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## Appendix D

### Freshwater Environment Report

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## Freshwater Environment

### Fish Habitat

Fish habitat surveys were conducted at the proposed Elmsdale Business Park Expansion on October 8<sup>th</sup>, and 15<sup>th</sup>, 2015. Four possible watercourses were assessed in the field and are predominately streams contiguous with wetlands. Key habitat characteristics for each watercourse/drainage channel are shown in Figure XX, and discussed in the sub-sections below.

#### Drainage channel 1 (Previously mapped as WC1)- Unnamed Channel

##### Reach 1

Reach 1 begins east of Enfield Road and runs until it meets the edge of WL1 outside of the Project Study Area (See Figure XX). This Reach has a defined channel for approximately 50 meters, but downstream towards the Project Study Area the channel becomes undefined with pockets of water throughout the whole swamp. An existing 55 cm culvert is located west of Reach 1 allowing an inlet in to WL1. The average wet width of the channel during the time of the survey was 60 cm wide and 14 cm deep. The average bank full width was 90 cm wide and 30 cm deep. The channel had vegetation growing within it and the substrate was mainly muck with very small amounts of rubble. The channel had stable banks on both sides. The canopy cover above the channel is approximately 3%; with no woody debris in the channel. The end of this reach runs to the edge of WL1 which is dominated by alders and tall grasses.

A fishing survey was not conducted at WC1 as no suitable fish habitat was observed in the study area.



Photo 1. Drainage channel at Reach 1 outside of the Project Study Area



Photo 2. Shrub Swamp approximately 20 metres northeast of WC1.

### **Watercourse 2- Unnamed Stream**

#### Reach 1

Reach 1 of Watercourse 2 (WC-2) begins in the south portion of Wetland 1 and runs downstream within Wetland 1 towards Park Road (See Figure XX). At reach 1 the watercourse is a large pool that has an average wet stream width of approximately 25 m and depth of 30 cm. The substrate of the watercourse is made up of organic muck and leaf litter that has an odor. The average bank full width is approximately 30 metres and 60 cm deep. During the survey no flow was observed, and the watercourse was abundant with aquatic plants and some algae. The watercourse had a large amount of blow down as well as the riparian area, which was most likely a result from hurricane Juan. No beaver dams were found during the survey; however there was evidence of old beaver activity from tree markings. A manmade hunting tree stand and wooden bridge was found next to the watercourse at Reach 1. The canopy cover over the Stream was approximately 50 – 60% and contained mixedwood. The water quality data collected at reach 1 during the survey was:

- Temperature: 11.5 °C,
- Dissolved Oxygen: 27%,
- pH: 6.98, and
- Conductivity: 345 µS/cm



Photo 3. Reach 1, Watercourse 2 with abundant aquatic plants and blowdown.

## Reach 2

Reach 2 is located approximately 60 meters downstream from Reach 1 and is very similar with an average wet width of approximately 15 meters and average wet depth of 20 cm. The watercourse at reach 2 consists mainly as a pool with approximately 60% canopy cover and is contiguous with wetland 1. The substrate of the watercourse is the same as Reach 1, and contained an abundance of aquatic plants, algae, and blowdown. The stream had no flow during the survey and the riparian area consisted of wetland and mixed wood forest. Both, the left and right banks of the watercourse were stable with a slope of approximately 5%. The water quality data collected at reach 2 during the survey was:

- Temperature: 13.21 °C,
- Dissolved Oxygen: 25.4%,
- pH: 6.93, and
- Conductivity: 365 µS/cm



Photo 4. Reach 2, No flow and abundant with aquatic plants.

### Reach 3

Reach 3 is located approximately 40 metres downstream from reach 2 and is wider, but is braided with an island contiguous with wetland 1. The average wet width and depth are approximately 25 metres and 20 cm, while the average bank full width is approximately 30 metres wide and 50 cm deep. This reach contains fewer blowdown, and less aquatic plants with no algae present. The stream substrate (organic leaf litter) and cover (60% mixedwood) are the same as reach 2. The water quality data collected at reach 3 during the survey was:

- Temperature: 11.41 °C,
- Dissolved Oxygen: 43%,
- pH: 6.88 ,and
- Conductivity: 345 µS/cm



Photo 5. Reach 3 with less aquatic plants and blowdown.

### Reach 4

Reach 4 is located approximately 50 meters downstream from reach 3 (See Figure XX) and contiguous with wetland 1. It is braided and has an organic leaf litter bottom with muck. The average wet stream width is approximately 15 m wide and 15 cm deep. The average bank full width is approximately 20 metres wide and 30 cm deep. The stream bank is stable on both sides with the upstream vegetation consisting mainly of mixedwood forest. No blowdown was evident at this location on the stream. Reach 4 consisted of a large pool that had no flow. The water quality data collected at reach 4 during the survey was:

- Temperature: 11.01 °C,
- Dissolved Oxygen: 31.7%,
- pH: 6.84 ,and
- Conductivity: 340 µS/cm



Photo 6. Reach 4, a braided channel with leaf litter

#### Reach 5

Reach 5 is located approximately 30 meters downstream of reach 4 and is not surrounded by wetland, rather mixed forest and tall grasses. The average wet stream width is 7.4 metres wide and 38 cm deep, and the average bank full width is 9.8 meters wide and 39 cm deep. The reach has a canopy cover of 70% and both banks are stable. The reach has several stream types including riffle (15%), run (5%), and the majority of it is a pool (80%). During the time of the survey no flow was observed. The water quality data collected at reach 5 during the survey was:

- Temperature: 10.82 °C,
- Dissolved Oxygen: 17.8%,
- pH: 6.75 ,and
- Conductivity: 345  $\mu\text{S}/\text{cm}$ .



Photo 7. Reach 5, comprised mainly of a large pool with stable banks.

#### Reach 6

Reach 6 is located 36 metres Northwest of Park road (dirt portion) and approximately 30 metres downstream of reach 5. This reach is not nearly as wide and has a flow of 0.19 m/s and slope of

3%. The average wet stream width is 1.09 metres and 14 cm deep, and the average bank full width is 1.55 meters and 50 cm deep. This reach has multiple braided channels approximately 10 meters upstream and turns into one defined channel at the 5 meter survey location. Both the left and right bank is stable and the stream has a canopy cover of 70% mixedwood forest. Reach 6 has blowdown across the watercourse causing potential fish obstruction. The water quality data collected at reach 6 during the survey was:

- Temperature: 10.89 °C,
- Dissolved Oxygen: 27.6%,
- pH: 7.68 ,and
- Conductivity: 345 µS/cm.

Downstream from reach 6 a double culvert is located on Park road.

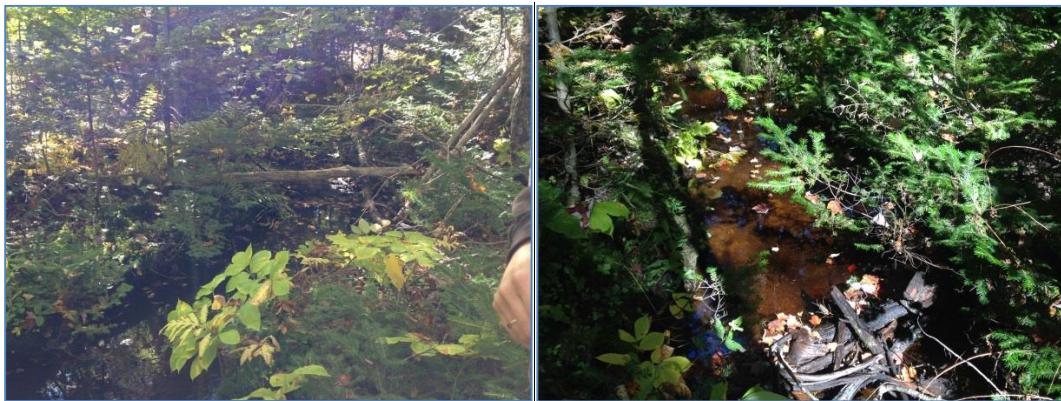


Photo 8 and 9. Reach 6, smaller watercourse channel with flow and woody debris.



Photo 10. Existing culverts where watercourse 2 meets Park road.

Due to the poor water quality during the fall spawning season a fishing survey was not conducted for watercourse 2 and no valuable fish habitat is expected.(Virgil thoughts???)

### Watercourse 3- Unnamed Stream

#### Reach 1

Reach 1 is located in the southeast portion of wetland 1 and approximately 140 meters upstream from Park Road. The average wet stream width for this reach was 2.55 metres and 28 cm deep. The average bank full width is approximately 20 meters since it has a large flood plain across the wetland and the average bank full depth is 65 cm deep. The stream substrate is comprised of mainly leaf litter and muck (80%) with some rock (2%), gravel (10%), and sand (8%) with grass species growing within it.. The stream has a canopy cover of 75% consisting of mixed wood. The stream was relatively flat with a slope of 1% with no flow during the time of assessment. Both banks were stable and the right bank had a slope of 2%, while the left had a slope of 5%. The upstream vegetation consisted of a shrub dominated swamp wetland (wetland 1). The water quality data collected at reach 1 during the survey was:

- Temperature: 10.16 °C,
- Dissolved Oxygen: 35.9%,
- pH: 5.33 ,and
- Conductivity: 27 µS/cm.

Upstream of this reach the watercourse does not have a defined channel and turns into puddled water within the wetland. Based on field surveys the watercourse is an outlet for wetland 1.



Photo 11. Reach 1 with a defined channel and pooled water.

### Reach 2

Reach 2 is located approximately 25 meters downstream of Reach 1 and had no flow with a minimal amount of water (average wet stream depth 10 cm), and a large average width (10.0 meters). The stream was less defined and was more of a flooded area with puddled water. The average full bank width was approximately 20 meters with an average depth of 40 cm. The reach consisted mainly of a run (90%), with some pooling (5%) and riffles (5%). Both banks were stable and the reach had no slope. The substrate was made up of leaf litter/ grass (95%), and a small amount of fine grains (5%). The vegetation around the stream bed consisted of a forested swamped wetland. The water quality data collected at reach 2 during the survey was:

- Temperature: 10.27 °C,

- Dissolved Oxygen: 38.9%,
- pH: 4.89 ,and
- Conductivity: 26 µS/cm.



Photo 12. Reach 2 with no flow.

### Reach 3

Reach 3 is located approximately 20 meters downstream from reach 2 and is similar to reach 1 and 2 with an abundance of grass growing within and along the streambed. The average wet width is 8 meters and the average wet depth is 15 cm deep. The channel is braided and has an average bank full width of 12 meters and an average depth of 50 cm. The stream canopy cover is 60% and is comprised of mixed wood. The stream type consists mainly of pool (60%), and runs (35%) with a small riffle (5%). During the survey the stream was not flowing. The water quality data collected at reach 3 during the survey was:

- Temperature: 10.44 °C,
- Dissolved Oxygen: 39.9%,
- pH: 4.82 ,and
- Conductivity: 29 µS/cm.



Photo 13. Watercourse 3, Reach 3

#### Reach 4

Reach 4 is located approximately 27 meters downstream of reach 3 and is a braided stream channel that has a stream slope of 1.5% with a flow of 0.01m/s. This reach is similar to reach 1 and 3 and has an average wet width of 0.95 meters and average depth of 25 cm. The average bank full width is 1.55 meters and the average bank full depth is 50 cm. The canopy cover is 75% mixed wood. The water quality data collected at reach 4 during the survey was:

- Temperature: 10.45 °C,
- Dissolved Oxygen: 42%,
- pH: 4.6 ,and
- Conductivity: 27 µS/cm.



Photo 14. Watercourse 3, Reach 4

#### Reach 5

Reach 5 is located 12 meters downstream from reach 4 and is similar to reach 4. Reach 5 has an average wet stream width of 0.9 meters and average depth of 20 cm. The average bank full width is 1.15 meters and the average bank full stream depth is 40 cm. The canopy cover is 65% mixedwood. The stream type is 70% run, 20% riffle and 10% pool with a slope of 2 % and a velocity of 0.01m/s. The substrate type is primarily leaf litter and vegetation (80%) with gravel (10%), sand (8%), and rock (2%). The water quality data collected at reach 5 during the survey was:

- Temperature: 10.45 °C,
- Dissolved Oxygen: 41.3%,
- pH: 4.58 ,and
- Conductivity: 27 µS/cm.



Photo 14. Watercourse 3, Reach 5

### Reach 6

Reach 6 is located 16 metres downstream from reach 5 and 38 metres upstream from the existing single culvert on Park rd. It has more of a defined channel and does not have grasses growing in it. The average wet stream width is 1.14 meters and the average depth is 21 cm. The average bank full width is 1.92 metres and the average bank full depth is 45 cm. The stream is sloped 0.5% and during the survey had no flow. The stream banks were stable and had approximately a 3% slope on the left and right. The stream type was mainly a pool (70%), with some riffles (28%), and runs (2%). The substrate contained a mixture of rock (12%), rubble (20%), gravel (20%), sand (30%), fines (16%), and leaf litter (2%). Like all of the other reaches, this reach was within the wetland. The water quality data collected at reach 6 during the survey was:

- Temperature: 10.46 °C,
- Dissolved Oxygen: 41.4%,
- pH: 4.59 ,and
- Conductivity: 27 µS/cm.

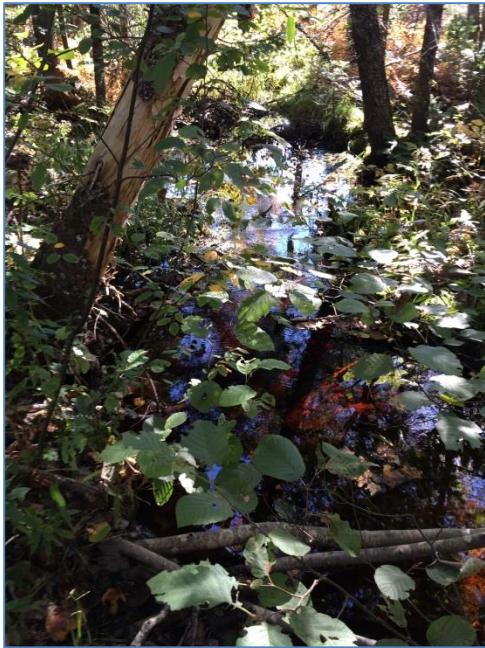


Photo 15. Watercourse 3, Reach 6

Due to the poor water quality during the fall spawning season, and the watercourse not having a defined channel for several reaches, a fishing survey was not conducted for watercourse 3 and no valuable fish habitat is expected.

#### **Watercourse 4- Unnamed tributary to Nine Mile River**

##### Reach 1, 2, and 3

Reach 1, 2 and 3 are located northeast of wetland 10 on the northeast side of the project study area (See Figure XX). These reaches are very similar and have a canopy of 75-80% consisting of shrubs (mostly speckled alder) and tall grasses along the edge of the watercourse. Their left and right banks were stable (90-95%) and their average wet stream width ranged from 1.83 metres to 0.81 meters. Their average wet stream depth ranged from 3.5 cm to 13 cm. The average bank full width ranged from 2.38 metres to 1.5 meters, and 36cm to 50 cm deep. On average these three reaches were dominated by pools (40-60%), but also had riffles (20-40%) and runs (10-40%). The stream substrate was made up of a mixture of gravel, fines, sand, rubble and minor amounts of boulder and rock. The range of water quality data collected at reach 1, 2, and 3 during the survey was:

- Temperature: 12 °C,
- Dissolved Oxygen: 51.7 to 60.1%,
- pH: 6.7 to 6.10 ,and
- Conductivity: 32-33 µS/cm.



Photo 16. Watercourse 4, Reach 1



Photo 17. Watercourse 4, Reach 2



Photo 18. Watercourse 4, Reach 3

Reach 4

Reach 4 is located on the edge of a field 20 meters downstream from reach 3 (See Figure XX). Reach 4 is similar to reach 1 through 3, but has less of a watercourse slope (2%) and did not have any flow during the survey. Reach 4 also has a higher percent of grasses/meadow species within the riparian area and less shrubs. The reach canopy cover is 56% and has stable banks. The average wet stream width is 0.79 metres and 12 cm deep. The average bank full width is 1.02 metres and 32 cm deep. The water quality data collected at reach 4 during the survey was:

- Temperature: 11.98 °C,
- Dissolved Oxygen: 60.1%,
- pH: 6.01 ,and
- Conductivity: 32 µS/cm.



Photo 19. Watercourse 4, Reach 4

#### Reach 5 and 6

Reach 5 and 6 are located 75 meters and 35 meters upstream from Elmsdale rd. (See figure XX). Both reaches are very similar and are within the field which appears to be used for local agriculture (hay). These reaches had stable banks and the riparian area consisted mainly of tall grasses, rushes and sedges. There stream cover was low with a 15% shrub canopy cover. The stream substrate consisted of fines (70-80%), sand (7-20%), gravel (3-5%), and some rubble (5%). The stream was flowing very slowly at reach 5 (0.001m/s) and had no flow at reach 6. These two reaches during the survey and had an average slope of 0-0.5%. The average wet stream width range was 0.9 to 0.59 meters and the average depth range was 9 to 10 cm. The average full bank width range was 0.98 m to 1.2 metres and the depth ranged from 17 to 36 cm. The range of water quality data collected at reach 5 and 6 during the survey was:

- Temperature: 11.98 to 12.05 °C,
- Dissolved Oxygen: 55.5 to 60.1%,
- pH: 5.88 to 6.01 ,and
- Conductivity: 32-34 µS/cm.



Photo 20. Watercourse 4, Reach 5



Photo 21. Watercourse 4, Reach 6

Due to the watercourse having poor water quality and an abundance of vegetation at reach 5, and 6, little to no flow during the fall spawning season fish are not expected to be in this watercourse within the study area. The watercourse disappears upstream near wetland 10. Watercourse 4 is most likely a wetland outlet that drains into nine mile river.