# Fish Passage Assessment Report
# Mare Brook Culverts

Fish Passage Assessment Component of Mare Brook Watershed Assessment and Community Engagement Project


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# 1.0 INTRODUCTION

This fish passage assessment report was prepared as part of the Mare Brook Watershed Assessment and Community Engagement Project (Project) by Stantec Consulting Services Inc. (Stantec). The objective of the preliminary fish passage assessment is to evaluate continuity of aquatic habitat in Mare Brook and Merriconeag Stream. The focus of this report is on upstream passage at culverts and other identified structures. Stantec performed the preliminary fish passage assessment as a subcontractor to FB Environmental Associates (FB Environmental). FB Environmental is performing the Project under contract to the Town of Brunswick, Maine (Town).

Field surveys and reporting for the fish passage assessment were performed as described in the survey implementation plan (SIP) titled "Survey Implementation Plan: Fish Passage Assessment at Mare Brook Culverts" dated June 15, 2016, that was prepared by Stantec as part of the Project (Appendix A).

## 1.1 SURVEY PURPOSE

The purpose of this fish passage assessment survey was to make visual observations and obtain limited measurements for use in the preparation of a preliminary assessment of upstream fish passage at each stream crossing for adult brook trout (*Salvelinus fontinalis*), which were identified in the SIP as the target species for evaluation as part of this study. This report also presents concept-level recommendations to improve upstream fish passage at the evaluated sites along Mare Brook and Merriconeag Stream.

### 1.1.1 Field Survey Extents and Elements

Sites that were surveyed as part of this study included 11 culverts and 1 dam along the reach of Mare Brook between Baribeau Drive and tidewater and 2 culverts and 1 dam along the reach of Merriconeag Stream from Beaver Pond Road to its confluence with Mare Brook.

Table 1 presents information on the 12 surveyed sites along Mare Brook, including feature identifiers (Feature IDs) assigned by Stantec, the waterway (Mare Brook), the type of feature (culvert or dam). Table 2 presents information on the three surveyed sites on Merriconeag Stream and is similar to Table 1. Figure 1 depicts the study reaches of Mare Brook and Merriconeag Stream with feature identifiers that are crossed referenced with Tables 1and 2.

### 1.1.2 Site Access

Access for surveys along Mare Brook between Baribeau Drive and State Route 123 (Harpswell Road) was coordinated by FB Environmental and the Town. Surveys in this area required access

to the overlying roadway and apparent roadway easement. Access for surveys of sites along Mare Brook upstream from State Route 123 was coordinated by FB Environmental and the Town.

Access for surveys of sites along Mare Brook downstream from State Route 123 and along Merriconeag Stream on land that is currently owned and/or managed by the Midcoast Regional Redevelopment Authority (MRRA) and the U.S. Navy and formerly part of Naval Air Station Brunswick was coordinated by FB Environmental and Stantec.

**Table 1: Surveyed Sites on Mare Brook**

| Feature ID | Feature Identifier | Type |
|---|---|---|
| MB_C01 | Baribeau Drive | Culvert |
| MB_C02 | Barrow Street | Culvert |
| MB_C03 | MacMillan Drive | Culvert |
| MB_C04 | Maine Street | Culvert |
| MB_C05 | Meadowbrook Road | Culvert |
| MB_D01 | Coffin Pond Dam | Dam |
| MB_C06 | State Route 123 | Culvert |
| MB_C07 | Security Road | Culvert |
| MB_C08 | Samuel Adams Drive | Culvert |
| MB_C09 | Runway Culvert | Culvert |
| MB_C10 | Major Pope Avenue | Culvert |
| MB_C11 | Liberty Crossing Drive | Culvert |

**Table 2: Surveyed Sites on Merriconeag Stream**

| Feature ID | Feature Identifier | Type |
|---|---|---|
| MS_C01 | Beaver Pond Road | Culvert |
| MS_D01 | Picnic Pond Dam | Dam |
| MS_C02 | Purinton Road | Culvert |

### 1.1.3 Schedule

Stantec performed the field survey component of this study on August 18, 2016. Surveyed locations on this date included 11 culverts and 1 dam on Mare Brook and 2 culverts and 1 dam on Merriconeag Stream. The field survey was performed by a Stantec staff with relevant experience in fish passage and river and culvert hydraulics.

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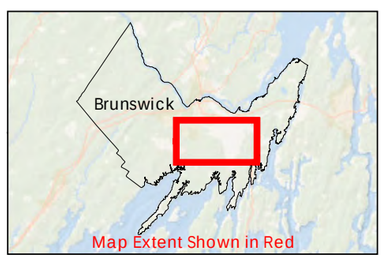
Prepared by GAC on 2016-09-14
Reviewed by MRC on 2016-09-14

01214_01_CulvertLocations.mxd




Legend
- Dam Location
- Culvert Location
- USGS Stream

Data Source
1. Aerial imagery provided by ArcGIS Online World Imagery Mapping Service (2015 NAIP) (http://server.arcgisonline.com/arcgis/services/World_Imagery/MapServer).

0 0.25 Miles
1 inch = 0.25 miles (At page size of 11"x17")

Client/Project
Mare Brook Fish Passage Assessment
Brunswick, Maine

Figure No.
1

Title
Culvert Location Map
9/30/2016

### 1.1.4 Definitions

The following conventions are used in the following descriptions of observed conditions at the study sites:

1) Directionals "right" and "left" are based on an observer facing downstream.
2) "Landward" and "seaward" are used in lieu of "upstream" and "downstream", respectively, where tidal influence was observed during the study site visit.
3) Culvert lengths are estimated from aerial photographs.
4) "Thalweg" refers to the deepest part of the stream channel.
5) "Inlet" and "outlet" refer to the upstream and downstream ends, respectively, of each culvert.
6) "Hydraulically perched" refers to a condition where the culvert outlet invert may be at or below the downstream water surface elevation but the observed water surface elevation was above the downstream water surface elevation. Flow over the downstream end of the culvert may be supercritical (e.g., fast) for a hydraulically perched culvert outlet.
7) Abbreviations:
    a. CMP: corrugated metal pipe
    b. CPP: corrugated plastic pipe
    c. PCP: precast concrete pipe
    d. CIP: cast-in-place (used in conjunction with "concrete")

### 1.1.5 Survey Methods

The preliminary assessment was based on observed conditions at each stream crossing, such as perched culvert outlets, steep culverts and higher-speed flow, and very shallow water. Stream crossing survey forms were prepared and representative photograph were taken as part of the field assessment.

The field survey was performed in accordance with methods described in Abbot (2012), and a "Stream Crossing Survey" form from Abbott (2012) was filled out for each evaluated site. Copies of the Stream Crossing Survey forms are included in Appendix B.

Digital photographs were taken at each evaluated stream crossing as described in Abbott (2012). Coordinate data was obtained using existing data sources (e.g., StreamStats, Google Earth).

## 1.2 UPSTREAM FISH PASSAGE ASSESSMENT CRITERIA

The preliminary assessment of upstream fish passage at the evaluated sites is based on qualitative observations and limited field measurements obtained during the study site visits.

The primary criteria that are used in this study to assess the potential for upstream fish passage at culverts are based on the observed depth, flow speed, and heterogeneity of hydraulic conditions at the culvert outlet, in the culvert barrel(s), and at the culvert inlet.

Factors that are considered at each location include perched conditions, including those that may result from accumulation of debris. Where applicable, identified structural factors that may affect upstream fish passage, such as deteriorated and leaking culvert barrels, are also addressed.

The assessed potential for upstream fish passage at each study site is assigned a qualitative rating; descriptions and brief definitions for these ratings are provided below.

- **Not passable**: this rating is assigned where upstream passage does not appear to be possible for the target fish species.
- **Poor**: this rating criteria is assigned where upstream passage may be possible during ideal conditions.
- **Good**: this rating criteria is assigned where upstream passage appears to be possible during the observed conditions during the site visit and under a narrow range of flows.
- **Very good**: this rating criteria is assigned where upstream passage appears to be possible during the observed conditions during the site visit and under a seasonal range of flow.

# 2.0 PRELIMINARY ASSESSMENT OF UPSTREAM FISH PASSAGE

The section presents information relevant to upstream fish passage, ratings of upstream fish passage, and conceptual recommendations for improvement of upstream fish passage at the 15 evaluated sites, including 11 culverts and one dam on Mare Brook and two culverts and one dam on Merriconeag Stream. Representative photos are presented for each of the surveyed sites.

## 2.1 MARE BROOK STUDY SITES

This section presents study findings for the 12 study sites along Mare Brook.

### 2.1.1 Baribeau Drive Stream Crossing (Feature ID MB_C01)

The Baribeau Drive stream crossing of Mare Brook is at the upstream limit of the study reach of Mare Brook and consists of three culverts installed in two groups ("left group" and "right group"). The left culvert group consists of a 2.5-ft-diameter CMP culvert with an estimated length of 150 ft. The right culvert group consists of two 2.5-ft-diameter PCP culverts that are parallel to each other along the right side of this stream crossing. The estimated length of the two PCP culverts is approximately 100 ft. Water was flowing through each of the three culverts during the site visit.

The inlets to both culvert groups are located on the west side of Baribeau Drive, with the inlet to the left culvert group location approximately 50 ft north of the inlet to the right culvert group. The outlets to the two culvert groups are approximately 10 ft apart.

The culvert barrel inverts are at the stream grade at the outlets of both culvert groups. The depth of water immediately downstream from the culvert outlets was less than 0.25 ft. Gravel and cobble material are the dominant substrates in the channel downstream from the culvert outlets, and include what appears to be installed angular rock. There is no defined plunge pool.

Conditions inside the culvert barrels were not observed during the site visit due to the length and relatively small diameter of the culverts.

The observed depth of water at the culvert barrel inlets was approximately 0.25 ft, which appears to result from a similar height of debris accumulation. The accumulated debris was largely comprised of woody material.

#### 2.1.1.1 Upstream Fish Passage Assessment

The length of the culverts under Baribeau Road, lack of corrugations in the right culvert group, and the relatively small diameter culverts (2.5 ft) are not conducive to upstream fish passage. The assigned rating for upstream fish passage at this stream crossing is therefore "not passable".

#### 2.1.1.2 Recommendations to Improve Upstream Fish Passage

The recommended action to improve upstream fish passage at the Baribeau Drive stream crossing is to replace the existing culverts with a larger culvert. An identified constraint to installation of a larger culvert(s) at this location is the relatively low height of the overlying roadway, which is estimated to be less than 3 ft. Providing conditions suitable for upstream fish passage by modifying the existing culverts or the downstream reach of stream channel (e.g., increasing the tailwater depth) does not appear to be feasible due to the small diameters and long lengths of these culverts.

**Photo 1: Outlet of Baribeau Drive Culverts. Stantec. August 2016.**

**Photo 2: Inlet to Right Culvert Group, Baribeau Drive Culverts. Stantec. August 2016.**

### 2.1.2 Barrow Street Stream Crossing (Feature ID MB_C02)

The Barrow Street stream crossing of Mare Brook consists of two adjacent CMP culverts. The left culvert is a 2.5-ft-diameter CMP and the right culvert is a 4-ft-diameter CMP. The estimated length of both culverts is approximately 60 ft. Water was flowing through both culverts during the site visit.

The culvert barrel outlet inverts are approximately at the streamed elevation and were approximately 0.5 ft below the water surface during the site visit. Discharge from the culverts has formed a plunge pool with substrates that include cobbles and small boulders.

Rust and associated deterioration of metal was observed in both culvert barrels as well as rock debris. In addition, a log with a diameter of approximately 1.5 ft was lodged in the downstream end of the 4-ft-diameter culvert.

Cobble-sized rock has accumulated at the inlet to both culverts and results in the culvert barrel inverts being below the thalweg of the upstream channel. The inlet invert of the 4-ft-diameter culvert is approximately 1 ft below the thalweg of the upstream channel, and the inlet invert of the 2.5-ft-diameter culvert is approximately 0.5 ft below the thalweg of the upstream channel.

#### 2.1.2.1 Upstream Fish Passage Assessment

The submerged condition of the culvert outlet, heterogeneous flow conditions in the culverts that results from rock and woody debris in the culvert barrels, and the incised culvert inlets contribute to conditions that are expected to provide for upstream fish passage at this culvert during lower flow conditions. However, it is expected that inlet control at this culvert occurs during higher flows and is a barrier to upstream fish passage. The assigned rating for upstream fish passage at this stream crossing is therefore “good”.

#### 2.1.2.2 Recommendations to Improve Upstream Fish Passage

Conditions suitable for upstream fish passage at this culvert are good, but could deteriorate with failure of the culvert and/or accumulation of additional debris at the culvert inlets or in the culvert barrels. The recommended action to improve upstream fish passage at Barrow Drive stream crossing is to install a single, larger culvert.

**Photo 3: Outlet of Barrow Street Culverts. Stantec. August 2016.**

**Photo 4: Inlet of Barrow Street Culverts. Stantec. August 2016.**

### 2.1.3 MacMillan Drive Stream Crossing (Feature ID MB_C03)

The MacMillan Drive stream crossing of Mare Brook consists of two adjacent CMP culverts. The left culvert is a 2.5-ft-diameter CMP and the right culvert is a 4-ft-diameter CMP. The estimated length of both culverts is approximately 50 ft. Water was flowing through both culverts during the site visit.

The culvert barrel outlet inverts are approximately at the elevation of the streambed downstream from the culverts and were approximately 1 ft below the water surface during the site visit. Discharge from the culverts has formed a plunge pool with substrates that include sand, gravel, and cobble material.

Rust and associated deterioration of metal was observed in both culvert barrels and deterioration of the concrete and rubble headwall was apparent.

The inlet invert of the right (4-ft-diameter) culvert was approximately 1 ft below the water surface during the site visit, and it appeared that water was backwatered through the culvert. The inlet of the left (2.5-ft-diameter) culvert was just below the water surface during the site visit, and is therefore approximately 1 ft higher than the invert of the right culvert. Substrate in the channel upstream from this stream crossing includes sand, gravel, and cobble material.

#### 2.1.3.1 Upstream Fish Passage Assessment

The submerged condition of the right culvert and backwater through the culvert during lower flows are expected to provide for upstream fish passage at this culvert. However, it is expected that inlet control conditions occur during higher flows and are a barrier to upstream fish passage. The assigned rating for upstream fish passage at this stream crossing is therefore “good”.

#### 2.1.3.2 Recommendations to Improve Upstream Fish Passage

Conditions suitable for upstream fish passage at this culvert are good, but could deteriorate with failure of the culvert and/or accumulation of additional debris at the culvert inlets or in the culvert barrels. The recommended action to improve upstream fish passage at the MacMillan Drive stream crossing is to install a single, larger culvert.

**Photo 5: Outlet of MacMillan Drive Culverts. Stantec. August 2016.**


**Photo 6: Inlet of MacMillan Drive Culverts. Stantec. August 2016.**

### 2.1.4 Maine Street Stream Crossing (Feature ID MB_C04)

The Maine Street stream crossing of Mare Brook consists of a CMP pipe arch culvert with a width of 6 ft, a height of 3.5 ft, and a length of approximately 75 ft. Water was flowing through the culvert during the site visit.

The culvert barrel outlet invert was perched approximately 0.1 ft above the water surface in the downstream plunge pool during the site visit, and there is a plunge pool with a depth of approximately 1.5 ft adjacent to the culvert outlet. Stone masonry retaining walls are located on both sides of the channel downstream from the culvert outlet and confine the channel. Substrate in the plunge pool included, gravel, and cobble material.

Rust and associated deterioration of metal was observed in the culvert barrel and deterioration of the concrete and rubble headwall was apparent. A few small boulders were observed in the culvert barrel. The observed depth of flow through the culvert during the site visit was uniform, and corrugations in the CMP reduce flow speeds during lower flows. The culvert barrel has an apparent slope, and the observed uniform flow condition indicate "barrel control" during lower flows such as those that were observed during the site visit. Some asphalt or tar was observed along the invert of the culvert barrel and appears to reduce otherwise beneficial effects of the corrugations to reduce flow speeds and thereby improve the potential for upstream fish passage.

The inlet invert appears to be perched and therefore resulted in some aggradation of sediment in the brook upstream from the culvert, and the observed depth of water at the inlet was approximately 0.2 ft.

#### 2.1.4.1 Upstream Fish Passage Assessment

The marginally perched condition of the culvert outlet and "barrel control" in the culvert during lower flows are expected to provide for very limited upstream fish passage at this culvert. While limited upstream passage through this culvert may be possible under ideal conditions, the assigned rating for upstream fish passage at this stream crossing is "not passable".

#### 2.1.4.2 Recommendations to Improve Upstream Fish Passage

Conditions suitable for upstream fish passage at this culvert are poor to unpassable. The recommended action to improve upstream fish passage at the Maine Street stream crossing is to install a single, larger culvert.

**Photo 7: Outlet of Maine Street Culvert. Stantec. August 2016.**

**Photo 8: Inlet of Maine Street Culvert. Stantec. August 2016.**

### 2.1.5 Meadowbrook Road Stream Crossing (Feature ID MB_C05)

The Meadowbrook Road stream crossing of Mare Brook consists of an elliptical CMP culvert with a width of 4.7 ft, a height of 3.3 ft, and a length of approximately 85 ft. Water was flowing through the culvert during the site visit.

The culvert barrel outlet invert was approximately 1 ft below the water surface in the downstream plunge pool during the site visit, and the depth of the plunge pool was estimated to be less than 3 ft. Substrate in the plunge pool included sand and gravel.

The culvert barrel appears to be constructed of aluminum, and corrosion was not observed. Observations during the site visit indicate that the culvert barrel was backwatered to within 10 ft of the culvert inlet, and corrugations in the culvert provide hydraulic conditions similar to a riffle.

The inlet invert appears to be perched approximately 0.5 ft above the upstream channel thalweg, which has sandy substrate, and the depth of flow over the culvert inlet was approximately 0.2 ft during the site visit. Some woody debris was accumulated at the culvert inlet.

#### 2.1.5.1 Upstream Fish Passage Assessment

The submerged and backwatered culvert outlet, backwatered conditions through most of the culvert barrel, and minimum observed depth of flow of approximately 0.2 ft at the culvert inlet are expected to provide for upstream fish passage at this culvert during lower flow conditions. The assigned rating for upstream fish passage at this stream crossing is therefore “good”.

#### 2.1.5.2 Recommendations to Improve Upstream Fish Passage

Conditions suitable for upstream fish passage at this culvert are good during lower flow conditions. However, it is expected that inlet control conditions occur during higher flows and are a barrier to upstream fish passage. The recommended action to improve upstream fish passage at the Meadowbrook Road stream crossing is to install a single, larger culvert.

**Photo 9: Outlet of Meadowbrook Road Culvert. Stantec. August 2016.**

**Photo 10: Inlet of Meadowbrook Road Culvert. Stantec. August 2016.**

### 2.1.6 Coffin Pond Dam (Feature ID MB_D01)

Coffin Pond Dam is located on Mare Brook downstream from Meadowbrook Road and upstream from State Route 123. The dam consists of an approximately 400-ft-long embankment with an uncontrolled spillway with an overlying footbridge. The spillway and footbridge are approximately 40 ft long and located adjacent to the right abutment of the dam. The spillway is constructed of stone rubble and cast-in-place concrete and is deteriorated. Steel sheet pile is present along the upstream side of the spillway, and was apparently installed as a repair to maintain water surface elevations in the impoundment. The estimated hydraulic and structural heights of the dam are 5 ft and 8 ft, respectively.

#### 2.1.6.1 Upstream Fish Passage Assessment

There are no provisions for upstream fish passage at Coffin Pond Dam, and the assigned rating for upstream fish passage is therefore “not passable”.

#### 2.1.6.2 Recommendations to Improve Upstream Fish Passage

Potential actions to provide upstream fish passage at Coffin Pond Dam include installation of a fishpass or removal of the dam. Additional study is therefore recommended at this site.

**Photo 11: Coffin Pond Dam Spillway. Stantec. August 2016.**

### 2.1.7 State Route 123 Stream Crossing (Feature ID MB_C06)

The State Route 123 stream crossing of Mare Brook consists of a CMP culvert with a diameter of 5 ft and a length of approximately 100 ft. Water was flowing through the culvert during the site visit.

The culvert barrel outlet invert was at the water surface of the tailwater plunge pool but was hydraulically perched by approximately 0.3 ft. The depth of the plunge pool was estimated to be more than 3 ft, and substrate in the plunge pool included sand, gravel, and cobble material. Deterioration of the culvert barrel was observed adjacent to the outlet, including loss of metal and exposure of fill.

The culvert barrel has metal struts installed along the length of the culvert, and debris was observed lodged on the struts. An obstruction that results in a hydraulic drop of approximately 1 to 2 ft was observed in the culvert. The physical condition of the culvert appears to be very poor. Flow in the downstream end of the culvert appeared to exhibit pipe control.

The culvert inlet invert appears to be perched approximately 1 ft above the upstream thalweg, and the depth of water at the lip of the culvert was approximately 0.2 ft. A deteriorated debris grate was lying across the bottom of the culvert inlet and there was accumulated woody debris on the debris grate. Substrate upstream from the culvert consists of sand.

#### 2.1.7.1 Upstream Fish Passage Assessment

It is not expected that this culvert is upstream-passable due to the perched condition of the culvert outlet, the length of the culvert and shallow depths of water in the culvert, and accumulation of debris in the culvert and at on the debris grate at the culvert inlet. The assigned rating for upstream fish passage at this stream crossing is therefore “not passable”.

#### 2.1.7.2 Recommendations to Improve Upstream Fish Passage

Providing conditions suitable for upstream fish passage by modifying the existing culvert or the downstream reach of stream channel (e.g., increasing the tailwater elevation) does not appear to be practical or feasible due to the length, hydraulic gradient between the upstream and downstream ends (estimated to be approximately 2 ft), and poor condition of this culvert.

The recommended approach to improving upstream fish passage at the State Route 123 stream crossing is to replace the existing culvert with a larger culvert that is designed to provide upstream fish passage. Identified constraints to installation of a larger culvert(s) at this location include high use of State Route 123 and relatively deep fill (estimated to be approximately 12 ft) over the culvert.

**Photo 12: Outlet of State Route 123 Culvert. Stantec. August 2016.**

**Photo 13: Inlet of State Route 123 Culvert. Stantec. August 2016.**

### 2.1.8 Security Road Stream Crossing (Feature ID MB_C07)

The Security Road stream crossing of Mare Brook consists of two smooth-bore CPP culverts with diameters of 4 ft and lengths of approximately 60 ft. Access during the site visit was limited to the overlying roadway and the downstream side of the culvert due a security fence along the upstream side of Security Road and security grates on the inlet and outlet of both culvert barrels. Accumulations of debris were visible on the security grates at the inlet and outlet of both culverts. Water was flowing through the culverts during the site visit.

The culvert barrel outlet inverts were perched approximately 0.25 ft above the water surface in the downstream plunge pool, and the water surface in the culvert on the upstream side of the outlet security grates approximately 1 ft above the water surface in the downstream plunge pool. The depth of the plunge pool was estimated to be approximately 1.5 ft, and substrate in the plunge pool included gravel and cobble material.

Flow through the culverts barrels was backwatered in the downstream section of both barrels due to accumulated debris on the security grates at the culvert outlet. Higher-speed flow was observed in the upstream section of both culvert barrels.

Observations through the culverts from the downstream end of the culverts indicate that accumulated debris on the culvert inlet security grates results in hydraulic drops of approximately 1 ft at the inlets to both culverts. Lack of access to the upstream side of this stream crossing during the site visit precluded observation of other conditions at the culvert inlets at this stream crossing. The photograph of the culvert inlet (Photo 15) was taken by Stantec during other Project studies.

#### 2.1.8.1 Upstream Fish Passage Assessment

Three primary factors that likely prevent upstream fish passage were identified at this site, including 1) the perched culvert outlets, 2) higher-speed flow through the smooth-bore culverts, and 3) barriers associated with accumulation of debris on security grates on the culvert inlets and outlets. The assigned rating for upstream fish passage at this stream crossing is therefore “not passable”.

#### 2.1.8.2 Recommendations to Improve Upstream Fish Passage

Accumulation of debris on the inlet and outlet security grates is expected to prevent upstream fish passage at this stream crossing even if the tailwater elevation is increased to backwater the culverts. The recommended approach to improving upstream fish passage at the Security Road stream crossing is to replace the existing culverts with a single, larger culvert. If it is determined that access for motorized vehicles is not required along the Security Road, a potential alternative approach is to remove the roadway embankment and culverts. This approach could be combined with installation of a pedestrian bridge to facilitate use as a pedestrian trail.

**Photo 14: Outlet of Security Road Culverts. Stantec. August 2016.**

**Photo 15: Inlet of Security Road Culverts. Stantec. August 2016.**

### 2.1.9 Samuel Adams Drive (Feature ID MB_C08)

The Samuel Adams Drive stream crossing of Mare Brook consists of two adjacent PCP culverts with diameters of 6 ft and lengths of approximately 75 ft. The left culvert is set approximately 2.5 ft lower than the right culvert, and water was flowing through the left culvert during the site visit. This culvert appears to have been designed to provide for upstream fish passage during typical flow conditions.

The depth of water at the left culvert barrel outlet invert was approximately 1 ft during the site visit, and there was a hydraulic drop of approximately 0.2 ft over a riffle between the culvert outlet and the downstream pool in Mare Brook. Streambed substrate downstream from the culvert outlet included sand and cobble material. The invert of the right culvert was approximately 1 ft above the downstream water surface and no water was flowing through this culvert during the site visit.

The left (wetted) culvert barrel was backwatered during the site visit and sandy substrate was observed along the bottom of the full length of this culvert.

There are security grates over the inlets to both culverts that are combined with a security fence along the downstream side of the overlying roadway to limit access to the Brunswick Executive Airport runway area. Woody debris was accumulated on the debris gate over the inlet to the left (wetted) culvert, and the estimated depth of water at the inlet to the left culvert was approximately 0.9 ft. The observed debris on the security grate did not appear to be a barrier to upstream fish passage.

#### 2.1.9.1 Upstream Fish Passage Assessment

The submerged condition of the left culvert and backwater through the culvert during the observed, lower-flow condition are expected to provide for upstream fish passage at this culvert. While the observed debris on the security grate did not appear to be a barrier to upstream fish passage during the site visit, additional accumulation of debris could hinder or prevent upstream fish passage. The assigned rating for upstream fish passage at this stream crossing is “good”.

While this culvert appears to have been designed to accommodate upstream fish passage, a rating of “very good” was not assigned based on the potential for accumulation of debris on the security grate.

#### 2.1.9.2 Recommendations to Improve Upstream Fish Passage

This culvert appears to have been designed to provide for upstream fish passage during typical flow conditions and the culvert appears to be upstream-passable during the site visit, but accumulation of debris on the left-barrel security grate could prevent upstream passage. The suggest approach to providing upstream fish passage at this culvert is regular maintenance to remove debris from the security grate over the inlet to the left culvert barrel.

**Photo 16: Outlet of Samuel Adams Drive Culverts. Stantec. August 2016.**

**Photo 17: Inlet of Samuel Adams Drive Culverts. Stantec. August 2016.**

### 2.1.10 Runway Culvert (Feature ID MB_C09)

The culvert that conveys Mare Brook under the Brunswick Executive Airport runway consists of three PCP culverts with diameters of 6 ft and lengths of approximately 3,500 ft. Water was observed flowing into and out of the three culvert barrels during the site visit.

The culvert barrel outlet inverts were approximately 1 ft below the water surface of the tailwater plunge pool, but accumulated debris on security grates attached to the culvert outlets resulted in hydraulic drops of 0.5 to 1 ft at the culvert outlets during the site visit. Observed substrate in the plunge pool downstream from the culverts consisted of sand.

No observations were made of conditions in the culvert barrels due to the long length of these culverts.

Accumulated woody debris at the culvert inlet resulted in a hydraulic drop of approximately 1 ft during the site visit. Metal fence posts installed in front of the culvert inlets appear to contribute to accumulation of debris. Substrate upstream from the culvert inlets consists of sand.

#### 2.1.10.1 Upstream Fish Passage Assessment

Accumulated debris at the culvert outlets and inlets may result in hydraulic conditions that hinder or prevent upstream fish passage, and the long length of the culvert may result in a behavioral barrier to upstream fish passage. In addition, there may be physical barriers in the culvert barrels that were not identified as part of this study. The assigned rating for upstream fish passage at this stream crossing is therefore “not passable”.

#### 2.1.10.2 Recommendations to Improve Upstream Fish Passage

Removal of debris from the culvert outlets and inverts could eliminate potential physical (hydraulic) barriers to fish passage, but it was not determined whether there may be other physical barriers to upstream passage in the culvert, such as obstructions and areas of very shallow and/or higher-speed flow. In addition, behavioral factors associated with the long length of these culverts and associated persistent darkness may preclude upstream passage even if physical factors are addressed.

A potential approach to restoring upstream fish passage in Mare Brook in the vicinity of the Brunswick Executive Airport runway is to realign the stream channel around the south side of the runway. This approach would be a significant undertaking, but is recommended for evaluation if it is determined that replacement of the existing culverts is necessary to maintain conveyance in Mare Brook. Additional study is therefore recommended at this site.

**Photo 18: Outlet of Runway Culverts. Stantec. August 2016.**

**Photo 19: Inlet of Runway Culverts. Stantec. August 2016.**

### 2.1.11 Major Pope Avenue Stream Crossing (Feature ID MB_C10)

The Major Pope Avenue stream crossing of Mare Brook consists of a CMP culvert with a diameter of 10 ft and a length of approximately 110 ft. Water was flowing through the culvert during the site visit.

The culvert barrel outlet invert was perched approximately 1 ft above the water surface in the downstream plunge pool and was hydraulically perched by approximately 1.5 ft. Flow discharges onto a riprap apron downstream from the culvert outlet. The depth of the plunge pool was estimated to be more than 3 ft, and substrate in the plunge pool included sand, gravel, cobble, and boulder material. Deterioration and deformation of the culvert barrel was observed at the outlet.

There is a metal security grate in the culvert approximately 15 ft upstream from the culvert outlet, and accumulated debris along the upstream side of the grate resulted in a hydraulic drop of approximately 1 ft.

There is another security grate over the inlet to the culvert that is combined with a security fence along the downstream side of the overlying roadway to limit access to the Brunswick Executive Airport runway area. The estimated depth of water at the culvert inlet was approximately 1 ft. While some woody debris was accumulated on the debris gate, the debris did not appear to result in a hydraulic drop. Debris obscured the inlet invert of the culvert during the site visit, and it was therefore not determined whether the culvert inlet is perched. Substrate upstream from the culvert inlet consists of sand.

#### 2.1.11.1 Upstream Fish Passage Assessment

It is not expected that this culvert is upstream-passable due to the perched condition of the culvert outlet and debris on the debris gate upstream from the culvert outlet. The assigned rating for upstream fish passage at this stream crossing is therefore “not passable”.

#### 2.1.11.2 Recommendations to Improve Upstream Fish Passage

Providing conditions suitable for upstream fish passage by modifying the existing culvert or the downstream reach of stream channel (e.g., increasing tailwater elevation) does not appear to be practical or feasible due to the hydraulic gradient between the upstream and downstream ends (estimated to be approximately 2.5 ft) and accumulation of debris on the two security grates that are installed in this culvert.

The recommended approach to improving upstream fish passage at the Major Pope Avenue stream crossing is to replace the existing culvert with a larger culvert that is designed to provide for upstream fish passage.

**Photo 20: Outlet of Major Pope Avenue Culvert. Stantec. August 2016.**

**Photo 21: Inlet of Major Pope Avenue Culvert. Stantec. August 2016.**

### 2.1.12 Liberty Crossing Drive Stream Crossing (Feature ID MB_C11)

The Liberty Crossing Drive stream crossing of Mare Brook consists of a rectangular CIP culvert with a height and width of 9 ft. The estimated length of both culverts is approximately 60 ft. This stream crossing is located in the tidally affected reach of Mare Brook, and water was observed flowing seaward ("downstream") through the culvert during the site visit.

The bottom of this culvert is flat in cross section and appears to have no slope in the streamwise direction. The depth of water during the site visit was approximately 0.5 ft at the inlet and outlet, but appeared to be falling with the ebb tide.

There is a large plunge pool seaward from the culvert, and boulder-size riprap was observed in the plunge pool. The estimated depth of the plunge pool is 6 ft. The low-tide water surface elevation was not observed during the site visit for this study, but observations by Stantec during other project studies indicate that the downstream water surface elevation drops below the culvert invert at low tide. Monitoring is therefore recommended to determine if the downstream water surface elevation drops below the elevation of the culvert bottom.

There are no pronounced features or accumulated sediment or debris on the bottom of the culvert. The inlet invert of the culvert was at the approximate elevation of the stream channel upstream from the culvert. Sand was the dominant substrate in the channel upstream from the culvert.

#### 2.1.12.1 Upstream Fish Passage Assessment

Observed conditions indicate that this culvert is upstream passable at higher tides during typical instream flows. The assigned rating for upstream fish passage at this stream crossing is therefore "good". A rating of "very good" was not assigned due to uncertainty regarding the potential for upstream fish passage during low-tide conditions.

#### 2.1.12.2 Recommendations to Improve Upstream Fish Passage

Additional study is recommended at this location to evaluate effects of regular tidal conditions on upstream fish passage. The recommended evaluation is to install datalogging pressure transducers in Mare Brook upstream and downstream from this culvert to obtain information on tidal water surface elevations and present findings of this evaluation as they relate to upstream fish passage.

**Photo 22: Inlet of Liberty Crossing Drive Culvert (seaward flow is into the image). Stantec. August 2016.**

**Photo 23: Outlet of Liberty Crossing Drive Culvert (seaward flow is from right to left). Stantec. August 2016.**

## 2.2 MERRICONEAG STREAM STUDY SITES

This section presents study findings for the three study sites along Merriconeag Stream.

### 2.2.1 Beaver Pond Road Stream Crossing (Feature ID MS_C01)

The Beaver Pond Road stream crossing of Mare Brook is at the upstream limit of the study reach of Merriconeag Stream. Beaver Pond Road is approximately 12 ft higher than the thalweg of the channel downstream from the roadway and approximately 6 ft higher than the channel thalweg upstream from the roadway.

No outlet or inlet to a culvert was identified at this site. Dispersed flow was observed into rock riprap and accumulated sediment along the upstream side of the roadway embankment, and flow along the downstream side of the embankment was diffuse prior to discharging into a defined channel with a width of less than 3 ft and a depth of approximately 1 ft.

#### 2.2.1.1 Upstream Fish Passage Assessment

The diffuse flow into and out of the Beaver Pond Road roadway embankment precludes upstream fish passage at this site, and the assigned rating for upstream fish passage at this stream crossing is therefore "not passable".

#### 2.2.1.2 Recommendations to Improve Upstream Fish Passage

Providing upstream fish passage at Beaver Pond Road would require installation of a larger culvert and restoration of the upstream reach of Merriconeag Stream. The need for restoration of the upstream reach of the brook is based on accumulation of sediment upstream from the road, which has an estimated depth of up to 6 ft based on the estimated heights of the roadway above the upstream and downstream channels of the brook. Additional study is therefore recommended at this site.

**Photo 24: Channel (foreground) and Roadway Embankment (background) on Downstream Side of Beaver Pond Drive. Stantec. August 2016.**

**Photo 25: Merriconeag Stream Upstream from Beaver Pond Drive (flow is into rock on right side of image). Stantec. August 2016.**

### 2.2.2 Picnic Pond Dam (Feature ID MS_D01)

Picnic Pond Dam is located on Merriconeag Stream downstream from Beaver Pond Road and upstream from Purinton Road. The dam is located to the east of a former picnic area, and consists of an approximately 160-ft-long embankment with drop-structure inlet for discharging normal flows into the downstream reach of Merriconeag Stream and a grouted-stone overflow spillway. The estimated hydraulic and structural heights of the dam are 6 ft and 8 ft, respectively.

#### 2.2.2.1 Upstream Fish Passage Assessment

There are no provisions for upstream fish passage at Picnic Pond Dam, and the assigned rating for upstream fish passage is therefore “not passable”.

#### 2.2.2.2 Recommendations to Improve Upstream Fish Passage

Potential actions provide upstream fish passage at Picnic Pond Dam include installation of a fishpass or removal of the dam. Additional study is therefore recommended at this site.

**Photo 26: Picnic Pond Dam (flow is from left to right). Stantec. August 2016.**

### 2.2.3 Purinton Road Stream Crossing (Feature ID MS_C02)

The Purinton Road stream crossing of Merriconeag Stream consists of two adjacent culverts. The left culvert is a 2.5-ft-diameter CMP and the right culvert is a 3-ft-diameter CPP with a smooth-bore. The estimated length of both culverts is approximately 40 ft, and water was flowing through both culverts during the site visit.

The culvert outlet inverts in the right and left culverts were approximately 0.5 ft and 0.3 ft, respectively, below the water surface in the downstream plunge pool during the site visit. Substrates in the plunge pool include gravel and cobble material.

Observations into the culvert barrels indicate that backwater conditions were present in the downstream ends of the culverts, but the pipe control was present in the upstream ends of the culverts downstream from the culvert inlets.

The inlet inverts of both culverts were approximately 0.5 ft below the water surface during the site visit, and some woody debris was apparent at the culvert inlets. Substrate in the channel upstream from this stream crossing includes muck, sand, gravel, and cobble material. The channel upstream from the culverts is poorly defined and the stream flows around vegetated hummocks and through a security fence that parallels Purinton Road approximately 15 ft upstream from the upstream side of the roadway embankment.

#### 2.2.3.1 Upstream Fish Passage Assessment

The submerged condition of the culvert inlets and backwatered conditions in the downstream sections of these culverts may allow for some upstream fish passage during lower flows. However, pipe control in the upstream sections of these culverts may hinder or prevent upstream fish passage. The assigned rating for upstream fish passage at this stream crossing is therefore “poor”.

#### 2.2.3.2 Recommendations to Improve Upstream Fish Passage

The recommended action to improve upstream fish passage at the Purinton Road stream crossing is to install a single, larger culvert.

**Photo 27: Outlets of Purinton Road Culvert. Stantec. August 2016.**

**Photo 28: Inlets of Purinton Road Culvert. Stantec. August 2016.**

# 3.0 SUMMARY AND DISCUSSION

This section summarizes information for the 13 culverts and two dams that are evaluated for upstream fish passage in Section 2.0.

## 3.1 SUMMARY

Table 3 presents a summary of the assigned upstream fish passage ratings and recommendations for the 12 study sites on Mare Brook, and Table 4 presents similar information for the three study sites on Merriconeag Stream.

**Table 3: Summary of Findings at Mare Brook Sites**

| Feature ID | Feature Identifier | Type | Assigned Rating | Recommendation |
|---|---|---|---|---|
| MB_C01 | Baribeau Drive | Culvert | Not Passable | Replacement |
| MB_C02 | Barrow Street | Culvert | Good | Replacement |
| MB_C03 | MacMillan Drive | Culvert | Good | Replacement |
| MB_C04 | Maine Street | Culvert | Not Passable | Replacement |
| MB_C05 | Meadowbrook Road | Culvert | Good | Replacement |
| MB_D01 | Coffin Pond Dam | Dam | Not Passable | Additional Study |
| MB_C06 | State Route 123 | Culvert | Not Passable | Replacement |
| MB_C07 | Security Road | Culvert | Not Passable | Replacement |
| MB_C08 | Samuel Adams Drive | Culvert | Good | Monitor |
| MB_C09 | Runway Culvert | Culvert | Not Passable | Additional Study |
| MB_C10 | Major Pope Ave. | Culvert | Not Passable | Replacement |
| MB_C11 | Liberty Crossing Drive | Culvert | Good | Monitor |

**Table 4: Summary of Findings at Merriconeag Stream Sites**

| Feature ID | Feature Identifier | Type | Assigned Rating | Recommendation |
|---|---|---|---|---|
| MS_C01 | Beaver Pond Road | Culvert | Not Passable | Additional Study |
| MS_D01 | Picnic Pond Dam | Dam | Not Passable | Additional Study |
| MS_C02 | Purinton Road | Culvert | Poor | Replacement |

## 3.2 DISCUSSION

Six of the 11 evaluated stream crossings and Coffin Pond Dam on Mare Brook were rated as "not passable" for upstream passage of the target fish species and life stage (adult brook trout). The remaining 5 stream crossings on Mare Brook were rated as "good" for upstream passage. Based on these findings, it is concluded that the evaluated sites substantially limit upstream movement of that target species and life stage in Mare Brook.

The evaluated stream crossings at Beaver Pond Road and Purinton Road on Merriconeag Stream were rated as "not passable" and "poor", respectively, and upstream fish passage is not available at Picnic Pond Dam. Similar to the evaluated conditions on Mare Brook, it is concluded that the evaluated sites substantially limit upstream movement of that target species and life stage in Merriconeag Stream.

Replacement of the existing culverts with culverts or bridges that are designed to provide for upstream passage appears to be practical at most of the study sites on Mare Brook and Merriconeag Stream, including those sites where upstream passage was rated as "not passable", "poor", and "good". Replacement in-kind is not recommended at any of the evaluated sites except for the Samuel Adams Drive culvert. While upstream fish passage at the Samuel Adams Drive culvert was rated as "good" and not "very good", the lower rating was assigned based on the potential for debris accumulation on the culvert inlet debris gate and can be addressed by regular maintenance.

Additional study is recommended for evaluation of potential approaches to improving upstream fish passage at the Runway Culvert on Mare Brook. As described in Section 2.1.10, behavioral factors may prevent upstream fish passage even with suitable hydraulic conditions through this culvert. Additional study is also recommended for evaluation of potential approaches to improving upstream fish passage at the Beaver Pond Road stream crossing on Merriconeag Stream. The suggested focus of this study is whether the existing stream crossing is hydraulically adequate to convey high flows in Merriconeag Stream given that the existing culvert inlet is not visible and may be occluded by debris.

Coffin Pond Dam on Mare Brook and Picnic Pond Dam on Merriconeag Stream are both barriers to upstream fish passage. Potential actions to improve upstream fish passage at these sites include installation of upstream fish passes and dam removal. Addition study is recommended at both dams.

# 4.0 REFERENCES

Abbott, A. 2012. Maine stream crossing survey manual. Gulf of Maine Coastal Program, U.S. Fish and Wildlife Service, Falmouth, Maine, USA. May.

# Appendix A SURVEY IMPLEMENTATION PLAN: FISH PASSAGE ASSESSMENT AT MARE BROOK CULVERTS

# Survey Implementation Plan: Fish Passage Assessment at Mare Brook Culverts

Fish Passage Assessment
Component of Mare Brook
Watershed Assessment and
Community Engagement Project


Prepared for:
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Prepared by:
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30 Park Drive
Topsham, ME 04086

June 15, 2016

# Table of Contents

# 1.0 INTRODUCTION

This Survey Implementation Plan (SIP) was prepared by Stantec Consulting Services Inc. (Stantec) as part of a preliminary fish passage assessment at culverts and other identified structures on Mare Brook in Brunswick, Maine. FB Environmental is contracted to the Town of Brunswick, Maine (Town), to perform the Project. Stantec is performing the preliminary fish passage assessment as a subcontractor to FB Environmental Associates (FB Environmental) as part of the Mare Brook Watershed Assessment and Community Engagement Project (Project).

## 1.1 PROJECT AND TASK ORGANIZATION

This section presents information on project and task organization. Stantec is a subcontractor to FB Environmental; as such, Stantec will provide reports and information to FB Environmental and FB Environmental will coordinate with external entities.

### 1.1.1 Stantec Roles and Responsibilities

Stantec will implement its internal review process in accordance with Stantec's Project Management Framework (PM Framework). The PM Framework is a component of Stantec's ISO 9001 Quality Management System.

- Michael Chelminski, P.E. of Stantec will serve as the Technical Lead for implementation of work described in this SIP.
- David Huntress, P.E. of Stantec will perform Stantec's internal Quality Review.
- Bryan Emerson of Stantec will perform Stantec's internal Independent Review.

Stantec will document the internal review process and provide this documentation in deliverables to FB Environmental.

### 1.1.2 FB Environmental Roles and Responsibilities

Stantec will provide deliverables to FB Environmental. FB Environmental will coordinate with external entities, including the Town and others. FB Environmental will identify the distribution list for materials prepared by Stantec and distribute the materials accordingly.

# 2.0 PRELIMINARY ASSESSMENT OF UPSTREAM FISH PASSAGE

## 2.1 SURVEY PURPOSE

The purpose of this survey is to make visual observations and obtain limited measurements of features and conditions that may be used to develop a preliminary assessment of upstream fish passage at each stream crossing for adult brook trout (*Salvelinus fontinalis*) on the study reach of Mare Brook in Brunswick, Maine.

## 2.2 SAFETY

Stantec will perform field surveys as part of this assessment in accordance with our Health and Safety Program.

## 2.3 SURVEY EXTENT

The extent of this survey is the reach of Mare Brook from Baribeau Drive to tidewater and the reach of Merriconeag Stream from Beaver Pond Road to its confluence with Mare Brook. The survey will include identified instream features, such as the Coffin Pond Dam adjacent to Harpswell Road (State Route 123) and the dam on Merriconeag Stream upstream from Purinton Road. Survey work along Mare Brook between Baribeau Drive and Harpswell Road (State Route 123) will be performed from the roadway and apparent roadway easement.

## 2.4 SITE ACCESS

FB Environmental will obtain permissions for access to other areas identified by Stantec as necessary to perform the survey, including access to the reach of Mare Brook and Merriconeag Stream in the former Brunswick Naval Air Station (BNAS).

## 2.5 SURVEY AND REPORTING

### 2.5.1 Schedule

Stantec will coordinate with FB Environmental for scheduling of the field surveys. The identified schedule is to perform the field surveys and submit draft deliverable prior to July 20, 2016.

### 2.5.2 Survey Methods

The preliminary assessment will be based on observed conditions at each stream crossing, such as perched culvert outlets, steep culverts, and very shallow water. Stream crossing survey forms will be prepared and representative photographs will be taken as part of the field assessment.

The field survey will be performed in accordance with methods described in Abbot (2012), and a "Stream Crossing Survey" form from Abbott (2012) will be filled out for each evaluated stream crossing. A copy of the Stream Crossing Survey form is included in Appendix A.

Digital photographs will be taken at each evaluated stream crossing as described in Abbott (2012). Coordinate data will be obtained using existing data sources (e.g., StreamStats, Google Earth).

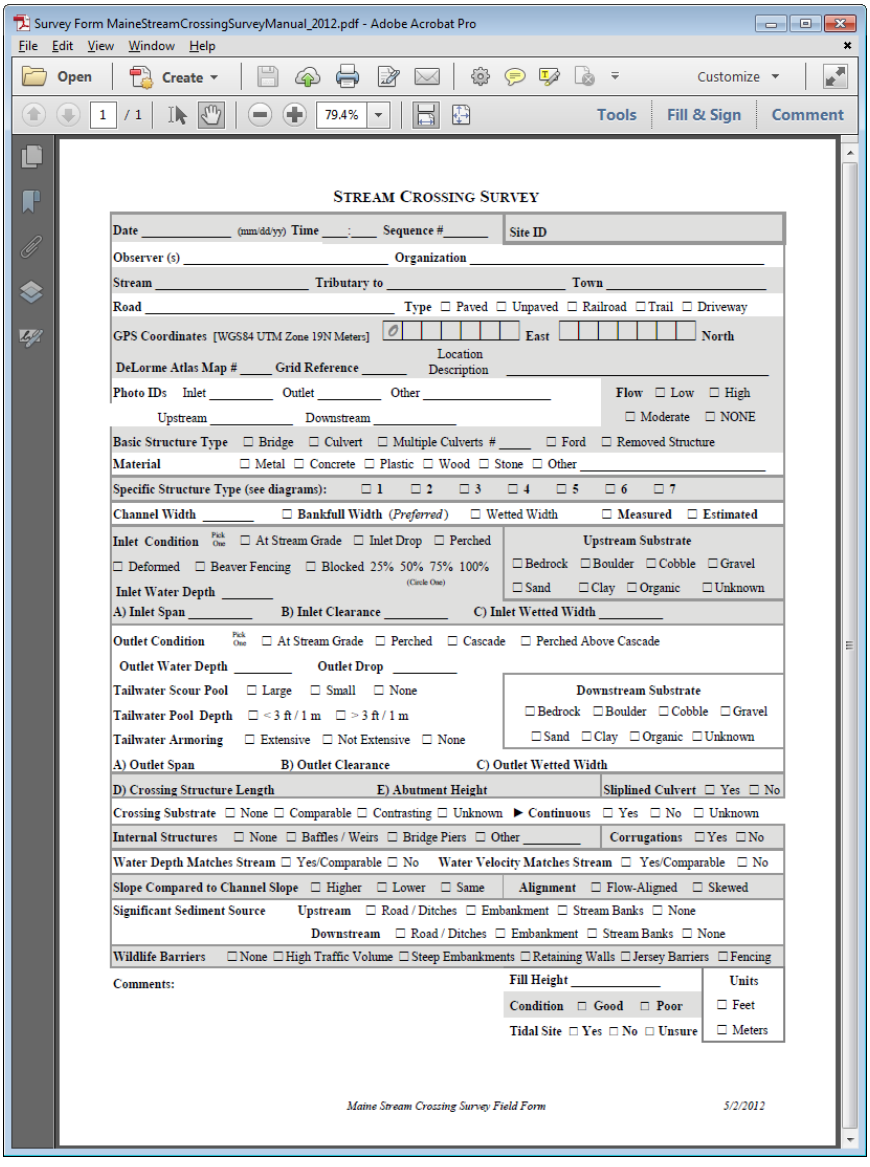
### 2.5.3 Reporting

Stantec will prepare draft and final reports based on information obtained as part of the field surveys. The draft report will include brief narrative assessments, photographs, and field forms for each evaluated site and concept-level recommendations to improve upstream fish passage. The draft report will be provided to FB Environmental in editable format (i.e., Microsoft Word). The final report will be provided in Adobe PDF file format. Additional deliverables will include photographs of each site.

# 3.0 REFERENCES

Abbott, A. 2012. Maine stream crossing survey manual. Gulf of Maine Coastal Program, U.S. Fish and Wildlife Service, Falmouth, Maine, USA. May.

# Appendix A STREAM CROSSING SURVEY FORM



Survey Form MaineStreamCrossingSurveyManual_2012.pdf - Adobe Acrobat Pro

File Edit View Window Help

Open Create Customize

1 / 1 79.4% Tools Fill & Sign Comment

## STREAM CROSSING SURVEY

Date _____ (mm/dd/yy) Time ___:___ Sequence #_____ | Site ID

Observer (s) _____ Organization _____

Stream _____ Tributary to _____ Town _____

Road _____ Type ☐ Paved ☐ Unpaved ☐ Railroad ☐ Trail ☐ Driveway

GPS Coordinates [WGS84 UTM Zone 19N Meters] 0 East North

DeLorme Atlas Map # ____ Grid Reference _____ Location Description _____

Photo IDs Inlet _____ Outlet _____ Other _____ Flow ☐ Low ☐ High ☐ Moderate ☐ NONE

Upstream _____ Downstream _____

Basic Structure Type ☐ Bridge ☐ Culvert ☐ Multiple Culverts # ____ ☐ Ford ☐ Removed Structure

Material ☐ Metal ☐ Concrete ☐ Plastic ☐ Wood ☐ Stone ☐ Other _____

Specific Structure Type (see diagrams): ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

Channel Width _____ ☐ Bankfull Width *(Preferred)* ☐ Wetted Width ☐ Measured ☐ Estimated

Inlet Condition (Pick One) ☐ At Stream Grade ☐ Inlet Drop ☐ Perched ☐ Deformed ☐ Beaver Fencing ☐ Blocked 25% 50% 75% 100% (Circle One)

Inlet Water Depth _____

Upstream Substrate ☐ Bedrock ☐ Boulder ☐ Cobble ☐ Gravel ☐ Sand ☐ Clay ☐ Organic ☐ Unknown

A) Inlet Span _____ B) Inlet Clearance _____ C) Inlet Wetted Width _____

Outlet Condition (Pick One) ☐ At Stream Grade ☐ Perched ☐ Cascade ☐ Perched Above Cascade

Outlet Water Depth _____ Outlet Drop _____

Tailwater Scour Pool ☐ Large ☐ Small ☐ None

Tailwater Pool Depth ☐ < 3 ft / 1 m ☐ > 3 ft / 1 m

Tailwater Armoring ☐ Extensive ☐ Not Extensive ☐ None

Downstream Substrate ☐ Bedrock ☐ Boulder ☐ Cobble ☐ Gravel ☐ Sand ☐ Clay ☐ Organic ☐ Unknown

A) Outlet Span B) Outlet Clearance C) Outlet Wetted Width

D) Crossing Structure Length E) Abutment Height | Sliplined Culvert ☐ Yes ☐ No

Crossing Substrate ☐ None ☐ Comparable ☐ Contrasting ☐ Unknown ▶ Continuous ☐ Yes ☐ No ☐ Unknown

Internal Structures ☐ None ☐ Baffles / Weirs ☐ Bridge Piers ☐ Other _____ | Corrugations ☐ Yes ☐ No

Water Depth Matches Stream ☐ Yes/Comparable ☐ No Water Velocity Matches Stream ☐ Yes/Comparable ☐ No

Slope Compared to Channel Slope ☐ Higher ☐ Lower ☐ Same | Alignment ☐ Flow-Aligned ☐ Skewed

Significant Sediment Source Upstream ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

Downstream ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

Wildlife Barriers ☐ None ☐ High Traffic Volume ☐ Steep Embankments ☐ Retaining Walls ☐ Jersey Barriers ☐ Fencing

Comments:

Fill Height _____

Condition ☐ Good ☐ Poor

Tidal Site ☐ Yes ☐ No ☐ Unsure

Units ☐ Feet ☐ Meters

*Maine Stream Crossing Survey Field Form* *5/2/2012*

# Appendix B STREAM CROSSING SURVEY FORMS

# STREAM CROSSING SURVEY

Date 8/18/16 (mm/dd/yy) Time 10:50 AM Sequence # _____ Site ID MB-C01

Observer (s) Michael Chwalinski Organization STANTEC

Stream MARO BROOK Tributary to HARPSWELL COVE Town BRUNSWICK

Road BARIBEAU DRIVE Type ☒ Paved ☐ Unpaved ☐ Railroad ☐ Trail ☐ Driveway

GPS Coordinates [WGS84 UTM Zone 19N Meters] 0 _____ East _____ North

DeLorme Atlas Map # _____ Grid Reference _____ Location Description _____

Photo IDs Inlet _____ Outlet _____ Other _____ Flow ☒ Low ☐ High

Upstream _____ Downstream _____ ☐ Moderate ☐ NONE

Basic Structure Type ☐ Bridge ☒ Culvert ☐ Multiple Culverts # _____ ☐ Ford ☐ Removed Structure

Material ☒ Metal ☒ Concrete ☐ Plastic ☐ Wood ☐ Stone ☐ Other (1) 2.5' CMP ; (2) 2.5' PCP

Specific Structure Type (see diagrams): ☒ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

Channel Width _____ ☐ Bankfull Width (*Preferred*) ☐ Wetted Width ☐ Measured ☐ Estimated

Inlet Condition Pick One ☐ At Stream Grade ☐ Inlet Drop ☒ Perched

☐ Deformed ☐ Beaver Fencing ☒ Blocked 25% 50% 75% 100% ~10% (Circle One)

Inlet Water Depth 2.3'

Upstream Substrate

☐ Bedrock ☐ Boulder ☒ Cobble ☐ Gravel

☒ Sand ☐ Clay ☒ Organic ☐ Unknown

A) Inlet Span _____ B) Inlet Clearance _____ C) Inlet Wetted Width _____

Outlet Condition Pick One ☒ At Stream Grade ☐ Perched ☐ Cascade ☐ Perched Above Cascade

Outlet Water Depth < 0.25' Outlet Drop _____

Tailwater Scour Pool ☐ Large ☐ Small ☒ None

Tailwater Pool Depth ☒ < 3 ft / 1 m ☐ > 3 ft / 1 m

Tailwater Armoring ☐ Extensive ☐ Not Extensive ☐ None

Downstream Substrate

☐ Bedrock ☐ Boulder ☒ Cobble ☒ Gravel

☐ Sand ☐ Clay ☐ Organic ☐ Unknown

A) Outlet Span _____ B) Outlet Clearance _____ C) Outlet Wetted Width _____

D) Crossing Structure Length _____ E) Abutment Height _____ Sliplined Culvert ☐ Yes ☒ No

Crossing Substrate ☐ None ☐ Comparable ☐ Contrasting ☒ Unknown ▶ Continuous ☐ Yes ☐ No ☐ Unknown

Internal Structures ☐ None ☐ Baffles / Weirs ☐ Bridge Piers ☐ Other ? Corrugations ☒ Yes ☒ No

Water Depth Matches Stream ☐ Yes/Comparable ☒ No Water Velocity Matches Stream ☐ Yes/Comparable ☒ No

Slope Compared to Channel Slope ☒ Higher ☐ Lower ☐ Same Alignment ☐ Flow-Aligned ☐ Skewed

Significant Sediment Source Upstream ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

Downstream ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

Wildlife Barriers ☐ None ☐ High Traffic Volume ☐ Steep Embankments ☐ Retaining Walls ☐ Jersey Barriers ☐ Fencing

Comments:

- OBSERVATION THROUGH PCP INDICATES ULTRA SHALLOW FLOW & NOT FP
- COVER ~ 3'

Fill Height _____

Condition ☐ Good ☐ Poor

Tidal Site ☐ Yes ☒ No ☐ Unsure

Units ☒ Feet ☐ Meters

# STREAM CROSSING SURVEY

Date 8/18/16 (mm/dd/yy) Time 10 : 30 Sequence # _____ Site ID MB-C02

Observer (s) Michael Chmielinski Organization STANTEC

Stream MARE BROOK Tributary to HARPSWELL COVE Town BRUNSWICK

Road BARROW STREET Type ☒ Paved ☐ Unpaved ☐ Railroad ☐ Trail ☐ Driveway

GPS Coordinates [WGS84 UTM Zone 19N Meters] 0 East _____ North _____

DeLorme Atlas Map # 6 Grid Reference C3 Location Description _____

Photo IDs Inlet _____ Outlet _____ Other _____ Flow ☒ Low ☐ High

Upstream _____ Downstream _____ ☐ Moderate ☐ NONE

Basic Structure Type ☐ Bridge ☒ Culvert ☐ Multiple Culverts # ____ ☐ Ford ☐ Removed Structure

Material ☒ Metal ☐ Concrete ☐ Plastic ☐ Wood ☐ Stone ☐ Other 4'Ø & 2.5'Ø

Specific Structure Type (see diagrams): ☒ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

Channel Width 15' ☐ Bankfull Width (*Preferred*) ☒ Wetted Width 4' ☐ Measured ☐ Estimated

Inlet Condition Pick One ☒ At Stream Grade ☐ Inlet Drop ☐ Perched

☐ Deformed ☐ Beaver Fencing ☐ Blocked 25% 50% 75% 100% (Circle One)

Inlet Water Depth 6"

Upstream Substrate

☐ Bedrock ☐ Boulder ☒ Cobble ☒ Gravel

☒ Sand ☐ Clay ☒ Organic ☐ Unknown

A) Inlet Span 4' B) Inlet Clearance _____ C) Inlet Wetted Width 4'

Outlet Condition Pick One ☐ At Stream Grade ☐ Perched ☐ Cascade ☐ Perched Above Cascade

Outlet Water Depth _____ Outlet Drop _____

Tailwater Scour Pool ☐ Large ☐ Small ☐ None

Tailwater Pool Depth ☐ < 3 ft / 1 m ☐ > 3 ft / 1 m

Tailwater Armoring ☐ Extensive ☐ Not Extensive ☐ None

Downstream Substrate

☐ Bedrock ☐ Boulder ☐ Cobble ☐ Gravel

☐ Sand ☐ Clay ☐ Organic ☐ Unknown

A) Outlet Span _____ B) Outlet Clearance _____ C) Outlet Wetted Width 2'

D) Crossing Structure Length _____ E) Abutment Height _____ Sliplined Culvert ☐ Yes ☒ No

Crossing Substrate ☐ None ☒ Comparable ☐ Contrasting ☐ Unknown ▶ Continuous ☐ Yes ☒ No ☐ Unknown

Internal Structures ☐ None ☐ Baffles / Weirs ☐ Bridge Piers ☐ Other DEBRIS Corrugations ☒ Yes ☐ No

Water Depth Matches Stream ☒ Yes/Comparable ☐ No Water Velocity Matches Stream ☒ Yes/Comparable ☐ No

Slope Compared to Channel Slope ☒ Higher ☐ Lower ☐ Same Alignment ☐ Flow-Aligned ☐ Skewed

Significant Sediment Source Upstream ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

Downstream ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

Wildlife Barriers ☐ None ☐ High Traffic Volume ☐ Steep Embankments ☐ Retaining Walls ☐ Jersey Barriers ☐ Fencing

Comments:

- 4'Ø recessed ~1.5' @ INLET
- 2.5' " ~1' @ " - BLOCKED
- ~ DROP of 0.75' to INLET
- ~1' DROP in SLOPE ~25' DS
- ~ DEBRIS (ROCK, LOG) in 4'Ø
- ~ MODEL CULVERT by BIGGER

- OUTLET DETERIORATED

Fill Height _____

Condition ☐ Good ☐ Poor

Tidal Site ☐ Yes ☒ No ☐ Unsure

Units ☒ Feet ☐ Meters

# STREAM CROSSING SURVEY

Date 8/18/16 (mm/dd/yy) Time 10 : 10 AM Sequence # _____ Site ID MB_C03

Observer (s) Michael Chelminski Organization STANTEC

Stream MAPLE BROOK Tributary to HARPSWELL COVE Town BRUNSWICK

Road MacMillan Drive Type ☒ Paved ☐ Unpaved ☐ Railroad ☐ Trail ☐ Driveway

GPS Coordinates [WGS84 UTM Zone 19N Meters] 0 East _____ North _____

DeLorme Atlas Map # 6 Grid Reference C3 Location Description _____

Photo IDs Inlet _____ Outlet _____ Other _____ Flow ☒ Low ☐ High

Upstream _____ Downstream _____ ☐ Moderate ☐ NONE

Basic Structure Type ☐ Bridge ☒ Culvert ☐ Multiple Culverts # 2 ☐ Ford ☐ Removed Structure

Material ☒ Metal ☐ Concrete ☐ Plastic ☐ Wood ☐ Stone ☐ Other CMP 4'Ø (R), 2.5'(L)

Specific Structure Type (see diagrams): ☒ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

Channel Width _____ ☐ Bankfull Width (*Preferred*) ☐ Wetted Width ☐ Measured ☐ Estimated

Inlet Condition Pick One ☐ At Stream Grade ☒ Inlet Drop ☐ Perched

☐ Deformed ☐ Beaver Fencing ☐ Blocked 25% 50% 75% 100% (Circle One)

Inlet Water Depth 1'

Upstream Substrate

☐ Bedrock ☐ Boulder ☒ Cobble ☒ Gravel

☒ Sand ☐ Clay ☒ Organic ☐ Unknown

A) Inlet Span _____ B) Inlet Clearance _____ C) Inlet Wetted Width _____

Outlet Condition Pick One ☒ At Stream Grade ☐ Perched ☐ Cascade ☐ Perched Above Cascade

Outlet Water Depth _____ Outlet Drop N/A

Tailwater Scour Pool ☐ Large ☒ Small ☐ None

Tailwater Pool Depth ☒ < 3 ft / 1 m ☐ > 3 ft / 1 m

Tailwater Armoring ☐ Extensive ☐ Not Extensive ☒ None

Downstream Substrate

☐ Bedrock ☐ Boulder ☒ Cobble ☒ Gravel

☒ Sand ☐ Clay ☐ Organic ☐ Unknown

A) Outlet Span _____ B) Outlet Clearance _____ C) Outlet Wetted Width _____

D) Crossing Structure Length _____ E) Abutment Height _____ Sliplined Culvert ☐ Yes ☒ No

Crossing Substrate ☐ None ☐ Comparable ☐ Contrasting ☐ Unknown ▶ Continuous ☐ Yes ☐ No ☒ Unknown

Internal Structures ☒ None ☐ Baffles / Weirs ☐ Bridge Piers ☐ Other _____ Corrugations ☒ Yes ☐ No

Water Depth Matches Stream ☒ Yes/Comparable ☐ No Water Velocity Matches Stream ☒ Yes/Comparable ☐ No

Slope Compared to Channel Slope ☐ Higher ☐ Lower ☒ Same Alignment ☒ Flow-Aligned ☐ Skewed

Significant Sediment Source Upstream ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

Downstream ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

Wildlife Barriers ☐ None ☐ High Traffic Volume ☐ Steep Embankments ☐ Retaining Walls ☐ Jersey Barriers ☐ Fencing

Comments: - Left culvert (2.5'Ø) ~1' Higher than right culvert (4'Ø)
- MASONRY INLET HEADWALL
- RUST

Fill Height 6'

Condition ☐ Good ☐ Poor

Tidal Site ☐ Yes ☒ No ☐ Unsure

Units ☒ Feet ☐ Meters

# STREAM CROSSING SURVEY

Date 9/18/16 (mm/dd/yy) Time 9 : 40 AM Sequence # _____ Site ID MB_C04

Observer (s) Michael Chelminski Organization SCANTEC

Stream MARE BROOK Tributary to HARPSWELL COVE Town BRUNSWICK

Road MAINE STREET Type ☒ Paved ☐ Unpaved ☐ Railroad ☐ Trail ☐ Driveway

GPS Coordinates [WGS84 UTM Zone 19N Meters] 0 East _____ North _____

DeLorme Atlas Map # 6 Grid Reference C3 Location Description _____

Photo IDs Inlet _____ Outlet _____ Other _____

Upstream _____ Downstream _____

Flow ☒ Low ☐ High ☐ Moderate ☐ NONE

Basic Structure Type ☐ Bridge ☒ Culvert ☐ Multiple Culverts # ____ ☐ Ford ☐ Removed Structure

Material ☒ Metal ☐ Concrete ☐ Plastic ☐ Wood ☐ Stone ☐ Other 6 lw x 3.5' H ellipse CMP

Specific Structure Type (see diagrams): ☒ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

Channel Width 20' US ☐ Bankfull Width (*Preferred*) ☐ Wetted Width ☐ Measured ☒ Estimated

Inlet Condition Pick One ☐ At Stream Grade ☐ Inlet Drop ☒ Perched

☐ Deformed ☐ Beaver Fencing ☐ Blocked 25% 50% 75% 100% (Circle One)

Inlet Water Depth < 2"

Upstream Substrate

☐ Bedrock ☐ Boulder ☒ Cobble ☒ Gravel

☒ Sand ☐ Clay ☒ Organic ☐ Unknown

A) Inlet Span _____ B) Inlet Clearance _____ C) Inlet Wetted Width 21' POOLED

Outlet Condition Pick One ☐ At Stream Grade ☒ Perched ☐ Cascade ☐ Perched Above Cascade

Outlet Water Depth 1.5' Outlet Drop ~1"

Tailwater Scour Pool ☐ Large ☒ Small ☐ None

Tailwater Pool Depth ☒ < 3 ft / 1 m ☐ > 3 ft / 1 m

Tailwater Armoring ☒ Extensive ☐ Not Extensive ☐ None

Downstream Substrate

☐ Bedrock ☐ Boulder ☒ Cobble ☒ Gravel

☐ Sand ☐ Clay ☐ Organic ☐ Unknown

A) Outlet Span _____ B) Outlet Clearance _____ C) Outlet Wetted Width _____

D) Crossing Structure Length _____ E) Abutment Height _____

Sliplined Culvert ☐ Yes ☒ No

Crossing Substrate ☒ None ☐ Comparable ☐ Contrasting ☐ Unknown ▶ Continuous ☐ Yes ☒ No ☐ Unknown

Internal Structures ☒ None ☐ Baffles / Weirs ☐ Bridge Piers ☐ Other _____

Corrugations ☒ Yes ☐ No TAR

Water Depth Matches Stream ☐ Yes/Comparable ☒ No Water Velocity Matches Stream ☐ Yes/Comparable ☒ No

Slope Compared to Channel Slope ☒ Higher ☐ Lower ☐ Same

Alignment ☐ Flow-Aligned ☐ Skewed

Significant Sediment Source Upstream ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

Downstream ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

Wildlife Barriers ☐ None ☐ High Traffic Volume ☐ Steep Embankments ☐ Retaining Walls ☐ Jersey Barriers ☐ Fencing

Comments:

- INLET CONTROLS US WSEL

Fill Height 3'

Condition ☐ Good ☒ Poor

Tidal Site ☐ Yes ☒ No ☐ Unsure

Units ☒ Feet ☐ Meters

# STREAM CROSSING SURVEY

Date 8/18/16 (mm/dd/yy) Time 9:55 AM Sequence # _____ Site ID MB-COS

Observer (s) Michael Chelminski Organization SCANTEC

Stream Mare Brook Tributary to Harpswell Cove Town Brunswick

Road Meadowbrook Road Type ☒ Paved ☐ Unpaved ☐ Railroad ☐ Trail ☐ Driveway

GPS Coordinates [WGS84 UTM Zone 19N Meters] 0 East North

DeLorme Atlas Map # 6 Grid Reference C3 Location Description _____

Photo IDs Inlet _____ Outlet _____ Other _____ Flow ☒ Low ☐ High

Upstream _____ Downstream _____ ☐ Moderate ☐ NONE

Basic Structure Type ☐ Bridge ☒ Culvert ☐ Multiple Culverts # ____ ☐ Ford ☐ Removed Structure

Material ☒ Metal ☐ Concrete ☐ Plastic ☐ Wood ☐ Stone ☐ Other 3'4" H x 4'8" W Ellipse Alum

Specific Structure Type (see diagrams): ☒ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

Channel Width 10 ☐ Bankfull Width (*Preferred*) ☐ Wetted Width ☐ Measured ☒ Estimated BANKED

Inlet Condition Pick One ☐ At Stream Grade ☐ Inlet Drop ☒ Perched

☐ Deformed ☐ Beaver Fencing ☐ Blocked 25% 50% 75% 100%

Inlet Water Depth US-6" / 2" in culvert, perched ~4" (Circle One)

Upstream Substrate

☐ Bedrock ☐ Boulder ☐ Cobble ☐ Gravel

☒ Sand ☐ Clay ☐ Organic ☐ Unknown

A) Inlet Span _____ B) Inlet Clearance _____ C) Inlet Wetted Width 21

Outlet Condition Pick One ☒ At Stream Grade ☐ Perched ☐ Cascade ☐ Perched Above Cascade

Outlet Water Depth 1' Outlet Drop _____ Culvert invert ~ 1' Below DS WSOL

Tailwater Scour Pool ☐ Large ☒ Small ☐ None

Tailwater Pool Depth ☒ < 3 ft / 1 m ☐ > 3 ft / 1 m

Tailwater Armoring ☐ Extensive ☐ Not Extensive ☒ None

Downstream Substrate

☐ Bedrock ☐ Boulder ☐ Cobble ☒ Gravel

☒ Sand ☐ Clay ☐ Organic ☐ Unknown

A) Outlet Span _____ B) Outlet Clearance _____ C) Outlet Wetted Width 4'8" (full width)

D) Crossing Structure Length _____ E) Abutment Height _____ Sliplined Culvert ☐ Yes ☒ No

Crossing Substrate ☒ None ☐ Comparable ☐ Contrasting ☐ Unknown ▶ Continuous ☐ Yes ☒ No ☐ Unknown

Internal Structures ☒ None ☐ Baffles / Weirs ☐ Bridge Piers ☐ Other _____ Corrugations ☒ Yes ☐ No

Water Depth Matches Stream ☒ Yes/Comparable ☐ No Water Velocity Matches Stream ☒ Yes/Comparable ☐ No

Slope Compared to Channel Slope ☒ Higher ☐ Lower ☐ Same Alignment ☐ Flow-Aligned ☐ Skewed

Significant Sediment Source Upstream ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

Downstream ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

Wildlife Barriers ☐ None ☐ High Traffic Volume ☐ Steep Embankments ☐ Retaining Walls ☐ Jersey Barriers ☐ Fencing

Comments: Some riffle in US ~10'

Fill Height 8'

Condition ☒ Good ☐ Poor

Tidal Site ☐ Yes ☒ No ☐ Unsure

Units ☒ Feet ☐ Meters

# STREAM CROSSING SURVEY

Date 8/18/16 (mm/dd/yy) Time 9:20 AM Sequence # _____ Site ID MB_D01

Observer (s) Michael Chelminski Organization STANTEC

Stream MARC BROOK Tributary to HARWELL COVE Town BRUNSWICK

Road N/A : COFFIN POND DAM Type ~~☐ Paved ☐ Unpaved ☐ Railroad~~ ☐ Trail ☐ Driveway TRAIL

GPS Coordinates [WGS84 UTM Zone 19N Meters] 0 _____ East _____ North

DeLorme Atlas Map # 6 Grid Reference C3 Location Description _____

Photo IDs Inlet _____ Outlet _____ Other _____

Upstream _____ Downstream _____

Flow ☒ Low ☐ High ☐ Moderate ☐ NONE

Basic Structure Type ☐ Bridge ☐ Culvert ☐ Multiple Culverts # ____ ☐ Ford ☐ Removed Structure

Material ☐ Metal ☐ Concrete ☐ Plastic ☐ Wood ☐ Stone ☐ Other _____

Specific Structure Type (see diagrams): ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

Channel Width _____ ☐ Bankfull Width (*Preferred*) ☐ Wetted Width ☐ Measured ☐ Estimated

Inlet Condition Pick One ☐ At Stream Grade ☐ Inlet Drop ☐ Perched

☐ Deformed ☐ Beaver Fencing ☐ Blocked 25% 50% 75% 100% (Circle One)

Inlet Water Depth _____

Upstream Substrate

☐ Bedrock ☐ Boulder ☐ Cobble ☐ Gravel

☐ Sand ☐ Clay ☐ Organic ☐ Unknown

A) Inlet Span _____ B) Inlet Clearance _____ C) Inlet Wetted Width _____

Outlet Condition Pick One ☐ At Stream Grade ☐ Perched ☐ Cascade ☐ Perched Above Cascade

Outlet Water Depth _____ Outlet Drop _____

Tailwater Scour Pool ☐ Large ☐ Small ☐ None

Tailwater Pool Depth ☐ < 3 ft / 1 m ☐ > 3 ft / 1 m

Tailwater Armoring ☐ Extensive ☐ Not Extensive ☐ None

Downstream Substrate

☐ Bedrock ☐ Boulder ☐ Cobble ☐ Gravel

☐ Sand ☐ Clay ☐ Organic ☐ Unknown

A) Outlet Span _____ B) Outlet Clearance _____ C) Outlet Wetted Width _____

D) Crossing Structure Length _____ E) Abutment Height _____ Sliplined Culvert ☐ Yes ☐ No

Crossing Substrate ☐ None ☐ Comparable ☐ Contrasting ☐ Unknown ▶ Continuous ☐ Yes ☐ No ☐ Unknown

Internal Structures ☐ None ☐ Baffles / Weirs ☐ Bridge Piers ☐ Other _____ Corrugations ☐ Yes ☐ No

Water Depth Matches Stream ☐ Yes/Comparable ☐ No Water Velocity Matches Stream ☐ Yes/Comparable ☐ No

Slope Compared to Channel Slope ☐ Higher ☐ Lower ☐ Same Alignment ☐ Flow-Aligned ☐ Skewed

Significant Sediment Source Upstream ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

Downstream ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

Wildlife Barriers ☐ None ☐ High Traffic Volume ☐ Steep Embankments ☐ Retaining Walls ☐ Jersey Barriers ☐ Fencing

Comments:

HYDRAULIC HEIGHT:

3' @ SPILLWAY

+ 2' AT Cobble Riprap

Σ = 5'

- POOR CONDITION
- BARRIER EXCEPT FOR ANGUILLA ROSTRATA

Fill Height _____

Condition ☐ Good ☒ Poor

Tidal Site ☐ Yes ~~☒~~ No ☐ Unsure

Units ☐ Feet ☐ Meters

# STREAM CROSSING SURVEY

**Date** 8/18/16 (mm/dd/yy) **Time** 9:00 AM **Sequence #** _____ **Site ID** MB_C06

**Observer (s)** Michael Chelminski **Organization** STANTEC

**Stream** Mare Brook **Tributary to** HARPSWELL COVE **Town** BRUNSWICK

**Road** State Route 123 **Type** ☒ Paved ☐ Unpaved ☐ Railroad ☐ Trail ☐ Driveway

**GPS Coordinates** [WGS84 UTM Zone 19N Meters] 0 **East** _____ **North**

**DeLorme Atlas Map #** 6 **Grid Reference** C3 **Location Description** _____

**Photo IDs** Inlet _____ Outlet _____ Other _____ Upstream _____ Downstream _____

**Flow** ☒ Low ☐ High ☐ Moderate ☐ NONE

**Basic Structure Type** ☐ Bridge ☒ Culvert ☐ Multiple Culverts # _____ ☐ Ford ☐ Removed Structure

**Material** ☒ Metal ☐ Concrete ☐ Plastic ☐ Wood ☐ Stone ☐ Other 5'Ø CMP

**Specific Structure Type (see diagrams):** ☒ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

**Channel Width** _____ ☐ **Bankfull Width** (*Preferred*) ☐ Wetted Width ☐ **Measured** ☒ **Estimated**

**Inlet Condition** Pick One ☒ At Stream Grade ☐ Inlet Drop ☐ Perched

☐ Deformed ☒ Beaver Fencing ☒ Blocked (25%) 50% 75% 100% (Circle One)

**Inlet Water Depth** FAILED 1' US / 2-5' in Culvert

**Upstream Substrate** US > 30'

☐ Bedrock ☐ Boulder ☐ Cobble ☐ Gravel ☒ Sand ☐ Clay ☐ Organic ☐ Unknown

**A) Inlet Span** _____ **B) Inlet Clearance** _____ **C) Inlet Wetted Width** _____

**Outlet Condition** Pick One ☐ At Stream Grade ☒ Perched ☐ Cascade ☐ Perched Above Cascade ~4" Hydraulic

**Outlet Water Depth** _____ **Outlet Drop** 4"

**Tailwater Scour Pool** ☒ Large ☐ Small ☐ None

**Tailwater Pool Depth** ☐ < 3 ft / 1 m ☒ > 3 ft / 1 m ~3'

**Tailwater Armoring** ☐ Extensive ☒ Not Extensive ☐ None

**Downstream Substrate**

☐ Bedrock ☐ Boulder ☒ Cobble ☒ Gravel ☒ Sand ☐ Clay ☐ Organic ☐ Unknown

**A) Outlet Span** _____ **B) Outlet Clearance** _____ **C) Outlet Wetted Width** _____

**D) Crossing Structure Length** _____ **E) Abutment Height** _____ **Sliplined Culvert** ☐ Yes ☒ No

**Crossing Substrate** ☒ None ☐ Comparable ☐ Contrasting ☐ Unknown ▶ **Continuous** ☐ Yes ☒ No ☐ Unknown

**Internal Structures** ☐ None ☐ Baffles / Weirs ☐ Bridge Piers ☐ Other Struts **Corrugations** ☒ Yes ☐ No

**Water Depth Matches Stream** ☐ Yes/Comparable ☒ No **Water Velocity Matches Stream** ☐ Yes/Comparable ☒ No

**Slope Compared to Channel Slope** ☒ Higher ☐ Lower ☐ Same **Alignment** ☐ Flow-Aligned ☐ Skewed

**Significant Sediment Source** **Upstream** ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

**Downstream** ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

**Wildlife Barriers** ☐ None ☐ High Traffic Volume ☐ Steep Embankments ☐ Retaining Walls ☐ Jersey Barriers ☐ Fencing

**Comments:**

- Apparent Slope & Bankfull Width
- Struts In Culvert
- Debris In Culvert

**Fill Height** 12'

**Condition** ☐ Good ☒ Poor

**Tidal Site** ☐ Yes ☒ No ☐ Unsure

**Units** ☒ Feet ☐ Meters

# STREAM CROSSING SURVEY

**Date** 8/18/16 (mm/dd/yy) **Time** 8 : 35 AM **Sequence #** _____ **Site ID** MB-C07

**Observer (s)** Michael Chelminski **Organization** Stantec

**Stream** Mare Brook **Tributary to** HARPSWELL COVE **Town** Brunswick

**Road** SECURITY ROAD **Type** ☐ Paved ☒ Unpaved ☐ Railroad ☐ Trail ☐ Driveway

**GPS Coordinates** [WGS84 UTM Zone 19N Meters] 0 **East** _____ **North**

**DeLorme Atlas Map #** 6 **Grid Reference** C3 **Location Description** _____

**Photo IDs** Inlet _____ Outlet _____ Other _____ Upstream _____ Downstream _____

**Flow** ☒ Low ☐ High ☐ Moderate ☐ NONE

**Basic Structure Type** ☐ Bridge ☒ Culvert ☐ Multiple Culverts # 2 ☐ Ford ☐ Removed Structure

**Material** ☐ Metal ☐ Concrete ☒ Plastic ☐ Wood ☐ Stone ☐ Other SMOOTH-BORE, 4' Ø

**Specific Structure Type (see diagrams):** ☒ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

**Channel Width** _____ ☐ **Bankfull Width** (*Preferred*) ☐ Wetted Width ☐ **Measured** ☐ **Estimated**

**Inlet Condition** (Pick One) ☐ At Stream Grade ☐ Inlet Drop ☐ Perched ☐ Deformed ☐ Beaver Fencing ☐ Blocked 25% 50% 75% 100% (Circle One) SECURITY

**Inlet Water Depth** _____ DEBRIS ~1'

**Upstream Substrate**
☐ Bedrock ☐ Boulder ☐ Cobble ☐ Gravel ☒ Sand ☐ Clay ☐ Organic ☐ Unknown

**A) Inlet Span** _____ **B) Inlet Clearance** _____ **C) Inlet Wetted Width** _____

**Outlet Condition** (Pick One) ☐ At Stream Grade ☒ Perched ☐ Cascade ☐ Perched Above Cascade ~0.5'

**Outlet Water Depth** 1.5' **Outlet Drop** ~0.5' Hydraulic

**Tailwater Scour Pool** ☐ Large ☐ Small ☐ None

**Tailwater Pool Depth** ☒ < 3 ft / 1 m ☐ > 3 ft / 1 m ~1.5'

**Tailwater Armoring** ☐ Extensive ☒ Not Extensive ☐ None

**Downstream Substrate**
☐ Bedrock ☐ Boulder ☒ Cobble ☒ Gravel ☐ Sand ☐ Clay ☐ Organic ☐ Unknown

**A) Outlet Span** _____ **B) Outlet Clearance** _____ **C) Outlet Wetted Width** _____

**D) Crossing Structure Length** _____ **E) Abutment Height** _____ **Sliplined Culvert** ☐ Yes ☒ No

**Crossing Substrate** ☒ None ☐ Comparable ☐ Contrasting ☐ Unknown ▶ **Continuous** ☐ Yes ☐ No ☐ Unknown N/A

**Internal Structures** ☒ None ☐ Baffles / Weirs ☐ Bridge Piers ☐ Other _____ **Corrugations** ☐ Yes ☒ No

**Water Depth Matches Stream** ☐ Yes/Comparable ☒ No **Water Velocity Matches Stream** ☐ Yes/Comparable ☒ No

**Slope Compared to Channel Slope** ☒ Higher ☐ Lower ☐ Same **Alignment** ☐ Flow-Aligned ☐ Skewed

**Significant Sediment Source** **Upstream** ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None
**Downstream** ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

**Wildlife Barriers** ☐ None ☐ High Traffic Volume ☐ Steep Embankments ☐ Retaining Walls ☐ Jersey Barriers ☐ Fencing

**Comments:**

**Fill Height** 8'

**Condition** ☒ Good ☐ Poor

**Tidal Site** ☐ Yes ☒ No ☐ Unsure

**Units** ☒ Feet ☐ Meters

# STREAM CROSSING SURVEY

**Date** 8/18/16 (mm/dd/yy) **Time** 8 :15 AM **Sequence #** _____ **Site ID** MB_C08

**Observer (s)** Michael Chelminski **Organization** STANTEC

**Stream** MARCH BROOK **Tributary to** HARPSWELL COVE **Town** BRUNSWICK

**Road** SAMUEL ADAMS DRIVE **Type** ☒ Paved ☐ Unpaved ☐ Railroad ☐ Trail ☐ Driveway

**GPS Coordinates** [WGS84 UTM Zone 19N Meters] 0 **East** _____ **North**

**DeLorme Atlas Map #** 6 **Grid Reference** C3 **Location Description** _____

**Photo IDs** Inlet _____ Outlet _____ Other _____ Upstream _____ Downstream _____

**Flow** ☒ Low ☐ High ☐ Moderate ☐ NONE

**Basic Structure Type** ☐ Bridge ☒ Culvert ☐ Multiple Culverts # 2 ☐ Ford ☐ Removed Structure

**Material** ☒ Metal ☒ Concrete ☐ Plastic ☐ Wood ☐ Stone ☐ Other 6' Ø

**Specific Structure Type (see diagrams):** ☒ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

**Channel Width** _____ ☐ **Bankfull Width** (*Preferred*) ☐ Wetted Width ☐ **Measured** ☐ **Estimated**

**Inlet Condition** Pick One ☐ At Stream Grade ☐ Inlet Drop ☐ Perched ☐ Deformed ☒ Beaver Fencing (SECURITY) ☒ Blocked 25% 50% 75% 100% (Circle One) < 10%

**Inlet Water Depth** 0.9'

**Upstream Substrate**
☐ Bedrock ☐ Boulder ☐ Cobble ☐ Gravel ☒ Sand ☐ Clay ☐ Organic ☐ Unknown

**A) Inlet Span** 5' **B) Inlet Clearance** _____ **C) Inlet Wetted Width** 5'

**Outlet Condition** Pick One ☐ At Stream Grade ☐ Perched ☐ Cascade ☐ Perched Above Cascade

**Outlet Water Depth** 1' **Outlet Drop** ~2"

**Tailwater Scour Pool** ☐ Large ☒ Small ☐ None

**Tailwater Pool Depth** ☒ < 3 ft / 1 m ☐ > 3 ft / 1 m

**Tailwater Armoring** ☐ Extensive ☒ Not Extensive ☐ None

**Downstream Substrate**
☐ Bedrock ☐ Boulder ☒ Cobble ☐ Gravel ☒ Sand ☐ Clay ☐ Organic ☐ Unknown

**A) Outlet Span** _____ **B) Outlet Clearance** _____ **C) Outlet Wetted Width** 5'

**D) Crossing Structure Length** _____ **E) Abutment Height** _____ **Sliplined Culvert** ☐ Yes ☐ No

**Crossing Substrate** ☐ None ☒ Comparable ☐ Contrasting ☐ Unknown ▶ **Continuous** (SAND) ☒ Yes ☐ No ☐ Unknown

**Internal Structures** ☒ None ☐ Baffles / Weirs ☐ Bridge Piers ☐ Other _____ **Corrugations** ☐ Yes ☒ No

**Water Depth Matches Stream** ☒ Yes/Comparable ☐ No **Water Velocity Matches Stream** ☒ Yes/Comparable ☐ No

**Slope Compared to Channel Slope** ☐ Higher ☐ Lower ☒ Same **Alignment** ☐ Flow-Aligned ☐ Skewed

**Significant Sediment Source** **Upstream** ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None
**Downstream** ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

**Wildlife Barriers** ☐ None ☐ High Traffic Volume ☐ Steep Embankments ☐ Retaining Walls ☐ Jersey Barriers ☐ Fencing

**Comments:**
- Right culvert perched ~1' @ outlet. and @ ~3' at Inlet.
- BACKWATERED THROUGH LOFT BARRIER
- SECURITY GRATE NOT A BARRIER TO USFP.

**Fill Height** 15'

**Condition** ☒ Good ☐ Poor

**Tidal Site** ☐ Yes ☒ No ☐ Unsure

**Units** ☒ Feet ☐ Meters

# STREAM CROSSING SURVEY

**Date** 8/18/16 (mm/dd/yy) **Time** 7:55 AM **Sequence #** _____ **Site ID** MB-C09

**Observer (s)** Michael Chelminsky **Organization** STANTEC

**Stream** Mare Brook **Tributary to** Harpswell Cove **Town** Brunswick

**Road** Runway Culvert Exit **Type** ☒ Paved ☐ Unpaved ☐ Railroad ☐ Trail ☐ Driveway

**GPS Coordinates** [WGS84 UTM Zone 19N Meters] 0 **East** _____ **North**

**DeLorme Atlas Map #** 6 **Grid Reference** C3 **Location Description** _____

**Photo IDs** Inlet _____ Outlet _____ Other _____ Upstream _____ Downstream _____

**Flow** ☒ Low ☐ High ☐ Moderate ☐ NONE

**Basic Structure Type** ☐ Bridge ☒ Culvert ☐ Multiple Culverts # 3 ☐ Ford ☐ Removed Structure

**Material** ☐ Metal ☒ Concrete ☐ Plastic ☐ Wood ☐ Stone ☐ Other 6' ϕ

**Specific Structure Type (see diagrams):** ☒ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

**Channel Width** 12' ☐ **Bankfull Width** (*Preferred*) ☒ Wetted Width ☐ **Measured** ☒ **Estimated**

**Inlet Condition** Pick One ☐ At Stream Grade ☒ Inlet Drop ~1' ☐ Perched ☐ Deformed ☒ Beaver Fencing ☒ Blocked 25% 50% 75% >100% (Circle One)

**Inlet Water Depth** 14"

**Upstream Substrate**
☐ Bedrock ☐ Boulder ☐ Cobble ☐ Gravel ☒ Sand ☐ Clay ☐ Organic ☐ Unknown

**A) Inlet Span** 18' **B) Inlet Clearance** 18' **C) Inlet Wetted Width** 18'

**Outlet Condition** Pick One @ 1500 PM ☒ At Stream Grade ☐ Perched ☐ Cascade ☐ Perched Above Cascade

**Outlet Water Depth** _____ **Outlet Drop** _____ UNCONSOLIDATED SAND

**Tailwater Scour Pool** ☒ Large ☐ Small ☐ None WIDE & SHALLOW

**Tailwater Pool Depth** ☒ < 3 ft / 1 m ☐ > 3 ft / 1 m ~0.5'

**Tailwater Armoring** ☐ Extensive ☒ Not Extensive ☐ None

**Downstream Substrate**
☐ Bedrock ☐ Boulder ☐ Cobble ☐ Gravel ☒ Sand ☐ Clay ☐ Organic ☐ Unknown

**A) Outlet Span** _____ **B) Outlet Clearance** _____ **C) Outlet Wetted Width** 25'

**D) Crossing Structure Length** _____ **E) Abutment Height** _____ **Sliplined Culvert** ☐ Yes ☒ No

**Crossing Substrate** ☐ None ☐ Comparable ☐ Contrasting ☒ Unknown ▶ **Continuous** ☐ Yes ☐ No ☒ Unknown

**Internal Structures** ☐ None ☐ Baffles / Weirs ☐ Bridge Piers ☐ Other UNKNOWN **Corrugations** ☐ Yes ☒ No

**Water Depth Matches Stream** ☐ Yes/Comparable ☒ No **Water Velocity Matches Stream** ☐ Yes/Comparable ☒ No

**Slope Compared to Channel Slope** ~~☐ Higher ☐ Lower ☐ Same~~ **Alignment** ☐ Flow-Aligned ☐ Skewed

**Significant Sediment Source** **Upstream** ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

**Downstream** ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

**Wildlife Barriers** ☐ None ☐ High Traffic Volume ☐ Steep Embankments ☐ Retaining Walls ☐ Jersey Barriers ☐ Fencing

**Comments:**

**Fill Height** ~40'

**Condition** ☐ Good ☐ Poor

**Tidal Site** ☐ Yes ☒ No ☐ Unsure

**Units** ☐ Feet ☐ Meters

# STREAM CROSSING SURVEY

Date 8/15/16 (mm/dd/yy) Time 1:30 Sequence # _____ Site ID MB_C10

Observer (s) Michael Chelminski Organization SCANTEC

Stream MARS Brook Tributary to HARPSWELL COVE Town Brunswick

Road MAJ. POND Ave. Type ☒ Paved ☐ Unpaved ☐ Railroad ☐ Trail ☐ Driveway

GPS Coordinates [WGS84 UTM Zone 19N Meters] 0 East North

DeLorme Atlas Map # 6 Grid Reference C3 Location Description _____

Photo IDs Inlet _____ Outlet _____ Other _____

Upstream _____ Downstream _____

Flow ☒ Low ☐ High ☐ Moderate ☐ NONE

Basic Structure Type ☐ Bridge ☒ Culvert ☐ Multiple Culverts # ____ ☐ Ford ☐ Removed Structure

Material ☒ Metal ☐ Concrete ☐ Plastic ☐ Wood ☐ Stone ☐ Other 10' Ø CMP

Specific Structure Type (see diagrams): ☒ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

Channel Width 12 ☐ Bankfull Width (*Preferred*) ☐ Wetted Width ☐ Measured ☐ Estimated

Inlet Condition Pick One ☒ At Stream Grade ☐ Inlet Drop ☐ Perched

☐ Deformed ☐ ~~Beaver~~ Security Fencing ☐ Blocked 25% 50% 75% 100% (Circle One)

Inlet Water Depth 1'

Upstream Substrate

☐ Bedrock ☐ Boulder ☐ Cobble ☐ Gravel

☒ Sand ☐ Clay ☐ Organic ☐ Unknown

A) Inlet Span _____ B) Inlet Clearance _____ C) Inlet Wetted Width 9'

Outlet Condition Pick One ☐ At Stream Grade ☒ Perched ☐ Cascade ☒ Perched Above Cascade 1'

Outlet Water Depth Rubble to Pool Outlet Drop _____

1.5' @ DS DEBRIS Screen

Tailwater Scour Pool ☐ Large ☐ Small ☐ None

Tailwater Pool Depth ☐ < 3 ft / 1 m ☒ > 3 ft / 1 m

Tailwater Armoring ☐ Extensive ☒ Not Extensive ☐ None

Downstream Substrate

☐ Bedrock ☒ Boulder ☒ Cobble ☐ Gravel

☒ Sand ☐ Clay ☐ Organic ☐ Unknown

A) Outlet Span _____ B) Outlet Clearance _____ C) Outlet Wetted Width _____

D) Crossing Structure Length _____ E) Abutment Height _____ Sliplined Culvert ☐ Yes ☒ No

Crossing Substrate ☒ None ☐ Comparable ☐ Contrasting ☐ Unknown ▶ Continuous ~~☐ Yes ☐ No ☐ Unknown~~

Internal Structures ☐ None ☐ Baffles / Weirs ☐ Bridge Piers ☐ Other DEBRIS

Corrugations ☒ Yes ☐ No

Water Depth Matches Stream ☐ Yes/Comparable ☒ No Water Velocity Matches Stream ☐ Yes/Comparable ☒ No

Slope Compared to Channel Slope ☒ Higher ☐ Lower ☐ Same

Alignment ☐ Flow-Aligned ☐ Skewed

Significant Sediment Source Upstream ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

Downstream ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

Wildlife Barriers ☐ None ☐ High Traffic Volume ☐ Steep Embankments ☐ Retaining Walls ☐ Jersey Barriers ☐ Fencing

Comments:

Fill Height 6'

Condition ☐ Good ☐ Poor

Tidal Site ☐ Yes ☒ No ☐ Unsure

Units ☒ Feet ☐ Meters

# STREAM CROSSING SURVEY

**Date** 8/18/16 (mm/dd/yy) **Time** 2:00 **Sequence #** _____ **Site ID** MB_C11

**Observer (s)** Michael Chelminski **Organization** STANTEC

**Stream** MAPLE BROOK **Tributary to** HARPSWELL GUT **Town** BRUNSWICK

**Road** LIBERTY CROSSING DRIVE **Type** ☒ Paved ☐ Unpaved ☐ Railroad ☐ Trail ☐ Driveway

**GPS Coordinates** [WGS84 UTM Zone 19N Meters] 0 _____ **East** _____ **North**

**DeLorme Atlas Map #** 6 **Grid Reference** C3 **Location Description** _____

**Photo IDs** Inlet _____ Outlet _____ Other _____ Upstream _____ Downstream _____

**Flow** ☒ Low ☐ High ☐ Moderate ☐ NONE

**Basic Structure Type** ☐ Bridge ☒ Culvert ☐ Multiple Culverts # ____ ☐ Ford ☐ Removed Structure

**Material** ☐ Metal ☒ Concrete ☐ Plastic ☐ Wood ☐ Stone ☐ Other 9'x9' CIP Box

**Specific Structure Type (see diagrams):** ☐ 1 ☐ 2 ☐ 3 ☒ 4 ☐ 5 ☐ 6 ☐ 7

**Channel Width** 20 ☒ **Bankfull Width** (*Preferred*) ☐ Wetted Width ☐ **Measured** ☒ **Estimated**

**Inlet Condition** Pick One ☒ At Stream Grade ☐ Inlet Drop ☐ Perched ☐ Deformed ☐ Beaver Fencing ☐ Blocked 25% 50% 75% 100% (Circle One)

**Inlet Water Depth** 0.5' (tidal)

**Upstream Substrate** ☐ Bedrock ☐ Boulder ☐ Cobble ☐ Gravel ☒ Sand ☐ Clay ☐ Organic ☐ Unknown

**A) Inlet Span** _____ **B) Inlet Clearance** _____ **C) Inlet Wetted Width** 9'

**Outlet Condition** Pick One ☐ At Stream Grade ☐ Perched ☐ Cascade ☐ Perched Above Cascade

**Outlet Water Depth** 0.5' (tidal) **Outlet Drop** up to 5'? w/ Tide?

**Tailwater Scour Pool** ☒ Large ☐ Small ☐ None

**Tailwater Pool Depth** ☐ < 3 ft / 1 m ☒ > 3 ft / 1 m

**Tailwater Armoring** ☐ Extensive ☒ Not Extensive ☐ None

**Downstream Substrate** ☐ Bedrock ☒ Boulder ☒ Cobble ☐ Gravel ☒ Sand ☐ Clay ☐ Organic ☐ Unknown

**A) Outlet Span** _____ **B) Outlet Clearance** _____ **C) Outlet Wetted Width** 9'

**D) Crossing Structure Length** _____ **E) Abutment Height** _____ **Sliplined Culvert** ☐ Yes ☒ No

**Crossing Substrate** ☒ None ☐ Comparable ☐ Contrasting ☐ Unknown ▶ **Continuous** ~~☐ Yes ☐ No ☐ Unknown~~

**Internal Structures** ☐ None ☐ Baffles / Weirs ☐ Bridge Piers ☐ Other _____ **Corrugations** ☐ Yes ☐ No

**Water Depth Matches Stream** ☐ Yes/Comparable ☐ No **Water Velocity Matches Stream** ☐ Yes/Comparable ☐ No

**Slope Compared to Channel Slope** ☐ Higher ☐ Lower ☐ Same **Alignment** ☐ Flow-Aligned ☐ Skewed

**Significant Sediment Source** **Upstream** ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

**Downstream** ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

**Wildlife Barriers** ☐ None ☐ High Traffic Volume ☐ Steep Embankments ☐ Retaining Walls ☐ Jersey Barriers ☐ Fencing

**Comments:**

- TIDAL SITE
- FORMER BRIDGE / DAM UPSTREAM

**Fill Height** 2'

**Condition** ☒ Good ☐ Poor

**Tidal Site** ☒ Yes ☐ No ☐ Unsure

**Units** ☒ Feet ☐ Meters

# STREAM CROSSING SURVEY

Date 8/18/18 (mm/dd/yy) Time 3 : 00 Sequence # _____ Site ID MS_C01

Observer (s) Michael Chwalinski Organization STANTEC

Stream MUSKRIDGEWORK Str Tributary to MUSK BROOK Town BRUNSWICK

Road BUNKER DAM DRIVE Type ☒ Paved ☐ Unpaved ☐ Railroad ☐ Trail ☐ Driveway

GPS Coordinates [WGS84 UTM Zone 19N Meters] 0 ☐☐☐☐☐☐ East ☐☐☐☐☐☐☐ North

DeLorme Atlas Map # 6 Grid Reference C3 Location Description _____

Photo IDs Inlet _____ Outlet _____ Other _____ Flow ☐ Low ☐ High

Upstream _____ Downstream _____ ☐ Moderate ☐ NONE

Basic Structure Type? ☐ Bridge ☐ Culvert ☐ Multiple Culverts # ____ ☐ Ford ☐ Removed Structure

Material 2, ☐ Metal ☐ Concrete ☐ Plastic ☐ Wood ☐ Stone ☐ Other _____

Specific Structure Type (see diagrams): ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

Channel Width _____ ☐ Bankfull Width (*Preferred*) ☐ Wetted Width ☐ Measured ☐ Estimated

Inlet Condition Pick One ☐ At Stream Grade ☐ Inlet Drop ☐ Perched

☐ Deformed ☐ Beaver Fencing ☐ Blocked 25% 50% 75% 100% (Circle One)

Inlet Water Depth _____

Upstream Substrate

☐ Bedrock ☐ Boulder ☐ Cobble ☐ Gravel

☐ Sand ☐ Clay ☐ Organic ☐ Unknown

A) Inlet Span _____ B) Inlet Clearance _____ C) Inlet Wetted Width _____

Outlet Condition Pick One ☐ At Stream Grade ☐ Perched ☐ Cascade ☐ Perched Above Cascade

Outlet Water Depth _____ Outlet Drop _____

Tailwater Scour Pool ☐ Large ☐ Small ☐ None

Tailwater Pool Depth ☐ < 3 ft / 1 m ☐ > 3 ft / 1 m

Tailwater Armoring ☐ Extensive ☐ Not Extensive ☐ None

Downstream Substrate

☐ Bedrock ☐ Boulder ☐ Cobble ☐ Gravel

☐ Sand ☐ Clay ☐ Organic ☐ Unknown

A) Outlet Span _____ B) Outlet Clearance _____ C) Outlet Wetted Width _____

D) Crossing Structure Length _____ E) Abutment Height _____ Sliplined Culvert ☐ Yes ☐ No

Crossing Substrate ☐ None ☐ Comparable ☐ Contrasting ☐ Unknown ▶ Continuous ☐ Yes ☐ No ☐ Unknown

Internal Structures ☐ None ☐ Baffles / Weirs ☐ Bridge Piers ☐ Other _____ Corrugations ☐ Yes ☐ No

Water Depth Matches Stream ☐ Yes/Comparable ☐ No Water Velocity Matches Stream ☐ Yes/Comparable ☐ No

Slope Compared to Channel Slope ☐ Higher ☐ Lower ☐ Same Alignment ☐ Flow-Aligned ☐ Skewed

Significant Sediment Source Upstream ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

Downstream ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

Wildlife Barriers ☐ None ☐ High Traffic Volume ☐ Steep Embankments ☐ Retaining Walls ☐ Jersey Barriers ☐ Fencing

Comments: NO CONDUIT OBSERVED AT INLET OR OUTLET!

Fill Height _____ Units

Condition ☐ Good ☐ Poor ☐ Feet

Tidal Site ☐ Yes ☐ No ☐ Unsure ☐ Meters

# STREAM CROSSING SURVEY

Date 8/18/16 (mm/dd/yy) Time 2:20 PM Sequence # _____ Site ID MS_D01

Observer (s) Michael Chelminski Organization STANTEC

Stream Muscongus Str Tributary to Mare Brook Town Brunswick

Road Picnic Pond Dam Type ☐ Paved ☐ Unpaved ☐ Railroad ☐ Trail ☐ Driveway

GPS Coordinates [WGS84 UTM Zone 19N Meters] 0 East North

DeLorme Atlas Map # 6 Grid Reference C3 Location Description DAM @ Picnic Pond

Photo IDs Inlet _____ Outlet _____ Other _____ Flow ☐ Low ☐ High

Upstream _____ Downstream _____ ☐ Moderate ☐ NONE

**Basic Structure Type** ☐ Bridge ☐ Culvert ☐ Multiple Culverts # ____ ☐ Ford ☐ Removed Structure

**Material** ☐ Metal ☐ Concrete ☐ Plastic ☐ Wood ☐ Stone ☐ Other _____

**Specific Structure Type (see diagrams):** ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

**Channel Width** _____ ☐ **Bankfull Width** (*Preferred*) ☐ Wetted Width ☐ **Measured** ☐ **Estimated**

**Inlet Condition** (Pick One) ☐ At Stream Grade ☐ Inlet Drop ☐ Perched

☐ Deformed ☐ Beaver Fencing ☐ Blocked 25% 50% 75% 100% (Circle One)

**Inlet Water Depth** _____

**Upstream Substrate**

☐ Bedrock ☐ Boulder ☐ Cobble ☐ Gravel

☐ Sand ☐ Clay ☐ Organic ☐ Unknown

**A) Inlet Span** _____ **B) Inlet Clearance** _____ **C) Inlet Wetted Width** _____

**Outlet Condition** (Pick One) ☐ At Stream Grade ☐ Perched ☐ Cascade ☐ Perched Above Cascade

**Outlet Water Depth** _____ **Outlet Drop** _____

**Tailwater Scour Pool** ☐ Large ☐ Small ☐ None

**Tailwater Pool Depth** ☐ < 3 ft / 1 m ☐ > 3 ft / 1 m

**Tailwater Armoring** ☒ Extensive ☐ Not Extensive ☐ None

**Downstream Substrate**

☐ Bedrock ☐ Boulder ☐ Cobble ☐ Gravel

☐ Sand ☐ Clay ☐ Organic ☐ Unknown

**A) Outlet Span** _____ **B) Outlet Clearance** _____ **C) Outlet Wetted Width** _____

**D) Crossing Structure Length** _____ **E) Abutment Height** _____ **Sliplined Culvert** ☐ Yes ☐ No

**Crossing Substrate** ☐ None ☐ Comparable ☐ Contrasting ☐ Unknown ▶ **Continuous** ☐ Yes ☐ No ☐ Unknown

**Internal Structures** ☐ None ☐ Baffles / Weirs ☐ Bridge Piers ☐ Other _____ **Corrugations** ☐ Yes ☐ No

**Water Depth Matches Stream** ☐ Yes/Comparable ☐ No **Water Velocity Matches Stream** ☐ Yes/Comparable ☐ No

**Slope Compared to Channel Slope** ☐ Higher ☐ Lower ☐ Same **Alignment** ☐ Flow-Aligned ☐ Skewed

**Significant Sediment Source** **Upstream** ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

**Downstream** ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

**Wildlife Barriers** ☐ None ☐ High Traffic Volume ☐ Steep Embankments ☐ Retaining Walls ☐ Jersey Barriers ☐ Fencing

**Comments:** outlet - perched 3'ø PCP

-2'ø HDPE w/ Drop Inlet

**Fill Height** _____

**Condition** ☐ **Good** ☐ **Poor**

**Tidal Site** ☐ **Yes** ☐ **No** ☐ **Unsure**

**Units** ☒ Feet ☐ Meters

# STREAM CROSSING SURVEY

Date 8/18/16 (mm/dd/yy) Time 2:40 PM Sequence # _____ Site ID MS_C02

Observer (s) Michael Chminski Organization STANTEC

Stream MERRICONEAG Stv Tributary to MARE BROOK Town BRUNSWICK

Road PURINTON RD. Type ☑ Paved ☐ Unpaved ☐ Railroad ☐ Trail ☐ Driveway

GPS Coordinates [WGS84 UTM Zone 19N Meters] 0 East _____ North _____

DeLorme Atlas Map # 6 Grid Reference C3 Location Description _____

Photo IDs Inlet _____ Outlet _____ Other _____ Flow ☐ Low ☐ High

Upstream _____ Downstream _____ ☐ Moderate ☐ NONE

Basic Structure Type ☐ Bridge ☑ Culvert ☐ Multiple Culverts # 2 ☐ Ford ☐ Removed Structure

Material ☑ Metal ☐ Concrete ☑ Plastic ☐ Wood ☐ Stone ☐ Other 2.5'Ø ALUM. CMP / 3' HDPE (SMOOTH)

Specific Structure Type (see diagrams): ☑ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

Channel Width 14' ☐ Bankfull Width (*Preferred*) ☐ Wetted Width ☐ Measured ☐ Estimated

Inlet Condition Pick One ☐ At Stream Grade ☐ Inlet Drop ☐ Perched

☐ Deformed ☐ Beaver Fencing ☒ Blocked (25%) 50% 75% 100% (Circle One)

Inlet Water Depth 4"-6"

Upstream Substrate

☐ Bedrock ☐ Boulder ☑ Cobble ☐ Gravel

☑ Sand ☐ Clay ☑ Organic ☐ Unknown

A) Inlet Span _____ B) Inlet Clearance _____ C) Inlet Wetted Width _____

Outlet Condition Pick One ☐ At Stream Grade ☐ Perched ☐ Cascade ☐ Perched Above Cascade 2.5' @ 3"

Outlet Water Depth _____ Outlet Drop _____ DEPTH of WATER: 3" = 4"

Tailwater Scour Pool ☑ Large ☐ Small ☐ None

Tailwater Pool Depth ☐ < 3 ft / 1 m ☐ > 3 ft / 1 m ~3'

Tailwater Armoring ☐ Extensive ☑ Not Extensive ☐ None

Downstream Substrate

☐ Bedrock ☐ Boulder ☑ Cobble ☑ Gravel

☑ Sand ☐ Clay ☐ Organic ☐ Unknown

A) Outlet Span _____ B) Outlet Clearance _____ C) Outlet Wetted Width _____

D) Crossing Structure Length _____ E) Abutment Height _____ Sliplined Culvert ☐ Yes ☒ No

Crossing Substrate ☒ None ☐ Comparable ☐ Contrasting ☐ Unknown ▶ Continuous ☐ Yes ☐ No ☐ Unknown

Internal Structures ☒ None ☐ Baffles / Weirs ☐ Bridge Piers ☐ Other _____ Corrugations ☑ Yes ☒ No

Water Depth Matches Stream ☐ Yes/Comparable ☒ No Water Velocity Matches Stream ☐ Yes/Comparable ☒ No

Slope Compared to Channel Slope ☒ Higher ☐ Lower ☐ Same Alignment ☐ Flow-Aligned ☐ Skewed

Significant Sediment Source Upstream ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

Downstream ☐ Road / Ditches ☐ Embankment ☐ Stream Banks ☐ None

Wildlife Barriers ☐ None ☐ High Traffic Volume ☐ Steep Embankments ☐ Retaining Walls ☐ Jersey Barriers ☐ Fencing

Comments:

- ROAD APPEARS TO HAVE OVERTOPPED.
- BOTH PIPES HAVE BAFFLES CONTROL DS FROM INLET.
- FENCE UPSTREAM.

Fill Height < 2' Condition ☐ Good ☐ Poor Tidal Site ☐ Yes ☐ No ☐ Unsure

Units ☑ Feet ☐ Meters