Improving Water Quality in the Shediac and Scoudouc Rivers

Final Report

By:

The Shediac Bay Watershed Association Inc.

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Acknowledgements

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1. INTRODUCTION

The primary mandate of the Shediac Bay Watershed Association is the protection and enhancement of water quality as well as increase public awareness of environmental issues. Since the implementation of the water classification program in 1999, the SBWA has conducted a water quality monitoring program for surface water in the Shediac and Scoudouc rivers. The program has evolved and improved over the past 20 years. To better understand the suitability for fish habitat and collect data on changing temperature trends, water temperature loggers have been installed in different areas of the watershed since 2016.

A long-term water monitoring program allows the Association and government agencies to detect changes or trends in water quality data. This information is used to prioritize areas that require restoration work or more in-depth investigations. Stream surveys are undertaken to determine specific restoration projects when needed.

Each year, actions are done to help improve riparian habitat based on the information gathered from monitoring and stream surveys. Stream banks are stabilized and reforested to help improve water quality. In 2020, we worked to reduce stream bank erosion in two areas of the watershed. Stream clean-ups are also regularly undertaken with the help of the summer students.

The SBWA continues to develop public educational materials such as signage, interpretation panels, videos, handouts and social media postings. The Association has expanded its digital outreach on several social media platforms. Normally, a variety of presentations and activities are done with both schools and the general public. Several programs were either modified or cancelled in 2020 due to the COVID-19 pandemic. The present report highlights the monitoring results and actions that have been undertaken in 2020.

1.1 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 cross into both Shediac and Moncton.

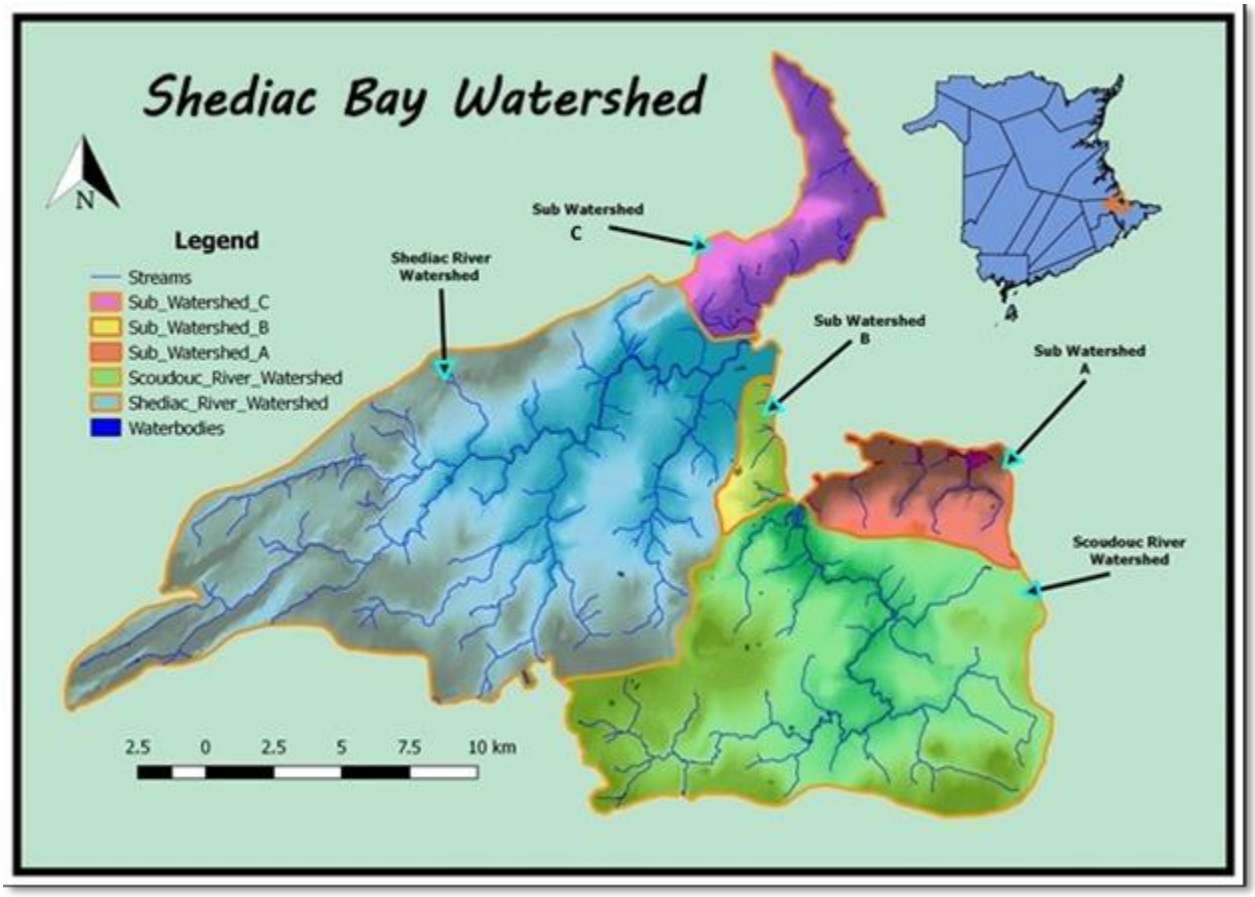


Figure 1: Map of Shediac Bay watershed boundaries and sub-watersheds

2. METHODOLOGY

2.1 Water Quality Sampling Protocol

Water quality monitoring was conducted once a month from June to October 2020, at 10 sampling stations in the major rivers and tributaries of the Shediac Bay watershed. Water quality sampling was performed using the protocol developed by the New Brunswick Department of Environment.

Regular water samples are to be collected during a period of dry weather, without the influence of non-point source pollution discharged in stormwater runoff. Ambient water quality data is used to determine the general health and water quality trends of a waterbody. A storm event sampling is the collection of water samples during or following a significant rainfall event. The result of a storm event sampling is an estimate of the pollution load leaving an area of land. It helps to better characterize concentrations of diffused contaminants entering a watercourse under a range of flow conditions.

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 habitat data includes; laboratory issued sample bottles, labels, latex or nitrile gloves, clipboard, waterproof paper for field sheets, pencils, waders or rubber boots, orange reflective vests for safety, GPS, a digital camera, YSI (water conditioning metre), metre stick, survey measuring tape, and a cooler with ice for the water samples.

2.2 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, Irishtown 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 *Waggin' 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	Unnamed tributaries of the 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

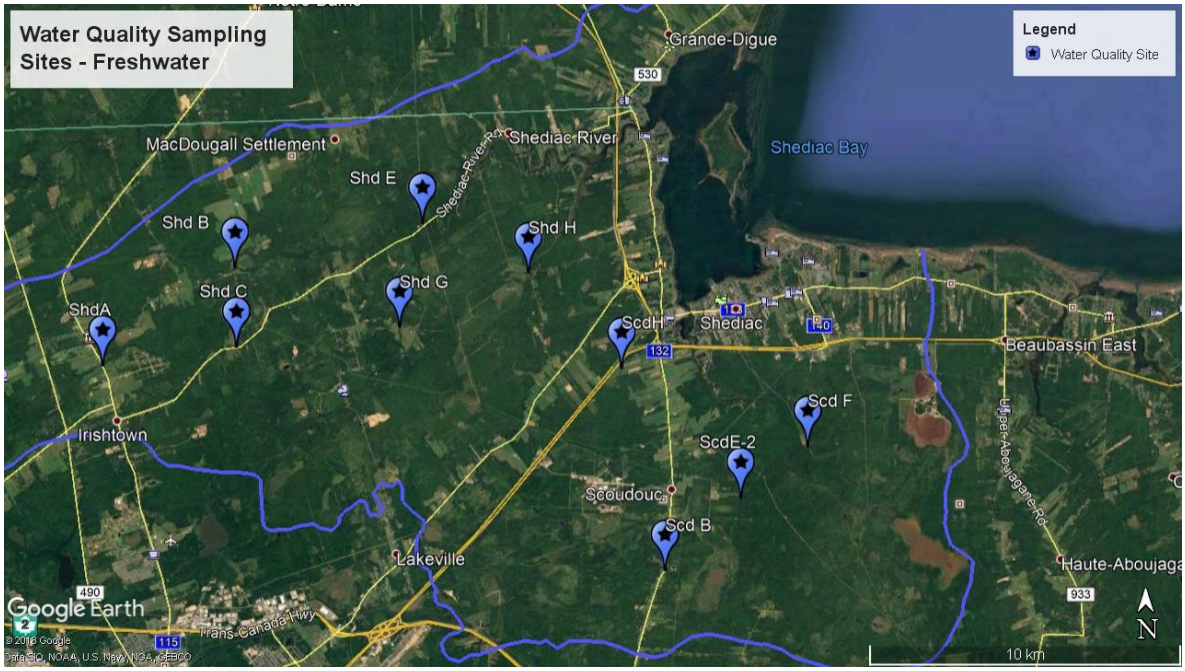


Figure 2: Water Quality Sampling Sites – Water Classification Stations

2.3 Water Quality Parameters

The water quality monitoring program analyses many chemical and physical parameters to assess the overall water quality for the protection of aquatic life. Although all results are presented in the report, only a few key parameters will be discussed in the report, as some of these were above the recommended guidelines or they are of greater significance to the assessment of the overall water quality.

2.3.1 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 ($^{\circ}$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 $^{\circ}$C is said to cause thermal stress to salmonid populations, causing them to stop feeding and search for thermal refugia.

2.3.2 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.

2.3.3 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.

2.3.4 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 fishery. Consequently, a higher conductivity level may indicate a higher amount of dissolved material in the water and the presence of contaminants.

2.3.5 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 2.9 mg/l (NO3).

2.3.6 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.

2.3.7 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 for recreational purposes is set at 400 MPN/100 ml.

2.3.8 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).

2.3.9 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).

2.3.10 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.

2.3.11 Lead

In many cases, the factors that influence the toxicity of xenobiotic substances have been identified. For example, relationships between water hardness and acute toxicity to fish have been established for several metals (e.g., cadmium, copper, lead, nickel, and zinc; CCREM 1987; Nagpal 1997).

In the case of Lead, the guidelines for the protection of aquatic life is as follows: when the hardness ($CaCO_3$) ranges from 0-60 mg/L, the limit is set at 1 μg/L, from 60-120 mg/L the limit is 2 μg/L, from 120-180 mg/L the limit is 4 μg/L, and when the hardness is higher than 180 mg/L the limit is 7 μg/L.

The combination of low dissolved oxygen and toxic chemicals may lead to stress responses in aquatic organisms. The toxicities of zinc, lead, copper, pentachlorophenol, cyanide, hydrogen sulphide and ammonia are enhanced by low dissolved oxygen. Dissolved metals may be removed from the water column by adsorption, precipitation, and co-precipitation processes. Lead, for example, is strongly adsorbed to particles and can be removed from the water column and concentrated in sediments (Canadian Council of Ministers of the Environment, 2008)

2.4 Health Canada - Guidelines for Canadian Recreational Water Quality

Table 2: Guidelines for Health Canada Recreational Water Quality Summary Table

Guidelines for Health Canada Recreational Water Quality		
Parameter	Considerations	Guideline
Escherichia coli (Primary-Contact Recreation)*	Geometric mean concentration (minimum 5 samples)	≤ 200 *E. coli* /100 mL
	Single sample maximum concentration	≤ 400 *E. coli* /100 mL
Enterococci (Primary-Contact Recreation)*	Geometric mean concentration (minimum 5 samples)	≤ 35 Enterococci /100 mL
	Single sample maximum concentration	≤ 70 Enterococci /100 mL
*Advice regarding waters intended for secondary-contact recreational activities is provided in Section 4.2. of the *Guidelines for Canadian Recreational Water Quality: Third Edition*		
https://www.canada.ca/content/dam/canada/health-canada/migration/healthy-canadians/publications/healthy-living-vie-saine/water-recreational-recreative-eau/alt/pdf/water-recreational-recreative-eau-eng.pdf		

2.5 CCME - Canadian Environmental Quality Guidelines (CEQGs) for the Protection of Aquatic Life (Freshwater)

Table 3: Summary of the CCME Canadian Environmental Quality Guidelines

CCME RECOMMENDED GUIDELINES FOR THE PROTECTION OF AQUATIC LIFE (FRESHWATER) SUMMARY						
Parameter	Condition	Value (mg/L)	Condition	Value (mg/L)	Equation Between Conditions	Notes
Ag	—	—	Long-Term	0.00025	—	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	0.005	pH≥6.5	0.1	—	
As	—	—	Upper	0.005	—	
B	Short-Term	29	Long-Term	1.5	—	
Cd (Short-Term)	HARD<5.3	0.00011	HARD>360	0.0077	10^(1.016*LOG(HARD)-1.71)	
Cd (Long-Term)	HARD<17	0.00004	HARD>280	0.00037	10^(0.83*LOG(HARD)-2.46)	
Cl	Short-Term	640	Long-Term	120	—	
CLRA	Narrative; refer to CCME website for more information.				—	
Cu	HARD<82	0.002	HARD>180	0.004	0.2*EXP(0.8545*LN(HARD)-1.465)	
DO (warm) †	Early	6	Other	5.5	—	
DO (cold)	Early	9.5	Other	6.5	—	
E-coli ‡	—	—	Upper	400 MPN/100mL	—	
Fe	—	—	Upper	0.3	—	
Mo	—	—	Upper	0.073	—	
NH3_T	Table; refer to CCME website for more information.				—	
NH3_Un	—	—	Long-Term	0.019	—	
Ni	HARD≤60	0.025	HARD>180	0.15	EXP(0.76*LN(HARD)+1.06)	
NO2	—	—	Upper	0.197	—	
NO3	Short-Term	124	Long-Term	2.9	—	
Pb	HARD≤60	0.001	HARD>180	0.007	EXP(1.273*LN(HARD)-4.705)	
pH	Lower L-T	6.5	Upper L-T	9	—	
Se	—	—	Upper	0.001	—	
Tl	—	—	Upper	0.008	—	
U	Short-Term	0.033	Long-Term	0.015	—	
Zn	—	—	Upper	0.03	—	

ALK_T	Ba	Be	HCO3
Bi	Br	Ca	CO3
Co	COND	Cr	F
HARD	K	Lang_Ind (20°C)	
Li	Mg	Mn	Na
NOX	Rb	pH (Sat)	Sb
Sn	SO4	Sr	TDS
Te	TKN	TOC	TP-L
TURB	V		

† The guideline for dissolved oxygen is separated into warm water biota, early life stages; warm water biota, other life stages; cold water biota, early life stages; and cold water biota, other life stages.

‡ There is no limit for the protection of aquatic wildlife. The limit of 400 MPN/100mL for the protection of environmental and human health is used instead.

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 the lowest acceptable dissolved oxygen concentrations 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	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/100 mL for the protection of environmental and human health is used instead.
	Upper long-term limit	9	—		
E. coli ‡	Upper limit	400	MPN/100 mL		

Table 5: CCME Guidance framework for Phosphorus

CCME Guidance Framework for Total Phosphorus (TP-L)					
Parameter	Description	Value	Units	Notes	
TP-L*	Hyper-eutrophic	> 0.100	mg/L	†	The CCME recommended guidelines for the protection of aquatic wildlife (freshwater) indicates 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	0.035 - 0.100	mg/L		
	Meso-eutrophic	0.020 - 0.035	mg/L		
	Mesotrophic	0.010 - 0.020	mg/L		
	Oligotrophic	0.004 - 0.010	mg/L		
	Ultra-oligotrophic	< 0.004	mg/L	*	Total phosphorus level

Table 6: CCME Canadian Environmental Quality Guidelines for Nitrates

CCME RECOMMENDED GUIDELINES FOR THE PROTECTION OF AQUATIC LIFE (FRESHWATER) SUMMARY						
Parameter	Condition	Value (mg/L)	Condition	Value (mg/L)	Equation Between Conditions	Notes
NO3	Short-Term	124	Long-Term	2.9	—	

2.6 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 inorganic results. The following provides the terms and definitions of the acronyms used in the data tables.

Table 7: 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 water 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 which water at 20 degrees Celsius is saturated with calcium carbonate
TDS	mg/L	Total dissolved solids measured in milligrams per litre
TURB	NTU	Water turbidity measured in nephelometric turbidity units

Table 8: 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_3I	µg/L	Total ammonia measured in micrograms per litre	—	—	—

Table 9: 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 following section contains the results on all the data collected during the water quality monitoring for 2020. All water samples are assigned with a designated field number so that it can be logged into the *Department of Environment and local Government* database.

It was discovered 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. 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, the site code was changed to ScdE-2.

In 2020, most water quality samplings were done under ambient conditions, with one sampling during the season that was to be performed following a rain event. The planned rain event sampling was October 15. During the sampling in July, the site ScdE-2 could not be sampled until the next day (July 29) and there was some rain the prior evening (< 5 mm). In addition to the planned rain event sampling, a thunderstorm and heavy downpour occurred around noon during the sampling on August 25. All the samples had been collected for the Scoudouc River, therefore the rain affected the 5 sites in the Shediac River that day.

3.1 Shediac River – ShdA

This water quality sampling site is located in the main branch of the Shediac River, off Route 115 in Irishtown. 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 5 years; 2 maps were added to compare the surrounding 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 2000s, to increase the buffer zones. There is a cattle fence along the river, but there is an access that allows the cows to cross the river in one area upstream of the sample site. There is a section of the brook, approximately 100 m in length near the cattle crossing area, that has a thin buffer zone (> 10 m) or none in some areas.

An apple orchard was established in 2016-2017, approximately 200 metres from the sampling site. Approximately 20 hectares was cleared of vegetation for the orchard. There is no tree buffer to help prevent drainage from these fields from reaching the river. 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 2020, 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 range (0.004 – 0.010 mg/L) in June; in the mesotrophic range (0.010 – 0.020 mg/L) in July, August and October; and in the eutrophic range (0.035 – 0.100 mg/L) in September.

Concentration results for the nitrate ion (NO3) are below the short term (124 mg/L) and long term (2.9 mg/L) CCME recommendations for direct toxicity to sensitive freshwater life (these guidelines do not consider indirect effects due to eutrophication, nor does this interpret results for assessment of eutrophic conditions).

Concentrations of aluminum reached or exceeded the guidelines in July (0.100 mg/L), September (0.233 mg/L), and October (0.155 mg/L) when the recommendation is 0.100 mg/L when the pH value is ≥ 6.5. Iron exceeded the guideline (0.3 mg/L) in one sample in September (0.42 mg/L).

Bacterial levels did not exceed the maximum concentration of *E. coli* from the Health Canada recreational guideline (≥ 400 MPN/100 mL).

Table 10: Water chemistry data and *E. coli* results for ShdA, 2020

SITE ShdA: FIELD DATA COLLECTED BY YSI AND LAB SAMPLES																		
Date (yy-mm-dd)	Temp (°C)		SAL (ppt)	DO (mg/L)	E. coli (MPN /100mL)	ALK_T (mg/L)	CLRA (TCU)	COND (mS/cm)		HARD (mg/L)	Lang_Ind (20°C)	pH (pH)			TDS (mg/L)		TURB (NTU)
	Air	Water						Field	Lab			Field	Lab	Sat (20°C)	Field	Lab	
20-06-24	32	23.4	0.12	7.90	110	79	6	0.237	0.252	103.0	0.14	8.26	8.1	8	158.20	133	1.5
20-07-28	26	21.9	0.12	8.06	63	83	11	0.248	0.267	102.0	0.16	8.42	8.1	7.9	171.60	146	3.9
20-08-25	20	19.0	0.11	9.33	279	77	8	0.205	0.228	94.4	0.00	8.11	8.0	8	150.15	127	1.7
20-09-29	23	18.2	0.13	8.42	336	76	18	0.233	0.233	97.7	0.01	8.12	8.0	8	173.55	135	17.6
20-10-15	17	10.4	0.11	11.23	75	70	23	0.171	0.244	101.0	-0.23	7.89	7.8	8	154.70	140	3.8

Table 11: Nutrient results for ShdA, 2020

SITE ShdA: NUTRIENT DATA																		
Date (yy-mm-dd)	HCO3 (mg/L)	Br (mg/L)	Ca (mg/L)	CO3 (mg/L)	Cl (mg/L)	F (mg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	NH3T (mg/L)	NH3_Un(mg/L)	NO2 (mg/L)	NO3 (mg/L)	NOX (mg/L)	SO4 (mg/L)	TKN (mg/L)	TN (mg/L)	TOC (mg/L)	TP-L (mg/L)
20-06-24	78.0	0.02	33.1	0.923	10.6	0.20	0.78	4.97	6.3	<0.05	<0.001	<0.05	1.47	1.47	20	—	1.3	1.8	0.009
20-07-28	82.0	0.02	33.1	0.970	19.0	0.09	0.78	4.67	11.3	<0.05	<0.001	<0.05	1.26	1.26	19	—	1.2	1.8	0.014
20-08-25	76.2	0.02	30.6	0.716	10.8	0.06	0.93	4.38	5.6	<0.05	<0.001	<0.05	1.38	1.38	19	—	1.2	2.2	0.015
20-09-29	75.2	0.02	31.5	0.707	13.2	0.10	0.96	4.63	6.7	<0.05	<0.001	<0.05	1.14	1.14	23	—	1.1	3.0	0.045
20-10-15	69.6	0.02	31.6	0.413	13.1	0.07	1.07	5.41	9.0	<0.05	<0.001	<0.05	1.25	1.25	28	—	1.2	3.4	0.012

Table 12: Inorganics results for ShdA, 2020

SITE ShdA: HEAVY METALS AND OTHER ELEMENTS																			
Date (yy-mm-dd)	Al (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Cd (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Li (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Rb (mg/L)	Sb (mg/L)	Sr (mg/L)	U (mg/L)	V (mg/L)	Zn (mg/L)
20-06-24	0.046	<0.001	0.032	0.051	<0.00001	<0.0001	<0.001	<0.001	0.15	0.0025	0.023	0.0033	<0.001	<0.0001	0.0010	0.0001	0.379	0.0026	<0.001	<0.001
20-07-28	0.100	<0.001	0.031	0.050	<0.00001	<0.0001	<0.001	<0.001	0.24	0.0026	0.025	0.0029	<0.001	0.0002	0.0011	0.0001	0.347	0.0025	<0.001	<0.001
20-08-25	0.059	<0.001	0.030	0.045	<0.00001	<0.0001	<0.001	<0.001	0.20	0.0025	0.045	0.0029	<0.001	0.0001	0.0011	0.0002	0.318	0.0031	<0.001	0.001
20-09-29	0.233	<0.001	0.033	0.055	<0.00001	0.0002	<0.001	<0.001	0.42	0.0029	0.070	0.0022	<0.001	0.0004	0.0012	0.0001	0.435	0.0021	0.001	0.003
20-10-15	0.155	<0.001	0.031	0.047	<0.00001	<0.0001	<0.001	<0.001	0.26	0.0026	0.020	0.0021	<0.001	0.0002	0.0011	0.0001	0.370	0.0021	<0.001	0.003

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)

Figure 5: Site photos for water quality sampling site ShdA

3.2 Shediac River – ShdB

This water quality sampling site is located in the McQuade Brook, off Scotch Settlement Road (175 m 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.

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 point 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 2020, meet the recommendations for the survival of freshwater aquatic life based on pH. However, one level of dissolved oxygen was slightly below the recommendation (6.5 mg/L) for general cold-water organisms in July (6.40 mg/L). The water temperature exceeded the limit for thermal stress in salmonids (22.5˚C) in June (25.8˚C) and July (24.6˚C).

Total phosphorus levels for long-term eutrophic conditions, according to the *CCME Guidance framework for Phosphorus*, were: in the oligotrophic range (0.004 – 0.010 mg/L) in June; in the mesotrophic range (0.010 – 0.020 mg/L) in July and September; and in the eutrophic range (0.035 – 0.100 mg/L) in August and October.

Concentration results for the nitrate ion (NO_3) are below the short term (124 mg/L) and long term (2.9 mg/L) CCME recommendations for direct toxicity to sensitive freshwater life (these guidelines do not consider indirect effects due to eutrophication, nor does this interpret results for assessment of eutrophic conditions).

Concentrations of aluminum exceeded the CCME water quality guideline (0.100 mg/L when the pH is ≥6.5) in the sample taken in August (0.124 mg/L). Iron levels exceeded the guideline (0.3 mg/L) in the samples taken in June (0.47 mg/L), July (0. 79 mg/L), August (1.10 mg/L), and September (0.34 mg/L), when the recommendation is 0.3 mg/L.

Bacterial levels did exceed the maximum concentration of *E. coli* from Health Canada recreational guideline (≥ 400 MPN/100 mL) for the samples taken in June (420 MPN/100 mL), July (457 MPN/100 mL), August (> 24,196 MPN/100 mL) and September (1,565 MPN/100 mL).

Table 13: Water chemistry data and *E. coli* results for ShdB, 2020

SITE ShdB: FIELD DATA COLLECTED BY YSI AND LAB SAMPLES																		
Date (yy-mm-dd)	Temp (°C)		SAL (ppt)	DO (mg/L)	E. coli (MPN /100mL)	ALK_T (mg/L)	CLRA (TCU)	COND (mS/cm)		HARD (mg/L)	Lang_Ind (20°C)	pH (pH)			TDS (mg/L)		TURB (NTU)
	Air	Water						Field	Lab			Field	Lab	Sat (20°C)	Field	Lab	
20-06-24	33	**25.8**	0.10	7.09	**420**	77	23	0.211	0.215	74.9	-0.52	7.60	7.6	8.1	135.85	111	1.3
20-07-28	27	**24.6**	0.10	**6.40**	**457**	87	12	0.219	0.220	79.7	-0.24	7.69	7.8	8	143.65	121	2.2
20-08-25	23	21.1	0.10	6.52	**> 24,196**	87	22	0.195	0.209	75.8	-0.46	7.62	7.6	8.1	137.15	118	4.6
20-09-29	24	18.9	0.12	8.70	**1,565**	74	18	0.215	0.245	74.3	-1.64	7.96	**6.5**	8.1	157.95	137	1.9
20-10-15	18	10.4	0.12	11.15	74	64	61	0.183	0.262	79.8	-0.59	7.54	7.6	8.2	165.75	154	0.8

Table 14: Nutrient results for ShdB, 2020

SITE ShdB: NUTRIENT DATA																			
Date (yy-mm-dd)	HCO3 (mg/L)	Br (mg/L)	Ca (mg/L)	CO3 (mg/L)	Cl (mg/L)	F (mg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	NH3T (mg/L)	NH3_Un(mg/L)	NO2 (mg/L)	NO3 (mg/L)	NOX (mg/L)	SO4 (mg/L)	TKN (mg/L)	TN (mg/L)	TOC (mg/L)	TP-L (mg/L)
20-06-24	76.7	0.05	22.7	0.287	12.3	0.21	1.12	4.43	11.3	<0.05	<0.001	<0.05	0.09	0.09	8	—	0.3	2.9	**0.005**
20-07-28	86.5	0.05	24.3	0.513	13.4	0.11	1.10	4.63	12.0	<0.05	<0.001	<0.05	<0.05	<0.05	8	—	<0.2	3.0	**0.016**
20-08-25	86.7	0.04	23.2	0.324	12.5	0.07	1.14	4.34	11.2	<0.05	<0.001	<0.05	<0.05	<0.05	7	—	<0.2	3.3	**0.048**
20-09-29	74.0	0.04	22.5	0.022	21.8	0.15	1.08	4.41	17.0	<0.05	<0.001	<0.05	<0.05	<0.05	20	—	<0.2	4.4	**0.011**
20-10-15	63.7	0.03	23.7	0.238	30.6	0.18	1.29	5.01	21.3	<0.05	<0.001	<0.05	<0.05	<0.05	25	—	0.3	7.9	**0.062**

Table 15: Inorganics results for ShdB, 2020

SITE ShdB: HEAVY METALS AND OTHER ELEMENTS																			
Date (yy-mm-dd)	Al (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Cd (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Li (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Rb (mg/L)	Sb (mg/L)	Sr (mg/L)	U (mg/L)	V (mg/L)	Zn (mg/L)
20-06-24	0.030	<0.001	0.013	0.089	<0.00001	0.0001	<0.001	<0.001	**0.47**	0.0010	0.306	0.0008	<0.001	<0.0001	0.0014	<0.0001	0.133	0.0002	<0.001	<0.001
20-07-28	0.069	<0.001	0.013	0.103	0.00001	0.0002	<0.001	<0.001	**0.79**	0.0010	0.528	0.0009	<0.001	0.0002	0.0014	<0.0001	0.152	0.0003	<0.001	0.001
20-08-25	**0.124**	0.002	0.013	0.105	0.00001	0.0003	<0.001	<0.001	**1.10**	0.0007	0.694	0.0009	<0.001	0.0003	0.0017	<0.0001	0.147	0.0003	<0.001	0.002
20-09-29	0.043	<0.001	0.018	0.092	<0.00001	0.0001	<0.001	<0.001	**0.34**	0.0011	0.230	0.0007	<0.001	<0.0001	0.0013	<0.0001	1.550	0.0002	<0.001	0.006
20-10-15	0.041	<0.001	0.017	0.087	<0.00001	<0.0001	<0.001	<0.001	0.20	0.0009	0.083	0.0006	<0.001	<0.0001	0.0011	<0.0001	0.136	0.0001	<0.001	0.003

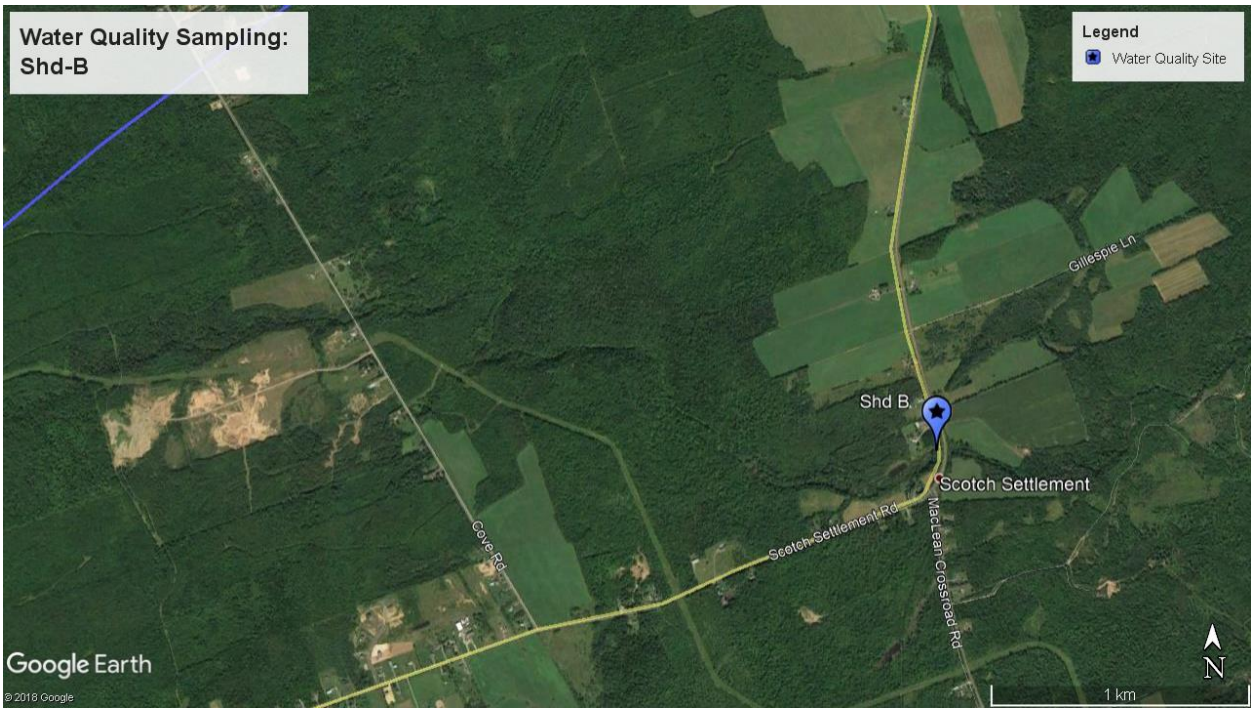


Figure 6: ShdB site location and surrounding land uses

Figure 7: Site photos for water quality sampling site ShdB

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 an appropriate bridge approx. 1.6 km downstream of the site.

The water sampling results for the site ShdC, for 2020, 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 ultra-oligotrophic range (<0.004 mg/L) in June; in the oligotrophic range (0.004 – 0.010 mg/L) in July; in the mesotrophic range (0.010 – 0.020 mg/L) in August and September, and in the meso-eutrophic range (0.020 – 0.035 mg/L) in October.

Concentration results for the nitrate ion (NO3) are below the short term (124 mg/L) and long term (2.9 mg/L) CCME recommendations for direct toxicity to sensitive freshwater life (these guidelines do not consider indirect effects due to eutrophication, nor does this interpret results for assessment of eutrophic conditions).

Concentrations of aluminum exceeded the CCME water quality guideline (0.100 mg/L when the pH is ≥6.5) in the samples taken in September (0.104 mg/L) and October (0.180).

Bacterial levels did exceed the maximum concentration of *E. coli* from Health Canada recreational guideline (≥ 400 MPN/100 mL) for the samples taken in August (1,789 MPN/100 mL), September (2,851 MPN/100 mL) and October (471 MPN/100 mL).

Table 16: Water chemistry data and *E. coli* results for ShdC, 2020

SITE ShdC: FIELD DATA COLLECTED BY YSI AND LAB SAMPLES																	
Date (yy-mm-dd)	Temp (°C)		SAL (ppt)	DO (mg/L)	E. coli (MPN /100mL)	ALK_T (mg/L)	CLRA (TCU)	COND (mS/cm)		HARD (mg/L)	Lang_Ind (20°C)	pH (pH)			TDS (mg/L)		TURB (NTU)
	Air	Water						Field	Lab			Field	Lab	Sat (20°C)	Field	Lab	
20-06-24	30	22.7	0.11	8.85	241	83	11	0.230	0.264	103.0	0.05	8.18	8.0	8	156.00	137	0.9
20-07-28	26	21.8	0.12	9.59	309	85	6	0.235	0.253	104.0	0.26	8.35	8.2	7.9	163.15	138	0.7
20-08-25	23	18.9	0.11	11.03	**1,789**	89	5	0.212	0.245	104.0	0.38	8.41	8.3	7.9	156.00	139	0.8
20-09-29	23	18.2	0.12	11.18	**2,851**	85	12	0.223	0.261	99.6	-0.35	8.60	7.6	8	166.40	149	2.8
20-10-15	18	10.4	0.14	12.19	**471**	79	35	0.206	0.294	97.9	-0.20	7.88	7.8	8	185.90	171	5.6

Table 17: Nutrient results for ShdC, 2020

SITE ShdC: NUTRIENT DATA																			
Date (yy-mm-dd)	HCO3 (mg/L)	Br (mg/L)	Ca (mg/L)	CO3 (mg/L)	Cl (mg/L)	F (mg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	NH3T (mg/L)	NH3_Un(mg/L)	NO2 (mg/L)	NO3 (mg/L)	NOX (mg/L)	SO4 (mg/L)	TKN (mg/L)	TN (mg/L)	TOC (mg/L)	TP-L (mg/L)
20-06-24	82.2	0.02	31.8	0.773	13.1	0.21	1.32	5.81	8.8	<0.05	<0.001	<0.05	0.75	0.75	20	—	0.9	1.9	0.003
20-07-28	83.7	0.02	32.6	1.250	14.2	0.09	1.12	5.58	8.2	<0.05	<0.001	<0.05	0.71	0.71	19	—	0.7	1.8	0.008
20-08-25	87.3	0.02	32.7	1.640	12.8	0.06	1.02	5.52	7.0	<0.05	<0.001	<0.05	0.81	0.81	20	—	0.6	1.5	0.011
20-09-29	84.7	0.02	31.1	0.317	19.0	0.12	1.26	5.32	12.1	<0.05	<0.001	<0.05	0.38	0.38	23	—	0.4	3.1	0.018
20-10-15	78.5	0.02	30.2	0.466	32.7	0.09	1.76	5.46	20.8	<0.05	<0.001	<0.05	0.59	0.59	24	—	0.7	4.8	0.028

Table 18: Inorganics results for ShdC, 2020

SITE ShdC: HEAVY METALS AND OTHER ELEMENTS																				
Date (yy-mm-dd)	Al (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Cd (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Li (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Rb (mg/L)	Sb (mg/L)	Sr (mg/L)	U (mg/L)	V (mg/L)	Zn (mg/L)
20-06-24	0.022	<0.001	0.027	0.077	<0.00001	<0.0001	<0.001	<0.001	0.03	0.0013	0.022	0.0018	<0.001	<0.0001	0.0013	<0.0001	0.342	0.0010	<0.001	<0.001
20-07-28	0.025	<0.001	0.026	0.072	<0.00001	<0.0001	<0.001	<0.001	0.04	0.0013	0.028	0.0019	<0.001	<0.0001	0.0011	<0.0001	0.343	0.0011	<0.001	<0.001
20-08-25	0.034	<0.001	0.025	0.067	<0.00001	<0.0001	<0.001	<0.001	0.04	0.0012	0.043	0.0019	<0.001	<0.0001	0.0010	<0.0001	0.337	0.0014	<0.001	<0.001
20-09-29	0.104	<0.001	0.025	0.078	<0.00001	<0.0001	<0.001	<0.001	0.11	0.0013	0.064	0.0011	<0.001	0.0001	0.0013	<0.0001	0.325	0.0009	<0.001	<0.001
20-10-15	0.180	<0.001	0.027	0.071	<0.00001	<0.0001	<0.001	0.001	0.23	0.0014	0.024	0.0012	<0.001	0.0002	0.0014	<0.0001	0.316	0.0011	<0.001	0.005

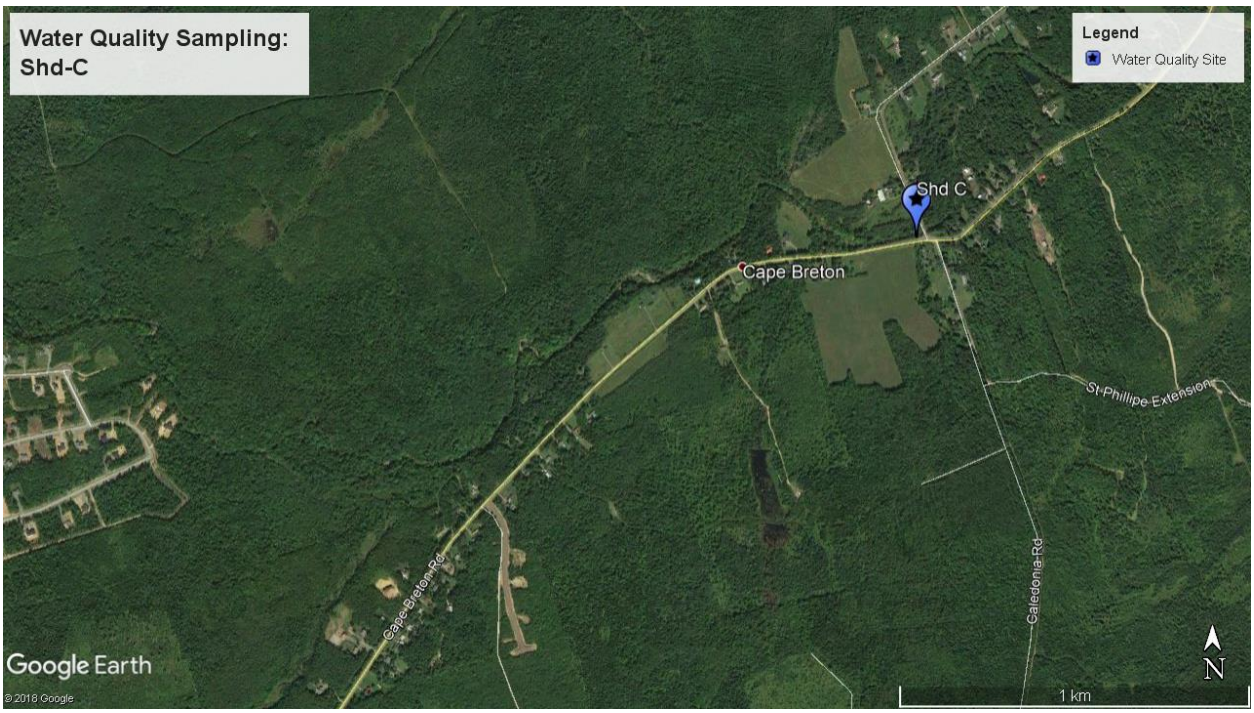


Figure 8: ShdC site location and surrounding land uses

Figure 9: Site photos for water quality sampling site ShdC

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 30 m.

The water sampling results for the site ShdE, for 2020, meets or exceeds all the recommendations for the survival of freshwater aquatic life based on pH and dissolved oxygen. The water temperature slightly exceeded the limit for thermal stress in salmonids (22.5˚C) in June (23.9˚C) and July (23.5˚C).

Total phosphorus levels for long-term eutrophic conditions, according to the *CCME Guidance framework for Phosphorus*, were: in the oligotrophic range (0.004 – 0.010 mg/L) in June and July; and in the mesotrophic range (0.010 – 0.020 mg/L) from August to October.

Concentration results for the nitrate ion (NO3) are below the short term (124 mg/L) and long term (2.9 mg/L) CCME recommendations for direct toxicity to sensitive freshwater life (these guidelines do not consider indirect effects due to eutrophication, nor does this interpret results for assessment of eutrophic conditions).

The results for each parameter of heavy metals and other elements for ShdE, in all samples collected in 2020, did not exceed any of the recommended CCME water quality guidelines.

Bacterial levels did exceed the maximum concentration of *E. coli* from Health Canada recreational guideline (≥ 400 MPN/100 mL) for the sample taken in August (1,178 MPN/100 mL).

Table 19: Water chemistry data and *E. coli* results for ShdE, 2020

SITE ShdE: FIELD DATA COLLECTED BY YSI AND LAB SAMPLES																	
Date (yy-mm-dd)	Temp (°C)		SAL (ppt)	DO (mg/L)	E. coli (MPN /100mL)	ALK_T (mg/L)	CLRA (TCU)	COND (mS/cm)		HARD (mg/L)	Lang_Ind (20°C)	pH (pH)			TDS (mg/L)		TURB (NTU)
	Air	Water						Field	Lab			Field	Lab	Sat (20°C)	Field	Lab	
20-06-24	28	23.9	0.10	6.83	63	76	10	0.208	0.219	78.6	-0.19	8.03	7.9	8.1	138.46	113	0.9
20-07-28	26	23.5	0.11	9.04	84	85	6	0.220	0.228	91.9	0.02	8.21	8.0	8	146.90	92	0.9
20-08-25	20	20.3	0.10	8.68	1,178	76	8	0.184	0.200	81.5	-0.17	8.14	7.9	8.1	131.30	111	1.3
20-09-29	23	19.2	0.10	7.35	187	70	15	0.197	0.224	75.7	-1.24	7.85	6.9	8.1	143.65	123	1.4
20-10-15	16	9.0	0.12	10.87	96	79	32	0.169	0.252	89.8	-0.33	7.62	7.7	8	158.60	144	2.2

Table 20: Nutrient results for ShdE, 2020

SITE ShdE: NUTRIENT DATA																			
Date (yy-mm-dd)	HCO3 (mg/L)	Br (mg/L)	Ca (mg/L)	CO3 (mg/L)	Cl (mg/L)	F (mg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	NH3T (mg/L)	NH3_Un(mg/L)	NO2 (mg/L)	NO3 (mg/L)	NOX (mg/L)	SO4 (mg/L)	TKN (mg/L)	TN (mg/L)	TOC (mg/L)	TP-L (mg/L)
20-06-24	75.4	0.03	24.7	0.563	12.5	0.20	1.17	4.12	8.3	<0.05	<0.001	<0.05	0.14	0.14	12	—	0.3	3.0	**0.008**
20-07-28	84.2	0.02	28.9	0.791	12.9	0.10	1.20	4.79	8.5	<0.05	<0.001	<0.05	0.22	0.22	13	—	0.3	2.2	**0.005**
20-08-25	75.4	0.02	25.7	0.563	12.6	0.05	1.04	4.20	7.2	<0.05	<0.001	<0.05	0.07	0.07	11	—	<0.2	1.9	**0.017**
20-09-29	69.9	0.02	23.8	0.052	17.5	0.10	1.18	3.96	11.5	<0.05	<0.001	<0.05	<0.05	<0.05	18	—	<0.2	4.2	**0.011**
20-10-15	78.6	0.02	27.7	0.370	23.5	0.11	1.54	5.00	15.1	<0.05	<0.001	<0.05	<0.05	<0.05	18	—	<0.2	4.7	**0.012**

Table 21: Inorganics results for ShdE, 2020

SITE ShdE: HEAVY METALS AND OTHER ELEMENTS																			
Date (yy-mm-dd)	Al (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Cd (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Li (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Rb (mg/L)	Sb (mg/L)	Sr (mg/L)	U (mg/L)	V (mg/L)	Zn (mg/L)
20-06-24	0.027	<0.001	0.015	0.085	<0.00001	<0.0001	<0.001	<0.001	0.09	0.0013	0.052	0.001	<0.001	<0.0001	0.0013	<0.0001	0.202	0.0005	<0.001	<0.001
20-07-28	0.018	<0.001	0.018	0.093	<0.00001	<0.0001	<0.001	<0.001	0.08	0.0014	0.043	0.0012	<0.001	<0.0001	0.0013	<0.0001	0.261	0.0006	<0.001	<0.001
20-08-25	0.042	<0.001	0.015	0.077	<0.00001	<0.0001	<0.001	<0.001	0.12	0.0012	0.062	0.0009	<0.001	0.0001	0.0011	<0.0001	0.227	0.0006	<0.001	0.001
20-09-29	0.043	<0.001	0.017	0.089	<0.00001	<0.0001	<0.001	<0.001	0.12	0.0013	0.044	0.0007	<0.001	<0.0001	0.0012	<0.0001	0.223	0.0004	<0.001	0.004
20-10-15	0.095	<0.001	0.017	0.088	<0.00001	<0.0001	<0.001	<0.001	0.15	0.0012	0.026	0.0007	<0.001	<0.0001	0.0012	<0.0001	0.226	0.0006	<0.001	0.003

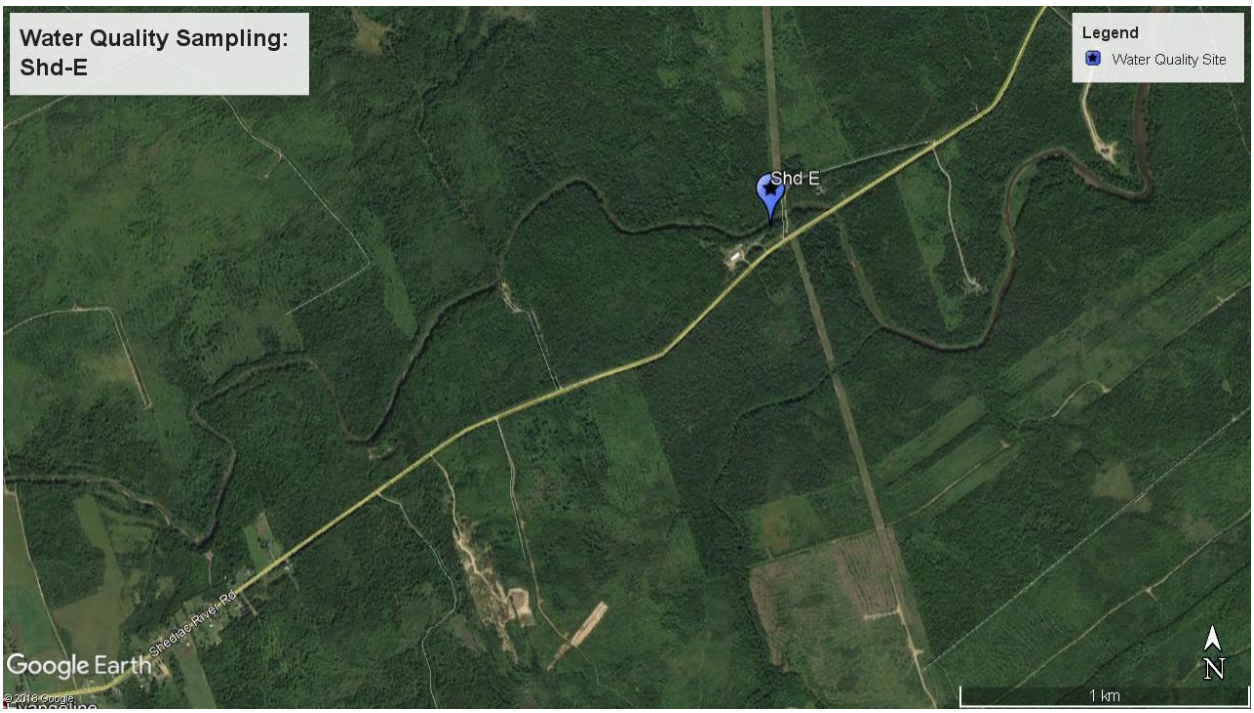


Figure 10: ShdE site location and surrounding land uses

Figure 11: Site photos for water quality sampling site ShdE

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.

The Weisner Brook is a major tributary of the Shediac River, a combination of many small streams and the Calhoun Brook. A defining characteristic of this brook is the cold water temperatures, in comparison to the rest of the Shediac River system. This factor is created by long stretches of forested riparian habitats and cold springs input into its tributaries. The Weisner Brook is recognized by the Department of Natural Resources as a "summer resting refuge for mature trout" due to the cooler temperatures. In addition, the *Department of Fisheries and Oceans Canada* has placed a variation order (GVO-2004-004) on this watercourse that prohibits any retention of brook trout (catch and release only, bag limit 0 at all times) within the "Weisner Brook from its confluence with the Shediac River upstream to its source, including all tributaries."

A few areas along the brook, in the open fields, have thinner buffer zone (> 10 m) mostly made up of young shrubs. To the left of the sampling site (looking upstream) directly upstream of the bridge, is a field recently transformed into a corn crop. In 2017-2018, the buffer zone was cut and the field was tilled in preparation for agriculture activities. The clearing had reached the riverbank, and has left little vegetation in the riparian area spanning approximately 175 m. Some alders on the riverbank were also shredded during the tilling of the field (see site photos). The field is being used to grow corn crops since 2018.

A gravel/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 2020, 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 range (0.010 – 0.020 mg/L) in July and September; and in the meso-eutrophic range (0.020 – 0.035 mg/L) in June, August and September.

Concentration results for the nitrate ion (NO3) are below the short term (124 mg/L) and long term (2.9 mg/L) CCME recommendations for direct toxicity to sensitive freshwater life (these guidelines do not consider indirect effects due to eutrophication, nor does this interpret results for assessment of eutrophic conditions).

Concentrations of aluminum exceeded the CCME water quality guideline (0.005 mg/L when the pH is <6.5) in the sample taken in September (0.026 mg/L).

Bacterial levels did exceed the maximum concentration of *E. coli* from Health Canada recreational guideline (≥ 400 MPN/100 mL) for the sample taken in August (631 MPN/100 mL).

Table 22: Water chemistry data and *E. coli* results for ShdG, 2020

SITE ShdG: FIELD DATA COLLECTED BY YSI AND LAB SAMPLES																		
Date (yy-mm-dd)	Temp (°C)		SAL (ppt)	DO (mg/L)	E. coli (MPN /100mL)	ALK_T (mg/L)	CLRA (TCU)	COND (mS/cm)		HARD (mg/L)	Lang_Ind (20°C)	pH (pH)			TDS (mg/L)		TURB (NTU)
	Air	Water						Field	Lab			Field	Lab	Sat (20°C)	Field	Lab	
20-06-24	28	18.2	0.07	8.67	173	64	15	0.138	0.166	60.9	-0.74	7.61	7.6	8.3	102.70	83	1.1
20-07-28	27	19.1	0.08	8.83	189	76	10	0.149	0.170	68.9	-0.51	7.76	7.7	8.2	109.20	69	0.6
20-08-25	20	16.6	0.08	10.65	**631**	73	1	0.142	0.173	71.6	-0.42	7.76	7.8	8.2	109.85	90	0.8
20-09-29	24	17.4	0.08	7.55	256	62	25	0.142	0.167	60.0	-2.06	7.62	**6.3**	8.4	107.26	92	0.7
20-10-15	16	9.9	0.07	9.52	30	51	74	0.110	0.158	58.5	-0.86	7.27	7.6	8.5	100.10	94	0.8

Table 23: Nutrient results for ShdG, 2020

SITE ShdG: NUTRIENT DATA																		
Date (yy-mm-dd)	HCO3 (mg/L)	Br (mg/L)	Ca (mg/L)	CO3 (mg/L)	Cl (mg/L)	F (mg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	NH3T (mg/L)	NH3_Un(mg/L)	NO2 (mg/L)	NO3 (mg/L)	NOX (mg/L)	SO4 (mg/L)	TKN (mg/L)	TN (mg/L)	TOC (mg/L)	TP-L (mg/L)
20-06-24	63.7	0.02	15.7	0.238	6.8	0.19	0.83	5.27	6.1	<0.05	<0.001	<0.05	0.26	0.26	5	—	0.4	2.6	**0.021**
20-07-28	75.6	0.02	18.1	0.356	6.3	0.11	0.86	5.76	6.5	<0.05	<0.001	<0.05	0.15	0.15	5	—	0.2	2.2	**0.017**
20-08-25	72.5	0.02	18.7	0.430	6.2	0.05	0.84	6.05	6.2	<0.05	<0.001	<0.05	0.21	0.21	5	—	<0.2	1.2	**0.024**
20-09-29	62.0	0.02	15.5	0.012	7.9	0.12	1.10	5.16	7.4	<0.05	<0.001	<0.05	0.08	0.08	11	—	6.0	6.0	**0.015**
20-10-15	50.8	0.02	15.1	0.190	11.2	0.17	1.32	5.05	8.9	<0.05	<0.001	<0.05	<0.05	<0.05	12	—	0.3	9.2	**0.021**

Table 24: Inorganics results for ShdG, 2020

SITE ShdG: HEAVY METALS AND OTHER ELEMENTS																				
Date (yy-mm-dd)	Al (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Cd (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Li (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Rb (mg/L)	Sb (mg/L)	Sr (mg/L)	U (mg/L)	V (mg/L)	Zn (mg/L)
20-06-24	0.021	<0.001	0.024	0.071	<0.00001	0.0001	<0.001	<0.001	0.12	0.0018	0.118	0.0001	<0.001	<0.0001	0.0009	<0.0001	0.093	0.0001	<0.001	<0.001
20-07-28	0.016	<0.001	0.019	0.078	<0.00001	<0.0001	<0.001	<0.001	0.12	0.0020	0.081	0.0002	<0.001	<0.0001	0.0009	<0.0001	0.111	0.0001	<0.001	<0.001
20-08-25	0.022	<0.001	0.018	0.081	<0.00001	<0.0001	<0.001	<0.001	0.10	0.0020	0.082	0.0001	<0.001	<0.0001	0.0008	<0.0001	0.114	0.0002	<0.001	0.002
20-09-29	**0.026**	<0.001	0.016	0.087	<0.00001	<0.0001	<0.001	<0.001	0.08	0.0020	0.069	0.0001	<0.001	<0.0001	0.0013	<0.0001	0.118	<0.0001	<0.001	0.005
20-10-15	0.035	<0.001	0.016	0.069	<0.00001	0.0001	<0.001	<0.001	0.15	0.0017	0.055	<0.0001	<0.001	<0.0001	0.0012	<0.0001	0.099	<0.0001	<0.001	0.001

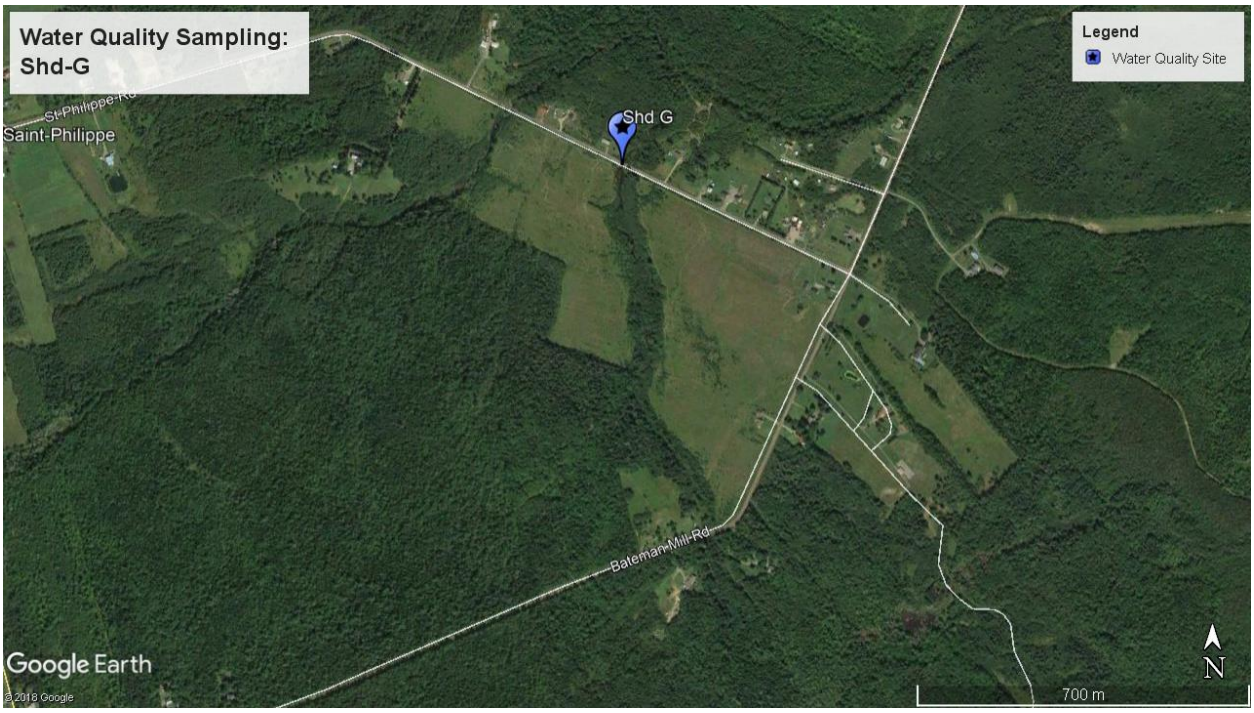


Figure 12: ShdG site location and surrounding land uses

Figure 13: Site photos for water quality sampling site ShdG

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 2020, meets or exceeds the recommendations for the survival of freshwater aquatic life based on pH and dissolved oxygen. The water temperature slightly exceeded the limit for thermal stress in salmonids (22.5˚C) in June (22.8˚C).

Total phosphorus levels for long-term eutrophic conditions, according to the CCME Guidance framework for Phosphorus, were: in the mesotrophic range (0.010 – 0.020 mg/L) in June and July; in the meso-eutrophic range (0.020 – 0.035 mg/L) in August and September; and in the eutrophic range (0.035 – 0.100 mg/L) in October.

Concentration results for the nitrate ion (NO3) are below the short term (124 mg/L) and long term (2.9 mg/L) CCME recommendations for direct toxicity to sensitive freshwater life (these guidelines do not consider indirect effects due to eutrophication, nor does this interpret results for assessment of eutrophic conditions).

Concentrations of iron exceeded the guideline (0.3 mg/L) in every sample taken in 2020; June (0.54 mg/L), July (0.48 mg/L), August (0.43 mg/L), September (0.45 mg/L) and October (0.45 mg/L).

Bacterial levels did exceed the maximum concentration of *E. coli* from Health Canada recreational guideline (≥ 400 MPN/100 mL) for the sample taken in August (1,664 MPN/100 mL).

Table 25: Water chemistry data and *E. coli* results for ShdH, 2020

SITE ShdH: FIELD DATA COLLECTED BY YSI AND LAB SAMPLES																		
Date (yy-mm-dd)	Temp (°C)		SAL (ppt)	DO (mg/L)	E. coli (MPN /100mL)	ALK_T (mg/L)	CLRA (TCU)	COND (mS/cm)		HARD (mg/L)	Lang_Ind (20°C)	pH (pH)			TDS (mg/L)		TURB (NTU)
	Air	Water						Field	Lab			Field	Lab	Sat (20°C)	Field	Lab	
20-06-24	26	22.8	0.10	6.91	20	73	24	0.198	0.125	69.9	-0.55	7.45	7.6	8.1	134.55	104	1.8
20-07-28	26	21.3	0.10	6.78	109	85	16	0.192	0.209	79.3	-0.63	7.41	7.4	8	134.55	79	2.6
20-08-25	20	18.8	0.10	7.53	1,664	85	2	0.180	0.207	80.0	-0.43	7.48	7.6	8	132.60	112	2.4
20-09-29	23	18.3	0.12	6.97	175	76	20	0.223	0.259	79.7	-0.68	7.45	7.4	8.1	166.40	140	1.5
20-10-15	14	10.2	0.12	10.45	20	78	26	0.181	0.259	85.5	-0.46	7.16	7.6	8.1	163.80	144	2.2

Table 26: Nutrient results for ShdH, 2020

SITE ShdH: NUTRIENT DATA																			
Date (yy-mm-dd)	HCO3 (mg/L)	Br (mg/L)	Ca (mg/L)	CO3 (mg/L)	Cl (mg/L)	F (mg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	NH3T (mg/L)	NH3_Un(mg/L)	NO2 (mg/L)	NO3 (mg/L)	NOX (mg/L)	SO4 (mg/L)	TKN (mg/L)	TN (mg/L)	TOC (mg/L)	TP-L (mg/L)
20-06-24	72.7	0.03	21.9	0.272	17.4	0.19	0.92	3.69	10.9	<0.05	<0.001	<0.05	<0.05	<0.05	<1	—	0.2	3.3	0.020
20-07-28	84.8	0.03	25.1	0.200	14.2	0.09	1.00	4.04	9.6	<0.05	<0.001	<0.05	<0.05	<0.05	<1	—	0.2	2.8	0.015
20-08-25	84.7	0.03	25.3	0.317	15.6	<0.05	1.20	4.09	9.3	<0.05	<0.001	<0.05	<0.05	<0.05	2	—	<0.2	2.4	0.021
20-09-29	75.8	0.03	25.3	0.179	34.4	0.08	1.31	4.02	17.8	<0.05	<0.001	<0.05	<0.05	<0.05	6	—	4.5	4.5	0.022
20-10-15	77.7	0.03	26.4	0.291	34.4	0.09	1.45	4.75	19.1	<0.05	<0.001	<0.05	<0.05	<0.05	5	—	<0.2	4.2	0.036

Table 27: Inorganics results for ShdH, 2020

SITE ShdH: HEAVY METALS AND OTHER ELEMENTS																			
Date (yy-mm-dd)	Al (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Cd (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Li (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Rb (mg/L)	Sb (mg/L)	Sr (mg/L)	U (mg/L)	V (mg/L)	Zn (mg/L)
20-06-24	0.032	<0.001	0.006	0.125	<0.00001	0.0002	<0.001	<0.001	0.54	0.0015	0.349	0.0001	<0.001	0.0001	0.0012	<0.0001	0.130	0.0003	<0.001	<0.001
20-07-28	0.025	<0.001	0.006	0.134	<0.00001	0.0001	<0.001	<0.001	0.48	0.0017	0.223	0.0001	<0.001	<0.0001	0.0014	<0.0001	0.152	0.0003	<0.001	<0.001
20-08-25	0.034	<0.001	0.006	0.130	<0.00001	0.0001	<0.001	<0.001	0.43	0.0016	0.153	0.0001	<0.001	0.0001	0.0015	<0.0001	0.151	0.0003	<0.001	0.002
20-09-29	0.023	<0.001	0.008	0.143	<0.00001	0.0001	<0.001	<0.001	0.45	0.0016	0.213	<0.0001	<0.001	<0.0001	0.0016	<0.0001	0.162	0.0002	<0.001	0.007
20-10-15	0.032	<0.001	0.008	0.138	<0.00001	0.0002	<0.001	<0.001	0.45	0.0015	0.211	<0.0001	<0.001	<0.0001	0.0014	<0.0001	0.165	0.0002	<0.001	0.006

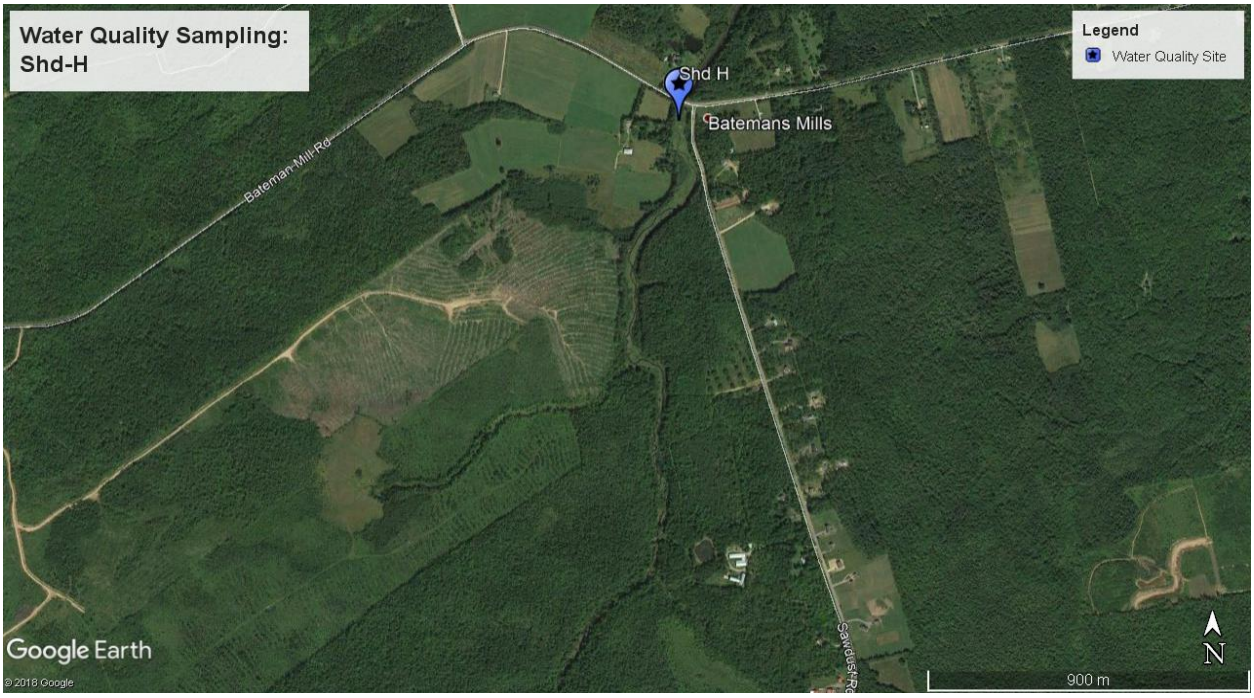


Figure 14: ShdH site location and surrounding land uses

Figure 15: Site photos for water quality sampling site ShdH

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 2020, meet the recommendations for the survival of freshwater aquatic life based on pH. However, levels of dissolved oxygen dropped below the recommendation (6.5 mg/L) for general cold-water organisms in June (4.69 mg/L), July (3.24 mg/L) and September (5.66 mg/L).

Total phosphorus levels for long-term eutrophic conditions, according to the *CCME Guidance framework for Phosphorus*, were: in the meso-eutrophic range (0.020 – 0.035 mg/L) in June, July, August and October; and in the eutrophic range (0.035 – 0.100 mg/L) in September.

Concentration results for the nitrate ion (NO3) are below the short term (124 mg/L) and long term (2.9 mg/L) CCME recommendations for direct toxicity to sensitive freshwater life (these guidelines do not consider indirect effects due to eutrophication, nor does this interpret results for assessment of eutrophic conditions).

Concentrations of aluminum exceeded the CCME water quality guideline (0.100 mg/L when the pH is ≥6.5) in the sample taken in October (0.287 mg/L). Concentrations of iron exceeded the guideline (0.3 mg/L) in every sample taken in 2020; June (0.71 mg/L), July (0.89 mg/L), August (0.88 mg/L), September (0.53 mg/L) and October (0.50 mg/L).

Bacterial levels did exceed the maximum concentration of *E. coli* from Health Canada recreational guideline (≥ 400 MPN/100 mL) for the sample taken in July (2,184 MPN/100 mL).

Table 28: Water chemistry data and *E. coli* results for ScdB, 2020

SITE ScdB: FIELD DATA COLLECTED BY YSI AND LAB SAMPLES																		
Date (yy-mm-dd)	Temp (°C)		SAL (ppt)	DO (mg/L)	E. coli (MPN /100mL)	ALK_T (mg/L)	CLRA (TCU)	COND (mS/cm)		HARD (mg/L)	Lang_Ind (20°C)	pH (pH)			TDS (mg/L)		TURB (NTU)
	Air	Water						Field	Lab			Field	Lab	Sat (20°C)	Field	Lab	
20-06-24	23	21.5	0.10	**4.69**	96	69	54	0.196	0.218	71.5	-0.44	7.3	7.7	8.1	137.15	112	7.0
20-07-28	25	20.5	0.14	**3.24**	**2,187**	110	27	0.261	0.283	111.0	-0.17	7.4	7.6	7.8	185.25	157	5.1
20-08-25	21	18.9	0.14	DND	134	120	15	0.266	0.304	129.0	0.13	7.4	7.8	7.7	195.65	170	3.9
20-09-29	23	15.7	0.10	**5.66**	108	58	43	0.179	0.212	64.4	-1.17	7.6	7.1	8.3	141.70	120	5.4
20-10-15	12	10.0	0.09	7.70	199	28	128	0.133	0.187	52.7	-1.18	7.1	7.5	8.7	120.90	118	5.1

Table 29: Nutrient results for ScdB, 2020

SITE ScdB: NUTRIENT DATA																		
Date (yy-mm-dd)	HCO3 (mg/L)	Br (mg/L)	Ca (mg/L)	CO3 (mg/L)	Cl (mg/L)	F (mg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	NH3T (mg/L)	NH3_Un(mg/L)	NO2 (mg/L)	NO3 (mg/L)	NOX (mg/L)	SO4 (mg/L)	TKN (mg/L)	TN (mg/L)	TOC (mg/L)	TP-L (mg/L)
20-06-24	68.7	0.08	23.6	0.324	20.6	0.25	0.77	3.06	12.2	0.070	0.001	<0.05	<0.05	<0.05	<1	—	0.4	8.3	**0.034**
20-07-28	110.0	0.11	37.2	0.410	22.0	0.17	0.92	4.29	11.8	<0.05	<0.001	<0.05	<0.05	<0.05	6	—	0.3	5.4	**0.030**
20-08-25	119.0	0.10	43.6	0.708	24.2	0.06	0.96	4.90	11.5	<0.05	<0.001	<0.05	<0.05	<0.05	7	—	<0.2	2.9	**0.021**
20-09-29	57.9	0.06	21.1	0.069	23.5	0.11	1.11	2.84	13.1	<0.05	<0.001	<0.05	0.10	0.10	13	—	0.3	9.2	**0.038**
20-10-15	27.9	0.04	16.8	0.083	29.1	0.24	1.20	2.61	14.8	<0.05	<0.001	<0.05	<0.05	0.09	19	—	0.6	16.6	**0.025**

Table 30: Inorganics results for ScdB, 2020

SITE ScdB: HEAVY METALS AND OTHER ELEMENTS																				
Date (yy-mm-dd)	Al (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Cd (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Li (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Rb (mg/L)	Sb (mg/L)	Sr (mg/L)	U (mg/L)	V (mg/L)	Zn (mg/L)
20-06-24	0.083	<0.001	0.010	0.037	<0.00001	0.0005	<0.001	<0.001	**0.71**	0.0009	0.554	0.0004	<0.001	0.0005	0.0015	<0.0001	0.091	0.0005	<0.001	0.001
20-07-28	0.040	0.002	0.009	0.056	<0.00001	0.0005	<0.001	<0.001	**0.89**	0.0011	0.952	0.0004	<0.001	0.0002	0.0019	<0.0001	0.132	0.0010	<0.001	0.002
20-08-25	0.087	<0.001	0.010	0.062	<0.00001	0.0004	<0.001	<0.001	**0.88**	0.0012	0.576	0.0005	<0.001	0.0005	0.0016	<0.0001	0.148	0.0013	<0.001	0.002
20-09-29	0.070	<0.001	0.019	0.041	<0.00001	0.0002	<0.001	<0.001	**0.53**	0.0010	0.240	0.0002	<0.001	0.0002	0.0018	<0.0001	0.098	0.0004	<0.001	0.001
20-10-15	**0.287**	<0.001	0.025	0.046	0.00001	0.0002	<0.001	<0.001	**0.50**	0.0012	0.101	0.0001	<0.001	0.0003	0.0017	<0.0001	0.073	0.0002	<0.001	0.012

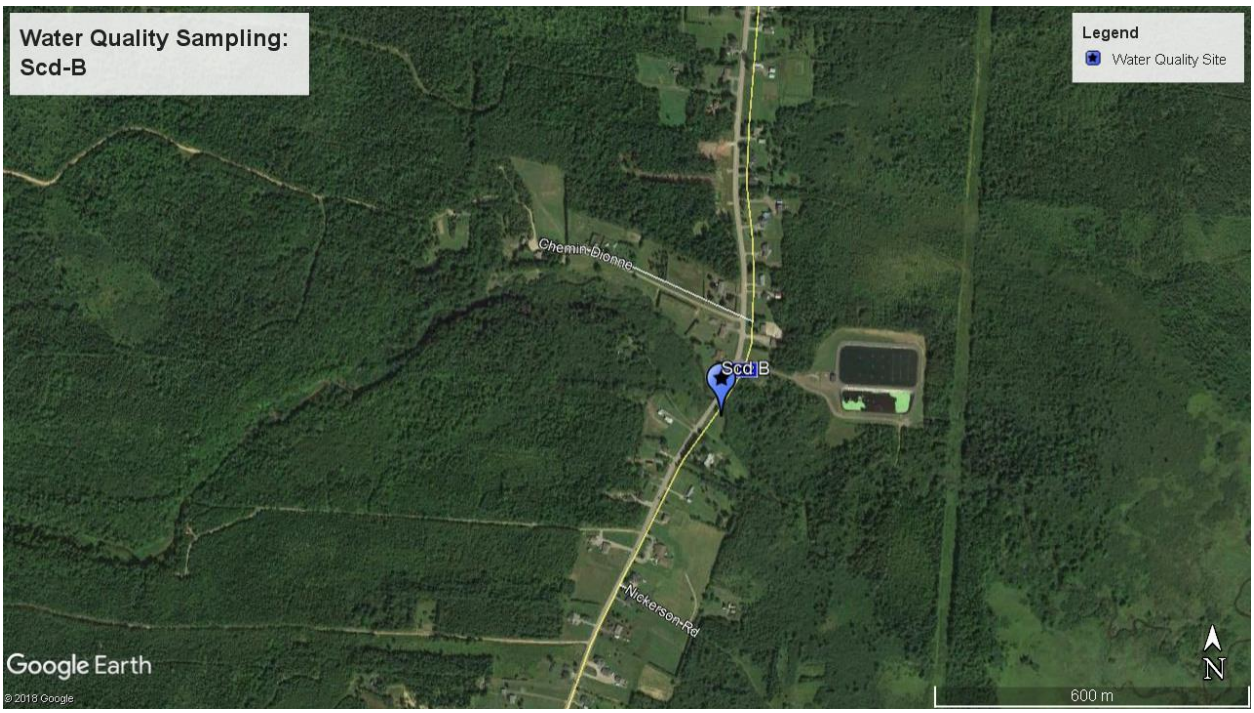


Figure 16: ScdB site location and surrounding land uses

Figure 17: Site photos for water quality sampling site ScdB

3.8 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 2020, meets or exceeds all the recommendations for the survival of freshwater aquatic life based on pH. However, levels of dissolved oxygen dropped below the recommendation (6.5 mg/L) for general cold-water organisms in June (6.19 mg/L), July (6.30 mg/L) and August (6.14 mg/L). The water temperature slightly exceeded the limit for thermal stress in salmonids (22.5˚C) in July (23.0˚C).

Total phosphorus levels for long-term eutrophic conditions, according to the CCME Guidance framework for Phosphorus, were: in the mesotrophic range (0.010 – 0.020 mg/L) in July, August and October; and in the meso-eutrophic range (0.020 – 0.035 mg/L) in June and September.

Concentration results for the nitrate ion (NO3) are below the short term (124 mg/L) and long term (2.9 mg/L) CCME recommendations for direct toxicity to sensitive freshwater life (these guidelines do not consider indirect effects due to eutrophication, nor does this interpret results for assessment of eutrophic conditions).

Concentrations of aluminum exceeded the CCME water quality guideline (0.100 mg/L when the pH is ≥6.5) in the sample taken in October (0.115 mg/L). Concentrations of iron exceeded the CCME water quality guideline (0.3 mg/L) in June (0.49 mg/L), July (0.30 mg/L) and August (0.40 mg/L).

Bacterial levels did exceed the maximum concentration of *E. coli* from Health Canada recreational guideline (≥ 400 MPN/100 mL) for the sample taken in July (620 MPN/100 mL).

Table 31: Water chemistry data and *E. coli* results for ScdE-2, 2020

SITE ScdE-2: FIELD DATA COLLECTED BY YSI AND LAB SAMPLES																	
Date (yy-mm-dd)	Temp (°C)		SAL (ppt)	DO (mg/L)	E. coli (MPN /100mL)	ALK_T (mg/L)	CLRA (TCU)	COND (mS/cm)		HARD (mg/L)	Lang_Ind (20°C)	pH (pH)			TDS (mg/L)		TURB (NTU)
	Air	Water						Field	Lab			Field	Lab	Sat (20°C)	Field	Lab	
20-06-24	24	22.2	0.07	6.19	288	40	57	0.139	0.154	40.5	-1.11	7.3	7.5	8.6	94.25	78	3.2
20-07-28	21	23.0	0.08	6.30	620	52	32	0.122	0.177	49.9	-0.71	7.7	7.7	8.4	116.35	96	2.5
20-08-25	21	19.6	0.10	6.14	63	55	5	0.189	0.213	53.3	-0.66	7.4	7.7	8.4	137.15	117	3.0
20-09-29	23	13.8	0.07	7.88	20	37	64	0.117	0.145	36.9	-1.49	7.6	7.2	8.7	96.85	83	3.2
20-10-15	13	10.1	0.07	8.46	86	39	87	0.110	0.158	48.4	-0.96	7.1	7.6	8.6	100.10	96	2.8

Table 32: Nutrient results for ScdE-2, 2020

SITE ScdE-2: NUTRIENT DATA																			
Date (yy-mm-dd)	HCO3 (mg/L)	Br (mg/L)	Ca (mg/L)	CO3 (mg/L)	Cl (mg/L)	F (mg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	NH3T (mg/L)	NH3_Un(mg/L)	NO2 (mg/L)	NO3 (mg/L)	NOX (mg/L)	SO4 (mg/L)	TKN (mg/L)	TN (mg/L)	TOC (mg/L)	TP-L (mg/L)
20-06-24	39.9	0.09	13.2	0.119	17.7	0.25	0.64	1.84	11.8	<0.05	<0.001	<0.05	<0.05	<0.05	<1	—	0.4	7.8	**0.025**
20-07-28	51.7	0.11	16.5	0.244	23.9	0.13	0.69	2.12	15.5	<0.05	<0.001	<0.05	<0.05	<0.05	<1	—	0.3	5.1	**0.014**
20-08-25	54.7	0.17	17.7	0.258	36.4	0.13	0.76	2.22	20.9	<0.05	<0.001	<0.05	<0.05	<0.05	<1	—	<0.2	5.0	**0.016**
20-09-29	36.9	0.07	11.7	0.055	18.4	0.12	0.69	1.87	11.3	<0.05	<0.001	<0.05	0.06	0.06	6	—	9.9	9.9	**0.030**
20-10-15	38.8	0.06	15.4	0.145	20.9	0.16	1.04	2.41	12.6	<0.05	<0.001	<0.05	0.09	<0.05	8	—	0.4	11.8	**0.020**

Table 33: Inorganics results for ScdE-2, 2020

SITE ScdE-2: HEAVY METALS AND OTHER ELEMENTS																				
Date (yy-mm-dd)	Al (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Cd (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Li (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Rb (mg/L)	Sb (mg/L)	Sr (mg/L)	U (mg/L)	V (mg/L)	Zn (mg/L)
20-06-24	0.052	<0.001	0.009	0.045	<0.00001	0.0002	<0.001	<0.001	**0.49**	0.0008	0.185	0.0002	<0.001	0.0002	0.0015	<0.0001	0.083	<0.0001	<0.001	0.001
20-07-28	0.063	<0.001	0.010	0.048	<0.00001	0.0002	<0.001	<0.001	**0.30**	0.0009	0.119	0.0002	<0.001	0.0001	0.0016	<0.0001	0.116	<0.0001	<0.001	0.002
20-08-25	0.099	<0.001	0.011	0.053	0.00001	0.0003	<0.001	<0.001	**0.40**	0.0011	0.237	0.0003	<0.001	0.0003	0.0016	<0.0001	0.135	<0.0001	<0.001	0.001
20-09-29	0.067	<0.001	0.012	0.048	<0.00001	0.0001	<0.001	<0.001	0.27	0.0008	0.060	0.0001	<0.001	0.0001	0.0014	<0.0001	0.094	<0.0001	<0.001	0.002
20-10-15	**0.115**	<0.001	0.013	0.048	<0.00001	0.0001	<0.001	<0.001	0.29	0.0008	0.032	0.0001	<0.001	0.0001	0.0017	<0.0001	0.086	<0.0001	<0.001	0.006

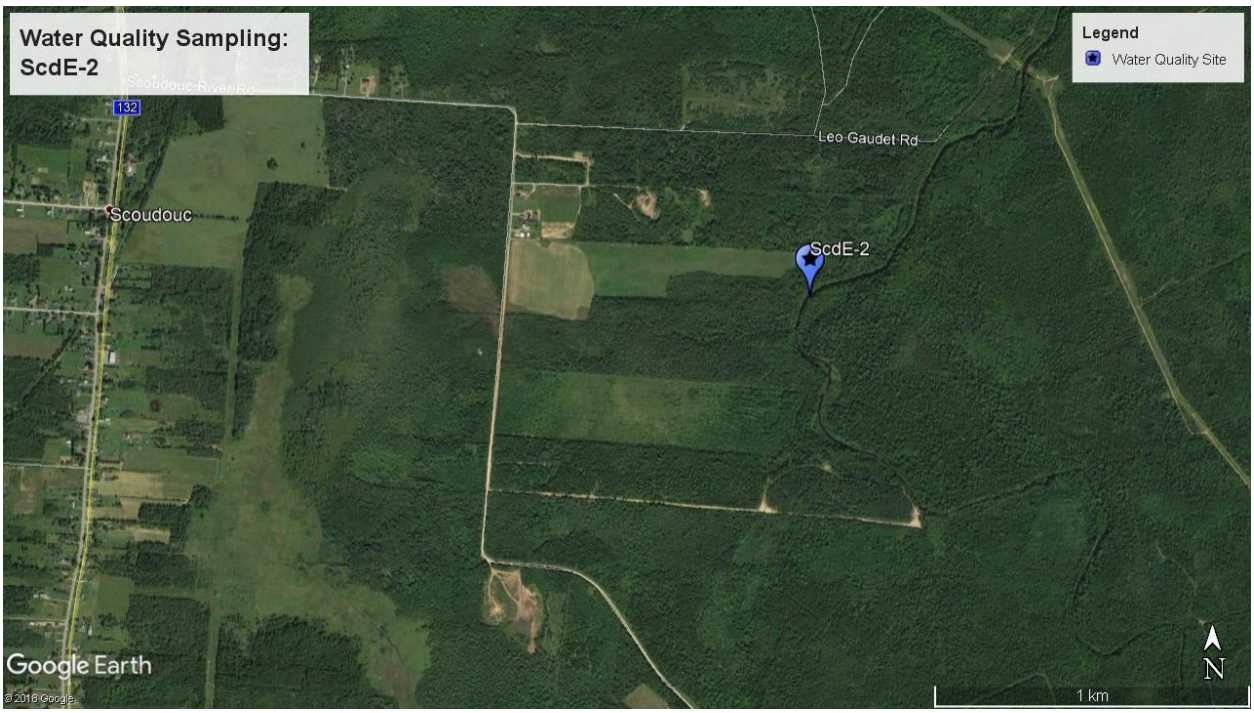


Figure 18: ScdE-2 site location and surrounding land uses

Figure 19: Site photos for water quality sampling site ScdE-2

3.9 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 2020, meets or exceeds all the recommendations for the survival of freshwater aquatic life based on pH and dissolved oxygen. However, one level of dissolved oxygen was slightly below the recommendation (6.5 mg/L) for general cold-water organisms in September (6.19 mg/L).

Total phosphorus levels for long-term eutrophic conditions, according to the CCME Guidance framework for Phosphorus, were: in the eutrophic range (0.035 – 0.100 µg/L) in June, August, September and October; and in the hyper-eutrophic range (>100 mg/L) in July.

Concentration results for the nitrate ion (NO3) are below the short term (124 mg/L) and long term (2.9 mg/L) CCME recommendations for direct toxicity to sensitive freshwater life (these guidelines do not consider indirect effects due to eutrophication, nor does this interpret results for assessment of eutrophic conditions).

Concentrations of aluminum exceeded the CCME water quality guideline (0.100 mg/L when the pH is ≥6.5) in the samples taken in July (0.404 mg/L), September (0.174 mg/L) and October (0.252 mg/L). Concentrations of iron exceeded the guideline (0.3 mg/L) in every sample taken in 2020; June (0.90 mg/L), July (1.14 mg/L), August (0.74 mg/L), September (0.69 mg/L) and October (0.88 mg/L).

Bacterial levels did exceed the maximum concentration of *E. coli* from Health Canada recreational guideline (≥ 400 MPN/100 mL) for the sample taken in July (1,274 MPN/100 mL).

Table 34: Water chemistry data and *E. coli* results for ScdF, 2020

SITE ScdF: FIELD DATA COLLECTED BY YSI AND LAB SAMPLES																	
Date (yy-mm-dd)	Temp (°C)		SAL (ppt)	DO (mg/L)	E. coli (MPN /100mL)	ALK_T (mg/L)	CLRA (TCU)	COND (mS/cm)		HARD (mg/L)	Lang_Ind (20°C)	pH (pH)			TDS (mg/L)		TURB (NTU)
	Air	Water						Field	Lab			Field	Lab	Sat (20°C)	Field	Lab	
20-06-24	20	19.7	0.06	5.51	323	56	75	0.118	0.402	51.7	-0.57	7.7	7.8	8.4	85.80	75	<0.1
20-07-28	23	21.1	0.08	6.97	**1,274**	68	64	0.149	0.149	61.7	-0.71	7.8	7.5	8.2	109.85	84	46.1
20-08-25	20	17.4	0.08	8.18	134	75	42	0.152	0.158	66.2	-0.55	8.0	7.6	8.1	115.70	90	4.4
20-09-29	21	14.6	0.07	**3.85**	41	47	52	0.120	0.129	44.1	-1.32	7.6	7.2	8.5	97.50	74	16.1
20-10-15	9	9.3	0.07	8.02	122	61	81	0.101	0.980	59.1	-0.69	7.0	7.6	8.3	92.95	86	26.5

Table 35: Nutrient results for ScdF, 2020

SITE ScdF: NUTRIENT DATA																			
Date (yy-mm-dd)	HCO3 (mg/L)	Br (mg/L)	Ca (mg/L)	CO3 (mg/L)	Cl (mg/L)	F (mg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	NH3T (mg/L)	NH3_Un(mg/L)	NO2 (mg/L)	NO3 (mg/L)	NOX (mg/L)	SO4 (mg/L)	TKN (mg/L)	TN (mg/L)	TOC (mg/L)	TP-L (mg/L)
20-06-24	55.6	0.03	16.3	0.330	5.6	0.23	0.85	2.68	5.3	0.080	0.002	<0.05	0.08	0.08	<1	—	0.5	8.6	**0.038**
20-07-28	67.8	0.03	19.7	0.202	5.2	0.13	0.97	3.04	5.7	<0.05	<0.001	<0.05	0.09	0.09	<1	—	0.4	6.4	**0.139**
20-08-25	74.7	0.03	21.1	0.280	5.4	0.07	0.96	3.27	6.2	<0.05	<0.001	<0.05	<0.05	<0.05	<1	—	0.2	6.6	**0.045**
20-09-29	46.9	0.03	13.7	0.070	7.9	0.08	1.13	2.41	189.0	<0.05	<0.001	<0.05	<0.05	<0.05	5	—	0.2	8.8	**0.065**
20-10-15	60.8	0.03	18.5	0.228	7.1	0.11	1.39	3.14	6.3	<0.05	<0.001	<0.05	<0.05	<0.05	2	—	0.3	8.9	**0.080**

Table 36: Inorganics results for ScdF, 2020

SITE ScdF: HEAVY METALS AND OTHER ELEMENTS																				
Date (yy-mm-dd)	Al (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Cd (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Li (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Rb (mg/L)	Sb (mg/L)	Sr (mg/L)	U (mg/L)	V (mg/L)	Zn (mg/L)
20-06-24	0.088	0.001	0.005	0.094	0.00001	0.0004	<0.001	<0.001	**0.90**	0.0005	0.347	0.0003	<0.001	0.0006	0.0020	<0.0001	0.095	0.0002	<0.001	<0.001
20-07-28	**0.404**	0.001	0.005	0.064	0.00002	0.0006	<0.001	<0.001	**1.14**	0.0007	0.245	0.0002	<0.001	0.0016	0.0022	<0.0001	0.113	0.0002	0.001	0.004
20-08-25	0.070	<0.001	0.007	0.043	<0.00001	0.0002	<0.001	<0.001	**0.74**	0.0004	0.179	0.0013	<0.001	0.0003	0.0019	<0.0001	0.124	0.0001	<0.001	<0.001
20-09-29	**0.174**	<0.001	0.008	0.053	<0.00001	0.0003	<0.001	<0.001	**0.69**	0.0005	0.180	0.0001	<0.001	0.0006	0.0019	<0.0001	0.094	<0.0001	<0.001	0.003
20-10-15	**0.252**	<0.001	0.489	0.058	0.00001	0.0004	<0.001	<0.001	**0.88**	0.0007	0.291	0.0001	<0.001	0.0007	0.0020	<0.0001	0.103	0.0001	<0.001	0.005

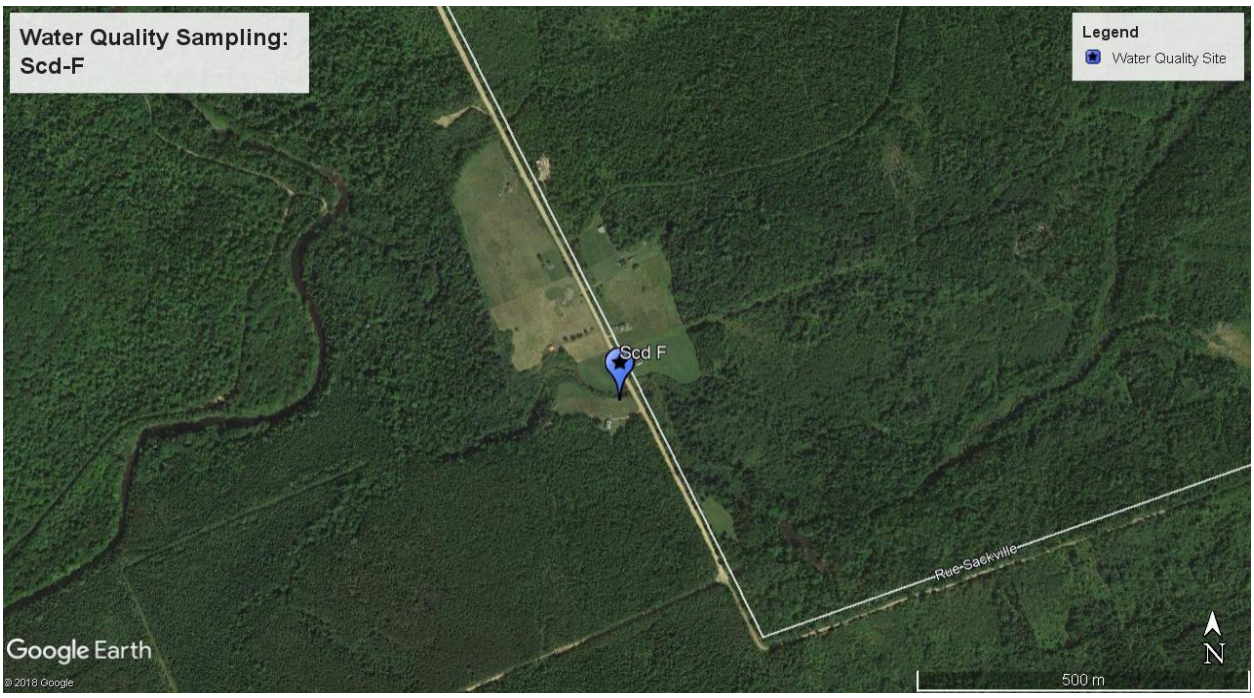


Figure 20: ScdF site location and surrounding land uses

Figure 21: Site photos for water quality sampling site ScdF

3.10 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 sand/gravel 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 are located near the Scoudouc 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 2020, meets or exceeds all the recommendations for the survival of freshwater aquatic life based on pH and dissolved oxygen. However, one level of dissolved oxygen was slightly below the recommendation (6.5 mg/L) for general cold-water organisms in September (6.19 mg/L).

Total phosphorus levels for long-term eutrophic conditions, according to the CCME Guidance framework for Phosphorus, were in the mesotrophic range (0.010 – 0.020 mg/L) in June; in the meso-eutrophic range (0.020 – 0.035 mg/L) in August and September; and in the eutrophic range (0.035 – 0.100 mg/L) in July and October.

Concentration results for the nitrate ion (NO3) are below the short term (124 mg/L) and long term (2.9 mg/L) CCME recommendations for direct toxicity to sensitive freshwater life (these guidelines do not consider indirect effects due to eutrophication, nor does this interpret results for assessment of eutrophic conditions).

Results exceeded the long-term limit for chloride in freshwater (120 mg/L) in September (243 mg/L) and October (200 mg/L). Consultations are needed to determine the possible sources and impacts of chloride on this watercourse.

Concentrations of aluminum exceeded the CCME water quality guideline (0.100 mg/L when the pH is ≥6.5) for the sample taken in July (0.186 mg/L). Concentrations of iron reached or exceeded the CCME water quality guideline (0.3 mg/L) for the samples taken in July (0.32 mg/L) and October (0.30 mg/L).

Bacterial levels did exceed the maximum concentration of *E. coli* from Health Canada recreational guideline (≥ 400 MPN/100 mL) for the samples taken in June (717 MPN/100 mL), July (5,476 MPN/100 mL) and August (435 MPN/100 mL).

Table 37: Water chemistry data and *E. coli* results for ScdH, 2020

SITE ScdH: FIELD DATA COLLECTED BY YSI AND LAB SAMPLES																	
Date (yy-mm-dd)	Temp (°C)		SAL (ppt)	DO (mg/L)	E. coli (MPN /100mL)	ALK_T (mg/L)	CLRA (TCU)	COND (mS/cm)		HARD (mg/L)	Lang_Ind (20°C)	pH (pH)			TDS (mg/L)		TURB (NTU)
	Air	Water						Field	Lab			Field	Lab	Sat (20°C)	Field	Lab	
20-06-24	23	17.2	0.17	7.64	**717**	100	14	0.308	0.138	88.8	0.08	7.7	8.0	7.9	234.65	204	1.6
20-07-28	25	21.2	0.26	6.76	**5,475**	120	58	0.500	0.547	100.0	-0.11	7.8	7.7	7.8	351.00	292	16.0
20-08-25	21	18.9	0.13	6.53	**435**	110	15	0.243	0.279	91.5	-0.16	7.7	7.7	7.9	178.75	159	1.7
20-09-29	22	18.6	0.59	**6.19**	85	130	28	1.040	1.120	132.0	-0.12	7.7	7.6	7.7	767.00	660	1.6
20-10-15	11	9.5	0.47	9.44	41	110	68	0.670	0.147	132.0	-0.08	7.5	7.7	7.8	617.50	553	1.6

Table 38: Nutrient results for ScdH, 2020

SITE ScdH: NUTRIENT DATA																			
Date (yy-mm-dd)	HCO3 (mg/L)	Br (mg/L)	Ca (mg/L)	CO3 (mg/L)	Cl (mg/L)	F (mg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	NH3T (mg/L)	NH3_Un(mg/L)	NO2 (mg/L)	NO3 (mg/L)	NOX (mg/L)	SO4 (mg/L)	TKN (mg/L)	TN (mg/L)	TOC (mg/L)	TP-L (mg/L)
20-06-24	99.0	0.10	29.5	0.931	54.6	0.23	1.80	3.67	41.4	<0.05	<0.001	<0.05	0.06	0.06	7	—	0.4	4.4	**0.017**
20-07-28	119.0	0.14	33.5	0.563	85.8	0.16	2.76	4.04	69.0	<0.05	<0.001	<0.05	0.15	0.15	17	—	0.5	5.5	**0.081**
20-08-25	109.0	0.04	29.9	0.516	21.8	0.08	2.06	4.08	21.4	0.050	<0.001	<0.05	0.51	0.51	6	—	0.7	3.7	**0.022**
20-09-29	129.0	0.24	43.6	0.485	**243.0**	0.25	6.22	5.53	5.9	<0.05	<0.001	<0.05	<0.05	<0.05	84	—	0.4	8.7	**0.025**
20-10-15	109.0	0.15	43.3	0.516	**200.0**	0.33	6.46	5.78	161.0	<0.05	<0.001	<0.05	<0.05	<0.05	69	—	0.8	24.0	**0.042**

Table 39: Inorganics results for ScdH, 2020

SITE ScdH: HEAVY METALS AND OTHER ELEMENTS																			
Date (yy-mm-dd)	Al (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Cd (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Li (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Rb (mg/L)	Sb (mg/L)	Sr (mg/L)	U (mg/L)	V (mg/L)	Zn (mg/L)
20-06-24	0.039	<0.001	0.269	0.046	0.00001	0.0001	<0.001	<0.001	0.11	0.0012	0.160	0.0018	<0.001	<0.0001	0.0015	<0.0001	0.157	0.0004	<0.001	<0.001
20-07-28	**0.186**	<0.001	0.396	0.117	0.00001	0.0003	<0.001	<0.001	**0.32**	0.0014	0.255	0.0012	0.001	0.0004	0.0024	<0.0001	0.188	0.0005	<0.001	0.002
20-08-25	0.074	<0.001	0.126	0.091	<0.00001	0.0001	<0.001	<0.001	0.25	0.0009	0.223	0.0003	<0.001	0.0001	0.0020	<0.0001	0.147	0.0006	<0.001	0.001
20-09-29	0.046	<0.001	0.746	0.156	0.00002	0.0003	<0.001	<0.001	0.15	0.0017	0.411	0.0041	0.002	0.0002	0.0034	0.0001	0.282	0.0004	<0.001	0.003
20-10-15	0.067	<0.001	0.007	0.128	0.00007	0.0004	0.001	0.001	**0.30**	0.0002	0.191	0.0039	0.003	0.0002	0.0025	0.0002	0.230	0.0002	<0.001	0.007

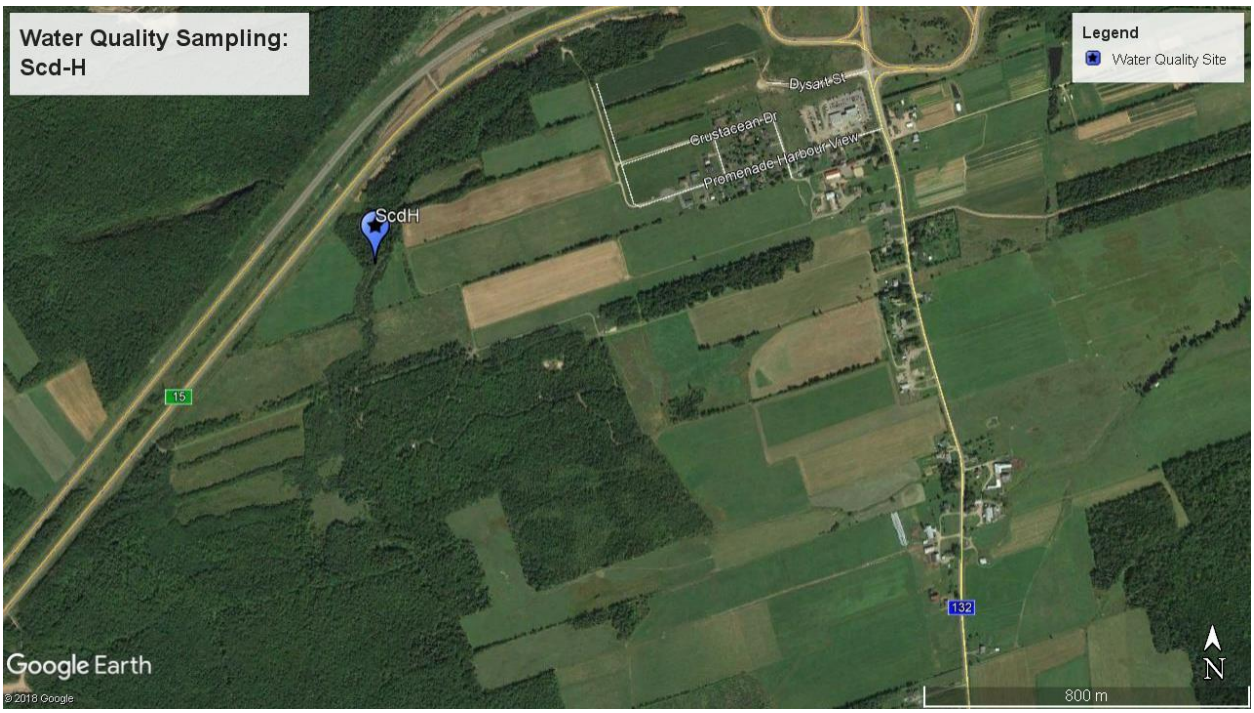


Figure 22: ScdH site location and surrounding land uses

Figure 23: Site photos for water quality sampling site ScdH

3.11 Bacterial Sampling Summary

The bacterial levels measured in 2020 in the Shediac and Scoudouc rivers have been high in comparison to previous years. The purpose of a long-term monitoring program is to evaluate a waterbody under various conditions, such as changes in surrounding land uses and changes in climate patterns. A long-term monitoring program allows to establish baseline trends in water quality, to detect abnormalities and significant changes over time. This year has demonstrated abnormalities in bacterial results.

Looking at the rainfall in the 24-48 hours prior to a round of sampling, the 2020 strategy was to collect 4 out of 5 samples under ambient conditions and 1 rain event sampling (>10 mm).

There was no rainfall prior to the samplings of June 24, July 28 and September 29. In July, there is an exception; the site ScdE-2 was sampled on July 29, and 4.6 mm of rainfall occurred the prior evening.

During the sampling on August 25, a severe thunderstorm and heavy downpour occurred in mid-day, lasting for over one hour and generating rainfall of 13.2 mm. The samples of the first 4 sites in the Scoudouc River had already been collected, leaving the last 5 sites in the Shediac River that were collected once the storm had passed. This sudden and heavy downpour served as an unplanned rain event sampling, providing a snapshot of the bacterial levels present in the river, following the first flush of stormwater runoff from the surrounding landscape. The rain event sampling took place on October 15, with 9 mm of rainfall on October 14 (according to the data from the weather monitoring station at the Greater Moncton Romeo Leblanc International Airport). The amount of rainfall that was received on October 14 was less than the predictions, and did not result in the expected bacterial spikes.

In August, following the thunderstorm, bacterial levels were especially high in the McQuade Brook (ShdB), with levels above the maximum detection limit (>24,196). Levels were also elevated at two stations of the Shediac River (ShdC & ShdE), the Bateman Brook (ShdH) and the Weisner Brook (ShdG).

The McQuade Brook (ShdB) had elevated bacterial level in all months except October. Only one monitoring station, Shediac River's ShdA, remained below the Canadian Recreational Water Quality Guideline (400 MPN/100 mL) in all samples collected in 2020.

For the Shediac River, there are 10 samples that surpassed the Canadian Recreational Water Quality Guideline (400 MPN/100 mL): the site ShdB in all months except October; the site ShdC in August, September and October; the site ShdE in August; the site ShdG in August; and the site ShdH in August.

For the Scoudouc River, there are 6 samples that surpassed the Canadian Recreational Water Quality Guideline (400 MPN/100 mL): the site ScdB in July; the site ScdE-2 in July; the site ScdF in July; and the site ScdH in June, July and August.

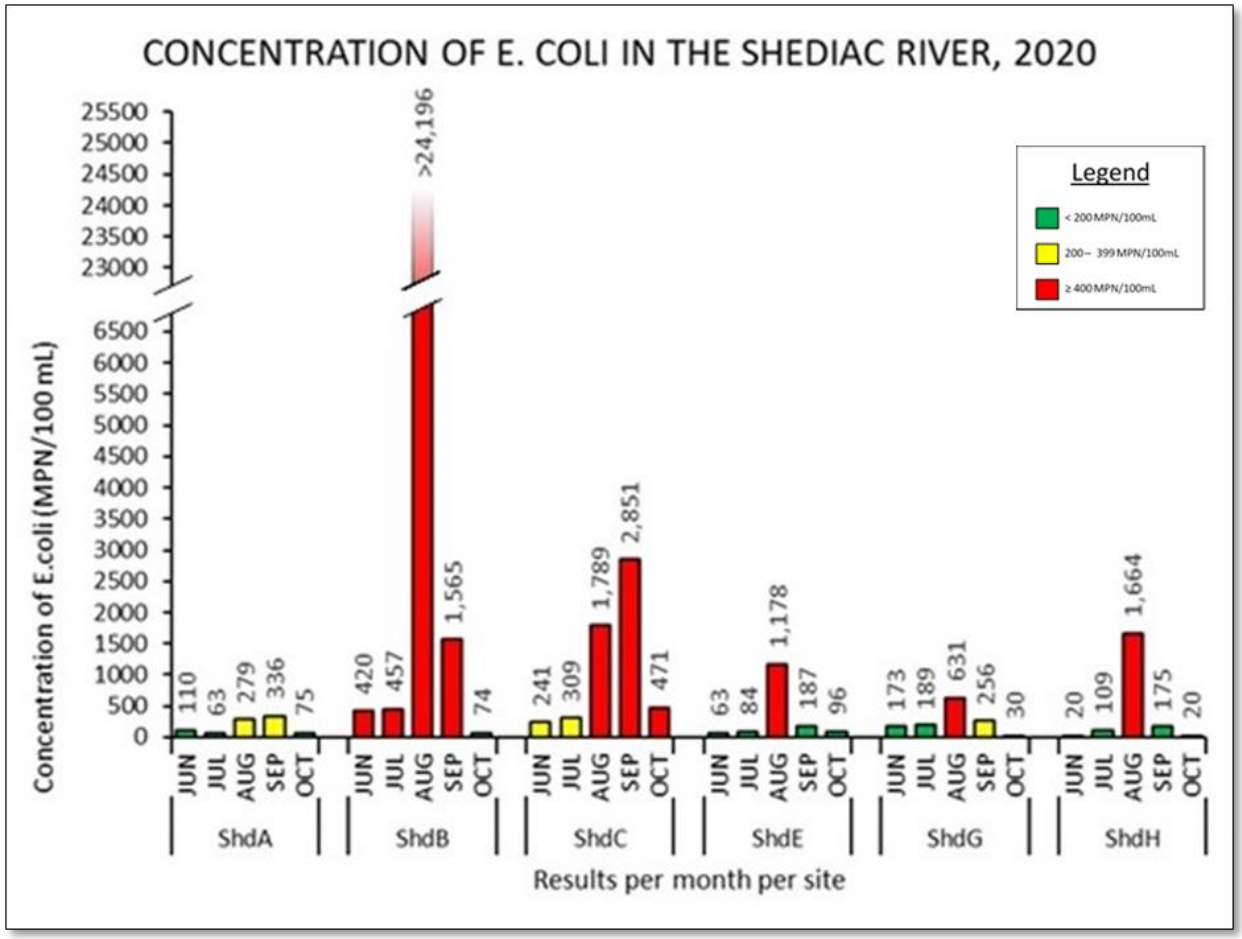


Figure 24: Summary of water quality results for *E. coli*, Shediac River sampling 2020

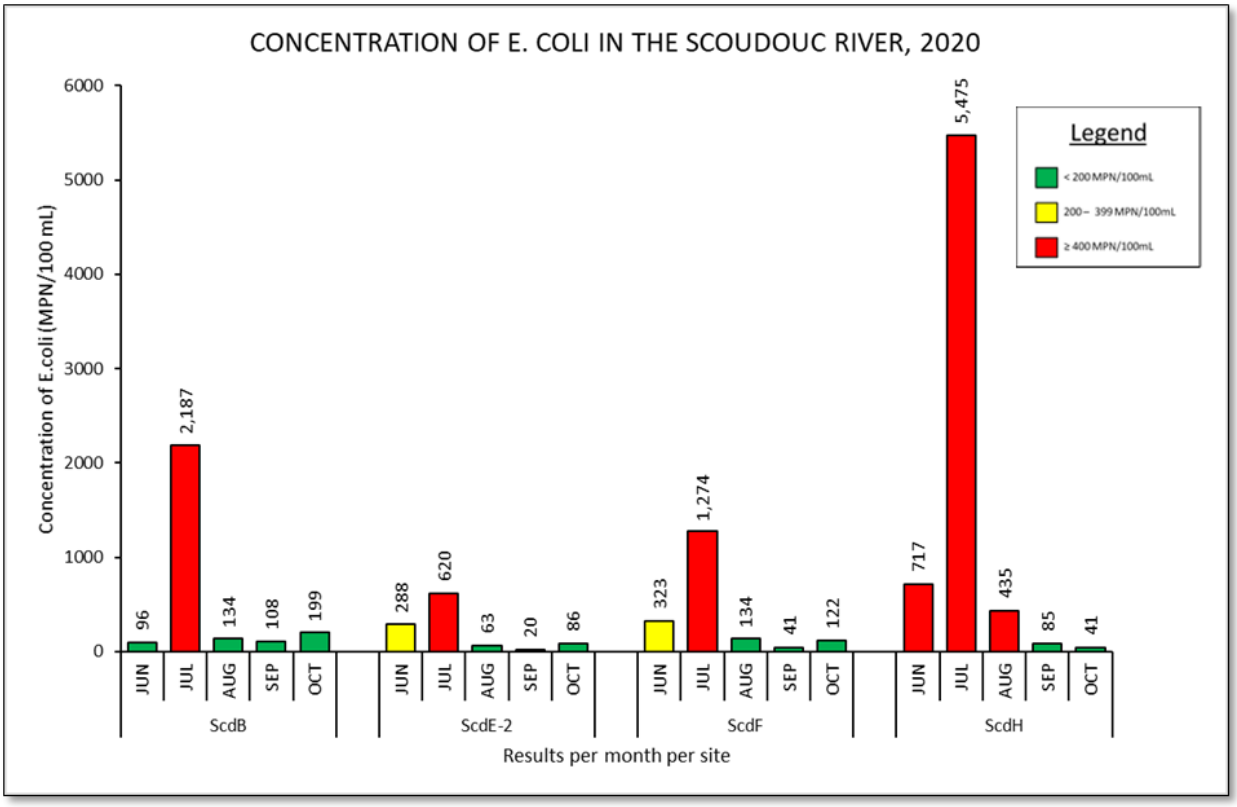


Figure 25: Summary of water quality results for *E. coli*, Scoudouc River sampling 2020

3.12 Investigative sampling

A program was initiated by the department of Environment and local government in 2018 to investigate areas of concern for water quality in the bay. The study continued in 2019 and reports can be found online at :
https://www2.gnb.ca/content/gnb/en/corporate/promo/ParleeBeach/reports.html

In 2020, the Shediac Bay Watershed Association continued this program to sample areas around agricultural fields and small streams that seem to have high bacteria content. The report was produced by Jim Weldon environmental consultant and is included as annex 1.

4. WATER TEMPERATURE MONITORING

This part of the project is done in partnership with the "*Institut national de la recherche scientifique*" (INRS-ETE) in the province of Quebec. This partnership began in 2016, where INRS-ETE provided the SBWA with 3 temperature loggers, and an additional 4 loggers were purchased by the SBWA (HOBO light pendants). Having a total of 7 loggers, the strategy is to monitor temperatures fluctuations in strategic locations. Areas of interest are those determined to be high risk for thermal stress in juvenile salmonids and other cold-water species. Other areas of interest are those determined to be colder zones suitable for thermal refugia, i.e. habitats containing colder water that provides a refuge for fish from high water temperatures.

Table 40: Thermograph monitoring Sites information, SBWA 2020

Site ID	Watercourse Name	Latitude	Longitude	Installation date	Date of retrieval
T-ShdA	Shediac River	N46° 11' 36.7"	W64° 48' 56.0"	07/01/2020	09/25/2020
T-ShdE	Shediac River	N46° 14' 41.5"	W64° 39' 56.3"	06/03/2020	09/25/2020
T-ShdE-2A	Weisner Brook	N46° 14' 24.1"	W64° 39' 46.0"	07/01/2020	09/25/2020
T-ShdM	Weisner Brook	N46° 12' 27.1"	W64° 40' 21.0"	06/03/2020	09/25/2020
T-ShdB	McQuade Brook	N46° 13' 54.9"	W64° 44' 31.9"	06/03/2020	09/25/2020
T-ScdD	Scoudouc River	N46° 11' 2.3"	W64° 30' 39.8"	06/01/2020	Lost
T-ScdB	Scoudouc River	N46° 08' 39.2"	W64° 33' 36.6"	06/01/2020	09/25/2020

The temperature loggers were primarily installed on June 1st and 3rd, except the site T-ShdA that was installed on July 1st. They were retrieved on September 25th (see Table 40 for installation details). In 2020, one temperature logger in the Scoudouc River was lost (T-ScdD).

The following section of this report shows the thermograph data (daily maximum temperatures) recorded. The recommended temperature limits indicate the threshold for thermal stress beginning at 22.5°C for juvenile Atlantic salmon, and lethal limit of 25°C or greater (Crisp 1999).

Figure 26: Installation of a water temperature logger in-stream

4.1 Water Temperature Monitoring Shediac River

Five sites are monitored in the Shediac River and its tributaries; two in the main branch, two in the Weisner Brook and one in the McQuade Brook. The following section reports on the temperature logger data for 2020.

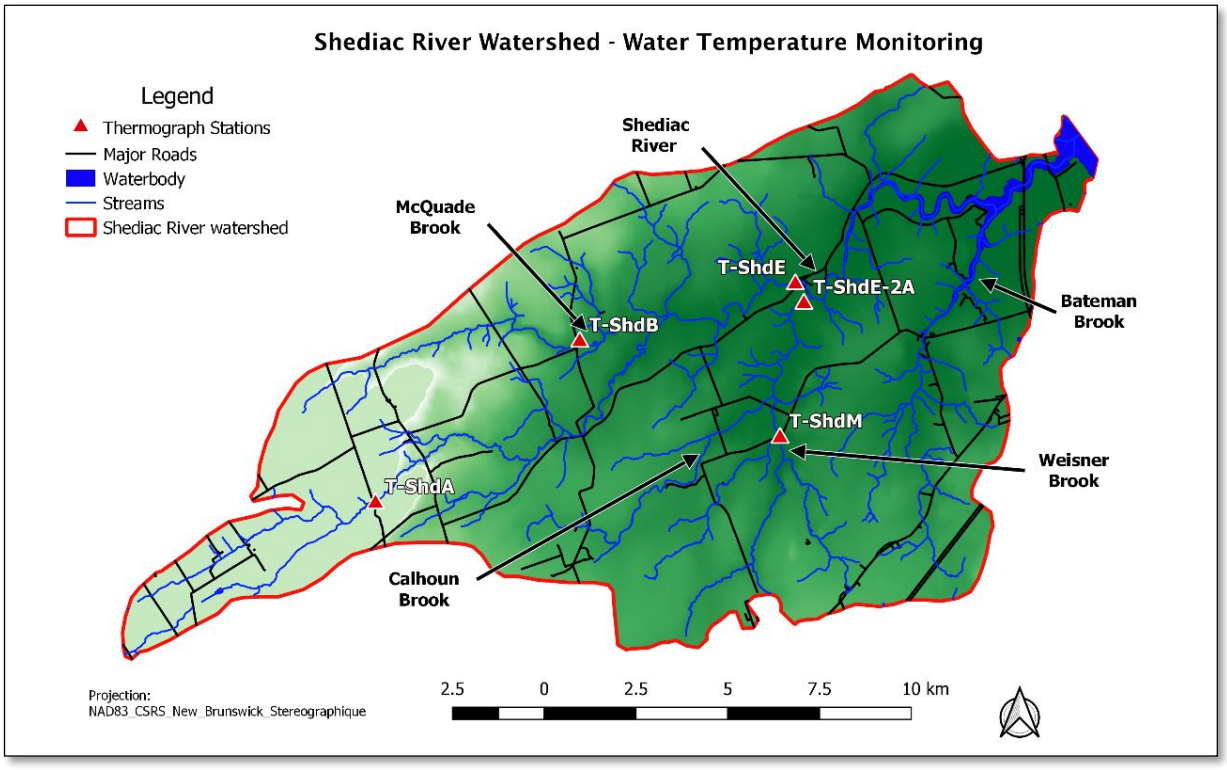


Figure 27: Map of temperature logger placement in the Shediac River

4.1.1 Water Temperature Monitoring Site - T-ShdA

This temperature logger is located in the main branch of the Shediac River, in the upper-reaches near Irishtown. 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.

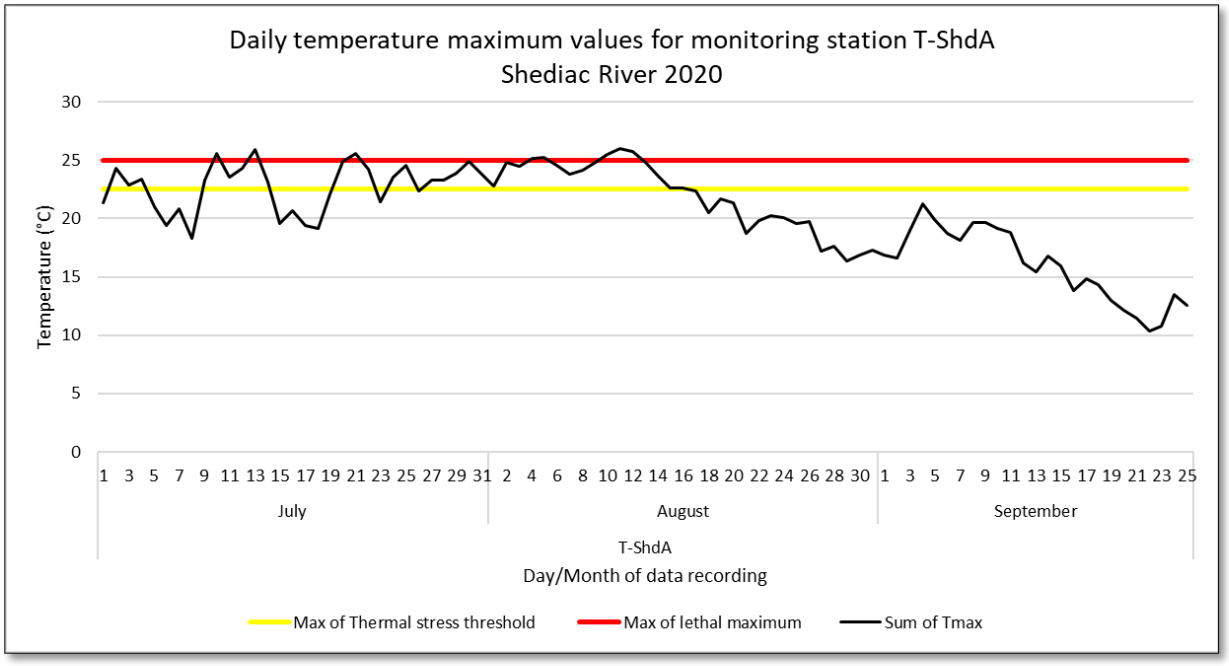


Figure 28: Thermograph data chart for monitoring station ID T-ShdA, Shediac River 2020

The thermograph shows the maximum daily temperature between July 1st and September 25th. The maximum temperatures exceeded the thermal stress threshold (22.5°C) on 35 occasions during the peak of the summer months. During theses 35 days, the maximum temperatures exceeded the lethal limit (25°C) on 8 occasions. Temperatures reached the thermal stress levels for 21 consecutive days, from July 27 to August 16.

The highest maximum temperature recorded at this station was 26.00°C, on August 11. The highest average daily temperature was 23.78°C.

4.1.2 Water Temperature Monitoring Site - T-ShdB

This temperature logger was installed in the McQuade Brook, approximately 35 metres downstream of the Scotch Settlement Road. The logger is downstream of the fish ladder.

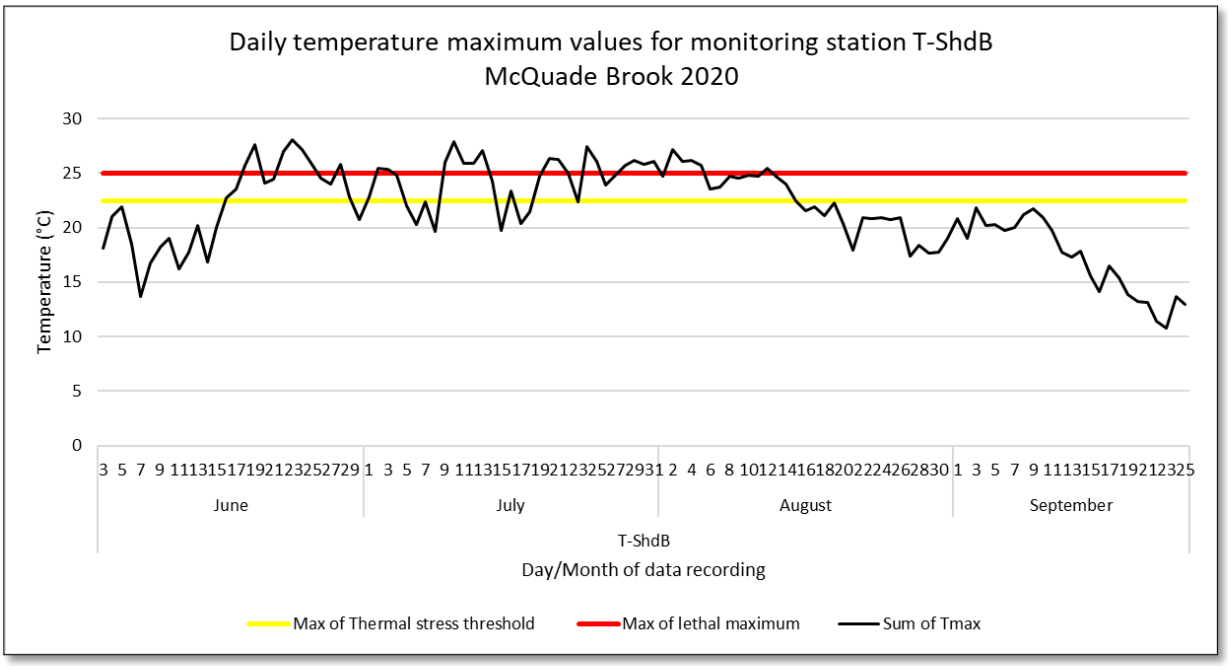


Figure 29: Thermograph data chart for monitoring station ID T-ShdB, McQuade Brook 2020

The thermograph shows the maximum daily temperature between June 3rd and September 25th. The maximum temperatures exceeded the thermal stress threshold (22.5°C) on 51 occasions during the peak of the summer months. During theses 51 days, the maximum temperatures exceeded the lethal limit (25°C) on 28 occasions. On 5 occasions, the lethal maximum temperature was exceeded for 3-5 consecutive days.

The highest maximum temperature recorded at this station was 28.06°C, on June 23rd. This highest temperature occurred in a four-day heat wave from June 22-25. The highest average daily temperature was 23.67°C.

4.1.3 Water Temperature Monitoring Site - T-ShdM

This temperature logger was installed in the Weisner Brook, a tributary of the Shediac River. This logger was predicted to show cooler temperatures, as the brook is recognized as a summer resting area for mature brook trout by the *Department of Natural Resources and Energy Development*, due to its colder characteristics. This stream has an excellent tree coverage; undeveloped forested lands along the majority of the brook. It also has a lot of input of cold water from natural underground springs. These conditions of shade from the forest and cold-water springs are great to keep the water temperatures cool.

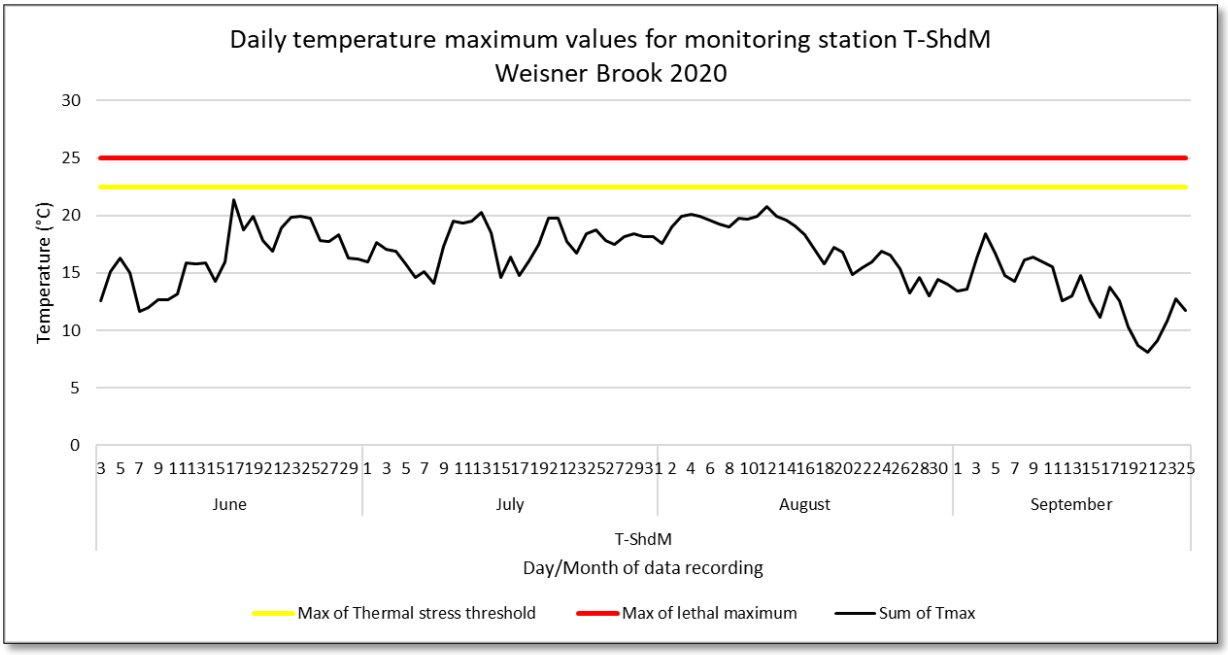


Figure 30: Thermograph data chart for monitoring station ID T-ShdM, Weisner Brook 2020

The thermograph shows the maximum daily temperatures between June 3rd and September 25th. The maximum temperatures did not exceed the thermal stress threshold (22.5°C) or the lethal limit (25°C). The highest temperature recorded was 21.378°C on June 17. The highest daily average temperature for this site was 19.41 °C.

4.1.4 Water Temperature Monitoring Site - T-ShdE

This temperature logger is located in the mid to lower reaches of the main branch of the Shediac River, 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.

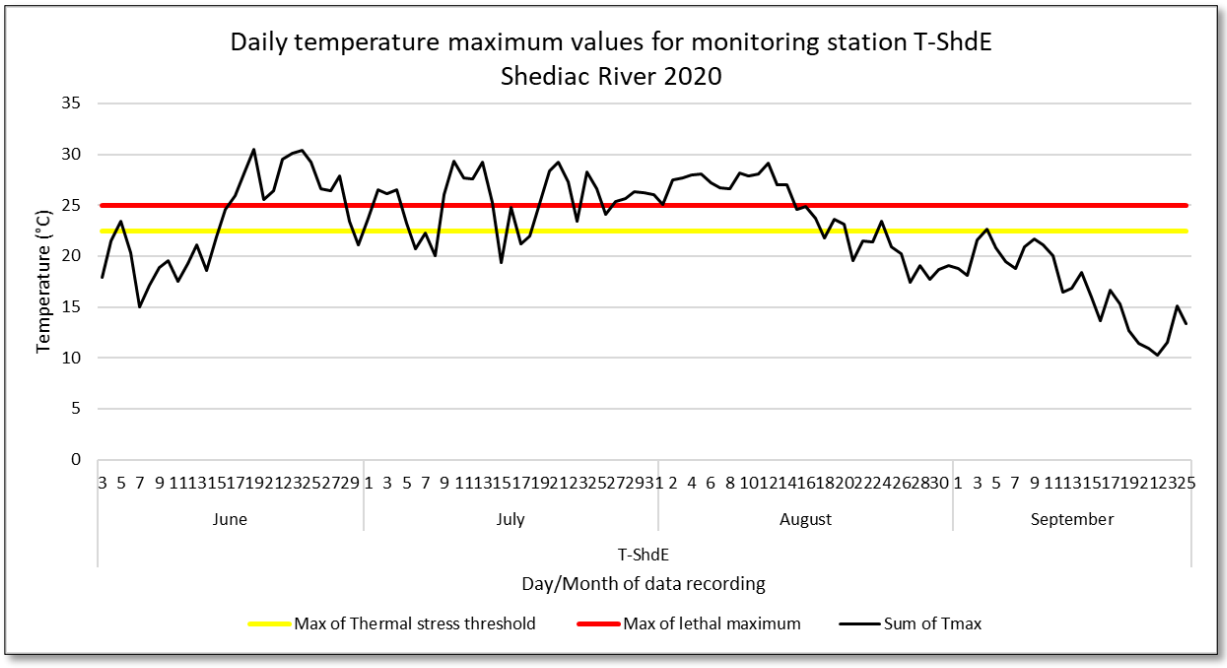


Figure 31: Thermograph data chart for monitoring station ID T-ShdE, Shediac River 2020

The thermograph shows the maximum daily temperature between June 3rd and September 25th. The maximum temperatures exceeded the thermal stress threshold (22.5°C) on 61 occasions during the peak of the summer months. Of those 61 days, the maximum temperatures exceeded the lethal limit (25°C) on 46 occasions. The lethal maximum temperature was exceeded for 12 consecutive days from June 17 to June 28, and again for 19 consecutive days from July 27 to August 14. The highest maximum temperature recorded at this station was 30.45°C on June 19, and the highest average daily temperature was 25.40°C.

In addition, the daily average temperatures exceeded the thermal stress threshold 36 times. Of those 36 days, there were 4 days during which the daily average exceeded the lethal limit. This demonstrates that temperatures remained elevated throughout the day and night cycle.

4.1.5 Water Temperature Monitoring Site - T-ShdE 2A

This temperature logger was installed in the Weisner Brook, approximately 300 metres upstream from its convergence with the Shediac River. This site is used to compare with the station of the covered bridge (T-ShdE), as it is the closest source of cold water for migrating fish looking for thermal refuge during high temperatures. This site is located approximately 5 km downstream from the second logger in the Weisner Brook; T-ShdM. Just like the other site in this brook (T-ShdM), the surrounding canopy coverage of the forested land and the input of cold water from natural springs contributes to the overall colder water temperatures.

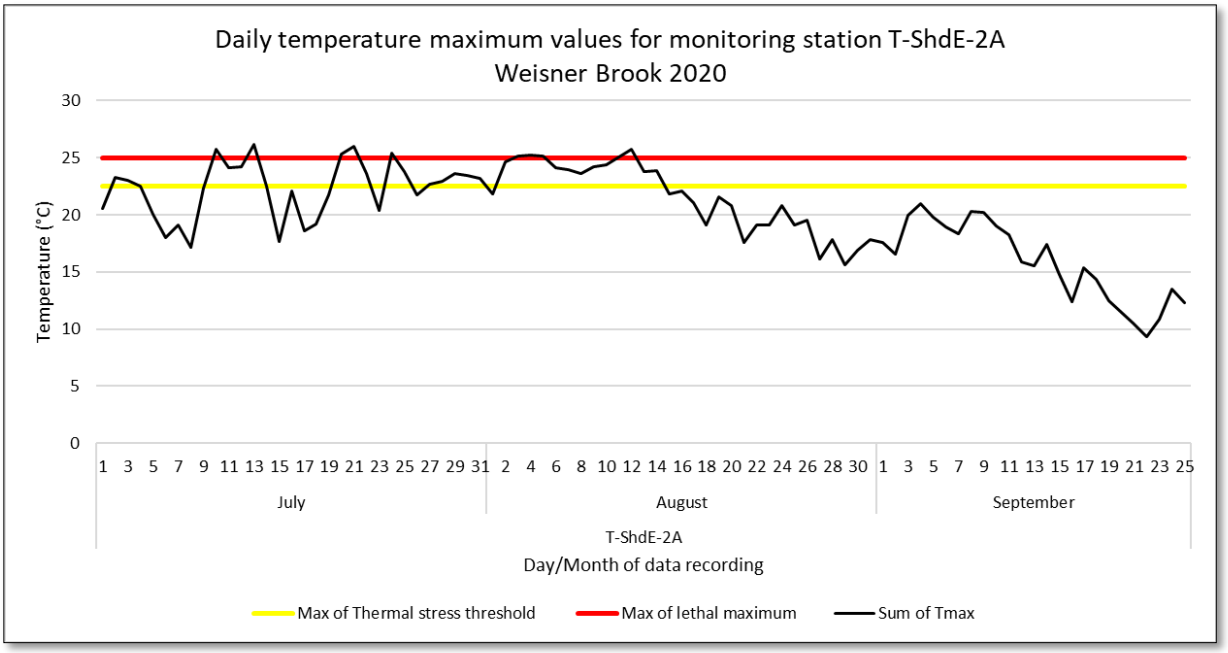


Figure 32: Thermograph data chart for monitoring station ID T-ShdE-2A, Weisner Brook 2020

The thermograph shows the maximum daily temperatures between June 1st and September 25th. The maximum temperatures exceeded the thermal stress threshold (22.5°C) on 31 occasions during the peak of the summer months. Of those 31 days, the maximum temperatures exceeded the lethal limit (25°C) on 13 occasions. There was a 13-day stretch during which the maximum daily temperatures surpassed the thermal stress level, from August 2 to August 14. During that period, the maximum daily temperature surpassed the lethal levels on 5 occasions.

The highest maximum temperature recorded at this station was 26.19°C on July 13, and the highest average daily temperature was 22.94°C.

4.2 Temperature monitoring Scoudouc River

Two sites are monitored for water temperature in the Scoudouc River. The temperature logger "T-ScdD" was lost this year (no data).

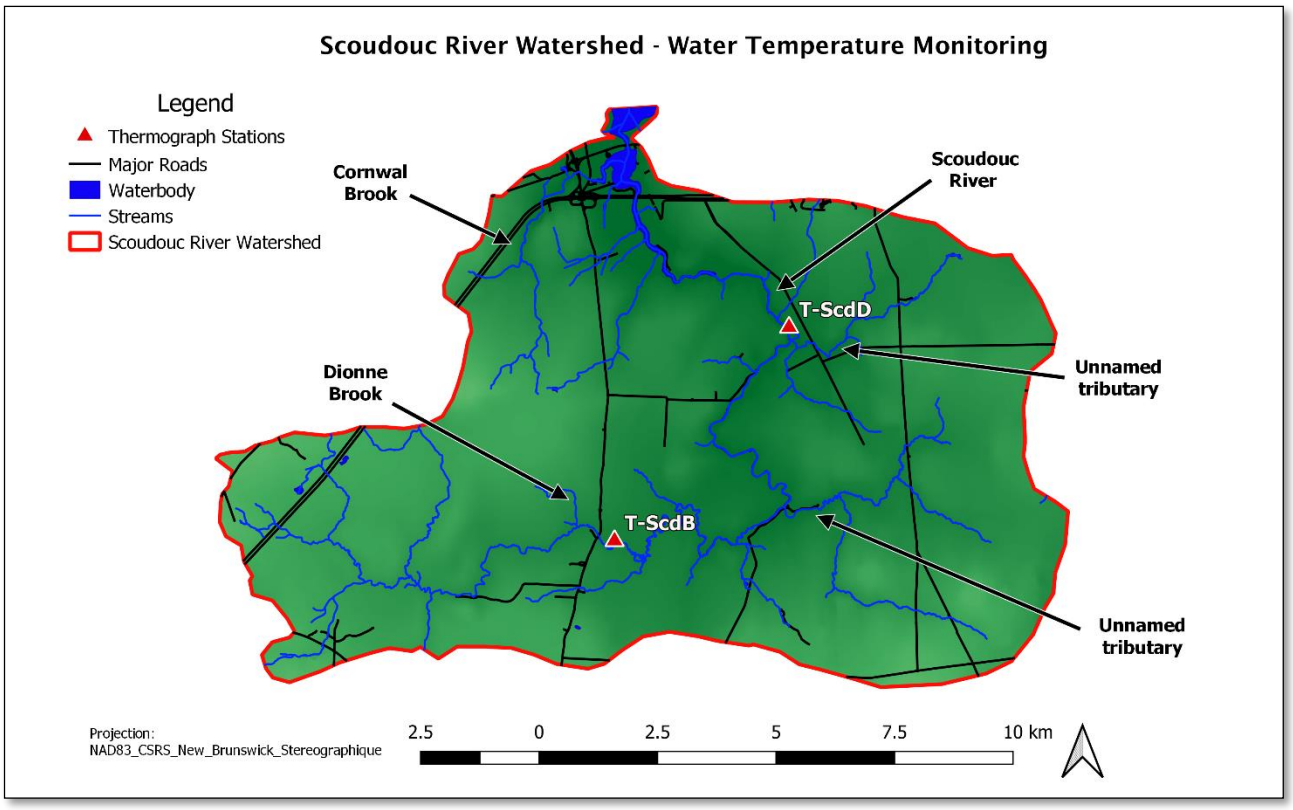


Figure 33: Map of temperature logger placement in the Scoudouc River

4.2.1 Water Temperature Monitoring Site - T-ScdB

This temperature logger was installed in the main branch of the Scoudouc River, next to the *Greater Shediac Sewage Commission's* treatment lagoons in Scoudouc. The logger is installed upstream of the effluent discharge pipe and upstream of the canoe access point.

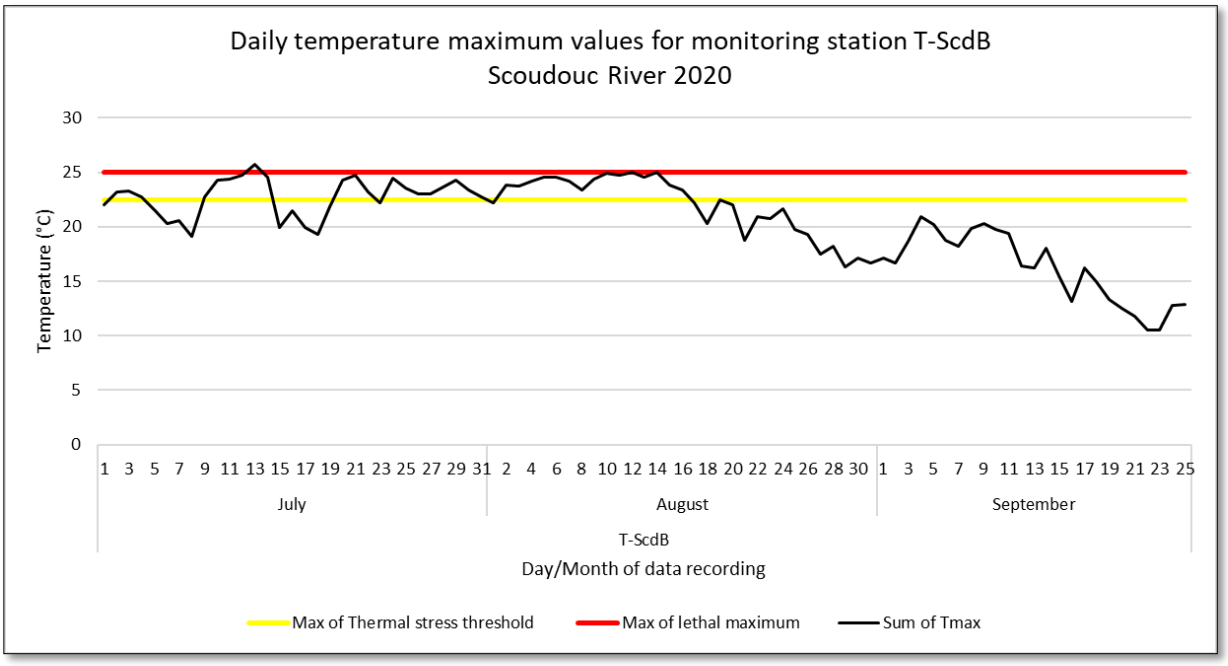


Figure 34: Thermograph data chart for monitoring station ID T-ScdB, Scoudouc River 2020

The thermograph shows the maximum daily temperatures between July 1st and September 25th. The maximum temperatures exceeded the thermal stress threshold (22.5°C) on 35 occasions during the peak of the summer months. Of those 35 days, the maximum temperatures exceeded the lethal limit (25°C) on 3 occasions. There was a 15-day stretch during which the maximum daily temperatures surpassed the thermal stress level, from August 3 to August 16. During that period, the maximum daily temperature surpassed the lethal levels on 2 occasions.

The highest temperature recorded during this time period was 25.70°C on July 13. The highest average daily temperature for this site was 23.56°C.

5. 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 bacterial analysis of these 10 water quality monitoring sites in 2020 has demonstrated high levels of diffused sources of bacterial contamination in certain areas. The results for the Shediac River this year are outside of the norm when compared to past years of data. Weather patterns this year were also considered abnormal, with long periods of warm weather and a lack of rainfall. Long periods of drought can lead to an accumulation of bacteria on the land surfaces, where a discharge event following a heavy rainfall can mobilize and transport a high flux of contaminants leading to a rapid change in water quality. The program will continue to monitor water quality in the freshwater sites of the Shediac Bay watershed.

All pH levels were found to be within the guidelines; between 6.5 and 9. However, dissolved oxygen fell below the recommended 6.5 mg/L for the protection of aquatic life, for early life stages of cold-water species, at these sites: ShdB (1 sample), ScdB (3 samples), ScdE-2 (3 samples), ScdF (1 sample), and ScdH (1 sample).

Looking at the averages of total phosphorous levels (TP-L), most sites in the Shediac River fall within the mesotrophic (0.010 – 0.020 mg/L) to meso-eutrophic range (0.020 – 0.035 mg/L). For the Scoudouc River and its tributaries, most sites fall within the meso-eutrophic range (0.020 – 0.035 mg/L) to eutrophic range (0.035 – 0.100 mg/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.

There are 2 levels of temperature that are evaluated for the protection of cold-water fish species: thermal stress (22.5°C) and lethal limits (25°C). When water temperatures attain these levels, fish such as salmonids, can be forced to migrate in search of colder water sources, such as deep-shaded pools and natural cold springs. The longer these temperatures remain, the higher the risk of fish mortality. Water temperature monitoring using pendant loggers is a widely used tool to monitor temperature fluctuations in watersheds. The goal is to identify hot spots and cold zones suitable

for thermal refuge in periods of thermal stress among fish. The data is used to measure changes over time, due to the impacts of human activities and development, as well as climate change.

This year, the covered bridge area of the Shediac River had the highest recorded temperature; 30.45°C. The logger recorded thermal stress levels on 61 occasions and lethal limits on 46 occasions, of which there was 19 consecutive days with temperatures exceeding 25°C.

The McQuade Brook was the second-warmest site in 2020; the highest temperature reading was 28.06°C, and thermal stress levels were reached 51 times. The lethal limits were exceeded 28 times, with 5 of them being consecutive days.

There are two loggers monitoring the Weisner Brook, the coldest tributary of the Shediac Bay watershed due to its long stretches of forested riparian habitats and cold springs input into its tributaries. As described in the section 3.5, the Weisner Brook is recognized by the Department of Natural Resources as a "summer resting refuge for mature trout", due to the cooler temperatures. The logger site T-ShdM recorded temperatures below 22.5°C during the 2020 season; the highest recorded temperature was 21.38°C. However, further downstream before the convergence of the Weisner Brook with the Shediac River, the second logger T-ShdE-2A recorded temperatures exceeding the thermal stress threshold on 31 occasions, and the lethal limits on 10 occasions. The highest recorded temperature was 26.19°C.

In the Scoudouc River, the logger at the site T-ScdB recorded temperatures exceeding the thermal stress threshold on 35 occasions, and exceeded the lethal limits on 3 occasions.

Our summers our becoming increasingly hot and dry. Longer periods without rainfall combined with extreme heats can cause water levels to drop and become warmer than is safe for cold-water loving species. Water temperatures will continue to be monitored to measure the impacts of our ever-changing climate.

6. ENVIRONMENTAL RESTORATION OF RIVERS AND STREAMS

6.1 Buffer zone reforestation

The reforestation of buffer zones around streams and wetlands is a priority for the SBWA. The riparian buffer zone is a natural, permanent strip of vegetation bordering a watercourse. Composed of a mixture of wildflowers, grasses, shrubs and trees native to the area, it is a transition zone between aquatic and terrestrial environments. Healthy riparian buffer zones filter pollutants before they can enter watercourses. Improving riparian zones also benefits the fish and insects that live in them.

Another area of focus for reforestation is where bank erosion occurs. This causes an excess of sediment in the watercourse. Sedimentation can cause various issues for aquatic ecosystems; it can suffocate fish and fish eggs, bury aquatic insects, can carry harmful pollutants such as heavy metals and excessive nutrients that can further worsen conditions of the ecosystem, etc. The SBWA mostly uses vegetation and bioengineering techniques to stabilize banks.

In 2020, two sites were selected for buffer zone enhancements. Work continued at the existing restoration site along the Scoudouc River known as Edna's Pond. The second restoration site was at a stream with an inadequate buffer zone within the municipality of Shediac.

Figure 35 : Native tree planting for riparian restoration is a technique used by the SBWA

6.1.1 SBWA Restoration Nursery

To help the Association save cost and provide a variety of tree and shrub species community native tree nurseries were implemented in 2017. In 2020, significant work was undertaken to improve the nursery. In the spring, trees were relocated from three existing tree nurseries located at the MFB School, the Grande-Digue School and at the Shediac community garden to a newly built tree nursery in the Shediac Cape community garden. Having all the trees in one location will be easier to maintain.

A total of 8 raised beds (4 m x 1.5 m x 0.5 m) were made using rough hemlock lumber. The boxes were filled halfway with different sizes of logs and branches mixed with leaves and other organic materials. The remainder was filled with compost. This technique is known as ``hugelkultur`` and it creates a natural decomposition process that can keep fertilizing the raised beds for years to come.

By maintaining a tree nursery for the association, a steady supply of native trees is now available for various tree planting projects. The association can grow species of native trees that are sometimes not available at local commercial nurseries. Also, CO2 emissions are diminished by reducing travelling to various tree nurseries. Finally, perhaps as important as habitat restoration is the education possibilities that the tree nurseries provide for the community. Presentations and voluntary work are often taking place at the nursery, involving school students and the overall community.

This project is also self-sufficient by taking cuttings and starting trees by seeds to keep replacing the trees that get planted for restoration projects. In late summer 2020, 134 willow cuttings were taken from the farm "*Vert l'Avenir*" woodlot and were planted in one of the raised beds. A few weeks later most of the cuttings were growing leaves and already sprouted roots. These will be planted for SBWA restoration projects in 2021.

In the fall of 2020, 100 acorns were also planted at the tree nursery which will hopefully sprout in the spring of 2021. These are only a few examples of how SBWA will continue to make their tree nursery efficient. Hundreds of seeds from several native tree species will be in the process of cold stratification in the winter of 2020-2021 and to be planted in small trays in the spring of 2021. The species of trees for the seeds are: White ash, American mountain ash, staghorn sumac, White birch, Yellow birch, tamarack, Eastern hemlock, White spruce, Red spruce, Red pine, White pine and Jack pine.

Figure 36 :Map of the SBWA tree nursery:

Table 41: Total trees at the tree nursery

Total Trees at the tree nursery		
Tree spp.	**Common name**	**Qty**
Picea glauca	White Spruce - Epinette blanches	**7**
Picea mariana	Black Spruce - Epinette noir	**0**
Abies balsamea	Balsam fir - Sapin Baumier	**6**
Tsuga canadensis	Eastern Hemlock - Pruche du Canada	**0**
Pinus strobus	White Pine - Pin blanc	**73**
Pinus resinosa	Red Pine - Pin rouge	**10**
Thuja occidentalis	White Cedar - Cèdre blanc	**0**
Larix laricina	Tamarack - Mélèze	**2**
Quercus rubra	Red Oak - chêne rouge	**60**
Quercus rubra	Red Oak *acorns* - chêne rouge *glands*	**100**
Quercus macrocarpa	Bur Oak - Chêne à gros fruit	**0**
Sorbus aucuparia	Mountain Ash - Sorbier	**12**
Fraxinus americana	White Ash - Frêne blanc	**0**
Rhus typhina	Staghorn Sumac - Sumac vinaigrier	**0**
Acer rubrum	Red Maple - Erable rouge	**9**
Acer saccharum	Sugar Maple - Erable à sucre	**8**
Betula populifolia	Grey Birch - Bouleau gris	**0**
B+A12:J19etula alleghaniensis	Yellow Birch - Bouleau jaune	**0**
Salix spp.	Willow *cuttings* - Saule *boutures*	**134**
Populus tremuloides	Trembling aspen - Peuplier faux-tremble	**0**
Rosa spp.	Rose bush - Rosier	**0**
Spiraea latifolia	Broadleaf meadowsweet - Reine des prés	**0**
	Total	**421**

Figure 37: Photos of the construction of the raised beds at the SBWA tree nursery

Figure 38: Photos of the Willow cuttings in the raised bed and seed saving from the cone of a White pine

6.2 Edna's Pond Restoration Site

Every year, SBWA continues to plant native trees at the major habitat restoration site at Edna`s pond in the Scoudouc River. This site is an important Atlantic salmon habitat for the Shediac Bay watershed. Assuring that enough trees will take at this location is crucial for the stabilization of the banks and runoff control to minimize sedimentation in the salmon pool.

The five sediment deflectors in the area require constant maintenance every year. They capture sediments from runoff which causes a sediment buildup on the logs. In the summer of 2020, small trenches were dug with a shovel to eliminate the sediment build up on the stabilizers and also to help direct the runoff towards the forested areas.

Actions have continued this year to block river crossing access trails. In the fall SBWA staff blocked access to the river using a log dug into the bank to prevent passage.

Figure 39: Blocking ATV trail access to river

Tree planting also continued at the site. A total of 45 native trees were planted on October 22nd. These include 23 Red oaks, 6 Red maples, 5 Sugar maples, 3 Eastern hemlocks, 1 White pine, 1 Balsam fir, 2 Staghorn sumacs and 4 Yellow birches. Approximately 50 Red oak acorns were also planted along the river bank. All of the trees were provided by the SBWA tree nursery.

Figure 40: Map of the tree planting area of Edna`s pond in the Scoudouc River

Figure 41 : Photos of the tree planting at Edna`s pond

A video was produced to educate on the project. The video was posted on November 9th and was viewed more than 387 times. The video is available on our YouTube page Sedimentation Control at Ednas Pond / Contrôle de la sédimentation - YouTube .

Figure 42 : Screen shot of Facebook post on sediment control

6.3 Cornwall Brook Restoration site

During the major road construction of a traffic circle and modification of the highway in 2018, a section of the Cornwall Brook was modified and left with no buffer zone. Downstream from the newly installed road containing a concrete double culvert is the location of this site`s habitat restoration by buffer zone implementation. A line of native trees was planted on both sides of the stream in 2020. This will help protect the bare banks from eroding from rain runoff on both sides and also increase biodiversity.

A total of 60 native trees were planted along the section of Cornwall Brook that was modified due to road construction. The habitat restoration took place on November 10th and the following trees were planted: 12 American mountain ash, 14 White spruce, 17 Balsam fir and 17 Red Oak. Large

wooden stakes and a SBWA habitat restoration sign was installed on site to signal and protect the newly planted trees.

This habitat restoration project will continue in the spring of 2021 by planting hundreds of willows in the rocks below the stream banks.

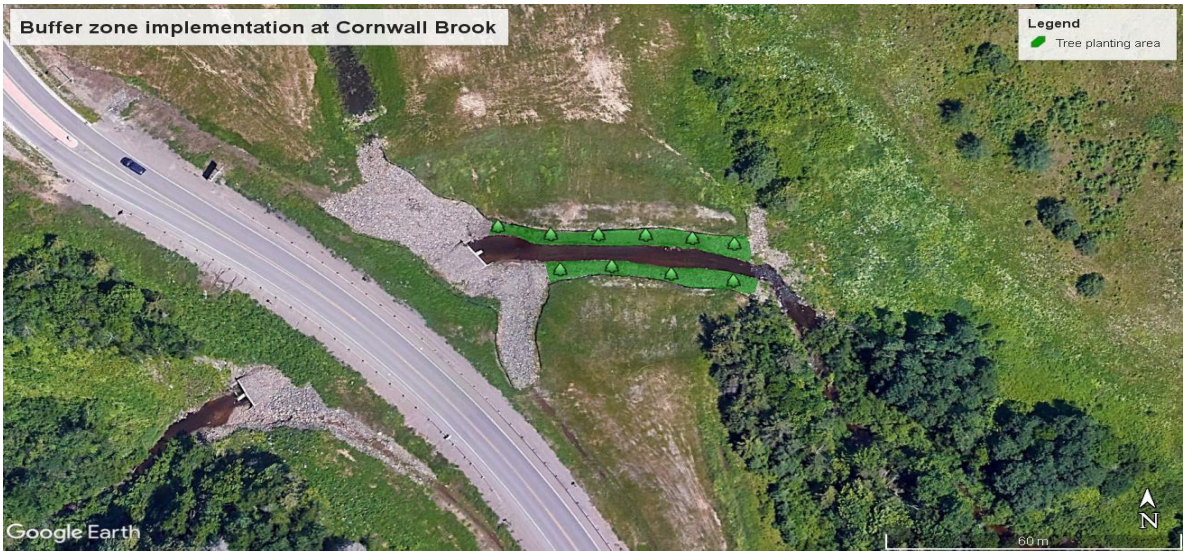


Figure 43: Map of the tree planting location at Cornwall Brook

An educational video was produced on this restoration project and posted on social media on November 19th. The video had more than 1500 views. The video can be found on the SBWA YouTube page [Buffer Zone Restoration - Restauration des bandes riveraines - YouTube .]

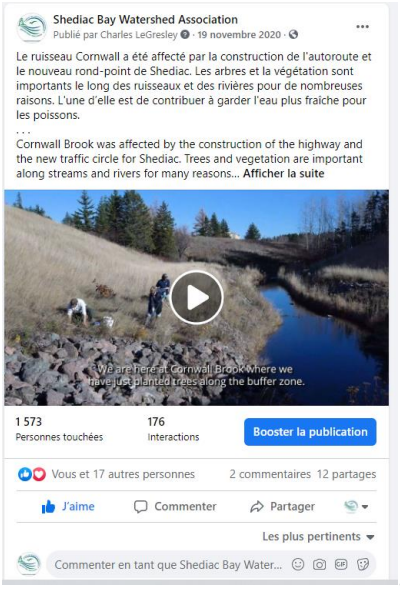


Figure 44 : Screen shot of Cornwall Brook video

6.4 Garbage Removal from Streams in the Watershed

Thanks to a partnership with the New Brunswick Wildlife Federation's *Adopt-a-Stream* program, the Shediac Bay Watershed Association's planned a cleanup of litter along the Scoudouc River in October.

This program would normally include volunteers during the cleanup. Unfortunately, the set date of the event was cancelled due to a change to the orange phase of the COVID-19 recovery protocol by the NB Department of Health. The cleanup was instead undertaken by SBWA staff only.

A total of 420 kg of trash and 2 bags of refundable beverage containers were collected between October 22nd and October 30th.

Details can be found in the project report in annex 2.

Figure 45: SBWA staff with garbage collected along the Scoudouc River

6.5 Farm Restoration

A restoration site was identified in 2019 on the Scoudouc River. A stream was to be reforested in a section of field with fencing placed to block cattle from trampling the trees. Unfortunately, in the spring the landowner changed their mind and didn't give permission to work on their property.

The NB agricultural Alliance and the NB agriculture department were contacted to find another project site. None were identified in time to organize permission and coordinate the work. The SBWA will continue to work with these agencies to find farmers that would like to participate in our program.

6.6 Tree Planting – CWF's WILD Outside Program

In 2019, The SBWA and TD trust fund held an annual TD Tree Days event in Shediac by a newly constructed traffic circle off of Chesley Street and along Shediac`s walking trail by the highway 15. The trees that were planted along the walking trail were mistakenly mowed in the spring of 2020.

SBWA decided to replant native trees along this trail in on October 3rd along with Canadian Wildlife Federation volunteers. About 10 enthusiastic teenagers planted a total of 60 native trees. The trees included: 16 White pine, 21 White spruce, 20 Balsam fir, 2 Red Oak and 1 Yellow birch. Large wooden stakes have been installed along the trees to ensure visibility and protect against another mowing.

Figure 46: Map of the tree planting at the Shediac walking trail

7. WATERSHED MANAGEMENT COMMITTEE

A committee was formed by the government of New Brunswick in order to develop a watershed management plan for the Shediac Bay.

The executive manager participated in this advisory committee and the plan was drafted by the department of Environment. The committee is composed of several stakeholders and government departments.

Two public consultations were held in 2020 to gather comments from the public.

The watershed management plan for the Shediac Bay Watershed will be finalized in the spring of 2021.

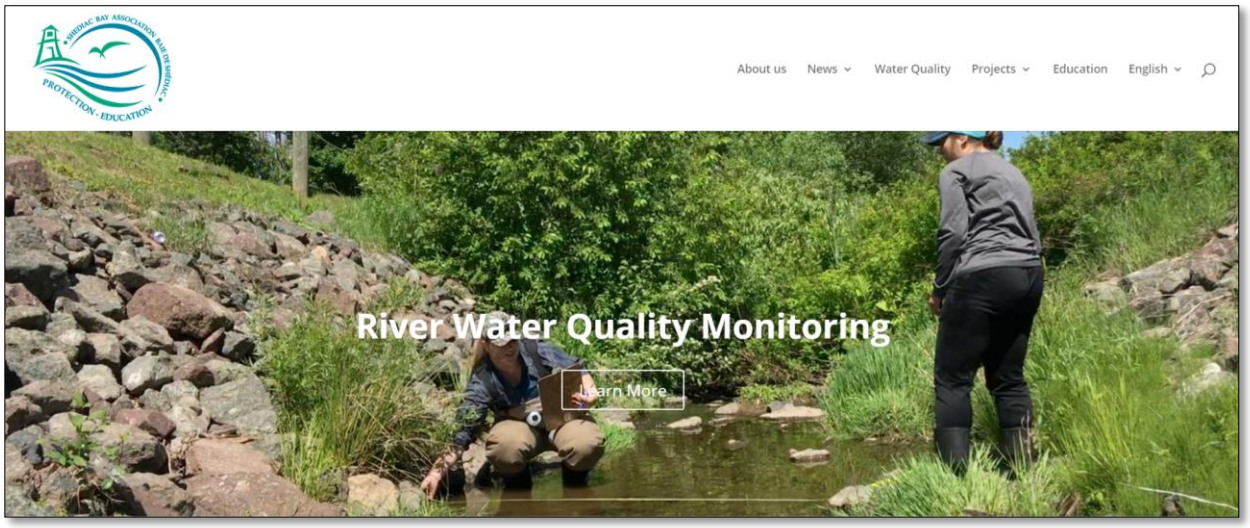
8. MEDIA OUTREACH

8.1 Newsletter

During the 2020-2021 fiscal year, 3 bilingual newsletters were produced. The newsletters display information and photos on the various projects that the SBWA has been doing in the year. The newsletter is now distributed electronically by email list and is available on our website and Facebook page.

8.2 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 now has a dedicated employee who focuses on outreach and communications, and the design and production of educational materials.



www.shediacbayassociation.org

www.facebook.com/#!/shediacbaywatershedassociation

https://www.instagram.com/bvshediacwatershed/?hl=en

https://www.youtube.com/channel/UCT1bsN08OyOeIzqqwn9ZhlQ

9. CLOSING COMMENTS

The Shediac Bay Watershed Association had a successful year in 2020-2021, thanks to the support of the NB Environmental Trust Fund. Although some activities were affected by the COVID-19 pandemic, the majority of activities could be accomplished while following the guidelines of the department of health.

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 the watershed management plan for the Shediac Bay watershed. The watershed management plan will serve as an action plan to address contamination sources. Recommendations from this report will help guide future activities of the Association.

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 next step for the Association is to start working more with the agricultural sector.

The Shediac Bay Watershed Association will continue to monitor water quality in the Shediac and Scoudouc rivers and implement environmental improvement initiatives in the years to come thanks to the support or the NB Environmental Trust Fund.

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APPENDIX A - WATER CHEMISTRY METHODOLOGY

Table 42: 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 43: 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