

Town-wide Rainwater Management Strategy Update

Overview of Stormwater Infrastructure Programs

Using the principles as explained in the report, the various recommendations from each study and/or infrastructure assessment were prioritized on a continuum based on the type of project driver, the likelihood of service impact and risk as illustrated in the table below. More detail on each individual program area have been described in the following paragraphs.

Category	1- 10 Year	11- 20 Years	21 – 30 Years	Total 30 Year Budget	Service Objective
Stormwater Life-Cycle Needs Maintenance/Renewal/Replacement (Based on Inspections/Condition Assessments)	Very Poor/Poor condition	Fair/Med Condition	Estimate Based on Historical Trends/Predicted Age/Condition	\$253.4 M	Maintain Infrastructure in Good Condition
Stormwater MP (Based on Study Priority)	High Score/High Priority	Med Score/ Med Priority	Low Score/ Low Priority	\$293.0 M	Minimize Urban Flood risk from intense storm
Riverine Studies* (Based on Study & Cost Benefit Prioritization)	Highest Ranked – Easy/Quick Wins	Med Ranked (to be aligned with IR)	Med Ranked (to be aligned with IR)	\$29.6 M	Minimize Riverine Flood Risk from intense storm
Ditch Rehab and/or New Storm Sewers (Based on Ditch Tracking Data)	High Priority/ High Service Impact	Med Priority/ Service Impact	Estimated Based on Trends	\$34.8M	Minimize risk Urban Flooding from intense storm
Parks/Harbour Shoreline Upgrades** (Based on Study & Service Impact Prioritization)	High Priority/ Service Impact	Med Priority/ Service Impact	Low Priority/ Service Impact	\$29.0 M	Increase Harbour Shoreline to prevent higher lake levels
Total				\$639.8 M	

* Some projects with low risk, high cost per property and high level of difficulty to implement remain outside 30 year period at this time.

**The budget for Highest Priority Harbour Projects were already included in 2022/2023 Capital Budget.

Stormwater Capital Renewal and Rehab – Estimated 30 Year Total \$253.4 Million

Through the town's asset management planning, condition assessments are regularly completed on the various rainwater related assets to determine what renewal and rehabilitation works are required over the near term and long-term 30 year horizon. Some of this infrastructure is approaching end of life and could potentially require significant investment in the future. Maintaining our existing infrastructure in a good state is essential in ensuring our storm network function properly to continue to provide current level of service for stormwater protection.

- **Storm sewers** – Storm sewers are an important part of the overall stormwater management network. The main purpose of the storm sewer system is to receive stormwater runoff drain surface water from the roadway and prevent flooding. The storm sewer collects surface water into underground pipes and conveys it directly to the lake. It is important that storm sewers function properly in order to meet the town's current standards and level of service for storm protection.

Evaluation and 30 Year Plan Development - closed circuit television (CCTV) inspection of 10% of storm sewer pipes over 20 years of age are performed annually. In 2021, 20 km of storm sewer pipes were inspected using CCTV, these pipes were suspected to be in poor condition based on information gathered for the Stormwater Master Plan. The resulting CCTV inspections were then assessed to determine specific rehab and renewal plans which include recommendations ranging from spot repairs, lining or full replacement where needed. Based on the results on of the evaluation, of the 396 pipes surveyed only 37 or 9% required some repair or rehabilitation. This indicates that the overall condition of the stormsewers in in very good condition. This information was combined with life-cycle/age data of the remaining storm sewer network to forecast the 30-year capital plan and estimating the storm sewer rehabilitation needs. The 30-year program has an estimated total of \$34.1 million and include a similar breakdown of spot repairs, lining and full replacement through-out the forecast.

- **Creek erosion** – Creeks play an important role in our system as they are a natural watercourse that helps support wetland and aquatic habitats and provides flood control and overland flow for stormwater drainage. It is important to monitor the creek channels and manage proper flows and control erosion so they continue to regulate water flow effectively and combat pollutants.

Evaluation and 30 Year Plan Development -creeks are inspected approximately every 5 years. Assessment of all 132 creek reaches was performed in 2021. The purpose of the assessments is to look at the geomorphic condition of each watercourse as well as the risk to surrounding infrastructure and property. Condition of infrastructure within the creeks are also evaluated along with locations of debris jams and other miscellaneous observations noted. An overall erosion hazard score is then generated for each site(reach) which is based eight risk criteria and then prioritized. The consultants then provide recommendations for infrastructure renewal and rehab strategies, cost estimates and implementation plan. A 30-year capital plan has been developed based on the creek rehabilitation needs identified as part of the 2021 creek assessment and then using historical trending of prior year erosion control needs projected out a rehabilitation cycle for the remaining 20 years. The 30-year program has an estimated total of \$69.2 million which includes a combination of larger reach-long rehabilitation projects and the smaller areas of concern rehabilitation projects. A

slope monitoring program for Bronte Creek and Sixteen Mile Creek was also initiated in 2022 and preliminary results do not identify any rehabilitation needs.

- **Shoreline** – similar to creeks it is also important to manage the infrastructure and erosion along the lakes shoreline. The lake acts as the primary outlet for the majority of the storm water and snow melt. It is important to monitor the shoreline regularly to manage lake levels and prevent unwanted overflow.

Evaluation and 30 Year Plan Development - the town's shoreline (outside of Harbours) is inspected approximately every 5 years to inspect protection structures, assess bank stability, overtopping damage and overall safety. An overall score is then generated for each site(reach) which is based fourteen risk criteria and then prioritized to provide recommendations for rehabilitation and an implementation plan. In the fall of 2021, a shoreline condition assessment of all town owned shoreline accounting for 8.8 km divided into 93 reaches was conducted. A 30-year capital plan has been developed based on the rehabilitation needs identified as part of the 2021 shoreline assessment and then using historical trending of prior year needs projected out a rehabilitation cycle for the remaining 20 years. The 30-year program has an estimated total of \$25.8 million.

- **Stormwater Pond Management** – stormwater ponds are a relatively newer standard (since 1980s) and help to reduce localized flooding and control erosion by controlling the release of stormwater that goes to nearby creeks and rivers. They also help to improve water quality by allowing dirt and other solids in stormwater runoff to settle to the bottom of the pond. The town currently has 67 assumed stormwater ponds across the town and are an important part of the overall stormwater network.

Evaluation and 30 Year Plan Development - In order to ensure these ponds function properly and to monitor sediment loading rates, sediment surveys are completed approximately every five years. The pond sediment surveys, the theoretical sediment loading rates and the MECP cleanout guidelines were used to development a 30-year pond cleanout program. The 30-year program has an estimated total of \$34.9 million.

- **Minor culverts** – culverts are part of the minor stormwater system and function primarily as conduits, conveying water from one side of a roadway or embankment to the other. Culverts help prevent flooding and related erosion and keep water flow below roadways rather than the water rising over the roadway.

Evaluation and 30 Year Plan Development - the development of a minor culvert inventory and assessment program has been initiated to identify capital improvement needs. Currently it is estimated that there are over 1,100 minor culverts across the town ranging in age and size. It is anticipated that replacement of minor culverts as they reach their end-of-service life will become an annual requirement based on current age and condition inventory information. The 30-year program has an estimated total of \$15.7 million.

- **Stormwater System Maintenance** – The town performs a number of stormwater system maintenance every year. This includes but is not limited to stormwater pond maintenance and inspections, catchbasin cleaning and maintenance, minor culvert repairs, annual ditch maintenance, storm sewer pipe maintenance and cleaning, responding to ditching problems and clearing. Also included are a number of monitoring programs related to ponds, creek flow and ECA monitoring which are required as part of MOE guidelines.

Evaluation and 30 Year Plan Develop - The 3 year operating budget identified in the 2023 budget and business plan included an average of \$1.8 million per year to perform annual maintenance and

repairs for stormwater infrastructure. The average budget required for monitoring programs is \$250,000 per year. This was used as the basis to forecast out the 30 Year plan needs at an estimated total of \$63 million.

Improvements for Climate Adaptation – Estimated 30 Year Total \$381M

Over the past several years a number of flood assessment studies have been completed to understand the impacts of the more intense storm events and to identify potential opportunities to increase the town's resiliency against climate change. Each of these studies include modeling to predict the impact of higher intense storm events such as the 100 year storm or higher lake levels to understand the potential for flooding. It has been noted that based on current data these type of storm events have a 1% probability of occurrence in any given year. In 2017 and 2019 the town's shoreline experienced flooding as a result of the high lake levels in the spring. The improvements identified in the various flood assessment reports would help to enhance the town's existing storm network and increase the resiliency to more intense storms and higher lake levels that may occur.

Stormwater Master Plan (SWMP) – 2019 – Reported to Council October 2019

Purpose: study of the potential for urban flooding based on the capacity of the Town's minor system (i.e. storm sewers) and major overland flow routes (i.e. roadways), to understand the extent of this vulnerability and develop an action plan to help minimize impacts. The study focused on areas of the town that were developed prior to 1980 as design standards have evolved over time. The purpose of the master plan was to analyze the capacity constraints within the Town's major / minor system, based upon analytical techniques which modeled performance to meet both the 100 Year storm event and the 5 year storm event. The recommendations identified in the report were evaluated to establish a preferred phasing for implementation and separated the works into "short-term" and "long-term" activities, based upon magnitude, complexity, cost and ease of implementation.

Evaluation and 30 Year Plan Development:

- *Short-term Works* - The "short-term" works represent those recommendations which are relatively low cost, require little to no additional consultation and/or analysis. This category of work is relatively low cost minor works that are deemed beneficial to advance in select areas that range in work from confirmation of existing condition, installing inlet control devices, improvements to storm sewer inlets and installing additional catch basins to improve drainage function and reduce flood risk exposure at an approximate cost of \$1.6 million.
- *Long-term Works* – The long-term work represent those recommendations consisting of larger capital projects, requiring additional stages of study, analysis, design, and consultation. The SWMP recommended approximately \$228 million in longer term capital upgrades and improvements to the storm sewer network in the study area. The study evaluated the longer-term improvements and prioritized based on a set of criteria that estimated current level of service against desired performance to meet both the 100 Year storm event and the 5 year storm event. Out of the 56 areas evaluated, 42 networks were identified with recommended long-term capital improvements that were prioritized into 3 categories, high, med and low. The recommended capital work ranged significantly both in total project cost and cost per property and level of service improvement that may result varied. There were 14 networks that did not require long-term works. A summary of the 3 categories is provided below:

Priority Group	# of Networks	Total Cost for Priority Group	Range in Cost for each Network (Consultant Estimate)	Range in # of Properties per each Network	Range in Cost per Property for each Network
High	12	\$114.7 M	\$120,000 to \$45.6 M	79 – 1,160	\$1,200 to \$40,600
Med	17	\$131.7 M	\$380,000 to \$40.7 M	80 – 1,430	\$816 to \$49,400
Low	13	\$46.6 M	\$260,000 to \$13.8 M	33 – 2,100	\$1,100 to \$54,200

- RWM strategy evaluation* - as part of the RWM strategy development a 30 year capital plan was developed using the studies priority recommendations with high priority projects to begin in the 1-10 year timeline, medium in the 11-20 year timeline and low in the 21-30 years, the project cost estimates have been updated to reflect 2022 cost, therefore the revised estimated total cost of the program is \$293 million. It should be noted that the study recommended that following the implementation of the short-term works the SW Master Plan should be re-assessed and condition scores re calculated to understand the impacts the short-term improvements have had on the performance of the network before proceeding to implement the long-term work.

Detailed Riverine Flood Improvement Studies – 2019 and ongoing

Purpose: Individual riverine studies have been completed or are underway for locations recommended as part of the Town-wide Flood Study report completed in 2008. The purpose of each individual river/creek study was to update hydrologic and hydraulic (i.e. floodplain) models developed to look at the specific flood plain area and surrounding community to identify potential improvements that could be incorporated to help mitigate flood damage against either the 100 Year or Regional storm event. The recommendations from the studies completed to date range in application from emergency preparedness; to minor improvements; to significant infrastructure upgrades. The identified infrastructure upgrades and improvements were to be evaluated and prioritized within the overall RWM Strategy.

A summary of the status of each study and various recommendations is provided below:

Study	Status of Study	Flood Plain Evaluated	Recommendations and Consultant Estimated Cost
Munn’s Creek	Completed and Reported to Council Sept, 2019	Regional (Hurricane Hazel)	McCraney Street and Miller Road Crossing Replacements, Onslow – Oakdale Pedestrian Bridge Crossing Replacement – Estimated total \$3.3 Million Estimated # of Properties - 6
Sheldon Creek	Completed and Reported to Council Nov, 2021	Regional (Hurricane Hazel)	Emergency preparedness Rebecca St. spill, Great Lakes Blvd and Wilmot Crescent Berm Construction Estimated total \$300,000 Estimated # of Properties 23

Appendix A

Lower Wedgewood/ Lower Morrison Creek	Study Target completion Q2/Q3 2023	100 Year	Offline flood storage Cornwall Road Park Underground Storage Tank, 11 culvert upgrades, four localized flood protection berms. Options Ranging from \$124,000 to \$6.4 million Estimated # of Properties – 3 - 106
Joshua Creek	Study Target completion July 2023	Regional (Hurricane Hazel)	Short-term – emergency preparedness Long-term –review opportunities to construct the rail bridge to pass the Regional Storm without overtopping Two options total \$7.1 million Estimated # of Properties - 88
Fourteen Mile & McCraney Creek	Study Target completion Q3/Q4 2023	Regional (Hurricane Hazel)	Flow diversion to Bronte Creek, Flow diversion to 14 Mile Creek, Off line storage tank, various culvert upgrades, Berming and Landscaping Range of options from \$750,000 to \$18.9 million Estimated # of Properties - 107

Evaluation and 30 Year Plan Development: As noted in the chart above, each riverine study had slightly different evaluation methods and presented various options and benefits. As part of the RWM strategy staff developed a methodology to evaluate all the recommended options across all the studies was developed in order to balance needs and direct resources to areas with the highest risk and highest benefit first. The methodology considered the risk, cost, complexity and ease of implementation and ranked projects High, Medium and Low (similar to the SWMP). The 30 year capital plan was developed using this criteria with high priority projects to begin in the 1-10 year timeline, medium in the 11-20 year timeline and low in the 21-30 years, the project cost estimates have been updated to reflect 2022 cost, therefore the revised estimated total cost of the program is \$29.6 million. It should be noted that at this time some options with low risk, high cost per property and high level of complexity/difficulty to implement remain outside 30 year period until further evaluation.

Ditch Improvements and/or New Storm Sewers – many neighbourhoods, primarily in south Oakville, have streets with rural cross-sections with ditches. Streets with flat topography can create challenges for proper ditch drainage which can result in standing water in the ditches for extended periods of time. When regrading the ditches will not improve the drainage conditions, installation of a storm sewer to receive the ditch drainage may be the only effective solution. A 30-year capital plan has been developed based on the various ditch improvement areas identified. The program includes budget for drainage evaluation studies and rehabilitation and/or potential new storm sewers which have been projected out 30 years. The 30-year program has an estimated total of \$34.7 million. The program also includes annual funding for ditch assessments to continue to evaluate problem areas and identify solutions that may require more than ditch regrading.

Parks & Harbours Risk and Flood Assessment Study – 2021/2022

Purpose: a flood impact study and assessment of the infrastructure in Oakville Harbour and Bronte Inner Harbour and Coronation Waterfront Park Shoreline to identify improvements to help reduce the potential for flooding. These studies were a result of the Flood Damage, Shoreline Restoration and Remediation report to Council in April 2020 in which staff were directed to undertake an assessment of vulnerable flood prone waterfront parks and harbours.

- The Harbour study was completed in April 2021 by Shoreplan Engineering Limited which included an assessment of the coastal site conditions, design water levels, and design wave heights in the

harbours considering the recent extreme water level conditions on Lake Ontario. An inventory and condition assessment of the Town’s harbour structures identifying key features of the structures, areas without protection and provided recommendations in various areas for renewal or repairs, flood proofing or control recommendations including time lines and construction cost estimates.

- The Coronation Waterfront Park Shoreline assessment reviewed three causes of flooding due to standing water from high lake levels and associated groundwater, channel outlet blockages and lake based storm surge and wave overtopping. Coronation Park experienced flooding as a result of the high lake levels in 2017 and 2019 which caused areas of the park to be closed or partially closed for public safety throughout the spring and summer months. The report recommended five options ranging in “Minor Maintenance” at \$190,000 to “Protect Parkland to 100 yr and 25 yr Flood Level for certain assets” at \$4.5 million. Staff are currently reviewing options along with emergency services and Conservation Halton partners to determine the best overall plan.

A summary of the recommendations is included in the table below, it should be noted that funding has already been included in the 2022 capital budget for Seawall Rehab at Shipyard Park in Oakville Harbour and Berta Point in Bronte Harbour due to very high priority needs.

Reach Location	Harbour	Consultant Estimated Cost*	Priority	Note
South shore of Oakville Yacht Squadron reach O25	Oakville Harbour	\$ 100,000	Very High	Combined with Shipyard Park project
Shipyard Park reach O27	Oakville Harbour	\$ 1,900,000	Very High	Included in 2022 budget
Berta Point reach B21	Bronte Harbour	\$ 1,761,000	Very High	Included in 2022 budget
Hillmer Park reach O1	Oakville Harbour	\$ 180,000	High	
Busby Park reach O8	Oakville Harbour	\$ 3,210,000	High	
Bronte Yacht Club reach B18-19	Bronte Harbour	\$ 550,000	High	
North shore of Bronte Creek reach B2-4	Bronte Harbour	\$ 4,500,000	High	
TOWARF reach O 14 – 18	Oakville Harbour	\$ 870,000	Med	
South shore of Bronte Creek reaches B18-19	Bronte Harbour	\$ 2,850,000	Med	
Berta Point reach B20	Bronte Harbour	\$ 2,400,000	Med	
Maintenance on east pier	Oakville Harbour	\$ 40,000	Med	
Erchless Estate reach O11-13	Oakville Harbour	\$ 470,000	Low	
Lakeshore Road Bridge reach O29	Oakville Harbour	\$ 340,000	Low	
Oyster Bay reach O22-23	Oakville Harbour	\$ 1,380,000	Low	
Total Harbour Study Cost		\$ 20,551,000		
Coronation Waterfront Park Shoreline		\$ 4,500,000	Med	
Total Estimated Parks/Harbour Costs		\$ 25,051,000		

*Costs do not include administration, testing & inspection

Evaluation and 30 Year Plan Development Priorities for improving the shoreline protection were established by the condition of the existing shore protection infrastructure and potential impacts due to flooding with priority rankings of high, medium and low provided. As part of the RWM strategy, staff further evaluated the recommendation and applied a operational service impact lense to further prioritize the projects. The remaining identified capital upgrades and improvements are to be evaluated and prioritized within the overall RWM Strategy. The 30 year capital plan was developed using this criteria with high priority projects to begin in the 1-10 year timeline, medium in the 11-20 year timeline and low in the 21-30 years, the project cost estimates have been updated to reflect 2022 cost, therefore the revised estimated total cost of the program is \$23.6 million.

Coronation Park EA Drainage Improvements – 2017 - Reported to Council June 2017

Purpose: Municipal Class Environmental Assessment (EA) study to investigate whether drainage improvements within and around Coronation Park would help to improve neighbourhood drainage and reduce flooding in Coronation Park. High priority drainage improvements identified in the report been summarized below of which all have been included in previous year budgets therefore not included in the RWM strategy.

Recommended Improvements	Status
Channel improvements within Coronation Park to receive flows from proposed storm sewers - \$1.1 million	Main channel reconstructed completed in 2019
New storm sewers and ditch improvements on Westminster Drive and outlet improvements - \$4.9 Million	Works to be tendered in 2022 with construction to begin in 2022
New storm sewers and ditch improvements on Woodhaven Park Drive and outlet improvements - \$10.6 Million	Design work to be completed in 2022 with construction to begin in 2023