# St. Mary's River Association

Year 2 Fish and Fish Habitat Monitoring Report



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# Contents

1.0 Introduction and Background	
1.1 Scope of Work	
1.2 Temperature Monitoring	5
1.3 pH Monitoring	7
1.4 Habitat Suitability Index Surveys	9
1.4.1 HSI Methodology	9
1.4.2 HSI Spreadsheet Evaluation and Interpretation	
1.4.3 Channel Width	
1.4.4 Channel Depth	
1.4.5 Pool Class Rating	
1.4.6 Percent Pool Habitat	
1.4.7 Substrate	
1.4.8 Instream Cover	
1.4.9 Spawning Habitat	
1.4.10 Riparian Zone Vegetation	
1.5 Electrofishing Surveys	
1.6 Redd Counts	
2.0 Study Site Breakdown	
2.1 Barren Brook	
2.1.1 HSI Assessment Analysis	
2.1.2 Aerial Photographs and Analysis	24
2.1.3 Redd Surveys	
2.1.4 Electrofishing Results	27
2.2 Garden River	
2.1.1 HSI Assessment Analysis	
2.2.2 Aerial Photos and Analysis	
2.2.3 Redd Counts	
2.2.4 Electrofishing Results	
2.3 Fraser's Brook	
2.3.1 HSI Assessment Analysis	
2.3.2 Aerial Photos and Analysis	45
2.3.3 Redd Counts	
2.3.4 Electrofishing Results	
2.4 Cross Brook	
2.4.1 HSI Assessment and Analysis	
2.4.2 Aerial Photographs and Analysis	54
2.4.3 Redd Survey Results	56
2.4.4. Electrofishing Results	56
2.5 Moose River	
2.5.1 HSI Assessment Analysis	59
2.5.2 Aerial Photographs and Analysis	63
2.5.3 Redd Counts	64
2.5.4. Electrofishing Results	65
2.6 McKeen Brook	67
2.6.1 HSI Assessment Analysis	
2.6.2 Aerial Photographs and Analysis	71

2.6.3 Redd Counts	73
2.7 North River St. Mary's	73
2.7.1 HSI Assessment and Analysis	74
2.7.2 Aerial Photographs and Analysis	75
3.0 Instream Restoration Planning	76
4.0 References	78
Appendices	
Appendix A: Water Quality	
Appendix B: Structure Design Photos	
Appendix C: Habitat Suitability Index Surveys	91
Barren Brook	91
Garden River	94
Frasers Brook	
Cross Brook	
Moose River	
McKeen Brook	
Appendix D: Electrofishing Results	
Barren Brook	
Garden River	
Fraser's Brook	
Cross Brook	
Moose River	
Appendix E: Geology and Soil Maps	
List of Tables	
Table of Figures	

# 1.0 Introduction and Background

In 2023, the St Mary's River Association (SMRA) received funding from Aquatic Ecosystem Restoration Fund (AERF) through the Department of Fisheries and Oceans (DFO) to conduct a five-year restoration and monitoring project that will cover seven rivers within the watershed. The funding breakdown can be found in Table 1. This project will follow the objectives set out in the four-year restoration and monitoring plan proposed in the SMRA's "Habitat Assessment and Restoration Plan for the East River St. Mary's". High-priority areas of the west and main branch will also be addressed. The restoration and monitoring in the ensuing years will focus on the implementation of important staging pools for Atlantic salmon migration along with priority tributaries on the West Branch St. Mary's.

The goals of this project are to (1) improve fish habitat and population and (2) to quantitively capture baseline and post-restoration data so that the restoration aspect of the project will be carried out with a strong scientific context.

In accordance with Schedule 7 (A to D) of the funding agreement, year-end reports are to be submitted annually and report on the activities carried out within a fiscal year (April 1<sup>st</sup> – March 31<sup>st</sup>).

Fiscal Year	Amount AERF Cash
2023-24	\$150,000
2024-25	\$550,000
2025-26	\$665,000
2026-27	\$200,000
Grand Total	\$1,565,000

#### Table 1. Annual Funding Breakdown.

The St. Mary's River is one of the largest watersheds in Nova Scotia at 1,538 km<sup>2</sup>, and its four branches total 250 km in length and span over four counties. A map of the watershed can be viewed in Figure 1. The East River branch begins in the community of Garden of Eden, Pictou County, and flows for 35.6 km to its confluence with the three other branches in the community of Glenelg, Guysborough County. The West River begins in the community of Trafalgar, Halifax County, and flows for 75.5 km to Glenelg. The North River begins in the community of Glen Alpine, Antigonish County, and flows for 26.25 km, including the large Lochaber Lake, to Glenelg. The main branch, beginning at the confluences in Glenelg, flows for 29.6 km to the community of Sonora, where it empties into the Atlantic Ocean.

The St. Mary's River is considered part of the Southern Uplands population of Atlantic salmon (*Salmo salar*), which has been considered endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) since 2010. It is not listed on the Species At Risk Act (SARA). The General Status of Species in Canada lists Atlantic salmon as S1, or critically imperiled (Wild Species, 2020). It lists brook trout (*Salvelinus fontinalis*) as S3, or vulnerable (Wild Species, 2020). Brook trout are not ranked by COSEWIC and are not listed on SARA. The St. Mary's River watershed is also home to terrestrial species-at-risk, including mainland moose (*Alces alces americana*) and wood turtle (*Glyptemys insculpta*). A wood turtle observed during surveying can be seen in Figure 2.



Figure 1. Map of St Mary's River watershed boundaries and location within Nova Scotia

Prior to European settlement, the St Mary's River was frequently used by the Mi'kmaw as both a source of food and as a major transportation route to and from the interior. It was known in Mi'kmaq as Napu'saqnuk, meaning "at the place of stringing beads." Fish that were once common throughout the watershed, such as Atlantic salmon and American eels, played a major role in the lives of Mi'kmaw people both before and after colonization.



Figure 2. Wood turtle observed nesting in Garden River during HSI assessments

After the arrival of Europeans, the St. Mary's River watershed became dominated by forestry. It was also used for commercial fishing, agriculture, and mining for gold and lead. The creation of mill dams that severely impeded fish passage and the use of log drives which resulted in the over-widening of waterways

significantly impacted Atlantic salmon populations in the 19<sup>th</sup> century. From 1815-1855, roughly 30 mills a year were constructed in Atlantic Canada. In Nova Scotia alone, there were a total of 1798 mills in 1851. Prior to 1870, as much as 50% of Atlantic salmon habitat was degraded, with up to 80% of habitat being impacted by dams (COSEWIC, 2010). While many of the historical mills are no longer operational and log drive no longer occur, many streams still contain remnants of old infrastructure, and are still impacted by runoff, erosion, and habitat degradation from modern industrial forest harvesting.

Despite historical impacts and declines, the St. Mary's River was long renowned as a world-class Atlantic salmon fishing river. Throughout the 1900s, locals and tourists alike flocked to the region to angle for these charismatic fish. For those who lived in the watershed, Atlantic salmon were about more than sportfishing for trophies, they were an invaluable food source and a way of life. However, by the mid-to-late 20<sup>th</sup> century, Atlantic salmon populations throughout Atlantic Canada declined to unsustainable levels. In 1984, commercial salmon fishing was closed for the entirety of the Maritimes, and a catch-and-release recreational fishery for large salmon was implemented. By 1992, the catch-and-retain fishery for all salmon in the Maritimes was closed. Today, the Atlantic salmon fishery remains closed for the St Mary's River and the entirety of the Southern Uplands population of Atlantic salmon. The recreational fishery for brook trout remains a popular draw throughout the St. Mary's River watershed.

On top of being impacted by historical habitat degradation from forestry, agriculture, and overfishing, the St. Mary's River continues to be affected by modern threats. Freshwater acidification is a major issue throughout the Southern Uplands region, and the St. Mary's is no exception. Sulphur emissions from industrial manufacturing throughout the 20<sup>th</sup> century created acid rain and significantly reduced freshwater pH levels below the 5.5 threshold for Atlantic salmon and brook trout. Despite international efforts in the 1990s to cap sulphur emissions, acidification has remained a persistent issue in Nova Scotia due to its predominant acid-leaching surficial geology.

Climate change is another major issue impacting native salmonids. Both Atlantic salmon and brook trout are cool-water species, and begin to experience detrimental health effects when water temperatures exceed 23°C. In Atlantic Canada, air temperatures are predicted to rise by 2°C to 6°C on average over the next century (COSEWIC, 2010), and the impact this will have on previously threatened salmonids is yet unknown. Combatting climate change and mitigating its impacts through habitat restoration and thermal refugia creation are key conservation elements for salmon and trout.

# 1.1 Scope of Work

The goal of collecting pre-restoration monitoring data is to establish baseline habitat conditions in the seven tributaries to the St. Mary's River where restoration will be completed in the subsequent years. Monitoring data is collected to scientifically track the success of in-stream restoration work. Monitoring is structured to record and evaluate:

- Water Temperature
- pH Levels
- Physical Habitat (i.e. pool quality meander sequences, etc.)
- Biological Metrics:
  - Juvenile abundance Spawning densities

Monitoring of physical habitat dimensions is completed using Habitat Suitability Index (HSI) surveys, adapted by the Nova Scotia Salmon Association (NSSA), which records metrics related to instream habitat such as thalweg depth, potential spawning areas, substrate composition, and percentage of instream cover. The results of the HSI surveys can be found in Appendix C. Biological parameters will be quantified using electrofishing surveys and redd counts. Electrofishing will be carried out annually between August and September. Redd counts are carried out in November and will act as a method of tracking the distribution of spawning areas within the watersheds.

Of the seven tributaries, one is the North Branch of the St. Mary's River, four are located on the East River St. Mary's and two are located on the West River St. Mary's. Garden River, Pictou County; Moose River, Pictou County; Fraser's River, Guysborough County; and McKeen Brook, Guysborough County are located on the East River. Cross Brook and Barren Brook, both located in Guysborough County, are located on the West River. A breakdown of the project tributaries can be found in Table 2, while a map of the tributaries can be viewed in Figure 3.

#	Name	Watershed Size (km²)	Avg Calculated Bankfull Width (m)	Stream Length (m)	Aquatic Habitat (m²)
1	Barren Brook	50.03	10.53	15,955.2	168,008.26
2	Garden River	34.14	9.43	14,823.6	139,786.55
3	Frasers Brook	13.81	7.26	9,101.0	66,073.26
4	Cross Brook	53.19	11.43	15,259.9	174,420.66
5	Moose River	47.90	10.40	18,067.5	187,902.00
6	McKeen Brook	79.11	12.02	9,790.2	117,678.20
7	North River St. Mary's	113.44	13.33	29,932.5	1,568,650.41

#### Table 2. Breakdown of subwatersheds of study.



Figure 3. Project watersheds and locations in St Mary's River watershed.

# 1.2 Temperature Monitoring

Fifteen HOBOware temperature probes were deployed throughout the watershed from May 27<sup>th</sup> to October 9<sup>th</sup>, 2024. Temperature probes were programmed to record temperatures at 15-minute intervals and were deployed for the hottest months of the year to identify temperature trends. Atlantic salmon begin to suffer detrimental effects when water temperatures reach or exceed 23°C for more than 24 hours. Atlantic salmon fry are more resilient, and can withstand temperatures up to and below 27°C.

Two probes were deployed in each of McKeen Brook, Fraser Brook, Garden River, Moose River, Cross Brook, and North River. One probe was deployed in Barren Brook and Black Brook. One probe was also deployed in the West River. A map of the probe locations can be seen in Figure 4, while a breakdown of site locations is available in Table 3. Temperature probes were secured with wire inside PVC pipes, which were then tied to bricks or cinderblocks. Blocks were placed into accessible but out-of-view areas and secured to trees with rope. All probes were retrieved intact.

Temperatures ranged from 5.27°C to 32.43°C, both recorded in Garden River. Average temperature for all sites was 18.41°C. Monthly averages for all sites ranged from 14.12°C to 22.68°C, below the 23°C threshold for Atlantic salmon. A breakdown of temperature probe data can be seen in Table 4. Fraser's Brook site FB01 did not have any days where water temperatures exceed 23°C or 27°C, while site FB02 only had two days of 23°C temperatures, indicating that this tributary may serve as thermal refugia for salmon and trout. North Branch site NR01 had 56 days - out of 133 days total deployed -exceeding 23°C, indicating the need for thermal refugia enhancement using instream structures. A breakdown of days exceeding salmonid temperature thresholds can be seen in Table 5.

Full temperature probe data can be viewed in Appendix A.

Tributary	Site	Probe ID#	Coordinates	Location Description
Moose River	MR01	21676962	45.430128, -62.312784	Near former beaver dam pond, off Kerrowgare Rd
	MR02	21676893	45.496802, -62.370927	~125m upstream from Moose River Rd. Crossing
Garden River	GR01	21676878	45.424965, -62.302361	Tied to large tree, beside Moose/Garden confluence
	GR02	21676892	45.443116, -62.303016	Tied to tree and tucked under boulder ~40m upstream
Fraser's Brook	FB01	21676949	45.357056, -62.126425	Tied to bridge at East River Rd crossing
	FB02	21676938	45.3747832, -62.1182079	Tied to tree ~20m downstream from College Rd crossing
North River	NR01	21676965	45.327606, -62.055160	Tied to hemlock tree on opposite bank from road
	NR02	21676917	45.382146, -62.043470	~50m downstream from College Rd crossing
McKeen's Brook	MB01	20356305	45.284625, -62.054393	Tied to tree below old concrete road pilings adjacent to current #7 Highway crossing
	MB02	21676940	45.279687, -62.037682	Tied to tree near confluence with tributary, through tree lot off McKeen Lake Rd.
Barren Brook	BB01	21676967	45.277513, -62.287982	Tied to tree ~15m downstream from Northside West River Rd crossing
Cross Brook	CB01	21676890	45.287683, -62.388726	Tied to tree under fallen log beside #347 highway crossing
	CB02	21676980	45.3425545, -62.4572718	Beside culvert at McIntosh/Calgar Rd crossing
West River	WR01	21676954	45.284935, -62.451661	At the bottom of new restoration road, near "Dan's Pool"
Black Brook	BLB01	21676977	45.391934, -62.172925	Tied to tree at newly-rock armoured corner pool

### Table 3. Temperature probe detailed locations.



Figure 4. Temperature probe locations in 2024.

Tributary	Site	June	July	August	Sept.	Overall	Min.	Max.
		Average	Average	Average	Average	Average	Temperature	Temperature
Moose	MR01	14.88	17.89	17.67	14.12	16.17	9.14	24.11
River	MR01	16.94	19.83	20.67	16.07	18.41	9.65	29.73
Garden	GR01	16.38	19.47	20.52	15.76	18.07	5.27	32.43
River	GR02	15.92	19.09	19.49	15.21	17.46	9.65	26.47
Fraser's	FB01	14.60	17.80	17.70	14.16	16.72	9.78	22.09
Brook	FB02	15.51	18.38	18.64	14.47	16.78	9.99	23.81
North	NR01	18.82	22.68	21.15	17.30	19.70	6.73	28.91
River	NR02	17.04	21.57	21.99	18.33	19.77	12.40	26.68
McKeen's	MB01	-	22.36	21.54	17.85	20.61	12.18	27.71
Brook	MB02	-	21.85	20.91	16.64	19.84	11.07	28.14
Barren	BB01	-	19.32	19.69	15.31	18.14	11.15	24.54
Brook								
Cross	CB01	-	19.39	18.37	14.36	17.41	9.95	24.32
Brook	CB02	-	19.25	19.92	15.27	18.18	9.99	26.85
West	WR01	-	21.73	22.39	17.44	20.55	11.32	29.60
Branch								

Table 4. 2024 Temperature Probe Averages

Tributary	Site	23°C+ Days	27°C+ Days
Moose River	MR01	1	0
	MR02	34	5
Garden River	GR01	30	4
	GR02	16	0
Fraser's Brook	FB01	0	0
	FB02	2	0
North River	NR01	56	4
	NR02	38	0
McKeen Brook	MB01	32	1
	MB02	30	1
Barren Brook	BB01	11	0
Cross Brook	CB01	10	0
	CB02	22	0
West Branch	WB01	50	10

#### Table 5. Number of days above 23°C and 27°C in each tributary

# 1.3 pH Monitoring

Ideally, freshwater pH should measure 5.5 or above, as both Atlantic salmon and brook trout are sensitive to water acidity. Each life stage has a different threshold for pH before mortality occurs. For Atlantic salmon parr, mortality occurs at 4.7 or below. Mortality for smolt and fry begins when pH is 5.0 or below. Eggs and alevins experience mortality beginning at 4.8. The smoltification process for Atlantic salmon is also negatively impacted by pH levels below 5.0 and makes it more difficult for salmon smolts to adapt to seawater (COSEWIC, 2010). Brook trout are less sensitive to acidity than Atlantic salmon - with their ideal range between 6.5-8.0 - however they are capable of tolerating pH levels as low as 3.8 (Vermont Fish and Wildlife Department, n.d). The impacts of acidity on anadromous brook trout and their ability to adapt to seawater is yet unknown.

In 2024, water quality monitoring was conducted at 17 sites throughout the watershed, with sites being sampled with a YSI ProQuatro multiparameter sonde every two weeks from May 24<sup>th</sup> to September 13<sup>th</sup>, with an additional round of data collected on November 27<sup>th</sup>. A full breakdown of water quality monitoring locations and data is available in Table 6, while a map of locations can be seen in Figure 5. The average pH overall was 6.3, which is well in the ideal range for both Atlantic salmon and brook trout. The lowest pH recorded was 4.85, in Barren Brook. The highest pH recorded was 7.11, also in Moose River. The average pH for West Branch waters is 5.95, while East Branch waters averaged 6.6.

While acid rain mitigation is not an outcome of the AERF project, the SMRA is working with the NSSA to establish an acid rain mitigation protocol within the watershed.

Full water quality results can be viewed in Appendix A.

Tributary	Site	Coordinates	Average Temperature	Average pH
	MR01	45.43255, -62.31583		
Moose River	MR02	45.49524, -62.36988	13.55	6.85
	GR01	45.4254762.30183		
Garden River	GR02	45.44258, -62.30275	14.70	6.76
	FB01	45.356968, -62.126450		
Fraser's Brook	FB02	45.366739, -62.128404	13.85	6.40
	EB01	45.281622, -62.059405		6.63
East Branch	EB02	45.299219, -62.062184	18.06	
	EB03	45.36325, -62.13651		
McKeen Brook	MB01	45.28499, -62.05511	18.52	6.20
	NR01	45.32880, -62.05388		6.97
North River	NR02	45.35519, -62.05846	20.3	
Barren Brook	BB01	45.27704, -62.28769	15.44	5.86
Cross Brook	CB01	45.28682, -62.38886	15.73	5.98
	WB01	45.25565, -62.07347		
West Branch	WB02	45.27361, -62.27317	18.75	6.01
Main Branch	MB01	45.1976335, -62.0078545	19.7	6.31

Table 6. Water quality monitoring locations and averages for 2024



Figure 5. 2024 Water quality monitoring locations.

# 1.4 Habitat Suitability Index Surveys

The assessment of physical habitat was completed by following the protocol in the *Nova Scotia Fish Habitat Suitability Assessment: Field Manual* (Nova Scotia Salmon Association, 2019).

The HSI protocol intends to standardize freshwater fish habitat while making use of habitat suitability variables and values specific to the rivers of study within Nova Scotia. The index standardizes field method assessments for variables such as site identification, substrate quality, channel cross-section, instream cover, pool quality, riverbank and riparian zone quality, and benthic macroinvertebrates.

The field methods are based on an HSI methodology developed by the U.S. Fish and Wildlife Department, specifically brook trout HSI, and have been modified to also incorporate the unique characteristics of Nova Scotia watercourses. On top of that, variables have been implemented to quantify habitat for Atlantic salmon as well. The methods are based on freshwater hydrology and geomorphology that develop physical habitat and water quality that are commonly degraded by anthropogenic change of water courses and corresponding water quality.

Due to the exceptionally high rainfall amounts that Nova Scotia received over the 2023 summer, depth measurements and wetted widths may not be indicative of low-flow conditions that are typical for streams in the region at this time of year. HSI assessments will be conducted again in the following years and will be used to compare how these extreme rainfall events have altered watercourses.

# 1.4.1 HSI Methodology

Channel width, in particular bankfull width and wetted width, are both measured at each transect. Locations of each measurement can be seen in Figure 6.



Figure 6. Visual guide of channel measurements (NSSA, 2018).

The following steps for collecting bankfull width and bankfull height are found below (adapted from the NSHSI field assessment protocol):

- At each cross-section, a bankfull width and its height above the water level is taken.
- Start measuring from the left bank looking downstream.
- Pin the measuring tape into the banks or have a colleague hold the tape at the bankfull level and record the width on the field sheet.

• Using a meter stick or second measuring tape, measure the bankfull height from the water surface to the top of the bank and record it on the field sheet.

The following steps (adapted from the NSHSI Protocol) are followed when measuring wetted width and wetted depths:

- At each cross-section, a wetted width and three wetted depths are taken at distances of ¼, ½, and ¾ across the wetted portion of the cross-section from left to right looking downstream.
- Pin the measuring tape into the banks or have a colleague hold the tape perpendicular to the banks at the edge of the water and record the width on the field sheet under wetted width.
- Divide the wetted width by 4 to determine the length of each quarter section
- Starting at the left bank use the meter stick to determine the depth of the water at distances of ¼, ½, and ¾ across the wetted portion of the cross-section
- Use the water level on the downstream side of the meter stick to determine depth as the level on the upstream side may be affected by stream velocity
- An estimated negative depth, or height above the water level, should be taken if a measurement is located with no water depth in the adjacent area (an island or section of riffle with no significant depth or flow). A measurement of zero can also be taken if the river bottom is approximately the same height as the water level
- A depth can be taken in a nearby representative area of the location if a depth location is on a rock or other feature that would misrepresent the cross-section (a boulder above the water level but with the adjacent area exhibiting depth).

Substrate composition is measured using a quadrant tool to calculate the composition of various substrate types (fines, cobble, gravels, boulders, and bedrock). Substrate size and embeddedness is measured using a random rock grab method, whereby three rocks are randomly selected from observed spawning areas and measure and record the diameter. Siltation lines are observable features on instream substrate that indicate the extent of siltation within the channel, the percentage of each rock that is below the silt line is recorded as a measure of embeddedness. The higher the percentage of rock that is covered by silt, the higher the level of embeddedness. The area of spawning habitat is calculated by recording the dimensions of each observed spawning area.

Cover was measured by using wooden dowels (10 cm and 30 cm each) that are representative in size of juvenile fish and adult fish. These dowels were used to quantify the carrying capacity for juvenile Atlantic salmon and Brook trout and adult Brook trout based on the total cover available for each age-class of fish across each HSI transect. Each dowel is manually moved across each transact, where potential cover features are evaluated by physically moving the dowel underneath potential cover (e.g. large rock or embedded wood). If the potential cover is sufficient to provide complete cover for the dowel, it is counted towards the overall number of fish. Cover for fish can be provided by instream debris, over-hanging vegetation and either boulders substrate for adult fish and cobble substrate for fry and parr.

Spawning habitat was evaluated based on substrate composition, substrate size (diameter), the level of embeddedness) and the overall area of spawning habitat. Atlantic salmon and Brook trout require spawning habitat that is comprised primarily of gravel and cobble. The presence of fines, boulders and bedrock are

known factors that contribute to increased egg mortality and therefore are calculated against the spawning score. To receive a very good score (>0.80) observed spawning habitat must have an average substrate size between 2 cm and 9.5 cm and the level of embeddedness must be >5%. Spawning habitat that does not meet one of these criteria receives a moderate score (0.60 to .79) and spawning habitat that does not meet either criteria will receive a poor score (<0.60).

# 1.4.2 HSI Spreadsheet Evaluation and Interpretation

The NSHSI Excel spreadsheet evaluates data collected in the field based on suitability models so that limiting factors can be easily identified for both Atlantic salmon and brook trout. The formula calculates 15 important criteria for each species in a range from 0-1, where poor quality is given a value of less than 0.4, moderate quality has a value between 0.4 and 0.8, and good quality has a value of greater than 0.8.

The criteria evaluated are:

- Percent pools
- Pool class rating
- Percent instream cover for adults and juveniles
- Dominant substrate type in riffle run areas
- Vegetation along the streambank
- Rooted vegetation and stable rocky ground
- Water temperature, pH, size of substrate in spawning areas
- Percent fines in spawning areas
- Percent fines in riffle-run areas
- Substrate size class for winter escape
- Thalweg depth during late growing season
- Percent stream shade

In 2024, as part of baseline data collection and to determine potential restoration areas, HSI surveys were completed in the five of the seven project subwatersheds to evaluate instream physical parameters. Surveys were performed at a total of 75 sites, covering 4.97 km of stream length in total. HSI surveys will continue to be conducted at the same sites in 2025 (year three) and 2026 (year four).

# 1.4.3 Channel Width

Bankfull width is the distance between the start of bank vegetation on one side of the channel across to the start of vegetative growth on the opposite bank. Areas that are flooded during bankfull discharge events are typically bare of vegetation and therefore easily identifiable.

# 1.4.4 Channel Depth

Channel depths are recorded at ¼ intervals throughout the stream, and the thalweg (deepest section of the channel) is also measured. The thalweg is an important metric for assessing potential for fish migration, as a thalweg of 15cm or greater is required for Atlantic salmon and Brook trout movement upstream. The thalweg is recorded at each transect as it is imperative to quantify physical habitat within a river. Instream structures are installed to promote the narrowing of the channel, which results in a deeper, more well-defined thalweg.

# 1.4.4.1 Late Season Growing for Adult Brook Trout

This metric is used to assess overall depth of pool habitat. This is important for brook trout parr and adults as

they feed primarily in pool habitat. A lack of sufficient depth in these areas increase the risk or predation and mortality during feeding periods. The score breakdown for this metric can be found in Table 7.

Rating	Thalweg Depth Requirement
Very Good	>40cm
Moderate	20-40cm
Poor	<20cm

able 7. Poo	l thalweg	depth	scoring	breakdown
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## 1.4.4.2 Fry Water Depth

This metric provides a score to thalweg depth found in rifle habitat, important to both Atlantic salmon and brook trout fry. Score breakdown for this metric can be found in Table 8.

Table 8. Riffle thalweg depth scoring breakdown.

Rating	Thalweg Depth Requirement		
Very Good	>20cm		
Moderate	10-20cm		
Poor	<10cm		

## 1.4.4.3 Parr Water Depth

This metric provides a score to thalweg depth in run habitat, and the depth requirements are the same to those in Table 7.

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Rating	Thalweg Depth Requirement
Poor	<20cm
Moderate	20-30cm
Very Good	>30cm

# 1.4.5 Pool Class Rating

Pool class rating is evaluated by measuring low flow pool depth and percentage of pool cover. Low flow pool depth is then calculated by subtracting the depth of the tail-end control from the deepest point of the pool. Percentage of pool cover consists of any area within the pool that contains suitable cover for fish from predation. Features such as embedded logs, over hanging vegetation, and deep water that prevents visibility are contributing factors to pool cover. Score breakdown for this metric can be viewed in Table 10.

Table 10. Pool class rating breakdown.

Pool Class	Low Flow Pool Depth	Percent of Cover
Very Good (A)	>1m, or >15% of width	>30%
Moderate (B)	≤15% of width, and ≥15cm	5-30%
Poor (C)	<15cm	<5%

# 1.4.6 Percent Pool Habitat

The total area in each HSI site that is considered pool habitat is an important metric for evaluating Atlantic salmon and Brook trout habitat. For Brook trout, ideally each HSI site is comprised of >50% in pool habitat, while Atlantic salmon require >25%. The value for Atlantic salmon is lower as the majority of their adult life

is spent in the marine environment, meaning less pool habitat is required for survival. The score breakdown for Brook trout and Atlantic salmon can be found in Table 11.

Species	Very Good	Moderate	Poor
Brook Trout	>50%	25-50%	<25%
Atlantic Salmon	>25%	10-25%	<10%

Table 11. Percent pool habitat scoring breakdown.

## 1.4.7 Substrate

To quantify substrate, the wetted width of a transect is divided by four, and the percentage of each type of substrate is measured at the  $\frac{1}{2}$ ,  $\frac{1}{2}$ , and  $\frac{3}{4}$  points. Substrates are categorized based on size as either fines, gravel, cobble, boulder, or bedrock. These categories are defined in Table 12.

Table 12. Substrate classification breakdown.

Substrate	Size (cm)
Fines (sand, silt)	< 0.2
Gravel	0.2-6.4
Cobble	6.4-25.6
Boulder	>25.6

# 1.4.7.1 Dominant Substrate Type in Riffle and Run Area

For both Atlantic salmon and brook trout, the substrate of riffle and run areas should have at minimum, 50% cobble and neither gravel nor boulders should exceed 25%. As well, the presence of any fines or boulders indicates stream degradation and will reduce the score of the site. Prescence of fines can negatively impact fish survival, food production, and escape cover.

## 1.4.8 Instream Cover

The scoring for instream cover is determined by habitat type. Runs and pools should contain mostly cobble and boulder, while riffles should have a mixture of cobble and gravel. Each habitat type benefits salmonids at different life stages. Riffles provide habitat for Atlantic salmon fry, runs provide habitat for Atlantic salmon parr, and pools provide habitat for adult Atlantic salmon and both adult and parr brook trout. Scores are based on the requirements of each species and life stage, as well as the embeddedness of substrates.

# 1.4.9 Spawning Habitat

Spawning habitat is scored based on two metrics: substrate size and embeddedness. To score very good, a site will contain substate ranging from 2-9.5cm and is no more than 5% embedded, a moderate score meets one of two of these criteria, and a poor score meets neither.

## 1.4.10 Riparian Zone Vegetation

Riparian zone vegetation is scored by measuring the amount of riparian area that consists of trees, shrubs, grasses, and bare ground within 10m of the stream course. Riparian vegetation is important for both preventing bank erosion as well as providing shade and cover for fish in the stream. Both Atlantic salmon and brook trout have the same requirements for riparian vegetation.

## 1.4.10.1 Riverbank Stability

Riverbank stability is scored by measuring the percentage of each streambank that is either stably rooted with vegetation or actively eroding. Both Atlantic salmon and brook trout have the same requirements for

riverbank stability.

# 1.5 Electrofishing Surveys

In accordance with DFO requirements, a Section 52 license for electrofishing will be acquired in order to conduct electrofishing surveys in the seven tributaries of study.

Electrofishing is a labour-intensive procedure carried out using a Halltech Aquatic Research Model HT2000B/MK5 Electrofisher. The electrofishing unit was set to a frequency of 60 hertz and the output voltage was set to 750 amps. Each electrofishing site was sectioned off with barrier nets at both the downstream and upstream extent of the survey site to ensure that fish were unable to exit or enter the survey site while electrofishing was being conducted. Fish were maintained in holding tanks with aerators during each ensuing sweep to ensure fish were kept alive and were not recorded twice. A field technician monitored each barrier net, and additional field technicians were in place to capture the shocked fish using small fishing nets, in addition to the operator of the electrofishing units.

Electrofishing standards put in place by the SMRA follow the Zippin's Method, otherwise known as the total removal estimate (Zippin, 1958).

This method requires that three sweeps be conducted on each site of interest. Following each sweep, fish are to be measured to determine age class, length, species, and total number of fish captured. "This is a multiple sweep method with three or more sweeps. It is based on the principle that a decrease in catch per effort (c/e) as the population is depleted bears a direct relationship to the extent of the population. Population size is derived by plotting a regression line of c/e on the cumulative catch" (UNB, 2003). This linear regression technique requires the conductors of the study to restart the electrofishing procedure should the total fish captured not decline each sweep.

The linear regression technique to calculate population size first determines probability of capture (P):

$$P = \frac{-(K3Tx - 3T3x)}{K3x^2 - (3x)^2}$$

And then the population estimate (N)

Where: K = number of sweeps completed T= number of fish caught per sweep x = cumulative number of fish removed in previous sweep(s)

In 2024, electrofishing surveys were carried out in nine sites in five of the seven project watersheds, with a total of 1332.36 m<sup>2</sup> being surveyed. A map of these sites can be viewed in Figure 7. Overall, 540 fish were captured, with a total of 296 Atlantic salmon and 99 brook trout. An overview of the sites is available in Table 13. Fish counts at individual sites ranged from 32 to 87 fish. Other species observed during surveys included sea lamprey (*Petromyzon marinus*), American eel (*Anguilla rostrata*), common shiner (*Luxilus cornutus*), golden shiner (*Notemigonus crysoleucas*), creek chub (*Semotilus atromaculatus*), white sucker (*Catostomus commersonii*), and stickleback.



Figure 7. Map of 2024 electrofishing sites.

Table 13. 2024	Electrofishing	site	summaries
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Site	Watershed	Coordinates	Site Description	# of Atlantic	# of Brook
				Salmon	Trout
1		45.496751, -62.370973	Upstream from Moose River	10	66
	Moose River		Rd crossing		
2		45.43134, -62.31591	Downstream from #347	9	0
			crossing		
3		45.443854, -62.302438	Upstream from McIntosh Rd	14	6
	Garden River		crossing		
4		45.439743, -62.300693	Downstream from McIntosh	24	3
			Rd		
5		45.374295, -62.118167	Downstream from College	44	20
	Fraser's Brook		Rd crossing		
6		45.357781, -62.127280	Upstream from East River Rd	80	4
			crossing		
7	Barren Brook	45.2774112, -62.2880873	Downstream from Barren	35	0
			Brook Rd crossing		
8		45.286341, -62.386748	Downstream from #348	0	57
	Cross Brook		crossing		
9		45.288596, -62.391426	Upstream from #348	0	27
			crossing		

# 1.6 Redd Counts

Spawning season takes place from October to December for both Atlantic salmon and brook trout. During spawning, female salmon and trout excavate a redd with their tail, where they deposit eggs that are fertilized by both adult and precocious parr males. Female Atlantic salmon typically select areas of upwelling, such as the heads of pools, while female brook trout prefer areas of downwelling, such as pool tails. Both require a substrate consisting most of gravel and cobble as well as cool, well-oxygenated water. Multiple redds can be created by a single female, and the number of redds a female is able to create increases with body size. A diagram of a salmonid redd can be seen in Figure 8.

Redd counts are a low-cost and effective method for determining spawning abundance for salmonids. During spawning season, these redds are counted by a field crew walking two 500 m to 1 km long sites in each tributary. The number of redds per 100m<sup>2</sup> are extrapolated in order to estimate the amount of redds within the entire stream course.



Figure 8. Salmonid redd diagram (DFO, 2018).

In 2024, redd counts were conducted throughout the St. Mary's watershed, in project tributaries as well as non-project tributaries. Barren Brook, Cross Brook, Garden River, Moose River, and Fraser's Brook were surveyed, a map of sites can be viewed in Figure 9. A total of 33 redds were observed during surveys, over a total length of 3.2 km of stream length. An overview of sites can be viewed in Table 14. Water conditions during Atlantic salmon and Brook trout spawning season in 2024 proved to be the most challenging for assessments. Low water levels during the standard migration period, followed by two weeks of bankfull flows, led to the rapid upstream migration and spawning during the first week of high water. The river remained inaccessible during the second week of high water, which resulted in the moving and deposition of substrate that made redds more difficult to observe.



Figure 9. 2024 redd survey locations

Table	14.	Redd	count	brea	kdown
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Location	2023 Redds	2024 Redds
Barren Brook	7	0
Cross Brook	-	0
Garden River	10	24
Moose River	20	5
Fraser's Brook	16	3
Sutherland's Brook	13	-
Chisholm Brook	4	-
Black Brook (East River)	15	-
Green's Brook	2	-
Campbell's Brook	-	1
Total	87	33

# 2.0 Study Site Breakdown

The following sections provide a detailed breakdown of monitoring activities and results from the seven rivers of study carried out in 2024, along with plans for 2025.

# 2.1 Barren Brook

Barren Brook is a 15.9 km long channel located on the West River branch of the St. Mary's, where its confluence forms Barren Brook Pool in Lower Caledonia. The watershed is 50.03 km<sup>2</sup>, and contains an additional 42.9 km from 29 tributaries, as well as 0.34 km<sup>2</sup> of lakes and 7815.3 m<sup>2</sup> of wetland habitat. A habitat summary of Barren Brook can be seen in Table 15, while a map of the Barren Brook watershed can be seen in Figure 10.

Watershed Size (km <sup>2</sup> )	Avg Calculated Bankfull Width (m)	Stream Length (m)	Estimated Habitat (m <sup>2</sup> )	Downstream Coordinates	Upstream Coordinates
50.03	10.53	15,955.2	168,008.26	45.276254 <i>,</i> -62.286430	45.376518, -62.355103

### Table 15. Barren Brook habitat summary.

Barren Brook is located entirely on Horton Formation geology. The Horton Formation formed during the Carboniferous era, and consists predominantly of shale, siltstone, and sandstone (Department of Natural Resources and Renewables, 2000). The soil within the watershed ranges from well to imperfectly drained, and is typically medium-textured, made up of sandy to loamy soils. According to the Ecological Land Classification of Nova Scotia, the Barren Brook watershed area consists of tolerant hardwood hills, spruce- pine hummocks, and floodplain habitat types. As its name suggests, due to repeated forest fires through history, the area also consists of barrens (Neily, Basquill, Quigley, Keys. 2017)

Historical and current land-use around Barren Brook has predominantly consisted of forestry, with many clearcuts and roads present throughout the watershed. There are 21 road crossings throughout the watershed. The Maritime & Northeast Pipeline also passes through Barren Brook. While there are very few permanent residences within the Barren Brook watershed, the area is frequently used for recreational purposes. Barren Brook itself is a popular brook trout fishing spot for both residential as well as sea-run brook trout during the early summer, while logging roads in the area are frequented by all-terrain and offroad vehicles.

From 2019 to 2022, an acid rain mitigation project was conducted in Barren Brook using helicopter application of limestone. Through a partnership with the Department of Natural Resources & Renewables and the Nova Scotia Salmon Association, powdered limestone was applied by helicopter to a total area of 80 ha over two years. This project saw success and raised the average pH in the treated area of the brook from 5.5 to 6.45.



Figure 10. Barren Brook Subwatershed with main channel highlighted in dark blue.

# 2.1.1 HSI Assessment Analysis

In 2023, six sites were assessed in Barren Brook beginning above its confluence with the West River St Mary's and ending at the Northside West River Road crossing. The site length totaled 255.8 m. In 2024, 15 sites were assessed in Barren Brook, beginning above the confluence and ending at a braided section 536 m above the Northside West River Rd crossing. A map of 2024's HSI sites can be seen in Figure 11. The site length totaled 829.4 m. Bankfull width ranged from 5.7 m to 23.7 m. Measured bankfull width exceeded the calculated bankfull width at 11 sites. Full HSI results can be viewed in Appendix C.

## Channel Depth

In 2024, one site contained a transect with a depth under 15cm, increased from 0 sites in 2023. Thalweg depths in Barren Brook ranged from 13 cm to 225 cm (Table 16).

Year	2 transects 15cm or less (Poor)	1 transect 15cm or less (Moderate)	0 transects 15cm or less (Very Good)
2023	0	0	6
2024	0	1	14

#### Table 16. Channel Depths for Barren Brook.



Figure 11. 2024 HSI site locations in Barren Brook

## Late Season Growing for Adult Brook Trout

In 2024, of the nine sites that contained pools, five sites scored very well, up from one site in 2023. The remaining four scored moderately, decreased from five sites in 2023 (Table 17). Pool depths in 2024 ranged from 42 cm to 250 cm.

### Table 17. Depth of pool habitat scores.

Year	Poor (<20cm)	Moderate (20-40cm)	Very Good (>40cm)
2023	0	5	1
2024	0	4	5

## Fry Water Depth

In 2024, five sites scored very well, while six sites received a moderate score (Table 18). Riffle thalweg depths ranged from 13 cm to 50 cm.

#### Table 18. Fry water depth scores.

Year	Poor (<10cm)	Moderate (10-20cm)	Very Good (>20cm)
2023	0	0	6
2024	0	6	5

## Parr Water Depth

In 2024, nine sites in Barren Brook scored very well, increased from six sites in 2023 (Table 19). Run thalweg depths ranged from 20 cm to 105 cm.

#### Table 19. Parr water depth scores.

Year	Poor (<20cm)	Moderate (20-30cm)	Very Good (>30cm)
2023	0	0	6
2024	0	3	9

### Pool Class Rating

In 2024, one site in Barren Brook received an A-class pool rating, increased from 0 sites in 2023 (Table 20). The remaining 10 received a B-class rating. No sites received a C-class rating, a decrease from one site in 2023. Pool habitat quantity and quality can be increased through in-stream structures such as digger logs and deflectors.

#### Table 20. Pool class rating scores.

Year	Poor (C)	Moderate (B)	Very Good (A)
2023	1	5	0
2024	0	10	1

### Percent Pool Habitat

In 2024, for brook trout, two sites scored moderately, a decrease from 6 in 2023 (Table 21). Nine sites scored poorly, increased from 0 sites in 2023. For Atlantic salmon, two sites received a very good score, decreased from three sites in 2023 (Table 22). Four sites received a moderate score - increased from two sites in 2023 - and five sites received a poor score, increased from one site in 2023. Pool percentages in 2024 ranged from 2.74% to 48.74%.

#### Table 21. Percent pool habitat scores for Brook trout.

Year	Poor (<25%)	Moderate (25-50%)	Very Good (>50%)
2023	0	6	0
2024	9	2	0

#### Table 22. Percent pool habitat scores for Atlantic salmon.

Year	Poor (<10%)	Moderate (10-25%)	Very Good (>25%)
2023	1	2	3
2024	5	4	2

### Dominant Substrate

In 2024, 12 sites received a moderate score – increased from six in 2023 - while three received a very good score, increased from zero sites in 2023 (Table 23).

Year	Poor	Moderate	Very Good
2023	0	6	0
2024	0	12	3

## In-stream Cover

In 2024, for brook trout fry in-stream cover, five sites scored very well, increased from two sites in 2023 (Table 24). Ten sites scored moderately, increased from four in 2023. While for adult and parr brook trout,

seven scored poorly, two scored moderately, and one scored very well, an increase from zero sites in 2023 (Table 27). For Atlantic salmon fry, nine sites scored moderately while six scored very well, increased from three in 2023 (Table 25). For salmon parr, six sites scored poorly, three sites scored moderately, and only one scored very well, increased from zero in 2023 (Table 26).

Year	Poor	Moderate	Very Good
2023	0	4	2
2024	0	10	5

#### Table 24. Scores for instream cover for Brook trout fry.

Table 25. Scores for instream cover for Atlantic salmon fry.

Year	Poor	Moderate	Very Good
2023	0	3	3
2024	0	9	6

#### Table 26. Scores for instream cover for Atlantic salmon parr.

Year	Poor	Moderate	Very Good
2023	3	3	0
2024	6	3	1

#### Table 27. Scores for instream cover for Brook trout parr and adults.

Year	Poor	Moderate	Very Good
2023	4	2	0
2024	7	2	1

### Spawning Habitat

Spawning habitat is evaluated on substrate size and embeddedness. To receive a Very Good score, substates should range between 2-9.5 cm and are less than 5% embedded. A moderate score meets one of these two criteria, and a poor score does not meet either criterion. In 2024, Atlantic salmon spawning habitat was present in six sites out of 15 assessed in Barren Brook, with an additional site containing brook trout spawning habitat, increased from three total sites in 2023 (Table 28). No sites assessed scored poorly.

#### Table 28. Spawning sites in Barren Brook.

Year	Species	Total Spawning Sites	Poor	Moderate	Very Good
2023	Brook Trout	1	0	1	0
	Atlantic Salmon	2	0	0	2
2024	Brook Trout	7	0	4	3
	Atlantic Salmon	6	0	4	2

## Riparian Vegetation

Riparian vegetation is evaluated by assessing the percentage of tree, shrub, and grass coverage as well as bare ground within 10 m of the streambank edge. In 2024, 12 sites scored moderately, while two received a very good score (Table 29).

Year	Poor	Moderate	Very Good
2023	0	1	5
2024	0	12	2

Table 29. Riparian vegetation scores in Barren Brook.

### *Riverbank Stability*

Riverbank stability is measured by assessing the percentage of each streambank that is covered in rooted vegetation and the percentage that is actively eroding. In 2024, two sites scored poorly while six sites received a moderate score (Table 30).

#### Table 30. Riverbank stability scores for Barren Brook.

Year	Poor	Moderate	Very Good
2023	0	0	6
2024	2	6	6

# 2.1.2 Aerial Photographs and Analysis

Photo Set	Date	Observation
	Range	
	Pre-1971	No clearcuts or roads are present in the watershed area. Riparian area is healthy and forested for entire stream length captured in photograph.
1	1971- 1975	The Northside W River Rd is now present near the downstream end of Barren Brook, just above its confluence with the West River St. Mary's. One large cut from the road into the riparian area of Barren Brook, along with a road into the cut, is also now present.
	1975-	Large cuts have expanded to the northern side of Barren Brook, into the riparian area.
	1991	Several new roads have also been constructed within the cuts.
	1991-	Previous cuts, as well as roads, appear to have regrown. New roads have also been
	2008	constructed in the northern extent of the photograph within the subwatershed

Table 31. Aerial photograph series summary for Barren Brook Set 1.



Figure 12. Photo set 1 of Barren Brook aerial photos

Photo Set	Date Range	Observation
	Pre-1975	One road is present south of Barren Brook (Barren Brook Rd.). No cuts are currently
		present within the watershed area.
		Large cuts with several in-roads are now present south of Barren Brook. Cuts extend well
	1975-1991	into riparian areas of the brook in several areas. No cuts or roads
2		are present on the north side of the brook.
-		Cuts on the south side of the brook have begun to regrow, while the roads are still
	1991-1997	present. Cuts are now present on the north side of the brook,
		including one in the riparian area at the lower corner of the photograph.
	1997-2008	Previous cuts have regrown, as well as cuts that occurred after 1991 and were not captured in previous photograph. A small cut is also present in the regrown section,
		south of the brook.
1975		1991





## Table 33. Aerial photograph series summary for Barren Brook Set 3.

Photo Set	Date Range	Observation
	Pre-1975	One very large clearcut is present to the west of Barren Brook, extending into the riparian zone for the entire length of the cut. Forests on the east side of the road are intact, with no roads or cuts.
2	1975-1991	Large cut on the west side of the brook has been cut even further since last photograph was captured but has begun to regrow. A large road to the east, running parallel to the brook, has been constructed.
3	1991-2007	Large cut to the west has regrown, though has several newer cuts along previously existing roads. Large cuts on the east side have appeared and extend into the riparian area for much of the length of the cuts. As well, the Maritimes & Northeast Pipeline that carries natural gas has been constructed since previous photo, and runs perpendicular to Barren Brook, cutting through it near the north end of the large cut.
	2007-2018	Previous cuts have regrown, including in riparian areas that were cut. Previously constructed roads, as well as the natural gas pipeline, are still present.



Figure 14. Photo set 3 of Barren Brook aerial photographs

## 2.1.3 Redd Surveys

In 2024, one 422 m site was surveyed in Barren Brook, beginning 100 m above its confluence with the West River (Figure 15). No redds were observed in this area, a decrease from seven redds observed in 2023 (Table 34).



Figure 15. Map depicting 2024 redd survey location in Barren Brook.

#### Table 34. Redd survey data.

Year	Site #	Site Length (m)	Redds Counted	Site Start Coordinates	Site End Coordinates	Redds per 100m
2023	1	500	7	45.276527, -62.287657	45.280313, -62.287442	1.4
2024	1	421.6	0	45.276482, -62.286584	45.278678, -62.288018	0

# 2.1.4 Electrofishing Results

In 2024, one 155 m<sup>2</sup> site was electrofished in Barren Brook, downstream of the Barren Brook Rd bridge. A map of the site can be seen in Figure 16. A total of 63 fish were captured here, 35 were Atlantic salmon. A summary of fish captured can be viewed in Table 35. No brook trout were captured in this site. Of the 35 Atlantic salmon, 27 were fry and eight were parr. Atlantic salmon fry densities are estimated at 0.174 per m<sup>2</sup>. A summary of Atlantic salmon densities can be seen in Table 36. Parr densities were estimated at 0.052 fish per m<sup>2</sup>. A summary of population estimates can be seen in Table 37.



Figure 16. Map depicting electrofishing survey site 1 in Barren Brook.

Table 35. Barren Brook electrofishing results

Site	Year	Total Area (m <sup>2</sup> )	Total # of Fish	Total # of Brook Trout	Total # of Atlantic Salmon
1	2024	155.04	63	0	35

#### Table 36. Atlantic Salmon densities in Barren Brook

Site	Year	Total Area (m <sup>2</sup> )	# of 0+ Atlantic Salmon	# of 1+ Atlantic Salmon	Density of 0+ Atlantic Salmon (per m <sup>2</sup> )	Density of 1+ Atlantic Salmon (per m <sup>2</sup> )
1	2024	155.04	27	8	0.174	0.052

#### Table 37. Barren Brook population estimates

	Total	Salmonid	0+ B	rook Trout	Estimated 1+ Brook		Estimated 0+ Atlantic salmon		Estimated 1+ Atlantic salmon	
Site	Est	95% Confidence	Est	95% Confidence	Est	95% Confidence	Est	95% Confidence	Est	95% Confidence
	Total	Interval Range	Total	Interval Range	Total	Interval Range	Total	Interval Range	Total	Interval Range
1	39.15	35-46.86	-	-	-	-	32.61	27-44	8.09	8-8.76

# 2.2 Garden River

Garden River is a 34.14 km<sup>2</sup> watershed located on the East River branch of the St. Mary's in the community of Garden of Eden. A habitat summary of Garden River can be viewed in Table 38. It begins in Laggan and flows for 14.8 km to its confluence with Moose River. The watershed also contains 29 tributaries which total 12.3 km in length, as well as 14,941 m<sup>2</sup> of wetland habitat and 223,740.3 m<sup>2</sup> of lakes. A map of the watershed can be viewed in Figure 17.

Watershed	Avg Calculated	Stream Length	Estimated	Downstream	Upstream
Size (km <sup>2</sup> )	Bankfull Width		Habitat (m <sup>2</sup> )	Coordinates	Coordinates
34.14	9.43	14,823.6	139,786.55	45.2530089N -62.187054W	45.3119711N -62.1858961W

Table 38. Habitat	summary	data	for	Garden	River

The Garden River watershed is located within several geological formations: Keppoch Formation, formed in the Neoproterozoic period, and made up predominantly of tholeiitic and calc-alkaline, mafic- intermediate-felsic flows and tuffs; Maple Ridge Formation, made up of mudstone, siltstone, and wacke, also formed during the Neoproterozoic period; and Beechhill Cove, Ross Brook, French River, McAdam, Knoydart and Stonehouse Formation, formed during the Silurian period and consisting of siltstone, mudstone, shale, and minor limestone (Department of Natural Resources and Renewables, 2000). Soils within the Garden River watershed range from imperfectly- to well-drained. Soils are fine to coarsely textured, ranging from silt and clay-dominated to gravel-dominated. According to the Ecological Land Classification, the watershed area consists of tolerant hardwood hills, red and black spruce hummocks, spruce-pine flats, and floodplain (Neily, Basquill, Quigley, Keys, 2017). Garden River is located in the Iron Oxide-Copper-Gold district of Nova Scotia, and while there are occurrences of iron deposits, no historical or proposed mining sites are present in the watershed.

Land use in and around the Garden River watershed is primarily forestry. There are many clearcuts of various ages throughout the watershed. There is also agriculture on the lower half of the system, including a few blueberry farms in the area. It is crossed by a large transmission line at 45.43932N, -62.30035W. There are 26 road crossings in the watershed – primarily logging roads – on both the main Garden River and tributaries. During Fall 2023, a culvert located on McIntosh Rd was blown out due to heavy rainfall. A beaver dam had been constructed inside the culvert over the summer, likely contributed to the blowout. The increased sedimentation caused by the blowout impacted the ability for Atlantic salmon and brook trout to spawn in this area of Garden River.

In Summer 2024, 41 in-stream structures were installed in Garden River. Beginning 966 m downstream from McIntosh Rd and extending 1007 m upstream, 31 deflectors, six digger logs, and seven rock sills were installed, resulting in a restored habitat of 18,742 m<sup>2</sup>. As well, a bank crib was installed to prevent further channel braiding. Additionally, in the Fall, the McIntosh Rd culvert that had previously blown out in Fall 2023, seen in Figure 18, was repaired and converted into a bridge, seen in Figure 19. This will ideally encourage more fish passage above McIntosh Rd.



Figure 17. Garden River subwatershed with main channel highlighted in dark blue.



Figure 18. McIntosh Rd culvert in Fall 2023, before repairs



Figure 19. New bridge on McIntosh Rd, constructed Fall 2024.

# 2.1.1 HSI Assessment Analysis

In the 2023 season, ten HSI assessments were conducted in Garden River. The assessments began above the route #348 crossing and extended 741 m upstream.

In 2024, 20 HSI assessments were conducted in Garden River, with a total site length of 1456 m. Assessments began 686 m downstream of the McIntosh Rd crossing and extended 770 m above the road crossing. Of the 20 sites assessed, 19 sites contained measured bankfull widths that exceeded the calculated bankfull widths. Bankfull widths ranged from 6 m to 30 m. A map of 2024's HSI sites can be viewed in Figure 20. A brook trout observed during surveying in Garden River can be seen in Figure 21.

# Channel Depth

In 2023, no transects recorded in Garden River had a thalweg depth of 15cm or less. In 2024, 19 sites had no transects with a 15 cm or less thalweg, while one site contained one transect with a 7.5 cm thalweg (Table 39). Thalweg depths ranged from 7.5 cm to 100 cm, with an average depth of 52 cm, indicating that fish passage is not an issue in this stretch.

Year	2 transects 15cm or less (Poor)	1 transect 15cm or less (Moderate)	0 transects 15cm or less (Very Good)	
2023	0	0	10	
2024	0	1	19	

### Table 39. Channel depth scores.



Figure 21: HSI site locations in Garden River.

Figure 20: Brook trout observed during HSI surveys in Garden River.

## Late Season Growing for Adult Brook Trout

In 2024, 13 sites contained pools, all were rated as very good, increased from nine in 2023 (Table 40). Pool depths ranged from 46 cm to 120cm.

#### Table 40. Pool habitat scores for Garden River.

Year	Poor (<20cm)	Moderate (20-40cm)	Very Good (>40cm)
2023	0	1	9
2024	0	0	13

## Fry Water Depth

In 2024, only one site received a poor score, while the remaining 19 sites scored very well, increased from seven in 2023 (Table 41). Riffle thalweg depths ranged from 23 cm to 60 cm.

### Table 41. Fry water depth scores for Garden River.

Year	Poor (<10cm)	Moderate (10-20cm)	Very Good (>20cm)
2023	0	0	7
2024	1	0	19

## Parr Water Depth

In 2024, all sites containing runs received a very good score, increased from nine in 2023 (Table 42). Run thalweg depths ranged from 22 cm to 80 cm.

#### Table 42. Parr water depth scores for Garden River.

Year	Poor (<20cm)	Moderate (20-30cm)	Very Good (>30cm)
2023	0	1	9
2024	0	1	19

## Pool Class Rating

In 2024, five sites in Garden River contained C-class pools, 15 sites contained B-class pools, an increase from nine in 2023.

Table 43.	Pool class	ratina tor	' Garden	River.
TUDIC 45.	1 001 01033	ruting jur	Guruch	1111

Year	Poor (C)	Moderate (B)	Very Good (A)
2023	1	9	0
2024	5	15	0

## Percent Pool Habitat

In 2024, for brook trout, nine sites scored poorly, three sites scored moderately, and three sites scored very well, an increase from zero sites in 2023 (Table 44). For Atlantic Salmon, three sites scored poorly, three sites scored moderately, and six sites scored very well, an increase from four in 2023 (Table 45). The percentage of pool habitat ranged from 2.5% to 202.6%, while the highest pool percentage in 2023 was 43.29%. Pool habitat will be increased in following years due to restoration conducted in Garden River in 2024.

#### Table 44. Percentage of pool habitat for Brook trout in Garden River.

Year	Poor (<25%)	Moderate (25-50%)	Very Good (>50%)
2023	6	4	0
2024	9	3	3

#### Table 45. Percentage of pool habitat for Atlantic salmon in Garden River.

Year	Poor (<10%)	Moderate (10-25%)	Very Good (>25%)
2023	3	3	4
2024	3	3	6

## Dominant Substrate

In 2024, one site scored poorly while the remaining 19 received a moderate score, an increase from seven in 2023 (Table 46).

#### Table 46. Riffle and run scores for Garden River.

Year	Poor	Moderate	Very Good
2023	0	7	3
2024	1	18	0
## In-stream Cover

In 2024, for brook trout fry, one site received a poor score while 12 scored moderately, an increase from 12 in 2023 (Table 47). For Atlantic salmon fry, one site scored poorly while 13 sites received a moderate score and six sites scored very well, an increase from three in 2023 (Table 48). For Atlantic salmon parr, 17 sites scored poorly, an increase from eight in 2023, and the remaining three sites scored moderately (Table 49). For brook trout fry and adult, 16 sites scored poorly, an increase from seven in 2023, while the remaining four sites received a moderate score (Table 50). Several brook trout were observed during HIS surveys (Figure 21).

Year	Poor	Moderate	Very Good
2023	0	6	4
2024	1	12	7

#### Table 47. In-stream cover for Brook trout fry in Garden River.

#### Table 48. In-stream cover for Atlantic salmon fry in Garden River.

Year	Poor	Moderate	Very Good
2023	0	7	3
2024	1	13	6

#### Table 49. In-stream cover for Atlantic salmon parr in Garden River.

Year	Poor	Moderate	Very Good
2023	8	2	0
2024	17	3	0

#### Table 50. In-stream cover for Brook trout parr and adults in Garden River.

Year	Poor	Moderate	Very Good
2023	7	3	0
2024	16	4	0

### Spawning Habitat

In 2024, 10 Atlantic salmon spawning areas were assessed, with all 10 sites scoring very well (Table 51). Nine brook trout spawning areas were also assessed, with two receiving a poor score, three receiving a moderate score, and four scoring very well. The total number of spawning sites observed over tripled from 2023 to 2024.

### Table 51. Spawning habitat scores for Garden River.

Year	Species	<b>Total Spawning Sites</b>	Poor	Moderate	Very Good
2023	Brook Trout	0	0	0	0
	Atlantic Salmon	3	0	0	3
2024	Brook Trout	9	2	3	4
	Atlantic Salmon	10	0	0	10

## Riparian Vegetation

In 2024, 8 sites received a moderate score, while 11 sites received a very good score, increased from six in 2023 (Table 52).

Tahle 52	Rinarian	vegetation	scores	for	Garden	River
TUDIE JZ.	mpunun	vegetation	300163	JUI	Guiuen	MIVEL.

Year	Poor	Moderate	Very Good
2023	1	1	6
2024	0	8	11

## Riverbank Stability

In 2024, all 20 sites assessed scored very well (Table 53).

### Table 53. Riverbank stability scores for Garden River.

Year	Poor	Moderate	Very Good
2023	0	0	10
2024	0	0	20

# 2.2.2 Aerial Photos and Analysis

Photo Set	Date Range	Observation
	Pre-1990	Majority of Garden River in photograph extent is unforested and surrounded by open field. One small section in the middle, above the #348 road crossing, is forested, as well as the upper section which also has a powerline cutting through it.
1	1990-1997	Unnamed road or driveway in the middle of photograph has been extended and the forest has been cut out at the end, the road extension crosses through Garden River. Ballfield beside #348 has been created. Forested section in the middle north of the ballfield has also been cut, including in the riparian area, reducing the forested area of the river even further.
	1997-2007	Previously photographed cuts have begun to regrow. Logging roads have also become revegetated.
	2007-2018	Previous cuts and logging roads now appear to be fully regrown. Riparian area is still significantly lacking in cover throughout most of the watershed area visible in photograph.

Table 54. Aerial photograph series summary for Garden River.



Figure 22. Aerial photograph series for Garden River.

## 2.2.3 Redd Counts

In 2024, one redd survey was performed over 1135 m of stream length. A summary of redd counts can be viewed in Table 55. The site began 102 m downstream of the McIntosh Rd crossing and extended 1032 m upstream of the crossing, seen in Figure 23. A total of 24 redds were observed in this section, resulting in a density of 2.1 redds per 100 m, four times the number of redds observed in 2023. This section was restored with in-stream structures in Summer 2024, which will increase spawning habitat.

Year	Site #	Site Length (m)	Redds Counted	Site Start Coordinates	Site End Coordinates	Redds per 100m
2023	1	1000	0	45.425580, -62.301950	45.427360, -62.296380	0.5
2023	2	1000	10	45.442660, -62.302760	45.435770, -62.300120	
2024	1	1135	24	45.441775, -62.302674	45.450409, -62.302098	2.1

#### Table 55. Redd survey summary in Garden River.



Figure 23. 2024 redd survey site in Garden River.

## 2.2.4 Electrofishing Results

In 2024, two sites were electrofished in Garden River, seen in Figure 24.

Site 1 was located below the McIntosh Rd, covered 148.5 m<sup>2</sup> and contained 45 fish, 23 of which were Atlantic salmon, as well as one brook trout fry. An overview of fish captured can be seen in Table 56. Of the Atlantic salmon, eight were fry and 16 were parr. Fry densities were estimated at 0.054 per m<sup>2</sup>, while parr densities were estimated at 0.101 per m<sup>2</sup>. An overview of Atlantic salmon densities can be viewed in Table 57. Brook trout fry density was estimated at 0.02 per m<sup>2</sup>. An overview of brook trout densities can be viewed in Table 59. A summary of population densities can be viewed in Table 60.

Site 2 was located above the McIntosh Rd crossing, covered 108 m<sup>2</sup> and contained 36 fish, 14 of which were Atlantic salmon and six were brook trout. Of the salmon, 11 were fry and three were parr. Fry densities were estimated at 0.102 per m<sup>2</sup> and parr densities were estimated at 0.028 per m<sup>2</sup>. Of the brook trout, four were fry and two were adults. Brook trout fry densities were estimated at 0.037 m<sup>2</sup>.



Figure 24. Electrofishing survey sites in Garden River

Table 56. Garden River electrofishing results

Site	Year	Total Area (m <sup>2</sup> )	Total # of Fish	Total # Brook Trout	Total # of Atlantic Salmon
1	2024	148.5	48	3	24
2	2024	108.0	36	6	14

Site	Year	Total Area (m²)	# of 0+ Atlantic Salmon	# of 1+ Atlantic Salmon	# of 2+ Atlantic Salmon	Density of 0+ Atlantic Salmon (per m²)	Density of 1+ Atlantic Salmon (per m <sup>2</sup> )
1	2024	148.5	8	15	1	0.054	0.101
2	2024	108.0	11	3	0	0.102	0.028

#### Table 58. Brook Trout densities in Garden River

Site	Year	Total Area (m <sup>2</sup> )	# of 0+ Brook Trout	# of 1+ Brook Trout	# of 2+ Brook Trout	Density of 0+ Brook Trout (per m <sup>2</sup> )	Density of 1+ Brook Trout (per m <sup>2</sup> )
1	2024	148.5	3	0	0	0.020	0
2	2024	108.0	4	0	2	0.037	0

	Total Poj	Salmonid oulation	0+ B	0+ Brook Trout Estimated 1+ Brook Trout		Estimated 0+ Atlantic salmon		Estimated 1+ Atlantic salmon		
Site	Est Total	95% Confidence Interval Range	Est Total	95% Confidence Interval Range	Est Total	95% Confidence Interval Range	Est Total	95% Confidence Interval Range	Est Total	95% Confidence Interval Range
1	28.24	27-31.44	3.07	3-3.78	-	-	11.69	8-26.66	15.19	15-16.23
2	20.37	20-21.85	4.04	4-4.52	-	-	11.72	11-14.36	3	3-3

### Table 59. Garden River population estimates

## 2.3 Fraser's Brook

Fraser's Brook, at 13.81 km<sup>2</sup> and 9.1 km long, is the smallest watershed and shortest stream in the study area. It flows into the East Branch of the St. Mary's River in Newtown. There is an additional 14.45 km from 13 tributaries located in the watershed, as well as 10,053.9 m<sup>2</sup> of lakes and 1950.8 m<sup>2</sup> of wetland habitat. A habitat summary of Fraser's Brook can be seen in Table 60, while a map of the watershed can be viewed in Figure 25.

#### Table 60. Habitat summary for Fraser's Brook

Watershed Size (km <sup>2</sup> )	Avg Calculated Bankfull Width (m)	Stream Length (m)	Estimated Habitat (m <sup>2</sup> )	Downstream Coordinates	Upstream Coordinates
13.81	7.26	9,101.0	66,073.26	45.353968, -62.123792	45.415951 <i>,</i> -62.133356

The Fraser's Brook watershed sits on several geological formations: the Horton Formation; the Knoydart and Stonehouse Formation, formed in the Silurian period, and consisting of mudstone and siltstone; and the Beechhill Cove, Ross Brook, French River, McAdam, Knoydart, and Stonehouse formation (Department of Natural Resources and Renewables, 2000). Its soils range from imperfectly to well-drained and consist of fine to coarsely textured soil types. According to the Ecological Land Classification, the Fraser's Brook watershed consists of tolerant hardwood hills, red and black spruce hummocks, spruce-pine hummocks, and floodplain (Neily, Basquill, Quigley, Keys, 2017). Fraser's Brook is included in the Iron Oxide-Copper- Gold district, however no historical or current mining activity is located within the area.

Historical and current land use predominantly consists of agriculture and forestry, as well as residential use. Agriculture, including a large dairy farm, is primarily centred on the lower reaches of the watershed, while forestry occurs throughout the watershed. There are large cuts of various ages throughout the watershed. There are 13 road crossings in the watershed, half of which are located on logging roads in the upper sections of the watershed.



Figure 25. Fraser's Brook subwatershed with main channel highlighted in dark blue.



Figure 26. 2024 HSI Survey site locations in Fraser's Brook

## 2.3.1 HSI Assessment Analysis

In 2023, seven sites were measured from the crossing with E River Rd to a beaver dam located in a section of field, while seven sites were measured above the beaver pond to the crossing with College Rd. A total of 642.37 m was assessed.

In 2024, 10 sites were measured from the crossing at College Rd, for a total of 317 m surveyed. Measured bankfull widths ranged from 4.7 m to 13.3 m, with 20 transects exceeding the calculated bankfull width. A map of this year's HIS sites can be viewed in Figure 26.

## Channel Depth

In 2024, two sites contained two transects with thalweg depths under 15 cm, another two sites contained one transect with a 15cm or less thalweg (Table 61). The number of transects with no thalwegs less than 15cm declined from 13 in 2023 to six in 2024. Thalweg depths ranged from 8 cm to 75 cm.

Year	2 transects 15cm or less	1 transect 15cm or less	0 transects 15cm or less
2023	1	0	13
2024	2	2	6

### Table 61. Channel depth scores for Fraser's Brook.

## Late Season Growing for Adult Brook Trout

In 2024, five sites did not contain pool habitat (Table 62). Three sites scored moderately, and three sites received a very good score, an increase from one in 2023. Pool depths ranged from 25 cm to 75 cm.

### Table 62. Depth for pool habitat scores for Fraser's Brook.

Year	Poor (<20cm)	Moderate (20-40cm)	Very Good (>40cm)
2023	10	3	1
2024	0	3	3

## Fry Water Depth

In 2024, three sites scored poor, five sites scored moderately, and only one site scored very good, a decrease from 14 sites in 2023 (Table 63). Riffle depths ranged from 3 cm to 30 cm.

#### Table 63. Fry water depth scores for Fraser's Brook.

Year	Poor (<10cm)	Moderate (10-20cm)	Very Good (>20cm)
2023	0	0	14
2024	3	5	1

## Parr Water Depth

In 2024, two sites scored poorly and three received a moderate score, while only one site received a very good score, a decrease from 12 in 2023 (Table 64). Run depths ranged from 5 cm to 31 cm.

Year	Poor (<20cm)	Moderate (20-30cm)	Very Good (>30cm)
2023	0	2	12
2024	2	3	1

#### Table 64. Parr water depth scores for Fraser's Brook.

### Pool Class Rating

In 2024, all sites that contained pools received a moderate score, a decrease from 11 in 2023 (Table 65). Pool class rating can be increased through in-stream restoration methods such as rock sills and digger logs.

#### Table 65. Pool class ratings in Fraser's Brook.

Year	Poor (C)	Moderate (B)	Very Good (A)
2023	3	11	0
2024	0	6	0

## Percent Pool Habitat

In 2024, five sites that contained pools scored poorly for brook trout pool habitat while one site received a moderate score (Table 66). No sites scored very well, a decrease from five sites in 2023. For Atlantic salmon, one site received a very good score, a decrease from six in 2023 (Table 67). While three sites scored moderately, and two sites scored poorly, a decrease from four in 2023. Pool percentages in Fraser's Brook ranged from 5.52% to 32.8%. The amount of pool habitat can be increased through in-stream restoration methods such as deflectors.

Table 66. Percent of pool habitat for Brook trout in Fraser's Brook.

Year	Poor (<25%)	Moderate (25-50%)	Very Good (>50%)
2023	3	6	5
2024	5	1	0

#### Table 67. Percentage of pool habitat for Atlantic salmon in Fraser's Brook.

Year	Poor (<10%)	Moderate (10-25%)	Very Good (>25%)
2023	4	4	6
2024	2	3	1

### Dominant Substrate

In 2024, two sites received a very good score, unchanged from 2023, while the remaining eight sites scored moderately, a decrease from 11 in 2023 (Table 68).

Year	Poor	Moderate	Very Good
2023	1	11	2
2024	0	8	2

Table 68. Riffle and run substrate scores for Fraser's Brook.

## In-stream Cover

In 2024, in-stream cover for brook trout (Table 69) and Atlantic salmon (Table 70) fry scored very good in six sites, a decline from 13 in 2023, while four sites scored moderately. For Atlantic salmon parr (Table 71) and brook trout parr and adult (Table 72), seven sites scored poorly, while the remaining three sites scored moderately. In-stream cover can be increased with the addition of large woody debris in a stream, such as digger logs and deflectors that can act as wooden bank cribs.

#### Table 69. In-stream cover for Brook trout fry in Fraser's Brook.

Year	Year Poor		Very Good	
2023	0	1	13	
2024	0	4	6	

### Table 70. In-stream cover for Atlantic salmon fry in Fraser's Brook.

Year	Poor	Moderate	Very Good	
2023	0	1	13	
2024	0	4	6	

#### Table 71. In-stream cover for Atlantic salmon parr in Fraser's Brook.

Year	Poor	Moderate	Very Good	
2023	<b>2023</b> 5		0	
2024	7	3	0	

Table 72. In-stream cover for Brook trout parr and adults in Fraser's Brook.

Year	Poor	Moderate	Very Good	
2023	5	9	0	
2024	7	3	0	

## Spawning Habitat

In 2024, three brook trout spawning sites were identified - a decrease from eight in 2023 - one received a poor score and two scored moderately (Table 73). Four Atlantic salmon spawning sites were identified – a decrease from 10 in 2023 - with one site receiving a very good score, two sites scoring moderately, and one site receiving a poor score.

Year	Species	<b>Total Spawning Sites</b>	Poor	Moderate	Very Good
2023	Brook Trout	8	1	2	5
	Atlantic Salmon	10	0	0	10
2024 Brook Trout		3	1	2	0
	Atlantic Salmon	4	1	2	1

#### Table 73. Spawning sites in Fraser's Brook.

## Riparian Vegetation

In 2024, one site received a poor score, an increase from zero in 2023 (Table 74). While eight sites received a moderate score, and one site received a very good score, a decrease from two in 2023.

#### Table 74. Riparian vegetation scores for Fraser's Brook.

Year	Poor	Moderate	Very Good
2023	0	12	2
2024	1	8	1

### **Riverbank Stability**

In 2024, seven sites received a moderate score, while three sites scored very good, a decrease from 12 in 2023 (Table 75). Riverbank stability may have been reduced from high water levels in 2023.

#### Table 75. Riverbank stability scores for Fraser's Brook.

Year	Poor	Moderate	Very Good
2023	0	2	12
2024	0	7	3

# 2.3.2 Aerial Photos and Analysis

Table 76. Aerial	photograph	series summary	for Fraser's Brook.

Photo Set	Date Range	Observation
	Pre-1975	Farms are present for a large portion of the stream course, with little vegetation in the riparian area. Above and below these fields is forested. College Rd crossing above field is present.
1	1975-1991	Fields have expanded north of College Rd crossing, reducing forested and riparian areas in this section even further. Riparian area along previously existing fields remains extremely minimal.
	1991-1997	Minimal changes during this time. Riparian areas are still poorly vegetated in field areas.
	1997-2007	Minimal changes during this time. Riparian areas are still poorly vegetated in field areas.



Figure 27. Aerial photograph series for Fraser's Brook.

## 2.3.3 Redd Counts

In 2024, two sites were surveyed in Fraser's Brook, with a total of 500.6 m of stream length being surveyed, an overview of this year's redd surveys can be seen in Table 77. Site 1 began at the East River Rd crossing and extended 136.5 m downstream, with no redds being observed in this area. A map of this site can be seen in Figure 28. Site 2 began at the College Rd crossing and extended 364.1 m downstream, a map of this site can be viewed in Figure 29. A total of three redds being observed in this section, resulting in a density of 0.5 redds per 100 m overall, a decrease by over half compared to 2023.

Year	Site	Site Length (m)	Redds Counted	Site Start Coordinates	Site End Coordinates	Redds per 100m
	1	470	0	45.2125309, -62.0735276	45.2114438, -62.0725712	
2023	2	500	6	45.35020, -62.126410	45.360400, -62.128010	1.17
	3	400	10	45.374950, -62.11818	45.371530, -62.118910	
2024	1	136.5	0	45.3570317, -62.1264765	45.3558697, -62.1263280	0.5
	2	364.1	3	45.3749971, -62.1182116	45.3718709, -62.1186023	

## Table 77. Redd count survey summary for Fraser's Brook.



Figure 28. Redd survey site 1 in Fraser's Brook.



Figure 29. Redd survey site 2 in Fraser's Brook.

## 2.3.4 Electrofishing Results

In 2024, two sites were electrofished in Fraser's Brook, seen in Figure 30 and Figure 31.

Site 1, located upstream from the East River Rd crossing, covered 130 m<sup>2</sup> and contained 83 fish, a summary of results can be viewed in Table 78. Of those, 68 were Atlantic salmon fry, 12 Atlantic salmon parr, as well as one brook trout fry and one adult brook trout. Atlantic salmon fry densities were estimated at 0.523 per m<sup>2</sup> and parr densities were estimated at 0.092 per m<sup>2</sup>, an overview of which can be viewed in Table 79. Brook trout fry densities were estimated at 0.023 per m<sup>2</sup>, which can be viewed in Table 80. An overview of population densities can be seen in Table 81.

Site 2 was located downstream of the College Rd crossing, covered 126.7 m<sup>2</sup>, and contained 60 fish, 43 of which were Atlantic salmon and 18 of which were brook trout. Of the Atlantic salmon, 39 were fry and five were parr. Salmon fry densities were estimated at 0.308 per m<sup>2</sup> and parr densities were estimated at 0.039 per m<sup>2</sup>. For brook trout, 13 were fry, four were parr, and three were adults. Brook trout densities were estimated at 0.103 per m<sup>2</sup> and parr densities were estimated at 0.103 per m<sup>2</sup> and parr densities were estimated at 0.103 per m<sup>2</sup>.



Figure 30. Electrofishing survey site 1 in Fraser's Brook.



Figure 31. Electrofishing survey site 2 in Fraser's Brook.

#### Table 78. Fraser's Brook electrofishing results

Site	Year	Total Area (m <sup>2</sup> )	Total # of Fish	Total # of Brook Trout	Total # of Atlantic Salmon
1	2024	130	87	4	80
2	2024	126.7	64	20	44

#### Table 79. Atlantic salmon population densities in Fraser's Brook

Site	Year	Total Area (m²)	# of 0+ Atlantic Salmon	# of 1+ Atlantic Salmon	# of 2+ Atlantic Salmon	Density of 0+ Atlantic Salmon (per m²)	Density of 1+ Atlantic Salmon (per m²)
1	2024	130	68	12	0	0.523	0.092
2	2024	126.7	39	5	0	0.308	0.039

#### Table 80. Brook trout population densities in Fraser's Brook

Site	Year	Total Area (m <sup>2</sup> )	# of 0+ Brook Trout	# of 1+ Brook Trout	# of 2+ Brook Trout	Density of 0+ Brook Trout (per m <sup>2</sup> )	Density of 1+ Brook Trout (per m <sup>2</sup> )
1	2024	130	3	0	1	0.023	0
2	2024	126.7	13	4	3	0.103	0.032

#### Table 81. Fraser's Brook population estimates

	Total Pop	Salmonid Sulation	0+ Br	ook Trout	Estima	ted 1+ Brook Trout	Estimated sal	l 0+ Atlantic mon	Estimate sa	ed 1+ Atlantic almon
Site	Est Total	95% Confidence Interval Range	Est Total	95% Confidence Interval Range	Est Total	95% Confidence Interval Range	Est Total	95% Confidenc e Interval Range	Est Total	95% Confidence Interval Range
1	119.68	84-163.53	3.07	3-3.78	-	-	102.88	68- 152.56	13.85	12-19.57
2	97.05	64-145.64	25.86	13-78.59	5.85	4-16.43	59.68	39-98.88	8.35	5-27.33

## 2.4 Cross Brook

Cross Brook is located on the West River St. Mary's in the community of Caledonia and is 15.26 km long. Its 53.19 km<sup>2</sup> watershed includes an addition 1.68 km of tributaries, as well as 1700 m<sup>2</sup> of lakes and 11342 m<sup>2</sup> of wetland habitat. A habitat summary of Cross Brook can be viewed in Table 82, while a map of the watershed can be viewed in Figure 32.

Watershed Size (km <sup>2</sup> )	Avg Calculated Bankfull Width	Stream Length (m)	Estimated Habitat (m <sup>2</sup> )	Downstream Coordinates	Upstream Coordinates
53.19	11.43	15,259.9	174,420.66	45.282470,	45.364783,

#### Table 82. Habitat summary of Cross Brook.

Cross Brook is located entirely on top of Horton Formation geology (Department of Natural Resources and Renewables, 2000). Soils range from well to imperfectly drained. Soils are fine to medium textured,

consisting of silt and clay to loam. According to the Ecological Land Classification, the Cross Brook watershed contains tolerant hardwood hills, spruce-pine hummocks, and spruce-pine flats (Neily, Basquill, Quigley, Keys, 2017).

The Cross Brook watershed's surrounding land-use is predominantly forestry, there are few residences and no active agriculture. Throughout the watershed, there are many large clearcuts. There are also 21 road crossings, primarily from logging roads. There are several cuts that appear, on satellite imagery, to not meet the minimum 20 m riparian buffer zone that is required for forest harvests along waterbodies in Nova Scotia. Violations of this regulation are frequent in the province. The Department of Natural Resources and Renewables admits to a 30% compliancy rate in forest harvests every year (CBC News, 2013). Clearcuts that infringe on the riparian zone can significantly impact stream courses and their inhabitants by increasing temperature, reducing cover from predators, contributing to acidification, and increasing erosion and sedimentation.



Figure 32.Map of Cross Brook watershed with main channel highlighted in dark blue.

## 2.4.1 HSI Assessment and Analysis

In 2024, 20 HSI assessments were conducted in Cross Brook. Assessments began 100 m above the confluence with the West St Mary's River and extended 1595 m upstream. A map of HSI sites can be viewed in Figure 33. Calculated bankfull width was determined to be 10.72 m. Measured bankfull widths ranged from 7.1 m to 25.4 m, with all 20 sites containing bankfull widths that exceeded the calculated bankfull width, indicating that the Cross Brook channel is significantly over-widened.

## Channel Depth

In 2024, three sites in Cross Brook contained transects with insufficient thalwegs - two sites contained one transect less than 15cm, and one site contained two transects less than 15cm (Table 83). Thalweg depths ranged from 13 cm to 200 cm.

### Table 83. Channel depth scores for Cross Brook.

Year	2 transects 15cm or	1 transect 15cm or less	0 transects 15cm or
	less (Poor)	(Moderate)	less (Very Good)
2024	1	2	17

## Late Season Growing for Adult Brook Trout

In 2024, of the seven sites in Cross Brook that contained pools, all scored very well (Table 84). Pool depths ranged from 30 cm to 200 cm. The lack of pool habitat present in Cross Brook indicates the need for in-stream structures such as digger logs and deflectors.

#### Table 84. Pool depth scores for Cross Brook.

Year	Poor (<20cm)	Moderate (20-40cm)	Very Good (>40cm)
2024	0	0	7



Figure 33. Cross Brook 2024 HSI survey locations.

## Fry Water Depth

In Cross Brook, 13 sites scored very well, while seven scored moderately (Table 85). Riffle thalweg depths ranged from 13 cm to 70 cm.

### Table 85. Fry water depth scores for Cross Brook.

Year	Poor (<10cm)	Moderate (10-20cm)	Very Good (>20cm)
2024	0	7	13

## Parr Water Depth

In 2024, nine sites received a very good score, 10 sites scored moderately, and one site scored poor in Cross Brook (Table 86). Run thalweg depths ranged from 20 cm to 68 cm.

Year	Poor (<20cm)	Moderate (20-30cm)	Very Good (>30cm)
2024	1	10	9

Table 86. Parr water depth scores for Cross Brook.

## Pool Class Rating

In 2024, one site in Cross Brook contained an A-class pool and seven pools received a B-class score (Table 87). There were no C-class pools assessed in Cross Brook. While the pool habitat that is present is highquality, there is still an insufficient amount of habitat, which can be increased with in-stream structures. *Table 87. Pool class ratings for Cross Brook.* 

Year	Poor (C)	Moderate (B)	Very Good (A)
2024	0	7	1

## Percent Pool Habitat

In 2024, for brook trout, one site in Cross Brook received a very good score, three sites received a moderate score, and five sites received a poor score (Table 88). For Atlantic salmon, four sites received a very good score, four sites received a moderate score, and one site received a poor score (Table 89). Percentage of pool habitat ranged from 1.95% to 63%.

Table 88. Percentage of pool habitat for Brook Trout in Cross Brook.

Year	Poor (<25%)	Moderate (25-50%)	Very Good (>50%)
2024	5	3	1

Table 89. Percentage of pool habitat for Atlantic salmon in Cross Brook

Year	Poor (<10%)	Moderate (10-25%)	Very Good (>25%)
2024	1	4	4

## Dominant Substrate

In 2024, no sites in Cross Brook scored poorly on dominant substrate, 13 sites received a moderate score, while seven received a very good score (Table 90).

Table 90. Riffle and run substrate scores for Cross Brook.

Year	Poor	Moderate	Very Good
2024	0	13	7

## In-stream Cover

In 2024, for brook trout fry, no sites received a poor score on instream cover, 11 received a moderate score, while another nine scored very good (Table 91). For Atlantic salmon fry, four sites received a moderate score, 10 received a very good score, and no sites scored poorly (Table 92). For Atlantic salmon parr 15 sites received a poor score (Table 93). For brook trout parr and adult, 16 sites received a poor score (Table 94). Instream cover can be increased with restoration methods such as digger logs.

#### Table 91. In-stream cover for Brook trout fry in Cross Brook

Year	Poor	Moderate	Very Good
2024	0	11	9

#### Table 92. In-stream cover for Atlantic salmon fry in Cross Brook

Year	Poor	Moderate	Very Good
2024	0	4	10

#### Table 93. In-stream cover for Atlantic salmon parr in Cross Brook

Year	Poor	Moderate	Very Good
2024	15	5	0

#### Table 94. In-stream cover for Brook trout parr and adults in Cross Brook

Year	Poor	Moderate	Very Good
2024	16	4	0

### Spawning Habitat

In 2024, Atlantic salmon spawning habitat was present in 10 of 20 sites and brook trout spawning habitat was present in nine of 20 sites (Table 95). One site in Cross Brook scored very well for brook trout spawning, while nine sites scored very well for Atlantic salmon spawning.

Table 95. Spawning sites and scores in Cross Brook

Year	Species	<b>Total Spawning Sites</b>	Poor	Moderate	Very Good
2024	Brook Trout	9	1	7	1
2024	Atlantic Salmon	10	0	1	9

### Riparian Vegetation

In 2024, 11 sites received a very good score for riparian vegetation, eight scored moderate, while none received a poor score (Table 96).

Table 96. Riparian vegetation scores for Cross Brook

Year	Poor	Moderate	Very Good	
2024	<b>2024</b> 0		11	

### **Riverbank Stability**

In 2024, 11 sites received a very good score for riverbank stability, indicating that bank erosion is a minimal issue in the watershed (Table 97).

Table 97. Riverbank stability scores in Cross Brook

Year	Poor	Moderate	Very Good	
2024	1	7	11	

# 2.4.2 Aerial Photographs and Analysis

Table 98. Aerial photograph series summaries for Cross Brook Set 1.

Photo Set	Date Range	Observation			
	Pre-1971	Farms and fields within the riparian area of Cross Brook are present along the lower section of the brook, below its crossing with route #348. Above this road crossing, there is little disturbance in the riparian or watershed area. Both the #348 and Calgar Rd. (now McIntosh Rd.) are already present.			
	1971-1975	Cuts above the #348 road crossing, as well as roads leading from the #348 into the cuts, are now present along Cross Brook. Farms are still present in the lower reach of the brook below the road crossing.			
1	1975-1991	Cuts have regrown along the brook above road crossing. New residences have also been constructed along #348. Large clearcut and road network is now present on the eastern side of the #348. Riparian area below road crossing have regrown.			
	1991-2008	Very large cuts are now present from Calgar Rd., along the entire western side of Cross Brook that is visible in the photograph. These cuts extend into the riparian area of the brook for most of their length. New roads are also present from the #348 and Calgar Rd into cuts. Farms below #348 crossing are no longer present, and riparian areas have regrown in these areas.			
1971 	K				
1991					
91308- 125	91-7-5 NEZ	6 1: 10,000 I-26-125 .s.н.сокнек 2008303 233 L-22 - 2008-07-03 11E78 1:12 500 45.28211 N, -62.34330 W			

Figure 34. Aerial photograph series #1 in Cross Brook

## Table 99. Aerial photograph series summaries for Cross Brook Set 2

Photo Set	Date Range	Observation
	Pre-1991	No disturbances are present within the riparian area of Cross Brook. Route #348 runs parallel to the brook and Calgar Rd is present in the bottom left of the photograph.
2	1991-1997	Very large cuts are now present on the western side of Cross Brook., with some cutting extending into riparian area in the north. Two smaller cuts in the riparian area are also present between the brook and #348.
Ζ	1997-2007	Large cuts on the west side of the brook have begun to regrow. More cuts are now present on the east side, between Cross Brook and the #348, extending into the riparian area of the brook.
	2007-2018	Large cuts in previous photos have now mostly regrown, including in the riparian areas. Several smaller cuts are now present within the watershed but outside of the riparian area.



Figure 35. Photo set 2 of Cross Brook aerial photographs

## 2.4.3 Redd Survey Results

In 2024, one site was surveyed in Cross Brook, beginning at the #348 road crossing and extending 182 m downstream. No redds were observed in this stretch. An overview of surveys can be viewed in Table 100, while a map of the survey area can be seen in Figure 36.

Year	Site	Site Length (m)	Redds Counted	Start Coordinates	End Coordinates	Redds per 100m
2024	1	182	0	45.287725, -62.388602	45.286540, -62.386896	0





Figure 36. 2024 redd survey site 1 in Cross Brook.

## 2.4.4. Electrofishing Results

In 2024, two sites were electrofished in Cross Brook. A map of both sites can be seen in Figure 37. Site 1 was located upstream from the #348 road crossing, covered 92.7 m<sup>2</sup> and contained 47 fish, 28 of which were Atlantic salmon. An overview of results can be seen in Table 101. No brook trout were observed in this section. Of the salmon, 22 were fry and five were parr. Fry densities were estimated at 0.237 per m<sup>2</sup>, parr densities were estimated at 0.54 per m<sup>2</sup>, a summary of salmon densities can be seen in Table 102. Population density estimates can be viewed in Table 103.

Site 2 was located below the #348 road crossing, covered 132.8 m<sup>2</sup> and contained 87 fish, 57 of which were Atlantic salmon fry. No Atlantic salmon parr were captured. Fry densities were estimated at 0.429 per m<sup>2</sup>. No brook trout of any age class were captured here.



Figure 37. 2024 electrofishing survey sites in Cross Brook.

Table 101. Cross Brook electrofishing results

Site	Year	Total Area (m <sup>2</sup> )	Total # of Fish	Total # of Brook Trout	Total # of Atlantic Salmon
1	2024	92.7	47	0	27
2	2024	132.8	87	0	57

## Table 102. Atlantic salmon population densities in Cross Brook

Site	Year	Total Area (m²)	# of 0+ Atlantic Salmon	# of 1+ Atlantic Salmon	# of 2+ Atlantic Salmon	Density of 0+ Atlantic Salmon (per m²)	Density of 1+ Atlantic Salmon (per m <sup>2</sup> )
1	2024	92.7	22	5	0	0.237	0.54
2	2024	132.8	57	0	0	0.429	0

### Table 103. Cross Brook population estimates

	Total Salmonid Population		0+ Brook Trout		Estimated 1+ Brook Trout		Estimated 0+ Atlantic salmon		Estimated 1+ Atlantic salmon	
Site	Est Total	95% Confidence Interval Range	Est Total	95% Confidence Interval Range	Est Total	95% Confidence Interval Range	Est Total	95% Confidence Interval Range	Est Total	95% Confidence Interval Range
1	32.61	27-44	-	-	-	-	26.77	22-37.51	5.86	5-9.94
2	87.82	57-136.42	-	-	-	-	87.82	57-136.42	-	-

## 2.5 Moose River

Moose River is an 18.06 km long stream located on the East River branch of St Mary's, meeting Eden Lake in the community of Garden of Eden. It's 47.9 km<sup>2</sup> watershed includes an additional 30.08 km in streams from 41 tributaries, as well as 5186.9 m<sup>2</sup> in wetland habitat and 10140.4 m<sup>2</sup> of lakes. A habitat summary of Moose River can be seen in Table 104, while a map of the watershed can be viewed in Figure 38.

Watershed	Avg Calculated	Stream Length	Estimated	Downstream	Upstream
Size (km <sup>2</sup> )	Bankfull Width		Habitat (m <sup>2</sup> )	Coordinates	Coordinates
47.90	10.4	18,067.5	187,902.00	45.424962, -62.302266	45.528685, -62.377992

### Table 104. Habitat summary of Moose River.

The Moose River watershed is located on the Keppoch Formation and the Bears Brook Formation, consisting of sandstone, arkose, siltstone, and basalt (Department of Natural Resources and Renewables, 2000). Its soils range from imperfectly to well drained and are fine to coarsely textured. According to the Ecological Land Classification, the Moose River watershed consists of tolerant mixed wood hills, spruce- pine flats, tolerant hardwood hills, and floodplains (Neily, Basquill, Quigley, Keys, 2017). It is located in the Iron Oxide-Copper-Gold and Zinc districts. While iron and gold deposits exist in the watershed, no historic or current mining activity is present.

The Moose River watershed's land-use is predominantly agriculture, with some forestry and residential use. There are dozens of active agricultural fields, including blueberry farms. There are also inactive agricultural fields that are being considered as candidates for riparian planting. Elsewhere in the watershed, there are several clearcuts of various ages. Moose River is crossed by a large transmission line at 45.43671N, - 62.31858W. There are 31 road crossings within the watershed, from both residential roads and logging roads.



Figure 38. Moose River subwatershed with main channel highlighted in dark blue.

## 2.5.1 HSI Assessment Analysis

In 2023, 14 HSI assessments were conducted in Moose River. Ten sites were assessed upstream of the route #347 road crossing and four sites were assessed downstream of the #347 road crossing. A total of 947.18 m was assessed.

In 2024, 10 HSI assessments were conducted in Moose River, with a total of 781 m being surveyed. A map of these sites can be viewed in Figure 39. The assessments began 65 m above the #347 road crossing and ended 235 m below the George Ross Rd crossing. Measured bankfull widths ranged from 7.4 m to 20 m, with 23 transects containing measured bankfull widths that exceed the calculated bankfull width.



Figure 39. 2024 Moose River HSI site locations

## Channel Depth

In 2024, no transects in Moose River contained thalweg depths 15 cm or less (Table 105). Thalweg depths ranged from 18 cm to 135 cm.

Year	2 transects 15cm or less (Poor)	1 transect 15cm or less (Moderate)	0 transects 15cm or less (Very Good)
2023	0	0	10
2024	0	0	10

Table 105. Channel depth scores for Moose River.

## Late Season Growing for Adult Brook Trout

In 2024, of the sites that contained pools, two sites scored moderately while two sites scored very good (Table 106). Pool depths ranged from 34 cm to 135 cm.

Year	Poor (<20cm)	Moderate (20-40cm)	Very Good (>40cm)
2023	0	0	6
2024	0	2	2

#### Table 106. Pool depth scores for Moose River.

## Fry Water Depth

In 2024, of the sites that contained riffles, six received a very good score – a decrease from eight in 2023 - and one received a moderate score (Table 107).

#### Table 107. Fry water depth scores for Moose River.

Year	Poor (<10cm)	Moderate (10-20cm)	Very Good (>20cm)
2023	0	0	8
2024	0	1	6

## Parr Water Depth

In 2024, two sites scored poorly – an increase from zero in 2023 – while three sites scored moderately and four sites received a very good score, a decrease from 10 in 2023 (Table 108).

#### Table 108. Parr water depth scores for Moose River.

Year	Poor (<20cm)	Moderate (20-30cm)	Very Good (>30cm)
2023	0	0	10
2024	2	3	4

## Pool Class Rating

In 2024, all six pools identified were scored as B-class pools, a decrease from the thirteen total pools measured in 2023, eight of which received a B-class rating (Table 109).

#### Table 109. Pool class ratings for Moose River.

Year	Poor (C)	Moderate (B)	Very Good (A)
2023	1	8	1
2024	0	6	0

## Percent Pool Habitat

Percentage of pool habitat for brook trout is lacking in Moose River. In 2024, for brook trout, five sites received a poor score, while one site scored very good (Table 110). For Atlantic salmon, four sites scored poorly, one scored moderately, and one scored very good (Table 111). Pool percentages in Moose River ranged from 2.14% to 53.66%.

#### Table 110. Percentage of pool habitat for Brook Trout in Moose River.

Year	Poor (<25%)	Moderate (25-50%)	Very Good (>50%)
2023	8	2	0
2024	5	0	1

#### Table 111. Percentage of pool habitat for Atlantic salmon in Moose River.

Year	Poor (<10%)	Moderate (10-25%)	Very Good (>25%)
2023	3	5	2
2024	4	1	1

#### Dominant Substrate

In 2024, one site scored poorly, an increase from zero in 2023, while the remaining nine sites received a moderate score, an increase from seven in 2023 (Table 112).

#### Table 112. Riffle and run substrate scores for Moose River.

Year	Poor	Moderate	Very Good
2023	0	7	3
2024	1	9	0

### In-stream Cover

In 2024, for brook trout fry, no sites received a poor score, seven sites scored moderately, an increase from seven in 2023, and the remaining three sites received a very good score (Table 113). For Atlantic salmon fry, six sites scored poorly, an increase from zero in 2023 (Table 114). For Atlantic salmon parr nine sites received a poor score, a decrease from 10 in 2023, and one site scored moderately (Table 115). Brook trout parr and adult had nine sites with a poor score, an increase from eight in 2023 (Table 116). Instream cover can be increased with restoration methods such as digger logs.

#### Table 113. In-stream cover for Brook trout fry in Moose River.

Year	Poor	Moderate	Very Good
2023	0	4	4
2024	0	7	3

#### Table 114. In-stream cover for Atlantic salmon fry in Moose River.

Year	Poor	Moderate	Very Good
2023	0	4	5
2024	6	0	4

#### Table 115. In-stream cover for Atlantic salmon parr in Moose River.

Year	Poor	Moderate	Very Good
2023	10	0	0

<b>2024</b> 9	1	0
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Table 116. In-strean	i cover for E	Brook trout parr	and adults in	Moose River.
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Year	Poor	Moderate	Very Good	
2023	8	1	0	
2024	9	1	0	

## Spawning Habitat

In 2024, a total of four spawning sites for both brook trout and Atlantic salmon were identified, a decrease from six sites for each species in 2023 (Table 117). All sites receiving a very good score, in comparison to 2023 where two sites scored moderately, and one site scored poorly for brook trout.

Year	Species	Total Spawning Sites	Poor	Moderate	Very Good
2023	Brook Trout	6	2	1	3
	Atlantic Salmon	6	0	0	6
2024	Brook Trout	4	0	0	4
	Atlantic Salmon	4	0	0	4

### **Riparian Vegetation**

In 2024, three sites received a very good score, the same amount as in 2023, while the remaining five sites scored moderately, an increase from four in 2023 (Table 118). No sites scored poorly, a decrease from one site in 2023.

#### Table 118. Riparian vegetation scores for Moose River.

Year	Year Poor		Very Good	
<b>2023</b> 1		4	3	
2024	0	5	3	

### **Riverbank Stability**

In 2024, eight sites received a very good score, a decrease from nine in 2023, while one scored moderately, an increase from zero in 2023 (Table 119).

### Table 119. Riverbank stability scores in Moose River.

Year	Poor	Moderate	Very Good	
2023	0	0	9	
2024	0	1	8	

# 2.5.2 Aerial Photographs and Analysis

Photo Set	Date Range	Observation
	Pre-1990	Majority of Moose River is surrounded by farms and fields, with very little intact riparian areas. Road crossings from route #347 and George Ross Rd are present. A powerline also crosses the river above the #347.
1	1990-1997	No increase in riparian areas, most of this segment within Moose River is still surrounded by fields. One small section, between the #347 and Sunnybrae-Eden Rd, as well as a segment on the east side above the #347, are still forested.
	1997-2007	No significant changes in watershed area – majority of riparian area is still poorly forested. Forest west of Sunnybrae-Eden Rd has begun to regrow.
	2007-2018	No significant changes in watershed area. Forest west of Sunnybrae-Eden Rd has regrown. Powerline cut has regrown as well.





Figure 40. Photo set 1 of Moose River aerial photographs

## 2.5.3 Redd Counts

In 2024, three sites in Moose River were surveyed for redds, totalling 1004 m of stream length. All redds were observed at Site 3. Site 1, seen in Figure 41, began 217 m above the George Ross Rd crossing and extended 361 m below the road crossing. Site 2, seen in Figure 42, began at the French River Rd crossing and extended 265.6 m upstream. Site 3, seen in Figure 43, began at the Moose River Rd crossing and extended 160.5 m upstream. A total of five redds were observed at Site 3, resulting in a density of 3.11 redds per 100 m. A summary of redd count results can be viewed in Table 121.



Figure 41. Redd survey site 1 location in Moose River.



Figure 42. Redd survey site 2 location in Moose River.



Figure 43. Redd survey site 3 location in Moose River.

Table 121. Redd survey summary for Moose Rive	able 121	. Redd survey	summary for	Moose	River
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Year	Site	Site Length	Redds	Site Start Coordinates	Site End Coordinates	Redds per
	#	(m)	Counted			100m
2023	1	1000	12	45. 439500, -62.321370	45.433420, -62.316380	0.8
	1	578	0	45.4379655, -62.3203874	45.4405522, -62.3239355	0
2024	2	265.6	0	45.481430, -62.357378	45.483467, -62.358349	0
	3	160.5	5	45.4959158, -62.3702010	45.4971429, -62.3710491	3.11

## 2.5.4. Electrofishing Results

In 2024, two sites were electrofished in Moose River, seen in Figure 44. Site 1, located downstream of the #348 road crossing, covered 151.3 m<sup>2</sup>. This site contained 76 fish in total, of which 10 were Atlantic salmon and 66 were brook trout. An overview of results can be viewed in Table 122. Of the ten Atlantic salmon, eight were fry and two were parr. Fry densities were estimated at 0.053 per m<sup>2</sup> and parr were estimated at 0.013 per m<sup>2</sup>. Atlantic salmon densities can be viewed in Table 123. Of the 66 brook trout captured, 59 were fry, 6 were parr, and one was an adult. Fry densities were estimated at 0.39 per m<sup>2</sup> and parr were estimated at 0.04 per m<sup>2</sup>. Brook trout densities can be seen in Table 124, while the population estimate summary is available in Table 125.

Site 2 was located upstream of the Moose River Rd crossing and covered 163.8 m<sup>2</sup> (Figure 45). This site contained 32 fish in total, of which nine were Atlantic salmon. No brook trout were captured. Of the Atlantic salmon, seven were fry and two were parr. Fry densities were estimated at 0.043 per m<sup>2</sup>, and parr densities were estimated at 0.012 per m<sup>2</sup>.



Figure 44. Electrofishing survey site 1 location in Moose River.



Figure 45. Electrofishing survey site 2 location in Moose River.

#### Table 122. Moose River electrofishing results

Site	Year	Total Area (m <sup>2</sup> )	Total # of Fish	Total # of Brook Trout	Total # of Atlantic Salmon
1	2024	151.32	76	66	10
2	2024	163.8	32	0	9

#### Table 123. Atlantic salmon population densities in Moose River

Site	Site	Total Area (m²)	# of 0+ Atlantic Salmon	# of 1+ Atlantic Salmon	# of 2+ Atlantic Salmon	Density of 0+ Atlantic Salmon (per m²)	Density of 1+ Atlantic Salmon (per m²)
1	2024	151.32	8	2	0	0.053	0.013
2	2024	163.8	7	2	0	0.043	0.012

#### Table 124. Brook trout population densities in Moose River

Site	Year	Total Area (m <sup>2</sup> )	# of 0+ Brook Trout	# of 1+ Brook Trout	# of 2+ Brook Trout	Density of 0+ Brook Trout (per m <sup>2</sup> )	Density of 1+ Brook Trout (per m <sup>2</sup> )
1	2024	151.32	59	6	1	0.390	0.040
2	2024	163.8	0	0	0	0	0

#### Table 125. Moose River population estimates

	Total	Salmonid	0+ Br	ook Trout	Estima	ted 1+ Brook	Est	imated 0+	Esti	imated 1+
Site	Est Total	95% Confidence Interval Range								
1	84.09	76-94.43	67.70	59-79.85	6.54	6-9.04	8.09	8-8.76	2.18	2-3.63
2	10.16	9-14.37	-	-	-	-	8	7-12.07	2.18	2-3.63

## 2.6 McKeen Brook

McKeen Brook is a 9.8 km channel that meets the East River St. Mary's in the community of Aspen, where its confluence forms McKeen Pool. Its 79.11 km<sup>2</sup> watershed includes over 700,000m<sup>2</sup> of lakes. A habitat summary of McKeen Brook is available in Table 126, while a map of the watershed can be viewed in Figure 46.

Table	126.	McKeen	Brook	habitat	summar	1.
i abic	<b>TTO</b> .	menceen	DICON	mabricat	summary	••

Watershed	Avg Calculated	Stream Length	Estimated	Downstream	Upstream
Size (km <sup>2</sup> )	Bankfull Width		Habitat (m <sup>2</sup> )	Coordinates	Coordinates
79.11	12.02	9,790.2	117,678.20	45.281907, -62.059100	45.269255, -61.994124

McKeen Brook is located entirely on Horton Formation geology (Department of Natural Resources and Renewables, 2000). Its soils range from well to imperfectly drained, and are typically medium textured, with

sandy to loamy soils. According to the Ecological Land Classification, the McKeen Brook watershed contains spruce-pine hummocks, tolerant hardwood hills, and tolerant hardwood drumlins (Neily, Basquill, Quigley, Keys, 2017).

McKeen Brook is located in one of Nova Scotia's gold districts and is near the proposed location of the Cochrane Hill open-pit gold mine. This gold mine is one of four proposed on the Eastern Shore – along with Moose River (Musquodoboit); Beaver Dam (Sheet Harbour); and Fifteen Mile Stream – that will be linked with a series of roads to the processing and refinement centre in Moose River. In August 2023, the Nova Scotia government announced the Archibald Lake Wilderness Area, close to the McKeen Brook watershed. Archibald's Lake is also the gold mine's proposed treated wastewater disposal area. While St. Barbara, the parent company for the gold mine, has continued to express interest in the Cochrane Hill area, it has rescinded its environment impact assessment proposals for the Cochrane Hill and Beaver Dam projects (CBC News, 2023). The Cochrane Hill project has been largely met with resistance by the local community and environmental non-profits, including the St. Mary's River Association, due to the foreseen negative consequences of open pit mining for watersheds, forests, and wildlife.

Historical and current land use in the watershed predominantly consists of forestry, with some agriculture and residential use. McKeen Pool is a popular fishing area, as it is the only barrier-free fishing area located in the St. Mary's, making it much more accessible than most areas of the St. Mary's, which are typically very remote.



Figure 46. McKeen Brook subwatershed with main channel highlighted in dark blue.

## 2.6.1 HSI Assessment Analysis

During the 2023 field season, ten sites were assessed in McKeen Brook, in a section of stream off MacKeen's Rd. A total of 573.75 m was assessed. The calculated bankfull width was determined to be 8.97 m. All ten sites contained measured bankfull widths that exceed the calculated width. Bankfull widths ranged from 11.9 m to 19.5 m, indicating that McKeen Brook is significantly overwidened. Each HSI site was measured at 54 m long, and each transect was 18 m long. Surveys conducted in McKeen Brook found inadequate pools and a lack of pool habitat, which can be attributed to the channel being severely overwidened. Full results can be viewed in Appendix C.

## Channel Depth

In 2023, no transects in McKeen Brook contained thalwegs measuring 15 cm or less (Table 127). This indicates good passage for Atlantic salmon and brook trout.

## Table 127. Channel depth scores for McKeen Brook.

Year	2 transects 15cm or	1 transect 15cm or less	0 transects 15cm or
	less (Poor)	(Moderate)	less (Very Good)
2023	0	0	10

## Late Season Growing for Adult Brook Trout

In 2023, no sites in McKeen Brook received a very good score for pool depths, six sites scored moderately, and four sites that did not contain any pool habitat scored poorly (Table 128). Pool depths ranged from 35 cm to 56 cm.

### Table 128. Pool habitat scores for McKeen Brook.

Year	Poor (<20cm)	Moderate (20-40cm)	Very Good (>40cm)
2023	4	6	0

## Fry Water Depth

In 2023, all sites in McKeen Brook received a very good score for fry depths (Table 129). Riffle habitat depths ranged from 25 cm to 59 cm.

Table 129. Fry water depth scores for McKeen Brook.

Year	Poor (<10cm)	Moderate (10-20cm)	Very Good (>20cm)
2023	0	0	10

## Parr Water Depth

In 2023, all sites in McKeen Brook received a very good score for parr depths (Table 130). Run habitat depths ranged from 21 cm to 55 cm.

Table 130. Poor water depth scores for McKeen Brook.

Year	Poor (<20cm)	Moderate (20-30cm)	Very Good (>30cm)
2023	0	0	10
# Pool Class Rating

In 2023, no sites in McKeen Brook received an A-class pool rating, two received a C-class rating and eight received a B-class rating (Table 131). Pool habitat and rating can be increased with in-stream restoration such as digger logs and rock sills.

Year	Poor (C)	Moderate (B)	Very Good (A)
2023	2	8	0

#### Table 131. Pool class ratings in McKeen Brook.

## Percent Pool Habitat

Pool habitat is lacking in McKeen Brook for both brook trout and Atlantic salmon. In 2023, for brook trout, five sites received a poor score (Table 132) and for Atlantic salmon, eight sites received a poor score (Table 133). Only one site for both species received a very good score. Pool habitat percentage can be increased with instream restoration methods such as digger logs.

#### Table 132. Percent pool habitat scores for Brook trout in McKeen Brook.

Year	Poor (<25%)	Moderate (25-50%)	Very Good (>50%)
2023	5	4	1

#### Table 133. Percent pool habitat scores for Atlantic Salmon in McKeen Brook.

Year	Poor (<10%)	Moderate (10-25%)	Very Good (>25%)
2023	8	1	1

#### Dominant Substrate

In 2023, one site received a poor score for riffle-run substrates, seven sites received a moderate score, and two sites received a very good score (Table 134).

#### Table 134. Riffle and run substrate scores for McKeen Brook.

Year	Poor	Moderate	Very Good
2023	1	7	2

## In-stream Cover

In-stream cover for both Atlantic salmon and brook trout parr is lacking. In 2023, eight sites receiving a poor score and two sites receiving a moderate score (Table 135 & Table 136). Fry cover for both species scored better, with three sites receiving a very good score and seven sites receiving a moderate score (Table 137 & Table 138). In-stream cover can be increased with the addition of large woody debris, such as digger logs and wooden bank overhangs.

#### Table 135. In-stream cover for Brook trout fry in McKeen Brook.

Year	Poor	Moderate	Very Good
2023	0	7	3

#### Table 136. In-stream cover for Atlantic salmon fry in McKeen Brook.

Year	Poor	Moderate	Very Good
2023	0	7	3

#### Table 137. In-stream cover for Atlantic salmon parr in McKeen Brook.

Year	Poor	Moderate	Very Good
2023	8	2	0

#### Table 138. In-stream cover for Brook trout parr and adults in McKeen Brook.

Year	Poor	Moderate	Very Good
2023	8	2	0

#### Spawning Habitat

McKeen Brook contains excellent spawning habitat, with all 10 sites assessed in 2023 scoring very good for Atlantic salmon spawning (Table 139). Nine sites contained brook trout spawning habitat, of which eight received a very good score and one received a moderate score.

#### Table 139. Spawning sites and scores for McKeen Brook.

Year	Species	<b>Total Spawning Sites</b>	Poor	Moderate	Very Good
2023	Brook Trout	9	0	1	8
	Atlantic Salmon	10	0	0	10

#### **Riparian Vegetation**

In 2023, six sites in McKeen Brook scored very good and four sites received a moderate score (Table 140). During HSI assessments, one clearcut area was observed that was cut up to the bank, leaving only a few single trees rooted directly into the bank and at risk for eroding. In Nova Scotia, forestry harvesting is required to maintain a minimum of a 20 m buffer zone around waterways. However, according to the Department of Natural Resources and Renewables, only 30% of harvesting operations are in compliance with provincial regulations (CBC News, 2013). Aside from this section, McKeen Brook is well-forested with hemlock, white pine, and yellow birch.

Table 140. Riparian vegetation scores for McKeen Brook.

Year	Poor	Moderate	Very Good
2023	0	4	6

## Riverbank Stability

Riverbank stability is excellent in McKeen Brook, with all 10 sites assessed in 2023 receiving a very good score (Table 141).

Table 141. Riverbank stability scores for McKeen Brook.

Year	Poor	Moderate	Very Good
2023	0	0	10

2.6.2 Aerial Photographs and Analysis

Table 142. Aerial photograph series summary for McKeen Brook	h series summary for McKeen Bi	photograph series summary for McKeen Broo	VicKeen Bro
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Photo Set	Date Range	Observation
	Pre-1971	Very few disturbances in the watershed area, riparian areas appear healthy and intact. Highway #7 crossing is present in lower segment of McKeen Brook. Some fields are present below the highway crossing.
1	1971-1991	Large clearcut and road network are now present to the north and east of McKeen Brook. Cuts extend into the riparian areas of the brook as well as McKeen Lake in several spots. A noticeably larger riparian area has been left around a tributary (from McKeen Lake) than along the main McKeen Brook and lake. South of the brook is relatively free of disturbance, with only one road and no cutting.
	1991-1997	Large cuts north of McKeen have begun to regrow, possibly planted due to organized, uniform line appearance of new forest compared to the surrounding natural forest. Roads through cuts are still present.
	1997-2019	Previous cuts have regrown. Two new, relatively (compared to past photographs) smaller cuts are now present on the north side of McKeen Brook and extend into the riparian areas of both McKeen Brook and the tributary that runs from the McKeen Lake to the main brook.



Figure 47. Aerial photograph series for McKeen Brook.

# 2.6.3 Redd Counts

In 2023 in McKeen Brook, one site spanning 500m was surveyed and 4 redds were found, resulting in a redds/100m of 0.8. An observed spawning issue in this stretch of river was high amounts of embeddedness and siltation from a result of forestry practices on land adjacent to the channel. A summary of redd survey data can be viewed in Table 143, while a map of the 2023 survey area can be seen in Figure 48.

Year	Site #	Site Length (m)	Redds Counted	Site Start Coordinates	Site End Coordinates	Redds per 100m
2023	1	500	4	45.1651065, -62.0233243	45.1647344, -62.0214857	0.8





Figure 48. 2023 redd count survey location in McKeen Brook.

# 2.7 North River St. Mary's

The North Branch of the St. Mary's River is a 29.9 km river with a watershed size of 113.14 km<sup>2</sup>. The river begins in southern Antigonish county and flows south through Lochaber and Lochiel lakes and then through Fishers Mills, where it's confluence with the East River St. Mary's is found in Aspen. A habitat summary for North River is available in Table 144, while a map of the watershed can be viewed in Figure 49.

Watershed	Avg Calculated	Stream Length	Estimated	Downstream	Upstream
Size (km <sup>2</sup> )	Bankfull Width		Habitat (m <sup>2</sup> )	Coordinates	Coordinates
113.14	13.33	29,932.3	1,568,650.41	45.182392 -62.0347515	45.2929742 -62.011286

Table 144. North River St. Mary's habitat summary.

The southern half of the watershed is made up of undivided Horton Group bedrock, and the northern half, around Lochaber, is made up of Fountain Lake group bedrock with granite deposits (Department of Natural Resources and Renewables). Surficial geology consists of stony & silty plain and drumlins, with alluvial

deposits found in between Lochaber and Lochiel lakes. The soil profile in the watershed varies, as to the north of Lochaber Lake there is moderately drained soil, with the immediate area surrounding the lake being very poorly drained soil. The dominant areas to both the east and west of the lake are considered well drained. Between Lochaber and Lochiel lakes, there is a mix of very poor to moderately drained soils, with the dominant area to the east and west being well drained.

Land use in the area is predominantly waterfront properties on Lochaber and Lochiel lakes, with agricultural fields to the north of Lochaber Lake, and forestry operations in the uplands to the east and west of the lakes.



Figure 49. North Branch St. Mary's subwatershed with main channel highlight in dark blue.

# 2.7.1 HSI Assessment and Analysis

Habitat suitability index surveys will begin during the 2025 field season, with 30 sites being surveyed over 2,400m of channel.

# 2.7.2 Aerial Photographs and Analysis

Table 145. Aerial photograph summary of the North River St. Mary's

Photo Set	Date Range	Observation
	Pre 1975	Agricultural activity visible between the North and East River St. Mary's with little to no riparian zones left intact. Early signs of forestry activity to the North.
1	1975 – 1991	Three new roads are visible. One heading northwest off Wallace Lake Rd., one to the north heading west off Hwy 7 presumably for forestry operations, and one to the south heading east off Hwy 7. A significant number of trees have been removed from the floodplain on the east side of the channel just above the confluence. There are signs of the North River braiding and there is visible erosion on the East River.
	1991 – 2008	Trees have been entirely removed on the west side of the channel north of Wallace Lake. There has been land cleared for power lines. Land has been cleared to the northwest of the channel, and there is another new road off Wallace Lake Rd.
	2008 – 2018	The land that was cleared to the northwest of the channel appears to have been replanted. The northwest corner of Wallace Lake is expanding and eroding into the floodplain. Agricultural fields on the East River has stopped and are reestablishing themselves as riparian forests, but the field in between the North and East Rivers remains operational.



Figure 50. Photo set 1 for North River St. Mary's aerial photographs

# 3.0 Instream Restoration Planning

The overall restoration outcome of this four-year project is set at 265,000 m<sup>2</sup> of habitat, with a significant portion of that consisting of instream restoration using established techniques including digger logs, deflectors, and rock sills. These structures have been designed to mimic the natural ecosystem of large woody debris (LWD) within a channel and have been developed to replace the historic abundance of LWD that would have naturally accumulated prior to European settlement and channelization for the purpose of log drives. LWD is vital for fostering complex instream environment such as rifles, runs, and pools, which are of a high priority for Atlantic salmon. The structures are installed at intervals of approximately six times the calculated bankfull width of the channel. Structures are installed in alternating directions as to create a pool habitat on the either the right or left side of the stream, this alternation of direction causes the river to adjust and recreate the historic stable meandering pattern. The process of scouring out these pools results in the downstream deposition of spawning substrate as well as the formation of gravel bars. Gravel bars are critical for narrowing the channel and encouraging the establishment of riparian zone vegetation. Structure design photos can be referenced in Appendix B.

The scope of work in 2025 will take place in three tributaries and will restore an estimate 72,074 m<sup>2</sup> in total. A summary of work planned for next year can be viewed in Table 146, maps of the planned area are in Figures 52 and 53. Work will include the installation of 50 structures in Cross Brook, 30 structures in Barren Brook, and 15 structures in the North Branch. Structures will include log and rock deflectors and digger logs.

Stream	Bankfull width (m)	Structures	Length under restoration (m)	Total habitat area restored (m <sup>2</sup> )
Cross Brook	10.72	50	3200	34,475
Barren Brook	10.53	30	1900	19,959
North Branch	14.00	15	1263	17,640
Total	-	95	6363	72,074

Table 146. Restoration planned for 2025.



Figure 51. Planned restoration area in Cross Brook



Figure 52. Planned restoration in Barren Brook

# 4.0 References

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# Appendices

# Appendix A: Water Quality

Site	Temperature (C)	Pressure (mmHg)	DO (%)	DO (mg/L)	SPC (uS/cm)	C (uS/cm)	TDS (mg/L)	SAL (ppt)	рН	pHmV
Kelly's Brook (above bridge)	6.0	760.3	101.8	12.67	19.8	12.6	12.9	0.01	5.50	76.1
Kelly's Brook (below bridge)	6.2	752.7	95.5	11.81	20.1	12.9	13.0	0.01	5.61	79.93
Kelly's Brook confluence	5.1	752.9	102.0	12.99	22.5	13.9	14.6	0.01	5.90	62.86
Cross Brook	5.2	752.5	91.4	11.60	26.8	16.7	17.4	0.01	5.99	57.71
West River (Caledonia)	5.0	752.7	91.6	11.69	22.4	13.9	14.6	0.01	5.92	61.71
West River (Lower Caledonia)	7.1	746.0	97.3	11.79	26.1	17.1	16.9	0.01	5.93	52.6
West River (Lake Rd.)	7.5	747.8	96.1	11.54	22.2	14.8	14.4	0.01	6.01	48.0
West River (Lead Mines Rd.)	7.2	748.1	91.9	11.11	22.5	14.8	14.6	0.01	5.90	54.0
Silvers Pool	8.1	748.7	84.2	9.95	35.5	24.0	23.1	0.02	6.46	23.0
Main River (Waternish)	7.6	749.2	88.9	10.63	29.1	19.4	18.9	0.01	6.29	32.4
East River (#347 Bridge, Aspen)	8.6	748.4	91.6	10.68	35.4	24.4	23.0	0.02	6.75	6.9
East River (E River Rd.)	5.9	759.4	98.1	12.30	28.5	18.1	18.5	0.01	6.52	19.3
East River (#347 Crossing, Newtown)	8.1	746.5	93.3	11.04	32.4	21.9	21.1	0.02	6.66	12.0
Fraser's Brook (E River Rd crossing)	5.3	758.2	95.4	12.12	22.9	14.3	14.9	0.01	6.08	43.8
Moose River (Old Campbell Rd.)	4.5	748.0	98.3	12.71	34.8	21.2	22.7	0.02	6.63	13.0
Moose River (George Ross Rd.)	4.6	750.2	98.8	12.74	33.2	20.2	21.5	0.02	6.52	19.5
Moose River (#347)	4.7	750.6	95.0	12.22	34.3	21.0	22.3	0.02	6.48	21.2
Garden River	4.7	750.2	97.3	12.51	27.6	16.9	17.9	0.01	6.67	16.4
Garden River (#347)	4.5	750.8	97.3	12.49	28.0	17.1	17.9	0.01	6.55	16.5
Fraser's Brook (College Rd.)	5.4	756.3	101.5	12.83	21.6	13.2	13.6	0.01	5.93	51.8
McKeens Brook (#7 Highway)	5.2	761.1	94.7	12.25	27.3	17.5	17.4	0.02	6.43	16.3

# Table 147. 2023 water quality measurement results.

## Table 148. 2024 Water Quality Results

Location	Site	Parameters	May 24	Jun 7	Jun 21	Jul 4	Jul 19	Aug 9	Aug 30	Sept 13	Nov 27
Moose	MR01	Temperature	21.8	12.9	20	13.9	24.3 (PM)	16.6	12.8	12.4	6.2
River		рН	7.08	7.04	7.19	6.81	7.02	7.16	6.95	6.94	6.1
	MR02	Temperature	12.5	11.7	17.3	13.2	17.6	13.8	11.1	10.9	5.5
		pН	7.6	7.11	7.27	7.04	5.65	7.04	7.08	7.07	6.39
		Temperature	21.0	13.1	20.1	14.8	19.4	18.1	12.6	12.5	5.7
Garden	GR01	рН	6.89	6.93	7.07	6.8	6.64	6.97	6.97	6.75	6.19
River	GR02	Temperature	12.8	12.8	19.5	14.1	18.9	16.3	12.6	-	5.7
	GNUZ	рН	6.73	6.85	6.94	6.74	6.79	6.63	6.97	-	6.19
	FB01	Temperature	19.8	12.4	19.0	13.7	19.1	15.2	13.1	11.5	6.3
Fraser's		рН	6.83	6.81	6.6	6.5	6.6	6.51	6.53	6.74	6.15
Brook	FB02	Temperature	17.5	21.1	17.1	13.6	18.7	15.6	11.8	11.8	6.3
		pН	6.5	6.53	6.63	6.29	6.21	6.57	6.57	6.35	5.85
McKeen Brook		Temperature	19.1	16.4	23.5	21.1	24.1	19.1	19.1	17.2	7.1
DIOOK	IVIBUI	рН	6.19	6.38	6.6	6.05	5.96	6.7	6.7	5.69	5.69
Barren	BB01	Temperature	18.4	13.8	20.4	15.3	20.0	17.4	14.5	12.8	6.4
BIOOK	BBUI	рН	6.15	6.29	5.8	5.78	5.83	6.14	6.17	5.74	4.85
Cross	0004	Temperature	18.5	13.8	21.4	15.8	21.7	17.0	14.1	13.0	6.3
Brook	CB01	рН	6.22	6.28	6.37	5.89	6.01	6.03	6.27	5.85	4.95
		Temperature	-	6.17	23.8	21.8	24.6	21.9	22.0	19.8	7.9
North	NR01	pН	-	7.04	7.01	8.72	6.79	6.97	6.85	6.96	6.79
River		Temperature	-	18.3	24.7	22.5	25.5	17.5	25.5	22.0	8.1
	NR02	рН	-	7.06	7.18	6.5	6.84	6.33	6.9	7.08	6.63
		Temperature	21.6	15.9	24.3	18.2	22.6	20.7	17.6	15.3	6.8
West Branch	WB01	рН	6.16	6.29	6.6	5.8	5.7	6.43	6.34	5.98	4.87
Dranch		Temperature	-	17.1	25.2	20.2	24.6	22.0	21.4	17.6	7.1
	WB02	рН	-	6.36	6.61	5.8	5.87	6.43	6.35	5.85	4.88
		Temperature	18.9	16.4	24.5	20.4	23.8	21.2	20.0	16.9	7.1
Feet	EB01	рН	6.56	6.72	6.81	6.49	6.54	6.86	6.74	6.22	6.25
East		Temperature	20.3	17.3	24.1	20.6	24.5	20.7	20.6	17.0	7.1
branch	EB02	рН	6.85	6.88	6.88	6.6	6.6	6.85	6.53	6.49	6.52
		Temperature	14.7	14.8	21.3	17.2	21.5	19.2	14.9	14.9	6.4
	EB03	pН	6.54	6.76	6.73	6.51	6.51	6.53	6.95	6.78	6.53
Main	MB01	Temperature	-	16.8	25.4	20.0	23.7	22.4	24.3	18.2	6.8
Branch		рН	-	6.62	6.63	6.17	6.18	6.45	6.63	6.09	5.72



Figure 53. Results of temperature probe at MR01, with red line highlighting  $23\,^\circ\!\mathrm{C}$ 



Figure 54. Results of temperature probe at MR02, with red line highlighting 23°C and 27°C



Figure 55. Results of temperature probe at GR01, with red line highlighting 23°C and 27°C



Figure 56. Results of temperature probe at GR02, with red line highlighting 23°C



Figure 57. Results of temperature probe at FB01



Figure 58. Results of temperature probe at FB02, with red line highlighting 23°C



Figure 59. Results of temperature probe at NR01, with red line highlighting 23°C and 27°C



Figure 60. Results of temperature probe at NR02, with red line highlighting 23°C



Figure 61. Results of temperature probe at MB01, with red line highlighting 23°C and 27°C



Figure 62. Results of temperature probe at MB02, with red line highlighting 23°C and 27°C



Figure 63. Results of temperature probe at BB01, with red line highlighting 23°C



Figure 64. Results of temperature probe at CB01, with red line highlighting 23°C



Figure 65. Results of temperature probe at CB02, with red line highlighting 23°C



Figure 66. Results of temperature probe at WB01, with red line highlighting 23°C and 27°C

# Appendix B: Structure Design Photos



Figure 67. Structural design of a digger log (NSSA, 2018)



Figure 68. Structural design of a rock sill (NSSA, 2018)



Figure 69. Structural design of a log deflector (NSSA. 2018).

# Appendix C: Habitat Suitability Index Surveys Barren Brook

	Downstream	Boundary	Upstream Boundary				
HSI Site #	Latitude	Longitude	Latitude	Longitude			
1	45.2766106	-62.2868136	45.2766369	-62.2872780			
2	45.2766282	-62.2873481	45.2766369	-62.2879528			
3	45.2766632	-62.2880229	45.2767947	-62.2885224			
4	45.2768122	-62.2886100	45.2771101	-62.2883559			
5	45.2771452	-62.2883121	45.2776710	-62.2880317			
6	45.2777148	-62.2880229	45.2780828	-62.2881368			

## Table 149. 2023 Barren Brook HSI site locations.

#### Table 150. 2024 Barren Brook HSI site locations.

	Downstream	Boundary	Upstream E	Boundary
HSI Site #	Latitude	Longitude	Latitude	Longitude
1	45.276615	-62.286739	45.276700	-62.287175
2	45.276664	-62.287283	45.276615	-62.287864
3	45.276639	-62.287973	45.276869	-62.288603
4	45.276930	-62.288651	45.277244	-62.288215
5	45.277281	-62.288240	45.277644	-62.287998
6	45.277813	-62.287973	45.278140	-62.288191
7	45.278201	-62.288264	45.278600	-62.287998
8	45.278636	-62.287913	45.278951	-62.287574
9	45.278987	-62.287489	45.279241	-62.287985
10	45.279302	-62.287961	45.279665	-62.287731
11	45.279726	-62.287586	45.279943	-62.287332
12	45.280077	-62.287308	45.280331	-62.287538
13	45.280403	-62.287538	45.280779	-62.287453
14	45.280875	-62.287453	45.281238	-62.286981
15	45.281359	-62.287005	45.281747	-62.286763

А	В	С	D	E	F	G	н	I	J	К	L	М
Field Sheet #	% Pools	Pool Class Rating	% In- stream Cover (fry)	% In-stream Cover (parr)	Dominant Substrate Type	Avg. % Veg Along Streambank	Avg. % Rooted Veg and Stable Rocky Ground Cover	Spawning Present	Avg. Size of Substrate in Spawning Areas	% Fines in Spawning Areas	Avg. Thalweg Depth During Late Growing Season	% Stream Shade
1	0.74	0.30	0.58	0.13	0.60	0.62	1.00	yes	0.18	0.94	0.69	1.00
2	0.71	0.60	1.00	0.51	0.60	0.86	1.00	no	-	-	0.47	1.00
3	0.54	0.60	0.71	0.21	0.60	0.94	1.00	no	-	-	0.56	0.86
4	0.68	0.60	1.00	0.72	0.60	0.96	0.92	no	-	-	1.00	0.86
5	0.66	0.60	0.70	0.20	0.60	1.00	0.92	no	-	-	0.62	0.72
6	0.44	0.60	0.56	0.12	0.60	1.00	1.00	no	-	-	0.77	0.58
Overall	0.64	0.60	0.83	0.40	0.60	0.90	0.97	-	0.18	0.94	0.68	0.84

## Table 151. Barren Brook 2023 HSI results for Brook trout.

Table 152. Barren Brook 2023 HSI results for Atlantic salmon.

А	В	С	D	E	F	G	Н	I	J	К	L	М	N
Field Sheet #	% Pools	Pool Class Rating	% In- stream Cover (fry)	% In-stream Cover (parr)	Dominant Substrate Type	Avg. % Veg Along Streambank	Avg. % Rooted Veg and Stable Rocky Ground Cover	Spawning Present	Avg. Size of Substrate in Spawning Areas	% Fines in Spawning Areas	Fry Water Depth	Parr Water Depth	% Stream Shade
1	0.90	0.60	1.00	0.67	0.60	0.62	1.00	yes	0.80	0.94	1.00	1.00	1.00
2	0.86	0.60	1.00	0.51	0.60	0.86	1.00	yes	0.96	0.81	1.00	1.00	1.00
3	0.55	0.60	0.71	0.21	0.60	0.94	1.00	no	-	-	1.00	1.00	0.86
4	0.82	0.60	1.00	0.72	0.60	0.96	0.92	no	-	-	0.86	1.00	0.86
5	0.78	0.60	0.70	0.20	0.60	1.00	0.92	no	-	-	1.00	1.00	0.72
6	0.35	0.60	0.56	0.12	0.60	1.00	1.00	no	-	-	1.00	1.00	0.58
Overall	0.73	0.60	0.83	0.40	0.60	0.90	0.97	-	0.88	0.88	0.98	1.00	0.84

Table 153. Barren Brook 2024 HSI results for brook trout

А	В	С	D	E	F	G	Н	I	J	к	L	М
Field Sheet #	% Pools	Pool Class Rating	% In- stream Cover (fry)	% In-stream Cover (parr)	Dominant Substrate Type	Avg. % Veg Along Streambank	Avg. % Rooted Veg and Stable Rocky Ground Cover	Spawning Present	Avg. Size of Substrate in Spawning Areas	% Fines in Spawning Areas	Avg. Thalweg Depth During Late Growing Season	% Stream Shade
1	0.55	0.60	0.83	0.18	0.6	0.65	0.77	no	-	-	0.01	1
2	0.70	0.60	0.54	0.05	0.6	0.72	0.91	yes	0.76	0.85	0.30	1
3	0.49	0.60	0.63	0.08	0.6	0.91	0.91	yes	0.85	0.53	0.23	1
4	0.86	0.60	0.69	0.18	0.6	0.80	0.91	yes	0.63	0.87	0.40	0.93

5	0.29	0.30	0.72	0.14	0.6	0.74	0.88	yes	0.92	0.64	0.29	1
6	0.53	0.60	0.74	0.23	1	0.87	0.68	no	-	-	0.88	1
7	0.84	1.00	0.87	1	0.6	0.72	0.38	no	-	-	0.99	0.79
8	0.29	0.30	0.92	0.36	1	0.68	0.96	yes	0.76	0.53	0.43	0.93
9	1	0.60	1	0.57	1	-	-	no	-	-	0.87	-
10	0.84	0.60	0.60	0.10	0.6	0.80	0.45	yes	0.49	0.64	0.64	0.86
11	0.37	0.60	0.64	0.13	0.6	0.59	0.68	no	-	-	0.63	1
12	0.91	0.60	1	0.68	0.6	0.60	0.77	no	-	-	1	1
13	0.29	0.30	0.71	0.22	0.6	0.68	0.77	yes	1	0.53	1	1
14	0.29	0.30	0.59	0.11	0.6	0.80	0.26	no	-	-	0.45	1
15	0.55	0.60	0.77	0.22	0.6	0.63	0.81	no	-	-	0.07	1
Overall	0.58	0.54	0.75	0.28	0.68	0.68	0.67	-	0.77	0.65	0.54	0.90

Table 154. Barren Brook 2024 HSI results for Atlantic salmon.

A	В	с	D	E	F	G	Н	I	J	к	L	м	Ν
Field Sheet #	% Pools	Pool Class Rating	% In- stream Cover (fry)	% In- stream Cover (parr)	Dominant Substrate Type	Avg. % Veg Along Streambank	Avg. % Rooted Veg and Stable Rocky Ground Cover	Spawning Present	Avg. Size of Substrate in Spawning Areas	% Fines in Spawning Areas	Fry Water Depth	Parr Water Depth	% Stream Shade
1	0.58	0.60	0.83	0.18	0.6	0.65	0.77	no	-	-	1	0.95	1
2	0.85	0.60	0.54	0.05	0.6	0.72	0.91	yes	0.96	0.85	1	1	1
3	0.45	0.60	0.63	0.08	0.6	0.91	0.91	yes	0.98	0.53	1	1	1
4	0.99	0.60	0.69	0.18	0.6	0.80	0.91	yes	0.92	0.87	1	1	0.93
5	0.11	0.30	0.72	0.14	0.6	0.74	0.88	yes	1	0.64	1	1	1
6	0.53	0.60	0.74	0.23	1	0.87	0.68	no	-	-	1	1	1
7	0.99	1.00	0.87	1	0.6	0.72	0.38	no	-	-	0.06	0.06	0.79
8	0.11	0.30	0.92	0.36	1	0.68	0.96	yes	0.96	0.53	1	1	0.93
9	0.42	0.60	1	0.57	1	-	-	no	-	-	1	1	-
10	0.42	0.60	1	0.57	1	-	-	no	-	-	1	1	-
11	0.24	0.60	0.64	0.13	0.6	0.59	0.68	no	-	-	1	1	1
12	0.98	0.60	1	0.68	0.6	0.60	0.77	no	-	-	0.73	1	1

13	0.11	0.30	0.71	0.22	0.6	0.68	0.77	yes	1	0.53	0.36	0.45	1
14	0.11	0.30	0.59	0.11	0.6	0.80	0.26	no	-	-	1	1	1
15	0.58	0.60	0.77	0.22	0.6	0.63	0.81	no	-	-	1	1	1
Overall	0.49	0.54	0.77	0.31	0.70	0.62	0.64	-	0.97	0.65	0.87	0.89	0.84

# Garden River

	Downstr	eam Boundary	Upst	ream Boundary
HSI Site #	Latitude	Longitude	Latitude	Longitude
1	45.433547	-62.316374	45.434028	-62.316596
2	45.4263184	-62.3016417	45.4267112	-62.3011678
3	45.4269752	-62.3007344	45.4269549	-62.3000167
4	45.4268127	-62.2997526	45.4264200	-62.2992109
5	45.4262846	-62.2990552	45.4259257	-62.2985812
6	45.4257971	-62.2984119	45.4256210	-62.2977551
7	45.4256142	-62.2972608	45.4257632	-62.2965431
8	45.4258174	-62.2962993	45.4259528	-62.2955748
9	45.4259460	-62.2955410	45.4263252	-62.2950738
10	45.4263591	-62.2950332	45.4267789	-62.2949790

#### Table 155. 2023 Garden River HSI site locations.

#### Table 156. 2024 Garden River HSI site locations.

	Downstrea	m Boundary	Upstrea	m Boundary
HSI Site #	Latitude	Longitude	Latitude	Longitude
1	45.437842	-62.299643	45.438440	-62.300023
2	45.438613	-62.300185	45.439109	-62.300283
3	45.439218	-62.300310	45.439703	-62.300599
4	45.439739	-62.300810	45.439945	-62.301602
5	45.439989	-62.301498	45.440521	-62.301249
6	45.440614	-62.301144	45.441171	-62.301398
7	45.441240	-62.301436	45.441561	-62.302141
8	45.441573	-62.302249	45.441859	-62.302717
9	45.441928	-62.302770	45.442528	-62.302810

10	45.442699	-62.302874	45.443364	-62.302903
11	45.443449	-62.302791	45.443996	-62.302550
12	45.444054	-62.302499	45.444256	-62.301937
13	45.444304	-62.301665	45.444795	-62.301361
14	45.444846	-62.301332	45.445371	-62.301677
15	45.445430	-62.301811	45.445965	-62.301770
16	45.446076	-62.301665	45.446541	-62.301844
17	45.446597	-62.301790	45.447248	-62.301658
18	45.447410	-62.301707	45.447285	-62.301584
19	45.447889	-62.302186	45.447805	-62.302085
20	45.448598	-62.302290	45.448734	-62.302271

## Table 157. Garden River 2023 HSI results for Brook trout.

А	В	С	D	E	F	G	н	I	J	К	L	М
Field Sheet #	% Pools	Pool Class Rating	% In-stream Cover (fry)	% In-stream Cover (parr)	Dominant Substrate Type	Avg. % Veg Along Streambank	Avg. % Rooted Veg and Stable Rocky Ground Cover	Spawning Present	Avg. Size of Substrate in Spawning Areas	% Fines in Spawning Areas	Avg. Thalweg Depth During Late Growing Season	% Stream Shade
1	0.51	0.60	1.00	0.62	1.00	0.88	1.00	no	-	1	0.79	0.37
2	0.95	0.60	0.95	0.52	0.60	0.95	1.00	no	-	-	0.61	0.93
3	1.00	0.60	0.73	0.17	0.60	0.86	1.00	no	-	-	0.65	0.93
4	0.30	0.30	0.76	0.23	0.60	0.34	1.00	no	-	-	0.28	0.79
5	0.32	0.60	0.64	0.15	1.00	0.45	1.00	no	-	-	0.56	0.77
6	0.61	0.60	0.69	0.17	1.00	0.79	1.00	no	-	-	0.29	1.00
7	0.76	0.60	0.76	0.19	0.60	0.45	1.00	no	-	-	0.50	0.76
8	0.61	0.60	0.84	0.33	0.60	0.92	1.00	no	-	-	0.45	1.00
9	0.96	0.60	0.73	0.19	0.60	0.93	1.00	no	-	-	0.67	0.79
10	0.93	0.60	1.00	0.48	0.60	0.81	1.00	no	-	-	0.42	0.72
Overall	0.76	0.57	0.81	0.30	0.72	0.74	1.00	-	-	-	0.52	0.81

Table 158. Garden River 2023 HSI results for Atlantic salmon.

A	В	С	D	E	F	G	Н	Ι	J	к	L	м	Ν

Field Sheet#	% Pools	Pool Class Rating	% In- stream Cover (fry)	% In- stream Cover (parr)	Dominant Substrate Type	Avg. % Veg Along Streambank	Avg. % Rooted Veg and Stable Rocky Ground Cover	Spawning Present	Avg. Size of Substrate in Spawning Areas	% Fines in Spawning Areas	Fry Water Depth	Parr Water Depth	% Stream Shade
1	0.49	0.60	1.00	0.62	1.00	0.88	1.00	yes	0.96	0.54	1.00	1.00	0.37
2	0.93	0.60	0.95	0.52	0.60	0.95	1.00	no	-	-	1.00	1.00	0.93
3	0.60	0.60	0.73	0.17	0.60	0.86	1.00	no	-	-	0.86	1.00	0.93
4	0.12	0.30	0.76	0.23	0.60	0.34	1.00	yes	1.00	0.64	1.00	1.00	0.79
5	0.15	0.60	0.64	0.15	1.00	0.45	1.00	no	-	-	1.00	1.00	0.77
6	0.68	0.60	0.69	0.17	1.00	0.79	1.00	no	-	-	1.00	1.00	1.00
7	0.93	0.60	0.76	0.19	0.60	0.45	1.00	yes	1.00	0.62	0.96	1.00	0.76
8	0.69	0.60	0.84	0.33	0.60	0.92	1.00	no	-	-	1.00	1.00	1.00
9	0.91	0.60	0.73	0.19	0.60	0.93	1.00	no	-	1	1.00	1.00	0.79
10	0.91	0.60	0.73	0.19	0.60	0.93	1.00	no	-	-	1.00	1.00	0.79
Overall	0.93	0.57	0.78	0.27	0.72	0.75	1.00	-	0.99	0.60	0.98	1.00	0.81

## Table 159. Garden River 2024 HSI results for brook trout.

А	В	С	D	E	F	G	н	I	J	К	L	М
Field Sheet #	% Pools	Pool Class Rating	% In-stream Cover (fry)	% In- stream Cover (parr)	Dominant Substrate Type	Avg. % Veg Along Streambank	Avg. % Rooted Veg and Stable Rocky Ground Cover	Spawning Present	Avg. Size of Substrate in Spawning Areas	% Fines in Spawning Areas	Avg. Thalweg Depth During Late Growing Season	% Stream Shade
1	0.29	0.30	0.87	0.26	0.6	1	1	yes	0.92	0.73	0.38	1
2	0	0.60	0.80	0.29	0.6	0.95	1	no	-	-	0.54	1
3	0.37	0.60	1	0.61	0.6	0.98	1	no	-	-	0.40	1
4	0.29	0.30	0.61	0.05	-	0.79	1	yes	1	0.92	0.39	1
5	0.99	0.60	0.78	0.23	0.6	0.93	0.91	yes	1	0.67	0.95	1
6	0.85	0.60	0.70	0.17	0.6	0.86	1	no	-	-	1	1
7	1	0.60	0.76	0.19	0.6	0.91	1	no	-	-	0.40	0.93
8	0.73	0.60	0	0	0.6	0.77	1	no	-	-	0.60	1
9	0.89	0.60	0.67	0.12	0.6	0.73	1	yes	0.59	0.64	0.85	1
10	0.29	0.30	1	0.55	0.6	0.46	0.96	no	-	-	0.67	1
11	0.60	0.60	0.84	0.20	0.6	0.73	0.99	no	-	-	0.41	1
12	0.29	0.30	0.66	0.15	0.6	0.97	0.99	no	-	-	0.49	0.93

13	0.70	0.60	1	0.78	0.3	-	-	no	-	-	1	1
14	1	0.60	0.76	0.22	0.6	0.49	1	yes	0.92	0.64	0.76	0.58
15	0.72	0.60	0.56	0.10	0.6	0.63	0.98	no	-	-	0.82	1
16	0.51	0.60	0.63	0.09	0.6	0.92	1	yes	0.28	0.94	0.39	1
17	1	0.60	1	0.49	0.6	0.84	0.96	yes	0.59	0.64	0.59	0.86
18	0.29	0.30	0.56	0.08	0.6	0.51	0.84	no	-	-	0.45	1
19	0.83	0.60	0.65	0.11	0.6	0.89	1	yes	0.72	0.90	0.66	0.93
20	0.53	0.60	0.67	0.13	0.6	0.82	-	yes	0.17	0.64	0.99	1
Overall	0.60	0.52	0.96	0.24	0.55	0.76	0.88	-	0.66	0.74	0.63	0.96

Table 160. Garden River 2024 HSI results for Atlantic salmon.

А	В	С	D	E	F	G	н	I	J	К	L	м	N
Field Sheet #	% Pools	Pool Class Rating	% In-stream Cover (fry)	% In- stream Cover (parr)	Dominant Substrate Type	Avg. % Veg Along Streambank	Avg. % Rooted Veg and Stable Rocky Ground Cover	Spawning Present	Avg. Size of Substrate in Spawning Areas	% Fines in Spawning Areas	Fry Water Depth	Parr Water Depth	% Stream Shade
1	0.11	0.30	0.87	0.26	0.6	1	1	yes	1	0.73	1	1	1
2	0	0.60	0.80	0.29	0.6	0.95	1	no	-	-	0.96	1	1
3	0.23	0.60	1	0.61	0.6	0.98	1	no	-	-	1	1	1
4	0.11	0.30	0.61	0.05	-	0.79	1	yes	1	0.92	1	1	1
5	0.13	0.60	0.78	0.23	0.6	0.93	0.91	yes	1	0.67	0.88	1	1
6	1.00	0.60	0.70	0.17	0.6	0.86	1	no	-	-	1	1	1
7	0.75	0.60	0.76	0.19	0.6	0.91	1	no	-	-	0.75	1	0.93
8	0.89	0.60	0	0	0.6	0.77	1	no	-	-	0.93	1	1
9	0.99	0.60	0.67	0.12	0.6	0.73	1	yes	0.91	0.64	0.96	1	1
10	0.99	0.60	0.67	0.12	0.6	0.73	1	yes	0.91	0.64	0.96	1	1
11	0.68	0.60	0.84	0.20	0.6	0.73	0.99	no	-	-	1	1	1
12	0.11	0.30	0.66	0.15	0.6	0.97	0.99	no	-	-	1	1	0.93
13	0.84	0.60	1	0.78	0.3	-	-	no	-	-	1	1	1
14	0.22	0.60	0.76	0.22	0.6	0.49	1	yes	1	0.64	0.65	0.88	0.58
15	0.87	0.60	0.56	0.10	0.6	0.63	0.98	no	-	-	1	1	1

16	0.50	0.60	0.63	0.09	0.6	0.92	1	yes	0.83	0.94	1	1	1
17	0.74	0.60	1	0.49	0.6	0.84	0.96	yes	0.91	0.64	1	1	0.86
18	0.11	0.30	0.56	0.08	0.6	0.51	0.84	no	-	-	1	1	1
19	0.99	0.60	0.65	0.11	0.6	0.89	1	yes	0.94	0.90	1	1	0.93
20	0.99	0.60	0.65	0.11	0.6	0.89	1	yes	0.94	0.90	1	1	0.93
Overall	0.56	0.54	0.70	0.21	0.58	0.79	0.93	-	0.94	0.76	0.95	1	0.95

# Frasers Brook

## Table 161. 2023 Frasers Brook HSI site locations.

	Downstream	m Boundary	Upstream Boundary				
HSI Site #	Latitude	Longitude	Latitude	Longitude			
1	45.3574508	-62.1265717	45.3576397	-62.1268041			
2	45.3576656	-62.1269948	45.3578115	-62.1274123			
3	45.3579614	-62.1275136	45.3581519	-62.1276676			
4	45.3583384	-62.1277811	45.3585370	-62.1280811			
5	45.3587316	-62.1281621	45.3590802	-62.1283405			
6	45.3593071	-62.1283729	45.3596314	-62.1284661			
7	45.3598381	-62.1283688	45.3599800	-62.1283324			
8	45.3719092	-62.1186021	45.3722565	-62.1185751			
9	45.3723375	-62.1185558	45.3726617	-62.1187835			
10	45.3727466	-62.1187102	45.3731055	-62.1187874			
11	45.3731557	-62.1187063	45.3735300	-62.1186369			
12	45.3737306	-62.1185751	45.3740509	-62.1183590			
13	45.3742207	-62.1182510	45.3745565	-62.1181391			
14	45.3745565	-62.1181391	45.3748536	-62.1182818			

#### Table 162. 2024 Frasers Brook HSI site locations

	Downstrea	am Boundary	Upstream Boundary				
HSI Site #	Latitude	Longitude	Latitude	Longitude			
1	45.3574391	-62.1265502	45.3576414	-62.1266909			
2	45.3576502	-62.1267789	45.3577470	-62.1270603			
3	45.3577734	-62.1271219	45.3579053	-62.1273770			

4	45.3579757	-62.1274737	45.3581692	-62.1276321
5	45.3582571	-62.1276672	45.3584242	-62.1278519
6	45.3585298	-62.1279047	45.3587145	-62.1280718
7	45.3588112	-62.1281158	45.3590487	-62.1282038
8	45.3591279	-62.1282214	45.3593654	-62.1283005
9	45.3594621	-62.1283093	45.3596908	-62.1283445
10	45.3598227	-62.1283181	45.3602009	-62.1282477

## Table 163: 2023 Fraser's Brook HSI results for Brook trout.

А	В	С	D	E	F	G	н	T	J	к	L	м
Field Sheet #	% Pools	Pool Class Rating	% In- stream Cover (fry)	% In- stream Cover (parr)	Dominant Substrate Type	Avg. % Veg Along Streambank	Avg. % Rooted Veg and Stable Rocky Ground Cover	Spawning Present	Avg. Size of Substrate in Spawning Areas	% Fines in Spawning Areas	Avg. Thalweg Depth During Late Growing Season	% Stream Shade
1	0.76	0.60	1.00	0.37	0.60	0.72	0.65	yes	1.00	0.65	0.14	1.00
2	0.82	0.60	1.00	0.46	0.60	0.68	0.95	yes	0.81	0.73	0.07	1.00
3	0.30	0.30	1.00	0.43	0.60	0.60	0.77	yes	1.00	0.65	0.33	1.00
4	0.61	0.60	0.74	0.16	0.60	0.81	1.00	yes	0.89	0.68	0.26	1.00
5	0.51	0.60	1.00	0.64	0.30	0.68	1.00	no	-	-	0.09	1.00
6	0.53	0.60	0.84	0.22	0.60	0.95	1.00	no	-	-	0.57	1.00
7	0.30	0.30	1.00	0.40	0.60	0.63	1.00	No	-	-	0.10	1.00
8	1.00	0.60	1.00	0.73	0.60	0.50	1.00	yes	0.24	0.43	0.13	1.00
9	0.93	0.60	1.00	0.47	0.60	0.63	1.00	yes	0.93	0.81	0.48	1.00
10	0.86	0.60	1.00	0.71	0.60	0.66	1.00	no	-	-	0.81	1.00
11	0.30	0.30	1.00	0.49	0.60	0.65	0.81	no	-	-	0.60	1.00
12	0.45	0.60	1.00	0.35	1.00	0.44	1.00	yes	0.45	0.88	0.08	1.00
13	0.87	0.60	1.00	0.80	0.60	0.58	0.97	yes	0.50	0.54	0.26	1.00
14	0.78	0.60	1.00	0.53	1.00	0.57	1.00	yes	1.00	0.88	0.33	0.93
Overall	0.72	0.54	0.96	0.46	0.57	0.69	0.94	-	0.81	0.66	0.30	1.00

Table 164. 2023 Fraser's Brook HSI results for Atlantic salmon.

А	В	С	D	E	F	G	Н	I	J	К	L	М	Ν
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Field Sheet #	% Pools	Pool Class Rating	% In- stream Cover (fry)	% In-stream Cover (parr)	Dominant Substrate Type	Avg. % Veg Along Streambank	Avg. % Rooted Veg and Stable Rocky Ground Cover	Spawning Present	Avg. Size of Substrate in Spawning Areas	% Fines in Spawning Areas	Fry Water Depth	Parr Water depth	% Stream Shade
1	0.93	0.60	1.00	0.37	0.60	0.72	0.65	yes	1.00	0.65	1.00	1.00	1.00
2	0.98	0.60	1.00	0.46	0.60	0.68	0.95	yes	0.97	0.73	1.00	1.00	1.00
3	0.12	0.30	1.00	0.43	0.60	0.60	0.77	yes	1.00	0.65	1.00	0.78	1.00
4	0.69	0.60	0.74	0.16	0.60	0.81	1.00	yes	0.99	0.68	1.00	0.95	1.00
5	0.48	0.60	1.00	0.64	0.30	0.68	1.00	no	-	-	1.00	1.00	1.00
6	0.53	0.60	0.84	0.22	0.60	0.95	1.00	no	-	-	1.00	1.00	1.00
7	0.12	0.30	1.00	0.40	0.60	0.63	1.00	no	-	-	1.00	1.00	1.00
8	0.65	0.60	1.00	0.73	0.60	0.50	1.00	yes	0.83	0.43	1.00	1.00	1.00
9	0.95	0.60	1.00	0.47	0.60	0.63	1.00	yes	1.00	0.48	1.00	1.00	1.00
10	0.95	0.60	1.00	0.47	0.60	0.63	1.00	yes	1.00	0.48	1.00	1.00	1.00
11	0.12	0.30	1.00	0.49	0.60	0.65	0.81	no	-	-	1.00	1.00	1.00
12	0.37	0.60	1.00	0.35	1.00	0.44	1.00	yes	0.88	0.88	1.00	0.79	1.00
13	1.00	0.60	1.00	0.80	0.60	0.58	0.97	yes	0.89	0.54	1.00	0.89	1.00
14	0.95	0.60	1.00	0.53	1.00	0.57	1.00	yes	1.00	0.88	1.00	1.00	0.93
Overall	0.87	0.54	0.96	0.44	0.57	0.68	0.94	-	0.97	0.58	1.00	0.97	1.00

А	В	С	D	E	F	G	н	I	J	к	L	М
Field Sheet #	% Pools	Pool Class Rating	% In- stream Cover (fry)	% In- stream Cover (parr)	Dominant Substrate Type	Avg. % Veg Along Streambank	Avg. % Rooted Veg and Stable Rocky Ground Cover	Spawning Present	Avg. Size of Substrat e in Spawnin g Areas	% Fines in Spawning Areas	Avg. Thalweg Depth During Late Growing Season	% Stream Shade
1	0.46	0.60	0.79	0.16	0.6	0.70	0.68	no	-	-	0.24	1
2	0.64	0.60	1	0.38	0.6	0.79	0.45	yes	0.68	0.90	0.07	1
3	0.29	0.30	0.52	0	0.6	0.64	0.52	yes	0	0.27	0.17	0.93
4	0.29	0.30	0.61	0.16	1	0.57	0.91	no	-	-	0.24	1
5	0.70	0.60	0.81	0.42	0.6	0.63	0.68	no	-	-	0.21	1
6	0.29	0.30	0.65	0.08	0.6	0.82	0.91	no	-	-	0.31	0.86
7	0.96	0.60	0.95	0.25	0.6	0.35	0.73	no	-	-	0.40	0.93
8	0.29	0.30	0.90	0.08	0.6	0.50	1	no	-	-	0.04	1
9	0.86	0.60	1	0.61	0.6	0.53	0.60	yes	0	0.75	0.10	1

10	0.45	0.60	1	0.76	1	0.97	0.99	no	-	-	0.33	1
Overall	0.52	0.48	0.82	0.29	0.68	0.65	0.75	-	0.68	0.64	0.21	0.97

Table 166. 2024 Fraser's Brook HSI results for Atlantic salmon.

А	В	С	D	E	F	G	н	I	J	К	L	М	Ν
Field Sheet #	% Pools	Pool Class Rating	% In- stream Cover (fry)	% In-stream Cover (parr)	Dominant Substrate Type	Avg. % Veg Along Streambank	Avg. % Rooted Veg and Stable Rocky Ground Cover	Spawning Present	Avg. Size of Substrate in Spawning Areas	% Fines in Spawning Areas	Fry Water Depth	Parr Water depth	% Stream Shade
1	0.39	0.60	0.79	0.16	0.6	0.70	0.68	no	-	-	1	0.99	1
2	0.75	0.60	1	0.38	0.6	0.79	0.45	yes	0.93	0.90	1	1	1
3	0.11	0.30	0.52	0	0.6	0.64	0.52	yes	0.09	0.27	1	0.76	0.93
4	0.11	0.30	0.61	0.16	1	0.57	0.91	no	-	-	1	0.87	1
5	0.84	0.60	0.81	0.42	0.6	0.63	0.68	no	-	-	1	0.95	1
6	0.11	0.30	0.65	0.08	0.6	0.82	0.91	no	-	-	1	1	0.86
7	0.90	0.60	0.95	0.25	0.6	0.35	0.73	no	-	-	1	1	0.93
8	0.11	0.30	0.90	0.08	0.6	0.50	1	no	-	-	0.66	0.33	1
9	0.99	0.60	1	0.61	0.6	0.53	0.60	yes	0.72	0.75	1	0.68	1
10	0.99	0.60	1	0.61	0.6	0.53	0.60	yes	0.72	0.75	1	0.68	1
Overall	0.53	0.48	0.82	0.28	0.64	0.61	0.71	-	0.62	0.66	0.97	0.83	0.97

# Cross Brook

#### Table 167. 2024 Cross Brook HSI site locations.

	Downstream	Boundary	Upstream Boundary				
HSI Site #	Latitude	Longitude	Latitude	Longitude			
1	45.282697	-62.386489	45.283239	-62.386761			
2	45.283435	-62.386841	45.284299	-62.387495			
3	45.284437	-62.387561	45.285033	-62.387767			
4	45.285140	-62.387755	45.285304	-62.387196			
5	45.285492	-62.386981	45.285984	-62.386707			
6	45.286212	-62.386647	45.286636	-62.387060			
7	45.286705	-62.387052	45.287288	-62.387604			

8	45.287408	-62.387667	45.287587	-62.388256
9	45.287671	-62.388388	45.287723	-62.388881
10	45.287777	-62.389098	45.287831	-62.389750
11	45.287804	-62.389886	45.287804	-62.390511
12	45.287886	-62.390620	45.288402	-62.391381
13	45.288483	-62.391381	45.289054	-62.391815
14	45.289054	-62.391870	45.289462	-62.392250
15	45.289516	-62.392304	45.289923	-62.392658
16	45.290114	-62.392631	45.290766	-62.393391
17	45.290603	-62.393636	45.290902	-62.394750
18	45.290929	-62.394831	45.291445	-62.395076
19	45.291554	-62.395266	45.291771	-62.395592
20	45.291907	-62.395728	45.292532	-62.396054

A	В	С	D	E	F	G	н	ļ	1	К	L	м
Field Sheet #	% Pools	Pool Class Rating	% In- stream Cover (fry)	% In- stream Cover (parr)	Dominant Substrate Type	Avg. % Veg Along Streambank	Avg. % Rooted Veg and Stable Rocky Ground Cover	Spawning Present	Avg. Size of Substrate in Spawning Areas	% Fines in Spawning Areas	Avg. Thalweg Depth During Late Growing Season	% Stream Shade
1	0.99	0.60	1	0.41	0.6	0.68	0.77	yes	0.40	0.94	0.54	0.93
2	0.97	0.60	0.57	0.06	0.6	0.92	0.28	no	-	-	0.50	1
3	0.58	0.60	1	0.40	0.6	-	-	yes	0.40	0.73	0.77	
4	1	0.60	1	0.47	0.6	0.89	0.77	no	-	-	1	1
5	0.60	0.60	0.67	0.14	0.6	0.86	0.94	no	-	-	1	1
6	0.65	0.60	0.60	0.08	0.6	0.91	0.77	no	-	-	0.86	1
7	0.29	0.30	0.71	0.17	1	0.73	0.77	no	-	-	0.59	0.72
8	0.29	0.30	0.85	0.25	1	0.91	0.84	yes	0.99	1	0.30	1
9	0.94	1.00	1	0.44	0.6	0.58	0.91	yes	0.68	0.94	1	0.93
10	0.83	0.60	1	0.32	1	0.80	0.88	no	-	-	0.27	1

11	0.29	0.30	0.82	0.21	0.6	0.85	1	no	-	-	1.0	1
12	0.29	0.30	0.55	0.04	1	0.82	0.91	yes	0.40	0.94	0.02	1
13	0.29	0.30	0.64	0.09	1	0.84	0.99	no	-	-	0.27	1
14	0.29	0.30	0.80	0.12	0.6	0.77	0.45	yes	0.49	0.94	0.30	1
15	0.29	0.30	0.49	0.03	0.6	0.65	0.77	no	-	-	0.16	1
16	0.29	0.30	0.52	0.08	0.6	0.80	0.77	yes	0	0.98	0.19	1
17	0.29	0.30	0.71	0.10	0.6	0.79	0.96	yes	0.49	0.80	0.12	1
18	0.35	0.60	0.71	0.19	0.6	1	0.96	yes	0.76	0.80	0.36	1
19	0.29	0.30	0.87	0.27	1	0.79	1	no	-	-	0.29	1
20	0.29	0.30	0.78	0.23	1	0.85	0.99	no	-	-	0.28	1
Overall	0.50	0.45	0.76	0.20	0.74	0.77	0.74	-	0.51	0.89	0.49	0.92

## Table 169. Cross Brook results for Atlantic salmon in 2024.

А	В	С	D	E	F	G	Н	I	J	К	L	М	N
Field Sheet #	% Pools	Pool Class Rating	% In- stream Cover (fry)	% In- stream Cover (parr)	Dominant Substrate Type	Avg. % Veg Along Streambank	Avg. % Rooted Veg and Stable Rocky Ground Cover	Spawning Present	Avg. Size of Substrate in Spawning Areas	% Fines in Spawning Areas	Fry Water Depth	Parr Water Depth	% Stream Shade
1	0.13	0.60	1	0.41	0.6	0.68	0.77	yes	0.86	0.94	1	1	0.93
2	0.89	0.60	0.57	0.06	0.6	0.92	0.28	no	-	-	1	1	1
3	0.63	0.60	1	0.40	0.6	-	-	yes	0.86	0.73	1	1	-
4	0.50	0.60	1	0.47	0.6	0.89	0.77	no	-	-	0.89	1	1
5	0.67	0.60	0.67	0.14	0.6	0.86	0.94	no	-	-	1	1	1
6	0.76	0.60	0.60	0.08	0.6	0.91	0.77	no	-	-	1	1	1
7	0.11	0.30	0.71	0.17	1	0.73	0.77	no	-	-	1	0.78	0.72
8	0.11	0.30	0.85	0.25	1	0.91	0.84	yes	1	1	1	0.95	1
9	0.93	1.00	1	0.44	0.6	0.58	0.91	yes	0.93	0.94	0.48	0.62	0.93
10	0.93	1.00	1	0.44	0.6	0.58	0.91	yes	0.93	0.94	0.48	0.62	0.93
11	0.11	0.30	0.82	0.21	0.6	0.85	1	no	-	-	1	1	1
12	0.11	0.30	0.55	0.04	1	0.82	0.91	yes	0.86	0.94	1	0.77	1

13	0.11	0.30	0.64	0.09	1	0.84	0.99	no	-	-	1	0.95	1
14	0.11	0.30	0.80	0.12	0.6	0.77	0.45	yes	0.89	0.94	1	0.88	1
15	0.11	0.30	0.49	0.03	0.6	0.65	0.77	no	-	-	1	0.88	1
16	0.11	0.30	0.52	0.08	0.6	0.80	0.77	yes	0.74	0.98	1	1	1
17	0.11	0.30	0.71	0.10	0.6	0.79	0.96	yes	0.89	0.80	1	0.91	1
18	0.20	0.60	0.71	0.19	0.6	1	0.96	yes	0.96	0.80	1	1	1
19	0.11	0.30	0.87	0.27	1	0.79	1	no	-	-	1	1	1
20	0.11	0.30	0.87	0.27	1	0.79	1	no	-	-	1	1	1
Overall	0.34	0.47	0.76	0.21	0.72	0.75	0.78	-	0.89	0.90	0.94	0.91	0.87

# Moose River

	Downstrea	m Boundary	Upstream Boundary			
HSI Site #	Latitude	Longitude	Latitude	Longitude		
1	45.4335378	-62.3163660	45.4340117	-62.3165946		
2	45.4341121	-62.3167730	45.4344578	-62.3173306		
3	45.4345581	-62.3174588	45.4351045	-62.3178547		
4	45.4352941	-62.3178547	45.4358349	-62.3179718		
5	45.4359687	-62.3180164	45.4361360	-62.3181725		
6	45.4361193	-62.3181669	45.4367158	-62.3186631		
7	45.4368943	-62.3186074	45.4373291	-62.3187300		
8	45.4374072	-62.3189196	45.4376414	-62.3193824		
9	45.4377585	-62.3198618	45.4380707	-62.3205030		
10	45.4382324	-62.3206090	45.4385725	-62.3198061		
11	45.4300925	-62.3121014	45.4302143	-62.3130288		
12	45.4302237	-62.3131225	45.4305328	-62.3140500		
13	45.4306359	-62.3141062	45.4313573	-62.3142936		
14	45.4314228	-62.3143123	45.4315915	-62.3146402		

#### Table 170. 2023 Moose River HSI site locations

#### Table 171. 2024 Moose River HSI site locations

	Downstre	am Boundary	Upstream Boundary									
HSI Site #	Latitude	Longitude	Latitude	Longitude								
1	45.433585	-62.316385	45.434080	-62.316575								
2	45.434207	-62.316740	45.434525	-62.317363								
3	45.434652	-62.317439	45.435109	-62.317782								
4	45.435274	-62.317820	45.435807	-62.317921								
5	45.435973	-62.317959	45.436392	-62.318442								
6	45.436519	-62.318569	45.437001	-62.318493								
7	45.437116	-62.318417	45.437471	-62.319001								
8	45.437598	-62.319128	45.437814	-62.319814								
9	45.437839	-62.319991	45.438132	-62.320499								
10	45.438246	-62.320588	45.438538	-62.319826								
A	В	С	D	E	F	G	Н	Ι	J	к	L	М
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Field Sheet #	% Pools	Pool Class Rating	% In- stream Cover (fry)	% In- stream Cover (parr)	Dominant Substrate Type	Avg. % Veg Along Streambank	Avg. % Rooted Veg and Stable Rocky Ground Cover	Spawning Present	Avg. Size of Substrate in Spawning Areas	% Fines in Spawning Areas	Avg. Thalweg Depth During Late Growing Season	% Stream Shade
1	0.62	0.60	1.00	0.21	1.00	0.89	1.00	no	-	-	0.13	0.79
2	0.77	0.60	0.31	0.39	0.60	0.99	1.00	no	-	-	0.34	0.72
3	0.36	0.60	0.53	0.06	0.60	0.95	1.00	no	-	-	0.24	0.79
4	0.82	0.60	0.79	0.20	1.00	0.90	1.00	no	-	-	0.42	1.00
5	0.44	0.60	0.50	0.10	1.00	0.80	1.00	no	-	-	0.86	0.65
6	0.89	1.00	0.88	0.31	0.60	0.67	1.00	no	-	-	1.00	1.00
7	0.30	0.30	0.64	0.12	0.60	0.66	1.00	yes	0.93	0.48	0.58	0.86
8	0.59	0.60	0.85	0.22	0.60	0.33	1.00	yes	0.32	0.27	0.23	0.58
9	0.94	0.60	1.00	0.37	0.60	0.68	0.97	yes	1.00	0.65	0.86	0.93
10	0.66	0.60	1.00	0.44	0.60	0.63	0.97	yes	0.77	0.54	0.42	0.58
11	0.30	0.30	0.73	0.22	1.00	0.45	1.00	no	-	-	0.33	0.58
12	0.32	0.60	0.86	0.32	1.00	0.36	1.00	yes	1.00	0.27	0.24	0.51
13	0.80	0.60	0.84	0.27	1.00	0.46	0.69	no	-	-	0.50	0.72
14	0.30	0.30	0.53	0.09	0.60	0.48	1.00	yes	0.41	0.08	0.55	0.65
Overall	0.58	0.56	0.75	0.24	0.77	0.66	0.97	-	0.74	0.38	0.49	0.74

#### Table 172. 2023 Moose River HSI results for Brook trout.

#### Table 173. 2023 Moose River HSI results for Atlantic salmon.

А	В	С	D	E	F	G	Н	I	J	К	I	L	М
Field Sheet #	% Pools	Pool Class Rating	% In- stream Cover (fry)	% In- stream Cover (parr)	Dominant Substrate Type	Avg. % Veg Along Streambank	Avg. % Rooted Veg and Stable Rocky Ground Cover	Spawning Present	Avg. Size of Substrate in Spawning Areas	% Fines in Spawning Areas	Fry Water Depth	Parr Water Depth	% Stream Shade
1	0.70	0.60	1.00	0.21	1.00	0.89	1.00	no	-	-	1.00	1.00	0.79
2	0.94	0.60	0.45	0.32	0.60	0.99	1.00	no	-	-	0.94	1.00	0.72
3	0.22	0.60	0.53	0.06	0.60	0.95	1.00	yes	0.85	0.21	1.00	1.00	0.79
4	0.98	0.60	0.79	0.20	1.00	0.88	1.00	yes	1.00	0.33	1.00	1.00	0.66
5	0.36	0.60	0.50	0.10	1.00	0.80	1.00	no	-	-	1.00	1.00	0.65
6	0.99	1.00	0.88	0.31	0.60	0.67	1.00	no	-	-	0.45	0.58	0.62
7	0.12	0.30	0.64	0.12	0.60	0.66	1.00	yes	1.00	0.48	1.00	1.00	0.86
8	0.65	0.60	0.85	0.22	0.60	0.33	1.00	yes	0.85	0.27	1.00	1.00	0.58
9	0.95	0.60	1.00	0.37	0.60	0.68	0.97	yes	1.00	0.65	1.00	1.00	0.93

10	0.95	0.60	1.00	0.37	0.60	0.68	0.97	yes	1.00	0.65	1.00	1.00	0.93
11	0.30	0.30	0.73	0.22	1.00	0.45	1.00	no	-	-	1.00	1.00	0.58
12	0.15	0.60	0.86	0.32	1.00	0.36	1.00	yes	0.73	0.27	1.00	1.00	0.51
13	0.97	0.60	0.84	0.27	1.00	0.46	0.69	no	-	-	1.00	1.00	0.72
14	0.12	0.30	0.53	0.09	0.60	0.48	1.00	yes	0.87	0.08	1.00	1.00	0.65
Overall	0.60	0.56	0.76	0.23	0.77	0.66	0.97	-	0.90	0.37	0.96	0.97	0.71

#### Table 174. 2024 Moose River HSI results for brook trout.

A	В	С	D	E	F	G	Н	Ι	J	К	L	М
Field Sheet #	% Pools	Pool Class Rating	% In- stream Cover (fry)	% In- stream Cover (parr)	Dominant Substrate Type	Avg. % Veg Along Streambank	Avg. % Rooted Veg and Stable Rocky Ground Cover	Spawning Present	Avg. Size of Substrate in Spawning Areas	% Fines in Spawnin g Areas	Avg. Thalweg Depth During Late Growing Season	% Stream Shade
1	0.29	0.30	0.71	0.21	0.6	0.86	1	no	-	-	0.77	0.37
2	0.59	0.60	0.73	0.19	0.6	-	0.68	no	-	-	0.82	0.58
3	0.29	0.30	0.77	0.20	0.6	0.86	1	no	-	-	0.43	0.3
4	0.50	0.60	1	0.30	0.6	-	-	no	-	-	0.36	-
5	0.36	0.60	0.54	0.11	0.6	0.74	1	no	-	-	0.58	0.51
6	1	0.60	0.52	0.07	-	0.86	1	no	-	-	1	0.37
7	0.29	0.30	0.73	0.16	0.6	0.74	1	yes	1	0.98	0.26	0.44
8	0.29	0.30	1	0.42	0.6	0.53	1	yes	0.92	0.80	0.06	0.37
9	0.50	0.60	1	0.34	0.6	0.77	0.99	yes	0.99	0.80	0.45	0.51
10	0.55	0.60	0.77	0.19	0.6	0.24	0.73	yes	0.92	1	0.45	0.58
Overall	0.47	0.48	0.78	0.22	0.60	0.70	0.93	-	0.96	0.90	0.52	0.45

Table 175. 2024 Moose River HSI results for Atlantic salmon.

А	В	C	D	E	F	G	Н	I	J	К	I	L	Μ
Field Sheet #	% Pools	Pool Class Rating	% In- stream Cover (fry)	% In- stream Cover (parr)	Dominant Substrate Type	Avg. % Veg Along Streambank	Avg. % Rooted Veg and Stable Rocky Ground Cover	Spawning Present	Avg. Size of Substrate in Spawning Areas	% Fines in Spawning Areas	Fry Water Depth	Parr Water Depth	% Stream Shade
1	0.11	0.30	0.71	0.21	0.6	0.86	1	no	-	-	1	1	0.37
2	0.66	0.60	0.73	0.19	0.6	-	0.68	no	-	-	0.92	1	0.58
3	0.11	0.30	0.77	0.20	0.6	0.86	1	no	-	-	1	1	0.3
4	0.47	0.60	1	0.30	0.6	-	-	no	-	-	1	1	-
5	0.21	0.60	0.54	0.11	0.6	0.74	1	no	-	-	1	1	0.51

6	0.30	0.60	0.52	0.07	-	0.86	1	no	-	-	0.62	0.83	0.37
7	0.11	0.30	0.73	0.16	0.6	0.74	1	yes	1	0.98	1	1	0.44
8	0.11	0.30	1	0.42	0.6	0.53	1	yes	1	0.80	1	1	0.37
9	0.48	0.60	1	0.34	0.6	0.77	0.99	yes	1	0.80	1	1	0.51
10	0.48	0.60	1	0.34	0.6	0.77	0.99	yes	1	0.80	1	1	0.51
Overall	0.30	0.48	0.80	0.23	0.60	0.60	0.96	-	1.00	0.85	0.95	0.98	0.44

### McKeen Brook

#### Table 176. 2023 McKeen Brook HSI site locations.

	Downstream	m Boundary	Upstream I	Boundary
HSI Site #	Latitude	Longitude	Latitude	Longitude
1	45.2809014	-62.0424496	45.2811791	-62.0419532
2	45.2812127	-62.0419027	45.2812464	-62.0413810
3	45.2812380	-62.0413052	45.2811875	-62.0407499
4	45.2811875	-62.0407078	45.2811707	-62.0400599
5	45.2811707	-62.0399926	45.2809098	-62.0393615
6	45.2808677	-62.0393194	45.2804975	-62.0390585
7	45.2804638	-62.0389576	45.2800515	-62.0388145
8	45.2800263	-62.0387724	45.2798916	-62.0385705
9	45.2798580	-62.0385284	45.2797570	-62.0376954
10	45.2797738	-62.0376365	45.2796897	-62.0373756

#### Table 177. 2023 McKeen Brook HSI results for Brook trout.

A	В	С	D	E	F	G	н	I	J	К	L	М
Field Sheet #	% Pools	Pool Class Rating	% In-stream Cover (fry)	% In-stream Cover (parr)	Dominant Substrate Type	Avg. % Veg Along Streambank	Avg. % Rooted Veg and Stable Rocky Ground Cover	Spawning Present	Avg. Size of Substrate in Spawning Areas	% Fines in Spawning Areas	Avg. Thalweg Depth During Late Growing Season	% Stream Shade
1	0.48	0.60	0.94	0.37	0.60	0.73	1.00	yes	1.00	0.81	0.24	1.00
2	0.36	0.60	0.72	0.19	1.00	0.90	1.00	yes	0.96	0.54	0.62	1.00
3	0.39	0.60	0.66	0.19	0.60	0.84	1.00	yes	0.97	0.69	0.57	1.00
4	0.41	0.60	0.79	0.25	1.00	0.60	0.97	yes	0.68	0.81	0.58	1.00
5	0.91	0.60	0.95	0.43	0.60	0.60	1.00	yes	1.00	0.94	0.21	1.00

6	0.30	0.30	0.53	0.07	0.60	0.89	1.00	yes	0.99	0.68	0.41	0.93
7	0.30	0.30	0.77	0.21	0.30	0.93	1.00	yes	1.00	0.76	0.51	1.00
8	0.44	0.60	0.90	0.47	0.60	0.92	1.00	yes	0.99	0.63	0.10	1.00
9	0.32	0.60	0.75	0.29	0.60	0.82	1.00	yes	0.81	0.81	0.78	1.00
10	0.48	0.60	0.70	0.19	0.60	0.76	1.00	no	-	-	0.19	1.00
Overall	0.46	0.54	0.77	0.27	0.65	0.80	1.00		0.93	0.74	0.42	0.99

#### Table 178. 2023 McKeen Brook HSI results for Brook trout.

A	В	C	D	E	F	G	Н	I	J	К	L	М	Ν
Field Sheet #	% Pools	Pool Class Rating	% In- stream Cover (fry)	% In- stream Cover (parr)	Dominant Substrate Type	Avg. % Veg Along Streambank	Avg. % Rooted Veg and Stable Rocky Ground Cover	Spawning Present	Avg. Size of Substrate in Spawning Areas	% Fines in Spawning Areas	Fry Water Depth	Parr Water Depth	% Stream Shade
1	0.44	0.60	0.94	0.37	0.60	0.73	1.00	yes	1.00	0.81	1.00	1.00	1.00
2	0.21	0.60	0.72	0.19	1.00	0.90	1.00	yes	1.00	0.72	1.00	1.00	1.00
3	0.27	0.60	0.66	0.19	0.60	0.84	1.00	yes	1.00	0.69	1.00	1.00	1.00
4	0.30	0.60	0.79	0.25	1.00	0.60	0.97	yes	0.94	0.81	1.00	1.00	1.00
5	0.98	0.60	0.95	0.43	0.60	0.60	1.00	yes	1.00	0.94	1.00	1.00	1.00
6	0.12	0.30	0.53	0.07	0.60	0.89	1.00	yes	1.00	0.68	1.00	0.82	0.93
7	0.12	0.30	0.77	0.21	0.30	0.93	1.00	yes	1.00	0.76	1.00	1.00	1.00
8	0.35	0.60	0.90	0.47	0.60	0.92	1.00	yes	1.00	0.63	1.00	1.00	1.00
9	0.15	0.60	0.75	0.29	0.60	0.82	1.00	yes	0.97	0.81	1.00	1.00	1.00
10	0.15	0.60	0.75	0.29	0.60	0.82	1.00	yes	0.97	0.81	1.00	1.00	1.00
Overall	0.39	0.54	0.78	0.28	0.65	0.80	1.00	-	0.99	0.76	1.00	0.98	1.00

# Appendix D: Electrofishing Results

### Barren Brook

# Survey Site Details & Measurements

Date	September 24 <sup>th</sup> , 2024
Crew	Bruce Wheadon, Emma Purdy, Bailey Randall, Rory Adams, Daniel Chisholm
Survey Site #	1
Upstream Limit	N 45.277118°
	W 62.288396°
Downstream Limit	N 45.276925°
	W 62.288690°
Area (m <sup>2</sup> )	155.04m <sup>2</sup>
Temperature (°C)	11.2°C
Acidity (pH)	5.6

#### Sweep #1:

#	Species	Size	Age
1	Creek Chub	3.5	0+
2	Creek Chub	4	0+
3	Creek Chub	4.5	0+
4	Creek Chub	3.5	0+
5	Creek Chub	5.5	0+
6	Creek Chub	4.5	0+
7	White Sucker	4.5	0+
8	Atlantic Salmon	5.5	0+
9	Atlantic Salmon	6	0+
10	Atlantic Salmon	6.5	0+
11	Creek Chub	5.5	0+
12	Atlantic Salmon	6	0+
13	Atlantic Salmon	6.5	0+
14	Atlantic Salmon	6	0+
15	Creek Chub	4.5	0+
16	Atlantic Salmon	10	1+
17	Atlantic Salmon	5	0+
18	White Sucker	5.5	0+
19	Atlantic Salmon	5.5	0+
20	Creek Chub	5	0+
21	Atlantic Salmon	10	1+
22	Atlantic Salmon	11.5	1+
23	Atlantic Salmon	6	0+
24	Atlantic Salmon	6.5	0+
25	Creek Chub	9.5	0+
26	Atlantic Salmon	9	0+
27	Atlantic Salmon	10.5	1+
28	Atlantic Salmon	5	0+
29	Atlantic Salmon	6	0+
30	Atlantic Salmon	10	1+
31	White Sucker	3	0+
32	Creek Chub	3	0+
33	White Sucker	4	0+
34	Atlantic Salmon	11.5	1+
35	Creek Chub	3	0+
36	Creek Chub	3.5	0+

#	Species	Size	Age
1	Creek Chub	4.5	0+
2	Atlantic Salmon	6.5	0+
3	Atlantic Salmon	6	0+
4	White Sucker	7	0+

5	Creek Chub	4	0+
6	Atlantic Salmon	7.5	0+
7	Atlantic Salmon	6	0+
8	Creek Chub	9	0+
9	White Sucker	2	0+
10	Stickleback	5	0+
11	Atlantic Salmon	4.5	0+
12	Atlantic Salmon	5.5	0+
13	Atlantic Salmon	6.5	0+
14	Atlantic Salmon	5	0+
15	Atlantic Salmon	5.5	0+
16	Atlantic Salmon	6	0+
17	Atlantic Salmon	10	1+
18	White Sucker	7	0+
19	Atlantic Salmon	11.5	1+
20	Atlantic Salmon	6.5	0+

#### <u>Sweep #3:</u>

#	Species	Size	Age
1	Atlantic Salmon	6.5	0+
2	Creek Chub	5.5	0+
3	Creek Chub	4	0+
4	Creek Chub	3.5	0+
5	Creek Chub	4.5	0+
6	Atlantic Salmon	6.5	0+
7	Atlantic Salmon	5.5	0+

### Survey Site Details & Measurements

Date	September 24 <sup>th</sup> , 2024
Crew	Bruce Wheadon, Emma Purdy, Bailey Randall, Rory Adams, Daniel Chisholm
Survey Site #	2
Upstream Limit	N 45.277522°
	W 62.288087°
Downstream Limit	N 45.277340°
	W 62.288179°
Area (m²)	140.0m <sup>2</sup>
Temperature (°C)	11.2°C
Acidity (pH)	5.6

#	Species	Size	Age
1	Creek Chub	8.5	0+
2	Atlantic Salmon	5.5	0+

3	Creek Chub	3.5	0+
4	Creek Chub	3.5	0+
5	Atlantic Salmon	5	0+
6	Atlantic Salmon	5.5	0+
7	Creek Chub	4	0+
8	Atlantic Salmon	5	0+
9	Creek Chub	4	0+
10	Atlantic Salmon	5.5	0+
11	Atlantic Salmon	7	0+
12	Atlantic Salmon	5	0+

### Garden River

# Survey Site Details & Measurements

Date	September 25 <sup>th</sup> , 2024
Crew	Bruce Wheadon, Emma Purdy, Bailey Randall, Rory Adams, Daniel Chisholm
Survey Site #	1
Upstream Limit	N 45.439926°
	W 62.301003°
Downstream Limit	N 45.439726°
	W 62.300645°
Area (m²)	148.5m <sup>2</sup>
Temperature (°C)	11.8°C
Acidity (pH)	6.7

#	Species	Size	Age
1	Atlantic Salmon	9.5	0+
2	Atlantic Salmon	11	1+
3	Atlantic Salmon	9.5	0+
4	Atlantic Salmon	13	1+
5	Atlantic Salmon	11	1+
6	Atlantic Salmon	11	1+
7	Creek Chub	5	0+
8	White Sucker	6.5	0+
9	Creek Chub	4.5	0+
10	White Sucker	6	0+
11	Atlantic Salmon	11	1+
12	White Sucker	4.5	0+
13	Atlantic Salmon	11.5	1+
14	Atlantic Salmon	11	1+
15	Atlantic Salmon	10	1+
16	Atlantic Salmon	12	1+
17	Atlantic Salmon	12	1+
18	Atlantic Salmon	6.5	0+

19	Atlantic Salmon	9	0+
20	Atlantic Salmon	11	1+
21	White Sucker	7	0+
22	Atlantic Salmon	10.5	1+
23	White Sucker	7	0+
24	White Sucker	5.5	0+
25	White Sucker	5.5	0+
26	Creek Chub	4.5	0+
27	White Sucker	5.5	0+
28	White Sucker	5	0+
29	White Sucker	5.5	0+
30	Atlantic Salmon	16.5	2+
31	Brook Trout	7	0+
32	Brook Trout	8.5	0+

### <u>Sweep #2:</u>

#	Species	Size	Age
1	Atlantic Salmon	11.5	1+
2	Brook Trout	7.5	0+
3	Creek Chub	5.5	0+
4	White Sucker	7.5	0+
5	White Sucker	7.5	0+
6	Atlantic Salmon	10	1+
7	White Sucker	6	0+
8	White Sucker	6	0+
9	White Sucker	5	0+
10	Atlantic Salmon	9	0+
11	Atlantic Salmon	8	0+

### Sweep #3:

#	Species	Size	Age
1	Atlantic Salmon	7	0+
2	Atlantic Salmon	8.5	0+
3	White Sucker	7.5	0+
4	Creek Chub	4.5	0+
5	Atlantic Salmon	11.5	1+

# Survey Site Details & Measurements

Date	September 25 <sup>th</sup> , 2024
Crew	Bruce Wheadon, Emma Purdy, Bailey Randall, Rory Adams, Daniel Chisholm
Survey Site #	2
Upstream Limit	N 45.443722°
	W 62.302680°
Downstream Limit	N 45.443546°
	W 62.302726°

Area (m <sup>2</sup> )	108m <sup>2</sup>
Temperature (°C)	11.5°C
Acidity (pH)	6.7

### Sweep #1:

#	Species	Size	Age
1	Atlantic Salmon	7.5	0+
2	Creek Chub	6.5	0+
3	Common Shiner	4.5	0+
4	Brook Trout	9.5	0+
5	Atlantic Salmon	7	0+
6	Brook Trout	7.5	0+
7	Atlantic Salmon	6.5	0+
8	Atlantic Salmon	8	0+
9	Atlantic Salmon	7	0+
10	Atlantic Salmon	10	1+
11	Atlantic Salmon	13	1+
12	Brook Trout	8.5	0+
13	Creek Chub	5	0+
14	Atlantic Salmon	13	1+
15	Brook Trout	16.5	2+
16	Brook Trout	22	2+
17	Atlantic Salmon	8.5	0+
18	Atlantic Salmon	7.5	0+
19	Creek Chub	5	0+
20	White Sucker	7	0+

### <u>Sweep #2:</u>

#	Species	Size	Age
1	Creek Chub	5	0+
2	Creek Chub	4.5	0+
3	Brook Trout	8	0+
4	White Sucker	5.5	0+
5	Creek Chub	4	0+
6	Atlantic Salmon	6	0+
7	White Sucker	6.5	0+
8	Atlantic Salmon	7	0+
9	Creek Chub	6	0+
10	Atlantic Salmon	5.5	0+

### Sweep #3:

#	Species	Size	Age
1	Atlantic Salmon	7	0+
2	White Sucker	5	0+
3	White Sucker	5	0+

4	Creek Chub	4.5	0+
5	White Sucker	4.5	0+
6	Stickleback	4.5	0+

# Fraser's Brook

# Survey Site Details & Measurements

Date	September 9 <sup>th</sup> , 2024
Crew	Bruce Wheadon, Emma Purdy, Bailey Randall, Rory Adams, Daniel Chisholm
Survey Site #	1
Upstream Limit	N 45.357696°
	W 62.126852°
Downstream Limit	N 45.357537°
	W 62.126598°
Area (m <sup>2</sup> )	130m <sup>2</sup>
Temperature (°C)	14.4°C
Acidity (pH)	6.32

#	Species	Size	Age
1	Atlantic Salmon	5	0+
2	Atlantic Salmon	5	0+
3	Atlantic Salmon	5.5	0+
4	Atlantic Salmon	5.5	0+
5	Atlantic Salmon	7	0+
6	Atlantic Salmon	5	0+
7	Atlantic Salmon	5.5	0+
8	Atlantic Salmon	4.5	0+
9	Atlantic Salmon	10	1+
10	Atlantic Salmon	5	0+
11	Atlantic Salmon	5.5	0+
12	Atlantic Salmon	5.5	0+
13	Atlantic Salmon	5	0+
14	Atlantic Salmon	6	0+
15	Atlantic Salmon	6	0+
16	Atlantic Salmon	5	0+
17	Atlantic Salmon	5.5	0+
18	Atlantic Salmon	5.5	0+
19	Atlantic Salmon	5	0+
20	Atlantic Salmon	4.5	0+
21	Atlantic Salmon	5	0+
22	Atlantic Salmon	4.5	0+

23	Atlantic Salmon	5.5	0+
24	Atlantic Salmon	6	0+
25	Atlantic Salmon	5	0+
26	Atlantic Salmon	5.5	0+
27	Atlantic Salmon	9.5	0+
28	Atlantic Salmon	5.5	0+
29	Atlantic Salmon	5	0+
30	Atlantic Salmon	6	0+
31	Atlantic Salmon	5	0+
32	Atlantic Salmon	10	1+
33	Atlantic Salmon	12.5	1+
34	Atlantic Salmon	13	1+
35	Atlantic Salmon	5	0+
36	Brook Trout	7	0+
37	Brook Trout	5.5	0+
38	Atlantic Salmon	12	1+
39	Atlantic Salmon	12.5	1+

#	Species	Size (cm)	Age
1	Atlantic Salmon	6	0+
2	Atlantic Salmon	6	0+
3	Atlantic Salmon	6	0+
4	Atlantic Salmon	5.5	0+
5	Atlantic Salmon	5.5	0+
6	Atlantic Salmon	5	0+
7	Atlantic Salmon	5	0+
8	Atlantic Salmon	6	0+
9	Atlantic Salmon	6	0+
10	Atlantic Salmon	6	0+
11	Atlantic Salmon	6	0+
12	Atlantic Salmon	6	0+
13	Atlantic Salmon	5	0+
14	Atlantic Salmon	5	0+
15	Creek Chub	3	0+
16	Creek Chub	4	0+
17	Brook Trout	6.5	0+
18	Atlantic Salmon	9	0+
19	Atlantic Salmon	10.5	1+
20	Atlantic Salmon	14	1+
21	Atlantic Salmon	11	1+
22	Atlantic Salmon	6.5	0+
23	Atlantic Salmon	10	1+
24	Atlantic Salmon	5.5	0+
25	Atlantic Salmon	10.5	1+

26	Atlantic Salmon	6.5	0+
27	Atlantic Salmon	5.5	0+
28	Atlantic Salmon	6.5	0+
29	Atlantic Salmon	6	0+
30	Atlantic Salmon	6	0+

#### Sweep #3:

#	Species	Size (cm)	Age
1	Atlantic Salmon	5	0+
2	Atlantic Salmon	6	0+
3	Atlantic Salmon	5.5	0+
4	Atlantic Salmon	6	0+
5	Creek Chub	7.5	0+
6	Atlantic Salmon	5	0+
7	Atlantic Salmon	6	0+
8	Atlantic Salmon	5	0+
9	Atlantic Salmon	5	0+
10	Atlantic Salmon	5.5	0+
11	Atlantic Salmon	5	0+
12	Atlantic Salmon	6	0+
13	Atlantic Salmon	5	0+
14	Atlantic Salmon	6	0+
15	Atlantic Salmon	5	0+
16	Atlantic Salmon	12	1+
17	Atlantic Salmon	6	0+
18	Brook Trout	15	2+

# Survey Site Details & Measurements

Date	September 9 <sup>th</sup> , 2024
Crew	Bruce Wheadon, Emma Purdy, Bailey Randall, Rory Adams, Daniel Chisholm
Survey Site #	2
Upstream Limit	N 45.374835°
	W 62.118223°
Downstream Limit	N 45.374595°
	W 62.118173°
Area (m <sup>2</sup> )	126.7m <sup>2</sup>
Temperature (°C)	14.6°C
Acidity (pH)	6.31

### Sweep #1:

#	Species	Size	Age
1	Brook Trout	5.5	0+
2	Atlantic Salmon	4.5	0+
3	Brook Trout	5	0+

4	Atlantic Salmon	9	0+
5	Atlantic Salmon	6	0+
6	Atlantic Salmon	4.5	0+
7	Atlantic Salmon	9	0+
8	Brook Trout	7	0+
9	Atlantic Salmon	5	0+
10	Atlantic Salmon	5.5	0+
11	Atlantic Salmon	5	0+
12	Atlantic Salmon	4.5	0+
13	Atlantic Salmon	5	0+
14	Atlantic Salmon	5	0+
15	Atlantic Salmon	9	0+
16	Atlantic Salmon	9	0+
17	Brook Trout	9	0+
18	Atlantic Salmon	8.5	0+
19	Atlantic Salmon	5	0+
20	Brook Trout	6	0+
21	Brook Trout	7.5	0+
22	Atlantic Salmon	5	0+
23	Atlantic Salmon	9.5	0+
24	Brook Trout	12.5	1+
25	Brook Trout	15	2+
26	Brook Trout	16.5	2+
27	Atlantic Salmon	11.5	1+
28	Atlantic Salmon	12	1+
29	Brook Trout	11.5	1+

#### Sweep #2:

#	Species	Size	Age
1	Atlantic Salmon	5	0+
2	Atlantic Salmon	5	0+
3	Brook Trout	6.5	0+
4	Atlantic Salmon	5	0+
5	Atlantic Salmon	5	0+
6	Atlantic Salmon	5	0+
7	Atlantic Salmon	4.5	0+
8	Atlantic Salmon	5.5	0+
9	Atlantic Salmon	5	0+
10	Atlantic Salmon	5	0+
11	Atlantic Salmon	5	0+
12	Atlantic Salmon	5.5	0+
13	Atlantic Salmon	9	0+
14	Atlantic Salmon	11	1+
15	Brook Trout	5	0+
16	Brook Trout	4.5	0+

17	Atlantic Salmon	8	0+
18	Atlantic Salmon	12	1+
19	Brook Trout	15	2+
20	Atlantic Salmon	5	0+
21	Brook Trout	11	1+

### Sweep #3:

#	Species	Size	Age
1	Brook Trout	7.5	0+
2	Atlantic Salmon	5.5	0+
3	Atlantic Salmon	8	0+
4	Brook Trout	5	0+
5	Atlantic Salmon	6	0+
6	Atlantic Salmon	5	0+
7	Atlantic Salmon	4.5	0+
8	Brook Trout	5.5	0+
9	Brook Trout	6.5	0+
10	Atlantic Salmon	5	0+
11	Atlantic Salmon	8	0+
12	Atlantic Salmon	5.5	0+
13	Atlantic Salmon	12	1+
14	Brook Trout	14	1+

## Cross Brook

# Survey Site Details & Measurements

Date	September 19 <sup>th</sup> , 2024
Crew	Bruce Wheadon, Emma Purdy, Russell Jackson, Maddison Miller, Hugo Medeiros
Survey Site #	1
Upstream Limit	N 45.288127°
	W 62.390822°
Downstream Limit	N 45.287971°
	W 62.390571°
Area (m²)	92.7m <sup>2</sup>
Temperature (°C)	18°C
Acidity (pH)	6.3

### Sweep #1:

#	Species	Size	Age
1	Creek Chub	4	0+
2	Creek Chub	4.5	0+
3	Atlantic Salmon	6	0+

4	Atlantic Salmon	9	0+
5	Atlantic Salmon	9.5	0+
6	Creek Chub	4	0+
7	Atlantic Salmon	10	1+
8	Atlantic Salmon	6.5	0+
9	Atlantic Salmon	9	0+
10	White Sucker	8	0+
11	Atlantic Salmon	5	0+
12	Atlantic Salmon	5.5	0+
13	Atlantic Salmon	9	0+
14	Atlantic Salmon	7	0+
15	Atlantic Salmon	10	1+
16	Atlantic Salmon	5.5	0+
17	Atlantic Salmon	10	1+
18	White Sucker	4	0+
19	Creek Chub	5.5	0+
20	Atlantic Salmon	5	0+
21	Atlantic Salmon	5.5	0+
22	White Sucker	5	0+
23	Creek Chub	3.5	0+
24	White Sucker	4.5	0+
25	Creek Chub	4	0+

### <u>Sweep #2:</u>

#	Species	Size	Age
1	Stickleback	4	0+
2	Creek Chub	5	0+
3	Creek Chub	3.5	0+
4	Creek Chub	3	0+
5	Creek Chub	2.5	0+
6	Atlantic Salmon	6	0+
7	Atlantic Salmon	7.5	0+
8	Atlantic Salmon	6	0+
9	Atlantic Salmon	7	0+
10	Creek Chub	4	0+
11	Atlantic Salmon	6.5	0+
12	Atlantic Salmon	6	0+
13	Atlantic Salmon	11.5	1+
14	White Sucker	4.5	0+

#	Species	Size	Age
1	Chub	2.5	0+
2	Chub	2	0+
3	Atlantic Salmon	12	1+

4	Atlantic Salmon	5.5	0+
5	Atlantic Salmon	6.5	0+
6	Sucker	6	0+
7	Atlantic Salmon	6	0+
8	Atlantic Salmon	6.5	0+

### Survey Site Details & Measurements

Date	September 19 <sup>th</sup> , 2024
Crew	Bruce Wheadon, Emma Purdy, Russell Jackson, Maddison Miller, Hugo Medeiros
Survey Site #	2
Upstream Limit	N 45.286719°
	W 62.387026°
<b>Downstream Limit</b>	N 45.286599°
	W 62.386871°
Area (m <sup>2</sup> )	132.8m <sup>2</sup>
Temperature (°C)	18°C
Acidity (pH)	6.3

#	Species	Size	Age
1	Creek Chub	3	0+
2	Creek Chub	3	0+
3	White Sucker	4.5	0+
4	Atlantic Salmon	5	0+
5	Atlantic Salmon	4	0+
6	Atlantic Salmon	4.5	0+
7	Atlantic Salmon	5	0+
8	Atlantic Salmon	8.5	0+
9	Atlantic Salmon	4.5	0+
10	Atlantic Salmon	5	0+
11	Atlantic Salmon	5	0+
12	Atlantic Salmon	5	0+
13	Atlantic Salmon	5.5	0+
14	Atlantic Salmon	5	0+
15	Atlantic Salmon	5.5	0+
16	Atlantic Salmon	5	0+
17	Atlantic Salmon	5	0+
18	Atlantic Salmon	5	0+
19	Atlantic Salmon	5	0+
20	Atlantic Salmon	9.5	0+
21	Atlantic Salmon	5.5	0+
22	Creek Chub	2.5	0+
23	Atlantic Salmon	5.5	0+
24	Atlantic Salmon	5.5	0+

25	Atlantic Salmon	5.5	0+
26	Creek Chub	4	0+
27	Creek Chub	3.5	0+
28	Creek Chub	3	0+
29	Atlantic Salmon	5	0+
30	Atlantic Salmon	4.5	0+
31	White Sucker	4.5	0+
32	Atlantic Salmon	9.5	0+
33	Creek Chub	3.5	0+
34	Creek Chub	2.5	0+
35	White Sucker	5	0+
36	Atlantic Salmon	5.5	0+

#### Sweep #2:

#	Species	Size	Age
1	Creek Chub	5.5	0+
2	Creek Chub	4	0+
3	Atlantic Salmon	5	0+
4	Creek Chub	3	0+
5	Atlantic Salmon	8	0+
6	Atlantic Salmon	5	0+
7	Atlantic Salmon	4.5	0+
8	Creek Chub	4	0+
9	Atlantic Salmon	7.5	0+
10	Atlantic Salmon	5	0+
11	Creek Chub	3.5	0+
12	Atlantic Salmon	8	0+
13	Atlantic Salmon	5.5	0+
14	Atlantic Salmon	5	0+
15	Atlantic Salmon	5	0+
16	White Sucker	4.5	0+
17	Creek Chub	4	0+
18	Atlantic Salmon	5.5	0+
19	Atlantic Salmon	5.5	0+
20	Atlantic Salmon	5.5	0+
21	Atlantic Salmon	8.5	0+
22	Atlantic Salmon	5.5	0+
23	Atlantic Salmon	4.5	0+
24	Atlantic Salmon	8.5	0+
25	Atlantic Salmon	5	0+
26	Atlantic Salmon	5.5	0+
27	Atlantic Salmon	6	0+
28	White Sucker	4	0+

Sweep #3:

#	Species	Size	Age
1	Creek Chub	6	0+
2	Atlantic Salmon	4.5	0+
3	Atlantic Salmon	5	0+
4	Atlantic Salmon	5	0+
5	Creek Chub	3.5	0+
6	Creek Chub	4	0+
7	Creek Chub	3.5	0+
8	Creek Chub	4	0+
9	Creek Chub	3	0+
10	Creek Chub	4.5	0+
11	Atlantic Salmon	5	0+
12	Creek Chub	5	0+
13	Atlantic Salmon	5.5	0+
14	Atlantic Salmon	9	0+
15	Atlantic Salmon	5	0+
16	Atlantic Salmon	5	0+
17	Creek Chub	2.5	0+
18	Atlantic Salmon	5.5	0+
19	Atlantic Salmon	4.5	0+
20	Atlantic Salmon	4.5	0+
21	White Sucker	5	0+
22	White Sucker	4	0+
23	Atlantic Salmon	8.5	0+

### Moose River

### Survey Site Details & Measurements

Date	September 10 <sup>th</sup> , 2024
Crew	Bruce Wheadon, Emma Purdy, Hugo Medeiros, Rory Adams, Daniel Chisholm
Survey Site #	1
Upstream Limit	N 45.496316°
	W 62.370841°
Downstream Limit	N 45.496133
	W 62.370738
Area (m <sup>2</sup> )	151.32m <sup>2</sup>
Temperature (°C)	12.5°C
Acidity (pH)	6.9

	Species	Size	Age
1	Brook Trout	6.5	0+
2	Brook Trout	6.5	0+

3	Brook Trout	6.5	0+
4	Brook Trout	7	0+
5	Brook Trout	7	0+
6	Brook Trout	5	0+
7	Brook Trout	7	0+
8	Brook Trout	7.5	0+
9	Brook Trout	7.5	0+
10	Brook Trout	8	0+
11	Brook Trout	7.5	0+
12	Brook Trout	6.5	0+
13	Brook Trout	6.5	0+
14	Brook Trout	6	0+
15	Brook Trout	6.5	0+
16	Brook Trout	7	0+
17	Brook Trout	6.5	0+
18	Brook Trout	7	0+
19	Brook Trout	6	0+
20	Brook Trout	8	0+
21	Brook Trout	6.5	0+
22	Brook Trout	6	0+
23	Brook Trout	6	0+
24	Brook Trout	6.5	0+
25	Atlantic Salmon	7	0+
26	Atlantic Salmon	7	0+
27	Brook Trout	10	1+
28	Brook Trout	5.5	0+
29	Brook Trout	6	0+
30	Atlantic Salmon	7	0+
31	Brook Trout	13	1+
32	Brook Trout	5	0+
33	Brook Trout	5.5	0+
34	Brook Trout	8	0+
35	Brook Trout	7	0+
36	Atlantic Salmon	6.5	0+
37	Atlantic Salmon	7	0+
38	Atlantic Salmon	12.5	1+
39	Brook Trout	8	0+
40	Brook Trout	8.5	0+
41	Atlantic Salmon	6.5	0+
42	Brook Trout	12	1+
43	Brook Trout	15	2+

### Sweep #2:

	Species	Size	Age
1	Brook Trout	8	0+

2	Brook Trout	8	0+
3	Brook Trout	8	0+
4	Brook Trout	7	0+
5	Brook Trout	7	0+
6	Brook Trout	6.5	0+
7	Brook Trout	8	0+
8	Atlantic Salmon	5.5	0+
9	Brook Trout	8.5	0+
10	Brook Trout	12.5	1+
11	Brook Trout	8	0+
12	Brook Trout	7.5	0+
13	Brook Trout	7	0+
14	Brook Trout	8	0+
15	Brook Trout	8	0+
16	Brook Trout	8	0+
17	Brook Trout	8	0+
18	Brook Trout	9	0+
19	Brook Trout	7	0+
20	Atlantic Salmon	10	1+
21	Brook Trout	11	1+
22	Brook Trout	6	0+
23	Brook Trout	6.5	0+
24	Atlantic Salmon	6	0+
25	Brook Trout	5.5	0+
26	Brook Trout	12.5	1+

### <u>Sweep #3:</u>

	Species	Size	Age
1	Brook Trout	8	0+
2	Brook Trout	6.5	0+
3	Brook Trout	5	0+
4	Brook Trout	5	0+
5	Brook Trout	6.5	0+
6	Brook Trout	7	0+
7	Brook Trout	7.5	0+

# Survey Site Details & Measurements

Date	September 10 <sup>th</sup> , 2024
Crew	Bruce Wheadon, Emma Purdy, Hugo Medeiros, Rory Adams, Daniel Chisholm
Survey Site #	2
Upstream Limit	N 45.431876°
	W 62.316012°
Downstream Limit	N 45.431763°
	W 62.315830°

Area (m <sup>2</sup> )	163.8m <sup>2</sup>
Temperature (°C)	12.4°C
Acidity (pH)	6.8

### <u>Sweep #1:</u>

	Species	Size	Age
1	Creek Chub	3.5	0+
2	Creek Chub	3	0+
3	Creek Chub	4	0+
4	Creek Chub	5	0+
5	Creek Chub	2.5	0+
6	Creek Chub	3.5	0+
7	Creek Chub	4.5	0+
8	Creek Chub	3.5	0+
9	Creek Chub	3	0+
10	Creek Chub	6	0+
11	Atlantic Salmon	8.5	0+
12	Atlantic Salmon	6.5	0+
13	Atlantic Salmon	6	0+
14	Creek Chub	3.5	0+
15	Atlantic Salmon	11.5	1+
16	Atlantic Salmon	6.5	0+

### Sweep #2:

	Species	Size	Age
1	Golden Shiner	8	0+
2	Creek Chub	3	0+
3	Creek Chub	5	0+
4	Creek Chub	4	0+
5	Creek Chub	4	0+
6	Creek Chub	4	0+
7	Creek Chub	3.5	0+
8	Creek Chub	3	0+
9	Atlantic Salmon	5.5	0+
10	Atlantic Salmon	6.5	0+
11	Atlantic Salmon	12	1+

#### Sweep #3:

	Species	Size	Age
1	Atlantic Salmon	5.5	0+
2	Creek Chub	5	0+
3	Stickleback	5.5	0+
4	Creek Chub	4	0+
5	Creek Chub	3	0+

# Appendix E: Geology and Soil Maps



Figure 70. Bedrock Geology Map of Nova Scotia (DNRR, 2000)



Figure 71. Surficial Geology Map of Nova Scotia (DNRR, 1992).



Figure 72. Soils of Antigonish County Map (Department of Agriculture, 1979)



Figure 73. Soils of Guysborough County Map (Department of Agriculture, 1979)

# List of Tables

Table 1. Annual Funding Breakdown	1
Table 2. Breakdown of subwatersheds of study	4
Table 3. Temperature probe detailed locations.	5
Table 4. 2024 Temperature Probe Averages	6
Table 5. Number of days above 23°C and 27°C in each tributary	7
Table 6. Water quality monitoring locations and averages for 2024	8
Table 7. Pool thalweg depth scoring breakdown	. 12
Table 8. Riffle thalweg depth scoring breakdown	. 12
Table 9. Run thalweg depth scoring breakdown	. 12
Table 10. Pool class rating breakdown	. 12
Table 11. Percent pool habitat scoring breakdown.	. 13
Table 12. Substrate classification breakdown.	. 13
Table 13. 2024 Electrofishing site summaries	. 15
Table 14. Redd count breakdown	. 17
Table 15. Barren Brook habitat summary	. 18
Table 16. Channel Depths for Barren Brook	. 19
Table 17. Depth of pool habitat scores.	. 20
Table 18. Fry water depth scores	. 20
Table 19. Parr water depth scores	. 21
Table 20. Pool class rating scores.	. 21
Table 21. Percent pool habitat scores for Brook trout	. 21
Table 22. Percent pool habitat scores for Atlantic salmon	. 21
Table 23. Riffle and run habitat scores	.21
Table 24. Scores for instream cover for Brook trout fry.	. 22
Table 25. Scores for instream cover for Atlantic salmon fry.	. 22
Table 26. Scores for instream cover for Atlantic salmon parr	. 22
Table 27. Scores for instream cover for Brook trout parr and adults.	. 22
Table 28. Spawning sites in Barren Brook.	. 22
Table 29. Riparian vegetation scores in Barren Brook.	. 23
Table 30. Riverbank stability scores for Barren Brook.	. 23
Table 31. Aerial photograph series summary for Barren Brook Set 1.	. 24
Table 32. Aerial photograph series summary for Barren Brook Set 2	. 25
Table 33. Aerial photograph series summary for Barren Brook Set 3.	. 26
Table 34. Redd survey data.	. 27
Table 35. Barren Brook electrofishing results	. 28
Table 36. Atlantic Salmon densities in Barren Brook	. 28
Table 37. Barren Brook population estimates	. 28
Table 38. Habitat summary data for Garden River	. 29
Table 39. Channel depth scores.	.31
Table 40. Pool habitat scores for Garden River.	. 32
Table 41. Fry water depth scores for Garden River	. 32
Table 42. Parr water depth scores for Garden River	. 33
Table 43. Pool class rating for Garden River	.33
Table 44. Percentage of pool habitat for Brook trout in Garden River.	.33
Table 45. Percentage of pool habitat for Atlantic salmon in Garden River	. 33
Table 46. Rittle and run scores for Garden River	. 33
Table 47. In-stream cover for Brook trout fry in Garden River	. 34

Table 48. In-stream cover for Atlantic salmon fry in Garden River	34
Table 49. In-stream cover for Atlantic salmon parr in Garden River	34
Table 50. In-stream cover for Brook trout parr and adults in Garden River.	34
Table 51. Spawning habitat scores for Garden River.	34
Table 52. Riparian vegetation scores for Garden River	35
Table 53. Riverbank stability scores for Garden River	35
Table 54. Aerial photograph series summary for Garden River.	36
Table 55. Redd survey summary in Garden River.	37
Table 56. Garden River electrofishing results	38
Table 57. Atlantic salmon densities in Garden River	38
Table 58. Brook Trout densities in Garden River	38
Table 59. Garden River population estimates	39
Table 60. Habitat summary for Fraser's Brook	39
Table 61. Channel depth scores for Fraser's Brook	41
Table 62. Depth for pool habitat scores for Fraser's Brook	41
Table 63. Fry water depth scores for Fraser's Brook	41
Table 64. Parr water depth scores for Fraser's Brook.	42
Table 65. Pool class ratings in Fraser's Brook	42
Table 66. Percent of pool habitat for Brook trout in Fraser's Brook	42
Table 67. Percentage of pool habitat for Atlantic salmon in Fraser's Brook	42
Table 68. Riffle and run substrate scores for Fraser's Brook	43
Table 69. In-stream cover for Brook trout fry in Fraser's Brook.	43
Table 70. In-stream cover for Atlantic salmon fry in Fraser's Brook.	43
Table 71. In-stream cover for Atlantic salmon parr in Fraser's Brook	43
Table 72. In-stream cover for Brook trout parr and adults in Fraser's Brook.	43
Table 73. Spawning sites in Fraser's Brook	44
Table 74. Riparian vegetation scores for Fraser's Brook.	44
Table 75. Riverbank stability scores for Fraser's Brook	44
Table 76. Aerial photograph series summary for Fraser's Brook.	45
Table 77. Redd count survey summary for Fraser's Brook	46
Table 78. Fraser's Brook electrofishing results	49
Table 79. Atlantic salmon population densities in Fraser's Brook	49
Table 80. Brook trout population densities in Fraser's Brook	49
Table 81. Fraser's Brook population estimates	49
Table 82. Habitat summary of Cross Brook	49
Table 83. Channel depth scores for Cross Brook	51
Table 84. Pool depth scores for Cross Brook	51
Table 85. Fry water depth scores for Cross Brook	51
Table 86. Parr water depth scores for Cross Brook	52
Table 87. Pool class ratings for Cross Brook	52
Table 88. Percentage of pool habitat for Brook Trout in Cross Brook	52
Table 89. Percentage of pool habitat for Atlantic salmon in Cross Brook	52
Table 90. Riffle and run substrate scores for Cross Brook.	52
Table 91. In-stream cover for Brook trout fry in Cross Brook	53
Table 92. In-stream cover for Atlantic salmon fry in Cross Brook	53
Table 93. In-stream cover for Atlantic salmon parr in Cross Brook	53
Table 94. In-stream cover for Brook trout parr and adults in Cross Brook	53
Table 95. Spawning sites and scores in Cross Brook	53

Table 96. Riparian vegetation scores for Cross Brook	53
Table 97. Riverbank stability scores in Cross Brook	53
Table 98. Aerial photograph series summaries for Cross Brook Set 1	54
Table 99. Aerial photograph series summaries for Cross Brook Set 2	55
Table 100. 2024 redd survey results in Cross Brook	56
Table 101. Cross Brook electrofishing results	57
Table 102. Atlantic salmon population densities in Cross Brook	57
Table 103. Cross Brook population estimates	57
Table 104. Habitat summary of Moose River.	58
Table 105. Channel depth scores for Moose River	59
Table 106. Pool depth scores for Moose River	60
Table 107. Fry water depth scores for Moose River	60
Table 108. Parr water depth scores for Moose River	60
Table 109. Pool class ratings for Moose River	60
Table 110. Percentage of pool habitat for Brook Trout in Moose River.	61
Table 111. Percentage of pool habitat for Atlantic salmon in Moose River	61
Table 112. Riffle and run substrate scores for Moose River.	61
Table 113. In-stream cover for Brook trout fry in Moose River.	61
Table 114. In-stream cover for Atlantic salmon fry in Moose River	61
Table 115. In-stream cover for Atlantic salmon parr in Moose River.	61
Table 116. In-stream cover for Brook trout parr and adults in Moose River.	62
Table 117. Spawning sites and scores in Moose River.	62
Table 118. Riparian vegetation scores for Moose River	62
Table 119. Riverbank stability scores in Moose River.	62
Table 120. Aerial photograph series summary for Moose River	63
Table 121. Redd survey summary for Moose River	65
Table 122. Moose River electrofishing results	67
Table 123. Atlantic salmon population densities in Moose River	67
Table 124. Brook trout population densities in Moose River	67
Table 125. Moose River population estimates	67
Table 126. McKeen Brook habitat summary.	67
Table 127. Channel depth scores for McKeen Brook.	69
Table 128. Pool habitat scores for McKeen Brook.	69
Table 129. Fry water depth scores for McKeen Brook.	69
Table 130. Poor water depth scores for McKeen Brook.	69
Table 131. Pool class ratings in McKeen Brook.	70
Table 132. Percent pool habitat scores for Brook trout in McKeen Brook.	70
Table 133. Percent pool habitat scores for Atlantic Salmon in McKeen Brook	70
Table 134. Riffle and run substrate scores for McKeen Brook	70
Table 135. In-stream cover for Brook trout fry in McKeen Brook	70
Table 136. In-stream cover for Atlantic salmon fry in McKeen Brook.	71
Table 137. In-stream cover for Atlantic salmon parr in McKeen Brook.	71
Table 138. In-stream cover for Brook trout parr and adults in McKeen Brook	71
Table 139. Spawning sites and scores for McKeen Brook.	71
Table 140. Riparian vegetation scores for McKeen Brook.	71
Table 141. Riverbank stability scores for McKeen Brook.	71
Table 142. Aerial photograph series summary for McKeen Brook.	72
Table 143. Redd count survey summary of McKeen Brook.	73
, , ,	-

Table 144. North River St. Mary's habitat summary.	73
Table 145. Aerial photograph summary of the North River St. Mary's	75
Table 146. Restoration planned for 2024	76
Table 147. 2023 water quality measurement results	80
Table 148. 2024 Water Quality Results	
Table 149. 2023 Barren Brook HSI site locations	91
Table 150. 2024 Barren Brook HSI site locations	91
Table 151. Barren Brook 2023 HSI results for Brook trout	92
Table 152. Barren Brook 2023 HSI results for Atlantic salmon.	92
Table 153. Barren Brook 2024 HSI results for brook trout	92
Table 154. Barren Brook 2024 HSI results for Atlantic salmon.	93
Table 155. 2023 Garden River HSI site locations	94
Table 156. 2024 Garden River HSI site locations	94
Table 157. Garden River 2023 HSI results for Brook trout.	95
Table 158. Garden River 2023 HSI results for Atlantic salmon	95
Table 159. Garden River 2024 HSI results for brook trout.	96
Table 160. Garden River 2024 HSI results for Atlantic salmon	97
Table 161. 2023 Frasers Brook HSI site locations	98
Table 162. 2024 Frasers Brook HSI site locations	98
Table 163: 2023 Fraser's Brook HSI results for Brook trout.	99
Table 164. 2023 Fraser's Brook HSI results for Atlantic salmon	99
Table 165. 2024 Fraser's Brook HSI results for Brook trout.	100
Table 166. 2024 Fraser's Brook HSI results for Atlantic salmon	101
Table 167. 2024 Cross Brook HSI site locations	101
Table 168. Cross Brook results for Brook trout in 2024.	102
Table 169. Cross Brook results for Atlantic salmon in 2024	103
Table 170. 2023 Moose River HSI site locations	105
Table 171. 2024 Moose River HSI site locations	105
Table 172. 2023 Moose River HSI results for Brook trout	106
Table 173. 2023 Moose River HSI results for Atlantic salmon	106
Table 174. 2024 Moose River HSI results for brook trout	107
Table 175. 2024 Moose River HSI results for Atlantic salmon.	107
Table 176. 2023 McKeen Brook HSI site locations.	108
Table 177. 2023 McKeen Brook HSI results for Brook trout	108
Table 178. 2023 McKeen Brook HSI results for Brook trout.	109

# Table of Figures

Figure 1. Map of St Mary's River watershed boundaries and location within Nova Scotia	2
Figure 2. Wood turtle observed nesting in Garden River during HSI assessments	2
Figure 3. Project watersheds and locations in St Mary's River watershed	4
Figure 4. Temperature probe locations in 2024	6
Figure 5. 2024 Water quality monitoring locations	8
Figure 6. Visual guide of channel measurements (NSSA, 2018)	9
Figure 7. Map of 2024 electrofishing sites	15
Figure 8. Salmonid redd diagram (DFO, 2018).	16
Figure 9. 2024 redd survey locations	17
Figure 10. Barren Brook Subwatershed with main channel highlighted in dark blue	19
Figure 11. 2024 HSI site locations in Barren Brook	20
Figure 12. Photo set 1 of Barren Brook aerial photos	24
Figure 13. Photo set 2 of Barren Brook aerial photographs	25
Figure 14. Photo set 3 of Barren Brook aerial photographs	26
Figure 15. Map depicting 2024 redd survey location in Barren Brook	27
Figure 16. Map depicting electrofishing survey site 1 in Barren Brook	28
Figure 17. Garden River subwatershed with main channel highlighted in dark blue.	30
Figure 18. McIntosh Rd culvert in Fall 2023, before repairs	30
Figure 19. New bridge on McIntosh Rd, constructed Fall 2024	31
Figure 20: Brook trout observed during HSI surveys in Garden River	32
Figure 21: HSI site locations in Garden River	32
Figure 22. Aerial photograph series for Garden River	36
Figure 23. 2024 redd survey site in Garden River	37
Figure 24. Electrofishing survey sites in Garden River	38
Figure 25. Fraser's Brook subwatershed with main channel highlighted in dark blue	40
Figure 26. 2024 HSI Survey site locations in Fraser's Brook	40
Figure 27. Aerial photograph series for Fraser's Brook	45
Figure 28. Redd survey site 1 in Fraser's Brook	46
Figure 29. Redd survey site 2 in Fraser's Brook	47
Figure 30. Electrofishing survey site 1 in Fraser's Brook	48
Figure 31. Electrofishing survey site 2 in Fraser's Brook	48
Figure 32.Map of Cross Brook watershed with main channel highlighted in dark blue	50
Figure 33. Cross Brook 2024 HSI survey locations	51
Figure 34. Aerial photograph series #1 in Cross Brook	54
Figure 35. Photo set 2 of Cross Brook aerial photographs	55
Figure 36. 2024 redd survey site 1 in Cross Brook	56
Figure 37. 2024 electrofishing survey sites in Cross Brook.	57
Figure 38. Moose River subwatershed with main channel highlighted in dark blue.	58
Figure 39. 2024 Moose River HSI site locations	59
Figure 40. Photo set 1 of Moose River aerial photographs	63
Figure 41. Redd survey site 1 location in Moose River	64
Figure 42. Redd survey site 2 location in Moose River	64
Figure 43. Redd survey site 3 location in Moose River	65
Figure 44. Electrofishing survey site 1 location in Moose River	66
Figure 45. Electrofishing survey site 2 location in Moose River	66
Figure 46. McKeen Brook subwatershed with main channel highlighted in dark blue	68

Figure 48. 2023 redd count survey location in McKeen Brook	73
Figure 49. North Branch St. Mary's subwatershed with main channel highlight in dark blue	74
Figure 51. Photo set 1 for North River St. Mary's aerial photographs	75
Figure 52. Planned restoration area in Cross Brook	76
Figure 53. Planned restoration in Barren Brook	77
Figure 54. Results of temperature probe at MR01, with red line highlighting 23°C	82
Figure 55. Results of temperature probe at MR02, with red line highlighting 23°C and 27°C	82
Figure 56. Results of temperature probe at GR01, with red line highlighting 23°C and 27°C	83
Figure 57. Results of temperature probe at GR02, with red line highlighting 23°C	83
Figure 58. Results of temperature probe at FB01	84
Figure 59. Results of temperature probe at FB02, with red line highlighting 23°C	84
Figure 60. Results of temperature probe at NR01, with red line highlighting 23°C and 27°C	85
Figure 61. Results of temperature probe at NR02, with red line highlighting 23°C	85
Figure 62. Results of temperature probe at MB01, with red line highlighting 23°C and 27°C	86
Figure 63. Results of temperature probe at MB02, with red line highlighting 23°C and 27°C	86
Figure 64. Results of temperature probe at BB01, with red line highlighting 23°C	87
Figure 65. Results of temperature probe at CB01, with red line highlighting 23°C	87
Figure 66. Results of temperature probe at CB02, with red line highlighting 23°C	88
Figure 67. Results of temperature probe at WB01, with red line highlighting 23°C and 27°C	88
Figure 68. Structural design of a digger log (NSSA, 2018)	89
Figure 69. Structural design of a rock sill (NSSA, 2018)	90
Figure 70. Structural design of a log deflector (NSSA. 2018).	90
Figure 71. Bedrock Geology Map of Nova Scotia (DNRR, 2000)	127
Figure 72. Surficial Geology Map of Nova Scotia (DNRR, 1992)	128
Figure 73. Soils of Antigonish County Map (Department of Agriculture, 1979)	129
Figure 74. Soils of Guysborough County Map (Department of Agriculture, 1979)	130