



City of
Peterborough

To: **Members of the Peterborough Environmental Advisory Committee**

From: **Michael Papadacos
Manager, Infrastructure Management Division**

Meeting Date: **November 17, 2021**

Subject: **Report PEAC21-027
Watershed Plan Update**

Purpose

A presentation to provide the Peterborough Environmental Advisory Committee with an overview of the Watershed Plan Phase 1 and 2 findings, and an update on Phase 3.

Recommendation

That the Peterborough Environmental Advisory Committee approve the recommendation outlined in Report PEAC21-027 dated November 17, 2021, of the Manager, Infrastructure Management Division as follows:

That the presentation from the Infrastructure Management Division regarding the Watershed Plan Phase 1 and 2 findings, and Phase 3 Update be received for information.

Budget and Financial Implications

There are no budgetary or financial implications associated with the recommendation.

Background

Watershed Planning

The Watershed Planning Study (WPS) provides a management framework for the protection of water resources, the management of human activities, land, water, aquatic life, and resources within the subwatersheds of the City of Peterborough.

The WPS incorporates a three-phase process, following guidance provided by the province.

- Phase 1(a) includes characterizing the watershed and collecting all available background information.
- Phase 1(b) involves drafting a vision for the study area and developing a set of goals and objectives.
- Phase 2 includes the completion of various technical components, such as groundwater and water quality modeling, natural hazard assessments, defining the natural heritage systems, and assessing cumulative impacts. Throughout Phase 2, the impacts associated with climate change have been an integral focus, with the intent to provide direction for climate mitigation and adaptation strategies in Phase 3.
- Phase 3 includes developing the Implementation Plan. The Implementation Plan provides direction to the City for areas to be protected, enhanced or rehabilitated, guidance on appropriate land-use and development criteria, servicing requirements, water management practices and performance measures, targets for protection and restoration, as well as best management practices for the management of water quality and quantity.

Consultation and Engagement

Watershed planning is an important topic that requires transparent and meaningful stakeholder and community engagement. The public engagement plan for this project has three principal goals:

1. Educate and increase the public understanding of watershed planning;
2. Collect input and feedback regarding watershed planning in Peterborough; and
3. Assist in the identification of issues, constraints and opportunities.

In addition to public engagement, the consultation for Phase 1 and 2 of the project included consultation with key stakeholders and First Nations, as follows:

Watershed Coordinating Committee (WCC): The Watershed Coordinating Committee includes study area Municipalities, the Peterborough County, First Nations and the Conservation Authority and provides a forum to review, discuss, and share information in relation to the watersheds and the Watershed Plan.

First Nations: Phase one included direct consultation with Williams Treaty First Nations having an interest in the watershed planning process. To date, the Hiawatha First Nation and Curve Lake First Nation have been involved in the project as part of the WCC.

Technical Working Group (TWG): The Technical Working Group consists of technical subject matter experts who live and work in the community. This committee has provided input and expertise on the various technical aspects of the study.

Stakeholders: Key stakeholders such as community groups, major landowners, academia, businesses and the development community attended a Stakeholder Workshop during Phase 1. An additional Stakeholder Workshop will be scheduled prior to adopting a completed Watershed Plan.

Vision, Goals and Objectives

Upon completion of the Phase 1 Watershed Characterization, the project team developed a watershed Vision, Goals and Objectives with input from the various groups listed above. The Vision is:

“A healthy and resilient watershed that protects, sustains and enhances our evolving communities.”

To achieve this vision, five distinct goals have been developed with associated objectives, these include:

1. Protect and enhance the natural hydrological function
2. Enhance or maintain water quality in creeks, wetlands and rivers
3. Conserve, protect and restore a healthy aquatic ecosystem
4. Conserve, protect and restore a healthy terrestrial ecosystem
5. Support social, economic, and cultural activities that rely on a healthy watershed

A working copy of the Vision, Goals and Objectives used throughout this project is included in **Appendix A**. Upon completion of the Implementation Plan, the watershed objectives will be revisited in consideration of the study findings to ensure they align with needs of the community and natural environment.

Subwatershed Characterization and Analysis

A key component of the Phase 1 Watershed Characterization was the watershed health analysis and identification of priority subwatersheds. The health analysis used a decision matrix that considered the state of the following health metrics:

- Terrestrial health
- Stormwater management
- Water quality
- Aquatic health

Priority 1 subwatersheds have the poorest conditions based on the four metrics analyzed, while Priority 4 subwatersheds have the best conditions. However, this does not mean that Priority 4 subwatersheds should be allowed to degrade and management practices should still be implemented to protect the subwatershed health and to enhance it where possible.

Priority 1 subwatersheds will have the greatest opportunities to enhance subwatershed health. Priority 1 subwatersheds include:

- Curtis Creek (urban portion)
- Bears Creek (urban portion)
- Stewart Hall (urban portion)
- Byersville Creek
- Fisher Creek
- Whitlaw Creek

Phase 2 of the study included completion of a series of technical analyses:

- natural heritage systems (NHS)
- water quality
- groundwater systems
- flood risk
- climate change

These five components make up the primary elements of a watershed plan. The findings of each of the Phase 2 technical analyses are summarized below.

Natural Heritage Systems

Work completed as part of the NHS builds upon the mapping and policies created as part of the City's Official plan. In general, the Watershed Plan will focus on the protection and enhancement of the NHS, including the creation of comprehensive watershed-based mapping that combines both the City's NHS, and the NHS within the County of Peterborough.

The highest priority for protection of the NHS at a regional scale is connectivity. Corridors and linkages are necessary for the overall functionality and health of the NHS. Protection and enhancement of existing regional connections and proximity linkages can be accomplished through restricting development, implementing wildlife crossing structures, and targeting urban tree canopy enhancements in these areas. Placement of less impactful land uses such as green space, parks, and storm water management facilities adjacent to linkages can also help mitigate impacts of development.

When road maintenance or upgrades are proposed, the ecological connectivity at the local and regional scale should be considered and the viability of wildlife crossing structures or other measures that can reduce the environmental impact of a road should be considered.

Promoting an increase in urban tree canopy cover, reduction or limitation of impervious surfaces, installation of shaded stormwater management ponds, and stream/riparian restoration and conservation strategies will assist in mediating increases in temperature and the maintenance of cool and cold watercourses.

Based on a priority to alleviate flood risk in the community and promote the attenuation of water, enhancement areas should be either marsh or swamp communities and placed where groundwater inputs are likely to remain stable or increase as much as possible. Restoration efforts should be focused on areas where wetlands will have the highest likelihood to thrive as climate change progresses as well as where they are most likely to provide flood attenuation.

To achieve the above a series of measurable and actionable targets have been developed. These targets further promote the objectives and vision of the watershed plan. All targets are currently being refined and will form part of the implementation plan.

Water Quality

Significant water quality monitoring has been conducted in the past and is summarized in the Phase 1 Characterization report. A key element for Phase 2 of the WPS is development of a water quality model to assess the annual loadings of water quality constituents generated from each subwatershed. Four (4) different design scenarios were modelled to reflect existing and projected development conditions, as well as the impact that existing stormwater management facilities have on improving water quality. The

modelled water quality parameters are listed below.

- Biochemical Oxygen Demand (BOD)
- Chloride
- Copper
- Nitrate
- Total Phosphorus (TP)
- Total Suspended Solids (TSS)
- Zinc

Model results showed that TSS is the most abundantly generated parameter, and that TSS is also most effectively treated by existing stormwater management facilities. This highlights the need to ensure ongoing upkeep of these facilities.

Chloride and BOD are the second and third most generated parameters. As expected, chloride is the only parameter that showed no reduction in annual loading as a result of stormwater management facilities. Under the future development scenarios, model results showed a substantial increase in annual loadings across all parameters, highlighting the need for effective stormwater management controls.

Preliminary recommendations as a result of the water quality modeling include:

1. Additional SWM facilities where retrofit opportunities exist throughout the study area. The Jackson Lower, Urban Sub-catchments and Byersville Subwatersheds should be targeted first as these are the largest sources of pollution.
2. Upgrade dry ponds to wet ponds where feasible as wet ponds typically provide superior water quality treatment.
3. Install additional OGS units in urban areas where end-of-pipe based treatment is not feasible.
4. Implement source and conveyance controls in urban areas (i.e. low-impact development (LID)).
5. Develop urban pollution control strategies concerning the application of road salts on municipal roads and large private parking lots.

6. Promote stewardship opportunities for rural subwatersheds that are external to the City and contribute to water quality degradation in Peterborough's local watercourses.

Groundwater Systems

Describing and understanding groundwater systems in the study area was a primary objective of the Watershed Plan. Considerable work, largely related to Municipal Groundwater Studies and Source Water Protection (SWP) program studies, has been undertaken in the Otonabee watershed over the last 10 years. This project updates and expands on findings of this and other previous studies.

A second objective of the study is to provide the critical background information used to develop and calibrate a hydrologic and groundwater model. The hydrologic model was used to quantitatively evaluate water budget elements (e.g. infiltration, overland runoff, evapotranspiration (ET), groundwater recharge, and runoff to streams) under current climate conditions. Average annual groundwater recharge determined using the hydrologic model was applied to the groundwater model and used to determine long-term average groundwater levels and groundwater discharge to streams. The coupled models were also used to evaluate change to the surface water and groundwater system under prolonged drought and future climate conditions. Results of these analyses will be used to aid in developing plans and measures to monitor and protect the natural functions of the Study Area subwatersheds.

Based on modeled results, mapping has been prepared that identifies Significant Groundwater Recharge Areas (SGRA) and Ecologically Significant Groundwater Recharge Areas (ESGRA). The ESGRA's identify groundwater recharge areas which are critical in the ecological health of a wetland or stream. This type of mapping product has not been produced for our area in the past and may be a critical component in future land-use policy.

Flood Risk

Flood risk is typically characterized as either urban or riverine. Urban flooding can be described as flooding that occurs as a result of surcharging sewers, poor overland flow routes and basement flooding (sewer backups). Riverine flooding is described as flooding that occurs when a watercourse exceeds its banks and flows overland, this can be a result of extreme rainfall, snowmelt, undersized crossings, or a combination of all. Risks associated with both urban and riverine flooding are becoming more prominent with a changing climate due to extreme high intensity rainfall, and seasonal weather anomalies.

Otonabee Conservation (ORCA) has the responsibility to regulate activities in natural and hazardous areas in accordance with the policies of O.Reg. 167/06, this includes regulating development in flooding hazards. ORCA produces and maintains floodplain mapping for most watercourses in the study area. This mapping is an essential tool for protecting people and property from flood risk. ORCA has conducted multiple studies in the past 40 years to define flood risk and develop mapping products. The Future Flood Assessment

has identified where updated or new mapping is needed due to a number of factors such as mapping age, land-use changes, and infrastructure upgrades.

The study area's overall flood risk has been assessed based on buildings currently within the flood plain, or close to the flood plain. As updated mapping is produced, it can be assumed that the flood limits will increase as a result of land-use changes and climate change. **Table 1** below identifies the number of flood-prone buildings in the study area.

Table 1 – Buildings Within Floodplain

	Within Existing Floodplain¹	Partially Within Floodplain²	Within 10m of Floodplain³	Within 25m of Floodplain⁴
Airport	34	14	3	7
Bears	11	9	1	27
Byersville	382	109	4	148
Cavan	16	11	1	9
Curtis	53	39	6	68
Fisher	14	0	0	1
Fleming	4	3	0	5
Harper	1	5	0	4
Jackson	177	86	4	103
North Thompson	0	0	0	0
Otonabee Catchments	125	8	0	10
Riverview	0	1	2	27
South Meade	117	35	6	84
South Thompson	0	5	0	10
Stewart Hall	22	1	0	2
Trent	0	2	0	1
Urban Subwatersheds	538	190	39	360
Whitlaw (North Meade)	35	9	17	47
Unknown	12	4	2	5

¹ Entire building footprint is within the existing regulatory floodplain

² Portions of a building footprint is within the existing regulatory floodplain

³ A building footprint is within 10m of the existing regulatory floodplain

⁴ A building footprint is within 25m of the existing regulatory floodplain

To better understand urban flood risk, part of the Watershed Plan included the development of a Terms of Reference to develop a Storm Sewer and Riverine Flood Model. This work is currently ongoing and will be a fundamental tool for assessing the

existing level of service and system performance, modeling climate change scenarios including vulnerability assessments and adaptation strategies and identifying areas most at risk during a range of flood scenarios.

The goal of the Storm Sewer and Riverine Flood Model is to prioritize capital projects to improve storm infrastructure, identify key operations and maintenance activities and meet an adequate level of service under existing and future growth scenarios. This includes testing the resiliency of capital improvement projects under various design storms and the impacts of climate change, flood risk mapping, and to inform site-specific land-use planning decisions to meet the overall objectives of the on-going Watershed Planning Study, the Flood Reduction Master Plan (2005) and the various subwatershed specific Flood Reduction Studies and Environmental Assessments.

Climate Change

The Watershed Plan will include recommendations for incorporating climate change adaptation into existing policies and programs wherever possible, including a science-based approach to the planning, design and management of stormwater management systems with consideration for climate change risk. The Watershed Plan will be flexible enough to accommodate ongoing improvement in our understanding of climate impacts and potential risks while recognizing that there is uncertainty in climate change projections and the associated impacts.

The general approach to Climate Change-based implementation planning will follow the following four-step approach:

1. Identifying Climate Change Considerations
2. Evaluating Risk caused by Climate Change Parameters
3. Climate Change Impact Management Planning
4. Monitoring and Adaptive Management Planning

Based on the information gathered and the analysis undertaken to date, the most significant climate change considerations that will need to be considered through implementation planning include, but are not limited to:

- Broad-scale climate shifts including higher seasonal temperatures (averages and maximums) as well as greater precipitation in all seasons.
- Decreases in winter snowpack water storage and associated reductions in spring freshet runoff response. A corresponding flashier runoff regime is expected throughout the winter as melt and intense rain-on-snow events become more frequent.

- Ecological range shift as aquatic and terrestrial species are forced out of their current range as temperatures and other environmental factors shift beyond their adaptation capacity.
- Changes to physical abiotic habitat characteristics including surficial flow, soil moisture, erosion and water table depth.
- The intensification of storm events, including those short-duration events that are used in the design of stormwater management infrastructure and used to assess compliance with desired level of service frameworks.

Phase 3 Implementation Plan

Phase 3 of the Watershed Plan development confirms the preferred management scenario and provides an implementation plan. In developing the implementation plan, the work undertaken in previous tasks — including watershed characterization, goals and targets, scenario assessment outcomes, and monitoring and adaptive management strategies — are consolidated into a readable, actionable Watershed Plan. Watershed Plans are meant to be readable documents that can be widely understood by municipalities, stakeholders, and the public, while also providing specific direction for implementation by various actors.

The Implementation Plan, which is currently under development will include various forms of policy, strategy, monitoring and management recommendations to ensure a healthy and sustainable watershed for generations to come. With respect to the implementation planning of projects and programs, priority considerations will include budget constraints, integration and synergies with other plans and policies, as well as subwatershed health needs. Recommendations associated with the Implementation Plan may include:

Stormwater Policy Updates

- Intensity-Duration-Frequency (IDF) augmentation for climate resiliency
- Water quality targets
 - Water quality targets for new development areas
 - Water quality targets for infill and redevelopment
- Volume control criteria (Low impact development)
- Risk based infiltration policy framework
- Integration with asset management strategies and level-of-service framework

Urban Water Quality Strategies

- Municipal pollution prevention, operations and maintenance practices
 - Catch basin clean-out, street sweeping and leaf pick-up
 - Oil and grit separator cleanouts
 - Changes to municipal and/or private salt management practices

- Low impact development of public roads during reconstruction
 - LID design standards
- Targeted LID marketing/incentive program
- Stormwater facility retrofits
- New stormwater facility opportunities

Flood Reduction Strategies

- Urban Flooding – City-wide flood risk model and monitoring (under development)
- Flood reduction study recommendations (update City's flood reduction capital program priorities)
- Risk-based prioritization of regulatory floodplain mapping updates (ORCA)

Rural Implementation Strategies

- Land stewardship opportunities
- Riparian buffers
- Cross-culvert rehabilitation approach (consideration for climate change)

Natural Heritage and Ecological Strategies

- Natural Heritage System recommendations
 - Urban areas
 - Rural Areas
- Targeted areas for ecological restoration within the Watershed
- Urban forestry

Climate Change Adaptation Recommendations

- Integration with Community Climate Change Resiliency Strategy
- LID as volume-based resiliency to intense rainfall and groundwater recharge
- IDF Updates into City-Wide Model to identify risks associated with desired level of service performance failure
- SWM facility flood risk assessment
- Restoration plan and planting plan augmentation

Watershed Monitoring Recommendations

- Water Quality Monitoring
- Water Quantity Monitoring
- Baseflow and Stream Temperature Monitoring
- Wetland Health Monitoring
- Benthic and Aquatic Monitoring

- Groundwater Monitoring

Table 2 outlines various considerations that will be assessed for each component in the Implementation Plan.

Table 2 – Implementation Considerations

	Notes / Examples
Key Next Steps	Steps to be undertaken in order to continue an existing measure or to kickstart a new program – including the identification of pilot project opportunities
Facilitator & Contributors	Definition of the party responsible for implementing the measure or the agency(ies) or groups(s) that will assist in implementing the measure by providing support in any number of ways, e.g., funding, labour, materials, technical expertise
Mechanisms for Implementation	Methods by which the recommended strategy will be implemented, whether voluntary or mandatory, incentive based or prescriptive
Development Requirements	Outlines the requirements of future new development, infill-development and redevelopments, rehabilitations and infrastructure replacements
Cost	Unit cost to implement recommended works and or life-cycle costs including staffing requirements, education & training requirements and technical resources both internal and external to the City
Funding	General funding approaches and alternatives considered
Timeframe	General timeframe for implementation of specific steps, projects, studies and the preferred strategy in general
Integration	How the recommended approach integrates with existing municipal programs
Prioritization	The order in which the recommended projects are to be implemented to best achieve goal, objectives and targets
Asset Management	How the recommended strategy, cost and implementation timeframes are integrated into existing and future Asset Management Plans
O&M	Operation and maintenance activities, approaches and costs associated with the implementation of the proposed measures
Monitoring & Verification Requirements	Mechanism by which the expected benefit can be quantified or assessed including the assessment interval, structure and adaptive management processes – associated monitoring costs will be identified

Next Steps

Upon completion of the Watershed Plan in an appropriate format, the plan will be presented to Council. Appropriate implementation mechanisms will be considered including, but not limited to future policy and procedure development, by-law review and development, and future Official Plan Amendments. The draft Official Plan (2021) includes policies throughout that support Watershed Planning and the recommendations that are being developed. The Watershed Plan will provide the strategic direction to implement policies within the OP, including providing the guidance necessary in the development of Secondary Plans throughout the City.

Prior to finalizing the Implementation Plan, several engagement and consultation activities must occur, including WCC and TWG meetings, a stakeholder workshop, public engagement, and consultation with Hiawatha and Curve Lake First Nations. Obtaining support for the plan through the WCC, will be of particular importance. Members of the WCC represent the various neighboring municipalities, including the County of Peterborough, First Nations and Otonabee Conservation and their support will be essential in the overall success of the plan. The PEAC will also have further opportunity to review and comment on the final plan prior to it being presented to Council for adoption.

Submitted by,

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Attachments

Appendix A – Watershed Plan Vision, Goals and Objectives