Seguin River Fish Habitat Assessment

Executive Summary

The Eastern Georgian Bay Stewardship Council (EGBSC) received funding from Environment and Climate Change Canada to carry out a thirty-two (32) month project to assess spawning, nursery, rearing, and foraging habitat in eight tributaries to eastern Georgian Bay, including the Seguin River. Fish habitat assessments were focused on Walleye, Lake Sturgeon, and Sucker species, between the river mouths and the first major spawning area or barrier to fish passage.

During the 2016 spawning season, EGBSC visited the Seguin River spawning bed thirteen (13) times between April 15 and June 8. Basic water chemistry measurements (water temperature, dissolved oxygen, pH, conductivity) were recorded on all site visits and were within the expected range.

Three stations were set up on the Seguin River to measure water velocity and water level fluctuations. Consistently taking measurements at the same location was challenging due to water level manipulations at the dam, located immediately upstream of the spawning area. Between May 2 and May 5, all stop-logs were inserted into the "north dam" which is situated immediately above the spawning bed. Two of the three stations went dry, and water levels dropped by 28.5 cm. Two of the flow stations had to be re-established in areas of the spawning bed that still had water.

Insertion of stop-logs between May 2 and May 5 resulted in a considerable amount of nearshore area and spawning habitat being left out of water. However, Walleye were not observed at the spawning bed until May 5, and no Walleye eggs were observed in the nearshore area until May 10 or counted on egg mats until May 12. Fortunately, the stop-logs were inserted before spawning occurred, otherwise there may have been egg stranding. No eggs were observed stranded out of water at the Seguin spawning bed.

Between day and night visual observations, there were very few Walleye and White Sucker observed. In addition, a low number of Walleye and Sucker eggs were deposited on the three installed egg mats, and only a small number of Walleye eggs were observed adjacent to the shoreline.

While there appears to be a large area of high-quality spawning substrate (ranging from gravel to boulders) at the Seguin spawning bed, not all areas with ideal substrate also have ideal depth for Walleye, Lake Sturgeon, and White Sucker.

A plankton sample was taken during the time when fry would likely be hatching. This sample was visually compared to samples collected from the other tributaries being assessed in 2016 – Magnetawan River, Shawanaga River, Shebeshekong River, and Sucker Creek. Plankton abundance at the Seguin River was less than that of the Shawanaga River but greater than the Magnetawan River. Plankton abundance at the Seguin River was similar to the Shebeshekong River and Sucker Creek.

Surveys were conducted to assess nursery, rearing, and foraging habitat available downstream of the Seguin River spawning bed. Bathymetry and side scan sonar data were collected from the base of the spawning bed into the Parry Sound Harbour. In that area, 44% of the shoreline is natural and the other 56% is altered. Alterations included mown grass to the waters' edge, buildings, retaining walls, exposed dirt/construction areas, riprap shoreline hardening, and docks.

Underwater surveys were taken for 100 m, spaced approximately 1 km apart from the outlet of the Seguin River, down around part of the Parry Sound Harbour. Based on these surveys, the area around the outlet of the Seguin River had more garbage than other tributaries, with the exception of Sucker Creek. Of all the rivers assessed, the outlets of the Seguin River and Sucker Creek were the most heavily impacted by human activities (boating, docks, marinas, construction businesses, etc.). Compared to the other rivers assessed, there is less natural habitat available along the shorelines downstream of the Seguin River for larval fry once they have hatched. The shoreline along eight of the nine underwater surveys had some form of alteration.

The underwater surveys showed a diverse mix of substrate in the nearshore area including bedrock, boulder, cobble, and soft substrate. The amount of aquatic vegetation varied from sparse to moderate. Fifty-six percent of the surveys had sparse vegetation, 11% had sparse to moderate levels of vegetation, and 33% had moderate levels of vegetation. The amount of underwater wood structure, an important component of fish habitat, ranged from sparse to abundant.

Two potential issues were identified from the 2016 assessment of the Seguin River. The first potential issue is the lack of natural habitat downstream of the spawning bed for larval fish. The second potential issue is that anglers were observed along the wharf directly below the spawning bed beginning on May 12. Walleye season in Georgian Bay opens on May 1 (Fisheries Management Zone 14). However, the Seguin River within the Town of Parry Sound is considered a fish sanctuary, restricting Walleye fishing until the third Saturday in May (May 21 in 2016). Active Walleye spawning was occurring during the time period when angling was observed. While the anglers were observed outside of the fish sanctuary, it is likely that Walleye being angled were going to spawn, or just recently finished spawning. It is possible that this is a recurring problem each spawning season.

Based on the 2016 assessment, EGBSC has several recommendations. First, EGBSC recommends revising the wording in the Seguin River Simplified Water Management Plan to clearly state that maximum flows be preferentially directed over the spawning bed (downstream of the north dam) throughout the spawning and incubation period. This stipulation is currently written in the plan, but it is not clearly worded and confusing in its intention. Managing flows in this way would not only increase the amount of spawning habitat, but it may also improve depths and enhance spawning conditions. Second, carry out future monitoring for Lake Sturgeon directly downstream of the spawning bed via frequent snorkel surveys (once flows have diminished). Third, investigate the spawning bed in a year with low Georgian Bay water levels to better assess accessibility of the spawning bed.

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Project Overview and Methodologies

In 2015, the Eastern Georgian Bay Stewardship Council (EGBSC) received funding from Environment and Climate Change Canada to carry out a thirty-two (32) month project to assess spawning, nursery, rearing, and foraging habitat in eight tributaries to eastern Georgian Bay, within the Parry Sound District. Lake Sturgeon, Walleye, and Sucker species have been experiencing varying levels of decline in parts of eastern Georgian Bay. Accordingly, fish habitat assessments were focused on these species with the goals of: (1) determining whether there is sufficient habitat available; and (2) identifying and prioritizing opportunities for restoration. Assessments were carried out between the river mouths and the first major spawning area or barrier to fish passage.

EGBSC formed a collaborative working group to aid in the development of a field protocol for data collection. This group consisted of:

- Arunas Liskauskas, Dave Gonder, Chris Davis, and Stephen James – Upper Great Lakes Management Unit, Ministry of Natural Resources and Forestry
- Scott Finucan – Ministry of Natural Resources and Forestry
- Greg Mayne – Environment and Climate Change Canada
- Karl Schiefer – Aquatic Biologist consultant and EGBSC member
- David Bywater – Environmental Scientist, Georgian Bay Biosphere Reserve
- David Sweetnam – Executive Director, Georgian Bay Forever

Two main protocols were considered for this project. The first was the Ontario Stream Assessment Protocol (OSAP), which is a standardized method of measuring and collecting field data in the province of Ontario. This protocol is applicable to wadeable streams. The rivers being considered in this project were non-wadeable. Nevertheless, components of the OSAP protocol were used when assessing spawning beds in late summer and fall.

The other protocol considered for tributary classification was the Rosgen Classification system. This protocol is often used in stream restoration projects. However, the Rosgen Classification system was designed based on U.S. rivers and may not be appropriate for central Ontario rivers. Consequently, the Rosgen Classification was not used.

EGBSC completed broad habitat surveys on each river – Shebeshekong, Seguin, Magnetawan, Shawanaga, Key, Pickerel, Naiscoot, Sucker Creek – to record the location and evaluate the amount and quality of habitat available. During assessments, EGBSC also considered whether there were habitat limitations from human or natural stressors and identified any potential restoration opportunities.

As part of the broad habitat assessments, the following information was collected on each river:

- Basic water quality parameters (pH, conductivity, dissolved oxygen)
- Water temperature
- Water velocity
- Water level fluctuations
- Aerial photographs
- Underwater photographs and videos

- Substrate type
- General size of habitat
- Accessibility of spawning areas during different flow regimes
- Potential limitations or indicators of stress
- Opportunity for restoration

For the assessments, EGBSC used a combination of methods to collect data and brought in standardized protocols where possible. The project advisory team helped guide the technical aspects of this project to ensure the data collected was not only valuable but useable for other work and reports.

To collect high quality imagery of the sites, EGBSC purchased and used a DJI Phantom 3 Advanced quadcopter.

Three software programs were used as part of this project. Pix4D was used to create orthomosaics from the drone photography. Reefmaster was used to map bathymetry and side scan sonar data that was collected using a Lowrance unit. Finally, QGIS 2.18 was used for mapping.

In addition to gathering field data, EGBSC also collected background information and local knowledge when possible. The information that can be shared is provided in the Background Information section.

Background Information

The Seguin River flows into the Parry Sound Harbour in the town of Parry Sound (Figure 1). The river and its watershed are situated in the ancestral and traditional territory of the Anishinabek people.

Figure 1. Location of Seguin River outlet into the Parry Sound Harbour, Georgian Bay

The Seguin River watershed is a large watershed. As described in the Seguin River Simplified Water Management Plan, the watershed drains an area of 1,023 km^2 (AMEC Earth & Environmental, 2009). The headwaters of the Seguin River start east of Sprucedale, near the ghost town of Whitehall. The river then flows west for approximately 40 km, through the town of Parry Sound where it outlets into Georgian Bay at the Parry Sound Harbour (AMEC Earth & Environmental, 2009). Based on Ministry of Natural Resources and Forestry (MNRF) quaternary watershed boundaries, the Seguin River watershed is actually comprised of several quaternary watersheds (2EA-14, 2EA-15, 2EA-18, 2EA-19), and the boundaries and total area differ slightly from those presented in the Seguin River Simplified Water Management Plan (Figure 2).

There is very little background information available in print regarding spawning and fish populations at the Seguin River. At some point during the 1980s, the Ministry of Natural Resources (MNR) undertook restoration work to enhance the Seguin River spawning bed for Walleye. No documentation on the restoration work could be found and there was no record of any focused fish sampling at the site.

Based on anecdotal information, the Seguin River has always been a Walleye spawning site and was historically a Lake Sturgeon spawning site. Some individuals suggest that Lake Sturgeon are still observed in the Parry Sound Harbour, and while they come to the Seguin River during the spawning season, they cannot pass the bottom ledge of the spawning bed. A 2009 MNRF document titled *The Lake Sturgeon in Ontario* lists Lake Sturgeon as extirpated from the Seguin River.

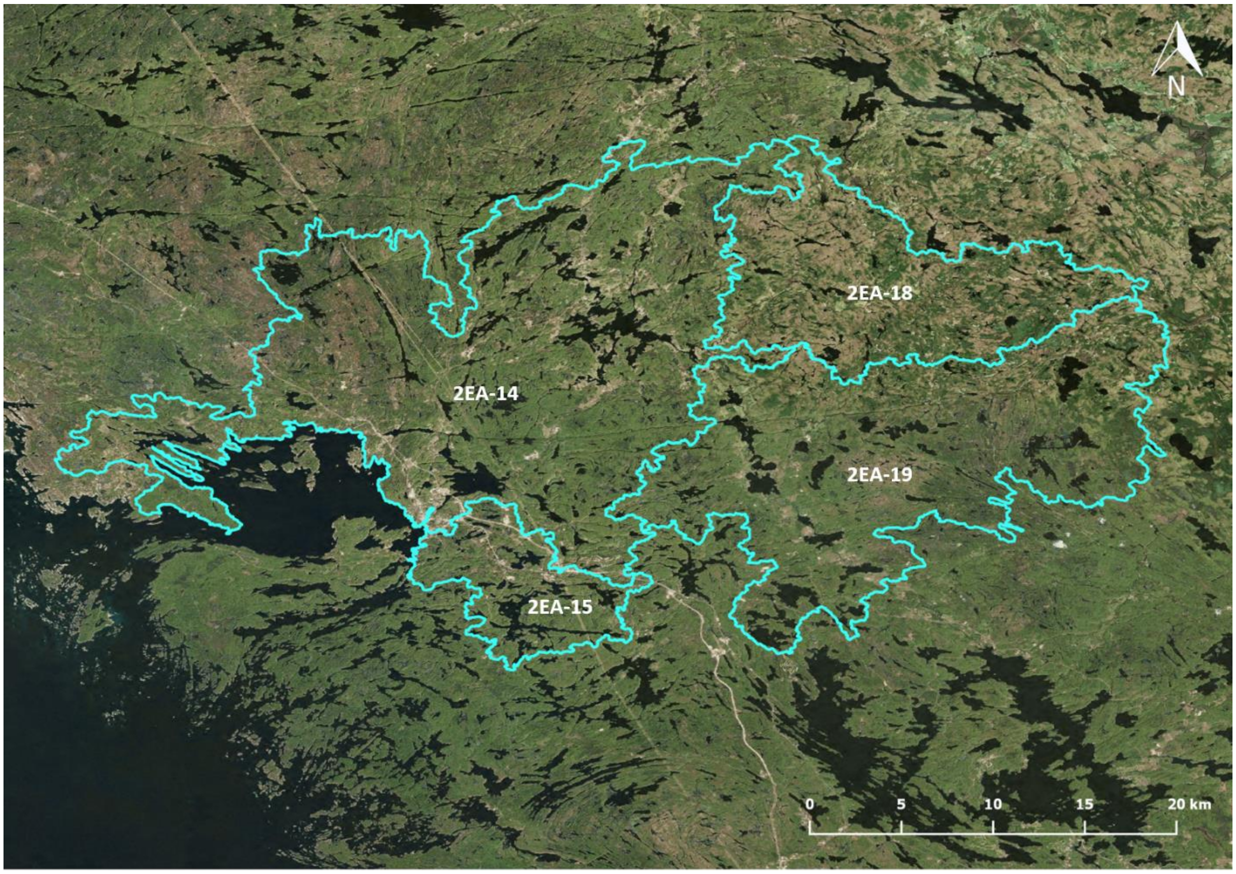

Figure 2. Seguin River watershed comprised of four quaternary watersheds (2EA-14, 2EA-15, 2EA-18, 2EA-19)

Spring Spawning Assessments

In 2016, EGBSC studied the first set of rapids upstream of the Seguin River outlet. This set of rapids is essentially situated right at the outlet of the river, only 300 m upstream of the Parry Sound Harbour (Figure 3). Two dams at this site prevent fish from moving farther upstream (Figure 4). Any spawning Walleye, Lake Sturgeon, or Sucker species would be limited to the studied spawning area.

EGBSC began spring field work at the Seguin River on April 15 and ended on June 8. During this period, the site was visited thirteen (13) times, approximately every three to four days whenever possible. Towards the end of the Walleye, Lake Sturgeon, and Sucker spawning period (end of May), site visits were less frequent.

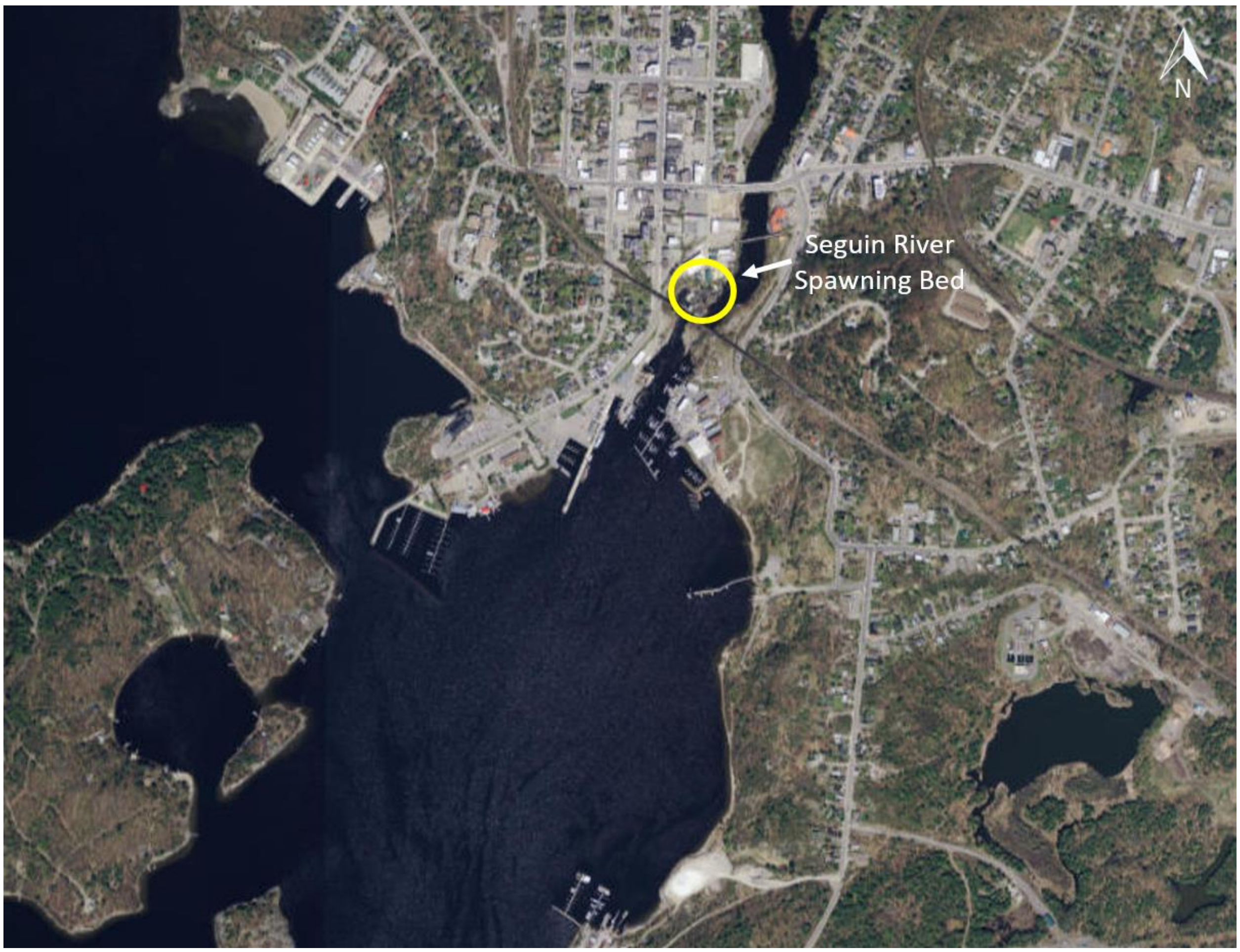

Figure 3. Location of Seguin River spawning bed

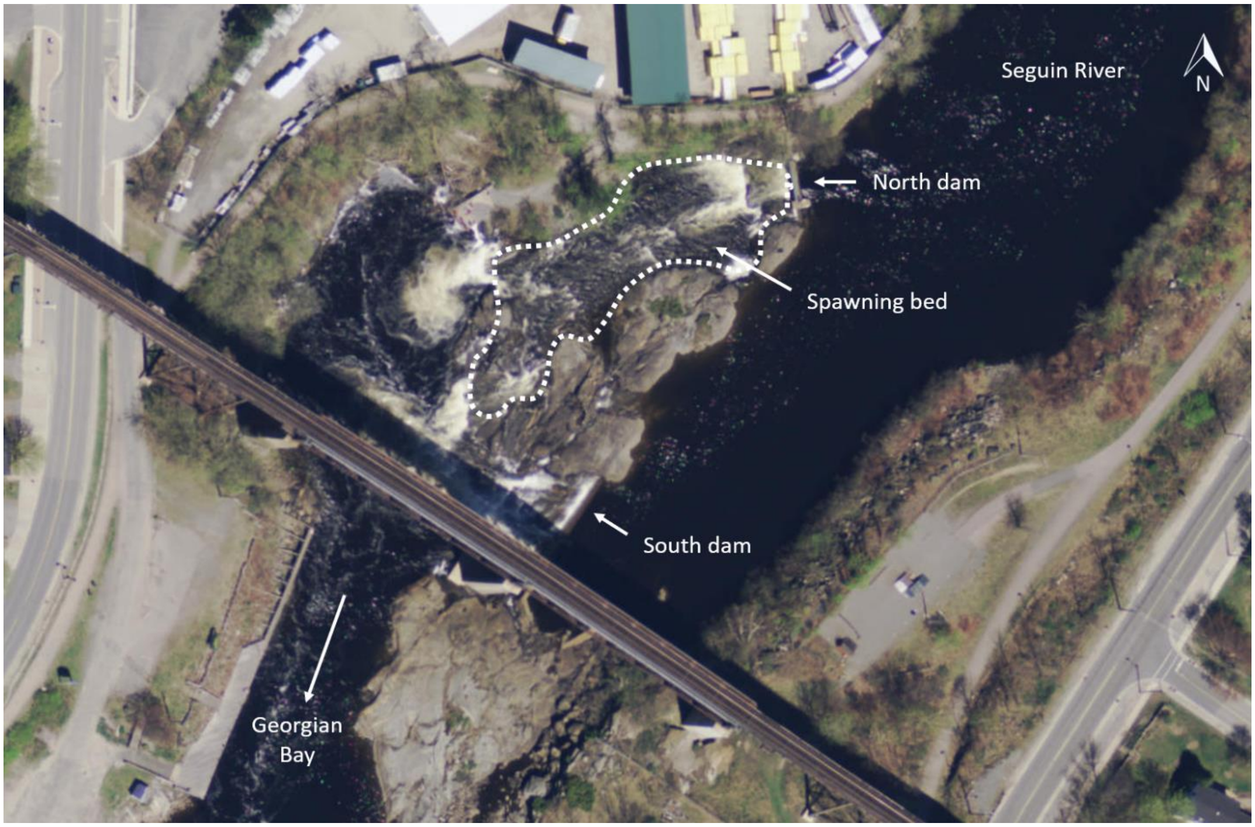

Figure 4. Seguin River spawning bed and dam locations

Water Chemistry

A YSI PROPLUS metre was used to measure basic water quality parameters on each site visit – water temperature, dissolved oxygen, conductivity, and pH. These parameters were selected because of the influence they can have on fish and fish activity, and to see if the levels recorded indicated any potential issues.

Water temperature is extremely important to fish. Aside from water velocity, water temperature is the main stimulus for spawning. For Walleye, spawning males begin to move towards spawning areas when water temperatures reach 2 to 5˚C. Spawning takes place through a variety of temperatures, but peak spawning typically occurs at 7 to 8˚C (Kerr et al., 1997). Conversely, spawning activity typically ceases once water temperatures reach 10 to 11˚C (Kerr et al., 1997). For Sucker species, spawning takes place between 10 and 16˚C (Hasnain et al., 2010). For Lake Sturgeon, main spawning activity occurs between 13 and 18˚C (Scott & Crossman, 1998). Water temperature also influences the speed and success of egg incubation. Optimal water temperature for egg incubation is 12.2˚C for Walleye, 14.5 ˚C for Lake Sturgeon, 15˚C for White Sucker, and 12.5˚C for Longnose Sucker (Hasnain et al., 2010).

As illustrated in Figure 5, water temperature slowly increased from 3.5˚C on April 16 to 21.0˚C on May 30 before dropping back down to 18.3˚C by June 8. Walleye and White Sucker were observed during site visits between May 5 and May 30. No Lake Sturgeon or Redhorse Sucker species were observed.

Fish require dissolved oxygen to breathe. Fast flowing, cold water has higher dissolved oxygen concentrations than slow moving, warm water. Cold water can hold more oxygen as it rolls through rapids, which incorporates air from the atmosphere into the water. Dissolved oxygen is typically highest in early spring and declines as water temperatures increase and velocity slows. As shown in Figure 5, dissolved oxygen levels dropped consistently throughout the study period. The highest level was recorded on April 15 (15.04 mg/L) and the lowest on May 24 (9.32 mg/L).

The pH of water refers to how alkaline or acidic the water is, and is ranked on a scale of 0 to 14. pH will influence how soluble and available nutrients and heavy metals are in a system. pH can also influence fish health and reproductive success. In general, Walleye do best in waterbodies with a pH ranging between 6.0 and 9.0. Reproductive success can be jeopardized at pH levels below 6.0. All pH levels recorded at the Seguin River spawning bed were above 6.0. The highest pH level was 7.36 on May 24 and the lowest pH recorded was 6.72 on May 10. The pH readings are mildly acidic and typical for Canadian Shield watersheds.

Figure 5 illustrates changes in temperature, dissolved oxygen, and pH over the spawning and egg incubation periods. pH remained relatively stable, while temperature and dissolved oxygen followed a typical pattern for spring.

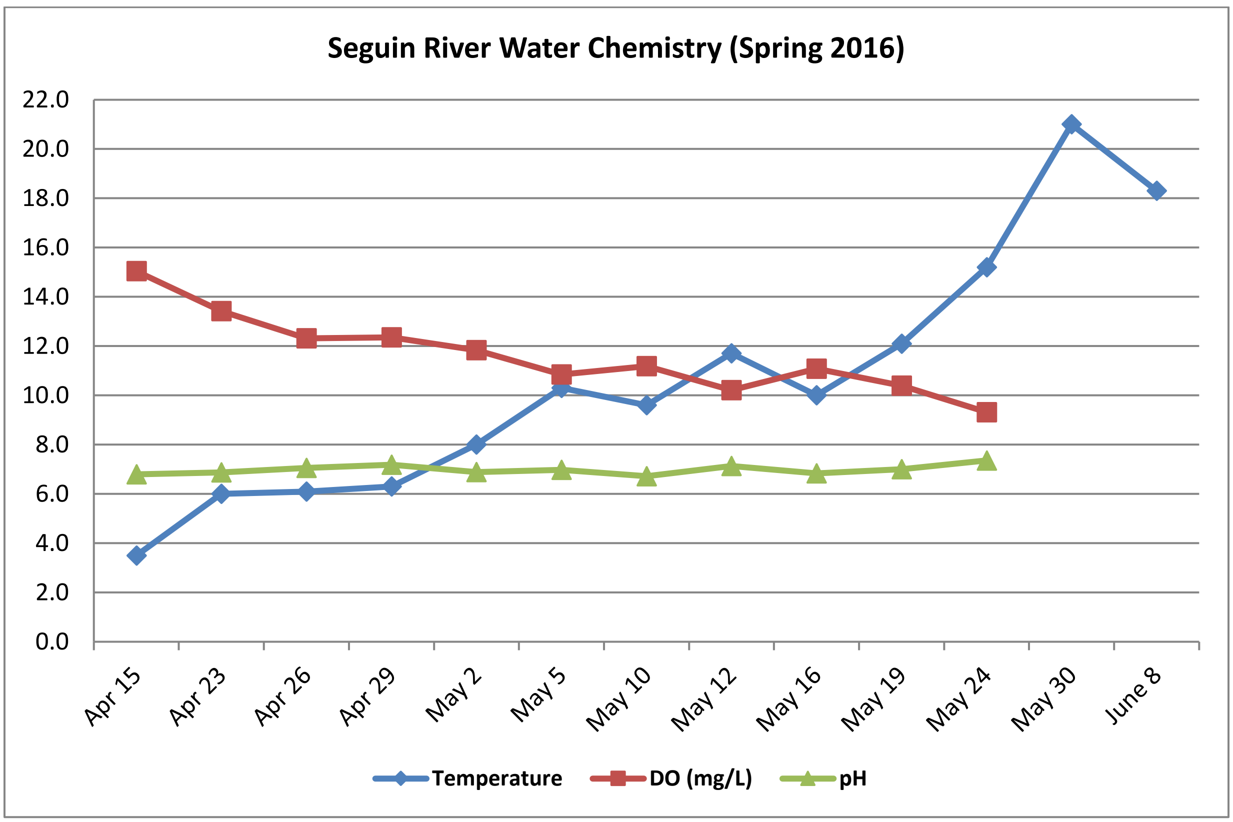

Figure 5. Water temperature (°C), dissolved oxygen (mg/L), and pH measurements taken at the Seguin River spawning bed in spring 2016

Conductivity was also measured at the Seguin River in 2016 (Figure 6). Conductivity measures the ability of water to pass an electrical current and is influenced by geology. For example, a clay substrate will have a high conductivity because of a greater amount of ions in the water. Rivers within the Parry Sound

District typically have low conductivity, but conductivity can be significantly affected by stormwater runoff, and a sudden increase or decrease can indicate issues in a waterbody. Conductivity was recorded between April 17 and May 24. Conductivity fluctuated between 37.0 and 57.1 uS/cm throughout the study period but remained fairly consistent. There were no significant increases that would indicate stormwater runoff issues during that time period, which also coincided with a lack of rain (only two rain events between April 15 and June 8 in 2016). The highest conductivity reading was taken on May 5 (57.1 uS/cm). The lowest reading was on April 23 (37.0 uS/cm).

For complete water chemistry data, refer to Appendix A.

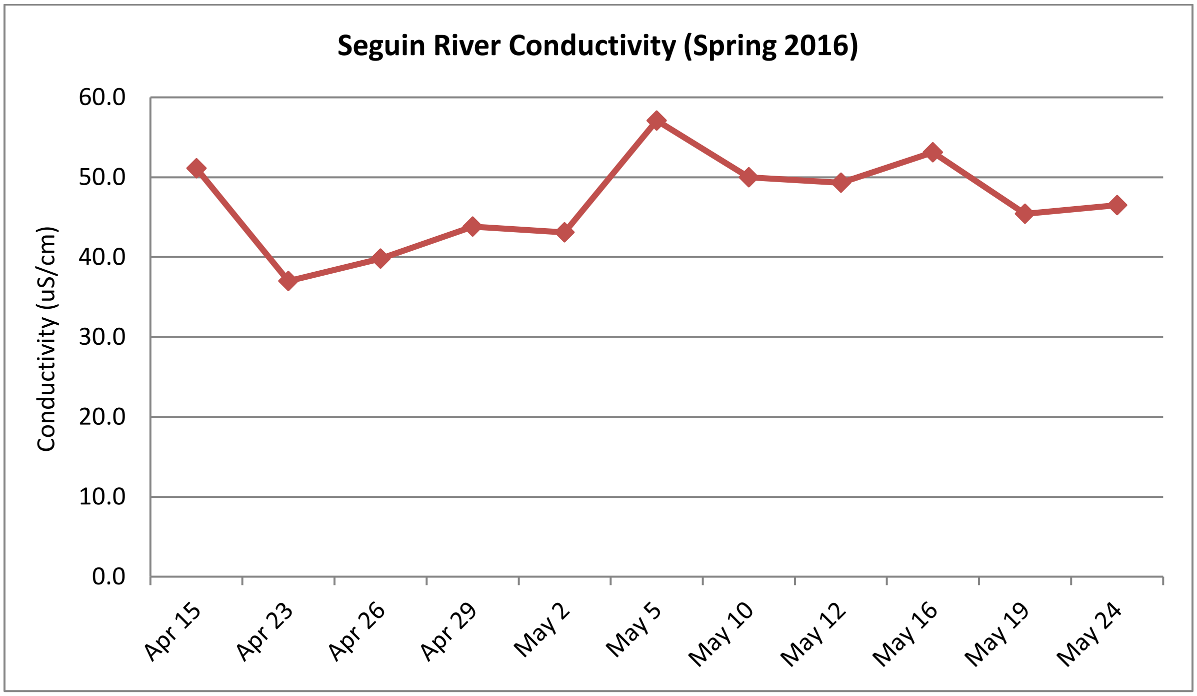

Figure 6. Conductivity measurements (uS/cm) at the Seguin River spawning bed in spring 2016

Water Velocity

Water velocity has an influence on fish spawning. Species such as Walleye spawn in areas of fast-moving water, during the spring freshet. Walleye prefer velocities less than 2.0 m/s (Kerr et al., 1997). Lake Sturgeon generally spawn in conditions with a minimum of 0.5 m/s to a maximum of 1.5 m/s (Golder Associates Ltd., 2011), and White Sucker typically spawn in velocities ranging from 0.14 m/s to 0.9 m/s (Twomey et al., 1984). Water velocity is typically high during the spawning period and declines over time.

Water velocity was measured with a Marsh McBirney Flo-mate 2000 flow meter to investigate whether there were areas where the flow would be too fast for fish to swim through. Mean velocity was measured at 60% of the water depth.

Three stations were established at the Seguin River spawning bed to collect information on water velocity from April 23 to June 8 (Figure 7). Station 1 went dry on May 5 and had to be moved approximately 4 m further instream. At that point the original station location was renamed station 1a and the new station became station 1b. Station 3 also went dry on May 5 and water velocity had to be taken approximately 6 m further instream, becoming station 3b (original location becoming station 3a). Figure 8 displays velocity measurements recorded at each station.

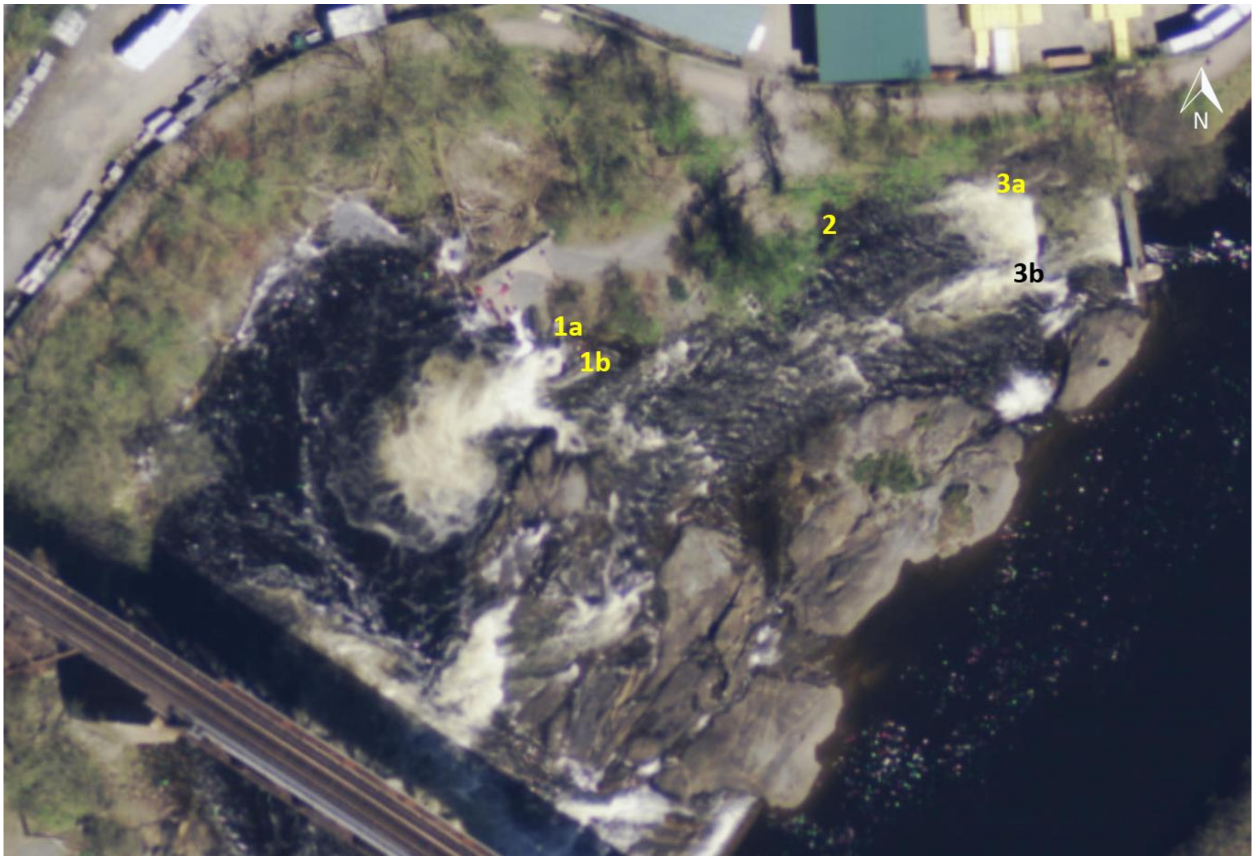

Figure 7. Water velocity and depth stations at the Seguin River spawning bed

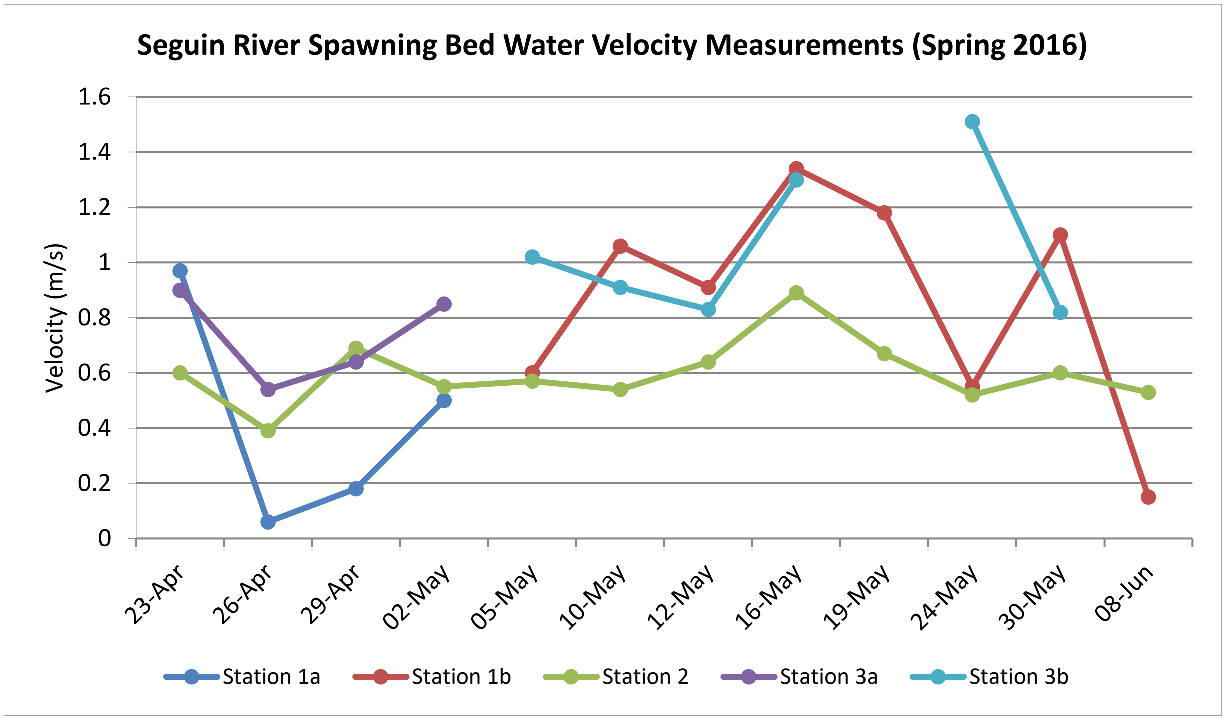

Figure 8. Water velocity measurements at the Seguin River spawning bed in spring 2016

As previously stated, water velocity could not be measured consistently at two of the three original stations (1a and 3a, see Figure 9). Velocity measurements were complicated by dam manipulation on two occasions. Sometime between May 2 and May 5, the insertion of stop-logs into the north dam (immediately above the spawning bed) resulted in a water level drop of 28.5 cm. On May 13, a half log was inserted in the south dam, adjacent to the CPR trestle (D. Albrook, personal communication, 2016), thereby directing more water into the spawning bed below the north dam. A subsequent major rainfall event on May 14 caused water levels to increase further. As a result, it was difficult to track changes in water velocity between April 23 and June 8; however, there were no velocity measurements recorded that would have excluded fish from accessing areas of the spawning bed. Station 3b had the highest velocity reading on May 24, at 1.51 m/s. Station 3b was located at the base of the dam in a narrow channel and would naturally have a faster flow due to its proximity to the dam. Because of the increase in water level and velocity after the dam manipulation on May 13 and a rain event on May 14, EGBSC could not safely access station 3b on the May 19 site visit (Figure 10). It is likely that velocity readings would have increased between May 16 and May 19, due to the fact that the site became inaccessible for measuring. Photographs taken between May 16 and May 19 capture an increase in water level. Velocities at this location would not have prevented fish from accessing the spawning bed, as the majority of the spawning bed is situated below station 3a and 3b. There were no velocities recorded at station 2 that would have prevented fish from accessing the spawning area.

Figure 9. Dry water velocity stations 1a (left) and 3a (right) at the Seguin River spawning bed in 2016

Figure 10. Seguin River spawning bed station 3b on May 19, 2016

Water Level Fluctuations

Water levels were recorded at station 1a (Figure 7) from April 23 to June 8 to understand how water levels change throughout spawning and egg incubation and how they change along the spawning bed. Typically, when the spring freshet begins, water levels are high. Water levels subsequently decline over the following months. If water levels decline rapidly after the spawning period, deposited eggs may be left out of water and will not hatch.

At station 1a, EGBSC used an existing metal spike driven into the bedrock as an elevation reference point (benchmark) to monitor changes in water level on the spawning bed. Measurements on the first site visit served as the benchmark against which future measurements were compared (i.e., water level up or down compared to the first site visit). Dam manipulation at the north dam between May 2 and May 5 and dam manipulation at the south dam on May 13, combined with a rain event on May 14, created dramatic changes in water levels over the spawning bed. Between April 23 and April 29, the water level at station 1a dropped by 15.5 cm, followed by an increase of 3 cm on May 2. Water levels then dropped by 28.5 cm after stop-logs were inserted into the north dam on May 5, resulting in a substantial reduction of the spawning bed area. Figure 11 illustrates the changes in water level at station 1a from April 23 to June 8. Refer to Appendix B for complete water level and velocity information.

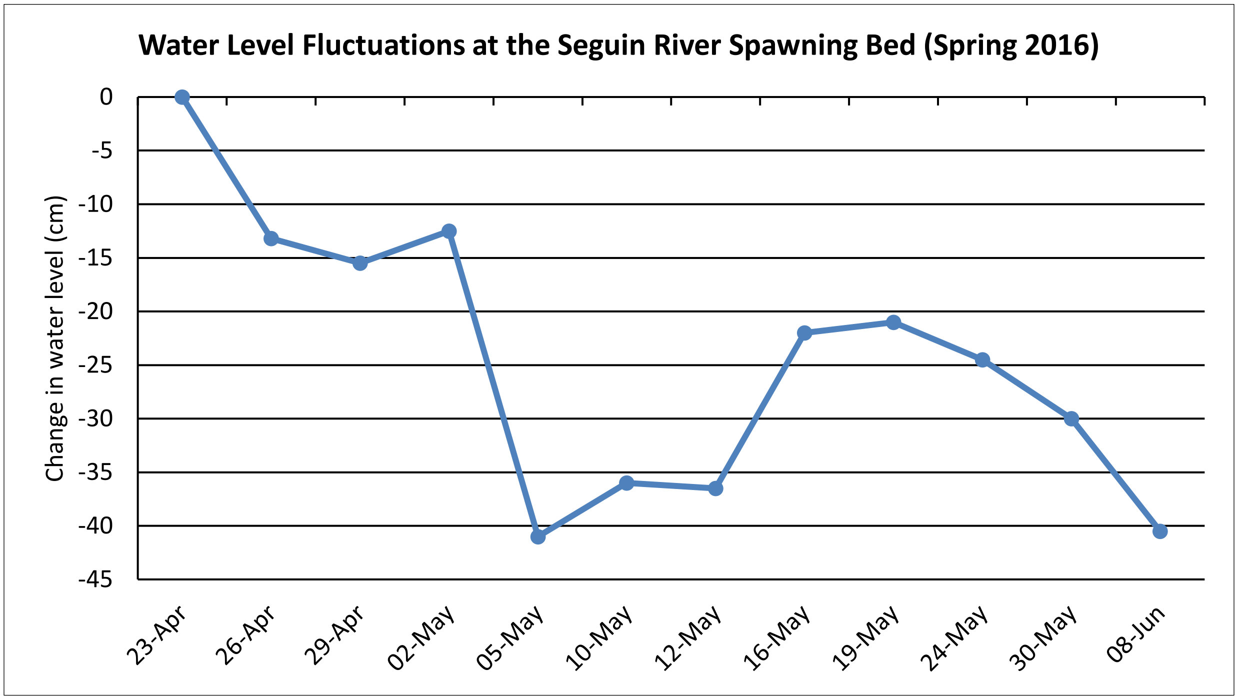

Figure 11. Water level fluctuations at the Seguin River spawning bed measured at station 1a. Measurements on the first site visit served as the benchmark against which future measurements were compared (i.e., water level up or down compared to the first site visit).

Aerial Photographs

An important component of the spawning bed assessments was taking a series of drone photographs during the spawning and egg incubation period to help evaluate how the spawning area changed throughout the spring freshet. However, EGBSC was unable to fly the drone at the Seguin River spawning bed due to the fact that it is located within airspace, making it illegal to fly a drone in the area. Instead, EGBSC took site photos from the same location each visit. Figures 12 and 13 provide an example of the change in water level between April 30 and May 5 site visits. Walleye did not begin to spawn until after May 5, and there were no observations of eggs being stranded out of water. However, the change in water level did reduce the overall area of spawning habitat available, which is discussed further in the Discussion and Recommendations section.

Figure 12. Seguin River spawning bed April 30, 2016

Figure 13. Seguin River spawning bed May 5, 2016

Fish Observations

EGBSC carried out visual observations (night and day) at the spawning bed to help ascertain fish movement and spawning activity. White Sucker were first observed during day surveys on May 10. The fish were seen congregating in a calm area downstream of the chute below the dam. White Sucker were also observed and recorded on GoPro video in a pool directly below the dam (Figure 14). White Sucker were last observed at the spawning bed on May 19.

Figure 14. White Sucker congregating below the north dam

Snorkeling at the site on May 30 revealed seven Walleye, at least fifteen (15) Brown Bullhead, at least ten (10) Smallmouth Bass, and a few Rock Bass (Figures 15 and 16). No Redhorse Sucker species or Lake Sturgeon were seen.

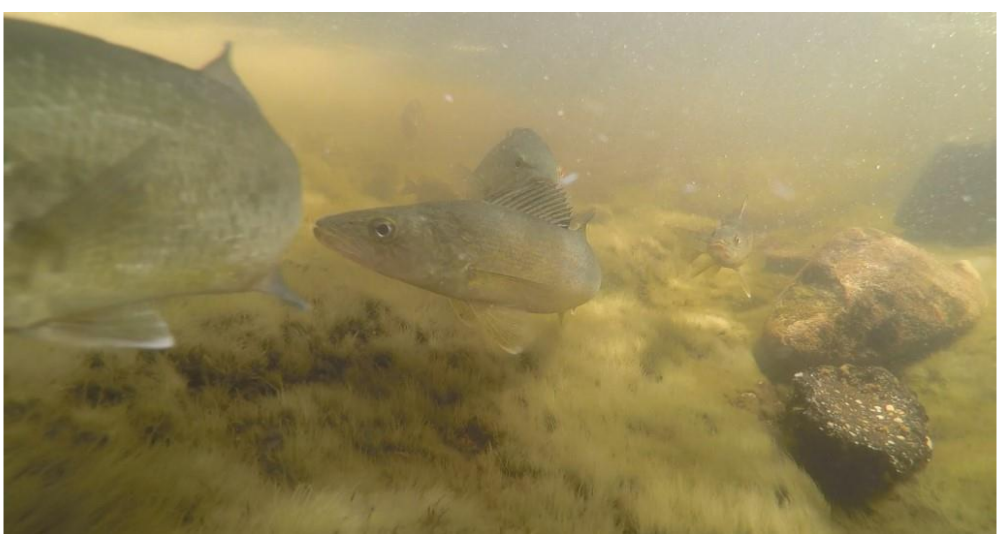

Figure 15. Fish observed at the Seguin River spawning bed on May 30, 2016

Figure 16. Fish observed at the Seguin River spawning bed on May 30, 2016

Seven night surveys were carried out between April 18 and May 10. No fish were observed during night surveys until May 5 when three Walleye were seen. On May 10, at least six White Sucker were observed, but no Walleye were seen. Table 1 lists the dates and species observed during day and night surveys. All fish and egg observations are detailed in Appendix C.

Table 1. Fish observations during day and night surveys

Date	Observation	Number
18-Apr	nothing	0
22-Apr	nothing	0
26-Apr	nothing	0
29-Apr	nothing	0
02-May	nothing	0
05-May	Walleye	3
10-May	White Sucker	over 6
12-May	White Sucker	over 15
19-May	White Sucker	4
30-May	Walleye	7
30-May	Smallmouth Bass	10-15
30-May	Brown Bullhead	15-20
30-May	Rock Bass	a few

On June 6, MNRF staff conducted larval trawls for Lake Sturgeon, downstream of the spawning bed near the wharf. Diminished flows made it difficult to effectively complete the trawls. No Lake Sturgeon larvae were captured during the effort.

Egg Deposition

EGBSC initially set three egg mats at the Seguin River spawning bed on April 15 to help assess the amount and location of egg deposition (Figure 17). All egg mats were removed on May 5, when water levels dropped. One mat was found completely out of water. No eggs were present on any of the mats.

Two egg mats were re-set in slightly different locations on May 5 and counted on May 12. Walleye and Sucker eggs were present on both mats. A total of sixty-eight (68) Sucker eggs and 143 Walleye eggs were counted on May 12. The two mats were re-set in the same locations and counted again on May 24. Only one Walleye egg and 117 Sucker eggs were counted. In total, egg mat 1 had forty (40) Walleye eggs and 122 Sucker eggs. Egg mat 2 had a total of 104 Walleye eggs and sixty-three (63) Sucker eggs. Overall total egg counts were 144 Walleye eggs and 185 Sucker eggs. Egg mats were only placed on a small portion of the spawning bed, and therefore, only represent a small portion of the entire spawning area.

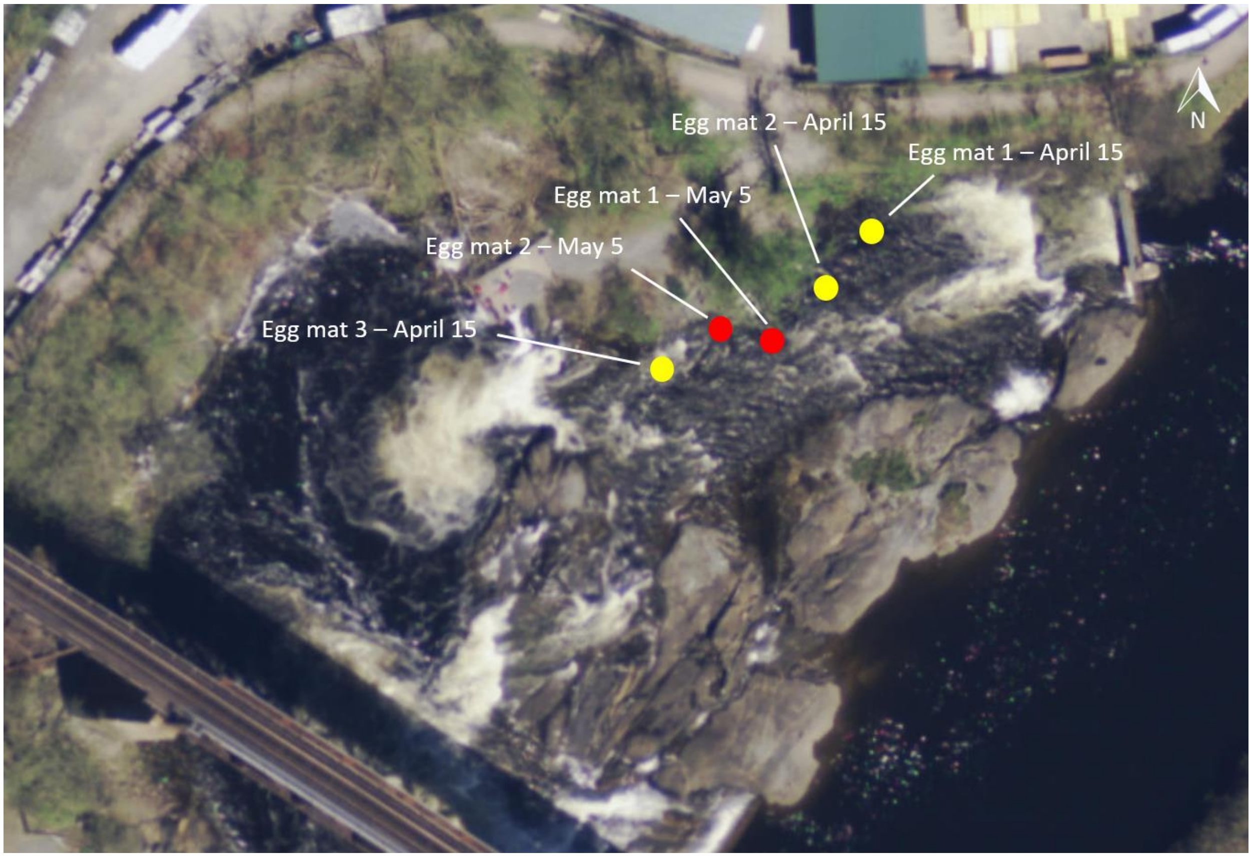

Figure 17. Location of egg mats installed at the Seguin River spawning bed in 2016

On May 10 and 12, EGBSC discovered other areas of Walleye egg deposition. Eggs were found deposited in cobble and also in cracks along a bedrock ledge near the bottom end of the rapids. Although the eggs were observed in shallow pockets, those areas remained underwater. The amount of Walleye egg deposition in these areas was sparse, with over fifty (50) counted on May 10 and only a few counted on May 12. Figure 18 shows the shoreline areas where eggs were observed. Figures 19 and 20 show a closeup of the egg deposition. As shown, the eggs collected in very shallow areas making them prone to stranding.

Figure 18. Areas of egg deposition at the Seguin River spawning bed highlighted in orange

Figure 19. Walleye eggs observed at the Seguin River spawning bed. Eggs are white indicating that they are dead, live Walleye eggs are translucent.

Figure 20. Area of Walleye egg deposition at the Seguin River spawning bed

In 2016, egg mats were set at four other spawning areas – Shawanaga River, Sucker Creek, Shebeshekong River, and Magnetawan River. The total Walleye egg counts for those sites were 57,900, 248, twenty-eight (28), and 559, respectively. The number of Walleye eggs counted at the Seguin River spawning bed was the second lowest. In 2016, Sucker egg counts at the Shawanaga River, Sucker Creek, Shebeshekong River, and Magnetawan River were 756, 208, thirty-four (34), and three, respectively. The number of Sucker eggs counted at the Seguin River spawning bed was the third highest, although still considered a low amount. As previously mentioned, water level manipulation reduced the amount of available spawning area for Walleye and Sucker species.

Plankton Sampling

Once eggs incubate and hatch, fish enter their larval stage. Larval Walleye have limited mobility and typically move by drifting with water flow and wave action. Shortly after hatching, Walleye need to feed on zooplankton to ensure survival, growth, and development. The availability of zooplankton is a major factor in surviving this life stage. To help evaluate the amount of zooplankton downstream of the Seguin River spawning bed, EGBSC conducted five plankton tows on May 30 using a 12” diameter, 153 micron plankton net.

EGBSC did not identify and count the zooplankton in the samples. Only a visual observation of the samples could be made and compared with the four other rivers sampled in 2016. An example of a sample taken at the Seguin River is shown in Figure 21. Relative to the samples from the other four rivers sampled in 2016, the Seguin River had moderate plankton density (less than Shawanaga River, more than Magnetawan River, and similar to Shebeshekong River and Sucker Creek).

Figure 21. Plankton sample from the Seguin River in 2016

Spawning Bed Measurements

Reproductive success for Walleye, Lake Sturgeon, and White Sucker is optimized when water depth, velocity, and appropriately sized substrate are present at the same location within a spawning area. The optimal substrate size for Walleye egg incubation ranges from gravel (0.2 to 6.4 cm) to cobble (6.4 to 25 cm) (Kerr et al., 1997). The optimal substrate size for Lake Sturgeon ranges from 10 to 60 cm in diameter (Golder Associates Ltd., 2011). White Sucker spawn on a clean bottom of coarse sand to gravel ranging from 2 to 16 mm in size (Twomey et al., 1984). Optimal depth for spawning Walleye ranges from 30 to 100 cm (Kerr et al., 1997) and 10 to 200 cm for Lake Sturgeon spawning (Golder Associates Ltd., 2011).

In the fall of 2016, transects were measured across the Seguin River spawning bed with the intent of identifying areas “ideal” for spawning for Walleye, Lake Sturgeon, and Sucker species. EGBSC used some of the methods from the Ontario Stream Assessment Protocol (developed by MNRF) to complete the transects. Along each transect, six points were measured for depth and substrate type, based on the width (taken at bankfull) of each transect (with the exception of areas where water depth or velocity prohibited safe access). In addition to depth and substrate, any aquatic vegetation was noted at each point, and shoreline vegetation was recorded at each transect. Depth was recorded with a metre stick and substrate was estimated with the aid of a grid marked at 10 cm increments. Transects were completed later in the season, when it was safe to wade across most of the spawning bed; because of this, only depth and substrate information was collected. Any velocity data collected would not have been the same as during the spawning season. Therefore, the analysis of ideal spawning habitat is based on depth and substrate only.

EGBSC completed twelve (12) transects across the spawning bed, spaced roughly 6 m apart (Figure 22). Data collected suggests that spawning habitat within the optimal range was present for all three species along the rapids.

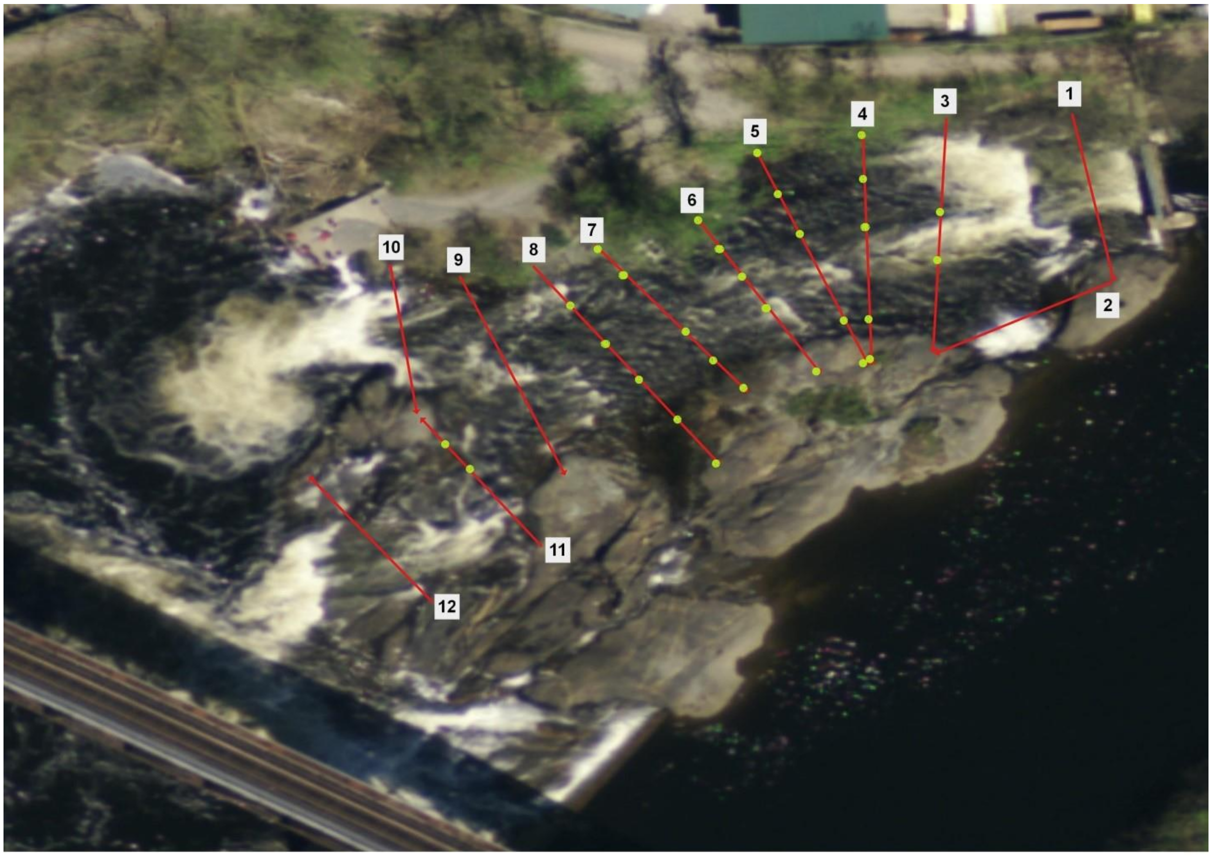

Figure 22. Spawning bed measurement transects at the Seguin River spawning bed. Green dots indicate ideal depth and substrate for Walleye, Lake Sturgeon, and/or Sucker spawning.

Figure 23. Measuring bankfull width at transect 7

In total, across the twelve (12) transects, seventy-one (71) points were measured for depth and substrate (one point on transect 10 could not be measured due to high velocity). For Walleye, 52% of the points met the optimal depth, but only 38% of the points met the optimal substrate type. Overall, only 20% of the points measured (14 of the 71) had both the ideal depth and the ideal substrate size. Transects 7 and 8 had the highest amount of both ideal depth and substrate for Walleye. For Lake Sturgeon, 98% of the points measured fell into the optimal depth range, and 41% of the points fell into the optimal substrate range. Overall, 41% of the points measured met both depth and optimal substrate for Lake Sturgeon. Transects 4-8 had the highest amount of both ideal depth and substrate for Lake Sturgeon. For White Sucker, EGBSC was unable to find the ideal depth for spawning in any of the literature searched. As a result, habitat for White Sucker was only based on ideal substrate type and size. Very few of the points measured at the Seguin River were ideal for White Sucker. Only 7% of the points measured had the ideal substrate (5 of the 71 points). White Sucker substrate was found on transects 3, 5, 7, and 10. Along transect 5, two of the six points were the ideal type and size of substrate for White Sucker. On transects 3, 7, and 10, only one point had the ideal substrate.

This evaluation was based on identifying ideal spawning habitat only. It does not indicate the actual amount of spawning, as fish will spawn in areas without ideal substrate. In addition, the ideal habitat has only been measured at certain points along the transect lines, and therefore does not represent the entire spawning bed. The measurements are a sample of the spawning bed and serve as an indicator of potential site limitations. Complete transect data is provided in Appendix D.

Nursery, Rearing, and Foraging Habitat

Until they become mobile, newly hatched fry of most riverine spawning species are dispersed largely according to water currents. In lake environments, wind-driven current can be a major factor in dispersing fry. Accordingly, the availability of nursery habitat in the downstream (or down-wind) vicinity of spawning sites is an important factor in reproductive success.

EGBSC completed surveys downstream of the Seguin River spawning bed to determine if there is habitat – nursery, rearing, and foraging – for Walleye, Lake Sturgeon, and Sucker fry. To assess nursery, rearing, and foraging habitat, EGBSC combined bathymetry and side scan sonar data, as well as, underwater survey data. The purpose of the underwater surveys was to help ground truth what was being displayed from the sonar data. In addition, EGBSC compared the length of natural shoreline (unaltered) downstream of each spawning bed to the length of altered shoreline. Natural shorelines are critical for maintaining water quality and fish habitat. Natural shorelines help to slow runoff from roads, houses, and other areas of development, improving water filtration and filtering nutrients before they reach the watercourse. Natural vegetation along watercourses helps to create shade and moderate temperature. Natural debris (branches, leaves, etc.) that fall into the water are a source of food for aquatic insects, which in turn, are a source of food for certain fish, such as White Sucker.

There were a number of challenges associated with gathering and interpreting the data collected. First, there is very little information on nursery, rearing, and foraging habitat for Sucker species. More information is available for Walleye and Lake Sturgeon, but it is quite vague. For example, adult Walleye are described as being found between 2 to 10 m depth, this wide range makes it challenging to focus in on specific habitat. EGBSC focused survey efforts in the nearshore area at depths of approximately 1.5 m. Second, once eggs hatch, the larvae drift downstream, according to currents and wind. It is not possible to say how far the larvae drift, and this distance likely varies river by river. Third, side scan sonar data was collected to help identify the type of substrate present in the river and identify areas with vegetation and boulders (.sl2 files are available upon request). However, in some areas, interpretation of the side scan data was very difficult making it challenging to discern between different types of substrate. In the areas where the substrate was not clear, that information was not used in determining fish habitat due to a lack of confidence in interpretation. Finally, the fourth challenge was integrating all of the data collected.

Underwater Surveys

Underwater videos were taken from a boat for 100 m approximately every 1 km, using a GoPro camera. In total, EGBSC carried out nine underwater surveys around the Parry Sound Harbour, from the east side of the harbour at the outlet of the Seguin River to the west side of the harbour. Two surveys were done along islands, South Island and Oak Island. Each survey location has been identified in Figure 24. Bathymetry maps are presented in Appendix E.

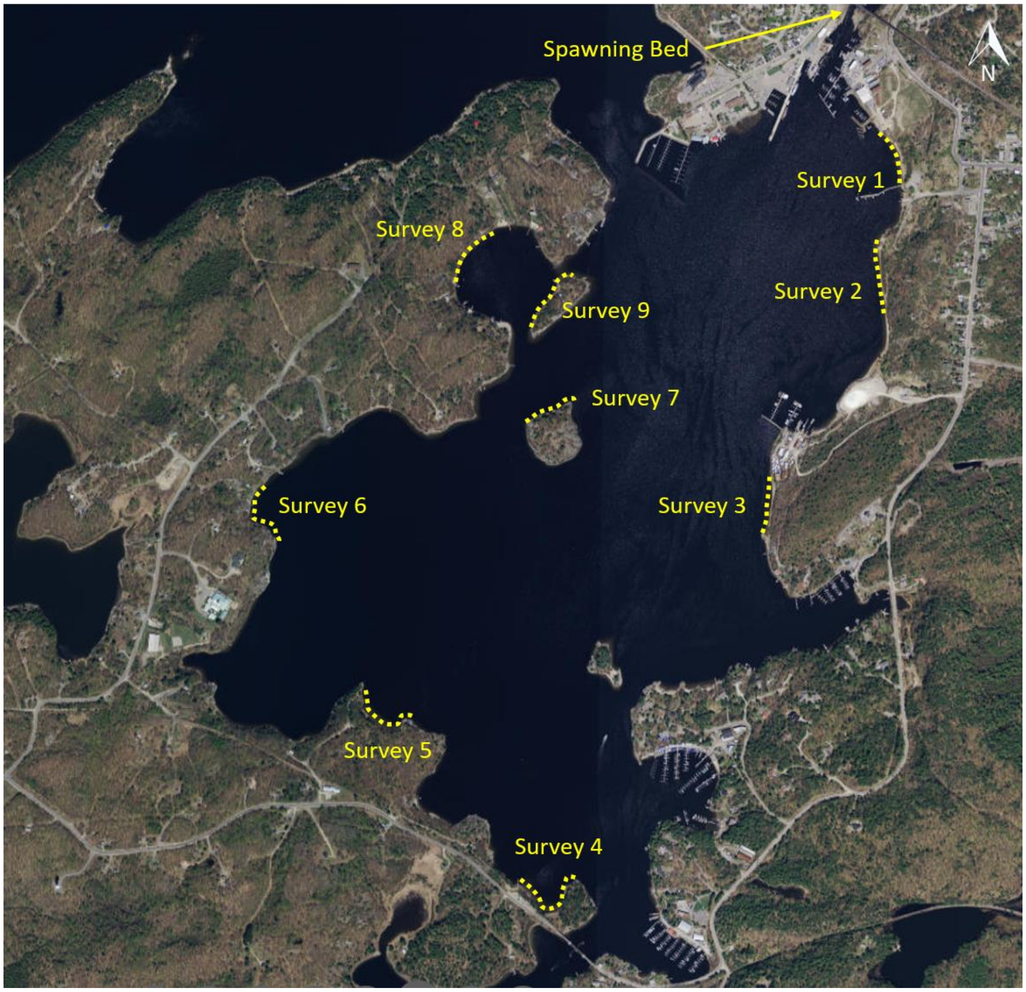

Figure 24. Underwater survey locations downstream of the Seguin River spawning bed

For each underwater survey, types of substrate and aquatic vegetation, as well as, abundance of aquatic vegetation and woody debris (sticks, branches, logs) were recorded. Aquatic vegetation and woody debris offer cover for fish at various life stages and provide cover for predatory fish to ambush their prey. Classifications and definitions of abundance are detailed in Table 2. Each of the nine underwater surveys is summarized in Table 3.

Table 2. Definitions of aquatic vegetation and wood structure abundances

Abundance	Sparse	Moderate	Abundant
Aquatic vegetation	Observed in small, inconsistent patches	Observed consistently along the substrate, camera moves easily through the area	Consistent and thick, difficult to move camera through the area
Wood structure	1-2 branches or sticks	2 logs and/or several branches or sticks (<10)	>3 logs and/or >10 branches

Table 3. Summary of findings from nine underwater surveys

Survey	Shoreline Substrate	Substrate	Woody Debris	Aquatic Vegetation
1	Boulders with soft substrate	Mix of sand, gravel, cobble and boulder	Moderate	Moderate

Survey	Shoreline Substrate	Substrate	Woody Debris	Aquatic Vegetation
2	Boulders with soft substrate	Mix of sand, gravel, cobble and boulder	Moderate	Sparse
3	Steeply sloped bedrock with boulder and cobble	Mix of sand, gravel, cobble and boulder	Moderate	Sparse
4	Low sloping bedrock changing to moderate to steeply sloped shoreline with boulders	Mix of sand, silt, clay, cobble and boulder	Sparse	Sparse vegetation with patches of moderate
5	Bedrock with soft substrate	Bedrock with cobble, small boulder and large gravel, clay, sand, silt	Sparse	Sparse
6	Bedrock with soft substrate	Bedrock with cobble, small boulder and large gravel, clay, sand, silt	Sparse for half, abundant for half	Sparse
7	Bedrock	Bedrock with cobble and gravel	Sparse	Sparse
8	Soft	Soft	Moderate	Moderate
9	Bedrock with soft substrate	Bedrock with silt and sand	Abundant	Moderate

The following list of aquatic vegetation (submergent, emergent, and floating) was recorded from the nine surveys: Tapegrass, Richardson's Pondweed, Potamogeton spp. (several), White Water Lily, algae, Fern-leaved Pondweed, Flat-stemmed Pondweed, and Large-leaved Pondweed. The most abundant species were Tapegrass (nine surveys), Richardson’s Pondweed (eight surveys), algae species (four surveys), and Potamogeton species (four surveys).

Shoreline Characteristics

Along each of the nine underwater surveys, shoreline characteristics were also recorded and photographed. The shoreline downstream of the spawning bed and around the Parry Sound Harbour is a mix of both natural and altered shoreline (44% natural, 56% altered) (Figure 25). Immediately downstream of the spawning bed, there is very little natural shoreline. The first area of natural shoreline is situated 285 m downstream, on the east side of the Parry Sound Harbour. Shorelines are altered by cement retaining walls and docks. This area is situated adjacent to downtown Parry Sound where two marinas, an airway company, and other tourism operators are located. Outside of the surveys, shoreline alterations observed included three marinas, residences and/or cottages (some with mown grass, artificial beaches, and retaining walls), and the salt dock.

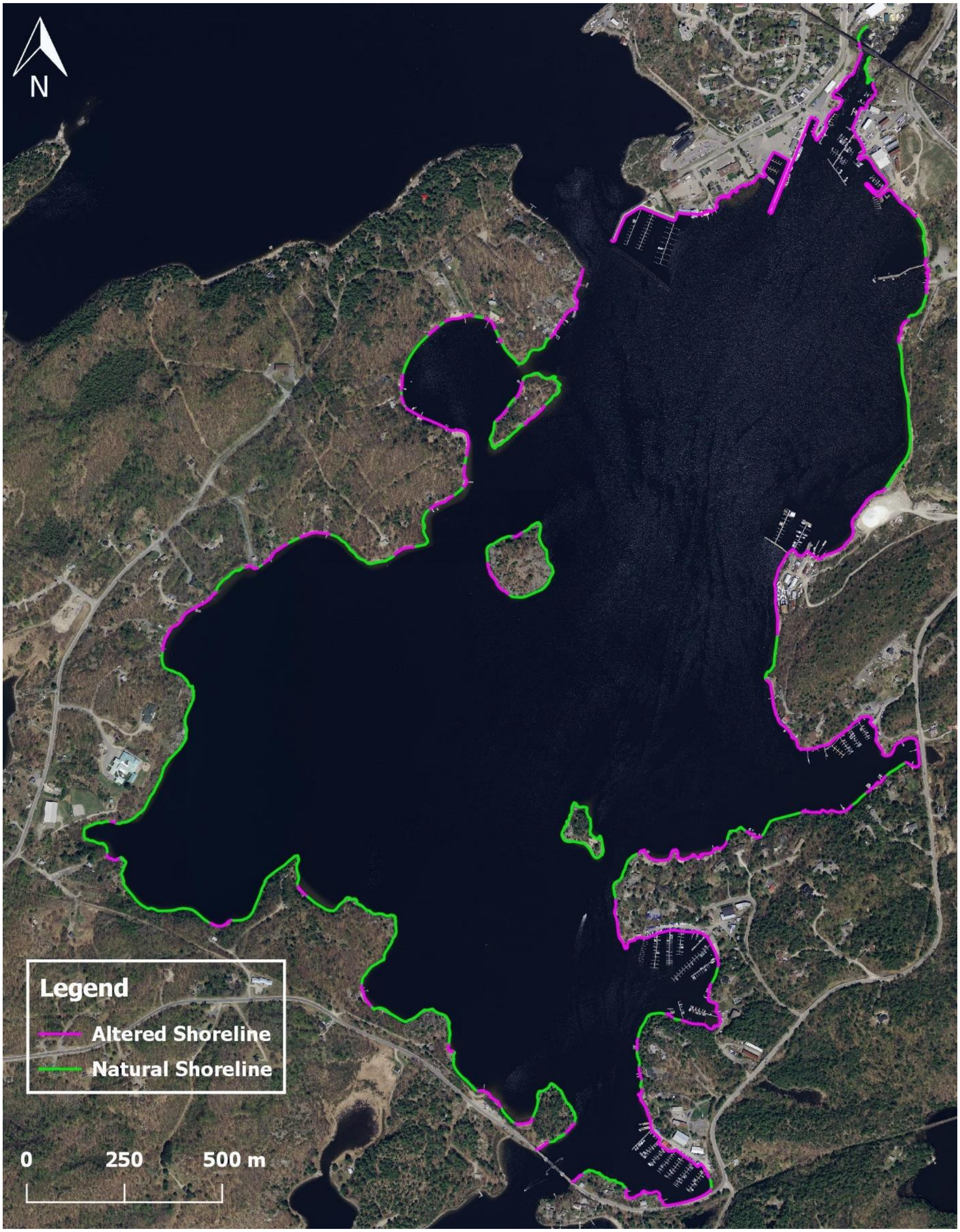

Figure 25. Natural and altered shoreline downstream of the Seguin River spawning bed

Of the nine surveys that were completed, all but one had some type of alteration, some of which were minor. Types of alterations identified were mown grass to the waters' edge (one survey), buildings (three surveys), retaining walls (three surveys), exposed dirt/construction areas (two surveys), riprap shoreline hardening (one survey), road (one survey), docks (three surveys), and some sort of access point (two surveys). Types of natural shoreline that were observed were wetland (two surveys), forest with a wetland fringe (seven surveys), forest (two surveys), and bedrock with patchy vegetation (three surveys). It is important to note that some surveys had more than one type of natural vegetation. It is also important to note that surveys did not cover the entire length of the shoreline, therefore, not all alterations along the shoreline were recorded. Photos of the shoreline from each survey can be found in Appendix F.

Shoreline substrate was also recorded and photographed for each of the nine surveys. Only the shoreline substrate that was visible was recorded. Of the nine surveys, one had bedrock, two had a mix of boulder and soft substrate, two had a mix of bedrock, cobble, and boulder, one survey had soft substrate, and three had a mix of bedrock and soft substrate.

In addition to substrate, shoreline vegetation that could be identified was recorded for each survey. The following list of species was identified from the surveys:

- Scirpus spp.
- Reed Canary Grass
- Common Cattail
- Sedge spp.
- Sweet Gale
- Common Boneset
- Goldenrod spp.
- Meadowsweet
- Grass spp.
- Alder spp.
- Willow spp.
- Poplar
- Manitoba Maple
- Maple
- White Birch
- White Pine
- Red Oak
- Eastern White Cedar
- Fraxinus spp.
- Common Juniper
- Bush Honeysuckle

Discussion and Recommendations

Water chemistry measurements that were monitored (water temperature, dissolved oxygen, pH, and conductivity) were all normal and typical of what one would expect from a Canadian Shield watershed. There was no indication of water quality having any adverse effects on fish spawning or egg incubation.

Water level manipulations on the Seguin River are controlled by Bracebridge Generation Limited who operate a hydro generating station on the Seguin River in the Town of Parry Sound. Flow over the Seguin River spawning bed during the spring spawning and incubation period is greatly impacted by upstream dam manipulations. This is especially true of the “CPR Trestle Dam” where the Seguin River outlets into the Parry Sound Harbour. There are two controlled sluiceways comprising the “CPR Trestle Dam”. In the Seguin River Simplified Water Management Plan they are referred to as the north and south dams. The south dam is located adjacent to the concrete base supporting the CPR trestle. The north dam is adjacent to Mcnabb Home Building Centre and at the upstream end of the spawning bed.

Between day and night visual observations, there were very few Walleye observed, aside from three observed on May 5 and seven observed on May 30 during a snorkel survey of the spawning bed. White Sucker were observed at the spawning bed beginning on May 10 and up until May 19; however, a maximum of only fifteen (15) were observed during a single visit. A low number of Walleye eggs (144) and Sucker eggs (185) were counted on the three egg mats placed along the north shore of the spawning bed. A small accumulation of Walleye eggs was observed adjacent to the north shore on May 10 and in a pocket at the last ledge of the spawning bed on May 12. While the egg counts were low, they were higher than anticipated given how few Sucker and Walleye were seen at the site.

During the early stages of the spring freshet, the north dam is generally stripped of all logs (four) to allow maximum passage of water. As flows diminish throughout the spring freshet (generally late April or early May), logs are reinstalled in the dam to maintain desired water levels in the upstream reach of the Seguin River. Dam manipulations throughout the Seguin River watershed by Bracebridge Generation Limited are guided by operating guidelines contained in the Seguin River Simplified Water Management Plan. The guidelines specified for the “CPR Trestle Dam” are as follows:

> “Operation of this structure during the walleye spawning season (typically mid to late April to early May) should be undertaken with a preference to the stop logs on the north (Lumber Store) side of the structure for the release of any flows, and to the south stop log bay for the additional retention of flows. This will promote the maintenance or augmentation of flows in the identified spawning area and existing fish passage structure to direct fish to the preferred spawning habitat below the Lumber Store gate.” (AMEC Earth & Environmental, 2009, p. 4-4)

The above guidelines state that water flows are to be preferentially directed over the spawning bed during the spring spawning and incubation period. Based on EGBSC’s 2016 habitat assessment and informal investigations in 2015, this did not occur. In 2016, a significant reduction in flow over the spawning bed occurred sometime between May 2 and May 5; and a reduction of 28.5 cm was documented on the May 6 site visit.

Despite the drastic reduction in water level and flow velocity over the spawning bed, no stranded fish eggs were observed along shoreline segments formerly covered by water. This was due to the fact that spawning had not yet begun. Nevertheless, spawning conditions were compromised by the drastic reduction of flow velocity and water levels over the spawning bed.

Overall, there is a considerable amount of high-quality spawning substrate at the Seguin River spawning bed. Seventy-one points in the spawning bed were measured for depth and substrate size and compared with the ideal spawning substrate and depth range for Walleye, Lake Sturgeon, and Sucker species. The measurements showed that there was more ideal habitat for Lake Sturgeon (41% of the points measured) than for Walleye (20% of the points measured), and there was a very low amount of ideal substrate for White Sucker (7% percent of points sampled). It is important to note that this evaluation was based on identifying ideal spawning habitat only, and the ideal habitat was measured at certain points along the transects, therefore, not representing the entire spawning bed. One minor concern was the presence of algae on much of the spawning substrate. This was very apparent on May 5, after water levels dropped.

Based on the snorkel surveys, the area around the outlet of the Seguin River had more garbage than other rivers, with the exception of Sucker Creek. The outlets of the Seguin River and Sucker Creek have the most human impact (boating, docks, marinas, construction businesses, etc.), and more human activity has resulted in more garbage in those rivers. Furthermore, because the outlet of the Seguin River into Parry Sound Harbour is heavily impacted by human activity, there is less natural habitat available along the shorelines in those areas for larval fry once they have hatched. Shorelines along eight of the nine surveys around the harbour had some sort of alteration. Because it is uncertain as to how far or in which direction larval fish would drift after hatching, it is difficult to know where nursery habitat is most needed.

Another issue identified in the 2016 spawning season was related to the May 1 opening of the Walleye angling season (Fisheries Management Zone 14). While the Seguin River spawning bed is considered a fish sanctuary, and fishing within this area is restricted until the third Saturday in May, the fish sanctuary boundary is located in such a location that anglers are able to fish legally while directly targeting Walleye moving in to spawn (Figure 26).

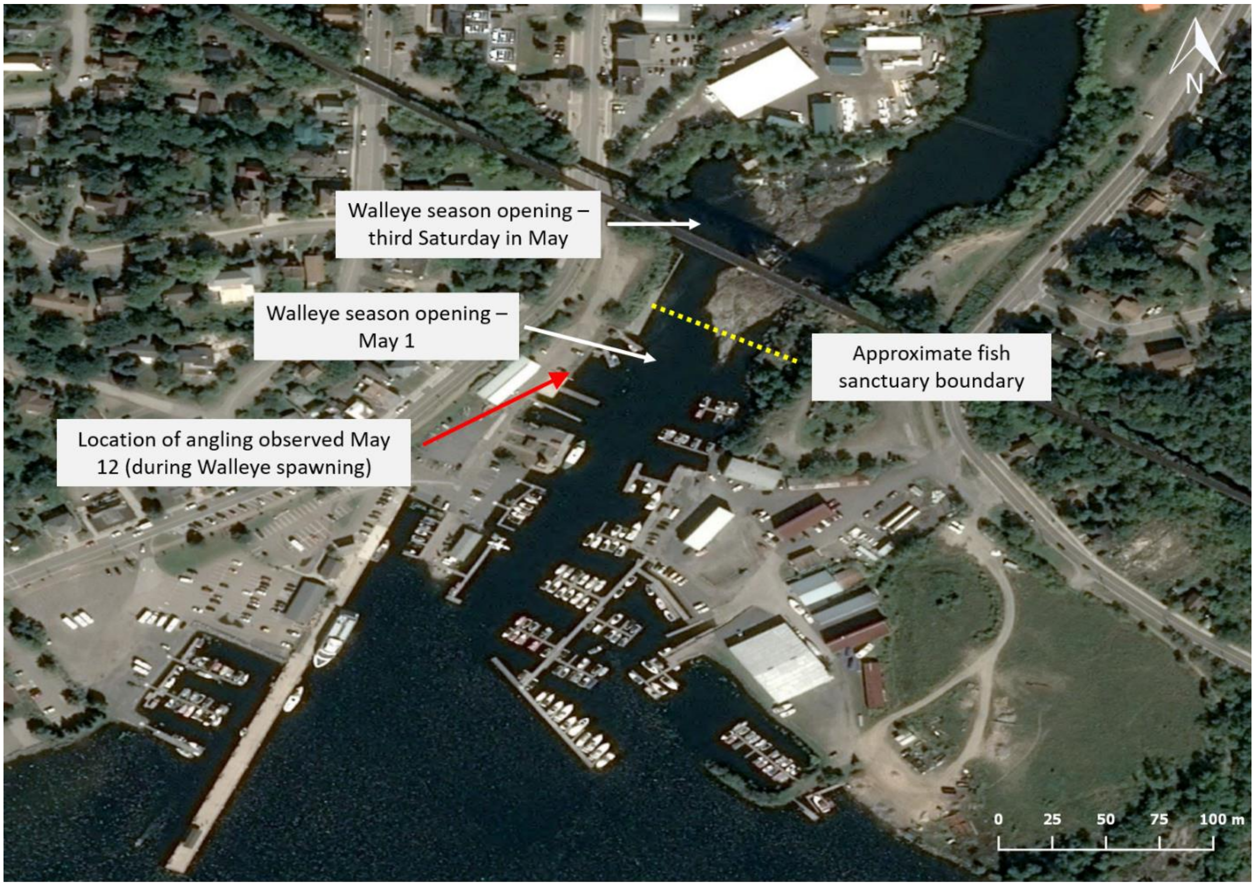

Figure 26. Approximate location of the Seguin River spawning bed fish sanctuary boundary

Based on the 2016 observations, egg deposition, and anecdotal information, Walleye spawn later at the Seguin River, and the season opening of May 1 is too early to protect spawning Walleye. In 2016, anglers were observed along the wharf directly downstream of the fish sanctuary boundary starting on May 12 (Figure 26). To improve the efficacy of the fish sanctuary regulations, the boundary should be moved farther downstream, or the opening season date should be delayed further.

Moving forward, EGBSC recommends the following actions:

- Carry out monitoring for Lake Sturgeon directly downstream of the spawning bed via frequent snorkel surveys (once flows have declined in later May) to better assess potential Lake Sturgeon activity at the site;
- Investigate the spawning bed in a year with low Georgian Bay water levels to better assess accessibility of the spawning bed;
- Conduct detailed analysis of the side scan sonar data to supplement the observations from underwater surveys and provide more in-depth insights into nursery, rearing, and foraging habitat (.sl2 files available upon request); and
- Work with Bracebridge Generation Limited and Wasauksing First Nation to clarify the water level management plan and foster good communication to ensure stop-logs are being managed as stipulated in the Seguin River Simplified Water Management Plan during the spawning season.

The most important recommendation from this report is to amend the Seguin River Simplified Water Management Plan to clearly state that maximum flows be preferentially directed over the spawning bed (downstream of the north dam) throughout the spawning and incubation period to enhance fish production on the spawning bed. This stipulation is currently written in the plan, but it is not clearly worded and not clear in its intention. There were a low number of Walleye and White Sucker observed at the Seguin River spawning bed in 2016. By preferentially directing flows over the spawning bed, more spawning substrate would remain underwater, increasing the potential spawning area, and increasing depth to help create more ideal spawning conditions for Walleye and Lake Sturgeon in certain areas of the spawning bed. Anecdotal reports refer to Lake Sturgeon spawning at this site in the past, and it may be that the current management of the north dam excludes Lake Sturgeon from the spawning bed. This is unknown, but worth further investigation.

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We would like to thank Wasauksing First Nation for sharing information on the Seguin River spawning bed and for requesting appropriate water level management from Bracebridge Generation Limited. We would also like to thank Delaina Arnold for volunteering her time to take frequent photos of, and water level measurements at, the Seguin River spawning bed.

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Appendix A – Water Chemistry

Date	Time	Temperature (°C)	DO (mg/L)	DO (%)	pH	Conductivity
Apr 15	12:00	3.5	15.04	113.2	6.79	51.1
Apr 23	12:31	6.0	13.42	107.9	6.88	37.0
Apr 26	16:26	6.1	12.31	103.0	7.06	39.8
Apr 29	13:43	6.3	12.35	100.1	7.19	43.8
May 2	14:30	8.0	11.83	100.0	6.89	43.1
May 5	15:40	10.3	10.85	97.7	6.98	57.1
May 10	9:15	9.6	11.19	98.4	6.72	50.0
May 12	15:38	11.7	10.21	94.2	7.14	49.3
May 16	11:54	10.0	11.08	98.1	6.84	53.1
May 19	18:00	12.1	10.40	96.8	7.00	45.4
May 24	10:26	15.2	9.32	92.7	7.36	46.5
May 30	15:30	21.0	n/a	n/a	n/a	n/a
June 8	16:00	18.3	n/a	n/a	n/a	n/a

Appendix B – Water Level and Velocity

Benchmark	Date	Depth (cm)
1a	23-Apr	18
1a	26-Apr	31.2
1a	29-Apr	33.5
1a	02-May	30.5
1a	05-May	59
1a	10-May	54
1a	12-May	54.5
1a	16-May	40
1a	19-May	39
1a	24-May	42.5
1a	30-May	48
1a	08-Jun	58.5

	Velocity (m/s)				
Date	Station 1a	Station 1b	Station 2	Station 3a	Station 3b
23-Apr	0.97	n/a	0.6	0.9	n/a
26-Apr	0.06	n/a	0.39	0.54	n/a
29-Apr	0.18	n/a	0.69	0.64	n/a
02-May	0.5	n/a	0.55	0.85	n/a
05-May	n/a	0.6	0.57	n/a	1.02
10-May	n/a	1.06	0.54	n/a	0.91
12-May	n/a	0.91	0.64	n/a	0.83
16-May	n/a	1.34	0.89	n/a	1.3
19-May	n/a	1.18	0.67	n/a	n/a
24-May	n/a	0.55	0.52	n/a	1.51
30-May	n/a	1.1	0.6	n/a	0.82
08-Jun	n/a	0.15	0.53	0.4	n/a

Appendix C – Visual Observations

Date	Walleye Observed	Common White Sucker Observed	Other Observations
18-Apr	0	0	0
22-Apr	0	0	0
26-Apr	0	0	0
29-Apr	0	0	0
02-May	0	0	0
05-May	3	0	0
10-May	0	6+	0
12-May	0	15+	0
19-May	0	4	0
30-May	7	0	10-15 Smallmouth Bass 15-20 Brown Bullhead A few Rock bass

Egg Mat	Date Set	Date Counted	Sucker Eggs	Walleye Eggs
1	15-Apr	05-May	0	0
2	15-Apr	05-May	0	0
3	15-Apr	05-May	0	0
1	05-May	12-May	48	39
2	05-May	12-May	20	104
1	12-May	24-May	74	1
2	12-May	24-May	43	0
		TOTAL	**185**	**144**

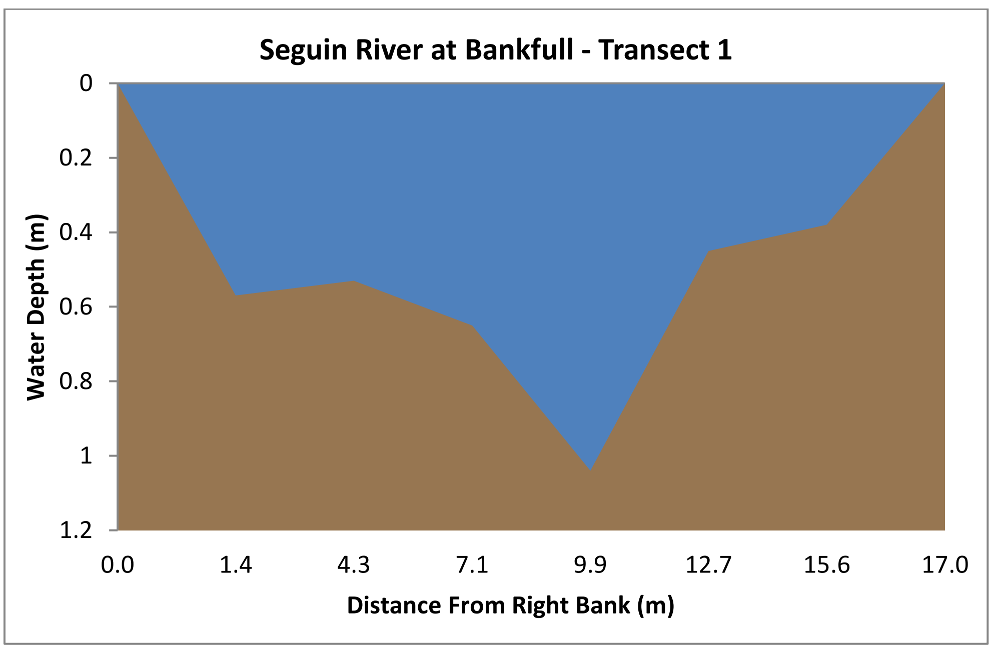
Date	Egg Observations	Number
10-May	Walleye eggs	>54
12-May	Walleye eggs	several

Appendix D – Transect Data

Transect 1

Point	Depth (m)		Particle sizes	Aquatic vegetation present
	Bankfull	Present		
(1) 1.42	0.57	0	100% bedrock	none
(2) 4.25	0.53	0	100% bedrock	none
(3) 7.08	0.65	0	100% bedrock	none
(4) 9.91	1.04	0.29	100% bedrock	none
(5) 12.74	0.45	0	100% bedrock	none
(6) 15.57	0.38	0	100% bedrock	none

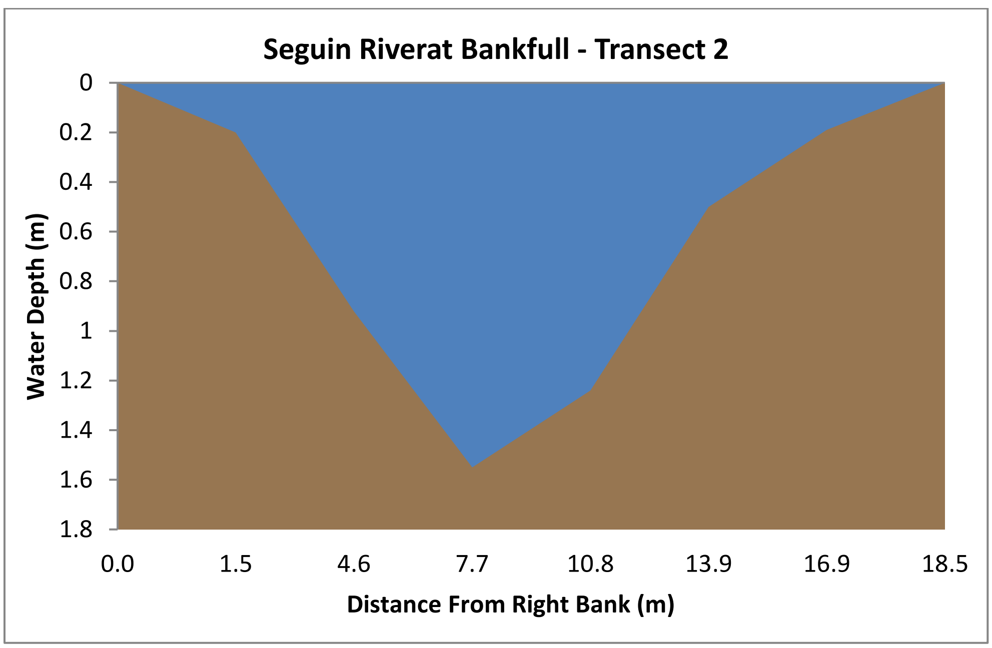
Walleye		Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
Optimal depth (m)	0.3 - 1.0						
Optimal substrate (cm)	0.2 - 25						
Lake Sturgeon							
Optimal depth (m)	0.1 - 2.0						
Optimal substrate (cm)	10 - 60						
Sucker species							
Optimal depth (m)							
Optimal substrate (cm)	0.2 - 1.6						



Transect 2

Point	Depth (m)		Particle sizes	Aquatic vegetation present
	Bankfull	Present		
(1) 1.54	0.2	0	100% bedrock	none
(2) 4.62	0.92	0	100% bedrock	none
(3) 7.70	1.55	0.32	100% bedrock	none
(4) 10.78	1.24	0.06	100% bedrock	none
(5) 13.86	0.5	0	100% bedrock	none
(6) 16.94	0.19	0	100% bedrock	none

Walleye		**Point 1**	**Point 2**	**Point 3**	**Point 4**	**Point 5**	**Point 6**
Optimal depth (m)	0.3 - 1.0						
Optimal substrate (cm)	0.2 - 25						
Lake Sturgeon							
Optimal depth (m)	0.1 - 2.0						
Optimal substrate (cm)	10 - 60						
Sucker species							
Optimal depth (m)							
Optimal substrate (cm)	0.2 - 1.6						

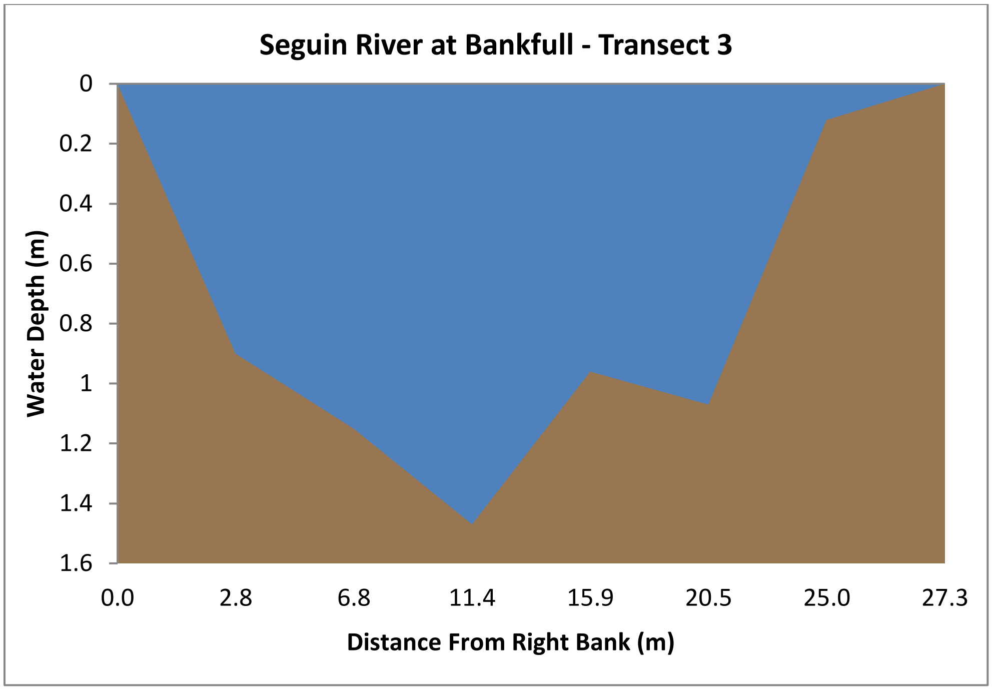


Transect 3

Point	Depth (m)		Particle sizes	Aquatic vegetation present
	Bankfull	Present		
(1) 2.28	0.9	0	100% bedrock	none
(2) 6.83	1.15	0.29	70% cobble, 30% sand	none
(3) 11.38	1.47	0.67	50% sm boulder, 50% cobble	none
(4) 15.93	0.96	0.12	100% bedrock	none
(5) 20.48	1.07	0.15	80% lg boulder, 20% bedrock	none
(6) 25.03	0.12	0	100% bedrock	none

Walleye		Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
Optimal depth (m)	0.3 - 1.0						
Optimal substrate (cm)	0.2 - 25			*			
Lake Sturgeon							
Optimal depth (m)	0.1 - 2.0						
Optimal substrate (cm)	10 - 60		*				
Sucker species							
Optimal depth (m)							
Optimal substrate (cm)	0.2 - 1.6		*				

*mixed substrate, some optimal



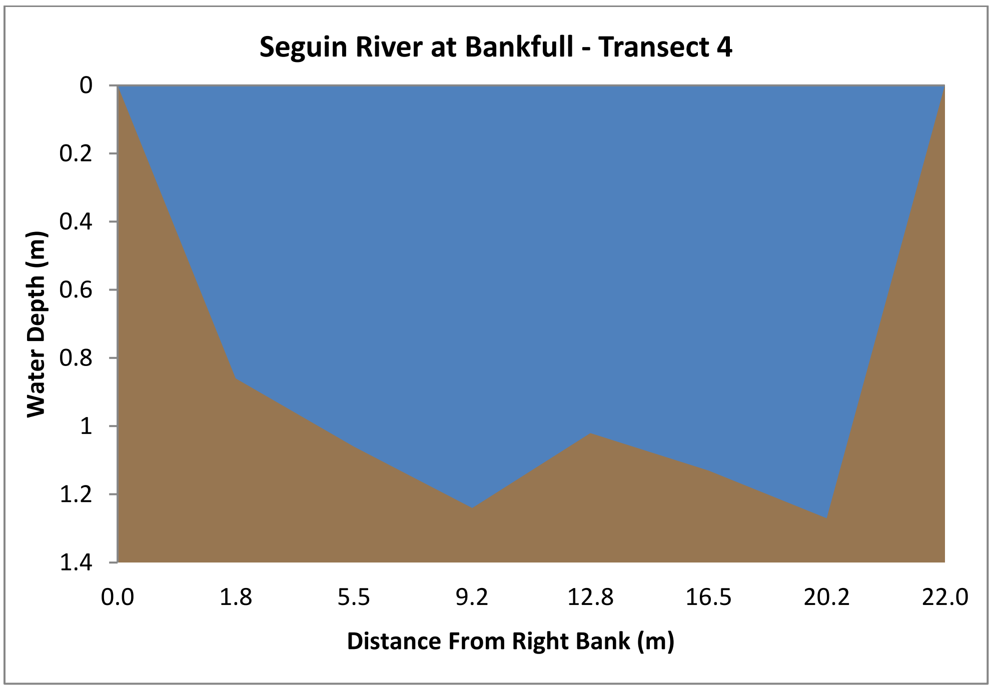
Transect 4

Point	Depth (m)		Particle sizes	Aquatic vegetation present
	Bankfull	Present		
(1) 1.83	0.86	0.22	75% lg boulder, 15% lg stone, 10% cobble	none
(2) 5.50	1.06	0.39	100% cobble	none
(3) 9.17	1.24	0.54	25% lg boulder, 25% sm boulder, 50% cobble	none

(4) 12.84	1.02	0.27	100% bedrock	none
(5) 16.51	1.13	0.27	40% sm boulder, 60% lg boulder	none
(6) 20.18	1.27	0.31	50% lg boulder, 40% sm boulder, 10% lg stone	none

Walleye		**Point 1**	**Point 2**	**Point 3**	**Point 4**	**Point 5**	**Point 6**
Optimal depth (m)	0.3 - 1.0						
Optimal substrate (cm)	0.2 - 25	*		*			*
Lake Sturgeon							
Optimal depth (m)	0.1 - 2.0						
Optimal substrate (cm)	10 - 60	*		*		*	*
Sucker species							
Optimal depth (m)							
Optimal substrate (cm)	0.2 - 1.6						

*mixed substrate, some optimal

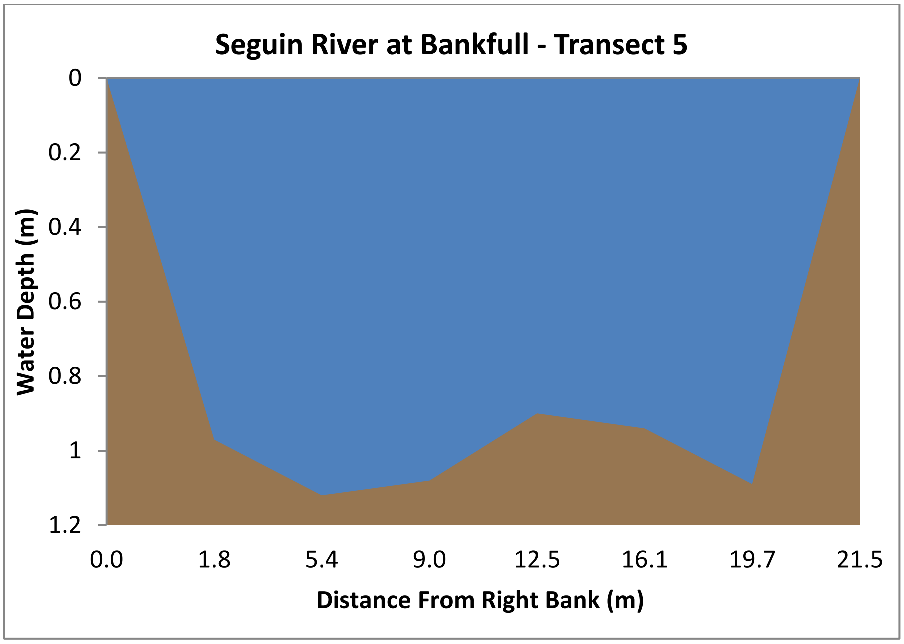


Transect 5

Point	Depth (m)		Particle sizes	Aquatic vegetation present
	Bankfull	Present		
(1) 1.79	0.97	0.26	20% bedrock, 40% cobble, 20% sm boulder, 20% sand	none
(2) 5.37	1.12	0.43	10% lg boulder, 60% cobble, 20% sm boulder, 10% lg stone	none
(3) 8.95	1.08	0.37	70% cobble, 20% sand, 10% lg stone	none
(4) 12.53	0.9	0.12	100% bedrock	none
(5) 16.11	0.94	0.11	50% lg boulder, 20% cobble, 30% sm boulder	none
(6) 19.69	1.09	0.17	60% lg boulder, 30% cobble, 10% lg stone	none

Walleye		Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
Optimal depth (m)	0.3 - 1.0						
Optimal substrate (cm)	0.2 - 25	*	*			*	*
Lake Sturgeon							
Optimal depth (m)	0.1 - 2.0						
Optimal substrate (cm)	10 - 60	*	*	*		*	*
Sucker species							
Optimal depth (m)							
Optimal substrate (cm)	0.2 - 1.6	*		*			

*mixed substrate, some optimal

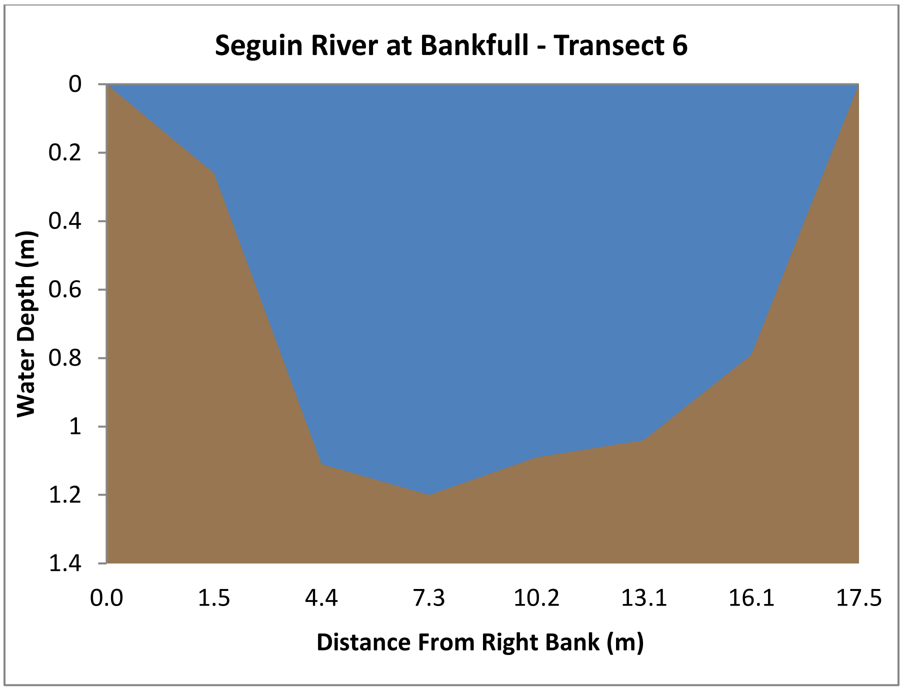


Transect 6

Point	Depth (m)		Particle sizes	Aquatic vegetation present
	Bankfull	Present		
(1) 1.46	0.26	0	80% lg boulder, 20% cobble	none
(2) 4.38	1.11	0.35	100% cobble	none
(3) 7.30	1.2	0.43	25% lg boulder, 25% bedrock, 50% cobble	none
(4) 10.22	1.09	0.29	60% bedrock, 40% cobble	none
(5) 13.14	1.04	0.19	100% lg boulder	none
(6) 16.06	0.79	0.02	90% lg boulder, 10% sm boulder	none

Walleye		Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
Optimal depth (m)	0.3 - 1.0						
Optimal substrate (cm)	0.2 - 25	*		*	*		
Lake Sturgeon							
Optimal depth (m)	0.1 - 2.0						
Optimal substrate (cm)	10 - 60	*		*	*		*
Sucker species							
Optimal depth (m)							
Optimal substrate (cm)	0.2 - 1.6						

*mixed substrate, some optimal

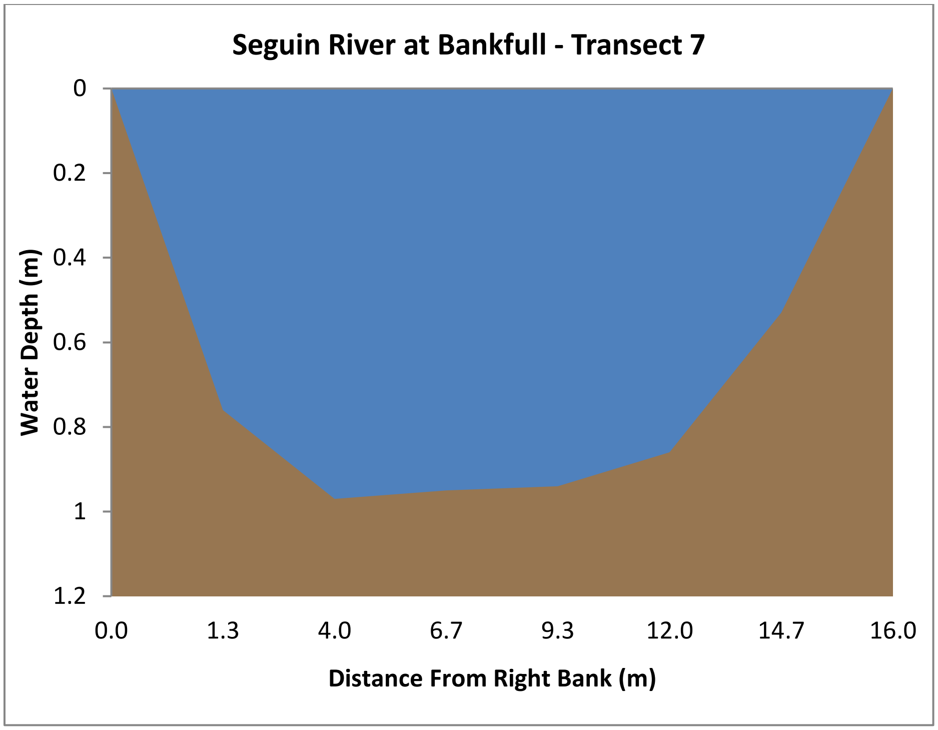


Transect 7

Point	Depth (m) Bankfull	Depth (m) Present	Particle sizes	Aquatic vegetation present
(1) 1.33	0.76	0	20% lg boulder, 20% lg stone, 30% cobble, 30% sand	none
(2) 4.0	0.97	0.21	50% sm boulder, 50% cobble	none
(3) 6.67	0.95	0.25	100% lg boulder, GP 1540	none
(4) 9.34	0.94	0.28	50% bedrock, 25% lg boulder, 25% sm boulder	none
(5) 12.01	0.86	0.18	10% sm boulder, 90% cobble	none
(6) 14.68	0.53	0	80% cobble, 10% sm boulder, 10% lg stone	none

Walleye		**Point 1**	**Point 2**	**Point 3**	**Point 4**	**Point 5**	**Point 6**
Optimal depth (m)	0.3 - 1.0						
Optimal substrate (cm)	0.2 - 25	*	*			*	*
Lake Sturgeon							
Optimal depth (m)	0.1 - 2.0						
Optimal substrate (cm)	10 - 60	*			*		*
Sucker species							
Optimal depth (m)							
Optimal substrate (cm)	0.2 - 1.6	*					

*mixed substrate, some optimal



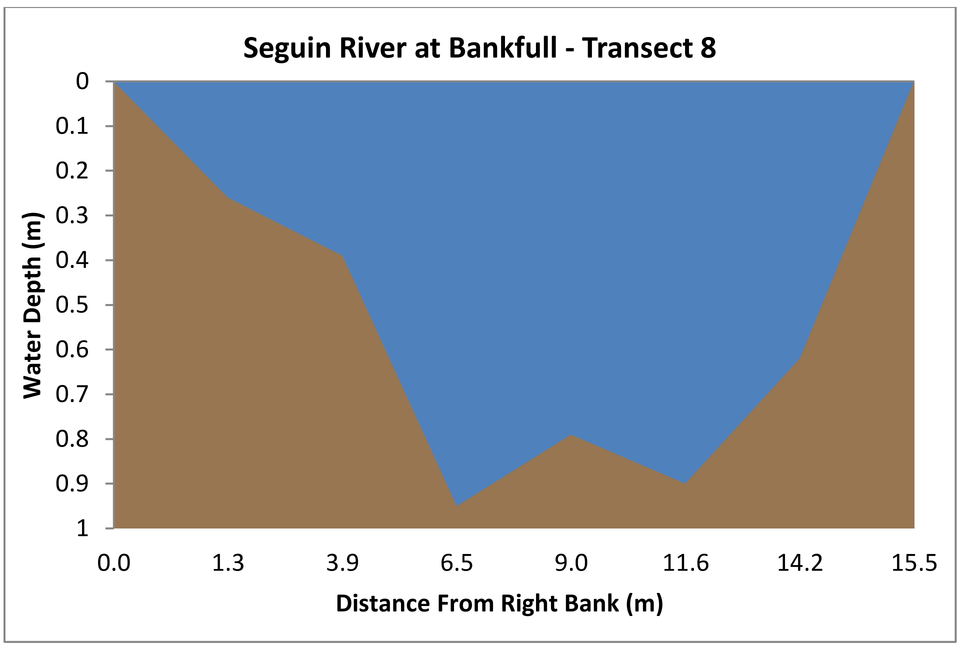
Transect 8

Point	Depth (m)		Particle sizes	Aquatic vegetation present
	Bankfull	Present		
(1) 1.29	0.26	0	100% bedrock	none
(2) 3.87	0.39	0	60% bedrock, 20% sm boulder, 20% cobble	none

(3) 6.45	0.95	0.41	50% bedrock, 25% cobble, 25% lg boulder	none
(4) 9.03	0.79	0.2	80% bedrock, 20% cobble	none
(5) 11.61	0.9	0.32	70% bedrock, 20% lg boulder, 10% cobble	none
(6) 14.19	0.62	0.02	30% lg boulder, 10% lg stone, 60% cobble	none

Walleye		**Point 1**	**Point 2**	**Point 3**	**Point 4**	**Point 5**	**Point 6**
Optimal depth (m)	0.3 - 1.0						
Optimal substrate (cm)	0.2 - 25		*	*	*	*	*
Lake Sturgeon							
Optimal depth (m)	0.1 - 2.0						
Optimal substrate (cm)	10 - 60		*	*	*	*	*
Sucker species							
Optimal depth (m)							
Optimal substrate (cm)	0.2 - 1.6						

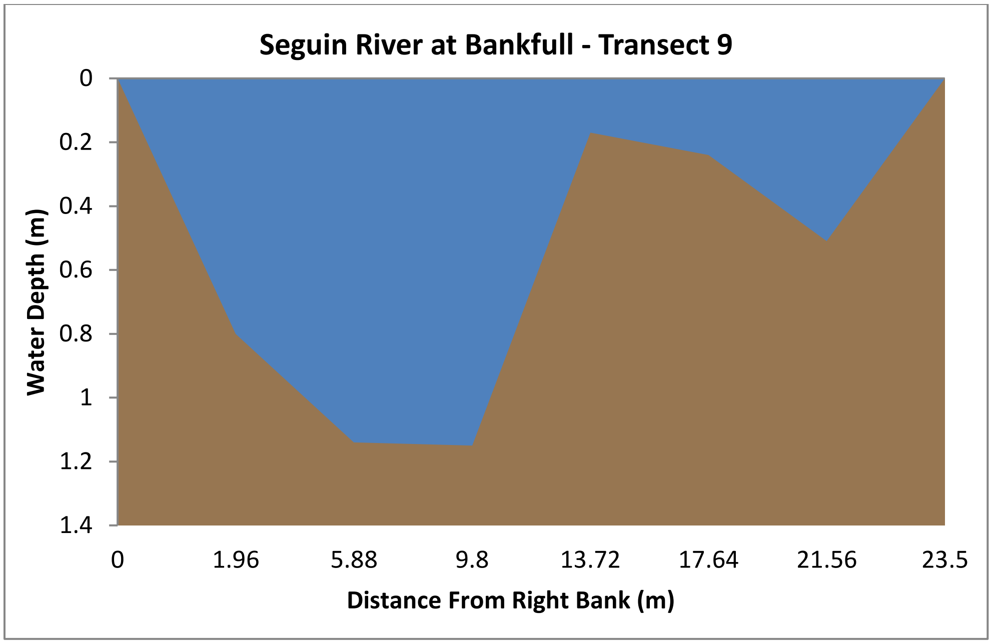
*mixed substrate, some optimal



Transect 9

Point	Depth (m)		Particle sizes	Aquatic vegetation present
	Bankfull	Present		
(1) 1.96	0.8	0	100% bedrock	none
(2) 5.88	1.14	0.35	100% bedrock	none
(3) 9.80	1.15	0.41	100% bedrock	none
(4) 13.72	0.17	0	100% lg boulder	none
(5) 17.64	0.24	0	100% bedrock	none
(6) 21.56	0.51	0	100% bedrock	none

Walleye		**Point 1**	**Point 2**	**Point 3**	**Point 4**	**Point 5**	**Point 6**
Optimal depth (m)	0.3 - 1.0						
Optimal substrate (cm)	0.2 - 25						
Lake Sturgeon							
Optimal depth (m)	0.1 - 2.0						
Optimal substrate (cm)	10 - 60						
Sucker species							
Optimal depth (m)							
Optimal substrate (cm)	0.2 - 1.6						

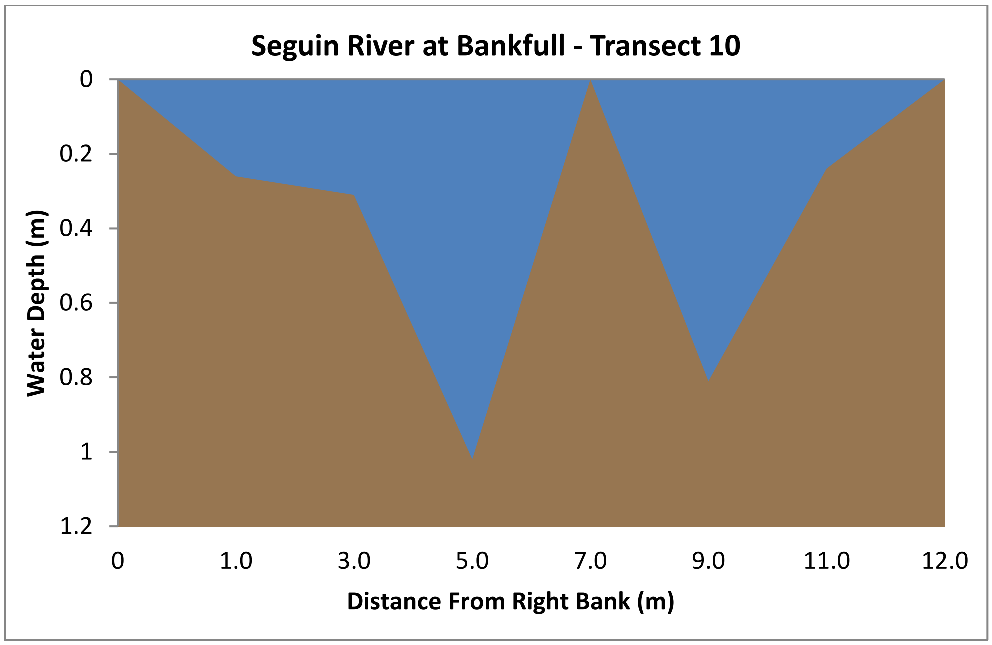


Transect 10

Point	Depth (m)		Particle sizes	Aquatic vegetation present
	Bankfull	Present		
(1) 1.08	0.26	0	40% bedrock, 30% lg stone, 30% sm stone	none
(2) 3.25	0.31	0	100% bedrock	none
(3) 5.42	1.02	0.39	100% bedrock	none
(4) 7.59	too dangerous to take measurements at this point			
(5) 9.76	0.81	0.14	100% bedrock	none

(6) 11.93	0.24	0	100% bedrock	none

Walleye		**Point 1**	**Point 2**	**Point 3**	**Point 4**	**Point 5**	**Point 6**
Optimal depth (m)	0.3 - 1.0						
Optimal substrate (cm)	0.2 - 25						
Lake Sturgeon							
Optimal depth (m)	0.1 - 2.0						
Optimal substrate (cm)	10 - 60						
Sucker species							
Optimal depth (m)							
Optimal substrate (cm)	0.2 - 1.6						

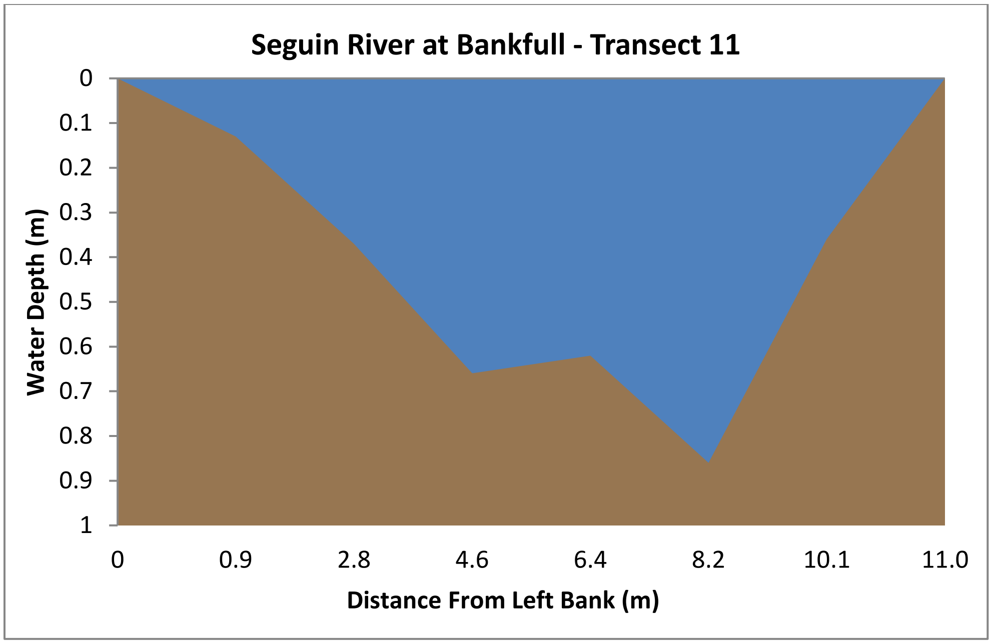


Transect 11

Point	Depth (m) Bankfull	Depth (m) Present	Particle sizes	Aquatic vegetation present
(1) 0.92	0.13	0	100% bedrock	none
(2) 2.75	0.37	0	100% bedrock	none
(3) 4.58	0.66	0.03	100% lg boulder	none
(4) 6.41	0.62	0.06	75% lg boulder, 10% cobble, 10% sm boulder, 5% lg stone	none
(5) 8.24	0.86	0.29	20% lg boulder, 60% cobble, 10% sm boulder, 10% lg stone	none
(6) 10.07	0.36	0	100% bedrock	none

Walleye		**Point 1**	**Point 2**	**Point 3**	**Point 4**	**Point 5**	**Point 6**
Optimal depth (m)	0.3 - 1.0						
Optimal substrate (cm)	0.2 - 25				*	*	
Lake Sturgeon							
Optimal depth (m)	0.1 - 2.0						
Optimal substrate (cm)	10 - 60				*	*	
Sucker species							
Optimal depth (m)							
Optimal substrate (cm)	0.2 - 1.6						

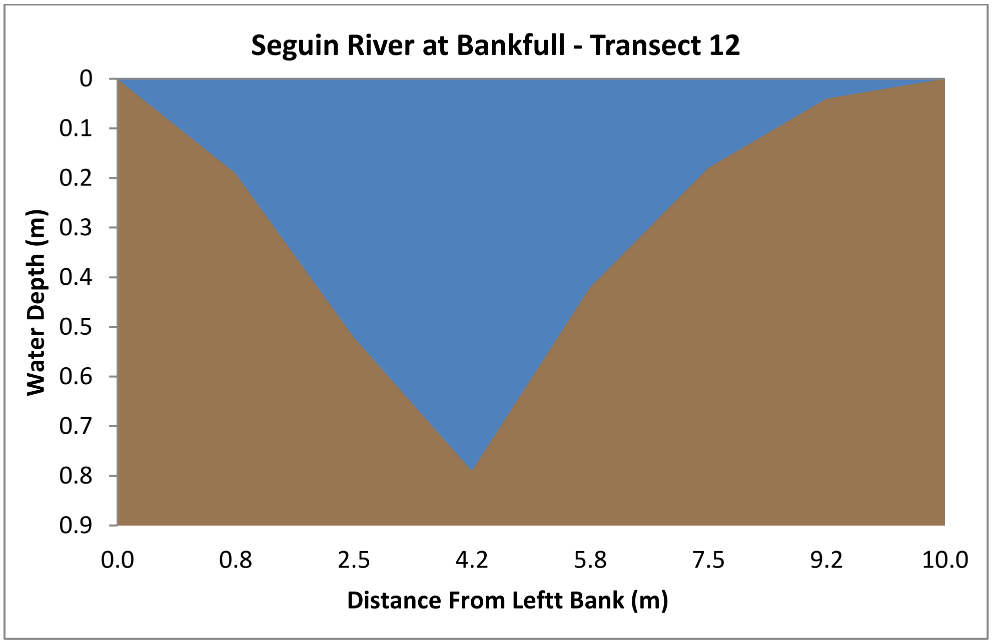
*mixed substrate, some optimal



Transect 12

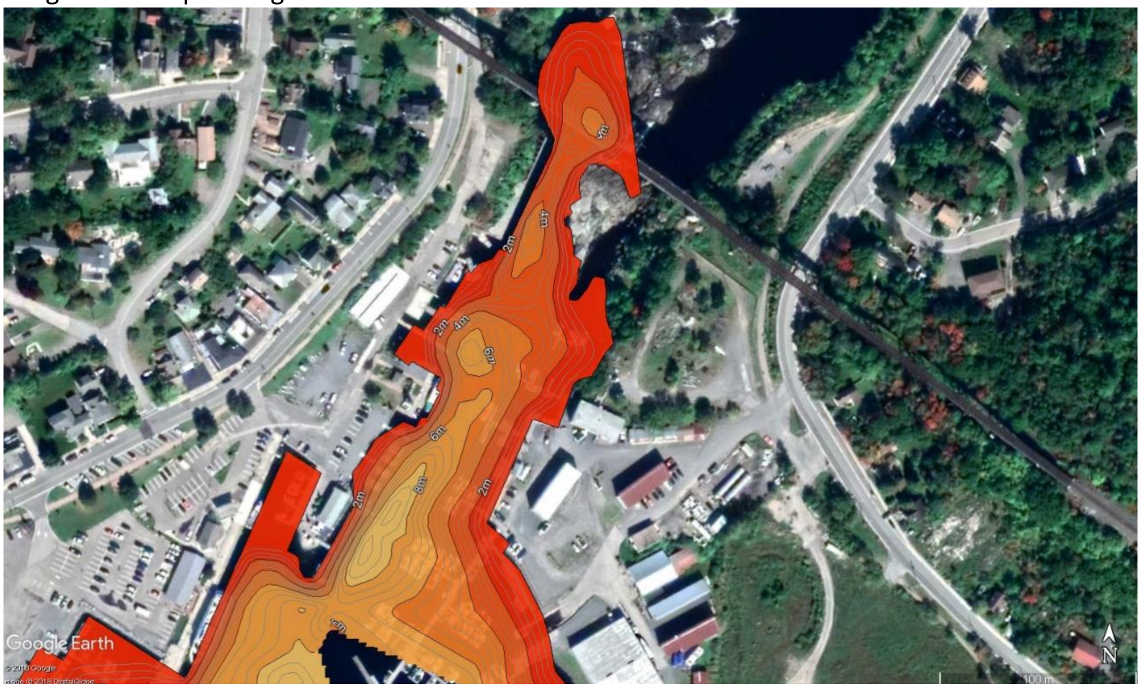
Point	Depth (m)		Particle sizes	Aquatic vegetation present
	Bankfull	Present		
(1) 0.83	0.19	0	100% bedrock	none
(2) 2.50	0.52	0	100% bedrock	none
(3) 4.17	0.79	0	100% bedrock	none
(4) 5.84	0.42	0	100% bedrock	none
(5) 7.51	0.18	0	100% bedrock	none
(6) 9.18	0.04	0	100% bedrock	none

Walleye		Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
Optimal depth (m)	0.3 - 1.0						
Optimal substrate (cm)	0.2 - 25						
Lake Sturgeon							
Optimal depth (m)	0.1 - 2.0						
Optimal substrate (cm)	10 - 60						
Sucker species							
Optimal depth (m)							
Optimal substrate (cm)	0.2 - 1.6						



Appendix E – Bathymetry Maps

Seguin River spawning bed



Downstream of Seguin River spawning bed

Parry Sound Harbour

Parry Sound Harbour

Appendix F – Shoreline Photos

Underwater Surveys – shoreline photos

Survey 1

Survey 2

Survey 3

Survey 4

Survey 5

Survey 6

Survey 7

Survey 8

Survey 9