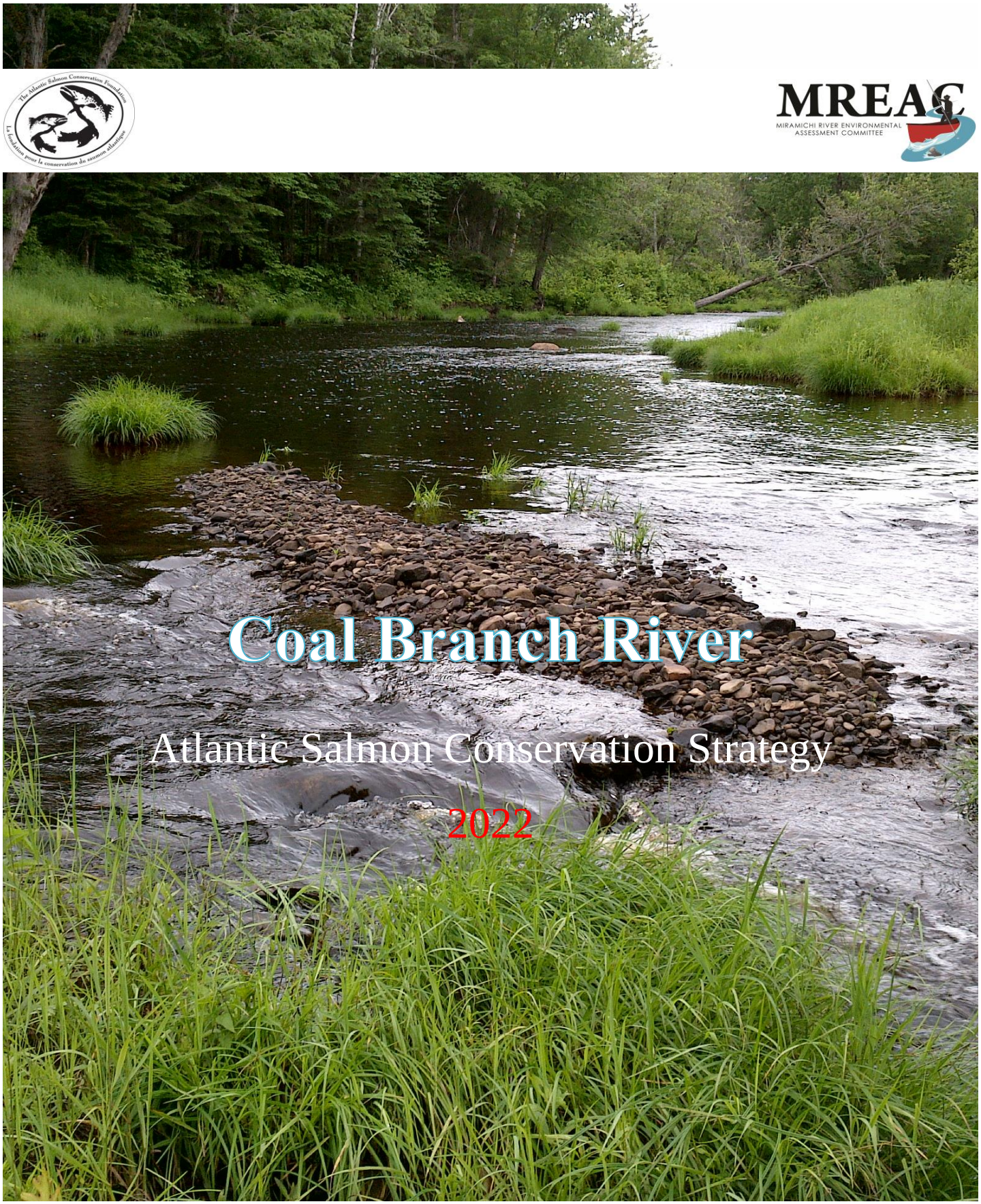


Coal Branch River

Atlantic Salmon Conservation Strategy

2022

Coal Branch River

Atlantic Salmon Conservation Strategy

2022

Harry Collins

Neil Collins

Vladimir King Trajkovic

Miramichi River Environmental Assessment Committee

PO Box 85, 21 Cove Road
Miramichi, New Brunswick
E1V 3M2

Phone: (506) 778-8591
Fax: (506) 773-9755

Email: mreac@nb.aibn.com
Website: http://mreac.org

November 2022

Acknowledgements

The Miramichi River Environmental Assessment Committee (MREAC) would like to thank the Atlantic Salmon Conservation Foundation (ASCF) for their funding support and this opportunity to work on Atlantic salmon conservation on the Coal Branch River drainage basin. The Richibucto River Association (Cathy Beck) provided access to monitoring equipment and other gear. MREAC volunteer and outfitter, Timothy Humes is likewise acknowledged for his field support and for the use and loan of outdoor equipment. The staff and students at New Brunswick Community College (NBCC-Miramichi) in the Environmental Technologies Program provide equipment, lab space and field support annually; thanks to all.

Executive Summary

In 2022, the Miramichi River Environmental Assessment Committee (MREAC) in partnership with the Richibucto River Association was supported by the Atlantic Salmon Conservation Foundation (ASCF) to prepare an Atlantic salmon conservation strategy for the Coal Branch River, one of the larger tributaries of the Richibucto River. MREAC staff and volunteers completed significant environmental monitoring and habitat assessment during the open water season of 2022. Some historical data was available for this drainage basin. Interviews with local recreational fishers were conducted when possible.

Based on available data, visual observations, river monitoring, and communication with river stakeholders, the Coal Branch appears to have habitat characteristics required to sustain significant Atlantic salmon production. Limiting factors to Atlantic salmon production, where possible, have been addressed. Some natural limiting factors will be unsurmountable. Future efforts should concentrate on maintaining the existing ecological values that sustain the existing stock of Atlantic salmon and other indigenous fish species. This and other comparable sized tributaries in eastern New Brunswick should be assessed further to determine the actual size of the annual spawning population. Resource protection should be enhanced as human resources allow.

Contents

List of Figures

1.0 Introduction

The Miramichi River Environmental Assessment Committee (MREAC) *Coal Branch River Atlantic Salmon Conservation Strategy* was monetarily supported by the Atlantic Salmon Conservation Foundation (ASCF) in 2022. Based on limited available survey data, recent monitoring efforts, other research, and opportunistic interviews, MREAC herein presents the *Coal Branch River Atlantic Salmon Conservation Strategy*.

The Richibucto River is the second largest of the watersheds located entirely within the province of New Brunswick. Situated on New Brunswick's eastern shoreline, the Richibucto is composed of eight significant tributaries. The Coal Branch is the second largest of these tributaries, after the Richibucto's main branch.

The Coal Branch River drainage basin is a stream order 4 riverine system and covers an area of 212.5 km². It is known to have an Atlantic salmon population, but little is known about the current size or sustainability of this population.

Of the approximate 40-kilometre length of the main branch of the Coal Branch from Coal Branch Lake to its mouth near Browns Yard, 30 kilometres were travelled by canoe during higher flow conditions on April 26, 2022.

Two one-kilometer reaches on the Coal Branch sub-watershed were surveyed applying the established (DNR/DFO) Stream Habitat Inventory protocol. Seven temperature loggers were deployed at widely distributed locations on the main branch, north and south forks of the river and smaller brooks.

Two electrofishing sites were surveyed on reaches of the Coal Branch (main branch) and a tributary stream, Blind Brook. These have contributed to the habitat assessment and to the overall conservation strategy.

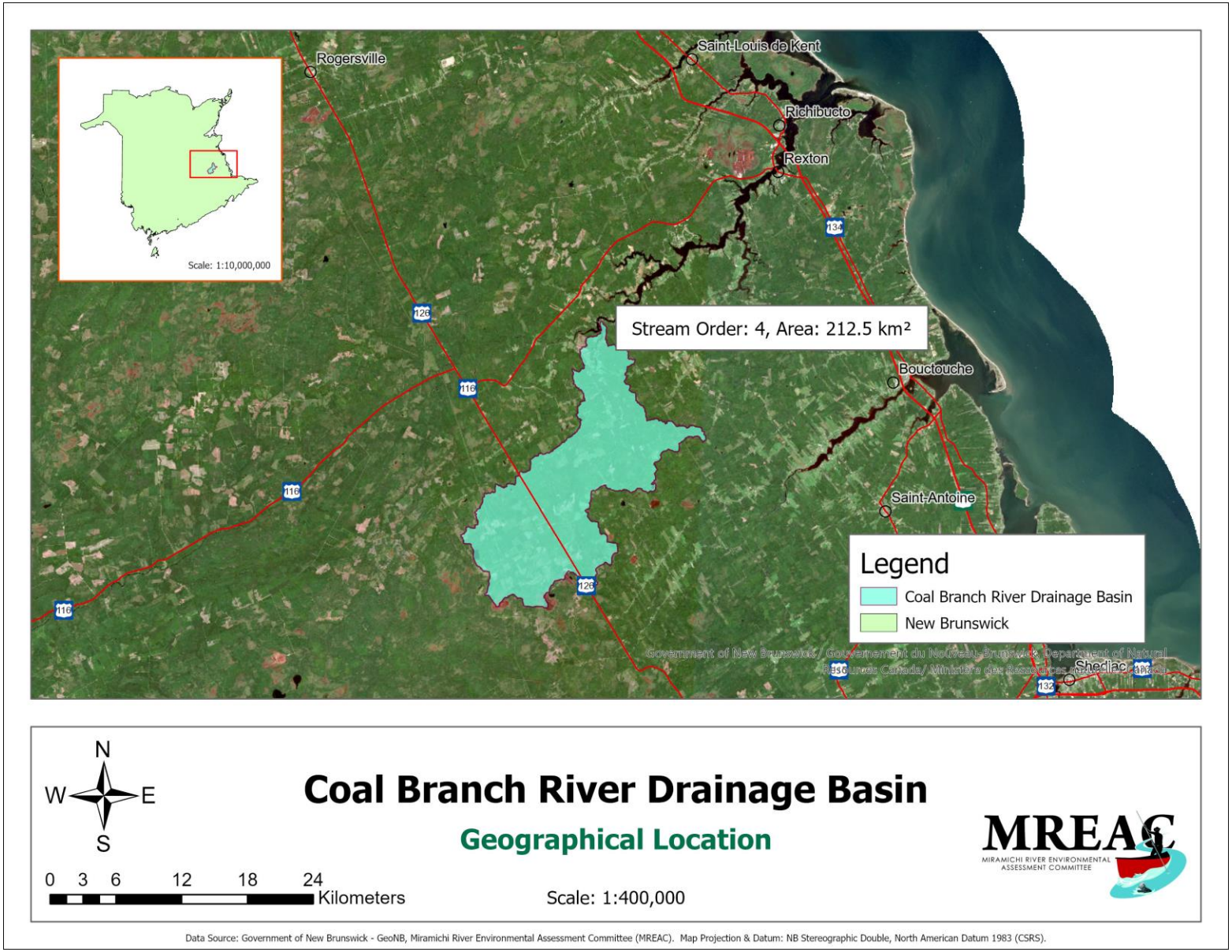


Figure 1 Coal Branch River Drainage Basin Geographical Location

The Coal Branch flows into the Richibucto River, which ultimately drains into the Northumberland Strait. The Richibucto is among a suite of smaller waterways south of the Restigouche and Miramichi rivers on the eastern New Brunswick shore. Each of these smaller waterways has its challenges due to size and often significant development pressures, especially concentrated along the tidal waters of their respective estuaries.

Little is known about the level of angling on the Coal Branch or the Richibucto River and the river's potential in producing Atlantic salmon. In 2022, with ASCF support, MREAC undertook the preparation of this Atlantic salmon conservation strategy. Temperature monitoring, field surveys, habitat assessment, electro-fishing, and opportunistic interviews were completed in 2022 to contribute to this strategy. The scope of this 2022 work on the Coal Branch cannot determine the current level of Atlantic salmon production. The report does consider the river's limiting factors, approaches to sustain the existing level of salmon production, and the prospect of enhancing that production.

In discussions with recreational fishers, with New Brunswick Department of Energy and Resource Development staff and as confirmed by our own electrofishing, the Coal Branch does have resident Atlantic salmon.

Trout were the target species of the few local fishers we encountered on the freshwater reaches of the river. Like other rivers of this scale in eastern New Brunswick the Coal Branch has a fall run of spawning salmon. Typically, low summer water levels and high-water temperatures limit access during the mid-summer months. There are a number of significant and somewhat isolated pools on the upper reaches of the main Coal Branch, above Hwy 465. The large pool situate just below Hwy 465 is very substantial but seems to be too accessible for salmon well-being. Testimonial reports suggest that Atlantic salmon are poached in various ways from this pool.

Figure 2 Coal Branch at Hwy 465 - ASCF Recognition

2.0 Conservation Strategy Objectives for Atlantic Salmon on the Coal Branch River

1. To maintain the ecological and recreational fishing values that the Coal Branch River currently possesses.

2. To conserve and protect existing Atlantic salmon stocks and their habitat.

3. To contribute to existing environmental knowledge and tap into the existing traditional knowledge through monitoring and interviews of recreational fishers.

4. To promote the cooperation and support of residents, landowners, recreational users, and other interested parties in effective management of recreational fisheries resources.

5. To promote shoreline stewardship principles among the camp, cottage and full-time residents along the Coal Branch to reduce negative impacts of siltation and shoreline destabilization.

6. To promote equity and fairness for all users in the application of management measures for the recreational fisheries.

7. To present a long-term strategy to conserve and maintain recreational fishes and their habitat.

3.0 River Setting & Access

The Coal Branch River sub-watershed covers 212.54 km² (Figure 1). The basin consists of the main branch and then separates into the South and North Forks. Other sizable tributary streams include Snake Brook, Blind Brook, Big Brook and a few other named tributaries. Some of these were selected to monitor the season-long temperature regime. The flow conditions during the hot and dry periods of summer limit the movement of larger fish. This limits the Coal Branch to a fall-run stream for spawning salmon.

East of Hwy 126, much of the land is in private hands including significant land holdings by Irving Pulp and Paper Ltd. West of the highway Crown lands predominate with JDI control of most of this land under lease-hold for forest harvesting. (Figure 3). Of note, the Coal Branch enters the Richibucto River in tidal waters and as such the mouth of the Coal Branch can be considered at head-of-tide.

4.0 Physical Setting & Climate

In 2022, conditions were wetter and cooler than the record-breaking drought and heat of 2020. Climate Normals for Harcourt New Brunswick (1981-2010) show a mean July temperature of 18.5°C and a mean January temperature of -10.2°C. The mean annual precipitation was 1160.2

mm. The past decade has shown that summer temperatures are on the rise, and this is in keeping with the expected climate change scenario.

The Coal Branch drainage basin is part of the Eastern Lowlands Ecoregion (Figure 4).
This makes the Coal Branch a fairly even, low gradient river with an average drop of 4 meters per kilometer.

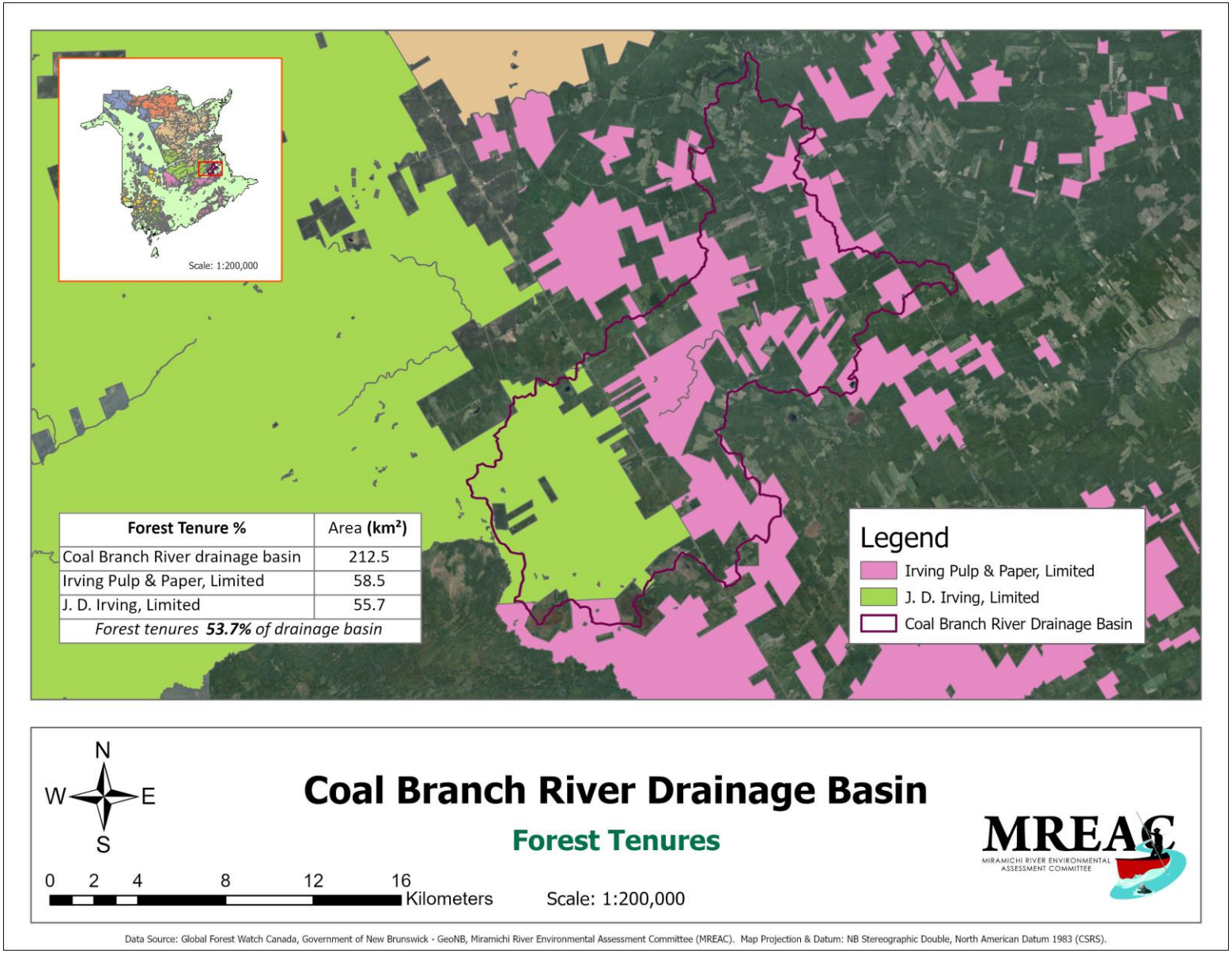


Figure 3 Coal Branch River Drainage Basin Forest Tenure

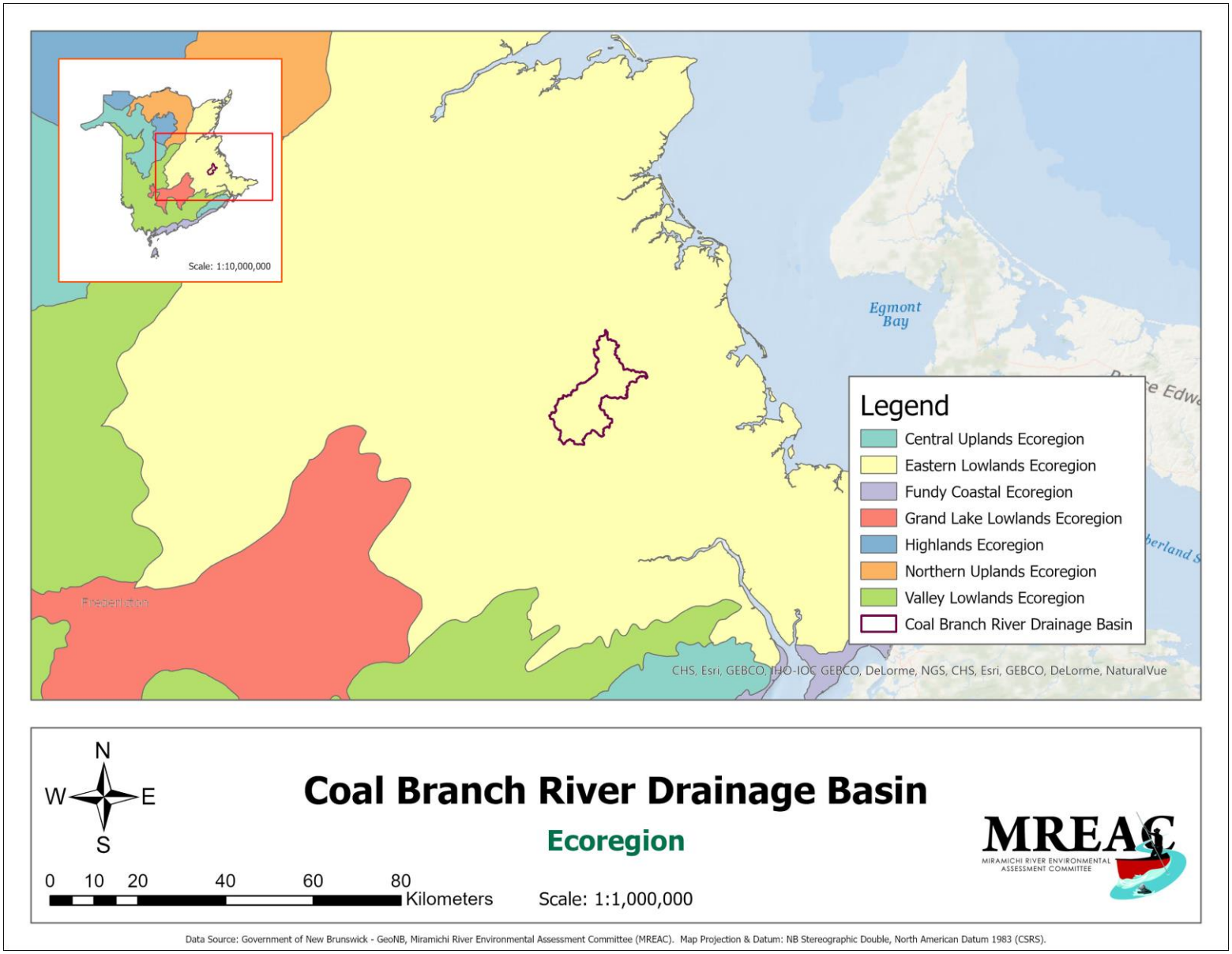


Figure 4 Coal Branch River Drainage Basin Within New Brunswick Ecoregions

4.1 Bedrock Geology

The bedrock geology of the Coal Branch River drainage basin is typical to that of the eastern lowlands ecoregion which is generally composed of grey sandstone and red mudstone. The stratum dates to the Carboniferous (Pennsylvanian) geologic era (Figure 5) (NBDNR, 2000). Exposed bedrock is a prominent feature of stretches of the river bottom with little other surficial material as a cover.

The surficial geology of the Coal Branch drainage basin is primarily composed of silt, sand, gravel, rubble, loamy lodgement till, and minor ablation till. The organic sediments found in bogs or fens are typically 1 to 5 meters thick. Wetlands are a prominent part of the landscape, this especially true in the headwaters of the Coal Branch. A significant peat harvesting operation is located on the headwaters of the Little Coal Branch, a tributary stream to the South Forks Coal Branch.

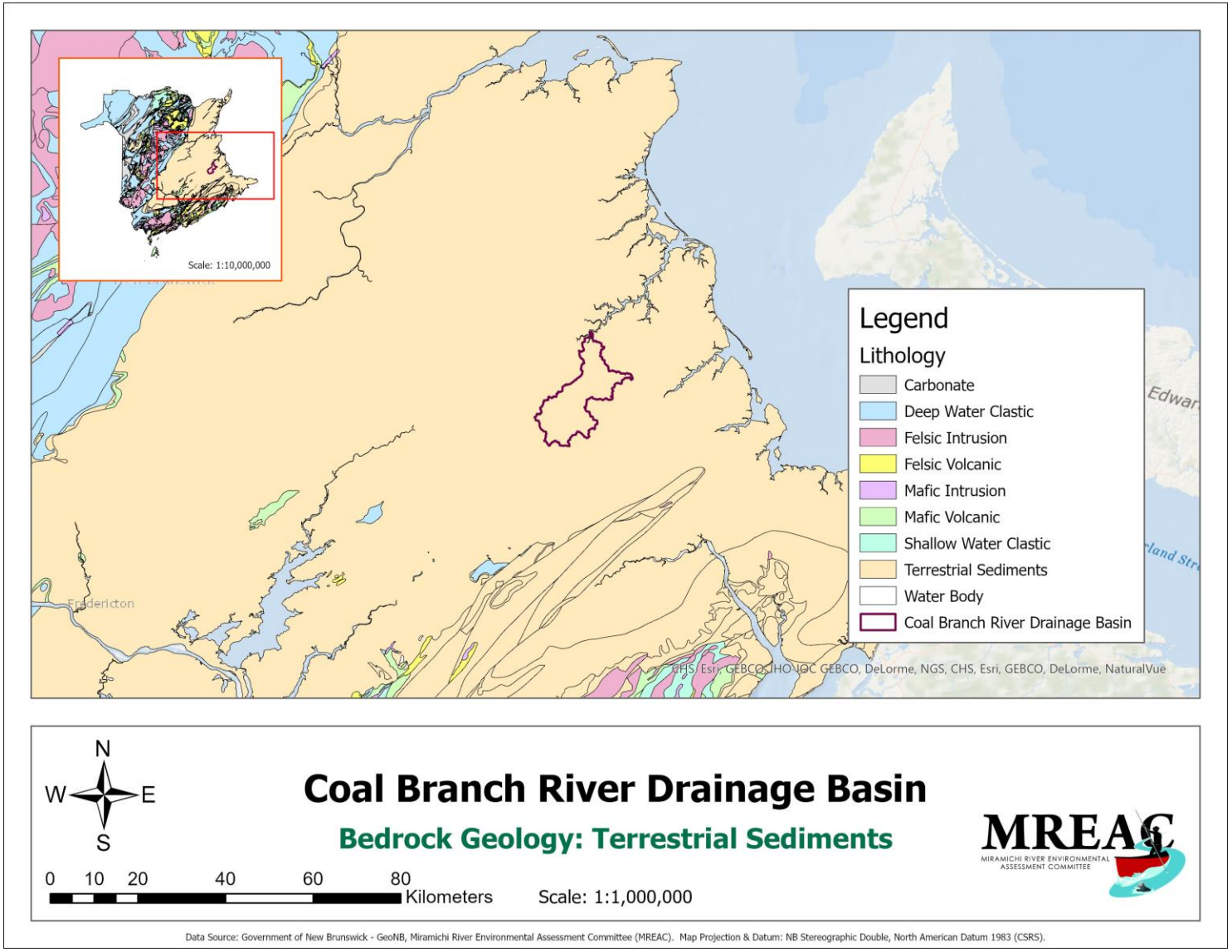


Figure 5 Coal Branch River Drainage Basin Bedrock Geology

5.0 Land Cover, Land Use & Land Use History

The predominant land-cover within the Coal Branch drainage basin is forest, comprising about 70% considering the various forest types (Figure 10). Forestry is the main economic activity on the watershed and has the greatest anthropogenic impact on the watershed. Most of the forest harvesting is industrial scale, worked by Irving-owned forest companies with large holdings of both private and lease hold crown lands. Harvesting on private woodlots is also common. Forestry is followed by other activities as shown in Figure 10.

Wetlands comprise 9.7 % of the landscape and are concentrated in the headwaters but are otherwise widely distributed. Where wetlands predominate in the headwaters, organic rich river bottom offers poor substrate for spawning. A large peat harvesting is operated by Sun Gro Horticulture Ltd. and situated in the headwaters of the Little Coal Branch River. No water quality impacts were detected from this operation.

There is no active tracking of the level of recreational fishing activity and even less resource data available on Atlantic salmon. Encountered anglers on the Coal Branch were targeting Brook trout and showed little awareness of resident Atlantic salmon.

5.1 Coal Mining History

Rich, albeit limited, coal deposits near the surface allowed for a brief history of coal mining on the Coal Branch sub-watershed, concentrated in the early 1900's. These resources and mining operations were significant enough to become the namesake of this tributary of the Richibucto River. While "Coal Branch" was adopted to name the tributary, a smaller brook that drains the larger of the two strip-mining sites is called Snake Brook. (Figure 9). Other mining operations included pit mining and were apparently much closer to the river. The scars of the riverside operations are now masked or gone and only remembered by long-term residents of the area (Pers Comm: Garth Robinson).

The strip-mining sites offer dramatic testimony to their impact on the landscape (Figure 6). Figure 6 and Figure 7 illustrate this mining history. The land has never been remediated and

decades later the mineral soil has been very slow in recolonizing except where organic matter collects in natural cavities.

Figure 6 Abandoned Coal Filed near Harcourt N.B. (3x vertical exaggeration to clarify the topographic features)

Figure 7 Tailings Field and Holding Pond from Coal Mining Operations

One might suspect that this mining history has significantly limited the capacity of the Coal Branch to be an Atlantic salmon producing stream. We do not know what impacts these operations may have had during the years of coal extraction. However, following significant monitoring effort in 2021 and 2022 of water quality parameters, there is little evidence to suggest long-term impacts persist into the current day. These conclusions are made from the following monitoring and observations:

- Results of pH monitoring of the Coal Branch and multiple feeder streams to the main branch do not suggest that this history is limiting salmon production. (See Appendix D.)
- A wide suite of general chemistry parameters did not flag any specific industry related compounds that would limit habitat conditions for Atlantic salmon. (See Appendix E.)

- A CABIN (Canadian Aquatic Biomonitoring Network) site on the Coal Branch near Beersville indicates near-reference habitat conditions for this waterway identifying a healthy benthic community.
- Past electrofishing results by the Richibucto River Association and the Southeastern Anglers suggest the Coal Branch is typical of the other tributaries to the Richibucto River.

Figure 8 pH Monitoring at Discharge from Former Coal Mining Site

Recommendation: *Monitoring of the Coal Branch River for pH levels should continue annually in late-winter and spring.*

Figure 9 Mouth of Snake Brook

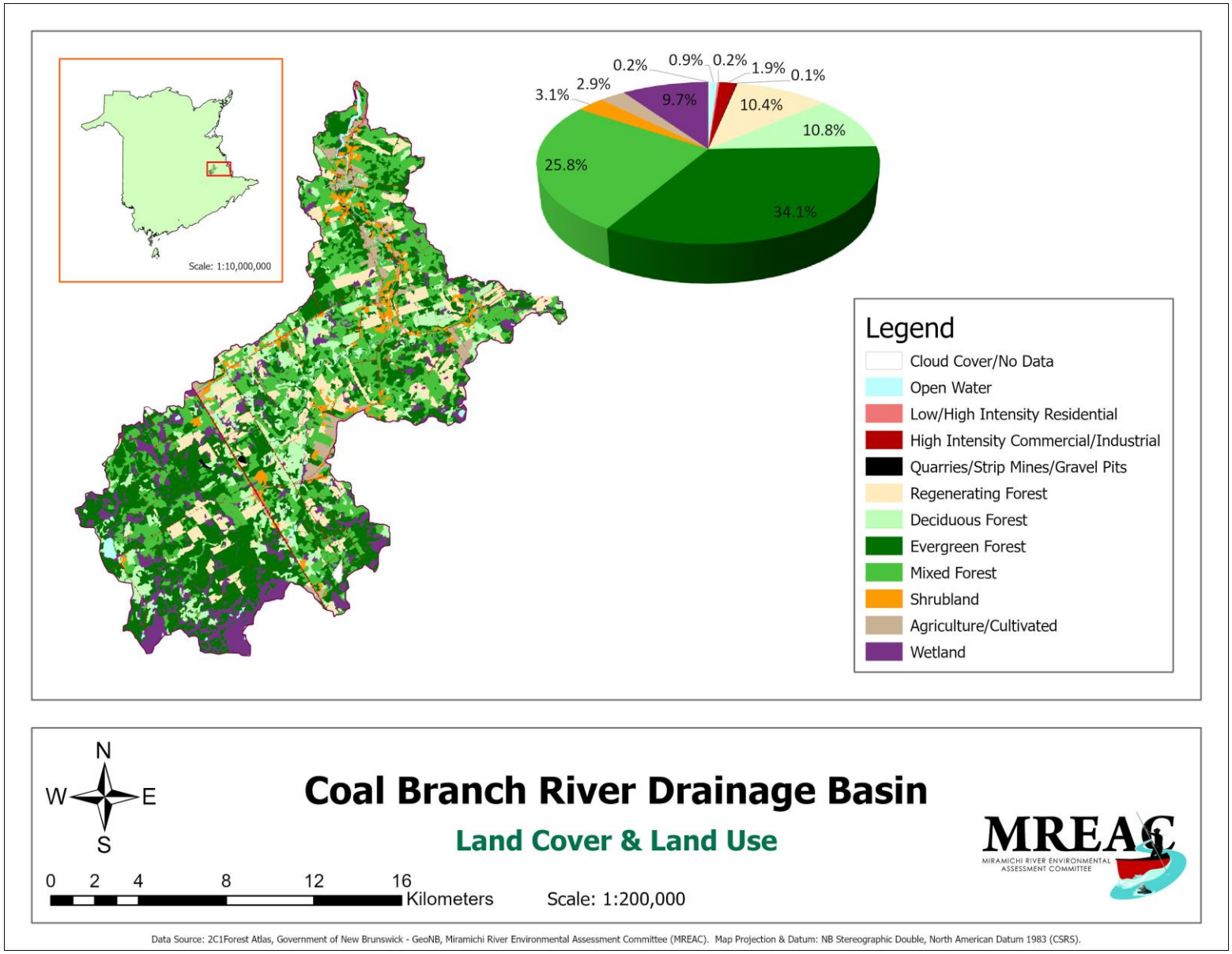


Figure 10 Coal Branch River Drainage Basin Land Cover & Land Use

6.0 Beaver Dams

From field work and specific river travels, beaver dams are a common feature in the headwaters of the Coal Branch. This is also true of the smaller tributary streams. Road access to many of these waterways is limited and beaver activity is likely to be more of a factor than realized. Three dams that blocked culverts (Blind Brook and Big Brook) were notched. Dams on Snake Brook and the South Forks were also notched to allow temporary access to migrating or spawning fishes. No fish were observed moving above these barriers at the time.

Figure 11 Notching a Beaver Dam to Allow Fish Passage

***Recommendation**: An annual program of notching beaver dams in the late fall during spawning season should be implemented to extend spawning further into the Coal Branch headwaters.*

7.0 Habitat Assessments

Two detailed stream habitat surveys were completed in 2022 on one kilometer reaches on the main branch of the Coal Branch River and on the North Fork Coal Branch River respectively. (Appendix C). These reaches are presented as representative sections of these waterways. The results of the habitat assessments showed general physical conditions conducive to rearing Atlantic salmon. The DNR&E / DFO – New Brunswick Stream Habitat Inventory field forms indicate that the overall physical characteristics show favorable conditions in the number and depth of pools, available shade, potential cover with woody debris, bank stability, and vegetation along banks. The substrate would allow for nesting activity (i.e. creating salmon redds).

Water temperature loggers were placed at seven Coal Branch watershed sites, distributed on various branches and tributaries, with one on the main branch. Only four of these were successful recovered. Beavers had removed at least two of the original seven loggers, but one of those was recovered, found embedded in the adjacent dam. The embedded logger provided a water temperature data set up to the point when the beaver, on July 9th, included it in the dam above water level. Figure 13 represents a water temperatures composite from the four Coal Branch River sites from 2022 monitoring. Appendix B provides the temperature profiles for each of the recovered loggers.

Of the four sites of the recovered loggers, only the main branch at Du Prêtre Rd exceeded the 23°C salmonid thermal stress level for a significant period. Much of the riparian zone here has been cleared and thus offers little shade. This is illustrated by the significant difference in temperature profiles from the other three logger locations (Figure 13) It also represents the most downstream and widest of the monitoring locations. Snake Brook was the coolest of the successfully monitored waterways in 2022.

The higher temperatures and low water levels of the summer prohibit an early run of Atlantic salmon. As a fall-run river, adult salmon are thus not at risk due to high stresses of water temperatures. Resident juvenile salmon will seek out cold water pools to wait out warm water conditions. The temperature profiles provided extend for over four months with deployment of loggers in the spring and extraction in the fall.

Figure 12 Habitat Assessment on North Fork Coal Branch River

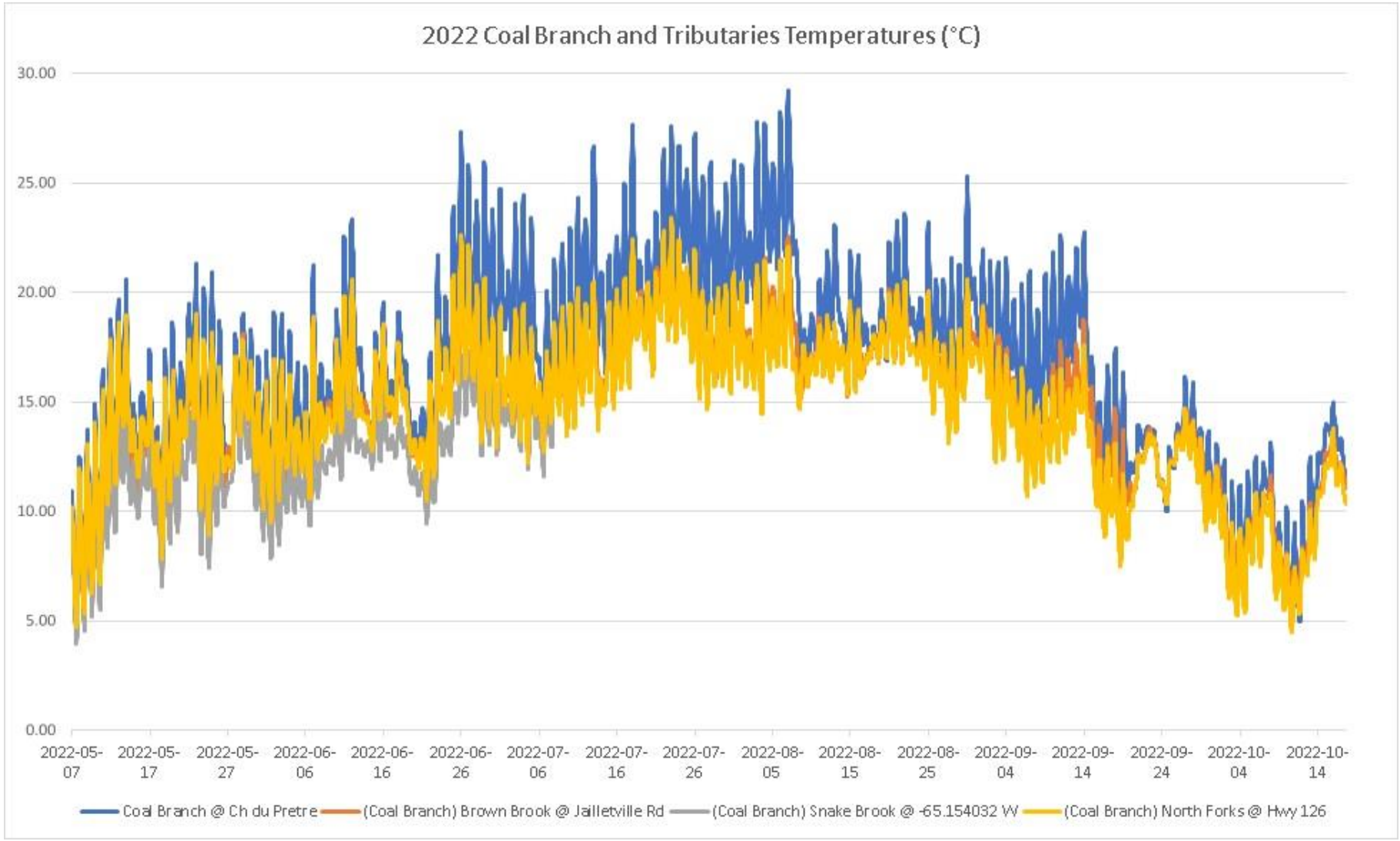


Figure 13 Water Temperature Profiles of Four Coal Branch Waterways

***Recommendation**: The Coal Branch River should be included in a comprehensive monitoring program of water temperature in eastern New Brunswick rivers to monitor long-term trends with the intent of providing special protection of colder water streams and pools as fish refuges*.

Two electrofishing sites were fished by Mr. Rod Currie, fish biologist with Hilcon Ltd, Fredericton, on September 20th and 27th respectively. Mr. Currie was assisted by Julia Horncastle (Hilcon Ltd, Fredericton) and two MREAC staff. These results are presented in Appendix A.

Figure 14 Salmon Parr Captured While Electrofishing on the Coal Branch River

The major current economic activities in the watershed - lumber harvesting, a peat production operation, and limited agriculture production - do not appear to pose any significant threat to fish

habitat. Testimonial reports from Richibucto River Association members and a recreational fisherman identified poaching as an issue at the pool below the Hwy 465 bridge crossing.

8.0 Water Quality

Water quality monitoring on the Coal Branch River in 2022 indicated that most parameters show conditions that are acceptable to support fish populations, including Atlantic salmon. Appendix E shows the general chemistry results taken in 2022. The general chemistry sample was processed by the RPC Laboratory (Fredericton). These results were compared to the Canadian Council of Ministers of the Environment's (CCME) Water Quality Guidelines for the Protection of Aquatic Life. No issues were noted.

Water temperature, however, is a water quality issue that has increasingly become a limiting factor for Atlantic salmon on the Coal Branch River and elsewhere on eastern New Brunswick waterways. As a smaller-scale shallow river, water temperatures, especially those in recent years, have resulted in temperatures above the stress threshold of salmonids. Water quantity is another limiting factor. Thus, with water temperature and water quantity, the Atlantic salmon spawning run is limited to the more favorable cooler and higher water conditions in the fall.

Dissolved Oxygen (DO) levels have been acceptable in repeated monitoring over multiple visits during 2022. The river's pH values are also within an acceptable range.

Sedimentation issues appear to be minimal. Industrial level forest harvesters comply with the 30m buffer zone along waterways. Some river fording sites were noted in the spring river reconnaissance, but none seemed to contribute significant sediment to the watercourse. There is no delta at the river mouth to suggest the river deposits large amounts of sediment.

Recommendation: *Monitoring of the Coal Branch River site at Hwy 465 in Beersville for pH levels should continue annually in late-winter and spring.*

Recommendation*: The Coal Branch River should be included in a comprehensive monitoring program of water temperature in eastern New Brunswick rivers to monitor long-term trends with the intent of providing special protection of colder water streams and pools as fish refuges.*

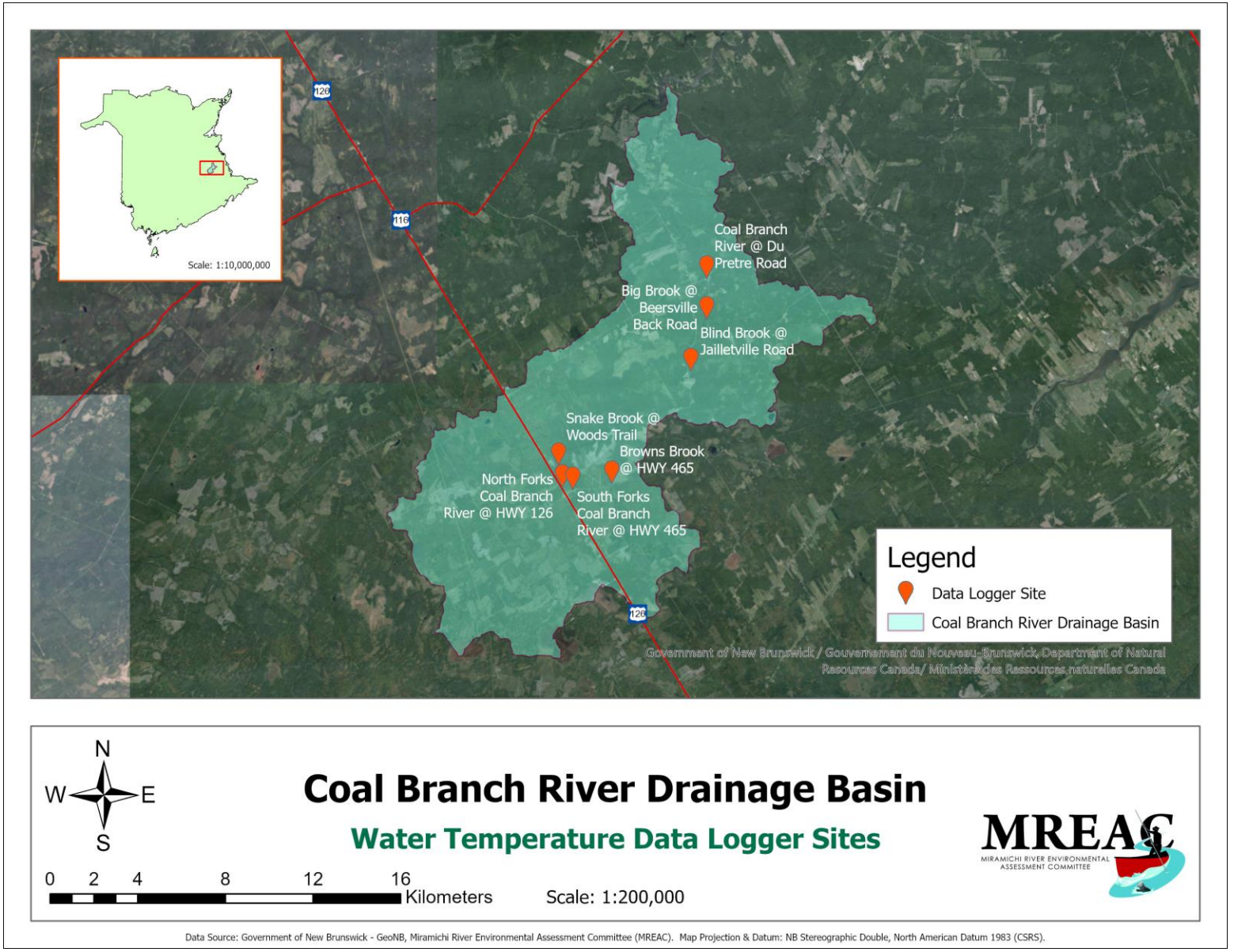


Figure 15 Coal Branch River Drainage Basin Water Temperature Data Logger Sites

9.0 Land Tenure

A review of private land holdings on the Coal Branch River (GeoNB) and a river reconnaissance by canoe show a significant number of river-side properties. These properties are concentrated toward the east end of the watershed below Hwy 465. Navigating sections of the North Forks, South Forks and all of the main branch of the river revealed no lumbering operations causing sedimentation by cutting in the riparian zone of the main branch or of the aforementioned main tributaries. However, by working with the New Brunswick Federation of Woodlot Owners, best management practices on these properties can be promoted among private woodlot owners.

***Recommendation**: Strategies to promote the use of best management practices among private woodlot owners should be promoted through the New Brunswick Federation of Woodlot Owners.*

***Recommendation**: Strategies to promote shoreline protection and river stewardship should include full time residents along with camp and cottage owners.*

10.0 Conclusion

The Coal Branch River is an intact waterway with an extant Atlantic salmon population. The watercourse is not a destination for recreational salmon anglers by virtue of a very limited salmon run and low productivity. The threat of poaching of existing stock is flagged as an issue, but its impact is unknown. The limited fishing pressure on this waterway suggest the Atlantic salmon stock, albeit small, is not in peril.

MREAC monitoring and research on the Coal Branch River in 2022 was important to the development of this strategy as limited historic information was available on this waterway.

Climate change impacts, as they increase, will be problematic on this waterway. Already suffering high temperatures during the peak of summer, the habitat for juvenile salmon seems limited at best and will not likely improve in the face of warming conditions. Apart from high temperatures and often low water quantity during hot dry summers, other water quality parameters seem acceptable for Atlantic salmon habitat.

Industrial forestry is the major industrial use on the Coal Branch River and - along with other rivers in New Brunswick - it continues to be “flashy”, with quickly rising and quickly falling water levels associated with larger rainfall events. The riparian zone is generally in good shape and with a relatively narrow channel on much of the river good shading occurs.

Waterfront properties are concentrated along the main branch of the Coal Branch and include camps, cottages, and full-time residents. Riparian zones have been cleared on several of these properties. All of these properties were provided with a stewardship manual related to waterfront living. (Rejean Roy)

Based on the data analyzed, visual observations recorded, and personal communications, the Coal Branch River does not appear to have significant production of Atlantic salmon. However, the current limited pressure from recreational fishers suggest that the existing salmon stock is currently secure. Increasing impacts from a warming climate suggest that the future of a sustainable salmon stock on the Coal Branch River, over the long-term, is in question. The prospect of seeding this waterway with salmon eggs from brood stock collected on the Coal Branch should be explored. In the interim, implementing the recommendations from this conservation strategy will stabilize the Atlantic salmon stock over the shorter-term.

All this considered, the future of Atlantic salmon in eastern New Brunswick waterways, including the Coal Branch River, seems more likely to be determined by far reaching global factors than local limiting conditions.

11.0 Summary of Recommendations

Recommendation: An annual program of notching beaver dams in the late fall during spawning season should be implemented to extend spawning further into the Coal Branch headwaters.

Recommendation: The Coal Branch River should be included in a comprehensive monitoring program of water temperature in eastern New Brunswick rivers to monitor long-term trends with the intent of providing special protection of colder water streams and pools as fish refuges.
Recommendation: Monitoring of the Coal Branch River for pH levels should continue annually in late-winter and spring.

Recommendation: Strategies to promote the use of best management practices among private woodlot owners should be promoted**.**
Recommendation: Strategies to promote shoreline protection and river stewardship should include full-time residents along with camp and cottage owners.
Recommendation: When feasible, the Coal Branch River (and other smaller waterways) should be assessed using "ARIS Sonar Population Tracking" to determine the actual size of the annual spawning population.

References

Government of Canada, Environment and natural resources. (2022). Climate Normals & Averages, Harcourt, New Brunswick. Retrieved November 23, 2022, from https://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnProv&lstProvince=&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=6170&dispBack=0

GeoNB Map Viewer GeoNB Map Viewer (arcgis.com)

Government of New Brunswick, Fish NB - Angling Regulations Guidebook Regular season 2022

NBDNR. (2000). *Bedrock Geology of New Brunswick*. New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division. Map NR-1(2000 Edition) (scale 1: 500 000).

Rampton, V.N. (1984). *Generalized Surficial Geology Map of New Brunswick*. Department of Natural Resources and Energy, Minerals. Policy and Planning Division. NR-8 (scale 1: 500 000).

Roy, Rajean, Guide for New Brunswick Waterfront Property Owners, Province of New Brunswick.

Appendix A: Electrofishing Report by Hilcon Ltd.

HILCON LIMITED
420 York St. Fredericton, NB E3B 3P7
Tel: 506.454.4455
www.hilcon.ca

2022 Miramichi River Environmental Assessment Committee Fish Population Surveys

Coal Branch River
Blind Brook

Project Information	
Watercourses	Coal Branch River, and Blind Brook
Surveys Completed	September 20 and 27, 2022
Report Completed	November 15, 2022
HILCON Staff	Clara Thaysen, Rod Currie, and Julia Horncastle
Job No.	22075

HILCON LIMITED

TABLE OF CONTENTS

INTRODUCTION AND RATIONALE

In 2022, HILCON Ltd via R. Currie was contracted by the Miramichi River Environmental Assessment Committee (MREAC) to conduct fish population surveys at the Coal Branch River and Blind Brook within the Richibucto River watershed in eastern New Brunswick. Surveys are conducted annually at different locations in order to maintain long-term data sets of fish species presence and density within watersheds that house Atlantic salmon (*Salmo salar*). The following report summarizes the results of the 2022 survey.

LOCATION

Fish population surveys were conducted at two separate watercourses within the Richibucto River watershed: the Coal Branch River, and Blind Brook. These watercourses were surveyed on September 20 and 27, 2022, respectively. The Coal Branch River site was located 50 m upstream of the Chemin du Prètre bridge crossing near Beersville, Kent County (46.443670, -65.064277), and the Blind Brook site was located 100 m downstream from the Jailletville Road bridge crossing, also near Beersville, Kent County (46.406042, -65.074594). Blind Brook is a tributary of the Coal Branch River. Please see Figure 1 for a map of the locations and Figures S1-S2 in the Supplementary Information for images of the sites.

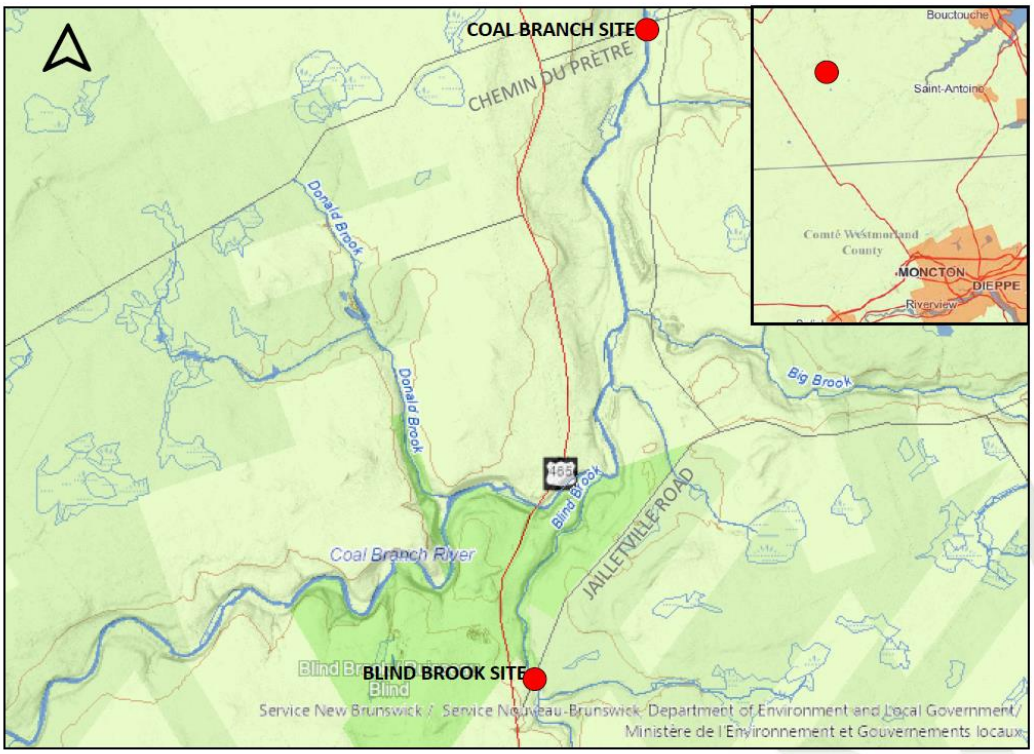


Figure 1. Location of 2022 field sites.

METHODOLOGY

The fish sampling methodology followed procedures for the removal method of population estimation for enclosed sites. The limits of the sampling area were marked with nets, then fish were collected from within each designated area during four consecutive sweeps using a Smith-Root Model LR24 backpack electrofisher, with the exception of the Coal Branch site where only three sweeps were made due to the exceptionally large size of the river. Electrical settings were selected automatically at each site using the Quick Setup method on the electrofisher. The midday water temperature was measured with a certified pocket thermometer, and the wetted width and length of the sites were recorded to determine the sampling site area. To account for meanders in the watercourse, the wetted width was determined by measuring several consecutive width measurements every couple of metres in between the nets and then calculating the average of these measurements. The environmental characteristics and electrofishing settings at each site are summarized in Table S1 in the Supplementary Information.

Electrofishing was conducted by moving back and forth across the stream while gradually moving upstream from the lower boundary towards the upper boundary of the site. Stunned fish were collected by several technicians using dip nets and placed in a pail that was partially filled with water. Following each sweep, fish were lightly anesthetized using tricaine methanesulfonate (TMS), identified to species, and counted. Individual brook trout (*Salvelinus fontinalis*) and Atlantic salmon (*Salmo salar*) were additionally measured for fork length, then assigned an age class based on their respective size class. Processed fish were then transferred to a holding cage placed in the stream until the final sweep was completed. When fish from the final sweep were processed, all of the fish were released unharmed back into the watercourse.

Estimates of population density for each species of fish, as well as for each age class of salmon and trout, were generated using the *Microfish 3.0* formula (Van Deventer and Platts, 1989). The density estimates were then adjusted based on the size of each site to achieve a standard unit area of 100 m^2 to permit the direct comparison of fish densities between sites and between years if sites are revisited in the future.

RESULTS AND DISCUSSION

The density estimates from the population surveys for each site are presented in Table 1. The results for each site are discussed in more detail below. The individual counts for each fish, including fork length measurements for salmonids, for each site can be found in Tables S2 and S3, respectively, in the Supplementary Information.

Table 1. Species density estimates.

Species	Age	Number/100 m²	
		Coal Branch	Blind Brook
Atlantic salmon (*Salmo salar*)	0+	6.2	2.0
	1+	2.1	1.0
	2+	0.1	0
	All age classes	8.7	2.5
Brook trout (*Salvelinus fontinalis*)	0+	0	0.5
	1+	0	2.0
	All age classes	0	2.5
Blacknose dace (*Rhinichthys atratulus*)		26.0	11.6
Creek chub (*Semotilus atromaculatus*)		3.5	0
Lake chub (*Couesius plumbeus*)		0	7.1
Common shiner (*Luxilus cornutus*)		2.1	0
White sucker (*Catostomus commersonii*)		3.1	0.5
Slimy sculpin (*Cottus cognatus*)		0	37.3
Threespine stickleback (*Gasterosteus aculeatus*)		0.7	0

The Coal Branch River is a tributary of the Richibucto River in eastern New Brunswick, and Blind Brook is a tributary of the Coal Branch. The survey results for both watercourses demonstrate some similarities such as the same number of fish species, as well as a number of shared common fish species, at both locations (Table S2). However, there are distinct differences in those fish communities as a result of habitat differences. The Coal Branch River site represents a shallow riffle habitat that has limited cover for fish and is totally devoid of shade cover (Figure S1). The complete exposure to the sun elevates the temperature of the water during the summer months which creates warm water habitat conditions. Brook trout (*Salvelinus fontinalis*) and slimy sculpin (*Cottus cognatus*) which are totally depended on cold-water habitats are completely absent from the fish community in the main stem Coal Branch River during summer and early fall (Table S2). Instead, the primary fish species in the river include blacknose dace (*Rhinichthys atratulus*), common shiner (*Luxilus cornutus*), creek chub (*Semotilus atromaculatus*), white sucker (*Catostomus commersonii*), and threespine stickleback (*Gasterosteus aculeatus*) (Table S2). These are all common species of coarse fish which are found in warm water habitats.

Although the tributary Blind Brook is geographically close to the Coal Branch River sampling site, the habitat is dramatically different. The brook is narrow and well shaded by overhanging tree and shrub vegetation, and there is abundant cover for fish in the form of large woody debris, coarse rock substrate and overhanging vegetation (Figure S2). The

water temperature is overall cooler due to the shade, as well as possible groundwater influences. The higher temperature recorded at Blind Brook on the day of sampling can be explained by the difference in air temperature: the daytime high reached 8°C on the Coal Branch sampling day, and 20°C on the Blind Brook sampling day. The cooler water and more abundant cover make Blind Brook a much better habitat for brook trout and slimy sculpin. Although the number of captured brook trout were not high, two age classes were present. With respect to slimy sculpin, sculpin represents the most abundant fish species at the Blind Brook sampling site. The remaining fish species, juvenile salmon (*Salmo salar*), lake chub (*Couesius plumbeus*), blacknose dace (*Rhinichthys atratulus*), and white sucker (*Catostomus commersonii*), appear in modest numbers (Table S2).

With respect to juvenile Atlantic salmon, low numbers of several age classes of salmon were found at both sampling locations. Higher densities of salmon fry (age class 0+) occur in the Coal Branch (Table 1) which might indicate that the river provides better spawning habitat than Blind Brook. Salmon parr occur in similarly low densities at both locations (Table 1).

CONCLUSION

In summary, the 2022 fish population surveys performed at the Coal Branch River and Blind Brook for the MREAC were completed successfully. Please contact myself, Clara Thaysen, if you have any questions about this report.

Thank you,

Clara Thaysen, M.Sc.
Ecologist
(647) 456-3358
clara.thaysen@hilcon.ca

HILCON LIMITED

REFERENCES

Van Deventer, J.S., and Platts, W.S. 1989. Microcomputer software system for generating population statistics from electrofishing data : user's guide for MicroFish 3.0. General Technical Report INT-254. United States Department of Agriculture, Forest Service, Intermountain Research Station: Ogden, Utah.

HILCON LIMITED

SUPPLEMENTARY INFORMATION

Table S1. Electrofisher settings and environmental characteristics for each site. Each voltage was maintained for during all sweeps for each site. Other settings on the unit were maintained at their default levels: pulse width = 6 milliseconds, and frequency = 40 hertz.

Site	Voltage (V)	Electrofisher on-time (s; sweep 1,2,3,4)	Water temperature (°C)	Average wetted site width (m)	Site length (m)	Area of sampling site (m^2)
Coal Branch	215	2073, 2574, 1186	12.0	21.2	32.0	678.4
Blind Brook	205	1210, 1287, 738, 1005	14.2	3.7	53.9	199.4

Table S2. Individual species counts for each site.

Species	Age	Number of individuals	
		Coal Branch	Blind Brook
Atlantic salmon (*Salmo salar*)	0+	37	4
	1+	10	1
	2+	1	0
	Total	***48***	***5***
Brook trout (*Salvelinus fontinalis*)	0+	0	1
	1+	0	4
	Total	***0***	***5***
Blacknose dace (*Rhinichthys atratulus*)		186	21
Creek chub (*Semotilus atromaculatus*)		20	0
Lake chub (*Couesius plumbeus*)		0	12
Common shiner (*Luxilus cornutus*)		8	0
White sucker (*Catostomus commersonii*)		16	1
Slimy sculpin (*Cottus cognatus*)		0	64
Threespine stickleback (*Gasterosteus aculeatus*)		5	0

Table S3. Individual salmonid fork length measurements for each site.

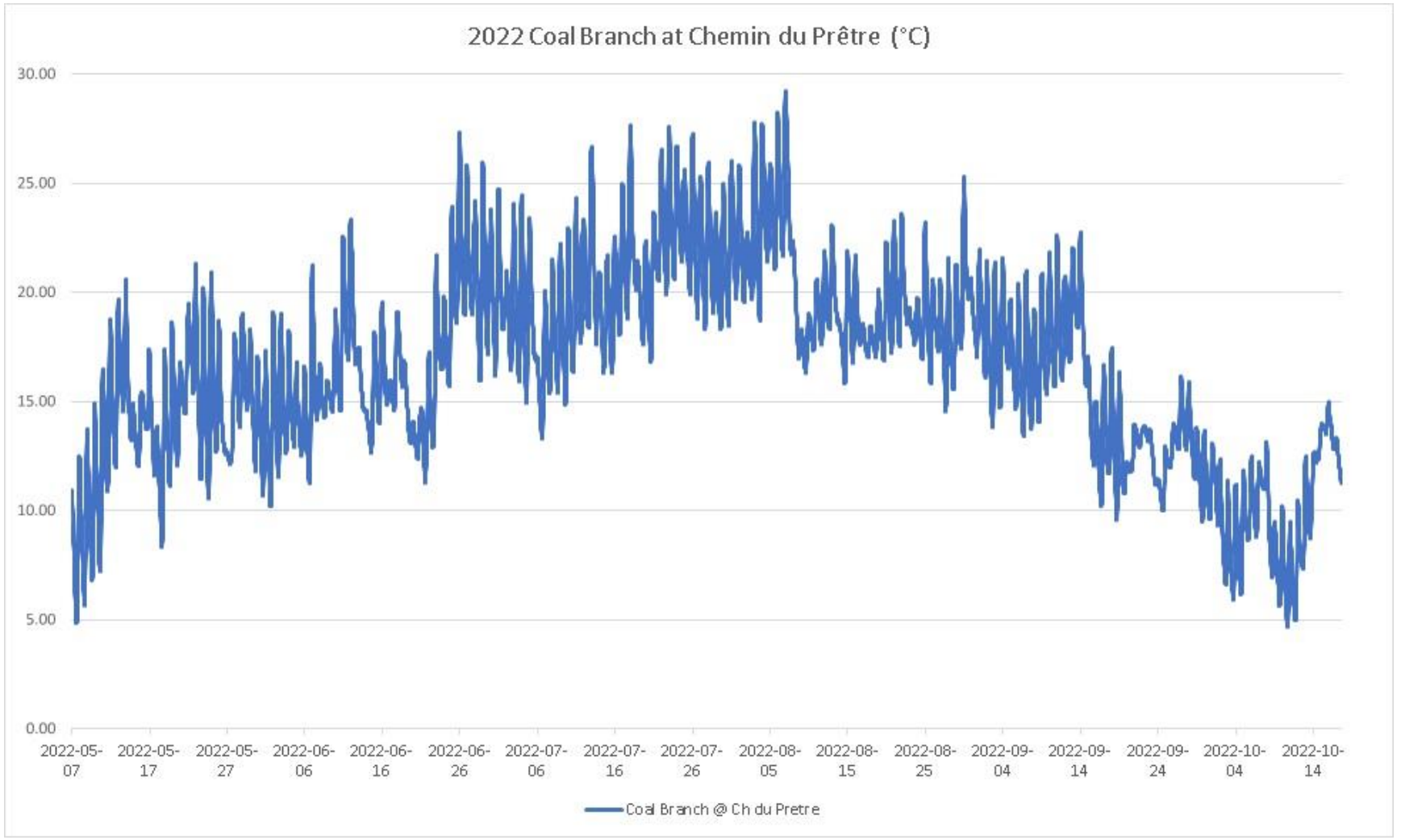
Species	Age	Fork length (mm)	
		Coal Branch	Blind Brook
Atlantic salmon (*Salmo salar*)	0+	51	52
		52	55
		53	57
		54	98
		57	
		59	
		59	
		59	
		59	
		59	
		60	
		60	
		60	
		61	
		61	
		61	
		61	
		62	
		62	
		63	
		63	
		64	
		64	
		64	
		65	
		65	
		65	
		65	
		65	
		65	
		66	
		67	
		67	
		67	
		67	
		67	
		71	
	1+	97	120
		102	
		106	

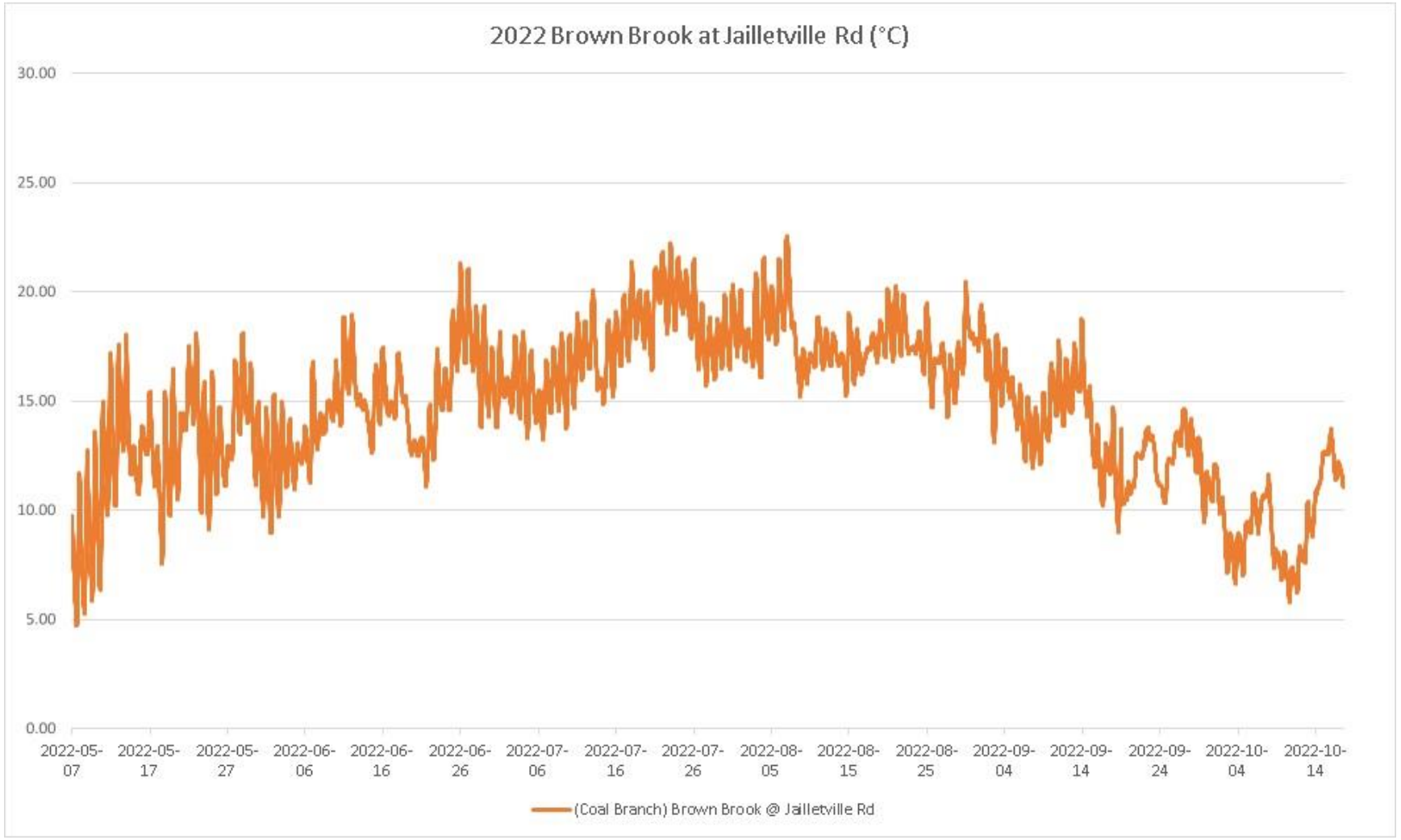
		110 110 111 116 116 120 120	
	2+	138	N/A
	Total individuals	***48***	***5***
Brook trout (*Salvelinus fontinalis*)	0+	N/A	58
	1+	N/A	58 89 110 143 145
	Total individuals	***0***	***5***

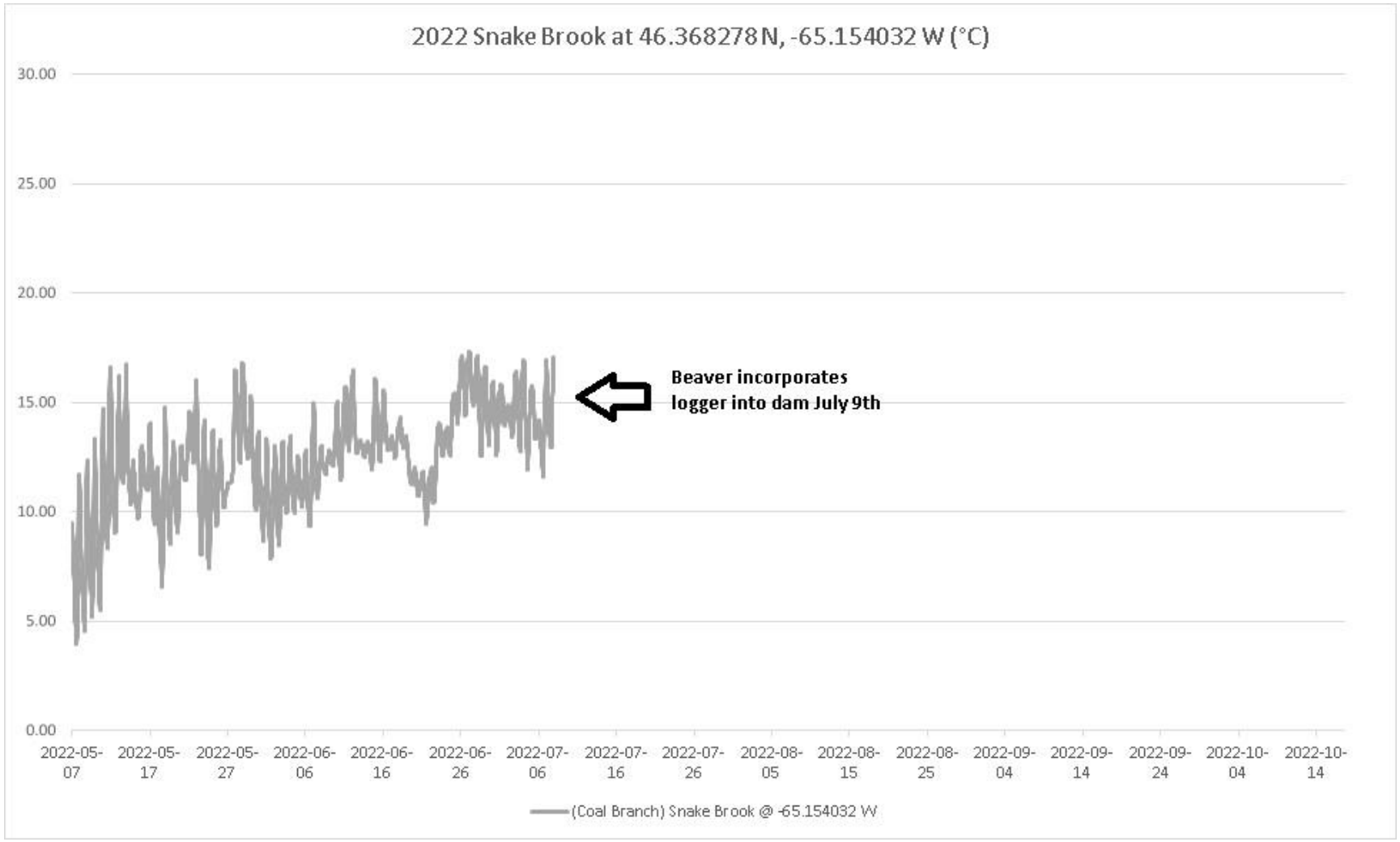
Figure S1. Coal Branch River sampling site on September 20, 2022.

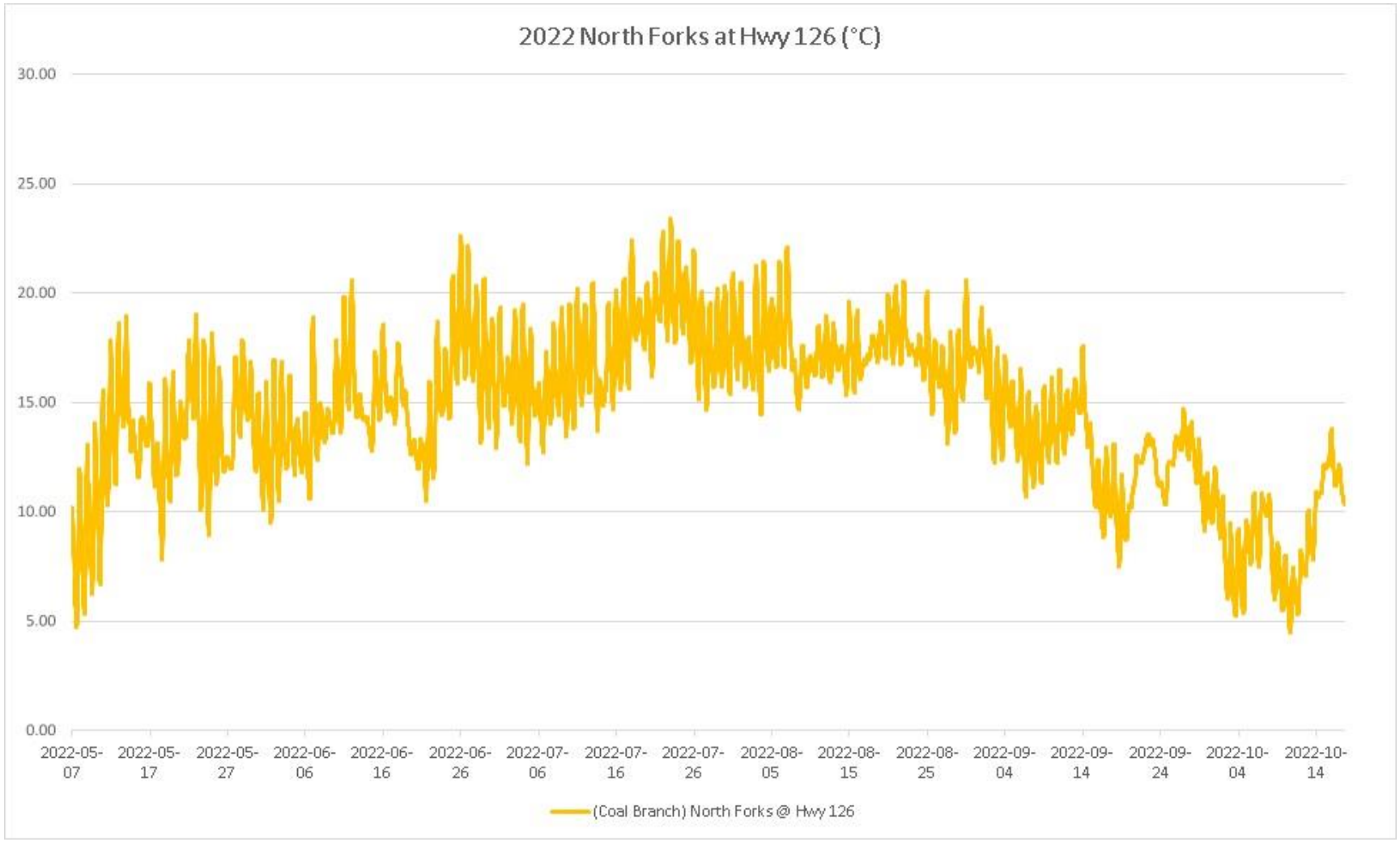
Figure S2. Blind Brook sampling site on September 27, 2022.

Appendix B: Temperature Profiles from Four Watershed Sites


2022 Coal Branch at Chemin du Prêtre (°C)
30.00
25.00
20.00
15.00
10.00
5.00
0.00
2022-05-07
2022-05-17
2022-05-27
2022-06-06
2022-06-16
2022-06-26
2022-07-06
2022-07-16
2022-07-26
2022-08-05
2022-08-15
2022-08-25
2022-09-04
2022-09-14
2022-09-24
2022-10-04
2022-10-14
Coal Branch @ Ch du Pretre


2022 Brown Brook at Jailletville Rd (°C)
30.00
25.00
20.00
15.00
10.00
5.00
0.00
2022-05-07
2022-05-17
2022-05-27
2022-06-06
2022-06-16
2022-06-26
2022-07-06
2022-07-16
2022-07-26
2022-08-05
2022-08-15
2022-08-25
2022-09-04
2022-09-14
2022-09-24
2022-10-04
2022-10-14
(Coal Branch) Brown Brook @ Jailletville Rd


2022 Snake Brook at 46.368278 N, -65.154032 W (°C)
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Beaver incorporates logger into dam July 9th
2022-05-07
2022-05-17
2022-05-27
2022-06-06
2022-06-16
2022-06-26
2022-07-06
2022-07-16
2022-07-26
2022-08-05
2022-08-15
2022-08-25
2022-09-04
2022-09-14
2022-09-24
2022-10-04
2022-10-14
(Coal Branch) Snake Brook @ -65.154032 W


2022 North Forks at Hwy 126 (°C)
30.00
25.00
20.00
15.00
10.00
5.00
0.00
2022-05-07
2022-05-17
2022-05-27
2022-06-06
2022-06-16
2022-06-26
2022-07-06
2022-07-16
2022-07-26
2022-08-05
2022-08-15
2022-08-25
2022-09-04
2022-09-14
2022-09-24
2022-10-04
2022-10-14
(Coal Branch) North Forks @ Hwy 126

Appendix C: Fish Habitat Assessment Field Sheets – Coal Branch

04-98 50

Bridge @ Hwy 465 N46.416358 W-65.075241

DNR&E / DFO - NEW BRUNSWICK
STREAM HABITAT INVENTORY

River: Coal Branch
No. 2
Personnel: Harry/Neil
No.

Start Point: N46.416358 End Point: 46.412948 -65.080943

Date: July 19/22

GIS Map No.

Drainage Code: □□ □□ □□ □□ □□

Drainage Name: Richibucto River tributary

REACH NO.	UNIT NO.	STREAM TYPE	CHANNEL TYPE	LENGTH (m)	AVG WIDTH (m) WET	AVG WIDTH (m) BANK CHANNEL	SUBSTRATE (%) BED-ROCK	BOULDER	ROCK	RUBBLE	GRAVEL	SAND	FINES	AVG DEPTH WET WIDTH (cm)	0-50% UNDERCUT BANK L	0-50% UNDERCUT BANK R	0-50% OVERHANGING VEGETATION L	0-50% OVERHANGING VEGETATION R	LARGE WOODY DEBRIS IN STREAM (m)	FLOWS* TYPE	FLOW (cms)	TIME Sec	TEMP (C) W	TEMP (C) A	EMBEDDEDNESS (CRITERIA)	COMMENTS Flow Rate m/Sec
1		B	1	80	11.5	17.2	-	-	10	70	15	5	-		0	15	0	5	-	1	10m	12.96	20.4	23		0.67 m/s
2		B	1	75	15	19.1	-	2	30	48	15	5	-		0	5	2	1	5	1	10 m	50.6	20.6	23	1	0.25 m/s
3		3	1	74	11	18	-	2	30	48	15	5	-		5	15	0	15	-	1			20.8	24		0.98 m/s
4		8	1	200	8.8	15.8	-	1	30	50	15	4	-		-	-	2	-	3	1	10 m	18 Sec	20.8	24		0.55 m/s
5		3	1	105	8.3	16.9	-	2	30	50	15	3	-		10	-	1	-	2	1	10 m	11.2 Sec	20.8	24		0.89 m/s
6		8	1	121	9	19.5	-	1	30	40	15	14	-		5	5	1	1	2	1	10	19.2	20.9	24		0.53 m/s
7		3	1	43	7.6	20.6	-	2	30	40	20	8	-		45	-	10	-	-	1	10 m	16.5	21.1	24		0.61 m/s
8		8	1	290	17.4	20.3	-	10	40	30	15	5	-		-	-	-	2	-	1	10	19.2	21.1	24		0.52 m/s
9		9	1	23	12.3	19	-	10	50	20	15	5	-		-	-	-	2	-	1	10	11.0	21.2	24		0.91 m/s

COMMENTS: Flow Rate m/Sec

CHECKLIST OF LAND USE ATTRIBUTES (COMMENTS)

1. ACTIVE BEAVER DAM
2. INACTIVE BEAVER DAM
3. WOODY DEBRIS (OBSTRUCTION)
4. MAN-MADE DAM OBSTRUCTION
5. ROCK DAM (SWIMMING POOL)
6. BRAIDED STREAM CHANNELS
7. OBSTRUCTION IN STREAM
8. ROAD FORD

POLLUTION CAUSED BY:

9. FOOD PROCESSING INDUSTRY
10. FORESTY INDUSTRY
11. CAMPSITES OR RESIDENTIAL
12. MINING
13. LITTER
14. OIL
15. AGRICULTURE WASTE
16. HEALTH HAZARD

17. CLEAR CUT TO STREAM EDGE
18. SELECTIVE CUT
19. BUFFER STRIP PRESENT

20. CATTLE CROSSING
21. EROSION FROM AGRICULTURE
22. SUSPENDED SILT NOTED
23. UNUSUAL STREAM SCOURING
24. LARGE BEDLOAD DEPOSIT
25. BANK EROSION - MODERATE
26. BANK EROSION - EXCESSIVE
27. STREAM DREDGING/BULLDOZING
28. GRAVEL REMOVAL
29. CHANNELIZATION (RIPRAP, ETC)
30. STREAM DIVERSION

31. WATER WITHDRAWAL
32. REGULATED STREAM FLOW
33. CAMP/COTTAGE PRESENT
34. RESIDENTIAL AREA
35. ACCESS - ATV'S
36. ACCESS - TRAILS
37. ACCESS - TRUCK/CAR
38. ACCESS - BOAT

39. ROAD CROSSING (BRIDGE)
40. ROAD CROSSING (CULVERT)
41. BOAT LANDING

42. ORGANIC LITTER
43. AQUATIC PLANTS ABUNDANT

44. GOOD SPAWNING
45. GOOD NURSERY
46. ATLANTIC SALMON OBSERVED
47. BROOK TROUT OBSERVED

STREAM TYPE

FASTWATER
1. Fall
2. Cascade
3. Riffle (GR/RB)
4. Riffle (B/B)
5. Riffle (Sand)
6. Sheet (ledge)
7. Chute
8. Run
9. Rapid

POOLS
10. Midchannel
11. Convergence
12. Lateral
13. Beaver
14. Trench
15. Plunge
16.
17. Bogan
18. Eddy
19. Gabion
20. Log Structure
21. Road Crossing
22. Wood Debris
23. Man-Made Dam
24. Natural Deadwater

CHANNEL TYPE

1. Main (if measurement refers to main area of river)
* 2. Side Channel (water diverted by islands)
* 3. Split (if river is split into various different stream types)
* 4. Bogan

*Specify Left (L), Right (R) or Middle (M)

SUBSTRATE

1. Bedrock, Ledge		
2. Boulder	=	> 601 mm
3. Rock	=	180 - 600 mm
4. Rubble	=	64 - 179 mm
5. Gravel	=	2.5 - 63 mm
6. Sand	=	0.06 - 2.5 mm
7. Fines	=	0.0005 - 0.05 mm

FLOW TYPE

1. Survey stream
2. Spring
3. Brook/River Tributary
4. Spring Seep

POOL RATING (reverse side)

CRITERIA NO.	% OF POOLS IN SITE (LETTER)
POOL DEPTH ≥ 1.5m	a - ≥ 30%
1 - Instream Cover ≥ 30%	b - ≥ 10 to 30%
2 - Instream Cover < 30%	c - < 10%
POOL DEPTH .5 - 1.5m	a - ≥ 30%
3 - Instream cover 5-30%	b - ≤ 30%
4 - Instream Cover > 30%	

REACH NO.	SITE (50m - interval)	% SITE		SHADE (%)	STREAM BANKS											O2 (mg/l)	pH	DEPTH						POOL RATING (CRITERIA ON OTHER SIDE)		POOL TAIL			% TURBULENCE
					VEGETATION (%)				EROSION (%)									¼ (m)		½ (m)		¾ (m)						
		RIFFLE/ RUN	POOLS		BARE GROUND	GRASSES	SHRUBS	TREES	LEFT BANK (0 - 50%)			RIGHT BANK (0 - 50%)						Wet	CHANNEL	Wet	CHANNEL	Wet	CHANNEL	NO.	LETTER	EMBEDDEDNESS (CRITERIA) 1: ≤ 20% 2: 20% - 35% 3: 35% - 50% 4: ≥ 50%	MEAN SUBSTRATE SIZE (cm)	% FINE	
									STABLE	BARE STABLE	ERODING	STABLE	BARE STABLE	ERODING															
1		1	-	0	1	75	15	9	40	10	-	25	5	20	7.2	1.65		17	50	35	50	33	50						
2			1	0	1	70	15	14	45	5	0	35	10	5	7.0	1.58		35	75	70	110	64	100			1			
3		1	-	15	1	75	15	10	"	-	50	25	10	15	7.64	1.91		25	50	15	30	38	65						
4		1	-	2	1	80	15	14	48	1	1	48	1	1	8.34	1.69		30	80	31	80	46	90						
5		1		2	2	65	20	13	45	-	5	48	2	-	8.18	1.69		45	100	47	100	23	65						
6		1	-	1	2	65	20	13	45	5	-	43	2	5	8.30	1.56		23	125	27	130	50	148						
7		1		1	2	80	5	18	30	-	70	45	5	-	8.63	1.40		28	76	30	75	30	75						
8		1		1	2	85	10	5	45	5	-	40	10	-	7.5	1.73		25	80	23	73	41	90						
9		1		1	5	95	-	30	-	50	-	50	-	-	7.5	1.73		17	65	43	88	63	105						

REACH NO.	UNIT NO.	STREAM TYPE	WET WIDTH (m)	DEPTH (cm)			AVERAGE DEPTH SUM/N		COEFFICIENT (0.5 - SMOOTH) (0.8 - ROUGH)	LENGTH (m)	FLOAT TIME (sec)				COMMENTS (LOCATION)
				⅛ WAY	½ WAY	⅞ WAY	CENTIMETERS (cm)	METERS (m)			⅛ WAY	½ WAY	⅞ WAY	AVERAGE	
															Start above pool Created by Bridge @ Km 4.5
															Reach 2 - Side Bogan - Pool 0.8m x 20m
															Reach 3 Bogan river right

FORMULA (CMS) = W (m) x D (m) x A x L (m) / T (sec) Where: W = width, D = depth, L = length, A is coefficient for the stream bottom

Appendix D: pH Sample Results from the Coal Branch River and Tributary Streams

Date	Site	River Water pH **(Units)**	Water Temperature **(°C)**
April 26 2022	South Forks Coal Branch River	7.03	5.6
	North Forks Coal Branch River	7.02	6.2
	RW RL Unnamed 1	7.04	4.9
	RL Snake Brook	6.83	5.6
	RL Unnamed 2	7.26	6.2
	RR Unnamed 3 (Small)	6.44	4.6
	RR Unnamed 4	6.64	6.5
	RL Unnamed 5	6.86	7.2
	RR Brown Brook	6.97	6.7
	RL Unnamed 6	6.36	4.8
	RL Unnamed 7	7.02	6.9
	RL Unnamed 8	7.30	6.8
	RR Unnamed 9	7.29	6.6
	RL Donald Brook	7.40	7.0
	RR Blind Brook	7.32	7.1
	Main Coal Branch	7.23	7.3
	RR Big Brook	7.17	7.0
	RR James Carruthers Brook	7.26	7.2
	RL Unnamed 10 (Ski Hill)	7.39	6.9
	RR Unnamed 11	7.22	7.5
	RL Unnamed 12 (Rocky Delta)	7.22	7.0
	RR Farrer Brook	7.35	6.8
	RL McWilliam Brook	7.29	7.7
May 7 2022	North Forks Coal Branch River #2	6.41	10.2
	Tailings Pond Discharge	6.25	11.6
	Blind Brook #2	6.82	9.7
	Big Brook #2	7.01	9.2
June 21 2022	Snake Brook	7.49	11.9
	Coal Branch (main branch)	7.61	12.7
	RL Unnamed Brook	7.49	13.1
	Brown Brook	7.4	13.6
	RL Unnamed brook	7.58	11.2

Appendix E: Water Chemistry Results 2022

Report/Rapport: 442172-MB
Date: 27-May-22
Date Received/Reçu: 26-May-22

CERTIFICATE OF ANALYSIS / CERTIFICAT D'ANALYSE

for/pour
Miramichi River Environmental
Assessment Committee
21 Cove Road
Miramichi, NB E1V 0A6

rpc
115A Harrisville Blvd
Moncton NB
Canada E1H 3T3
Tel: 506.855.6472
Fax: 506.855.8294
www.rpc.ca

Attention: Harry Collins

Location: Coal Branch River

Examination of Water/Examen de l'eau

RPC Sample ID/No. d'échantillon de RPC:				442172-1
Client Sample ID/ID d'échantillon du client:				Coal Branch @ Hwy 465 - ASCF
Date collected/Date du prélèvement:				25-May-22
Time sampled/Heure du prélèvement:				2:30:00 PM
Analytes/Paramètre(s)	**Method Méthode**	**Date Analyzed Date Analysé**	**Units Unités**	
E. coli	MB01	26-May-22	MPN/100mL	52

This report relates only to the sample(s) and information provided to the laboratory.

Le présent rapport ne s'applique qu'aux échantillons et à l'information transmis au laboratoire.

LEGEND:

RL/SD = Reporting Limit/Seuil de déclaration cfu/ufc = Colony Forming Units/Unités formant des colonies

MPN/NPP = Most Probable Number/Nombre Plus Probable A = Absence P = Presence/Présence

Nadine Godin
Microbiology Supervisor
Moncton Laboratory/Laboratoire de Moncton

Matthew Poole
Lab Technician
Moncton Laboratory/Laboratoire de Moncton

Report ID: 442172-IAS
Report Date: 02-Jun-22
Date Received: 26-May-22

CERTIFICATE OF ANALYSIS

for

Miramichi River Environmental
Assessment Committee
21 Cove Road
Miramichi, NB E1V 0A6

rpc
921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Harry Collins
Project #: Not Available
Location: Coal Branch River

Analysis of Surface Water

RPC Sample ID:			442172-1
Client Sample ID:			Coal Branch @ Hwy 465 - ASCF
Date Sampled:			25-May-22
Analytes	**Units**	**RL**	
Sodium	mg/L	0.05	6.05
Potassium	mg/L	0.02	0.51
Calcium	mg/L	0.05	11.0
Magnesium	mg/L	0.01	1.82
Alkalinity (as $CaCO_3$)	mg/L	2	39
Chloride	mg/L	0.5	4.2
Fluoride	mg/L	0.05	0.30
Sulfate	mg/L	1	5
Bromine	mg/L	0.01	0.01
Ammonia (as N)	mg/L	0.05	0.10
Un-ionized @ 20ºC	mg/L	-	0.002
Nitrate + Nitrite (as N)	mg/L	0.05	< 0.05
Nitrite (as N)	mg/L	0.05	< 0.05
Nitrate (as N)	mg/L	0.05	< 0.05
Nitrogen - Total	mg/L	0.2	0.3
Phosphorus - Total	mg/L	0.002	0.016
Carbon - Total Organic	mg/L	0.5	8.3
Colour	TCU	5	92
Conductivity	µS/cm	1	95
pH	units	-	7.8
Turbidity	NTU	0.1	1.4
Calculated Parameters			
Bicarbonate (as $CaCO_3$)	mg/L	-	38.7
Carbonate (as $CaCO_3$)	mg/L	-	0.230
Hardness (as $CaCO_3$)	mg/L	0.2	35.0
TDS (calc)	mg/L	-	62
Saturation pH (20°C)	units	-	8.7
Langelier Index (20°C)	-	-	-0.89

This report relates only to the sample(s) and information provided to the laboratory.
RL = Reporting Limit

Peter Crowhurst, B.Sc., C.Chem.
Director
Inorganic Analytical Chemistry

Brannen Burhoe
Supervisor
Inorganic Analytical Services

Report ID: 442172-IAS
Report Date: 02-Jun-22
Date Received: 26-May-22

CERTIFICATE OF ANALYSIS

for

Miramichi River Environmental
Assessment Committee
21 Cove Road
Miramichi, NB E1V 0A6

rpc
921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Harry Collins
Project #: Not Available
Location: Coal Branch River

Analysis of Surface Water

RPC Sample ID:			442172-1
Client Sample ID:			Coal Branch @ Hwy 465 - ASCF
Date Sampled:			25-May-22
Analytes	**Units**	**RL**	
Aluminum	mg/L	0.001	0.118
Antimony	mg/L	0.0001	< 0.0001
Arsenic	mg/L	0.001	< 0.001
Barium	mg/L	0.001	0.036
Beryllium	mg/L	0.0001	< 0.0001
Bismuth	mg/L	0.001	< 0.001
Boron	mg/L	0.001	0.005
Cadmium	mg/L	0.00001	< 0.00001
Calcium	mg/L	0.05	11.0
Chromium	mg/L	0.001	< 0.001
Cobalt	mg/L	0.0001	0.0001
Copper	mg/L	0.001	< 0.001
Iron	mg/L	0.02	0.44
Lead	mg/L	0.0001	0.0002
Lithium	mg/L	0.0001	0.0021
Magnesium	mg/L	0.01	1.82
Manganese	mg/L	0.001	0.031
Molybdenum	mg/L	0.0001	< 0.0001
Nickel	mg/L	0.001	< 0.001
Potassium	mg/L	0.02	0.51
Rubidium	mg/L	0.0001	0.0009
Selenium	mg/L	0.001	< 0.001
Silver	mg/L	0.0001	< 0.0001
Sodium	mg/L	0.05	6.05
Strontium	mg/L	0.001	0.071
Tellurium	mg/L	0.0001	< 0.0001
Thallium	mg/L	0.0001	< 0.0001
Tin	mg/L	0.0001	< 0.0001
Uranium	mg/L	0.0001	< 0.0001
Vanadium	mg/L	0.001	< 0.001
Zinc	mg/L	0.001	< 0.001

Report ID: 442172-IAS
Report Date: 02-Jun-22
Date Received: 26-May-22

CERTIFICATE OF ANALYSIS
for
Miramichi River Environmental
Assessment Committee
21 Cove Road
Miramichi, NB E1V 0A6

rpc
921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Methods

Analyte	RPC SOP #	Method Reference	Method Principle
Ammonia	IAS-M47	APHA 4500-NH_3 G	Phenate Colourimetry
pH	IAS-M03	APHA 4500-H^+ B	pH Electrode - Electrometric
Alkalinity (as $CaCO_3$)	IAS-M43	EPA 310.2	Methyl Orange Colourimetry
Chloride	IAS-M44	APHA 4500-CL E	Ferricyanide Colourimetry
Fluoride	IAS-M30	APHA 4500-F- D	SPADNS Colourimetry
Sulfate	IAS-M45	APHA 4500-SO_4 E	Turbidimetry
Nitrate + Nitrite (as N)	IAS-M48	APHA 4500-NO_3 H	Hydrazine Red., Derivitization, Colourimetry
Nitrite (as N)	IAS-M49	APHA 4500-NO2- B	Ferrous Ammonium Sulfate Colourimetry
Nitrogen - Total	IAS-M57	ASTM D8083-16	Combustion/Chemiluminescence
Phosphorus - Total	IAS-M17	APHA 4500-P E	Digestion, Manual Colourimetry
Carbon - Total Organic	IAS-M57	APHA 5310 B	Combustion/NDIR
Turbidity	IAS-M06	APHA 2130 B	Nephelometry
Colour	IAS-M55	APHA 2120 Color (A,C)	Single Wavelength Spectrophotometry
Conductivity	IAS-M04	APHA 2510 B	Conductivity Meter - Electrode
Trace Metals	IAS-M01/IAS-M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES

Report ID: 457375-IAS
Report Date: 23-Sep-22
Date Received: 14-Sep-22

CERTIFICATE OF ANALYSIS

for
Miramichi River Environmental
Assessment Committee
21 Cove Road
Miramichi, NB E1V 0A6

rpc
921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Harry Collins
Project #: Not Available
Location: Coal Branch River

Analysis of Surface Water

RPC Sample ID:			457375-1
Client Sample ID:			Coal Branch @ Hwy 465
Date Sampled:			13-Sep-22
Analytes	**Units**	**RL**	
Sodium	mg/L	0.05	8.52
Potassium	mg/L	0.02	0.52
Calcium	mg/L	0.05	16.2
Magnesium	mg/L	0.01	2.16
Alkalinity (as $CaCO_3$)	mg/L	2	55
Chloride	mg/L	0.5	3.8
Fluoride	mg/L	0.05	0.25
Sulfate	mg/L	1	12
Bromine	mg/L	0.01	0.01
Ammonia (as N)	mg/L	0.05	< 0.05
Un-ionized @ 20°C	mg/L	-	< 0.001
Nitrate + Nitrite (as N)	mg/L	0.05	< 0.05
Nitrite (as N)	mg/L	0.05	< 0.05
Nitrate (as N)	mg/L	0.05	< 0.05
Nitrogen - Total	mg/L	0.2	0.3
Phosphorus - Total	mg/L	0.002	0.010
Carbon - Total Organic	mg/L	0.5	8.1
Colour	TCU	5	69
Conductivity	µS/cm	1	130
pH	units	-	7.8
Turbidity	NTU	0.1	1.0
Calculated Parameters			
Bicarbonate (as $CaCO_3$)	mg/L	-	54.6
Carbonate (as $CaCO_3$)	mg/L	-	0.324
Hardness (as $CaCO_3$)	mg/L	0.2	49.3
TDS (calc)	mg/L	-	77
Saturation pH (20°C)	units	-	8.4
Langelier Index (20°C)	-	-	-0.59

This report relates only to the sample(s) and information provided to the laboratory.
RL = Reporting Limit

Peter Crowhurst, B.Sc., C.Chem.
Director
Inorganic Analytical Chemistry

Matthew Norman
Senior Chemist
Inorganic Analytical Chemistry

Report ID: 457375-IAS
Report Date: 23-Sep-22
Date Received: 14-Sep-22

CERTIFICATE OF ANALYSIS

for
Miramichi River Environmental
Assessment Committee
21 Cove Road
Miramichi, NB E1V 0A6

rpc
921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Harry Collins
Project #: Not Available
Location: Coal Branch River

Analysis of Surface Water

RPC Sample ID:			457375-1
Client Sample ID:			Coal Branch @ Hwy 465
Date Sampled:			13-Sep-22
Analytes	**Units**	**RL**	
Aluminum	mg/L	0.001	0.054
Antimony	mg/L	0.0001	< 0.0001
Arsenic	mg/L	0.001	< 0.001
Barium	mg/L	0.001	0.047
Beryllium	mg/L	0.0001	< 0.0001
Bismuth	mg/L	0.001	< 0.001
Boron	mg/L	0.001	0.008
Cadmium	mg/L	0.00001	< 0.00001
Calcium	mg/L	0.05	16.2
Chromium	mg/L	0.001	< 0.001
Cobalt	mg/L	0.0001	< 0.0001
Copper	mg/L	0.001	< 0.001
Iron	mg/L	0.02	0.32
Lead	mg/L	0.0001	0.0001
Lithium	mg/L	0.0001	0.0027
Magnesium	mg/L	0.01	2.16
Manganese	mg/L	0.001	0.046
Molybdenum	mg/L	0.0001	0.0001
Nickel	mg/L	0.001	< 0.001
Potassium	mg/L	0.02	0.52
Rubidium	mg/L	0.0001	0.0010
Selenium	mg/L	0.001	< 0.001
Silver	mg/L	0.0001	< 0.0001
Sodium	mg/L	0.05	8.52
Strontium	mg/L	0.001	0.106
Tellurium	mg/L	0.0001	< 0.0001
Thallium	mg/L	0.0001	< 0.0001
Tin	mg/L	0.0001	< 0.0001
Uranium	mg/L	0.0001	< 0.0001
Vanadium	mg/L	0.001	< 0.001
Zinc	mg/L	0.001	0.005

Report ID: 457375-IAS
Report Date: 23-Sep-22
Date Received: 14-Sep-22

CERTIFICATE OF ANALYSIS
for
Miramichi River Environmental
Assessment Committee
21 Cove Road
Miramichi, NB E1V 0A6

rpc
921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Methods

Analyte	RPC SOP #	Method Reference	Method Principle
Ammonia	IAS-M47	APHA 4500-NH_3 G	Phenate Colourimetry
pH	IAS-M03	APHA 4500-H^+ B	pH Electrode - Electrometric
Alkalinity (as $CaCO_3$)	IAS-M43	EPA 310.2	Methyl Orange Colourimetry
Chloride	IAS-M44	APHA 4500-CL E	Ferricyanide Colourimetry
Fluoride	IAS-M30	APHA 4500-F- D	SPADNS Colourimetry
Sulfate	IAS-M45	APHA 4500-SO_4 E	Turbidimetry
Nitrate + Nitrite (as N)	IAS-M48	APHA 4500-NO_3 H	Hydrazine Red., Derivitization, Colourimetry
Nitrite (as N)	IAS-M49	APHA 4500-NO2- B	Ferrous Ammonium Sulfate Colourimetry
Nitrogen - Total	IAS-M57	ASTM D8083-16	Combustion/Chemiluminescence
Phosphorus - Total	IAS-M17	APHA 4500-P E	Digestion, Manual Colourimetry
Carbon - Total Organic	IAS-M57	APHA 5310 B	Combustion/NDIR
Turbidity	IAS-M06	APHA 2130 B	Nephelometry
Colour	IAS-M55	APHA 2120 Color (A,C)	Single Wavelength Spectrophotometry
Conductivity	IAS-M04	APHA 2510 B	Conductivity Meter - Electrode
Trace Metals	IAS-M01/IAS-M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES