

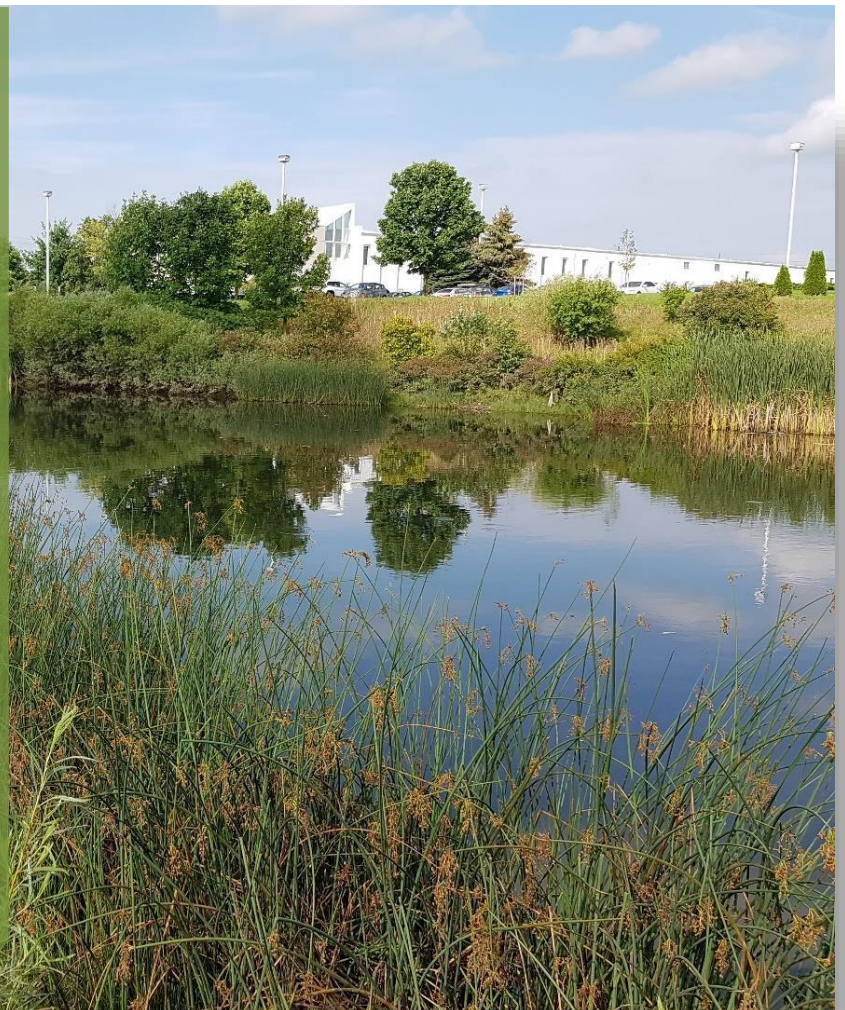
# Stormwater Management Master Plan

## Appendix M: Erosion Assessment Technical Memorandum – Field Investigations

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Appendix A: Erosion Site Summary Sheets

Appendix B: Maintenance Site and Management Issue Summary Sheets

Appendix C: Erosion Assessment Prioritization Plan

## 1.0 Introduction

Aquafor Beech has been retained by the City of Guelph to undertake the 2019 Stormwater Management Master Plan (SWM-MP) which is an update to the original master plan completed in 2012. As part of this update, Aquafor is completing an assessment of the watercourse conditions within the City of Guelph limits, which includes an inventory of outfall structures, documenting erosion sites, and identification of watercourse restoration opportunities. The purpose of this technical memorandum is to outline the methodology and results of the field assessments (field-walks, erosion and outfall inventory) completed as part of the overall watercourse condition assessment.

Further memorandums that will be issued as part of the watercourse condition assessment include:

- Geomorphic System Assessment Technical Memorandum, which will provide a Subwatershed-based assessment of the fluvial geomorphology conditions within the City and the results of the Rapid Geomorphic Assessments undertaken during the field-walks.
- Final Erosion Site Prioritization and Implementation Plan, which will provide a final prioritized list of the thirty (30) erosion sites will outline restoration alternatives for each of the thirty (30) erosion sites, including proffered alternatives, conceptual designs, and cost estimations. This report will also include the outfall and retaining wall information collected in the field, including any maintenance and repair recommendations

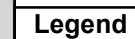
## 2.0 Study Area

At the onset of the study, the City provided Aquafor with their hydrology shapefile and virtual drainage layer. After reviewing the data provided, Aquafor identified approximately 90km of stream systems that extend through 7 distinct sub-watersheds and catchment areas, all of which ultimately all drain into the Speed River watershed (**Figure 2-1**). The City of Guelph has a current population of approximately 141,000, adding more than 26,000 since 2006, and has been experience considerable growth during the last decade. Associated with increased development and urbanization are both direct and indirect factors of human activity on stream geomorphology. Direct impacts include changes of channel form, alignment, bank and bed materials; as well as in-stream structures including weirs, culverts, and dams. Indirect impacts relate primarily to changes in catchment land use which significantly influences the pathways, rates, and volume of water and sediment routing through the drainage networks.

The largest watershed within the City of Guelph is the Lower Speed River which has a drainage area of about 60km<sup>2</sup> (within the City boundary). Within this watershed, there are multiple small streams and unnamed channels that drain directly into the Speed River. The second-largest watershed within the City limits, the Hanlon Creek system also drains directly into the Speed River. The other smaller subwatersheds, which include Hadati Creek, Clythe Creek, and Torrance Creek, all first drain into the Eramosa River which ultimately merges with the Speed River.

Stream reaches were identified and reclassified as part of the 2012 SWM-MP. These reaches and sub-reaches represent convenient watercourse management units that are typically divided by road crossings, pedestrian bridges, or other infrastructure markers within the drainage network (e.g. major outfalls). While these stream reach boundaries often correspond with geomorphically significant changes in channel conditions, these management units are not perfectly consistent with stream morphology reaches and thus may or may not encompass reach-based variations in natural processes.





- Subwatershed (GRCA):**

- ## LOCATOR MAP



## Study Area

A horizontal number line with tick marks at 0, 1, and 2. The word "Kilometres" is written below the line.





## 3.0 Methods

To complete the erosion inventory and assessment for watercourses within the City of Guelph, all watercourses identified during the background review (as identified in **Figure 2-1**) were walked and visually assessed over the period of June-September 2020. Of the estimated 90km of watercourses measured from the City's GIS mapping database, about 75km was walked continuously. The balance of the watercourses were assessed by walking in and out from road crossings, were not accessible due to private property restrictions, or were not visually located in the field as per the referenced mapping information. This field assessment includes the reaches that were identified and assessed during the 2012 SWM-MP, but aims to expand on the work completed for the 2012 SWM-MP which was primarily done using desktop analysis.

### 3.1 Erosion Site Identification and Scoring

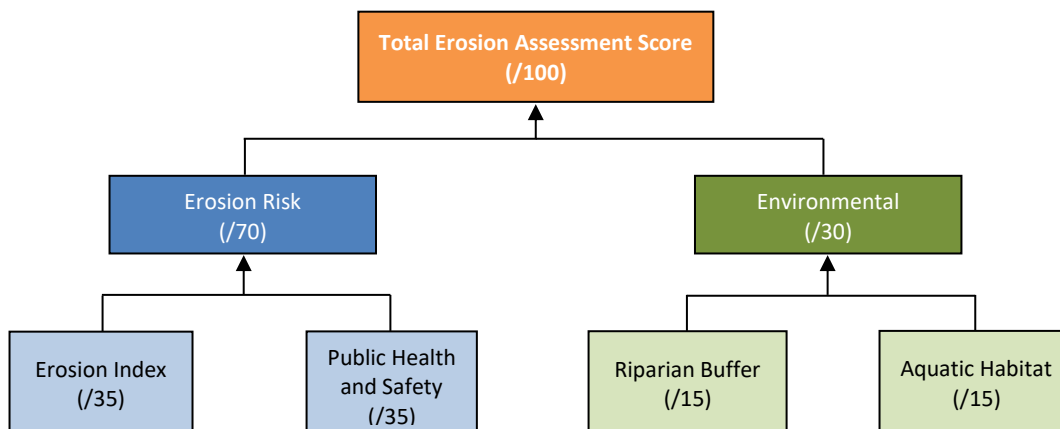
Erosion sites were identified as locations with erosional issues that pose risk to surrounding infrastructure or public health that would require intervention to be mitigated. Furthermore, erosion sites were in some cases also identified as having an impact on the larger reach-scale health of the stream system. Erosion sites were visually identified in the field and locations were recorded on maps. The approximate extents of the erosion sites were measured and photographs of the sites were taken.

To standardize the erosion and risk, and environmental opportunity during the field assessments, a semi-quantitative technical scoring methodology was developed in consultation with City of Guelph staff as well as the Grand River Conservation Authority (GRCA). The Erosion Assessment Prioritization Plan, provided in **Appendix C**, provides an overview of the methodology used for the evaluation of each erosion site in the field.

Each erosion site was given a score out of 100, with larger scores representing sites with high levels of erosion risk and/or higher degrees of environmental opportunity. **Table 3-1** and **Figure 3-1** summarize the technical scoring approach including the evaluation criteria of each scoring component. The erosion risk component included an erosion index of 35% (distance, extent, stress, and erodibility) and a public health and safety index of 35% (type of risk). The environmental opportunity component included opportunities to enhance riparian cover (15%) and opportunities to enhance aquatic habitat (15%). The total score out of 100 provides a semi quantitative measure of risk and opportunity to guide subsequent decisions regarding stream restoration opportunities within the SWM-MP, but the final prioritization and implementation plan will be integrated with other stormwater, infrastructure, and environmental management objectives.

**Table 3-1: Erosion Site Assessment Evaluation Criteria**

| Parameter                              | Definition  |  | Evaluation Criteria   |                          |   |          |       |
|--|---|--|---|--------------------------|---|----------|-------|
| Erosion & Risk Component               |   |  |   |                          |   |          |       |
| Erosion Index                          |   |  |   |                          |   |          |       |
| Distance                               | Distance from top of bank to resource type  | Small Tributaries (~ 2-15m wide)   | Speed and Eramosa (~ 30m wide)                              |                          |   | Rating   |       |
|  |   | In channel   | In channel  |                          |   | 15       |       |
|  |   | 0 – 2 m  | 0 – 5 m   |                          |   | 12       |       |
|  |   | 2 – 5 m  | 5 – 10 m  |                          |   | 10       |       |
|  |   | 5 – 10 m   | 10 – 20 m   |                          |   | 5        |       |
|  |   | 10 – 20 m  | 20 – 40 m   |                          |   | 2        |       |
|  |   | >20 m  | >40 m   |                          |   | 0        |       |
| Extent                                 | The spatial area encompassed by the erosion site  | Site Length  | Slope Height  |                          |   |          |       |
|  |   |  | <1 m  | 1 – 2 m                  | 2 – 5 m                                       | 5 – 10 m | >10 m |
|  |   | <10 m  | 2   | 3                        | 4   | 5        | 6     |
|  |   | 10 – 20 m  | 3   | 4                        | 5   | 6        | 7     |
|  |   | 20 – 50 m  | 4   | 5                        | 6   | 7        | 8     |
|  |   | 50 – 100 m   | 5   | 6                        | 7   | 8        | 9     |
| 10 – 20 m                              | 6   | 7  | 8   | 9                        | 10  |          |       |
| Stress                                 | Stream energy and flow regime   | Stream Energy  | Flow Regime   |                          |   |          |       |
|  |   |  | Flashy (urban)  | Transitional             | Undeveloped (rural)                           |          |       |
|  |   | High   | 5   | 4                        | 3   |          |       |
|  |   | Moderate   | 4   | 3                        | 2   |          |       |
| Low                                    | 3   | 2  | 1   |                          |   |          |       |
| Erodibility                            | Physical characteristics of bank materials  | High, sand/silt  |   | 5                        |   |          |       |
|  |   | Sandy Bed  |   | 4                        |   |          |       |
|  |   | Moderate, gravel   |   | 3                        |   |          |       |
|  |   | Coarse gravel, cobble  |   | 2                        |   |          |       |
|  |   | Low, cobble, boulders, rip-rap   |   | 1                        |   |          |       |
| Public Health and Safety               |   |  |   |                          |   |          |       |
| Type of Risk                           | Identified the type of infrastructure that was closest to the Erosion Site  | Critical Infrastructure (buildings, major dams, water/gas main, major roads, sanitary sewer/stormwater infrastructure, other buried utilities) |   |                          |   | 35       |       |
|  |   | Minor Roads and Bridges; Multi-use Trails (Type 1)   |   |                          |   | 30       |       |
|  |   | Private Property (and Crossings)   |   |                          |   | 25       |       |
|  |   | Secondary Infrastructure (public parking lot, minor dams/weirs, active park land and trails (Type 2-4))  |   |                          |   | 15       |       |
|  |   | Open Park Space (inactive); Type 5 trails  |   |                          |   | 5        |       |
| Total Erosion and Risk Component Score |   |  |   |                          | /70   |          |       |
| Environmental Component                |   |  |   |                          |   |          |       |
| Riparian Cover                         |   |  |   |                          |   |          |       |
| Riparian Buffer                        | Evaluation of the quality of the surrounding riparian cover   | Highest sensitivity to disturbance (i.e. endangered species)   |   |                          |   | 0        |       |
|  |   | High Quality (i.e. dense, mature, native)  |   |                          |   | 5        |       |
|  |   | Moderate Quality   |   |                          |   | 10       |       |
|  |   | Low Quality (i.e. no buffer)   |   |                          |   | 15       |       |
| Aquatic Habitat                        |   |  |   |                          |   |          |       |
| Existing Aquatic Habitat               | General evaluation of the thermal regime of the system and evaluation of the quality of the channel bed to provide suitable habitat for fish or invertebrates | Thermal Regime/Fisheries Sensitivities   | High Quality Habitat (i.e. riffle/pool, natural substrates) | Moderate Quality Habitat | Low Quality Habitat (i.e. engineered channel) |          |       |
|  |   | Coldwater/Intolerant fish community  | 1   | 3                        | 5   |          |       |
|  |   | Mixed/Moderately tolerant fish community   | 5   | 8                        | 10  |          |       |
|  |   | Warmwater/Tolerant   | 10  | 13                       | 15  |          |       |
| Total Environment Component Score      |   |  |   |                          | /30   |          |       |



**Figure 3-1: Schematic of the Erosion Assessment Scoring, Identifying all Evaluation Categories**

## 3.2 Outfall Inventory

During the field walks retaining walls lining watercourse banks, and two-hundred forty-five (245) stormwater outfalls that drain into the watercourses were identified and assessed. The City provided Aquafor with GIS base mapping of their stormwater network including outfall locations, which was used as a starting point for finding and identifying the outfalls. In the initial mapping provided, there were 678 outfalls identified however this included numerous outfalls that did not outlet to the watercourses being assessed. Where possible, at least one photograph was taken of each outfall. Some outfalls were not able to be photographed as there was no vantage point to take the photograph from, or there were too many obstacles in the way for the photograph to be clear.

The condition of the outfalls identified was classified as good, fair or poor based on their structural integrity and functionality (e.g. if there were any obstructions). The information collected during this inventory will be further detailed in the Outfall and Retaining Wall Inventory and Assessment Technical Memorandum, and a GIS layer with the inventory data will be provided to the City.

## 3.3 Maintenance Site Identification and Other Management Issues

During the field walks, maintenance sites were identified as localized erosion, deposition, structural failures or disrepairs, or flow obstructions. The maintenance sites differ from the erosion sites in that the effects of the maintenance sites were very localized and/or associated with city infrastructure included within regular operations and maintenance responsibilities.

In addition to maintenance sites, other issues identified as “management issues” were identified throughout the field walks. These issues did not fit consistently into the erosion inventory or maintenance site frameworks, but were identified as issues the City should be aware of for consideration in the integrated stormwater and watercourse management plans. Examples of management issues include, but are not limited to, fish barriers, hydraulic “pinch-points”, and noxious weeds (e.g. Giant Hogweed).

## 4.0 Erosion Assessment















### 4.1 Erosion Sites

A preliminary number of 30 erosion sites were identified during the field investigations (see **Figure 4-1**). Each site was evaluated using the erosion site assessment scoring described above in **Table 3-1**. A



summary of all the erosion sites inventoried is presented in **Table 4-1** primarily in the order they were identified (i.e. this is not a prioritized list). Erosion site summary sheets and field photos for each of the identified sites can be found in **Appendix A**.

### Legend

-  Municipal Boundary
  -  River
  -  Road Centreline
  -  Erosion Site
- Subwatershed (GRCA):**
-  Clythe Creek
  -  Ellis Creek
  -  Eramosa River - Lower
  -  Hadati Creek
  -  Hanlon Creek
  -  Irish Creek
  -  Mill Creek - Upper
  -  Speed River - Lower
  -  Speed River - Upper
  -  Torrance Creek

### LOCATOR MAP

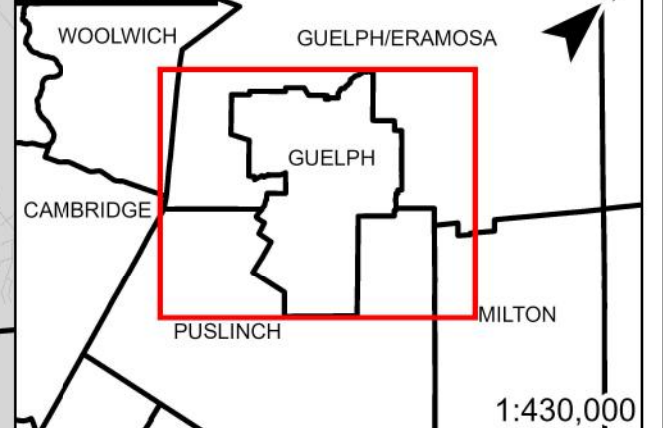
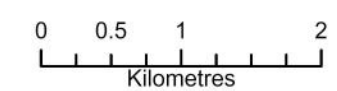


Figure 4-1:

### Erosion Site Locations

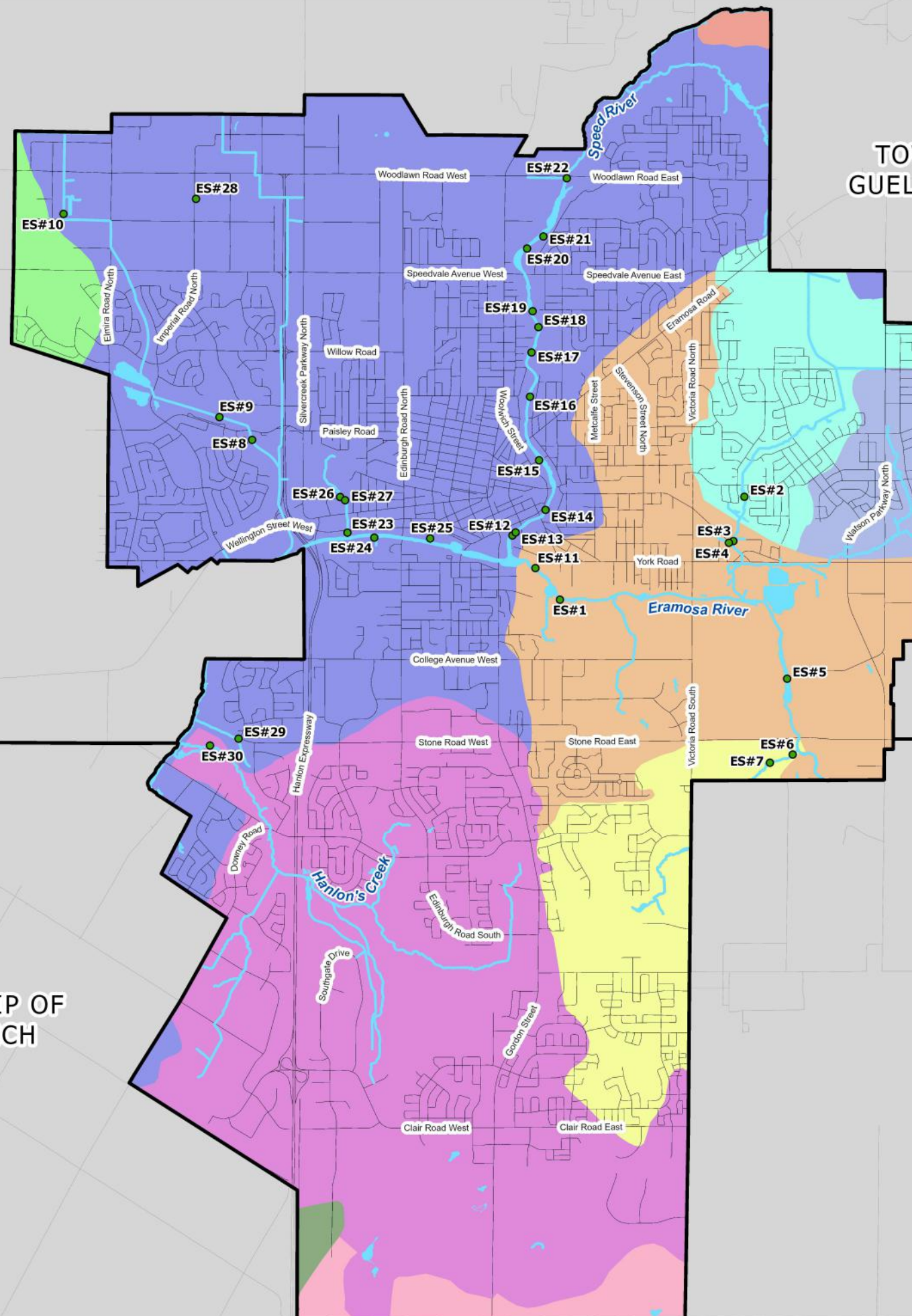
Date: 2020-11-20  
Projection: NAD83\_UTM\_Zone\_17N  
Data Source: City of Guelph, GRCA  
Created by: A.V.



TOWNSHIP OF  
PUSLINCH

TOWNSHIP OF  
GUELPH/ERAMOSA

TOWN OF  
MILTON



**Table 4-1: Preliminary list of Erosion Sites identified during field walks**

| Field ID # | Watercourse              | Reach    | Date           | Erosion Length | Risk  |
|------------|--------------------------|----------|----------------|----------------|---|
| ES#1       | Eramosa River            | ER-1     | June 4, 2020   | 15m            | Stormwater outfall                                    |
| ES#2       | Hadati Creek             | HC-3     | June 4, 2020   | 10m            | Private property, bank erosion                        |
| ES#3       | Hadati Creek             | HC-2     | June 17, 2020  | 25m            | Private property, retaining wall                      |
| ES#4       | Hadati Creek             | HC-A1    | June 17, 2020  | 10m            | Road, stormwater outfall                              |
| ES#5       | Eramosa River            | ER-4     | June 30, 2020  | 5m             | Pedestrian bridge                                     |
| ES#6       | Torrance Creek           | TC-7     | July 6, 2020   | 5m             | Private property, small road/bridge                   |
| ES#7       | Torrance Creek           | TC-3     | July 6, 2020   | 10m            | Weir structure, bank erosion                          |
| ES#8       | Tributary of Speed River | SR-I2    | July 7, 2020   | 3m             | Stormwater outfall, bank erosion                      |
| ES#9       | Tributary of Speed River | SR-I3    | July 7, 2020   | 5m             | Stormwater outfall, bank erosion                      |
| ES#10      | Tributary of Speed River | SS-8     | July 7, 2020   | 2.5m           | Stormwater outfall, bank erosion                      |
| ES#11      | Eramosa River            | ER-1     | July 14, 2020  | 3m             | Stormwater outfall, bank erosion                      |
| ES#12      | Speed River              | SR-8     | July 14, 2020  | 3m             | Retaining wall  |
| ES#13      | Speed River              | SR-8     | July 14, 2020  | 5m             | Retaining wall, stormwater outfalls                   |
| ES#14      | Speed River              | SR-8     | July 14, 2020  | 30m            | Sanitary sewer pipe                                   |
| ES#15      | Speed River              | SR-9     | July 14, 2020  | 3m             | Stormwater outfall, retaining wall                    |
| ES#16      | Speed River              | SR-10    | July 14, 2020  | 8m             | Weir, stormwater outfall                              |
| ES#17      | Speed River              | SR-10    | July 14, 2020  | 5m             | Stormwater outfall, bank erosion                      |
| ES#18      | Speed River              | SR-10    | July 14, 2020  | 11m            | Exposed pipe (potential watermain)                    |
| ES#19      | Speed River              | SR-10    | July 14, 2020  | 5m             | Stormwater outfall                                    |
| ES#20      | Speed River              | SR-11    | July 23, 2020  | 10m            | Retaining wall  |
| ES#21      | Speed River              | SR-11    | July 23, 2020  | 10m            | Retaining wall  |
| ES#22      | Speed River              | SR-12    | July 23, 2020  | 4m             | Stormwater outfall, bank erosion                      |
| ES#23      | Tributary of Speed River | SR-J1    | July 24, 2020  | 15m            | Stormwater outfall, sanitary sewer, retaining walls   |
| ES#24      | Speed River              | SR-5     | July 24, 2020  | 10m            | Weir, retaining wall                                  |
| ES#25      | Tributary of Speed River | SR-K1    | July 24, 2020  | 40m            | Sanitary sewer, retaining walls, unknown pipe exposed |
| ES#26      | Silver Creek             | SR-J2    | July 24, 2020  | 15m            | Private property, bank erosion                        |
| ES#27      | Silver Creek             | SR-J1    | July 24, 2020  | 10m            | Weir  |
| ES#28      | Tributary of Speed River | Un-named | July 28, 2020  | 4m             | Stormwater outfall                                    |
| ES#29      | Hanlon Creek             | SR-F2    | August 6, 2020 | 10m            | Stormwater outfall, bank erosion                      |
| ES#30      | Hanlon Creek             | HAC-1    | August 6, 2020 | 4m             | Pedestrian bridge, trail                              |



#### 4.1.1 Preliminary Top 5 Erosion Sites

Based on the field scoring methodology described above in **Section 3.1**, the following five (5) erosion sites were given the highest total scores:

1. ES#3
2. ES#4
3. ES#25
4. ES#23
5. ES#29

All of these erosion sites were associated with critical infrastructure that is at risk, including exposed sanitary sewer pipes and stormwater outfall infrastructure. These sites are also located in areas which have relatively low-quality aquatic habitat and low-quality riparian cover, which are optimal conditions if erosion protection works are to be conducted. Provided below are the Erosion Site Summary Sheets for each of these aforementioned sites which display the scoring matrix sheet and field photos taken at the site.

|   |                |  |               |
|---|----------------|--|---------------|
| <b>Erosion Site</b>   | 3              | <b>Date:</b>   | June 17, 2020 |
| Watercourse   | Reach number   | Photo Numbers  |               |
| Hadati  | HC-2           | 48, 49, 50   |               |
| Bankfull W (m)  | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |               |
| 8   | 4              | Site length: 25m, Site height: 4m  |               |
| <b>Observations Upstream:</b> <ul style="list-style-type: none"> <li>Upstream culvert takes stream under Suburban Ave, private property upstream of Suburban Ave, knickpoint/fish barrier (see photo 42)</li> </ul>       |                |  |               |
| <b>Observations Downstream:</b> <ul style="list-style-type: none"> <li>Stream passes under private pedestrian bridge (Durose Manufacturing) and through culvert under Elizabeth Street (see Photo 48)</li> </ul>          |                |  |               |
| <b>Site Description:</b> <ul style="list-style-type: none"> <li>Realigned channel between Suburban Ave and Elizabeth St, private building (Durose Manufacturing) immediately beside channel (see photo 46, 47)</li> </ul> |                |  |               |

### Risk-Distance Matrix

| Small Tributaries:  | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|---|---------|------|-------|--------|--------|------|
| Speed and Eramosa:  | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure   | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail  | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing   | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure  | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail   | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)   | 15      | 12   | 10    | 5      | 2      | 0    |
| <b>Critical Infrastructure</b><br><input checked="" type="checkbox"/> Buildings<br><input type="checkbox"/> Major Dams<br><input type="checkbox"/> Water or Gas Main<br><input type="checkbox"/> Major Roads/Bridges<br><input type="checkbox"/> Sanitary Sewer Infrastructure<br><input checked="" type="checkbox"/> Stormwater Infrastructure |         |      |       |        |        |      |
| <b>Secondary Infrastructure</b><br><input type="checkbox"/> Public Parking Lot<br><input type="checkbox"/> Minor Dam/Weir<br><input type="checkbox"/> Active Park Land<br><input type="checkbox"/> Trail Type 2-4<br><input type="checkbox"/> Other   |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>87</b> |
|-------------------------|-----------|

| Extent      | Slope Height |         |         |          |        |
|-------------|--------------|---------|---------|----------|--------|
| Site Length | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m      | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m   | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m   | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m  | 5            | 6       | 7       | 8        | 9      |
| > 100 m     | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |







|  |                |  |               |
|--|----------------|--|---------------|
| <b>Erosion Site</b>  | 4              | <b>Date:</b>   | June 17, 2020 |
| Watercourse  | Reach number   | Photo Numbers  |               |
| Hadati   | HC-A1          | 54, 55, 56   |               |
| Bankfull W (m)   | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |               |
| 3m   | 4m             | Site Length: 10m, Site Height: 5m  |               |
| Observations Upstream<br>- Box culvert at Industrial St, watercourse becomes piped   |                |  |               |
| Observations Downstream<br>- Confluence of reach HC-2 at HC-A1 at downstream box culvert   |                |  |               |
| Site Description<br>- Stormwater outfall pipe emerging from eroding right bank, Elizabeth street is at the top of the right bank |                |  |               |

### Risk-Distance Matrix

| Small Tributaries:<br>Speed and Eramosa:   | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|--|---------|------|-------|--------|--------|------|
|  | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure  | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail   | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing  | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure   | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail  | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)  | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input checked="" type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> Stormwater Infrastructure           </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other           </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>86</b> |
|-------------------------|-----------|

| Extent<br>Site Length | Slope Height |         |         |          |        |
|-----------------------|--------------|---------|---------|----------|--------|
|                       | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m                | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m             | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m             | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m            | 5            | 6       | 7       | 8        | 9      |
| > 100 m               | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |







|  |                |  |               |
|--|----------------|--|---------------|
| <b>Erosion Site</b>  | 25             | <b>Date:</b>   | July 24, 2020 |
| Watercourse  | Reach number   | Photo Numbers  |               |
| Tributary of Speed River   | SR-K1          | 30-36  |               |
| Bankfull W (m)   | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |               |
| 8m   | 2.5m           | Site length: 40m, Site Height: 2.5m  |               |
| Observations Upstream<br>- Pedestrian bridge and large sanitary pipe crossing the channel  |                |  |               |
| Observations Downstream<br>- confluence with speed river   |                |  |               |
| Site Description<br>- exposed pipe (type unknown) in channel, retaining walls upstream, downstream and at pipe location are eroding and falling into the channel |                |  |               |

### Risk-Distance Matrix

| Small Tributaries:   | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|--|---------|------|-------|--------|--------|------|
| Speed and Eramosa:   | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure  | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail   | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing  | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure   | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail  | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)  | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <u>Critical Infrastructure</u><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input checked="" type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> Other buried utilities           </div> <div> <u>Secondary Infrastructure</u><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input checked="" type="checkbox"/> Other (retaining wall)           </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>82</b> |
|-------------------------|-----------|

| Extent      | Slope Height |         |         |          |        |
|-------------|--------------|---------|---------|----------|--------|
| Site Length | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m      | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m   | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m   | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m  | 5            | 6       | 7       | 8        | 9      |
| > 100 m     | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |











|   |                |  |               |              |               |
|---|----------------|--|---------------|--------------|---------------|
| <b>Erosion Site</b>   | #23            |  |               | <b>Date:</b> | July 24, 2020 |
| Watercourse   |                | Reach number   | Photo Numbers |              |               |
| Tributary of Speed River  |                | SR-J1  | 9-14          |              |               |
| Bankfull W (m)  | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |               |              |               |
| 5m  | 2m             | Site length: 15m, Site Height: 2m  |               |              |               |
| Observations Upstream<br>- Culvert crossing under Wellington St and a weir structure  |                |  |               |              |               |
| Observations Downstream<br>- pedestrian bridge and convergence with the speed river   |                |  |               |              |               |
| Site Description<br>- retaining walls just downstream of SW outfall and culvert are undermined, eroded and falling into the creek, potential concrete sanitary line being exposed |                |  |               |              |               |

### Risk-Distance Matrix

| Small Tributaries:<br>Speed and Eramosa:  | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|---|---------|------|-------|--------|--------|------|
|   | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure   | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail  | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing   | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure  | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail   | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)   | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input checked="" type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> Stormwater Outfall           </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input checked="" type="checkbox"/> Other (retaining wall)           </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>81</b> |
|-------------------------|-----------|

| Extent<br>Site Length | Slope Height |         |         |          |        |
|-----------------------|--------------|---------|---------|----------|--------|
|                       | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m                | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m             | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m             | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m            | 5            | 6       | 7       | 8        | 9      |
| > 100 m               | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |



9



10



11



12







|  |                |  |  |              |             |
|--|----------------|--|--|--------------|-------------|
| <b>Erosion Site</b>  | 29             |  |  | <b>Date:</b> | Aug 6, 2020 |
| Watercourse  | Reach number   | Photo Numbers  |  |              |             |
| Hanlon Creek   | SR-F2          | MB3,5  |  |              |             |
| Bankfull W (m)   | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |  |              |             |
| 8m   | 2m             | Site length: 10m, Site Height: 3m  |  |              |             |
| Observations Upstream<br>- Large stormwater outfall                                |                |  |  |              |             |
| Observations Downstream<br>- Coarse gravel/cobble stream, walking path on LB       |                |  |  |              |             |
| Site Description<br>- Stone/concrete grouted wall eroded around stormwater outfall |                |  |  |              |             |

### Risk-Distance Matrix

| Small Tributaries:<br>Speed and Eramosa:   | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|--|---------|------|-------|--------|--------|------|
|  | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure  | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail   | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing  | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure   | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail  | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)  | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> Stormwater outfall </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>79</b> |
|-------------------------|-----------|

| Extent<br>Site Length | Slope Height |         |         |          |        |
|-----------------------|--------------|---------|---------|----------|--------|
|                       | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m                | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m             | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m             | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m            | 5            | 6       | 7       | 8        | 9      |
| > 100 m               | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |







## 4.2 Outfall Inventory

A summary of the outfall inventory is provided in **Table 4-2**, which shows the number of outfalls along each stream and the assessed condition of the outfalls. In total 243 outfalls were identified during the field walks with the majority within the Speed River and its tributaries (see **Figure 4-2**). Based on the visual assessment conducted in the field, each outfall was assigned one of the following conditions:

- Good: No flow obstructions or structural deficiencies, no maintenance needed
- Fair: May be partially obstructed and/or have minor structural deficiencies, minor maintenance may be needed in future
- Poor: Large flow obstructions (>50% of pipe) and/or has major structural issues, maintenance is required

Out of all those identified, 56% of the outfalls were classified as being in “good” condition, 34% were classified as being in “fair” condition and 10% were classified as being in “poor” condition.

**Table 4-2: Summary of Outfall Inventory**

| Creek Name                             | Total Number of Outfalls Identified | Number of Outfalls Ranked “Good” | Number of Outfalls Ranked “Fair” | Number of Outfalls Ranked “Poor” |
|--|-------------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Clythe Creek                           | 7                                   | 3                                | 3                                | 1                                |
| Eramosa River                          | 16                                  | 4                                | 9                                | 3                                |
| - Unnamed Tributaries of Eramosa River | 3                                   | 0                                | 1                                | 2                                |
| Hadati Creek                           | 21                                  | 16                               | 5                                | 0                                |
| Hanlon Creek                           | 18                                  | 7                                | 8                                | 3                                |
| Silvercreek                            | 2                                   | 1                                | 1                                | 0                                |
| Speed River                            | 81                                  | 50                               | 22                               | 9                                |
| - Unnamed Tributaries of Speed River   | 79                                  | 43                               | 31                               | 5                                |
| Torrance Creek                         | 7                                   | 6                                | 0                                | 1                                |
| Watson Creek                           | 9                                   | 5                                | 3                                | 1                                |
| <b>TOTAL</b>                           | <b>243</b>                          | <b>135</b>                       | <b>83</b>                        | <b>25</b>                        |



- Outfall Condition:**

- Subwatershed (GRCA):**

- Clythe Creek
- Ellis Creek
- Eramosa River - Lower
- Hadati Creek
- Hanlon Creek
- Irish Creek
- Mill Creek - Upper
- Speed River - Lower
- Speed River - Upper
- Torrance Creek

## LOCATOR MAP

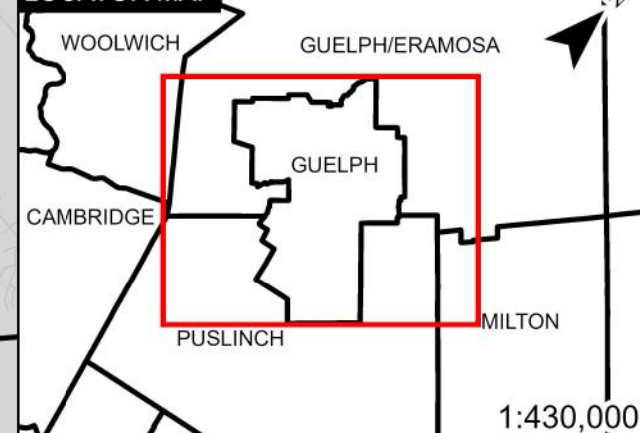
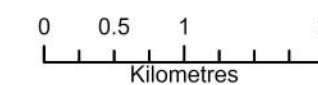


Figure 4-2:

### Outfall Condition

Date: 2020-11-20  
Projection: NAD83\_UTM\_Zone\_17N  
Data Source: City of Guelph, GRCA  
Created by: A.V.



## 4.3 Maintenance and Management Issues

### 4.3.1 Maintenance Sites

The maintenance sites identified in the field were reviewed and tabulated into a database. A total of 30 maintenance sites were identified within 9 different watercourses (see **Figure 4-3**). A summary of the maintenance sites identified is provided in **Table 4-3** below.

**Table 4-3: Summary of Maintenance Sites**

| Creek Name                             | Number of Maintenance Sites Identified | Maintenance Sites Associated with Outfalls |            |
|--|--|--|------------|
|  |  | Count                                      | Percent    |
| Clythe Creek                           | 1                                      | 1  | 100%       |
| Eramosa River                          | 6                                      | 5  | 83%        |
| - Unnamed Tributaries of Eramosa River | 3                                      | 3  | 100%       |
| Hadati Creek                           | 1                                      | 0  | 0%         |
| Hanlon Creek                           | 6                                      | 5  | 83%        |
| Speed River                            | 8                                      | 6  | 75%        |
| - Unnamed Tributaries of Speed River   | 3                                      | 2  | 67%        |
| Torrance Creek                         | 1                                      | 0  | 0%         |
| Watson Creek                           | 2                                      | 0  | 0%         |
| <b>TOTAL</b>                           | <b>31</b>                              | <b>22</b>                                  | <b>71%</b> |

The majority of the maintenance sites identified during the field walks were associated with outfalls. Most of the issues associated with these outfalls related to sediment disposition in or around that outlet that restricts the outflow performance of the outfall. Another issue commonly associated with these identified outfalls is minor erosion that compromises the structural stability of the outfall. It was observed throughout the field walks that many of the outfalls throughout the City did not have any headwalls or aprons. The addition of headwalls and aprons generally stabilize the embankment around the outfall pipe and transition the water from the pipe to the active channel.

The remaining nine (9) maintenance sites not associated with outfalls are composed of a variety of different issues included debris jams obstructing flow in the channels, potential repairs necessary on public trails near watercourses, and garbage and other large debris noted in the channels.

Summary sheets for each maintenance site identified are provided in **Appendix B**.

### 4.3.2 Management Issues

A list of management issues identified and documented as part of the field walks is provided in **Table 4-4** below. Generally, these management issues are highlighted to ensure that a broad range of management issues are flagged under the Stormwater Master Plan. Overall, there were sixteen (16) issues identified covering a range of different managerial issues (see **Figure 4-3**). Summary sheets for each management issue identified are provided in **Appendix B**.



**Table 4-4: Summary of Management Issues**

| No.   | Watercourse              | Reach | Description  |
|-------|--------------------------|-------|--|
| MI#1  | Hadati Creek             | HC-3  | Encroachment from private property   |
| MI#2  | Hadati Creek             | HC-3  | Encroachment from private property   |
| MI#3  | Hadati Creek             | HC-B1 | No defined channel anymore, SWMF has extended to absorb channel                                |
| MI#4  | Hadati Creek             | HC-2  | Major fish barrier in channel  |
| MI#5  | Hadati Creek             | HC-4  | Encroachment from private property, small bridge made over channel                             |
| MI#6  | Hadati Creek             | HC-4  | Gabion baskets in channel have burst and opened, fish barriers                                 |
| MI#7  | Clythe Creek             | CC-3  | Large DICB has shifted   |
| MI#8  | Clythe Creek             | CC-1  | Large beaver dam across channel  |
| MI#9  | Clythe Creek             | CC-2  | Fish barriers in channel   |
| MI#10 | Clythe Creek             | CC-2  | Fish barrier in channel  |
| MI#11 | Tributary of Speed River | SR-I4 | Numerous fish barriers in succession in channel  |
| MI#12 | Speed River              | SR-8  | Giant Hogweed  |
| MI#13 | Speed River              | SR-10 | No headwall structure, outfall seems unstable  |
| MI#14 | Speed River              | SR-11 | Headwall/retaining wall has heaved around outfall, cracked and in poor condition               |
| MI#15 | Speed River              | SR-12 | Exposed pipe in water (type unknown) exposed near path, another pipe outletting to Speed River |
| MI#16 | Tributary of Speed River | SR-H1 | Fence around channel and outfall have fallen over and in poor condition                        |



## 5.0 Final Prioritization and Next Steps

This technical memo presents the results of the 2020 field-walks and erosion site inventory completed for the City of Guelph in order to assess the existing conditions of the stream reaches, map erosion risks, and identify any potential stream restoration works. The technical field scoring methodology for erosion sites in this study assesses both erosion risks and the environmental opportunities of potential stream restoration sites. The field scoring is intended to inform a first-order classification of erosion sites. Ultimately, the erosion assessment, including identified erosion sites and restoration opportunities, will need to consider broad City interests, priorities and initiatives.

Moving forward on the next steps of the SWM-MP, this draft erosion assessment lays the groundwork to contribute to a subsequent system-wide project prioritization and implementation plan for the overall health of watercourses within the City of Guelph. Aquafor will work with City staff to identify other criteria and project opportunities to refine the erosion site priority list and develop and implementation plan that groups the sites into general planning time horizons (e.g., 1 to 5 years, 5 to 10 years, 10 to 15 years, etc.) with some flexibility to select future projects as existing conditions change and/or new opportunities arise within the City's broader public mandate.



# Appendix A

|  |                |  |              |
|--|----------------|--|--------------|
| <b>Erosion Site</b>  | 1              | <b>Date:</b>   | June 4, 2020 |
| Watercourse  | Reach number   | Photo Numbers  |              |
| Eramosa  | ER-1           | June4 (MB) – 1-3, Sept1 (MB) – 10, 11, 13  |              |
| Bankfull W (m)   | Bankfull D (m) | Site Length (m) and Height (m) <input type="checkbox"/> Bank <input checked="" type="checkbox"/> Valley Wall |              |
| 10m  | 2m             | Length = 10-20m, Height = 2-3m   |              |
| Observations Upstream:<br>- Water is approximately 1-2m deep (see photo 3)           |                |  |              |
| Observations Downstream:<br>- Island downstream with secondary channel (see photo 1) |                |  |              |
| Site Description:<br>~1200mm stormwater outfall (see photo 2)                        |                |  |              |

**Risk-Distance Matrix**

| Small Tributaries:<br>Speed and Eramosa:  | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|---|---------|------|-------|--------|--------|------|
|   | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure   | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail  | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing   | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure  | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail   | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)   | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> Stormwater Infrastructure           </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other           </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>57</b> |
|-------------------------|-----------|

| Extent<br>Site Length | Slope Height |         |         |          |        |
|-----------------------|--------------|---------|---------|----------|--------|
|                       | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m                | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m             | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m             | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m            | 5            | 6       | 7       | 8        | 9      |
| > 100 m               | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |







|   |                |  |              |
|---|----------------|--|--------------|
| <b>Erosion Site</b>   | 2              | <b>Date:</b>   | June 4, 2020 |
| Watercourse   | Reach number   | Photo Numbers  |              |
| Hadati  | HC-3           | 41, 42, 43   |              |
| Bankfull W (m)  | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |              |
| 2m  | 0.5            | Site length: 10m, Site height: 2m  |              |
| <b>Observations Upstream</b><br>- Fallen trees and organic debris, water is clear and moving well, Grange St. bridge approximately 100m upstream (see photo 41)   |                |  |              |
| <b>Observations Downstream</b><br>- Fallen tree immediately downstream, railway at downstream end up reach (see photo 42)   |                |  |              |
| <b>Site Description</b><br>- Previous channel works (boulders) upstream, dense vegetation, heavily wooded (dogwood trees/shrubs), private property fencing nearby |                |  |              |

### Risk-Distance Matrix

| Small Tributaries:<br>Speed and Eramosa:  | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|---|---------|------|-------|--------|--------|------|
|   | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure   | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail  | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing   | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure  | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail   | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)   | 15      | 12   | 10    | 5      | 2      | 0    |
| <b>Critical Infrastructure</b><br><input type="checkbox"/> Buildings<br><input type="checkbox"/> Major Dams<br><input type="checkbox"/> Water or Gas Main<br><input type="checkbox"/> Major Roads/Bridges<br><input type="checkbox"/> Sanitary Sewer Infrastructure               |         |      |       |        |        |      |
| <b>Secondary Infrastructure</b><br><input type="checkbox"/> Public Parking Lot<br><input type="checkbox"/> Minor Dam/Weir<br><input type="checkbox"/> Active Park Land<br><input type="checkbox"/> Trail Type 2-4<br><input checked="" type="checkbox"/> Other (private property) |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>66</b> |
|-------------------------|-----------|

| Extent<br>Site Length | Slope Height |         |         |          |        |
|-----------------------|--------------|---------|---------|----------|--------|
|                       | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m                | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m             | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m             | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m            | 5            | 6       | 7       | 8        | 9      |
| > 100 m               | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

\*Stream bed is gravellier, bank is more sandy

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |







|   |                |  |               |
|---|----------------|--|---------------|
| <b>Erosion Site</b>   | 3              | <b>Date:</b>   | June 17, 2020 |
| Watercourse   | Reach number   | Photo Numbers  |               |
| Hadati  | HC-2           | 48, 49, 50   |               |
| Bankfull W (m)  | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |               |
| 8   | 4              | Site length: 25m, Site height: 4m  |               |
| <b>Observations Upstream:</b> <ul style="list-style-type: none"> <li>Upstream culvert takes stream under Suburban Ave, private property upstream of Suburban Ave, knickpoint/fish barrier (see photo 42)</li> </ul>       |                |  |               |
| <b>Observations Downstream:</b> <ul style="list-style-type: none"> <li>Stream passes under private pedestrian bridge (Durose Manufacturing) and through culvert under Elizabeth Street (see Photo 48)</li> </ul>          |                |  |               |
| <b>Site Description:</b> <ul style="list-style-type: none"> <li>Realigned channel between Suburban Ave and Elizabeth St, private building (Durose Manufacturing) immediately beside channel (see photo 46, 47)</li> </ul> |                |  |               |

### Risk-Distance Matrix

| Small Tributaries:<br>Speed and Eramosa:  | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|---|---------|------|-------|--------|--------|------|
|   | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure   | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail  | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing   | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure  | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail   | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)   | 15      | 12   | 10    | 5      | 2      | 0    |
| <b>Critical Infrastructure</b><br><input checked="" type="checkbox"/> Buildings<br><input type="checkbox"/> Major Dams<br><input type="checkbox"/> Water or Gas Main<br><input type="checkbox"/> Major Roads/Bridges<br><input type="checkbox"/> Sanitary Sewer Infrastructure<br><input checked="" type="checkbox"/> Stormwater Infrastructure |         |      |       |        |        |      |
| <b>Secondary Infrastructure</b><br><input type="checkbox"/> Public Parking Lot<br><input type="checkbox"/> Minor Dam/Weir<br><input type="checkbox"/> Active Park Land<br><input type="checkbox"/> Trail Type 2-4<br><input type="checkbox"/> Other   |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>87</b> |
|-------------------------|-----------|

| Extent      | Slope Height |         |         |          |        |
|-------------|--------------|---------|---------|----------|--------|
| Site Length | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m      | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m   | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m   | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m  | 5            | 6       | 7       | 8        | 9      |
| > 100 m     | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |







|  |                |  |               |
|--|----------------|--|---------------|
| <b>Erosion Site</b>  | 4              | <b>Date:</b>   | June 17, 2020 |
| Watercourse  | Reach number   | Photo Numbers  |               |
| Hadati   | HC-A1          | 54, 55, 56   |               |
| Bankfull W (m)   | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |               |
| 3m   | 4m             | Site Length: 10m, Site Height: 5m  |               |
| Observations Upstream<br>- Box culvert at Industrial St, watercourse becomes piped   |                |  |               |
| Observations Downstream<br>- Confluence of reach HC-2 at HC-A1 at downstream box culvert   |                |  |               |
| Site Description<br>- Stormwater outfall pipe emerging from eroding right bank, Elizabeth street is at the top of the right bank |                |  |               |

### Risk-Distance Matrix

| Small Tributaries:<br>Speed and Eramosa:   | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|--|---------|------|-------|--------|--------|------|
|  | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure  | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail   | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing  | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure   | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail  | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)  | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input checked="" type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> Stormwater Infrastructure           </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other           </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>86</b> |
|-------------------------|-----------|

| Extent<br>Site Length | Slope Height |         |         |          |        |
|-----------------------|--------------|---------|---------|----------|--------|
|                       | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m                | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m             | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m             | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m            | 5            | 6       | 7       | 8        | 9      |
| > 100 m               | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |







|   |                |  |               |
|---|----------------|--|---------------|
| <b>Erosion Site</b>   | 5              | <b>Date:</b>   | June 30, 2020 |
| Watercourse   | Reach number   | Photo Numbers  |               |
| Eramosa   | ER-4           | 5,6,7  |               |
| Bankfull W (m)  | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |               |
| 30m   | 3m             | Site Length: 5m, Site Height: 3m   |               |
| Observations Upstream<br>- Island approximately 100m upstream of bridge structure   |                |  |               |
| Observations Downstream<br>- Slow moving water, ~25m wide open river  |                |  |               |
| Site Description<br>- Old pedestrian bridge (unsure whether still active), fencing blocking path at top of bridge has been ripped away. Beams under bridge on right bank are broken and cracking, erosion under bridge. |                |  |               |

### Risk-Distance Matrix

| Small Tributaries:<br>Speed and Eramosa:  | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|---|---------|------|-------|--------|--------|------|
|   | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure   | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail  | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing   | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure  | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail   | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)   | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure           </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input checked="" type="checkbox"/> Trail Type 2-4<br/> <input checked="" type="checkbox"/> Other (small bridge)           </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>57</b> |
|-------------------------|-----------|

| Extent<br>Site Length | Slope Height |         |         |          |        |
|-----------------------|--------------|---------|---------|----------|--------|
|                       | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m                | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m             | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m             | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m            | 5            | 6       | 7       | 8        | 9      |
| > 100 m               | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |





|   |                |  |  |              |
|---|----------------|--|--|--------------|
| <b>Erosion Site</b>   | 6              | <b>Date:</b>   |  | July 6, 2020 |
| Watercourse   | Reach number   | Photo Numbers  |  |              |
| Torrance Creek  | TC-7           | 10,11,12   |  |              |
| Bankfull W (m)  | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |  |              |
| 5   | 1.5m           | Site Length: 5m, Site Height: 3m   |  |              |
| Observations Upstream<br>- Forested channel, railway crossing   |                |  |  |              |
| Observations Downstream<br>- Confluence with Eramosa river  |                |  |  |              |
| Site Description<br>- Culvert going under roadway, erosion occurring around culvert and road/bridge structure |                |  |  |              |

### Risk-Distance Matrix

| Small Tributaries:<br>Speed and Eramosa:  | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|---|---------|------|-------|--------|--------|------|
|   | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure   | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail  | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing   | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure  | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail   | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)   | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> private property/road </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>68</b> |
|-------------------------|-----------|

| Extent<br>Site Length | Slope Height |         |         |          |        |
|-----------------------|--------------|---------|---------|----------|--------|
|                       | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m                | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m             | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m             | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m            | 5            | 6       | 7       | 8        | 9      |
| > 100 m               | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |





|   |                |  |  |              |              |
|---|----------------|--|--|--------------|--------------|
| <b>Erosion Site</b>   | 7              |  |  | <b>Date:</b> | July 6, 2020 |
| Watercourse   | Reach number   | Photo Numbers  |  |              |              |
| Torrance Creek  | TC-3           | MB13-16  |  |              |              |
| Bankfull W (m)  | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |  |              |              |
| 4m  | 5m             | Site length: 10m, Site Height: 5m  |  |              |              |
| Observations Upstream<br>- Open wetland area  |                |  |  |              |              |
| Observations Downstream<br>- Forested channel, railway crossing, confluence with Eramosa                                    |                |  |  |              |              |
| Site Description<br>- Weir/dam structure at outlet of wetland in poor condition (eroding at bottom, cracking and crumbling) |                |  |  |              |              |

### Risk-Distance Matrix

| Small Tributaries:<br>Speed and Eramosa:   | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|--|---------|------|-------|--------|--------|------|
|  | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure  | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail   | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing  | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure   | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail  | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)  | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input type="checkbox"/> Stormwater outfall </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input checked="" type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>58</b> |
|-------------------------|-----------|

| Extent<br>Site Length | Slope Height |         |         |          |        |
|-----------------------|--------------|---------|---------|----------|--------|
|                       | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m                | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m             | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m             | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m            | 5            | 6       | 7       | 8        | 9      |
| > 100 m               | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |







|   |                |  |              |
|---|----------------|--|--------------|
| <b>Erosion Site</b>   | 8              | <b>Date:</b>   | July 7, 2020 |
| Watercourse   | Reach number   | Photo Numbers  |              |
| Tributary of Speed River  | SR-I2          | 8,9,10   |              |
| Bankfull W (m)  | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |              |
| 8m  | 2m             | Site Length: 3m, Site Height: 1-2m   |              |
| Observations Upstream<br>- Paisley street and large culvert upstream  |                |  |              |
| Observations Downstream<br>- Runs along the Hanlon express, confluence with reach SR-I-B1   |                |  |              |
| Site Description<br>- Urbanized channel with new path and sediment fencing on left bank, broken concrete pipe outfall on right bank |                |  |              |

### Risk-Distance Matrix

| Small Tributaries:   | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|--|---------|------|-------|--------|--------|------|
| Speed and Eramosa:   | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure  | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail   | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing  | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure   | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail  | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)  | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <u>Critical Infrastructure</u><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> Stormwater Infrastructure/Outfall           </div> <div> <u>Secondary Infrastructure</u><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other           </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>71</b> |
|-------------------------|-----------|

| Extent      | Slope Height |         |         |          |        |
|-------------|--------------|---------|---------|----------|--------|
| Site Length | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m      | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m   | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m   | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m  | 5            | 6       | 7       | 8        | 9      |
| > 100 m     | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |





|   |                |  |              |
|---|----------------|--|--------------|
| <b>Erosion Site</b>   | 9              | <b>Date:</b>   | July 7, 2020 |
| Watercourse   | Reach number   | Photo Numbers  |              |
| Tributary of Speed River  | SR-I3          | 23, 24   |              |
| Bankfull W (m)  | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |              |
| 4m  | 1m             | Site Length: 5m, Site Height: 1.5m   |              |
| Observations Upstream<br>- Straightened, concrete lined channel (photo 20)  |                |  |              |
| Observations Downstream<br>- Straightened concentrate lined channel leading to culvert at Paisley street (photo 19) |                |  |              |
| Site Description<br>- Edge of stormwater outfall slope eroding and scour pool formed in channel                     |                |  |              |

### Risk-Distance Matrix

| Small Tributaries:<br>Speed and Eramosa:   | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|--|---------|------|-------|--------|--------|------|
|  | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure  | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail   | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing  | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure   | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail  | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)  | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <u>Critical Infrastructure</u><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> Stormwater Infrastructure/Outfall </div> <div> <u>Secondary Infrastructure</u><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>67</b> |
|-------------------------|-----------|

| Extent<br>Site Length | Slope Height |         |         |          |        |
|-----------------------|--------------|---------|---------|----------|--------|
|                       | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m                | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m             | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m             | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m            | 5            | 6       | 7       | 8        | 9      |
| > 100 m               | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |





|   |                |   |              |
|---|----------------|---|--------------|
| <b>Erosion Site</b>   | 10             | <b>Date:</b>  | July 7, 2020 |
| Watercourse   | Reach number   | Photo Numbers   |              |
| Tributary of Speed River  | SS-8           | DK2481,2482   |              |
| Bankfull W (m)  | Bankfull D (m) | Site Length (m) and Height (m) <input type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |              |
| 3m  | 0.5m           | Site Length: 2.5m, Site Height: 1m  |              |
| Observations Upstream<br>- Woodlawn Road crossing   |                |   |              |
| Observations Downstream<br>- Large box culvert with grate, watercourse becomes piped                  |                |   |              |
| Site Description<br>- Corrugated metal pipe (type unknown) obstructed, bank around outfall is eroding |                |   |              |

### Risk-Distance Matrix

| Small Tributaries:  | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|---|---------|------|-------|--------|--------|------|
| Speed and Eramosa:  | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure   | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail  | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing   | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure  | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail   | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)   | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <u>Critical Infrastructure</u><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> Other Buried Utilities </div> <div> <u>Secondary Infrastructure</u><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>79</b> |
|-------------------------|-----------|

| Extent      | Slope Height |         |         |          |        |
|-------------|--------------|---------|---------|----------|--------|
| Site Length | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m      | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m   | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m   | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m  | 5            | 6       | 7       | 8        | 9      |
| > 100 m     | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |







|   |                |   |  |              |               |
|---|----------------|---|--|--------------|---------------|
| <b>Erosion Site</b>   | 11             |   |  | <b>Date:</b> | July 14, 2020 |
| Watercourse   | Reach number   | Photo Numbers   |  |              |               |
| Eramosa   | ER-1           | 1,2   |  |              |               |
| Bankfull W (m)  | Bankfull D (m) | Site Length (m) and Height (m) <input type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |  |              |               |
| ~25m  | ~2m            | Site Length: 3m, Site Height: 1.5m  |  |              |               |
| Observations Upstream<br>- Wooded banks, some debris in water   |                |   |  |              |               |
| Observations Downstream<br>- Confluence with Speed River  |                |   |  |              |               |
| Site Description<br>- Area/bank around stormwater outfall eroded, concrete pie cracked and broken, partially obstructed |                |   |  |              |               |

### Risk-Distance Matrix

| Small Tributaries:<br>Speed and Eramosa:   | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|--|---------|------|-------|--------|--------|------|
|  | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure  | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail   | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing  | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure   | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail  | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)  | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> Stormwater outfall </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>64</b> |
|-------------------------|-----------|

| Extent<br>Site Length | Slope Height |         |         |          |        |
|-----------------------|--------------|---------|---------|----------|--------|
|                       | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m                | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m             | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m             | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m            | 5            | 6       | 7       | 8        | 9      |
| > 100 m               | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |







|  |                |  |               |
|--|----------------|--|---------------|
| <b>Erosion Site</b>  | 12             | <b>Date:</b>   | July 14, 2020 |
| Watercourse  | Reach number   | Photo Numbers  |               |
| Speed River  | SR-8           | 10,11  |               |
| Bankfull W (m)   | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |               |
| 40   | 3              | Site length: 3m, Site Height: 2m   |               |
| Observations Upstream<br>- Wyndham St. bridge and multiple outfalls upstream (MB photo 12)                           |                |  |               |
| Observations Downstream<br>- Confluence with the Eramosa (MB photo 13)   |                |  |               |
| Site Description<br>- Retaining wall approximately 3-4m downstream of outfall is broken and falling into the channel |                |  |               |

### Risk-Distance Matrix

| Small Tributaries:   | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|--|---------|------|-------|--------|--------|------|
| Speed and Eramosa:   | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure  | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail   | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing  | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure   | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail  | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)  | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> Outfall (type unknown)           </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other           </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>68</b> |
|-------------------------|-----------|

| Extent      | Slope Height |         |         |          |        |
|-------------|--------------|---------|---------|----------|--------|
| Site Length | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m      | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m   | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m   | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m  | 5            | 6       | 7       | 8        | 9      |
| > 100 m     | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |





|   |                |  |               |
|---|----------------|--|---------------|
| <b>Erosion Site</b>   | 13             | <b>Date:</b>   | July 14, 2020 |
| Watercourse   | Reach number   | Photo Numbers  |               |
| Speed River   | SR-8           | 16, 17   |               |
| Bankfull W (m)  | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |               |
| 40  | 3-4m           | Site length: 5m, Site Height: 2-3m   |               |
| Observations Upstream<br>- Wyndham St. bridge and multiple outfalls upstream                              |                |  |               |
| Observations Downstream<br>- Confluence with the Eramosa  |                |  |               |
| Site Description<br>- Retaining wall around 2 outlets is eroding and breaking apart, falling into channel |                |  |               |

### Risk-Distance Matrix

| Small Tributaries:   | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|--|---------|------|-------|--------|--------|------|
| Speed and Eramosa:   | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure  | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail   | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing  | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure   | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail  | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)  | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> Outfall (type unknown) </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>71</b> |
|-------------------------|-----------|

| Extent      | Slope Height |         |         |          |        |
|-------------|--------------|---------|---------|----------|--------|
| Site Length | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m      | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m   | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m   | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m  | 5            | 6       | 7       | 8        | 9      |
| > 100 m     | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |



16



17



|   |                |   |               |
|---|----------------|---|---------------|
| <b>Erosion Site</b>   | 14             | <b>Date:</b>  | July 14, 2020 |
| Watercourse   | Reach number   | Photo Numbers   |               |
| Speed River   | SR-8           | 35-39   |               |
| Bankfull W (m)  | Bankfull D (m) | Site Length (m) and Height (m) <input type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |               |
| 30  | 5m             | Site length: 30m, Site Height: 2m   |               |
| Observations Upstream<br>- Railway crossings, Macdonell St bridge, and large weir structure upstream (MB photo 40)            |                |   |               |
| Observations Downstream<br>- Neeve st. bridge and small island/bar downstream (MB photo 41)                                   |                |   |               |
| Site Description<br>- Exposed sanitary sewer pipe in channel, concrete covering pipe is eroding and breaking apart in channel |                |   |               |

### Risk-Distance Matrix

| Small Tributaries:  | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|---|---------|------|-------|--------|--------|------|
| Speed and Eramosa:  | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure   | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail  | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing   | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure  | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail   | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)   | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input checked="" type="checkbox"/> Sanitary Sewer Infrastructure           </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other           </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>68</b> |
|-------------------------|-----------|

| Extent      | Slope Height |         |         |          |        |
|-------------|--------------|---------|---------|----------|--------|
| Site Length | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m      | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m   | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m   | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m  | 5            | 6       | 7       | 8        | 9      |
| > 100 m     | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |













|  |                |   |       |               |
|--|----------------|---|-------|---------------|
| Erosion Site   | 15             |   | Date: | July 14, 2020 |
| Watercourse  | Reach number   | Photo Numbers   |       |               |
| Speed River  | SR-9           | July14(MB) – 50, Oct23(MB) – 1,2,3  |       |               |
| Bankfull W (m)   | Bankfull D (m) | Site Length (m) and Height (m) <input type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |       |               |
| 50   | 5m             | Site length: 3m, Site Height: 3m  |       |               |
| Observations Upstream<br>-    Eramosa Rd, Bridge   |                |   |       |               |
| Observations Downstream<br>-    Mcdonell st bridge and railway crossings   |                |   |       |               |
| Site Description<br>-    Stone retaining wall structure below stormsewer outfall is failing, pieces falling into river |                |   |       |               |

### Risk-Distance Matrix

| Small Tributaries:  | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|---|---------|------|---|--------|--------|------|
| Speed and Eramosa:  | Channel | 0-5m | 5-10m   | 10-20m | 20-40m | >40m |
| Critical Infrastructure   | 50      | 47   | 45  | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail  | 45      | 42   | 40  | 35     | 32     | 30   |
| Private Property/Xing   | 40      | 37   | 35  | 30     | 27     | 25   |
| Secondary Infrastructure  | 30      | 27   | 25  | 20     | 17     | 15   |
| Open Space Parks, Trail   | 20      | 17   | 15  | 10     | 7      | 5    |
| Green Space (no risk)   | 15      | 12   | 10  | 5      | 2      | 0    |
| <u>Critical Infrastructure</u><br><input type="checkbox"/> Buildings<br><input type="checkbox"/> Major Dams<br><input type="checkbox"/> Water or Gas Main<br><input type="checkbox"/> Major Roads/Bridges<br><input checked="" type="checkbox"/> Storm Sewer Infrastructure |         |      | <u>Secondary Infrastructure</u><br><input type="checkbox"/> Public Parking Lot<br><input type="checkbox"/> Minor Dam/Weir<br><input type="checkbox"/> Active Park Land<br><input type="checkbox"/> Trail Type 2-4<br><input type="checkbox"/> Other |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>63</b> |
|-------------------------|-----------|

| Extent      | Slope Height |         |         |          |        |
|-------------|--------------|---------|---------|----------|--------|
| Site Length | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m      | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m   | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m   | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m  | 5            | 6       | 7       | 8        | 9      |
| > 100 m     | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |







|  |                |  |  |              |               |
|--|----------------|--|--|--------------|---------------|
| <b>Erosion Site</b>  | 16             |  |  | <b>Date:</b> | July 14, 2020 |
| Watercourse  | Reach number   | Photo Numbers  |  |              |               |
| Speed River  | SR-10          | 64,65,66   |  |              |               |
| Bankfull W (m)   | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |  |              |               |
| 25m  | 1m             | Site length: 8m, Site Height: 1m   |  |              |               |
| Observations Upstream<br>- Wooded banks and debris in stream   |                |  |  |              |               |
| Observations Downstream<br>- Wooded banks and debris in stream, pedestrian bridge (Heritage site) downstream |                |  |  |              |               |
| Site Description<br>- Concrete weir has been outflanked just upstream of stormwater outfall                  |                |  |  |              |               |

### Risk-Distance Matrix

| Small Tributaries:  | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|---|---------|------|-------|--------|--------|------|
| Speed and Eramosa:  | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure   | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail  | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing   | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure  | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail   | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)   | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> Stormwater outfall </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input checked="" type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>61</b> |
|-------------------------|-----------|

| Extent      | Slope Height |         |         |          |        |
|-------------|--------------|---------|---------|----------|--------|
| Site Length | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m      | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m   | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m   | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m  | 5            | 6       | 7       | 8        | 9      |
| > 100 m     | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |







|   |                |   |               |
|---|----------------|---|---------------|
| <b>Erosion Site</b>   | 17             | <b>Date:</b>  | July 14, 2020 |
| Watercourse   | Reach number   | Photo Numbers   |               |
| Speed River   | SR-10          | DK2743,2744, MB72-74  |               |
| Bankfull W (m)  | Bankfull D (m) | Site Length (m) and Height (m) <input type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |               |
| 35m   | 2m             | Site Length: 5m, Site Height: 5m  |               |
| Observations Upstream<br>- Wooded banks, some debris in channel, meander bends                    |                |   |               |
| Observations Downstream<br>- Wooded banks and some debris in channel                              |                |   |               |
| Site Description<br>- Metal pipe emerging from bank, bank beneath/around sides of pipe is eroding |                |   |               |

### Risk-Distance Matrix

| Small Tributaries:   | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|--|---------|------|-------|--------|--------|------|
| Speed and Eramosa:   | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure  | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail   | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing  | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure   | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail  | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)  | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> Stormwater outfall           </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other           </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>64</b> |
|-------------------------|-----------|

| Extent      | Slope Height |         |         |          |        |
|-------------|--------------|---------|---------|----------|--------|
| Site Length | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m      | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m   | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m   | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m  | 5            | 6       | 7       | 8        | 9      |
| > 100 m     | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |







|   |                |  |  |              |               |
|---|----------------|--|--|--------------|---------------|
| <b>Erosion Site</b>   | 18             |  |  | <b>Date:</b> | July 14, 2020 |
| Watercourse   | Reach number   | Photo Numbers  |  |              |               |
| Speed River   | SR-10          | 82,83  |  |              |               |
| Bankfull W (m)  | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |  |              |               |
| 14m   | 1m             | Site length: 11m, Site Height: N/a   |  |              |               |
| Observations Upstream<br>- Some debris in channel and forested banks (photo 84)   |                |  |  |              |               |
| Observations Downstream<br>- Some debris in channel and forested banks (photo 85) |                |  |  |              |               |
| Site Description<br>- Exposed pipe (type unknown, possible watermain) in channel  |                |  |  |              |               |

### Risk-Distance Matrix

| Small Tributaries:<br>Speed and Eramosa:   | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|--|---------|------|-------|--------|--------|------|
|  | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure  | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail   | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing  | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure   | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail  | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)  | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> Other buried utilities </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>65</b> |
|-------------------------|-----------|

| Extent<br>Site Length | Slope Height |         |         |          |        |
|-----------------------|--------------|---------|---------|----------|--------|
|                       | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m                | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m             | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m             | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m            | 5            | 6       | 7       | 8        | 9      |
| > 100 m               | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |



82



83



|  |                |   |  |              |               |
|--|----------------|---|--|--------------|---------------|
| <b>Erosion Site</b>  | 19             |   |  | <b>Date:</b> | July 14, 2020 |
| Watercourse  | Reach number   | Photo Numbers   |  |              |               |
| Speed River  | SR-10          | DK2755,2756   |  |              |               |
| Bankfull W (m)   | Bankfull D (m) | Site Length (m) and Height (m) <input type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |  |              |               |
| ~50m   | ~3m            | Site Length: 5m, Site Height: <1m   |  |              |               |
| Observations Upstream<br>- Speedvale Ave bridge  |                |   |  |              |               |
| Observations Downstream<br>- Wooded banks, small amounts of debris in channel                  |                |   |  |              |               |
| Site Description<br>- Exposed corrugated metal pipe (potential stormwater outfall), top eroded |                |   |  |              |               |

### Risk-Distance Matrix

| Small Tributaries:<br>Speed and Eramosa:   | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|--|---------|------|-------|--------|--------|------|
|  | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure  | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail   | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing  | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure   | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail  | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)  | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> Stormwater outfall </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>63</b> |
|-------------------------|-----------|

| Extent<br>Site Length | Slope Height |         |         |          |        |
|-----------------------|--------------|---------|---------|----------|--------|
|                       | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m                | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m             | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m             | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m            | 5            | 6       | 7       | 8        | 9      |
| > 100 m               | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |







|  |                |  |  |              |               |
|--|----------------|--|--|--------------|---------------|
| <b>Erosion Site</b>  | 20             |  |  | <b>Date:</b> | July 23, 2020 |
| Watercourse  | Reach number   | Photo Numbers  |  |              |               |
| Speed River  | SR-11          | 11, 13   |  |              |               |
| Bankfull W (m)   | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |  |              |               |
| 50m  | 2m             | Site length: 10m, Site Height: 1m  |  |              |               |
| Observations Upstream<br>- Weir structures upstream, concrete retaining walls LB and RB                          |                |  |  |              |               |
| Observations Downstream<br>- Weir structures downstream, concrete retaining walls LB and RB, Speedvale Rd bridge |                |  |  |              |               |
| Site Description<br>- concrete retaining wall cracked and in poor condition, has been outflanked on RB           |                |  |  |              |               |

### Risk-Distance Matrix

| Small Tributaries:  | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|---|---------|------|-------|--------|--------|------|
| Speed and Eramosa:  | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure   | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail  | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing   | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure  | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail   | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)   | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input checked="" type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>51</b> |
|-------------------------|-----------|

| Extent      | Slope Height |         |         |          |        |
|-------------|--------------|---------|---------|----------|--------|
| Site Length | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m      | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m   | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m   | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m  | 5            | 6       | 7       | 8        | 9      |
| > 100 m     | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |





|  |                |  |               |
|--|----------------|--|---------------|
| <b>Erosion Site</b>  | 21             | <b>Date:</b>   | July 23, 2020 |
| Watercourse  | Reach number   | Photo Numbers  |               |
| Speed River  | SR-11          | 16, 17   |               |
| Bankfull W (m)   | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |               |
| 50m  | 2m             | Site length: 10m, Site Height: 1m  |               |
| Observations Upstream<br>- Pedestrian bridge and large weir structure (knickpoint)               |                |  |               |
| Observations Downstream<br>- multiple weir structures, concrete retaining walls on LB and RB     |                |  |               |
| Site Description<br>- concrete retaining wall cracked and in poor condition, has been outflanked |                |  |               |

### Risk-Distance Matrix

| Small Tributaries:<br>Speed and Eramosa:  | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|---|---------|------|-------|--------|--------|------|
|   | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure   | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail  | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing   | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure  | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail   | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)   | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure           </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input checked="" type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other           </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>51</b> |
|-------------------------|-----------|

| Extent<br>Site Length | Slope Height |         |         |          |        |
|-----------------------|--------------|---------|---------|----------|--------|
|                       | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m                | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m             | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m             | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m            | 5            | 6       | 7       | 8        | 9      |
| > 100 m               | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |





|   |                |  |  |              |               |
|---|----------------|--|--|--------------|---------------|
| <b>Erosion Site</b>   | 22             |  |  | <b>Date:</b> | July 23, 2020 |
| Watercourse   | Reach number   | Photo Numbers  |  |              |               |
| Speed River   | SR-12          | 34, 35, 36   |  |              |               |
| Bankfull W (m)  | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |  |              |               |
| 30m   | 1.5m           | Site length: 4m, Site Height: 2m   |  |              |               |
| Observations Upstream<br>- Woodlawn rd bridge, vegetated island near RB   |                |  |  |              |               |
| Observations Downstream<br>- Pedestrian bridge, forested banks, some organic debris in water                        |                |  |  |              |               |
| Site Description<br>- Concentrate headwall structure falling over, bank eroded, connection to interior pipe visible |                |  |  |              |               |

### Risk-Distance Matrix

| Small Tributaries:                                     | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|--|---------|------|---|--------|--------|------|
| Speed and Eramosa:                                     | Channel | 0-5m | 5-10m                                       | 10-20m | 20-40m | >40m |
| Critical Infrastructure                                | 50      | 47   | 45  | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail                               | 45      | 42   | 40  | 35     | 32     | 30   |
| Private Property/Xing                                  | 40      | 37   | 35  | 30     | 27     | 25   |
| Secondary Infrastructure                               | 30      | 27   | 25  | 20     | 17     | 15   |
| Open Space Parks, Trail                                | 20      | 17   | 15  | 10     | 7      | 5    |
| Green Space (no risk)                                  | 15      | 12   | 10  | 5      | 2      | 0    |
| <u>Critical Infrastructure</u>                         |         |      | <u>Secondary Infrastructure</u>             |        |        |      |
| <input type="checkbox"/> Buildings                     |         |      | <input type="checkbox"/> Public Parking Lot |        |        |      |
| <input type="checkbox"/> Major Dams                    |         |      | <input type="checkbox"/> Minor Dam/Weir     |        |        |      |
| <input type="checkbox"/> Water or Gas Main             |         |      | <input type="checkbox"/> Active Park Land   |        |        |      |
| <input type="checkbox"/> Major Roads/Bridges           |         |      | <input type="checkbox"/> Trail Type 2-4     |        |        |      |
| <input type="checkbox"/> Sanitary Sewer Infrastructure |         |      | <input type="checkbox"/> Other              |        |        |      |
| <input checked="" type="checkbox"/> Stormwater Outfall |         |      |   |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>62</b> |
|-------------------------|-----------|

| Extent      | Slope Height |         |         |          |        |
|-------------|--------------|---------|---------|----------|--------|
| Site Length | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m      | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m   | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m   | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m  | 5            | 6       | 7       | 8        | 9      |
| > 100 m     | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |





|   |                |  |               |              |               |
|---|----------------|--|---------------|--------------|---------------|
| <b>Erosion Site</b>   | #23            |  |               | <b>Date:</b> | July 24, 2020 |
| Watercourse   |                | Reach number   | Photo Numbers |              |               |
| Tributary of Speed River  |                | SR-J1  | 9-14          |              |               |
| Bankfull W (m)  | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |               |              |               |
| 5m  | 2m             | Site length: 15m, Site Height: 2m  |               |              |               |
| Observations Upstream<br>- Culvert crossing under Wellington St and a weir structure  |                |  |               |              |               |
| Observations Downstream<br>- pedestrian bridge and convergence with the speed river   |                |  |               |              |               |
| Site Description<br>- retaining walls just downstream of SW outfall and culvert are undermined, eroded and falling into the creek, potential concrete sanitary line being exposed |                |  |               |              |               |

### Risk-Distance Matrix

| Small Tributaries:  | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|---|---------|------|-------|--------|--------|------|
| Speed and Eramosa:  | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure   | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail  | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing   | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure  | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail   | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)   | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input checked="" type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> Stormwater Outfall           </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input checked="" type="checkbox"/> Other (retaining wall)           </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>81</b> |
|-------------------------|-----------|

| Extent      | Slope Height |         |         |          |        |
|-------------|--------------|---------|---------|----------|--------|
| Site Length | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m      | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m   | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m   | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m  | 5            | 6       | 7       | 8        | 9      |
| > 100 m     | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |



9



10



11



12









|   |                |  |               |              |               |
|---|----------------|--|---------------|--------------|---------------|
| <b>Erosion Site</b>   | 24             |  |               | <b>Date:</b> | July 24, 2020 |
| Watercourse   |                | Reach number   | Photo Numbers |              |               |
| Speed River   |                | SR-5   | 21, 22        |              |               |
| Bankfull W (m)  | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |               |              |               |
| 50m   | 2m             | Site length: 10m, Site Height: 1m  |               |              |               |
| Observations Upstream<br>- Wooded banks, weir structure and bridge upstream               |                |  |               |              |               |
| Observations Downstream<br>- Wooded banks, shallow water, confluence with tributary SR-J1 |                |  |               |              |               |
| Site Description<br>- Weir structure eroding and partially outflanked retaining wall      |                |  |               |              |               |

### Risk-Distance Matrix

| Small Tributaries:   | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|--|---------|------|-------|--------|--------|------|
| Speed and Eramosa:   | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure  | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail   | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing  | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure   | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail  | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)  | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input type="checkbox"/> Stormwater Outfall           </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input checked="" type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other           </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>44</b> |
|-------------------------|-----------|

| Extent      | Slope Height |         |         |          |        |
|-------------|--------------|---------|---------|----------|--------|
| Site Length | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m      | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m   | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m   | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m  | 5            | 6       | 7       | 8        | 9      |
| > 100 m     | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |

21



22





|  |                |  |               |
|--|----------------|--|---------------|
| <b>Erosion Site</b>  | 25             | <b>Date:</b>   | July 24, 2020 |
| Watercourse  | Reach number   | Photo Numbers  |               |
| Tributary of Speed River   | SR-K1          | 30-36  |               |
| Bankfull W (m)   | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |               |
| 8m   | 2.5m           | Site length: 40m, Site Height: 2.5m  |               |
| Observations Upstream<br>- Pedestrian bridge and large sanitary pipe crossing the channel  |                |  |               |
| Observations Downstream<br>- confluence with speed river   |                |  |               |
| Site Description<br>- exposed pipe (type unknown) in channel, retaining walls upstream, downstream and at pipe location are eroding and falling into the channel |                |  |               |

### Risk-Distance Matrix

| Small Tributaries:   | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|--|---------|------|-------|--------|--------|------|
| Speed and Eramosa:   | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure  | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail   | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing  | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure   | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail  | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)  | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <u>Critical Infrastructure</u><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input checked="" type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> Other buried utilities           </div> <div> <u>Secondary Infrastructure</u><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input checked="" type="checkbox"/> Other (retaining wall)           </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>82</b> |
|-------------------------|-----------|

| Extent      | Slope Height |         |         |          |        |
|-------------|--------------|---------|---------|----------|--------|
| Site Length | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m      | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m   | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m   | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m  | 5            | 6       | 7       | 8        | 9      |
| > 100 m     | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |











|   |                |  |               |              |               |
|---|----------------|--|---------------|--------------|---------------|
| <b>Erosion Site</b>   | 26             |  |               | <b>Date:</b> | July 24, 2020 |
| Watercourse   |                | Reach number   | Photo Numbers |              |               |
| Silver Creek  |                | SR-J2  | 70-72         |              |               |
| Bankfull W (m)  | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |               |              |               |
| 10m   | 1 m            | Site length: 15m, Site Height: 3m  |               |              |               |
| Observations Upstream<br>- Forested banks, residential properties on LB |                |  |               |              |               |
| Observations Downstream<br>- Meandering channel in wetland              |                |  |               |              |               |
| Site Description<br>- Chute eroding slope backing onto private property |                |  |               |              |               |

### Risk-Distance Matrix

| Small Tributaries:<br>Speed and Eramosa:               | Channel | 0-2m | 2-5m   | 5-10m  | 10-20m | >20m |
|--|---------|------|--|--------|--------|------|
|  | Channel | 0-5m | 5-10m  | 10-20m | 20-40m | >40m |
| Critical Infrastructure                                | 50      | 47   | 45   | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail                               | 45      | 42   | 40   | 35     | 32     | 30   |
| Private Property/Xing                                  | 40      | 37   | 35   | 30     | 27     | 25   |
| Secondary Infrastructure                               | 30      | 27   | 25   | 20     | 17     | 15   |
| Open Space Parks, Trail                                | 20      | 17   | 15   | 10     | 7      | 5    |
| Green Space (no risk)                                  | 15      | 12   | 10   | 5      | 2      | 0    |
| <u>Critical Infrastructure</u>                         |         |      | <u>Secondary Infrastructure</u>                              |        |        |      |
| <input type="checkbox"/> Buildings                     |         |      | <input type="checkbox"/> Public Parking Lot                  |        |        |      |
| <input type="checkbox"/> Major Dams                    |         |      | <input type="checkbox"/> Minor Dam/Weir                      |        |        |      |
| <input type="checkbox"/> Water or Gas Main             |         |      | <input type="checkbox"/> Active Park Land                    |        |        |      |
| <input type="checkbox"/> Major Roads/Bridges           |         |      | <input type="checkbox"/> Trail Type 2-4                      |        |        |      |
| <input type="checkbox"/> Sanitary Sewer Infrastructure |         |      | <input checked="" type="checkbox"/> Other (private property) |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>58</b> |
|-------------------------|-----------|

| Extent<br>Site Length | Slope Height |         |         |          |        |
|-----------------------|--------------|---------|---------|----------|--------|
|                       | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m                | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m             | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m             | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m            | 5            | 6       | 7       | 8        | 9      |
| > 100 m               | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |







|  |                |  |  |              |               |
|--|----------------|--|--|--------------|---------------|
| <b>Erosion Site</b>  | 27             |  |  | <b>Date:</b> | July 24, 2020 |
| Watercourse  | Reach number   | Photo Numbers  |  |              |               |
| Silver Creek   | SR-J1          | MB64-67  |  |              |               |
| Bankfull W (m)   | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |  |              |               |
| 3m   | 3m             | Site length: 10m, Site Height: 3m  |  |              |               |
| Observations Upstream<br>- Meandering channel, wetland environment   |                |  |  |              |               |
| Observations Downstream<br>- Channel goes to Speed river under Waterloo and Wellington roads, forested banks |                |  |  |              |               |
| Site Description<br>- Old dam structure and retaining wall outflanked, base eroding                          |                |  |  |              |               |

### Risk-Distance Matrix

| Small Tributaries:   | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|--|---------|------|-------|--------|--------|------|
| Speed and Eramosa:   | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure  | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail   | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing  | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure   | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail  | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)  | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input type="checkbox"/> Stormwater outfall </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input checked="" type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>54</b> |
|-------------------------|-----------|

| Extent      | Slope Height |         |         |          |        |
|-------------|--------------|---------|---------|----------|--------|
| Site Length | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m      | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m   | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m   | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m  | 5            | 6       | 7       | 8        | 9      |
| > 100 m     | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |







|  |                |  |                         |              |               |
|--|----------------|--|-------------------------|--------------|---------------|
| <b>Erosion Site</b>  | 28             |  |                         | <b>Date:</b> | July 28, 2020 |
| Watercourse  |                | Reach number   | Photo Numbers           |              |               |
| Silver Creek   |                | Unnamed (map SN2)  | MB29-31, DK3193, DK3196 |              |               |
| Bankfull W (m)   | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |                         |              |               |
| 10m  | 3 m            | Site length: 4m, Site Height: 3m   |                         |              |               |
| Observations Upstream<br>- Drainage channel next to railway line   |                |  |                         |              |               |
| Observations Downstream<br>- Channel makes 90° turn into culvert and runs along Imperial Rd N                                |                |  |                         |              |               |
| Site Description<br>- Sink hole/bank erosion above and beneath 600mm stormwater outfall, adjacent to Imperial Rd and railway |                |  |                         |              |               |

### Risk-Distance Matrix

| Small Tributaries:<br>Speed and Eramosa:   | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|--|---------|------|-------|--------|--------|------|
|  | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure  | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail   | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing  | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure   | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail  | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)  | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> Stormwater outfall           </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other           </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>79</b> |
|-------------------------|-----------|

| Extent<br>Site Length | Slope Height |         |         |          |        |
|-----------------------|--------------|---------|---------|----------|--------|
|                       | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m                | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m             | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m             | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m            | 5            | 6       | 7       | 8        | 9      |
| > 100 m               | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |



29



30



3193



3196





|  |                |  |  |              |             |
|--|----------------|--|--|--------------|-------------|
| <b>Erosion Site</b>  | 29             |  |  | <b>Date:</b> | Aug 6, 2020 |
| Watercourse  | Reach number   | Photo Numbers  |  |              |             |
| Hanlon Creek   | SR-F2          | MB3,5  |  |              |             |
| Bankfull W (m)   | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |  |              |             |
| 8m   | 2m             | Site length: 10m, Site Height: 3m  |  |              |             |
| Observations Upstream<br>- Large stormwater outfall                                |                |  |  |              |             |
| Observations Downstream<br>- Coarse gravel/cobble stream, walking path on LB       |                |  |  |              |             |
| Site Description<br>- Stone/concrete grouted wall eroded around stormwater outfall |                |  |  |              |             |

### Risk-Distance Matrix

| Small Tributaries:<br>Speed and Eramosa:   | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|--|---------|------|-------|--------|--------|------|
|  | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure  | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail   | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing  | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure   | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail  | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)  | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input checked="" type="checkbox"/> Stormwater outfall </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>79</b> |
|-------------------------|-----------|

| Extent<br>Site Length | Slope Height |         |         |          |        |
|-----------------------|--------------|---------|---------|----------|--------|
|                       | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m                | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m             | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m             | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m            | 5            | 6       | 7       | 8        | 9      |
| > 100 m               | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |





|  |                |  |               |              |             |
|--|----------------|--|---------------|--------------|-------------|
| <b>Erosion Site</b>  | 30             |  |               | <b>Date:</b> | Aug 6, 2020 |
| Watercourse  |                | Reach number   | Photo Numbers |              |             |
| Hanlon Creek   |                | HAC-1  | MB12-14       |              |             |
| Bankfull W (m)   | Bankfull D (m) | Site Length (m) and Height (m) <input checked="" type="checkbox"/> Bank <input type="checkbox"/> Valley Wall |               |              |             |
| 4m   | 1m             | Site length: 4m, Site Height: 1m   |               |              |             |
| Observations Upstream<br>- Some wooded debris in channel, small riffle                 |                |  |               |              |             |
| Observations Downstream<br>- Wooded banks, wetland environment                         |                |  |               |              |             |
| Site Description<br>- Concrete supports of pedestrian/trail bridge cracked and eroding |                |  |               |              |             |

### Risk-Distance Matrix

| Small Tributaries:<br>Speed and Eramosa:   | Channel | 0-2m | 2-5m  | 5-10m  | 10-20m | >20m |
|--|---------|------|-------|--------|--------|------|
|  | Channel | 0-5m | 5-10m | 10-20m | 20-40m | >40m |
| Critical Infrastructure  | 50      | 47   | 45    | 40     | 37     | 35   |
| Minor Roads/Bridge/Trail   | 45      | 42   | 40    | 35     | 32     | 30   |
| Private Property/Xing  | 40      | 37   | 35    | 30     | 27     | 25   |
| Secondary Infrastructure   | 30      | 27   | 25    | 20     | 17     | 15   |
| Open Space Parks, Trail  | 20      | 17   | 15    | 10     | 7      | 5    |
| Green Space (no risk)  | 15      | 12   | 10    | 5      | 2      | 0    |
| <div> <div> <b>Critical Infrastructure</b><br/> <input type="checkbox"/> Buildings<br/> <input type="checkbox"/> Major Dams<br/> <input type="checkbox"/> Water or Gas Main<br/> <input type="checkbox"/> Major Roads/Bridges<br/> <input type="checkbox"/> Sanitary Sewer Infrastructure<br/> <input type="checkbox"/> Stormwater outfall           </div> <div> <b>Secondary Infrastructure</b><br/> <input type="checkbox"/> Public Parking Lot<br/> <input type="checkbox"/> Minor Dam/Weir<br/> <input type="checkbox"/> Active Park Land<br/> <input checked="" type="checkbox"/> Trail Type 2-4<br/> <input type="checkbox"/> Other           </div> </div> |         |      |       |        |        |      |

|                         |           |
|-------------------------|-----------|
| <b>Total Score /100</b> | <b>50</b> |
|-------------------------|-----------|

| Extent<br>Site Length | Slope Height |         |         |          |        |
|-----------------------|--------------|---------|---------|----------|--------|
|                       | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m                | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m             | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m             | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m            | 5            | 6       | 7       | 8        | 9      |
| > 100 m               | 6            | 7       | 8       | 9        | 10     |

| Erodibility     | Rate |
|-----------------|------|
| High, sand/silt | 5    |
| Sandy Bed       | 4    |
| Moderate Gr     | 3    |
| Coarse Gr, Cb   | 2    |
| Low Cb,Bo,RR    | 1    |
| Concrete        | 0    |

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

| Riparian     | Rate |
|--------------|------|
| Sensitive    | 0    |
| High Quality | 5    |
| Moderate     | 10   |
| Low Quality  | 15   |

| Fisheries Sensitivity<br>(10 points to be updated based on GIS reach assessment) | High Quality Habitat | Moderate Quality |    |    | Low Quality Habitat | Thermal Regime Notes<br>Fish Community |
|--|----------------------|------------------|----|----|---------------------|--|
| Coldwater / Intolerant   | 1                    | 2                | 3  | 3  | 5                   |  |
| Mixed / Moderately Tolerant  | 6                    | 7                | 8  | 9  | 10                  |  |
| Warmwater / Tolerant   | 11                   | 12               | 13 | 14 | 15                  |  |





# Appendix B



**Site ID: MS#1**

**Watercourse: Eramosa River**

**Reach: ER-1**

**Issue:**

Buildup of organic debris just  
downstream of stormwater outfall



**Site ID: MS#2**

**Watercourse: Eramosa River**

**Reach: ER-1**

**Issue:**

Sediment buildup in and around stormwater outfall restricting flow





**Site ID: MS#3**

**Watercourse: Eramosa River**

**Reach: ER-1**

**Issue:**

Gabion basket headwall structure  
falling into watercourse



**Site ID: MS#4**

**Watercourse: Eramosa River**

**Reach: ER-1**

**Issue:**

Localized erosion occurring  
around/underneath stormwater  
outfall





**Site ID: MS#5**

**Watercourse: Eramosa River**

**Reach: ER-1**

**Issue:**

Gabion basket headwall structure around stormwater outfall in poor condition, buildup of organic debris in channel



**Site ID: MS#6**

**Watercourse: Hadati Creek**

**Reach: HC-A1**

**Issue:**

Exposed cable over box  
culvert





**Site ID: MS#7**

**Watercourse: Watson Creek**

**Reach: WC-3**

**Issue:**

Buildup of sediment and  
vegetation in culvert outlet



**Site ID: MS#8**

**Watercourse: Watson Creek**

**Reach: WC-3**

**Issue:**

Culvert has been damaged by fallen tree, also flow obstructed by organic debris





**Site ID: MS#9**

**Watercourse: Clythe Creek**

**Reach: CC-2**

**Issue:**

Sediment buildup in and around outlet, vegetation growth in front of outlet





**Site ID: MS#10**

**Watercourse: Torrance Creek**

**Reach: TC-1**

**Issue:**

Culvert running under trail becoming exposed





**Site ID: MS#11**

**Watercourse:** Tributary of  
Speed River

**Reach:** SR-I2

**Issue:**

Buildup of sediment just  
downstream of outfalls and  
culverts, buggies and other  
garbage in channel



**Site ID: MS#12**

**Watercourse:** Tributary of Speed River

**Reach:** SR-I3

**Issue:**

Large amount of sediment buildup obstructing outfall





**Site ID: MS#13**

**Watercourse: Speed River**

**Reach: SR-8**

**Issue:**

Large amount of sediment  
buildup in stormwater outfall



**Site ID: MS#14 &  
MS#15**

**Watercourse: Speed River**  
**Reach: SR-8**

**Issue:**

Garbage and debris built  
up on stormwater outfall  
grates





**Site ID: MS#16**

**Watercourse: Speed River**

**Reach: SR-10**

**Issue:**

Large pieces of fallen tress and other organic debris blocking outfall



**Site ID: MS#17**

**Watercourse: Speed River**

**Reach: SR-12**

**Issue:**

Localized erosion around stormwater outfall, retaining wall is beginning to get outflanked





**Site ID: MS#18**

**Watercourse: Speed River**

**Reach: SR-12**

**Issue:**

Pipe becoming exposed under trail, localized erosion occurring near outfall



**Site ID: MS#19**

**Watercourse: Speed River**

**Reach: SR-13**

**Issue:**

Gabion baskets have burst open under outfall, scour pool has also formed. Grate on outfall is broken.





**Site ID: MS#20**

**Watercourse: Speed River**

**Reach: SR-6**

**Issue:**

Buildup of garbage and debris on stormwater outfall grate



**Site ID: MS#21**

**Watercourse:** Tributary of Speed River

**Reach:** SR-H1

**Issue:**

Grate on stormwater outfall has become dislodged





**Site ID: MS#22**

**Watercourse: Hanlon Creek**

**Reach: HAC-1**

**Issue:**

Large debris jam in channel





**Site ID: MS#23**

**Watercourse: Hanlon Creek**

**Reach: HAC-2**

**Issue:**

Stormwater outfall almost completely filled with sediment





**Site ID: MS#24**

**Watercourse: Hanlon Creek**

**Reach: HAC-A4**

**Issue:**

Grate on stormwater outfall is  
dislodged



**Site ID: MS#25**

**Watercourse: Hanlon Creek**

**Reach: Un-named**

**Issue:**

Sediment buildup in stormwater outfall





**Site ID:** MS#26 and  
MS#27

**Watercourse:** Hanlon Creek

**Reach:** HAC-C3

**Issue:**

Sediment built up in 2  
stormwater outfalls



**Site ID: MS#28**

**Watercourse:** Tributary of Eramosa River

**Reach:** Un-named

**Issue:**

Large amount of sediment built up in outfall





**Site ID: MS#29**

**Watercourse:** Tributary of Eramosa River

**Reach:** Un-named

**Issue:**

Large amount of sediment built up in outfall



**Site ID: MS#30**

**Watercourse:** Tributary of Eramosa River

**Reach:** Un-named

**Issue:**

Large amount of sediment built up in outfall, outfall almost completely obstructed





**Site ID: MS#31**

**Watercourse: Eramosa River**

**Reach: ER-1**

**Issue:**

Grate on stormwater outfall is partially dislodged and damaged



**Site ID: MI#1**

**Watercourse: Hadati Creek**

**Reach: HC-3**

**Issue:**

Encroachment from private property





**Site ID: MI#2**

**Watercourse: Hadati Creek**

**Reach: HC-3**

**Issue:**

Encroachment from private property



**Site ID: MI#3**

**Watercourse: Hadati Creek**

**Reach: HC-B1**

**Issue:**

No defined channel anymore, channel enters and exits SWMF. Original watercourse mapping showed reach being separate from SWMF.





**Site ID: MI#4**

**Watercourse: Hadati Creek**

**Reach: HC-2**

**Issue:**

Fish barrier in channel



**Site ID: MI#5**

**Watercourse: Hadati Creek**

**Reach:**

**Issue:**

Encroachment from private property





**Site ID: MI#6**

**Watercourse:** Hadati  
Creek

**Reach:** HC-4

**Issue:**

Multiple gabion baskets in channel have burst, some minor fish barriers





**Site ID: MI#7**

**Watercourse: Clythe Creek**

**Reach: CC-3**

**Issue:**

Large catch basin appears to have shifted in ground





**Site ID: MI#8**

**Watercourse: Clythe Creek**

**Reach: CC-1**

**Issue:**

Large beaver dam across  
channel





**Site ID: MI#9**

**Watercourse: Clythe Creek**

**Reach: CC-2**

**Issue:**

Multiple fish barriers in  
close proximity in channel





**Site ID: MI#10**

**Watercourse: Clythe Creek**

**Reach: CC-2**

**Issue:**

Fish barrier in channel



**Site ID: MI#11**

**Watercourse:** Tributary of Speed  
River

**Reach:** SR-I4

**Issue:**

Multiple fish barriers extend  
throughout reach, fish were  
observed at downstream end of  
reach





**Site ID: MI#12**

**Watercourse: Speed River**

**Reach: SR-8**

**Issue:**

Potential Giant Hogweed spotted  
on bank



**Site ID: MI#13**

**Watercourse: Speed River**

**Reach: SR-10**

**Issue:**

No headwall structures on outlet,  
outfall seems unstable





**Site ID: MI#14**

**Watercourse: Speed River**

**Reach: SR-11**

**Issue:**

Headwall  
structure/retaining wall  
around outfall is cracked,  
breaking up, in general  
poor condition



**Site ID: MI#15**

**Watercourse: Speed River**

**Reach: SR-12**

**Issue:**

Exposed pipe in river and just off of foot trail, appears to be from nearby golf course





**Site ID: MI#16**

**Watercourse:** Tributary of  
Speed River

**Reach:** SR-H1

**Issue:**

Fence around channel and  
outfall is not secure, channel  
can be easily accessed



# Appendix C



## **City of Guelph**

### **Erosion Assessment Prioritization Plan**

(Revised May 15<sup>th</sup>, 2020)

This document provides an overview of the approach proposed to identify priority erosion sites for the City of Guelph  
SWMMP - Watercourse Erosion Assessment.

## ENVIRONMENTAL ASSESSMENT PRIORITIZATION SCHEME

**Table 1. Draft Weighting for Discussion**

| Component               | Criteria                       |
|-------------------------|--------------------------------|
| 1. Erosion & Risk (70%) | Erosion Index (35%)            |
|                         | Public Health and Safety (35%) |
| 2. Environmental (30%)  | Riparian Buffer (15%)          |
|                         | Aquatic Habitat (15%)          |

### 1 COMPONENT #1 – EROSION AND RISK (70%)

| Criteria  | Weighting |
|---|-----------|
| Erosion Index – factors that contribute to risk | 35%       |
| Public Health and Safety – type of risk         | 35%       |



## 1.1 Erosion Index (Weighting = 35% of total score)

| Parameter                          | Definition                                       | Component Score |
|------------------------------------|--|-----------------|
| Distance                           | Distance from top of bank to resource type       | 15              |
| Extent                             | The spatial area encompassed by the erosion site | 10              |
| Stress                             | Stream energy and flow regime.                   | 5               |
| Erodibility                        | Physical characteristics of bank materials       | 5               |
| <b>Risk of Erosion Total Score</b> |  | <b>35</b>       |

### 1.1.1 Distance Parameter

**Distance** – a determination of how far the erosion site is from a component identified under health and safety (e.g., building, subsurface infrastructure, manhole, road etc.).

| Distance<br>Small Tributaries<br>(~ 2 – 15 m wide) | Distance<br>Speed and Eramosa Rivers<br>(~ 30 m wide) | Rating/15 |
|--|---|-----------|
| In channel   | In channel  | 15        |
| 0 – 2 m  | 0 – 5 m   | 12        |
| 2 – 5 m  | 5 – 10 m  | 10        |
| 5 – 10 m   | 10 – 20 m   | 5         |
| 10 – 20 m  | 20 – 40 m   | 2         |
| > 20 m   | > 40 m  | 0         |

### 1.1.2 Extent Parameter

**Extent** - defined as the spatial area that is encompassed by the erosion site. The larger the site, the higher the ranking.

| Site Length | Slope Height |         |         |          |        |
|-------------|--------------|---------|---------|----------|--------|
|             | < 1 m        | 1 – 2 m | 2 – 5 m | 5 – 10 m | > 10 m |
| < 10 m      | 2            | 3       | 4       | 5        | 6      |
| 10 – 20 m   | 3            | 4       | 5       | 6        | 7      |
| 20 – 50 m   | 4            | 5       | 6       | 7        | 8      |
| 50 – 100 m  | 5            | 6       | 7       | 8        | 9      |
| > 100 m     | 6            | 7       | 8       | 9        | 10     |

### 1.1.3 Stress Parameter

**Stress** – the hydraulic stress of flow at each site will influence, in part, the erosion rate and hence influences the erosion risk.

| Stream Energy | Flow Regime    |              |                     |
|---------------|----------------|--------------|---------------------|
|               | Flashy (Urban) | Transitional | Undeveloped (Rural) |
| High          | 5              | 4            | 3                   |
| Moderate      | 4              | 3            | 2                   |
| Low           | 3              | 2            | 1                   |

**Stream Energy Field Interpretations** – Stream power is proportional to the product of bankfull discharge and channel slope. As such, the rapid field interpretation of stream energy is adapted for main channels and tributaries.

| Small Tributaries             | Speed and Eramosa Rivers       | Field Interpretation  |
|-------------------------------|--------------------------------|---|
| High (slope >0.01)            | High (slope >0.005)            | Frequent cobble riffles/runs spaced < 5-7 channel widths, with or without short pools       |
| Moderate (slope 0.001 – 0.01) | Moderate (slope 0.001 – 0.005) | Regular gravel-cobble riffles/runs spaced about 5-7 channel widths, may include pools       |
| Low (slope < 0.001)           | Low (slope < 0.001)            | Infrequent riffles or grade controls spaced > 5-7 channel widths, with slack water in reach |

### Flow Regime Field Interpretations (estimated from base mapping)

| Flow Regime         | Percent Urbanization in Catchment |
|---------------------|-----------------------------------|
| Flashy (Urban)      | 50-100%                           |
| Transitional        | 10-50%                            |
| Undeveloped (Rural) | <10%                              |



#### 1.1.4 Erodibility Parameter

**Erodibility** – the rate of erosion at any site is a function of the physical characteristics of the site. Seven parameters have been identified each of which contribute to the overall assessment of site erodibility.

| Erodibility                    | Rating/5 |
|--------------------------------|----------|
| High, sand/silt                | 5        |
| Sandy Bed                      | 4        |
| Moderate, Gravel               | 3        |
| Coarse Gravel, Cobble          | 2        |
| Low, Cobble, Boulders, Rip-Rap | 1        |

#### 1.2 Public Health and Safety / Type of Risk (Weighting = 35% of total score)

This index is intended to identify and rank relative risk with respect to public health and safety. An eroding bank adjacent to an open space would rate lower than an eroding bank in proximity to a City of Guelph road.

| Type of Risk   | Rating/35 |
|--|-----------|
| Critical Infrastructure <ul style="list-style-type: none"> <li>• Buildings</li> <li>• Major Dams</li> <li>• Water or Gas Main</li> <li>• Major Roads/Bridges</li> <li>• Sanitary Sewer Infrastructure</li> <li>• Other Utilities (including buried)</li> </ul> | 35        |
| Minor Roads and Bridges; Multi-Use Trails (Type 1)   | 30        |
| Private Property (and Crossings)   | 25        |
| Secondary Infrastructure: Public Parking Lots; Minor Dams/Weirs; Active Park Land and Trails (Type 2-4)  | 15        |
| Open Park Space (Inactive); Type 5 Trails  | 5         |

## 2 COMPONENT #2 – ENVIRONMENTAL (30%)

| Criteria        | Weighting |
|-----------------|-----------|
| Riparian Cover  | 15%       |
| Aquatic Habitat | 15%       |

### 2.1 Riparian Cover (Weighting = 15% of total score)

This index is intended to protect high quality riparian buffer from disturbances caused by erosion protection works, where dense & mature riparian forest provide a high quality and manicured grasses or developed areas to the edge of the bank is considered the least optimal.

| Riparian Buffer                          | Rating / 15 |
|--|-------------|
| Highest Sensitivity to Disturbance       | 0           |
| High Quality (ie. dense, mature, native) | 5           |
| Moderate Quality                         | 10          |
| Low Quality (ie. no buffer)              | 15          |

### 2.2 Aquatic Habitat (Weighting = 15% of total score)

**Aquatic Habitat** – accounting for thermal flow regime and impacts of restoration on range of tolerance of fish communities, as well as protection of high quality of aquatic habitat.

| Aquatic Habitat:<br>Fisheries Sensitivity*    | High Quality<br>Habitat (ie. Riffle /<br>Pool, Natural<br>Substrate) | Moderate Quality<br>Habitat | Low Quality Habitat (ie.<br>Engineered Channel) |
|---|--|-----------------------------|---|
| Coldwater / Intolerant Fish<br>Community      | 1  | 3                           | 5   |
| Mixed / Moderately Tolerant<br>Fish Community | 5  | 8                           | 10  |
| Warmwater / Tolerant                          | 10   | 13                          | 15  |

\***Fisheries sensitivity** – will be reassessed after the field inventory with a score of 1 to 10 using a reach-based GIS assessment of fisheries sensitivity based on available MNRF and GRCA open data for thermal regime and fish community.



**Aquatic Habitat Quality** – is to be interpreted in the field using adapted RSAT evaluation categories. Specifically, Physical Instream Habitat and Water Quality RSAT evaluation schemes are referenced to score the aquatic habitat quality (5%). A score of 1 to 4 is given for Physical Instream Habitat from the RSAT tables (Excellent = 1 to Poor = 4); and a score of 0 or 1 is given for Water Quality from the RSAT tables (Excellent or Good = 0 to Fair or Poor = 1). Sum total is out of 5%.

| Evaluation Category          | Relative Significance   | Excellent   | Good   | Fair   | Poor  |
|------------------------------|---|---|--|--|---|
| 3. Physical Instream Habitat | <ul style="list-style-type: none"> <li>Relates to the ability of a stream to meet basic physical requirements necessary for the support of a well-balanced aquatic community (e.g. depth of flow, water-velocity, water temperature, substrate type and quality, etc.)</li> </ul> | <ul style="list-style-type: none"> <li>wetted perimeter &gt;85% of bottom channel width (&gt;90% for large mainstem areas);</li> <li>riffles, runs, and pool habitat present, diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water);</li> <li>rifle substrate composition - cobble, gravel, rubble, boulder mix with little sand, (≥50% cobble);</li> <li>rifle depth ≥ 8" for large mainstem areas;</li> </ul> | <ul style="list-style-type: none"> <li>wetted perimeter 61-85% of bottom width (66-90% for large mainstem areas);</li> <li>good mix between riffles, runs and pools, relatively diverse velocity/depth of flow;</li> <li>rifle substrate composition has good mix of gravel, cobble and rubble material (25-49% cobble);</li> <li>rifle depth 6-7.9" for large mainstem area;</li> </ul> | <ul style="list-style-type: none"> <li>wetted perimeter 40-60% of bottom width (45-65% for large mainstem areas);</li> <li>few pools present, riffles and runs dominant, velocity/depth generally slow-shallow (for large mainstem areas runs and pools dominant, velocity/depth diversity intermediate);</li> <li>rifle substrate composition predominantly small cobble, gravel and sand (5-24% cobble);</li> <li>rifle depth 4-5.9" for large mainstem area;</li> </ul> | <ul style="list-style-type: none"> <li>wetted perimeter &lt;40% of bottom width (&lt;45% for large mainstem areas);</li> <li>dominated by one habitat type (usually runs) and by one velocity/depth condition (slow-shallow) (for large mainstem areas few riffles present, runs and pools dominant, velocity/depth diversity low);</li> <li>rifle substrate composition predominantly gravel with high percentage of sand (&lt;5% cobble);</li> <li>rifle depth &lt;4" for large mainstem area;</li> </ul> |

| Evaluation Category                    | Relative Significance | Excellent   | Good   | Fair   | Poor  |
|--|-----------------------|---|--|--|---|
| 3. Physical Instream Habitat (cont'd.) |                       | <ul style="list-style-type: none"> <li>large pools generally &gt;24 in. deep (&gt;48 in. for large mainstem areas) with good overhead cover/structure;</li> <li>no channel alteration or significant point bar formation or enlargement;</li> <li>* riffle/pool ratio- 0.9-1.1:1</li> <li>* summer afternoon H<sub>2</sub>O temp &lt;68°F.</li> </ul> | <ul style="list-style-type: none"> <li>large pools generally 18-24 in. deep (36-48 in. for large mainstem areas) with some cover/structure;</li> <li>slight increase in point bar formation/enlargement or slight amount of channel modification;</li> <li>* riffle/pool ratio- 0.7-0.89:1; 1.11-1.3:1</li> <li>* summer afternoon H<sub>2</sub>O temp 68-75°F.</li> </ul> | <ul style="list-style-type: none"> <li>large pools generally 12-18 in. deep (24-36 in. for large mainstem areas) with little or no cover/structure;</li> <li>moderate increase in points bars and/or in amount of channel modification;</li> <li>* riffle/pool ratio- 0.5-0.69:1; 1.31-1.5:1</li> <li>* summer afternoon H<sub>2</sub>O temp 75-80°F.</li> </ul> | <ul style="list-style-type: none"> <li>large pools generally &lt;12 in. deep (&lt;24 in. for large mainstem areas) and devoid of cover/structure;</li> <li>extensive channel alteration or point bar formation/enlargement;</li> <li>* riffle/pool ratio- 0.49:1 ≤; ≥ 1.51:1</li> <li>* summer afternoon H<sub>2</sub>O temp &gt;80°F.</li> </ul> |
| Point Range                            |                       | 7-8   | 5-6  | 3-4  | 0-2   |

| Evaluation Category | Relative Significance   | Excellent   | Good  | Fair   | Poor  |
|---------------------|---|---|---|--|---|
| 4. Water Quality    | <ul style="list-style-type: none"> <li>Indicative of: watershed perturbations/ general level of human activity, point and nonpoint source loads, and aquatic habitat conditions.</li> </ul> | <ul style="list-style-type: none"> <li>substrate fouling<sup>2</sup> level 0-10% (rock underside).</li> <li>TDS<sup>3</sup>: &lt;50 mg/L;</li> <li>clear water - objects &gt;3 ft. deep visible;</li> <li>no odor;</li> </ul> | <ul style="list-style-type: none"> <li>substrate fouling level - very light-light (11-20%).</li> <li>TDS: 50-100 mg/L;</li> <li>objects visible down 1.5-3.0 ft;</li> <li>slight organic odor;</li> </ul> | <ul style="list-style-type: none"> <li>substrate fouling level - moderate (21-50%).</li> <li>TDS: 101-150 mg/L;</li> <li>objects visible down 0.5-1.5 ft.;</li> <li>slight-moderate odor;</li> </ul> | <ul style="list-style-type: none"> <li>substrate fouling level - high (&gt;50%).</li> <li>TDS: &gt;150 mg/L;</li> <li>objects visible to depth &lt;0.5 ft.;</li> <li>moderate-strong organic odor;</li> </ul> |
| Point Range         |   | 7-8   | 5-6   | 3-4  | 0-2   |