BELLEISLE WATERSHED COALITION

Restoring Access and Assessing Barriers to Fish Passage in the Belleisle Watershed

This report is submitted in fulfilment of the 2023 Foundation for Conservation of Atlantic Salmon project # NB-2023-02 entitled, "*Restoring Access and Assessing Barriers to Fish Passage in the Belleisle Watershed*"

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Executive Summary

Fish require passage between and within watercourses to complete necessary stages of their life cycle. These passages are used by fish to move upstream to spawn, find food and shelter, and to aid the environment by allowing fish to recycle the nutrients taken in throughout the watercourse. By assessing crossings, the Belleisle Watershed Coalition (BWC) helped to identify barriers that block the natural movement of fish.

The Belleisle Watershed Covers an approximate 37,000 ha (370 km^2) of land, running from Pearsonville to Lower Kars on the northern side of the Belleisle Bay, and from Mercer Settlement to Kingston Corner on the southern side. This project focused on the lower portion of the watershed. Over the course of the summer of 2023, field staff assessed a total of 46 watercourse crossings, exceeding the initial goal of 30 crossings. Watercourses within the lower Belleisle watershed that were assessed during this project include Urquhart's Brook, First Run Brook, McCutcheon's Brook, Second Run Brook, Reddin Brook, Roger's Brook, Durian Brook, Tennant's Cove Brook, West Tennant's Cove Brook, and several unnamed watercourses.

Road-watercourse crossings were mapped and at each road-watercourse crossing, an Atlantic Canada Culvert Assessment Toolkit (ACCAT) data sheet was completed. Elevation measurements were taken within the watercourse using an automatic optical level at foresight (FS). While one member of staff looked through the level, another member stood at various points within the water course with a 3 metre leveling rod. Inflow, outflow, tailwater control, left and right bankfull at tailwater, and second riffle were all measured using this method. Finally, the height, width, and length of the structure was measured using a 30-metre tape.

Results indicate that only 7 of the 46 structures (15.22%) assessed were found to be completely passable by fish. Of the remaining 39 structures, 23 structures (50%) require remediation of a full barrier, and 15 (32.61%) require remediation of a partial barrier. Elevation measurements could not be taken at one structure, so accessibility information is not available for 1 out of 46 of the structures (2.17%). A total of 286.72 kilometers (km) of upstream habitat gain was found to be accessible to fish if all barriers were remediated. First Run Brook contains the most significant upstream habitat gain at 144.01 km (50.22%). Much of this gain comes from the various tributaries that feed into First Run Brook. Fish were observed at 14 of the 46 sites (30.43%).

Structures with a barrier that contains a significant outflow drop or culvert slope should be remediated as soon as possible, especially regarding upstream habitat gain. It is suggested that partial barriers be remediated with the installation of rock weir, baffles, and/or an outflow. Full barriers are suggested to be remediated with the same method as partial barriers. Installation of a fish ladder may be used either in conjunction or in lieu of these methods should they be insufficient.

Lastly, as part of this project the BWC worked to remove barriers and restore access through eight culverts in the upper watershed that had been assessed as barriers during our 2022 fish passage survey. Results of this part of the project saw approximately 0.50 tons of mostly woody debris cleared from the inlet or outlet for culverts along with any anthropogenic rubbish. In total the removal of the debris opened 50 km of watercourse with valuable salmonid habitat on six watercourses where fish passage was restricted in the upper watershed.

Introduction

Overview of the Belleisle Watershed Coalition

The Belleisle Watershed Coalition (BWC) is a non-profit multi-stakeholder environmental organization that was established in 2013 to support scientific research, aquatic restoration, and environmental education within the Belleisle watershed. Our projects focus on water quality, environmental monitoring, fish and aquatic habitats, riparian assessment, enhancement, and management, and community outreach. The BWC's strategic mandate is to engage the multi-sectoral communities of Belleisle in the collaborative management and restoration of our watershed.

Overview of Restoring Access and Assessing Barriers to Fish Passage in the Belleisle Watershed Project

Habitat alteration is a significant factor in the decline of aquatic species and is detrimental to their recovery. As anthropogenic expansion increases, instances of river crossings and alterations also increase. These changes in land use and road development are often the cause of aquatic habitat fragmentation. Often, the importance of maintaining connectivity of the watercourse and the detrimental impacts to aquatic species are overlooked during these projects. Culverts are the most commonly installed structure for watercourse crossings as they are pre-fabricated, cheap to build, and provide a quick installation as they are simply dropped into place and covered. If culverts are poorly designed, installed improperly, and/or not maintained these structures can create physical barriers to fish passage.

Culverts can impede fish migration via the creation of a vertical barrier at the inflow or outflow of the culvert, the creation of turbulence in baffled culverts, increased velocity in undersized or high slope culverts, and accumulation of debris blocking fish passage in poorly maintained culverts. These barriers in a watercourse can cause fragmentation and negatively affect ecologically significant processes by altering natural channel morphology and creating physical barriers that directly affect aquatic connectivity to both upstream and downstream habitats. The interruption of unrestricted travel to aquatic species, specifically anadromous fish species, can limit their access to suitable habitat required for spawning and rearing, as well as limit their connectivity with neighbouring populations, and ultimately cause declines and inhibit recovery of at-risk fish populations.

The fragmentation of aquatic habitats is considered a significant concern and priority for the Belleisle Watershed Coalition. While some of the barriers to fish passage are known due to their visibility along major travel routes, there has been no concerted effort to date in accurately identifying, assessing, and delineating these barriers. For '*Restoring Access and Assessing Barriers to Fish Passage in the Belleisle Watershed*' the Belleisle Watershed Coalition identified, assessed, and delineated barriers to fish passage in the lower Belleisle watershed. Specifically, the purpose of this project was to identify and assess barriers to fish passage and create a database of these barriers that will be used to prioritize future fish habitat restoration projects.

Additionally, the nature of this project is to begin removing these barriers and restore unrestricted access through the debris blocked culverts in the upper watershed. The re-establishment of fish passage at eight culvert sites on six watercourses will assist in mitigating barriers issues that are responsible for aquatic habitat fragmentation and aide in recovery for salmonids within the watershed. The direct benefits will be evident in the subsequent completion of debris removal and fish passage restoration that will have immediate and long-term benefits by way of mitigating barriers to fish passage in the Belleisle Watershed and providing unrestricted access to an additional 50 km of watercourse.

The specific objectives of this project:

- Identify, assess and delineate the barriers to fish passage in the Belleisle watershed
- Remove blockages assessed as barriers and restore open access to 50 km of fish habitat at eight culvert sites on six watercourses in the upper watershed
- Identify and engage the stakeholder(s) interested in mitigating barriers to fish passage and assisting in recovery of Atlantic Salmon, an aquatic species at risk
- Develop a database of watercourse crossings to prioritize restoration projects that facilitate fish passage through culverts assessed as barriers

The goals of the project:

- Increase stakeholder awareness on the extent to which barriers to fish passage are occurring within the lower Belleisle watershed
- Increase stakeholder awareness on aquatic species at risk, including Atlantic salmon and American eel within the watershed

- Develop mitigation plans and restore fish passage, watercourse connectivity, and enhance aquatic habitats within the Belleisle watershed for aquatic species at risk

Project Methodology

Prioritizing Assessment Area

The Belleisle Watershed covers approximately 370 Km^2 (37,000 ha), and is a freshwater offshoot of the Saint John River, slightly affected by tidal influences from the Bay of Fundy. Given its size, this assessment focused on the lower watershed as this area has a moderate concentration of roads and tributaries in the watershed, and the Upper Watershed was covered in 2022 (Figure 1). The area was further divided into sub-assessment areas based on tributaries that were prioritized based on water quality and the presence of fish populations, most notably salmonids. Specifically, the fish passage assessment was conducted on Urquhart's Brook, First Run Brook, McCutcheon's Brook, Second Run Brook, Reddin Brook, Roger's Brook, Durian Brook, Tennant's Cove Brook, West Tennant's Cove Brook, and various Unknown streams on Route 124, Route 850, Brown's Cove Road, and Belleisle Shore Road; tributaries that flow into the lower portion of Belleisle Bay (Appendix 1).

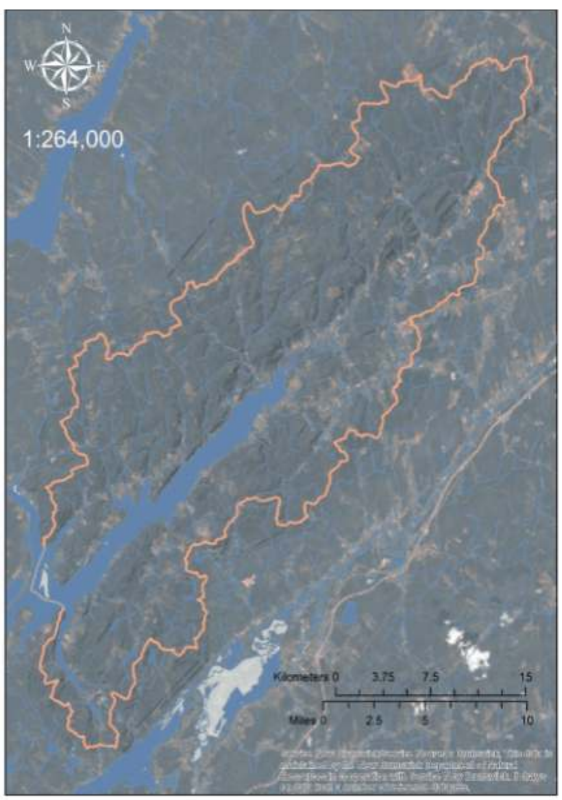

Figure 1: Map of the Belleisle Watershed.

GIS Mapping Watercourse Crossings

Having prioritized the partitioning of the assessment area, the project then focused on identifying and mapping the locations of watercourse crossings (Figure 2). To achieve this, ArcGIS software was used to create a map of the area of study. The locations of potential culvert/crossing sites were identified by overlaying the road and watercourse maps and plotting a symbol at each instance where a road intersected a watercourse (Figure 2). Coordinates were then extracted from the maps and used to locate each site on the ground. Once watercourse crossing identification was completed and coordinates acquired, field assessments were conducted (Figure 2).

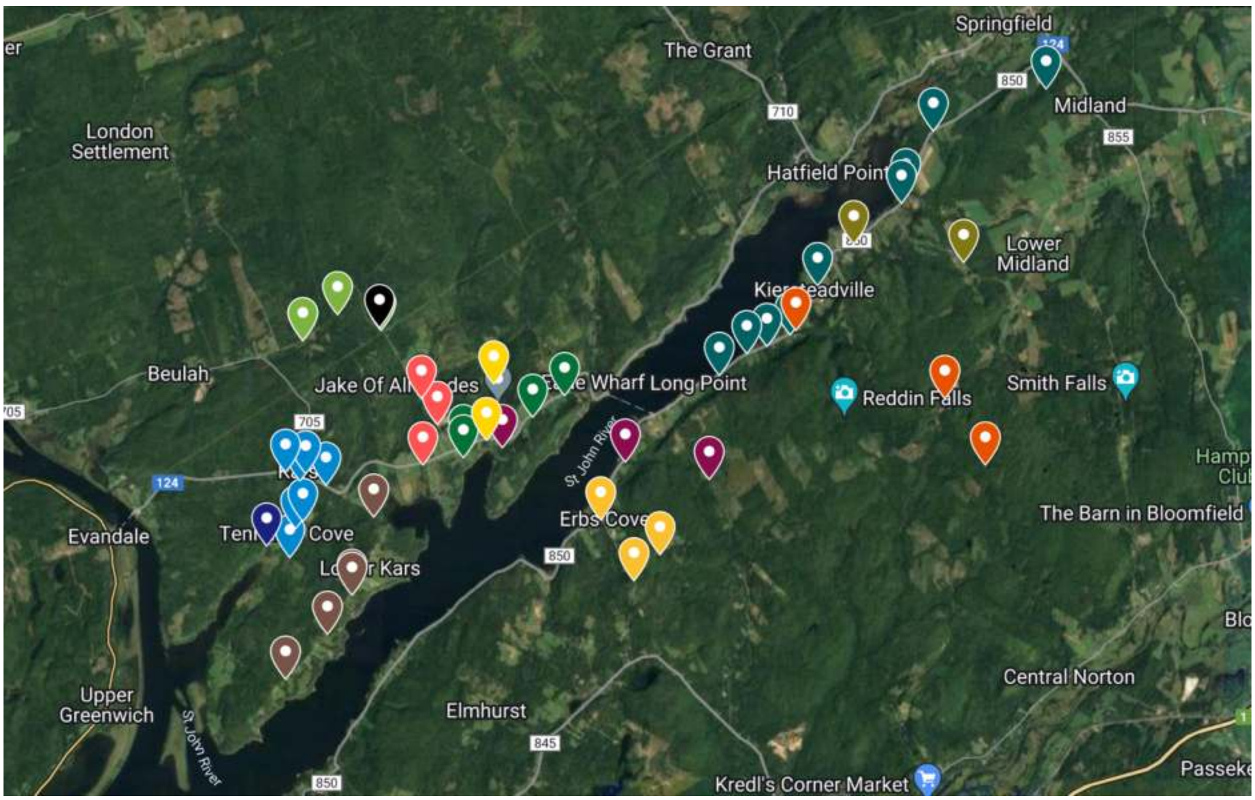

Figure 2: Map of road-watercourse crossings assessed in the lower Belleisle watershed.

Watercourse Crossing Assessments

The protocol for assessing culverts/crossings for fish passage in the Belleisle Watershed was based on the Atlantic Canadian Culvert Assessment Toolkit (ACCAT) rapid assessment method created by the Petitcodiac Watershed Alliance. The ACCAT assessment method allowed for culverts to be rapidly assessed and placed into one of three categories (non-barrier, partial barrier, or full barrier) with the intent to prioritize culverts for restoration activities ensuring aquatic connectivity (Table 1, Appendix 2). The assessment protocol was modified to be more specific to the habitat requirements of Salmonids. An equipment list for field assessment can be found in Appendix 3.

Table 1: Three barrier categories and culvert criteria.

Barrier Type	Criteria
Non-Barrier (Passable)	Both of the following are met: • No Outflow Drop • Culvert Slope < 0.5%
Partial Barrier	One or more of the following are met: • Outflow Drop < 10cm • Culvert Slope between 0.5% - 2.5%
Full Barrier	One or more of the following are met: • Outflow Drop > 10cm • Culvert Slope > 2.5%

Elevation measurements taken in the field were inserted into several equations to determine which of the three categories a culvert should be placed in. All field measurements were taken using a foreshot (FS); this means that the tripod did not move from its location for each measurement taken at the culvert site. Therefore, to determine elevation results, the height of the instrument (HI) remained static. Elevations were taken for culvert inflow and outflow, tailwater control, left and right bankfull width at tailwater, and second riffle (Table 2). The raw data was then used to determine the relative elevation of each location for computing results using the following equation:

$$Elevation = HI - FS$$

Table 2: Example of relative elevation calculated from field data.

Station	HI	FS	Elevation (m)
Inflow	10.00	3.56	6.44
Outflow	10.00	3.98	6.02
Tailwater Control	10.00	4.25	5.75
Left Bankfull at Tailwater	10.00	4.06	5.94
Right Bankfull at Tailwater	10.00	4.10	5.90
Second Riffle	10.00	4.22	5.78

Outflow drop was determined using the results of the relative elevation data. Distance from tailwater control to second riffle, bankfull width at tailwater control, and the height, width, and length of the culvert were also measured. These were used in conjunction with the relative elevation to determine the slope of the culvert and the downstream slope. Slope was calculated using a rise over run formula. For example, the slope in Table 2 would be calculated as follows:

$$CulvertSlope(\%) = \frac{Inflow - Outflow}{CulvertLength} x100$$

$$CulvertSlope(\%) = \frac{6.44m - 6.02m}{28m} x100$$

$$CulvertSlope(\%) = \frac{0.42m}{28m} x100$$

$$CulvertSlope(\%) = 0.015mx100$$

$$CulvertSlope(\%) = 1.50\%$$

The outflow drop in Table 2 would be calculated as follows:

$$OutflowDrop = Outflow - TailwaterControl$$

$$OutflowDrop = 6.02m - 5.75m$$

$$OutflowDrop = 0.27m$$

Using the slope and outflow drop results, the barrier category was determined by following a flowchart seen in Figure 3.

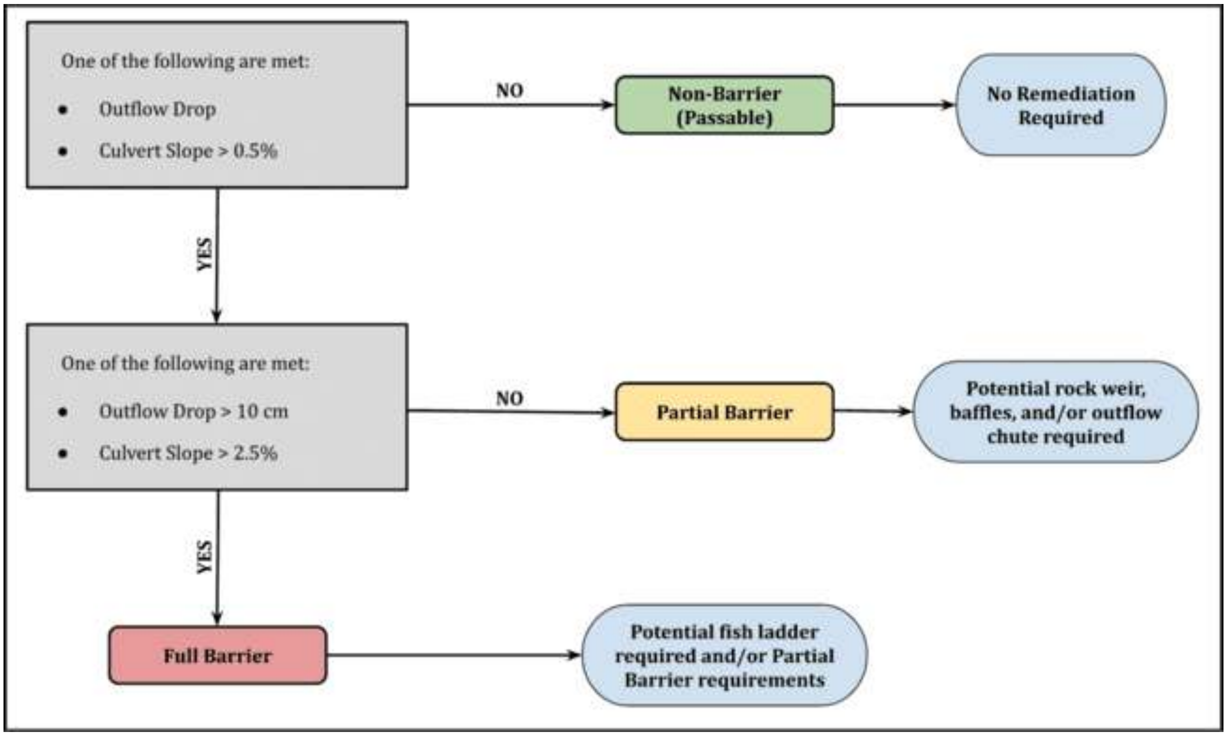

Figure 3: Flowchart followed to determine barrier type and remediation action.

Watercourse Crossings Database Design

The Watercourse Crossings Database was designed to manage assessment data and prioritize water crossings for remediation. To achieve this objective, all the field and desktop assessment data was entered into the database and analyzed, resulting in each crossing being placed into one of three overarching categories: non-barrier, partial barrier, or full barrier based on a criteria checklist. Once classified as a barrier type, the remediation actions were determined, and barrier restoration was prioritized based on the number of downstream barriers and the upstream habitat gain of each crossing. These two variables were subdivided into categories, each with a corresponding score. The barrier with the highest cumulative score was deemed to be the highest priority barrier. After receiving a prioritization score, culverts were then classified into one of three categories: high, medium, or low priority, based upon their scores. These prioritization scores will be used to guide future restoration work while also taking into consideration feasibility, in-stream habitat quality above and below the barrier as well as its location within the watershed.

Prioritizing Culverts for Debris Removal

The Belleisle Watersheds Fish Passage Barriers Database was consulted to generate a prioritized list and map of culverts in the upper watershed requiring debris removal (Figure 4). These culverts were prioritized based on the culvert assessment data collected, up-stream habitat gain, water quality and physical parameters of the stream and the presence of salmonid populations.

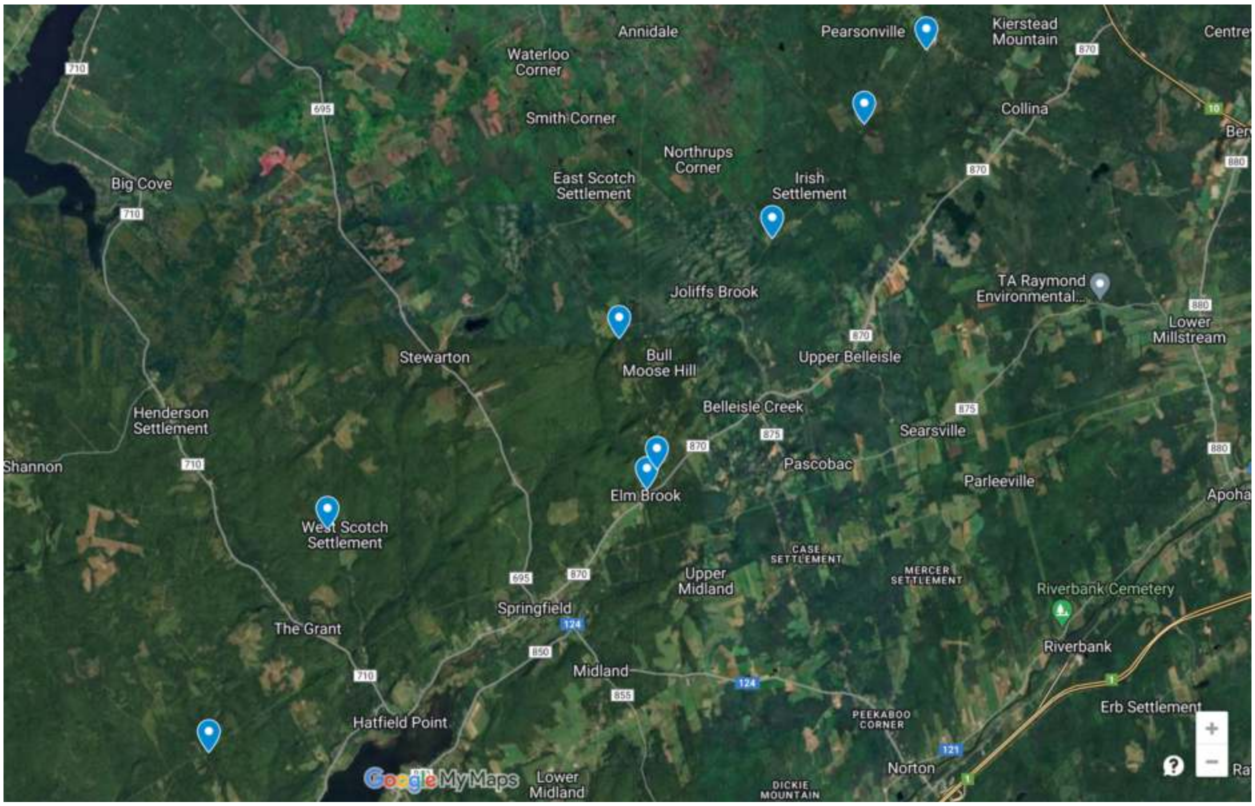

Figure 4: Map of debris blockages removed in 2023 in the upper Belleisle watershed.

Planning and Implementation of Culvert Debris Removal

Once the prioritized list was generated a site visit to each of the eight culverts was conducted to provide current information and photos of the barrier and asses how best to proceed with removal to mitigate impacts on the watercourse. Information from the site visit was used to generate a debris removal plan that followed an established method for efficient debris removal with minimal impact to aquatic and riparian habitats. Additionally, a Watercourse and Wetland Alteration Permit was obtained from the NB Department of Environment and Local Government, as will permission from the NB Department of Transportation and Infrastructure to proceed with debris removal.

Once the debris removal plan was complete and permits and permissions were obtained debris removal at the eight culverts started. Debris Removal followed our developed methodology. Staff collected by hand any human generated debris and transported it to a landfill to be properly disposed of. The natural debris removal process proceeded from the upstream side of the culvert (Figure 5). Removal of large branches was completed prior to removing entire logs. For large log debris it was cut into smaller pieces to ensure safety and easy of transport. All woody debris blocking each culvert was removed from both the inlet and outlet as needed to mitigate the barrier and restore fish passage. The removed organic debris was transported to a waste management facility to be composted. At each debris removal site data was collected on the type and quantity of debris comprising the blockage and added to the fish passage database for future reference. Once fish passage was restored the BWC will conduct an annual site visit to monitor of the amount and frequency of debris accumulation at each culvert. If at any site, debris accumulation continues as reoccurring issue, the BWC will investigate options to mitigate debris accumulation at each culvert as needed.

Figure 5: Staff conducting debris removal at a culvert in the Upper Watershed.

Communication and Outreach

As with all the BWC's projects, this project, and its partners were promoted online through both our social media accounts and our website. Additionally, this project was promoted through our outreach to landowners in order to gain permission for the assessment of watercourse crossing on private land, and to increase awareness of the importance of fish passage as an integral part of healthy aquatic ecosystems. Upon completion of the project, this final report with the funding supports acknowledged will be posted on the Belleisle Bay website. The results and final report will be posted on the BWC webpage and announced through our social media accounts.

Results

A total of 46 road-watercourse crossings were assessed during this project. Fish were observed at 14 sites, being active both upstream and downstream at 4 sites. 7 of the 46 structures assessed were found to be completely passable by fish. Of the remaining 39 structures, 23 structures contain a full barrier and 15 contain a partial barrier, with one structure not having the information available to say if it’s passable or not (Figure 6).

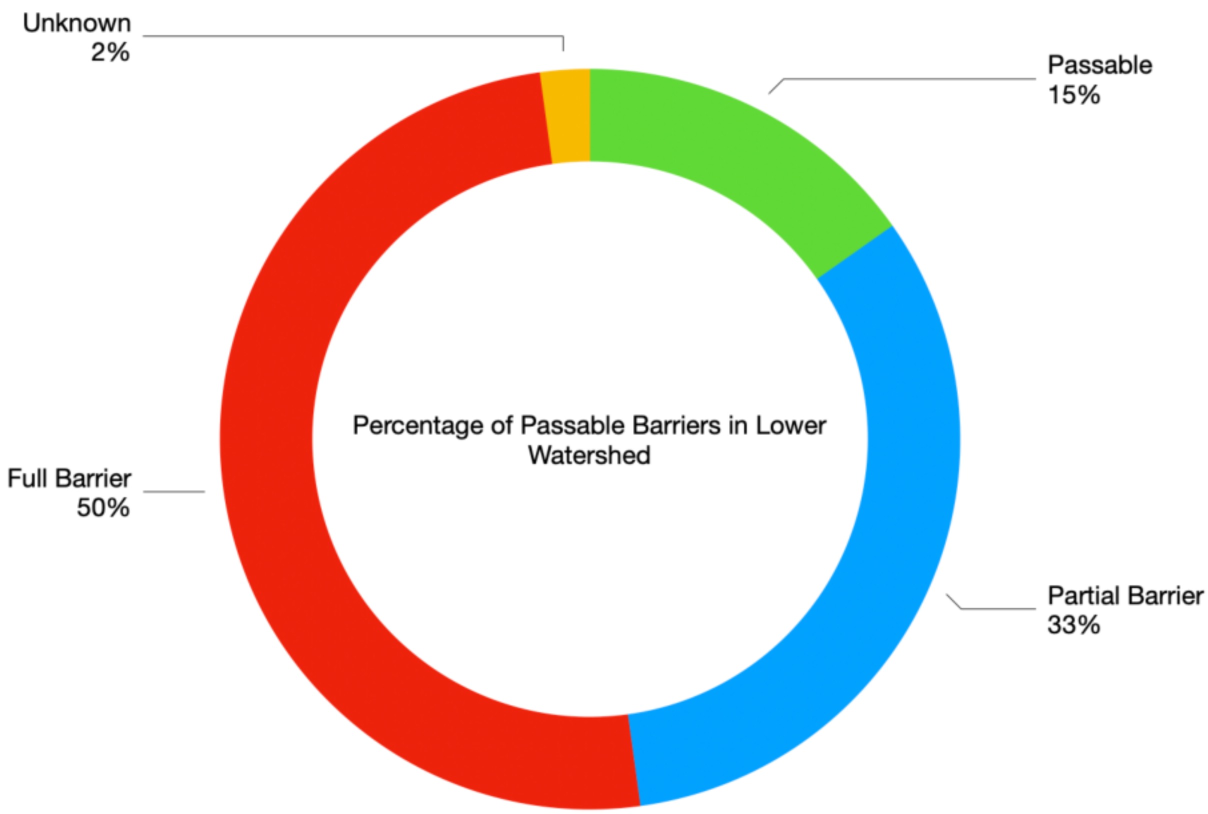

Figure 6 : Circle chart detailing the percentage of passable to non-passable barriers.

Debris Removal Fish Passage Barriers

As part of this project the BWC worked to remove barriers and restore access through eight culverts in the upper watershed that had been assessed as barriers during our 2022 fish passage survey (Table 3, Figure 7). Results of this part of the project saw approximately 0.50 tons of mostly woody debris cleared from the inlet or outlet for culverts along with any anthropogenic rubbish (Table 3, Figure 9). In total the removal of the debris opened 50 km of watercourse with valuable salmonid habitat on six watercourses where fish passage was restricted in the upper watershed (Table 3, Figure 8).

Table 3: Total amount of debris removed, and upstream habitat gained from remediated barriers.

Crossing ID	Watercourse Name	Debris Blockage Present	Description of Debris	Debris Removed (Tons)	Upstream Habitat Gain (km)
PSB005	Pascobac Brook	Yes	Wood, Tarp, fibreglass insulation	0.0700	7.8
ISB001	Irish Settlement Brook	Yes	Trees, Branches	0.0530	0.96
HNB003	Henderson Brook	Yes	Trees, Branches	0.0620	10.00
DLB003	Daley Brook	Yes	Trees, Branches	0.0800	7.35
ELB002	Elm Brook	Yes	dead trees, plastic, geotextile	0.0975	6.88
ELB003	Elm Brook	Yes	Trees, Branches, geo textile	0.0850	6.88
ELB004	Elm Brook	Yes	Branches	0.0425	6.88
SPG006	Spragg Brook	Yes	Branches	0.0100	3.25
				0.5	50

Figure 7 : Before and After photos of debris removal at culvert barrier ELB002.

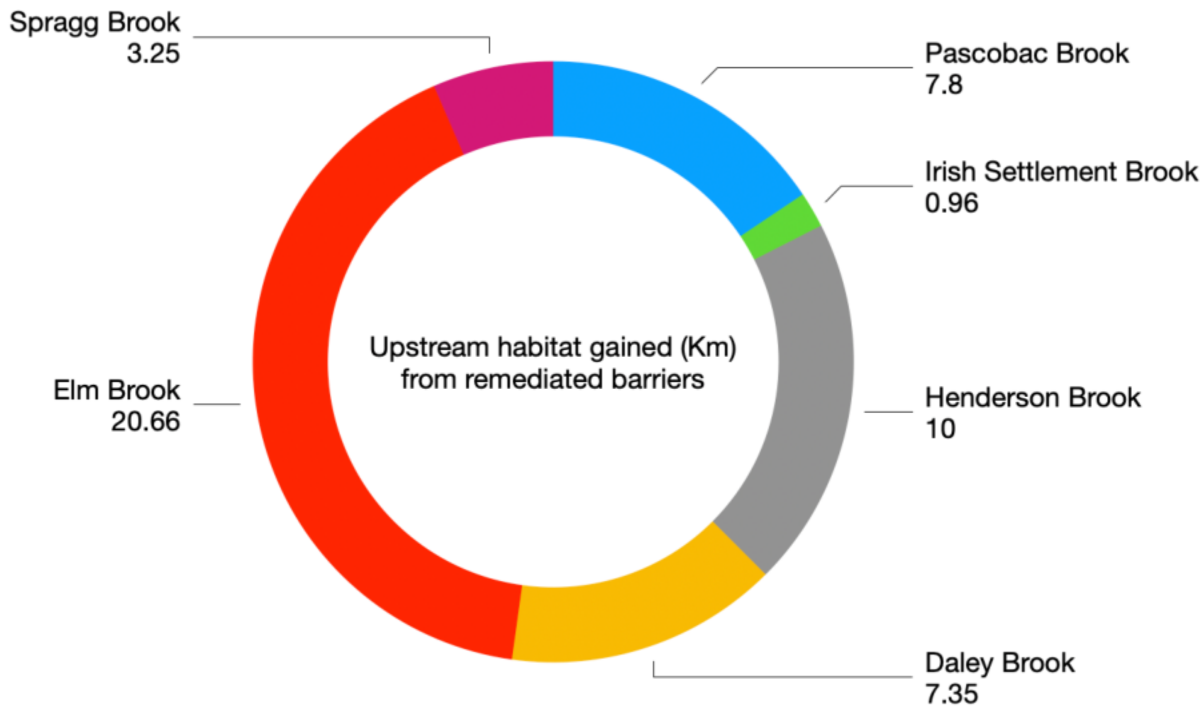

Figure 8: Circle chart detailing the amount of upstream habitat gain from remediated debris barriers.

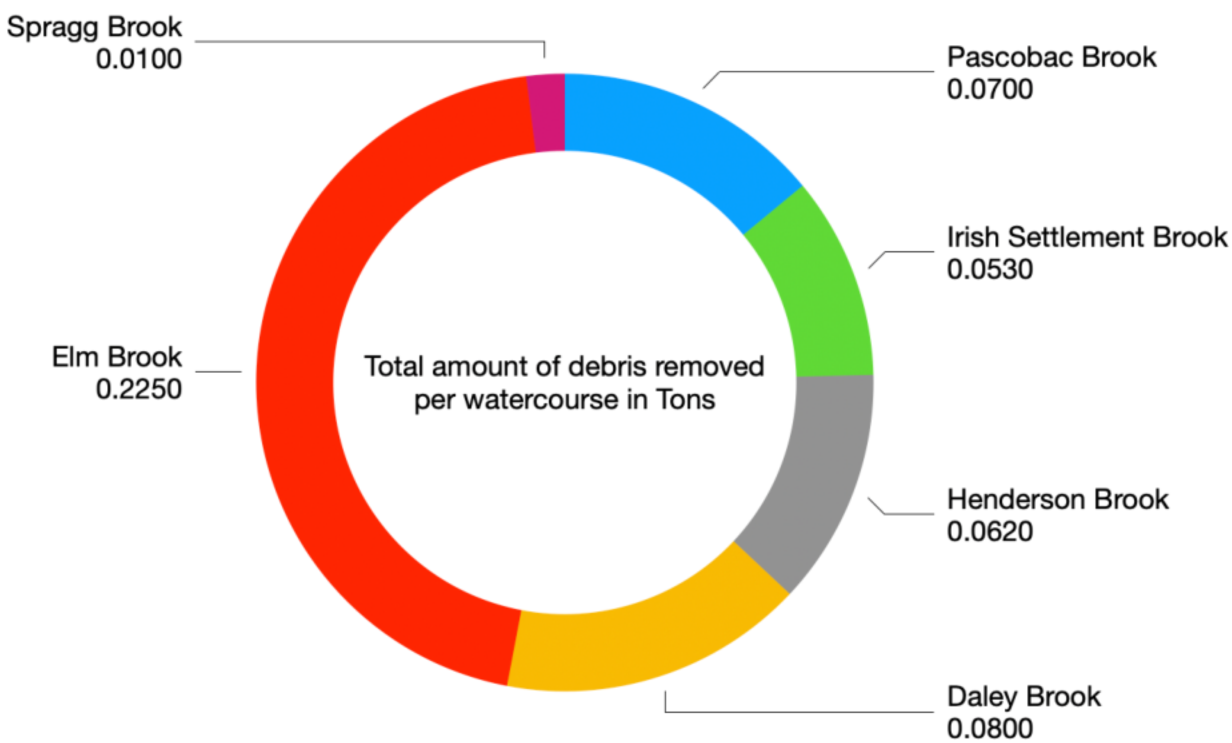

Figure 9: Circle chart detailing the amount of debris removed from watercourse barriers.

Assessed Fish Passage Barriers

Unnamed watercourses on Route 850 had the most structures assessed at a total of 9. None of these structures were passable, with 3 requiring remediation of partial barriers and 6 of full barriers (Table 4, Figure 10, Appendices 4, 5, 6 & 7). Tennant's Cove Brook saw 7 structures assessed, 2 being passable, 2 having partial barriers, and 3 having full barriers (Table 4, Figure 10, Appendices 4, 5, 6 & 7). The 5 sites assessed off Belleisle Shore Road presented 2 passable structure, 2 structures with partial barriers, and 1 structure with a full barrier in need of remediation (Table 4, Figure 10, Appendices 4, 5, 6 & 7). Four structures in Second Run Brook and unnamed watercourses off Route 124 were assessed; Second Run Brook contained 2 passable structures, 1 with a partial barrier, and 1 with a full barrier. The unnamed watercourses off Route 124 had 1 partial barrier and 3 full barriers (Table 4, Figure 10, Appendices 4, 5, 6 & 7). Durian, Reddin, and First Run Brooks each had 3 culverts assessed. It was observed that Durian Brook contained 1 full barrier and 1 partial barrier requiring remediation, and structure where passability was not determined. Reddin Brook had 1 full barrier structure and 2 partial barriers. First Run Brook contained 3 full barriers to its structures (Table 4, Figure 10, Appendices 4, 5, 6 & 7). Urquhart, Rogers, and McCutcheon Brooks had 2 structures assessed, where Urquhart's had 1 full barrier and 1 partial-barrier structure in need of remediation, Roger's Brook also had 1 full barrier structure and 1 partial barrier, and McCutcheon's possessed 1 passable structure and 1 full barrier (Table 4, Figure 10, Appendices 4, 5, 6 & 7). Unnamed watercourses on Brown's Cove Road and West Tennant's Cove Brook, just had 1 structure assessed. Brown's Cove Road contained a partial barrier to fish passage, and West Tennants Cove brook contained a full barrier (Table 4, Figure 10, Appendices 4, 5, 6 & 7).

Table 4: Barriers assessed broken down by stream and category type.

Stream Name	Full Barrier	Partial Barrier	No Barrier (Passable)	N/A	Total Assessed
Durian Brook	1	1	0	1	3
Route 124	3	1	0	0	4
Brown's Cove Road	0	1	0	0	1
Urquhart's Brook	1	1	0	0	2
First Run Brook	3	0	0	0	3
Second Run Brook	1	1	2	0	4
Belleisle Shore Road	1	2	2	0	5
Route 850	6	3	0	0	9

Reddin Brook	1	2	0	0	3
Rogers Brook	1	1	0	0	2
Tennants Cove Brook	3	2	2	0	7
West Tennants Cove Brook	1	0	0	0	1
McCutcheons Brook	1	0	1	0	2
TOTAL	23	15	7	1	46

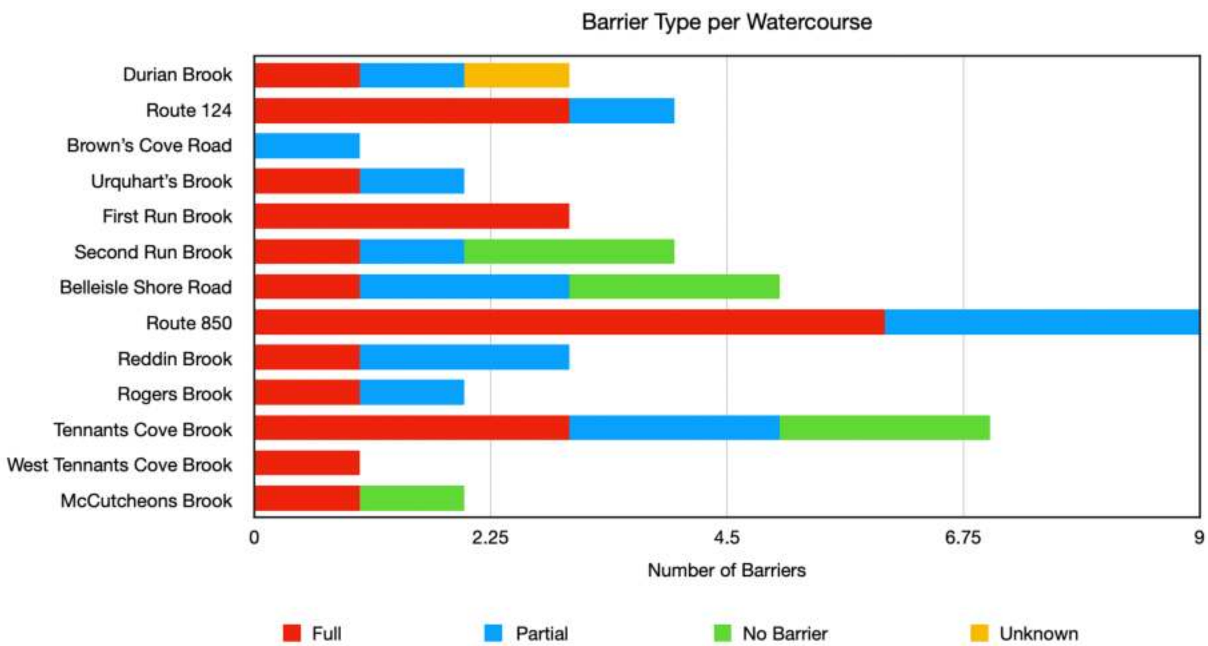

Figure 10: Stacked bar chart detailing the total barriers per category by watercourse.


Figure 11: Field staff using automatic optical level to read levelling rod.

Assessment of Upstream Habitat Gain Results

The total amount of upstream habitat gain that could be accessible to fish if all streams were completely clear of all barriers to fish passage was calculated to be 286.72 Kilometers (km) (Table 5, Figure 12 & Appendix 8). The three full barriers on First Run Brook obstruct the most significant upstream habitat gain, which was calculated to be 144.01 km (Table 5, Figure 12 & Appendix 8). McCutcheon's Brook has the least significant gain, calculated at only having 0.08 km of accessible habitat (Table 5, Figure 12 & Appendix 8). Out of the thirteen streams assessed, only three streams have over 20 km of habitat that is inaccessible to fish (Table 5, Figures 11, 12 & Appendix 8).

Table 5: Total amount of upstream habitat gain potentially accessible to fish if all barriers were remediated.

Stream Name	Total Upstream Habitat Gain (km)	%
Brown's Cove Rd – Unknown Watercourse	1.02	0.36
Belleisle Shore Road – Unknown Watercourse	1.7	0.59
Durian Brook	17.27	6.02
First Run Brook	144.01	50.23
McCutcheon's Brook	0.08	0.03
Reddin Brook	24.79	8.65
Rogers Brook	12.83	4.47
Route 124 – Unknown Watercourse	2.41	0.84
Route 850 – Unknown Watercourse	6.65	2.32
Second Run Brook	55.61	19.40
Tennants Cove Brook	7.91	2.76
Urquharts Brook	11.74	4.09
West Tennants Cove Brook	0.70	0.24
Total	286.72	100.00

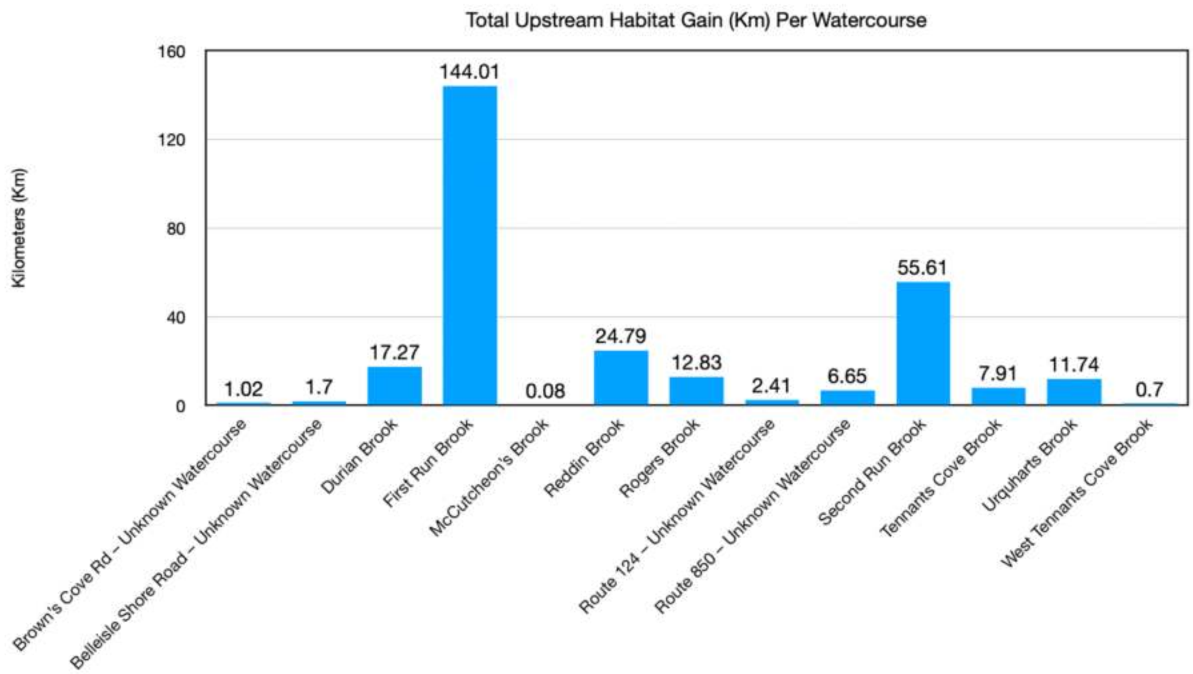

Figure 12: Bar graph detailing combined upstream habitat gain for all barriers categorized by stream.

First Run Brook's three full barriers free up 53.21 km, 52.41km, and 38.39 km of stream respectively, opening up 144.01 km of upstream habitat total, much of which flows from connecting tributaries (Table 5, Figure 8 & Appendix 8). If remediated, the full barrier and partial barriers on Durian Brook would open 12.98 km, 4.08 km, and 0.21 km of additional habitat for fish (Table 5, Figure 8 & Appendix 8). The three full and one partial barriers on the unknown waterway off Route 124 would open 0.96 km, 0.23 km, 0.52 km, and 0.7 km of stream respectively if cleared (Table 5, Figure 8 & Appendix 8). The watercourse off of Brown's Cove Road's partial barrier would give fish an additional 1.02 km (Table 5, Figure 8 & Appendix 8). The one full and one partial barrier on Urquhart's Brook would open 6.89 km and 4.85 km respectively (Table 5, Figure 8 & Appendix 8). Second Run Brook's one full barrier would free up 55.35 km, while its partial barrier would open 0.26 km (Table 5, Figure 8 & Appendix 8). Belleisle Shore Road has 0.16 km and 0.88 km of stream blocked by two partial barriers, and 0.66 km blocked by a full barrier (Table 5, Figure 8 & Appendix 8). The six full barriers on unknown streams off Route 850 would clear 1.03 km, 0.48 km, 0.26 km, 0.15 km, 0.41, and 0.46 km of upstream habitat, while the three partial barriers being remediated would open 0.54 km, 2.46 km, and 0.86 km of stream (Table 5, Figure 8 & Appendix 8). Reddin Brook's full barrier being cleared would mean 23.57 km of upstream habitat gain, while its two partial barriers would free up 0.34 km and 0.88 km(Table 5, Figure 8 & Appendix 8). The full barrier on Rogers Brook is blocking 2.24 km of habitat, while the partial barrier is blocking 10.59 km (Table 5, Figure 8 & Appendix 8).

Tennants Cove Brook's three full barriers are obstructing 0.5 km, 0.76 km, and 0 km as one site is at the end of the waterway. Its two partial barriers being remediated would free 5.82 km and 0.83 km of upstream habitat (Table 6, Figure 12 & Appendix 8). The full barrier on West Tennants Cove Brook being remediated would mean 0.7 km of habitat gain (Table 6, Figure 12 & Appendix 8). Finally, the full barrier on McCutcheon's Brook would clear 0.08 km of upstream habitat (Table 6, Figure 12 & Appendix 8).

Table 6: Upstream habitat gain for crossings with barriers detailed by Crossing ID.

Crossing ID	Stream Name	Upstream Habitat Gain (km)
UKN124001	UKNBK 2914 RTE 124	0.96
UKN124002	UKNBK 2986 RTE 124	0.23
UKNBCR001	UKNBK 15 Brown's Cove Rd	1.02
UQB001	Urquharts Brook	6.89
UQB002	Urquharts Brook	4.85
FRB001	First Run Brook	53.21
UKN124003	UKNBK 3168 RTE 124	0.52
UKN124004	UKNBK 3142 RTE 124	0.7
FRB002	First Run Brook	52.41
FRB003	First Run Brook	38.39
SRB001	Second Run Brook	55.35
SRB002	Second Run Brook	0.26
UKNBSR001	UKNBK 119 Belleisle Shore Rd	0.66
UKNBSR002	UKNBK 241 Belleisle Shore Rd	0.16
UKNBSR005	UKNBK 469 Belleisle Shore Rd	0.88
UKN850002	UKNBK 1635 RTE 850	1.03
UKN850003	UKNBK 1515 RTE 850	0.54
UKN850001	UKNBK1866 RTE 850	2.46
UKN850004	UKNBK 1501 RTE 850	0.86
MCB002	McCutcheon's Brook	0.08
UKN850006	UKNBK 1254 RTE 850	0.46
RB001	Reddin Brook	23.57

Crossing ID	Stream Name	Upstream Habitat Gain (km)
UKN124001	UKNBK 2914 RTE 124	0.96
UKN124002	UKNBK 2986 RTE 124	0.23
UKNBCR001	UKNBK 15 Brown's Cove Rd	1.02
UQB001	Urquharts Brook	6.89
RB002	Reddin Brook	0.34
RB003	Reddin Brook	0.88
UKN850007	UKNBK 1134 RTE 850	0.48
UKN850008	UKNBK Quamebis Ln	0.26
UKN850009	UKNBK 1044 RTE 850	0.15
UKN850010	UKNBK1015 RTE 850	0.41
ROB003	Rogers Brook	2.24
DBK001	Durian Brook	12.98
ROB001	Rogers Brook	10.59
DBK002	Durian Brook	4.08
DBK003	Durian Brook	0.21
TCB004	Tennants Cove Brook	0
TCB001	Tennants Cove Brook	5.82
TCB003	Tennants Cove Brook	0.76
TCB005	Tennants Cove Brook	0.83
TCB007	Tennants Cove Brook	0.50
WTB001	West Tennants Cove Brook	0.70

Conclusions

Structures with a significant outflow drop or culvert slope should be remediated as soon as possible, especially with regards to upstream habitat gain. First Run Brook is the stream with the most upstream habitat to be gained if its three full barriers are remediated, and all three of those barriers presented significant outflow drops over 40 cm high. Mini-fishways are suggested for all three sites to attempt to create fish passage, however due to the severity of the culvert slope percentage at least two of the sites also could benefit from baffles being installed. Various other structures will also require the same solution as the issue of fish passage lies in the outflow drop. Specifically, some crossings on Second Run Brook, off Route 850, McCutcheon's Brook, and Tennant's Cove Brook could all benefit from mini-fishways being constructed. Mccutcheon's Brook (MCB002) with an outflow drop of 144 cm, and Route 850 (UKN850006) with an outflow drop of 112 cm are particularly in need of remediation, although they are not the highest priority as they free up less than 1 kilometer of upstream habitat combined.

Half of the sites measured, so 23 out of 46 sites, have culvert slopes over 0.5% and are therefore recommended baffle installation to facilitate fish passage. Tennant's Cove Brook (TCB007) contains the most severe culvert slope at 6.30%. The only site we assessed that contained already-constructed baffles was Durian Brook (DBK001). Six sites had outflow drops between 20-25 cm that could benefit from an outflow chute being installed. A few sites could benefit from some digging out mud and debris, such as Rogers Brook (ROB003) and Route 124 (UKN124002) to aid in fish passage. Durian Brook (DBK003) would benefit from brush and trees being cleared as it was too dense at that site to take elevation measurements.

Appendix 1 - Coordinates of Watercourses Assessed

Table 7: Watercourses assessed by BWC field staff and their location.

Stream Assessed	Coordinates	
	Latitude	Longitude
Durian Brook	45.59303	-65.91451
Route 124 – Unknown Waterways	45.61385	-65.92307
Brown's Cove Road – Unknown Waterway	45.6052	-65.93775
Urquhart's Brook	45.60639	-65.94177
First Run Brook	45.60226	-65.95667
Second Run Brook	45.60193	-65.97066
Reicker Road – Unknown Waterway	45.62508	-65.96699
Belleisle Shore Road – Unknown Waterways	45.5936	-65.96838
Route 850 – Unknown Waterways	45.66962	-65.80872
Reddin Brook	45.62466	-65.86835
Rogers Brook	45.60276	-65.90884
Tennants Cove Brook	45.58686	-65.98825
West Tennants Cove Brook	45.60073	-65.9844
McCutcheon's Brook	45.63899	-65.85434

Appendix 2: Equipment List

Materials required to perform the fish passage assessment are as follows:

- Pencil and eraser
- ACCAT data sheets
- 30m tape
- Leveling rod
- Automatic optical level
- Tripod
- Clipboard
- Chest waders
- Rubber boots
- GPS
- Cellphone
- First aid kit
- Flowmeter
- Hat
- Sunscreen
- Bug spray

Appendix 3 - Atlantic Canada Culvert Assessment Toolkit Data Sheet

Crossing Data				
Observers				
Crossing ID			Date Observed	
Road Type	□ Public □Rail Bed ROW □ Private □ Logging Road			
Road Name		Crossing Condition	□ New □ Old □ Eroding □ Rusted □ Collapsing	
Stream Name				
Upstream Habitat Gain				
Tidal Site	Yes □ No □ Unknown □			
Crossing Type	□ Bridge □ Ford □ Dam □ Removed □ Inaccessible □ Not Fish Habitat □ Culvert # ____			
GPS Coordinates	LAT		LONG	
Beaver dam present	□ Yes □ No	Fish observed	□ Upstream	□ Downstream
Evidence of erosion	□ Upstream (□ Left bank □ Right bank □ Fill slope) □ Downstream (□ Left bank □ Right bank □ Fill slope)		Estimated area of active erosion (m^2)	

Photo IDs			
Upstream		Downstream	
Inlet		Outlet	
Other		Other	

Structure 1					
Debris blockage present	□Yes □No	Description of debris			
Culvert material	□ Concrete □ Corrugated Metal Pipe □ Corrugated Plastic □ Smooth □ Wood □ Other				
Culvert shape	□ Round □ Pipe Arch □ Open bottom arch □ Box				
Culvert bottom	□Unnatural □Natural	Culvert dimensions (m)	Width	Height	Length
Backwatered	□ 0% □ 25% □ 50% □ 75% □ 100%		Baffles	□ Present	□ Absent
Water depth in crossing matches that of stream: yes no (significantly deeper) no (significantly shallower)					
Water velocity in crossing matches that of stream: yes no (significantly faster) no (significantly slower)					
Embedment	□ from upstream □ from downstream	Length of Culvert with Embedment	□0% □ 25% □ 50% □75% □100%		

Elevations (m)						
Station	BS	HI	FS	Elevation (HI – FS)	Distances (m)	Tailwater Control Bankfull Width:
Inflow						
Outflow						
Tailwater Control						Distance from Tailwater Control to Second Riffle:
Left Bankfull at Tailwater						
Right Bankfull at Tailwater						
Second Riffle						

Culvert Slope (%) (Inflow-Outflow)/Culvert length*100		Outflow Drop (outflow – tailwater control)	
Downstream Slope (Tailwater Control – Second Riffle/distance from tailwater control to second riffle			

Structure 2							
Debris blockage present	□Yes	□No	**Description of debris**				
Culvert material	□ Concrete	□ Corrugated Metal Pipe	□ Corrugated Plastic	□ Smooth	□ Wood	□ Other	
Culvert shape	□ Round	□ Pipe Arch	□ Open bottom arch	□ Box			
Culvert bottom	□Unnatural □Natural	**Culvert dimensions (m)**	Width	Height	Length		
Backwatered	□ 0% □ 25% □ 50% □ 75% □ 100%	**Baffles**	□ Present	□ Absent			
Water depth in crossing matches that of stream: yes no (significantly deeper) no (significantly shallower)							
Water velocity in crossing matches that of stream: yes no (significantly faster) no (significantly slower)							
Embedment	□ from upstream □ from downstream	**Length of Culvert with Embedment**	□0% □ 25%□50%□75%□100%				

Elevations (m)

Station	BS	HI	FS	Elevation (HI – FS)	Distances	
Inflow						**Tailwater Control Bankfull Width:**
Outflow						
Tailwater Control						**Distance from Tailwater Control to Second Riffle:**
Left Bankfull at Tailwater						
Right Bankfull at Tailwater						
Second Riffle						

Culvert Slope (%) (Inflow-Outflow)/Culvert length*100		**Outflow Drop** (outflow – tailwater control)	
Downstream Slope (Tailwater Control – Second Riffle/distance from tailwater control to second riffle			

Structure 3							
Debris blockage present	□Yes	□No	**Description of debris**				
Culvert material	□ Concrete	□ Corrugated Metal Pipe	□ Corrugated Plastic	□ Smooth	□ Wood	□ Other	
Culvert shape	□ Round	□ Pipe Arch	□ Open bottom arch	□ Box			
Culvert bottom	□Unnatural □Natural	**Culvert dimensions (m)**	Width	Height	Length		
Backwatered	□ 0% □ 25% □ 50% □ 75% □ 100%	**Baffles**	□ Present	□ Absent			
Water depth in crossing matches that of stream: yes no (significantly deeper) no (significantly shallower)							
Water velocity in crossing matches that of stream: yes no (significantly faster) no (significantly slower)							
Embedment	□ from upstream □ from downstream	**Length of Culvert with Embedment**	□0% □ 25%□50%□75%□100%				

Elevations

Station	BS	HI	FS	Elevation (HI – FS)	Measurements	
Inflow						**Tailwater Control Bankfull Width:**
Outflow						
Tailwater Control						**Distance from Tailwater Control to Second Riffle:**
Left Bankfull at Tailwater						
Right Bankfull at Tailwater						
Second Riffle						

Culvert Slope (%) (Inflow-Outflow)/Culvert length*100		**Outflow Drop** (outflow – tailwater control)	
Downstream Slope (Tailwater Control – Second Riffle/distance from tailwater control to second riffle			

Appendix 4 - Results Data

Table 8: Road-watercourse barrier results for surveys conducted in the Lower Belleisle watershed during the summer of 2023.

Crossing Id	Is Culvert Passable?	Barrier Type	Options
UKN124001	No	Full Barrier	Baffles
UKN124002	No	Full Barrier	Dig out Culvert
UKNBCR001	No	Partial barrier	Baffles
UQB001	No	Partial Barrier	Rock Weir
UQB002	No	Full Barrier	Rock Weir
FRB001	No	Full Barrier	Mini-fishway + Baffles
UKN124003	No	Full Barrier	Outflow Chute + Baffles
UKN124004	No	Partial Barrier	Baffles
FRB002	No	Full Barrier	Mini-fishway
SRB002	No	Partial Barrier	Baffles
SRB003	Yes	No Barrier	No Remediation Required
SRB004	Yes	No Barrier	No Remediation Required
FRB003	No	Full Barrier	Mini-fishway + Baffles
SRB001	No	Full Barrier	Mini-fishway
SRB001	No	Full Barrier	Mini-fishway + Baffles
UKNBSR001	No	Full Barrier	Outflow Chute
UKNBSR002	No	Partial Barrier	Rock Weir
UKNBSR003	Yes	No Barrier	No Remediation Required
UKNBSR004	Yes	No Barrier	No Remediation Required
UKNBSR005	No	Partial Barrier	Rock Weir
UKN850002	No	Full Barrier	Mini-fishway + Baffles
UKN850003	No	Partial Barrier	Rock Weir + Baffles
UKN850001	No	Partial Barrier	Baffles
UKN850004	No	Partial Barrier	Rock Weir
MCB001	Yes	No Barrier	No Remediation Required
MCB002	No	Full Barrier	Mini-fishway
UKN850006	No	Full Barrier	Mini-fishway + Baffles
RB001	No	Full Barrier	Outflow Chute + Baffles
RB002	No	Partial Barrier	Rock Weir
RB003	No	Partial Barrier	Baffles
UKN850007	No	Full Barrier	Rock Weir + Baffles
UKN850008	No	Full Barrier	Outflow Chute + Baffles
UKN850009	No	Full Barrier	Rock Weir + Baffles

UKN850010	No	Full Barrier	Outflow Chute with Downstream Weirs + Baffles
ROB003	No	Full Barrier	Clean out Debris
DBK001	No	Partial Barrier	Baffles
ROB001	No	Partial Barrier	Baffles
ROB001	No	Partial barrier	Rock Weir
DBK002	No	Full Barrier	Rock Weir
DBK003	N/A	N/A	Clear out Trees and Brush
TCB004	No	Full Barrier	Mini-fishway + Baffles
TCB001	No	Partial Barrier	Baffles
TCB002	Yes	No barrier	No Remediation Required
TCB003	No	Full Barrier	Rock Weir + Baffles
TCB005	No	Partial Barrier	Rock Weir + Baffles
TCB006	Yes	No Barrier	No Remediation Required
TCB007	No	Full Barrier	Baffles
WTB001	No	Full Barrier	Outflow Chute

Appendix 5 - Raw Structure Data

Table 9: Road-watercourse structure data collected from surveys conducted in the Lower Belleisle watershed during the summer of 2023.

Crossing ID	Debris Blockage Present	Description of Debris	Culvert Material	Culvert Shape	Culvert Bottom	Culvert Width (m)	Culvert Height (m)	Culvert Length (m)
UKN124001	Yes	Remnants of culvert and rocks	Wood	Box	Unnatural	1.431	0.914	28.652
UKN124002	Yes	N/A	Wood	Box	Unnatural	N/A	N/A	N/A
UKNBCR001	Yes	Rocks	Concrete	Box	Unnatural	2.438	1.219	16.053
UQB001	No	N/A	Concrete	Box	Unnatural	3.05	1.828	13.9
UQB002	Yes	Rocks	Corrugated Metal Pipe	Round	Unnatural	2.2	2.2	16.3
FRB001	No	N/A	Concrete	Pipe Arch	Unnatural	3	2.6	18.6
UKN124003	Yes	Sticks and Rocks	Concrete	Round	Unnatural	1.5	1.5	20.6
UKN124004	No	N/A	Concrete	Pipe Arch	Unnatural	1.1	1.05	28
FRB002	N/A	N/A	Corrugated Plastic	Round	Unnatural	0.62	1.8	N/A
SRB002	No	N/A	Corrugated Plastic	Round	Unnatural	0.62	0.62	14.7
SRB003	No	N/A	Corrugated Metal Pipe	Round	Unnatural	0.95	0.9	10
SRB004	No	N/A	Corrugated Metal Pipe	Round	Unnatural	4	2.5	20.7
FRB003	No	N/A	Corrugated Metal PIpe	Round	Natural	4	2.5	24.1

SRB001	No	N/A	Concrete	Box	Unnatural	2.4384	2.4384	40
SRB001	No	N/A	Concrete	Box	Unnatural	2.4384	2.4382	40
UKNBSR001	No	N/A	Concrete	Round	Unnatural	0.9	0.9	19.6
UKNBSR002	No	N/A	Concrete	Round	Unnatural	0.74	0.82	14.4
UKNBSR003	Yes	Leaves, sticks, rocks	Corrugated Metal Pipe	Round	Unnatural	0.75	0.75	16
UKNBSR004	Yes	Leaves, sticks, rocks	Corrugated Metal Pipe	Round	Unnatural	1.85	1.85	16.1
UKNBSR005	No	N/A	Concrete	Round	Unnatural	0.6	0.6	15
UKN850002	Yes	Sticks, Rocks	Corrugated Metal Pipe	Round	Unnatural	1.8	1.6	25.4
UKN850003	Yes	Twigs, Rocks	Corrugated Metal Pipe	Round	Unnatural	1.2	1.2	15.6
UKN850001	Yes	Organic, rocks	Corrugated Metal Pipe	Round	Unnatural	1.14	1.14	19
UKN850004	No	N/A	Corrugated Metal Pipe	Round	Natural	1.3	1.1	12.3
MCB001	No	N/A	Corrugated Metal Pipe	Round	Natural	2.4	2.14	20.94
MCB002	Yes	Rocks	Corrugated Metal Pipe	Round	Unnatural	0.9	0.9	10.1
UKN850006	No	N/A	Corrugated Metal Pipe	Round	Natural	1.4	1.04	15.85
RB001	No	N/A	Concrete	Box	Natural	10.55	1.62	7.8
RB002	Yes	Vegetation/Sticks/Leaves	Concrete	Round	Unnatural	0.7	0.7	10
RB003	No	N/A	Concrete	Round	Unnatural	0.62	0.62	8
UKN850007	Yes	Sand, Silt, Grass	Corrugated Metal Pipe	Round	Unnatural	1.1	0.65	11.5
UKN850008	Yes	medium rocks	Wood	Box	Unnatural	0.9	0.9	9
UKN850009	No	N/A	Corrugated Metal Pipe	Round	Unnatural	1.2	1.2	15.5

UKN850010	No	N/A	Corrugated Metal Pipe	Round	Unnatural	1.75	1.75	18.8
ROB003	Yes	Vegetation, mud	Corrugated Metal Pipe	Round	Unnatural	0.6	0.6	
DBK001	No	N/A	Concrete	Box	Unnatural	3	2.75	29
ROB001	No	N/A	Concrete	Round	Natural	3	3	24.7
ROB001	No	N/A	Concrete	Round	Natural	3	3	24.7
DBK002	No	N/A	Corrugated Metal Pipe	Round	Unnatural	1.5	1.5	20
DBK003	Yes	Impeded by alder	Concrete	Round	Natural	0.8	0.8	12.4
TCB004	No	N/A	Wood	Box	Unnatural	1	1	22.3
TCB001	No	N/A	Concrete	N/A	Natural	3	1.86	7.5
TCB002	No	N/A	Concrete	Round	Unnatural	1.5	1.5	17.45
TCB003	No	N/A	Concrete	Round	Unnatural	1.1	1.1	15.3
TCB005	No	N/A	Corrugated Plastic	Round	Unnatural	1.3	1.3	12.4
TCB006	No	N/A	Wood	Box	Natural	1	1	19.2
TCB007	No	N/A	Wood	Box	Natural	1.2	2	16.3
WTB001	No	N/A	Concrete	Round	Unnatural	1.5	1.5	15.8

Appendix 6 - Raw Elevation Data

Table 10: Road-watercourse elevation data collected from surveys conducted in the Lower Belleisle watershed during the summer of 2023.

Crossing ID	HI	BS/FS	Inflow	Outflow	Tailwater Control	Left Bankfull at Tailwater	Right Bankfull at Tailwater	Second Riffle	Tailwater Control at Bankfull Width	Distance from Tailwater Control to Second Riffle
UKN124001	10	FS	0.482	1.485	0.863	1.016	0.965	0.584	6.248	9.677
UKN124002	10	FS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
UKNBCR001	10	FS	0.558	0.965	0.812	1.346	0.127	0.991	9.06	4.75
UQB001	10	FS	1.498	1.346	1.371	1.397	1.321	1.905	21	9.15
UQB002	10	FS	1.193	0.66	0.838	0.355	0.838	1.016	24.8	7
FRB001	10	FS	0.5	0.65	1.18	1.31	1.64	1.57	60	5.53
UKN124003	10	FS	0.55	0.75	0.95	0.95	0.95	1.3	7.4	6.8
UKN124004	10	FS	0.25	0.79	0.5	0.6	0.58	0.6	27.8	5.25
FRB002	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SRB002	10	FS	0.3	0.4	0.3	0.24	0.3	0.25	6	2.05
SRB003	10	FS	0.43	0.45	0.3	0.36	0.26	0.45	5.52	5.72
SRB004	10	FS	1.15	1.2	0.97	1.9	1.2	1.8	20.35	15.61
FRB003	10	FS	0.4	0.73	1.3	0.47	0.54	1.4	21.2	14.06
SRB001	10	FS	0.85	0.75	1.17	1.17	0.94	1.76	6.6	14.9
SRB001	10	FS	0.5	0.72	1.17	1.17	1.17	1.76	6.6	14.9
UKNBSR001	10	FS	0.56	0.58	0.8	0.8	0.94	0.75	14.64	5.87
UKNBSR002	10	FS	0.35	0.5	0.42	0.25	0.25	1	9.2	5.1
UKNBSR003	10	FS	0.75	0.7	1.55	1.8	1.6	1.7	8.6	6.4
UKNBSR004	10	FS	0.75	0.72	1.6	1.49	1.2	2.05	14.7	7
UKNBSR005	10	FS	0.6	0.3	0.45	0.7	0.7	0.45	9.2	6.3
UKN850002	10	FS	0.04	0.77	1.34	1.33	1.33	1.85	8.4	5.6

UKN850003	10	FS	0.54	0.93	0.99	0.98	0.91	0.94	6.4	4.5
UKN850001	10	FS	0.5	0.66	0.34	0.26	0.4	0.52	30	4
UKN850004	10	FS	0.6	0.46	0.54	0.52	0.5	0.56	4.5	6
MCB001	10	FS	1.22	1.1	0.88	0.86	0.92	1.34	13	9.95
MCB002	10	FS	0.54	0.22	1.66	1.88	1.6	1.92	3.9	2.4
UKN850006	10	FS	0.44	0.62	1.74	1.4	1.54	2	3.7	6.4
RB001	10	FS	1.06	1.12	1.34	1.14	1.2	1.6	120	15.52
RB002	10	FS	0.66	0.44	0.52	0.54	0.4	0.43	4.4	4
RB003	10	FS	0.2	0.38	0.33	0.3	0.52	0.44	5.65	6.55
UKN850007	10	FS	0.26	0.35	0.5	0.44	0.44	0.44	4	0.4
UKN850008	10	FS	0.4	0.5	0.7	0.68	0.72	0.9	4.6	3.6
UKN850009	10	FS	0.28	0.78	0.91	0.9	0.92	1.13	2.4	3.3
UKN850010	10	FS	0.56	0.95	1.24	1.32	1.26	1.86	4.15	6.7
ROB003	10	FS	N/A	0.74	0.54	0.34	0.34	0.78	37.5	8.1
DBK001	10	FS	1.34	1.71	1.32	1.36	1.25	1.48	14.3	11.1
ROB001	10	FS	1.3	1.68	1.26	0.74	0.92	1.72	93.2	28.4
ROB001	10	FS	1.3	1.22	1.26	0.74	0.92	1.72	93.2	28.4
DBK002	10	FS	0.82	0.72	0.84	0.78	0.86	1.04	62.6	3.8
DBK003	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.1	4.4
TCB004	10	FS	0.08	0.28	0.68	0.68	0.7	0.64	4.1	5.36
TCB001	10	FS	0.96	1.02	0.85	0.9	0.9	0.78	6.2	24.55
TCB002	10	FS	0.5	0.58	0.58	0.53	0.56	0.84	10.8	8.6
TCB003	10	FS	o.42	0.86	1.01	1.04	1.02	1.54	20	7.25
TCB005	10	FS	0.52	0.65	0.73	0.68	0.7	0.84	5.2	5.32
TCB006	10	FS	0.5	0.46	0.34	0.58	0.46	0.4	7.52	7.2
TCB007	10	FS	0.48	1.52	0.64	0.65	0.45	0.92	3.8	12.2
WTB001	10	FS	0.66	0.66	0.91	0.72	0.78	1.54	6.3	11.42

Appendix 7 - Raw Elevation Data HI-FS

Table 11: Road-watercourse HI-FS results for surveys conducted in the Lower Belleisle watershed during the summer of 2023.

Crossing ID	Inflow	Outflow	Tailwater Control	Left Bankfull at Tailwater	Right Bankfull at Tailwater	Second Riffle
UKN124001	2.565	1.562	2.184	2.032	2.082	2.463
UKN124002	N/A	N/A	N/A	N/A	N/A	N/A
UKNBCR001	2.49	2.08	2.23	1.7	2.92	2.06
UQB001	1.55	1.7	1.68	1.64	1.73	1.14
UQB002	1.86	2.39	2.2	3.3	2.2	2
FRB001	9.5	9.35	8.82	8.69	8.36	8.43
UKN124003	9.45	9.25	9.05	9.05	9.05	8.7
UKN124004	9.75	9.21	9.5	9.4	9.42	9.4
FRB002	N/A	N/A	N/A	N/A	N/A	N/A
SRB002	9.7	9.6	9.7	9.76	9.7	9.75
SRB003	9.57	9.55	9.7	9.64	9.74	9.55
SRB004	8.85	8.8	9.03	8.1	8.8	8.2
FRB003	9.6	9.27	8.7	9.53	9.46	8.6
SRB001	9.15	9.25	8.83	8.83	9.06	8.24
SRB001	9.5	9.28	8.83	8.83	9.06	8.24
UKNBSR001	9.44	9.42	9.2	9.2	9.06	9.25
UKNBSR002	9.65	9.5	9.58	9.75	9.75	9
UKNBSR003	9.25	9.3	8.45	8.2	8.4	8.3
UKNBSR004	9.25	9.28	8.4	8.51	8.8	7.95
UKNBSR005	9.4	9.7	9.55	9.3	9.3	9.55
UKN850002	9.96	9.23	8.66	8.67	8.67	8.15
UKN850003	9.46	9.07	9.01	9.02	9.09	9.06
UKN850001	9.5	9.34	9.66	9.74	9.6	9.48

UKN850004	9.4	9.54	9.46	9.48	9.5	9.44
MCB001	8.78	8.9	9.12	9.14	9.08	8.66
MCB002	9.46	9.78	8.34	8.12	8.4	8.08
UKN850006	9.56	9.38	8.26	8.6	8.46	8
RB001	8.94	8.88	8.66	8.86	8.8	8.4
RB002	9.34	9.56	9.48	9.46	9.6	9.57
RB003	9.8	9.62	9.67	9.7	9.48	9.56
UKN850007	9.74	9.65	9.5	9.56	9.56	9.56
UKN850008	9.6	9.5	9.3	9.32	9.28	9.1
UKN850009	9.72	9.22	9.09	9.1	9.08	8.87
UKN850010	9.44	9.05	8.76	8.68	8.74	8.14
ROB003	N/A	9.26	9.46	9.66	9.66	9.22
DBK001	8.66	8.29	8.68	8.64	8.75	8.52
ROB001	8.7	8.32	8.74	9.26	9.08	8.28
ROB001	8.7	8.78	8.74	9.26	9.08	8.28
DBK002	9.18	9.28	9.16	9.22	9.14	8.94
DBK003	N/A	N/A	N/A	N/A	N/A	N/A
TCB004	9.92	9.72	9.32	9.32	9.3	9.36
TCB001	9.04	8.89	9.15	9.1	9.1	9.22
TCB002	9.5	9.42	9.42	9.47	9.44	9.16
TCB003	9.58	9.14	8.99	8.96	8.98	8.46
TCB005	9.48	9.35	9.27	9.32	9.3	9.16
TCB006	9.5	9.45	9.66	9.42	9.54	9.6
TCB007	9.52	8.48	9.36	9.35	9.55	9.08
WTB001	9.34	9.34	9.09	9.28	9.22	8.46

Appendix 8 - Raw Crossing Data

Table 12: Road-watercourse crossing data collected from surveys conducted in the Lower Belleisle watershed during the summer of 2023.

Crossing ID	Garmin Waypoint ID	Date (dd/mm/yyyy)	Road Type	Road Name	Stream Name	Upstream Habitat Gain (km)	Tidal Site	Crossing Condition	Crossing Type
UKN124001	361	07/07/2023	Public	Route 124	UKNBK 2914 RTE 124	0.96	No	Old	Culvert
UKN124002	363	12/07/2023	Public	Route 124	UKNBK 2986 RTE 124	0.23	No	Old	Inaccessible, Not Fish Habitat
UKNBCR001	364	12/07/2023	Public	Browns Cove Rd	UKNBK 15 Brown's Cove Rd	1.02	No	New	Culvert
UQB001	365	12/07/2023	Public	Route 124	Urquharts Brook	6.89	No	New	Culvert
UQB002	366	12/07/2023	Private	Urquharts Rd	Urquharts Brook	4.85	No	Old, Rusted	Culvert
FRB001	367	13/07/2023	Public	Route 124	First Run Brook	53.21	No	New	Culvert
UKN124003	368	14/07/2023	Public	Route 124	UKNBK 3168 RTE 124	0.52	No	New	Culvert
UKN124004	370	18/07/2023	Public	Route 124	UKNBK 3142 RTE 124	0.7	No	Old	Culvert
FRB002	371	18/07/2023	Public	Reicker Rd	First Run Brook	52.41	No	New	Culvert
SRB002	372	18/07/2023	Public	Reicker Rd	Second Run Brook	0.26	No	New	Culvert
SRB003	373	18/07/2023	Public	Reicker Rd	Second Run Brook	0	No	Old	Culvert

SRB004	375	19/07/2023	Public	Baseline Rd	Second Run Brook	0	No	Old	Culvert
FRB003	377	19/07/2023	Public	Reicker Rd	First Run Brook	38.39	No	Old	Culvert
SRB001	378	18/07/2023	Public	Route 124	Second Run Brook	55.35	No	New	Culvert
SRB001	378	18/07/2023	Public	Route 124	Second Run Brook	55.35	No	New	Culvert
UKNBSR001	379	19/07/2023	Public	Bellleisle Shore Rd	UKNBK 119 Belleisle Shore Rd	0.66	No	Collapsing	Culvert
UKNBSR002	380	20/07/2023	Public	Belleisle Shore Rd	UKNBK 241 Belleisle Shore Rd	0.16	No	New	Culvert
UKNBSR003	381	20/07/2023	Public	Belleisle Shore Rd	UKNBK 259 Belleisle Shore Rd	0	No	Old	Culvert
UKNBSR004	382	24/07/2023	Public	Belleisle Shore Rd	UKNBK 342 Belleisle Shore Rd	0	No	Old	Culvert
UKNBSR005	383	24/07/2023	Public	Belleisle Shore Rd	UKNBK 469 Belleisle Shore Rd	0.88	No	Old	Culvert
UKN850002	386	25/07/2023	Public	Route 850	UKNBK 1635 RTE 850	1.03	No	Old, Eroded	Culvert
UKN850003	387	25/07/2023	Public	Route 850	UKNBK 1515 RTE 850	0.54	No	Old	Culvert
UKN850001	385	25/07/2023	Public	Route 850	UKNBK 1866 RTE 850	2.46	No	Old	Culvert
UKN850004	388	26/07/2023	Public	Route 850	UKNBK 1501 RTE 850	0.86	No	Old	Culvert

MCB001	389	26/07/2023	Public	Route 850	McCutcheon's Brook	0	No	Old, Rusted	Culvert
MCB002	390	26/07/2023	Public	Route 850	McCutcheon's Brook	0.08	No	Old	Culvert
UKN850006	391	26/07/2023	Public	Route 850	UKNBK 1254 RTE 850	0.46	No	Old	Culvert
RB001	392	31/07/2023	Public	Route 850	Reddin Brook	23.57	No	New	Bridge
RB002	393	01/08/2023	Public	Ravine Rd	Reddin Brook	0.34	No	Old	Culvert
RB003	394	02/08/2023	Public	Ravine Rd	Reddin Brook	0.88	No	Old	Culvert
UKN850007	396	03/08/2023	Public	Route 850	UKNBK 1134 RTE 850	0.48	No	Old, Eroded	Culvert
UKN850008	397	03/08/2023	Public	Route 850	UKNBK Quamebis Ln	0.26	No	Old	Culvert
UKN850009	398	03/08/2023	Public	Route 850	UKNBK 1044 RTE 850	0.15	No	Old, Eroding, Rusted	Culvert
UKN850010	399	04/08/2023	Public	Route 850	UKNBK 1015 RTE 850	0.41	No	Old, Rusted	Culvert
ROB003	400	18/08/2023	Public	Rogers Rd	Rogers Brook	2.24	No	Old, Rusted	Culvert
DBK001	401	21/08/2023	Public	Route 850	Durian Brook	12.98	No	New	Culvert (#E700)
ROB001	402	22/08/2023	Public	Route 850	Rogers Brook	10.59	Yes	New	Left Culvert
ROB001	402	22/08/2023	Public	Route 850	Rogers Brook	10.59	Yes	New	Right Culvert
DBK002	403	23/08/2023	Public	Johnson Rd	Durian Brook	4.08	No	Old	Culvert
DBK003	404	29/08/2023	Public	Johnson Rd	Durian Brook	0.21	No	Old	Culvert
TCB004	405	29/08/2023	Public	Route 124	Tennants Cove Brook	0	No	Old	Culvert
TCB001	406	29/08/2023	Public	East Tenant Cove Rd	Tennants Cove Brook	5.82	No	Old	Bridge

TCB002	408	29/08/2023	Public	East Tennant Cove Rd	Tennants Cove Brook	0	No	Old	Culvert
TCB003	410	31/08/2023	Public	Gravelly Hill Rd	Tennants Cove Brook	0.76	No	Old	Culvert
TCB005	411	31/08/2023	Public	East Tennants Cove Rd	Tennants Cove Brook	0.83	No	New	Culvert
TCB006	412	31/08/2023	Public	Route 124	Tennants Cove Brook	0	No	Old	Culvert
TCB007	N/A	31/08/2023	Public	Route 124	Tennants Cove Brook	0.5	No	Old	Culvert
WTB001	413	31/08/2023	Public	East Tennants Cove Rd	West Tennants Cove Brook	0.7	No	Old	Culvert