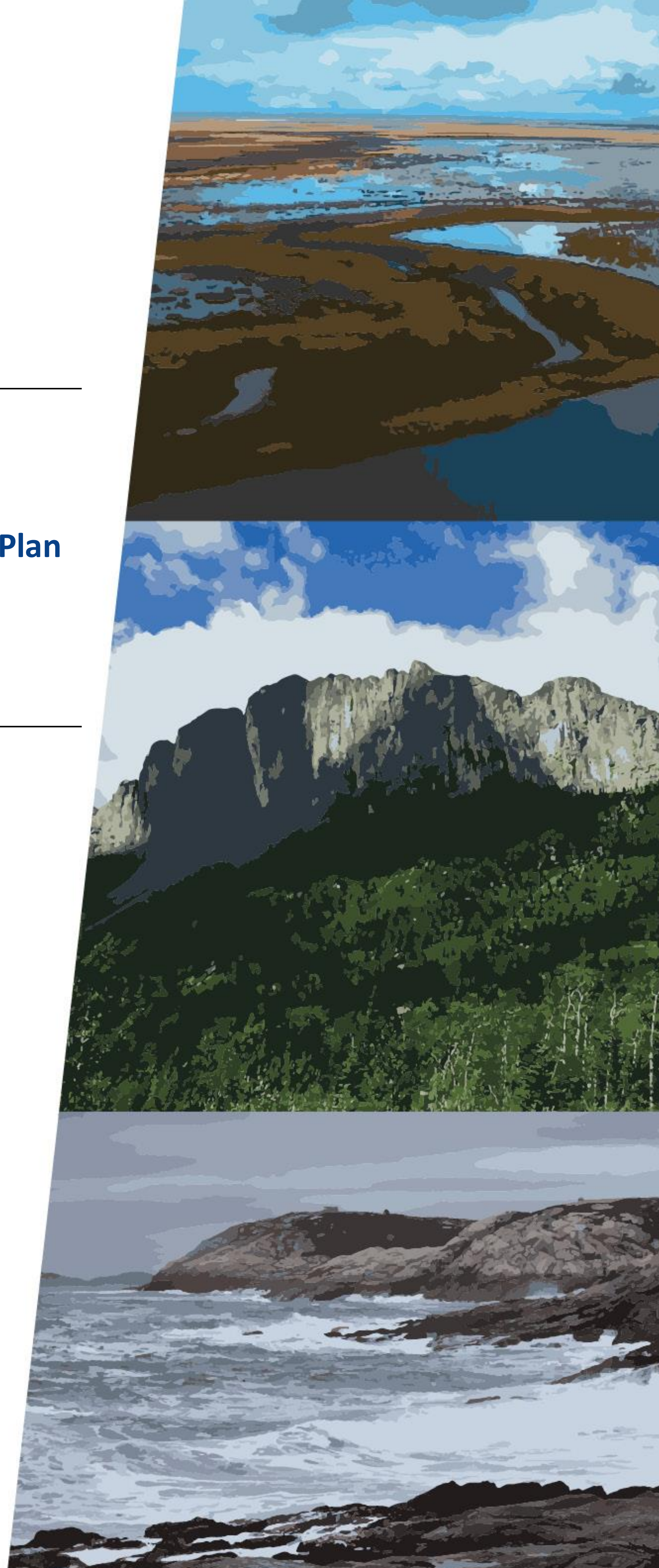
Goldboro Gold Project

MDMER Schedule 2
Fish Habitat Compensation Plan and Fisheries Act Paragraph 34.4(2)(b) & 35(2)(b) Authorization Offset Plan



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August 25, 2023 (revised May 2024)

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EXECUTIVE SUMMARY

Signal Gold Inc. (Signal Gold) proposes to develop the Goldboro Gold Project (the Project) located near Goldboro, Guysborough County, Nova Scotia (NS). The Project will be operated by Goldboro Gold Mines Inc. (Goldboro Gold Mines), a wholly owned subsidiary of Signal Gold. The Project consists of conventional open pit mining operation and a 4,000 tonnes per day (tpd) processing facility based on a combined gravity and leaching circuit using carbon-in-pulp technology. The Project also includes an engineered, fully lined tailings management facility (TMF), three waste rock storage areas (WRSAs), till and organic material stockpiles, and associated infrastructure.

To facilitate development of the Project, there is a need to overprint or otherwise impact aquatic features that contain fish and/or provide fish habitat after all avoidance, minimization, and mitigation measures have been considered. As a result, the implementation of measures to offset these impacts are required. This Offsetting Plan is intended to meet the information and documentation requirements set out under both Schedule 1: Section 16 of the Authorizations Concerning Fish and Fish Habitat Protection Regulations and Subsection 27.1(2) of the Metal and Diamond Mining Effluent Regulations (MDMER).

The offsetting projects described herein have been selected based on feedback received from DFO, as well as through continued engagement the Mi'kmaq of Nova Scotia, municipal officials, and local community watershed and fisheries organizations. This final Offsetting Plan incorporates the feedback received on both the preliminary Conceptual Fish Habitat Offsetting Plan (submitted June 2022) and Interim Fisheries Offsetting Plan (submitted January 2023).

The residual effects to fish and fish habitat that are anticipated to remain after the implementation of avoidance and mitigation measures are related to permanent loss of aquatic habitat (destruction), and changes in flow regimes and temperatures (alteration). These impacts will require offsetting (or 'compensation' under MDMER) to counterbalance the effects to fish and fish habitat.

Goldboro Gold Mines is seeking authorization for a harmful alteration, disruption, or destruction (HADD) of 232,666 m^2 (23.2666 ha) of fish habitat, which is inclusive of the 2,707 m^2 of fish habitat associated with the watercourses requiring an amendment to Schedule 2 of the MDMER. A range of proposed offset ratios are presented based on the magnitude, frequency, timing, and duration of the HADD (when applicable), as well as the species, life stages, and type of habitat impacted, and anticipated productivity of proposed offsetting measures. Based on the proposed offsetting ratios, 179,578 m^2 (17.9578 ha) of fish habitat offsetting is recommended to counterbalance the Project HADD of fish habitat.

The Offsetting Plan identifies five (5) offsetting measures involving the instream restoration and enhancement of degraded waterways in the Salmon River, Country Harbour River, Guysborough River, and Pomquet River watersheds. Degradation from historical logging and agriculture has led to over-widened channels, straightened sections, unstable banks, and a lack of large woody debris all culminating in homogenous habitat compositions lacking fish habitat diversity. All systems support Atlantic salmon as well as fish species expected to be impacted by the Project (brook trout and American eel).

A robust monitoring program has been developed to ensure the offsetting measures are implemented and functioning as proposed. Adaptive management and contingencies measures will be implemented should the monitoring work identify deficiencies in the effectiveness of the offsetting measures, or if the offsetting measures fail to meet their objectives.

Combined, the five fisheries offsetting projects amount to 182,825 m^2 (or 18.2825 ha) of habitat offsetting area. This area is considered sufficient to counterbalance the Project HADD (including proposed offsetting ratios) of 179,578 m^2 (17.9578 ha). Watercourses requiring an amendment to Schedule 2 of the MDMER are proposed to be compensated specifically through the East Pomquet offset project (5,414 m^2 or 0.54 ha).

Based on the nature of the habitat losses and alterations, fisheries offsetting measures presented in this Offsetting Plan are expected to counterbalance Project impacts successfully.

TABLE OF CONTENTS

LIST OF TABLES

1 INTRODUCTION

1.1 Purpose

Signal Gold Inc. (Signal Gold) proposes to develop the Goldboro Gold Project (the Project) located near Goldboro, Guysborough County, Nova Scotia (NS). The Project will be operated by Goldboro Gold Mines Inc. (Goldboro Gold Mines), a wholly owned subsidiary of Signal Gold. The Project consists of conventional open pit mining operation and a 4,000 tonnes per day (tpd) processing facility based on a combined gravity and leaching circuit using carbon-in-pulp technology. The Project also includes an engineered, fully lined tailings management facility (TMF), three waste rock storage areas (WRSAs), till and organic material stockpiles, and associated infrastructure.

To facilitate development of the Project, there is a need to overprint or otherwise impact aquatic features that contain fish and/or provide fish habitat after all avoidance, minimization, and mitigation measures have been considered. As a result, the implementation of measures to offset these impacts are required. The purpose of this MDMER Schedule 2 Fish Habitat Compensation Plan and Fisheries Act Paragraph 34.4(2)(b) & 35(2)(b) Authorization Offset Plan (herein referred to as the Offsetting Plan) is to demonstrate that appropriate offsetting of fisheries impacts has been provided for by the Project.

This Offsetting Plan is intended to meet the information and documentation requirements set out under both Schedule 1: Section 16 of the Authorizations Concerning Fish and Fish Habitat Protection Regulations and Subsection 27.1(2) of the Metal and Diamond Mining Effluent Regulations (MDMER).

1.2 Proponent Contact Information

Name and Address of Owner
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Toronto, Ontario, Canada
M5C 2T6
Tel: (416) 304-6622, Fax: (416) 363-4567

Authorized Contact Person
Name: Deidre Puddister
Title: Vice President, Sustainability
Tel: (709) 689-8086
Email: dpuddister@signalgold.com

1.3 Regulatory Considerations

The Project requires both an Authorization under Paragraphs 34.4(2)(b) and 35(2)(b) of the *Fisheries Act*, and the amendment of Schedule 2 of the Metal and Diamond Mining Effluent Regulations (MDMER), pursuant to subsection 36(5) of the *Fisheries Act* before construction of certain works can commence.

The *Fisheries Act* prohibits the carrying out of any work, undertaking or activity, other than fishing, that results in the death of fish (other than fishing) and/or HADD of fish habitat. If a project cannot avoid, or is likely to cause, death of fish and/or HADD, then a *Fisheries Act* Authorization (FAA) is required. Based on the review of the Project EARD, DFO concluded that the Project requires authorization pursuant to paragraphs 34.4(2)(b) (death of fish) and 35(2)(b) (HADD of fish habitat) of the *Fisheries Act* in order to proceed. The Project is not likely to result in prohibited effects on listed aquatic species at risk, and as such no permit is required under the *Species at Risk Act* (File #22-HMAR-00377).

This Offsetting Plan is accompanying an application for an Authorization in accordance with the information requirements outlined in Schedule 1 of the Authorizations Concerning Fish and Fish Habitat Protection Regulations. The required components of the Offsetting Plan and relevant section references within this document are provided in Table 1-1.

Table 1-1. Schedule 1 of the Authorizations Concerning Fish and Fish Habitat Protection Regulations: Offsetting Plan Requirements

Schedule 1 Section 16 Offsetting Plan Requirements	Section Reference
(a) the geographic coordinates of the location where offsetting measures will be implemented	Section 5
(b) a small-scale site plan identifying the general location and boundaries of the location where the measures will be implemented	Section 5.2
(c) a detailed description of the measures and how those measures will meet their objectives	Section 5.2
(d) a detailed description of the monitoring measures that will be implemented to assess the effectiveness of the measures referred to in paragraph (c)	Section 6.3
(e) a detailed description of the contingency measures and associated monitoring measures that will be implemented if the measures referred to in paragraph (c) do not meet their objectives	Section 6.4
(f) a detailed description of any adverse effects on fish and fish habitat that could result from the implementation of the plan	Section 6. 2
(g) a detailed description of the measures and standards that will be implemented to avoid or mitigate the adverse effects and how those measures will meet their objectives	Section 6.2
(h) the timeline for the implementation of the plan	Section 6.1
(i) an estimate of the cost of implementing each element of the plan	Section 6.7

Schedule 1 Section 16 Offsetting Plan Requirements	Section Reference
(j) if the implementation of the plan requires access to lands, water sources or water bodies that are not owned by the applicant, a description of the steps that are proposed to be taken to obtain the authorization required for the applicant, the Department of Fisheries and Oceans and anyone authorized to act on the Department's behalf to access the lands, water sources or water bodies in question. This information is not required if the applicant is Her Majesty in right of Canada, Her Majesty in right of a province or the government of a territory.	Section 6.6

Subsection 36(3) of the *Fisheries Act* prohibits "anyone from depositing or permitting the deposit of a deleterious substance of any type in water frequented by fish, or in any place under any conditions where the deleterious substance, or any other deleterious substance that results from the deposit of the deleterious substance, may enter such water". The amendment to Schedule 2 of the MDMER specifically applies to the deposition of a deleterious substance resulting from the placement of mine waste (for this project, into the TMF). Any fish and fish habitat that may be subject to a MDMER Schedule 2 designation will be subject to a fish habitat compensation process. Section 27.1 of the MDMER requires fish habitat compensation to offset losses of fish habitat associated with the deposit of a deleterious substance into the water body(ies) that are added to Schedule 2. Subsection 27.1(2) states that the purpose of the Compensation Plan is to offset the loss of fish habitat resulting from the deposition of any deleterious substance into a tailings impoundment area and identifies the required components of the Compensation Plan. The required components of the Compensation Plan and relevant section references are presented in Table 1-2.

Table 1-2. MDMER Subsection 27.1(2): Compensation Plan Requirements

Section 27.1 (2) Compensation Plan Requirements	Section Reference
(a) a description of the location of the tailings impoundment area and of fish habitat that will be affected by the deposit	Summarized in Section 2.2 (fully described in FAA Application)
(b) a quantitative impact assessment of the deposit on fish habitat	Summarized in Section 3 (fully described in FAA Application)
(c) a description of the measures to be taken to offset the loss of fish habitat	Section 5.2
(d) a description of the measures to be taken during the planning and implementation of the compensation plan to mitigate any potential adverse effects on fish habitat that could result from the plan's implementation	Section 6.2

Section 27.1 (2) Compensation Plan Requirements	Section Reference
(e) a description of the measures to be taken to monitor the plan's implementation	Section 6.3
(f) a description of the measures to be taken to verify the extent to which the plan's purpose has been achieved	Section 6.3 and 6.4
(g) the time required to implement the plan that allows for the achievement of the plan's purpose within a reasonable time	Section 6.1
(h) an estimate of the cost of implementing each element of the plan	Section 6.7

Offsetting and compensation requirements for the FAA (subsections 34.4(2)(b) and 35(2)(b) of the *Fisheries Act*) and MDMER (subsection 36(5) of the *Fisheries Act)* as a result of the Project are presented collectively in this Offsetting Plan.

1.4 **Consultation and Engagement**

The offsetting projects described herein have been selected based on the advice and recommendations received from DFO, as well as through continued engagement the Mi'kmaq of Nova Scotia, municipal officials, and local community watershed and fisheries organizations.

1.4.1 Department Consultation

Goldboro Gold Mines has completed consultation with DFO to identify requirements for Authorization under the *Fisheries Act* and to prioritize offsetting projects for inclusion in the final Offsetting Plan. This final Offsetting Plan reflects the advice and recommendations received from DFO for both the Conceptual Fish Habitat Offsetting Plan as submitted with the EARD (June 2022) and subsequent Interim Offsetting Plan (submitted January 2023).

The Interim Fisheries Offsetting Plan was submitted to DFO outlining Goldboro Gold Mines's updated approach to fisheries offsetting based on feedback received from DFO in response to the Conceptual Offsetting Plan submitted with the EARD. Comments on the Interim Fisheries Offsetting Plan were received from DFO in March 2023 and a meeting with Goldboro Gold Mines and Project consultants followed to discuss the comments received. This final Offsetting Plan comprises those instream habitat restoration options noted by DFO as "appropriate for counterbalancing project impacts to fish and fish habitat. These methods have been demonstrated to be effective in meeting their objectives in Nova Scotia" (DFO comments March 17, 2023).

Goldboro Gold Mines has continued to consult with DFO through 2023 on the Project's effects assessment, HADD determination, and the submission of the FAA. These discussions are outlined in the FAA Application supporting document (McCallum Environmental, 2023).

1.4.2 Mi'kmaq of Nova Scotia

Engagement with the Mi'kmaq of Nova Scotia commenced prior to the EARD process and has continued through permitting and the selection and implementation of offsetting projects.

Goldboro Gold Mines commenced engagement with Mi'kmaq of Nova Scotia in 2017 to support the development of the Project and to commence dialogue relating to impacts to fish and offsetting requirements and potential offsetting project identification. Goldboro Gold Mines has reached out to individual community members who are familiar with the local landscape to identify local degraded fish habitat in need of restoration or enhancement in close proximity to the Project. Engagement related to fisheries offsetting has also included staff of the Kwilmu'kw Maw-klusuaqn Office (KMKNO), the Unama'ki Institute of Natural Resources (UINR), and Mi'kmaw Conservation Group (MCG). Mi'kmaq engagement specifically related to fisheries offsetting consisted of the following actions:

- In person meeting with Paqtnkek First Nation and KMKNO on November 19, 2019
- Teleconference with Jamie Lantz of the Mi'kmaq Conservation Group (MCG), December 13, 2019
- Email correspondence with Darryl McDonald from Paqtnkek First Nation on December 13, 2019, and January 7, 2020
- Virtual meeting with KMKNO July 15, 2021
- Virtual meeting with KMKNO August 17, 2021
- Virtual meeting with UINR on February 23, 2022, and follow up telephone conversations through 2022
- Meeting with Paqtnkek First Nation (Chief and Council and community meeting) on April 19, 2022
- Teleconference between MEL and MCG (Christian Francis) August 17, 2022, to discuss potential collaboration and implementation of a reef ball project
- Email correspondence from Goldboro Gold Mines to MCG introducing the company and invite to collaborate re fisheries offsetting, September 23, 2022
- Email correspondence between Goldboro Gold Mines and Kerry Prosper regarding potential fisheries offsetting on the Pomquet River, December 14, 2022
- Meeting with Paqtnkek First Nation (Kerry Prosper and Darryl MacDonald) regarding fisheries offsetting projects including the Pomquet River, January 12, 2023
- Meeting with Paqtnkek First Nation (Chief Corey Julian, Community Members, and Council Members) March 14, 2023, regarding fish and fish habitat impacts and fisheries offsetting, as well as opportunities for partnership and collaboration
- Email correspondence with MCG (Stephen Williams) March 17, 2023, regarding conceptual fish habitat and wetland offsetting options
- Virtual meeting with KMKNO March 22, 2023, with introduction to fisheries offsetting

- Open house in Paqtnkek First Nation April 26, 2023, with more than 50 local community members in attendance

- Email correspondence with We'koqma'q, Pictou Landing, Glooscap, Bear River, Acadia, Sipekne'katik, Paqtnkek, Eskasoni, Annapolis Valley, Membertou, Potlotek, and Wagmatcook First Nations on May 3, 2023, with general project information including fisheries impacts and offsetting projects

- Virtual meeting with KMKNO May 23, 2023, regarding fisheries offsetting projects

1.4.3 Other Engagement

Public engagement activities have occurred to support the EA process for the Project since early 2017. This includes community and virtual open houses, ongoing two-way information sharing with the Community Liaison Committee (CLC), and meetings with interested local stakeholders. Since submission of the EARD and subsequent approval, community engagement related to fisheries offsetting has continued.

In Fall of 2022, Goldboro Gold Mines initiated engagement with the Municipality of the District of Guysborough (MODG) and the Guysborough County Inland Fisheries Association (GCIFA) regarding potential offsetting projects throughout the region. Through this engagement, the restoration/creation of coastal eel grass habitat was identified as a potential fisheries offsetting opportunity of interest but was not brought forward into the final Offsetting Plan based on the advice and recommendations received from DFO.

The following engagement activities have occurred between the Project Team and interested local stakeholders in relation to fisheries offsetting:

- Email correspondence Charles Clattenburg from the Eastern Shore Wildlife Association on December 13, 2019, and January 7, 2020

- Email correspondence Jim Cameron, retired DFO officer, January 7, 2020

- Virtual meeting with Warren Parsons, president of the Friends of Taylor Head, retired DFO officer Jan 30, 2020

- Virtual meeting with St. Mary's River Watershed Association Representatives May 10, 2022

- Virtual meeting between MEL and MODG (Gordon MacDonald), October 21, 2022, to introduce fisheries offsetting portfolio of work and potential collaboration

- Email correspondence from MEL to GCIFA, November 1, 2022, introducing fisheries offsetting portfolio of work and potential collaboration opportunities

- Virtual meeting between the Project Team and MODG, November 1, 2022, to discuss fisheries offsetting opportunities

- Virtual meeting between the Project Team and GCIFA, November 10, 2022, to discuss potential fisheries offsetting collaboration

- Virtual meeting between the Project Team and GCIFA, December 1, 2022, to discuss potential eel grass restoration/creation projects

- Email correspondence with Clean Foundation December 2, 2022, regarding eel grass restoration opportunities
- Email correspondence with GCIFA December 5, 2022, regarding artificial reef structures and potential offsetting sites
- Virtual meeting with GCIFA April 5, 2023, to discuss Interim Fisheries Offsetting Plan and feedback received
- Open House in Goldboro April 27, 2023, with more than 100 attendees
- Virtual meeting with GCIFA May 17, 2023, to discuss offsetting project types and locations for inclusion in final offsetting plan

2 OVERVIEW OF THE PROJECT

A brief overview of the Project including location, and associated activities are provided in Sections 2.1 and 2.2. Detailed descriptions and schedules for each Project component, including technical drawings and specifications (issued for permitting), and sequencing of actions specific to each activity have been submitted with the Project's application for authorization under the *Fisheries Act*.

2.1 Project Location

The Project is located in Goldboro, Guysborough County, Nova Scotia, Canada, 175 km northeast of the city of Halifax, and 60 km southeast of the town of Antigonish. The Project Area (PA) is 1.6 km north of the community of Goldboro on the eastern shore of Isaacs Harbour (Figure 2-1). The PA is primarily disturbed by historical mining activities, road construction, and timber harvesting. The Fish Habitat Study Area (FHSA) for the Project includes all of the PA and the entirety of Gold Brook downstream to its confluence with Seal Harbour Lake (Figure 2-1). The FHSA is considered the spatial boundary for impacts to fish and fish habitat as a result of the Project.

The Goldboro area was an active and productive mining area from 1893 to 1958. There are historic workings as well as known environmental hazards throughout the area due to this history of mining. Locations that are known to have been used for tailings disposal during past milling operations have neither been contained nor remediated. Tailings migrated from the streams and wetlands where they were deposited into the downstream receiving environment (Gold Brook) and are likely to have a continued effect on fisheries resources.

The FHSA is predominantly found within the New Harbour/Salmon Primary watershed (1EQ), and the secondary shore direct watershed (1EQ-SD31, herein referred to as the "Gold Brook secondary watershed") (Figure 2-2). Gold Brook Lake is the predominant feature within the Gold Brook secondary watershed. It collects flow from Oak Hill Lake in the north and Rocky Lakes in the east. The Country Harbour primary watershed (1EP) overlaps a small portion of the western edge of the PA. Smaller fractions of the overall PA fall within additional secondary watersheds that drain to Issacs Harbour, Coddles Harbour, and New Harbour.

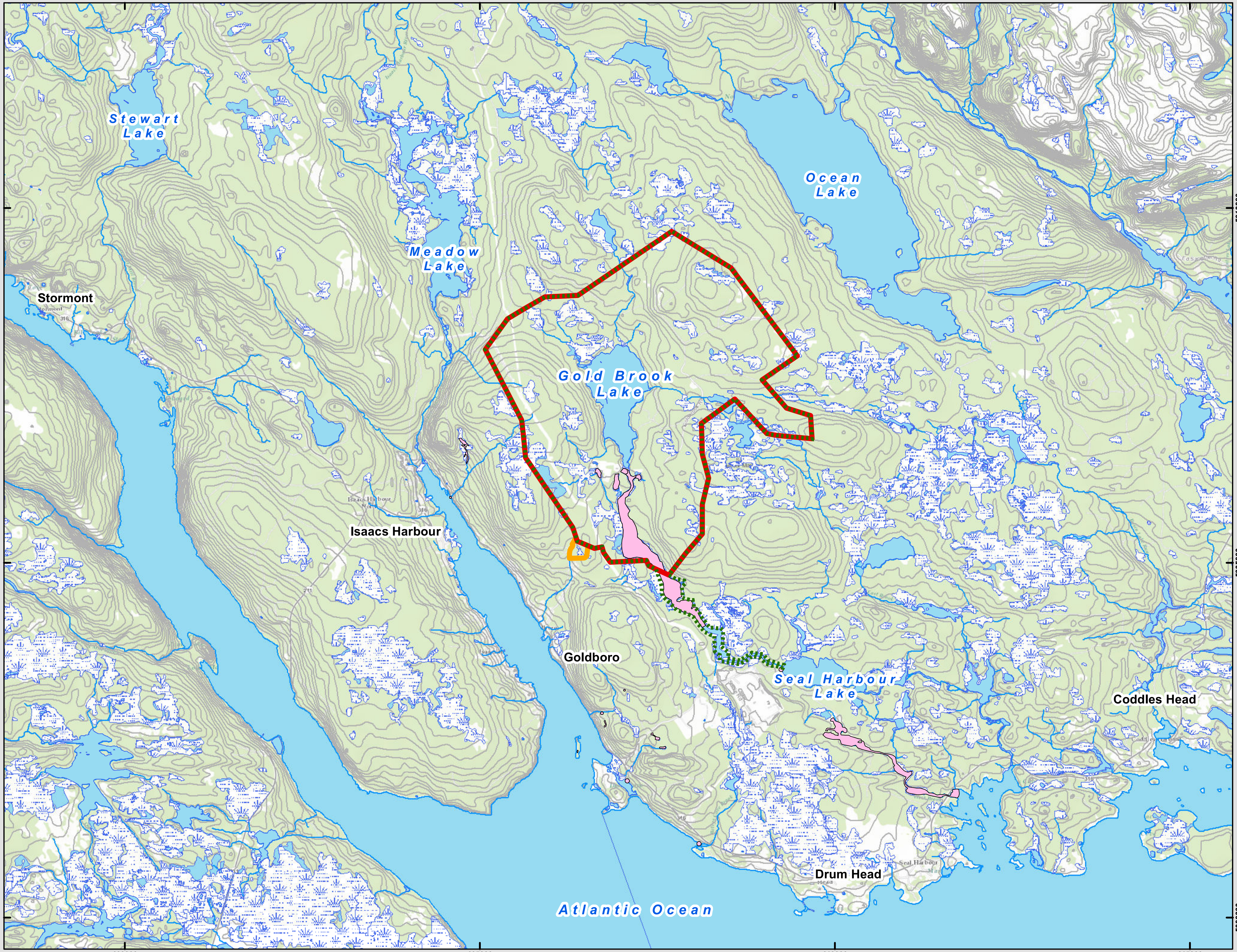

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FIGURE 2.1

Goldboro Gold Project
Study Area

Goldboro, Guysborough, NS

- NSTDB Mapped Watercourses
- Historic Tailings
- NSTDB Mapped Open Water
- NSECC Mapped Wetlands
- Fish Habitat Study Area
- Employee Accomodation Study Area
- Project Area

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 0.5 1 2 km

1:50,000 Scale when printed @ 11" x 17"

Drawn By: KF
Reviewed By: MMD
Date: 2023-06-23

McCallum Environmental Ltd.

Document Name: 230601_Study_Area

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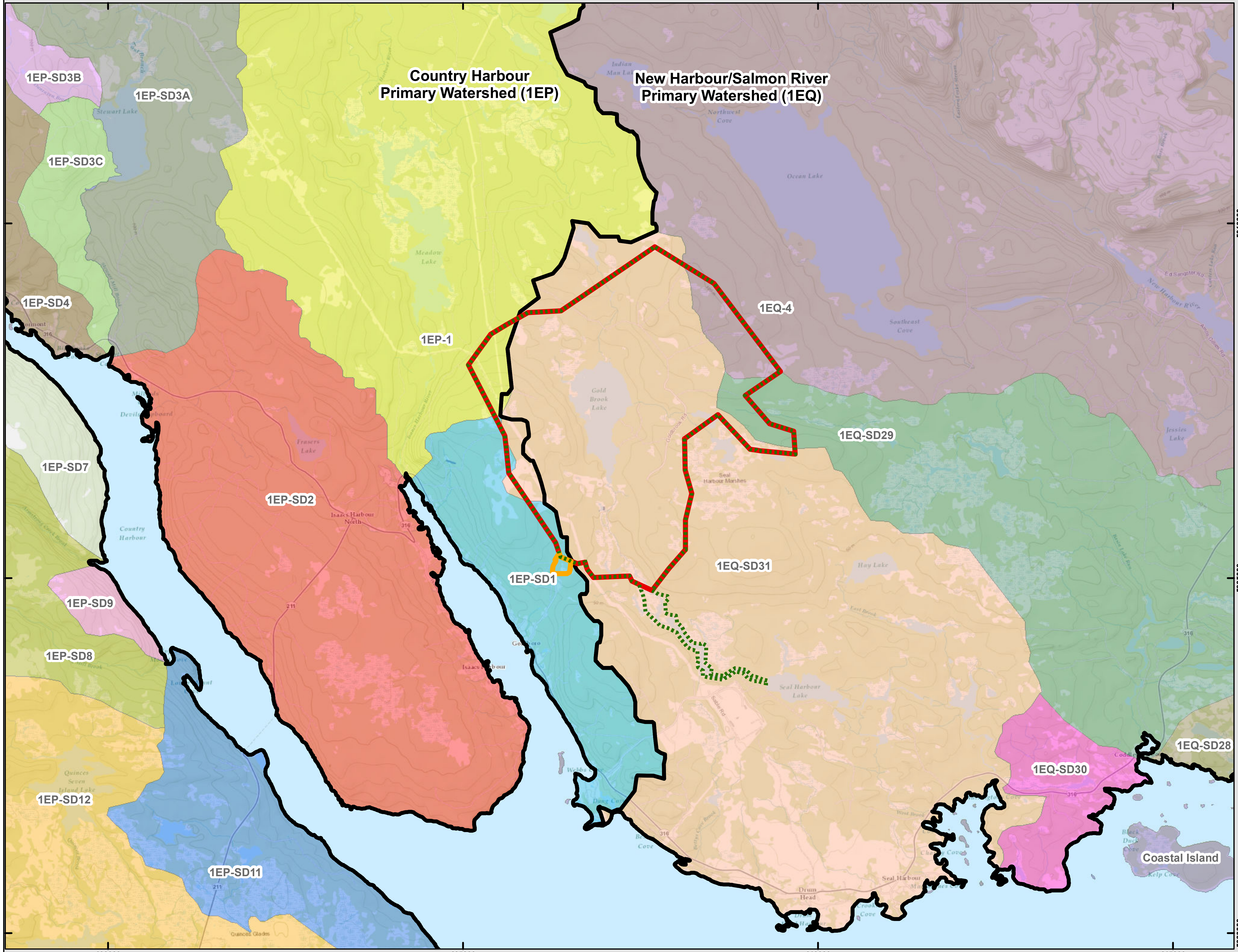
FIGURE 2.2

Goldboro Gold Project Primary and Seconday Watersheds

Goldboro, Guysborough, NS



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Units: Meter

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Drawn By: KF
Reviewed By: MMD
Date: 2023-06-23

McCallum Environmental Ltd.

Document Name: 230601_Watersheds

2.2 Proposed Work, Undertakings and Activities

Goldboro Gold Mines proposes to develop the Project as a 4,000-tonne per day mine and processing facility. The mine plan includes two open pits (East Pit and West Pit), an ore processing facility, a TMF, three waste rock storage areas (WRSAs), overburden and organic stockpiles, support buildings, and associated infrastructure. The anticipated mine life for extraction of ore is approximately 11 years.

The scope of the Project includes activities associated with construction, operation, and closure. Project timelines are discussed according to a numbered year system, where the construction phase is described as Years -2 and -1 and the operations phase begins in Year 1. Project infrastructure is shown on Figure 2-3. Project phases and schedules are summarized in Table 2-1.

Table 2-1. Planned Project Schedule

Activity/Milestone		Planned Schedule
Construction		Years -2 and -1
Operation	East Pit extraction	Years 1 through 8
	West Pit extraction	Years 1 through 11
Closure		Years 12 through 35

Project construction activities will include clearing and grubbing the overburden and organic stockpiles, WRSAs, pit, plant, and TMF areas, and construction of the initial lift of the TMF, plant site, secondary access roads, construction laydowns, Run-of-Mine (ROM) pad, surface water management and other site infrastructure. The operation phase will include conventional ore extraction methods (drilling, blasting, loading, and hauling), ore processing, and waste management. ROM ore will go directly to the crusher while stockpiled high-grade and low-grade ore will be progressively processed throughout the mine life. Non-ore bearing waste rock that isn't for construction or backfill, will be stockpiled in WRSAs, managed and reclaimed in place. The closure phase will include earthworks and demolition required to return the PA to a safe, stable, and vegetated state, and all monitoring and treatment, if required.

Stockpiles will be progressively capped throughout the Project and as such, active closure (i.e., capping of all stockpiles and removal of all unnecessary infrastructure) will be completed by 2038. Following the conclusion of active closure, the only remaining work to be completed will consist of the filling of the West and East Pits, which will be completed passively by directing water from the central settling pond and the east settling pond, respectively (and through groundwater inflow and precipitation). Following active closure in 2038, no active water treatment is required. Based on the predictive water quality analysis completed for the Project, active water treatment is anticipated to be required to remove metals and cyanide from effluent in the first two years of the closure phase (Years 12 and 13). Passive water treatment methods are proposed for Years 14 through 18 and will be applied at the TMF, north settling pond, and southeast settling pond. The TMF, north, and southeast ponds will be operational until water quality monitoring demonstrates that the systems are no longer required to treat discharge prior to entering Gold Brook Lake or Gold Brook.

Construction start is anticipated in February 2025, commissioning in 2026, operations until 2037, and initiation of closure in 2038. Preparation and construction for the Project is anticipated to begin in 2025 and will continue into 2026. Unless otherwise specified, all impacts to fish and fish habitat are expected to be permanent. The majority of earthworks associated with the construction phase will occur in 2025. All permanent loss of fish habitat will occur during the earthworks phase of construction.

Avoidance of impacts to fish and fish habitat was considered as a primary constraint to infrastructure placement. Throughout the iterative process of developing the current Project infrastructure layout, avoidance of effects to fish habitat was attained through several key design considerations. To that end, all till and organic stockpiles, WRSAs, employee accommodations, mill areas and water treatment ponds have been placed in a manner to avoid direct impacts to fish habitat. Further details on project-specific avoidance and mitigations measures are provided in Section 3.

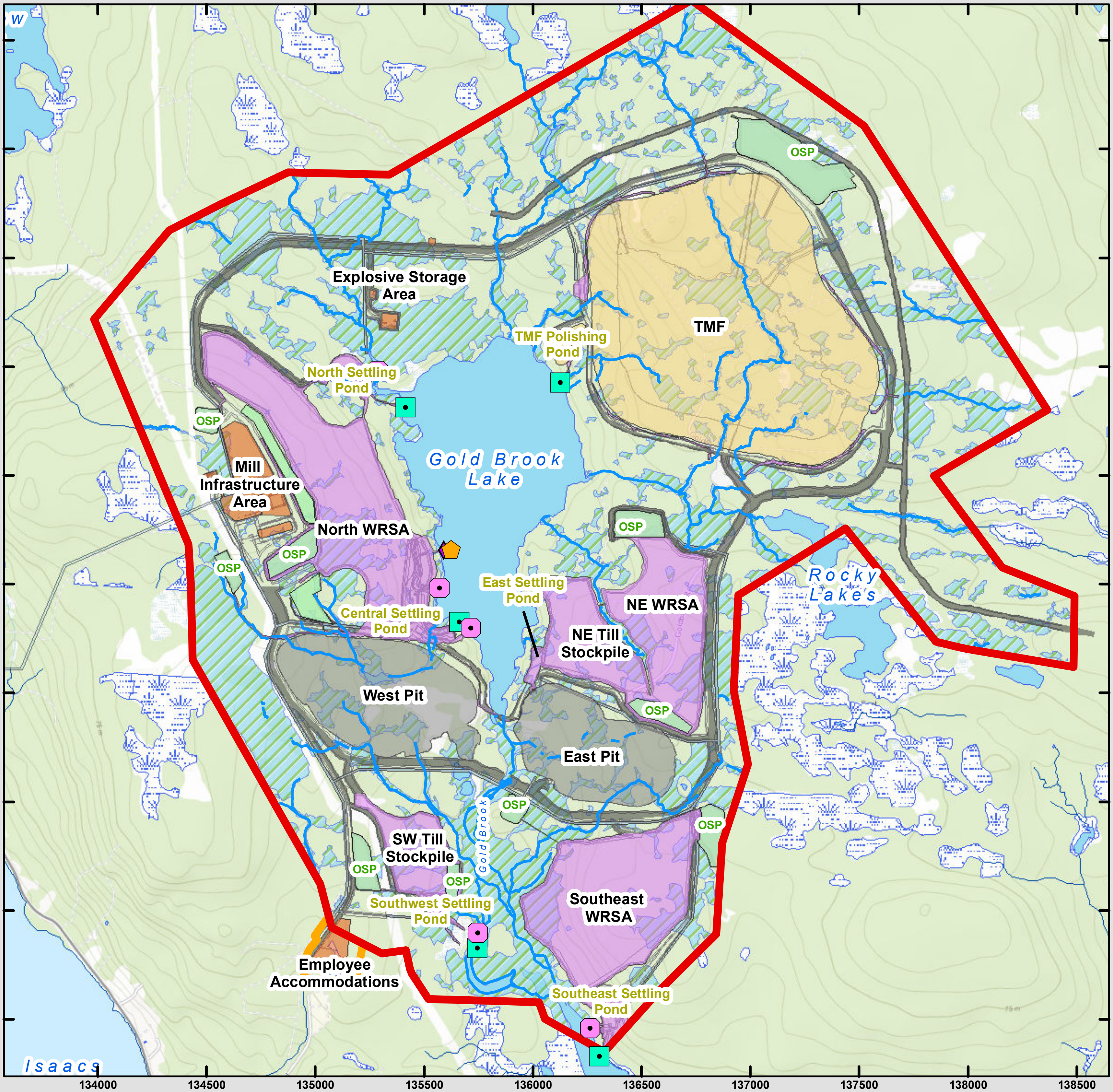

FIGURE 2.3

Goldboro Gold Project

Project Infrastructure

Goldboro, Guysborough, NS

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Discharge

Intake

Pump House

Emergency Spillway

Organic Stockpile (OSP)

Proposed Site Road

Mill Infrastructure Area

Pit

Power line

Tailings Management Facility (TMF)

Waste Rock Storage Area (WRSA)

Employee Accomodation Study Area

Project Area

Prepared By: KF
Reviewed By: MMD

Date: 2023-08-23

Coordinate System: NAD 1983 UTM Zone 21N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter

0 0.25 0.5 1 km

1:25,000 Scale when printed @ 11" x 17"

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2.3 Description of Fish and Fish Habitat

The PA comprises sixty-six field delineated watercourses and two hundred and twenty-three (223) wetlands (Figure 2-4). Gold Brook Lake is the central waterbody in the PA, draining to the south through Gold Brook. Rocky Lake, located at the eastern extent of the PA, is a small headwater system that drains west to Gold Brook Lake. Additional open water features identified include two historic settling ponds, Beaver Pond (located within WL18), and portions of Gold Brook where it opens into wide open flat habitat. Furthermore, two wetland mosaics and two watercourse mosaics were identified along Gold Brook. For portions of Gold Brook that diverged and converged multiple times within a relatively small area, the extent of the complex was mapped and called a “watercourse mosaic.” These watercourse mosaics are shown on a map as a polygon but are comprised of dozens of small (sometimes under 1 m) branches.

In complex perennial wetland systems that have bilateral flow with the watercourse, the extent of the wetted wetland was delineated and called a “wetland mosaic.” These areas are dominated by non-defined channels and permanent standing water, interspersed with vegetative cover exceeding 50%.

All watercourses (linear), waterbodies (lentic), and mosaics within the FHSA are considered to provide fish habitat, regardless of whether they are proven to be occupied by fish. In an effort to make conservatively inclusive decisions in the effects assessment, even those watercourses which lack connectivity to known fish bearing streams (i.e., WC99, WC57, WC69, etc.) are included as fish habitat and considered in the Offsetting Plan if a Project interaction is proposed. The only wetlands identified as fish habitat within the PA are described as wetland-fish habitat mosaics (see definition above). All other wetlands were terrestrial in nature, lacking standing water that would support fish. Where fish habitat is present in a watercourse that flows through a wetland in an entrenched channel, that habitat is described in the context of the watercourse.

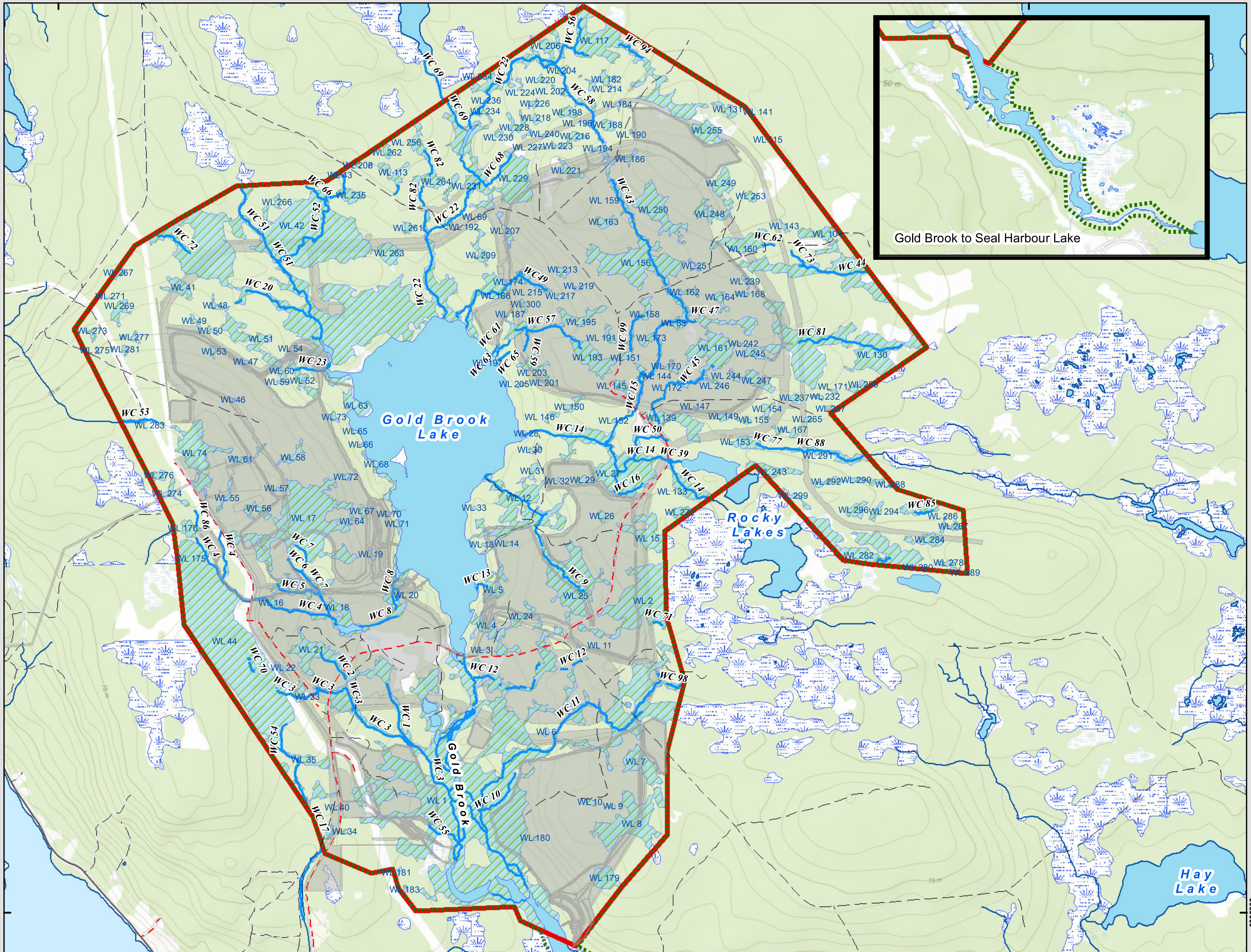

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FIGURE 2.4

Goldboro Gold Project Field Delineated Watercourses and Wetlands

Goldboro, Guysborough, NS

- Gravel Road
- Paved Road
- Access Road
- Field Delineated Watercourses
- NSTDB Watercourses Outside the PA
- Field Delineated Wetlands
- Open Water
- NSECC Wetlands Outside the PA
- Project Infrastructure
- Fish Habitat Study Area
- Project Area

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 0.25 0.5 1 km

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Drawn By: KF
Reviewed By: MMD Date: 2023-06-16

McCallum Environmental Ltd.

Document Name: 230601_WC_WL_Field

2.3.1 Fish Community

Fish collection efforts within the PA have involved thousands of trapping hours (minnow, traps, fyke nets, and eel pots) and over 1,500 minutes of qualitative electrofishing and 1,098 minutes of quantitative electrofishing. A total of six fish species were confirmed to inhabit the PA, including: yellow perch (*Perca flavescens)*, American eel (*Anguilla rostrata)*, brook trout (*Salvelinus fontinalis)*, golden shiner (*Notemigonus crysoleucas)*, banded killifish (*Fundulus diaphanous*), and blacknose shiner (*Notropis heterolepis*).

Throughout the 2020-2021 extensive fish collection program, 30.1% of caught fish were yellow perch and 29.6% American eel, representing almost 60% of the total catch for all fishing efforts. Brook trout and golden shiner were less frequently represented, accounting for 21.7% and 10.2% of the total catch, respectively. Banded killifish and blacknose shiner were the least represented fish, accounting for 7.0% and 1.4% of all fish caught. Size-distribution graphs are provided in Figure **2-5** Figure **2-8**.

All yellow perch captured within the PA were captured in Gold Brook Lake and Gold Brook (Figure **2-7**). American eel was the most widely distributed species and captured in Gold Brook; Gold Brook Lake; Rocky Lake; Eastern, Northern, and Western Tributaries; WC1; WC8, and WC9. Gold Brook accounted for the majority of individuals (72%) and widest range of lengths, with sizes ranging from 30 – 790 mm (Figure **2-6**). Smaller class sizes of eel were concentrated within lotic tributaries to Gold Brook Lake and within Gold Brook, while more infrequent, larger class sizes were noted in lacustrine systems (Gold Brook Lake and Rocky Lake).

Brook trout were captured in Gold Brook; Gold Brook Lake; the Eastern, Northern, and Western Tributaries; WC1; WC9; and WC49, ranging in lengths from 20 mm to 260 mm. The highest abundance and widest range of lengths was documented in the Eastern Tributary to Gold Brook Lake (comprising captures from WC14 and WC15). The Eastern Tributary also had the greatest occurrence of young of year (YOY), accounting for approximately 88% of all YOY trout captured less than 89 mm total length. YOY trout were also present in the Western Tributary, Northern Tributary, and WC1, but less frequently. Brook trout representing the largest class sizes (200 mm +) were limited to a few individuals present in Gold Brook, Gold Brook Lake, and the Western Tributary (Figure **2-5**).

Banded killifish, golden shiner, and blacknose shiner were documented exclusively within Gold Brook, Gold Brook Lake, and Rocky Lakes (Figure **2-8**). Killifish were relatively evenly distributed between Gold Brook and Gold Brook Lake. Gold Brook Lake had the greatest occurrence of banded killifish within the smallest class size (20 mm), which is likely indicative of higher recruitment within this system. Blacknose shiner were exclusively caught in Gold Brook Lake, occupying two length classes (20 and 30 mm). Golden shiner was captured in all three noted systems, with Gold Brook accounting for only one individual. The highest abundance and length class range was in Rocky Lake, where sizes ranged from 40 to over 140 mm. Gold Brook Lake had lower abundance of golden shiner, with individuals concentrated within large size classes (110 mm +).

Atlantic salmon (*Salmo salar)* are not expected to be present within the Gold Brook Lake watershed. Environmental DNA results were consistent with expectations of Atlantic salmon distribution based on site knowledge, historical knowledge and fish collection efforts to date, with no Atlantic salmon being detected within the Gold Brook Lake watershed. Atlantic salmon DNA was detected within the adjacent New Harbour River Secondary Watershed as anticipated.

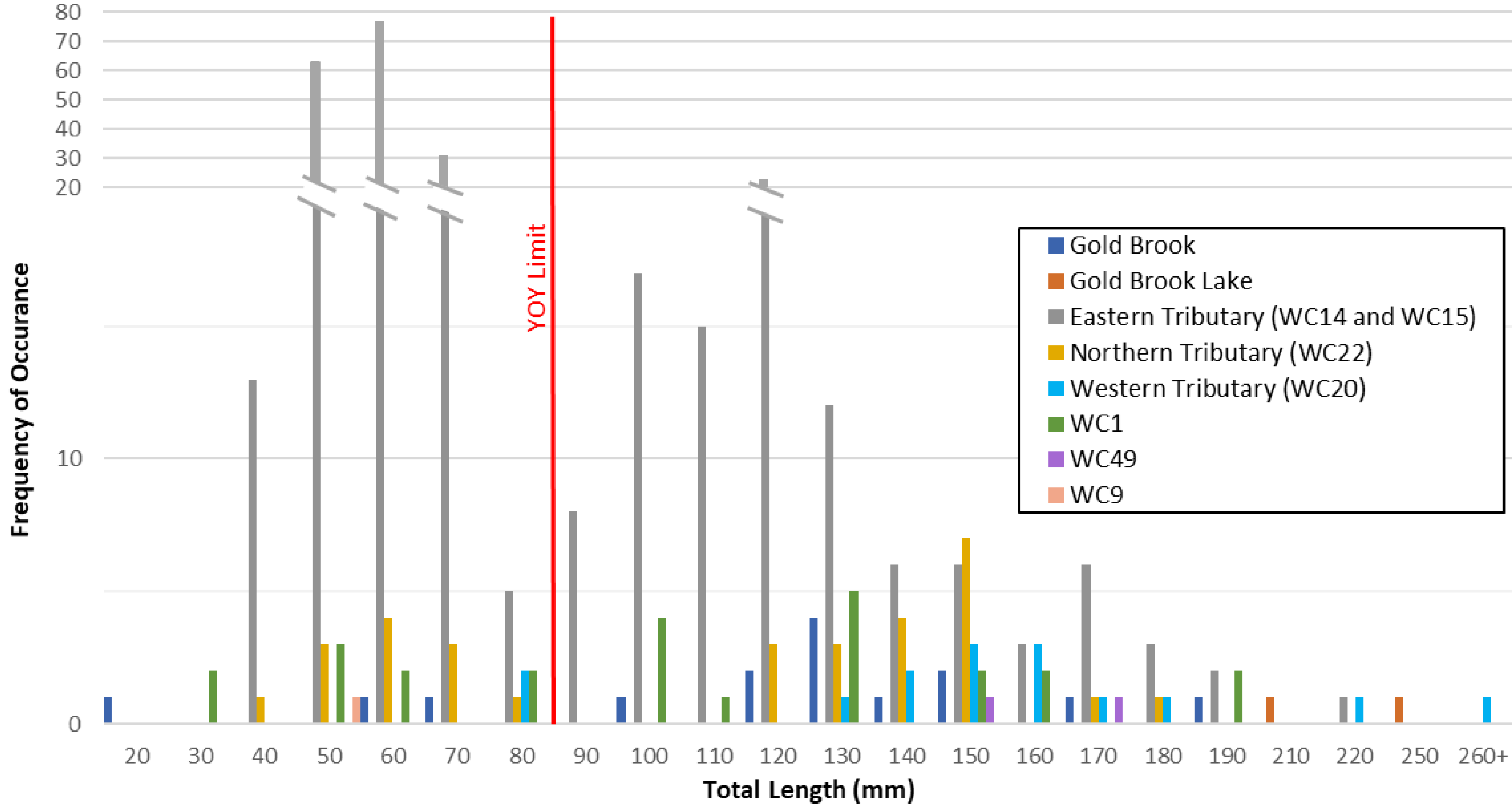

Figure 2-5. Brook trout size distribution by system

Note: YOY total length limit was derived from fork length limit (85 mm) through a regression analysis of length data collected through fish surveys. Regression equation: total length (mm) = 1.041 (fork length (mm)) + 0.7194, with $R^2 = 0.99$.

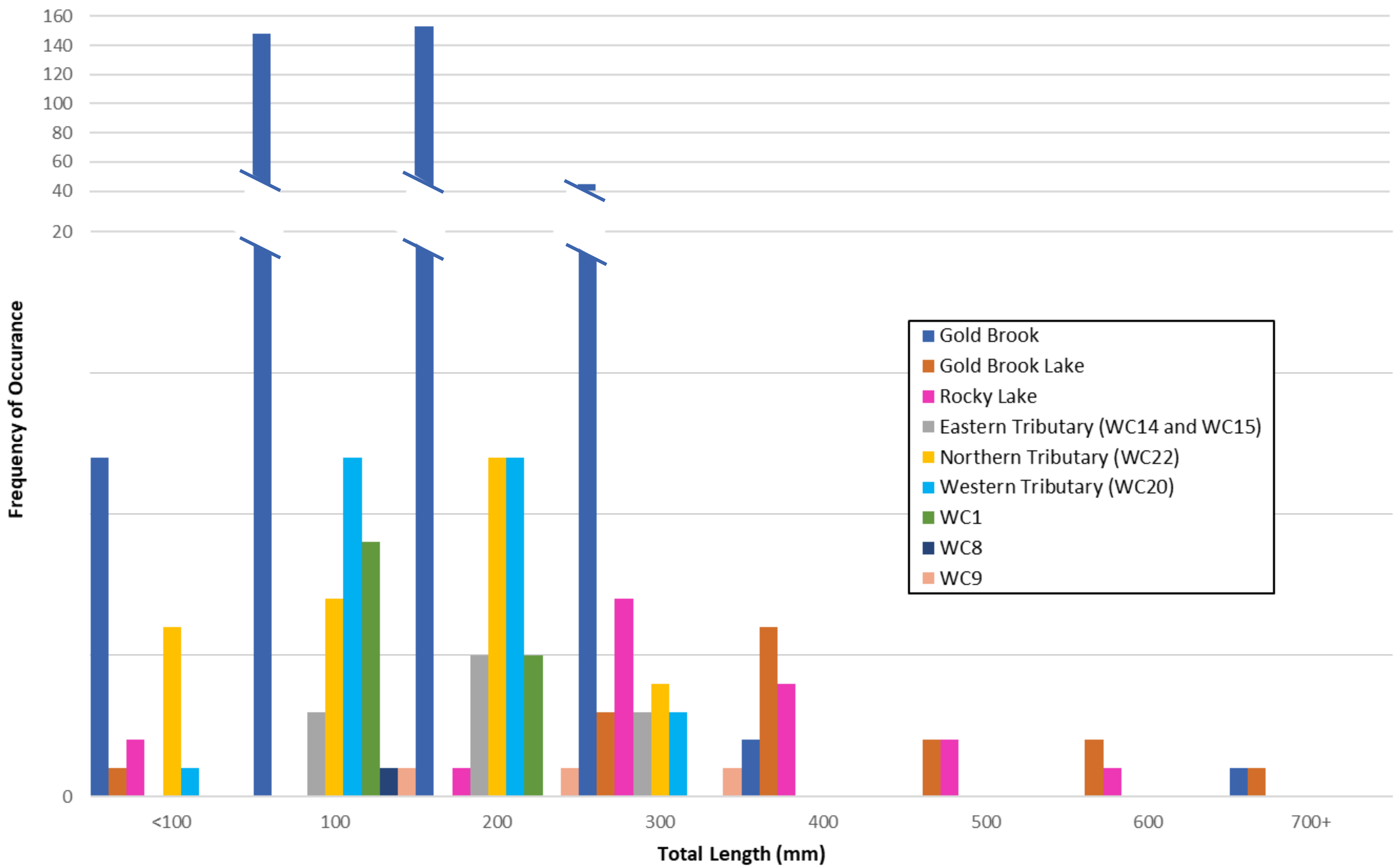

Figure 2-6. American eel size distribution by system

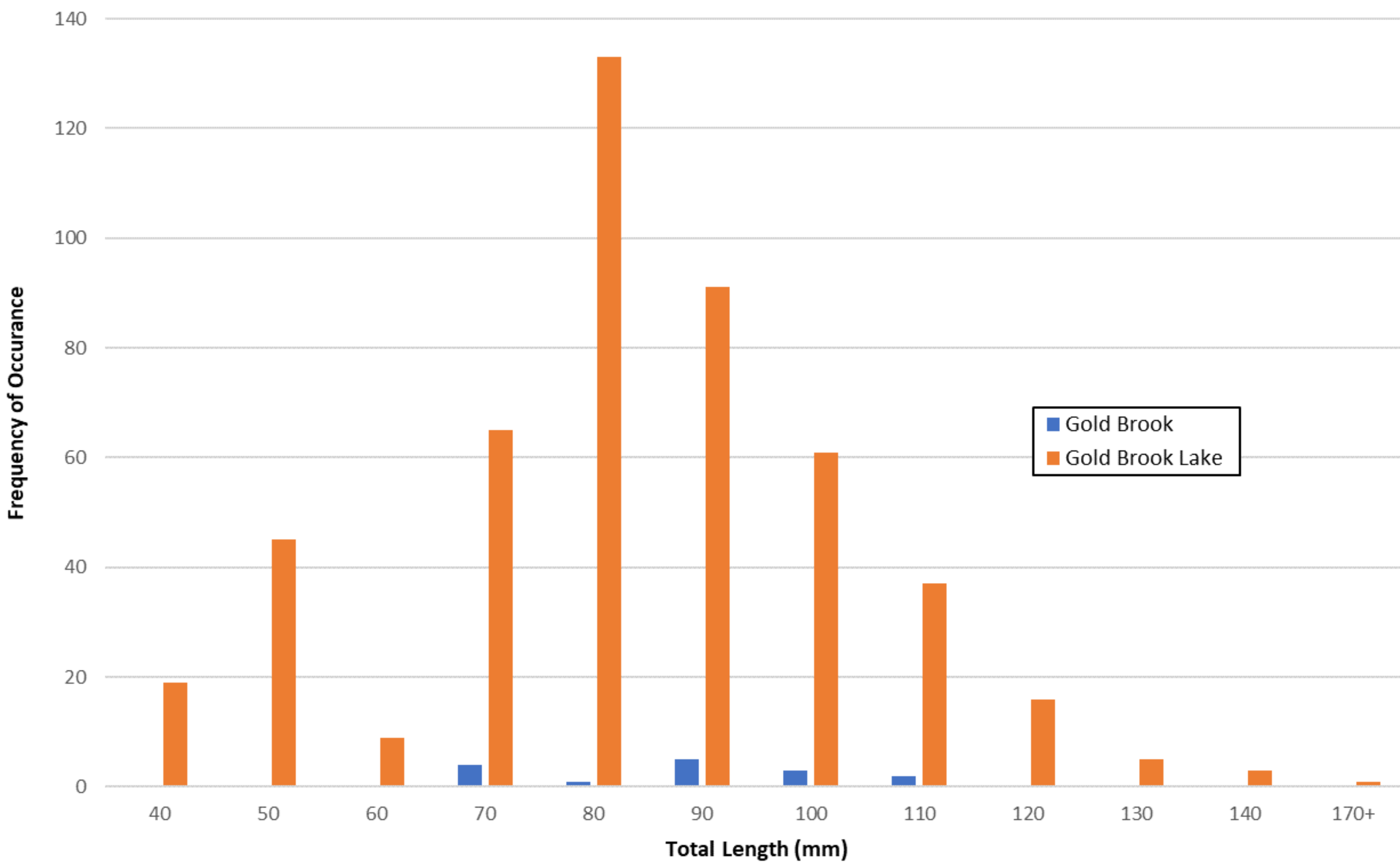

Figure 2-7. Yellow perch size distribution by system

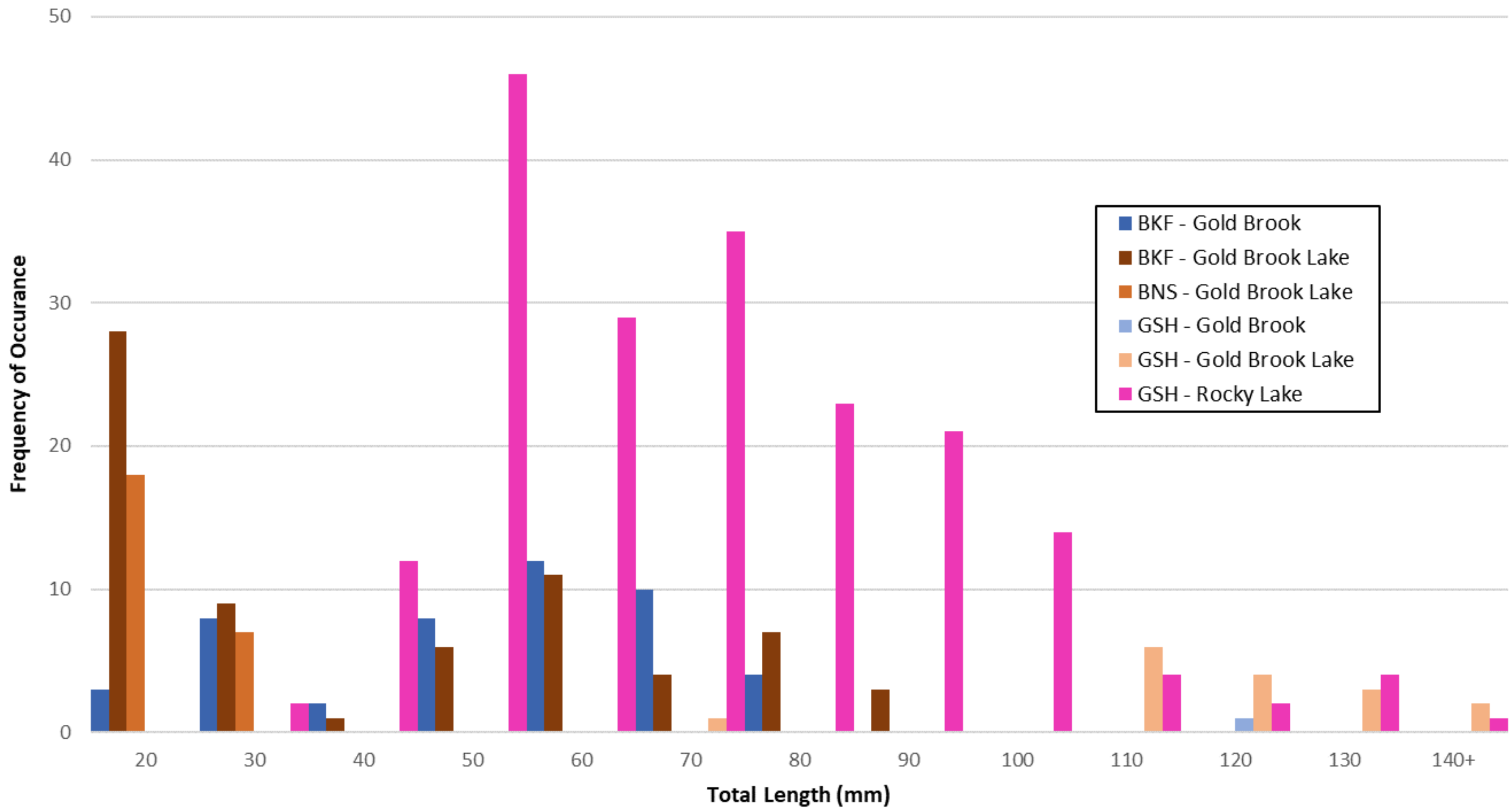

Figure 2-8. Banded killifish (BKF), blacknose shiner (BNS), and golden shiner (GSH) size distribution by system

2.3.2 Habitat Characterization

The aquatic ecosystem within the PA is characterized by acidic conditions, with a site-wide average pH of 4.98 (ranging from 3.89-7.71). Low pH values are common to the Southern Uplands region and fish species within the PA (American eel, brook trout, and yellow perch) are relatively tolerant of acidic conditions. The thermal regimes of Gold Brook Lake and the upstream reaches of Gold Brook are described as cool-warm to warm, and outside of the preferred range of coldwater species like salmonids. Colder thermal regimes have been identified within the Western and Northern tributaries to Gold Brook. In-situ temperature measures within smaller, first and second order streams generally remain within suitable temperature range for salmonids. Aquatic habitats within the PA support a diversity of aquatic macroinvertebrates that represent a range of tolerances to water quality and organic pollution values.

Aside from Gold Brook, watercourses within the PA are primarily first and second order intermittent and perennial streams. Fish habitat viability and accessibility within these systems are partially restricted by seasonally low water levels and resultant obstacles to fish passage. These aquatic features primarily provide suitable YOY and juvenile rearing habitat for brook trout and juvenile American eel, as well as foraging opportunities for adult life stages. The Eastern and Northern tributaries to Gold Brook Lake and Gold Brook are considered the only aquatic features providing major passage routes to upgradient aquatic habitats (Rocky Lakes, Oak Hill Lake, and Gold Brook Lake, respectively).

Although ideal brook trout spawning habitats were scarce within the FSHA (i.e., clean gravels over areas of upwelling), the presence of YOY would suggest that Brook trout are spawning within or in the vicinity of the FHSA. Witzel and MacCrimmon (1983) note that brook trout in southwestern Ontario have been found to spawn over suboptimal substrate (silt and detritus) providing there is groundwater seepage; at this fine spatial scale, spawning habitat would be difficult to detect during standard fish habitat surveys. Thermal imaging work conducted throughout the PA identified only one apparent groundwater seep in Wetland Mosaic B (Gold Brook). Optimal brook trout habitat with potential for spawning (based on extremely low occurrences of preferred spawning substrates within the PA) was infrequent and mapped only within select reaches of the Eastern Tributary to Gold Brook Lake and Gold Brook (Figure 2-9). Still, it is anticipated that spawning habitat would be likely near systems where YOY brook trout were captured (e.g., Eastern, Northern, and Western Tributaries, WC1, and Gold Brook).

Optimal American eel habitat was more widespread within the FHSA, including portions of the Western and Eastern tributaries, WC9, WC11, WC49, the lower reaches, open water sections of Gold Brook, and Gold Brook and Rocky Lakes (Figure 2-10). This is a function of the muck-dominated beds of aquatic features within the FHSA which allow for burrowing. Habitat suitability for American eel is considered high across the PA; consequently, the quantification of HADD is reflective of this suitability. Through a conservative approach to impact quantification, all fish habitat impacted has been considered to provide highly suitable habitat for American eel. And thus, no adjustments were made to fish habitat quantifications to account for reduced habitat suitability. The methods to quantify HADD are discussed further in Section 3.

Other species confirmed or potentially residing in the PA are generally restricted to low velocity areas within Gold Brook Lake, Gold Brook, and Rocky Lakes.

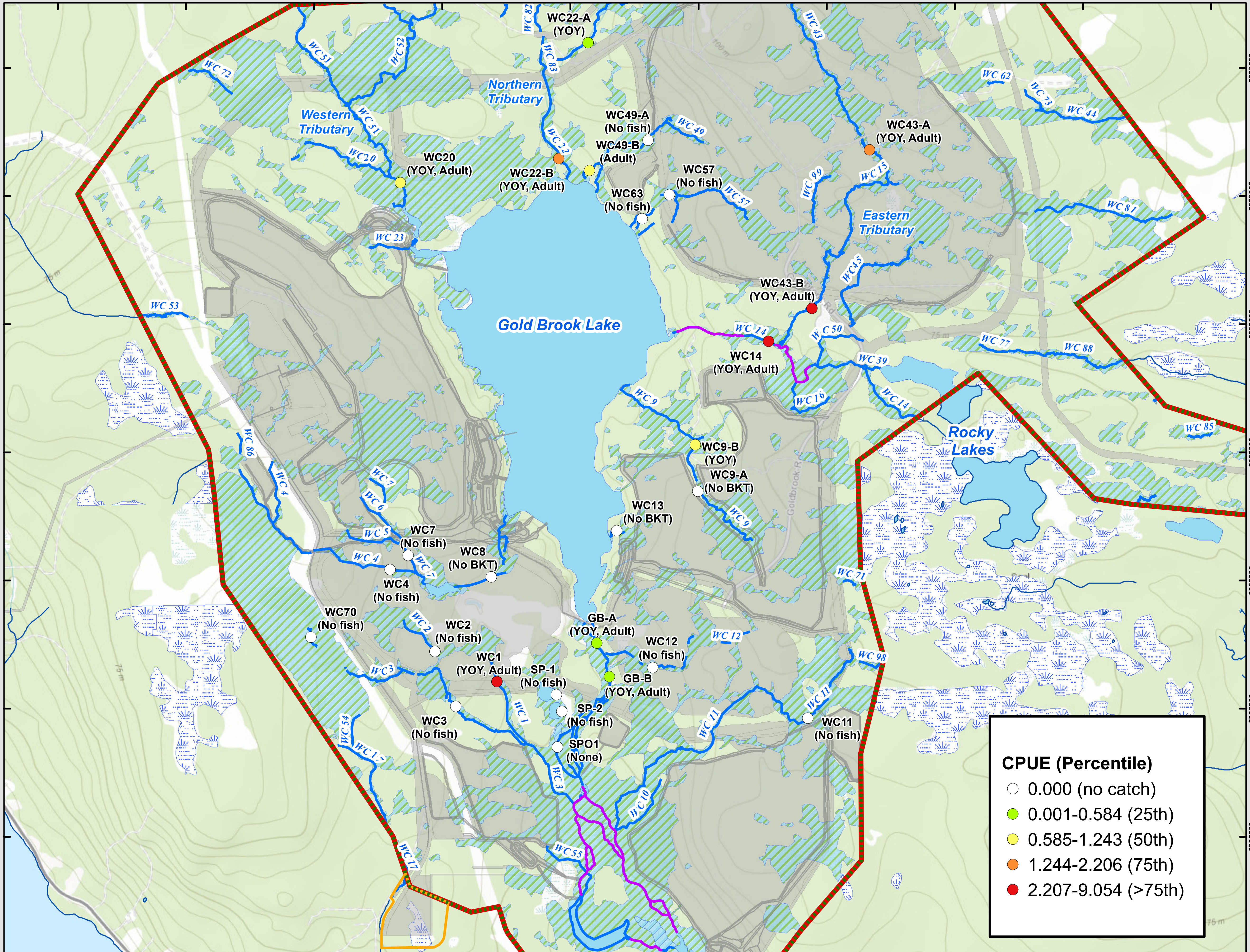

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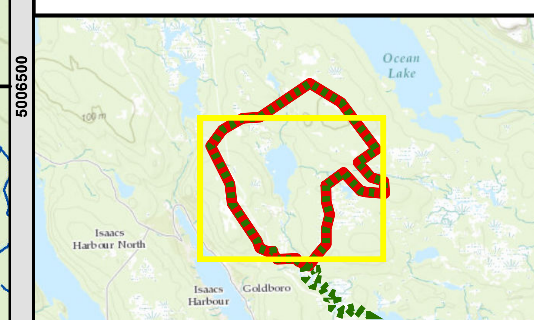
FIGURE 2.9

Goldboro Gold Project Brook Trout Spatial Distrubtion and Abundance (CPUE)

Goldboro, Guysborough, NS

- Optimal BKT Habitat
- Delineated Watercourses
- NSTDB Watercourses Outside the PA
- Project Infrastructure
- Field Delineated Wetlands
- Open Water
- Watercourse Mosaic
- Wetland Mosaic
- NSECC Wetlands Outside the PA
- Fish Habitat Study Area
- Employee Accomodation Study Area
- Project Area



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

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Drawn By: AS
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Project Number: 22-670
Date: 2023-06-23

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Document Name: 230511_BKT Dist Abun

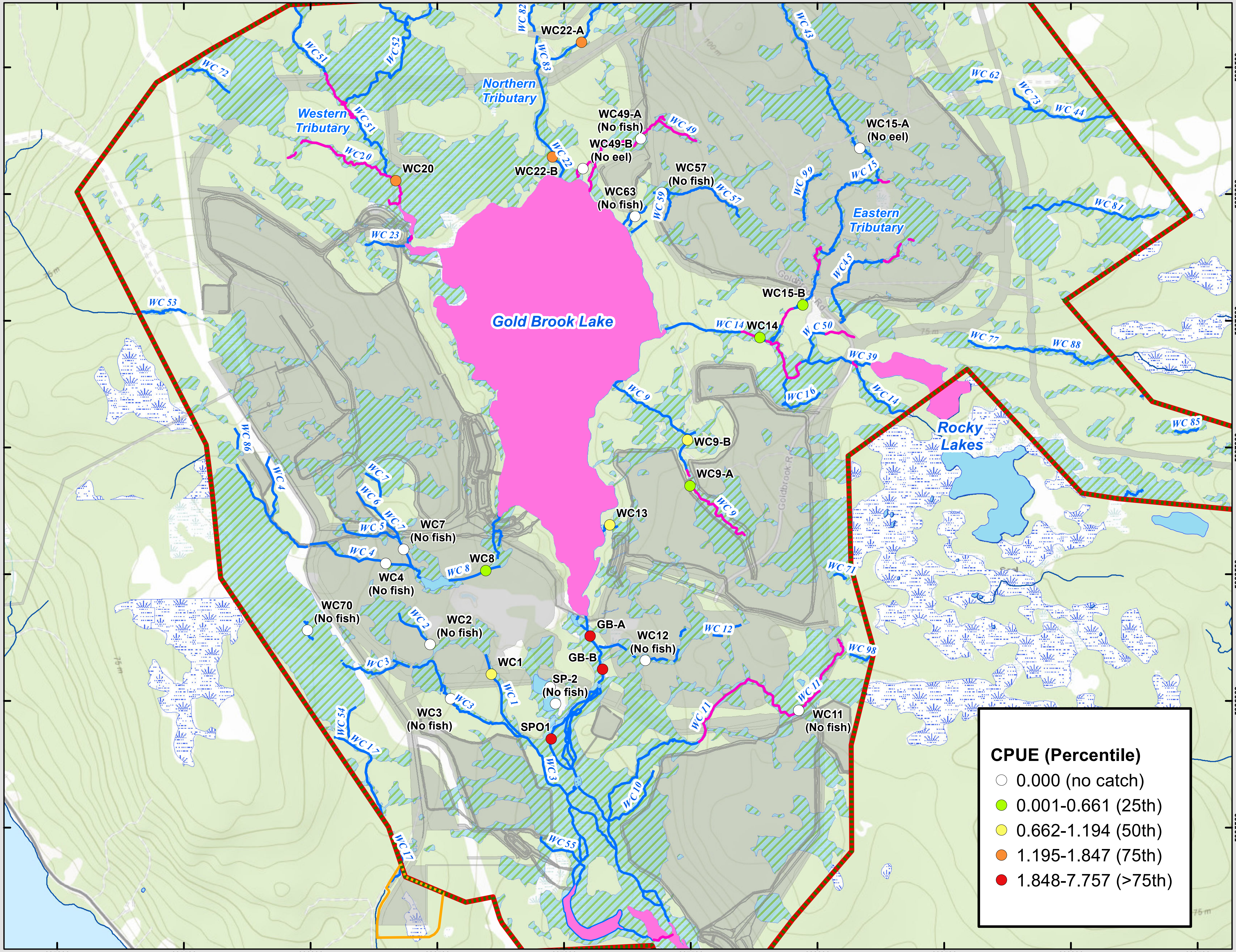

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FIGURE 2.10

Goldboro Gold Project
American Eel Spatial Distrubtion and Abundance (CPUE)

Goldboro, Guysborough, NS

- Optimal EEL Habitat
- Delineated Watercourses
- NSTDB Watercourses Outside the PA
- Optimal EEL Habitat
- Project Infrastructure
- Field Delineated Wetlands
- Open Water
- Watercourse Mosaic
- Wetland Mosaic
- NSECC Wetlands Outside the PA
- Fish Habitat Study Area
- Employee Accomodation Study Area
- Project Area

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
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Drawn By: AS
Reviewed By: MMD

Project Number: 22-670
Date: 2023-06-23

McCallum Environmental Ltd.

Document Name: 230609_EEL Dist Abun

3 SUMMARY OF IMPACT ASSESSMENT

The assessment of potential impacts of the Project on fish and fish habitat was completed using a combination of effects assessment methods to evaluate the complex suite of potential effects resulting from a number of interrelated pathways. Potential pathways of effects were identified based on guidance from Sergeant et al. (2022) and DFO's Pathways of Effects (DFO, 2018b).

The effects assessment considered five categories of impacts encompassing both direct and indirect effects, including:

- Permanent loss of aquatic habitat from infrastructure placement, substantial direct impacts to headwaters, and/or upstream habitat isolation;
- Changes to surface flow and baseflow (i.e., groundwater contributions) from a combination of mine site surface water management, groundwater drawdown, and changes to contributing drainage areas;
- Changes to water temperature from reductions in baseflow, mine site discharge, and loss of wetland habitat; and,
- Changes to water levels within Gold Brook and Gold Brook Lake as a result of pit development.

Other pathways of effects (e.g., blasting, sediment release) were identified in the FAA and evaluated but determined, with appropriate and well understood mitigation measures, to not require a detailed effects assessment.

The overall objective of effects assessment was to identify anticipated effects on fish and fish habitat that are likely to result in the death of fish or the HADD of fish habitat, as well as to identify further mitigation measures, where appropriate. As outlined in the Fish and Fish Habitat Protection Policy Statement (DFO, 2019a), "the Department interprets "harmful alteration, disruption or destruction" as any temporary or permanent change to fish habitat that directly or indirectly impairs the habitat's capacity to support one or more life processes of fish." When applicable, project-related effects have been described based on the definitions of Harmful Alteration, Disruption, and Destruction provided within DFO's fish habitat management policy in increasing order of severity (DFO, 2006):

- Disruption - Any change to fish habitat occurring for a limited period that reduces its capacity to support one or more life processes of fish.
- Harmful alteration - Any change to fish habitat that reduces its long-term capacity to support one or more life processes of fish but does not permanently eliminate the habitat.
- Destruction - Any permanent change of fish habitat that renders it completely unsuitable for future production of fish, regardless of the means employed in causing the change (e.g., by removal, infilling, blockage etc.).

The effects assessment was performed for mining activities through each Project phase (construction, operations, and closure), with specific years within these phases selected (e.g., West Pit end of mine (EOM)) to evaluate the temporal duration of impacts or "worst-case scenario". The spatial scope for the effects assessment was defined as the FHSA (Figure 2-1). The FHSA includes areas downstream of the PA where Project related effects to fish and fish habitat are reasonably expected to occur (i.e., the full extent of Gold Brook). Boundaries for the FHSA were defined considering the maximum expected extent of direct and indirect impacts to the aquatic environment, as well as the type and location of Project activities in each watershed. Brook trout and American eel were selected as key indicator species to evaluate potential effect to fish and fish habitat. Both species are highly mobile, widely distributed in the FHSA, and may use a range of habitats to fulfil life processes. As such, they are considered to provide a good measure of the overall impacts and pressures to fish and fish habitat within the FHSA.

A biological interpretation of the scale of effects to fish and fish habitat for each pathway of effect (low, moderate, or high-negative effect) was completed for each system assessed and was subsequently used to inform proposed offsetting ratios. The scale of effect was determined by a team of fisheries biologists in consideration of a holistic set of factors carried forward through the effects assessment process, including the magnitude, timing, duration, frequency, and spatial extent of the impacts; the existing fish community and function of existing fish habitat; and habitat requirements per life stage.

A summary of anticipated potential effects to fish and fish habitat is presented in Section 3.1. A fulsome description of the effects assessment methods and results are provided in the FAA Application supporting document (McCallum Environmental, 2023).

3.1 Summary of Project Interactions and Potential Effects

Table 3-1 provides a summary of all Project-related impacts. These impacts are summarized in Sections 3.1.1 through 3.1.4. The magnitude, duration, timing, and spatial extent of the impacts are provided by aquatic system. Based on infrastructure placement and the model-based predicted effects, the probability of these impacts occurring are considered high. However, it should be noted that the models are built with layers of conservatism, and thus impacts to fish and fish habitat may be over-represented. Project-related impacts to fish and fish habitat are displayed on Figure 3-1

Table 3-1. Summary of Project-related impacts to fish and fish habitat

System	WC#	Description of the Potential Effect (s)	Magnitude	Timing	Duration	Spatial extent (m^2)
-	WC1, WC2, WC3, WC4, WC5, WC6, WC7, WC8, WC11, WC12, WC13, WC15, WC16, WC23, WC43, WC45, WC47, WC49, WC50, WC55, WC57, WC59, WC61, WC63,	Permanent loss of aquatic habitat	H	Year -2	Permanent	17,877 (of which 2,707 to be compensated as per MDMER)

System	WC#	Description of the Potential Effect (s)	Magnitude	Timing	Duration	Spatial extent (m^2)
	WC65, WC86, WC99 Beaver Pond Settling Pond Open Water (Gold Brook)					
Eastern Tributary	WC14 WC16 WC50	Change in flow regime	M-H	Year -2	Permanent	3,234
		Change in temperature	M-H			
Western Tributary	WC19 WC20	Change in flow regime	L	Year -2	Permanent	3,623
WC9	-	Change in flow regime	H	Year -2	Permanent	1,097
		Change in temperature	H			
Gold Brook Tributaries (WC3, WC10, WC11, WC55)	WC3 WC10 WC11 WC55	Change in flow regime	H	Year -2	Permanent	1,566
		Change in temperature	H			
Upper Gold Brook (Lake Outlet and GB-DS1)	WC64 (reaches 1-5, portion of reach 6, reach 8)	Change in flow regime	L	Year 1	Temporary: Operations – Closure (post-pit filling)	14,072
		Change in temperature	L			
Lower Gold Brook (GB-DS2 to Seal Harbour Lake Inlet)	WC64 (portion of reach 6, reach 7, reaches 9-13).	Change in flow regime	L-M	Year 1	Temporary: Operations – Closure (post-pit filling)	191,197
		Change in temperature	L			

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FIGURE 3.1

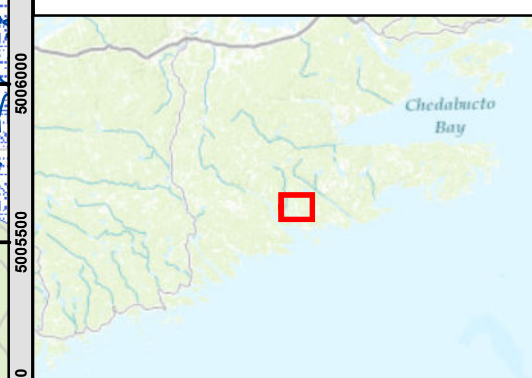
Goldboro Gold Project Impacts to Fish Habitat

Goldboro, Guysborough, NS

- Field Delineated Watercourses
- NSTDB Watercourses Outside PA

Impacts to Fish Habitat

- Flow Reduction
- Habitat Loss - HADD
- Habitat Loss - MDMER
- Open Water
- Wetland Mosaic
- Field Delineated Wetland
- NSECC Wetland Outside the PA
- Project Infrastructure
- Fish Habitat Study Area
- Employee Accomodation Study Area
- Project Area



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Date: 2023-06-23

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Document Name: 230420_FishImpacts

3.1.1 Permanent loss of Aquatic Habitat

As noted in

Table 3-1, direct losses (i.e., destruction) of fish habitat are required for 27 watercourses and three open water features (the Beaver Pond, located within WL18; and a portion of an open water feature in Gold Brook and the northern settling pond). Apart from WC8 and the open water features noted, all fish habitats proposed for direct impact are first and second order watercourses that do not provide passage to upstream aquatic features such as waterbodies or lakes. WC8 is a third order watercourse, however it is relatively small, anthropogenically disturbed, and has discontinuous flow, particularly in the downstream reach as it approaches Gold Brook Lake. In total, 17,877 m^2 will constitute the destruction of fish habitat. No wetland habitats that will be permanently lost as a result of Project construction are considered accessible to fish. All destruction of fish habitat is expected to occur during construction (Project Year -2 and Year-1) and will be permanent.

Note that of the quantified area of destruction of fish habitat (17,877 m^2), 2,707 m^2 of fish habitat across seven watercourses (WC15, WC43, WC45, WC47, WC49, WC57, WC99) will require an amendment to Schedule 2 of the MDMER due to the deposition of mine waste from the placement of the TMF (Figure 3-1).

In systems where the headwater or a large component of the catchment area will be removed due to the placement of structures (i.e., WC13, WC49, WC61, WC63 and WC65), habitats will be left as-is (i.e., no disturbance or infilling of the channels). It is expected that, as these systems slowly and naturally dehydrate, fishes will selectively avoid these habitats. Left intact, the watercourse channels can provide basic water conveyance functions and potentially life history support for various fish species (i.e., cover, refuge, foraging).

Permanent losses of aquatic habitats are expected to primarily affect brook trout and American eel, based on abundance and distribution of these species, and the locations of permanent losses (most in linear, 1st-2nd order stream systems). None of the systems proposed for permanent loss contain optimal brook trout habitat (Figure 2-9). Portions of optimal eel habitat (overwintering), which is more widespread throughout the PA and FHSA, will be impacted through the destruction of WC11, WC15, WC45, WC47, WC49, and WC50. However, these represent a small proportion of the overall optimal eel habitat that has been mapped within the FHSA, with most of the habitat area provided in Gold Brook, Gold Brook Lake, and Rocky Lakes (Figure 2-10).

3.1.2 Changes in Flow Regime

Changes in flow regime were evaluated through a holistic and hierarchical impact determination pathway that considered the results of ecological flow indicators from both hydrological and hydraulic modelling collectively. The pathway incorporates all flow indicators and flow scenarios which represent the site flow regime and thus its ecological condition. The ecological flow indicators were ranked based on the greatest potential to alter fish habitat and the hierarchy is listed from highest to lowest potential for impact: alteration to baseflow, depth and velocity (Gold Brook only), and daily flows.

Through the impact determination pathway, harmful flow alterations were predicted for the Western Tributary, Eastern Tributary, and Gold Brook (Figure 3-1). Flow reductions predicted for WC3, WC9, WC11, and WC55 (direct tributaries to Gold Brook) and WC16 and WC50 of the Eastern Tributary have been defined as a harmful alteration based on the results of hydrological modelling only and have been carried forward into the quantification of impacts (Section 3.3). Flow alterations are expected to be permanent in all systems except for Gold Brook. Alterations in flow within all tributaries to Gold Brook Lake and Gold Brook are expected to commence during construction (Year -2 and Year -1), while flow alterations within Gold Brook are conservatively expected to commence at operations (Year 1). No harmful alterations as a result of changes in flow are expected for the Northern Tributary, WC51 of the Western Tributary, Gold Brook Lake, and Rocky Lakes. Hydrological monitoring will be conducted in these systems to confirm that predictions made through hydrological modelling and ecological flow evaluations are accurate.

A high-negative effect to brook trout is anticipated within the Eastern Tributary (WC14) from the proposed Haul Road crossing west to its confluence with Gold Brook Lake. This is based on the magnitude (moderate-high), frequency (mostly continuous), timing (most of the year to year-round), and duration (permanent) of predicted changes in flow regime, and the optimal brook trout habitat available within the system. Predicted changes in both low flow (baseflow) and higher flow metrics can be expected to result in changes to water quality, temperature, benthic community, and habitat structure and cover that reduce the system's capacity to support multiple life stages of brook trout, including spawning/recruitment, rearing, and growth. As such, while some pockets of individuals may persist, the existing brook trout population within the system is not expected to be maintained. Post-development, the habitat within WC14 is expected to support American eel, which is a species that is generally more tolerant to disturbance and "highly plastic in habitat use" (COSEWIC, 2006). Seasonal fish movement is expected to be maintained between Rocky Lakes and Gold Brook Lake via WC14, as the timing of seasonally low and high flows is not expected to be impacted as a result of changes in flow regime. Ultimately, the fish community of Rocky Lakes is not anticipated to be impacted by the predicted changes in flow in the Eastern Tributary. The impacts of flow reductions in the Eastern Tributary are expected to be reduced during closure with planned mitigation measures to redirect run-off inputs to the system through the regrading of the TMF.

The designation of harmful alteration from changes in flow within Western Tributary is based on permanent predicted changes in median and high daily flows (with reductions predicted between 11 and 33% from baseline). These changes have the potential to alter average, high-pulse and high-infrequency flows which maintain riparian vegetation, flush substrates, and facilitate exchange of nutrients, sediments, and woody debris. Though defined as a harmful alteration, these changes are considered to have a potential overall low-negative effect on fish habitat. The effect is not directly tied to one or more life history phases of fish. No harmful baseflow reductions were predicted in the Western Tributary. This is based on no predicted changes in baseflow or negligible changes (+/- 0.001 m^3/s in baseflow rates) in baseflow during West Pit EOM compared to baseline conditions. Baseflows and the habitat functions they sustain (water quality, temperature, benthic community) are therefore expected to be maintained from baseline through post-development conditions.

Harmful alterations in flow within the Western Tributary are spatially restricted to WC20. WC19, which is upgradient but hydrologically isolated from W20, has been conservatively grouped with WC20 based on its location within the sub-catchment (Figure 3-1). WC19 is presumed to be accessible to fish at some times of the year, despite the subterranean gap between WC19 and WC20.

Based on the results of the flow effects assessment, low-moderate negative effects to fish and fish habitat are expected throughout the length of Gold Brook (Figure 3-1). The magnitude and frequency of these impacts vary from upstream to downstream reaches, and through Project phases. These impacts are expected to be temporary, with no anticipated effects to fish and fish habitat by closure (post-pit filling; Project Year 37).

Within the most upstream reaches of the brook, impacts from predicted flow alterations are limited to median and high daily flows, which are considered to have a potential low negative effect on fish and fish habitat. This upstream section of the brook is expected to experience a small increase in drainage area from baseline conditions compared to assessment points further downstream in the system, which contributes to an overall lower degree of alteration. Within the lower reaches of Gold Brook, harmful impacts are anticipated from a combination of predicted baseflow reductions, changes to physical habitat characteristics, and changes to median and high daily flows. The magnitude and frequency of impacts results in a potential low negative impact to brook trout spawning, egg development and emergency, and American eel overwintering habitat. Harmful changes to physical habitat parameters were predicted in four transects within this section of Gold Brook, which are expected to result in low-moderate negative effects to brook trout spawning/incubation/emergence, and brook trout feeding and rearing. However, the predicted degree of impacts from changes to physical habitat parameters are based on extremely small changes to water depths and velocities (Δ 1 cm/0.01 m/s), and as such these conclusions are considered highly conservative. The brook will continue to provide suitable fish habitat and passage within the Gold Brook Lake secondary watershed during all phases of the project and after closure.

3.1.3 Pit Development and Preferential Flow Pathways

The assessment of potential effects to fish and fish habitat through pit development was completed through an evaluation of bedrock and surficial geology characteristics. The goal of this assessment was to identify the risk of pit development creating preferential flow pathways between Gold Brook Lake, Gold Brook, and the pits, which could then result in loss of aquatic habitat for fish, and to ensure that mitigation measures and monitoring programs are in place to identify and mitigate this effect if it arises.

Hydrogeologic data suggests that the bedrock onsite has a low hydraulic conductivity, especially below 30 m with more variable results above 30 m. Further, relative to underground workings and the final depths of the pits, the lake is quite shallow and not expected to interact with either pit wall development or historic mine workings. There is uncertainty around the potential presence of faults with unknown hydraulic conductivity. Additional testing is currently underway to describe these potential faults, to reduce uncertainty, and to inform monitoring programs and mitigation measures based on potential faulting and higher hydraulic conductivity in the upper 30 m of the bedrock.

A rigorous monitoring program consisting of instrumentation, piezometers, and pit face observations will be undertaken as a primary control mechanism. Static water levels will be monitored via level loggers on a continuous basis, while groundwater quality and manual level readings will be collected quarterly. Changes in surface water levels will be detected through monitoring of a series of surface water stations within Gold Brook Lake and Gold Brook. Surface water and groundwater contingency plans will guide adaptive management and mitigation measures should changes in surface water elevations or groundwater levels be observed. Potential mitigation measures include both preventative measures (e.g., cut-off walls) and reactionary measures (e.g., injection of grout into fractures).

Given the nature of the bedrock and surficial geology, and implementation of mitigation measures and monitoring programs, the risk of unexpected flow of water between Gold Brook and/or Gold Brook Lake and the pits is low.

3.1.4 Changes in Temperature

Predicted reductions in baseflow, mine site discharge, and wetland area loss were evaluated collectively through both quantitative and qualitative assessment methods. Given the variation between the methods and uncertainties inherent to modelling, effects determinations have been formed with measures of conservatism and caution.

A moderate-high negative effect on fish and fish habitat is anticipated as a result of changes in temperatures in the Eastern Tributary (from the proposed Haul Road crossing to its confluence with Gold Brook Lake), WC9, and tributaries to Gold Brook (WC3, WC10, WC11, and WC55) as a result of predicted reductions in baseflow and loss of wetland area. These watercourses are expected to persist, however, and may provide fish habitat functions (at least temporally) to fish species with temperature preferences within cool-warm thermal regimes.

No impacts to the thermal regimes of the Western and Northern Tributaries (cold-cool to cool) are expected as a result of Project development. These systems will continue to provide suitable habitat for brook trout and cold-water inputs into Gold Brook Lake. No changes or negligible changes in groundwater inputs are expected within these systems, there is minimal wetland loss within their respective sub-catchments, and riparian areas will be largely maintained.

Impacts to water temperatures within Gold Brook Lake are expected to be negligible, with effects from settling pond discharge and loss of wetland area expected to be localized to the discharge locations/tributary inlets. No impacts to the thermal regime of the lake (cool-warm to warm) or the fish community (cool-warm water species) are predicted.

In Gold Brook, a combination of reduction in baseflow, mine site discharge, and loss of wetland area is anticipated to result in a low negative impact to water temperatures and brook trout habitat. However, the overall cool thermal regime of the system is expected to be maintained. Groundwater contributions within the system are expected to persist through Project development which may continue to support brook trout life history stages.

Overall, no additional HADD of fish habitat is expected as a result of potential changes in water temperatures, as all predicted temperature-related impacts correspond with harmful alterations from flow reductions (Figure 3-1). Water temperatures will be monitored in the Western Tributary (WC51), Northern Tributary (WC22), the northern Rocky Lake, and Gold Brook Lake to confirm predictions and determine whether additional mitigation or adaptive measures are required at any point over the life of the Project (see Section 3.2).

3.2 Summary of Avoidance and Mitigation Measures

Throughout the iterative process of developing the current Project infrastructure layout, avoidance of effects to fish habitat was attained through several key design considerations. The Project layout has been developed to avoid direct impacts to lacustrine environments to the extent feasible, including Gold Brook Lake and Rocky Lakes. The following Project components have been planned to avoid direct impact to fish and fish habitat:

- Mill area
- Northwest WRSA
- Southwest till stockpile
- Employee accommodations
- Southwest WRSA
- Northeast till stockpile
- Northeast WRSA
- Organic stockpiles

Substantial measures were employed to place site infrastructure nearly entirely within the Gold Brook (1EQ-SD31) watershed to prevent impacts to Atlantic salmon in adjacent watersheds. This includes the optimization of the placement of the TMF through an alternatives assessment using multiple accounts analysis methodology which considered 13 different sites. Different mine water management options were also considered, including variations of the volume and rate of site water discharge to the open pits to balance faster pit filling times with controlled flow reductions in Gold Brook, and locations of settling pond discharges to avoid potential impacts from temperature plumes.

Goldboro Gold Mines has planned for two individual pits to avoid direct impacts to historic tailings and fish habitat, despite the confirmation through exploratory drilling of a continuous resource and the potential for a single, large pit.

Where avoidance of impacts to fish and fish habitat is not possible, mitigation measures have been employed to further reduce impacts to fish and fish habitat. Key mitigation strategies are described below. A full list of Project mitigation measures is provided in the FAA application supporting document (McCallum Environmental, 2023).

Fish rescues are the key method to avoid death of fish where permanent losses of fish habitat are unavoidable. The primary goal of fish rescue work is to capture and relocate as many fish as is reasonably practical, with habitat area and complexity, water temperature and turbidity, access, and safety considerations as the key constraints. Fish rescues are proposed to be completed where permanent loss of habitat is proposed (i.e., direct removal of habitat).

Potential impacts to fish and fish habitat from blasting will be minimized through the implementation of a Blast Management Plan, which has been developed with guidance from Measures to Avoid Causing Harm to Fish and Fish Habitat Including Aquatic Species at Risk Pertaining to Blasting (DFO, 2018a). All blasting will adhere to guidelines outlined by Wright and Hopky (1998) and will adhere to Nova Scotia Blasting Regulations. Blasting mitigation is expected to minimize or eliminate the potential for negative effects on fish or fish habitat which might occur as a result of the use of explosives in open pit workings.

The Project will not be permitted to release water which exceeds regulatory guidelines; all mine contact water will be collected, treated, and monitored prior to release. A Surface Water Management Plan has been prepared which supports and guides surface water management through the construction, operation, and closure stages of the Project. The primary objectives of water management are to reduce operational risks and environmental impacts of the Project. The following strategies are planned to achieve the primary objectives:

- Mitigate water quality and quantity impacts on receiving waters through design of water management infrastructure;
- Reduce the amount of water managed by directing non-contact water away from Project infrastructure;
- Incorporate system flexibility to manage water under variable climatic conditions;
- Improve water quality monitoring efficiency by consolidating effluent discharge to minimize discharge points; and,
- Provide an effective adaptive monitoring program to manage surface water quantity and quality throughout various stages of Project development and maintain compliance with regulatory requirements and approval conditions.

The combined implementation of the Surface Water Management Plan, all associated management plans (e.g., the Hazardous Material Handling Plan, Contingency Plan, ML/ARD Management Plan and erosion and sediment control plans), and their integrated mitigation measures, are expected to have a high degree of effectiveness for the maintenance of water quality standards within the PA and subsequent protection of fish and fish habitat. Routine surface water quality sampling and analysis conducted as part of Environmental Effects Monitoring (EEM) will be applied to confirm compliance with regulatory requirements, confirm predicted impacts to water quality, update predictive modelling, and determine whether additional mitigation or adaptive measures are required at any point over the life of the Project. Surface water quality monitoring will adhere to the Industrial Approval to be obtained for the Project.

Goldboro Gold Mines has prepared an Aquatic Effects Monitoring Plan (AEMP) to confirm effects assessment predictions where a HADD of fish habitat has not been predicted. The monitoring program will employ a Before – After – Control – Impact design to identify if unpredicted effects occur, so adaptive management techniques, mitigation measures, or permitting processes can be implemented.

Goldboro Gold Mines has committed to minimizing all unnecessary clearing throughout the PA – this applies to all wetland, riparian, and upland vegetation. Vegetation clearing within wetlands will be restricted to only that which is required for construction of infrastructure (with appropriate permitting in place). Disturbed areas will be limited to the extent practical, and will be progressively graded and/or scarified, covered with organic material and till, where required, and seeded as appropriate to promote natural plant colonization and succession.

When feasible, infrastructure designs have employed a minimum 30 m buffer from any fish habitat not directly overlaid by infrastructure footprints. The exceptions to this include: the TMF polishing pond and North Settling Pond, settling pond discharge ditches and emergency spillways; water intake pipe; Haul Road, Bypass Road, and site access roads; the Northeast Till Stockpile and WRSA (on WC9), the Southwest Till Stockpile (on WC3), and the Southeast WRSA. Across the PA, approximately 90% of the 30 m riparian buffer of all watercourses present on the landscape will be maintained once the mine is constructed and in operations. For Gold Brook Lake and Rocky Lakes, approximately 95% of the 30 m riparian buffer will be maintained. Large riparian buffers (100 m +) will be left intact wherever possible.

Monitoring of water temperatures will be conducted as outlined within the AEMP in key habitats including the Western Tributary (WC51), Northern Tributary, Rocky Lake and Gold Brook Lake. Thermal regimes will be compared to before and after conditions within the PA and reference site to determine if a significant change is thermal regime has occurred. Action thresholds will be triggered if negative effects to fish and fish habitat are identified through monitoring, at which point additional analysis and monitoring will be required. Based on the results of monitoring, Goldboro Gold Mines will consider mitigation measures to remediate any thermal impacts, including but not limited to cooling trenches or engineered wetlands at settling pond discharge locations.

3.3 Quantification of Impacts

The residual effects that are anticipated to remain after the implementation of avoidance and mitigation measures are related to permanent loss of aquatic habitat (destruction), and changes in flow regimes and temperatures (alteration). These impacts will require offsetting (or ‘compensation’ under MDMER) to counterbalance the effects to fish and fish habitat.

Though Project activities may result in death of fish, this loss is considered largely non-quantifiable and incidental. The death of fish as a result of Project activities will be minimized through fish rescues, isolating in-water work areas, implementation of sediment and erosion control measures, water treatment, blast management, and in-water work timing windows where appropriate.

The effects assessment to fish and fish habitat described in Section 3.1 was used to quantify the Project HADD (and those watercourses to be listed under Schedule 2) after the implementation of avoidance and mitigation measures. Through the effects assessment, the magnitude, frequency, timing, and duration of the HADD (when applicable), as well as the species, life stages, and type of habitat impacted have been described. These descriptions have been used to evaluate the impacts to fish and fish habitat, which have informed proposed ratios for offsetting, in addition to the anticipated productivity of proposed offsetting measures (Section 5) compared to the productivity of fish habitat within the FHSA.

Through a conservative approach to impact quantification, no adjustments were made to fish habitat quantifications to account for reduced habitat suitability within the FHSA. For example, all permanent impacts to fish habitat have been treated equally, despite many watercourses having no to extremely low fish captures, low habitat suitability, and/or barriers to fish access. Also, it has been conservatively assumed that all harmful alterations in Gold Brook commence at Year 1 operations, though impacts are predicted to commence through the operations phase and peak at West Pit EOM.

Table 3-2 provides the quantification of Project HADD in area of fish habitat (m^2) and proposed offsetting areas per system. The type of HADD (harmful alteration, disruption, or destruction) has also been defined. Proposed offsetting ratios for each system to be impacted are displayed on Figure 3-2.

For all destruction of fish habitat (i.e., permanent loss), a 2:1 offsetting ratio has been proposed. These will be permanent changes of fish habitat that renders the fish habitat unsuitable for future production of fish. This corresponds to the greatest severity of impacts to fish and fish habitat and as such, the highest offsetting ratio is proposed.

The same 2:1 offset ratio is proposed for harmful alterations to the Eastern Tributary, WC9, and Gold Brook tributaries (Figure 7-1). The degree of impact to fish and fish habitat as a result of flow reductions and changes in temperature have been quantified as moderate-high based on the magnitude, frequency, timing, and duration of harmful alterations to daily flows and baseflows. These impacts have the potential to result in changes to water quality, temperature, benthic community, and habitat structure and cover that reduce each system's capacity to support multiple life stages of their respective fish communities. The level of severity to fish and fish habitat is considered less than destruction (alteration only), as these habitats may continue to support one or more life processes of fish after impacts are realized.

For harmful alterations within the Western Tributary (WC19 and WC20), a 0.33:1 ratio of offsetting is proposed (Figure 3-2). This is based on the following rationale:

- HADD was determined based on predicted annual flow reductions greater than 10% during median flows and high flow scenarios, which have the potential to alter average, high-pulse and high-infrequency flows which maintain riparian vegetation, flush substrates, and facilitate exchange of nutrients, sediments and woody debris. A low negative degree of effect to fish and fish habitat are predicted as a result. There are no anticipated effects during baseflow, the effects of which are directly tied to the timing of one or more life history phases of fish. Harmful alterations based on median and high flow scenarios are not anticipated to negatively impact one or more life history phases of fish.

- There are no anticipated effects to the system's thermal regime (cold-cool), as there are no predicted impacts from mine site discharge, reductions in groundwater inputs, or substantial impacts to wetland areas. Riparian buffers (30-100 m +) will be largely maintained and will further support the maintenance of water temperatures.

Similarly, a low, negative degree of impact is predicted for the upper reach of Gold Brook, and therefore 0.33:1 is proposed (Figure 3-2):

- HADD was determined based on minor reductions during predominantly high flow scenarios which have potential (low) to alter average high-infrequency flows which maintain riparian vegetation, flush substrates, and facilitate exchange of nutrients, sediments and woody debris. A low negative degree of effect to fish and fish habitat are predicted as a result.

- Though long-term, predicted impacts are temporary and are expected to resolve once both East and West Pits are filled with overflows discharging to Gold Brook Lake (Year 37). The brook will continue to provide fish habitat during all phases of the Project and after closure.

- There are no anticipated effects during baseflow, the effects of which are directly tied to the timing one or more life history phases of fish. Harmful alterations based on median and high flow scenarios are not anticipated to negatively impact one or more life history phases of fish. No predicted reductions or loss of physical habitat (velocity, depth) during annual and seasonal low flow scenarios.
- There is a potential negative impact (low) to water temperatures and brook trout habitat. However, the overall cool thermal regime of the system is expected to be maintained.
- Historic mining has resulted in degraded habitat and tailings depositions throughout the extent of Gold Brook. All offsetting measures are located in salmon-bearing watersheds with no identified impacts from historic mining. Habitat degradation within these sites (from forestry, agriculture, and other related activities) are relatively simple to address through instream restoration methods, which are expected to result in high quality and productive salmonid habitat.

For Gold Brook remaining downstream section, a 0.66:1 ratio is recommended based on the following rationale (Figure 3-2):

- Predicted changes in baseflow during West Pit EOM, minor changes in physical fish habitat (velocity, depth), reductions in median flows and high flow scenarios are considered to pose a low-moderate degree of effect to fish and fish habitat.
- No impacts were anticipated during baseflow for all other project phases, with the exception of West Pit EOM, as described above.
- There is a potential low negative impact to water temperatures and brook trout habitat. However, the overall cool thermal regime of the system is expected to be maintained based on the maintenance of riparian buffers and continuation of inputs from baseflow (groundwater) through Project development.
- Though long term, predicted impacts are temporary and are expected to be resolved by closure. The brook will continue to provide fish habitat during all phases of the Project and after closure.
- Historic mining has resulted in degraded habitat and tailings depositions throughout the extent of Gold Brook. All offsetting measures are located in salmon-bearing watersheds with no identified impacts from historic mining. Habitat degradation within these sites (from forestry, agriculture, and other related activities) are relatively simple to address through instream restoration methods, which are expected to result in high quality and productive salmonid habitat.

Table 3-2. Project HADD quantification and proposed offsetting ratios

System	Impact Type (HADD)	Area of HADD (m^2)	Proposed Offsetting Ratio	Proposed Offset Area (m^2)
ALL Permanent Loss	Destruction	17,877 (of which 2,707 to be compensated as per MDMER)	2:1	35,754

System	Impact Type (HADD)	Area of HADD (m²)	Proposed Offsetting Ratio	Proposed Offset Area (m²)
Eastern Tributary (WC14, 16, WC50)	Harmful Alteration	3,234	2:1	6,468
WC9	Harmful Alteration	1,097	2:1	2,194
Gold Brook Tributaries (WC3, WC10, WC11, WC55)	Harmful Alteration	1,566	2:1	3,132
Lower Gold Brook (GB-DS2 to Seal Harbour Lake Inlet)	Harmful Alteration	191,197	0.66:1	126,190
Upper Gold Brook (Lake Outlet and GB-DS1)	Harmful Alteration	14,072	0.33:1	4,644
Western Tributary (WC19, WC20)	Harmful Alteration	3,623	0.33:1	1,196
Total Area of HADD		**232,666 (2,707 falling under MDMER)**	**Total Proposed Offset Area**	**179,578 (5,414 to be compensated as per MDMER)**

Goldboro Gold Mines is seeking authorization for a HADD of 232,666 m² (23.2666 ha) of fish habitat. Note that 2,707 m² of this tallied fish habitat is associated with the seven watercourses requiring an amendment to Schedule 2 of the MDMER. The same offsetting ratio for habitat destruction (2:1) has been applied to these impacts. Based on the range of proposed offset ratios, 179,578 m² (17.9578 ha) of fish habitat offsetting is recommended to counterbalance the Project HADD of fish habitat.

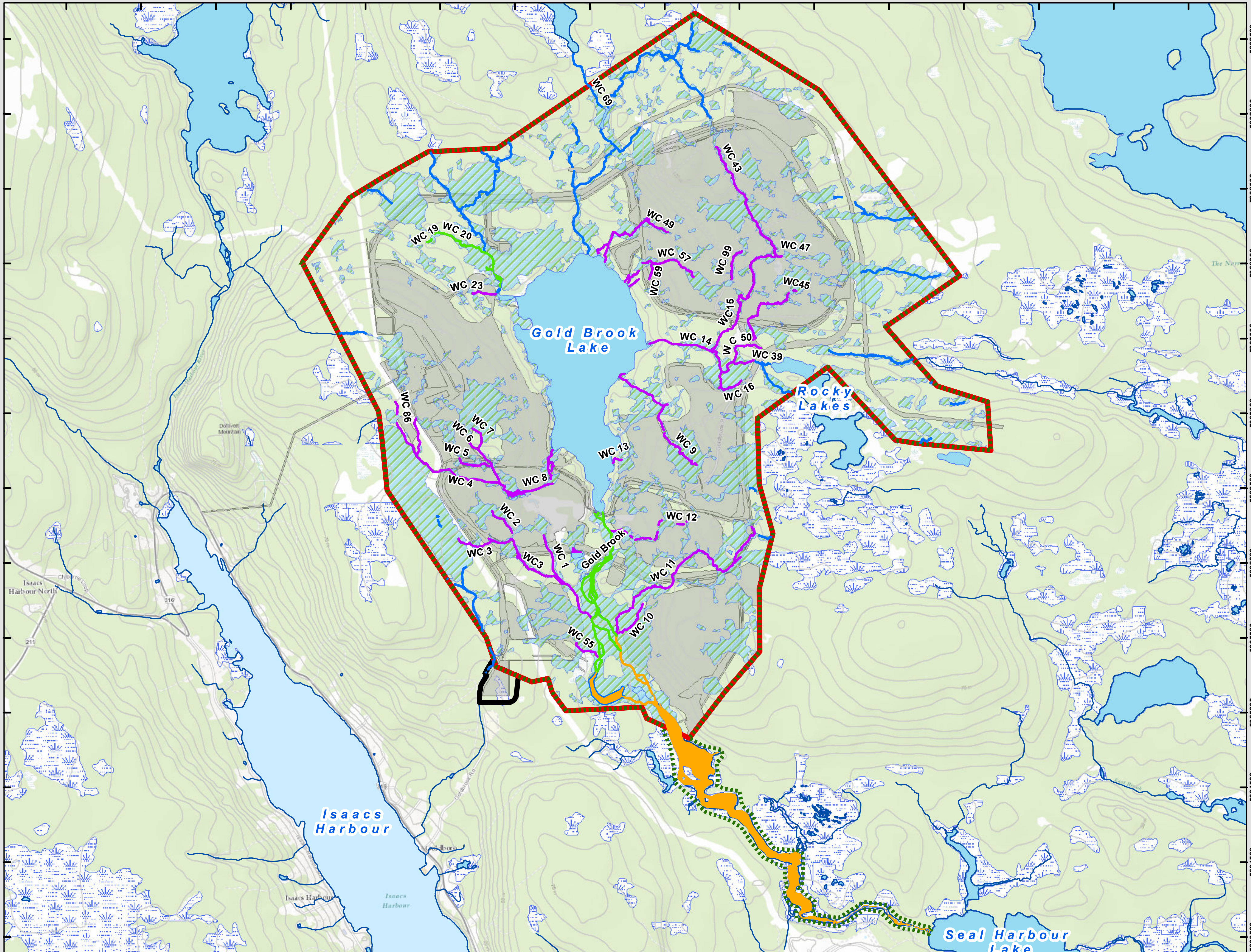

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FIGURE 3.2

Goldboro Gold Project Proposed Offsetting Ratios

Goldboro, Guysborough, NS

Proposed Offsetting Ratio

- 0.33:1
- 0.66:1
- 2:1
- Field Delineated Watercourses
- NSTDB Watercourses Outside PA
- Open Water
- Wetland Mosaic
- Field Delineated Wetland
- NSECC Wetland Outside the PA
- Project Infrastructure
- Fish Habitat Study Area
- Employee Accomodation Study Area
- Project Area

Chedabucto Bay

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 250 500 1,000 m

1:24,000 Scale when printed @ 11" x 17"

Drawn By: AS
Reviewed By: MMD

Date: 2023-06-23

McCallum Environmental Ltd.

Document Name: 230621_ProposedRatios

4 APPROACH TO FISH HABITAT OFFSETTING

Identification of suitable offsetting opportunities for the Project has been ongoing since EARD Approval (August 2, 2022). The process has involved a of a multi-step review process including consultation with DFO involving the following tasks:

- Desktop review of local watersheds;
- Desktop review of watersheds containing aquatic Species-at-Risk, with an emphasis on those containing Atlantic salmon;
- Desktop review of watersheds that are known to have been anthropogenically degraded and where fish habitat restoration and enhancement projects could potentially exist;
- Engagement with the Mi'kmaq of Nova Scotia to discuss fish habitat restoration priorities;
- Engagement with community-based watershed groups to discuss fish habitat restoration and enhancement priorities;
- Engagement and collaboration with qualified local professionals with experience and expertise in fish habitat offsetting;
- Engagement with landowners; and,
- Field assessment of potential locations identified to determine their feasibility and collect pertinent information to support offsetting design.

The offsetting projects presented within this Offsetting Plan been developed using DFO Offsetting Policy guidance (DFO, 2019a) and feedback (written and verbal) provided by DFO in response to the following documents:

1. Preliminary Fisheries Offsetting Plan submitted as part of the EARD (June 2022);
2. Technical Memorandum, Goldboro Gold Mines Fisheries Offsetting Project Review (December 2022); and,
3. Goldboro Gold Project – Interim Fish Habitat Offsetting Plan (January 2023)

Proposed offsetting opportunities include locations where offsets may be both technically and logistically feasible while also being primarily beneficial for fish species impacted by the Project – American eel and brook trout.

Sections 4.1.1 through 4.1.4 describe the approach for identification and selection of proposed offsetting measures.

Offsetting measures proposed for implementation are presented in Section 5. The proposed projects include those that meet the goals and objectives discussed in the following sections and which DFO have recommended suitable to offset for Project related impacts to fish and fish habitat.

4.1 Goals and Objectives

Identification and selection of offsetting sites has been guided by the principles from DFO's Policy for Applying Measures to Offset Adverse Effects on Fish and Fish Habitat (2019a):

- Principle 1: Measures to offset should support fisheries management objectives and give priority to the restoration of degraded fish habitat.
- Principle 2: Benefits from measures to offset should balance the adverse effects resulting from the works, undertakings of activities.
- Principle 3: Measures to offset should provide additional benefits to the ecosystem.
- Principle 4: Measures to offset should generate self-sustaining benefits over the long term.

The first principle states that DFO gives priority to offsetting measures that focus on the restoration of degraded fish habitat. Measures to offset should be designed to contribute to the restoration of degraded fish habitat provided within existing fisheries management plans, or to consult with Indigenous groups, fisheries managers, local organizations, and stakeholders to help identify areas that would benefit from restoration or enhancement (DFO, 2019a). Section 5 outlines the types of projects considered for offsetting, with priority given to those that address habitat degradation. The Elver Integrated Fisheries Management Plan (IFMP; DFO, 2018c) was the only fisheries management plan identified with possible implications for project offsetting; however, elver fishing typically occurs in tidal waters or up to 1000 m upstream of the tidal water boundary, and specific issues relating to freshwater habitat degradation are not addressed in the IFMP. Aside from species predicted to be directly impacted by the Project, priority for offsetting projects has been given to those located in watersheds that support aquatic Species-at-Risk, particularly Atlantic salmon, as per comments received from DFO during EARD review (DFO 2022). Atlantic salmon are extremely well studied and threats to freshwater habitat are well documented (e.g., COSEWIC Assessments, Recovery Potential Assessments, Recovery Plans and Action Plans). In addition, American eel was identified as a priority species for offset planning through engagement with the Mi'kmaq of Nova Scotia as well as their abundance on site.

The second principle describes how measures to offset should be scaled such that they are proportional to the residual effects. Measures are most likely to balance the residual effects when they benefit the specific local fish population and fish habitat, and it is therefore preferable that offsetting projects be located within the vicinity of the works or within the same waterbody or watershed (DFO, 2019a). However, there is flexibility in the selection of measures to locations outside of the immediate project area provided the measures are supported by clear fisheries management objectives and regional restoration priorities (DFO, 2019a). In keeping with the second principle, the identification of offsetting opportunities was first performed within the local watershed, then in consideration of the regional context, expanded to southern upland watersheds of the eastern shore. Rationale for the selection of priority watersheds, including those located away from the PA, is provided in Section 4.2. American eel and brook trout, the two species primarily impacted from residual effects, are ubiquitous throughout mainland Nova Scotia and occupy a variety of freshwater habitat types. As such, opportunities to offset outside of the immediate PA are targeted towards these species.

The second principle also provides flexibility in offsetting forms, differentiating between "in-kind" and "out-of-kind" approaches. Priority for offsetting concepts was given to in-kind measures to offset, through which fish and fish habitat that is adversely affected is replaced by the same quantity or quality of the same type of fish or fish habitat (DFO, 2019a). Offsetting concepts may also employ an "out-of-kind" approach, by which fish habitat that is adversely affected is replaced by an appropriate quantity and quality of a different type of fish or fish habitat than was adversely affected. Though it can be more difficult to measure and compare the residual effects with fish and fish habitat benefits associated with out-of-kind approaches, in some cases the resulting habitat has greater capability to produce and sustain fish (DFO, 2019a). As a result of their review of the 2022 Conceptual Offsetting Plan, DFO (2022) recommended two types of offsetting project types that would be classified as “out of kind”; 1) measures that improve Atlantic salmon habitat and 2) restoring low salt marsh and/or creating refuge habitat for migrating salmon in the estuaries of important salmon watersheds.

Under the third principle, any coincidental positive benefits or gains to fish and fish habitat of Project activities have not been considered as measures to offset. Furthermore, the restoration of degraded sites for which Goldboro Gold Mines, or another person or organization is responsible for (e.g., public road crossings), have not been considered in the overall quantification of offsetting measures. The restoration of orphaned sites (i.e., those with no known responsible party or owner or with no possibility of restoration due to company closure, bankruptcy, or other similar circumstance) was considered as a potential measure during offset identification and selection.

The fourth and final principle states that measures to offset should strive to generate self-sustaining benefits to fish and fish habitat conservation and protection, wherein the benefits of offsetting should last at least as long as the adverse effects from the project (DFO, 2019a). Therefore, measures that would require continuous intervention to sustain fish were not considered given the largely permanent nature of fish and fish habitat losses associated with this Project.

Adherence to these goals and objectives during the offsetting identification process was also completed with consideration of the following recommendations and feedback provided by DFO in their review of the Conceptual Offsetting Plan which was submitted as part of the EARD for the Project (DFO 2022):

1. Restoring, enhancing or creating spawning or cold-water habitats for salmonids;

2. Measures that improve Atlantic salmon (*Salmo salar)* and brook trout (*Salvelinus fontinalis)* habitat in nearby watersheds within the Southern Upland Region of Nova Scotia (e.g., St. Mary’s, Country Harbour, Musquodoboit) is an appropriate approach for the project Offsetting Plan; and,

3. Restoring low salt marsh and/or creating refuge habitat for migrating salmon in the estuaries of important salmon watersheds.

General goals and objectives for each proposed offsetting measure are provided in the offsetting project descriptions in Section 5 based on the project type, existing fish habitat, fish community, and expected outcomes of restoration. In addition, measurable goals and objectives are presented and based on baseline data collection and detailed design work that was completed in Spring 2023.

4.2 Priority Watersheds

DFO’s guiding principles clarify a preference for offsetting measures located within the vicinity of a Project, as measures to benefit local fish populations and fish habitat are most likely to balance the residual effects of a project (DFO, 2019a). The PA is predominantly found within the secondary shore direct watershed (1EQ-SD31, herein referred to as the “Gold Brook secondary watershed”), extending slightly into New Harbour/Salmon Primary watershed. Project impacts are present within the Gold Brook secondary watershed (with the exception of minor direct impacts to wetlands straddling the watershed divides). In keeping with DFO’s guiding principles, preliminary offset identification was first initiated within the Gold Brook secondary watershed, in the immediate vicinity of the PA. The Gold Brook secondary watershed contains tailings deposits from historic mining operations, none of which have been contained or remediated. Tailings migrated from the streams and wetlands where they were deposited into the downstream receiving environment (Gold Brook) and are likely to have a continued effect on fisheries resources. Restoration projects within the secondary watershed were deemed unsuitable for fisheries offsetting based on the potential for interactions with and exacerbation of impacts from historic tailings.

Following this, additional drivers guided selection of priority watersheds for offset identification (in order of priority):

1. The primary watersheds that contain the PA – the New Harbour/Salmon primary watershed and Country Harbour primary watershed.
2. Watersheds with anticipated ecological similarities and in close proximity to that of the PA (i.e., Southern Upland watersheds along the eastern shore that support Atlantic salmon (and brook trout and American eel). In addition to the above, this included the St. Mary's and Guysborough River watersheds.
3. Watersheds that support Atlantic salmon (and brook trout and American eel) and are located nearby to a potential Mi'kmaw First Nation partner. This included the Pomquet River watershed and a potential collaboration with Paqtnkek Mi'kmaw First Nation.
4. Important salmon watersheds that contain salt marsh restoration opportunities.
5. Watersheds not located near the PA but which support Atlantic salmon (Southern Uplands), brook trout, and American eel. This included the LaHave River watershed.

Proven techniques in these geographic settings that could support similar fish species through in-kind habitat restoration were prioritized to offset lost habitat, as they were considered lower-risk and biologically relevant.

4.2.1.1 *Atlantic Salmon*

Supported by ongoing consultation with DFO, Goldboro Gold Mines has identified Atlantic Salmon as a priority species for offsetting projects. Atlantic Salmon populations are categorized into three Designatable Units within mainland Nova Scotia, including the Inner Bay of Fundy population (iBoF; Schedule 1 – Endangered, COSEWIC - Endangered), Southern Uplands population (SU; Schedule 1 – pending, COSEWIC – Endangered), and the Gaspé-Southern Gulf of St. Lawrence population (COSEWIC – Threatened). Atlantic Salmon require several different habitats to complete a life cycle including both marine and freshwater habitat. The major freshwater habitat types for Atlantic salmon are used for feeding, overwintering, spawning, early life-stage nursery, and rearing habitats (DFO, 2010).

Freshwater salmon habitat is threatened by the effects of agriculture, urbanization, poor forestry practices, road building, and other factors related to human activities. Decreased smolt production due to habitat degradation, low pH, and temperature increases have been observed. Acidification of freshwater habitats brought about by acidic precipitation is a major threat, particularly for the SU population (DFO, 2013).

Recovery actions focused on improving freshwater productivity are expected to reduce extinction risk for SU salmon. DFO states that "watershed-scale factors have the potential to override factors controlling salmon abundance at smaller spatial scales (i.e., within the stream reach)" (DFO, 2013). Extinction risk for SU salmon may be reduced by focusing recovery actions on improving freshwater productivity (DFO, 2013). More specifically, "the ability to reach recovery targets may be partially dependent on the mitigation of freshwater threats" (DFO, 2013).

The St. Mary's, Liscomb, and the West River Sheet Harbour watersheds are SU salmon watersheds recognized by the Nova Scotia Salmon Association as a focus for restoration. Furthermore, the Musquodoboit River watershed is also considered a priority SU salmon watershed for restoration and was identified by DFO to Goldboro Gold Mines as a potential salmon habitat improvement location in their comments associated with the Conceptual Offsetting Plan (DFO, 2022). However, given the quality and size of opportunities identified in salmon (and brook trout and American eel) supporting watersheds closer to the PA, the Liscomb, Musquodoboit and West River Sheet Harbour watersheds were not considered a high priority focus. Although potential fisheries offsetting projects exist within the St. Mary's Watershed, attempts to collaborate with the St. Mary's River Association were unsuccessful. As such, efforts have been directed to areas as close as possible to PA impacts and in locations that are known to provide habitat for the fish species of interest.

4.2.2 Site Identification Methods

For the priority watershed sites, the Project Team collaborated with MacInnis Natural Resources (MNR) to identify potential offsetting opportunities. MNR initiated ground surveys during Fall 2022 within multiple stream systems within the eastern shore priority watersheds and one in the Pomquet River watershed. A combination of MNR's experience working in the region combined with their knowledge of historical degradation and land alteration activities in these watersheds supported the prioritization of the specific stream systems in question.

In addition, the Project Team engaged with the Municipality of the District of Guysborough (MODG) and the Guysborough County Inland Fisheries Association (GCIFA) regarding potential offsetting projects within the estuaries of the eastern shore, particularly those in close proximity to the PA.

In the LaHave watershed, Goldboro Gold Mines collaborated with Coastal Action and aquatic habitat specialist Will Daniels to identify valuable aquatic restoration and enhancement projects. Coastal Action have developed multiple sub-watershed restoration plans in the LaHave River watershed. This previous work was used to narrow down high priority offsetting opportunities for further investigation via ground surveys in Fall 2022.

The Project Team also engaged Ducks Unlimited Canada (DUC) in Fall 2022 to explore opportunities for collaboration in implementing freshwater and estuarine fisheries offsetting projects.

4.2.3 Types of Projects Considered

Within the Interim Fish Habitat Offsetting Plan (January 2023), Goldboro Gold Mines presented to DFO the following types of offsetting projects for their consideration:

- Instream Habitat Restoration – Eastern Shore (Roman Valley River; Campbells Brook; McAllister Brook; Minister Brook; North Branch Salmon River; Gunns Brook; Sutherlands Brook) and Pomquet River (East Pomquet River);
- Salt Marsh Restoration – Bakers Marsh;
- Barrier Mitigation – Harley Mill Lake Mill Brook;
- Barrier Mitigation – Eel Bypass Structures; and,
- Eelgrass Restoration – Eastern Shore

As a result of this submission, DFO provided feedback to the Project Team in March 2023 (and during a subsequent meeting on March 20, 2023) on the options presented. DFO noted that based on a preliminary review of the Interim Offsetting Plan, the following instream habitat restoration projects would be acceptable for inclusion in the final authorization for the Goldboro Gold Project:

- East Pomquet River (Pomquet R. watershed.)
- Roman Valley River (Guysborough R. watershed)
- Campbells Brook (St. Mary's R. watershed)
- McAllister Brook (Salmon R. watershed)
- Minister Brook (Salmon R. watershed)
- North Branch Salmon River (Salmon R. watershed)
- Gunns Brook (Country Harbour R. watershed)
- Sutherlands Brook (Country Harbour R. watershed)

As discussed in the Interim Offsetting Plan, these projects are examples of degraded waterways that have been subject to over-widening, channelization (i.e., straightening), historic and current riparian land-use impacts, resulting in a transition to homogenous stream characteristics and lack of instream functional components. Many of the opportunities identified are in waterways subject to upstream and adjacent landscape alteration (i.e., agriculture), or in some cases, features that have been over-widened/straightened in the past to accommodate log driving associated with historical forestry activities.

As a result of this process, some of these projects were advanced throughout Spring 2023 for inclusion in this Offsetting Plan. Work completed to further the design and baseline data collection for each opportunity during this period is described in Section 5.

5 OFFSETTING PROJECTS

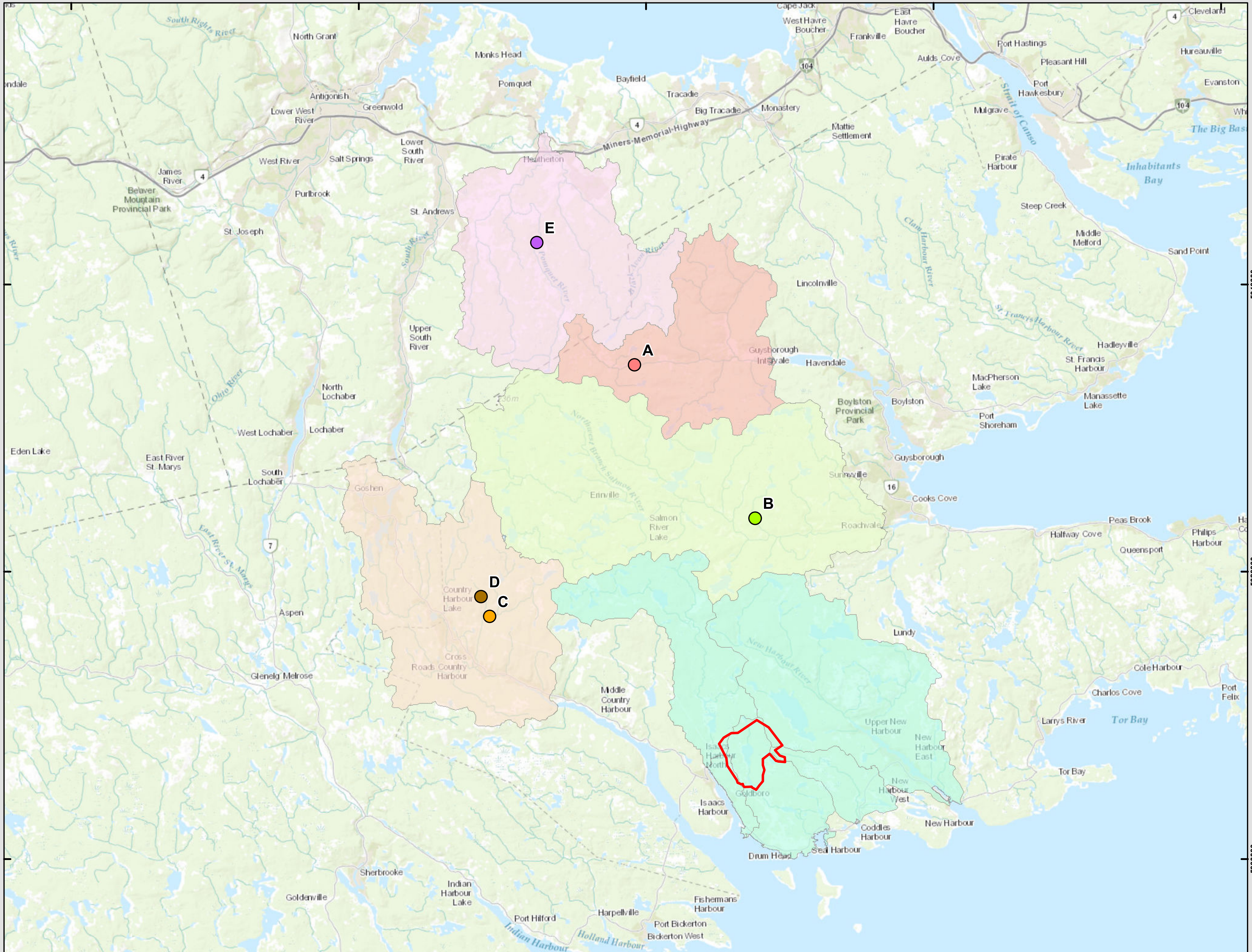
Instream habitat restoration and enhancement are proposed to be completed in degraded streams and rivers in eastern shore and Pomquet River priority watersheds. MNR, who were retained to evaluate the potential for these projects in these priority watersheds, initially focused their efforts within the seven primary systems in the Southern Upland region which flow towards the Atlantic Ocean, and the Pomquet River watershed which drains north into St. George's Bay in the Gulf of St. Lawrence (as presented in Section 4.2). As noted in the Interim Fisheries Offsetting Plan (January 2023), the initial seven sites were deemed suitable as offsetting options based on fish species of interest, their location in a Priority Watershed, a preliminary evaluation of fish habitat restoration and enhancement potential, and through consultation with DFO and engagement with the Mi'kmaq and the local municipality and other interest groups. However, based on the final HADD and subsequent offsetting requirements for the Project (Section 3), the seven sites were narrowed down to five for inclusion in this Offsetting Plan. Determination of the final projects for inclusion in this Offsetting Plan was completed through a combination of watercourse conditions observed during Spring 2023 and the following variables:

- Proximity to the PA;
- Landowner access to the proposed offsetting site;
- Constructability of the offsetting site (i.e., presence of bedrock, availability of materials on site, or need for machine work versus hand work); and,

- Ecological value of offsetting project (i.e., sites that present larger offsetting extents along a longer length of stream are considered higher value opportunities than shorter extents).

The instream habitat restoration sites included as part of this Offsetting Plan are shown on Figure 5-1.

The following sections provide general background information for each of the proposed offsetting locations and discuss the methods implemented as part of the baseline data collection and offsetting design work that was completed during Spring 2023. Specific offsetting site information is presented in detail within Sections 5.2.1 through 5.2.5.



Prepared For:

SIGNAL GOLD

FIGURE 5.1

Goldboro Gold Project

Proposed Fisheries Offsetting Projects

Nova Scotia

- Roman Valley River
- McAllister Brook
- Gunns Brook
- Sutherlands Brook
- East Pomquet River
- Goldboro Gold Project Area

Watershed

- Country Harbour R.
- Guysborough R.
- Pomquet R.
- Salmon R. (Guy Co)
- Watersheds intersected by Goldboro Gold Project Area

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 2.5 5 10 km

1:250,000

Scale when printed @ 11" x 17"

Drawn By: AS
Reviewed By: MM

Date: 2023-06-30

McCallum Environmental Ltd.

Document Name: 230630_OffsettingProjects

5.1 **Background**

5.1.1 Watershed Conditions

The watersheds of focus for instream habitat restoration projects as evaluated by MNR include the Salmon River, Country Harbour River, Guysborough River, and Pomquet River secondary watersheds (Figure 5-1). Land-use within these watersheds is predominantly undeveloped. While active watershed degradation is nominal, historical and ongoing forestry operations, together with intermittent areas of agriculture, have affected aquatic systems and associated fisheries habitat. Nova Scotia Salmon Association (NSSA) share this sentiment in their 2020 report "Characterizing water chemistry and the distribution of Atlantic Salmon on Nova Scotia's eastern shore based on environmental DNA (eDNA)" (NSSA, 2020) where they state that the main decline of Atlantic salmon along the eastern shore is due to an increase in acid rain levels in the 1970's and 1980's which altered soil and water chemistry causing low nutrients. In addition, they state other impacts are due to barriers to connectivity of streams, poor land use practices (e.g., poor agricultural practices), and widespread forestry, including the legacy of log-driving activities.

5.1.2 Stream Conditions

An initial evaluation of potential candidate sites for offsetting were evaluated by MNR based on overall stream and adjacent land use characteristics. From these general surveys, more site-specific evaluations were performed to assess the extent of fish habitat degradation and feasibility for restoration. Streams were initially surveyed in Fall 2022 and observations noted to direct future field programs. This work was completed by Charles MacInnis of MNR who has 35 years of identifying degraded waterways in need of restoration in NS.

Rutherford and MacInnis (1998) state that many brooks in the Maritimes have been impacted by direct human intervention such as diversions, channelization, ice jam removal, road crossings and log driving, as well as the indirect impacts of poor land use. Individually or in combination, these impacts have left Maritime streams approximately 20% over-widened and dominated by runs and flats, with poorly sorted and embedded substrates. Site observations made during the Fall 2022 offsetting identification process indicated that these conditions were true within the six primary systems evaluated along the eastern shore and the Pomquet site. Overall, degradation within these systems has been attributed to historical logging and agriculture whereby extensive removal of vegetation has led to changes in stream hydrology. This has resulted in highly mobile channels that have altered the functional composition of the streams. The most common examples of this include evidence of over-widened channels, straightened sections, unstable banks, and a lack of large woody debris, all culminating in fish habitat lacking diversity. Site specific degradation and fish habitat conditions are provided in Sections 5.2.1 through 5.2.5.

5.1.3 Fish Community

Fish species within the priority systems evaluated within the Eastern Shore region are known to comprise populations of the fish species of offsetting interest (Atlantic salmon, brook trout and American eel) as well as the freshwater habitat to support them. The eastern shore systems are all known to be historic salmon rivers, and anecdotal information from landowners, anglers, and river associations indicate that the fish species noted above are currently present, including Atlantic salmon. MNR identified brook trout spawning at all high priority sites during the Fall 2022 site identification program.

5.1.4 Baseline Data Collection Methods

MEL initiated baseline data collection within the priority instream offsetting sites in Fall 2022 to support the Interim Offsetting Plan. Commencing in Spring 2023, MEL initiated pre-construction data collection at the offsetting sites proposed for implementation through completion of HSI assessments and electrofishing surveys. These surveys will continue through Summer 2023 to support the fulsome collection of pre-construction data for each offsetting measure. Survey methods are further discussed in Section 6.3.

5.1.5 Proposed Restoration Method(s)

All offsetting options presented involve the installation of instream structures to restore, enhance, and create functional fish habitat components (i.e., remedy over-widened channels through creation of gravel bars, pool creation and down-stream deposition of spawning substrate, and creation of meandering channels). This will be achieved through the installation of well-established and proven structures such as digger logs, deflectors, and rock sills. These structures are designed to mimic the natural ecosystem functions of large woody debris and large substrate within the channel. When properly designed and installed, the structures not only produce pool habitat for rest and cover, but also the formation of suitable salmonid spawning habitat, along with the sorting of spawning gravels. The installation of these structures is not intended to be located on unimpaired or undegraded habitats (e.g., existing suitable spawning areas).

In some instances, the installation of instream structures is proposed to be accompanied by other restoration techniques such as bank stabilization, breach repair, and culvert remediation to address additional habitat degradation issues including bank erosion, braided channels, and barriers to fish passage. Any sites that include bank or culvert works are proposed to be implemented in combination with permanent, instream structures.

Design and field siting of all structure locations was completed between April – June 2023 by experienced instream restoration designers (MNR). The design process included completion of the following tasks:

1. Initial reconnaissance of the stream system to identify potential habitat improvement locations and structure/stabilization options, identification of potential constraints (i.e., access, beaver activity, or adjacent land use) and evaluate constructability; and,

2. Field fit structure locations, size, and construction methods. This incorporated flagging structure location, recording precise location (coordinates) of each offsetting measure, collecting pre-construction photos and any other notable information.

Results of the baseline data collection and design process discussed above are incorporated into each individual offsetting site discussion presented in Section 5.1.6. A summary of all offsetting measures proposed is provided in Table 5-1.

Table 5-1. Summary of Offsetting Projects (Figure 5-1)

Figure Ref[1]	Site Name	Secondary Watershed (Code)	Proximity to Project	Geographic Coordinates (UTM)		Habitat Description	Proposed Restoration Technique	Objective(s)
				Downstream	Upstream			
A	Roman Valley River	Guysborough R. (1ER-5)	28 km N	600803 mE, 5034643 mN	595533 mE, 5036199 mN	Various brooks and rivers in Southern Upland watersheds impacted by historic and current land-use practices (e.g., forestry, log drives, agriculture, mill dams, channelization for road construction, etc.). Habitat degradation is exemplified by oversimplified channels. Systems lack the complexity that supports quality habitat for freshwater life stages of Atlantic salmon, brook trout, and American eel.	In-stream structures (e.g., digger logs, deflectors, rock sills) applicable to all sites and to be installed by hand. Bank stabilization methods, scour and erosion remediation/prevention methods, and culvert remediation considered in combination with instream structures for applicable sites.	Overarching objective of structures is to mimic or replace the components of habitat complexity to restore and/or enhance fish habitat components for Southern Uplands salmon, brook trout, and American eel.
B	McAllister Brook	Salmon R. (1EQ-1)	15 km N	608456 mE, 5024349 mN	607346 mE, 5024349 mN			
C	Gunns Brook	Country Harbour R. (1EP-2)	20 km NW	588282 mE, 5013546 mN	590250 mE, 5017264 mN			
D	Sutherlands Brook	Country Harbour R. (1EP-2)	20 km NW	589565 mE, 5016983 mN	589829 mE, 5019251 mN			
E	East Pomquet River	Pomquet R. (1DS-1)	40 km N	592592 mE, 5043327 mN	593357 mE, 5040157 mN	Productive trout and salmon river highly impacted by agriculture, forestry, and historical land clearing. Lower extent was previously restored by Antigonish Rivers Association through bank stabilization projects, riparian buffer establishment, and installation digger logs. Upper portion of river remains oversimplified and lacks pools, hindering upstream migration of salmon to spawning areas.	In-stream structures (e.g., digger logs, deflectors, rock sills) to be installed by hand. Bank stabilization methods, scour and erosion remediation/prevention methods considered in combination with instream structures.	Mimic or replace the components of habitat complexity to restore and/or enhance fish habitat components for Gaspe-Southern Gulf of St. Lawrence salmon. Improve accessibility to key habitat components for target species and increase instream habitat connectivity.

5.1.6 Quantification of Offsetting Areas

Total offsetting areas for each site were calculated by multiplying the total stream length to be restored by the calculated bankfull width. Bankfull widths are calculated based on the upstream catchment size and the annual rainfall amounts for each site. Measuring the actual bankfull width at each site can lead to an over-calculation of the restored area as the habitat in these sites is typically over-widened. Typical structures spacing falls approximately every 6 calculated bankfull widths. If site conditions warranted structure spacing farther apart (e.g., due to flooding from beaver dams, bedrock ledges, etc.), then this additional spacing was not included in the overall restoration area. Similarly, gaps between restoration "sections" along a river system were not included. This is a standard approach to measuring restored areas in Nova Scotia and it reflects the total area of fish habitat that is expected to be restored by the time the restoration structures have influenced the adjacent habitat.

5.2 Site Specific Offsetting Projects

5.2.1 Gunns Brook

Stream restoration and enhancement is proposed along 6,400 m of Gunns Brook. Restoration work has been divided into three restoration sections based on changes in hydrology (Figure 5-2). Note that these sections are continuous (one after the other) but warrant different structure spacing based on varying drainage area size. The downstream extent of Section 1 begins at the HWY 316 bridge and continues upstream for 4,100 m. Section 2 continues upstream for 1,500 m to the confluence of Sutherlands Brook. Section 3 begins at the confluence of Sutherlands Brook and terminates 800 m upstream at the Guysborough Nature trail. Sections are presented on Figure 5-2, and location information including upstream/downstream coordinates and section lengths are presented in Table 5-2.

Table 5-2. Gunns Brook – Location Information

Section	Downstream Coordinate (UTM)	Upstream Coordinate (UTM)	Section Length (m)
1	588282, 5013546	588721, 5017009	4,100 m
2	588721, 5017009	589564, 5016977	1,500 m
3	589564, 5016977	590250, 5017264	800 m

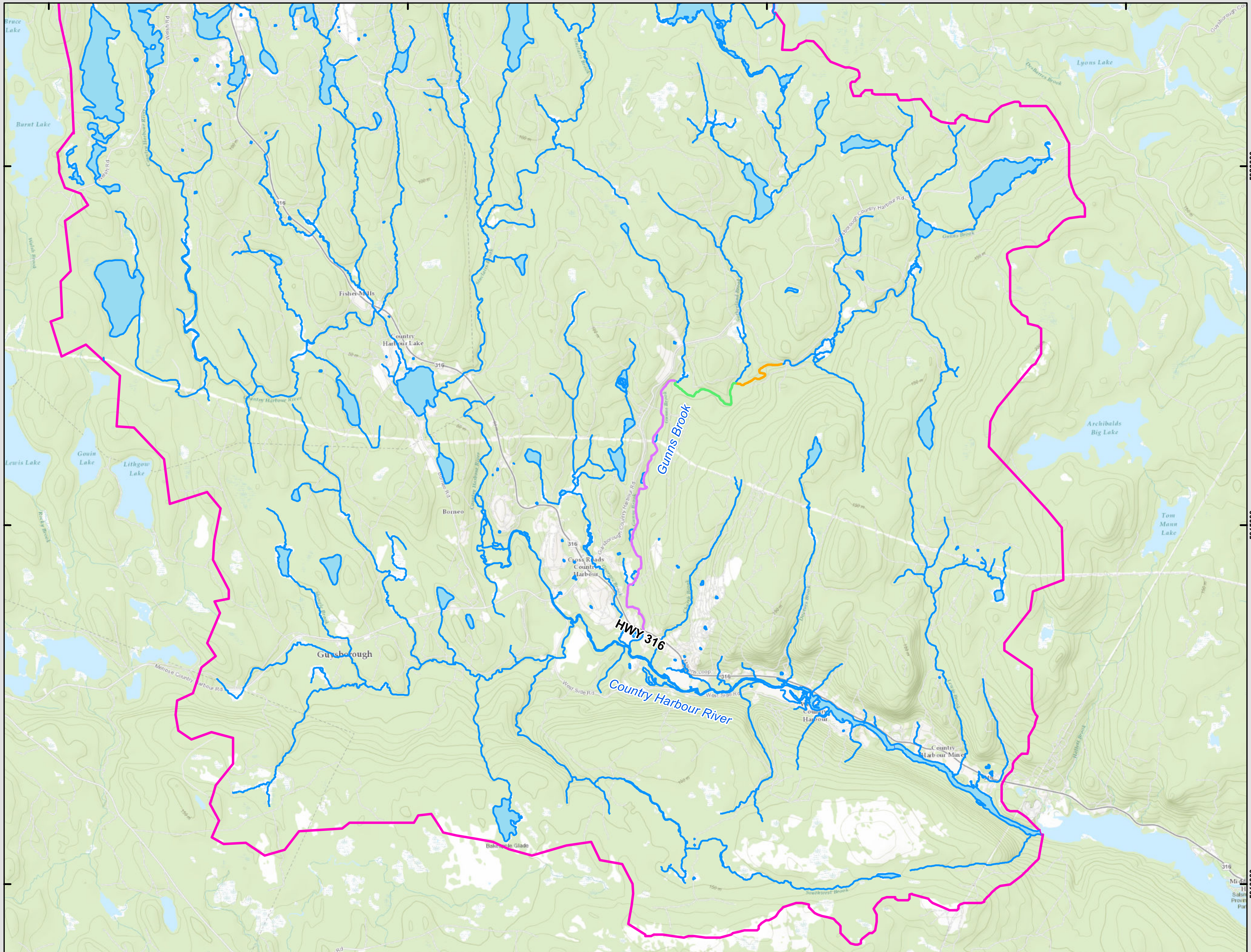


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FIGURE 5.2

Goldboro Gold Project Fisheries Offsetting

Project Location: Gunns Brook

Country Harbour Crossroads, NS

Restoration Section

- Section 1
- Section 2
- Section 3
- NSTDB Watercourses
- Country Harbour Secondary Watershed

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 500 1,000 2,000 m

1:50,000 Scale when printed @ 11" x 17"

Drawn By: AS
Reviewed By: AW
Date: 2023-06-30

McCallum Environmental Ltd.

Document Name: 230620_Project Location_Gunns

5.2.1.1 *Background*

Gunns Brook is a major tributary to the Country Harbour River in Guysborough County, Nova Scotia. The community of Country Harbour was originally settled in the late 1700s and established as a port for timber exports. As such, the landscape was cleared, and the presence of mill dams was common. Historical logging practices relied on log drives, resulting in the severe degradation of instream habitats. It is likely that these practices continued well into the 20th century. The presence of logging in the area remains strong to this day and practices such as clearcutting and riparian zone loss create persistent challenges that have slowed the recovery of natural aquatic ecosystems. Evidence of historic farming activities (e.g., old fence lines and machine access points) was found throughout the proposed restoration site.

5.2.1.2 *Existing Conditions*

Existing instream habitat conditions were assessed within the proposed offsetting area of Gunns Brook River in Spring 2023 using the NS Fish Habitat Assessment Protocol's Habitat Suitability Index (HSI) survey (NSSA & AAS, 2018). The survey is designed to evaluate habitat features within a watercourse that are necessary to support the various life-stage requirements for Atlantic salmon and Brook trout. The HSI surveys provide practitioners with a quantifiable data set that can be used to determine if the habitat within a watercourse is degraded. The results of these surveys can help guide river restoration practitioners to select the appropriate techniques required to restore and improve habitat conditions and provides the baseline data set for future monitoring to verify that restoration efforts have been effective (see Section 6.3.1.2 for additional details on HSI survey methods).

Sixty HSI sites were surveyed in May 2023. Sites were grouped throughout the proposed restoration area: Groups 1, 3, 4, and 5 were each composed of 10 HSI surveys, while Group 2 contained 20 HSI surveys. HSI surveys are grouped to gain an understanding of habitat conditions across a longer stream segment, which provides a more fulsome view of overall habitat quality. The results of surveys in Gunns Brook confirmed that the habitat is severely degraded. Issues with pool quantity and quality were identified throughout the proposed restoration site and instream cover for juvenile Atlantic salmon and adult Brook trout was commonly rated as poor through each survey site. Spawning habitat was also limited and most observed spawning habitat was found to be low quality. The absence of pool habitat, spawning substrate, and instream cover represents a critical deficiency in habitat which would limit the ability of all life-stages of salmonids. HSI survey data is presented in Appendix A.

Bankfull width is an important indicator of instream habitat condition. Hydrological estimates are used to predict the calculated bankfull width for each proposed restoration area, which is based on the upstream catchment size and the annual rainfall amounts for each section. The calculated bankfull width in Gunns Brook ranges from 9.5 meters to 11 meters wide. In total, 180 bankfull width measurements were taken in Gunns Brook (3 measurements per HSI site) and the mean bankfull width from these measurements was 15.34 meters, indicating that the channel was approximately 50% over-widened when compared to the upstream area. Like most over-widened streams, Gunns Brook is degraded and lacks important habitat features such as pools and spawning habitat.

Gunns Brook is a tributary to the Country Harbour River, therefore it has the potential to provide habitat for fish species such as Atlantic salmon, brook trout, white sucker, and American eel known to be present in that system. During the May 2023 habitat evaluation and design work, field teams observed brook trout fry and parr, as well as juvenile American eel (elvers). Previous environmental assessments completed in 1997 by Maritimes and Northeast Pipeline confirmed the presence of brook trout and Atlantic salmon during electrofishing surveys (Appendix B). Pre-construction electrofishing surveys are being conducted to document the existing fish community within the proposed offsetting area in Summer 2023 (Section 6.3.2).

Water quality data was collected at each HSI location in Gunns Brook during May 2023. Results are provided in Table 5-3. Parameters measured in-situ (i.e., dissolved oxygen, pH, conductivity, water temperature) are considered suitable for target species (Atlantic salmon, brook trout, and American eel).

Table 5-3. In-situ water quality parameters recorded at Gunns Brook (May 2023)

Temperature (°C)	DO (mg/L)	pH	Conductivity (µS/cm)	TDS (mg/L)
Median: 9.4 Range: 3.6-14.7	Median: 10.93 Range: 7.91-13.99	Median: 5.7 Range: 5.52-6.26	Median: 137.6 Range: 118.3-199.6	Median: 127.4 Range: 122.9-162.5

5.2.1.3 *Restoration Objectives*

The overall objective of the proposed work in Gunns Brook is to improve instream fish habitat through the introduction of large woody debris (LWD) replicating structures such as digger logs and deflectors to restore channel complexity and ecological function. The goal of this work will be to create a self-sustaining and stable aquatic environment with improved spawning habitat, increased pool frequency and quality, and a narrower bankfull width. Atlantic salmon and brook trout have diverse life-stage requirements and therefore the current conditions of the channel (i.e., simplified) is not conducive to the success of either fish species. By creating an improved channel using established restoration techniques, the habitat in Gunns Brook will become more suited to the proliferation of these important fish species. The improvements in habitat created by the installation of LWD structures will improve fish passage throughout the project site by establishing important staging pools and a deeper thalweg. These changes will also aid in improving the migration capability of juvenile Atlantic salmon and adult brook trout during the summer months when fish are seeking cooler headwater reaches. Restoration objectives for Gunns Brook are outlined in Table 5-4.

Table 5-4. Gunns Brook – Restoration Objectives

Aquatic Impact	Description	Example Photo	Restoration Objectives	Proposed Restoration and Enhancement Techniques
Over-widened channel	Macro impacts such as clearcutting and micro impacts such as site-specific riparian zone loss have created over-widened channels that lack defined thalweg and limit ecological function.		Narrow the channel so that bankfull width is closer to hydrology calculations.	Digger logs, rock sills, and deflectors.
Absence of spawning and pool habitat	Absence of LWD has resulted in the lack of a sufficient quantity and quality of important channel features for salmonids.		Promote pool scouring and subsequent deposition of gravel and cobbles to restore and enhance spawning habitats.	Digger logs, rock sills and deflectors.

Aquatic Impact	Description	Example Photo	Restoration Objectives	Proposed Restoration and Enhancement Techniques
Braided channel	Due to lack of mature riparian zone forest, there is a lack streambank stability resulting in the formation of braided channels which limit migration due to poor channel depth.		Restore a single flow path in order to increase water volume and maintain fish passage through site.	Digger logs, rock sills, deflectors, rock mattress, and channel breach repairs.
Simplified channel with poor meander sequence	Healthy riverine habitat should follow a back-and-forth meander pattern which is conducive to setting up pool-riffle-run sequences. Without LWD structures in channel these sequences are often absent and may present as riffle-dominant channels.		Develop a meandering channel thalweg through the introduction of LWD structures that promote the development of pools, riffles and runs. Structures will alternate from left to right creating both meander stability and complexity	Digger logs, rock sills and deflectors.

5.2.1.4 *Project Design*

One-hundred and eleven restoration structures will be installed to promote the recovery of instream habitats as described in Table 5-4. Structures will include 75 deflectors, 22 rock sills, 3 digger logs, 6 bank stabilization sites, 1 rock mattress and 4 structure combinations (e.g., rock sill with a deflector). Structures will be placed approximately 60 m apart in Section 1, 54 m apart in Section 2, and 48 m apart in Section 3 in order to account for changes in hydrology caused by differences in upstream drainage area. All proposed structures, structure locations (GPS waypoints), and current photograph representations are presented in Table 1 (Appendix C) and Figure 5-3 A-E. Note that structures have been labelled in a downstream to upstream sequence.

5.2.1.5 *Quantification of Habitat Offsetting Area*

Based on the length of the offsetting extent (6,400 m), and the calculated bankfull width of the Gunns Brook system (8 to 10 m), the overall habitat restoration footprint has been calculated as 60,900 m^2 (Table 5-5).

Table 5-5: Gunns Brook – Offsetting Area

Section #	Site Length (m)	Upstream Drainage Area ($km^{2)}$	Calculated Bankfull Width (m)	Restoration Footprint (m^2)
1	4,100	38.6	10	41,000
2	1,500	32.1	9.0	13,500
3	800	16.1	8.0	6,400
Total	6400	N/A	N/A	60,900

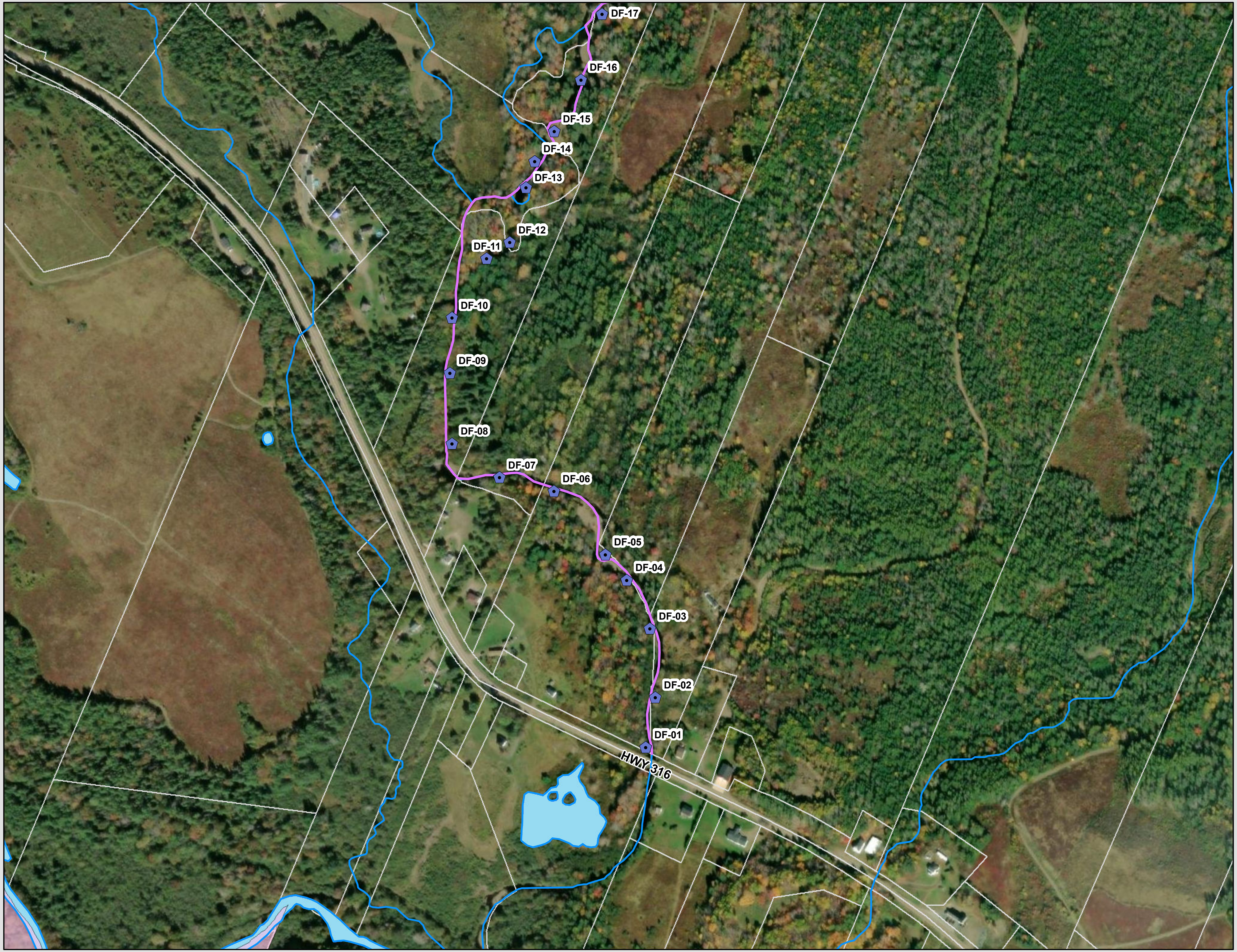

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FIGURE 5.3-A

Goldboro Gold Project
Fisheries Offsetting

Detailed Design: Gunns Brook

Goldboro, Guysborough, NS

Structure Type

- Deflector
- Section 1
- NSTDB Watercourses
- Crown Land
- PID Boundaries

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 25 50 100 m

1:4,000 Scale when printed @ 11" x 17"

Drawn By: KF
Reviewed By: MMD
Date: 2023-06-30

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Document Name: 230606_DD_Gunns

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FIGURE 5.3-B

Goldboro Gold Project
Fisheries Offsetting

Detailed Design: Gunns Brook

Goldboro, Guysborough, NS

Structure Type

- Deflector
- Section 1
- NSTDB Watercourses
- Crown Land
- PID Boundaries

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 25 50 100 m

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Drawn By: KF
Reviewed By: MMD Date: 2023-06-30

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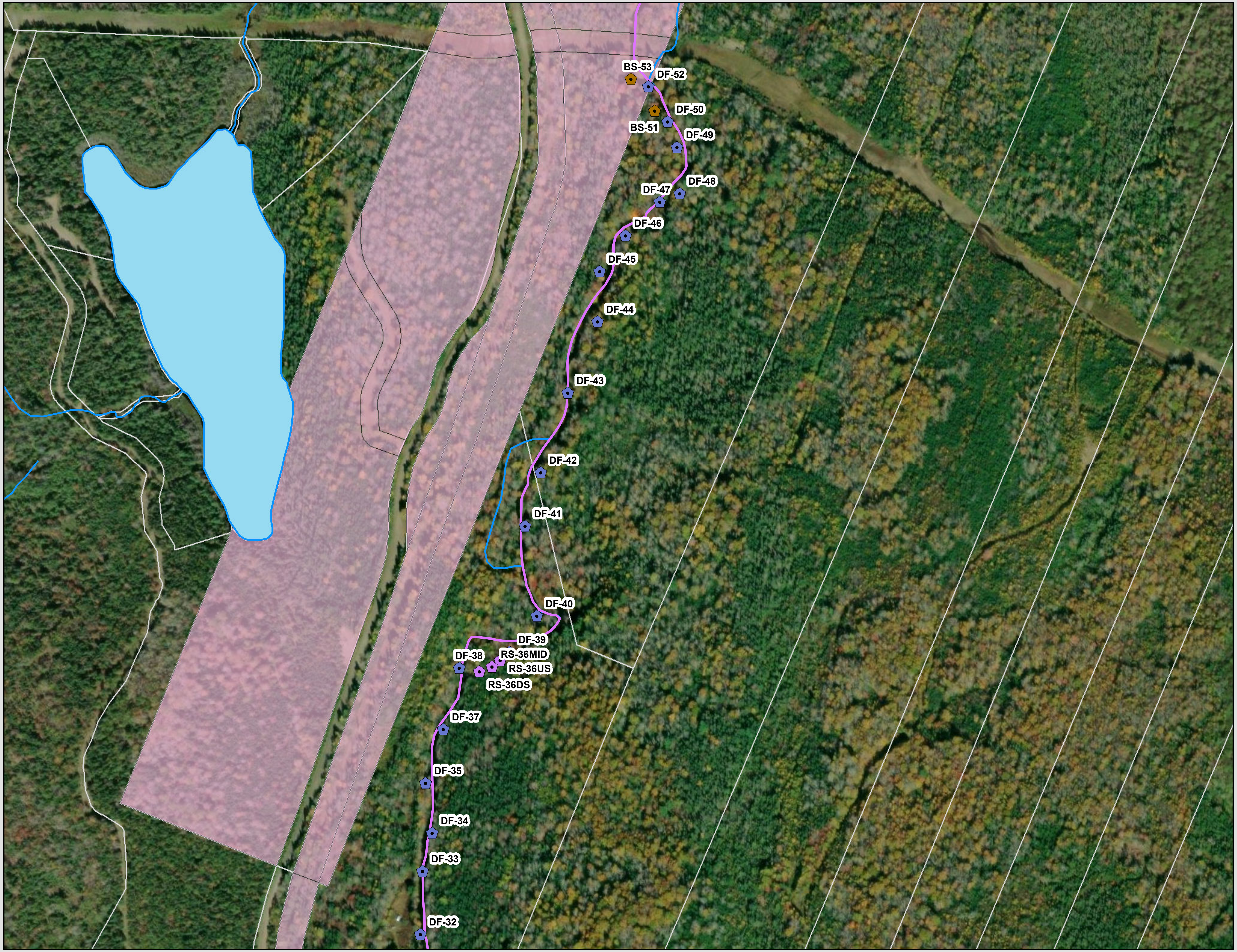

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FIGURE 5.3-C

Goldboro Gold Project
Fisheries Offsetting

Detailed Design: Gunns Brook

Goldboro, Guysborough, NS

Structure Type

- Bank Stabilization
- Deflector
- Rock Sill
- Section 1
- NSTDB Watercourses
- Crown Land
- PID Boundaries

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 25 50 100 m

1:4,000 Scale when printed @ 11" x 17"

Drawn By: KF
Reviewed By: MMD
Date: 2023-06-30

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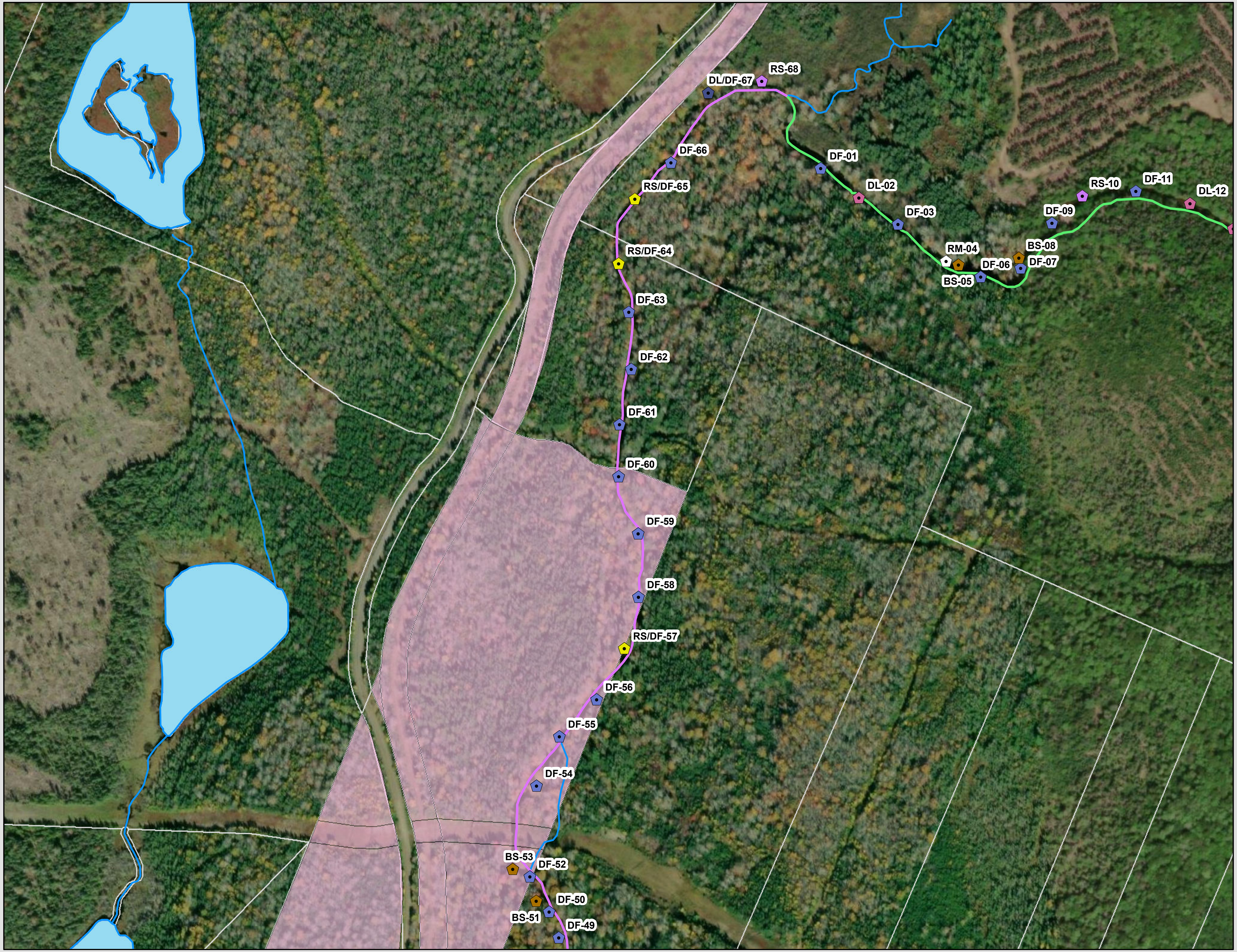
Document Name: 230606_DD_Gunns



Prepared For:

SIGNAL GOLD

FIGURE 5.3-D

Goldboro Gold Project
Fisheries Offsetting

Detailed Design: Gunns Brook

Goldboro, Guysborough, NS

Structure Type

- Digger Log
- Bank Stabilization
- Deflector
- Deflector and Digger Log
- Rock Mattress
- Rock Sill
- Rock Sill and Deflector
- Section 1
- Section 2
- NSTDB Watercourses
- Crown Land
- PID Boundaries

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 25 50 100 m

1:4,000 Scale when printed @ 11" x 17"

Drawn By: KF
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Date: 2023-06-30

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Document Name: 230606_DD_Gunns

Prepared For:

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FIGURE 5.3-E

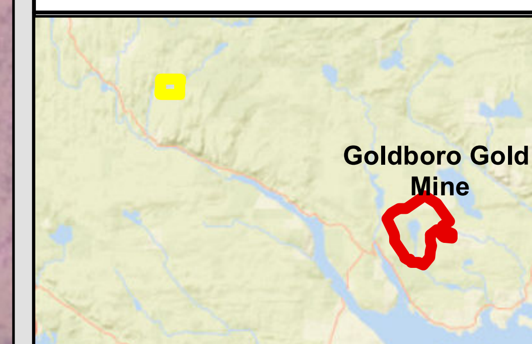
Goldboro Gold Project
Fisheries Offsetting

Detailed Design: Gunns Brook

Goldboro, Guysborough, NS

Structure Type

- Digger Log
- Bank Stabilization
- Deflector
- Rock Sill
- Section 2
- Section 3
- NSTDB Watercourses
- Crown Land
- PID Boundaries



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 25 50 100 m

1:4,000 Scale when printed @ 11" x 17"

Drawn By: KF
Reviewed By: MMD
Date: 2023-06-30

McCallum Environmental Ltd.

Document Name: 230606_DD_Gunns

5.2.2 Sutherlands Brook

Stream restoration and enhancement is proposed along 3,300 m of Sutherlands Brook, which has been divided into 2 sections of restoration work based on changes in hydrology and site access. Section 1 begins at the confluence of Sutherlands Brook with Gunns Brook and continues upstream for 1,250 m to where the watercourse reaches Guysborough Country Harbour Road. Section 2 begins at this road crossing and continues upstream for 2,050 m to the outflow of Nelsons Lake. Like Gunns Brook, these sections are continuous, and degraded habitat has been identified throughout the proposed offsetting area. Sections are presented on Figure 5-4, and location information including upstream/downstream coordinates and section lengths are presented in Table 5-6.

Table 5-6. Sutherlands Brook – Location Information

Section	Downstream Coordinate (UTM)	Upstream Coordinate (UTM)	Section Length (m)
1	589565, 5016983	589628, 5017999	1,250
2	589628, 5017999	589829, 5019251	2,050

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FIGURE 5.4

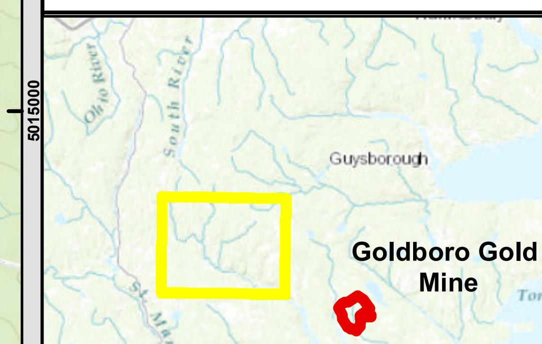
Goldboro Gold Project Fisheries Offsetting

Project Location: Sutherlands Brook

Country Harbour Crossroads, NS

Restoration Section

- Section 1
- Section 2
- NSTDB Watercourses
- Country Harbour Secondary Watershed



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 500 1,000 2,000 m

1:50,000 Scale when printed @ 11" x 17"

Drawn By: AS
Reviewed By: AW
Date: 2023-06-30

McCallum Environmental Ltd.

Document Name: 230620_Project Location_Gunns

5.2.2.1 *Background*

Sutherlands Brook is a major tributary to Gunns Brook (Figure 5-4). The sub-watershed drains several headwater lakes, including Nelson Lake and Grassy Lake which likely provide over-wintering habitat for adult brook trout and juvenile Atlantic salmon (MNR, personal communication, December 2022). The landscape within the Sutherlands Brook sub-watershed has been greatly impacted by human settlement and resource extraction since the community of Country Harbour was settled in the late 1700s. The primary historic activity within this watershed was timber extraction, which used watercourses such as Sutherland's Brook for mill dams and log drives. The remnants of an old mill dam can still be found at the headwaters of Sutherlands Brook at the outflow of Nelsons Lake. The lower reaches of Sutherlands Brook appear to have been used for agriculture in the first half of the 1900s as indicated by the presence of cleared land and old barb wire fences. Cumulatively, these historic practices have greatly altered the surrounding forests and riparian zones in Sutherlands Brook and have led to habitat degradation.

5.2.2.2 *Existing Conditions*

The habitat within Sutherlands Brook is representative of the habitat conditions found in streams throughout Nova Scotia that have been subject to significant historical forestry activities. Past logging practices were not regulated by riparian zone protections, as such the frequency and size of LWD accumulations within impacted streams is well-below levels required to promote the recovery of instream habitats. The absence of LWD results in over-widened channels that are disconnected from the floodplain, a condition known as channel incision, which prevents channels from establishing pool – riffle – run sequences that are critical for supporting diverse and abundant aquatic life and in particular, salmonid fish (Heggenes et al., 1999).

Thirty HSI sites were surveyed throughout the proposed restoration sections on Sutherlands Brook between May and June 2023. Sites were grouped into 3, each composed of 10 HSI surveys, and were sited throughout the proposed restoration area. The results of these surveys indicated that pool quality and quantity within the proposed restoration site were poor, instream cover, an important metric for juvenile Atlantic salmon and adult brook trout survival was poor, and spawning habitat for Atlantic salmon was absent throughout all sites. These results indicate that the fish habitat within Sutherlands Brook is degraded for use by all stages of the salmonid life-cycle. HSI survey data is presented in Appendix A.

As a tributary to Gunns Brook, the fish community in Sutherlands Brook is expected to comprise similar species, i.e., Atlantic salmon, brook trout, white sucker and American eel. Pre-construction electrofishing surveys are currently being conducted to document the existing fish community within the proposed offsetting area (Section 6.3.2).

Water quality data was collected at all HSI locations in Sutherlands Brook from May-June 2023. Results are provided in Table 5-7. Parameters measured in-situ are considered suitable for target species (Atlantic salmon, brook trout, and American eel).

Table 5-7. In-situ water quality parameters recorded at Sutherlands Brook (May-June 2023)

Temperature (°C)	DO (mg/L)	pH	Conductivity (µS/cm)	TDS (mg/L)
Median: 9.6 Range: 7.1-18.9	Median: 11.59 Range: 10.19-13.83	Median: 5.52 Range: 5.39-5.71	Median: 129.6 Range: 123.1-136.4	Median: 120.3 Range: 117.7–122.2

5.2.2.3 *Restoration Objectives*

Work to restore fish habitat in Sutherlands Brook will focus on improving the condition of key habitat features necessary to support the various life-stages of Atlantic salmon and brook trout. HSI surveys were completed throughout the proposed restoration site and the results indicate that instream cover for juvenile Atlantic salmon and adult brook trout were poor, the frequency and quality of pool habitat was low, and that spawning habitat for Atlantic salmon was absent. The objectives of the restoration work proposed on Sutherlands Brook will be to restore these three key habitat features through the installation of LWD mimicking structures such as digger logs, deflectors and rock sills. These structures have been used successfully to restore fish habitat throughout Nova Scotia. Restoration objectives for Sutherlands Brook are outlined in Table 5-8.

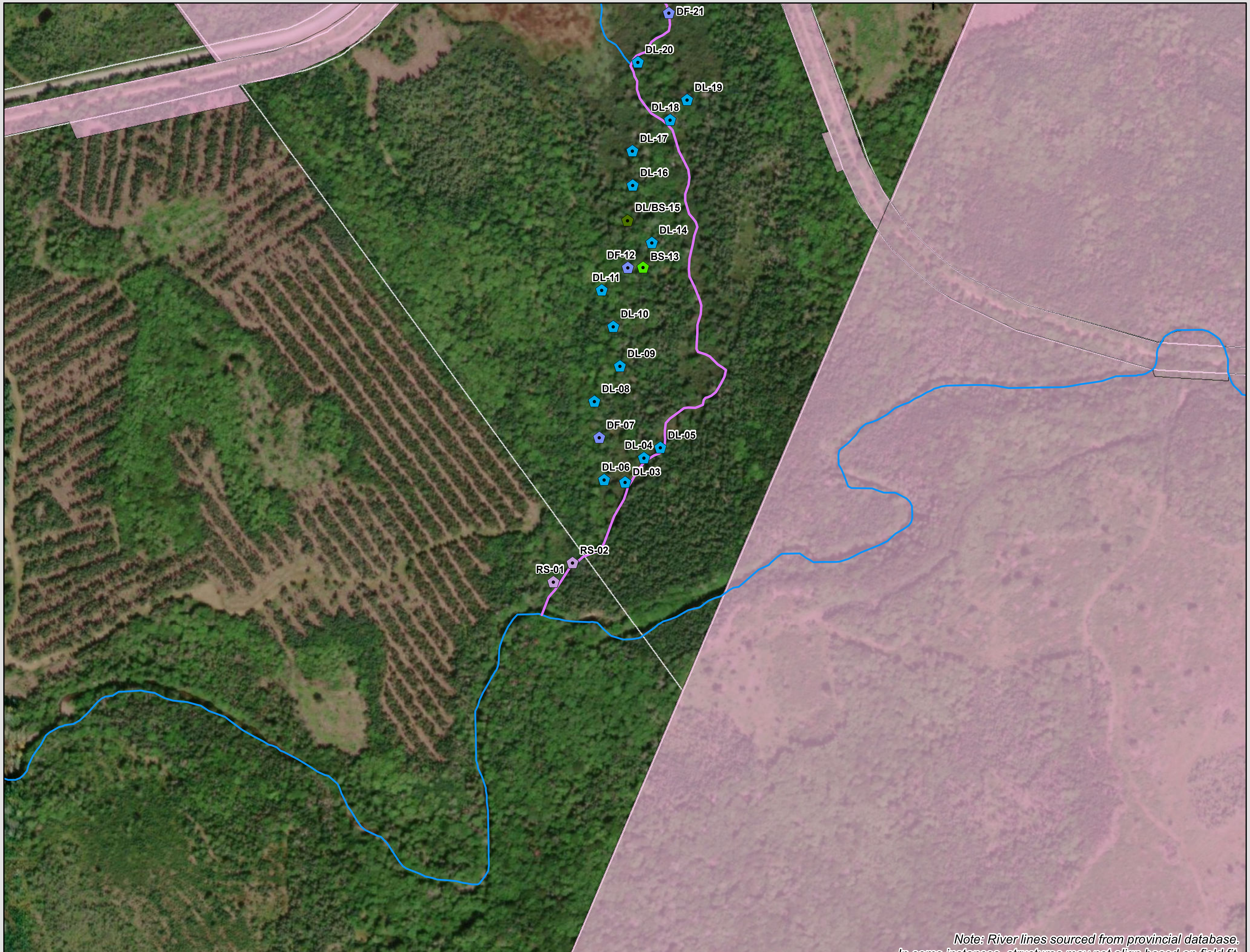
Table 5-8. Sutherlands Brook - Restoration Objectives

Aquatic Impact	Description	Example Photo	Restoration Objectives	Proposed Restoration and Enhancement Techniques
Over-widened channel	Macro impacts such as clearcutting and micro impacts such as site-specific riparian zone loss have created over-widened channels that lack defined thalweg and limit ecological function.		Narrow channel so that bankfull width is closer to hydrology calculations.	Digger logs, rock sills and deflectors.
Absence of spawning and pool habitat	Absence of LWD has resulted in absence of sufficient quantity and quality of important channel features for salmonids.		Promote pool scouring and subsequent deposition of gravel and cobbles to restore and enhance spawning habitats.	Digger logs, rock sills and deflectors.

Aquatic Impact	Description	Example Photo	Restoration Objectives	Proposed Restoration and Enhancement Techniques
Braided channel	Due to lack of mature riparian zone forest, there is a lack of streambank stability resulting in the formation of braided channels which limit migration due to poor channel depth.		Restore a single flow path in order to increase water volume and maintain fish passage through site.	Digger logs, rock sills, channel breach repairs and deflectors.
Simplified channel with poor meander sequence	Healthy riverine habitat should follow a back-and-forth meander pattern which is conducive to setting up pool-riffle-run sequences. Without proper structure in channel, these sequences are often absent and may present as riffle-dominant channels.		Develop a meandering channel thalweg through the introduction of LWD structures that promote the development of pools, riffles and runs. Structures will alternate from left to right creating both meander stability and complexity.	Digger logs, rock sills and deflectors.

5.2.2.4 *Project Design*

This offsetting project requires the installation of 75 structures which includes 45 digger logs, 9 rock sills, 14 deflectors, 2 breach repairs, and 5 structure combinations (e.g., digger log and deflector). Structures will be placed approximately 42 m apart. All proposed structures, structure locations (GPS waypoints), and current photo representation are presented in Table 2 (Appendix C) and Figure 5-5 A-C (note that structure locations presented may not align with provincial watercourse lines as presented on the figures -for example, the watercourse line may not be true to the field or structures may be placed on a braided channel).



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SIGNAL GOLD

FIGURE 5.5-A

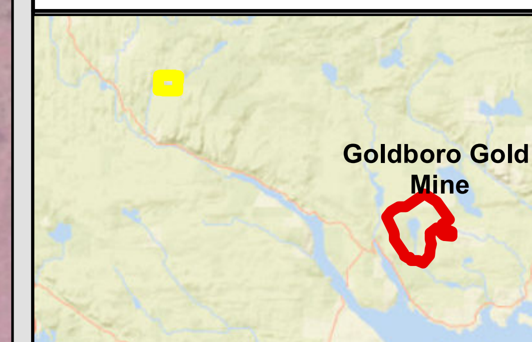
Goldboro Gold Project
Fisheries Offsetting

Detailed Design: Gunns Brook

Goldboro, Guysborough, NS

Structure Type

- Breach Repair
- Deflector
- Digger Log
- Digger Log and Breach Repair
- Rock Sill
- Section 1
- NSTDB Watercourses
- Crown Land
- PID Boundaries



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Projection: Transverse Mercator
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Units: Meter

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1:4,000 Scale when printed @ 11" x 17"

Drawn By: KF
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Date: 2023-06-30

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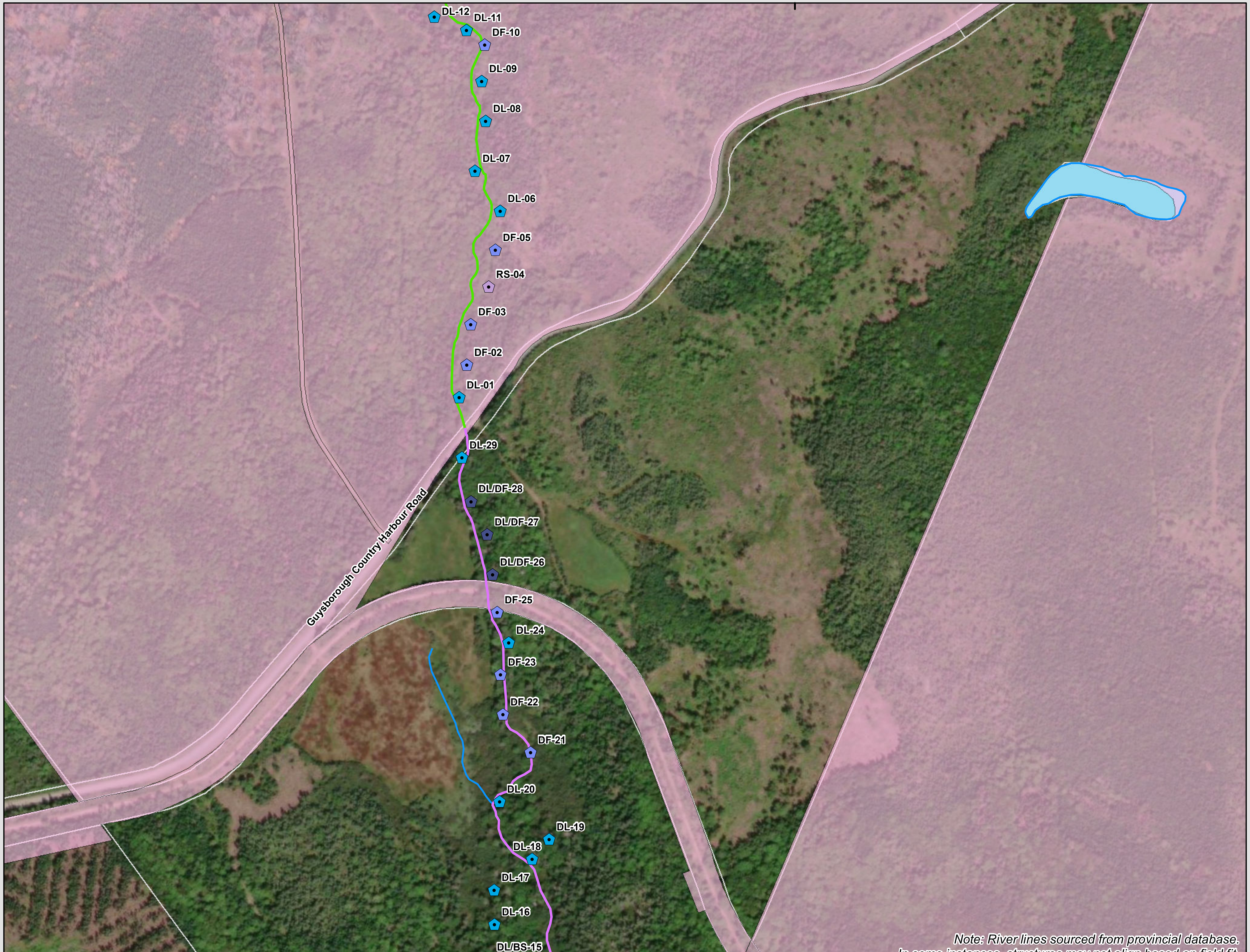
Document Name: 230630_DD_Sutherlands



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SIGNAL GOLD

FIGURE 5.5-B

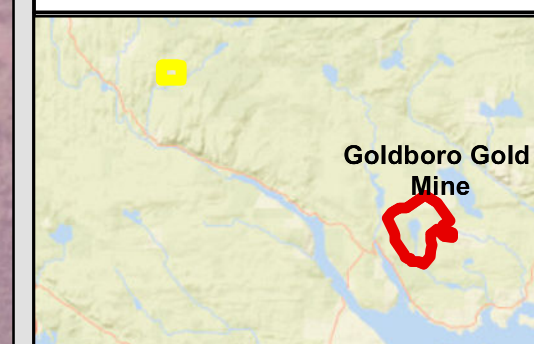
Goldboro Gold Project Fisheries Offsetting

Detailed Design: Gunns Brook

Goldboro, Guysborough, NS

Structure Type

- Deflector
- Digger Log
- Digger Log and Breach Repair
- Deflector and Digger Log
- Rock Sill
- Section 1
- Section 2
- NSTDB Watercourses
- Crown Land
- PID Boundaries



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

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1:4,000 Scale when printed @ 11" x 17"

Drawn By: KF
Reviewed By: MMD
Date: 2023-06-30

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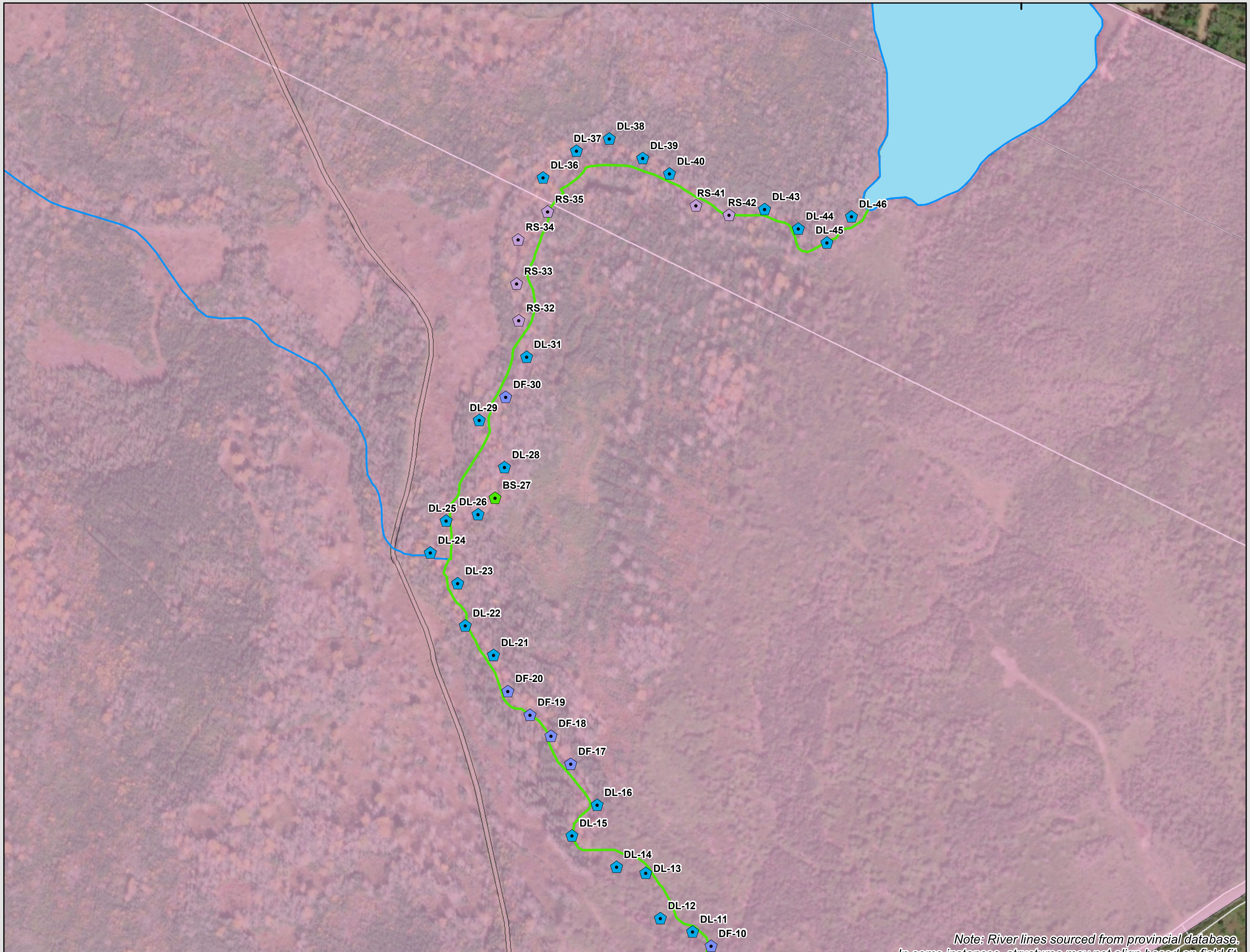
Document Name: 230630_DD_Sutherlands



Prepared For:

SIGNAL GOLD

FIGURE 5.5-C

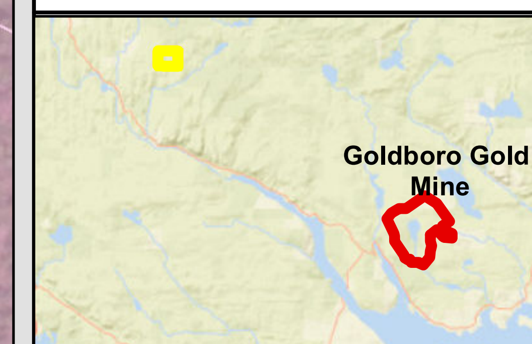
Goldboro Gold Project Fisheries Offsetting

Detailed Design: Gunns Brook

Goldboro, Guysborough, NS

Structure Type

- Breach Repair
- Deflector
- Digger Log
- Rock Sill
- Section 2
- NSTDB Watercourses
- Crown Land
- PID Boundaries



Coordinate System: NAD 1983 CSRS UTM Zone 20N
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Datum: North American 1983 CSRS
Units: Meter

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1:4,000 Scale when printed @ 11" x 17"

Drawn By: KF
Reviewed By: MMD
Date: 2023-06-30

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Document Name: 230630_DD_Sutherlands

5.2.2.5 *Quantification of Habitat Offsetting Area*

Based on the length of the offsetting extent (3,300 m), and the calculated bankfull width of the Sutherlands Brook system (7.0-7.1 m), the overall habitat restoration footprint has been calculated as 23,125 m^2 (Table 5-9).

Table 5-9. Sutherlands Brook - Offsetting Area

Section #	Stream Length (m)	Upstream Drainage Area (km^2)	Calculated Bankfull Width	Restoration Footprint (m^2)
1	1,250	14.65	7.10	8,875
2	2,050	12.31	7.00	14,250
Total	3,300	N/A	N/A	23,125

5.2.3 East Pomquet River

Stream restoration and enhancement is proposed along 3,300 m of East Pomquet River in two sections where degraded habitat has been identified (Figure 5-6). The downstream extent of Section 1 begins approximately 1,300 km downstream of the Beauly Road bridge and continues upstream to the bridge. In Section 1, a 300 m stretch of bedrock outcrop has been omitted in this Section as the area is not conducive to instream structure installation (Figure 5-7A). Project designers have confirmed that this area is not considered a barrier to fish passage, nor a limitation to the broader objectives of restoration and fish passage. Section 2 of the East Pomquet Restoration site begins approximately 450 meters upstream from the Beauly Road bridge to avoid low gradient habitat that has been colonized by beavers. Section 2 continues 2,300 m upstream, terminating approximately 650 m south of the transmission line (Figure 5-7B). Location information including upstream/downstream coordinates and section lengths are presented in Table 5-10.

Table 5-10. East Pomquet – Location Information

Section	Downstream Coordinate (UTM)	Upstream Coordinate (UTM)	Section Length (m)
1	592592, 5043327	592288, 5042092	1,000
2	592405, 5041669	593357, 5040157	2,300

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FIGURE 5.6

Goldboro Gold Project Fisheries Offsetting

Project Location: East Pomquet River

Beauly, NS

Restoration Section

- Section 1
- Section 2
- NSTDB Watercourses
- Pomquet River Secondary Watershed

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

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Reviewed By: AW
Date: 2023-06-30

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Document Name: 230620_Pomquet_WS

5.2.3.1 *Background*

The East Pomquet River is one of three tributaries that make up the Pomquet River watershed (Figure 5-6). The landscape surrounding the East Pomquet watershed has been greatly impacted by human settlement and resource extraction since the settlement of the area in the early 1800s. The primary activities historically within this watershed were agriculture and forestry. Channelization was commonly practiced throughout the watershed to accommodate public and logging road construction and to straighten channels to improve adjacent farmland drainage. Many of these channel altering activities continued into the early 1980s. Cumulatively, these historic practices have greatly altered the surrounding landscape and limited the channel sinuosity of the river. As a result of channelization, the rate of surface water to groundwater interchange (i.e., groundwater discharge) has been severely compromised. This has reduced groundwater supply throughout the river and, as a result, extremely low base-flow conditions can occur during summer drought periods.

5.2.3.2 *Existing Conditions*

Both historical and present activities within the floodplains and riparian zones along the East Pomquet River have reduced the frequency of LWD within the system, resulting in widespread and persistent habitat degradation. The absence of LWD within the proposed restoration site on the East Pomquet River is preventing the establishment of habitat recovery processes such as gravel bar formation and pool scouring.

The East Pomquet River is an important sub-watershed to the Pomquet River, containing cold-water refuge, spawning habitat and important juvenile rearing habitat for both Atlantic salmon and brook trout in the headwaters (e.g., Ushton’s Lake; Figure 5-6). Instream restoration was previously completed by the Antigonish Rivers Association (ARA) in 2012 just downstream of the proposed offsetting area. This past restoration work included installation of digger logs and deflectors at approximately six-channel width intervals. All of these structures remain intact and functioning. Anecdotal evidence from the ARA suggests that in restored reaches the channel width has narrowed considerably and pool abundance and quality has significantly improved. The creation of spawning habitat for Atlantic salmon and brook trout has also occurred post restoration. Atlantic salmon have been observed spawning within the restored section of East Pomquet River annually since 2018 and there is an active recreational fishery for brook trout in the river.

Existing instream habitat conditions were assessed within the proposed offsetting area of the East Pomquet River in Spring 2022 through HSI surveys. In total, 20 sites were surveyed in groups of 10 within portions of the proposed restoration area. Sites 1-10 (the most downstream HSI surveys) contained the most degraded habitat. The absence of pools through the lower half of the proposed restoration site (approximately 1.0 km of stream) is likely enough to limit successful upstream migration of both juvenile and adult Atlantic salmon, and is particularly concerning given the extent of potential upstream habitat. The installation of log structures will facilitate the narrowing of the channel and the creation of pools, which will facilitate upstream migration of salmon. Overall, the entire site can be characterized as degraded with a low occurrence of spawning habitat, a lack of instream cover for juvenile Atlantic salmon (fry and parr), and poor pool quality. Fifteen of these sites did not contain any spawning habitat while 5 sites had spawning habitat which received a very good score (1.00). Eighteen out 20 sites received poor scores for instream cover for parr. Pool quality scored poor in 9 sites, moderate in 10, and only one site received very good scores. Conversations with landowners in the area indicate that the portion of channel found between sites 1 and 10 was anthropogenically channelized in the 1950’s to allow for the stream bed to be used as a road for timber extraction. HSI survey results are presented in Appendix A. Pre-construction (baseline) HSI surveys will continue through Summer 2023 to further quantify representation of habitat quality across the proposed restoration site (Section 6.3.1.2).

Though no water quality values have been provided for the East Pomquet River, pH levels within this system are unlikely to be limiting to habitat quality. Acid sensitivity of watersheds outside the Southern Uplands region is generally lower and freshwater systems exhibit mean pH levels greater than 5.4 (NS

Museum of Natural History, 1996). In-situ water quality parameters are currently being collected as part of remaining pre-construction HSI surveys (Section 6.3.1.2). Pre-construction electrofishing surveys are also being conducted to document the existing fish community within the proposed offsetting area (Section 6.3.1.2).

5.2.3.3 *Restoration Objectives*

Restoration objectives for the East Pomquet offsetting project are presented in Table 5-11. Fish habitat restoration and enhancement measures intend to target four key aquatic impacts: over-widened channel; absence of spawning and pool habitat; braided channel; and simplified channel with poor meander sequence.

Table 5-11. East Pomquet River – Restoration Objectives

Aquatic Impact	Description	Example Photo	Restoration Objectives	Proposed Restoration and Enhancement Techniques
Over-widened channel	Macro impacts such as clearcutting and micro impacts such as site-specific riparian zone loss have created over-widened channels that lack defined thalweg and limit ecological function.		Narrow channel so that bankfull width is closer to hydrology calculations.	Digger logs, deflectors, bank stabilization work and rock sills.
Absence of spawning and pool habitat	Absence of LWD has resulted in absence of sufficient quantity and quality of important channel features for salmonids.		Promote pool scouring and subsequent deposition of gravel and cobbles to restore and enhance spawning habitats.	Digger logs, deflectors and rock sills.

Aquatic Impact	Description	Example Photo	Restoration Objectives	Proposed Restoration and Enhancement Techniques
Braided channel	Due to lack of mature riparian zone forest, there is a lack of streambank stability resulting in the formation of braided channels which limit migration due to poor channel depth.		Restore a single flow path in order to increase water volume and maintain fish passage through site.	Deflectors, bank stabilization work and channel breach repairs.
Simplified channel with poor meander sequence	Healthy riverine habitat should follow a back-and-forth meander pattern which is conducive to setting up pool-riffle-run sequences. Without proper structure in channel, these sequences are often absent and may present as riffle-dominant channels.		Develop a meandering channel thalweg through the introduction of LWD structures that promote the development of pools, riffles and runs. Structures will alternate from left to right creating both meander stability and complexity.	Digger logs, deflectors and rock sills.

5.2.3.4 *Project Design*

Sixty-three restoration structures will be installed to promote the recovery of instream habitats as described in Table 5-8. Structures will include 7 digger logs, 8 rock sills, 36 deflectors, 2 breach repairs, 3 bank stabilization sites, and 7 structure combinations (e.g., digger log with a deflector). Structures will be placed approximately 60 m apart in Section 1 and 57 m apart in Section 2 in order to account for changes in hydrology caused by differences in upstream drainage area. All proposed structures, structure locations (GPS waypoint), and current photo representation are presented in Table 3 (Appendix C) and Figure 5-7 A-B.

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FIGURE 5.7-A

Goldboro Gold Project Fisheries Offsetting

Detailed Design: East Pomquet River

Beauly, NS

Structure Type

- Bank Stabilization
- Breach Repair
- Deflector
- Rock Sill
- Section 1
- NSTDB Watercourses
- Crown Land
- PID Boundaries

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

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1:6,000 Scale when printed @ 11" x 17"

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Document Name: 230620_DD_Pomquet

Prepared For:

FIGURE 5.7-B

Goldboro Gold Project Fisheries Offsetting

Detailed Design: East Pomquet River

Beauly, NS

Structure Type

- Bank Stabilization
- Breach Repair
- Deflector
- Deflector and Breach Repair
- Digger Log
- Digger Log and Breach Repair
- Digger Log and Deflector
- Digger Log and Deflector, Breach Repair
- Section 2
- NSTDB Watercourses
- Crown Land
- PID Boundaries

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

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1:6,000 Scale when printed @ 11" x 17"

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Date: 2023-06-30

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5.2.3.5 *Quantification of Habitat Offsetting Area*

Based on the length of the offsetting extent (3,300 m), and the calculated bankfull width of the East Pomquet River system (9.0 to 9.5 m), the overall habitat restoration footprint has been calculated as 30,200 m^2 (Table 5-12). This excludes the 300 m bedrock outcrop that was omitted in Section 1 (Figure 5-6).

Table 5-12. East Pomquet River – Offsetting Area

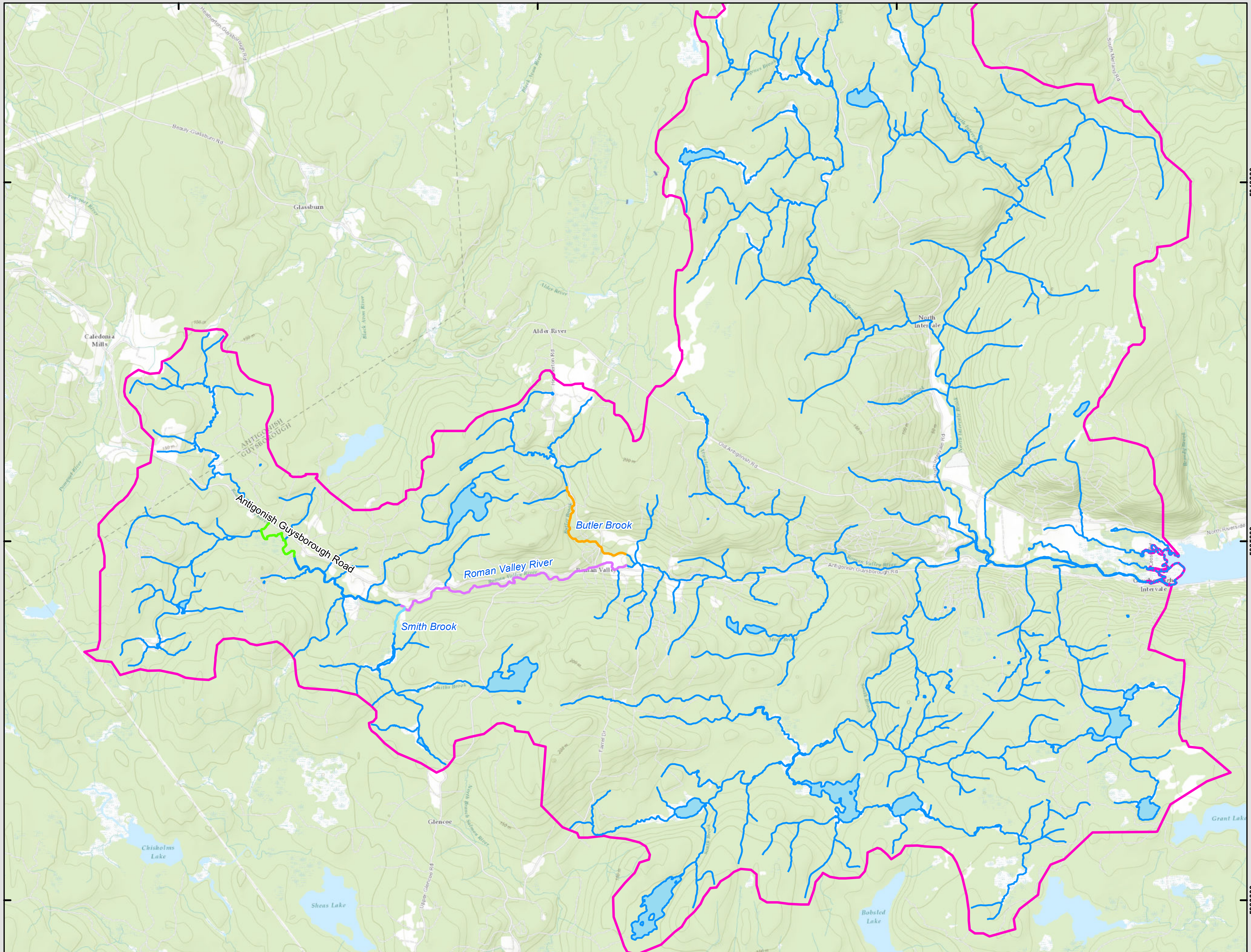
Section #	Stream Length (m)	Upstream Drainage Area (km^2)	Calculated Bankfull Width (m)	Restoration Footprint (m^2)
1	1,000	32	9.5	9,500
2	2,300	23	9.0	20,700
Total	3,300	N/A	N/A	30,200

5.2.4 Roman Valley River

Restoration and habitat enhancement work on Roman Valley River is proposed across four sections (Figure 5-8). Two sections occur in the main river channel (Sections 1 and 2), and two sections are located on tributaries, Butler Brook (Section 3) and Smith Brook (Section 4). Section 1 begins below the bridge on Heatherton Road and extends upstream for 4,000 m. Section 2 begins above a private quarry road crossing and continues upstream for 1,200 m to the Antigonish Guysborough Road. Sections 1 and 2 have been purposefully spaced apart to avoid low gradient habitat that has been colonized by beavers. Section 3 starts in Butlers Brook below Heatherton Road, extending upstream for 1,900 m. Section 4, Smith Brook, begins at its confluence with the Roman Valley River and extends upstream for 600 m. Location information including upstream/downstream coordinates and section lengths are presented in Table 5-13.

Table 5-13. Roman Valley River – Location Information

Section	Watercourse	Downstream Coordinate (UTM)	Upstream Coordinate (UTM)	Section Length (m)
1	Roman Valley River	601231, 5034666	598096, 5034103	4,000
2	Roman Valley River	596282, 5035288	596609, 5034790	1,200
3	Butlers Brook	601212, 5034818	600413, 5035755	1,900
4	Smith Brook	598095, 5034096	598006, 5033730	600



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SIGNAL GOLD

FIGURE 5.8

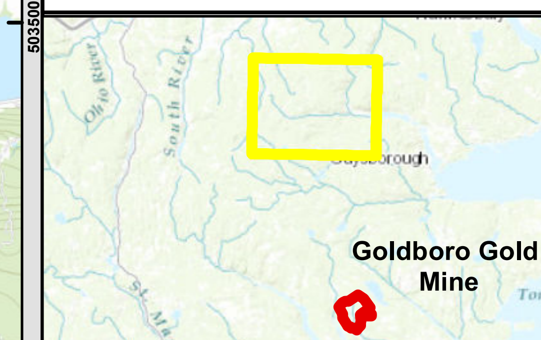
Goldboro Gold Project
Fisheries Offsetting

Project Location: Roman Valley River

Roman Valley, NS

Restoration Section

- Section 1
- Section 2
- Section 3
- Section 4
- Guysborough River Secondary Watershed



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Projection: Transverse Mercator
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Units: Meter

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Document Name: 230620_Project Location_RVR

5.2.4.1 *Background*

Roman Valley River is one of two major watersheds that empties into Milford Haven Harbour in Guysborough County Nova Scotia. The landscape within the Roman Valley River watershed has been significantly altered since European settlement, first through extensive timber harvesting in the late 1700s, followed by the establishment of agriculture in the 1800s. The most fertile soil in the watershed was found in the floodplains adjacent to the Roman Valley River and many of these areas remain actively farmed today. Between timber drives, the construction of mill dams, and the dredging of the main stem of the river, the present habitat is characterized as highly degraded and over-simplified. In many areas throughout the river, the legacy of channelization activities (i.e., stream straightening) persists to this day. These impacts have created a stream channel that can be characterized as incised, which can have far-reaching ecological effects. Channel incision can reduce groundwater storage and cause mortality of riparian species, reduce habitat complexity and access to off-channel habitats, and negatively impact fish communities (Reilly and Johnson 1982; Shields et al., 1994; Davies et al., 2005).

5.2.4.2 *Existing Conditions*

The predominant channel condition throughout the Roman Valley River restoration can be described as incised, simplified, straightened, and over-widened. These characteristics are typical of degraded habitat in Nova Scotia and create conditions that limit the abundance of fish species such as Atlantic salmon and brook trout. Furthermore, these conditions often persist for long periods of time as the necessary inputs for recovery (i.e., large wood accumulation) can take decades to occur. The absence of LWD is of particular concern for the Roman Valley River due to the relative immaturity of the adjacent streamside vegetation which consists of a mix of early successional tree and shrub species. Cumulatively, these factors are limiting the availability of important habitat features such as spawning beds, holding pools, and instream cover for adult and juvenile salmonids.

HSI surveys were completed in Fall 2022 to quantify these conditions. In total, 8 sites were surveyed across the span of 2 km of the main channel of the Roman Valley River. The results of these surveys indicate that the habitat for all life stages of salmonid fish species is compromised. Spawning habitat was of limited quantity and poor quality, particularly from embeddedness (i.e., percent fines in spawning areas). Pool habitat, critical for the survival and migration of adult brook trout and juvenile Atlantic salmon, was also limited. Habitat for juvenile fish lacked sufficient instream cover, a factor that can lead to increased predation and lower survival rates (Allouche, 2002). The channel was frequently over-widened, with field-measured bankfull widths largely in excess of the bankfull width calculated based on the catchment area of the system. HSI survey results are presented in Appendix A. Pre-construction (baseline) HSI surveys have continued through Summer 2023 to further quantify representation of habitat quality across the proposed restoration site (Section 6.3.1.2).

Roman Valley River eventually flows into the Milford Haven River which is a popular destination for anglers, many of whom have reported catching Atlantic salmon while targeting brook trout and brown trout. Conversations with anglers in the area suggest that Atlantic salmon frequently spawn within the farm land of Roman Valley River downstream from the proposed restoration site. Brook trout redds were observed within the proposed restoration site in early November 2022 as well (MNR, personal communication, December 2022). Pre-construction electrofishing surveys will be conducted to document the existing fish community within the proposed offsetting area in Summer 2023 (Section 6.3.2).

Water quality data was collected at all HSI locations in Roman Valley River in Fall 2022. Results are provided in Table 5-14 (note that probes for dissolved oxygen, conductivity, and total dissolved solids malfunctioned at the time of assessment, which is why this data is not included). Parameters measured in-situ (pH and water temperature) are considered suitable for target species (Atlantic salmon, brook trout, and American eel).

Table 5-14. In-situ water quality parameters recorded at Roman Valley River (November 2022)

Temperature (°C)	DO (mg/L)	pH	Conductivity (µS/cm)	TDS (mg/L)
Median: 9.15 Range: 9.0-10.1	-	Median: 6.13 Range: 5.69-7.17	-	-

5.2.4.3 *Restoration Objectives*

Restoration objectives for the Roman Valley River offsetting project are presented in Table 5-15. Fish habitat restoration and enhancement measures intend to target five key aquatic impacts: over-widened channel; absence of spawning and pool habitat; braided channel; simplified channel with poor meander sequence; and incised channel that is disconnected from the floodplain.

Table 5-15. Restoration Objectives - Roman Valley River

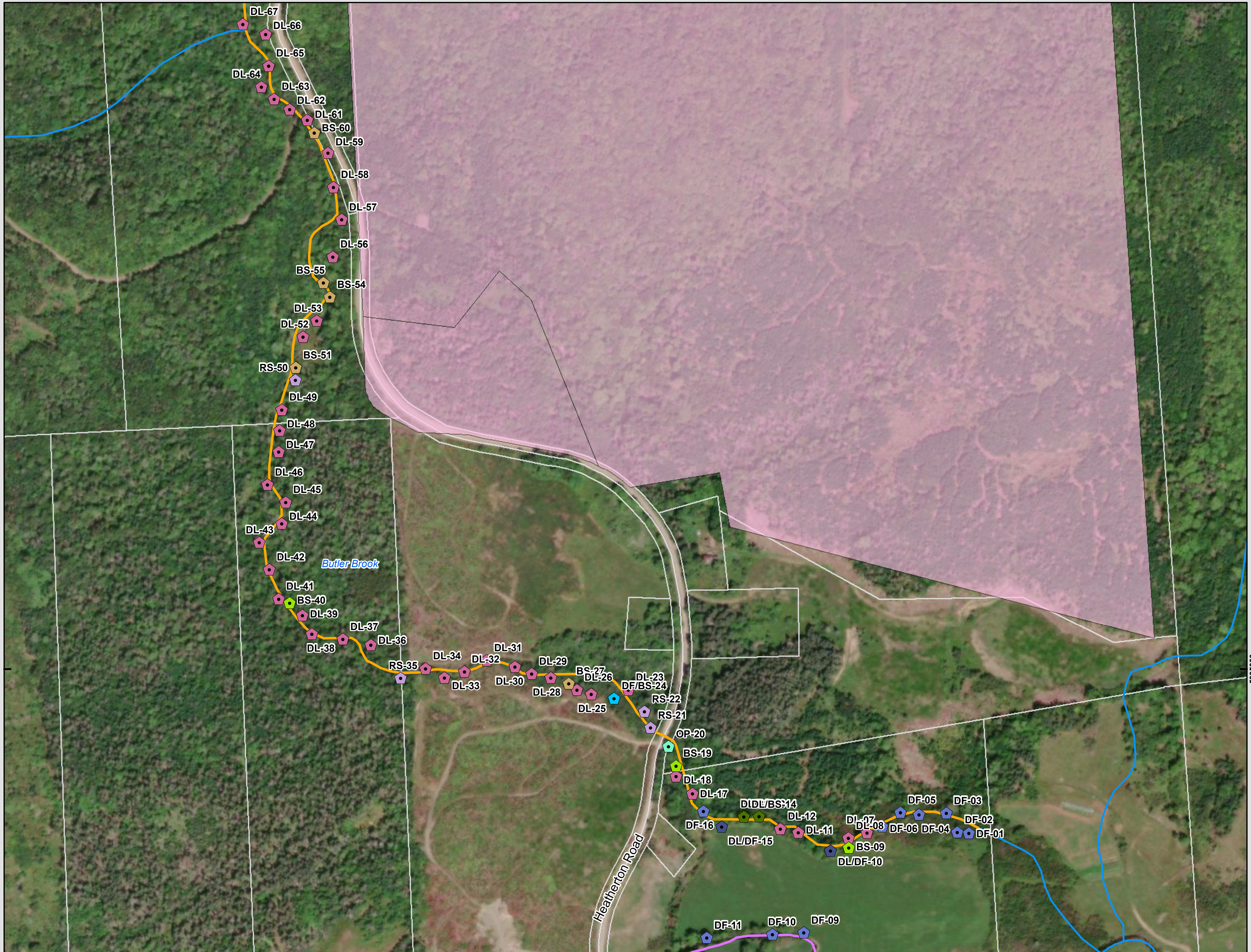
Aquatic Impact	Description	Example Photo	Restoration Objectives	Proposed Restoration and Enhancement Techniques
Over-widened channel	Macro impacts such as clearcutting and micro impacts such as site-specific riparian zone loss have created over-widened channels that lack defined thalweg and limit ecological function.		Narrow channel so that bankfull width is closer to hydrology calculations.	Digger logs, deflectors, bank stabilization work and rock sills.
Absence of spawning and pool habitat	Absence of LWD has resulted in absence of sufficient quantity and quality of important channel features for salmonids.		Promote pool scouring and subsequent deposition of gravel and cobbles to restore and enhance spawning habitats.	Digger logs, deflectors and rock sills.

Aquatic Impact	Description	Example Photo	Restoration Objectives	Proposed Restoration and Enhancement Techniques
Braided channel	Due to lack of mature riparian zone forest, there is a lack of streambank stability resulting in the formation of braided channels which limit migration due to poor channel depth.		Restore a single flow path in order to increase water volume and maintain fish passage through site.	Deflectors, bank stabilization work and channel breach repairs.
Simplified channel with poor meander sequence	Healthy riverine habitat should follow a back-and-forth meander pattern which is conducive to setting up pool-riffle-run sequences. Without proper structure in channel, these sequences are often absent and may present as riffle-dominant channels.		Develop a meandering channel thalweg through the introduction of LWD structures that promote the development of pools, riffles and runs. Structures will alternate from left to right creating both meander stability and complexity.	Digger logs, deflectors and rock sills.

Aquatic Impact	Description	Example Photo	Restoration Objectives	Proposed Restoration and Enhancement Techniques
Incised channel that is disconnected from the floodplain.	The inability of a watercourse to breach the banks and disperse flow into the floodplain during spring and fall freshets is prohibitive to the recovery of instream habitats.		Promote the scouring of streambed material via digger logs and the accumulation of that material downstream via the deflectors. This process creates gravel bars and increases the tail-end control height of pools which promotes floodplain connection.	Digger logs and deflectors.

5.2.4.4 *Project Design*

Restoration work in Section 1 will require the installation of 82 structures, including 49 deflectors, 4 rock sills, 13 digger logs, 14 digger log – deflector combination structures, and 2 breach repairs. The calculated bankfull width for Section 1 is 8.8 meters and the structures have been spaced at approximately 53 m intervals. Restoration of Section 2 will require the installation of 28 structures which will include 21 digger logs, 4 digger log – deflector combination structures, and 3 deflectors. The calculated bankfull width for Section 2 is 7.0 meters and the approximate structure spacing is 42 meters. Note that between the two most downstream structures (DL-01 and DF-02), approximately 400 m of randomly scattered debris will be removed to improve fish passage through the system (Figure 5-9 E). Restoration work on Section 3 (Butler Brook) will require the installation of 68 structures, comprising 43 digger logs, 7 deflectors, 4 rock sills, 8 bank stabilization structures/breach repairs, 5 structure combinations, and one outlet pool downstream of an existing culvert (Figure 5-9 A). The calculated bankfull width of Site 3 is 4.0 m and the structures will be placed at approximately 24 m intervals. Section 4 (Smith Brook) is proposed to contain 11 structures. Structures will include 3 digger logs, 5 rock sills, 2 deflectors, and one digger log/deflector structure combination. The calculated bankfull width for Smith Brook is 4.0 meters and the approximate structure spacing will be 42 m (wider structure spacing has been proposed despite the relatively narrow channel width due to bedrock outcrops between structures). All proposed structures, structure locations (GPS waypoints), and current photo representation are presented in Table 4 (Appendix C) and Figure 5-9 A-E.



Prepared For:

SIGNAL GOLD

FIGURE 5.9-A

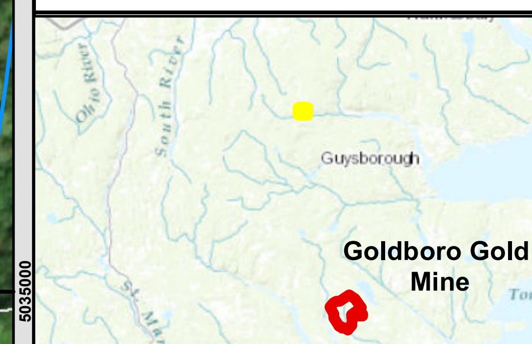
Goldboro Gold Project Fisheries Offsetting

Detailed Design: Roman Valley River

Roman Valley, NS

Structure Type

- Breach Repair
- Deflector
- Deflector and Breach Repair
- Digger Log
- Digger Log and Breach Repair
- Digger Log and Deflector
- Debris Removal
- Outlet Pool
- Rock Sill
- Section 1
- Section 3
- NSTDB Watercourses
- Crown Land
- PID Boundaries



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Document Name: 230630_DD_RomanValley

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SIGNAL GOLD

FIGURE 5.9-B

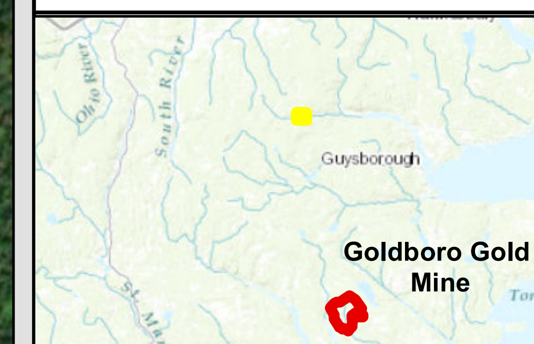
Goldboro Gold Project Fisheries Offsetting

Detailed Design: Roman Valley River

Roman Valley, NS

Structure Type

- Breach Repair
- Deflector
- Deflector and Breach Repair
- Digger Log
- Digger Log and Breach Repair
- Digger Log and Deflector
- Debris Removal
- Outlet Pool
- Rock Sill
- Section 1
- Section 3
- NSTDB Watercourses
- Crown Land
- PID Boundaries



Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

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1:4,000 Scale when printed @ 11" x 17"

Drawn By: AS
Reviewed By: AW
Date: 2023-06-30

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Document Name: 230630_DD_RomanValley

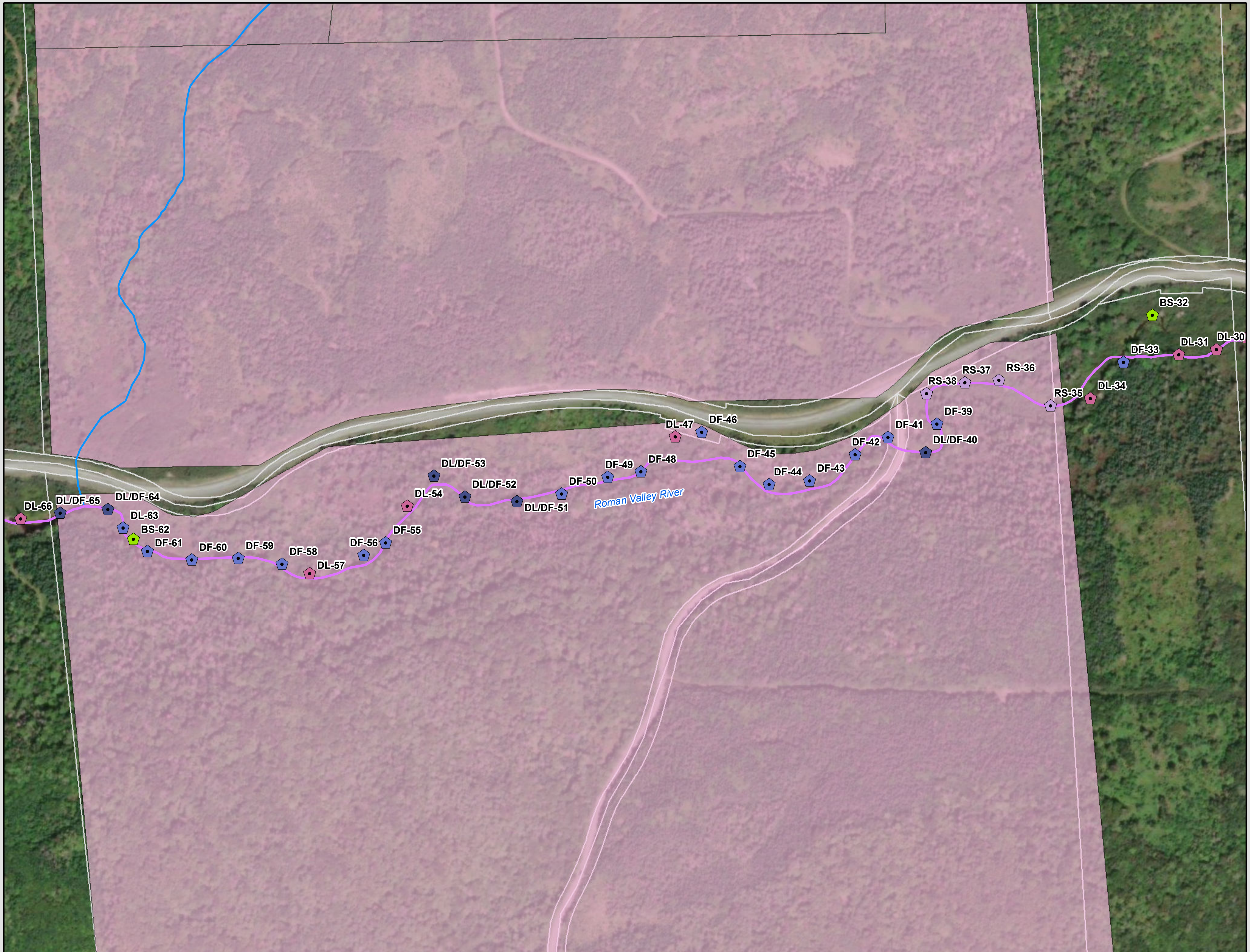

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FIGURE 5.9-C

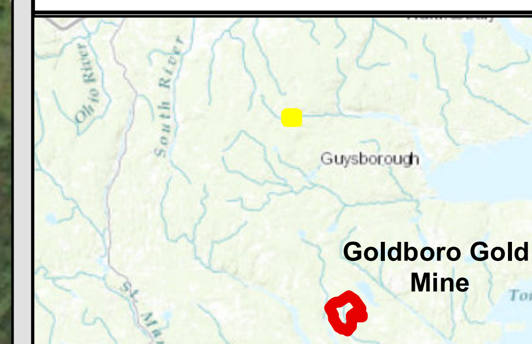
Goldboro Gold Project
Fisheries Offsetting

Detailed Design: Roman Valley River

Roman Valley, NS

Structure Type

- Breach Repair
- Deflector
- Digger Log
- Digger Log and Deflector
- Rock Sill
- Section 1
- NSTDB Watercourses
- Crown Land
- PID Boundaries



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Document Name: 230630_DD_RomanValley

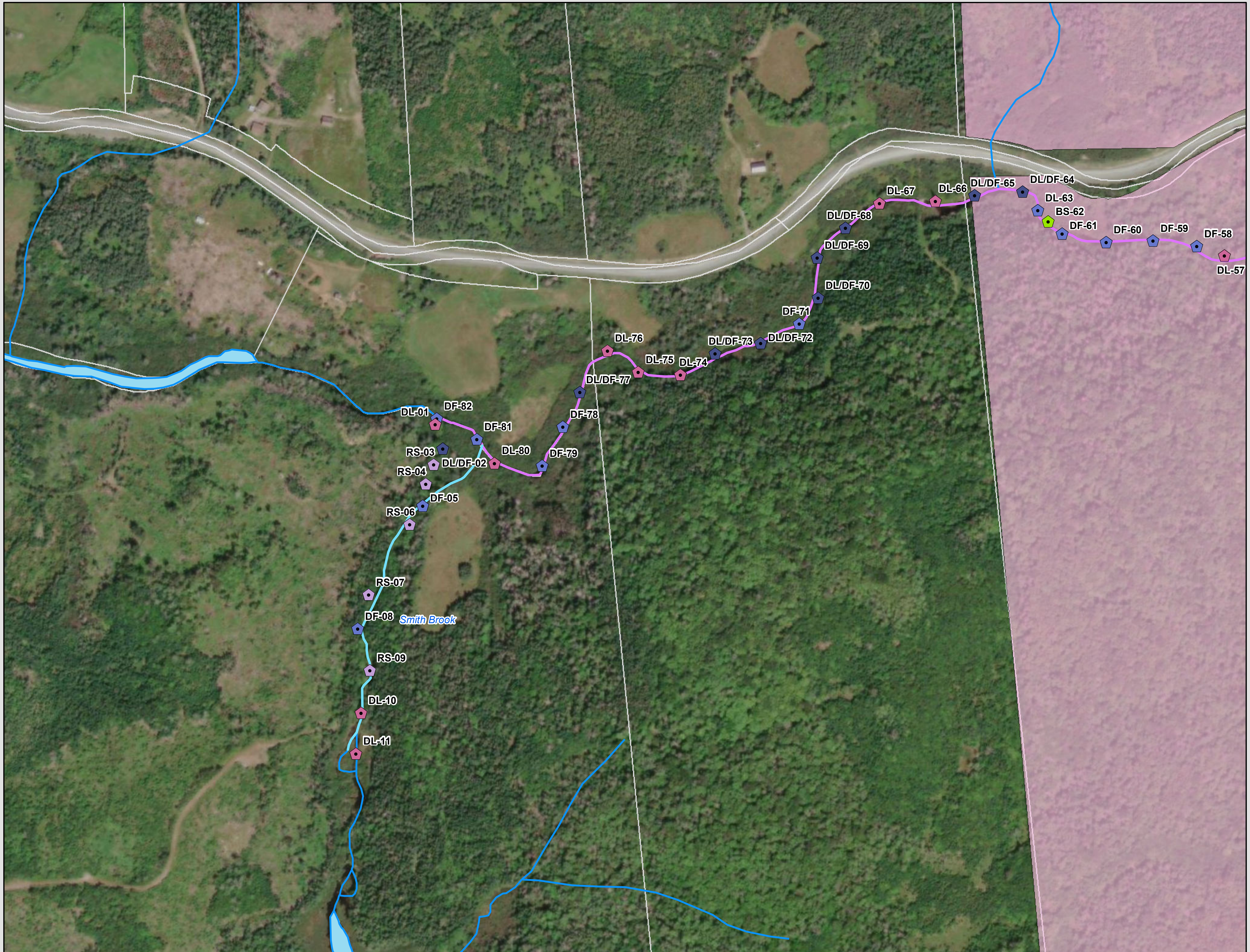

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FIGURE 5.9-D

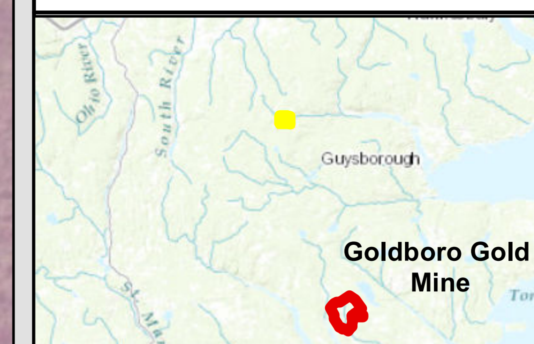
Goldboro Gold Project
Fisheries Offsetting

Detailed Design: Roman Valley River

Roman Valley, NS

Structure Type

- Breach Repair
- Deflector
- Digger Log
- Digger Log and Deflector
- Rock Sill
- Section 1
- Section 4
- NSTDB Watercourses
- Crown Land
- PID Boundaries



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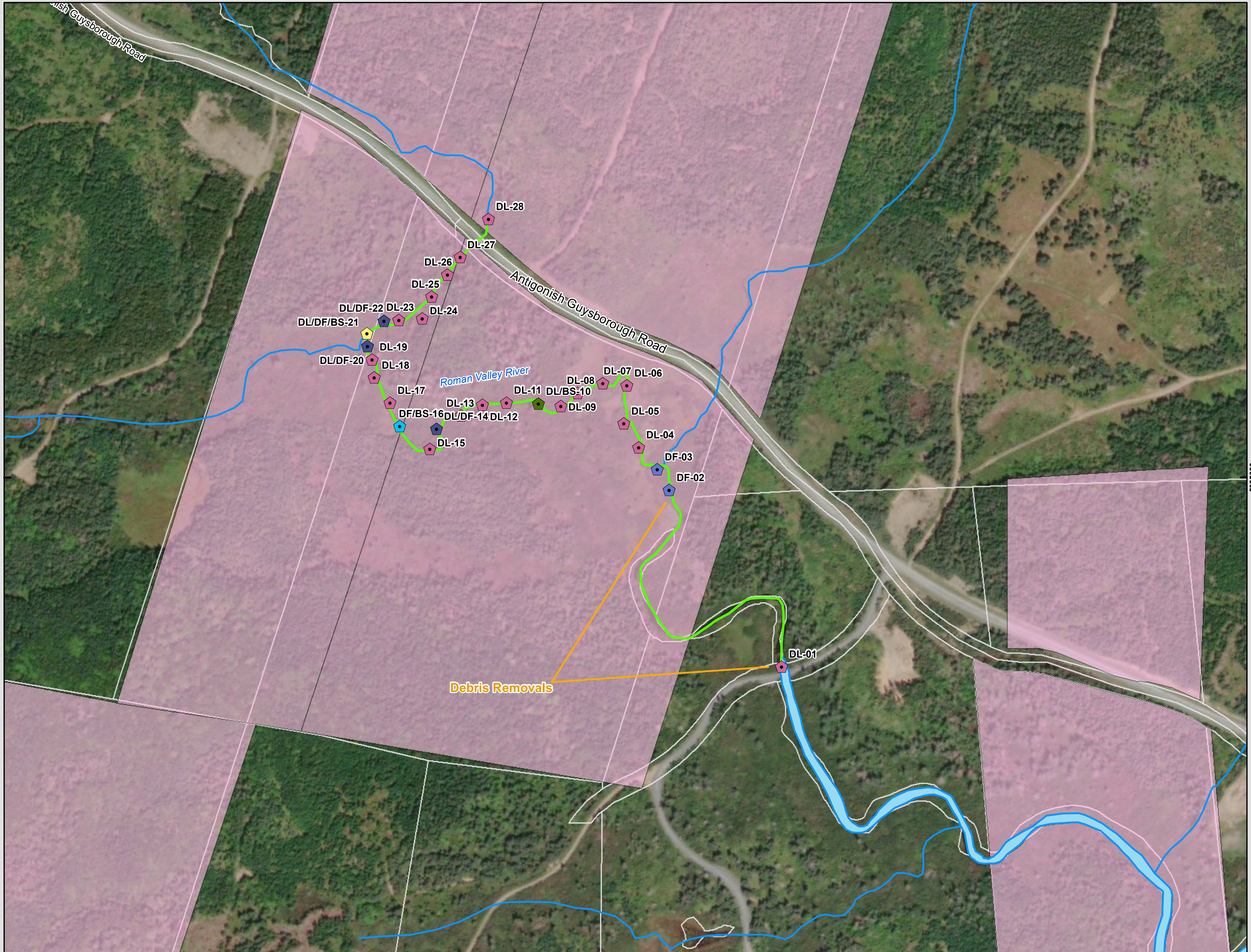
Document Name: 230630_DD_RomanValley



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SIGNAL GOLD

FIGURE 5.9-E

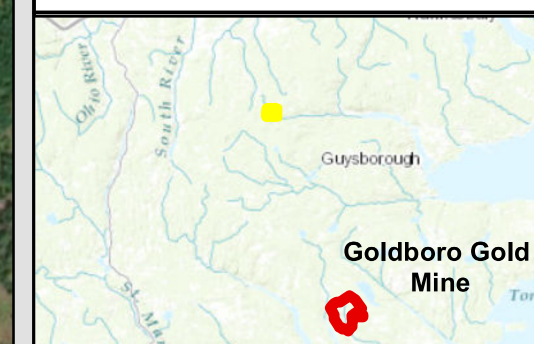
Goldboro Gold Project Fisheries Offsetting

Detailed Design: Roman Valley River

Roman Valley, NS

Structure Type

- Deflector
- Deflector and Breach Repair
- Digger Log
- Digger Log and Breach Repair
- Digger Log and Deflector
- Digger Log and Deflector, Breach Repair
- Section 2
- NSTDB Watercourses
- Crown Land
- PID Boundaries



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Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 25 50 100 m

1:4,000 Scale when printed @ 11" x 17"

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Reviewed By: AW
Date: 2023-06-30

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Document Name: 230630_DD_RomanValley

5.2.4.5 *Quantification of Habitat Offsetting Area*

Based on the length of the offsetting extent (7,700 m), and the calculated bankfull width of the Roman Valley River system (4.0-8.8 m), the overall habitat restoration footprint has been calculated as 53,600 m^2 (Table 5-16).

Table 5-16. Roman Valley River - Offsetting Area

Section #	Stream Length (m)	Upstream Drainage Area (km^2)	Calculated Bankfull Width (m)	Restoration Footprint (m^2)
1	4,000	24	8.8	35,200
2	1,200	11	7.0	8,400
3	1,900	5.0	4.0	7,600
4	600	4.8	4.0	2,400
Total	7,700	N/A	N/A	53,600

5.2.5 McAllister Brook

The proposed offsetting project of McAllister Brook will focus on instream restoration of a continuous section of watercourse that begins just upstream of where the brook crosses the South River Lake Road (Figure 5-10). Restoration work will extend upstream for 2,500 m. The offsetting project will also include a retrofit of the culvert on the South River Lake Road to improve fish passage. Location information including upstream/downstream coordinates and section length are presented in Table 5-17.

Table 5-17. McAllister Brook - Location Information

Section	Downstream Coordinate (UTM)	Upstream Coordinate (UTM)	Section Length (m)
1	608456, 5024349	607346, 5024349	2,500

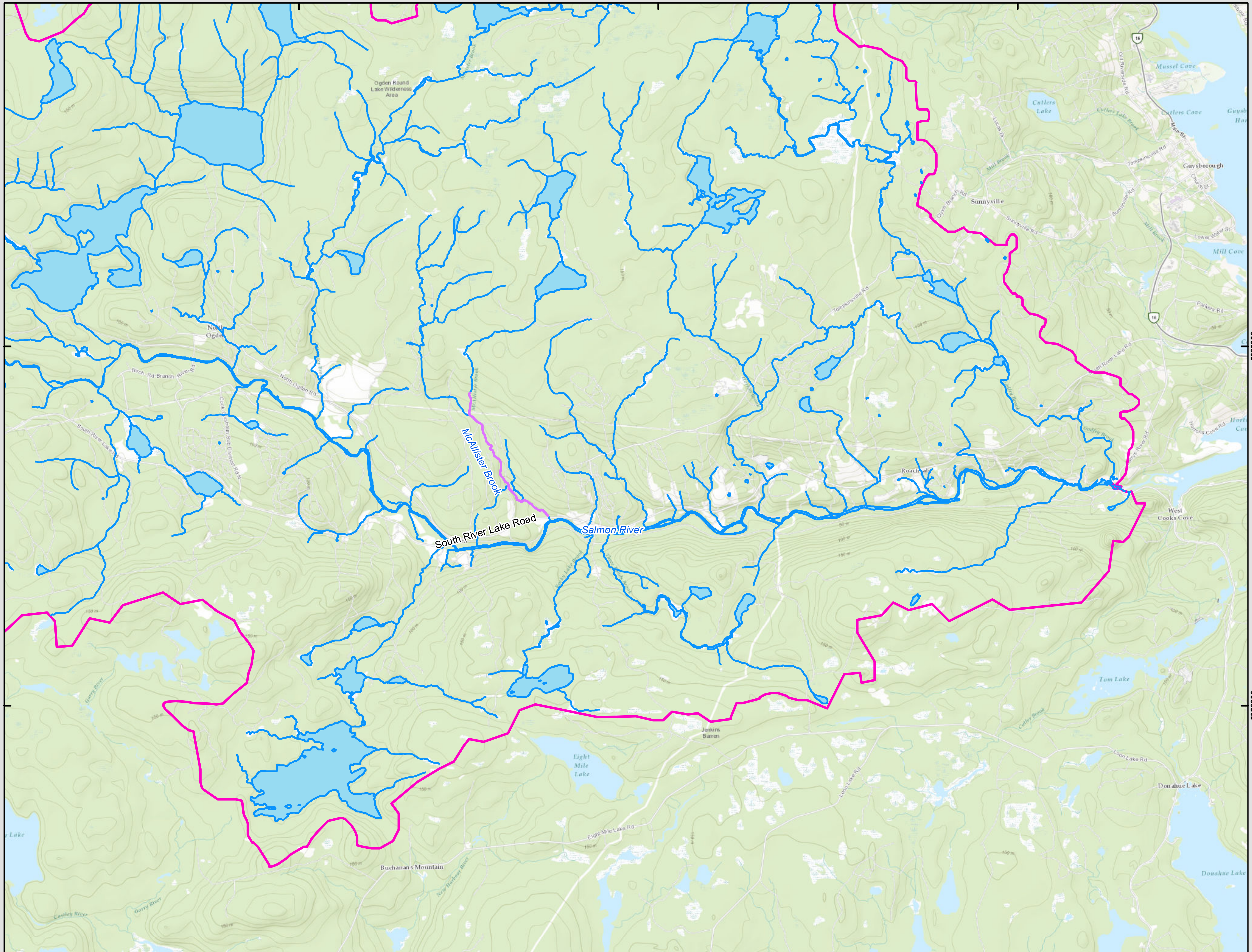

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FIGURE 5.10

Goldboro Gold Project Fisheries Offsetting

Project Location: McAllister Brook

Ogden, NS

Restoration Section

- Section 1
- NSTDB Watercourses
- Salmon River Secondary Watershed

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 500 1,000 2,000 m

1:50,000 Scale when printed @ 11" x 17"

Drawn By: AS
Reviewed By: AW
Date: 2023-06-30

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Document Name: 230620_Project Location_McAllister

5.2.5.1 *Background*

McAllister Brook is a tributary to the Salmon River watershed in Guysborough County. This tributary has a 10.5 km^2 watershed that has been impacted by historical land clearing practices that likely began in the early 1800s during the settlement of the region by Europeans. In more recent years, the channel has been impacted by road construction and agricultural practices. Most of the watershed was converted to pastureland and kept in that condition into the mid-1900s resulting in changes in hydrology patterns and reducing the availability of riparian zone vegetation. The impacts of these practices include streambank erosion and channel widening. Some areas of the floodplain remain actively farmed for hay production.

5.2.5.2 *Existing Conditions*

Present day habitat conditions in McAllister Brook can be classified as severely degraded as the habitat contains deficiencies across the habitat niches required for the multiple life stages of freshwater fish within the system. HSI surveys were completed in May 2023 to quantify indices of habitat degradation for brook trout and Atlantic salmon. A total of 40 HSI sites were surveyed across three groupings: Groups 1 and 3 comprised 10 HSI surveys each, while Group 2 comprised 20 HSI surveys. The results of these surveys indicated that spawning habitat, particularly clean gravels and cobbles found at the tail-end of pools, was almost completely absent within the proposed restoration site. Pool habitat, which is utilized by both adult brook trout and adult Atlantic salmon, was also found to be limited in quantity and of poor value. The impact of the absence of pool habitat includes a reduction in summer-time refuge for brook trout as well as limiting the upstream migration of adult Atlantic salmon during the fall. Thalweg depth, an important habitat feature for promoting fish migration, was also found to be insufficient and received poor scores throughout many of the 40 HSI sites that were surveyed. HSI surveys also demonstrated instream cover (e.g., embedded and over-handing woody vegetation), an important metric related to the survival of all life stages of salmonids overall, ranked poor for the majority (75%) of sites surveyed. The overall absence of spawning and pool habitat, coupled with a systemic lack of instream cover, indicates the existing conditions of fish habitat within McAllister Brook are highly degraded and can be attributed to the overall absence of accumulated LWD, likely a result of historical land clearing practices.

The headwaters of McAllister Brook drain two lakes, known together as Jakes Lakes (Figure 5-10). These two headwater lakes likely provide over-wintering habitat for juvenile Atlantic salmon and summer habitat for American eel (MNR, personnel communication, December 2022). Pre-construction electrofishing surveys are being conducted to document the existing fish community within the proposed offsetting area in Summer 2023 (Section 6.3.2).

The wooden box culvert on McAllister Brook at the South River Lake Road has been assessed as a significant barrier for fish species across most discharge levels. A fish passage assessment was conducted on June 16th, 2023, by aquatic habitat specialist Will Daniels and Charles MacInnis, the results of which are provided in Appendix D. The culvert exhibits a velocity/depth barrier due to a 25 cm outflow drop, which creates challenging conditions for fish trying to migrate upstream. A plunge pool with a maximum depth of approximately 1.5 m provides leaping species, such as salmonids, an opportunity to leap and overcome the outflow drop. However, once adult salmonids enter the culvert, they encounter water depths and velocities that hinder their passage during most discharge levels. Backwatering from the Salmon River may also make it more feasible for some adult salmon and large trout to pass through the culvert. However, despite these potential mitigating factors, it is evident that fish passage remains heavily restricted at this location. Juvenile salmonid species and smaller fish species would face considerable challenges in overcoming this culvert at any discharge level, and their ability to pass through it may be severely limited or nonexistent.

Water quality data was collected at all HSI locations in McAllister Brook in May 2023. Results are provided in Table 5-18. Parameters measured in-situ are considered suitable for target species (Atlantic salmon, brook trout, and American eel).

Table 5-18. In-situ water quality parameters recorded at McAllister (May 2023)

Temperature (°C)	DO (mg/L)	pH	Conductivity (µS/cm)	TDS (mg/L)
Median: 10.1 Range: 7.1-13.7	Median: 11.74 Range: 8.34-13.38	Median: 5.91 Range: 5.14-6.22	Median: 191.0 Range: 178.0-208.0	Median: 175.5 Range: 116.9-201.5

5.2.5.3 *Restoration Objectives*

Restoration objectives for the McAllister Brook offsetting project are presented in Table 5-19Table 5-15Table 5-11. Fish habitat restoration and enhancement measures intend to target four key aquatic impacts: over-widened channel; absence of spawning and pool habitat; simplified channel with poor meander sequence; and impaired habitat connectivity.

Table 5-19. McAllister Brook - Restoration Objectives

Aquatic Impact	Description	Example Photo	Restoration Objectives	Proposed Restoration and Enhancement Techniques
Over-widened channel	Macro impacts such as clearcutting and micro impacts such as site-specific riparian zone loss have created over-widened channels that lack defined thalweg and limit ecological function.		Narrow channel so that bankfull width is closer to hydrology calculations.	Digger logs, deflectors, bank stabilization work and rock sills.
Absence of spawning and pool habitat	Absence of LWD has resulted in absence of sufficient quantity and quality of important channel features for salmonids.		Promote pool scouring and subsequent deposition of gravel and cobbles to restore and enhance spawning habitats.	Digger logs, deflectors, and rock sills.

Simplified channel with poor meander sequence	Healthy riverine habitat should follow a back-and-forth meander pattern which is conducive to setting up pool-riffle-run sequences. Without proper structure in channel, these sequences are often absent and may present as riffle-dominant channels.		Develop a meandering channel thalweg through the introduction of LWD structures that promote the development of pools, riffles and runs. Structures will alternate from left to right creating both meander stability and complexity.	Digger logs, deflectors, and rock sills.
Impaired habitat connectivity	The culvert on South River Lake Road has been assessed as a significant barrier to fish passage for most fish species and life stages.		Improve habitat connectivity by enhancing the culvert's functionality and enabling the passage of various fish species/life stages.	Low-flow barrier, baffles, an outflow chute, and an elver climbing rope.

5.2.5.4 *Project Design*

Restoration and enhancement work planned for McAllister Brook will require the installation of 66 structures which will includes 39 digger logs, 3 deflectors, 14 digger log – deflector combinations, 6 rock sills and 4 channel breach repairs. The calculated bankfull width for this site is 6.0 meters and the structures spacing will be approximately 38 meters (which has been slightly adjusted up from the standard 6X bankfull width based on site-conditions which suggest the river has naturalized to a consistently wider channel).

The wooden box culvert on South River Lake Road will be retrofit to improve fish passage through the culvert. Prescribed mitigation measures include a low-flow barrier, baffles, an outflow chute, and an elver climbing rope. The culvert retrofit will be completed exclusively using hand tools. Design details for the retrofit and accompanying culvert assessment are provided in the McAllister Brook Fish Passage Assessment and Retrofit Work Plan report (Appendix D).

All proposed structures, structure locations (GPS waypoints), and current photograph representations are presented in Table 5 (Appendix C) and Figure 5-11 A-B.

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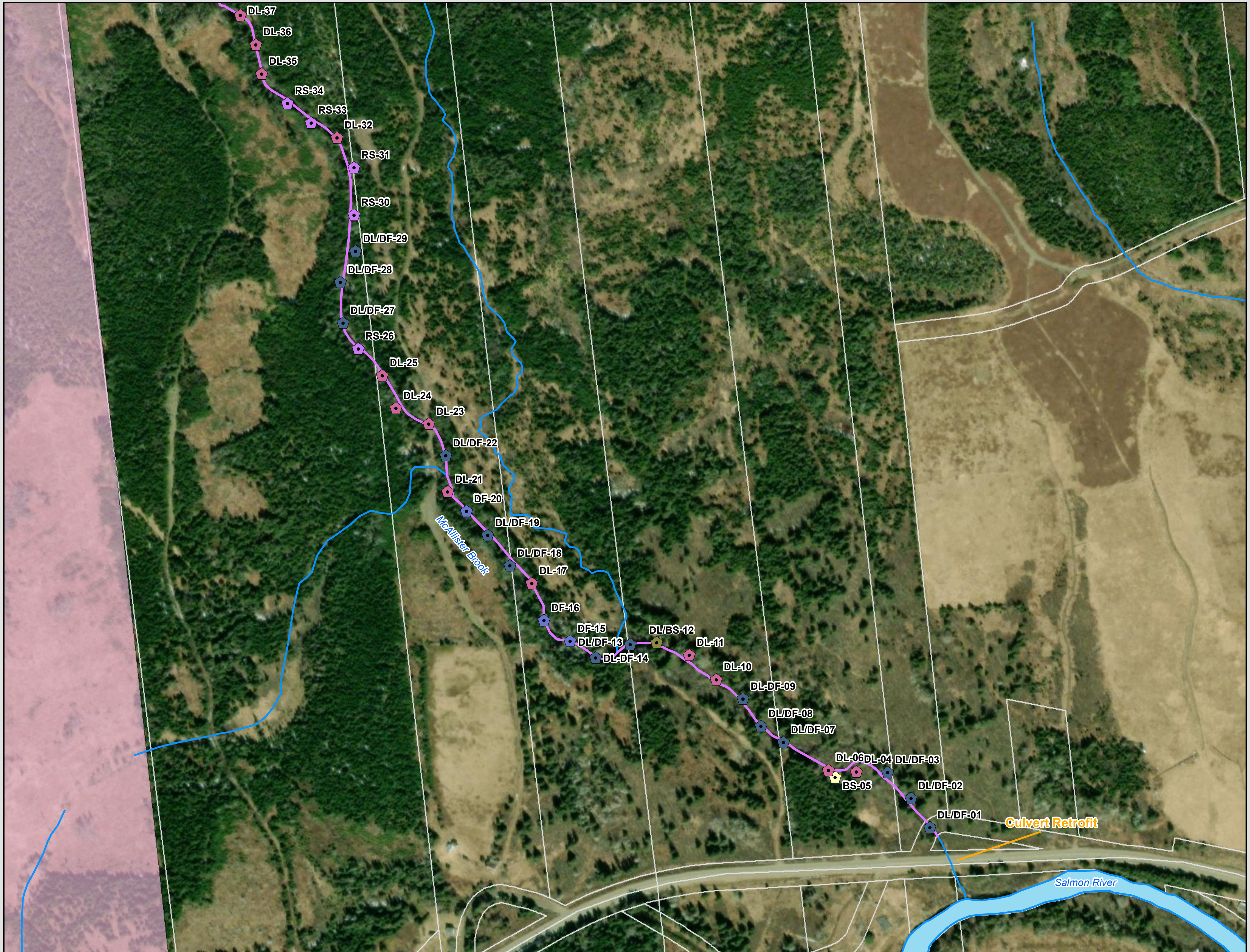
FIGURE 5.11-A

Goldboro Gold Project Fisheries Offsetting

Detailed Design: McAllister Brook

Ogden, NS



Structure Type

- Breach Repair and Debris Removal
- Deflector
- Digger Log
- Digger Log and Breach Repair
- Digger Log and Deflector
- Rock Sill
- Section 1
- NSTDB Watercourses
- Crown Land
- PID Boundaries

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 25 50 100 m

1:4,000 Scale when printed @ 11" x 17"

Drawn By: AS
Reviewed By: AW
Date: 2023-06-30

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Document Name: 230630_DD_McAllister

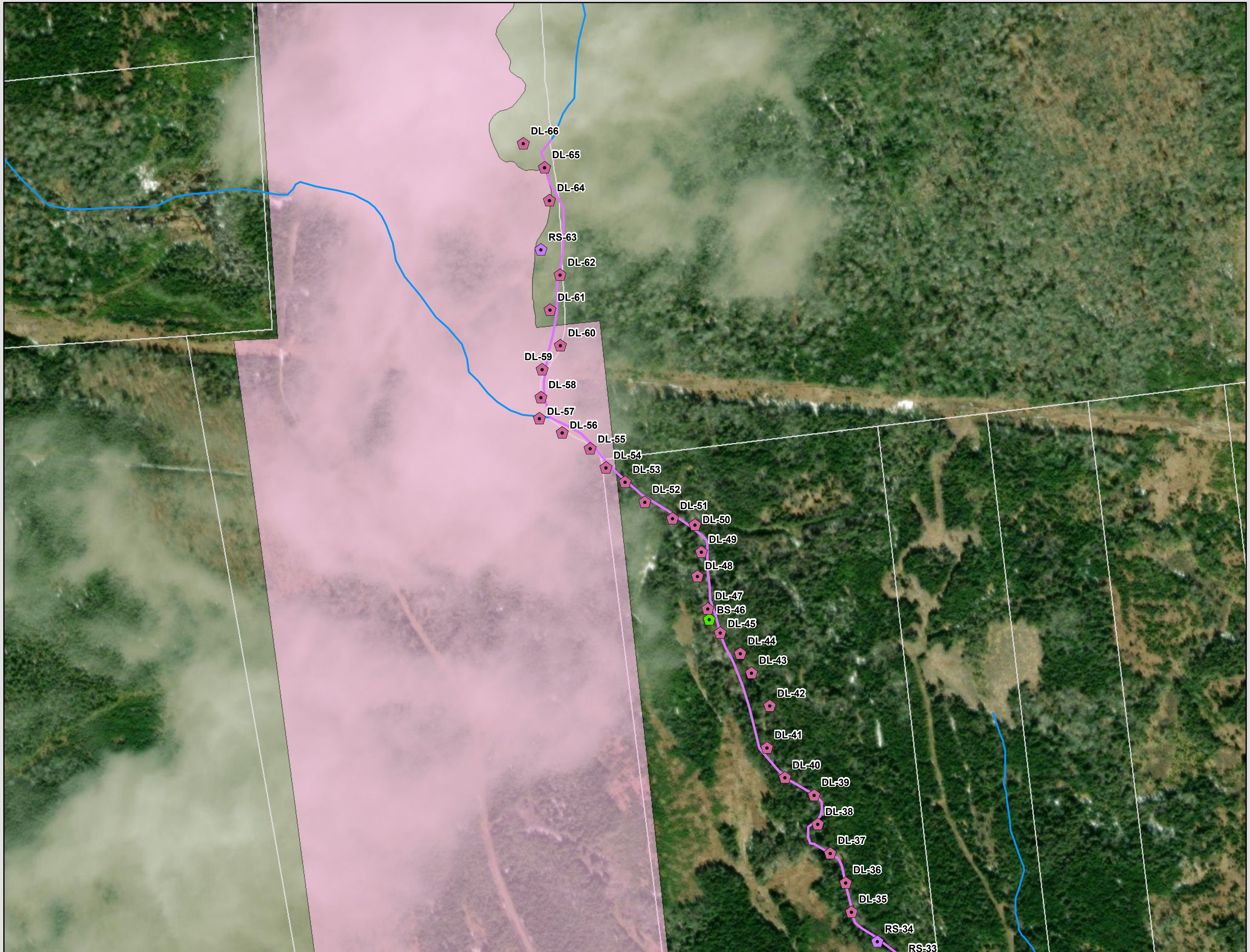

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FIGURE 5.11-B

Goldboro Gold Project
Fisheries Offsetting

Detailed Design: McAllister Brook

Ogden, NS

Structure Type

- Breach Repair
- Digger Log
- Rock Sill
- Section 1
- NSTDB Watercourses
- Crown Land
- PID Boundaries

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

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Document Name: 230630_DD_McAllister

5.2.5.5 *Quantification of habitat offsetting Area*

Based on the length of the offsetting extent (2,500 m), and the calculated bankfull width of McAllister Brook (6.0 m), the overall habitat restoration footprint has been calculated as 15,000 m^2 (Table 5-20).

Table 5-20. McAllister Brook - Offsetting Area

Section #	Stream Length (m)	Upstream Drainage Area (km^2)	Calculated Bankfull Width (m)	Restoration Footprint (m^2)
1	2,500	32 km^2	6.0	15,000
Total	2,500 m	N/A	N/A	15,000 m^2

5.3 Offset Summary

In total, five offsetting projects are proposed to restore and enhance degraded waterways in priority watersheds. These river systems have been subject to over-widening, channelization, and historic and current riparian land-use impacts resulting in a transition to homogenous stream characteristics and lack of instream functional components. Habitat complexity required to support the various life stages of salmonids will be restored through the introduction of structures that mimic the natural components of a healthy aquatic ecosystem. These restoration techniques are well-proven and are widely used throughout Nova Scotia for freshwater fish habitat restoration. Proposed offsetting areas for all five projects are summarized in Table 5-21.

Table 5-21. Proposed Fisheries Offsetting Areas

Offsetting Project Identification	Proposed Offsetting Area (m^2)
Gunns Brook	60,900
Sutherlands Brook	23,125
East Pomquet River	30,200
Roman Valley River	53,600
McAllister Brook	15,000
Total Available Offsetting Area	**182,825**
Total Proposed Offsetting Area (based on Project HADD/MDMER requirements)	***179,578***

Combined, the five fisheries offsetting projects amount to 182,825 m^2 (or 18.2825 ha) of habitat offsetting area. This area is considered sufficient to counterbalance the Project HADD and MDMER compensation requirements (including proposed offsetting ratios) of 179,578 m^2 (17.9578 ha).

6 IMPLEMENTATION

6.1 Timelines

Timelines for the implementation of offsetting projects have been selected based on the anticipated timing of Project impacts and the feasibility of construction within standard instream work timing windows (June 1st – September 30th).

The implementation of offsetting projects is proposed to commence with the start of Project construction (Year -2). It is anticipated that all destruction of fish habitat and harmful alterations from flow reductions within tributaries to Gold Brook Lake and Gold Brook (i.e., Eastern and Western tributaries, WC3, WC9, WC10, WC11, WC55) will occur during the construction phase (Mine Years -2 and -1). As such, two offsetting project (East Pomquet and Sutherlands Brook) are proposed to be constructed in Mine Year -2 to counterbalance these impacts (Table 6-1). Proposed compensation under per MDMER (5,414 m^2) will be accounted for under the East Pomquet project.

Harmful alterations from flow reductions in Gold Brook have been conservatively assumed to commence at the start of Project operations (Mine Year 1). Predictive modelling demonstrates that impacts to Gold Brook will progress through East Pit EOM (Mine Year 8) until West Pit EOM (Mine Year 12), improve through East Pit Filled (Mine Year 21), and then resolve by closure when both pits are filled (Mine Year 37). To counterbalance these impacts, the remaining three offsetting projects (Gunns, Roman Valley, and McAllister) are proposed to commence in Year 1 and be staggered by one year each. Note that the McAllister Brook offsetting project is proposed to be constructed over two years. The culvert retrofit will be constructed in Year 2 along with Roman Valley River to allow time for fish to propagate upstream of the culvert before instream structures are installed.

Timelines associated with construction and post-construction monitoring for each offsetting project are provided in Table 6-1.

Table 6-1. Offsetting Project Timelines

Project(s)	Construction		Post-Construction Monitoring		Cumulative Project Impacts (m^2)	Cumulative Offsetting Area (m^2)
	Mine Year	Actual Year	Mine Year	Actual Year		
East Pomquet Sutherlands Brook	Year -2	2025	Year -1 Year 1 Year 2 Year 3 Year 4	2026 2027 2028 2029 2030	46,037 (HADD) + 2,707 (MDMER)	47,821 (HADD) + 5,414 (MDMER)
Gunns Brook	Year 1	2027	Year 2 Year 3 Year 4 Year 5 Year 6	2028 2029 2030 2031 2032	179,578*	114,225
Roman Valley River McAllister Brook (Culvert Retrofit)	Year 2	2028	Year 3 Year 4 Year 5 Year 6 Year 7	2029 2030 2031 2032 2033	179,578	167,825
McAllister Brook (Instream)	Year 3	2029	Year 4 Year 5 Year 6 Year 7 Year 8	2030 2031 2032 2033 2034	179,578	182,825

*Note: Cumulative project impact based on 130,834 m^2 of HADD in Gold Brook (i.e., the total HADD for Gold Brook) as realized in Year 1 of operations. This is considered an extremely conservative assumption based on modeled impacts.

6.2 Potential Effects and Mitigation Measures

The offsetting measures proposed will employ well established techniques that are designed to mimic the natural ecosystem functions of fallen large woody debris (LWD) within the channel. Methods and structures have been chosen to provide the most benefit to the watercourse while avoiding unnecessary disturbance to the bed or bank. These structures maintain the natural bank and bed, and therefore inherently have a low environmental risk. Part of the rationale for choosing LWD-type structures over more invasive restoration techniques (i.e., machine work) was to reduce or eliminate, to the extent possible, potential adverse effects to fish and fish habitat. All in-stream structures will be installed by hand, which excludes the need to create work-in-the-dry site conditions.

Improperly constructed or designed structures, however, can negatively impact fish habitat and aquatic life. Altering channel structure and flow will impact stream morphology and the overall flow dynamics of the system, which can create unstable channel conditions if not done appropriately. The monitoring programs proposed (Section 6.3) incorporate measures to verify that structures have been installed as per the approved designs. The design and layout of instream structures have been determined by local habitat restoration professionals with extensive experience in instream restoration techniques in the region to ensure proper sizing and design of restoration works. No soil disturbance or sedimentation is anticipated as a result of instream works. In addition, no fording or crossing of watercourses by machinery or vehicles will be required.

No adverse effects are expected from properly implemented restoration work. NGO groups in Nova Scotia have been doing this work for several decades and have developed design and installation techniques that avoid adverse effects on the fish that are resident in the watercourse or those migrating through the restoration work areas. This type of work (hand-tool based restoration) is low-impact and the likelihood of adverse effects is very low. The digging of digger log trenches has the potential to release fines into the watercourse but this will be localized, small scale, and extremely temporally restricted.

The following standards and best practices will be employed to reduce or avoid adverse effects to fish and fish habitat from the implementation of offsetting measures:

- All in-water work will be timed to occur during the summer low flow period to avoid sensitive life stages of fish (June 1 – September 30), as per DFO Timing Window for Nova Scotia (DFO, 2019c).
- Tools and equipment shall arrive on site in a clean condition and maintained free of fluid leaks.
- Gas-powered hand tools (e.g., chainsaws) for felling trees will be refueled a minimum of 30 m from any surface water feature (watercourse or wetland).
- Fuel shall be stored a minimum of 30 m away from all watercourses.
- Tools shall be washed and serviced in such a way as to prevent any deleterious substances from entering the water.
- Bar oil for chainsaws shall be vegetable based rather than petroleum.
- During construction, all mitigation requirements associated with the FAA approval and provincial watercourse alteration permits will be adhered to.

6.3 Monitoring

To ensure that the offsetting measures are implemented and functioning as proposed, qualified personnel with experience and/or training in fish habitat restoration, fish and fish habitat surveys, and data collection will monitor construction, implementation, and effectiveness of the measures through select monitoring criteria. The following monitoring program has been developed as an overarching program applicable to all five instream offsetting measures proposed. A summary of monitoring plan components and applicable success and supporting criteria is provided in Table 6-2.

As outlined in DFO's guidance policy (DFO, 2019a), monitoring should be designed to confirm that measures to offset are effective in counterbalancing the HADD and identify corrective actions or contingency measures if deficiencies are found. The monitoring program design has integrated DFO guidance on functional monitoring of offsetting measures (2019b). As defined by DFO (2019b), functional monitoring is a "science-based, scaled-down version of effectiveness monitoring that relies on surrogate metrics to assess whether management measures provide expected conditions suitable for fish to carry out their life processes". The purpose of functional monitoring is to provide a relatively rapid and objective assessment of the performance of offsetting measures that goes beyond compliance. DFO notes that "functional monitoring should only be implemented when there is low uncertainty of both the expected performance of the management measure, and the strength of the linkage between the surrogate metric(s) measured and the desired fish outcome". The instream offsetting measures described within this plan have been demonstrated to be effective in meeting their objectives in Nova Scotia. As such, these uncertainties are considered low and functional monitoring is appropriate.

The proposed monitoring program includes both offsetting success and supporting metrics. Success metrics (fish habitat components) comprise the functional monitoring component of the overall monitoring program to assess the performance of the offsetting measures. Supporting metrics (fish community and usage) will be implemented to evaluate general trends in productivity as a result of offsetting measures but are not definitive of offsetting measure performance.

Goldboro Gold Mines has adopted an adaptive management approach to periodically identify the need for any further mitigation or compensation measures if deficiencies are detected (see Section 6.4).

Table 6-2. Summary of Monitoring Program Components

Component	Endpoints	Objective	Location	Scope	Timing/Frequency	Success Criteria
Habitat	Structures	To document whether instream structures are in place and functioning as designed.	All installed locations.	Visual inspection (photo documentation) of structure and function. Details of inspection methods provided in Section 6.3.1.1.	Once per year during every monitoring year (Years 1, 2, 3, 4, 5 post-construction).	Structures are functioning as intended.
	Suitability	To document changes in habitat suitability for salmonids as a result of structure installation.	Key locations within restoration sites (a minimum of 10 surveys per km of restored stream).	HSI surveys to collect key habitat variables and quality indicators related to salmonids. Details of HSI survey methods are provided in Section 6.3.1.2.	To occur prior to construction (baseline) and once per year during monitoring Years 1, 3, and 5 post-construction.	Improvement in one or more habitat variables.

Component	Endpoints	Objective	Location	Scope	Timing/Frequency	Success Criteria
Fish	Spawning	To document temporal changes in spawning success.	Along entire length of each restoration area.	Document number and locations of salmon redds. Details of survey methods are provided in Section 6.3.2.2.	3 repeat surveys within salmon spawning window (October-November). To occur prior to construction and every monitoring year (Years 1, 2, 3, 4, 5 post-construction).	None (will be used as a supportive metric)
	Abundance	To track temporal change in fish occupancy, abundance and population structure.	Key locations within restoration sites (approximately 1 survey per km of restored stream).	Abundance will be estimated using standardized electrofishing techniques. Catch-per-unit-effort and density (fish/m^2) will be determined. Details of survey methods are provided in Section 6.3.2.	To occur prior to construction (baseline) and once per year (summer) during monitoring Years 1, 3, and 5 post-construction.	None (will be used as a supportive metric)

6.3.1 Success Criteria

6.3.1.1 *Structure Assessment*

Visual structure assessments will follow specific methods based on the structure design and intended function. For example, digger log structures will be inspected to ensure (1) the log is still in place, (2) if log is still intact, that the rock ramp behind the log is still sufficiently full of material. For deflectors, similarly they (1) will be inspected for structural soundness and (2) to ensure the rock materials within the log frame of the structure are still in place.

Photographic documentation will be taken during construction and post-construction monitoring programs to document that all structures were installed as per the approved designs. It should be noted that these structures are intended to be incorporated into the stream bed and banks over time. For example, functioning deflectors will often become naturally buried within their created point bars as they allow silts to redeposit alongside the bank. The success criteria of this monitoring component are therefore proposed to be based on the resulting function of the structure rather than the physical appearance of the structure (i.e., the structure is meeting or has successfully met the objective of its installation).

Micrositing of structures in the field is anticipated and will be determined based on stream conditions at the time of construction. Photographs will be taken from specific vantage points corresponding to pre-construction photographs so that comparisons can be made for “as-built” purposes as well as comparisons across monitoring years. A comparison of the constructed habitat to the approved plan will be made to confirm that the area of replacement habitat is equal to or greater than that specified in the plan.

Observations will be made once per year in Years 1, 2, 3, 4 and 5 post construction, to confirm that structures are functional. Stability of the structures and general condition will be assessed by mapping and photographic documentation of the habitats.

6.3.1.2 *HSI Surveys*

Habitat suitability index (HSI) surveys will be conducted following the protocols contained in the *Nova Scotia Fish Habitat Suitability Assessment: Field Manual* which was produced in 2019 by the Nova Scotia Salmon Association. HSI surveys were developed to standardize freshwater fish habitat assessment while making use of habitat suitability variables and values specific to NS rivers (NSSA & AAS, 2018).

HSI surveys are used to characterize instream habitat quality metrics specific to salmonids, such as pool quality, pool frequency, spawning habitat quality, spawning habitat frequency, and instream cover. Each category of habitat is evaluated and receives a suitability score between 0 and 1 based on the data collected during the survey. A suitability score of less than 0.4 represents highly degraded habitat. A rating between 0.4 and 0.8 is classified as moderate habitat. Categories that score 0.8 or higher are considered high quality habitat that is conducive to salmonid activity.

Baseline HSI surveys were completed in Spring and Summer 2023 to document pre-construction habitat suitability parameters for each stream. Depending on when the specific offsetting project is constructed, baseline HSI may be repeated to establish up to date stream characteristics. A minimum of ten HSI surveys will be conducted per kilometer length of stream to be restored. HSI surveys are generally conducted in groups of 10 (with a group constituting a ‘HSI site’) with the intention of averaging stream conditions across a longer stream segment, which is likely to more fully capture the impacts of restoration efforts. All HSI survey start and end points will include GPS waypoints to ensure that sites can be duplicated in post-construction.

In post-construction, HSI surveys will be conducted in monitoring Years 1, 3, and 5. Surveys will be undertaken within the same month as pre-construction surveys (generally late spring or summer) to account for varying stream conditions. Success will be measured by the improvement in one or more habitat variables averaged for each HSI site (e.g., metrics averaged over surveys 1-10). For example, success could be considered an average suitability metric going from a moderate habitat quality to high habitat quality classification after the implementation of the offsetting measure. Success will be determined based on an improvement at every HSI site completed for each offsetting measure.

If habitat suitability success criteria (improvement in one or more habitat variables) are not observed through post-construction monitoring, an evaluation as to the underlying cause will be undertaken in conjunction with restoration design professionals as per the Adaptive Management and Contingencies plan outlined in Section 6.4. Potential examples of underlying causes include not enough time passing to detect measurable changes in habitat form, and/or structure deficiencies/failures. Any evaluation undertaken will be fully described in the applicable year's monitoring report, along with any prescribed intervention (corrective actions) required to remedy offsetting project effectiveness/conditions.

6.3.2 Supporting Information

6.3.2.1 *Electrofishing Surveys*

Electrofishing surveys are proposed as a supportive metric to assess the utilization of restored habitats by targeted fish species (Atlantic salmon, brook trout, and American eel).

Electrofishing survey locations will be selected based on the following criteria:

- Representative of the overall restoration project site. The best and worst habitat as indicated by HSI, for example, may be excluded from electrofishing eligibility;
- Presence of habitat that provides, or is likely to provide, cover for the targeted species once restoration measures are in place (e.g., riffles with substrate cover);
- Suitability of the site and the substrate to facilitate barricading (rocks, velocity, depth, banks, vegetation); and
- Access and crew safety.

Electrofishing sites will be selected approximately every 1 km stream length restored. Surveys will be undertaken in closed (multi-pass depletion) sites using barrier nets secured to the stream bed at either end of the reach to isolate an area of habitat within each watercourse. Within each isolated reach, a minimum of three passes with the electrofisher will be completed. Additional passes will be completed if depletion in catch (i.e., less fish with each pass until a catch of zero or near zero) is not obtained after the first three passes. Crews will aim for a standardized 500 seconds of on-time (as recorded by the electrofishing unit) per pass.

Fish will be sampled using a Halltech Battery Backpack Electrofisher (HT-2000) or equivalent with un-pulsed direct current (DC). A crew member will walk alongside the electrofisher operator to net any stunned fish using a landing net with suitable mesh size. All captured fish will be held in a live well containing ambient stream water, to be kept out of the sun and checked regularly for any signs of stress. At the conclusion of each pass, fish in the live well will be identified (species confirmation) and measured (length and weight). After recuperating, all fish will be released back into the watercourse, downstream of the isolated reach.

Baseline electrofishing surveys commenced in Summer 2023 and will continue through to the end of the designated sampling period (October 1, 2023) to document pre-construction fish community assemblages and population metrics for each stream. Similar to baseline HSI survey timing, baseline electrofishing may be repeated to establish up to date fish community characteristics.

Post-construction, electrofishing surveys will be conducted in monitoring Years 1, 3, and 5. Surveys will be undertaken within the same month as pre-construction surveys to account for varying stream conditions. Community assemblage (species and life stages), abundance (CPUE), and population metrics (density) will be compared to pre-construction surveys to supplement the evaluation of the effectiveness of restoration measures.

6.3.2.2 *Redd Surveys*

Similar to electrofishing surveys, redd surveys are proposed as a supportive metric to assess the utilization of restored habitats through temporal changes in salmon spawning success. Redd distribution mapping within a restoration area over time will supplement the evaluation of the effectiveness of stream restoration projects on increasing available and quality spawning habitat.

Redd surveys will be conducted by field personnel trained in the identification of salmon spawning nests. A crew of two surveyors will walk upstream on opposite sides of the channel along the entire length of each restoration area counting all salmon redds encountered. Redds will be photographed, and a GPS waypoint of all redd locations will be taken. Notes on redd condition (i.e., complete or test redd, habitat type, etc.) will also be recorded.

Baseline redd surveys will be conducted during the salmon spawning window (October – November) prior to construction. Surveys will begin at the onset of spawning, and all streams will be resurveyed at a maximum of every two weeks (less than 14 days) until spawning is complete for a total of three repeat surveys. Repeat surveys are conducted to capture potential spawning activity more fully versus a single survey when spawning activities may not be complete. However, it is acknowledged that survey timing can be difficult due to higher water levels and/or reduced visibility during the spawning window. Any amendments to this proposed schedule due to safety considerations of field crews will be noted in post-construction reports. Surveys are proposed to occur prior to construction and every monitoring year (Years 1, 2, 3, 4, 5 post-construction).

6.4 **Adaptive Management and Contingency Measures**

As discussed in Section 6.3, monitoring will be completed at Offsetting Project sites to assess the effectiveness of the measures implemented to counterbalance the HADD. Should the monitoring work identify deficiencies in the effectiveness of the offsetting measures, or that they didn't meet their objectives within the monitoring period, the following Adaptive Management and Contingencies plan will be administered:

1) Potential deficiencies identified during the post construction monitoring program will be carefully observed to determine if conditions are likely to resolve themselves throughout the full extent of the monitoring program, or if early intervention (corrective actions) are required to remedy offsetting project effectiveness/conditions. Potential deficiencies are those related to structure integrity and the resulting function of the structure noted in Section 6.3.1.1. Success of structure installation will be determined based on the structure having achieved its desired outcome (i.e., habitat function).
2) In some circumstances, corrective actions may be determined early on (i.e., during the first two years of the five-year post-construction monitoring period), or at the completion of the five-year monitoring period.

Corrective actions may include:

i. small scale modifications to in-stream structures;
ii. replacement of deficient/nonfunctional structures; or
iii. installation of additional structures to achieve objectives.

3) Potential deficiencies and recommendations for corrective actions will be identified to DFO in annual post construction monitoring reports.
4) Any corrective actions will be accompanied by an updated monitoring plan to assess the effectiveness of the proposed work and a revised timeline for monitoring that particular corrective action will be proposed. Any proposed revised timelines will be recommended in annual reports and determined in consultation with DFO.
5) In the event that an entire Offsetting Project is considered deficient, the Goldboro Gold Mines will consider the following contingency options:
    a. Implementation of an alternate offsetting option. The option would be chosen from one of the previously investigated offsetting options as presented to DFO in earlier offsetting plan submissions, with further consultation with DFO. To support this process, Goldboro Gold Mines completed baseline work on some of these alternate options as a contingency measure to support future development if required; and/or,
    b. Consult with DFO, Mi'kmaq of Nova Scotia, municipal officials, and local community watershed and fisheries organizations, as applicable, to identify a list of other high priority offsetting options that could be implemented.

6.5 **Reporting**

The implementation of offsetting measures will be conveyed to DFO in an "as-built" report to be provided within 12 months of the works being completed for each specific offsetting site. The intention of the "as-built" report will be to verify that each offsetting measure was implemented as designed and approved. Goldboro Gold Mines will maintain a photographic record (using consistent vantage points) of all structures and provide final locations (GPS waypoints) and maps of all instream structures installed.

The data collected using the methods described in Section 6.3 will be summarized in an annual monitoring report for each year of the monitoring program (Years 1, 2, 3, 4 and 5 after construction). Results will be interpreted by comparing data from the offsetting sites with baseline data collected pre-construction. In addition, data interpretation will be based on comparisons of the current year's data with those of previous monitoring years to illustrate trends, if any.

The annual monitoring reports will discuss and interpret results for each offsetting site to determine whether or not a particular site is meeting the success criteria. The reports will discuss whether the offsetting measures are generally progressing effectively in achieving the habitat improvements intended by the design and installation of instream structures, using results from supportive metrics (electrofishing and redd surveys) where applicable. A proposed reporting schedule is provided in Table 6-3. Modifications to the proposed monitoring schedule may be requested by Goldboro Gold Mines, in writing, to DFO to reflect changes in the construction schedule and monitoring results.

Table 6-3. Reporting Schedule for Offsetting Measures

Report	Components	Schedule
As-built	As-built survey will be conducted within 12 months of construction of the offset measures on a site-by-site basis. Photo documentation will be taken during construction to document that all offsetting measure were constructed as per the described designs. Locations (GPS waypoints) and maps of structures to be provided in report. A comparison of the construction to the approved plan will be made to confirm that the area of offsetting is equal to or greater than that specified in the plan.	Submitted to DFO within 12 months of construction.
Monitoring Reports	To present outcomes of both Habitat and Fish monitoring components (Table 6-2): • Stability, condition, and function of structures (following as-built survey design with added functional assessment) • HSI survey results (habitat scores) • Redd survey results (# of redds identified) • Electrofishing survey results (species presence, abundance, and age structure) Monitoring reports will note any deficiencies in offsetting measures and provide recommendations for implementation of adaptive management or contingency strategies to ensure offsetting objectives are met.	Submitted to DFO on or before February 28th following each monitoring year (Years 1, 2, 3, 4, and 5 post-construction).

The monitoring program will also incorporate recommendations for adaptive management and contingency strategies (Section 6.4) if deficiencies are identified and will include recommendations for replacing structures, expanding offsetting areas, and/or additional offsetting sites, if necessary, to achieve offsetting objectives. The determination of whether an offsetting site is not functioning as designed will be informed based on monitoring data, assessment of results, and professional judgment on the part of the Goldboro Gold Mines and qualified professionals.

At such a time when the site has been determined to meet its original offsetting objectives, a recommendation will be provided to DFO in the applicable annual monitoring report that the site should be considered complete. At minimum, this would occur in the Year 5 monitoring report, unless deficiencies and modifications have been implemented that could extend the duration of the monitoring plan. Goldboro Gold Mines acknowledges that DFO will have final authority on whether each offsetting measures’ objectives have been achieved, and what/if any actions are required to ensure Project offsetting requirements are met.

6.6 Land Access

Landowner collaboration is essential to the viability of fisheries offsetting projects. The Project Team continues to achieve productive, working relationships with landowners for the offsetting projects discussed in Section 5.

By nature of the proposed offsetting projects (in-stream), all offsetting measures are being completed within the bed and banks of provincially regulated watercourses that are owned by the Crown. As such, permission to alter the lands outside of the watercourse is not required for any of the proposed offsetting projects and landowner permission is not required.

To date, Goldboro Gold Mines has gained access to the proposed offsetting sites to complete detailed design work and baseline monitoring via public access, and/or via private lands where permission has been obtained from landowners. Goldboro Gold Mines has also sent information to landowners bordering proposed offsetting sites to communicate Goldboro Gold Mines's intention to complete future offsetting projects and make landowners aware that ongoing data collection is taking place during summer 2023.

As proposed offsetting construction draws nearer, the offsetting team will assess the following criteria as it relates to landowner access:

- <u>Machinery and or equipment access:</u> access for construction teams and necessary equipment may require permission from additional landowners to gain access to offsetting sites.
- <u>Materials:</u> collection of large woody debris and rocks existing adjacent to proposed offsetting sites can assist in the construction of in-stream features (i.e., digger logs, deflectors and rock sills). For these scenarios, Goldboro Gold Mines will engage with specific landowners to obtain permission for harvesting or collecting large woody debris and/or rock material for installation of proposed offsetting features. In instances where permission is not granted, or materials are not present, construction material will be sourced from elsewhere.
- <u>Permission for construction</u>: Upon completion of final design, should land alteration be required outside of the banks of the bed or banks of the watercourse, written permission from the landowner will be obtained to perform the work on their property. Written permission would likely be obtained via a formal Agreement between the landowner and Goldboro Gold Mines.

6.7 Costs

Costs have been determined for implementation of each offsetting site. This process has been completed to meet DFO Offsetting Policy guidance (DFO, 2019a) and an associated requirement to provide a financial guarantee for the offsetting projects proposed for implementation. As per the policy guidance *"the monetary value of the financial guarantee is determined by estimating the cost for implementing all elements of the offsetting plan, including elements related to monitoring, and maintenance of the measures to offset. The estimate should consider any additional expenses that could be incurred by the Department to complete the offsetting plan (e.g., costs for administration, costs for mobilization, cost of external expertise, etc.), and allow for cost overruns for remobilizing machinery onto the work site".*

The costs outlined in this section are used to determine how much each offsetting project will cost to implement. The per offsetting site cost has been individually determined based on its proposed timeline for construction, as presented in Section 6.1. Costing for the East Pomquet offsetting project has been divided based on compensation requirements under MDMER and offsetting under the *Fisheries Act (*i.e., HADD).

Costing is based on two overall implementation components: 1) Construction Costs and 2) Post Construction Monitoring Costs. Each overall component comprises individual components presented in

Table 6-4, that have been applied to the costing determination for each offsetting project:

Table 6-4: Offsetting Costing Components

Overall Component	Individual Component	Cost Consideration
Construction	Construction of the proposed offsetting measures including: - Construction labour - Project supervision - Equipment - Construction materials - Property purchase or lease - Maintenance of structures to achieve objectives - Regulatory reporting - Land Access/Lease agreements	Costs to complete the individual components listed has been estimated at **$6 per m²**
	Contingency: contingencies include additional costs likely to apply if a third party has to take over the project: - Additional project management costs; - Seasonality of when the project takes place; - Availability of staff and their associated contractor costs.	A contingency of 20% has been added to the per m² cost presented above resulting in a **$7.20 per m² cost**
	Inflation Costs have been considered for construction of projects that initiate in 2024 onward.	The rate of inflation has been determined based on a 2% annual increase[1].
Post Construction Monitoring	Post Construction Monitoring efforts to complete the following tasks at each offsetting site: - Structure assessments - yearly - HSI surveys -Years 1, 3 and 5 - Electrofishing - Years 1, 3 and 5 - Redd Surveys - Years 1, 3 and 5 - Annual Reporting	Costed on a site-by-site basis, based on the size of the offsetting area.
	Inflation costs have been considered yearly depending on when each monitoring program is proposed to be started.	The rate of inflation has been determined based on a 2% annual increase[1].

[1] *The Bank of Canada aims to keep inflation at the 2 per cent midpoint of an inflation-control target range of 1 to 3 per cent. The inflation target is expressed as the year-over-year increase in the total consumer price index (CPI).*

Utilizing the information presented in

Table 6-4, proposed costs for the purposes of the financial guarantee have been determined. The estimates provided in Table 6-5 are based on the timeline of each offsetting project as presented in Section 6.1.

Goldboro Gold Mines is currently in the process of obtaining a Letter of Credit/Bond for the total estimated amount of $2,460,356. This will provided to DFO within 60 days of the submission of the FAA application. Of the total estimated LOC, costs associated with the implementation of compensation under MDMER equate to $66,979.

Table 6-5. Offsetting Cost Estimates

Offsetting Site	Size (m^2)	Project Component	2025 (Year -2)	2026 (Year -1)	2027 (Year 1)	2028 (Year 2)	2029 (Year 3)	2030 (Year 4)	2031 (Year 5)	2032 (Year 6)	2033 (Year 7)	2034 (Year 8)	TOTALS BY PROJECT
East Pomquet (HADD)	24,786	Construction	$187,128.38										$187,128
		PCM		$29,640.00	$15,340.00	$30,825.60	$15,953.60	$32,058.62					$123,818
East Pomquet (MDMER)	5,414	Construction	$39,760.42										$39,761
		PCM		$7,020.00	$2,600.00	$7,300.80	$2,704.00	$7,592.83					$27,218
Sutherlands Brook	23,125	Construction	$174,930.00										$174,930
		PCM		$36,660.00	$17,940.00	$38,126.40	$18,657.60	$39,651.46					$151,035
Gunns Brook	60,900	Construction			$470,624.52	N/A							$470,625
		PCM				$65,070.00	$29,430.00	$67,672.80	$30,607.20	$70,379.71			$263,160
Roman Valley River (Smith Brook, Butlers Brook)	53,600	Construction				$423,144.38							$423,144
		PCM					$75,900.00	$34,100.00	$78,936.00	$35,464.00	$82,093.44		$306,493
McAllister Brook	N/A	Culvert retrofit (in advance of Year 3 restoration work)				$10,000							$10,000
McAlister Brook	15,000	Construction					$124,761.13						$124,761
		PCM						$38,080.00	$19,320.00	$39,603.20	$20,092.80	$41,187.33	$158,283
TOTALS	**182,825**	**Cost By Year**	**$401,818.80**	**$73,320**	**$506,504.52**	**$574,467.18**	**$267,406.33**	**$219,155.71**	**$128,863.20**	**$145,446.91**	**$102,186.24**	**$41,187.33**	**$2,460,356** (of which **$66,979** applies to compensation under MDMER)

7 CONCLUSION

Five offsetting measures are proposed to restore and enhance degraded waterways to counterbalance Project-related impacts to fish and fish habitat. The offsetting measures described herein have been selected based on the advice and recommendations received from DFO through the submission of multiple iterations of the Offsetting Plan, as well as through continued engagement with the Mi'kmaq of Nova Scotia, municipal officials, and local community watershed and fisheries organizations.

In collaboration with local fisheries offsetting experts, these five offsetting measures have been designed using proven and well-established instream restoration and enhancement techniques for Atlantic salmon, brook trout, and American eel habitat.

All offsetting measures are proposed in freshwater systems that have been subject to over-widening, channelization, and historic and current riparian land-use impacts resulting in a transition to homogenous stream characteristics and lack of instream functional components. Habitat complexity required to support the various life stages of salmonids will be restored through the introduction of structures that mimic the natural components of a healthy aquatic ecosystem. Restoration methods and structures have been chosen to provide the most benefit to the watercourse while avoiding unnecessary disturbance to the bed or bank, which reduces or eliminates potential adverse effects to fish and fish habitat.

The amount of offsetting area presented in this Offsetting Plan (182,825 m^2) is considered sufficient to counterbalance the Project HADD (including proposed offsetting ratios) of 179,578 m^2. Watercourses requiring an amendment to Schedule 2 of the MDMER are proposed to be compensated specifically through the East Pomquet offset project. Monitoring and contingency measures are proposed to ensure that the measures to offset are effective in meeting their stated objectives.

Based on the nature of the habitat losses and alterations as a result of the Project, the fisheries offsetting measures presented in this Offsetting Plan are expected to counterbalance Project impacts successfully.

Sincerely,

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Appendix A: HSI Survey Results

McCallum Environmental Ltd.

Table 1. Gunns Brook HSI Survey Results - Surveys 1.1-1.10 (Brook Trout)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (Juvenile)	% Instream Cover- Late Growing Season (Adult)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	% Fines in Riffle-Run Areas	% Substrate Size Class for Winter Escape	Avg. Thalweg Depth During the Late Growing Season	% Stream Shade
1.1	0.63	0.60	1.00	0.58	0.60	0.90	1.00	1.00	1.00	0.32	0.37
1.2	0.77	0.60	1.00	0.21	0.60	0.99	1.00	1.00	1.00	0.32	0.58
1.3	0.87	0.60	1.00	0.09	0.60	0.78	1.00	1.00	1.00	0.32	0.51
1.4	0.62	0.60	1.00	0.56	0.60	0.97	1.00	1.00	1.00	0.32	0.65
1.5	0.64	0.60	1.00	0.23	0.60	0.99	0.77	1.00	1.00	0.32	0.51
1.6	0.96	0.60	1.00	0.08	0.60	1.00	0.92	1.00	1.00	0.32	0.44
1.7	0.68	0.60	1.00	0.10	0.60	0.94	1.00	1.00	1.00	0.32	0.58
1.8	0.30	0.60	1.00	0.05	0.60	1.00	1.00	1.00	1.00	0.32	0.58
1.9	0.30	0.60	1.00	0.26	0.60	0.97	0.81	1.00	1.00	0.32	0.51
1.10	0.71	0.60	1.00	1.00	0.60	0.95	0.88	1.00	1.00	0.32	0.37
Overall	**0.64**	**0.60**	**1.00**	**0.31**	**0.60**	**0.94**	**0.93**	**1.00**	**1.00**	**0.32**	**0.51**

Table 2. Gunns Brook HSI Survey Results - Surveys 1.1-1.10 (Atlantic Salmon)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (fry)	% Instream Cover (parr)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	Spawning Present	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Depth Water	Parr Water Depth	% stream Shade
1.1	0.71	0.60	1.00	0.58	0.60	0.90	1.00	no			1.00	1.00	0.37
1.2	0.94	0.60	1.00	0.21	0.60	0.99	1.00	no			1.00	1.00	0.58
1.3	1.00	0.60	1.00	0.09	0.60	0.78	1.00	no			1.00	1.00	0.51
1.4	0.71	0.60	1.00	0.56	0.60	0.97	1.00	no			1.00	1.00	0.65
1.5	0.74	0.60	1.00	0.23	0.60	0.99	0.77	no			1.00	1.00	0.51
1.6	0.91	0.60	1.00	0.08	0.60	1.00	0.92	no			1.00	1.00	0.44
1.7	0.81	0.60	1.00	1.00	0.60	0.94	1.00	no			1.00	0.97	0.58
1.8	0.12	0.30	1.00	0.05	0.60	1.00	1.00	no			1.00	1.00	0.58
1.9	0.12	0.30	1.00	0.26	0.60	0.97	0.81	no			1.00	1.00	0.51
1.10	0.87	0.60	1.00	1.00	0.60	0.95	0.88	no			1.00	1.00	0.37
Overall	**0.69**	**0.54**	**1.00**	**0.31**	**0.60**	**0.94**	**0.93**	**no**			**1.00**	**0.99**	**0.51**

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Table 3. Gunns Brook HSI Survey Results - Surveys 2.1-2.20 (Brook Trout)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (Juvenile)	% Instream Cover- Late Growing Season (Adult)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	% Fines in Riffle-Run Areas	% Substrate Size Class for Winter Escape	Avg. Thalweg Depth During the Late Growing Season	% Stream Shade
2.1	0.40	0.60	0.88	0.03	0.60	0.99	1.00	1.00	1.00	0.67	0.65
2.2	0.30	0.30	1.00	0.16	0.60	0.72	1.00	1.00	1.00	0.67	0.44
2.3	0.30	0.30	1.00	0.13	0.60	1.00	0.73	1.00	1.00	0.00	0.72
2.4	0.51	0.60	1.00	0.31	0.60	1.00	0.53	1.00	1.00	0.67	0.44
2.5	0.30	0.30	1.00	0.37	0.60	1.00	1.00	1.00	1.00	0.67	0.51
2.6	0.46	0.60	1.00	0.13	0.60	1.00	1.00	1.00	1.00	0.67	0.44
2.7	0.30	0.30	1.00	0.16	0.60	1.00	1.00	1.00	1.00	0.67	0.65
2.8	0.30	0.30	1.00	0.08	0.60	1.00	0.77	1.00	1.00	0.67	0.44
2.9	0.30	0.30	1.00	0.04	0.60	0.95	0.95	1.00	1.00	0.67	0.40
2.10	0.30	0.30	1.00	0.13	0.60	1.00	1.00	1.00	1.00	0.67	0.37
2.11	0.30	0.30	1.00	0.32	0.60	0.99	0.92	1.00	1.00	0.67	0.37
2.12	0.30	0.30	1.00	0.06	0.60	1.00	1.00	1.00	1.00	0.67	0.44
2.13	0.30	0.30	1.00	0.18	0.60	0.97	0.77	1.00	1.00	0.67	0.44
2.14	0.39	0.60	1.00	0.81	0.60	1.00	0.88	1.00	1.00	0.67	0.44
2.15	0.69	0.60	0.88	0.02	0.60	0.98	0.92	1.00	1.00	0.67	0.44
2.16	0.30	0.30	1.00	0.10	0.60	1.00	0.58	1.00	1.00	0.67	0.44
2.17	0.30	0.30	1.00	0.34	0.60	1.00	1.00	1.00	1.00	0.67	0.51
2.18	0.31	0.60	1.00	0.03	0.60	1.00	0.49	1.00	1.00	0.67	1.00
2.19	0.71	0.60	1.00	0.62	0.60	1.00	1.00	1.00	1.00	0.67	0.44
2.20	0.42	0.60	0.97	0.00	0.60	0.98	0.88	1.00	1.00	0.67	0.51
Overall	**0.37**	**0.42**	**0.98**	**0.20**	**0.60**	**0.97**	**0.87**	**1.00**	**1.00**	**0.63**	**0.50**

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Table 4. Gunns Brook HSI Survey Results - Surveys 2.1-2.20 (Atlantic Salmon)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (fry)	% Instream Cover (parr)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	Spawning Present	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Depth Water	Parr Water Depth	% stream Shade
2.1	0.27	0.60	0.88	0.03	0.60	0.99	1.00	no			1.00	1.00	0.65
2.2	0.12	0.30	1.00	0.16	0.60	0.72	1.00	no			1.00	1.00	0.44
2.3	0.12	0.30	1.00	0.13	0.60	1.00	0.73	no			1.00	0.82	0.72
2.4	0.48	0.60	1.00	0.31	0.60	1.00	0.53	no			1.00	0.64	0.44
2.5	0.12	0.30	1.00	0.37	0.60	1.00	1.00	yes	0.71	0.08	1.00	1.00	0.51
2.6	0.39	0.60	1.00	0.13	0.60	1.00	1.00	no			1.00	1.00	0.44
2.7	0.12	0.30	1.00	0.16	0.60	1.00	1.00	no			1.00	1.00	0.65
2.8	0.12	0.30	1.00	0.08	0.60	1.00	0.77	no			1.00	1.00	0.44
2.9	0.12	0.30	1.00	0.04	0.60	0.95	0.95	no			1.00	1.00	0.40
2.10	0.12	0.30	1.00	0.13	0.60	1.00	1.00	no			1.00	1.00	0.37
2.11	0.12	0.30	1.00	0.32	0.60	0.99	0.92	no			1.00	1.00	0.37
2.12	0.12	0.30	1.00	0.06	0.60	1.00	1.00	no			1.00	1.00	0.44
2.13	0.12	0.30	1.00	0.12	0.60	0.97	0.77	no			1.00	1.00	0.44
2.14	0.26	0.60	1.00	0.81	0.60	1.00	0.88	no			1.00	1.00	0.44
2.15	0.82	0.60	0.88	0.02	0.60	0.98	0.92	no			1.00	0.91	0.44
2.16	0.12	0.30	1.00	0.10	0.60	1.00	0.58	no			1.00	1.00	0.44
2.17	0.12	0.30	1.00	0.34	0.60	1.00	0.85	no			1.00	1.00	0.51
2.18	0.13	0.60	1.00	0.03	0.60	1.00	0.49	no			1.00	0.71	1.00
2.19	0.86	0.60	1.00	0.62	0.60	1.00	1.00	no			1.00	1.00	0.44
2.20	0.32	0.60	0.97	0.00	0.60	0.98	0.98	no			1.00	1.00	0.51
Overall	**0.24**	**0.42**	**0.98**	**0.19**	**0.60**	**0.97**	**0.86**	**-**	**-**	**-**	**1.00**	**0.94**	**0.50**

Table 5. Gunns Brook HSI Survey Results - Surveys 3.1-3.10 (Brook Trout)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (Juvenile)	% Instream Cover- Late Growing Season (Adult)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	% Fines in Riffle-Run Areas	% Substrate Size Class for Winter Escape	Avg. Thalweg Depth During the Late Growing Season	% Stream Shade
3.1	0.33	0.60	1.00	0.21	0.60	0.90	1.00	1.00	1.00	0.32	0.58
3.2	0.30	0.30	1.00	0.17	0.60	1.00	1.00	1.00	1.00	0.67	0.37
3.3	0.30	0.30	1.00	0.08	0.60	1.00	1.00	1.00	1.00	0.32	0.51
3.4	0.30	0.30	1.00	0.10	0.60	1.00	1.00	1.00	1.00	0.32	0.44
3.5	0.30	0.30	1.00	0.20	0.60	0.95	1.00	1.00	1.00	0.67	0.37
3.6	1.00	0.60	1.00	0.30	0.60	0.60	1.00	1.00	1.00	0.67	0.72
3.7	0.30	0.30	1.00	0.06	0.60	1.00	1.00	1.00	1.00	0.32	0.3
3.8	0.30	0.30	1.00	0.10	0.60	1.00	1.00	1.00	1.00	0.67	0.51
3.9	0.48	0.60	1.00	0.09	0.60	1.00	1.00	1.00	1.00	0.32	0.44
3.10	0.30	0.30	1.00	0.00	0.60	1.00	1.00	1.00	1.00	0.67	0.65
Overall	**0.39**	**0.39**	**1.00**	**0.13**	**0.60**	**0.94**	**1.00**	**1.00**	**1.00**	**0.49**	**0.48**

Table 6. Gunns Brook HSI Survey Results - Surveys 3.1-3.10 (Atlantic Salmon)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (fry)	% Instream Cover (parr)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	Spawning Present	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Depth Water	Parr Water Depth	% stream Shade
3.1	0.17	0.60	1.00	0.21	0.60	0.90	1.00	no			1.00	0.86	0.58
3.2	0.12	0.30	1.00	0.17	0.60	1.00	1.00	no			1.00	1.00	0.37
3.3	0.12	0.30	1.00	0.08	0.60	1.00	1.00	no			1.00	1.00	0.51
3.4	0.12	0.30	1.00	0.10	0.60	1.00	1.00	no			1.00	0.89	0.44
3.5	0.12	0.30	1.00	0.20	0.60	0.95	1.00	no			1.00	1.00	0.37
3.6	0.60	0.60	1.00	0.30	0.60	1.00	1.00	no			1.00	1.00	0.72
3.7	0.12	0.30	1.00	0.06	0.60	1.00	1.00	no			1.00	1.00	0.30
3.8	0.12	0.30	1.00	0.10	0.60	1.00	1.00	no			1.00	0.92	0.51
3.9	0.43	0.60	1.00	0.09	0.60	1.00	1.00	no			1.00	1.00	0.44
3.10	0.12	0.30	1.00	0.00	0.60	1.00	1.00	no			1.00	0.94	0.65
Overall	**0.20**	**0.39**	**1.00**	**0.13**	**0.60**	**0.98**	**1.00**	**no**			**1.00**	**0.96**	**0.48**

Table 7. Gunns Brook HSI Survey Results - Surveys 4.1-4.10 (Brook Trout)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (Juvenile)	% Instream Cover- Late Growing Season (Adult)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	% Fines in Riffle-Run Areas	% Substrate Size Class for Winter Escape	Avg. Thalweg Depth During the Late Growing Season	% Stream Shade
4.1	0.45	0.60	0.89	0.03	0.60	1.00	1.00	1.00	1.00	0.32	0.44
4.2	0.47	0.60	1.00	0.02	0.60	1.00	1.00	1.00	1.00	0.67	0.37
4.3	0.30	0.30	1.00	0.98	0.60	1.00	1.00	1.00	1.00	0.67	0.44
4.4	0.30	0.30	1.00	0.11	0.60	1.00	1.00	1.00	1.00	0.67	0.44
4.5	0.30	0.30	1.00	0.03	0.60	1.00	1.00	1.00	1.00	0.67	0.3
4.6	0.30	0.30	1.00	0.09	0.60	1.00	1.00	1.00	1.00	0.67	0.44
4.7	0.35	0.60	1.00	0.03	0.60	1.00	1.00	1.00	1.00	0.67	0.44
4.8	0.30	0.30	1.00	0.07	0.60	1.00	0.88	1.00	1.00	0.67	0.37
4.9	0.51	0.60	1.00	0.53	0.60	1.00	1.00	1.00	1.00	0.67	0.44
4.10	0.30	0.30	1.00	0.07	0.60	1.00	1.00	1.00	1.00	0.67	0.65
Overall	**0.35**	**0.42**	**0.98**	**0.19**	**0.60**	**1.00**	**0.98**	**1.00**	**1.00**	**0.63**	**0.43**

Table 8. Gunns Brook HSI Survey Results - Surveys 4.1-4.10 (Atlantic Salmon)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (fry)	% Instream Cover (parr)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	Spawning Present	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Depth Water	Parr Water Depth	% stream Shade
4.1	0.37	0.60	0.89	0.03	0.60	1.00	1.00	no			1.00	0.89	0.44
4.2	0.41	0.60	1.00	0.02	0.60	1.00	1.00	no			1.00	1.00	0.37
4.3	0.12	0.30	1.00	0.98	0.60	1.00	1.00	no			1.00	1.00	0.44
4.4	0.12	0.30	1.00	0.11	0.60	1.00	1.00	no			1.00	0.98	0.44
4.5	0.12	0.30	1.00	0.03	0.60	1.00	1.00	no			1.00	1.00	0.30
4.6	0.12	0.30	1.00	0.09	0.60	1.00	1.00	no			1.00	0.99	0.44
4.7	0.2	0.60	1.00	0.03	0.60	1.00	1.00	no			1.00	1.00	0.44
4.8	0.12	0.30	1.00	0.07	0.60	1.00	0.88	no			1.00	1.00	0.37
4.9	0.50	0.60	1.00	0.53	0.60	1.00	1.00	no			1.00	1.00	0.44
4.10	0.12	0.30	1.00	0.07	0.60	1.00	1.00	no			1.00	0.97	0.65
Overall	**0.22**	**0.42**	**1.00**	**0.19**	**0.60**	**1.00**	**0.98**	**no**			**1.00**	**0.98**	**0.43**

Table 9. Gunns Brook HSI Survey Results - Surveys 5.1-5.10 (Brook Trout)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (Juvenile)	% Instream Cover- Late Growing Season (Adult)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	% Fines in Riffle-Run Areas	% Substrate Size Class for Winter Escape	Avg. Thalweg Depth During the Late Growing Season	% Stream Shade
5.1	0.56	0.60	1.00	0.32	0.60	0.95	1.00	1.00	1.00	0.67	0.37
5.2	0.30	0.30	1.00	0.19	0.60	0.75	1.00	1.00	1.00	0.67	0.37
5.3	0.30	0.30	1.00	0.25	0.60	0.97	1.00	1.00	1.00	0.67	0.37
5.4	0.30	0.30	1.00	0.17	0.60	1.00	1.00	1.00	1.00	0.67	0.37
5.5	0.30	0.30	1.00	0.15	0.60	0.96	1.00	1.00	1.00	0.67	0.37
5.6	0.30	0.30	1.00	0.13	0.60	1.00	1.00	1.00	1.00	0.67	0.37
5.7	0.30	0.30	1.00	0.13	0.60	1.00	1.00	1.00	1.00	0.67	0.30
5.8	0.30	0.30	1.00	0.06	0.60	0.99	0.77	1.00	1.00	0.67	0.51
5.9	0.30	0.30	1.00	0.45	0.60	0.99	1.00	1.00	1.00	0.67	0.30
5.10	0.30	0.30	1.00	0.05	0.60	1.00	0.97	1.00	1.00	0.67	0.37
Overall	**0.32**	**0.33**	**1.00**	**0.19**	**0.60**	**0.96**	**0.97**	**1.00**	**1.00**	**0.67**	**0.37**

Table 10. Gunns Brook HSI Survey Results - Surveys 5.1-5.10 (Atlantic Salmon)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (fry)	% Instream Cover (parr)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	Spawning Present	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Depth Water	Parr Water Depth	% stream Shade
5.1	0.60	0.60	1.00	0.32	0.60	0.95	1.00	no			1.00	0.90	0.37
5.2	0.12	0.30	1.00	0.19	0.60	0.75	1.00	no			1.00	1.00	0.37
5.3	0.12	0.30	1.00	0.25	0.60	0.97	1.00	no			1.00	0.97	0.37
5.4	0.12	0.30	1.00	0.17	0.60	1.00	1.00	no			1.00	1.00	0.37
5.5	0.12	0.30	1.00	0.15	0.60	0.96	1.00	no			1.00	0.91	0.37
5.6	0.12	0.30	1.00	0.13	0.60	1.00	1.00	no			1.00	1.00	0.37
5.7	0.12	0.30	1.00	0.13	0.60	1.00	1.00	no			1.00	1.00	0.30
5.8	0.12	0.30	1.00	0.06	0.60	0.99	0.77	no			1.00	1.00	0.51
5.9	0.12	0.30	1.00	0.45	0.60	0.99	1.00	no			1.00	0.74	0.30
5.10	0.12	0.30	1.00	0.05	0.60	1.00	0.97	no			1.00	0.59	0.37
Overall	**0.16**	**0.33**	**1.00**	**0.19**	**0.60**	**0.96**	**0.97**	**no**			**1.00**	**0.91**	**0.37**

Table 11. Sutherlands Brook HSI Survey Results - Surveys 1.1-1.10 (Brook Trout)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (Juvenile)	% Instream Cover- Late Growing Season (Adult)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	% Fines in Riffle-Run Areas	% Substrate Size Class for Winter Escape	Avg. Thalweg Depth During the Late Growing Season	% Stream Shade
1.1	0.30	0.30	1.00	0.23	0.60	1.00	0.77	1.00	1.00	0.67	0.79
1.2	0.67	0.60	1.00	1.00	0.60	1.00	0.45	1.00	1.00	0.67	1.00
1.3	0.30	0.30	1.00	0.44	0.60	1.00	0.85	1.00	1.00	0.67	0.93
1.4	0.30	0.30	1.00	0.00	0.60	1.00	0.69	1.00	1.00	0.67	1.00
1.5	0.41	0.60	1.00	0.35	0.60	1.00	1.00	1.00	1.00	0.67	1.00
1.6	0.35	0.60	1.00	0.07	0.60	1.00	0.77	1.00	1.00	0.67	1.00
1.7	0.76	0.60	1.00	0.31	0.60	1.00	0.60	1.00	1.00	0.67	1.00
1.8	0.30	0.30	1.00	0.00	0.60	1.00	0.61	1.00	1.00	0.67	1.00
1.9	0.30	0.30	1.00	0.50	0.60	1.00	0.42	1.00	1.00	0.67	1.00
1.10	0.30	0.30	1.00	0.00	0.60	1.00	0.85	1.00	1.00	0.67	0.58
Overall	**0.39**	**0.42**	**1.00**	**0.29**	**0.60**	**1.00**	**0.70**	**1.00**	**1.00**	**0.67**	**0.92**

Table 12. Sutherlands Brook HSI Survey Results - Surveys 1.1-1.10 (Atlantic Salmon)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (fry)	% Instream Cover (parr)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	Spawning Present	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Depth Water	Parr Water Depth	% stream Shade
1.1	0.12	0.30	1.00	0.23	0.60	1.00	0.77	no			1.00	1.00	0.79
1.2	0.79	0.60	1.00	1.00	0.60	1.00	0.45	no			1.00	0.79	1.00
1.3	0.12	0.30	1.00	0.44	0.60	1.00	0.85	no			1.00	0.91	0.93
1.4	0.12	0.30	1.00	0.00	0.60	1.00	0.69	no			1.00	0.98	1.00
1.5	0.30	0.60	1.00	0.35	0.60	1.00	1.00	no			1.00	1.00	1.00
1.6	0.20	0.60	1.00	0.07	0.60	1.00	0.77	no			1.00	0.83	1.00
1.7	0.92	0.60	1.00	0.31	0.60	1.00	0.61	no			1.00	1.00	1.00
1.8	0.12	0.30	1.00	0.00	0.60	1.00	0.61	no			1.00	0.86	1.00
1.9	0.12	0.30	1.00	0.50	0.60	1.00	0.42	no			1.00	1.00	1.00
1.10	0.12	0.30	1.00	0.00	0.60	1.00	0.85	no			1.00	1.00	0.58
Overall	**0.29**	**0.42**	**1.00**	**0.29**	**0.60**	**1.00**	**0.71**	**no**			**1.00**	**0.93**	**0.92**

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Table 13. Sutherlands Brook HSI Survey Results - Surveys 2.1-2.10 (Brook Trout)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (Juvenile)	% Instream Cover- Late Growing Season (Adult)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	% Fines in Riffle-Run Areas	% Substrate Size Class for Winter Escape	Avg. Thalweg Depth During the Late Growing Season	% Stream Shade
2.1	0.30	0.30	1.00	0.28	0.60	0.61	1.00	1.00	1.00	0.32	1.00
2.2	0.42	0.60	1.00	0.30	0.60	0.69	0.88	1.00	1.00	0.67	0.72
2.3	0.40	0.60	1.00	0.50	0.60	0.99	1.00	1.00	1.00	0.67	0.79
2.4	0.30	0.30	1.00	0.50	0.60	0.92	1.00	1.00	1.00	0.67	0.34
2.5	0.30	0.30	1.00	0.10	0.60	0.73	1.00	1.00	1.00	0.67	0.58
2.6	0.30	0.30	1.00	0.16	0.60	1.00	1.00	1.00	1.00	0.32	0.93
2.7	0.30	0.30	1.00	0.26	0.60	1.00	1.00	1.00	1.00	0.67	1.00
2.8	0.53	0.60	1.00	0.21	0.60	0.93	1.00	1.00	1.00	0.32	0.72
2.9	0.59	0.60	1.00	0.28	0.60	1.00	1.00	1.00	1.00	0.32	0.72
2.10	0.30	0.30	1.00	0.19	0.60	1.00	1.00	1.00	1.00	0.67	0.65
Overall	**0.37**	**0.42**	**1.00**	**0.27**	**0.60**	**0.88**	**0.98**	**1.00**	**1.00**	**0.53**	**0.74**

Table 14. Sutherlands Brook HSI Survey Results - Surveys 2.1-2.10 (Atlantic Salmon)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (fry)	% Instream Cover (parr)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	Spawning Present	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Depth Water	Parr Water Depth	% Stream Shade
2.1	0.12	0.30	1.00	0.28	0.60	0.61	1.00	no			1.00	1.00	1.00
2.2	0.31	0.60	1.00	0.30	0.60	0.69	0.88	no			1.00	1.00	0.72
2.3	0.28	0.60	1.00	0.50	0.60	0.99	1.00	no			1.00	1.00	0.79
2.4	0.12	0.30	1.00	0.50	0.60	0.92	1.00	no			1.00	1.00	0.34
2.5	0.12	0.30	1.00	0.10	0.60	0.73	1.00	no			1.00	0.87	0.58
2.6	0.12	0.30	1.00	0.16	0.60	1.00	1.00	no			1.00	1.00	0.93
2.7	0.12	0.30	1.00	0.26	0.60	1.00	1.00	no			1.00	1.00	1.00
2.8	0.53	0.60	1.00	0.21	0.60	0.93	1.00	no			1.00	1.00	0.72
2.9	0.65	0.60	1.00	0.28	0.60	1.00	1.00	no			0.99	1.00	0.72
2.10	0.12	0.30	1.00	0.19	0.60	1.00	1.00	no			1.00	0.98	0.65
Overall	**0.24**	**0.42**	1.00	**0.27**	**0.60**	**0.88**	**0.98**	**no**			**0.99**	**0.98**	**0.74**

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Table 15. Sutherlands Brook HSI Survey Results - Surveys 3.1-3.10 (Brook Trout)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (Juvenile)	% Instream Cover- Late Growing Season (Adult)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	% Fines in Riffle-Run Areas	% Substrate Size Class for Winter Escape	Avg. Thalweg Depth During the Late Growing Season	% Stream Shade
3.1	0.55	0.60	1.00	0.20	0.60	1.00	0.95	1.00	1.00	0.32	0.72
3.2	0.42	0.60	1.00	0.12	0.60	1.00	0.69	1.00	1.00	0.32	0.72
3.3	0.67	0.60	1.00	0.09	0.60	1.00	1.00	1.00	1.00	0.32	0.93
3.4	0.30	0.30	1.00	1.00	0.60	1.00	1.00	1.00	1.00	0.32	0.72
3.5	0.30	0.30	1.00	0.00	0.60	1.00	1.00	1.00	1.00	0.32	0.86
3.6	0.30	0.30	1.00	0.15	0.60	1.00	1.00	1.00	1.00	0.32	0.86
3.7	0.30	0.30	1.00	0.07	0.60	1.00	1.00	1.00	1.00	0.67	0.72
3.8	0.62	0.60	1.00	0.71	0.60	1.00	1.00	1.00	1.00	0.32	0.86
3.9	0.69	0.60	1.00	0.14	0.60	1.00	1.00	1.00	1.00	0.32	0.93
3.10	0.30	0.30	1.00	0.13	0.60	1.00	1.00	1.00	1.00	0.32	0.72
Overall	**0.44**	**0.45**	**1.00**	**0.26**	**0.60**	**1.00**	**0.96**	**1.00**	**1.00**	**0.35**	**0.80**

Table 16. Sutherlands Brook HSI Survey Results - Surveys 3.1-3.10 (Atlantic Salmon)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (fry)	% Instream Cover (parr)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	Spawning Present	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Depth Water	Parr Water Depth	% stream Shade
3.1	0.56	0.60	1.00	0.20	0.60	1.00	0.95	no			1.00	0.71	0.72
3.2	0.31	0.60	1.00	0.12	0.60	1.00	0.69	no			1.00	0.89	0.72
3.3	0.80	0.60	1.00	0.09	0.60	1.00	1.00	no			1.00	0.97	0.93
3.4	0.12	0.30	1.00	1.00	0.60	1.00	1.00	no			1.00	1.00	0.72
3.5	0.12	0.30	1.00	0.00	0.60	1.00	1.00	no			1.00	1.00	0.86
3.6	0.12	0.30	1.00	0.15	0.60	1.00	1.00	no			1.00	1.00	0.86
3.7	0.12	0.30	1.00	0.07	0.60	1.00	1.00	no			1.00	0.93	0.72
3.8	0.70	0.60	1.00	0.71	0.60	1.00	1.00	no			1.00	1.00	0.86
3.9	0.83	0.60	1.00	0.14	0.60	1.00	1.00	no			1.00	1.00	0.93
3.10	0.12	0.30	1.00	0.13	0.60	1.00	1.00	no			1.00	1.00	0.72
Overall	**0.38**	**0.45**	**1.00**	**0.26**	**0.60**	**1.00**	**0.96**	**no**			**1.00**	**0.95**	**0.80**

Table 17. McAllister Brook HSI Survey Results - Surveys 1.1-1.10 (Brook Trout)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (Juvenile)	% Instream Cover-Late Growing Season (Adult)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	% Fines in Riffle-Run Areas	% Substrate Size Class for Winter Escape	Avg. Thalweg Depth During the Late Growing Season	% Stream Shade
1.1	0.30	0.30	1.00	0.63	0.60	1.00	1.00	1.00	1.00	0.32	1.00
1.2	0.30	0.30	1.00	0.44	0.60	1.00	1.00	1.00	1.00	0.01	1.00
1.3	0.30	0.30	1.00	0.86	0.60	1.00	1.00	1.00	1.00	0.32	1.00
1.4	0.30	0.30	1.00	0.31	0.60	1.00	1.00	1.00	1.00	0.32	1.00
1.5	0.30	0.30	0.67	0.00	0.60	1.00	1.00	1.00	1.00	0.32	0.93
1.6	0.30	0.30	0.94	0.05	0.60	1.00	0.97	1.00	1.00	0.32	0.86
1.7	0.30	0.30	1.00	1.00	0.60	0.98	1.00	1.00	1.00	0.32	0.86
1.8	0.30	0.30	1.00	0.33	0.60	1.00	1.00	1.00	1.00	0.32	0.58
1.9	0.85	0.60	1.00	0.00	0.60	1.00	1.00	1.00	1.00	0.32	0.72
1.10	0.41	0.60	1.00	0.19	0.60	1.00	1.00	1.00	1.00	0.32	0.51
Overall	**0.36**	**0.36**	**0.96**	**0.38**	**0.60**	**1.00**	**1.00**	**1.00**	**1.00**	**0.29**	**0.84**

Table 18. McAllister Brook HSI Survey Results - Surveys 1.1-1.10 (Atlantic Salmon)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (fry)	% Instream Cover (parr)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	Spawning Present	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Depth Water	Parr Water Depth	% stream Shade
1.1	0.12	0.30	1.00	0.63	0.60	1.00	1.00	no			1.00	0.72	1.00
1.2	0.12	0.30	1.00	0.44	0.60	1.00	1.00	no			1.00	1.00	1.00
1.3	0.12	0.30	1.00	0.86	0.60	1.00	1.00	no			1.00	0.92	1.00
1.4	0.12	0.30	1.00	0.31	0.60	1.00	1.00	no			1.00	0.71	1.00
1.5	0.12	0.30	0.67	0.00	0.60	1.00	1.00	no			1.00	1.00	0.93
1.6	0.12	0.30	0.94	0.05	0.60	1.00	0.97	no			1.00	0.85	0.86
1.7	0.12	0.30	1.00	1.00	0.60	0.98	1.00	no			1.00	1.00	0.86
1.8	0.12	0.30	1.00	0.33	0.60	1.00	1.00	no			1.00	1.00	0.58
1.9	1.00	0.60	1.00	0.00	0.60	1.00	1.00	no			1.00	1.00	0.72
1.10	0.29	0.60	1.00	0.19	0.60	1.00	1.00	no			1.00	0.94	0.51
Overall	**0.22**	**0.36**	**0.96**	**0.38**	**0.60**	**1.00**	**1.00**	**no**			**1.00**	**0.91**	**0.85**

Table 19. McAllister Brook HSI Survey Results - Surveys 2.1-2.20 (Brook Trout)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (Juvenile)	% Instream Cover-Late Growing Season (Adult)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	% Fines in Riffle-Run Areas	% Substrate Size Class for Winter Escape	Avg. Thalweg Depth During the Late Growing Season	% Stream Shade
2.1	0.30	0.30	1.00	0.42	0.60	1.00	1.00	1.00	1.00	0.32	0.58
2.2	0.30	0.30	1.00	0.07	0.60	1.00	0.85	1.00	1.00	0.67	1.00
2.3	0.46	0.60	1.00	0.14	0.60	0.93	1.00	1.00	1.00	0.32	0.72
2.4	0.30	0.30	1.00	1.00	0.60	0.99	1.00	1.00	1.00	0.67	1.00
2.5	0.30	0.30	1.00	0.00	0.60	1.00	1.00	1.00	1.00	0.67	0.58
2.6	0.54	0.60	1.00	0.07	0.60	0.95	1.00	1.00	1.00	0.67	0.44
2.7	0.30	0.30	1.00	0.10	0.60	0.97	1.00	1.00	1.00	0.67	0.44
2.8	0.30	0.30	1.00	0.00	0.60	0.97	1.00	1.00	1.00	0.67	0.72
2.9	0.30	0.30	1.00	0.24	0.60	0.98	1.00	1.00	1.00	0.67	0.93
10	0.30	0.30	1.00	0.03	0.60	1.00	1.00	1.00	1.00	0.67	0.51
2.11	0.30	0.30	1.00	0.03	0.60	0.88	1.00	1.00	1.00	0.32	0.58
2.12	0.43	0.60	1.00	0.08	0.60	0.92	1.00	1.00	1.00	0.32	1.00
2.13	0.81	0.60	1.00	0.00	0.60	0.88	1.00	1.00	1.00	0.32	0.79
2.14	0.30	0.30	1.00	0.96	0.60	1.00	1.00	1.00	1.00	0.32	1.00
2.15	0.30	0.30	0.91	0.00	0.60	1.00	1.00	1.00	1.00	0.32	0.85
2.16	0.72	0.60	1.00	0.15	0.60	1.00	1.00	1.00	1.00	0.32	0.37
2.17	0.30	0.30	1.00	0.19	0.60	0.92	1.00	1.00	1.00	0.32	0.86
2.18	0.30	0.30	1.00	0.25	0.60	1.00	1.00	1.00	1.00	0.32	0.79
2.19	0.91	0.60	1.00	0.29	0.60	1.00	1.00	1.00	1.00	0.32	0.58
2.20	0.85	0.60	1.00	0.72	0.60	0.99	1.00	1.00	1.00	0.32	0.58
Overall	**0.43**	**0.40**	**0.99**	**0.23**	**0.60**	**0.96**	**0.99**	**1.00**	**1.00**	**0.46**	**0.71**

Table 20. McAllister Brook HSI Survey Results - Surveys 2.1-2.20 (Atlantic Salmon)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (fry)	% Instream Cover (parr)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	Spawning Present	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Depth Water	Parr Water Depth	% stream Shade
2.1	0.12	0.30	1.00	0.42	0.60	1.00	1.00	no			1.00	0.71	0.58
2.2	0.12	0.30	1.00	0.07	0.60	1.00	0.85	no			1.00	0.73	1.00
2.3	0.40	0.60	1.00	0.14	0.60	0.93	1.00	no			1.00	1.00	0.72
2.4	0.12	0.30	1.00	1.00	0.60	0.99	1.00	no			1.00	0.59	1.00
2.5	0.12	0.30	1.00	0.00	0.60	1.00	1.00	no			1.00	0.83	0.58
2.6	0.54	0.60	1.00	0.07	0.60	0.95	1.00	no			1.00	0.51	0.44
2.7	0.12	0.30	1.00	0.10	0.60	0.97	1.00	no			1.00	0.82	0.44
2.8	0.12	0.30	1.00	0.00	0.60	0.97	1.00	no			1.00	0.73	0.72
2.9	0.12	0.30	1.00	0.24	0.60	0.98	1.00	no			1.00	0.74	0.93
2.10	0.12	0.30	1.00	0.03	0.60	1.00	1.00	no			1.00	0.98	0.51
2.11	0.12	0.30	1.00	0.03	0.60	0.88	1.00	no			1.00	0.56	0.58
2.12	0.34	0.60	1.00	0.08	0.60	0.92	1.00	no			1.00	0.83	1.00
2.13	0.98	0.60	1.00	0.00	0.60	0.88	1.00	no			1.00	0.97	0.79
2.14	0.12	0.30	1.00	0.96	0.60	1.00	1.00	no			1.00	0.88	1.00
2.15	0.12	0.30	0.91	0.00	0.60	1.00	1.00	no			1.00	0.67	0.85
2.16	0.87	0.60	1.00	0.15	0.60	1.00	1.00	no			1.00	1.00	0.37
2.17	0.12	0.30	1.00	0.19	0.60	0.92	1.00	no			1.00	0.71	0.86
2.18	0.12	0.30	1.00	0.25	0.60	1.00	1.00	no			1.00	0.79	0.79
2.19	0.98	0.60	1.00	0.29	0.60	1.00	1.00	no			1.00	1.00	0.58
2.20	1.00	0.60	1.00	0.72	0.6	0.99	1.00	no			1.00	1.00	0.58
Overall	0.33	0.40	0.99	0.23	0.6	0.96	0.99	**no**			1.00	0.80	0.71

Table 21. McAllister Brook HSI Survey Results - Surveys 3.1-3.10 (Brook Trout)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (Juvenile)	% Instream Cover-Late Growing Season (Adult)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	% Fines in Riffle-Run Areas	% Substrate Size Class for Winter Escape	Avg. Thalweg Depth During the Late Growing Season	% Stream Shade
3.1	0.30	0.30	1.00	0.79	0.60	0.97	1.00	1.00	1.00	0.32	0.72
3.2	0.30	0.30	1.00	0.73	0.60	1.00	0.92	1.00	1.00	0.32	0.58
3.3	0.30	0.30	1.00	0.13	0.60	1.00	1.00	1.00	1.00	0.32	0.72
3.4	0.50	0.30	1.00	0.34	0.60	1.00	1.00	1.00	1.00	0.32	0.51
3.5	0.45	0.60	1.00	0.00	0.60	0.98	1.00	1.00	1.00	0.32	0.72
3.6	0.30	0.30	1.00	0.11	0.60	1.00	0.91	1.00	1.00	0.32	0.58
3.7	1.00	0.60	1.00	0.00	0.60	0.95	1.00	1.00	1.00	0.32	1.00
3.8	0.30	0.30	1.00	1.00	0.60	1.00	1.00	1.00	1.00	0.32	0.79
3.9	0.30	0.30	1.00	0.07	0.60	0.97	1.00	1.00	1.00	0.32	0.79
3.10	0.30	0.30	1.00	0.15	0.60	1.00	1.00	1.00	1.00	0.32	0.58
Overall	**0.40**	**0.36**	**1.00**	**0.33**	**0.60**	**0.98**	**0.98**	**1.00**	**1.00**	**0.32**	**0.69**

Table 22. McAllister Brook HSI Survey Results - Surveys 3.1-3.10 (Atlantic Salmon)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (fry)	% Instream Cover (parr)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	Spawning Present	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Depth Water	Parr Water Depth	% stream Shade
3.1	0.12	0.30	1.00	0.79	0.60	0.97	1.00	no			1.00	0.82	0.72
3.2	0.12	0.30	1.00	0.73	0.60	1.00	0.92	no			1.00	1.00	0.58
3.3	0.12	0.30	1.00	0.13	0.60	1.00	1.00	no			1.00	0.59	0.72
3.4	0.47	0.30	1.00	0.34	0.60	1.00	1.00	no			1.00	0.87	0.51
3.5	0.38	0.60	1.00	0.00	0.60	0.98	1.00	no			1.00	0.92	0.72
3.6	0.12	0.30	1.00	0.11	0.60	1.00	0.91	no			1.00	1.00	0.58
3.7	0.74	0.60	1.00	0.00	0.60	0.95	1.00	no			1.00	0.66	1.00
3.8	0.12	0.30	1.00	1.00	0.60	1.00	1.00	no			1.00	0.84	0.79
3.9	0.12	0.30	1.00	0.07	0.60	0.97	1.00	no			1.00	0.67	0.79
3.10	0.12	0.30	1.00	0.15	0.60	1.00	1.00	no			1.00	0.95	0.58
Overall	**0.24**	**0.36**	**1.00**	**0.33**	**0.60**	**0.98**	**0.98**	**no**			**1.00**	**0.80**	**0.69**

Table 23. East Pomquet HSI Survey Results - Surveys 1-10 (Brook Trout)

HSI Survey	Percent Pools	Pool Class Rating	Percent Instream Cover Juvenile	Percent Instream Cover During Late Growing Season Adult	Dominant Substrate Type in Riffle-Run Areas	Average Percent Vegetation Along the Streambank	Average Percent Rooted Vegetation and Stable Rocky Ground Cover	Percent Fines in Riffle-Run Areas	Percent Substrate Size Class for Winter Escape	Average Thalweg Depth During the Late Growing Season	Percent Stream Shade
1	0.48	0.60	0.66	0.02	0.60	1.00	1.00	0.96	1.00	0.12	0.65
2	0.30	0.30	0.52	0.04	0.30	0.95	1.00	1.00	1.00	0.11	0.79
3	0.35	0.60	0.54	0.05	0.30	0.95	1.00	1.00	1.00	0.20	0.79
4	0.30	0.30	0.11	0.00	0.30	0.98	1.00	1.00	0.36	0.08	0.93
5	0.30	0.30	0.41	0.00	0.60	0.92	1.00	1.00	1.00	0.03	1.00
6	0.30	0.30	0.43	0.00	0.30	0.48	1.00	1.00	1.00	0.11	0.86
7	0.56	0.60	0.45	0.02	0.60	0.78	1.00	1.00	1.00	0.21	1.00
8	0.30	0.30	0.38	0.00	0.60	0.84	1.00	1.00	1.00	0.05	1.00
9	0.30	0.30	0.40	0.00	0.60	0.95	1.00	1.00	1.00	0.05	1.00
10	0.55	0.60	0.48	0.04	0.60	0.83	1.00	1.00	1.00	0.09	1.00
Overall	**0.38**	**0.42**	**0.44**	**0.02**	**0.48**	**0.87**	**1.00**	**1.00**	**0.94**	**0.10**	**0.90**

Table 24. East Pomquet HSI Survey Results - Surveys 1-10 (Atlantic Salmon)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (fry)	% Instream Cover (parr)	Dominant Substrate Type in Riffle-Run Areas	Avg % Vegetation Along the Streambank	Avg % Rooted Vegetation and Stable Rocky Ground Cover	Spawning Present	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Water Depth	Parr Water Depth	% Stream Shade
1	0.43	0.60	0.66	0.02	0.60	1.00	1.00	no			1.00	1.00	0.65
2	0.12	0.30	0.52	0.04	0.30	0.95	1.00	no			1.00	0.69	0.79
3	0.20	0.60	0.54	0.05	0.30	0.95	1.00	no			1.00	0.69	0.79
4	0.12	0.30	0.11	0.00	0.30	0.98	1.00	no			1.00	0.53	0.93
5	0.12	0.30	0.41	0.00	0.60	0.92	1.00	no			1.00	0.53	1.00
6	0.12	0.30	0.43	0.00	0.30	0.48	1.00	no			1.00	0.83	0.86
7	0.59	0.60	0.45	0.02	0.60	0.78	1.00	no			1.00	0.61	1.00
8	0.12	0.30	0.38	0.00	0.60	0.84	1.00	no			1.00	0.63	1.00
9	0.12	0.30	0.40	0.00	0.60	0.95	1.00	no			0.94	0.47	1.00
10	0.12	0.30	0.40	0.00	0.60	0.95	1.00	no			0.94	0.47	1.00
Overall	**0.24**	**0.39**	**0.43**	**0.01**	**0.48**	**0.88**	**1.00**	**no**			**0.99**	**0.65**	**0.90**

Table 25. East Pomquet HSI Survey Results - Surveys 11-20 (Brook Trout)

HSI Survey	Percent Pools	Pool Class Rating	Percent Instream Cover Juvenile	Percent Instream Cover During Late Growing Season Adult	Dominant Substrate Type in Riffle-Run Areas	Average Percent Vegetation Along the Streambank	Average Percent Rooted Vegetation and Stable Rocky Ground Cover	Percent Fines in Riffle-Run Areas	Percent Substrate Size Class for Winter Escape	Average Thalweg Depth During the Late Growing Season	Percent Stream Shade
11	0.84	0.60	1.00	0.43	0.60	1.00	1.00	0.93	1.00	0.23	0.51
12	0.87	0.60	1.00	0.43	0.60	1.00	1.00	0.93	1.00	0.49	0.51
13	0.30	0.30	1.00	0.18	0.60	0.80	1.00	1.00	1.00	0.79	0.44
14	0.64	0.60	0.97	0.13	1.00	1.00	1.00	1.00	1.00	0.60	1.00
15	0.92	1.00	0.63	0.19	0.30	1.00	1.00	1.00	0.86	1.00	0.51
16	0.88	0.60	0.66	0.07	0.30	0.81	1.00	1.00	0.94	0.49	0.65
17	1.00	0.60	0.53	0.02	0.60	0.95	1.00	0.83	1.00	0.18	1.00
18	1.00	0.60	0.78	0.13	0.60	0.96	1.00	0.60	1.00	0.54	1.00
19	0.46	0.60	0.64	0.08	0.60	0.90	1.00	0.84	0.97	0.18	1.00
20	0.30	0.30	0.67	0.03	0.60	0.98	1.00	1.00	1.00	0.02	1.00
Overall	**0.78**	**0.58**	**0.79**	**0.17**	**0.58**	**0.94**	**1.00**	**0.91**	**0.98**	**0.45**	**0.76**

Table 26. East Pomquet HSI Survey Results - Surveys 11-20 (Atlantic Salmon)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (fry)	% Instream Cover (parr)	Dominant Substrate Type in Riffle-Run Areas	Avg % Vegetation Along the Streambank	Avg % Rooted Vegetation and Stable Rocky Ground Cover	Spawning Present	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Water Depth	Parr Water Depth	% Stream Shade
1	0.99	0.60	1.00	0.43	0.60	1.00	1.00	no			1.00	0.97	0.51
2	1.00	0.60	1.00	0.43	0.60	1.00	1.00	no			1.00	0.94	0.51
3	0.12	0.30	1.00	0.18	0.60	0.80	1.00	yes	1.00	0.00	1.00	1.00	0.44
4	0.74	0.60	0.97	0.13	1.00	1.00	1.00	no			1.00	1.00	1.00
5	0.97	1.00	0.63	0.19	0.30	1.00	1.00	no			1.00	1.00	0.51
6	1.00	0.60	0.66	0.07	0.30	0.81	1.00	yes	1.00	0.03	1.00	1.00	0.65
7	0.73	0.60	0.53	0.02	0.60	0.95	1.00	yes	1.00	0.00	1.00	0.72	1.00
8	0.76	0.60	0.78	0.13	0.60	0.96	1.00	no			1.00	1.00	1.00
9	0.40	0.60	0.64	0.08	0.60	0.90	1.00	yes	1.00	0.00	1.00	0.65	1.00
10	0.40	0.60	0.64	0.08	0.60	0.90	1.00	yes	1.00	0.00	1.00	0.65	1.00
Overall	**0.95**	**0.61**	**0.78**	**0.18**	**0.58**	**0.93**	**1.00**	**-**	**-**	**-**	**1.00**	**0.89**	**0.76**

Table 27. Roman Valley River HSI Survey Results (Brook Trout)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (Juvenile)	% Instream Cover-Late Growing Season (Adult)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	% Fines in Riffle-Run Areas	% Substrate Size Class for Winter Escape	Avg. Thalweg Depth During the Late Growing Season	% Stream Shade
1	0.30	0.30	1.00	0.12	0.60	1.00	1.00	1.00	1.00	0.32	0.58
2	0.30	0.30	1.00	0.45	0.60	0.95	1.00	1.00	1.00	0.32	0.65
3	0.30	0.30	1.00	0.19	0.60	0.96	1.00	1.00	1.00	0.32	1.00
4	0.53	0.60	1.00	0.48	0.60	1.00	1.00	1.00	1.00	0.32	0.86
5	0.93	0.30	1.00	0.10	0.60	1.00	1.00	1.00	1.00	0.32	0.72
6	0.60	0.60	0.73	0.07	0.60	1.00	1.00	1.00	0.16	0.32	0.37
7	0.43	0.60	0.81	0.06	0.60	1.00	1.00	1.00	0.86	0.32	0.44
8	0.30	0.30	0.89	0.06	0.60	1.00	1.00	1.00	1.00	0.32	1.00
Overall	**0.46**	**0.41**	**0.93**	**0.19**	**0.60**	**0.99**	**1.00**	**1.00**	**0.88**	**0.32**	**0.70**

Table 28. Roman Valley River HSI Survey Results (Atlantic Salmon)

HSI Survey	% Pools	Pool Class Rating	% Instream Cover (fry)	% Instream Cover (parr)	Dominant Substrate Type in Riffle Run Areas	Avg. % Vegetation Along the Streambank	Avg. % Rooted Vegetation and Stable Rocky Ground Cover	Spawning Present	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Depth Water	Parr Water Depth	% stream Shade
1	0.12	0.30	1.00	0.12	0.60	1.00	1.00	yes	1.00	0.54	1.00	0.79	0.58
2	0.12	0.30	1.00	0.45	0.60	0.95	1.00	yes	0.90	0.00	1.00	1.00	0.65
3	0.12	0.30	1.00	0.19	0.60	0.96	1.00	no			1.00	1.00	1.00
4	0.52	0.60	1.00	0.48	0.60	1.00	1.00	no			1.00	1.00	0.86
5	0.95	0.30	1.00	0.10	0.60	1.00	1.00	yes	0.87	0.00	1.00	1.00	0.72
6	0.67	0.60	0.73	0.07	0.60	1.00	1.00	yes	0.80	0.54	0.84	1.00	0.37
7	0.33	0.60	0.81	0.06	0.60	1.00	1.00	yes	1.00	0.00	1.00	1.00	0.44
8	0.12	0.30	0.89	0.06	0.60	1.00	1.00	no			1.00	1.00	1.00
Overall	**0.37**	**0.41**	**0.93**	**0.19**	**0.60**	**0.99**	**1.00**	**-**	**-**	**-**	**0.98**	**0.97**	**0.70**

Appendix B: Extract from the Maritimes and Northeast Pipeline Environmental Assessment

MARITIMES & NORTHEAST PIPELINE MANAGEMENT LIMITED
ENVIRONMENTAL PROTECTION PLAN

SECTION 5.2 AQUATIC AND TERRESTRIAL RESOURCES — PAGE 29 OF 290

Crossing #7 - Gunns Brook

This stream is a major tributary of Country Harbour River. Although Country Harbour River is a minor salmon angling stream, Gunns Brook is primarily a nursery stream for salmon. The principal sport fish in Gunns Brook is the brook trout. Brook trout, and juvenile Atlantic salmon were taken in the electrofishing survey at the site downstream of the proposed pipeline RoW. Salmonid density at this site was, however, very low.

The alkalinity of the water at the time of the survey was 13.3 mg/l, a moderate-to-low value, that would, nonetheless buffer acid precipitation events. It is indicative of an acceptable level of instream biological productivity.

The proposed RoW is located at the head of a riffle/tail of a small lateral pool where the dominant substrate is gravel and rubble. The channel is approximately 12 metres wide. There is a small amount of overhead cover provided by undercut bank and overhanging vegetation at the proposed crossing site.

The embeddedness of the spawning habitat in downstream pool tails is moderately low. The particle size of the material at the proposed trench site is significantly smaller than that at potential sites of critical habitat. Since only 17% of the fine material in the trench site needs to be mobilized to cause significant habitat damage (Anderson et. al., 1996), Gunns Brook was judged to be sensitive to the potential effects of wet crossing. Standard mitigation plus additional habitat protection is required at this site.

Figure 1: Screenshot from the wet crossings survey report supplemental to the Maritime and Northeast Pipeline Environmental Assessment 1998.

Appendix C: Detailed Design Tables

Table 1: Restoration Design Details – Gunns Brook

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
Gunns Brook Section 1			
DF-01	Deflector	588275, 5013557	
DF-02	Deflector	588286, 5013613	
DF-03	Deflector	588280, 5013690	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-04	Deflector	588254, 5013745	
DF-05	Deflector	588229, 5013774	
DF-06	Deflector	588171, 5013845	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-07	Deflector	588110, 5013861	
DF-08	Deflector	588057, 5013899	
DF-09	Deflector	588054, 5013978	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-10	Deflector	588057, 5014040	
DF-11	Deflector	588096, 5014107	
DF-12	Deflector	588122, 5014125	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-13	Deflector	587140, 5014187	
DF-14	Deflector	588150, 5014217	
DF-15	Deflector	588172, 5014250	

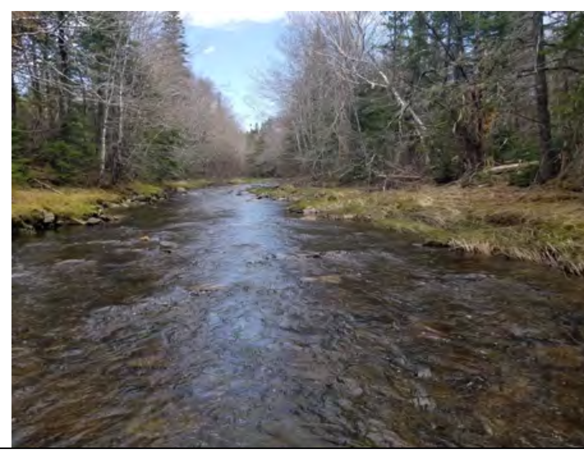
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-16	Deflector	588202, 5014309	
DF-17	Deflector	588226, 5014383	
DF-18	Deflector	588242, 5014453	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-19	Deflector	588247, 5014491	
DF-20	Deflector	588234, 5014547	
DF-21	Deflector	588185, 5014603	

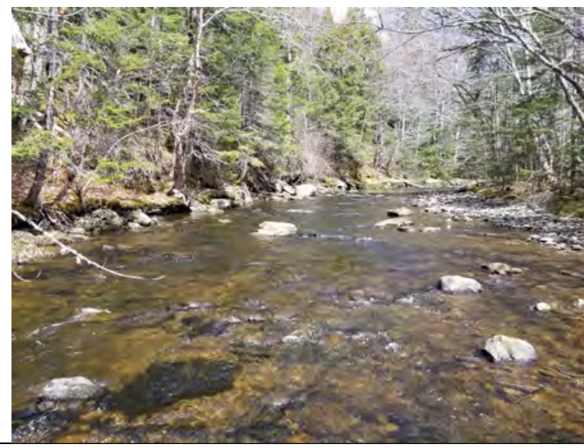
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-22	Deflector	588156, 5014624	
DF-23	Deflector	588135, 5014705	
DF-24	Deflector	588121, 5014731	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-25	Deflector	588112, 5014781	
DF-26	Deflector	588126, 5014818	
DF-27	Deflector	588123, 5014862	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-28	Deflector	588144, 5014916	
DF-29	Deflector	588162, 5014967	
DF-30	Deflector	588191, 5015070	

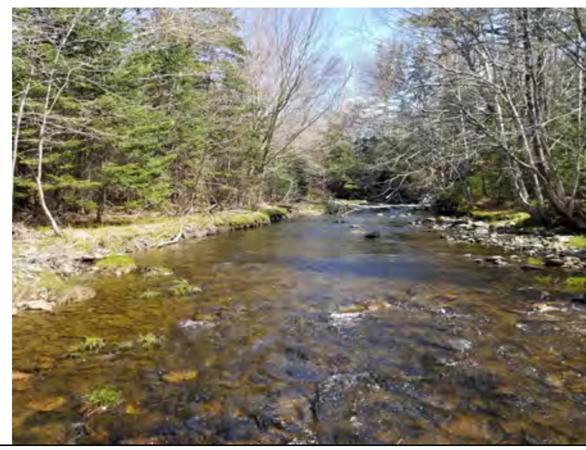
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-31	Deflector	588181, 5015121	
DF-32	Deflector	588175, 5015177	
DF-33	Deflector	588177, 5015248	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-34	Deflector	588188, 5015291	
DF-35	Deflector	588181, 5015347	
RS-36	Rock Sills	US 588264, 5015485 MID 588255, 5015478 DS 588241, 5015473	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-37	Deflector	588201, 5015408	
DF-38	Deflector	588218, 5015477	
DF-39	Deflector	588275, 5015495	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-40	Deflector	588305, 5015536	
DF-41	Deflector	588293, 5015637	
DF-42	Deflector	588310, 5015697	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-43	Deflector	588340, 5015787	
DF-44	Deflector	588374, 5015866	
DF-45	Deflector	588377, 5015924	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-46	Deflector	588405, 5015964	
DF-47	Deflector	588444, 5016002	
DF-48	Deflector	588466, 5016011	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-49	Deflector	588464, 5016064	
DF-50	Deflector	588453, 5016092	
BS-51	Bank Stabilization	588438, 5016105	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-52	Deflector	588432, 5016132	
BS-53	Bank Stabilization	588412, 5016140	
DF-54	Deflector	588439, 5016234	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-55	Deflector	588465, 5016290	
DF-56	Deflector	588506, 5016332	
RS/DF-57	Rock Sill and Deflector	588538, 5016389	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-58	Deflector	588554, 5016447	
DF-59	Deflector	588553, 5016519	
DF-60	Deflector	588531, 5016583	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-61	Deflector	588533, 5016641	
DF-62	Deflector	588546, 5016704	
DF-63	Deflector	588543, 5016768	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
RS/DF-64	Rock Sill and Deflector	588531, 5016823	
RS/DF-65	Rock Sill and Deflector	588549, 5016896	
DF-66	Deflector	588590, 5016936	

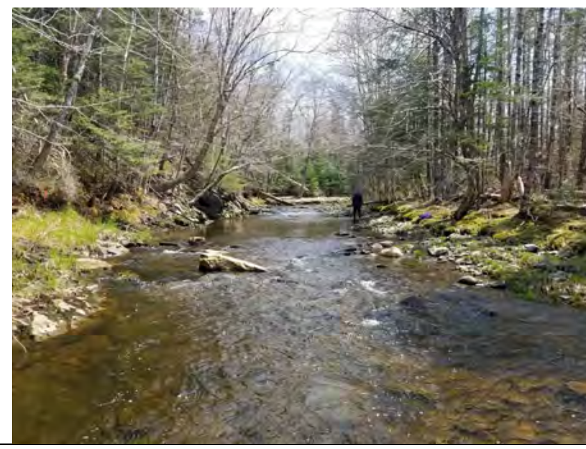
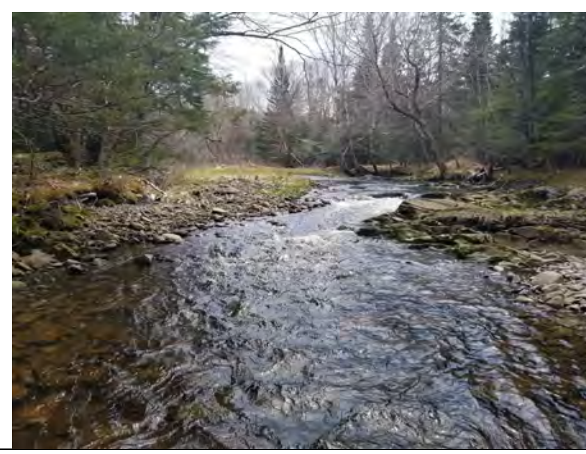
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DLDF-67	Digger Log and Deflector	588632, 5017015	
RS-68	Rock Sill	588693, 5017028	
Gunns Brook Section 2			
DF-01	Deflector	588759, 5016930	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-02	Digger Log	588802, 5016897	
DF-03	Deflector	588846, 5016867	
RM-04	Rock Mattress	588900, 5016825	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
BS-05	Breach Repair	588914, 5016821	
DF-06	Deflector	588939, 5016808	
DF-07	Deflector	588984, 5016818	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
BS-08	Breach Repair	588982, 5016829	
DF-09	Deflector	589019, 5016868	
RS-10	Rock Sill	589053, 5016899	

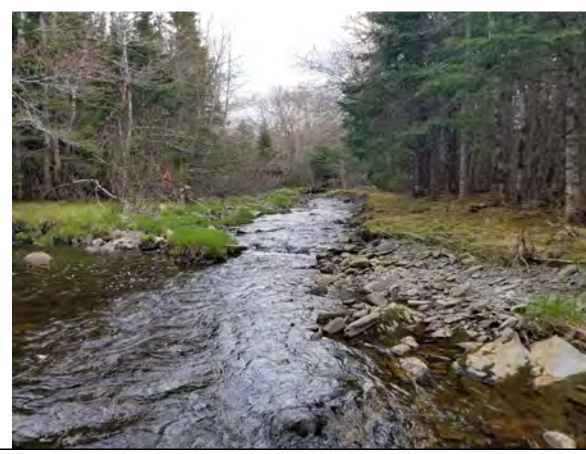
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-11	Deflector	589114, 5016904	
DL-12	Digger Log	589175, 5016891	
DL-13	Digger Log	589224, 5016862	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-14	Deflector	589257, 5016836	
RS-15	Rock Sill	589312, 5016819	
DF-16	Deflector	589344, 5016771	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-17	Deflector	589375, 5016742	
DF-18	Deflector	589402, 5016713	
DF-19	Deflector	589433, 5016683	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-20	Deflector	589462, 5016681	
DF-21	Deflector	589504, 5016708	
BS-22	Breach Repair	589505, 5016731	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-23	Deflector	589498, 5016750	
RS-24	Rock Sill	589500, 5016807	
DF-25	Deflector	589500, 5016907	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
RS-26	Rock Sill	589517, 5016934	
RS-27	Rock Sill	589550, 5016984	
Gunns Brook Section 3			
RS-01	Rock Sill	589570, 5016983	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-02	Deflector	589609, 5016972	
BS-03	Breach Repair	589647, 5016952	
RS-04	Rock Sill	589657, 5016954	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
RS-05	Rock Sill	589697, 5016975	
RS-06	Rock Sill	589746, 5016992	
RS-07	Rock Sill	589787, 5017027	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
RS-08	Rock Sill	589914, 5017051	
RS-09	Rock Sill	589958, 5017074	
RS-10	Rock Sill	589955, 5017126	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
RS-11	Rock Sill	589896, 5017172	
RS-12	Rock Sill	589952, 5017206	
RS-13	Rock Sill	590007, 5017246	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
RS-14	Rock Sill	590084, 5017234	
RS-15	Rock Sill	590141, 5017233	
RS-16	Rock Sill	590179, 5017247	

Table 2. Restoration Design Details – Sutherlands Brook

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
Sutherlands Section 1			
RS-01	Rock Sill	589577, 5017016	
RS-02	Rock Sill	589598, 5017038	
DL-03	Digger Log	589656, 5017127	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-04	Digger Log	589677, 5017154	
DL-05	Digger Log	589696, 5017166	
DL-06	Digger Log	589633, 5017130	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-07	Deflector	589628, 5017177	
DL-08	Digger Log	589622, 5017217	
DL-09	Digger Log	588651, 5017257	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-10	Digger Log	589643, 5017301	
DL-11	Digger Log	589630, 5017341	
DF-12	Deflector	589659, 5017366	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
BS-13	Breach Repair	589677, 5017367	
DL-14	Digger log	589686, 5017394	
DL/BS-15	Digger Log and Breach Repair	589659, 5017419	

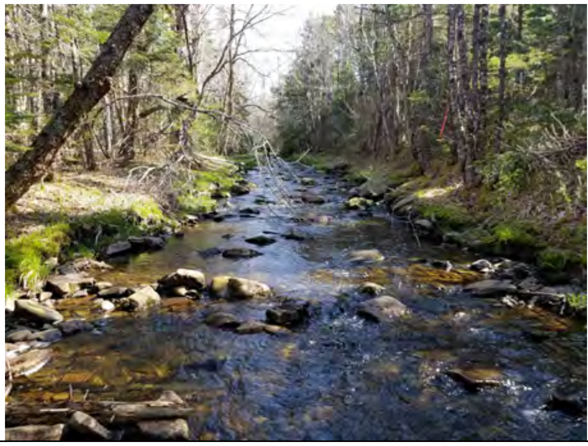
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-16	Digger Log	589665, 5017458	
DL-17	Digger Log	589665, 5017496	
DL-18	Digger Log	589707, 5017531	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-19	Digger Log	589726, 5017553	
DL-20	Digger Log	589671, 5017595	
DF-21	Deflector and Debris Removal	589705, 5017650	

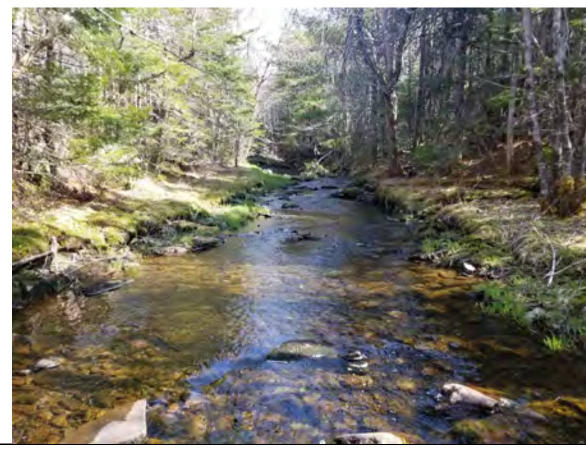
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-22	Deflector	589675, 5017692	
DF-23	Deflector	589672, 5017737	
DL-24	Digger Log	589680, 5017772	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-25	Deflector	589668, 5017806	
DL/DF-26	Digger Log and Deflector	589663, 5017848	
DL/DF-27	Digger Log and Deflector	589657, 5017893	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL/DF-28	Digger Log and Deflector	589639, 5017930	
DL-29	Digger Log	589629, 5017979	
Sutherlands Brook Section 2			
DL-01	Digger Log	589626, 5018046	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-02	Deflector	589634, 5018082	
DF-03	Deflector	589638, 5018127	
RS-04	Rock Sill	589659, 5018169	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-05	Deflector	589666, 5018210	
DL-06	Digger Log	589671, 5018253	
DL-07	Digger Log	589643, 5018298	

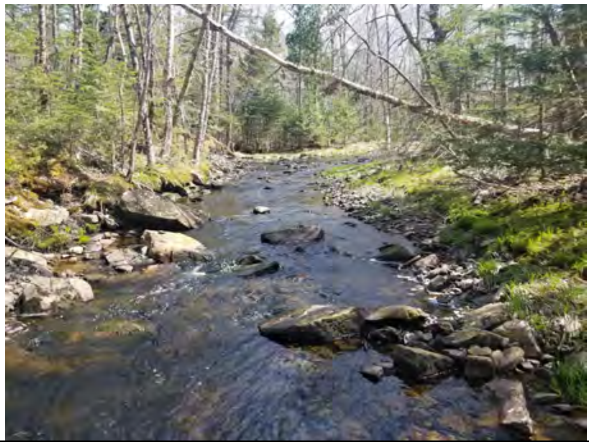
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-08	Digger Log	589655, 5018354	
DL-09	Digger Log	589651, 5018398	
DF-10	Deflector	589654, 5018439	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-11	Digger Log	589634, 5018455	
DL-12	Digger Log	589598, 5018470	
DL-13	Digger Log	589581, 5018520	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-14	Digger Log	589549, 5018527	
DL-15	Digger Log	589500, 5018562	
DL-16	Digger Log	589527, 5018596	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-17	Deflector	589498, 5018641	
DF-18	Deflector	589476, 5018673	
DF-19	Deflector	589453, 5018696	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-20	Deflector	589428, 5018723	
DL-21	Digger Log	589412, 5018763	
DL-22	Digger Log	589381, 5018796	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-23	Digger Log	589372, 5018843	
DL-24	Digger Log	589341, 5018877	
DL-25	Digger Log	589359, 5018913	

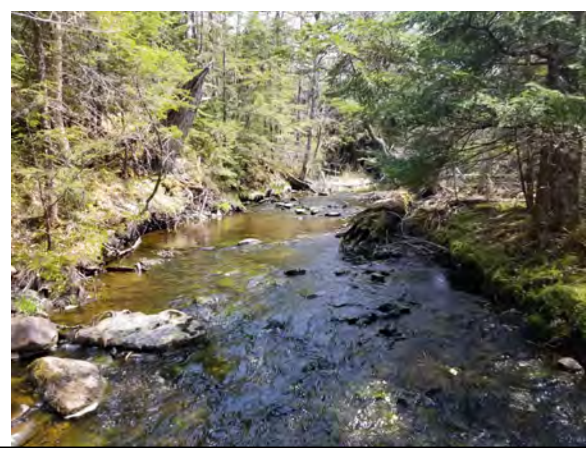
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-26	Digger Log	589395, 5018919	
BS-27	Breach Repair	589413, 5018938	
DL-28	Digger Log	589424, 5018972	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-29	Digger Log	589396, 5019025	
DF-30	Deflector	589425, 5019050	
DL-31	Digger Log	589449, 5019095	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
RS-32	Rock Sill	589440, 5019136	
RS-33	Rock Sill	589438, 5019177	
RS-34	Rock Sill	589439, 5019226	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
RS-35	Rock Sill	589472, 5019257	
DL-36	Digger Log	589467, 5019295	
DL-37	Digger Log	589504, 5019324	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-38	Digger Log	589541, 5019338	
DL-39	Digger Log	589578, 5019317	
DL-40	Digger Log	589608, 5019299	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
RS-41	Rock Sill	589637, 5019264	
RS-42	Rock Sill	589674, 5019253	
DL-43	Digger Log	589714, 5019260	

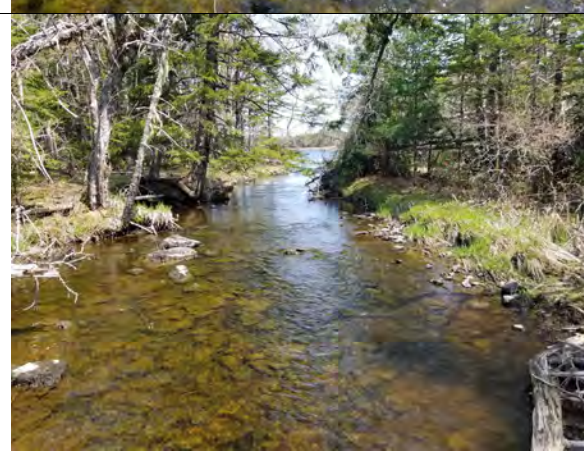
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-44	Digger Log	589752, 5019238	
DL-45	Digger Log	589784, 5019222	
DL-46	Digger Log	589810, 5019251	

Table 3: Restoration Design Details – East Pomquet River

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
East Pomquet Section 1			
DF-01	Deflector	592591, 5043298	
DF-02	Deflector	592575, 5043259	
DF-03	Deflector	592490, 5043167	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-04	Deflector	592464, 5043111	
RS-05	Rock Sill	592448, 5043061	
RS-06	Rock Sill	592432, 5042984	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
RS-07	Rock Sill	592393, 5042724	
RS-08	Rock Sill	592382, 5042712	
RS-09	Rock Sill	592365, 5042695	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
BS-10	Bank Stabilization	592335, 5042697 to 592325, 5042692	
DF-11	Deflector	592299, 5042647	
DF-12	Deflector	592257, 5042614	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
RS-13	Rock Sill	592186, 5042533	
DF-14	Deflector	592178, 5042485	
RS-15	Rock Sill	592167, 5042437	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-16	Deflector	592176, 5042383	
DF-17	Deflector	592196, 5042317	
RS-18	Rock Sill	592221, 5042274	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-19	Deflector	592246, 5042236	
DF-20	Deflector	592267, 5042188	
DF-21	Deflector	592260, 5042159	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
BS-22	Breach Repair	592244, 5042135 to 592244, 5042133	
East Pomquet Section 2			
DF-01	Deflector	592438, 5041676	
DF-02	Deflector	592453, 5041627	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL/DF-03	Digger Log and Deflector	592484, 5041581	
DL/DF/BS-04	Digger Log and Deflector, Breach Repair	592466, 5041517	
DS-05	Deflector	592495, 5041472	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-06	Digger Log	592535, 5041449	
DL-07	Digger Log	592592, 5041409	
DF-08	Deflector	592583, 5041351	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-09	Deflector	592603, 5041298	
DF-10	Deflector	592621, 5041252	
DL-11	Digger Log	592627, 5041201	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-12	Deflector	592641, 5041155	
DF-13	Deflector	592669, 5041116	
BS-14	Bank Stabilization	592666,5041095 to 592678, 5041065	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-15	Digger Log	592681, 5041067	
BS-16	Bank Stabilization	592690, 5041036 to 592708, 5041013	
DF-17	Deflector	592725, 5041012	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF/BS-18	Deflector and Breach Repair	592765, 5040989	
DF-19	Deflector	592807, 5040957	
DL-20	Digger Log	592803, 5040934	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-21	Deflector	592801, 5040887	
DF-22	Deflector	592801, 5040852	
BS-23	Breach Repair	592842, 5040828	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-24	Deflector	592852, 5040816	
DF-25	Deflector	592887, 5040763	
DF-26	Deflector	592917, 5040725	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL/DF-27	Deflector and Digger Log	592959, 5040720	
DL/DF-28	Deflector and Digger Log	592990, 5040702	
DL-29	Digger Log	593016, 5040660	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL/BS-30	Digger Log and Breach Repair	593036, 504063o5	
DF/BS-31	Deflector and Breach Repair	593031, 5040583	
DF-32	Deflector	593049, 5040529	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-33	Deflector	593086, 5040503	
DF-34	Deflector	593122, 5040478	
DL-35	Digger Log	593175, 5040430	

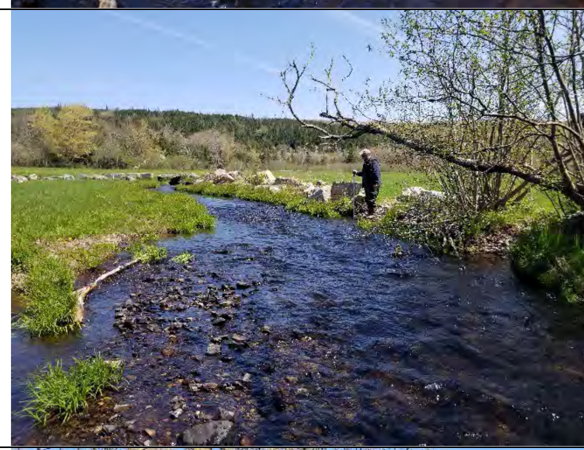
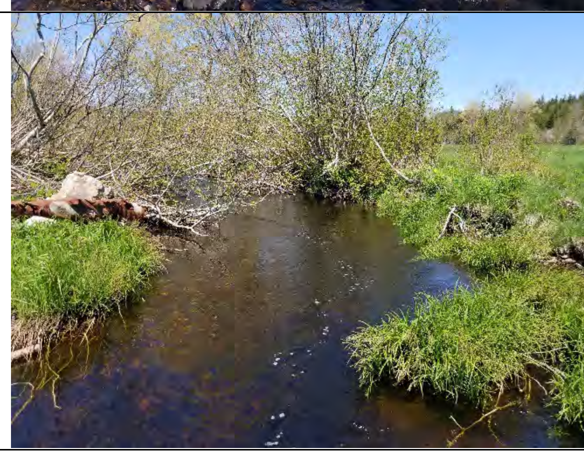
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-36	Deflector	593171, 5040394	
DF-37	Deflector	593150, 5040375	
DF-38	Deflector	593150, 5040323	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-39	Deflector	593264, 5040283	
DF-40	Deflector	593330, 5040220	
DF-41	Deflector	593357, 5040162	

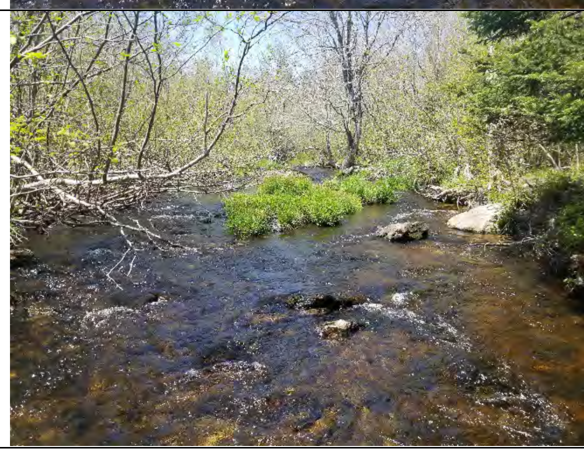
Table 4: Restoration Design Details – Roman Valley River

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
Roman Valley Section 1			
DF-01	Deflector	601231, 5034666	
DF-02	Deflector	601202, 5034649	
DF-03	Deflector	601171, 5034642	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-04	Deflector	601104, 5034616	
DF-05	Deflector	601065, 5034607	
DF-06	Deflector	601043, 5034627	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-07	Deflector	601025, 5034645	
DF-08	Deflector	601037, 5034669	
DF-09	Deflector	601028, 5034707	

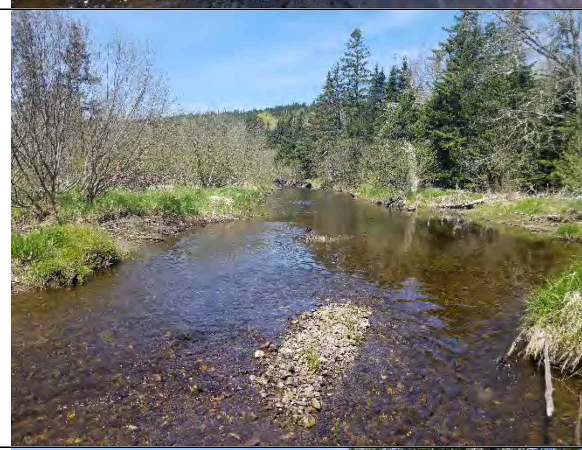
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-10	Deflector	600993, 5034705	
DF-11	Deflector	600920, 5034701	
DF-12	Deflector	600854, 5034662	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-13	Deflector	600746, 5034641	
DF-14	Deflector	600700, 5034617	
DF-15	Deflector	600661, 5034610	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-16	Deflector	600619, 5034591	
DF-17	Deflector	600560, 5034599	
DF-18	Deflector	600518, 5034574	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL/DF-19	Digger Log and Deflector	600441, 5034509	
DF-20	Deflector	600402, 5034485	
DF-21	Deflector	600360, 5034468	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-22	Deflector	600311, 5034466	
DF-23	Deflector	600282, 5034493	
DF-24	Deflector	600220, 5034495	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-25	Digger Log	600174, 5034465	
DF-26	Deflector	600137, 5034498	
DF-27	Deflector	600108, 5034544	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL/DF-28	Digger Log and Deflector	600059, 5034567	
DL-29	Digger Log	600018, 5034547	
DL-30	Digger Log	599984, 5034534	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-31	Digger Log	599942, 5034528	
BS-32	Breach Repair	599913, 5034572	
DF-33	Deflector	599881, 5034519	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-34	Digger Log	599844, 5034479	
RS-35	Rock Sill	599800, 5034471	
RS-36	Rock Sill	599742, 5034498	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
RS-37	Rock Sill	599704, 5034497	
RS-38	Rock Sill	599661, 5034485	
DF-39	Deflector	599673, 5034451	

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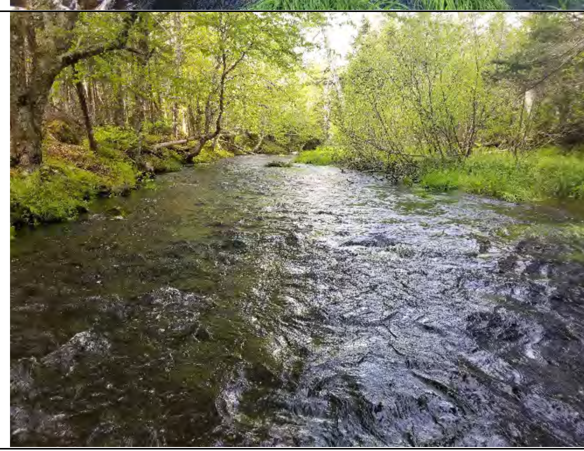
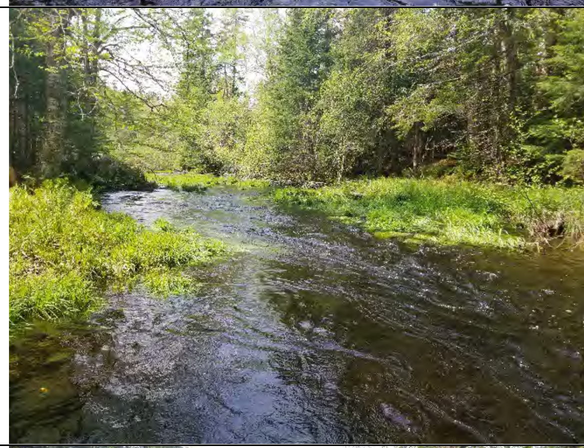
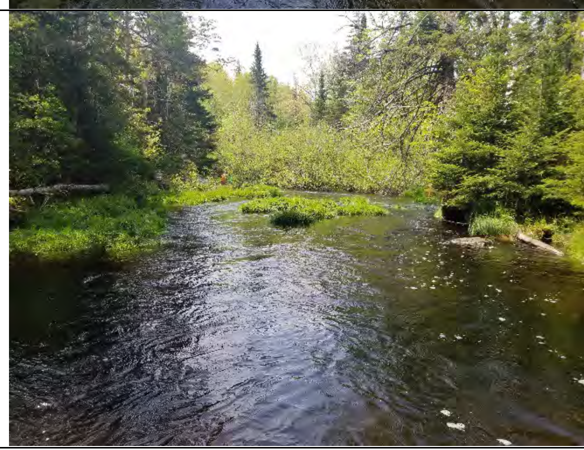
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL/DF-40	Digger Log and Deflector	598660, 5034419	
DF-41	Deflector	599619, 5034436	
DF-42	Deflector	599582, 5034417	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-43	Deflector	599531, 5034387	
DF-44	Deflector	599486, 5034383	
DF-45	Deflector	599453, 5034403	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-46	Deflector	599411, 5034442	
DL-47	Digger Log	599381, 5034436	
DF-48	Deflector	599343, 5034398	

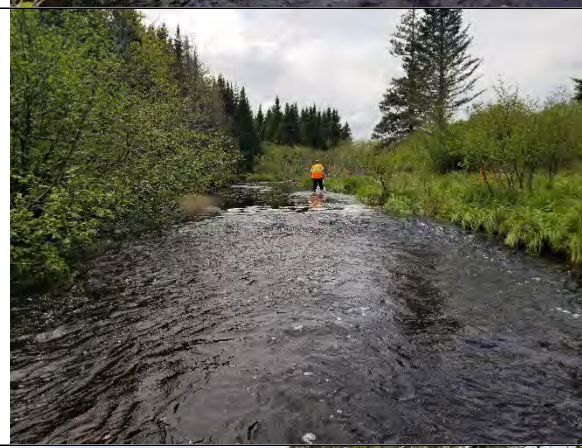
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-49	Deflector	599306, 5034391	
DF-50	Deflector	599255, 5034373	
DL/DF-51	Digger Log and Deflector	599205, 5034364	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL/DF-52	Digger Log and Deflector	599147, 5034369	
DL/DF-53	Digger Log and Deflector	599112, 5034393	
DL-54	Deflector	599082, 5034359	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-55	Deflector	599058, 5034318	
DF-56	Deflector	599034, 5034304	
DL-57	Digger Log	598974, 5034284	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-58	Deflector	598943, 5034295	
DF-59	Deflector	598894, 5034301	
DF-60	Deflector	598842, 5034299	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-61	Deflector	598793, 5034309	
BS-62	Breach Repair	598777, 5034322	
DL-63	Digger Log	598766, 5034335	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL/DF-64	Digger Log and Deflector	598749, 5034356	
DL/DF-65	Digger Log and Deflector	598696, 5034351	
DL-66	Deflector	598652, 5034345	

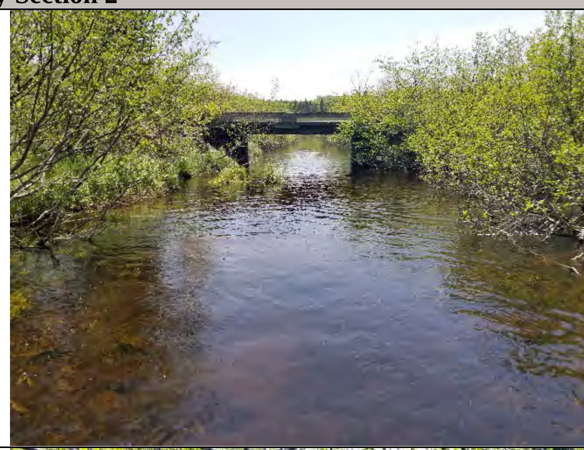
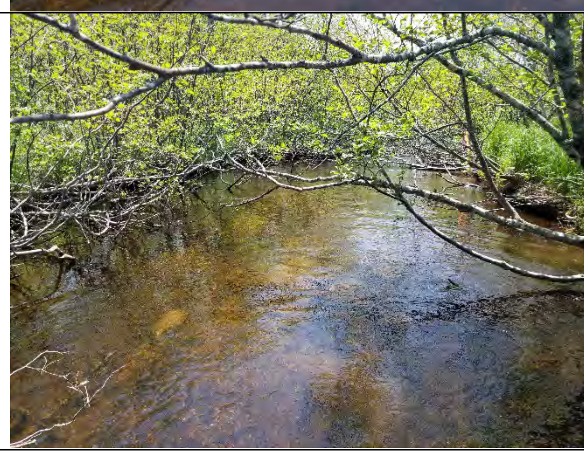
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-67	Digger Log	598590, 5034342	
DL/DF-68	Digger Log and Deflector	598552, 5034315	
DL/DF-69	Digger Log and Deflector	598520, 5034282	

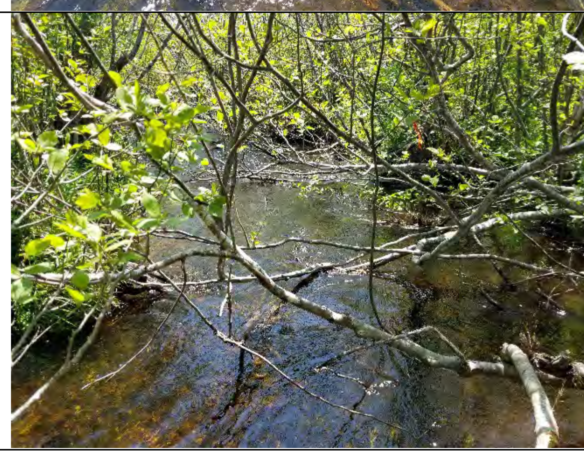
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL/DF-70	Digger Log and Deflector	598521, 5034237	
DF-71	Deflector	598500, 5034208	
DL/DF-72	Digger Log and Deflector	598457, 5034187	

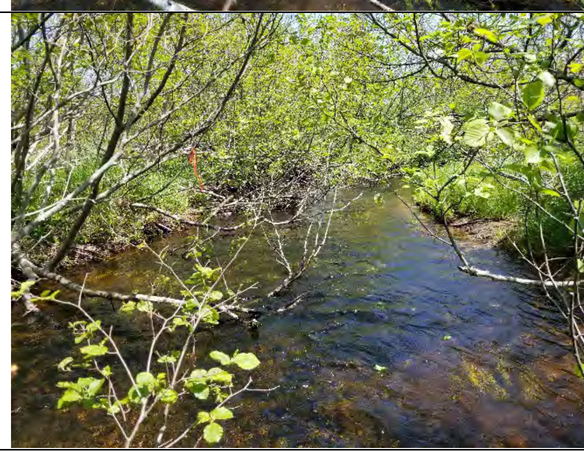
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL/DF-73	Digger Log and Deflector	598406, 5034175	
DL-74	Digger Log	598368, 5034152	
DL-75	Digger Log	598321, 5034154	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-76	Digger Log	598287, 5034178	
DL/DF-77	Digger Log and Deflector	598256, 5034132	
DF-78	Deflector	598237, 5034094	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-79	Deflector	598213, 5034050	
DL-80	Digger Log	598160, 5034053	
DF-81	Deflector	598141, 5034080	

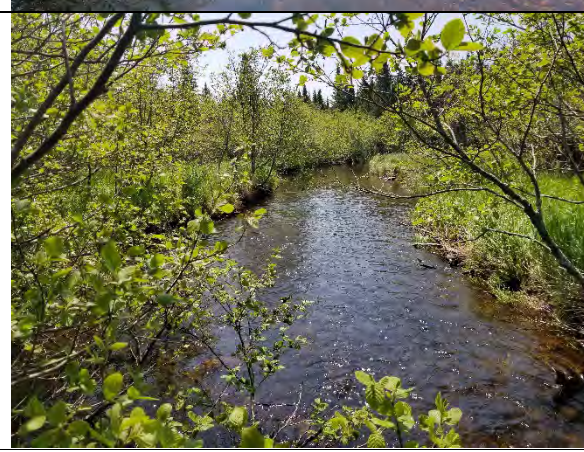
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-82	Deflector	598096, 5034103	
Roman Valley Section 2			
DL-01	Digger Log	596609, 5034790	
DF-02	Deflector	596484, 5034987	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-03	Deflector	596471, 5035009	
DL-04	Digger Log	596450, 5035034	
DL-05	Digger Log	596433, 5035061	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-06	Digger Log	596437, 5035103	
DL-07	Digger Log	596410, 5035105	
DL-08	Digger Log	596382, 5035095	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-09	Digger Log	596363, 5035080	
DL/BS-10	Digger Log and Breach Repair	596339, 5035083	
DL-11	Digger Log	596303, 5035084	

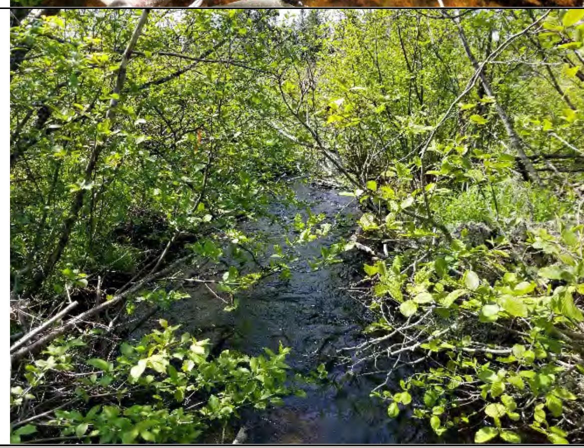
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-12	Digger Log	596276, 5035081	
DL-13	Digger Log	596252, 5035069	
DL/DF-14	Digger Log and Deflector	596225, 5035055	

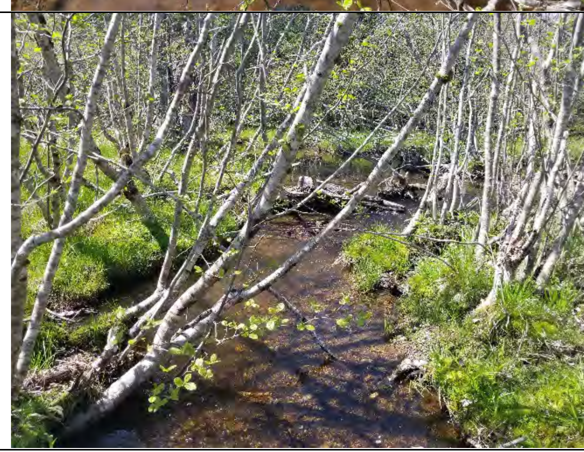
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-15	Digger Log	596218, 5035032	
DF/BS-16	Deflector and Breach Repair	596184, 5035058	
DL-17	Digger Log	596173, 5035084	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-18	Digger Log	596155, 5035112	
DL-19	Digger Log	596153, 5035132	
DL/DF-20	Digger Log and Deflector	596148, 5035147	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL/DF/BS-21	Digger Log, Deflector and Breach Repair	596147, 5035161	
DL/DF-22	Digger Log and Deflector	596166, 5035175	
DL-23	Digger Log	596183, 5035176	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-24	Digger Log	596209, 5035178	
DL-25	Digger Log	596219, 5035202	
DL-26	Digger Log	596237, 5035226	

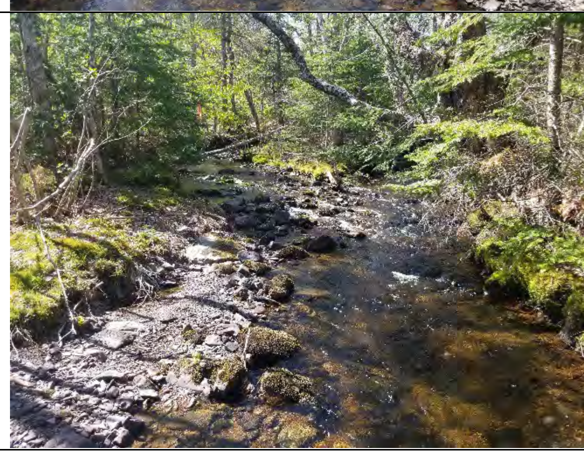
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-27	Digger Log	596251, 5035246	
DL-28	Digger Log	596282, 5035288	
Roman Valley Section 3 (Butler Brook)			
DF-01	Deflector	601212, 5034818	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-02	Deflector	601199, 5034819	
DF-03	Deflector	601187, 5034840	
DF-04	Deflector	601156, 5034838	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DF-05	Deflector	601135, 5034841	
DF-06	Deflector	601115, 5034825	
DL-07	Digger Log	601098, 5034818	

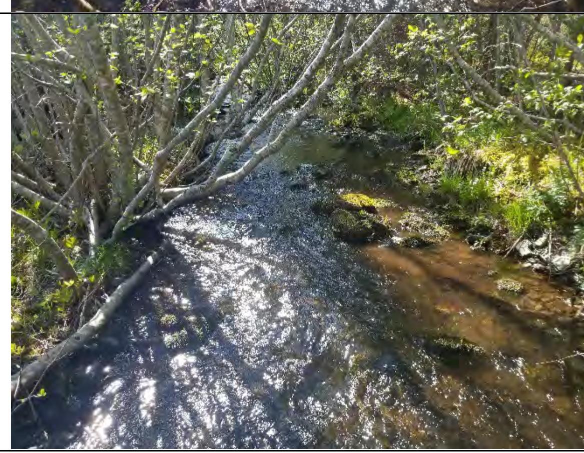
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-08	Digger Log	601078, 5034812	
BS-09	Breach Repair	601078, 5034802	
DL/DF-10	Digger Log and Deflector	601058, 5034798	

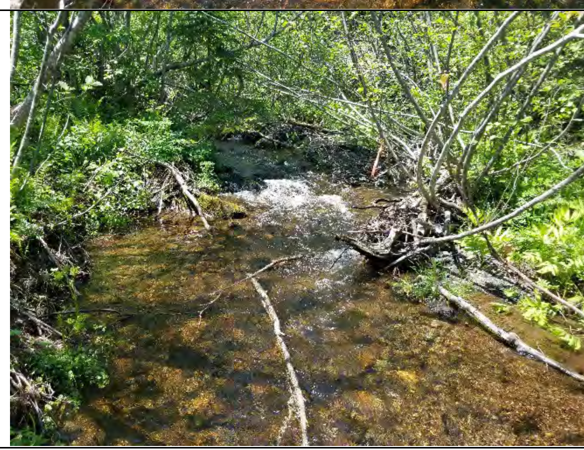
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-11	Digger Log	601022, 5034819	
DL-12	Digger Log	601002, 5034823	
DL/BS-13	Digger Log and Breach Repair	600978, 5034837	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL/BS-14	Digger Log and Breach Repair	600961, 5034836	
DL/DF-15	Digger Log and Deflector	600936, 5034825	
DF-16	Deflector	600916, 5034842	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-17	Digger Log	600904, 5034862	
DL-18	Digger Log	600885, 5034881	
BS-19	Breach Repair	600886, 5034893	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
OP-20	Outlet Pool	600877, 5034914	
RS-21	Rock Sill	600857, 5034935	
RS-22	Rock Sill	600851, 5034953	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-23	Digger Log	600833, 5034977	
DF/BS-24	Deflector and Breach Repair	600817, 5034968	
DL-25	Digger Log	600791, 5034973	

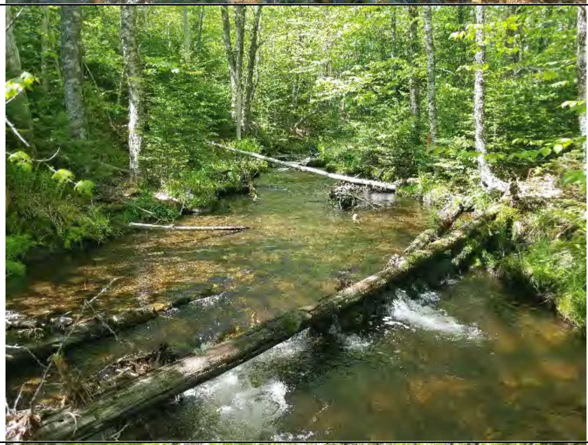
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-26	Digger Log	600775, 5034977	
BS-27	Debris Removal	600762, 5034986	
DL-28	Digger Log	600746, 5034991	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-29	Digger Log	600725, 5034995	
DL-30	Digger Log	600706, 5035003	
DL-31	Digger Log	600674, 5035010	

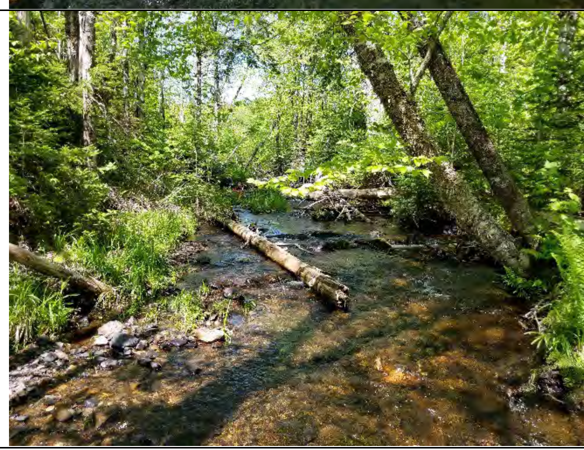
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-32	Digger Log	600650, 5034998	
DL-33	Digger Log	600627, 5034991	
DL-34	Digger Log	600607, 5035001	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
RS-35	Rock Sill	600579, 5034990	
DL-36	Digger Log	600545, 5035027	
DL-37	Digger Log	600514, 5035034	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-38	Digger Log	600480, 5035040	
DL-39	Digger Log	600470, 5035060	
BS-40	Breach Repair	600456, 5035074	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-41	Digger Log	600443, 5035079	
DL-42	Digger Log	600433, 5035111	
DL-43	Digger Log	600421, 5035141	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-44	Digger Log	600447, 5035163	
DL-45	Digger Log	600451, 5035186	
DL-46	Digger Log	600430, 5035206	

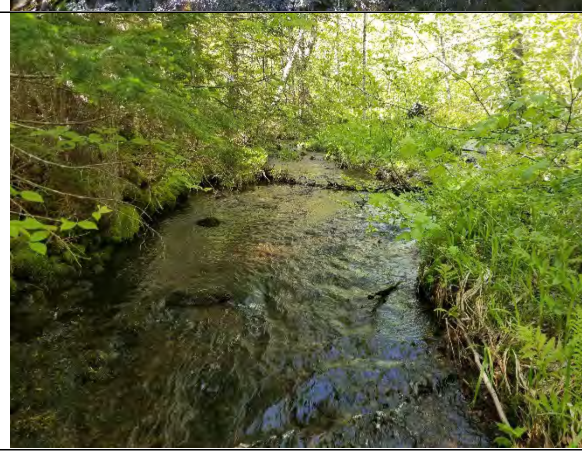
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-47	Digger Log	600443, 5035242	
DL-48	Digger Log	600444, 5035266	
DL-49	Digger Log	600446, 5035289	

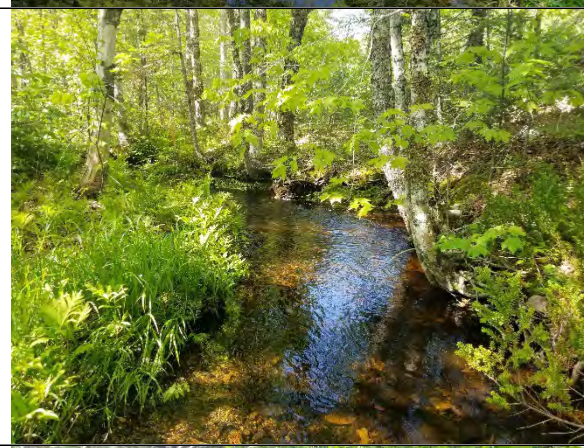
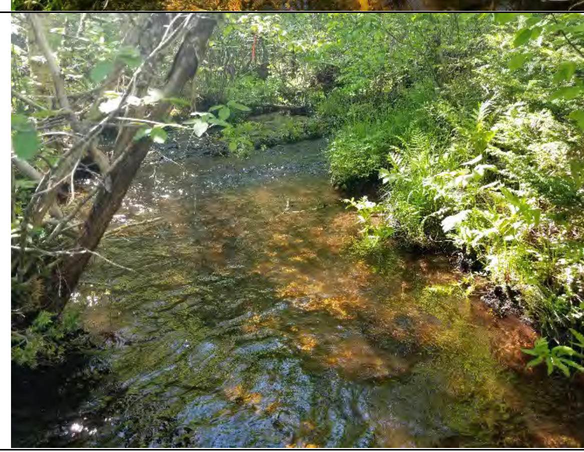
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
RS-50	Rock Sill	600462, 5035322	
BS-51	Debris Removal	600462, 5035336	
DL-52	Digger Log	600470, 5035370	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-53	Digger Log	600485, 5035388	
BS-54	Debris Removal	600500, 5035415	
BS-55	Debris Removal	600493, 5035431	

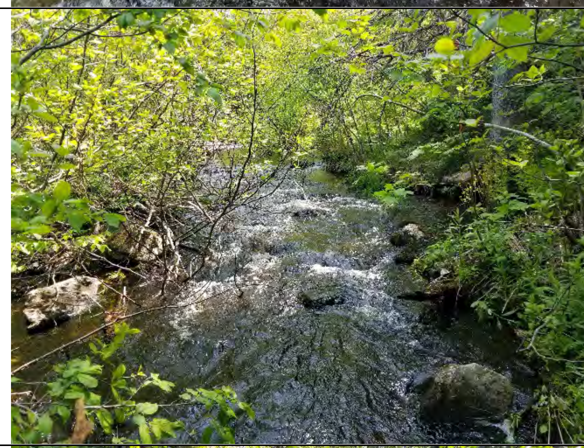
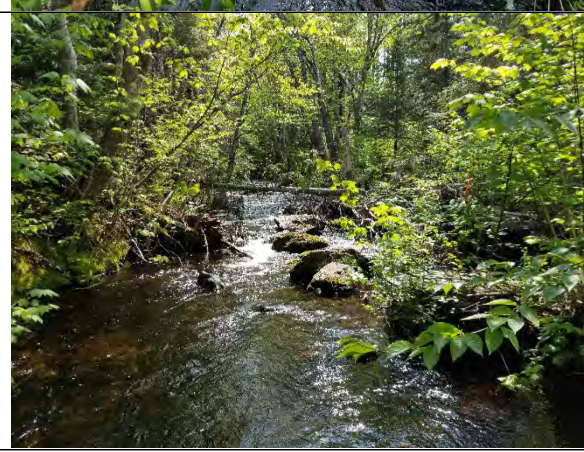
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-56	Digger Log	600503, 5035460	
DL-57	Digger Log	600513, 5035501	
DL-58	Digger Log	600504, 5035537	

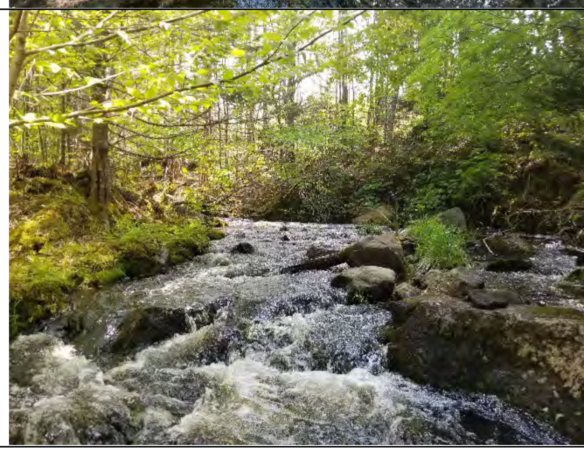
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-59	Digger Log	600498, 5035575	
BS-60	Debris Removal	600482, 5035598	
DL-61	Digger Log	600475, 5035612	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-62	Digger Log	600455, 5035624	
DL-63	Digger Log	600438, 5035635	
DL-64	Digger Log	600424, 5035649	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-65	Digger Log	600432, 5035672	
DL-66	Digger Log	600428, 5035708	
DL-67	Digger Log	600403, 5035719	

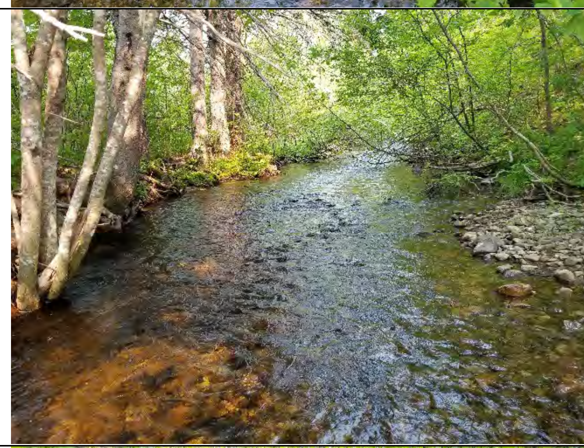
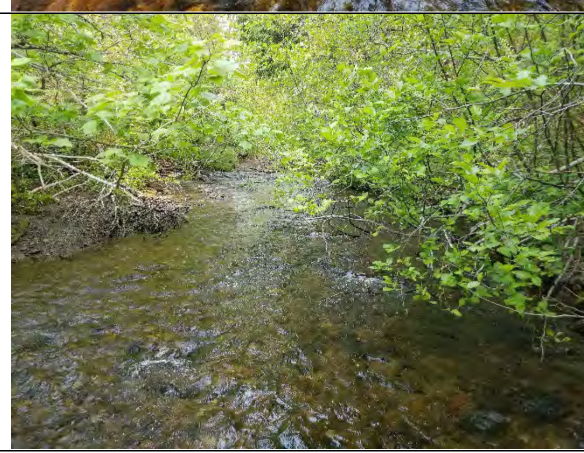
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
DL-68	Digger Log	600413, 5035755	
Roman Valley Section 4 (Smiths Brook)			
DL-01	Digger Log	598095, 5034096	
DL/DF-02	Digger Log and Deflector	598103, 5034069	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
RS-03	Rock Sill	598093, 5034052	
RS-04	Rock Sill	598084, 5034030	
DF-05	Deflector	598080, 5034006	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
RS-06	Rock Sill	598066, 5033985	
RS-07	Rock Sill	598021, 5033907	
DF-08	Deflector	598008, 5033869	

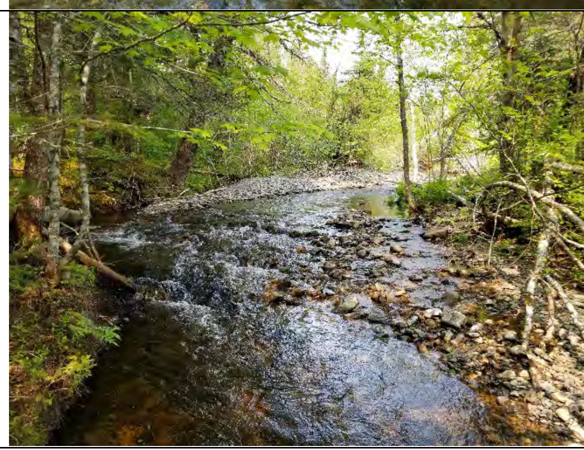
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
RS-09	Rock Sill	598022, 5033822	
DL-10	Digger Log	598012, 5033775	
DL-11	Digger Log	598006, 5033730	

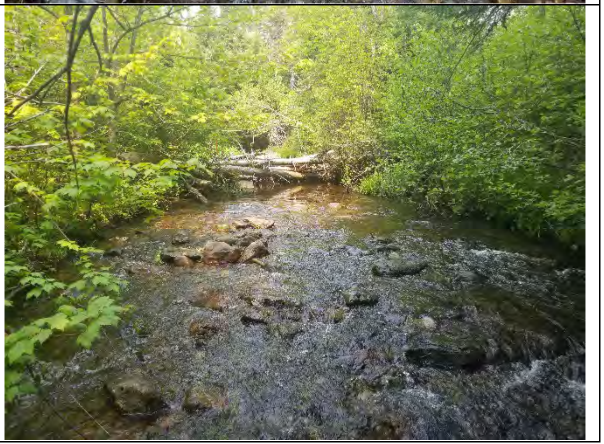
Table 5. Restoration Design Details – McAllister Brook

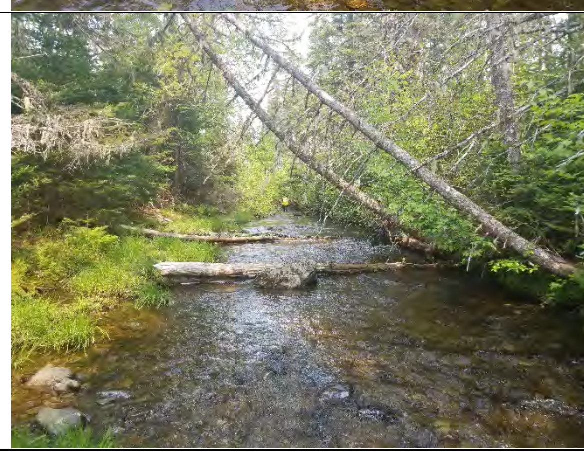
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
DL/DF-01	Digger Log and Deflector	608456, 5022654	
DL/DF-02	Digger Log and Deflector	608435, 5022687	
DL/DF-03	Digger Log and Deflector	608409, 5022716	

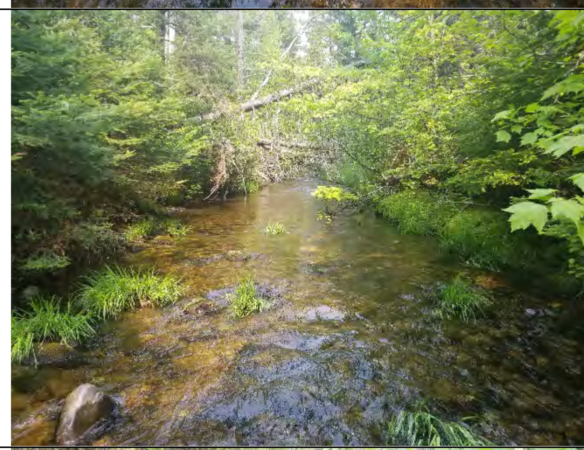
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
DL-04	Digger Log	608374, 5022717	
BS-05	Breach Repair and Debris Removal	608351, 5022710	
DL-06	Digger Log and Debris Removal	608343, 5022718	

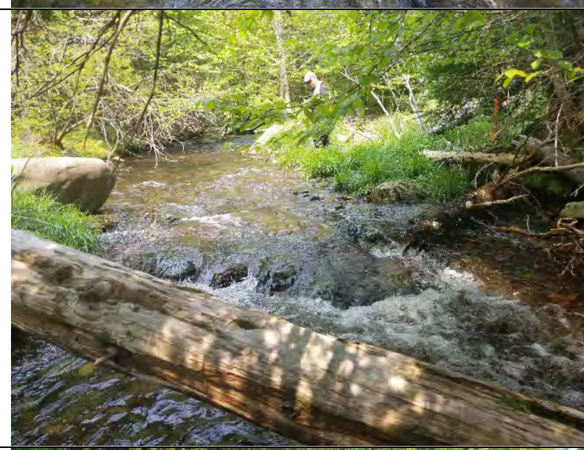
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
DL/DF-07	Digger Log and Deflector	608293, 5022749	
DL/DF-08	Digger Log and Deflector	608268, 5022767	
DL/DF-09	Digger Log and Deflector	608248, 5022798	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
DL-10	Digger Log	608219, 5022819	
DL-11	Digger Log	608188, 5022846	
DL/BS-12	Digger Log and Breach Repair	608152, 5022860	

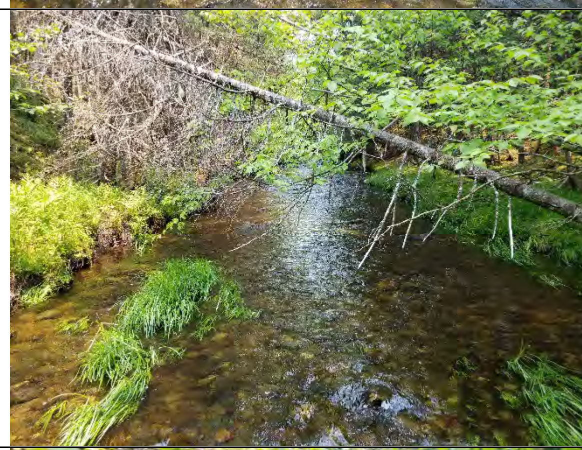
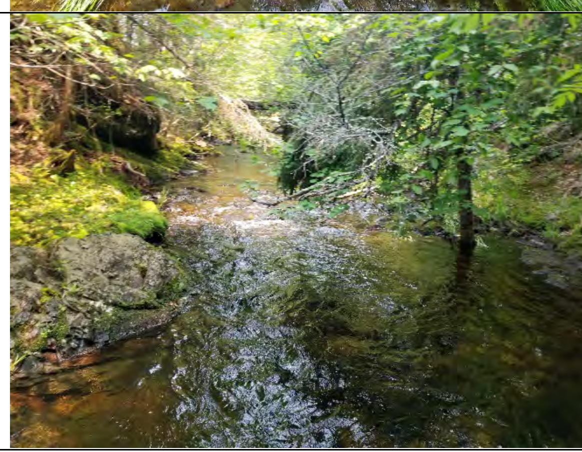
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
DL/DF-13	Digger Log and Deflector	608122, 5022858	
DL/DF-14	Digger Log and Deflector	608084, 5022844	
DF-15	Deflector	608055, 5022862	

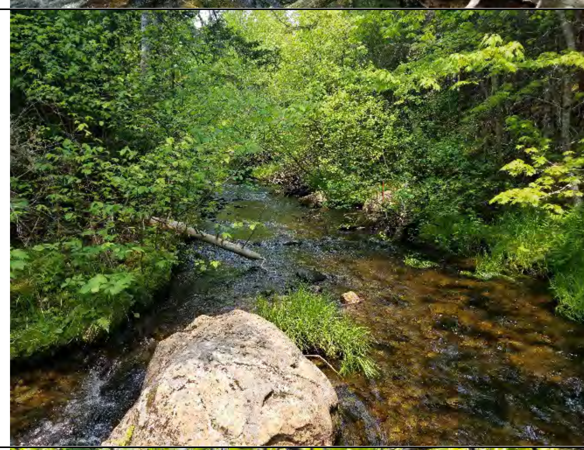
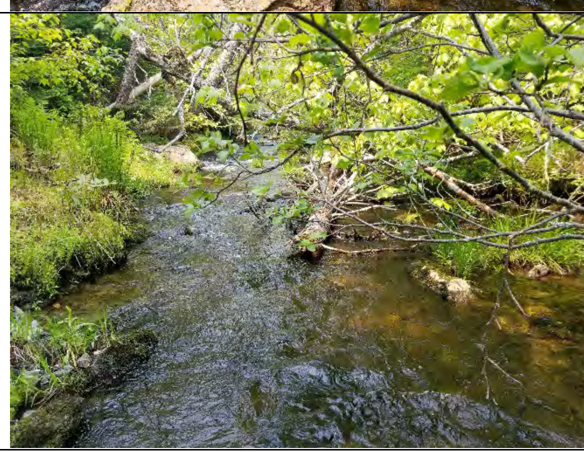
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
DF-16	Deflector	608026, 5022885	
DL-17	Digger Log	608013, 5022926	
DL/DF-18	Digger Log and Deflector	607988, 5022946	

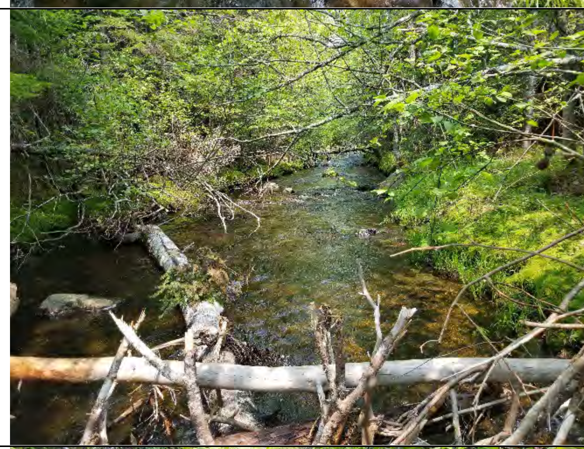
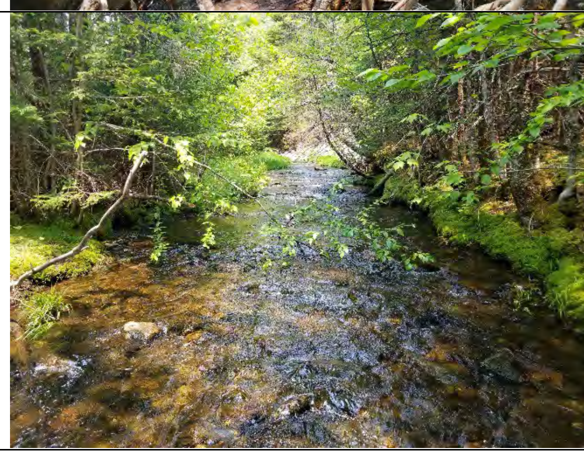
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
DL/DF-19	Digger Log and Deflector	607964, 5022980	
DF-20	Deflector	607940, 5023007	
DL-21	Digger Log	607919, 5023028	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
DL/DF-22	Digger Log and Deflector	607917, 5023069	
DL-23	Digger Log	607898, 5023104	
DL-24	Digger Log	607861, 5023121	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
DL-25	Digger Log	607846, 5023158	
RS-26	Rock Sill	607819, 5023188	
DL/DF-27	Digger Log and Deflector	607802, 5023216	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
DL/DF-28	Digger Log and Deflector	607799, 5023262	
DL/DF-29	Digger Log and Deflector	607816, 5023296	
RS-30	Rock Sill	607814, 5023337	

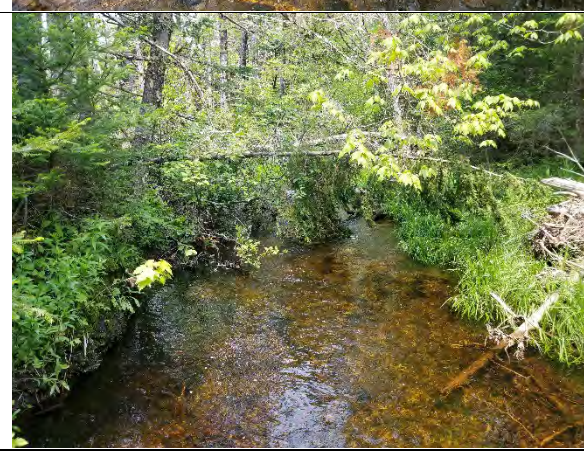
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
RS-31	Rock Sill	607814, 5023389	
DL-32	Digger Log	607796, 5023423	
RS-33	Rock Sill	607766, 5023439	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
RS-34	Rock Sill	607740, 5023461	
DL-35	Digger Log	607711, 5023494	
DL-36	Digger Log	607705, 5023526	

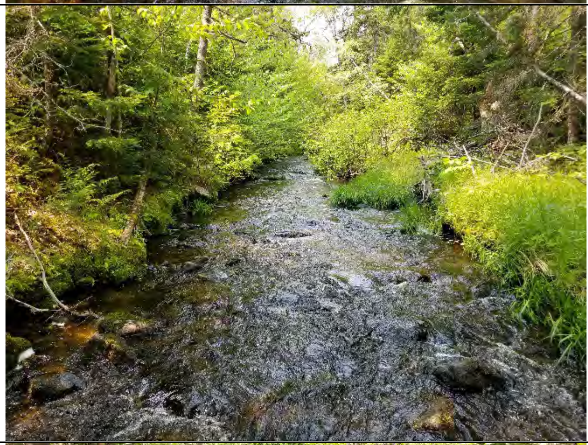
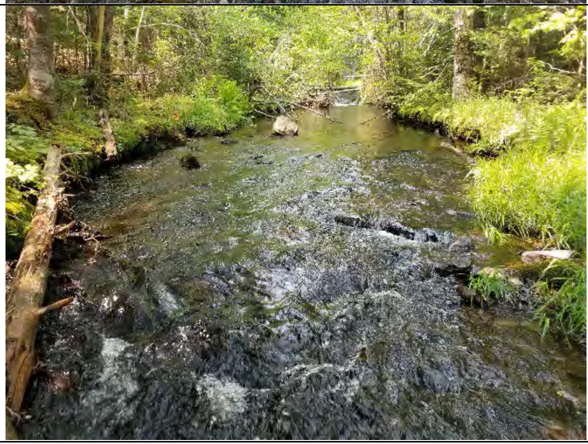
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
DL-37	Digger Log	607688, 5023559	
DL-38	Digger Log	607674, 5023591	
DL-39	Digger Log	607670, 5023624	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
DL-40	Digger Log	607637, 5023643	
DL-41	Digger Log	607617, 5023677	
DL-42	Digger Log	607620, 5023723	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
DL-43	Digger Log	607600, 5023760	
DL-44	Digger Log	607588, 5023782	
DL-45	Digger Log	607565, 5023805	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
BS-46	Breach Repair	607553, 5023819	
DL-47	Digger Log	607551, 5023831	
DL-48	Digger Log	607540, 5023868	

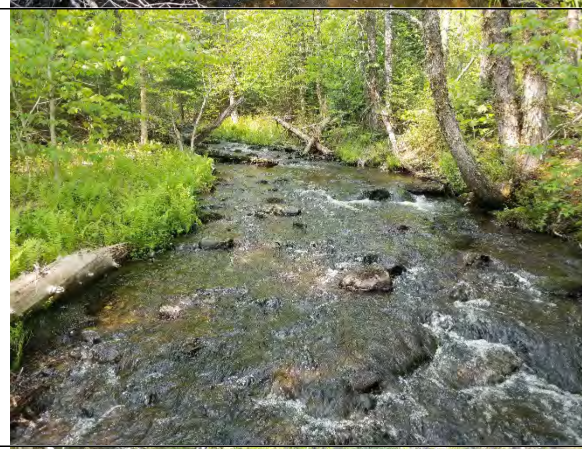
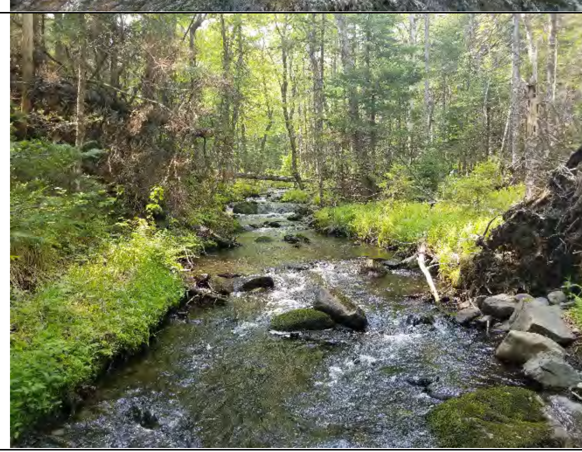
Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
DL-49	Digger Log	607544, 5023895	
DL-50	Digger Log	607537, 5023925	
DL-51	Digger Log	607512, 5023932	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
DL-52	Digger Log	607481, 5023950	
DL-53	Digger Log	607459, 5023973	
DL-54	Digger Log	607438, 5023988	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
DL-55	Digger Log	607420, 5024010	
DL-56	Digger Log	607389, 5024027	
DL-57	Digger Log	607363, 5024044	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
DL-58	Digger Log	607366, 5024067	
DL-59	Digger Log	607367, 5024098	
DL-60	Digger Log	607387, 5024125	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
DL-61	Digger Log	607376, 5024164	
DL-62	Digger Log	607387, 5024203	
RS-63	Rock Sill	607366, 5024231	

Structure ID	Structure Type	Location (coordinates, UTM NAD 83)	Photo
McAllister Brook Section 1			
DL-64	Digger Log	607375, 5024286	
DL-65	Digger Log	607369, 5024323	
DL-66	Digger Log	607346, 5024349	

Appendix D: McAllister Brook Fish Passage Assessment and Retrofit Work Plan

McAllister Brook Fish Passage Assessment and Retrofit Work Plan

Prepared by: Will Daniels

Prepared for: McCallum Environmental Ltd.

June 20th, 2023

Fish Passage Summary

The wooden box culvert on McAllister Brook is a significant barrier for fish species across most discharge levels. The culvert exhibits a velocity/depth barrier due to a 25cm outflow drop, which creates challenging conditions for fish trying to migrate upstream. A plunge pool with a maximum depth of approximately 1.5m provides leaping species, such as salmonids, an opportunity to leap and overcome the outflow drop. However, once adult salmonids enter the culvert, they encounter inadequate depths and velocities that hinder their passage during most discharge levels.

The hydraulic conditions within the culvert during high discharge events will likely allow the passage of some adult Salmon and large Trout due to the backwatering of the culvert increasing depths and reducing velocities significantly. The tailwater cross-section data indicates that the inflow elevation of the culvert is below the bankfull level of the tailwater control. Thus, the culvert will backwater during flood events. When the Salmon River experiences high water levels, the combined effect of elevated water levels could further exacerbate the backwatering within the culvert. This backwatering phenomenon would slow down velocities and increase depths through the culvert, making it more feasible for some adult salmon and large trout to overcome the culvert at certain flow levels when the tailwater and/or Salmon River fully backwaters the culvert.

The culvert outlet's proximity to McAllister Brook's confluence with the Salmon River (~30m) increases the likelihood of the main river backwatering the McAllister Brook culvert during flood levels. Thus, further reducing velocities and facilitating fish passage during a broader range of discharge levels.

However, despite these potential mitigating factors, it is evident that fish passage remains heavily restricted at this location. Juvenile salmonid species and smaller fish species would face considerable challenges in overcoming this culvert at any discharge level, and their ability to pass through it may be severely limited or nonexistent.

Fish Passage Retrofit Work Plan

McAllister Brook culvert is a great candidate for a fish passage improvement retrofit project. Several techniques can be implemented at this crossing to improve fish passage significantly.

Installing a low-flow barrier, baffles, an outflow chute, and an elver climbing rope is recommended. These modifications would enhance the culvert's functionality and enable the passage of various fish species.

Baffles should be installed on the river left side of the culvert at a spacing of 6.15m. The notches on the baffles should be 20cm deep and 30cm wide, sized to accommodate a Q60 flow of 0.058m3/s. The baffle notches should alternate from left to right and be located 20cm off the sidewall of the culvert to limit velocities through the notches. The spacing of the baffles can be adjusted during installation, considering the culvert's variable slope. The slope of the culvert is steeper in the upstream section and lower in the downstream section therefore spacing should be shorter in the upstream section and longer in the downstream section. The baffles should be constructed from Hemlock timber (rough cut of 10"x10"), but other rot-resistant wood may be used.

An outflow chute should be installed on the bottom baffle according to the specified dimensions from the provided diagram. A low flow barrier, 20cm in height, should be placed across the inflow of the river left culvert to divert base flows into the river right culvert with the baffles. Hemlock timber, with a rough cut of 10"x10", is also recommended the low-flow barrier. Reinforcing the culvert structure to which the outflow chute and baffle will be attached is advisable.

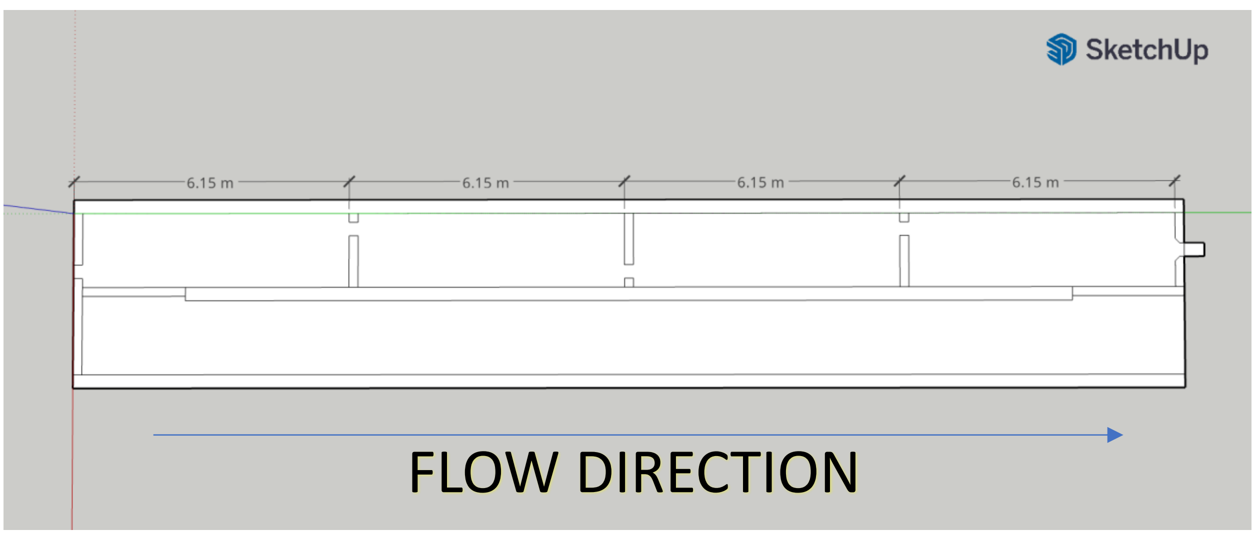
An elver climbing rope should be added to the culvert to facilitate the passage of juvenile American eels. The rope should be securely anchored on the upstream end and run through the culvert, with the end hanging into the plunge pool. It is suggested to install the rope on the river right side of the culvert. A heavily frayed line, such as mussel spat rope or any other suitable rope, can be used for this purpose.

In addition to the prescribed modifications, timber should be added on the centerline of the culvert at the inflow and outflow to retain base flows, particularly for Q60 and lower flows in the river left culvert, as depicted in the provided diagram.

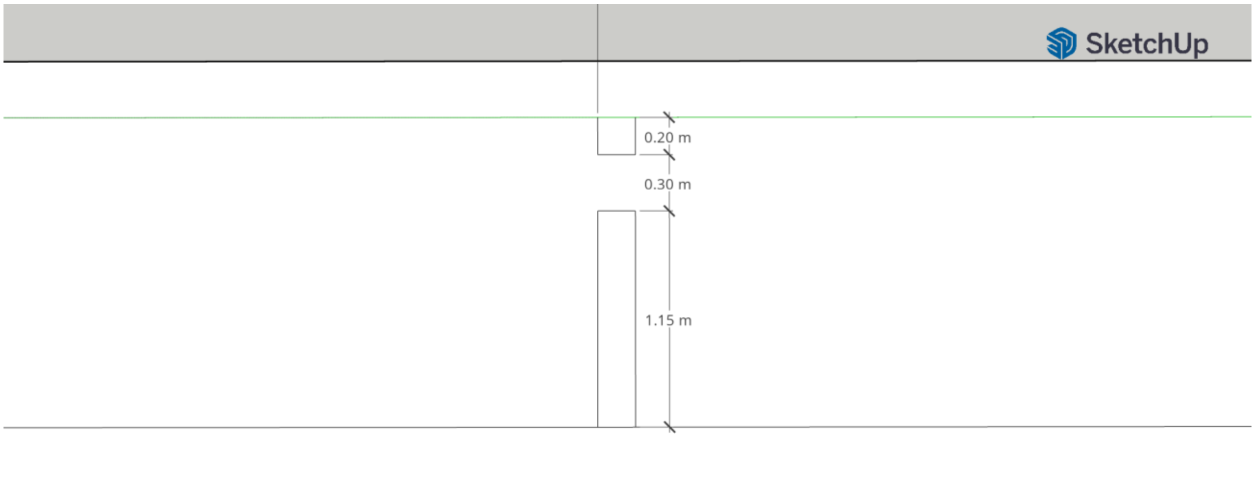
Post-installation maintenance and check-ins are recommended for this culvert retrofit project. Particularly before anticipated migration events to ensure the notches are not obstructed by debris.

The accompanying figures illustrate the dimensions and specifications of the baffles, notches, low flow barrier, and outflow chute. They also include examples of projects that have implemented similar fish passage improvement techniques, serving as references for the proposed modifications at McAllister Brook.

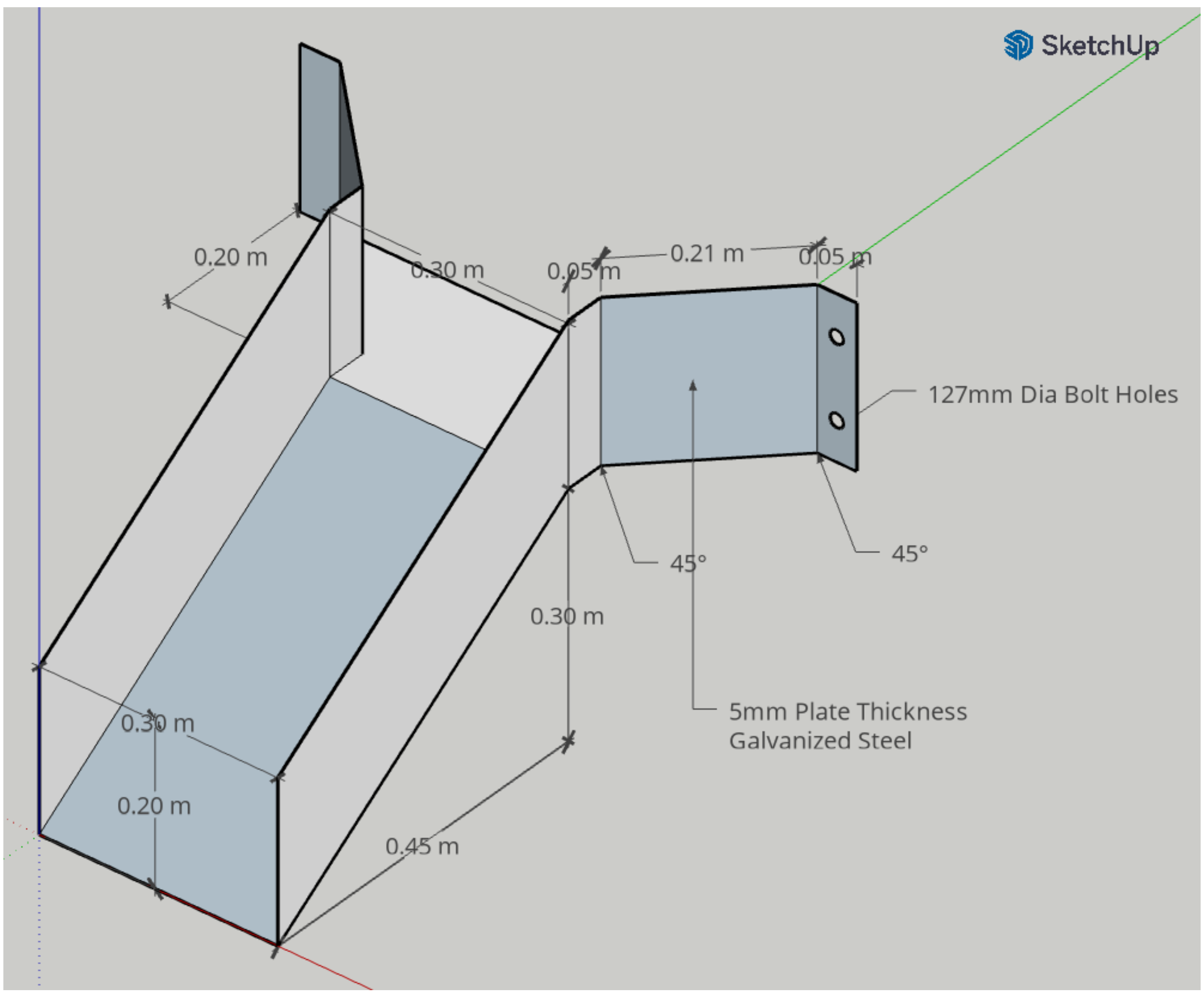
By implementing these recommended measures, the fish passage at the culvert can be significantly improved, allowing for the successful migration of various fish species and enhancing the overall health and resilience of the aquatic ecosystem in McAllister Brook.



Plan view of culvert, baffles, low flow barriers, and outflow chute.



Plan view of a baffle and notch inside culvert



Outflow chute dimensions and specs

Moore Brook fish passage improvement project where hemlock 10"x10" timbers were installed as baffles to increase depth and decrease velocities.

Dry Brook fish passage improvement project where wooden baffles, a low flow barrier, and an outflow chute were installed on a double wooden box culvert.

Sizing

This culvert is adequately sized as sized using the Nova Scotia Watercourse Alterations Sizers Manual. The addition of baffles and a low flow barrier is not expected to impact the sizing of the culvert significantly.

Sizing Calculations	
Design Flow (Q)	10.15 m^3/s
Required X-Sectional Area for Q	4.52m^2
Actual X-Sectional Area of Culvert	9m^2

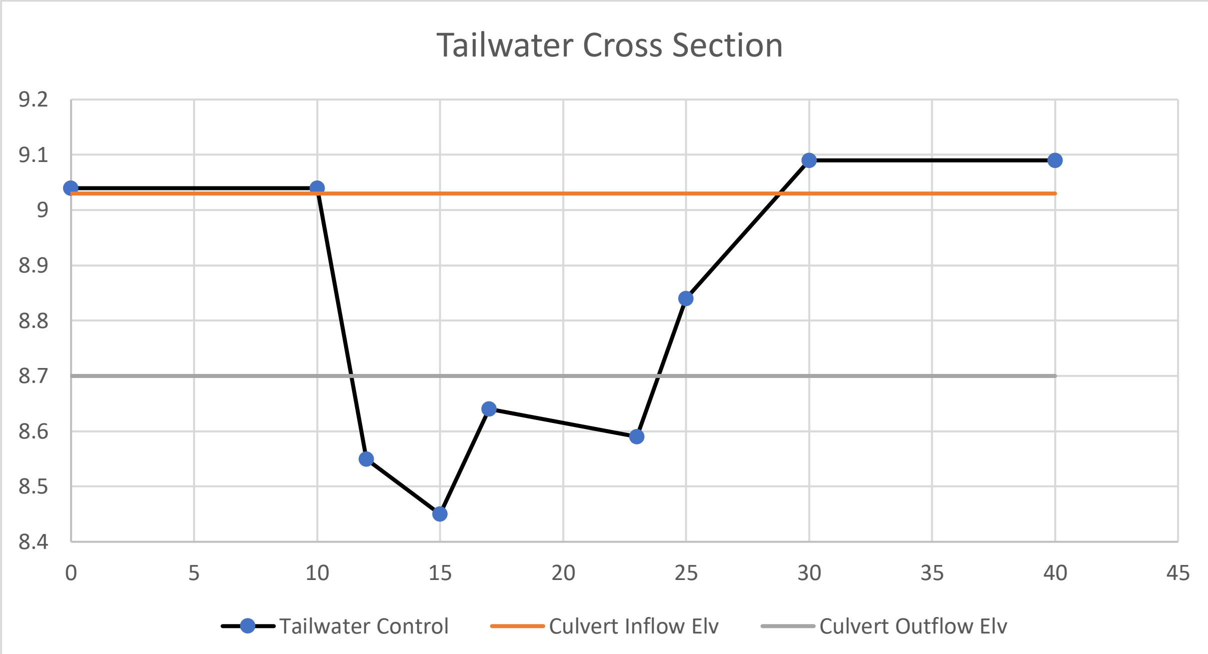
Assessment Data	
Site Information	
Watercourse Name	McCallister Brook
Road Name	South River Lake Rd.
Ownership	Nova Scotia Department of Public Works
Latitude	45.348644
Longitude	-61.615207
Fish Habitat	YES
Assessment Information	
Date of Assessment	June 16, 2023
Time of Assessment	10:00 AM
Assessors	Will Daniels, Charles MacInnis
Stream Characteristics	
Channel Measurements	~5m
Substrate	Cobble Gravel
Catchment Size	8.12km^2
U/S Linear Habitat	6.52
U/S Lake Habitat	0.35km^2
D/S Distance to Confluence	30m
Inflow Habitat Type	Run
Beaver Activity	None Noted
Culvert Information	
Debris Jam Presence	None
# of Culverts	1
Culvert Material	Creosote Wood Timber
Culvert Shape	Box
Entrance Type	Mitered
Exit Type	Mitered
Culvert Deformation	Yes, Culvert walls bowed in at upstream end.
Culvert Deterioration	None
Baffle Presence	None
Culvert Bottom	Closed
Embedment	None
Variable Bottom Slope	Yes, D/S end of culvert lower slope than U/S
Culvert Dimensions	
Culvert Width	3.6m
Culvert Height	2.5m
Culvert Length	24.8m
Plunge Pool Width	~15m
Plunge Pool Length	~15m
U/S Riffle to Inflow Distance	15.6m
Tailwater Control to D/S Riffle Distance	~15m

Culvert Elevations	
U/S Riffle	9.31
Inflow	9.03
Outflow RL	8.7
Outflow RR	8.86
Tailwater Control	8.45
Tailwater Cross Section 0m (LB)	9.04
Tailwater Cross Section 2m	8.55
Tailwater Cross Section 5m	8.45
Tailwater Cross Section 7m	8.64
Tailwater Cross Section 13m	8.59
Tailwater Cross Section 15m	8.84
Tailwater Cross Section 20m (RB)	9.09
Salmon River Water Level	9.09
Salmon River June 6, 2023 Flood Water Level	8.88
Culvert Calculations	
Upstream Channel Slope	1.8%
Culvert Slope	1.3%
Outflow Drop	0.25m
Downstream Channel Slope	1.6%

Assessment Notes

- Floodplain on left and right bank are continuous with the Salmon River and are not inhibited by a contour.
- Outflow slopes downward from river right to river left and has an elevation difference of 17cm from one side to the other.
- Minor structural issue consisting of river right culvert wall is bowed in at the upstream end.
- Water level elevation of a recent flood at the time of the assessment as indicated by knocked down grass on bank of Salmon River was measured (denoted as “Salmon River June 6, 2023 Flood Water Level”)
- The culvert has a variable slope with the downstream end of the culvert having a lower slope than the upstream end. This can be seen in the images by the hydraulic jump ~1/3 of the way from the bottom of the culvert.

Tailwater Cross Section



Tailwater Discharge Ratings Table*

Discharge (cms)	Tailwater Water Level Elv (m)
0	8.45
0.02	8.5
0.06	8.54
0.15	8.57
0.24	8.6
0.39	8.64
0.76	8.67
1.24	8.7
1.82	8.74
2.48	8.77
3.23	8.81
4.07	8.84
4.92	8.87
5.85	8.91
6.88	8.94
8	8.97
9.22	9.01
10.54	9.04 (Bankfull)

*It should be noted that the values in the tailwater discharge ratings table change significantly with the water level of the Salmon River, so these values are likely underestimated, and the water level likely increases at a higher rate because of this.

McAllister Brook Culvert Images

Looking upstream from culvert inflow.

Looking at culvert inflow from upstream

Looking downstream through river right culvert.

Looking downstream through river left culvert.

Looking upstream at culvert outflow.

Looking upstream at culvert outflow and plunge pool.

Looking downstream from culvert outflow.


Confluence of McAllister Brook with Salmon River looking downstream.


Looking upstream of Salmon River from the confluence of McAllister Brook and Salmon River.

Looking upstream of McAllister Brook from confluence of McAllister Brook and Salmon River.

River left bank of tailwater control.

River right bank of tailwater control.


Looking downstream from tailwater control.