad consultation with experts is needed to interpret these inorganic results.

Water temperature monitoring using loggers is a widely used tool to monitor temperature fluctuation in watersheds. The goal is to identify hot spots and cold zones suitable for thermal refugia in periods of thermal stress among fish. Although 7 temperature loggers were installed, the data from one logger (T-ShdE-2A) was lost during the transfer into the software. Being the first time SBWA staff used the software, a mistake was done and the logger was reformatted, erasing all the data. However, that particular logger was out of water when it was retrieved, being in a small stream, the water levels had dropped way below the logger, making the use of its data questionable.

When looking at the predictions of which site would be warm and which would be cooler, the site at the covered bridge (T-ShdE) was indeed extremely warm and the Weisner Brook was correctly assumed to be the coldest tributary. The site in Irish Town (T-ShdA), located next to new development of a residential area and new major road, showed warmer temperatures than expected. This could possibly be due to a warmer and dryer summer than usual, or could possibly be related to the deforestation activities going on around the site. This location will continue to be monitored to measure changes over time. The second location that was warmer than expected is the Scoudouc River (T-ScdD), where again could be attributed to extremely low water levels and very warm summer. This site will also continue to be monitored to measure temperatures from year to year. We were pleased to see lower water temperatures in the McQuade Brook (T-ShdB) than expected, although there were periods where temperatures reach thermal stress levels, general conditions were good. This logger was also placed in a shallow area, so the higher levels could be attributed to that. However, further upstream of the fish ladder, intensive tree planting was done to help eventually replenish the tree canopy, as severe beaver activity causing flooding and denudation of the riverbank's trees have caused long section of the brook to be fully exposed to sunlight.

This past summer was extremely hot and dry; rainfall amounts were at a record-breaking low, and more heat records days were broken than any other year in recent history. Water levels in the river and brooks of the Shediac Bay Watershed were very low, leading to higher water temperatures than normal. In addition, low water levels may have exposed temperature loggers in some areas. Being that this was a summer out of the norm, we look forward to comparing the data with the readings in 2018.

7. HABITAT AND WATER QUALITY ENHANCEMENT

Fish Habitat restoration is a major initiative of the SBWA. Areas where bank erosion occurs causes an excess of sediment in the watercourse, which can cause various issues for aquatic ecosystems; it can suffocate fish and fish eggs, bury aquatic insects, can carry harmful pollutants such as phosphorus that can further worsen conditions of the ecosystem, etc.

Blockage to fish migration are both naturally occurring and man-made, like debris jams, hanging culverts, and man-made dams. When these barriers occur in lower areas of a watershed, it can close off a large amount of suitable spawning grounds for important migratory fish species like the Atlantic salmon.

Three sites were selected for habitat enhancement in 2017. The project was funded by; the Recreational Fisheries Conservation Partnership Program by the Department of Fisheries and Oceans Canada, the New Brunswick Wildlife Trust Fund, the NB Environmental Trust Fund and the Atlantic Salmon Conservation Foundation. The habitat enhancement involved alder overgrowth thinning, garbage and debris clean up, erosion and sediment runoff control, planting native trees and the installation of habitat protection signs for public education. The sites selected for rehabilitation and clean-up were the Scoudouc River, the Cornwall Brook and the unnamed brook on Ohio Road.

7.1 Scoudouc River

An area in the Scoudouc River was selected for remediation due to erosion and sedimentation problems surrounding sensitive salmon habitat. The site is surrounded by ATV trails and is a popular stop of the annual Scoudouc River canoe and ATV run. The primary trail was causing heavy sediment to runoff in the river after rainfall events. The site is also impacted by erosion problems. The purpose of the restoration work is to control sediment runoff and stabilize the eroding banks, using biotechnical techniques.

Figure 27: Map showing where restoration work was done at the Scoudouc River in 2017

7.1.1 Sediment Control – Channelizing Runoff

The section of ATV Trail in question is aligned with the Scoudouc River and has a steep slope, which causes sediment-filled runoff to flow down into the river. The riverbanks surrounding the popular resting area had damaged and erosion problems, bringing even more sediments in the water. The remediation strategy was to redirect rainwater runoff towards the wooded area, to be filtered from its sediment by the natural vegetation. A Water and Wetland Alteration Permit (WAWA) was acquired for each activity performed (ALT 42297'17).

The first step was to widen the trail to allow the excavator to come in to do its work. Members of the Scoudouc ATV Club volunteered to help clear cut a small section of trees on the right-hand side of the trail. An excavator was brought in through the ATV road connected to Red Bridge Road in Scoudouc. The excavator began its work by rebuilding the trail to reduce the slope, shifting the soil in several bulldozing passes. Next, four large cross-slope trenches were dug along the trail. Machinery work was done over two days.

Trees of similar diameters were selected and cut to serve as channel stabilizers; they were anchored in the trenches using steel rebar (3-feet in length). Once the logs were installed along each trench, strips of geotextile material was stapled along the logs to prevent water from eroding the soil beneath them. Rocks found on site were used to weigh down the geotextile material on the ground. Grass seed (110 Lbs fall rye) was spread over the entire area where soil was disturbed by machinery, to minimize the impact of the work. Trees were replanted along the site and in the area cleared for the work.

Figure 28: Before photos of the restoration area of the Scoudouc River, 2017

Figure 29: Work photos of machinery on the ATV trail, Scoudouc River 2017

Figure 30: Photos of sediment deflector logs, Scoudouc River 2017

Figure 31: Before and after of the restoration work of the ATV Trail, Scoudouc River 2017

7.1.2 Tree Planting

Trees were replanted along the newly sculpted ATV trail, to reforest the area that was cleared to realize this project, as well as to help secure the disturbed soil. Trees were also planted along the riverbank to help control erosion. A total of 134 native trees were planted; 71 red oaks, 20 red maples, 11 grey birches, 2 trembling aspens, 2 willows and 24 white spruces.

The trees used were provided by the farm "*Vert l`Avenir*", from the forested lot and from the tree nursery created and managed by the SBWA.


Figure 32: Photos of trees planted along the ATV trail and riverbank below, Scoudouc River 2017

7.1.3 Blocking Access Upstream

The SBWA became aware that not only were the ATV's crossing the river at the restoration site, but they were also crossing at a secondary site approximately 1.2 km upstream. In some areas, the ATV's also drive within the watercourse to get to that area. A decision was taken to install two large metal cables to block the access and placed a habitat protection sign.

Figure 33: Blocked access area and habitat protection signs, Scoudouc River 2017

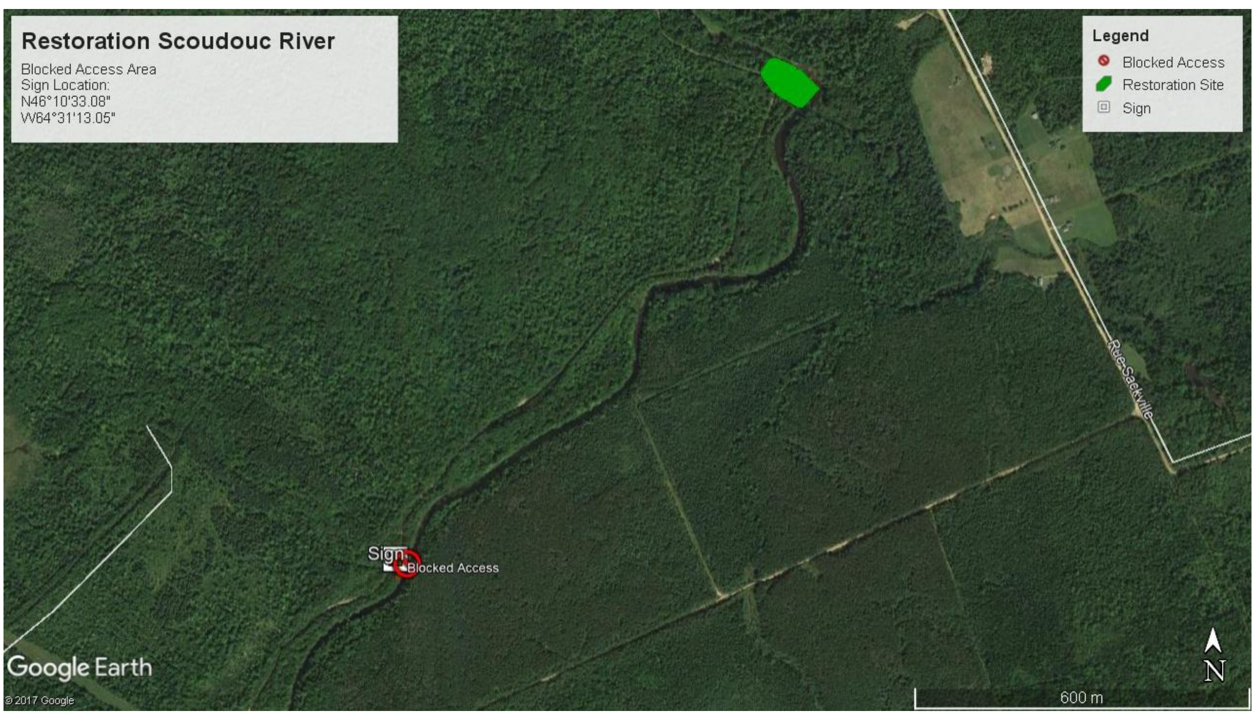


Figure 34: Map displaying location where SBWA blocked ATV access and installed signage, Scoudouc River 2017

7.1.4 Signage

A total of 5 signs were installed around the Scoudouc River restoration site to inform and educate the people who use the area for recreational activities, of the work that has been done and the ecological importance of this area. Three different signs were designed for this area: “Riverbank Protection Zone”, “Working Together to Restore Fish Populations”, and the primary large sign of the restoration work “Sediment Mitigation of the Scoudouc River: Edna`s Pond” (see photos Fig.28 and 29). All signs were installed around the restoration area, except for one “Working Together to Restore Fish Populations” was installed further upstream where the SBWA blocked the access of one river crossing area.

The GPS coordinated of each sign are as follows:

- “Riverbank Protection Zone”: N46°11'00.30" W64°30'38.00" and N46°11'01.20" W64°30'36.80"
- “Working Together to Restore Fish Populations”: N46°11'00.60" W64°30'38.40" and N46°10'33.08" and W64°31'13.05"
- “Sediment Mitigation of the Scoudouc River: Edna`s Pond”: N46°11'01.00" W64°30'40.90"

Figure 35: Photos of the 4 small signs installed along the Scoudouc River restoration site, 2017

Figure 36: Photo of the primary restoration sign installed along the Scoudouc River restoration site, 2017

7.2 Cornwall Brook

A stream assessment survey was conducted in the Cornwall Brook in the fall of 2016. The team discovered alders overgrowth clusters in several areas, fallen trees, debris pile-ups causing blockages, and severe bank erosion on each side of the brook, mainly upstream of the access road. A poor buffer zone was identified in the area where the agriculture fields begin, which also used to contain cows that used the brook to drink. The damage from these past farming activities are still evident.

The landowner is a former partner of the SBWA, who had granted access and permission for work and surveys in 2005-2006. He was contacted again prior to the survey, and granted permission of access and work once again.

The restoration plan for this site included: planting native trees to stabilize the riverbanks and enhance buffer zones; selective trimming of alder overgrowths using manual tools; installation of waddle fences to halt erosion; and the cleaning of debris pile-ups causing obstacles to fish migration. A Water and Wetland Alteration Permit (WAWA) was acquired for each activity performed (ALT 42109'17).

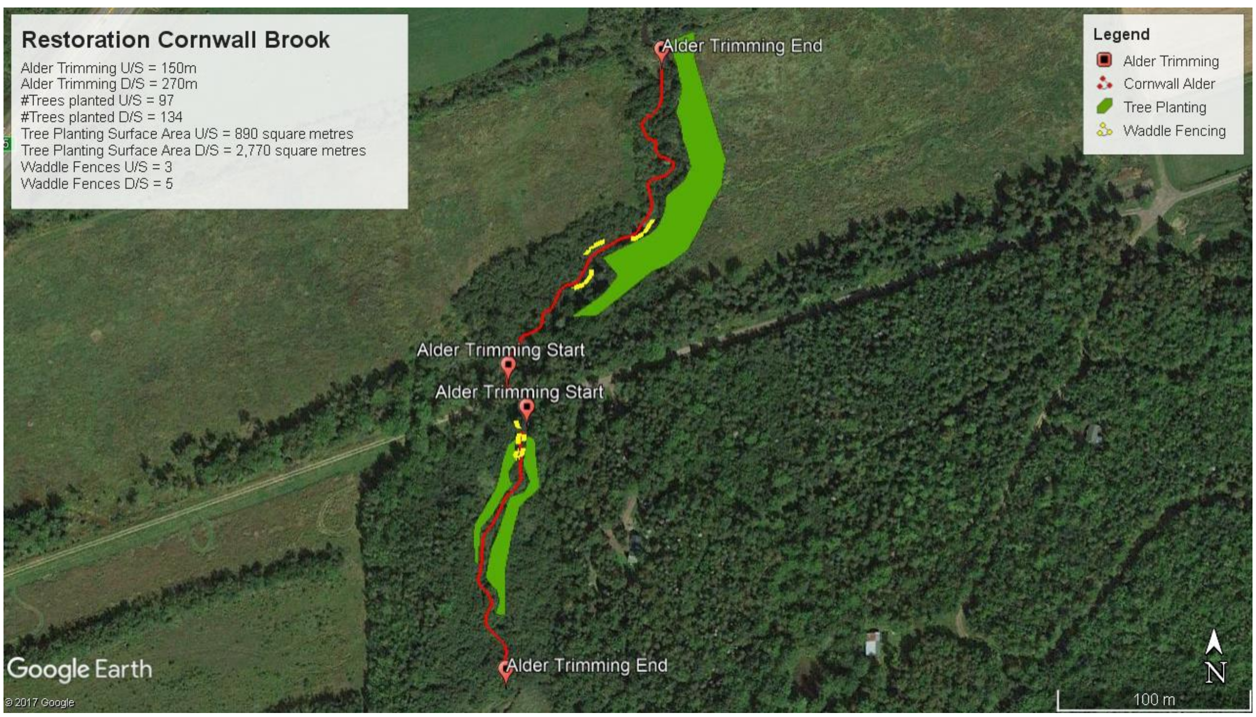


Figure 37: Map showing the locations where restoration work was done in the Cornwall Brook, 2017

7.2.1 Alder thinning and debris removal

The selective alder trimming was done carefully in order to preserve a healthy cover over the Cornwall Brook. Healthy overhanging branches from alders provide shade that maintains lower water temperatures. They are also important for fish habitat by providing habitat for insects, which in turn provides food for fish when they fall to the water below. Therefore, trained staff were careful to select and remove only dead and unhealthy alder clusters obstructing water flow.

The overgrowth alders had caused pile-ups of the debris in several areas. There were also a few areas where fallen trees and debris had caused blockages. The trees and debris were removed to restore optimal water flow and velocity. The alder and blockage cleanup were done in both directions of the private road used to access the site. The cleanup was done on a distance of 150 m upstream of the road, and 270 m downstream.

Figure 38: Examples of fallen trees and debris pile-ups causing blockages, Cornwall Brook 2017

Figure 39: Before and after photos of alder and debris cleanup, Cornwall Brook 2017

7.2.2 Waddle Fencing

The bank erosion of the area of remediation of the Cornwall Brook was quite severe on both sides of the steam. The branches and woody debris cleared from the brook during the first phase of the project was re-used for building materials; stakes were carved as fence posts and branches were used for fencing. The fences were built using manual tools such as sledgehammers, axe and cutters. A total of 8 waddle fences were built; 5 upstream of the access road and 3 downstream.

Waddle fences are built by weaving branches around wooden posts hammered in the soil, and filling the back with additional wooden debris. This structure will help stop erosion by deflecting the energy of the currents, and will also capture sediment over time and rebuild the eroded banks. An additional benefit of the waddle fences is the creation of shelter for fish.

Figure 40: Before and after photos of the waddle fences, Cornwall Brook 2017

Figure 41: Building process of waddle fences, Cornwall Brook 2017

7.2.3 Tree Planting

Native trees were planted on this site in order to re-establish a healthy buffer zone between the stream and the cultivated field, and to help stabilize eroding banks. Trees planted on the Cornwall Brook were provided by the wooded lot and nursery of the farm "*Vert l`Avenir*". Also, 97 balsam fir trees were donated by the landowner's forested land, and were replanted along the riverbank.

A total of 231 native trees were planted along the Cornwall Brook in 2017. Upstream of the access road, trees were planted primarily for erosion control (97 balsam fir). Downstream of the access site, around the second waddle fence site and the buffer zone of the old farm field, 134 trees were planted: 25 red oaks, 3 red maples, 2 grey birches, 1 trembling aspen, 1 mountain ash, 27 white spruces, 51 black spruces, 8 eastern hemlocks, 8 white pines and 8 white cedars. The species of trees chosen were mainly coniferous due to the presence of beavers, to reduce the chances of those trees planted becoming food for them.

Figure 42: Photos of the deforested buffer of the farm field

Figure 43: Trees planted in the buffer area, Cornwall Brook 2017

Figure 44: Trees planted for bank stabilization, Cornwall Brook 2017

7.3 Unnamed Brook Ohio Road/Cap-Brulé

An unnamed brook that crosses Ohio Road and flows into the Shediac Bay between The Bluff and Cap-Brûlé, was the subjects of a stream assessment survey in the fall of 2016. The survey revealed mainly trash and sections that would benefit from alder trimming and debris clearing.

Only 6 landowners were able to be reached and gave permission for alder maintenance on their property. These properties were accessed via Cartier rd. in Shediac. A build-up of fallen trees and woody debris was cleaned, and alders were selectively cut using manual tools. A Water and Wetland Alteration Permit (WAWA) was acquired for the removal of problematic vegetation (ALT 42511'17). Total distance of alder and debris cleanup was 140 m, all trash found in that zone was also collected.

Trash cleanup began from Ohio Road, and ended at the alder and debris cleanup site. The distance of the watercourse between Ohio Road and the end of the previous site is 205 metres, making a total of 345 m of trash collection. Trash found in the brook consisted of: tires, road signs, road construction cones, bottles and cans, and other assorted plastics and scrap metal. Trash was brought to *Eco360* sanitary landfill. A total of 130 kg (0.13 Metric Ton) trash was removed from the brook.

Figure 45: Map of unnamed brook cleanup, 2017

Figure 46: Photos of the cleanup of alders and debris jam, unnamed brook 2017

Figure 47: Photos of trash collected from the stream

7.4 Fish Ladder

This 10-foot heavy-duty aluminum fish ladder was installed on the elevated culvert of the McQuade Brook in 2015. In 2016, water deflectors were added to increase efficiency of the structure. Ongoing maintenance such as clearing the occasional debris and repairing minor winter damage is being done every year by the SBWA.


Figure 48: Fish ladder installed on the McQuade Brook.

8. NATURAL INFRASTRUCTURE COLLABORATIVE

The SBWA partnered in 2015 with Nature NB, the Regional Commission 7, and the University of Moncton, to assess the impacts of increased heavy rainfall events on the landscape due to climate change. The study looked at how natural landscapes, such as marshes and forests, helps reduce flooding. The study regroups researchers, planners and watershed groups to discuss climate change and adaptations for southeastern NB.

This group has evolved in the Maritime Natural Infrastructure Collaborative. The collaborative works to raise awareness about the role that nature plays in keeping communities healthy and resilient. The collective focuses on the roles of wetlands, forests and rivers in adaptation strategies for the increased rainfall events caused by climate change. A summary of the project was prepared to explain ecosystem services and the project details.

The collaborative looks at the impact of climate change on the landscape, mostly on increased high precipitation events and flooding. The Université de Moncton has developed models to predict flood risks in Southeastern NB with changes to land use. The model is still being adopted in order to be used by watershed groups or land-use planners.

Another aspect of the collaborative looks at incorporating ecosystem services in land-use planning. Two reports were made in 2017 on this topic. The report “Integrating Ecosystem Services into Land Use Planning in Maritime Canada” investigated methodology that can be used by local organizations, planners, and other levels of government, to identify, assess, value, and integrate ecosystem services into land-use planning. The report ‘Planning the Blue Zone’ examined different models of land-use planning that has been applied in Canada. Nature NB prepared a presentation on the work done by the collaborative for the 2017 Atlantic Planners Institute annual conference in Charlottetown.

Finally, the SBWA participated with the collaborative in developing educational materials. A brochure and infographic were designed to explain the services offered by keeping natural areas around rivers and wetlands. These materials can be used by different groups in presentations or at educational kiosks.

The collaborative had a meeting November 2, 2017, in Sackville to discuss next steps for the project both on the scientific and the educational aspect of the project. Project proposals are being developed by Nature NB to continue this partnership.

9. Groundtruthing Surveys in the Shediac River

In partnership with Nature NB, the Shediac Bay Watershed Association conducted groundtruthing surveys to verify the precision of the data displayed on their watershed mapping layers. The map developed for the Shediac River Watershed displays watercourses, wetlands, and various land uses such as agriculture and forest losses due to logging activity.

A pilot site was chosen within the sub-watershed area for field visits to assess the accuracy of the displayed data. The pilot site is marked in red within on the map below.

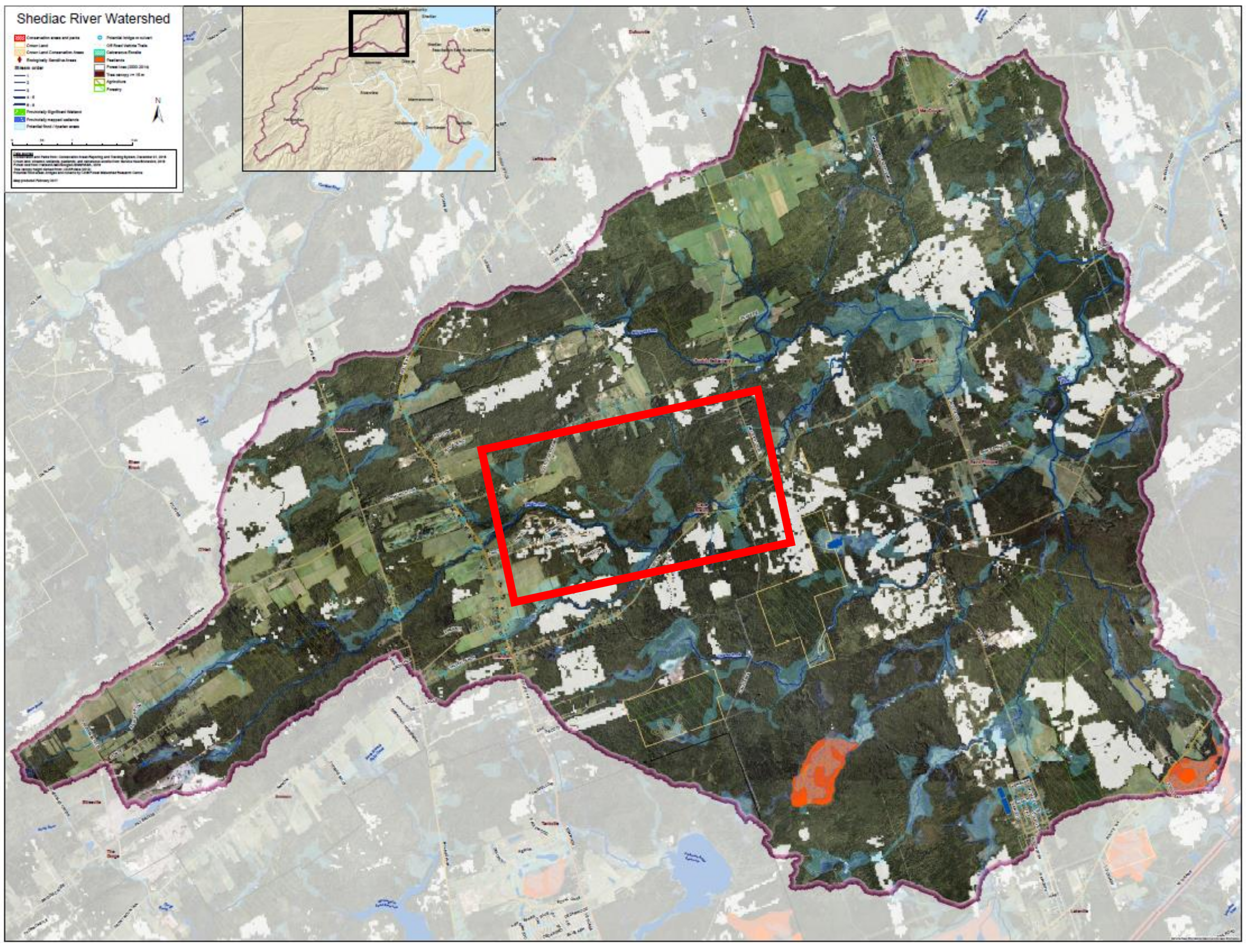


Figure 49: Map of the Shediac River Watershed, *Nature NB* February 2017

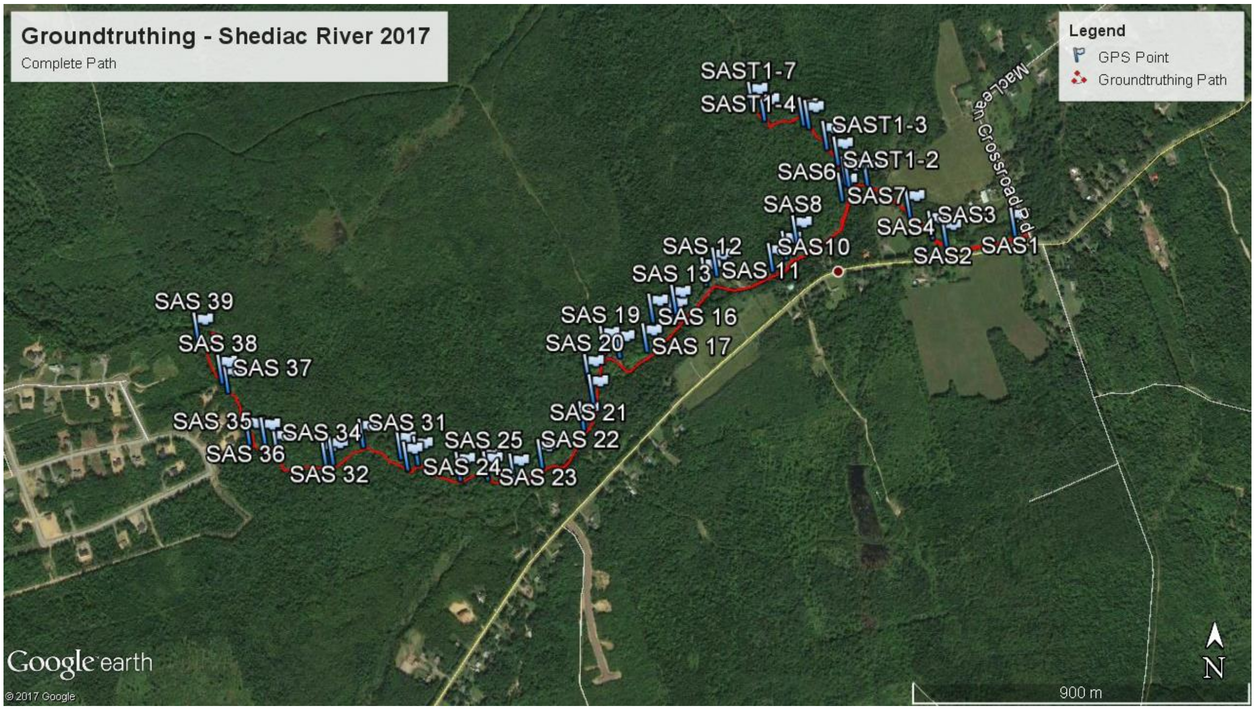


Figure 50: Groundtruthing site map summary, 2017

In total, approximately 3 km of the Shediac River was assessed under this part of the project. Small seasonal tributaries or inlets were identified that are not displayed on GeoNB. No new wetlands were positively discovered. Other observations such as isolated ponds or vernal ponds were identified, and those are important habitat for amphibians looking to lay their eggs. However, most of those isolated ponds were mainly infested with mosquito larvae.

Other important data was gathered that will help in future actions within the greater watershed management plan, such as;

- Areas with severe erosion, that might be subject to future stabilization projects;
- ATV crossings causing damage;
- Old garbage dump sites needing cleanup;
- Habitat data such as substrate types, areas with a lot of riffles and deep pools important for fish, suitable areas for future surveys, such as red counts and CABIN samplings.

The groundtruthing survey confirmed the highest reach of freshwater mussel populations in the Shediac River. A freshwater mussel surveys in 2014 began from MacLean Crossroads moving downstream (North-Est) and searched for freshwater mussels and suitable mussel habitat. The first freshwater mussel, as well as the beginning of a mussel bed or habitat, was found approximately 2 km down from the starting point. In 2015, another survey was done upstream and downstream of the culvert on Route 115 in Irish Town. No mussels were found in either direction. This survey confirmed that there are no freshwater mussel beds in the entirety of the path of the groundtruthing survey, providing a great piece of information on the reach of freshwater mussel population in the Shediac River.

The groundtruthing survey helped the SBWA identify possible spawning grounds for Atlantic salmon. The team discovered a new access path to the river, a snowmobile trail easily accessible from Cape Breton Road. From this access point heading upstream, the substrate is composed of clean gravel, an excellent habitat for salmon spawning. In November 2017, SBWA staff returned to that location to conduct the first redd count survey, as a test site to look for signs of spawning activity. The redd survey was done over 1 km, and found 14 possible salmon redds. This new piece of information will benefit the greater watershed management plan, by providing the first piece of positively identified spawning habitat for the Atlantic salmon.

10. EDUCATIONAL KIOSKS

10.1 Shediac Farmer’s Market

An education kiosk was displayed on Sundays at the Shediac Farmer’s market, for 10 weeks out of the summer. The main objective was to speak on water conservation and stormwater management, and giveaway water conservation kits and rain barrels. SBWA staff and summer students talked to visitors of all ages on the various other projects of the year. In the summer of 2017, staff spoke to over 1,400 visitors about the watershed group, local environmental issues and projects realized to mitigate these issues. The market kiosk is always a great tool to find people interested in receiving free rain barrels and water conservation kits for their homes.

Figure 51: Shediac Farmer's Market in the Park

10.2 Lobster Festival

In partnership with the Homarus Eco-centre, a kiosk was set up for four days at the Shediac Lobster festival from July 5th to July 8th. Our summer students spoke of our projects in the same fashion as the Shediac Farmer’s market in the Park.

Figure 52: Shediac Lobster Festival

10.3 Media Outreach

10.3.1 Newsletter

Two bilingual newsletters were produced during the 2017-2018 fiscal year. The newsletter display information and photos on the various projects that the SBWA has been doing in the year. The Association had 250 copies produced for each edition, printed on 100% recycled paper. The newsletters are distributed to various businesses, medical offices, hair salons, and anywhere else that had a waiting area or that was appropriate to leave newsletters for the public to take. The rest were distributed during the Shediac Market, during public presentations and other meetings. The newsletters can be found on the Shediac Bay Watershed Association website.

10.3.2 Socials Medias and Website

The SBWA is working to keep its website and social media up to date, posting photos and short description of activities and projects. The SBWA also attended a conference on social media for non-profit organizations, helping us to develop a social media communications strategy. The association is also working on the development of infographic and fact sheets, being professionally designed, to be posted to the website and social media.

www.shediacbayassociation.org www.facebook.com/#!/shediacbaywatershedassociation

11. CLOSING COMMENTS

The Shediac Bay Watershed Association had a successful year in 2017-2018, thanks to the support of the NB Environmental Trust Fund. The Association has met its targets regarding the monitoring and partnerships created to improve water quality in the Shediac Bay watershed. Sampling results will help in the development of new projects with the purpose of addressing environmental issue targeting water quality. With the help of sampling results, land use investigation, habitat evaluations and several invaluable partners such as the *Department of Environment and Local Government*, an action plan can be developed to address contamination sources. When dealing with non-point source pollution in a watershed, one cannot be expected to solve the issues of human activities overnight. Problems related stormwater runoff and faults in both private and municipal infrastructure can take several years and even decades to be detected and resolved. Collaborations between environmental groups, businesses, private citizen and government are crucial in the development and implementation of an action plan.

Habitat restoration projects for fish have been funded by different organizations in 2017-18, including the Atlantic Salmon Conservation Fund, The Recreation Fisheries Conservation Partnership Program, the NB Wildlife Trust Fund and the NB Environmental Trust Fund. The support received allowed for more projects to be realized. The restoration sites will be monitored in future years to ensure that measures taken will have a positive impact on water quality and fish populations.

The studies on climate change adaptation will benefit the association by providing action priorities for adaptation projects that can then be applied by the SBWA and its partners.

Partnerships are essential for environmental groups to accomplish their work. The Association is building good relationships with the town of Shediac, the local schools and other local groups. We hope to diversify our activities to involve more people in the protection of water quality in Shediac Bay. The Association will continue to participate in the various local events and give presentations when requested.

The Environmental Trust Fund remains a critical partner for the Shediac Bay Watershed Association. Improving water quality is a long-term endeavour that can be accomplished one project at a time. We hope to continue receiving support as our programs develop to address water quality issues in the Shediac Bay watershed.

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APPENDIX A - WATER CHEMISTRY METHODOLOGY

Table 41: RPC Laboratory Analytical Methods

RPC LABORATORY ANALYTICAL METHODS				
Analyte	Parameter	RPC SOP Number	Method Reference	Method Principle
Ammonia	NH_3T	4.M47	APHA 4500-NH3 G	Phenate Colourimetry
pH	pH	4.M03	APHA 4500-H+ B	pH Electrode - Electrometric
Alkalinity (as CaCO3)	ALK_T	4.M43	EPA 310.2	Methyl Orange Colourimetry
Chloride	Cl	4.M44	APHA 4500-CL E	Ferricyanide Colourimetry
Fluoride	F	4.M30	APHA 4500-F- D	SPADNS Colourimetry
Sulfate	SO_4	4.M45	APHA 4500-SO4 E	Turbidimetry
Nitrate + Nitrite (as N)	NO_X	4.M48	APHA 4500-NO3 H	Hydrazine Red., Derivitization, Colourimetry
Nitrite (as N)	NO_3	4.M49	APHA 4500-NO2- B	Ferrous Ammonium Sulfate Colourimetry
Phosphorus - Total	TP-L	4.M17	APHA 4500-P E	Digestion, Manual Colourimetry
Carbon - Dissolved Organic	TOC	4.M38	APHA 5310 C	UV-Persulfate Digestion, NDIR Detection
Turbidity	TURB	4.M06	APHA 2130 B	Nephelometry
Colour	CLRA	4.M55	APHA 2020 Color (A,C)	Single Wavelength Spectrophotometry
Conductivity	COND	4.M04	APHA 2510 B	Conductivity Meter, Pt Electrode
Trace Metals	—	4.M01/4.M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES

Table 42: RPC Laboratory Analytical Methods for E. coli

RPC LAB ANALYTICAL METHODS FOR E. COLI		
Method	ID	Max Detection Limit
Membrane Filtration	FSA-01	10000 MPN/100 mL
Colilert	FSA-10	2419.6 MPN/100 mL

APPENDIX B – CABIN DATA 2017

Table 43: CABIN Site Data Report for SHA-01, 2017

Site Information			
Variable	**Value**		
Site Code	SHA-01		
Name	Shediac River		
Basin	Northumberland Strait		
Stream Order (1:50000)	3		
Eco-Region	Maritime Lowlands		
Eco-Zone	Atlantic Maritime		
Envirodat Code	RPC Fredericton Lab		
Sampling Device	Kick Net		
Protocol	CABIN - Wadeable Streams		
Date	Oct 25, 2017		
Sample(s) Taken	1		
Kick Time (Min)	3		
Mesh Size (µ.m)	400		
Description	The site is downstream from culvert, located on Route 490 near Irishtown, approximately 1 km north from Ammon road.		
Latitude & Longitude	46.1935 & -64.815472222		
Altitude	334 feet		
Datum	nad83		
Taxonomist	Jo-Anne Monahan		
ID Date	Nov 13, 2017		
Certifications			
Sampling Crew	Crew 17		
	Jolyne Hébert		
	Rémi Donelle		
Habitat			
Type	**Variable**	Value	Unit
Channel	% Canopy Coverage	3	PercentRange
Channel	Avg Channel Depth	13.2	cm
Channel	Avg Velocity	0.21	m/s
Channel	Bank Full Width	9	m
Channel	Bankfull-Wetted Depth	46	cm
Channel	Dominant Streamside Vegetation	3	Category (1-4)
Channel	Macrophyte Score	1	PercentRange
Channel	Max Channel Depth	14	cm
Channel	Max Velocity	0.42	m/s
Channel	Presence of Coniferous Trees	1	Binary
Channel	Presence of Deciduous Trees	1	Binary
Channel	Presence of Grasses	1	Binary
Channel	Presence of Shrubs	1	Binary

Channel	Riffle in Reach	1	Binary
Channel	Slope	1	m/m
Channel	Straight Run in Reach	0.016	Binary
Channel	Velocity Measurement Method	1	Category (1-3)
Channel	Wetted Width	1	m
Substrate Data	% Bedrock	3.2	%
Substrate Data	% Boulder	3	%
Substrate Data	% Cobble	0	%
Substrate Data	% Gravel	49	%
Substrate Data	% Pebble	11	%
Substrate Data	% Sand	37	%
Substrate Data	% Silt+Clay	0	%
Substrate Data	2nd Dominant Substrate	0	Category(0-9)
Substrate Data	Dominant Substrate	5	Category(0-9)
Substrate Data	Embeddedness	6	Category(1-5)
Substrate Data	Geometric Mean Particle Size	4	cm
Substrate Data	Median Particle Size	5.1	cm
Substrate Data	Periphyton Coverage	6.5	Category(1-5)
Substrate Data	Surrounding Material	1	Category(0-9)
Water Chemistry			
Type	Variable	Value	Unit
Water Chemistry	Air Temperature	18	Degrees Celsius
Water Chemistry	Alkalinity	78	mg/L
Water Chemistry	Aluminum	0.044	mg/L
Water Chemistry	Ammonia	0.025	mg/L
Water Chemistry	Antimony	0.00005	mg/L
Water Chemistry	Arsenic	0.0005	mg/L
Water Chemistry	Barium	0.05	mg/L
Water Chemistry	Beryllium	0.00005	mg/L
Water Chemistry	Bismuth	0.0005	mg/L
Water Chemistry	Boron	0.028	mg/L
Water Chemistry	Bottom Dissolved Oxygen	9.53	mg/L
Water Chemistry	Bromide	0.02	mg/L
Water Chemistry	Cadmium	0.000005	mg/L
Water Chemistry	Calcium	33.3	mg/L
Water Chemistry	Carbonate	0.366	mg/L
Water Chemistry	Chromium	0.0005	mg/L
Water Chemistry	Cobalt	0.00005	mg/L
Water Chemistry	Conductivity	181	µS/cm
Water Chemistry	Copper	0.0005	mg/L
Water Chemistry	Dissolved Chloride	9.6	mg/L
Water Chemistry	Dissolved Organic Carbon	3.2	mg/L
Water Chemistry	Fluoride	0.14	mg/L

Water Chemistry	Hardness	106	mg/L
Water Chemistry	Iron	0.26	mg/L
Water Chemistry	Lead	0.00005	mg/L
Water Chemistry	Lithium	0.002	mg/L
Water Chemistry	Magnesium	5.47	mg/L
Water Chemistry	Manganese	0.069	mg/L
Water Chemistry	Molybdenum	0.0023	mg/L
Water Chemistry	Nickel	0.0005	mg/L
Water Chemistry	Nitrate	0.35	mg/L
Water Chemistry	Nitrate/Nitrite	0.35	mg/L
Water Chemistry	Nitrite	0.025	mg/L
Water Chemistry	pH	7.8	pH
Water Chemistry	Potassium	0.98	mg/L
Water Chemistry	Selenium	0.0005	mg/L
Water Chemistry	Silver	0.00005	mg/L
Water Chemistry	Sodium	6.81	mg/L
Water Chemistry	Strontium	0.4	mg/L
Water Chemistry	Sulphate	26	mg/L
Water Chemistry	TDS (Filterable Residue)	132	mg/L
Water Chemistry	Tellurium	0.00005	mg/L
Water Chemistry	Temperature	11.7	Degrees Celsius
Water Chemistry	Thallium	0.00005	mg/L
Water Chemistry	Tin	0.00005	mg/L
Water Chemistry	TKN (Water)	0.2	mg/L
Water Chemistry	Total Nitrogen	0.6	mg/L
Water Chemistry	Total Phosphorus (Water)	0.012	mg/L
Water Chemistry	Turbidity	157.3	NTU
Water Chemistry	Uranium	0.0014	mg/L
Water Chemistry	Vanadium	0.0005	mg/L
Water Chemistry	Zinc	0.004	mg/L

Taxonomy

Phylum	Class	Order	Family	Raw Count	Mean Count	Notes
Annelida	Oligochaeta	Lumbriculida	—	1	20	
Arthropoda	Insecta	Plecoptera	—	3	60	Immature
Arthropoda	Insecta	Trichoptera	—	3	60	Immature
Arthropoda	Insecta	Diptera	Athericidae	2	40	
Arthropoda	Insecta	Ephemeroptera	Baetidae	8	160	
Arthropoda	Insecta	Plecoptera	Capniidae	20	400	
Arthropoda	Insecta	Diptera	Ceratopogonidae	1	20	
Arthropoda	Insecta	Diptera	Chironomidae	112	2240	

Arthropoda	Insecta	Megaloptera	Corydalidae	1	20	
Arthropoda	Insecta	Coleoptera	Elmidae	26	520	
Arthropoda	Insecta	Ephemeroptera	Ephemerellidae	15	300	
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	33	660	
Arthropoda	Insecta	Trichoptera	Hydropsychidae	7	140	
Arthropoda	Arachnida	Trombidiformes	Lebertiidae	7	140	
Arthropoda	Insecta	Trichoptera	Lepidostomatidae	1	20	
Arthropoda	Insecta	Ephemeroptera	Leptophlebiidae	49	980	
Arthropoda	Insecta	Plecoptera	Leuctridae	3	60	
Arthropoda	Insecta	Trichoptera	Limnephilidae	1	20	
Annelida	Oligochaeta	Tubificida	Naididae	4	80	
Arthropoda	Insecta	Trichoptera	Odontoceridae	1	20	
Arthropoda	Insecta	Plecoptera	Perlidae	5	100	
Arthropoda	Insecta	Trichoptera	Philopotamidae	5	100	
Arthropoda	Insecta	Trichoptera	Polycentropodidae	1	20	
Arthropoda	Insecta	Trichoptera	Rhyacophilidae	1	20	
Arthropoda	Arachnida	Trombidiformes	Sperchontidae	1	20	
Arthropoda	Insecta	Plecoptera	Taeniopterygidae	4	80	
Arthropoda	Insecta	Diptera	Tipulidae	2	40	
Arthropoda	Arachnida	Trombidiformes	Torrenticolidae	1	20	

Table 44: **CABIN Site Data Report for SHM-01, 2017**

Site Information	
Variable	**Value**
Site Code	SHM01
Name	Shediac River
Basin	Northumberland Strait
Stream Order (1:50000)	3
Eco-Region	Maritime Lowlands
Eco-Zone	Atlantic Maritime
Envirodat Code	RPC Fredericton Lab
Sampling Device	Kick Net
Protocol	CABIN - Wadeable Streams
Date	Oct 25, 2017
Sample(s) Taken	1
Kick Time (Min)	3
Mesh Size (µ.m)	400
Description	This site is located in Weisner Brook, tributary of the Shediac River, at a bridge on Bateman Mill rd. It is a residential area but surrounded by forest, there is a house on the land of the site.
Latitude & Longitude	46.206888889 & -64.672277778
Altitude	42 feet

Datum	nad83		
Taxonomist	Jo-Anne Monahan		
ID Date	Nov 13, 2017		
Certifications			
Sampling Crew	Crew 16		
	Jolyne Hébert		
	Rémi		
Habitat			
Type	Variable	Value	Unit
Channel	% Canopy Coverage	2	PercentRange
Channel	Avg Channel Depth	8.4	cm
Channel	Avg Velocity	0.26	m/s
Channel	Bank Full Width	9	m
Channel	Bankfull-Wetted Depth	60	cm
Channel	Dominant Streamside Vegetation	3	Category (1-4)
Channel	Macrophyte Score	0	PercentRange
Channel	Max Channel Depth	10.9	cm
Channel	Max Velocity	0.51	m/s
Channel	Presence of Coniferous Trees	1	Binary
Channel	Presence of Deciduous Trees	1	Binary
Channel	Presence of Grasses	1	Binary
Channel	Presence of Shrubs	1	Binary
Channel	Riffle in Reach	1	Binary
Channel	Slope	1	m/m
Channel	Straight Run in Reach	0.003	Binary
Channel	Velocity Measurement Method	1	Category (1-3)
Channel	Wetted Width	1	m
Substrate Data	% Bedrock	7.6	%
Substrate Data	% Boulder	4	%
Substrate Data	% Cobble	0	%
Substrate Data	% Gravel	19	%
Substrate Data	% Pebble	4	%
Substrate Data	% Sand	73	%
Substrate Data	% Silt+Clay	0	%
Substrate Data	2nd Dominant Substrate	0	Category(0-9)
Substrate Data	Dominant Substrate	5	Category(0-9)
Substrate Data	Embeddedness	4	Category(1-5)
Substrate Data	Geometric Mean Particle Size	4	cm
Substrate Data	Median Particle Size	3.7	cm
Substrate Data	Periphyton Coverage	3.3	Category(1-5)
Substrate Data	Surrounding Material	3	Category(0-9)
Water Chemistry			
Type	Variable	Value	Unit
Water Chemistry	Air Temperature	18	Degrees Celsius
Water Chemistry	Alkalinity	65	mg/L

Water Chemistry	Aluminum	0.018	mg/L
Water Chemistry	Ammonia	0.025	mg/L
Water Chemistry	Antimony	0.00005	mg/L
Water Chemistry	Arsenic	0.0005	mg/L
Water Chemistry	Barium	0.075	mg/L
Water Chemistry	Beryllium	0.00005	mg/L
Water Chemistry	Bismuth	0.0005	mg/L
Water Chemistry	Boron	0.014	mg/L
Water Chemistry	Bottom Dissolved Oxygen	9.08	mg/L
Water Chemistry	Bromide	0.02	mg/L
Water Chemistry	Cadmium	0.000005	mg/L
Water Chemistry	Calcium	17	mg/L
Water Chemistry	Carbonate	0.242	mg/L
Water Chemistry	Chromium	0.0005	mg/L
Water Chemistry	Cobalt	0.00005	mg/L
Water Chemistry	Conductivity	121	µS/cm
Water Chemistry	Copper	0.0005	mg/L
Water Chemistry	Dissolved Chloride	6.8	mg/L
Water Chemistry	Dissolved Organic Carbon	8.2	mg/L
Water Chemistry	Fluoride	0.2	mg/L
Water Chemistry	Hardness	66.4	mg/L
Water Chemistry	Iron	0.13	mg/L
Water Chemistry	Lead	0.00005	mg/L
Water Chemistry	Lithium	0.0022	mg/L
Water Chemistry	Magnesium	5.81	mg/L
Water Chemistry	Manganese	0.082	mg/L
Water Chemistry	Molybdenum	0.0001	mg/L
Water Chemistry	Nickel	0.0005	mg/L
Water Chemistry	Nitrate	0.025	mg/L
Water Chemistry	Nitrate/Nitrite	0.025	mg/L
Water Chemistry	Nitrite	0.025	mg/L
Water Chemistry	pH	7.2	pH
Water Chemistry	Potassium	1.14	mg/L
Water Chemistry	Selenium	0.0005	mg/L
Water Chemistry	Silver	0.00005	mg/L
Water Chemistry	Sodium	7.43	mg/L
Water Chemistry	Strontium	0.127	mg/L
Water Chemistry	Sulphate	5	mg/L
Water Chemistry	TDS (Filterable Residue)	83	mg/L
Water Chemistry	Tellurium	0.00005	mg/L
Water Chemistry	Temperature	12.7	Degrees Celsius

Water Chemistry	Thallium	0.00005	mg/L
Water Chemistry	Tin	0.00005	mg/L
Water Chemistry	TKN (Water)	0.3	mg/L
Water Chemistry	Total Nitrogen	0.3	mg/L
Water Chemistry	Total Phosphorus (Water)	0.019	mg/L
Water Chemistry	Turbidity	103.35	NTU
Water Chemistry	Uranium	0.0001	mg/L
Water Chemistry	Vanadium	0.0005	mg/L
Water Chemistry	Zinc	0.003	mg/L

Taxonomy						
Phylum	Class	Order	Family	Raw Count	Mean Count	Notes
Arthropoda	Insecta	Plecoptera		3	60	
Arthropoda	Insecta	Odonata	Aeshnidae	1	20	
Arthropoda	Insecta	Ephemeroptera	Baetidae	39	780	
Arthropoda	Insecta	Plecoptera	Capniidae	23	460	
Arthropoda	Insecta	Diptera	Ceratopogonidae	3	60	
Arthropoda	Insecta	Diptera	Chironomidae	130	2600	
Arthropoda	Insecta	Megaloptera	Corydalidae	1	20	
Arthropoda	Insecta	Coleoptera	Elmidae	14	280	
Arthropoda	Insecta	Diptera	Empididae	1	20	
Annelida	Oligochaeta	Enchytraeida	Enchytraeidae	1	20	
Arthropoda	Insecta	Ephemeroptera	Ephemerellidae	61	1220	
Arthropoda	Insecta	Trichoptera	Glossosomatidae	2	40	
Arthropoda	Insecta	Odonata	Gomphidae	1	20	
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	5	100	
Arthropoda	Insecta	Trichoptera	Hydropsychidae	16	320	
Arthropoda	Arachnida	Trombidiformes	Lebertiidae	4	80	
Arthropoda	Insecta	Ephemeroptera	Leptophlebiidae	47	940	
Arthropoda	Insecta	Plecoptera	Leuctridae	1	20	
Arthropoda	Insecta	Trichoptera	Limnephilidae	1	20	
Annelida	Oligochaeta	Lumbriculida	Lumbriculidae	4	80	
Annelida	Oligochaeta	Tubificida	Naididae	1	20	
Arthropoda	Insecta	Plecoptera	Nemouridae	1	20	
Arthropoda	Insecta	Plecoptera	Perlidae	7	140	
Arthropoda	Insecta	Plecoptera	Perlodidae	3	60	
Mollusca	Bivalvia	Veneroida	Pisidiidae	3	60	
Arthropoda	Insecta	Trichoptera	Polycentropodidae	1	20	
Arthropoda	Insecta	Trichoptera	Rhyacophilidae	1	20	
Arthropoda	Insecta	Megaloptera	Sialidae	1	20	
Arthropoda	Arachnida	Trombidiformes	Sperchontidae	5	100	

Arthropoda	Insecta	Plecoptera	Taeniopterygidae	2	40	
Arthropoda	Insecta	Diptera	Tipulidae	9	180	
Arthropoda	Arachnida	Trombidiformes	Torrenticolidae	1	20	

Table 45: CABIN Site Data Report for SCF-01, 2017

Site Information	
Variable	**Value**
Site Code	SCF01
Name	Scoudouc River
Local Basin Name	Northumberland Strait
Stream Order (1:50000)	0
Eco-Region	Maritime Lowlands
Eco-zone	Atlantic Maritime
Envirodat Code	
Sampling Device	Kick Net
Protocol	CABIN - Wadeable Streams
Date	Oct 26, 2017
Sample(s) Taken	1
Kick Time (min)	3
Mesh Size (µm)	400
Description	Near Southeast Regional Correctional Center in Shediac, down the road turn on left on Pellerin Rd. drive 3.4 km and there's a ATV trail on the right walk 230 m.
Latitude & Longitude	46.1838806 & -64.5107528
Altitude	29 feet
Datum	nad83
Taxonomist	Jo-Anne Monahan
ID Date	Nov 13, 2017
Certifications	
Sampling Crew	Crew 16
	Jolyne Hébert
	Rémi Donelle

Habitat			
Type	Variable	Value	Unit
Channel	% Canopy Coverage	0	PercentRange
Channel	Avg Channel Depth	8	cm
Channel	Avg Velocity	0.39	m/s
Channel	Bank Full Width	15.8	m
Channel	Bankfull-Wetted Depth	98	cm
Channel	Dominant Streamside Vegetation	4	Category (1-4)
Channel	Macrophyte Score	1	PercentRange
Channel	Max Channel Depth	14.5	cm

Channel	Max Velocity	0.46	m/s
Channel	Presence of Coniferous Trees	1	Binary
Channel	Presence of Deciduous Trees	1	Binary
Channel	Presence of Grasses	1	Binary
Channel	Presence of Shrubs	1	Binary
Channel	Riffle in Reach	1	Binary
Channel	Slope	0.00522	m/m
Channel	Straight Run in Reach	1	Binary
Channel	Velocity Measurement Method	3.4	Category (1-3)
Channel	Wetted Width	14	m
Substrate Data	Periphyton Coverage	4	Category(1-5)
Substrate Data	Surrounding Material	53	Category(0-9)

Water Chemistry

Type	Variable	Value	Unit
Water Chemistry	Alkalinity	43	mg/L
Water Chemistry	Aluminum	0.044	mg/L
Water Chemistry	Ammonia	0.025	mg/L
Water Chemistry	Antimony	0.00005	mg/L
Water Chemistry	Arsenic	0.0005	mg/L
Water Chemistry	Barium	0.05	mg/L
Water Chemistry	Beryllium	0.00005	mg/L
Water Chemistry	Bismuth	0.0005	mg/L
Water Chemistry	Boron	0.011	mg/L
Water Chemistry	Bottom Dissolved Oxygen	8.59	mg/L
Water Chemistry	Bromide	0.07	mg/L
Water Chemistry	Cadmium	0.000005	mg/L
Water Chemistry	Calcium	15.7	mg/L
Water Chemistry	Carbonate	0.128	mg/L
Water Chemistry	Cobalt	0.0001	mg/L
Water Chemistry	Conductivity	128	µS/cm
Water Chemistry	Copper	0.0005	mg/L
Water Chemistry	Dissolved Chloride	18.5	mg/L
Water Chemistry	Dissolved Organic Carbon	12	mg/L
Water Chemistry	Fluoride	0.22	mg/L
Water Chemistry	Hardness	48.3	mg/L
Water Chemistry	Iron	0.34	mg/L
Water Chemistry	Lead	0.0001	mg/L
Water Chemistry	Lithium	0.0009	mg/L
Water Chemistry	Magnesium	2.22	mg/L
Water Chemistry	Manganese	0.062	mg/L
Water Chemistry	Molybdenum	0.0001	mg/L

Water Chemistry	Nickel	0.0005	mg/L
Water Chemistry	Nitrate	0.025	mg/L
Water Chemistry	Nitrate/Nitrite	0.025	mg/L
Water Chemistry	Nitrite	0.025	mg/L
Water Chemistry	pH	8	pH
Water Chemistry	Potassium	0.96	mg/L
Water Chemistry	Selenium	0.0005	mg/L
Water Chemistry	Silver	0.00005	mg/L
Water Chemistry	Sodium	13.2	mg/L
Water Chemistry	Strontium	0.097	mg/L
Water Chemistry	Sulphate	0.5	mg/L
Water Chemistry	TDS (Filterable Residue)	77	mg/L
Water Chemistry	Tellurium	0.00005	mg/L
Water Chemistry	Temperature	15.5	Degrees Celsius
Water Chemistry	Thallium	0.00005	mg/L
Water Chemistry	Tin	0.00005	mg/L
Water Chemistry	TKN (Water)	0.4	mg/L
Water Chemistry	Total Nitrogen	0.4	mg/L
Water Chemistry	Total Phosphorus (Water)	0.022	mg/L
Water Chemistry	Turbidity	101.4	NTU
Water Chemistry	Uranium	0.0001	mg/L
Water Chemistry	Vanadium	0.0005	mg/L
Water Chemistry	Zinc	0.002	mg/L

Taxonomy

Phylum	Class	Order	Family	Raw Count	Mean Count	Notes
Arthropoda	Insecta	Ephemeroptera	Baetidae	2	40	
Arthropoda	Insecta	Trichoptera	Brachycentridae	3	60	
Arthropoda	Insecta	Plecoptera	Capniidae	3	60	
Arthropoda	Insecta	Diptera	Ceratopogonidae	1	20	
Arthropoda	Insecta	Diptera	Chironomidae	124	2480	
Arthropoda	Insecta	Coleoptera	Elmidae	10	200	
Arthropoda	Insecta	Diptera	Empididae	4	80	
Arthropoda	Insecta	Ephemeroptera	Ephemerellidae	57	1140	
Arthropoda	Insecta	Ephemeroptera	Ephemeridae	1	20	
Arthropoda	Insecta	Odonata	Gomphidae	1	20	
Arthropoda	Insecta	Trichoptera	Helicopsychidae	1	20	
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	49	980	
Arthropoda	Insecta	Trichoptera	Hydropsychidae	43	860	
Arthropoda	Insecta	Trichoptera	Hydroptilidae	2	40	
Arthropoda	Insecta	Trichoptera	Lepidostomatidae	4	80	

Arthropoda	Insecta	Ephemeroptera	Leptophlebiidae	50	1000	
Annelida	Oligochaeta	Tubificida	Naididae	14	280	
Arthropoda	Insecta	Plecoptera	Perlidae	3	60	
Mollusca	Bivalvia	Veneroida	Pisidiidae	2	40	
Arthropoda	Insecta	Trichoptera	Polycentropodidae	2	40	
Arthropoda	Insecta	Trichoptera	Rhyacophilidae	2	40	
Arthropoda	Arachnida	Trombidiformes	Sperchontidae	1	20	
Arthropoda	Insecta	Plecoptera	Taeniopterygidae	1	20	

APPENDIX C – CABIN DATA 2016 : TAXONOMY

Table 46: CABIN Site Information and Taxonomy Date Report for SHA-01, 2016

Site Information						
Variable	**Value**					
Site Code	SHA-01					
Name	Shediac River					
Basin	Northumberland Strait					
Stream Order (1:50000)	3					
Eco-Region	Maritime Lowlands					
Eco-Zone	Atlantic Maritime					
Envirodat Code	RPC Fredericton Lab					
Sampling Device	Kick Net					
Protocol	CABIN - Wadeable Streams					
Date	06-October-2016					
Sample(s) Taken	1					
Kick Time (Min)	3					
Mesh Size (µ.m)	400					
Description	The site is downstream from culvert, located on Route 490 near Irishtown, approximately 1 km north from Ammon road.					
Latitude & Longitude	46.1935 & -64.815472222					
Altitude	334 feet					
Datum	nad83					
Taxonomist	Jo-Anne Monahan					
ID Date	Feb 27, 2017					
Certifications						
Sampling Crew	Crew 16					
	Jolyne Hébert					
	Mélissa Tremblay					
	Jamie Richard					
Taxonomy						
Phylum	Class	Order	Family	Raw Count	Mean Count	Notes
Arthropoda	Insecta	Plecoptera	—	9	112.5	Immature
Arthropoda	Insecta	Trichoptera	—	3	37.5	Immature
Arthropoda	Insecta	Ephemeroptera	Baetidae	4	50	
Arthropoda	Insecta	Plecoptera	Capniidae	10	125	
Arthropoda	Insecta	Diptera	Ceratopogonidae	1	12.5	
Arthropoda	Insecta	Diptera	Chironomidae	87	1087.5	
Arthropoda	Insecta	Plecoptera	Chloroperlidae	2	25	
Arthropoda	Insecta	Megaloptera	Corydalidae	1	12.5	
Arthropoda	Insecta	Coleoptera	Elmidae	46	575	
Arthropoda	Insecta	Diptera	Empididae	2	25	
Arthropoda	Insecta	Ephemeroptera	Ephemerellidae	39	487.5	

Arthropoda	Insecta	Ephemeroptera	Heptageniidae	25	312.5	
Arthropoda	Insecta	Trichoptera	Hydropsychidae	6	75	
Arthropoda	Arachnida	Trombidiformes	Lebertiidae	3	37.5	
Arthropoda	Insecta	Ephemeroptera	Leptophlebiidae	32	400	
Arthropoda	Insecta	Plecoptera	Leuctridae	2	25	
Annelida	Oligochaeta	Lumbriculida	Lumbriculidae	3	37.5	
Annelida	Oligochaeta	Tubificida	Naididae	2	25	
Arthropoda	Insecta	Plecoptera	Perlidae	2	25	
Arthropoda	Insecta	Plecoptera	Perlodidae	1	12.5	
Arthropoda	Insecta	Trichoptera	Philopotamidae	4	50	
Mollusca	Bivalvia	Veneroida	Pisidiidae	1	12.5	
Arthropoda	Insecta	Trichoptera	Polycentropodidae	1	12.5	
Arthropoda	Insecta	Trichoptera	Rhyacophilidae	1	12.5	
Arthropoda	Arachnida	Trombidiformes	Sperchontidae	9	112.5	
Arthropoda	Insecta	Plecoptera	Taeniopterygidae	12	150	
Arthropoda	Insecta	Diptera	Tipulidae	6	75	
Arthropoda	Arachnida	Trombidiformes	Torrenticolidae	1	12.5	

Table 47: CABIN Site Information and Taxonomy Date Report for SHM-01, 2016

Site Information	
Variable	**Value**
Site Code	SHM01
Name	Shediac River
Basin	Northumberland Strait
Stream Order (1:50000)	3
Eco-Region	Maritime Lowlands
Eco-Zone	Atlantic Maritime
Envirodat Code	RPC Fredericton Lab
Sampling Device	Kick Net
Protocol	CABIN - Wadeable Streams
Date	Oct. 6, 2016
Sample(s) Taken	1
Kick Time (Min)	3
Mesh Size (µ.m)	400
Description	This site is located in Weisner Brook, tributary of the Shediac River, at a bridge on Bateman Mill rd. It is a residential area but surrounded by forest, there is a house on the land of the site.
Latitude & Longitude	46.206888889 & -64.672277778
Altitude	42 feet
Datum	nad83
Taxonomist	Jo-Anne Monahan
ID Date	Feb 27, 2017
Certifications	

Sampling Crew	Crew 16					
	Jolyne Hébert					
	Mélissa Tremblay					
	Jamie Richard					
Taxonomy						
Phylum	Class	Order	Family	Raw Count	Mean Count	Notes
Arthropoda	Insecta	Plecoptera	—	2	33.33	Immature
Arthropoda	Insecta	Ephemeroptera	Baetidae	19	316.67	
Arthropoda	Insecta	Trichoptera	Brachycentridae	1	16.67	
Arthropoda	Insecta	Plecoptera	Capniidae	28	466.67	
Arthropoda	Insecta	Diptera	Ceratopogonidae	4	66.67	
Arthropoda	Insecta	Diptera	Chironomidae	71	1183.33	
Arthropoda	Insecta	Megaloptera	Corydalidae	2	33.33	
Arthropoda	Insecta	Coleoptera	Elmidae	9	150	
Arthropoda	Insecta	Ephemeroptera	Ephemerellidae	98	1633.33	
Arthropoda	Insecta	Trichoptera	Glossosomatidae	1	16.67	
Arthropoda	Insecta	Odonata	Gomphidae	1	16.67	
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	11	183.33	
Arthropoda	Insecta	Trichoptera	Hydropsychidae	22	366.67	
Arthropoda	Arachnida	Trombidiformes	Lebertiidae	2	33.33	
Arthropoda	Insecta	Ephemeroptera	Leptophlebiidae	22	366.67	
Arthropoda	Insecta	Plecoptera	Leuctridae	1	16.67	
Annelida	Oligochaeta	Lumbriculida	Lumbriculidae	1	16.67	
Annelida	Oligochaeta	Tubificida	Naididae	1	16.67	
Arthropoda	Insecta	Plecoptera	Perlidae	5	83.33	
Arthropoda	Insecta	Plecoptera	Perlodidae	3	50	
Arthropoda	Insecta	Trichoptera	Philopotamidae	1	16.67	
Arthropoda	Arachnida	Trombidiformes	Sperchontidae	3	50	
Arthropoda	Insecta	Diptera	Tipulidae	10	166.67	

Table 48: CABIN Site Information and Taxonomy Date Report for SHB01, 2016

Site Information	
Variable	**Value**
Site Code	SHB01
Name	Mcquade Brook/Shediac river tributary
Basin	Northumberland Strait
Stream Order (1:50000)	2
Eco-Region	Maritime Lowlands
Eco-Zone	Atlantic Maritime
Envirodat Code	RPC Fredericton Lab
Sampling Device	Kick Net

Protocol	CABIN - Wadeable Streams
Date	Oct 19, 2016
Sample(s) Taken	1
Kick Time (Min)	3
Mesh Size (µ.m)	400
Description	The site is downstream from the culvert at the Mcquade Brook a tributary to the Shediac River. It is located in Scotch Settlement, near Maclean Crossroad road intersection.
Latitude & Longitude	46.231633334 & -64.744161111
Altitude	88 feet
Datum	nad83
Taxonomist	Jo-Anne Monahan
ID Date	Feb 27, 2017
Certifications	
Sampling Crew	Crew 16
	Jolyne Hébert
	Mélissa Tremblay
	Jamie Richard

Taxonomy

Phylum	Class	Order	Family	Raw Count	Mean Count	Notes
Arthropoda	Insecta	Plecoptera	—	9	56.25	Immature
Arthropoda	Insecta	Trichoptera	—	8	50	Immature
Arthropoda	Arachnida	Trombidiformes	Aturidae	1	6.25	
Arthropoda	Insecta	Ephemeroptera	Baetidae	4	25	
Arthropoda	Insecta	Plecoptera	Capniidae	1	6.25	
Arthropoda	Insecta	Diptera	Ceratopogonidae	5	31.25	
Arthropoda	Insecta	Diptera	Chironomidae	107	668.75	
Arthropoda	Insecta	Plecoptera	Chloroperlidae	5	31.25	
Arthropoda	Insecta	Megaloptera	Corydalidae	1	6.25	
Arthropoda	Insecta	Coleoptera	Elmidae	77	481.25	
Arthropoda	Insecta	Diptera	Empididae	1	6.25	
Arthropoda	Insecta	Ephemeroptera	Ephemerellidae	26	162.5	
Arthropoda	Insecta	Ephemeroptera	Ephemeridae	1	6.25	
Arthropoda	Insecta	Trichoptera	Hydropsychidae	2	12.5	
Arthropoda	Arachnida	Trombidiformes	Lebertiidae	5	31.25	
Arthropoda	Insecta	Trichoptera	Lepidostomatidae	2	12.5	
Arthropoda	Insecta	Trichoptera	Leptoceridae	1	6.25	
Arthropoda	Insecta	Ephemeroptera	Leptophlebiidae	9	56.25	
Arthropoda	Insecta	Plecoptera	Leuctridae	1	6.25	
Annelida	Oligochaeta	Lumbriculida	Lumbriculidae	7	43.75	
Annelida	Oligochaeta	Tubificida	Naididae	8	50	
Arthropoda	Insecta	Plecoptera	Perlidae	2	12.5	
Arthropoda	Insecta	Trichoptera	Polycentropodidae	1	6.25	

Arthropoda	Arachnida	Trombidiformes	Sperchontidae	8	50	
Arthropoda	Insecta	Plecoptera	Taeniopterygidae	10	62.5	
Arthropoda	Insecta	Diptera	Tipulidae	3	18.75	

Table 49: CABIN Site Information and Taxonomy Date Report for SCF-01, 2016

Site Information	
Variable	**Value**
Site Code	SCF01
Name	Scoudouc River
Local Basin Name	Northumberland Strait
Stream Order (1:50000)	0
Eco-Region	Maritime Lowlands
Eco-zone	Atlantic Maritime
Envirodat Code	
Sampling Device	Kick Net
Protocol	CABIN - Wadeable Streams
Date	11-October-2016
Sample(s) Taken	1
Kick Time (min)	3
Mesh Size (µm)	400
Description	Near Southeast Regional Correctional Center in Shediac, down the road turn on left on Pellerin Rd. drive 3.4 km and there's a ATV trail on the right walk 230 m.
Latitude & Longitude	46.1838806 & -64.5107528
Altitude	29 feet
Datum	nad83
Taxonomist	Jo-Anne Monahan
ID Date	Feb 27, 2017
Certifications	
Sampling Crew	Crew 16
	Jolyne Hébert
	Mélissa Tremblay
	Jamie Richard

Taxonomy

Phylum	Class	Order	Family	Raw Count	Mean Count	Notes
Arthropoda	Insecta	Trichoptera	—	4	80	Immature
Arthropoda	Insecta	Ephemeroptera	Baetidae	2	40	
Arthropoda	Insecta	Plecoptera	Capniidae	3	60	
Arthropoda	Insecta	Diptera	Ceratopogonidae	1	20	
Arthropoda	Insecta	Diptera	Chironomidae	52	1040	
Arthropoda	Insecta	Odonata	Coenagrionidae	1	20	
Arthropoda	Insecta	Coleoptera	Elmidae	7	140	

Arthropoda	Insecta	Diptera	Empididae	1	20	
Arthropoda	Insecta	Ephemeroptera	Ephemerellidae	52	1040	
Arthropoda	Insecta	Ephemeroptera	Ephemeridae	1	20	
Arthropoda	Insecta	Odonata	Gomphidae	1	20	
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	48	960	
Arthropoda	Insecta	Trichoptera	Hydropsychidae	44	880	
Arthropoda	Arachnida	Trombidiformes	Lebertiidae	1	20	
Arthropoda	Insecta	Trichoptera	Lepidostomatidae	12	240	
Arthropoda	Insecta	Trichoptera	Leptoceridae	9	180	
Arthropoda	Insecta	Ephemeroptera	Leptophlebiidae	77	1540	
Arthropoda	Insecta	Plecoptera	Leuctridae	1	20	
Annelida	Oligochaeta	Lumbriculida	Lumbriculidae	3	60	
Arthropoda	Insecta	Plecoptera	Perlidae	5	100	
Arthropoda	Insecta	Trichoptera	Philopotamidae	11	220	
Mollusca	Bivalvia	Veneroida	Pisidiidae	4	80	
Arthropoda	Insecta	Trichoptera	Polycentropodidae	2	40	
Arthropoda	Insecta	Trichoptera	Rhyacophilidae	2	40	
Arthropoda	Insecta	Plecoptera	Taeniopterygidae	1	20	
Arthropoda	Insecta	Diptera	Tipulidae	1	20	