

ST. MARY'S RIVER TRIBUTARY STREAM RESTORATION ASSESSMENT AND  
PLANNING FOR 2012.

Sean C. Mitchell, M.Sc., PhD  
SMRA Executive Director

November 7, 2011

St. Mary's River Association Technical Report #012



## ACKNOWLEDGEMENTS

Funding for these surveys was provided by the NSLC Adopt-a-stream program, for which I thank them for their investment.

---

## TABLE OF CONTENTS

---

INTRODUCTION _____	1
STREAM (BRIEF) DESCRIPTIONS _____	1
West Branch Streams	
Clarke Brook _____	1
Kelly Brook _____	2
Mitchell Brook _____	4
Ross Brook _____	6
Bryden Brook _____	8
Nelson River _____	9
East Branch Streams	
Big Meadow Brook _____	11
McKeen's Brook _____	13
North Branch Streams	
Bogg's Brook _____	15
Main Branch Streams	
Archibald's Brook (Stillwater) _____	18
DISCUSSION/CONCLUSION _____	19
LITERATURE CITED _____	22
PLATES (1-11) _____	23

---

## LIST OF TABLES

---

Table 1: Significant streams in the St. Mary's River system _____	20
remaining to be surveyed.	

## INTRODUCTION

There are an estimated 118 tributary streams of various size (1<sup>st</sup> order to 3<sup>rd</sup> order) in the St. Mary's River watershed (53 on the West Branch, 27 on each of East and North branches, and 11 on the Main Branch). Twenty three (19.5%) of these streams were surveyed at various levels of completeness between May 16, 2008 and October 5, 2010 with 11 of these on the West Branch, 7 on East Branch, 2 on North Branch, and 3 on Main Branch (see Mitchell, 2010a, for details). An additional 10 streams were surveyed in 2011, comprising six on the West Branch, two on the East, and one each on the North and Main branches. Three of these (Clarke Brook, McKeen's Brook, Archibald's Brook at Stillwater) were re-surveys of previously incomplete surveys. This report brings the total number of streams surveyed in the St. Mary's River watershed to 30. Efforts were made in 2011 to walk a minimum of 20% of the lower reach of stream length in order to be focussed on the lower reaches where effects of cumulative upstream impacts would be expected. The 20% length was not met on every stream for a variety of reasons. Ten streams were assessed of which they had a total main channel length of 120.75 km. The total length walked of this was 25.3 km (20.9% of total). The purpose of these surveys was to assess these tributary streams for existing condition as fish habitat and evaluate for potential future restoration efforts.

## STREAM (BRIEF) DESCRIPTIONS

### WEST BRANCH STREAMS

CLARKE BROOK (surveyed July 19, 2011). Total length surveyed 1.4 km (13% of total length)

Length of longest branch: 10.8 km  
Stream order: 3rd

Two sections of Clarke Brook were surveyed: (1) a 0.7 km length from the confluence with the West Branch, St. Mary's River to a series of beaver dams, and (2) a 0.6 km section located approximately 1.0 km upstream of the confluence. This disjunct approach was done as the beaver dam complex is large and difficult to navigate so an alternate road access to area upstream of the beaver dam complex was taken. Access to the upper area was via an old logging road to the east of the brook. The area between the beaver dams and lower part of the upper surveyed section (river km 0.7 to 0.95 km) was not surveyed.

In the lower section, between the confluence and the beaver complex (located at UTM 0562761E, 5012997N) the stream is low gradient, with small substrate (predominately gravel and sand; cobble <10%), consistently wide (8-10 m) and primarily comprised of moderate depth (20-30 cm) run (60%-70%) with lower frequency of riffle (25%) and pool (10%). See Plate 1 for photographs of this brook. Some of the pools approach 1.0-1.2 m depth. There is well developed meander and the banks are stable. Near the confluence with the St. Mary's River the meander increases, gradient lessens and there is an increase in small gravels and fines in the

substrate. In the lower portion of this section are historical restoration structures (7 digger logs and 3 deflectors) installed in 2007.

In the upstream section, between approximately river km 0.95 and 1.5 the stream is a different character than near the confluence. It is of slightly higher gradient, with more gravels and less sand than the lower section. Habitat types are present as approximately 30% each of riffle, pool, and run, and the pools are deep and frequent. There is an appropriate amount of LWD in-channel and over-channel, frequently acting as digger logs and functioning to sort and retain sediment. There are very few, and small, debris accumulations. There is very good meander development with some signs of aggradations (bar development) but this does not appear to be severe. Within this section is a great amount of fish habitat in the form of undercut banks (banks are stable), deep pools, and pools with LWD in them for cover.

Overall, this stream appears to suffer from little impact and possess very good trout habitat. Salmon habitat is not abundant in this stream.

### **Recommended activities:**

No future new restoration is recommended on this stream for the following reasons:

1. There exist historical restoration structures; effort should be placed on their maintenance.
2. There exists abundant, excellent fish (trout) habitat and from all appearances the stream looks to be functioning appropriately.
3. The large beaver complex/ponds are excellent fish habitat, but the dams not so large as to be impassable to upstream moving adult salmonids during autumn floods.

However, annual maintenance of existing restoration structures is required on an ongoing basis.

**Estimated Effort:** Six (6) man-days per year.

**Priority Category:** Primary

---

KELLY BROOK (surveyed August 17, 2011). Total length surveyed 1.7 km (28% of total length)

Length of longest branch: 6.0 km  
Stream order: 2nd

The length of Kelly Brook surveyed was divided into three reaches, proceeding from the confluence with the West Branch, St. Mary's River upstream.

Reach 1 (length 0.40 km; location: from river km 0.0 to 0.4 km).

Approximately 10 m upstream of the Highway 348 bridge crossing (i.e., within approximately 80 m of the stream confluence) is a falls/chute, which is in all likelihood impassable. Immediately upstream of these falls is beautiful step-pool sequence, covered in moss. Reach 1 is high gradient, with a substrate of bedrock-boulder (together about 60%), cobble (~25%) and pockets of large gravels. Habitat is cascade, cascade-pool, and steep riffle. Channel width is variable

from ~3-4 m to 8-10 m. Riparian is young to mature forest of hemlock, birch and fir. Ferns are thick in understory indicating a wet environment. The channel is confined with steep banks on either side. There is a heavy growth of moss on rocks indicating stable (i.e., non-scouring) flow. Approximately 200 m upstream of the Highway 348 bridge is a second impassable falls. The upper extent of Reach 1 is estimated at river km 0.4 (cannot receive GPS signal in canyon and so precise location uncertain).

Reach 2 (length 0.6 km; location: from river km 0.4 to 1.0 km).

This part of the stream is still bedrock controlled but more alluvial than Reach 1. It is lower gradient, with cobble bars present, and regular riffles rather than cascades. The valley is less confined, with the beginnings of a true floodplain appearing. The riparian is principally hardwoods – maple and birch - and hemlock. These are mature trees of impressive size and likely still present as harvesting is not feasible in this area due to steep slopes. This reach may be better treated as similar to the stream below the highway bridge (i.e., lower 80 m of stream), with the entire reach (combined reaches 1 & 2) interrupted by the bedrock canyon. Above the canyon there is a transition out of bedrock control to a substrate mostly boulder and cobble, but with increasing amounts of gravel. Gradient remains high (similar to that below the highway bridge) and the habitat is primarily riffle-pool with very little run. There is a debris jam at UTM 0553146E, 5012288N; (see Plate 2) it is a small jam comprised of SWD and some LWD, but appears to be obstructive. Throughout this reach (upstream of canyon) the stream has been becoming gradually less confined, though there remain high steep banks on alternate sides with a small floodplain on the opposite bank. Occurrence of high bank and floodplain alternate (i.e., switch sides of stream. There are bedrock steps at UTM 0553232, 5012062, and these are considered the upper extent of Reach 2. Approximately 50 m downstream of the bedrock steps, the high banks are reduced on either side and true floodplain develops. Within Reach 2 there is very little woody debris in channel. The identified debris jam and small one further downstream (not obstructive and so not location documented) were only noted debris.

Reach 3 (length 0.7 km; location: from river km 1.0 to 1.7 km).

Reach 3 begins about 100 m upstream of bedrock steps. It is an alluvial reach, of lower gradient, with a substrate primarily of gravels and cobble. Undercut banks and meanders are present. Habitat types are riffle (40%), run (40%), pool (20%). There are accumulations of gravel in bars (these absent in Reaches 1 & 2). LWD and SWD are now in stream and functioning. There are some very straightened sections (log driving?). This reach shows sign of impact – highly regular channel width, shallow riffle-run predominating; few and small pools; channel overwidened and flat plain; diagonal riffles. The upstream extent of the survey is an old bridge on a logging road (1.7 km upstream of confluence) (see Plate 3). The bridge is contributing to an obstructive debris jam, pushing high flows onto river right (looking downstream) and cutting new channel.

Weather: Sunny, warm; calm, no wind. 1245 hours (Air temperature 25 °C; water temperature 15 °C).

### **Recommended activities:**

There are two possible targets for restoration on this brook – the obstructive debris jam in Reach 2 and the failing bridge at the top of Reach 3. Access to both is by an old logging road immediately to the east of, and closely paralleling, the brook. Ownership of the bridge will need

to be determined and permission obtained prior to removal or modification of that structure. Both bridge and debris jam may be removed with hand tools and power saw. Apart from debris clearing in this stream there is little need for restoration practices. The high gradient canyon/chutes near the mouth of the brook prelude movement into Kelly Brook from the river and so restoration would be aimed above the canyon at resident species. Restoration efforts likely are more effective on streams without passage issues and where access for workers is easier.

Within Kelly Brook the major habitat issue is less likely to be physical habitat and more likely low pH. Based on 12 pH samples taken in 1990, 1991, and 2009, mean pH of this brook is 5.38 (SD=0.37 units; range 4.9-6.3 pH units; from Mitchell, 2011). Kelly Brook has been identified by Mitchell (2011) as one of the few brooks in the St. Mary's with sufficiently low pH to likely pose a pH-risk to Atlantic salmon. For this reason, physical habitat restoration is not viewed as a constructive use of resources as it is most likely not the limiting factor, but rather the limitation is imposed by low pH. No significant physical restoration is recommended for this system at this time.

**Estimated Effort:** Clearing debris jam = 2 man-days; Bridge clearing = 4 man-days.

**Priority Category: Secondary**

---

MITCHELL BROOK (surveyed July 28, 2011). Total length surveyed 1.9 km (27% of total length)

Length of longest branch: 7.0 km

Stream order: 2nd

The length of Mitchell Brook surveyed was divided into four reaches, proceeding from the confluence with the West Branch, St. Mary's River upstream. See Plate 4 for representative photographs of this brook).

Reach 1 (length 0.35 km; location: from river km 0.0 to 0.35 km).

In this reach, Mitchell Brook is a small stream (channel width 3-5 m) more typical of a 1<sup>st</sup> order stream. It is heavily overgrown with alders and low gradient, with a substrate of fines, sands, and small gravels. The brook flows through what is likely a very old beaver meadow. The water surface is 0.5-1.0 m below ground level, with vertical channel walls. It is very much like typical stream through a beaver meadow. Much of this reach is deep run (20-40 cm) and deep pools (occasionally >1.2 m deep). Habitat is almost entirely run and pool (70% and 30%, respectively), with ~5% riffle. There are short sections where the stream is almost dry preventing movement upstream and downstream but the stream stage is low at time of survey. Under higher water these low flow areas are likely not problematic.

Reach 2 (length 0.25 km; location: from river km 0.35 to 0.60 km).

The channel is wider here than Reach 1 (5-8 m wide). The riparian forest is mature fir, maple and birch. This is a higher gradient section, with substrate primarily cobble. Habitat is primarily

rifle (50%) and run (35%), with few pools (15%). The pools are deep, approaching 1.2 m depth. There is considerable evidence of aggradation (bars, channel splitting) and several small debris accumulations of SWD. The thalweg is well developed but channel widened. There is an area of 3 to 4 debris jams approximately mid-reach (could not get GPS signal at this location), blocking sediment movement and altering channel morphology. These debris jams impede flow sufficiently to form sediment wedges. The Highway 348 bridge forms the upstream extent of this reach.

Reach 3 (length 0.25 km; location: from river km 0.60 to 0.85 km).

Reach 3 is a higher gradient section with a substrate composed of bedrock, boulder, and cobble. Habitat types present are riffle/cascade, and small cascade pools; runs are absent in this reach. There is a cutblock on river left (looking upstream) 30 m upstream of the Highway 348 bridge resulting in blowdowns across brook (not extensive). There is an old stone mill wheel ~50 m upstream of the bridge; the wheel is covered in moss. The channel in this area is very straight; i.e., little meander. Cascades in this area may be barriers at low flows but unlikely to be so at higher flows. This reach is bedrock dominated and confined, with cutblocks on each side. There are impassable falls (UTM 0549898E, 5013191N). These falls form the upstream extent of Reach 3. The bedrock dominance of this reach is interspersed with areas dominated by boulder and large cobble; these are lower gradient than bedrock areas but still high gradient.

Reach 4 (length 1.05 km; location: from river km 0.85 to 1.9 km).

Upstream of the impassable falls the habitat is primarily riffle/run/cascade with some pool. In this areas there is a great diversity of habitat, and is likely quite productive, having abundant cover. Riparian in this area is intact forest of maple, birch and hemlock. All along river left (looking downstream) is a cutblock on top of a bench. The bench is about 10 m above stream and is cut right to edge of bench. Some areas in this reach appear overwidened (log driving?) and the water spreads across the channel rather than having a well developed thalweg. However, those areas are relatively infrequent and short. There is a second set of impassable falls in mid-reach (cannot get GPS signal for precise location), and about 100 m upstream of those falls is a third falls. Upstream extent of survey is forestry bridge across stream 1.9 km upstream of confluence with St. Mary's River.

This is a beautiful stream – scenic and likely a good rearing system, though uncertain if there would be any large trout upstream of falls. Likely supports smaller fish which then move into larger river as they grow. Fish moving out of Mitchell Brook would be unable to return due to the impassable falls at river km 0.85.

Weather: Cool (~20 °C), heavy overcast, isolated drizzle/raining; calm; no wind. Air temperature (1315 hours) 17°C; water temperature 16 °C

### **Recommended activities:**

The small debris jams identified in this survey (Reach 2) were cleared by the SMRA summer crew in August. Repeated accumulation of debris at these sites should be monitored and removed as required in the future. Aside from this activity, there is no need for further restoration activity on this brook.



Within Mitchell Brook the major habitat issue is less likely to be physical habitat and more likely low pH. Based on 25 pH samples taken in 1990, 1991, and 2009, mean pH of this brook is 5.22 (SD=0.46 units; range 4.5-6.4 pH units; from Mitchell, 2011). Mitchell Brook has been identified by Mitchell (2011) as one of the few brooks in the St. Mary's with sufficiently low pH to likely pose a pH-risk to Atlantic salmon. For this reason, physical habitat restoration is not viewed as a constructive use of resources as it is most likely not the limiting factor, but rather the limitation is imposed by low pH. No physical restoration is recommended for this system at this time.

**Estimated Effort:** 0.5 man-day per year.

**Priority Category:** Tertiary

---

ROSS BROOK (surveyed September 12, 2011). Total length surveyed 3.65 km (24% of total length)

Length of longest branch: 15.0 km

Stream order: 3rd

The length of Ross Brook surveyed was divided into three reaches, proceeding from the confluence with the West Branch, St. Mary's River upstream. See Plate 5 for representative photographs of this brook).

Reach 1 (length 1.9 km; location: from river km 0.0 to 1.9 km).

Reach 1 is a low gradient section, with a small sized substrate of fines (20%), small gravel (40%), large gravel (30%), and small cobble (10%). Channel width 5-8 m throughout most of the reach, but increasing to 10-12 m in the lowest areas (i.e., within influence of West Branch, St. Mary's River). Within the lower area is submergent vegetation and the confluence area is deep (1.2 m) run. Also within this lower area there is increasing fines (sands) in banks as well as substrate and some instream clay exposures. Habitat type through the reach is almost entirely run (~90% run; 40% deep; 50% shallow), with a small amount (10%) of pool. There is an abundance of functional LWD and SWD providing cover. Riparian is mature forest of fir, maple, and some pine. Banks are stable and there is good meander for the most part, though some straight sections are present. This reach is good trout rearing habitat with spawning habitat upstream. Reach 1 may be summarized as the lower 300-400 m being very low gradient, deep run with silt bottom. The remainder of the reach is low gradient, overwidened channel, with small gravel substrate, aggraded, and containing an abundance of debris jams.

Reach 2 (length 1.0 km; location: from river km 1.9 to 2.9 km).

In this reach the channel is overwidened and aggraded. There are several debris jams which have historically altered flow direction and created new channels. Habitat is primarily run (20-35 cm deep), being about 80% run, 15% pool, and 5% riffle. Channel width is 5-8 m. The substrate is composed of fines (10%), small gravel (20%), large gravels (40%), small cobble (25%), and large cobble (5%). Aggradation, as large unvegetated gravel and cobble bars, is

evident. The riparian is intact, young to mature maple-fir-aspen with occasional pine. There is young forest of maple and alder along significant lengths of this reach. Eroding banks are present which are somewhat stable but outside of present flow so no value as fish habitat. There is significant meander to stream. A large beaver dam/pond (abandoned) is present at UTM 0550253E, 5014769N. The pond and runs are very good habitat – see a lot of fish. Debris jams (comprised of LWD and SWD) are frequent on this reach; creating new channels; anastomosing, etc.

Reach 3 (length 0.75 km; location: from river km 2.9 to 3.65 km).

Within Reach 3, the gradient has increased relative to the previous two reaches. The substrate is composed of fines (5%), small gravel (5%), large gravel (20%), small cobble (40%), large cobble (20%), boulder (5%), and bedrock (5%). Habitat types see increasing abundance of riffles, with run (60%), riffle (30%), shallow pool (10%), and very occasional deep pool (1.0 m). The channel is slightly narrower, being 3-5 m wide. The riparian is similar to Reach 2. There are signs of aggradation – bars, few pools, grassy bars encroaching on channel. The channel is straight, with little meander. There are many eroding banks (stabilized by roots) as gravel accumulations push flow to opposite bank (i.e., trying to recover meander). At the top of the reach is a cutblock on top of slope on river left (looking downstream). Near the lower end of reach is an old, dried out large pond, originally backwatered by a large debris jam – the jam no longer obstructive.

Weather: Sunny, warm light wind from north, clear sky. Air temperature 22 °C; water temperature 14 °C.

#### NOTES

Large number of trout and frogs during survey. The survey was done during baseflow. Three wood turtles (*Glyptemis insculpta*) seen on brook during survey. These turtles seen at: (1) confluence with West Branch, (2) at UTM0550736E, 5014117N, and (3) at UTM 0550060E, 5015176N.

#### Recommended activities:

The principal issues associated with human impacts on this stream are (i) excess LWD/SWD (debris), (ii) aggradation (gravel and cobble), (iii) overwidening of channel, and (iv) shallowing of channel (though not severe as deep runs remain frequent). There is good riparian providing shade. Restoration potential is low for this brook. The majority of the surveyed stream is not salmon habitat (gradient too low), but is reasonable trout habitat (deep pools and runs). The large number of fish observed suggest habitat is adequate to maintain a large population. Access for restoration purposes to this brook is very difficult, as only one old road/trail is present to get to the brook. For this survey I walked across the West Branch from the south side than half a kilometre downstream to confluence of Ross Brook and the West Branch. For these reasons, no physical restoration is recommended for this system at this time.

**Estimated Effort:** None

**Priority Category:** Tertiary

---

BRYDEN BROOK (surveyed September 13, 2011). Total length surveyed 2.4 km (17% of total length)

Length of longest branch: 14.3 km

Stream order: 3rd

The length of Bryden Brook surveyed was divided into four reaches, proceeding from the confluence with the West Branch, St. Mary's River upstream. See Plate 6 for representative photographs of this brook).

Reach 1 (length 0.4 km; location: from river km 0.0 to 0.4 km).

This reach is almost entirely run (~80% run; 10% riffle; 10% pool). The substrate is comprised of fines (20%), small gravel (20%), large gravel (20%), small cobble (30%), and large cobble (10%). There is evidence of aggradation in the form of large bars of small material; this material is smaller than that upstream. The gradient of this reach is lower than upstream and so material is being deposited. Eroding banks are stable as shown by tree growth curved to compensate for erosion. The channel is overwidened.

Reach 2 (length 1.0 km; location: from river km 0.4 to 1.4 km).

In this reach begin to see evidence of impacts. There is a predominance of runs, with some aggradation and diagonal riffles. However, runs still have depth (cross section variability; not flat plain). Aggradation is in the form of vegetated and non-vegetated bars; but not excessive. The channel is overwidened (8-12 m wide) and there is loss of thalweg. There is almost no instream debris, which is curious given the evidence of impact. Meander is still good. There is some clay exposure and eroding banks, but these banks are stable. Habitat types are run (55%), pool (25%), and riffle (20%). Deep pools/runs with excellent cover (overhanging trees, cutbanks, boulder) are frequent. The substrate is fines (10%), small gravel (20%), large gravel (25%), small cobble (25%), large cobble (15%), and boulder (<5%). Riparian is primarily young maple, with small amount of young birch and fir. Cover is in the form of water depth, boulder and cobble. There is little functional LWD instream.

Reach 3 (length 0.3 km; location: from river km 1.4 to 1.7 km).

This reach is higher gradient than the more upstream Reach 4, with larger substrate. It is a very short reach, but sufficiently different to be a reach on its own. The riparian forest is intact maple, fir, pine, and hemlock. Habitat types are run (50%), riffle (25%), and pool (25%). The substrate is composed of fines (5%), small gravel (25%), large gravel (30%), small cobble (20%), large cobble (10%), boulder (5%), and bedrock (5%). Eroding banks are present but stable (i.e. tree curving in response to erosion rate)

Reach 4 (length 0.7 km; location: from river km 1.7 to 2.4 km).

Within this reach channel width is 3-5 m. Habitat types are run (75%), pool (20%), and riffle (5%). The runs are generally reasonably deep (30 cm). Soft (clay) eroding banks are present, but stable. The substrate is fines (20%), small gravel (40%), large gravel (20%), small cobble (10%), large cobble (5%), and boulder (5%). The water clarity is clear, not tea coloured. There is little LWD, SWD or instream debris. Approximately 100 m downstream of UTM 0537382E,

5016395N is old (abandoned) beaver dam, still backing up some water in pond and creating good trout habitat. There is good meander to the stream. The riparian of this reach is alder, larch, and spruce. It is a young recovering forest of alder and scattered mature trees. The lower half of Reach 4 riparian forest includes mature fir and occasional young maple. See a large number of fish in Reach 4. There is no major evidence of impacts (e.g., overwidening; loss of thalweg, aggradation, debris accumulation, etc.). This section is not salmon habitat and could not be made into it. It is, however, good trout rearing habitat. There are isolated short sections of submergent vegetation or increases in cobble abundance in lower 200 m of the reach – i.e., short sections of vegetation out of character with rest of reach. Reach 4 has low order stream characteristics, such as being small, narrow, shallow and with heavy alder overgrowth.

Weather: High overcast clouds, warm, calm (no wind). 1155 hours air temperature 20 °C; water temperature 14 °C.

#### NOTES

The survey was done during baseflow. Two wood turtles and one snapping turtle (*Chelydra serpentina*) seen during survey. Wood turtles seen at (1) confluence with West Branch, and (2) at UTM0537746E, 5016482N. Snapping turtle seen in West Branch at UTM 0537694E, 5015333N.

#### Recommended activities:

Bryden Brook is quite a nice trout stream, though less so for salmon. It possesses a very nice mix of spawning and rearing areas. There is plenty of water depth, even at baseflow and abundance of cover in forms of boulders, cobble, and depth. There exists a very nice diversity of habitats in close proximity to each other. There were many trout observed during the walk. There is little evidence of impacts; some aggradation in Reach 1 but not extreme. The lack of LWD is surprising. For these reasons, there are no recommended restoration activities on this brook. In addition, access for restoration to this brook is moderately difficult.

**Estimated Effort:** None.

**Priority Category:** Tertiary

NELSON RIVER (surveyed September 30, 2011). Total length surveyed 4.0 km (24% of total length)

Length of longest branch: 16.8 km  
Stream order: 3rd

The length of Nelson River surveyed was divided into five reaches, proceeding from the confluence with the North Nelson River (UTM 0524470E, 5016089N) upstream. These reaches may, however, be too tightly discriminated. Between the Ellis Brown Road crossing and Nelson/North Nelson confluence, the river is basically one long reach. See Plate 7 for

representative photographs of this brook). It is almost entirely wide run (often greater than waist deep). There are short sections of riffle and/or grassy islands but these may be considered as being nested within the runs reach itself, rather than individual reaches. The channel is very homogenous with good meander for the most part, but some long straight stretches. The substrate throughout most of the reach is full spectrum from fines to boulders, sorted by current and deposited in various areas. There is submergent vegetation, of various taxa, throughout the length of the reach, indicating slow current and soft bottom. The riparian along the entire 4 km section is intact mature mix of softwoods (balsam fir, spruce spp.) and hardwoods (maple and birch). The stream is good trout habitat but not salmon habitat (at least not for spawning and rearing by Atlantic salmon; it may be used by adults as quiet water).

Reach 1 (length 1.0 km; location: from river km 0.0 to 1.0 km).

This lowest section near the confluence is narrow (~5 m width) riffle and shallow run. Banks are grassy with forest set back from edge. Substrate is cobble and gravel. This stream appears very productive with abundance of submergent vegetation of various taxa and stone caddisflies. About 200 m upstream of confluence is bedrock exposure. Upstream of the bedrock exposure habitat changes to deep runs (> 1.0 m deep) with bedrock, boulder and cobble in them. There is a high degree of cover and habitat heterogeneity in these runs. Runs are dominant (90%) over riffles (10%). This part of the reach is open to solar insolation as banks are alder and shrubs and so there is little shading. At upper end of reach is transition from bedrock and cobble runs to gravel and cobble runs. That is, there is increasing gravels and reduction of larges (cobble and boulder) though they are still present. Stream width increases to 10-12 m width.

Reach 2 (length 0.3 km; location: from river km 1.0 to 1.3 km).

This reach is 90% run and 10% riffle. The runs are gravel bottom and deep; run-pool would be a better description.

Reach 3 (length 0.7 km; location: from river km 1.3 to 2.0 km).

This reach sees a return to larger substrate. There are riffles with boulder and cobble substrate. This reach is runs with boulder/bedrock/cobble substrate (similar to Reach 1) interspersed with riffles. This abundance of boulder in Reach 3 is providing abundant cover in riffles and runs. Habitat type is approximately 60% run and 40% riffles. The riparian is mature forest right to stream edge, there are no grassy banks.

Reach 4 (length 1.45 km; location: from river km 2.0 to 3.45 km).

This reach is deep runs and pools which is slightly different from the previous reaches. Deep run substrate is fines and small material; a soft bottom. There is abundance of waterlogged decayed LWD and SWD. It is reminiscent of a beaver pond which this area may have historically been. This reach is 95% run and 5% riffle. Apart from the runs near the “switchback” (see map (NTS topographic map 11E/07 for obvious switchback of river in this reach), throughout the rest of reach the substrate in runs is primarily gravel. The substrate is still smaller than in lower reaches but larger than fines in runs of lower end of Reach 4. In the upper half of this reach, riffle presence increases from about 5% to 10%, and run substrate is dominated by large gravel and small cobble.

Reach 5 (length 0.6 km; location: from river km 3.45 to 4.05 km).

Habitat in this reach is wide deep runs with fines/silt bottom. The riparian is alder with the forest set back from stream edge, similar to Reach 3. Upstream end of this reach is the Ellen Brown Road crossing of Nelson River (culvert crossing – 2 large culverts).

Weather: Day began high overcast and humid. Turned sunny and warm. Light wind; almost calm at water level. 1225 hours air temperature 26 °C; water temperature 17 °C.

**Recommended activities:**

The Nelson River is excellent trout habitat – deep runs and pools, lots of cover, apparently productive. There were an abundance of trout seen during survey. There is little evidence that it would be used extensively by salmon in the area surveyed (no spawning or rearing habitat). This is a great system, functioning appropriately. For these reasons, there are no recommended restoration activities on this brook.

**Estimated Effort:** None.

**Priority Category:** Tertiary

---

## **EAST BRANCH STREAMS**

BIG MEADOW BROOK (surveyed July 25, 2011). Total length surveyed 2.3 km (22% of total length)

Length of longest branch: 10.5 km  
Stream order: 2nd

The length of Big Meadow Brook surveyed was divided into three reaches, proceeding from the confluence with the East Branch, St. Mary's River upstream. See Plate 8 for representative photographs of this brook.

Reach 1 (length 0.45 km; location: from river km 0.0 to 0.45 km).

Reach 1 is an alluvial reach with relatively small material. The substrate is primarily gravels, with some cobble, though some boulder (5%) is present. The stream has good meander. Habitat types are present as approximately riffle (30%), pool (30%), and run (30%). Scour pools are present along edges. Maximum pool depth in Reach 1 about 1.0 m. The banks are stable and undercut. Forestry (cutblocks) not immediately visible through buffer (i.e., they are removed from stream), unlike further upstream. The riparian is hardwood dominated (birch, maple; 60%-70%) over softwood (balsam fir ; 30%-40%). The channel is unconfined, with a nice floodplain. There is an appropriate amount of LWD; it is neither excessive nor absent. The channel appears stable. Stable undercut banks are providing habitat. There is some evidence of aggradation but this is not extensive. In last 100 m or so of stream, approaching confluence with East Branch, St. Mary's River there is braiding and multiple channels. This is likely due to historical debris jams here. There are no problem jams at present.

Reach 2 (length 0.35 km; location: from river km 0.45 to 0.80 km).

A very short, transition reach, between alluvial (Reach 1) and bedrock (Reach 3). A large debris jam at the Reach 2/3 break. This reach characterized by narrow channel lost in sedges and rushes

Reach 3 (length 0.70 km; location: from river km 0.80 to 1.50 km).

Reach 3 is higher gradient than the more upstream Reach 4, and is boulder and bedrock dominated. Habitat distribution is approximately riffle (60%), run (30%), and pool (<10%). The lack of pools is largely due to the bedrock. The channel is confined on the left bank (looking downstream). There are some very nice bedrock pools, relatively infrequent but important fish habitat. Cascades are frequent in this section, though not sufficiently large to be barriers to movement. Forestry (cutblocks) are obvious on either side of brook, though buffer strips are in place. There is very little LWD in this section.

Reach 4 (length 0.80 km; location: from river km 1.50 to 2.30 km).

There is a bridge crossing and active forestry operation at 2.30 km upstream of the confluence, marking the upper extent of this survey. The bridge is temporary and if not removed would be a choke point during flooding/ice movement as there is only 10-15 cm clearance over water (at low flow). Downstream from this bridge the reach is an alluvial channel, with a substrate primarily of gravels and cobble. There is abundant LWD and SWD in-channel and over-channel (blowdown). Alders are thick over stream in some areas. The channel width is variable from about 2 m to 6-8 m. The habitat is almost entirely run (60%) and short riffles (30%), with few to no pools (10%) to speak of. The deepest pools are 30-40 cm deep. Evidence of logging (old and current cutblocks within sight of the stream) is apparent along almost the entire reach. There is little meander to the stream, with straight stretches separated by curves (function of historical log driving?). Aggradation is occurring in the form of small point and side bars forming. Some erosion is present, but not extensive. Many trees showing curved growth in response to erosion. There is increasing boulder presence as one moves downstream through the reach (boulder approaches 10%). Several debris jams are present, but they are not too large nor too frequent.

This survey was done during baseflow; I suspect when water is higher this reach is a beautiful trout stream – likely highly productive. Productivity appears high (a lot of moss, algae, filamentous algae on rocks, plenty of caddisflies). Observed many trout darting away as surveyed stream.

### **Recommended activities:**

Reaches 1, 2 and 3 are in fine shape and do not require restoration. Specifically, Reach 1 is a beautiful stream with minor impacts/limitations. Reach 2 is very short and not worth expending effort as fish can pass through it. Reach 3 is bedrock controlled and so bedrock forms habitat. Reach 4 is in poorer shape but restoration feasibility is compromised by difficulty of access. I do not think it worth restoration effort, as the existing LWD will fall into channel over time and maintain/create channel structure. I anticipate an increase in frequency and depth of pools over time as LWD recruits into channel. Restoration actions would speed this up but I am not sure the improvement in habitat would be significant given the effort. I expect SMRA restoration efforts would be better spent somewhere else.

**Estimated Effort:** None.

## Priority Category: Tertiary

---

McKEEN'S BROOK (surveyed August 22, 2011) Total length surveyed 3.35 km (18% of total length)

Length of longest branch: 18.25 km (Walsh Brook Branch)  
Stream order: 3rd

The length of McKean's Brook surveyed was divided into three reaches, proceeding from the confluence with the East Branch, St. Mary's River upstream. See Plate 9 for representative photographs of this brook.

Reach 1 (length 0.60 km; location: from river km 0.0 to 0.60 km).

There is a small bar (earth, rock, vegetation) partway across the stream mouth at the confluence with the East Branch St. Mary's. This bar is not an impassable barrier. The first ~100 m of Reach 1 is very wide (20-25 m) deep run/pool, with clay/mud bottom and clay banks. This area is likely influenced by East Branch flooding and high water. This lowest section is not typical of the brook, but rather an area transitioning into East Branch. Between the stream confluence and Highway 7 bridge, the brook is wide (10-15 m) and comprised of riffle/run sequences. Some of the runs are deep and approach pool status. The substrate is 85% gravels (large and small) and the rest fines (10%) and cobble (5%). The large gravel and cobble are dark (black? shale?) in colour and flat. All of the substrate is underlain by clay. Banks are largely clay – there are several areas of eroding banks but nothing problematic. Meander is well developed. Riparian forest is intact maple/alder ranging along length from immature to mature. One large oak tree was seen in the riparian. Stream gradient is very low through this section, typical of the lowest reaches of brooks where they join larger main rivers.

Reach 2 (length 0.35 km; location: from river km 0.60 to 0.95 km).

About 30 m upstream of the Highway 7 bridge are concrete abutments of an old bridge. On the north side of the Highway 7 bridge, the riparian has transitioned to mature pine/fir/hemlock/maple/birch. Deep runs/pools are in centre of channel; pools are not present along banks. Banks no longer clay, but rather till and stone. Upstream of the highway bridge channel is straight, very little meander.

Reach 3 (length 2.4 km; location: from river km 0.95 to 3.35 km).

Above UTM 0574400, 5014958 the substrate has changed. There are isolated areas of bedrock exposure, greater abundance of cobble (20%-30%), some boulder presence, but still also gravels and sands. Throughout the survey, to this point habitat types have been run (~85%), riffle (5%) and deep run/pool (10%). Also throughout survey there has been very little LWD in channel. Debris has been present along banks but not functioning in channel. Is this due to ice? flood removal? The channel itself has been remarkably constant in width, grade and habitat types since the confluence with the East Branch. There is some variation in meander with long straight sections interspersed by good meandering. In Reach 3, erosion does not appear to be



problematic. Curved trees growing over water, accommodating rate of erosion of banks. Banks are stable and undercut. There is evidence of aggradation. Those riffles present tend to be diagonal. In the upper sections of Reach 3 there are vegetated (grass) bars extending across channel. A small (active) beaver dam at UTM 0575707, 5014400. Not likely obstructive at high flows.

Nested within Reach 3 is a very low gradient, long stillwater between approximately river km 2.6 and 2.75. It is not sufficiently large to create a distinct reach and so viewed as a stillwater nested within the existing reach. This stillwater possesses slight current, fine sediment bottom (fines/small gravels), and abundance of submergent vegetation (cover). These characteristics indicate a depositional environment and soft bottom. This is not salmon habitat but may be useable for trout. Upstream of this stillwater is a return to Reach 3 conditions

Tributary survey: McKeen Lake outflow stream (length 1.2 km; location: Confluence at river km 2.6 of McKeen's Brook mainstem).

Proceed up McKeen Lake outflow on return downstream. This brook is smaller than McKeen's mainstem (5-8 m wide). It is primarily shallow run (75%), riffle (20%), and pool (5%). Aggradation is apparent (diagonal bars, grassy bars, extensive grassy bars at mouth). The substrate is gravel/cobble (dark, black, flat stones) as approximately 20% cobble; 60% gravel; 20% fines. This appears to be better trout and salmon habitat than the McKeen mainstem; even it is not great though – there is a notable lack of pools. The channel is flat in cross section. Riparian is a mature forest of maple, birch, and spruce. There is good meander to the stream. Proceeding upstream get into slightly higher gradient. With increasing gradient, see increase in riffles relative to run; increase in pool number and depth; much better thalweg development; good channel profile (not a flat plain any longer). In the higher gradient section the substrate is gravel, cobble, boulder, bedrock. There is a large beaver dam/debris jam at UTM 0575578E, 5015262N, which is not obstructive to water flow. The beaver dam appears to be abandoned based on dropped water level in the pond. The influence and remnant of the pond extends ~80 m upstream to the bridge (secondary, gravel, road) below McKeen's Lake. This bridge is upstream extent of survey.

Weather: 1110 hours: air temperature 22.5 °C; water temperature 20.0 °C

### **Recommended activities:**

The habitat issue in McKeen's Brook is a preponderance of a single habitat type (run in this case) at the expense of riffles and pools, and the homogeneity of the channel in terms of width, grade, and sinuosity. Run habitats will support salmon and trout, but access to a variety of habitats (riffles for rearing salmon, pools for trout and salmon to retreat to under conditions of low flow and elevated temperature, space under cobble for overwintering) would increase capacity of the stream to rear salmonids. Standard restoration techniques to create riffles and pools are limited on McKeen's Brook for a variety of reasons. The width and inferred power of the stream (as evidenced by having little LWD) suggests channel-crossing structures such as digger logs may not be successful. Rock work (e.g., rock horseshoes, vortex weirs, boulder groupings), while likely to be successful, are limited in placement due to relatively poor road,

and so machine, access to the stream. The stream size, power and access, somewhat limit restoration options.

Recommendations for restoration, taking these limitations into account, are for half-log devices and log bank covers (see NSSA 2005 and Adams and Whyte, 1990 for design of these structures) downstream of the Highway 7 bridge (Reach 1) and deflectors upstream of this bridge (Reaches 2 and 3). Reach 1 should include 15-20 half log structures and 4-6 bank cover devices over the 600 m of this reach. These structures will provide shading and protection from overhead visual predators. These will need to be installed with sufficient depth or armouring to protect them from ice-scour. While not replacing the function of pools, these devices will mimic some of their necessary characteristics.

Upstream of the bridge, deflectors should be installed. Given that Reaches 2 and 3 account for approximately 2.5 km of stream, and these reaches are homogenous and require restoration along their length, a program of installing approximately 40 deflectors should be initiated. Using a spacing of approximately 96 m based on a natural channel width of 16 m for this stream<sup>1</sup> this would result in 27 deflectors, but 13 of these locations should include paired deflectors, one on each side, bringing the total to 40. This could be accomplished in three years by installing 12-15 deflectors per year. Note that the channel design width of 16 m is subject to revision using more local or regional models not available to the author of this report and so these estimates may change. These deflectors are designed to narrow the channel, create pools, and initiate some meander.

A parallel project currently ongoing is evaluating the historical electrofishing data for the St. Mary's River (soon to be published as SMRA Technical Report). This stream has a long history of electrofishing data and that analysis may revise the conclusions drawn here if it is shown that McKeen's Brook has historically had high densities of salmon and trout.

**Estimated Effort:** Reach 1 (cover and bank devices): 40 man-days.  
Reach 2 & 3 (deflectors): 50 man-days per year

**Priority Category: Primary**

---

## NORTH BRANCH STREAMS

BOGGS BROOK (surveyed September 22, 2011). Total length surveyed 1.75 km (29% of total length)

Length of longest branch: 6.1 km  
Stream order: 2nd

---

<sup>1</sup> 16 m estimate based on a watershed area of estimate of approximately 70 km<sup>2</sup> and a relationship of stream width to watershed area of  $\text{Width (ft)} = 14.73 * \text{Area (mi. sq.)}^{0.38}$  based on a regional assessment of streams from the eastern US as reported by Ohio Department of Natural Resources (2005).

The length of Boggs Brook surveyed was divided into four reaches, proceeding from the confluence with the North Branch, St. Mary's River upstream.

Reach 1 (length 0.45 km; location: from river km 0.0 to 0.45 km).

There is a small active beaver dam on the North Branch St. Mary's River at the confluence of Boggs Brook and the North Branch. This dam is not obstructive at this flow and time of year. The confluence is effectively at the outflow of Boggs Lake. This reach has use by cattle as evidenced by two electric fences across stream, with 3-4 cattle fords between these two fences. The channel width of this reach is 3-5 m and habitat type distribution estimated as riffle 70%, run 15%, and pool 15%. There is evidence of aggradation in the form of relatively large (and high) gravel and cobble bars and accumulations of woody debris (primarily SWD, though some LWD). The debris in the channel is not excessive and appears to be stable and functional. The riparian is young maple forest with alders and some birch, and the occasional apple tree. Agricultural fields/pastures are visible on each side of stream through buffer strip. The substrate is variable among riffle, run and pool but "typically" is: fines (10%), small gravel (20%), large gravel (35%), small cobble (25%), large cobble (10%), and boulder (<5%). Near the confluence with the North Branch are short exposures of clay. Banks are eroding but stable, with an abundance of undercut banks associated with pools – very nice habitat. There is very occasional channel splitting of flow due to aggradation/island formation. Numerous small debris jams are apparent, but these are not problematic and are working to maintain channel structure. There is very good meander to stream (quite sinuous). There is excellent over-stream cover in form of alders and occasional mature trees. The water stage is low to moderate – there was significant rain three days previous but brook has since dropped, though not yet back to baseflow. There is a lot of bar formation/aggradation, but the channel appears stable and so has accommodated this. In upper 100-150 m of reach there is "true" riparian forest (mature maple/birch); the agricultural fields are absent here. The bridge on the gravel road, west side Lochiel Lake, is upper extent of Reach 1.

Reach 2 (length 0.20 km; location: from river km 0.45 to 0.65 km).

This is a short reach with a large debris complex forming upstream extent. For approximately 50 m upstream and downstream of bridge on gravel road West side Lochiel Lake, are residential lawns on river left (looking downstream). Associated riparian here is narrow band of shrubs and small trees. Reach 2 is higher gradient (larger substrate) than Reach 1. The channel is much straighter (less meander). The riparian is now a mix of hardwoods (birch and maple) and softwoods (balsam fir) and is now a mature forest. There is evidence of previous restoration with some logs anchored into left bank (looking downstream) immediately upstream of gravel road bridge. Placed to prevent erosion and channel movement and place a long time ago as tops covered in moss.

Reach 3 (length 0.50 km; location: from river km 0.65 to 1.15 km).

Reach 3 is similar to Reach 4 in many ways (high gradient, larger substrate than Reaches 1 and 2, little meander, natural digger logs). However, it differs from Reach 4 in that (i) there is no bedrock present, (ii) there is a true floodplain on each side of brook (i.e., not confined), (iii) riparian zone contains abundant (20-40%) softwoods (balsam fir), and (iv) there is primarily only one habitat type (riffle). Riffle accounts for approximately 70%, run 20%, and pool 10%. There is a debris jam (non-obstructive) at the reach 3/4 boundary. There is more woody debris in

Reach 3 than 4, this debris is in-channel – functional and non-functional. It is fetched up against the bank. There are no problematic debris jams in the reach. There is one small (~10 m long) section of open slope with blow down to stream (at UTM 0573321E, 5025075N), but it is not problematic. Substrate is fines (<5%), small gravel (10%), large gravel (30%), small cobble (35%), large cobble (15%), and boulder (10%). There is a vehicle ford in this reach at UTM 0573350E, 5025023N. Reach 3 is dominated by riffle but good habitat for rearing salmon. There are few pools and runs for diversity however. Lots of LWD stabilizing banks and providing cover. Reach 3 has a fair variety of habit. The proportion of pool and riffle changes a bit along the length of it but it is maintained as one reach due to the dominance of a characteristic steep riffle habitat. Lower 50-100 m of the reach includes much more run and less riffle. Marking downstream end of reach is large (problematic) debris jam (Plate 10). This jam (UTM 0573476E, 5024810N) defines the boundary between Reaches 2 and 3. It is a large mass of blowdown, LWD and SWD about 10-20 m in length. It obstructs the channel and redirects flow. A mess. There are flooded trees, gravel in forest (from overflow during floods), and sediment wedges.

Reach 4 (length 0.60 km; location: from river km 1.15 to 1.75km).

This reach is a moderately high gradient section, with large substrate. Habitat type distribution is estimated as cascade-riffle (15%), steep riffle (60%), run (15%), and pool (10%). The channel is wide (5-10 m), frequently 8-10 m. There is frequent LWD functioning as natural digger logs, sorting sediments and creating small plunge pools. The riparian is mature hardwood maple-birch forest. There is evidence of forestry (cutblocks) on benches alongside streams. Stream somewhat confined in upper part of reach, lots of bedrock exposure. There is a cascade-chute at UTM 0573281E, 5025566N which is likely impassable to fish at some flows, but passable at others. Banks are stable and the channel is very straight (low sinuosity/little meander). LWD recruitment is appropriate – present but not excessive. There is abundance of in-channel LWD in various states of entry into the water. The substrate is large : fines (<5%), small gravel (5%), large gravel (15%), small cobble (45%), large cobble (20%), boulder (10%), and bedrock (5%). At the lower end, as Reach 4 transitions to Reach 3, there is increasing proportion of gravels and less confined channel (i.e., developing true floodplain). Though this is not classic salmon or trout habitat, it is still very good habitat. Lots of diversity and microhabitats. Likely well used for rearing. The College Grant Road crossing forms the upstream extent of this survey and the culvert allowing crossing of the College Grant Road has been identified as a problematic barrier to fish movement by Mitchell (2010b).

Weather: High, broken cloud, calm (no wind). Air temperature 20 °C; water temperature 12.5 °C.

### **Recommended activities:**

Within Bogg's Brook the removal of the large debris jam at the border of Reaches 2 and 3 is recommended. This jam is large and interfering with water flow and likely fish passage upstream. Work should include selective remove of material to allow proper flow and restore flow to single channel. Work can be accomplished with chainsaw and hand tools. This is high priority as it is cutting new channel and is the only unstable channel feature seen on the survey

**Estimated Effort:** 8 man-days.

**Priority Category:** Primary

---

## MAIN BRANCH STREAMS

ARCHIBALD'S BROOK – STILLWATER (surveyed July 19, 2011). Total length surveyed 2.9 km (18% of total length)

Length of longest branch: 16.0 km  
Stream order: 2nd

The length of Archibald's Brook surveyed was classified as a single reach, proceeding from the confluence with the Main Branch, St. Mary's River upstream. See Plate 11 for representative photographs of this brook.

Reach 1 (length 2.9 km; location: from river km 0.0 to 2.9 km).

The section of brook between the Highway 7 bridge and confluence with the Main Branch, St. Mary's River is high gradient steep riffle. Habitat is riffle (75%), deep run (30-40 cm; 20%), deep pool (5%). Substrate is large: (boulders 15%, large cobble 30%, small cobble 20%, large gravel 20%, small gravel 10%, fines 5%). Riparian is young alder forest, with agricultural field on right bank (looking downstream); there is some maple, spruce, and birch (young forest). There is some woody debris about 50 m upstream of the confluence, but is not obstructive. The water is dark (tea coloured); difficult to see bottom. Upstream of the highway bridge, on river right, is a residential lawn and abandoned field for ~100 m upstream. On river left for 50 m is a road on bench, paralleling brook to house. Above the bridge, the gradient remains high, dominantly riffle, with some deep run and very occasional deep pool (i.e., 1 pool in 50-100 m). At UTM 0580658E, 5003647N, 90% of habitat is riffle or cascade riffle; 10% deep run, 2% pool. The very large substrate continues. There is little meander, rather long straight stretches interrupted by bends. There is no thalweg to speak of, flow extends across entire channel (5-8 m wide; varying from place to place, but quite consistent width). An abundance of microhabitats for fish – lots of quiet eddies in all of the boulder. Upstream of the residential fields the riparian is youngish-mature intact forest of pine, fir, maple, and some hemlock and birch. Bedrock showing near UTM 580800E, 5004100N. There is very little LWD in channel (<15 pieces so far) and only about 4-5 pieces functional in water. This suggests a high power to this stream which sweeps out LWD. To the point where an unnamed brook meets Archibald's Brook (UTM 0581030, 5004455) the stream has been remarkably constant all the way to here. Repeat substrate estimate to compare with below bridge. fines <5%; small gravel 5%; large gravel 15%; small cobble 20%; large cobble 30%; boulder 20%; bedrock <5%. There is a large cascade/falls about 2 m high at UTM 0581735, 5004821. Upstream of cascade/falls is 50-60 m long bedrock run with deep holes. Very nice habitat. There are impassable falls at UTM 0582038, 5004868, and form the upstream extent of this survey. These falls are 5-6 m tall, comprised of two falls – a Lower (step-falls ~ 3 m high), and Upper (vertical falls ~2-3 m high). The Upper and Lower

falls are separated by about 10 m horizontal distance. Along the entire stream there has been moss on boulders/bedrock indicating some stability to flow (i.e., little apparent scour).

On Cross Brook is a large (impassable) falls (10-15 m high) about 50-100 m upstream of confluence with Archibald's Brook.

Weather: Sunny, warm, clear sky. At 1100 hours air temperature 26 °C; water temperature 19.5 °C.

### **Recommended activities:**

The habitat issue in Archibald's Brook is a preponderance of a single habitat type (riffle in this case) at the expense of pools.. Riffle habitats are excellent for rearing salmon, but access to pools is also important for use under conditions of low flow and elevated temperature. As well, brook trout prefer pools and their absence will reduce trout use. Within Archibald's Brook, however, the major habitat issue is less likely to be physical habitat and more likely low pH. Based on 78 pH samples taken in 1990, 1991, and 2009, mean pH of this brook is 5.44 (SD=0.59 units; range 4.6-6.9 pH units; from Mitchell, 2011). Archibald's Brook (Stillwater) has been identified by Mitchell (2011) as one of the few brooks in the St. Mary's with sufficiently low pH to likely pose a pH-risk to Atlantic salmon. For this reason, physical habitat restoration is not viewed as a constructive use of resources as it is most likely not the limiting factor, but rather the limitation is imposed by low pH. No physical restoration is recommended for this system at this time.

A parallel project currently ongoing is evaluating the historical electrofishing data for the St. Mary's River (soon to be published as SMRA Technical Report). This stream has some limited electrofishing data and that analysis may revise the conclusions drawn here if it is shown that Archibald's Brook has historically had high densities of salmon and trout.

**Estimated Effort:** None

**Priority Category:** Tertiary

## **DISCUSSION/CONCLUSIONS**

In 2011, ten streams were surveyed covering 25.3 km which, combined with previous surveys, brings completed stream surveys for restoration to 30 in the St. Mary's River which represents 40% of the 75 significant streams<sup>2</sup> in the watershed. These brooks are thought to represent cross section of stream types and locations throughout the watershed and so, it is hoped, be a representative sample of stream conditions in the St. Mary's River. There remain several large systems which would be of benefit to survey in the future (Table 1) but these may be seen as lower priority. Survey of these 14 streams would bring the total significant streams surveyed in the St. Mary's River to almost 60-% of the total.

<sup>2</sup> "Significant" is defined here as being named on the NTS 1:50,000 scale map series. Unnamed streams (43 of these in the St. Mary's River watershed) are assumed to be small and so represent little fish habitat.

Table 1: Significant streams in the St. Mary's River system remaining to be surveyed. Surveys of these streams would be beneficial, but within the context of a restoration program is secondary to conducting the work described below.

North Branch	East Branch	West Branch
North River St. Mary's <sup>a</sup>	McKay Brook	Beaver Brook
Unnamed brook 1 <sup>b</sup>	Fraser's Brook	Chisholm Brook
Unnamed brook 2 <sup>c</sup>	Mitchell's Brook	Upper Bryden Brook
	Leitch Lake Brook	North Nelson River
	Archibald Mill's Brook	South Brook
	Bryden Brook (Glenelg)	

*a* = North River St. Mary's at the north end of Lochaber Lake; should be surveyed from lake to confluence with Gusset Brook.

*b* = Unnamed Brook 1 is stream draining Taylor, Murray, Copper and Round lakes on the east side of Lochaber/Lochiel lakes.

*c* = Unnamed Brook 2 is stream draining Hattie Lake on the east side of Lochaber/Lochiel lakes.

The 2011 stream surveys found much the same, in general terms, as that reported by Mitchell (2010a) and so some of his findings are repeated here below.

(The following bullets from Mitchell, 2010a). There were certain themes encountered on most of these brooks during these surveys which can inform us of significant influence on channel structure in the St. Mary's River.

- Debris accumulations and jams were quite frequent and appear to be major influences affecting the dynamics and frequency of channel changes as they redirect water. A certain amount of debris is essential for channel maintenance and cover for fish, but excessive debris leads to inappropriately high rates of flow diversion and lack of stability within the channel, to the detriment of fish habitat. Future surveys should pay more attention to quantity of debris in-channel and over-channel to determine what the optimal density is in these systems, thereby allowing placement of debris or digger logs in those channels lacking it, and removal of excess LWD in those in which density is artificially high.
- Beaver activity was quite common on several streams. There were few identified problematic dams, but beavers tend to increase the size of their dams in late summer and early autumn; a time most of the surveys reported here missed. The most problematic dams will be those lowest down on a stream near the stream mouth where they may cut off access to the entire brook. Due to the lack of feasibility of comprehensive autumn beaver dam surveys and lack of knowledge of stream use by spawning salmonids in the St. Mary's, beaver activity will likely continue to be an undocumented and unmanaged factor in this drainage.

- Frequently habitat was somewhat partitioned along the length of a stream with “trout” habitat (deep pools, greater frequency of runs, smaller substrate size) in lower sections of streams and “salmon” habitat (riffles, larger substrate size) in the mid sections of these streams. In the future, consideration should be given in restoration in this watershed to mimic that pattern. That is, to restore lower sections to deep water, relatively slow moving areas) and avoid trying to turn these areas into “salmon” habitat.

The findings flowing out of the four years (2008-2011) of stream surveys, and other surveys conducted, indicate that there are three general categories of restoration to be conducted in the St. Mary’s River:

**Category 1:** Culvert passage: Mitchell (2010b) identified eight culverts which likely present passage issues to fish. Of particular priority and significance are problematic culverts at McQuarries Brook, Fraser’s Brook, Boggs Brook and Bryden Brook (Glenelg). Efforts should be made to rehabilitate these culverts as outlined in Mitchell (2010b).

**Category 2:** Debris jam clearing: Problematic small and large debris jams possibly affecting fish passage and likely affecting channel morphology and stability have been identified on Boggs Brook, Kelly Brook, Archibald’s Brook (Glenelg) and Tait Brook. These debris jams should be modified through selective removal of material to maintain cover function but reduce issues with passage or altering channel morphology.

**Category 3:** Large scale restoration programs: Four systems (East Branch mainstem, McKeen’s Brook, Sutherland’s Brook, and Campbell’s Brook) have been identified as being appropriate for large scale restoration activities. McKeen’s Brook is described in this report, Sutherland’s and Campbell’s Brook will be described in a forthcoming SMRA Technical Report, and the East Branch mainstem is as yet not adequately surveyed to prescribe restoration activities. Each of these systems will require multi-year and multiple structure approaches.

Recommendations for future restoration activities in the St. Mary’s River watershed are:

1. Rehabilitating problematic culverts should be a priority for future restoration activities. This will need to be done in conjunction and cooperation with Nova Scotia Department of Transportation and Infrastructure Renewal.
2. Focussed large scale restoration (multi-year on single systems) should be initiated in 2012. Sutherland’s Brook and McKeen’s Brook should be the initial target brooks before attempting the larger and more comprehensive requirements of Campbell’s Brook and the East Branch mainstem. This will allow some learning opportunities and experimentation.
3. Debris jam clearing may be done using SMRA volunteers (work parties) or short term hiring of youth/contractors. Requirement of chain saw operation to clear debris jam will interfere with some funding sources (e.g., Nova Scotia Youth Conservation Corp will not fund activities in which employees are required to use power tools).



4. Conduct a small number (4-5) stream surveys each year, focussing on the streams identified in Table 1. This will allow continual and systematic increase in knowledge of stream conditions and required restoration, while not being expensive.

#### LITERATURE CITED

Adams, M.A. and I. W. Whyte. 1990. Fish habitat enhancement. A manual for freshwater, estuarine and marine habitats. Prepared for Government of Canada, Fisheries and Oceans by Envirowest Environmental Consultants.

Mitchell, S.C. 2010a. St. Mary's River Tributary Stream Restoration Assessment and Planning for 2011. St. Mary's River Association Technical Report #009.

Mitchell, S.C. 2010b. A Culvert Survey of the St. Mary's River, Guysborough County, Nova Scotia, Assessing and Priorizing Culverts as Obstructions to Fish Passage.. St. Mary's River Association Technical Report #008.

Mitchell, S.C. 2011. Water Quality of the St. Mary's River Watershed: A detailed Analysis. St. Mary's River Association Technical Report #011.

Nova Scotia Salmon Association (NSSA). 2005. Adopt-a-stream. A watershed approach to community-based stewardship. Prepared for Department of Fisheries and Oceans and Nova Scotia Department of Fisheries by Thaumass Environmental Consultants, Ltd. Dartmouth, NS.

Ohio Department of Natural Resources. 2005. Getting the point about nonpoint. Ohio nonpoint source pollution management plan. Available online at:  
<http://web.epa.ohio.gov/dsw/nps/NPSMP/index.html>.



**Plate 1:** Photographs of typical habitat conditions in Clarke Brook, West Branch St. Mary's River. Photographs taken July 19, 2011.





**Plate 2:** Photographs of debris jam in Reach 2 of Kelly Brook, West Branch St. Mary's River. Photographs taken August 17, 2011.





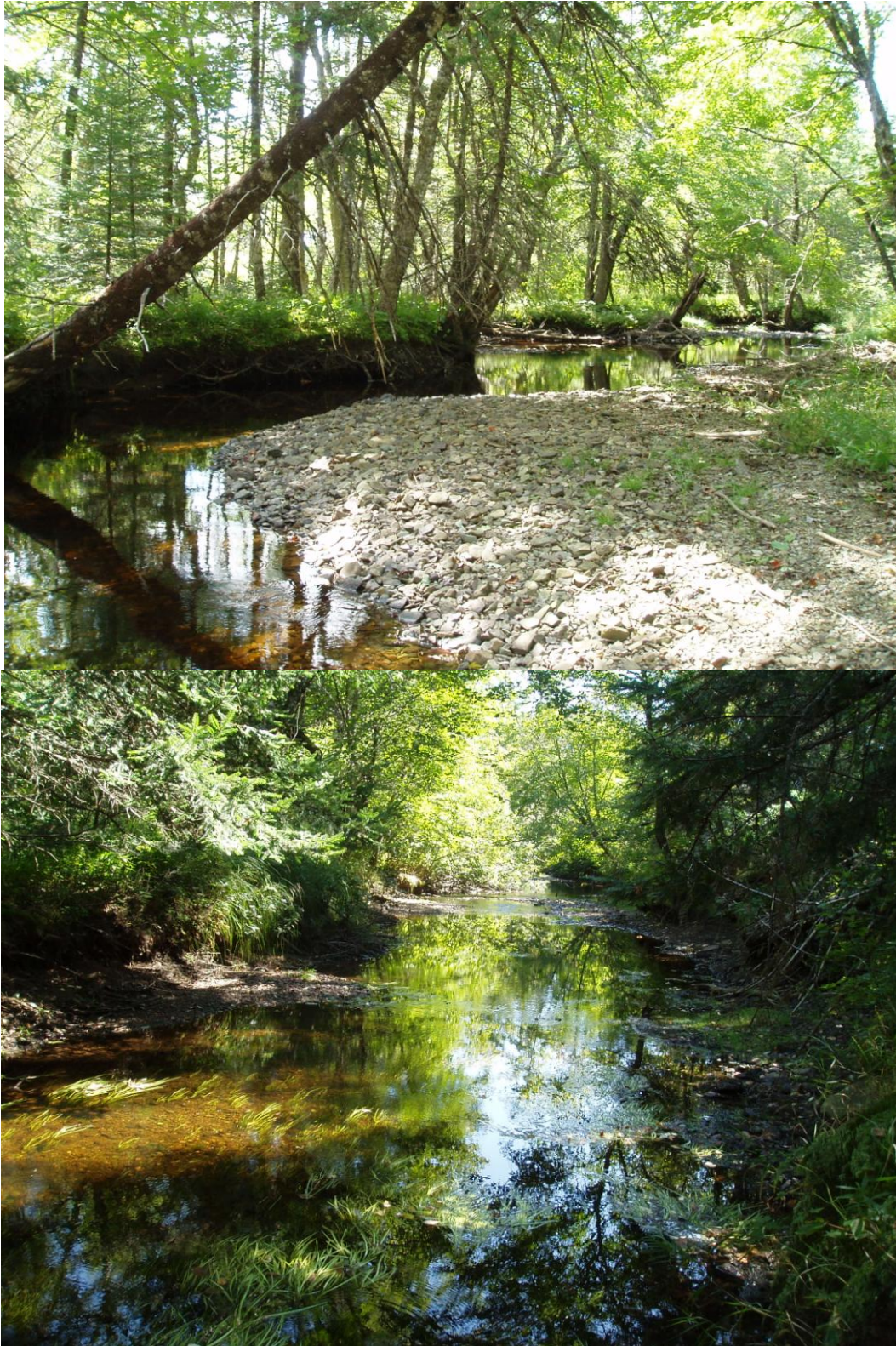
**Plate 3:** Photographs of decrepit bridge at upper extent of Reach 3 of Kelly Brook, West Branch St. Mary's River. Photographs taken August 17, 2011.





**Plate 4:** Photographs of typical habitat conditions (Reach 1 upper photo; Reach 3 lower photo) in Mitchell Brook, West Branch St. Mary's River. Photographs taken July 28, 2011.





**Plate 5:** Photographs of typical habitat conditions (Reach 2 upper photo; Reach 1 lower photo) in Ross Brook, West Branch St. Mary's River. Photographs taken September 12, 2011.





**Plate 6:** Photographs of typical habitat conditions (Reach 1 upper photo; Reach 2 lower photo) in Bryden Brook, West Branch St. Mary's River. Photographs taken September 13, 2011.





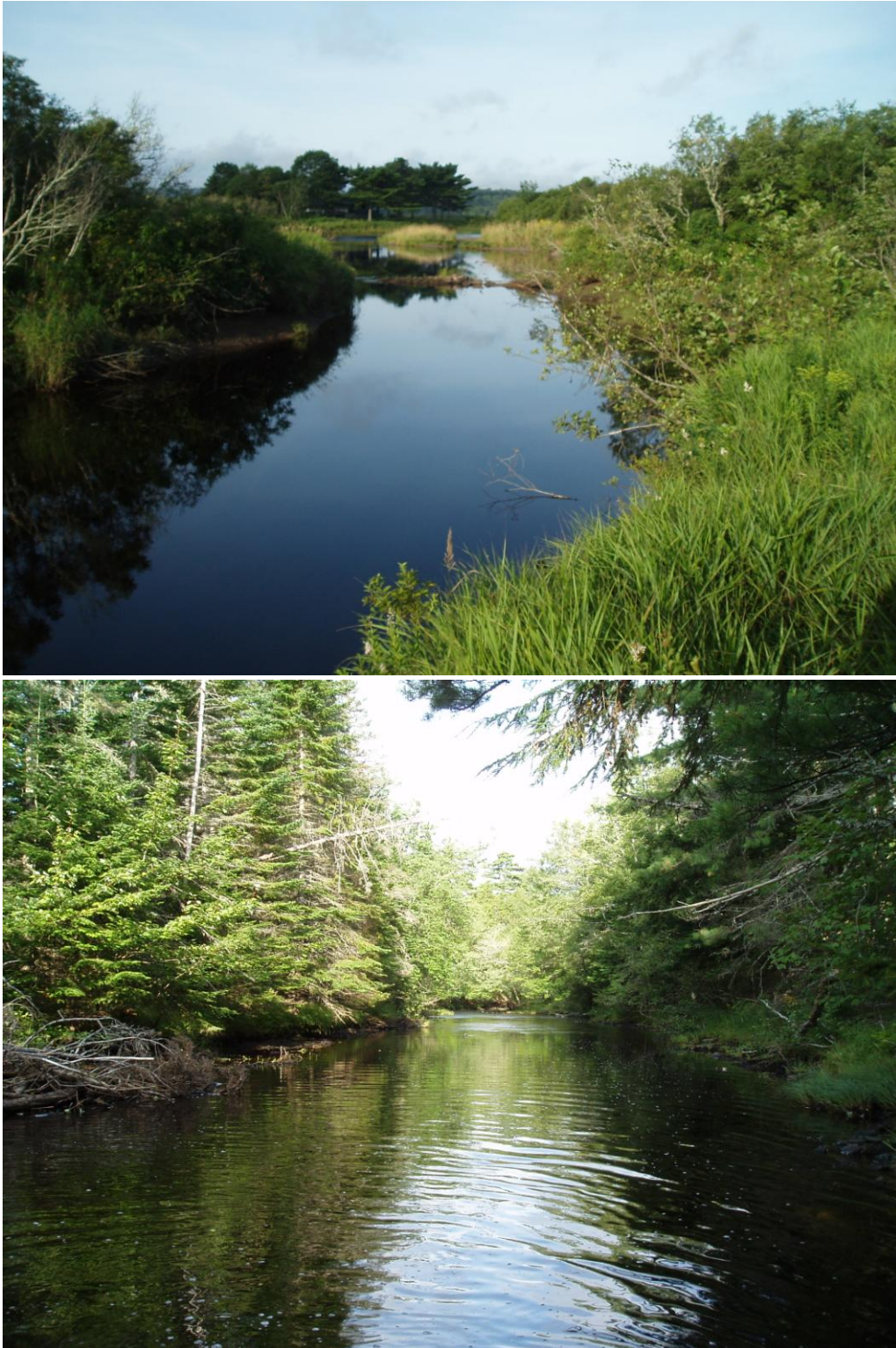
**Plate 7:** Photographs of typical habitat conditions (Reach 1 upper photo; Reach 4 lower photo) in Nelson River, West Branch St. Mary's River. Photographs taken September 30, 2011.





**Plate 8:** Photographs of typical habitat conditions (Reach 1 upper photo; Reach 4 lower photo showing temporary bridge with little clearance) in Big Meadow Brook, East Branch St. Mary's River. Photographs taken July 25, 2011.





**Plate 9:** Photographs of typical habitat conditions (Reach 1 upper photo – confluence with East Branch; Reach 3 lower photo) in McKeen's Brook, East Branch St. Mary's River. Photographs taken August 22, 2011.





**Plate 10:** Photographs of large debris jam on reach 2/3 boundary of Bogg's Brook, North Branch St. Mary's River. Photographs taken September 22, 2011.





**Plate 11:** Photographs of typical habitat conditions (upper photo – upstream of Highway 7 bridge; lower photo near upstream extent of survey) in Archibald's Brook (Stillwater), Main Branch St. Mary's River. Photographs taken July 19, 2011.