Environmental Evaluation and Stewardship of the Shediac Bay

Final Report

The Shediac Bay Watershed Association Inc.

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1 INTRODUCTION

The Shediac Bay Watershed Association (SBWA) was founded in 1999 as a result of growing concerns from local community residents over the ecological health of Shediac Bay. In order to establish a long-term water quality-monitoring program, a community-based association was formed. To address growing concerns on water quality in the Shediac Bay, the program "Evaluating the Health of the Shediac Bay" was initiated in 2016. The program aims to assess water contamination sources in small urbanized and agricultural streams, assess the quality of coastal habitats, evaluate eelgrass habitats, launch restoration initiatives and education campaigns.

The Association has been monitoring freshwater quality in the Shediac River and Scoudouc River watersheds since 1999. In 2015, funding became available to collect water quality data in the saltwater ecosystems of the Shediac Bay. It began with 7 saltwater sampling sites along the coastline, and expanded to 10 sites in 2016. These sites were sampled for *E. coli*, once per month from May to August.

In the fall of 2016, a study was done using Environmental DNA (e-DNA) testing to assess the *source* of the *E. coli* bacteria at 5 of the 10-saltwater sampling sites. Since *E. coli* is present in the lower intestines of humans and warm-blooded animals, the source of fecal contamination can be traced back to the species of which it came from by analyzing the DNA of the bacteria. The results are available online in the archives of the SBWA. This information was used to help prioritize sites for restoration and actions to help reduce bacterial contamination.

In 2017, 11 monitoring stations were added to evaluate small urban and agricultural streams that flow into the Shediac Bay. These sites are sampled for *E. coli*, nutrients and inorganic parameters, once per month between June and October (funding dependent). These tributaries are further evaluated by characterizing the surrounding land uses, collecting habitat observations and assessing the health of the riparian zones.

A partnership was formed with the *Southern Gulf of Saint Lawrence Coalition on Sustainability* in 2016, to begin the assessment of the eelgrass habitats in the Shediac Bay. The study has established 4 eelgrass monitoring transects from 2016-2019; in the Scoudouc River Estuary (2016), the Shediac River Estuary (2017), the South Cove Estuary near Pointe-du-Chêne (2018), and near the Grande-Digue dunes (2019). These transect are monitored once per year using the *SeagrassNet* protocol, to measure changes in density of the eelgrass beds due to the threat of the invasive green crab. .

Public education and outreach activities are an integral part of all SBWA projects. A partnership with the Shediac Bay Yacht club has produced a boater awareness campaign, aiming to promote best environmental practices for boaters and the promotion of pumping station locations in Southeast NB. The Shediac Bay Yacht Club and Parlee Beach Provincial Park both received a Blue Flag certification in 2019. As a partner in this program, the SBWA helps deliver educational materials and resources.

In 2020 a new program was initiated to restore coastal land using techniques such as the living shoreline. A workshop was organised by the SBWA and partner organisations in Pointe-du-Chêne to demonstrate a variety of techniques.

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 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 small tributaries covering watersheds of 201.8 Km2 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 water arm of the Shediac River is the continuation of the Batemans Brook.

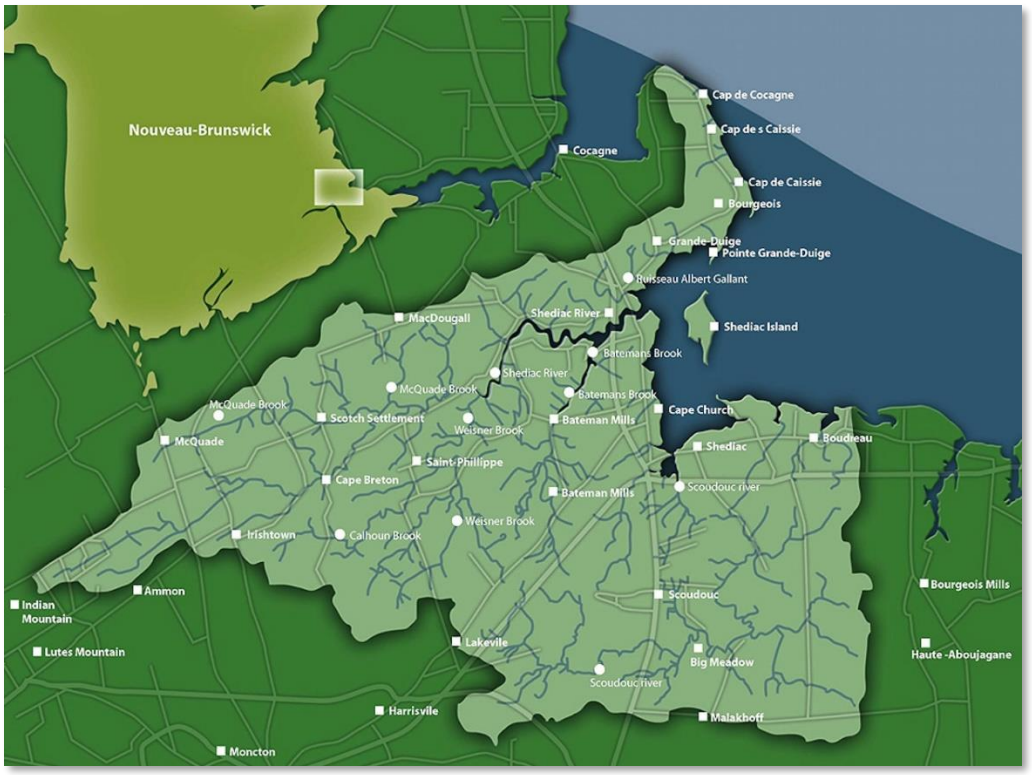


Figure 1: Map of Shediac Bay watershed boundaries

2 METHODOLOGY

2.1 Water Quality Sampling Protocol

Water quality monitoring was conducted once a month from June to October 2020, at 11 sampling stations in small streams and tributaries of the Shediac Bay. 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.

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 sample after a rain event was taken in September.

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 vest 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 - Small Tributaries of the Shediac Bay

The following describes the sample site information for the 11 small stream water quality monitoring stations.

Table 1: Water Quality Monitoring – Small Streams Site Information

Site ID	Latitude	Longitude	Elevation (m) Google Earth	Brook Name	Location Description
WQ-1	N46°13'24.19"	W64°28'30.36"	10	Unnamed Brook	907 route NB-133, Boudreau-Ouest, Dirt Road after this address, going through the field (sample upstream of the culvert)
WQ-2	N46°13'35.25"	W64°29'48.39"	9	Unnamed Brook	725 route NB-133, Boudreau-Ouest (sample upstream from culvert)
WQ-3	N46°13'18.25"	W64°31'30.94"	13	Unnamed Brook	482 Main St., Shediac, In front of Shediac Bakery (sample upstream of culvert)
WQ-4	N46°13'11.25"	W64°32'56.17"	3	Unnamed Brook	Shediac Town Hall, 290 Main st, sample downstream culvert
WQ-5	N46°13'22.17"	W64°33'58.17"	8	Unnamed Brook	Park at Atkinson Court, walk on Route 133 (sample upstream from culvert)
WQ-6	N46°14'23.90"	W64°34'2.29"	8	Unnamed Brook	Park at Old Mill Rd (Sample upstream from culvert)
WQ-7	N46°14'43.38"	W64°34'7.29"	3	Unnamed Brook	Brook flows between Bay Vista Lodge at 3521 Route 134, Shediac Cape, (sample upstream from culvert)
WQ-8	N46°15'11.99"	W64°34'14.01"	1	Unnamed Brook	In front of Dr. Chiropractor, 3694 Route NB-134, Shediac Cape, (sample upstream of culvert)
WQ-9	N46°16'41.70"	W64°35'13.77"	1	Albert-Gallant Brook	2487 Shediac Rd., (sample downstream from culvert due to beaver flooding)
WQ-10	N46°17'8.24"	W64°34'29.13"	3	Unnamed Brook	Brook is after Antoine Rd, Grande-Digue, (sample from upstream of culvert)
WQ-11	N46°17'52.15"	W64°33'18.27"	1	Unnamed Brook	Brook crossing Route 530 in Grande-Digue, near Chemin des Sœurs. Sample upstream of double culvert, in pool
WQ-11B	N 46°17'52.37"	W 64°33'18.73"	1	Unnamed Brook	Sample is collected approximately 15 metres upstream of the pool WQ-11, brook flowing from the northern field

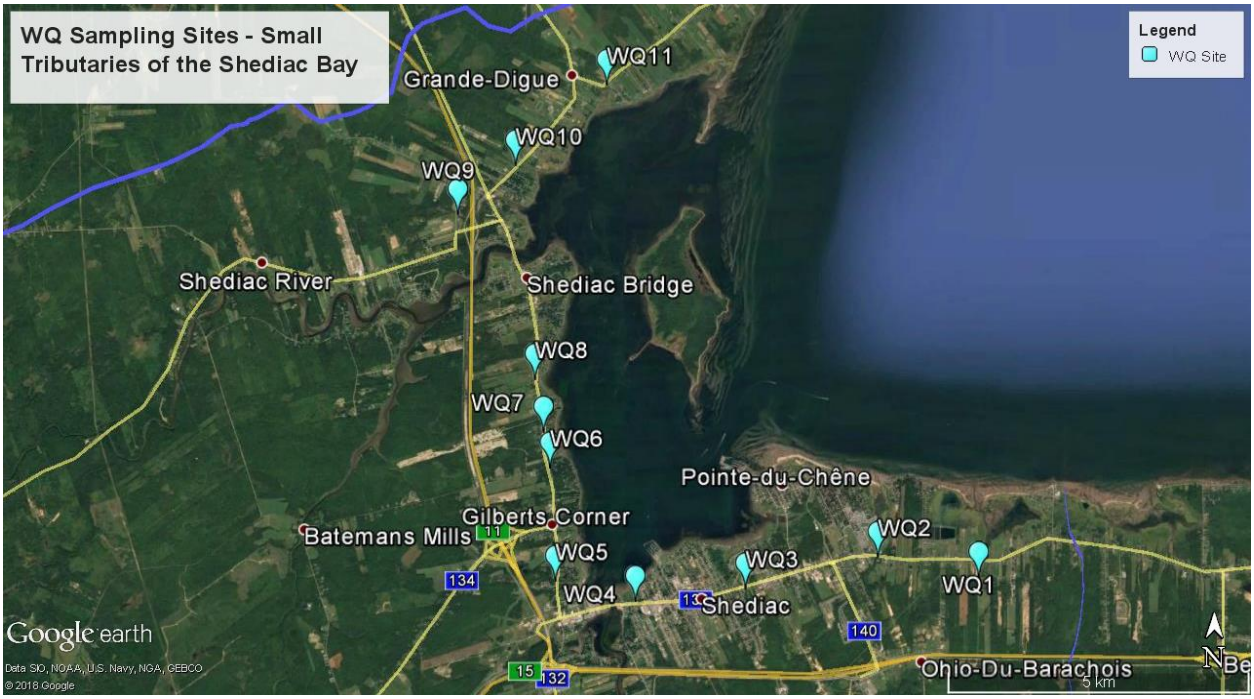


Figure 2: Water Quality Sampling Sites - Small Streams

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 systems 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 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: 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
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.				—	† 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.
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**	—	‡ 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.
Se	—	—	Upper	**0.001**	—	
Tl	—	—	Upper	**0.008**	—	
U	Short-Term	**0.033**	Long-Term	**0.015**	—	
Zn	—	—	Upper	**0.03**	—	

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	—	

2.5.1 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_3T	µg/L	Total ammonia measured in micrograms per litre	—	—	—

3 Water Quality Sampling in the Shediac Bay

In 2017, the SBWA has expanded the water quality sampling program to evaluate the smaller tributaries of the Shediac Bay. These small brooks had never been assessed for water contaminants or evaluated for surrounding land uses and buffer zones. All samples are analysed by RPC Laboratory and results are sent to the *Department of Environment and Local Government*.

The purpose of the samples taken by the SBWA is to determine priority areas where restoration programs can be implemented to improve water quality, such as planting trees to restore the buffer along riparian zones. The data is not used to determine the safety of the recreational uses of the bay, such as swimming advisories.

There are many different guideline criteria for determining water quality. For example, Health Canada recommended microbiological guideline values for recreational water quality. The values are based on the presence of fecal indicator bacteria, namely *Enterococci* for marine water and *Escherichia coli* for freshwater.

In marine water, the guideline value is set at a geometric mean of 35 enterococci/100 mL when a minimum of 5 samples are collected (average bacterial concentrations of the 5 bottles must be below 35 MPN/100 mL), and the value of a single sample must be below 70 enterococci/100 mL.

In freshwater, the guideline value is set at a geometric mean of 200 *E. coli* /100 mL when a minimum of 5 samples are collected (average bacterial concentrations of the 5 bottles must be below 200 MPN/100 mL), and the value of a single sample must be below 400 *E. coli* /100 mL.

For this project, all samples collected are single samples and are analyzed for *E. coli*, since the small tributaries are freshwater (however, 2 sites are impacted by rising tides, but *E. coli* can still be used for brackish water). All bacterial data in this report is flagged when levels exceed 400 MPN/100 mL.

3.1 Sampling Results

The following section will describe the water quality data collected at the 11 small streams sampling sites for the 2020 field season. The surrounding land uses, as visible from aerial imagery from several years of images on *Google Earth*, are also described for each site. The information is meant to complement the data and provide information on potential causes for contamination.

3.2 WQ-1

This water quality sampling site is located in a residential area in Boudreau-West, and is accessed by a private dirt road (with landowner permission) connected to NB-Route 133. The samples are taken upstream from the culvert of the dirt road. The surrounding land uses includes agricultural fields, several gravel pits, and the Highway 15. The buffer zone dividing the stream and the farm fields (± 10 hectares, 2 hectares, 1.3 hectares) ranges between 15 and 50 metres in density. There is a good buffer zone that separates the brook and the gravel pits (> 50 m on each side) that should prevent sediment from running off into the water.

The tributary joins the Shediac Bay approximately 1 km downstream of the sampling site. The small stream ends with a small estuary surrounded by a salt marsh. Next to this salt marsh is the Greater Shediac Sewage Commission's aeration lagoons, as well as a lift station with an outfall discharge pipe at the edge of the estuary. The water quality station is located higher than the highest tidal zone.

The water sampling results for the site WQ-1, 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 October; mesotrophic range (0.010 – 0.020 mg/L) in June; in the meso-eutrophic (0.020-0.035 mg/L) in August and September; and in the eutrophic range (0.035 – 0.100 mg/L) in July.

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).

The results for each parameter of heavy metals and other elements for WQ-1, in all samples collected in 2020, did not exceed any of the recommended CCME water quality guidelines.

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

Table 9: Water chemistry data and *E. coli* results for WQ-1, 2020

SITE WQ-1: 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	
20-06-16	22	10.6	0.16	11.85	< 10	45	<5	0.244	0.344	73.4	-1.07	7.86	7.30	8.40	218.40	170	0.80
20-07-20	22	15.4	0.18	9.55	63	51	5	0.311	0.394	90.0	-0.73	7.72	7.50	8.20	247.65	192	0.90
20-08-19	18	14.4	0.19	9.72	301	52	<5	0.311	0.396	95.2	-0.70	7.48	7.50	8.20	253.50	198	0.40
20-09-24	14	10.5	0.34	10.5	201	44	11	0.510	0.769	120.0	-0.70	7.70	7.50	8.20	440.05	369	0.40
20-10-21	8	9.2	0.28	12.08	31	58	23	0.407	0.583	115.0	-0.70	7.28	7.40	8.10	379.60	312	0.50

Table 10: Nutrient results for WQ-1, 2020

SITE WQ-1: 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)
20-06-16	44.9	0.05	22.6	0.084	72.7	0.15	0.93	4.13	31.2	<0.05	<0.001	<0.05	0.70	0.70	6	—	0.6	1.4	**0.012**
20-07-20	50.8	0.05	28.1	0.151	79.9	0.11	1.04	4.82	35.2	0.07	<0.001	<0.05	0.62	0.62	7	—	0.7	1.3	**0.057**
20-08-19	51.8	0.05	29.8	0.154	84.3	0.08	1.04	5.05	35.9	<0.05	<0.001	<0.05	0.55	0.55	6	—	0.5	1.3	**0.030**
20-09-24	43.9	0.06	38.3	0.130	180.0	0.10	2.60	5.94	92.3	<0.05	<0.001	<0.05	0.51	0.51	18	—	2.9	2.9	**0.021**
20-10-21	57.9	0.06	35.3	0.137	151.0	0.08	1.70	6.47	67.7	<0.05	<0.001	<0.05	0.20	0.20	10	—	0.3	3.3	**0.008**

Table 11: Inorganics results for WQ-1, 2020

SITE WQ-1: 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)
20-06-16	0.015	<0.001	0.009	0.072	<0.00001	<0.0001	<0.001	<0.001	0.05	0.0009	0.039	<0.0001	<0.001	<0.0001	0.0009	<0.0001	0.065	<0.0001	<0.001	<0.001
20-07-20	0.035	<0.001	0.010	0.082	<0.00001	<0.0001	<0.001	<0.001	0.12	0.0010	0.120	<0.0001	<0.001	0.0001	0.0011	<0.0001	0.076	<0.0001	<0.001	<0.001
20-08-19	0.012	<0.001	0.011	0.080	<0.00001	<0.0001	<0.001	<0.001	0.07	0.0009	0.066	<0.0001	<0.001	<0.0001	0.0011	<0.0001	0.079	<0.0001	<0.001	<0.001
20-09-24	0.024	<0.001	0.012	0.125	<0.00001	<0.0001	<0.001	<0.001	0.09	0.0009	0.057	<0.0001	<0.001	<0.0001	0.0020	<0.0001	0.105	<0.0001	<0.001	0.001
20-10-21	0.007	<0.001	0.012	0.106	<0.00001	<0.0001	<0.001	<0.001	0.10	0.0010	0.043	<0.0001	<0.001	<0.0001	0.0015	<0.0001	0.096	<0.0001	<0.001	0.003

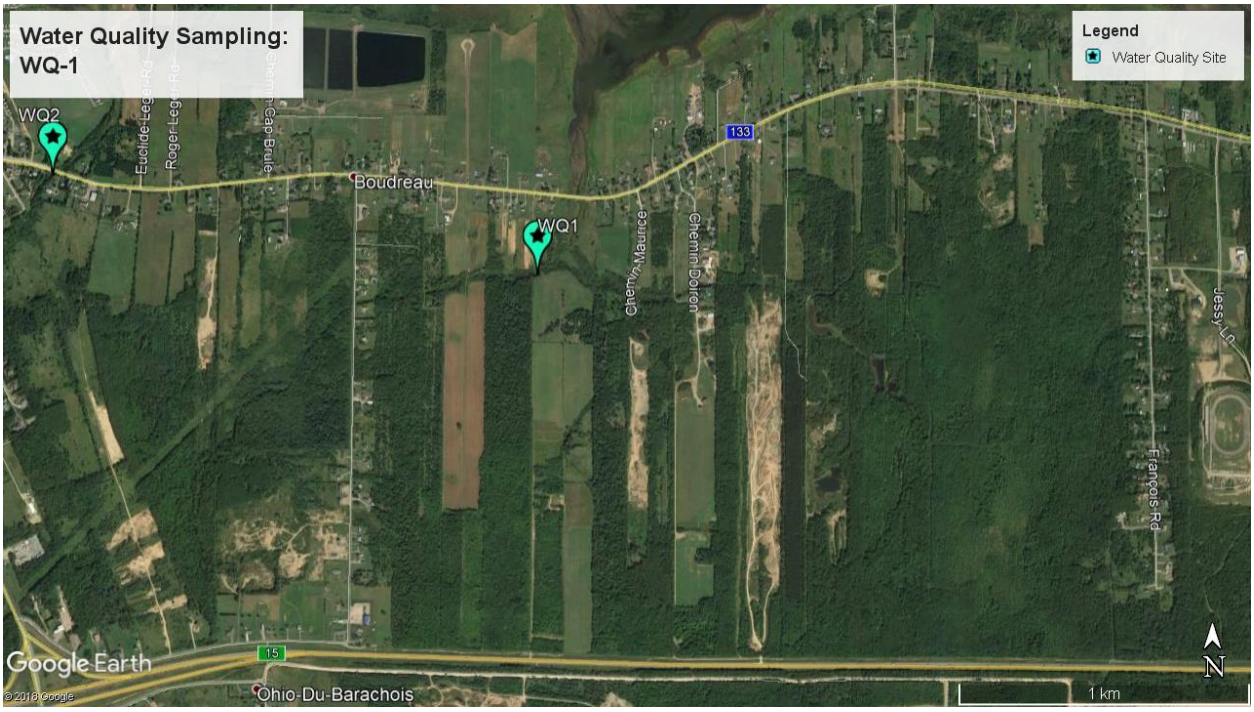


Figure 3: WQ-1 site location and surrounding land uses

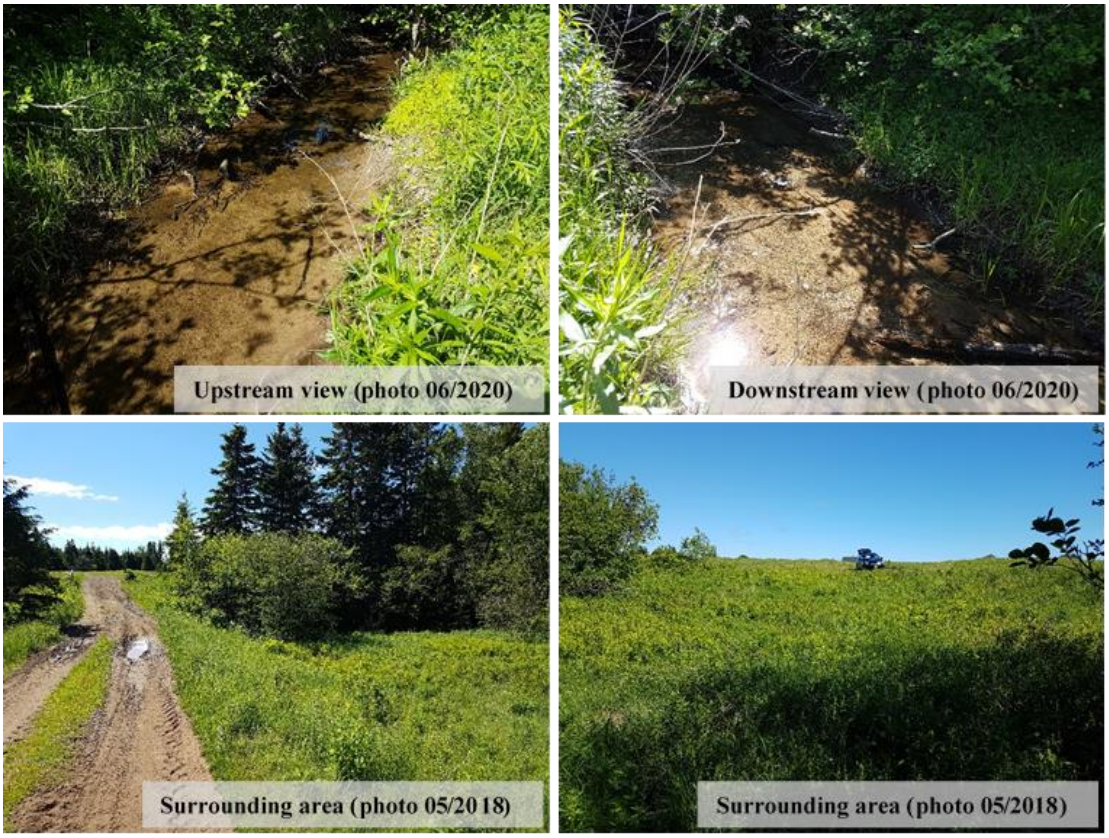


Figure 4: Site photos for the water quality monitoring station WQ-1

3.3 **WQ-2**

This water quality sampling site is also located in a residential area in Boudreau-West, near the convenience store "Handy Andy's" on Route NB-133. The samples are taken upstream of the wooden culvert. The surrounding land uses is mainly residential, roads, and has a drive-in movie theatre upstream (300 m). Below the culvert of Route NB-133, directly following the sampling site, is the beginning of a provincially regulated freshwater wetland. The freshwater wetland is approximately 170 metres in length before transitioning to a coastal salt marsh at the highest tidal point.

Within the salt marsh area is the *Ocean Surf RV Campground*. There are no trees between the campground and the wetland and brook areas, making any buffer zone only made up of wild grasses and shrubs. The Shediac Bay Watershed Association has been working with Ocean Surf to improve their coastal zone. A living shoreline workshop held in 2020 concentrated on restoring 225 m of coastline in the campground.

The water sampling results for the site WQ-2, 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 June and October; in the meso-eutrophic range (0.020 – 0.035 mg/L) in August; in the eutrophic range (0.035 – 0.100 mg/L) in September; and in the hyper-eutrophic range (>100 mg/L) in July.

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 September (0.144 mg/L). Concentrations of iron exceeded the CCME water quality guideline (0.3 mg/L) in September (0.32 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 July (880 MPN/100 mL) and September (820 MPN/100 mL).

Table 12: Water chemistry data and *E. coli* results for WQ-2, 2020

SITE WQ-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	
20-06-16	22	11.7	0.21	11.07	160	60	<5	0.315	0.409	95.2	-0.74	7.70	7.40	8.10	281.40	201	0.90
20-07-20	23	17.0	0.20	8.37	**880**	69	7	0.346	0.422	114.0	-0.41	7.69	7.60	8.00	255.85	209	1.20
20-08-19	18	15.7	0.19	8.12	109	73	11	0.320	0.392	109.0	-0.39	7.50	7.60	8.00	253.50	203	1.00
20-09-24	14	11.5	0.24	9.62	**820**	51	17	0.365	0.530	104.0	-0.58	7.56	7.60	8.20	319.15	257	10.30
20-10-21	8	9.6	0.26	10.31	31	70	25	0.371	0.528	120.0	-0.70	7.34	7.30	8.00	341.25	279	1.20

Table 13: Nutrient results for WQ-2, 2020

SITE WQ-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)
20-06-16	59.8	0.05	29.3	0.141	83.1	0.16	1.02	5.34	36.1	<0.05	<0.001	<0.05	0.35	0.35	6	—	0.5	1.5	**0.014**
20-07-20	68.7	0.05	35.3	0.257	80.8	0.12	1.15	6.23	34.1	<0.05	<0.001	<0.05	0.25	0.25	6	—	0.4	1.6	**0.143**
20-08-19	72.7	0.05	34.4	0.272	75.4	0.11	1.24	5.69	30.7	<0.05	<0.001	<0.05	0.12	0.12	6	—	<0.2	3.7	**0.024**
20-09-24	50.8	0.06	32.8	0.190	104.0	0.13	1.93	5.30	53.8	<0.05	<0.001	<0.05	0.53	0.53	21	—	4.7	4.7	**0.058**
20-10-21	69.9	0.06	36.4	0.131	122.0	0.07	1.72	6.94	53.9	<0.05	<0.001	<0.05	0.17	0.17	11	—	0.2	2.7	**0.011**

Table 14: Inorganics results for WQ-2, 2020

SITE WQ-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)
20-06-16	0.021	<0.001	0.009	0.114	<0.00001	<0.0001	<0.001	<0.001	0.13	0.0015	0.134	<0.0001	<0.001	<0.0001	0.0010	<0.0001	0.090	0.0003	<0.001	0.004
20-07-20	0.024	<0.001	0.011	0.127	<0.00001	<0.0001	<0.001	<0.001	0.19	0.0018	0.183	<0.0001	<0.001	<0.0001	0.0012	<0.0001	0.110	0.0002	<0.001	<0.001
20-08-19	0.011	<0.001	0.012	0.122	<0.00001	<0.0001	<0.001	0.002	0.11	0.0017	0.103	<0.0001	<0.001	<0.0001	0.0013	<0.0001	0.111	0.0002	<0.001	<0.001
20-09-24	**0.144**	<0.001	0.014	0.135	<0.00001	0.0001	<0.001	0.003	**0.32**	0.0016	0.136	0.0001	<0.001	0.0003	0.0016	<0.0001	0.116	0.0002	<0.001	0.002
20-10-21	0.027	<0.001	0.012	0.147	<0.00001	<0.0001	<0.001	0.001	0.18	0.0018	0.159	<0.0001	<0.001	<0.0001	0.0014	<0.0001	0.127	0.0002	<0.001	0.003

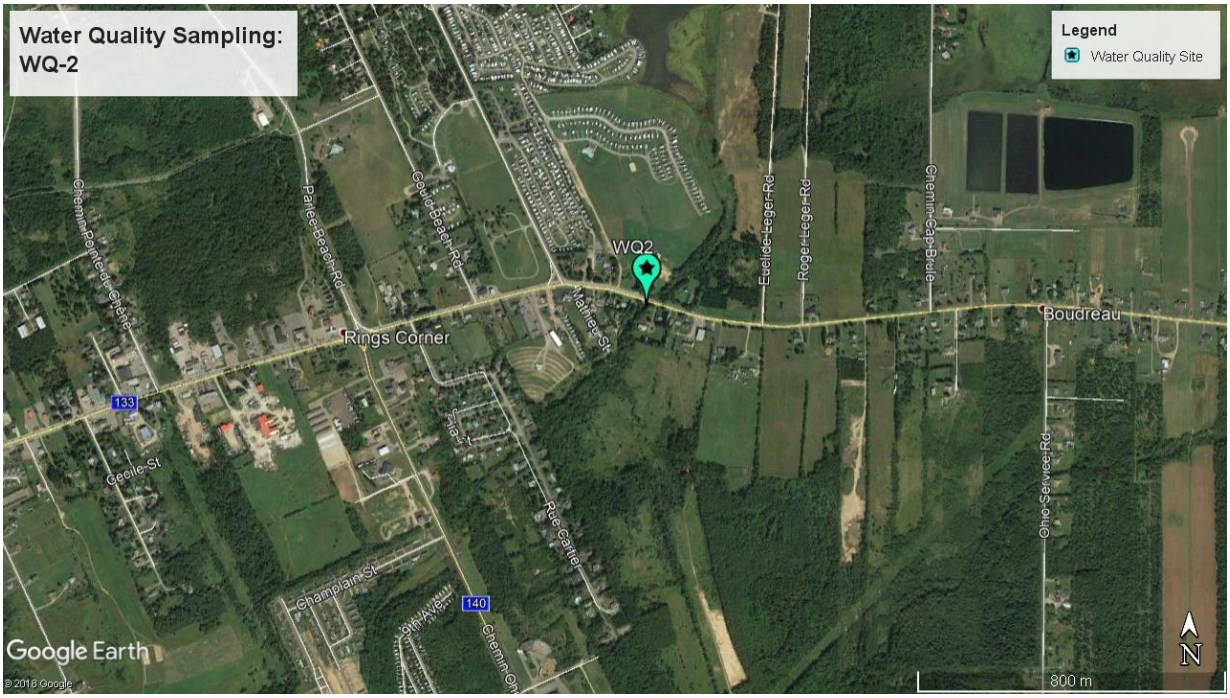


Figure 5: WQ-2 site location and surrounding land uses

Figure 6: Site photos for the water quality monitoring station WQ-2

3.4 **WQ-3**

This water quality sampling site is located in a residential and commercial area in the Town of Shediac, directly off Main St., next to the *Shediac Bakery*. The samples are taken upstream of the culvert. The surrounding land uses upstream is mainly a large residential sector, up to the approximate headwaters below Highway 15. It is important to note that for most of the riparian zones along this brook, there are inadequate buffer zones (< 15 m). This unnamed brook reaches the tidal zone approximately 400 metres downstream of the sampling site.

The water sampling results for the site WQ-3, 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 meso-eutrophic range (0.020 - 0.035 mg/L) in June; in the eutrophic range (0.035 – 0.100 mg/L) in August, September and October; and in the hyper-eutrophic range (>100 mg/L) in July.

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 samples taken in August (0.107 mg/L) and September (0.134 mg/L).

Bacterial levels did exceed the maximum concentration of *E. coli* from Health Canada recreational guideline (≥ 400 MPN/100 mL), for all the samples taken in 2020: June (2,224 MPN/100 mL), July (504 MPN/100 mL), August (24,196 MPN/100 mL), September (2,382 MPN/100 mL) and October (450 MPN/100 mL).

Table 15: Water chemistry data and *E. coli* results for WQ-3, 2020

SITE WQ-3: 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	
20-06-16	22	12.9	0.15	10.82	**2,224**	78	6	0.235	0.311	93.7	-0.20	8.07	7.80	8.00	1,018.25	160	0.80
20-07-20	23	19.4	0.16	9.01	**504**	98	11	0.260	0.335	115.0	0.18	8.24	8.00	7.80	208.10	180	0.40
20-08-19	19	19.1	0.16	8.2	**24,196**	96	15	0.295	0.335	115.0	0.17	8.19	8.00	7.80	216.45	186	3.90
20-09-24	14	12.2	0.42	10.12	**2,382**	73	18	0.640	0.914	143.0	-0.20	7.77	7.70	7.90	552.50	457	4.40
20-10-21	8	10.1	0.44	12.11	**450**	83	23	0.640	0.896	156.0	-0.22	7.56	7.60	7.80	585.00	486	2.90

Table 16: Nutrient results for WQ-3, 2020

SITE WQ-3: 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)
20-06-16	77.5	0.05	30.5	0.460	44.2	0.14	1.04	4.25	20.0	<0.05	<0.001	<0.05	0.68	0.68	7	—	0.6	2.0	**0.022**
20-07-20	97.0	0.05	37.7	0.912	44.0	0.11	1.62	4.99	20.7	<0.05	<0.001	<0.05	0.50	0.50	6	—	0.6	2.4	**0.112**
20-08-19	95.1	0.05	38.1	0.894	45.6	0.09	2.36	4.76	21.0	0.06	0.002	<0.05	0.74	0.74	7	—	0.8	4.8	**0.064**
20-09-24	72.6	0.06	48.3	0.342	201.0	0.13	2.99	5.50	115.0	<0.05	<0.001	<0.05	1.49	1.49	27	—	5.6	5.6	**0.054**
20-10-21	82.7	0.06	50.8	0.309	227.0	0.10	2.85	7.07	117.0	<0.05	<0.001	<0.05	0.61	0.61	23	—	0.6	4.8	**0.039**

Table 17: Inorganics results for WQ-3, 2020

SITE WQ-3: 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)
20-06-16	0.043	<0.001	0.012	0.084	<0.00001	<0.0001	<0.001	<0.001	0.05	0.0008	0.021	0.0001	<0.001	<0.0001	0.0009	<0.0001	0.066	0.0007	<0.001	0.003
20-07-20	0.031	<0.001	0.016	0.091	<0.00001	<0.0001	<0.001	<0.001	0.04	0.0008	0.009	0.0003	<0.001	<0.0001	0.0015	<0.0001	0.080	0.0007	<0.001	<0.001
20-08-19	**0.107**	<0.001	0.021	0.098	<0.00001	<0.0001	<0.001	0.001	0.10	0.0008	0.007	0.0003	0.002	0.0001	0.0026	<0.0001	0.092	0.0006	<0.001	0.002
20-09-24	**0.134**	<0.001	0.034	0.148	<0.00001	0.0001	<0.001	0.002	0.14	0.0010	0.017	0.0002	<0.001	0.0002	0.0020	0.0001	0.119	0.0011	<0.001	0.002
20-10-21	0.078	<0.001	0.024	0.160	<0.00001	<0.0001	<0.001	0.001	0.09	0.0010	0.009	0.0002	<0.001	0.0001	0.0020	0.0001	0.123	0.0005	<0.001	0.005

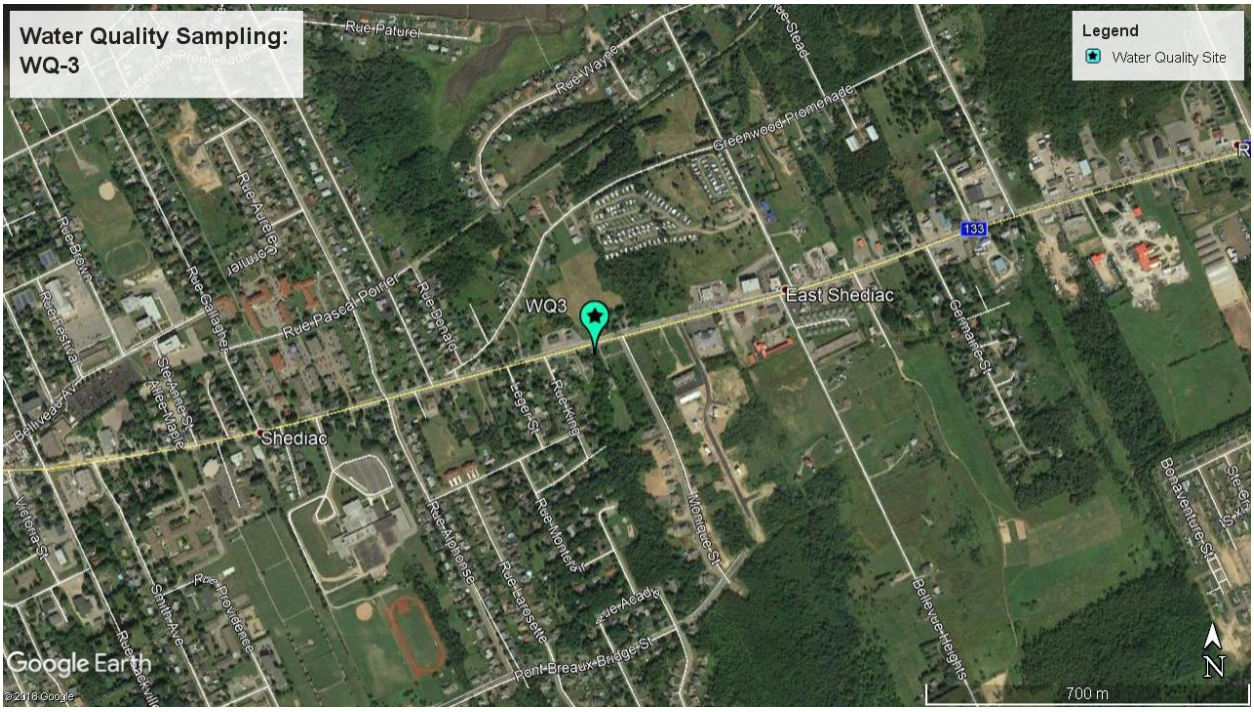


Figure 7: WQ-3 site location and surrounding land uses

Figure 8: Site photos for the water quality monitoring station WQ-3

3.5 **WQ-4**

This water quality sampling site is located behind the Town of Shediac's city hall. There is a culvert where this brook exits the underground canal along the edge of the parking lots for Town Hall and *Auberge Gabrièle's Inn & Restaurant,* and the sample is taken directly below this culvert. The surrounding land uses for small unnamed brook is mainly residences, business parking lots and roads. A part of this brook is channelled in an underground pipe somewhere along Chelsey Street, before reaching Main Street. There is also a dog park upstream (600 metres) next to a drainage ditch that connects to this brook. The SBWA built its first rain garden below this dog park, in an effort to capture stormwater runoff from the park and from the surrounding area (parking lot of the *Vestiaire St-Joseph* and Centennial Park). The brook flows into the Shediac Bay approximately 200 metres downstream from the sampling site, and is unaffected by normal tides.

The water sampling results for the site WQ-4, 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 meso-eutrophic (0.020 – 0.035 mg/L) in June; in the eutrophic range (0.035 – 0.100 mg/L) in August and October; and in the hyper-eutrophic range (>100 mg/L) in July and September.

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 September (0.181 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 August (595 MPN/100 mL) and September (624 MPN/100 mL).

Table 18: Water chemistry data and *E. coli* results for WQ-4, 2020

SITE WQ-4: 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	
20-06-16	23	11.4	0.31	10.86	173	120	<5	0.470	0.647	130.0	-0.04	7.75	7.70	7.70	412.75	344	1.40
20-07-20	23	13.6	0.77	10.22	384	140	<5	1.180	1.560	241.0	0.43	7.93	7.90	7.50	981.50	792	0.40
20-08-19	19	14.0	0.30	9.86	**598**	100	<5	0.483	0.620	107.0	0.00	7.95	7.90	7.90	397.90	307	0.90
20-09-24	14	12.9	0.26	10.25	**624**	130	<5	0.416	0.584	116.0	0.16	7.88	7.90	7.70	351.65	305	3.00
20-10-21	8	11.2	0.27	12.09	52	150	<5	0.408	0.594	116.0	0.11	7.73	7.80	7.70	360.10	323	1.00

Table 19: Nutrient results for WQ-4, 2020

SITE WQ-4: 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)
20-06-16	119.0	0.13	40.3	0.563	123.0	0.29	1.84	7.14	75.4	<0.05	<0.001	<0.05	1.11	1.11	17	—	1.0	1.1	**0.028**
20-07-20	139.0	0.16	75.9	1.040	372.0	0.23	3.44	12.60	222.0	<0.05	<0.001	<0.05	0.85	0.85	16	—	0.9	0.9	**0.171**
20-08-19	99.2	0.16	32.9	0.741	105.0	0.33	1.76	6.14	81.4	<0.05	<0.001	<0.05	0.06	0.06	17	—	0.5	1.6	**0.041**
20-09-24	129.0	0.10	36.5	0.963	82.2	0.21	1.99	5.92	72.7	<0.05	<0.001	<0.05	1.55	1.55	18	—	1.4	1.6	**0.140**
20-10-21	149.0	0.14	35.5	0.884	85.5	0.28	1.66	6.58	78.8	<0.05	<0.001	<0.05	1.07	1.07	18	—	0.9	0.8	**0.036**

Table 20: Inorganics results for WQ-4, 2020

SITE WQ-4: 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)
20-06-16	0.056	<0.001	0.027	0.192	<0.00001	<0.0001	<0.001	0.002	0.10	0.0059	0.032	0.0001	<0.001	0.0002	0.0012	<0.0001	0.251	0.0007	<0.001	0.002
20-07-20	0.036	<0.002	0.030	0.443	<0.00002	<0.0002	<0.002	0.003	0.05	0.0117	0.024	0.0009	<0.001	<0.0002	0.0021	<0.0002	0.736	0.0007	<0.002	0.002
20-08-19	0.046	<0.001	0.037	0.153	<0.00001	<0.0001	<0.001	0.002	0.06	0.0085	0.020	0.0015	<0.001	<0.0001	0.0013	<0.0001	0.331	0.0006	<0.001	0.002
20-09-24	**0.181**	<0.001	0.040	0.151	0.00001	0.0001	<0.001	0.002	0.24	0.0060	0.057	0.001	<0.001	0.0009	0.0016	<0.0001	0.215	0.0009	0.001	0.004
20-10-21	0.038	<0.001	0.042	0.144	<0.00001	<0.0001	<0.001	<0.001	0.11	0.0077	0.032	0.0253	<0.001	<0.0001	0.0013	<0.0001	0.238	0.0007	<0.001	0.002

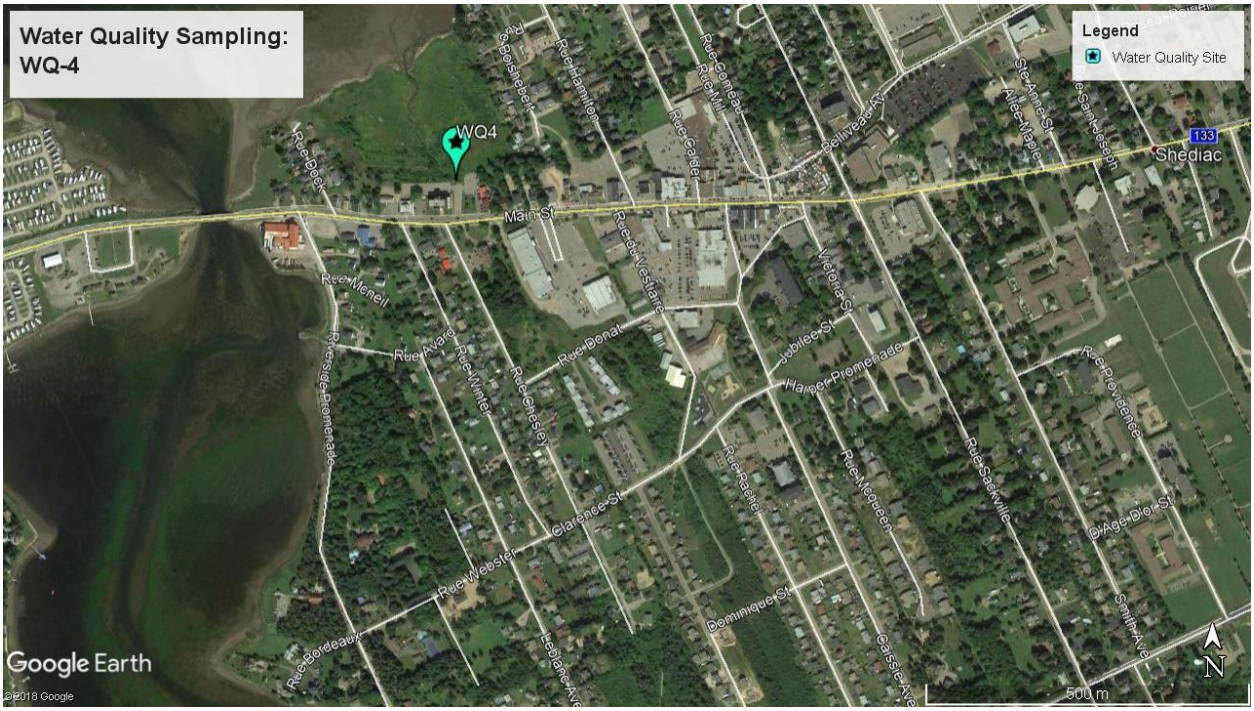


Figure 9: WQ-4 site location and surrounding land uses

Figure 10: Site photos for the water quality monitoring station WQ-4

3.6 **WQ-5**

This water quality sampling site is also located off Route 133, past *Guy's Frenchys* heading towards Gilbert's Corner. The stream crosses the road 75 m past Atkinson Court. The samples are taken upstream from the culvert. The sample site is located approximately 90 m from the tidal zone and the beginning of a salt marsh. The surrounding land uses is mainly residential, forested land, and farm fields. The riparian area around the residential properties have little buffer (< 15 m), but this constitutes small sections of the brook. However, there are good buffer zones between the farmlands and the head ponds of this brook; 25 m – 50 m in tree density. There is a thinner buffer zone where the pond discharges into the brook, approximately 20 m between the bank and a field. Another brook joins these ponds upstream, supplying water from the other side of Highway 11, up to Route 134 (Lakeville Road). In this area, there is more cultivated land where the brook passes, but there is no buffer zone visible from aerial imagery. There is no indication that animals, such as cows, are being pastured in that field, but the lack of a buffer around this brook passing around and through these fields may be impacted by sediment and could explain the higher levels of total phosphorus.

The water sampling results for the site WQ-5, 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 meso-eutrophic range (0.020 – 0.035 mg/L) in June and October; in the eutrophic range (0.035 – 0.100 mg/L) September; and in the hyper-eutrophic range (>100 mg/L) in July and August.

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 samples taken in July (0.230 mg/L), August (0.103 mg/L) and September (0.141 mg/L). Concentrations of iron exceeded the CCME water quality guideline (0.3 mg/L) in July (1.60 mg/L), August (0.52 mg/L) and September (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 September (3,441 MPN/100 mL).

Table 21: Water chemistry data and *E. coli* results for WQ-5, 2020

SITE WQ-5: 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	
20-06-16	24	15.7	0.38	9.43	31	79	6	0.630	0.775	122.0	-0.21	7.75	7.70	7.90	500.50	399	1.00
20-07-20	24	18.0	0.31	8.04	86	93	6	0.560	0.661	134.0	-0.08	7.98	7.70	7.80	416.00	354	1.70
20-08-19	21	16.0	0.34	8.67	233	100	<5	0.570	0.696	161.0	0.23	7.84	7.90	7.70	448.50	370	1.00
20-09-24	14	11.3	0.56	10.09	**3,441**	47	31	0.820	1.120	143.0	-0.60	7.69	7.50	8.10	728.00	591	5.80
20-10-21	8	9.5	0.49	10.48	< 10	74	18	0.690	0.991	145.0	-0.29	7.66	7.60	7.90	637.00	534	0.80

Table 22: Nutrient results for WQ-5, 2020

SITE WQ-5: 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)
20-06-16	78.6	0.05	41.9	0.370	198.0	0.15	1.25	4.26	98.4	<0.05	<0.001	<0.05	<0.05	<0.05	3	—	0.2	3.2	**0.027**
20-07-20	92.5	0.04	47.3	0.436	156.0	0.08	1.41	3.93	76.2	<0.05	<0.001	<0.05	0.09	0.09	3	—	0.3	2.2	**0.151**
20-08-19	99.2	0.04	57.4	0.741	165.0	0.27	1.52	4.30	73.1	<0.05	<0.001	<0.05	0.06	0.06	3	—	<0.2	1.7	**0.112**
20-09-24	46.8	0.05	48.8	0.139	296.0	0.15	3.11	5.24	168.0	0.05	<0.001	<0.05	0.19	0.19	32	—	0.4	7.2	**0.056**
20-10-21	73.7	0.05	49.3	0.276	272.0	0.07	2.32	5.32	137.0	<0.05	<0.001	<0.05	<0.05	<0.05	18	—	0.3	4.4	**0.022**

Table 23: Inorganics results for WQ-5, 2020

SITE WQ-5: 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)
20-06-16	0.008	<0.001	0.007	0.180	<0.00001	<0.0001	<0.001	<0.001	0.18	0.0005	0.852	<0.0001	<0.001	<0.0001	0.0012	<0.0001	0.094	0.0001	<0.001	<0.001
20-07-20	**0.230**	<0.001	0.009	0.438	0.00004	0.0006	<0.001	0.002	**1.60**	0.0005	5.380	<0.0001	<0.001	0.0003	0.0016	<0.0001	0.091	0.0002	<0.001	0.007
20-08-19	**0.103**	<0.001	0.010	0.243	<0.00001	0.0003	<0.001	<0.001	**0.52**	0.0004	1.810	<0.0001	<0.001	0.0003	0.0016	<0.0001	0.100	0.0002	<0.001	0.022
20-09-24	**0.141**	<0.001	0.010	0.227	<0.00001	0.0003	<0.001	0.001	**0.45**	0.0005	1.020	0.0001	<0.001	0.0003	0.0024	<0.0001	0.116	0.0001	<0.001	0.002
20-10-21	0.013	<0.001	0.009	0.196	<0.00001	<0.0001	<0.001	<0.001	0.11	0.0005	0.352	0.0003	<0.001	<0.0001	0.0019	<0.0001	0.105	<0.0001	<0.001	0.003

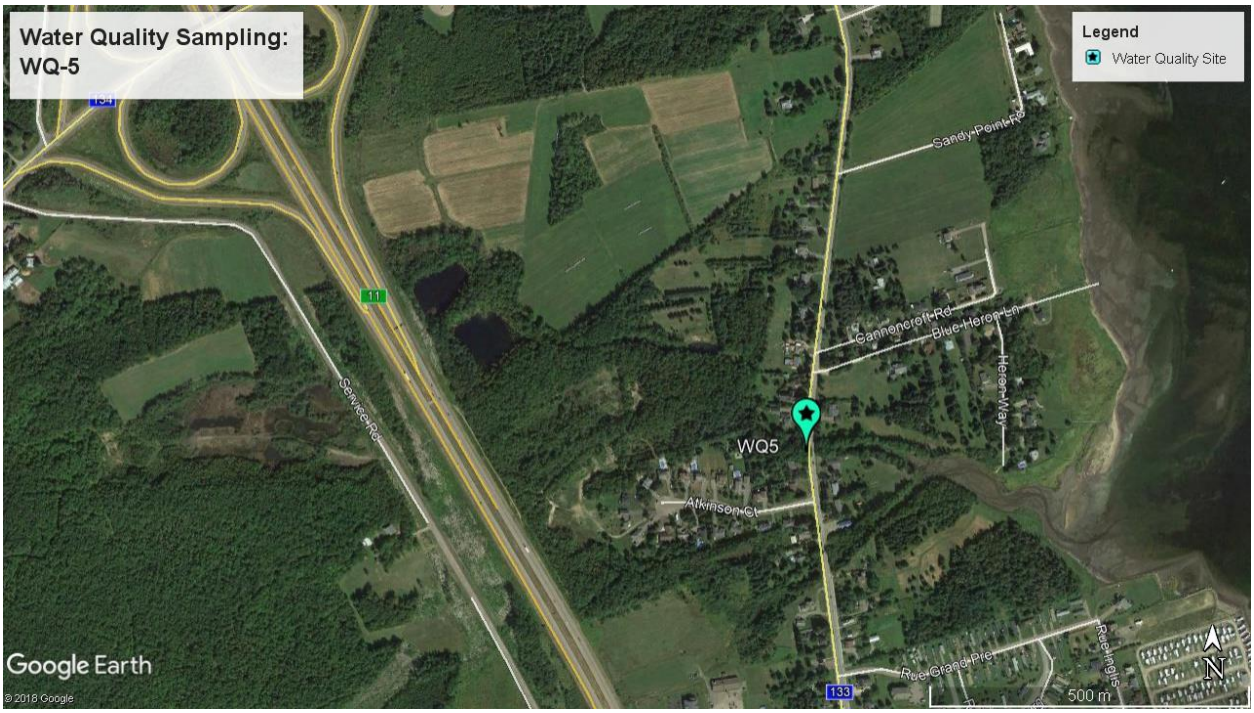


Figure 11: WQ-5 site location and surrounding land uses

Figure 12: Site photos for the water quality monitoring station WQ-5

3.7 **WQ-6**

This water quality sampling site is located off Route 134, past the Shediac Cape School, right next to Old Mill Road. The vehicle is parked on Old Mill Road, and the samples are taken downstream of the culvert crossing Route 134, to capture the water coming from both directions; coming from along Old Mill Road and along Route 134. The sample site is located approximately 175 m from the tidal zone. The surrounding land uses includes; residential, active farm fields for cultivation and pasture (cows seen on aerial imagery), and a gravel pit. There is very little or no buffer along the brook as it flows through the fields. It is unknown if cows are held in this area on a regular basis, but there are visible cow tracks that cross the brook in one particular area and animals visible in aerial views from several years. There is also no buffer between the gravel pit area and the brook. Passed the gravel pit heading upstream is a more forested lot, with healthier riparian zones. The next parcel of land and leading up to the end of the brook near Highway 11 are more cow pastures, as animals, cow tracks and cattle fencing can be seen on aerial imagery. There is more vegetation in the buffer zones in this field, with tree density ranging from 5 – 30 metres.

The water sampling results for the site WQ-6, 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 July (3.49 mg/L), August (0.62 mg/L) and October (3.23 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 October; and in the eutrophic range (0.035 – 0.100 mg/L) July, August and September.

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 September (0.174 mg/L). Concentrations of iron reached or exceeded the CCME water quality guideline (0.3 mg/L) in September (0.30 mg/L) and October (0.32 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 September (2,014 MPN/100 mL).

Table 24: Water chemistry data and *E. coli* results for WQ-6, 2020

SITE WQ-6: 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	
20-06-16	26	11.7	0.23	8.86	41	83	<5	0.351	0.445	114.0	-0.43	7.52	7.50	7.90	306.15	226	0.60
20-07-20	26	15.4	0.39	**3.49**	20	87	<5	0.670	0.304	101.0	-0.44	7.26	7.50	7.90	539.20	159	0.40
20-08-19	21	15.9	0.73	**0.62**	41	96	6	1.210	0.290	104.0	-0.18	6.91	7.70	7.90	942.50	157	0.90
20-09-24	15	11.2	0.42	7.75	**2,014**	62	35	0.630	0.918	108.0	-0.80	7.61	7.30	8.10	559.00	455	4.70
20-10-21	9	10.5	0.59	**3.23**	107	89	13	0.870	0.705	136.0	-0.05	7.09	7.80	7.90	767.00	378	7.80

Table 25: Nutrient results for WQ-6, 2020

SITE WQ-6: 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)
20-06-16	82.7	0.04	35.5	0.246	82.3	0.15	1.36	6.10	36.4	<0.05	<0.001	<0.05	1.35	1.35	5	—	1.3	1.9	**0.011**
20-07-20	86.7	0.03	31.7	0.258	37.9	0.08	1.80	5.34	17.0	<0.05	<0.001	<0.05	1.14	1.14	5	—	1.2	1.3	**0.053**
20-08-19	95.5	0.03	32.9	0.450	34.8	0.07	1.80	5.41	13.5	0.06	0.001	<0.05	0.74	0.74	4	—	0.8	1.4	**0.046**
20-09-24	61.9	0.03	35.2	0.116	201.0	0.14	2.92	4.95	128.0	<0.05	<0.001	<0.05	0.28	0.28	36	—	0.5	7.5	**0.077**
20-10-21	88.4	0.04	42.5	0.524	165.0	0.08	2.63	7.37	80.8	<0.05	<0.001	<0.05	0.65	0.65	19	—	0.6	3.3	**0.022**

Table 26: Inorganics results for WQ-6, 2020

SITE WQ-6: 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)
20-06-16	0.006	<0.001	0.010	0.096	<0.00001	<0.0001	<0.001	<0.001	0.12	0.0006	0.165	<0.0001	<0.001	<0.0001	0.0009	<0.0001	0.069	0.0002	<0.001	<0.001
20-07-20	0.010	<0.001	0.012	0.085	<0.00001	<0.0001	<0.001	<0.001	0.19	0.0006	0.458	<0.0001	<0.001	<0.0001	0.0010	<0.0001	0.056	0.0001	<0.001	<0.001
20-08-19	0.007	<0.001	0.013	0.089	<0.00001	0.0001	<0.001	<0.001	0.28	0.0005	0.533	<0.0001	0.001	<0.0001	0.0011	<0.0001	0.056	0.0001	<0.001	<0.001
20-09-24	**0.174**	<0.001	0.011	0.086	<0.00001	0.0002	<0.001	0.002	**0.30**	0.0005	0.098	0.0001	<0.001	0.0004	0.0021	<0.0001	0.065	<0.0001	<0.001	0.002
20-10-21	0.010	<0.001	0.012	0.121	<0.00001	0.0001	<0.001	<0.001	**0.32**	0.0006	0.330	<0.0001	<0.001	<0.0001	0.0018	<0.0001	0.078	0.0001	<0.001	0.004

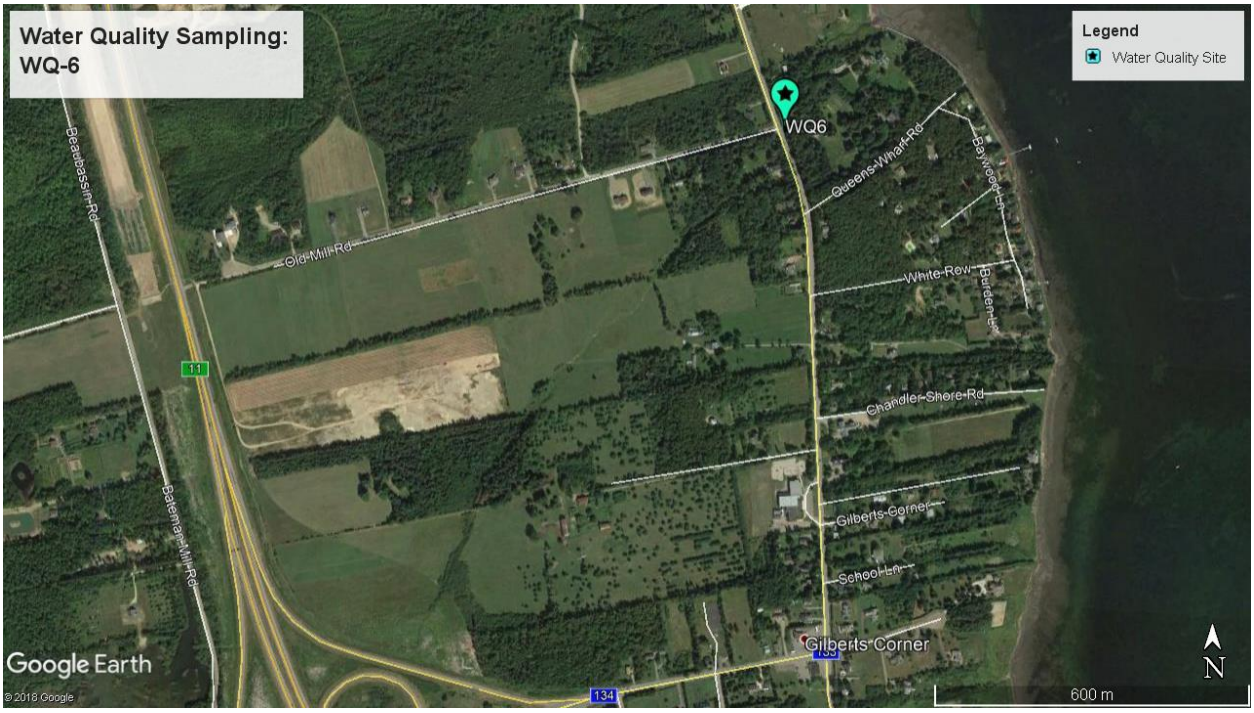


Figure 13: WQ-6 site location and surrounding land uses

Figure 14: Site photos for the water quality monitoring station WQ-6

3.8 **WQ-7**

This water quality sampling site is located off Route 134, on the property of *Bay Vista Lodge*. The samples are taken upstream of the culvert crossing the main road. The sample site is located approximately 160 m from the tidal zone and the beginning of a salt marsh. The surrounding land uses is mainly residential the cottages of *Bay Vista*. This brook is very short; the only obvious source of water being a pond (1,700 m^2) approximately 200 m away. The brook does not appear on GeoNB, only a separate brook nearby which flows into the same coastal wetland. This other nearby brook leads up to a gravel pit approximately 550 metres upstream from Route 134, but it is surrounded by forested lots.

The water sampling results for the site WQ-7, for 2020, meet the recommendations for the survival of freshwater aquatic life based on pH and dissolved oxygen. However, one level of dissolved oxygen dropped below the recommendation (6.5 mg/L) for general cold-water organisms in August (4.2 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 September; in the eutrophic range (0.035 – 0.100 mg/L) in October; and in the hyper-eutrophic range (>100 mg/L) in July and August.

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 samples taken in July (0.222 mg/L), September (0.138 mg/L) and October (0.266 mg/L). Concentrations of iron exceeded the CCME water quality guideline (0.3 mg/L) in June (0.62 mg/L), July (1.17 mg/L), August (0.59 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 samples taken in July (1,500 MPN/100 mL) and August (1,989 MPN/100 mL).

Table 27: Water chemistry data and *E. coli* results for WQ-7, 2020

SITE WQ-7: 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	
20-06-16	26	16.5	0.10	9.08	74	55	14	0.276	0.335	82.3	-0.65	7.73	7.60	8.30	214.50	172	2.20
20-07-20	26	20.3	0.11	6.99	**1,500**	50	12	0.206	0.234	64.8	-0.90	7.81	7.50	8.40	147.55	124	48.40
20-08-19	22	18.8	0.10	**4.2**	**1,989**	51	13	0.184	0.193	61.3	-1.00	7.30	7.40	8.40	135.85	107	9.70
20-09-24	15	12.1	0.12	8.71	327	32	20	0.190	0.274	68.6	-1.16	7.51	7.40	8.60	163.80	135	3.40
20-10-21	9	9.7	0.14	9.37	97	46	23	0.204	0.292	81.9	-0.84	7.44	7.50	8.30	187.20	153	2.60

Table 28: Nutrient results for WQ-7, 2020

SITE WQ-7: 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)
20-06-16	54.8	0.04	24.2	0.205	69.9	0.14	0.90	5.31	28.9	<0.05	<0.001	<0.05	0.18	0.18	5	—	0.3	2.8	**0.019**
20-07-20	49.8	0.04	18.1	0.148	42.4	0.08	0.96	4.75	17.2	<0.05	<0.001	<0.05	0.21	0.21	4	—	0.7	3.5	**1.140**
20-08-19	50.9	0.03	17.4	0.120	30.1	0.10	1.36	4.34	13.4	<0.05	<0.001	<0.05	0.08	0.08	4	—	0.2	3.5	**0.105**
20-09-24	31.9	0.03	20.0	0.075	47.5	0.08	1.15	4.54	18.8	0.05	<0.001	<0.05	0.13	0.13	19	—	<0.2	3.3	**0.028**
20-10-21	45.8	0.04	23.3	0.136	57.1	0.06	1.22	0.19	20.3	<0.05	<0.001	<0.05	<0.05	<0.05	13	—	0.3	2.9	**0.058**

Table 29: Inorganics results for WQ-7, 2020

SITE WQ-7: 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)
20-06-16	0.080	<0.001	0.006	0.094	<0.00001	0.0002	<0.001	<0.001	**0.62**	0.0015	0.153	<0.0001	<0.001	0.0002	0.0008	<0.0001	0.066	0.0001	<0.001	0.006
20-07-20	**0.222**	0.001	0.007	0.084	0.00001	0.0004	<0.001	0.001	**1.17**	0.0013	0.770	<0.0001	<0.001	0.0008	0.0011	<0.0001	0.055	0.0001	0.001	0.001
20-08-19	0.065	0.001	0.042	0.086	0.00001	0.0002	<0.001	<0.001	**0.59**	0.0012	1.120	<0.0001	<0.001	0.0002	0.0016	<0.0001	0.055	<0.0001	<0.001	0.004
20-09-24	**0.138**	<0.001	0.007	0.073	<0.00001	0.0001	<0.001	<0.001	0.24	0.0012	0.050	<0.0001	<0.001	0.0001	0.0007	<0.0001	0.051	<0.0001	<0.001	0.002
20-10-21	**0.266**	<0.001	0.006	0.006	0.00002	0.0003	<0.001	<0.001	**0.88**	0.0012	0.190	<0.0001	<0.001	0.0012	0.0011	<0.0001	0.060	<0.0001	0.001	0.008

Figure 15: WQ-7 site location and surrounding land uses

Figure 16: Site photos for the water quality monitoring station WQ-7

3.9 **WQ-8**

This water quality sampling site is located off Route 134, in front of a chiropractor's office (3694 Route NB-134, Shediac Cape). The site is within the tidal zone, being approximately 75 metres from the outlet into the Shediac Bay. The samples are taken upstream from the culvert. The surrounding land uses includes; residences, farmlands and a chicken farm. The farm fields possess little to no buffer around the lots; mainly wide-open fields with little tree line density. There is a settling pond behind the chicken farm buildings, with a thin band of vegetation surrounding it (> 10 m). Observations taken during the sampling includes dark colouration and bad odours in the water.

The water sampling results for the site WQ-8, 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 July (2.54 mg/L), August (0.67 mg/L), September (3.37 mg/L) and October (1.15 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 mg/L) in June; and in the hyper-eutrophic range (>100 mg/L) in July, August, September 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 October (0.230 mg/L). Concentrations of iron exceeded the CCME water quality guideline (0.3 mg/L) in July (1.00 mg/L), and October (1.00 mg/L).

There are four samples that have been flagged for boron. It is important to note that this site is impacted by tides, and that marine water disqualifies several flagged parameters that only apply to freshwater, and that includes boron. There is a correlation between the flagged samples of boron and the high salinity content shown in Table 32.

Bacterial levels exceed the maximum concentration of *E. coli* from Health Canada recreational guideline (≥ 400 MPN/100 mL) in July (5,794 MPN/100 mL), August (12,997 MPN/100 mL), September (15,531 MPN/100 mL) and October (3,654 MPN/100 mL).

Table 30: Water chemistry data and *E. coli* results for WQ-8, 2020

SITE WQ-8: 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	
20-06-16	26	18.1	6.82	7.51	262	100	10	10.300	4.200	268.0	-0.39	7.52	7.60	8.00	7,788.00	1890	2.50
20-07-20	26	21.9	25.75	**2.54**	**5,794**	120	15	37.560	3.710	3,010.0	0.27	7.36	7.50	7.20	26,130.00	18300	7.40
20-08-19	22	21.6	28.02	**0.67**	**12,997**	150	42	40.620	49.800	4,980.0	0.41	7.18	7.20	6.80	28,216.50	27400	3.00
20-09-24	15	13.3	27.25	**3.37**	**15,531**	110	<5	32.910	55.800	4,540.0	0.02	7.33	7.00	7.00	27,573.00	25900	11.10
20-10-21	9	11.9	23.46	**1.15**	**3,654**	130	10	27.950	29.900	2,590.0	-0.29	6.57	7.00	7.30	24,362.00	14400	7.20

Table 31: Nutrient results for WQ-8, 2020

SITE WQ-8: 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)
20-06-16	99.6	2.02	38.4	0.373	1,240.0	0.37	12.90	41.90	326.0	0.10	0.002	<0.05	0.37	0.37	160	—	1.2	3.2	**0.044**
20-07-20	120.0	29.20	219.0	0.356	11,200.0	1.30	179.00	598.00	4,950.0	0.42	0.005	<0.05	<0.05	<0.05	1100	—	1.0	5.2	**0.270**
20-08-19	150.0	49.00	331.0	0.223	15,100.0	1.60	285.00	1010.00	8,730.0	1.32	0.008	<0.05	<0.05	<0.05	1840	—	1.6	6.5	**0.288**
20-09-24	110.0	42.80	318.0	0.103	14,800.0	1.55	267.00	910.00	7,660.0	0.59	0.002	<0.05	<0.05	<0.05	1880	—	3.5	14.9	**0.990**
20-10-21	130.0	25.50	190.0	0.122	8,780.0	1.05	143.00	0.97	4,300.0	1.90	0.008	<0.05	<0.05	<0.05	344	—	2.5	6.9	**0.462**

Table 32: Inorganics results for WQ-8, 2020

SITE WQ-8: 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)
20-06-16	0.078	<0.002	0.161	0.318	<0.00002	<0.0002	<0.002	<0.002	0.28	0.0116	0.230	0.0006	0.002	0.0003	0.0044	<0.0002	0.503	0.0009	<0.002	0.011
20-07-20	0.070	<0.05	**2.090**	0.170	<0.0005	<0.005	<0.05	<0.05	**1.00**	0.0820	1.120	<0.005	0.005	<0.005	0.0540	<0.005	3.710	<0.005	<0.05	<0.05
20-08-19	0.080	<0.05	**3.490**	0.170	<0.0005	<0.005	<0.05	<0.05	<1	0.1330	2.050	0.007	0.008	<0.005	0.0930	<0.005	6.200	<0.005	<0.05	<0.05
20-09-24	0.090	<0.05	**3.090**	0.080	<0.0005	<0.005	<0.05	<0.05	<1	0.1180	0.350	0.007	0.002	<0.005	0.0770	<0.005	5.440	<0.005	0.050	<0.05
20-10-21	**0.230**	<0.05	**1.720**	1.720	<0.00001	<0.005	<0.05	<0.05	**1.00**	<0.005	0.970	<0.005	0.008	<0.005	0.0460	<0.005	3.080	<0.005	<0.05	<0.05

Figure 17: WQ-8 site location and surrounding land uses

Figure 18: Site photos for the water quality monitoring station WQ-8

3.10 **WQ-9**

This water quality sampling site is located in the Ruisseau Albert-Gallant, off Babineau Access Road, 320 m after turning to the left off Viaduc Road (turning to the right is Shediac River Road). The samples are taken downstream of the culvert, due to flooding on the other side caused by a beaver dam at the mouth of the culvert, creating conditions unfit for chest waders. The sample site is located approximately 300 m from the tidal zone. The surrounding land uses is mainly residences and large agricultural fields. There is a farming lot (1.2 hectares) along the right side of the brook (looking upstream), with no buffer zone along the total length of its riverbank (100 metres). On the left side of the sampling site is a much larger cultivated farm field; 14.6 Hectares and another lot 5.3 Hectares. The drainage from these fields flows down to the ditch along Shediac River Rd. and Babineau Access Rd., and may flow down to the brook's culvert. There are no trees around any of these farm fields. There is also the presence of the large junkyard of *Bastarache's Auto Salvage*, but there is approximately 1 km of forested buffer between the salvage lot and the head ponds of the brook (as delineated on GeoNB).

The water sampling results for the site WQ-9, for 2020, meet 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 meso-eutrophic range (0.020 – 0.035 mg/L) in October; in the eutrophic range (0.035 – 0.100 mg/L) in June, August and September; and in the hyper-eutrophic range (>100 mg/L) in July.

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 samples taken in June (0.151 mg/L), July (0.146 mg/L) and September (0.164 mg/L). Concentrations of iron exceeded the guideline (0.3 mg/L) in every sample taken in 2020; June (0.97 mg/L), July (1.50 mg/L), August (0.95 mg/L), September (0.61 mg/L) and October (0.76 mg/L).

Bacterial levels exceed the maximum concentration of E. coli from Health Canada recreational guideline (≥ 400 MPN/100 mL) in August (563 MPN/100 mL) and September (987 MPN/100 mL).

Table 33: Water chemistry data and *E. coli* results for WQ-9, 2020

SITE WQ-9: 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	
20-06-16	28	22.8	0.12	11.3	74	63	13	0.224	0.168	59.1	-0.45	8.30	7.80	8.30	153.40	88	4.80
20-07-20	29	22.1	0.22	7.52	282	71	23	0.455	0.177	68.5	-0.54	7.92	7.60	8.10	306.15	96	5.70
20-08-19	24	19.3	0.09	8.03	563	76	17	0.170	0.183	69.6	-0.50	7.77	7.60	8.10	122.86	100	3.70
20-09-24	17	12.0	0.26	7.8	987	42	71	0.363	0.194	54.3	-1.27	8.20	7.20	8.50	260.00	101	5.50
20-10-21	10	9.9	0.24	9.06	85	69	17	0.341	0.198	71.5	-0.64	8.11	7.50	8.10	317.26	108	3.30

Table 34: Nutrient results for WQ-9, 2020

SITE WQ-9: 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)
20-06-16	62.6	0.03	19.6	0.371	11.3	0.14	0.76	2.46	6.6	<0.05	<0.001	<0.05	0.06	0.06	4	—	0.2	3.3	0.046
20-07-20	70.7	0.03	23.0	0.265	10.5	0.12	0.84	2.70	6.9	<0.05	<0.001	<0.05	0.07	0.07	3	—	0.3	2.9	0.195
20-08-19	75.7	0.03	23.5	0.283	10.4	0.12	0.84	2.65	6.9	<0.05	<0.001	<0.05	0.06	0.06	5	—	<0.2	2.9	0.045
20-09-24	41.9	0.03	17.9	0.062	20.3	0.13	1.31	2.33	12.3	<0.05	<0.001	<0.05	0.28	0.28	13	—	0.5	6.4	0.059
20-10-21	68.8	0.03	23.8	0.205	16.2	0.07	0.89	0.48	9.3	<0.05	<0.001	<0.05	<0.05	<0.05	9	—	0.3	2.7	0.031

Table 35: Inorganics results for WQ-9, 2020

SITE WQ-9: 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)
20-06-16	0.151	0.001	0.007	0.084	<0.00001	0.0002	<0.001	<0.001	0.97	0.0009	0.544	0.0001	<0.001	0.0002	0.0009	<0.0001	0.058	0.0002	<0.001	0.002
20-07-20	0.146	0.002	0.008	0.091	0.00001	0.0002	<0.001	<0.001	1.50	0.0011	0.530	<0.0001	<0.001	0.0005	0.0009	<0.0001	0.077	0.0001	0.001	0.003
20-08-19	0.045	0.001	0.009	0.086	<0.00001	<0.0001	<0.001	<0.001	0.95	0.0010	0.370	0.0001	<0.001	<0.0001	0.0009	<0.0001	0.090	<0.0001	0.001	0.001
20-09-24	0.164	<0.001	0.011	0.076	0.00001	0.0002	<0.001	0.001	0.61	0.0008	0.463	<0.0001	<0.001	0.0003	0.0012	<0.0001	0.052	<0.0001	<0.001	0.002
20-10-21	0.065	<0.001	0.008	0.008	<0.00001	0.0001	<0.001	<0.001	0.76	0.0010	0.482	0.0001	<0.001	0.0001	0.0008	<0.0001	0.080	0.0001	<0.001	0.010

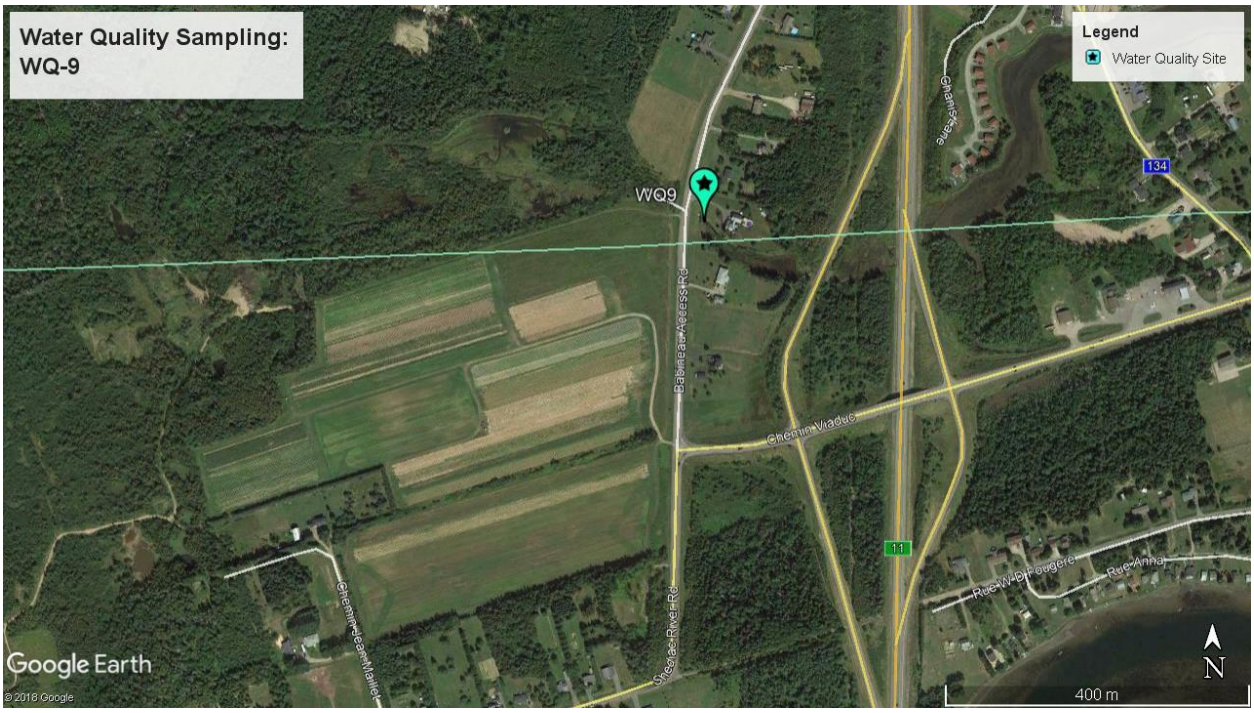


Figure 19: WQ-9 site location and surrounding land uses

Figure 20: Site photos for the water quality monitoring station WQ-9

3.11 **WQ-10**

This water quality sampling site is located off Route 530 (Grande-Digue Rd.), 100 m after Chemin Antoine. The samples are taken upstream of the culvert. The sample site is located approximately 130 m from the tidal zone. The surrounding land uses is mainly residences and a possible agricultural field (> 1 ha.). There is a buffer zone that separates the field and the brook (average 5-15 m in thickness).

The water sampling results for the site WQ-10, 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 July (5.84 mg/L) and August (5.15 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 (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 samples taken in September (0.250 mg/L) and October (0.201 mg/L). Concentrations of iron exceeded the CCME water quality guideline (0.3 mg/L) in June (0.47 mg/L), August (0.61 mg/L), September (0.35 mg/L) and October (0.62 mg/L).

Bacterial levels did exceed the maximum concentration of E. coli from Health Canada recreational guideline (≥ 400 MPN/100 mL), for all the samples taken in 2020: June (8,664 MPN/100 mL), July (2,755 MPN/100 mL), August (910 MPN/100 mL), September (4,106 MPN/100 mL) and October (15,531 MPN/100 mL).

Table 36: Water chemistry data and *E. coli* results for WQ-10, 2020

SITE WQ-10: 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	
20-06-16	29	17.5	0.11	8.31	**8,664**	46	34	0.190	0.221	62.9	-0.89	7.65	7.50	8.40	144.95	114	2.70
20-07-20	30	19.7	0.18	**5.84**	**2,755**	62	18	0.328	0.362	112.0	-0.54	7.48	7.50	8.00	237.25	180	1.20
20-08-19	25	19.0	0.29	**5.15**	**910**	77	12	0.520	0.559	167.0	-0.19	7.18	7.60	7.80	383.50	293	1.20
20-09-24	17	11.8	0.14	10.14	**4,106**	11	115	0.220	0.318	38.2	-2.43	7.56	6.80	9.20	191.10	163	2.50
20-10-21	10	9.5	0.10	9.86	**15,531**	26	222	0.142	0.202	47.3	-1.46	7.51	7.30	8.80	131.30	124	1.40

Table 37: Nutrient results for WQ-10, 2020

SITE WQ-10: 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)
20-06-16	45.8	0.04	20.1	0.136	38.2	0.17	0.82	3.09	13.5	0.52	0.006	<0.05	0.29	0.29	2	—	0.9	5.2	**0.074**
20-07-20	61.8	0.05	35.9	0.184	68.2	0.10	1.23	5.33	22.6	0.06	<0.001	<0.05	0.44	0.44	3	—	0.7	3.4	**0.108**
20-08-19	76.7	0.06	54.5	0.287	134.0	0.11	1.89	7.42	35.3	0.15	0.002	<0.05	0.48	0.48	4	—	0.7	3.4	**0.058**
20-09-24	11.0	0.03	12.1	0.007	74.3	0.25	1.05	1.94	38.2	<0.05	<0.001	<0.05	0.74	0.74	9	—	1.0	16.1	**0.039**
20-10-21	25.9	0.03	14.7	0.049	47.3	0.37	1.07	2.57	18.7	0.19	0.001	<0.05	<0.05	<0.05	<1	—	0.6	22.0	**0.041**

Table 38: Inorganics results for WQ-10, 2020

SITE WQ-10: 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)
20-06-16	0.056	<0.001	0.009	0.040	0.00001	<0.0001	<0.001	<0.001	**0.47**	0.0004	0.242	<0.0001	0.006	0.0002	0.0016	<0.0001	0.054	<0.0001	<0.001	0.001
20-07-20	0.017	<0.001	0.014	0.045	<0.00001	0.0001	<0.001	<0.001	0.21	0.0004	0.476	0.0001	<0.001	<0.0001	0.0018	<0.0001	0.083	<0.0001	<0.001	<0.001
20-08-19	0.053	<0.001	0.022	0.083	0.00002	0.0005	<0.001	<0.001	**0.61**	0.0004	2.150	<0.0001	0.002	0.0002	0.0029	<0.0001	0.113	<0.0001	<0.001	0.001
20-09-24	**0.250**	<0.001	0.008	0.053	0.00002	0.0001	<0.001	<0.001	**0.35**	0.0005	0.091	<0.0001	<0.001	0.0002	0.0011	<0.0001	0.043	<0.0001	<0.001	0.001
20-10-21	**0.201**	<0.001	0.008	0.046	<0.00001	0.0001	<0.001	<0.001	**0.62**	0.0005	0.187	<0.0001	0.001	0.0001	0.0014	<0.0001	0.044	0.0001	<0.001	0.001

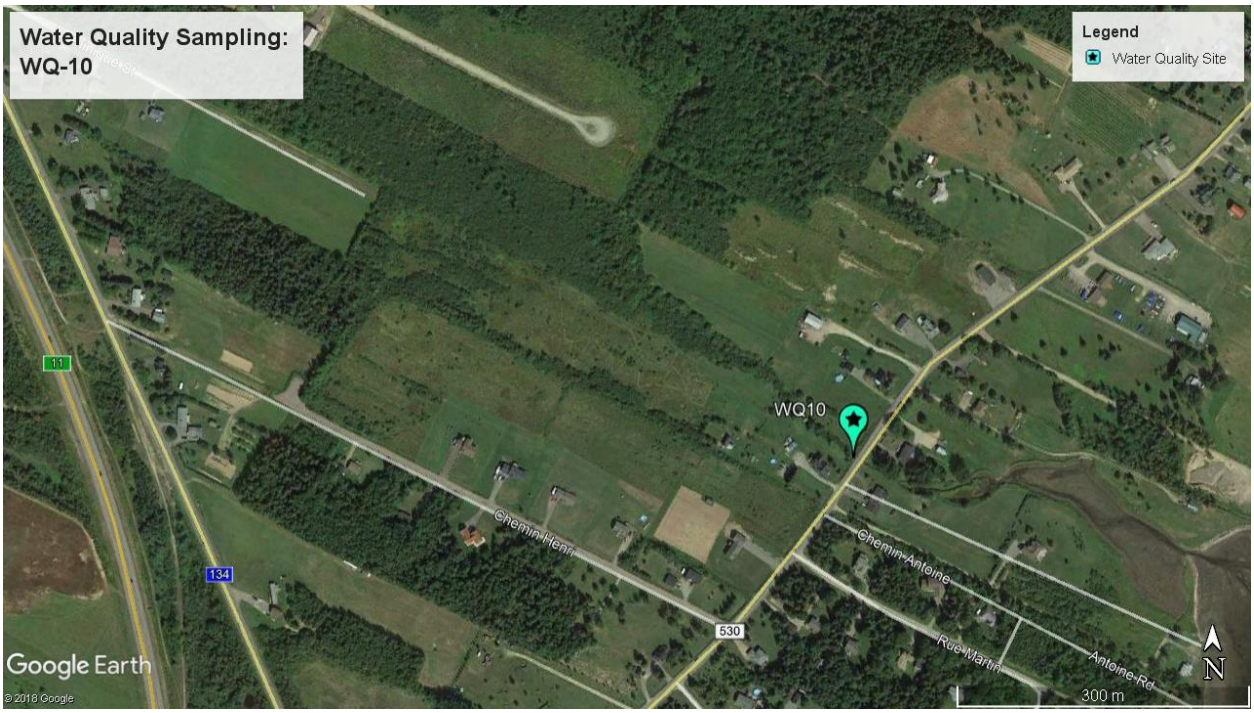


Figure 21: WQ-10 site location and surrounding land uses

Figure 22: Site photos for the water quality monitoring station WQ-10

3.12 **WQ-11B**

This water quality sampling site is located off Route 530 (Grande-Digue Rd.), just before the Chemin des Soeurs. The samples are taken upstream of the culvert. The sample site is located approximately 80 m from the tidal zone. The surrounding land uses is mainly residential and agricultural farms. The farm lands are made up of various parcels of land, spanning over 58 hectares of land leading up to the watershed boundary. There is very little evidence of any tree buffer over this area from aerial imagery, except for one forested parcel and a few thin lines of trees along property lines.

The water sampling results for the site WQ-11B, for 2020, meet the recommendations for the survival of freshwater aquatic life based on pH. However, the levels of dissolved oxygen levels fell below the recommendation (6.5 mg/L) for general cold-water organisms in July (1.96 mg/L), August (2.09 mg/L), September (2.95 mg/L) and October (4.28 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 October; in the eutrophic range (0.035 – 0.100 mg/L) in June and September; and in the hyper-eutrophic range (>100 mg/L) in July and August.

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 reached or exceeded the CCME water quality guideline (0.100 mg/L when the pH is ≥6.5) in the samples taken in July (0.160 mg/L), August (0.100 mg/L) and September (0.142 mg/L). Concentrations of iron exceeded the CCME water quality guideline (0.3 mg/L) in June (0.44 mg/L), August (1.00 mg/L), September (0.50 mg/L) and October (0.50 mg/L).

There are three samples that have been flagged for boron. It is important to note that this site is impacted by tides, and that marine water disqualifies several flagged parameters that only apply to freshwater, and that includes boron. There is a correlation between the flagged samples of boron and the high salinity content shown in Table 39.

Bacterial levels did exceed the maximum concentration of E. coli from Health Canada recreational guideline (≥ 400 MPN/100 mL), for all the samples taken in 2020: June (480 MPN/100 mL), July (>24,196 MPN/100 mL), August (670 MPN/100 mL), September (4,352 MPN/100 mL) and October (504 MPN/100 mL).

Table 39: Water chemistry data and *E. coli* results for WQ-11B, 2020

SITE WQ-11B: 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	
20-06-16	30	20.7	0.32	9.9	480	91	16	0.600	2.250	153.0	-0.70	7.82	7.40	8.10	422.50	951	4.60
20-07-20	31	22.0	24.88	1.96	> 24,196	130	16	37.100	3.340	2,490.0	-0.10	7.12	7.20	7.30	25,486.00	15400	7.50
20-08-19	27	22.8	25.82	2.09	670	120	18	38.740	35.200	3,040.0	0.49	7.20	7.70	7.20	26,318.00	18400	8.40
20-09-24	18	12.7	9.07	2.95	4,352	58	23	11.990	3.230	362.0	-1.11	6.55	7.00	8.10	10,153.50	1590	5.80
20-10-21	10	10.6	3.55	4.28	504	100	16	4.810	3.910	359.0	-0.62	6.72	7.30	7.90	4,309.50	1980	3.30

Table 40: Nutrient results for WQ-11B, 2020

SITE WQ-11B: 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)
20-06-16	90.8	0.89	27.8	0.214	620.0	0.26	5.90	20.20	132.0	<0.05	<0.001	<0.05	0.14	0.14	84	—	0.4	3.1	0.038
20-07-20	130.0	23.70	186.0	0.193	9,570.0	1.23	151.00	492.00	4,040.0	0.07	<0.001	<0.05	<0.05	<0.05	930	—	0.6	5.5	0.115
20-08-19	119.0	31.40	226.0	0.563	10,700.0	1.25	182.00	600.00	5,370.0	0.25	0.005	<0.05	<0.05	<0.05	1190	—	0.6	8.0	0.110
20-09-24	57.9	2.51	49.0	0.054	879.0	0.25	16.40	58.10	426.0	0.11	<0.001	<0.05	<0.05	<0.05	121	—	0.5	6.8	0.046
20-10-21	99.8	2.68	46.7	0.187	1,230.0	0.27	15.90	58.80	419.0	0.15	0.001	<0.05	<0.05	<0.05	145	—	0.4	4.2	0.026

Table 41: Inorganics results for WQ-11B, 2020

SITE WQ-11B: 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)
20-06-16	0.082	<0.001	0.075	0.051	<0.00001	0.0002	<0.001	<0.001	0.44	0.0024	0.570	0.0004	<0.001	0.0002	0.0024	<0.0001	0.177	0.0003	<0.001	0.001
20-07-20	0.160	<0.05	1.940	0.140	<0.0005	0.005	<0.05	<0.05	<1	0.0630	1.850	<0.005	<0.001	<0.005	0.0470	<0.005	3.080	<0.005	<0.05	<0.05
20-08-19	0.100	<0.05	2.430	0.140	<0.0005	<0.005	<0.05	<0.05	1.00	0.0770	1.470	0.005	0.005	<0.0001	0.0610	<0.005	4.070	<0.005	<0.05	<0.05
20-09-24	0.142	<0.005	0.176	0.088	<0.00005	<0.0005	<0.005	<0.005	0.50	0.0039	0.585	<0.0005	<0.001	<0.0005	0.0047	<0.0005	0.418	<0.0005	<0.005	<0.005
20-10-21	0.037	<0.005	1.720	0.078	<0.00005	<0.0005	<0.005	<0.005	0.50	0.0051	0.806	<0.0005	0.001	<0.0005	0.0049	<0.0005	0.417	<0.0005	<0.005	<0.005

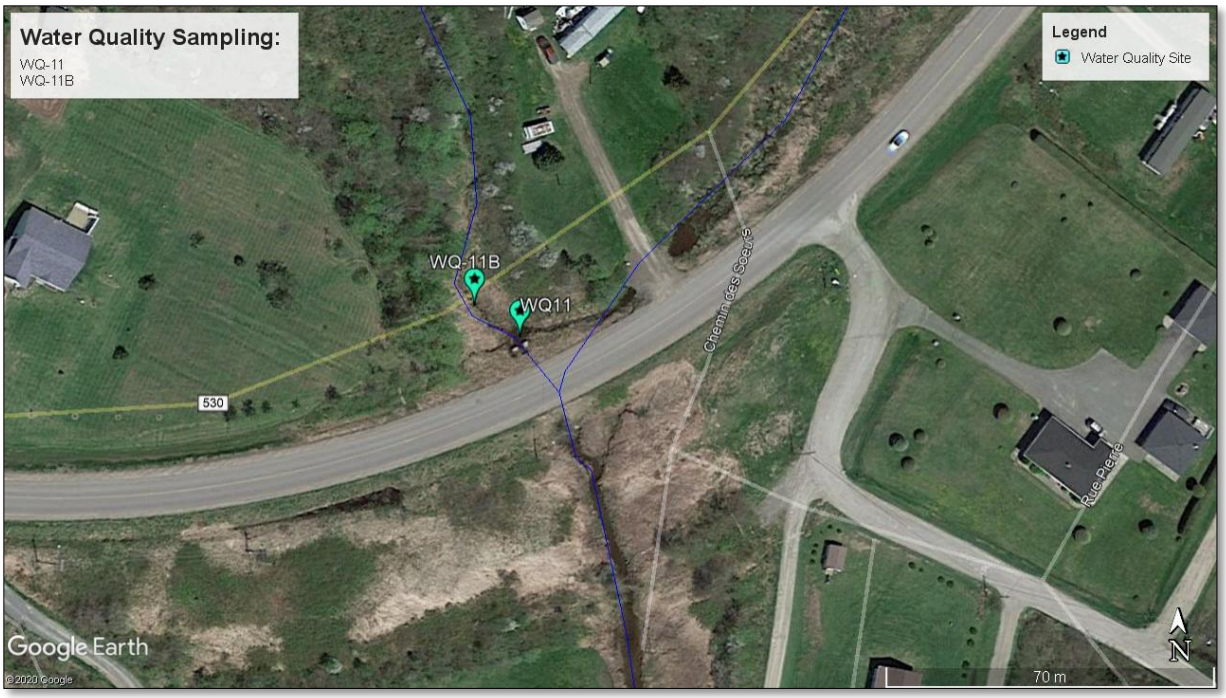


Figure 23: WQ-11B site location and surrounding land uses

Figure 24: Site photos for the water quality monitoring station WQ-11B

3.13 **Bacterial Sampling Summary**

The bacterial levels measured in 2020 in the small tributaries of the Shediac Bay 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 in June and July. The rain event sampling took place in September, with 12.3 mm of rainfall on Sept. 23 (according to the data from the weather monitoring station at the Greater Moncton Romeo Leblanc International Airport). In August and October, there was light rain in the 24 hours prior to the samplings (1.8 mm and 0.6 mm respectively).

Only one site remained below the limits for *E. coli* based on Health Canada Recreational Guidelines, even following the rain event sampling: WQ-1. All other sampling stations had at least one event that surpassed the recommended 400 MPN/100 mL. Two sites reached or surpassed the maximum detection limit of 24,196 MPN/100 mL; WQ-3 and WQ-11B.

The site WQ-3 has not been a station of concern in the past; the highest level of bacteria recorded before the August 2020 sample was 4,839.2 MPN/100 mL, in July of 2018. The site WQ-11B was over the detection limit in July, when the weather had been in a hot and dry spell. This watercourse had consistently high bacterial levels this year, and is targeted for additional investigation.

The site WQ-8 is a station of concern that is being closely monitored. Bacterial levels were consistently high throughout the sampling season. The site WQ-10 has also been consistently high this year, when on average, approximately 50% of samples collected from 2017 to 2019 were above the guideline. The sites WQ-8 and WQ-10 had the second-highest *E. coli* levels.

These are the highest recorded bacterial levels in this monitoring program since its beginning in 2017. The sites that are showing trends of having high contamination levels will be a priority for further investigation and remediation projects.

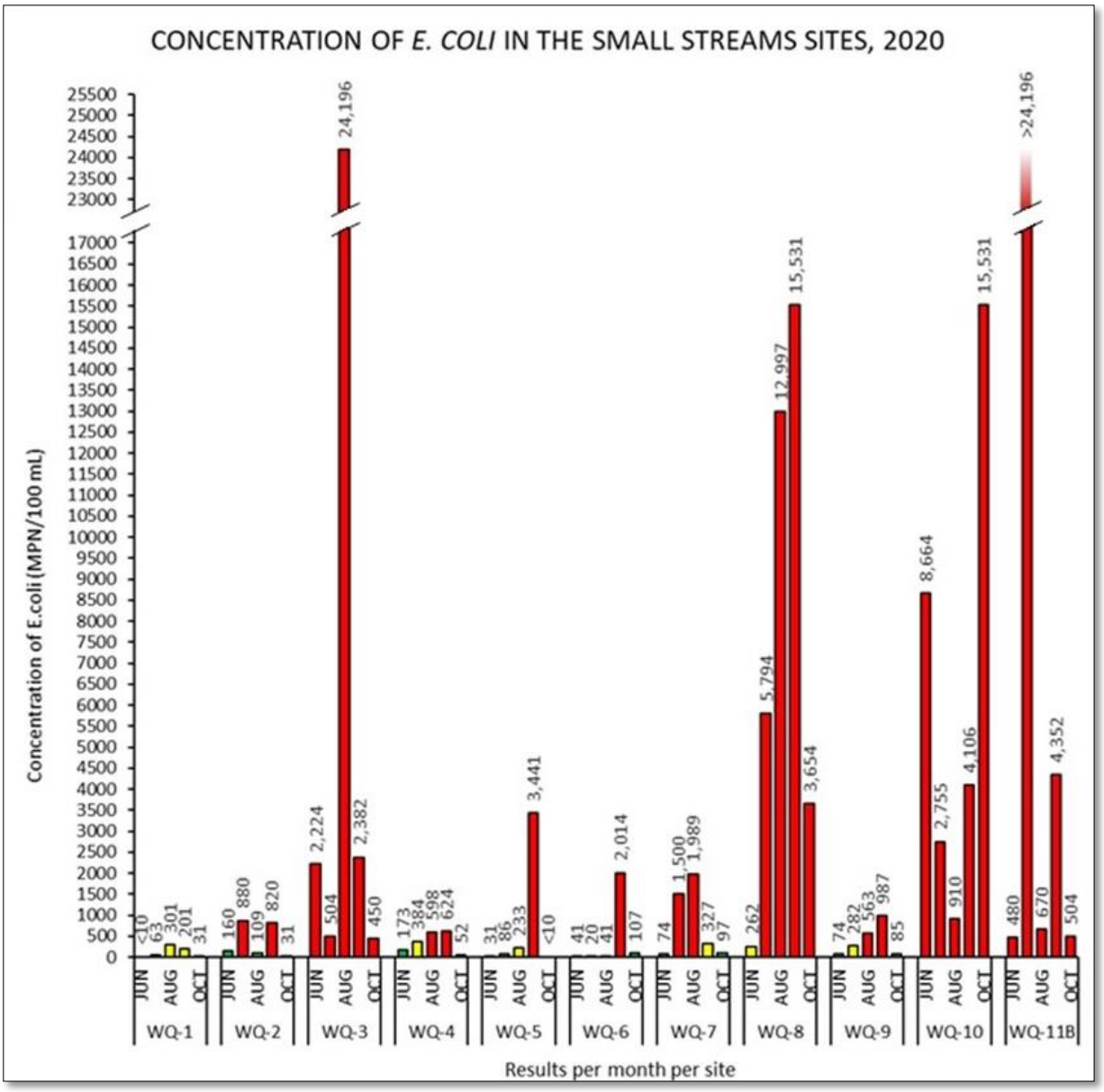


Figure 25: Summary of water quality results for *E. coli*, small streams sampling 2020

3.14 **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 11-water quality monitoring sites in 2020 has demonstrated high levels of diffused sources of bacterial contamination. 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 small tributaries of the Shediac Bay.

All pH levels were found to be within the guidelines; between 6.5 and 9. However, dissolved oxygen was very poor in certain areas during the summer months. With very warm temperature and long periods without rain in the 2020 sampling season, the water in some of those sampling sites became very warm and depleted of its dissolved oxygen. High levels of bacteria and algal growth caused by excessive nutrients are also factors that depletes the dissolved oxygen available for aquatic life due to biological oxygen demand (BOD). Several of these urbanized and agricultural streams have suffered a loss of its forested buffer zones, creating a lack of shade that helps to keep the water temperatures down. Given the direct correlation between water temperature and dissolved oxygen levels, reforestation of urban and agricultural stream's buffer zone would greatly benefit aquatic habitats by keep the water colder and thus, maintain a suitable level of dissolved oxygen for cold-water species.

Looking at the averages of total phosphorous levels (TP-L), 1 stream (WQ-1) falls within the meso-eutrophic range (0.020 – 0.035 mg/L), 8 out of the 11 streams (WQ-2, WQ-3, WQ-4, WQ-5, WQ-6, WQ-9, WQ-10 and WQ-11) falls within the eutrophic range (0.035 – 0.100 mg/L), and 2 streams (WQ-7 and WQ-8) falls into the hyper-eutrophic range (>0.100 mg/L). The site WQ-8 had total phosphorous levels in the hyper-eutrophic range in 4 out of the 5 samples in 2020, with the highest level of 0.990 mg/L in September. The highest level of total phosphorous recorded this year was 1.140 mg/L, at the site WQ-7 in July. These levels of total phosphorous must be evaluated for possible long-term impacts on the Shediac Bay.

4 Eelgrass Monitoring in the Shediac Bay

The *SeagrassNet* program is a global seagrass monitoring network that monitors the status of seagrass and the threats to these ecosystems. The program started in 2001, and now includes more than 126 sites in 33 countries.

The Southern Gulf of Saint Lawrence Coalition on Sustainability (Coalition-SGSL) has implemented the SeagrassNet program in Atlantic Canada since 2015. They have provided equipment and training to the SBWA for the monitoring program to begin in the Shediac Bay. The first monitoring site was established in the estuary of the Scoudouc River in 2016, and a second site was established in the Shediac River estuary in 2017. In 2018, a third monitoring site was added in the Shediac Bay, near the mouth of the South Cove Estuary (in Pointe-du-Chêne). The final site was established in 2019 on the north shore of the bay in Grande-Digue.

The data collected from these annual surveys will serve to measure changes in eelgrass density in these sensitive habitats. Since the first appearance of the invasive green crab in the Shediac Bay in 2010, Green crab population varies between years. The green crab is an invader is capable of devastating eelgrass habitats. The SeagrassNet program provides a protocol to measure the impacts of the green crab in the Shediac Bay. The protocol for the sampling can be found at www.seagrassnet.org.

Reports on eelgrass and green crab monitoring are included in annexes of this report and will be available on the SBWA website. The reports will give an update on data recorded.

Figure 26 Sampling quadrant for eelgrass and Green crabs in sampling trap

5 Living Shoreline Workshops

The coastline in Southeastern New Brunswick is impacted by climate change with sea level rise and a rise in storms such as hurricanes. In 2019 Hurricane Dorian caused extensive damage along Shediac Bay.

The environmental organisations in Southeastern New Brunswick received a number of calls from citizens for information on shoreline protection. It was decided in September 2019 that 3 groups, the Shediac Bay Watershed Association (SBWA), the Groupe de développement durable du Pays de Cocagne (GDDPC) and Vision H2O would collaborate on education and restoration of the coastal zone. Since the issues are similar for the organisations, capacity building and outreach materials could be shared.

The SBWA received a request from Ocean surf Campground in Pointe-du-Chêne for information on how to repair damages to their coastline from hurricane Dorian and restore the natural environment. This was received as an opportunity to implement a trial restoration project and increase the capacity of the organisations in shoreline restoration.

A workshop proposal was drafted. The organisation Helping Nature Heal was contacted to provide their expertise in coastal restoration and public education. The partnership with Helping Nature Heal began in 2019 when the GDDPC and the SBWA held an information session on shoreline restoration in Shediac Cape.

This project was proposed to the Environmental Trust Fund. At that time, the Commission de services regionals de la Péninsule Acadienne also wanted to do a workshop with Helping Nature Heal in the Acadian Peninsula. It was decided to include the CSR-PA in the project proposal and to organise two workshops in the same time frame.

Following the positive responses from the ETF in May 2020, the first meetings of the new GIN-South East (Natural Infrastructure Group - South East) took place in order to plan the restoration workshop with Rosmarie Lohnes and to collaborate on coastal erosion.

Eight meetings were held to plan the workshop (May 12, June 23, July 9, 14 and 22 and 23, August 12 and 18, 2020). We developed a workshop plan including all the necessary logistics for the workshop: leaders, materials, snacks, promotion, tickets, budget, Covid operation plan, etc.

A press release was sent out in July 2020 which was followed by several newspaper articles (Acadie Nouvelle, Moniteur). A Facebook event was created including online registration through the NBEN. In addition, a promotional video with Rosmarie Lohnes was published on Facebook. The invitation was distributed to our members and friends of the groups. In addition, the activity was added to the NBEN calendar and the organizers' websites.

In July, we participated in several field visits with Rosmarie Lohnes. We visited the restoration site for the workshop in Shediac on the Ocean Surf campground and this allowed us to meet the owners, employees and neighbours of the campground who welcomed us with open arms.

Then we visited other potential restoration sites in Cap-Bîmet and Cocagne. After the workshop in August, several visits followed in Cocagne, Grand-Barachois and Bas-Cap-Pelé. Often, landowners, neighbours and other interested people participated and there were many exchanges and strong interest. These were very much appreciated as we were able to observe and discuss with an expert in the field.

5.1 Workshop results

The two workshops in Northern and Southern New Brunswick followed the same format: one day of preparation with local groups followed by a day-long conference in the morning and with the hands-on restoration portion in the afternoon. The first workshop was held on Wednesday, August 26th in Inkerman with the restoration on the Pokemouche River. Despite the strong winds, there was a very good participation of 50 people.

The second workshop was held on Friday, August 28, 2020 in Shediac with the restoration on the coast. The participation was also very good with 50 people. Participants were from various backgrounds such as residents and staff of the campground, city councillors, university professors, watershed group staff and waterfront property owners.

The workshop committee was organised with an operational plan to conform to public health restrictions to prevent the spread of COVID-19. The workshop provided a great experience for the organisers and the public. The workshop was a great community effort to deal with erosion using natural and affordable methods, which seems like a good alternative to rip rap only.

A total of 240 metres of shoreline were stabilized using Living Shoreline techniques in Shediac. The techniques learned were the use of berms, alder fencing, brush mats, chevrons and planting native vegetation. All the exposed soil was covered with hay, requiring a total of 50 bales for the event.

Figure 27 : Participants applying Living Shoreline techniques

The participants planted a total of 24 native trees and 64 native shrubs. Around 50 native plants were also included in the restoration.

Figure 28 : Participants and organizers of the 2020 Living Shoreline workshop

6 Boater Awareness Program

The Shediac Bay Marina received Blue Flag certification in 2019. The Blue Flag certification requires that marina's display information relating to local ecosystems and environmental elements. Environmental education and engagement activities are also encouraged.

The SBWA a privileged partner with the marina and helps coordinate environmental awareness activities. In 2019, an eelgrass interpretation panel was installed at the marina.

Boater education was expanded in 2020 through a partnership with the New Brunswick Invasive Species Council. This program aims to reduce the spread of undesirable aquatic species. Boat owners are informed to clean, empty and dry all boats, trailers, motors and equipment before changing water bodies. This practice helps prevent the introduction of invasive species such as green crab or invasive tunicates into New Brunswick bays.

Two signs provided by the New Brunswick Invasive Species Council were installed at the Shediac Bay Yacht Club in the summer of 2020.

Figure 29: Boater awareness signs installed at the Shediac Bay Yatch Club

7 Beach Sweep

In celebration of World's Oceans Day, a public beach sweep event is organized every year by the SBWA, in partnership with the Town of Shediac. This activity aims to combat marine litter, to raise awareness, and contribute to the protection and conservation of our marine environment in the Shediac Bay.

This year due to the COVID-19 pandemic the event was modified. Our beach sweep was included with the community clean-up event coordinated by the municipalities in Southeastern New Brunswick as part of the Ecovision2025 green strategy. The community clean-up day was replaced by an awareness and clean-up week beginning May 31 and ending with Ocean Day on June 8. A committee was set up to coordinate this activity.

Invitations to participate were sent out on May 13. Due to health restrictions that prevented gatherings, guidelines were added to the event's publications to encourage people to practise good habits that ensure the safety of all citizens. Participants were required to clean with people from their family bubble. They were asked to share their results with the municipalities or by posting with the hashtag #nettoyageecovisioncleanup2020.

Shediac Bay Watershed Association staff each chose a section of shoreline to clean individually during this initiative.

7.1 Results

The Facebook event reached 6064 people. However, few people confirmed their participation through this means. Only 23 people expressed their interest in the event (including 2 organizers).

The City of Shediac only received one photo, but estimates that there were about 30 participants at the event. The amount of garbage collected by the public was not compiled.

The Shediac Bay Watershed Association staff collected approximately 100 lbs of garbage, including rope, plastic, metal, packaging, cans, roof shingles and a huge block of polystyrene foam.

The traditional beach sweep will resume in 2021 if public health restrictions permit to safely organize the event.

Figure 30 : SBWA staff cleaning shorelines during the community clean-up week

8 Tar clean up

The Shediac Bay Watershed Association was alerted by a citizen of a tar pile on a beach in Beaubassin-Est. The tar was being eroded in the sea. The tar originated from previous industrial uses of the property.

A plan was formed to collect and dispose of the tar patch. The provincial and federal environmental authorities were contacted to ensure that the necessary permits were obtained. No special permits were required for the operation.

Permission to access the site was granted by the rural community of Beaubassin Est and Le Rivage condominiums.

Local environmental groups were invited to help with the clean-up. Each group had an operational plan for COVID-19. Thanks to our friends at Vision H2O, the Pays de Cocagne Sustainable Development Group, Bird Canada and other community volunteers for their help.

The tar was manually picked up with shovels and buckets on October 29, 2020, a beautiful sunny day.

A half-ton truck load of sand and tar was collected. The load was transported to Regional Petroleum Products Recycling in Saint John for decontamination and proper disposal.

Figure 31 : Tar patch and cleanup crew

9 Salt marsh educational park in Pointe-du-Chêne

A partnership has been initiated between the Anglican Parish of Shediac and the Shediac Bay Watershed Association and Ducks Unlimited to develop an educational park on a parcel of land in Pointe-du-Chêne.

We envision coordinating a Wetland Center of Excellence (WCE) program at this site (https://www.ducks.ca/initiatives/wetland-centres-of-excellence/). The site is eligible and first steps are being undertaken to implement this program. Permission was granted to bring school groups to the site.

However, because of the Covid-19 pandemic no meetings were possible with the Anglican Parish. Duck unlimited also put on hold the WCE program in 2020.

The project has been postponed until further notice.

10 Living Shoreline Video

The SBWA produced a video on Living Shorelines for the New Brunswick Environmental Network. The video is available on Youtube and was shared on Facebook.

Figure 32: Living Shoreline video Facebook post

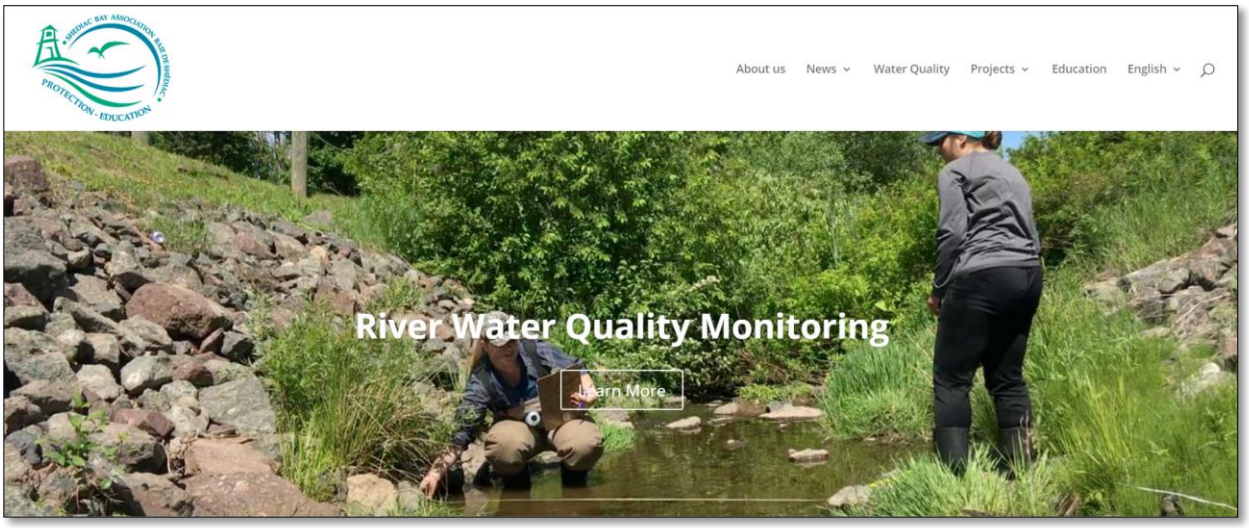
11 Media Outreach

11.1.1 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.

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

12 Closing Comments

The evaluation and stewardship of Shediac Bay program has terminated its fifth year. The aim of the program is to identify areas and ecosystems that can benefit from restoration activities and gather data on the health of the Shediac Bay.

The water quality monitoring this year has shown several instances of high bacterial counts in small streams. Land use around these areas will continue to be examined to determine if the causes of the contamination can be found. Landowners will be invited to participate in restoration efforts and stewardship programs to reforest the buffer zones of urbanized streams.

When dealing with non-point source pollution in a watershed, one cannot be expected to solve the issues of human activities overnight. Problems related with stormwater runoff and faults in both private and municipal infrastructure can take several years and even decades to be detected and resolved. Collaborations between environmental groups, businesses, private citizens, homeowners and government are crucial in the development and implementation of an action plan. For example, the Shediac Bay Watershed Association has put in place a storm water management program to reduce runoff within the municipality of Shediac.

The eelgrass monitoring program was continued and will be used to assess the evolution of eelgrass beds in Shediac Bay. Sites that have been sampled over several years are already showing changes. However, several more years of sampling are required to see trends. Participation in the Southern Gulf of St. Lawrence Coalition eelgrass working group will enable comparisons between different bays in New Brunswick, Nova Scotia and Prince Edward Island.

A decrease in eelgrass coverage was noted in 2020. The probable cause is the impact of Hurricane Dorian in the fall of 2019. This hurricane caused a lot of damage to coastal infrastructure. Eelgrass at the Shediac Bridge site has almost completely disappeared. The Grande-Digue site on the north shore of the bay was more sheltered from the winds and suffered less damage. Long-term monitoring of the sites will allow us to measure the recovery of these eelgrass beds.

The average number of plants in the quadrants increased in 2020 despite a decrease in the average % coverage. Sampling in 2021 will be used to determine if plantings can help restore the initial cover measured in 2019.

Green crab catches decreased in number in the summer of 2020. Total catches were 168 green crabs. The maximum of 928 crabs caught was reached in 2016. The monitoring of eelgrass and green crabs will make it possible to establish the impact of the arrival of this invasive species in Shediac Bay. More details on the monitoring of green crabs are described in the report available on our website.

In the coming years, there will be sufficient data to establish conservation and restoration priorities. Meetings with the Southern Gulf of St. Lawrence Coalition on Sustainability and the Department of Fisheries and Oceans will determine if restoration activities are feasible and desirable. The SBWA wants the ecological integrity of Shediac Bay to be maintained in the face of invasive species and climate change.

A coastal restoration and protection committee was started with neighbouring environmental groups to help coordinate efforts along the coast of South Eastern New Brunswick. This group is involved in planning priorities for conservation of the coastal zone. More demonstration sites and education projects are proposed for 2021.

There was great interest in the coastal restoration workshop from the public. A second workshop is proposed for 2021 in partnership with the Town of Shediac.

Unfortunately, the Wetland Center of Excellence program was postponed due to the pandemic. We hope to engage the local community and schools in this program soon.

The Shediac Bay Watershed Association will continue the various educational campaigns around the health of the Shediac Bay. Stewardship activities with the public such as shoreline clean-ups and tree planting activities will resume as soon as public health regulations permit.

The partnerships with the local marinas will continue to promote best practices for boaters of Shediac Bay. Other partnerships such as the beach sweep with the Town of Shediac will help increase awareness around the importance of a healthy environment. Educational materials will continue to be produced by the SBWA for all its projects.

The Shediac Bay Health Evaluation project has gathered a wide range of information since 2016. The project will continue to expand in the coming years with increasing partnerships. There is still more that can be done to advance our knowledge. As the project evolves, the Association will concentrate on more stewardship projects to help improve the environment around Shediac Bay.

Figure 33: Salt marsh in Grande-Digue

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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