

Water Environment Strategy Phase 1 – Annexes

Annex 1: Existing Watershed Conditions 2

Annex 2: Watershed Governance, Regulatory Framework and Key Agencies 6

Annex 3: Applying Asset Management to Natural Systems 16

Annex 4: Learning from Best Practices 19

Annex 1: Existing Watershed Conditions

Understanding the health of watersheds is complex. Standard indicators include indexes of water quality (phosphorous, *e.coli*, metals and other chemical and physical parameters), forest and wetland cover, and riparian cover (vegetated shoreline buffers). While provincial and federal guidelines recommend targets for these indicators, understanding how specific subwatersheds and catchments change over time is also important in guiding their management and protection.

Existing conditions for watersheds in Ottawa are described in various reports, such as the Lower Rideau Watershed Strategy, subwatershed report cards and catchment reports, Source Protection reports, stormwater retrofit studies, analysis of water quality data, and the 2011 Characterization of Ottawa's Watersheds. Mississippi Valley Conservation released its Watershed Report Card in 2013 (www.mvc.on.ca), and Rideau Valley Conservation Authority released Report Cards for the Jock River Subwatershed in 2010 and the Lower Rideau Subwatershed in 2012, with detailed information in specific catchment reports (www.rvca.ca).

The following is a very cursory overview of water quality, riparian cover, groundwater and source water protection, land use, forest cover, wetland cover, species-at-risk and climate change.

Water Quality

- The City has a comprehensive surface water monitoring program comprising over 130 monitoring sites located across 6 rivers, 4 lakes and 40 creeks. Water quality samples are collected on a monthly basis, conditions permitting, and analyzed for 43 parameters including *E.coli*, nutrients and standard metals. The Canadian Council of Ministers of the Environment (CCME) Water Quality Index is then used to summarize the data into simpler terms (i.e. excellent, good, poor) for reporting purposes and to provide a relative comparison of the water quality in the City's rivers and streams.
- Overall, water quality in the City's major rivers (Ottawa, Rideau and Mississippi) is generally good to excellent and the major tributaries (e.g. Jock, Carp, Castor and Bear Brook) range from fair to good. Smaller tributaries vary between poor and excellent, but generally fall in the fair to good range. This reflects their lesser ability to withstand the effects of pollution.
- Overall, the City has many healthy creeks and rivers, but experiences localized impacts. The Ottawa River in particular is in very good condition, as is the lowest reach of the Rideau River (see Maps 1-5 for details).
- Phosphorus levels regularly exceed provincial targets at sites across the City
- With the exception of localized areas, *E. coli* is less of a concern in the major rivers, but can exceed water quality targets in smaller watercourses such as urban creeks
- Chlorides are elevated in urban creeks during the winter reflecting run-off from roads and parking lots.

- Metals are also a concern in smaller urban tributaries.

Riparian Cover and Physical Condition of Streams

- A vegetated or riparian buffer is a vegetated area near a stream that shades or protects the stream. Based on preliminary analysis of 2008 aerial photography, the percentage of naturally vegetated riparian buffers in Ottawa was well below the threshold recommended by Environment Canada. Environment Canada recommends a 15m buffer in agricultural areas and 30m buffer for all other watercourses¹. Ottawa is at 35% compared to the recommended 75% for the 30m buffer and only 1% of Ottawa watercourses in agricultural areas met the buffer of 15m².
- It is important to recognize that desired guidelines for watercourse buffer width are not always practical in well established agricultural, residential and commercial areas, and agencies must work with landowners and developers in order to maximize opportunities that do exist. The *Lower Rideau Watershed Strategy* (2005) set riparian cover targets at 50% of the riparian corridor³.
- Many streams and creeks in both urban and rural areas have been physically altered from development pressures and changes in land use and land practice. Streams have been straightened, filled in or hardened, and many have lost critical shoreline vegetation⁴.
- While some information is available through catchment reports, overall, there is a lack of consistent and systematic information on physical condition of streams and tributaries, to proactively identify and address risks across the City.

Small Streams

- The City's smaller creeks and streams, in both rural and urban areas, are more vulnerable to the effects of development and are the least able to tolerate pollutants. Small streams constitute more than 90% of the City's watercourses with 50% being 'headwater' streams. As the 'capillaries' of the watershed, protecting these small streams is essential for the health of downstream watercourses.
- A key finding of the Lower Rideau Watershed Strategy was that while the Lower Rideau River itself was in moderately good condition, the tributaries exhibited poor environmental condition due to changes in drainage practices, straightening, removal of riparian vegetation, nutrient and bacteria loads that exceed provincial guidelines, and altered hydrology causing erosion and loss of aquatic habitat⁵. Catchment reports for the 16 catchments of the Lower Rideau detail the condition of smaller streams and tributaries and the key issues and threats⁶.

Groundwater and Source Water Protection

- The draft Source Water Protection Plans⁷ identified policy and programming actions to prevent or mitigate significant threats to the City's five communal wells and two intake zones.
- Significant aquifers – such as the Nepean Aquifer – and recharge areas need further assessment to determine how they can be best protected.
- Periodic water testing in some village aquifers shows high nitrates.
- Although groundwater quantity has not yet been a concern⁸, more detailed analysis is required to determine the stress levels on aquifers under various low water scenarios, understand the effects on water supply and demand, and propose mitigation and adaptation measures.

Land Use

- Increased imperviousness (paved surfaces) in urban areas causes greater runoff volume in streams. Impervious land is frequently greater than 25% in the City's urban subwatersheds and higher than 40% in certain areas (such as in parts of central Ottawa, Green Creek and Lower Rideau subwatersheds)⁹.
- Agricultural tile drains have changed surface flows and groundwater storage in rural areas.
- Imperviousness and changes in drainage affect the natural functions of a watershed such as peak and base flows, recharge/ discharge, sediment and nutrient transfer¹⁰, and fish and wildlife habitat.

Forest and Wetlands

- Overall forest cover for the City is 32%, however this varies greatly across the City (Map 6). Catchments in the Lower Rideau, for example, vary from 7% to 45%. Changes from 2002 to 2008 also vary, with 7 catchments showing an increase in cover, and 9 showing a loss, including as much as 10%¹¹.
- Additionally, only 3% of forest cover city-wide is considered 'deep or interior forest' compared to the recommended 5% target¹².
- Wetland cover is approximately 20% overall, which generally meets or exceeds federal targets¹³, however the condition of wetlands needs further assessment

Species at Risk and Invasive Species

- Ottawa's watersheds are home to nearly 50 at-risk species, including many that depend on healthy watercourses such as Blanding's turtles, snapping turtles, American Eel and the Northern Brook Lamprey.
- Invasive species such as dog-strangling vine, common and glossy buckthorn, zebra mussels, Eurasian water-milfoil and flowering rush are crowding out native species.

Adapting to a Changing Climate

- Analysis of 120 years of data show that winters have become warmer and drier, and spring and fall seasons have become wetter¹⁴. Changes can alter hydrology and habitat, and can pose risks to property and safety, as seen by intense rainfall, ice storms and prolonged periods of low or no rainfall.
- Mississippi Valley Conservation and partners used integrated watershed hydrologic and hydraulic modelling to examine potential changes to the Mississippi River watershed and assess the risks and implications for water resource management, as well fish and fisheries. Modeling foresees lower stream flows in the spring with peak flows 6-7 weeks earlier¹⁵

¹ Environment Canada, 2004 *How Much Habitat is Enough?*

² City of Ottawa *Report on Balanced Scorecard*. July 2013

³ *Lower Rideau Subwatershed Report Card* 2012

⁴ As much as 85% of reaches in the Lower Rideau are designated as altered or degraded, as the result of erosion, shore hardening, livestock access or removal of shoreline vegetation (Lower Rideau Watershed Strategy (2005) Appendix E)

⁵ Lower Rideau Watershed Strategy Executive Summary (2005)

⁶ Catchment reports can be found at: www.rvca.ca/watershed/subwatershed_reporting/lower/lower_rideau.html

⁷ The Mississippi-Rideau and Raisin-South Nation Source Protection Plans were submitted to MOE in July 2012.

www.mrsourcewater.ca and www.yourdrinkingwater.ca

⁸ Overall water demand is small compared to supply, although there are some communal wells with high demand and limited supply

⁹ *Characterization of Ottawa's Watersheds* (2011) Table 5.6

¹⁰ Erosion is a natural process that enables sediment and nutrient transfer and supports aquatic habitat; the problem occurs when excessive run-off interferes with the natural functioning of the ecosystem

¹¹ *Lower Rideau Subwatershed Report* (2012) www.rvca.ca

¹² *Characterization of Ottawa's Watersheds* (2011) Table 6.1

¹³ Environment Canada, 2004. *How Much Habitat Is Enough?*

http://www.on.ec.gc.ca/wildlife/factsheets/fs_habitat-e.html

¹⁴ Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR)

<http://www.climateontario.ca/datasheets.php>; *Characterization of Ottawa's Watersheds* (2011) Chapter 3

¹⁵ A 2012 workshop on Adaptation Planning IN Eastern Ontario highlighted effects on water management, fish and fisheries www.climateontario.ca/w_APEO.php; See also *Fish, Fisheries, and Water Resources: Adapting to Ontario's Changing Climate* (2011) on www.mvc.on.ca/conservation-education/climate-change/80-current-projects

Annex 2: Watershed Governance, Regulatory Framework and Key Agencies

Water environment resources are managed by all three levels of government, working closely with the Conservation Authorities. Jurisdictional responsibilities are outlined in the table below, followed by a description of roles, relevant legislation and key programs.

Agency	Water-related Jurisdiction
Federal	
Environment Canada (EC) (freshwater management)	<ul style="list-style-type: none"> • national policies and standards (environment and health) • water resource quantity and quality monitoring and data/information (with provincial/territorial counterparts)
Fisheries and Oceans Canada (DFO)	<ul style="list-style-type: none"> • protection of fisheries habitat (frequently delegated to CAs)
National Capital Commission (NCC)	<ul style="list-style-type: none"> • managing federal lands in the national capital (incl. greenbelt)
Parks Canada (PC)	<ul style="list-style-type: none"> • managing water on federal lands (e.g. Rideau Canal)
Transport Canada	<ul style="list-style-type: none"> • navigable waters
Provincial (Ontario)	
Ministry of Agriculture, Food and Rural Affairs (OMAFRA)	<ul style="list-style-type: none"> • agricultural policy • drainage • nutrient management (promotion)
Ministry of Environment (MOE)	<ul style="list-style-type: none"> • drinking water protection • water supply (permits to take water) • water pollution control (ground and surface) • environmental assessment approvals (including Municipal Class EAs)
Ministry of Municipal Affairs and Housing (MMAH)	<ul style="list-style-type: none"> • creation and authority of municipalities • municipal planning (consistent with Provincial Policy Statement) • planning and housing
Ministry of Natural Resources (MNR)	<ul style="list-style-type: none"> • water levels and flows • natural hazards (floods, low water, erosion etc.) • natural heritage and ecosystem restoration • species at risk/ endangered species • watershed planning and management (delegated via CA Act) • Provincial parks • water use and thermal and waterpower development
Municipal/ Local (Ontario)	
City of Ottawa	<ul style="list-style-type: none"> • treatment and distribution of drinking water within the City of Ottawa • collection and treatment of urban and rural water, sanitary and storm water, and drainage infrastructure within the City of Ottawa • protection of natural heritage through control and coordination of land use activities and other management within the City of Ottawa
Conservation Authorities	<ul style="list-style-type: none"> • watershed planning and management • alterations to wetlands, rivers, ravines or streams • fish habitat (delegated authority)¹ • natural hazards (flood plain management, hazardous slopes, unstable soils) (delegated authority)
<p>As part of Phase 2, an analysis of the water-related Jurisdictions within Quebec will be undertaken, including a review of roles and responsibilities of the Province of Quebec, Quebec watershed agencies, the City of Gatineau and surrounding municipalities as they pertain to stewardship of the Ottawa River watershed.</p>	

Key Agencies - Roles, Services and Relevant Legislation

City of Ottawa

Guided by the *Municipal Act*, Official Plan and the Provincial Policy Statement (PPS), the City of Ottawa is responsible for environmentally sustainable land use planning and development; the protection of natural systems; the management of water-related infrastructure (drinking, waste and storm water); and compliance, monitoring and reporting.

The PPS (Policy 2.2.1), revised in 2014, directs planning authorities to protect, improve or restore the quality and quantity of water by:

- a) using the watershed as the ecologically meaningful scale for integrated and long-term planning, which can be a foundation for considering cumulative impacts of development;
- b) minimizing potential negative impacts, including cross-jurisdictional and cross-watershed impacts;
- c) identifying water resource systems consisting of ground water features, hydrologic functions, natural heritage features and areas, and surface water features including shoreline areas, which are necessary for the ecological and hydrological integrity of the watershed²;
- d) maintaining linkages and related functions among ground water features, hydrologic functions, natural heritage features and areas, and surface water features including shoreline areas;
- e) implementing necessary restrictions on development and site alteration to:
 - protect all municipal drinking water supplies and designated vulnerable areas; and
 - protect, improve or restore vulnerable surface and ground water, sensitive surface water features and sensitive ground water features, and their hydrologic functions;
- f) planning for efficient and sustainable use of water resources, through practices for water conservation and sustaining water quality;
- g) ensuring consideration of environmental lake capacity, where applicable; and
- h) ensuring stormwater management practices minimize stormwater volumes and contaminant loads, and maintain or increase the extent of vegetative and pervious surfaces.

Recent changes to the PPS³ (effective April 2014) place greater emphasis on the watershed as an appropriate scale for integrated and long-term planning, including considering cumulative impacts of development, and as well as the importance of shoreline areas. The revised PPS (2014) also includes greater emphasis on: green infrastructure (including natural features such as forests and streams, as well as green roofs and other built infrastructure⁴) for ecological and hydrological benefits; stormwater best management practices (including vegetative and pervious surfaces and those that attenuate and reuse stormwater); and planning and adapting for the impacts of climate change.

Several City departments play key roles in the management of the water environment:

Environmental Services Department (Drinking Water; Wastewater; Surface Water, Environmental Business Services branches)

- Operates, maintains, and repairs drinking water, wastewater and stormwater collection and treatment systems, and responds to related emergencies;
- Monitors and reports on surface waters (water chemistry, flow, aquatic biology) as well as quality of treated water, combined sewer overflows, drinking water and landfill leachate;
- Manages the *Municipal Drain* program;
- Maintains ditches, drains and other watercourses outside of the Right of Way (including clearing of debris), and manages stream restoration and rehabilitation projects;
- Develops and facilitates water environment-related strategies in collaboration with other departments/agencies (e.g. Ottawa River Action Plan);
- Prioritizes, coordinates and tracks watershed actions (Subwatershed Studies, EMPs, Stream Restoration)
- Implements stormwater management retrofit programs and participates in the implementation of Source Water Protection Plan;
- Builds public awareness and engagement on water issues;
- Responds and re-directs water-related public inquiries;
- Monitors compliance with and enforces the *Sewer Use By-law* and investigates sewer blockages;
- Monitors compliance with and enforces the *Water By-law* and *Drainage By-Law*;
- Develops, advises and reports on long-term environmental planning and policies, such as Air Quality and Climate Change Plan and the Environmental Strategy;
- Promotes and administers water conservation programs (*Water Loss Control, Water Efficiency*) and residential support programs (*Lead Pipe Replacement, Residential Protective Plumbing* and *Residential Compassionate Grants for Sewer Backups*).
- Administers and/or funds stewardship programs including the City's *Community Environmental Projects Grant Program* and the *Rural Clean Water Grants Program*; and
- Liaises with Conservation Authorities on annual budgets, operational issues, stewardship programs and communications.

Planning and Growth Management Department (Policy Development & Urban Design; Development Review branches)

- Identifies drinking water, wastewater, stormwater and drainage infrastructure needs for growth areas;
- Conducts studies and develops, monitors and revises policies, plans and guidelines to guide growth and the protection of natural resources including the Official Plan, Community Design Plans, Subwatershed plans, Infrastructure Master Plan, drainage plans, stormwater management/ retrofit plans, groundwater plans, Environmental Management Plans and floodplain mapping;
- Reviews and advises on planning applications, such as subdivisions, site plans, and severances, for compliance with Federal, Provincial, and Municipal policies and plans;
- Provides technical and policy advice on integrated environmental issues;
- Undertakes Integrated Watershed Modelling

- Coordinates the City's responsibilities for implementation of Source Protection Plans;
- Consolidates and reports on the *Characterization of Ottawa's Watersheds (COW)* and facilitates data access;
- Acquires and/ or secures land; and
- Liaises with Conservation Authorities on planning, policy and development review.

Infrastructure Services Department (Asset Management; Design and Construction branches)

- Development and implementation of the Wet Weather Infrastructure Master Plan;
- Construction of water-related infrastructure including park re-development, pumping stations, pipes, culverts and stream restoration works; and
- Modelling of sanitary/ combined/ storm collection systems

Public Works (Forestry Services; Traffic Management and Operational Support; Parks, Building and Ground Operations and Maintenance branches)

- Develops and implements Forest Management Strategies and Plans;
- administers and/or funds tree planting programs (including the Green Acres program that is delivered in partnership with the RVCA);
- Maintains roadside drains, culverts and stormwater grates;
- Manages potential harmful effects from road operation (salt management);
- Manages parks, beaches, and pathways, including developing and implementing strategies to reduce the harmful effects of bird waste (e.g. gull wires, geese hazing, park naturalization and public education)

Real Estate Partnerships and Development Office

- Manages the acquisition, leasing and disposition of City property.

Ottawa Public Health

- Ensures the provision of public health programs and services to the citizens of Ottawa, including testing and reporting on water quality at public beaches.

Conservation Authorities

Conservation Authorities (CAs) are watershed-based management agencies that deliver services and programs that protect and manage water and other natural resources in partnership with government, landowners and other organizations. Created under the *Conservation Authorities Act (1946)* of Ontario, CAs promote an integrated watershed management approach balancing human, environmental and economic needs.

Three CAs are responsible for the watersheds in the City of Ottawa boundary: Mississippi Valley; Rideau Valley; and South Nation.

Key services and programs delivered by the CAs include:

- Watershed planning and management, such as a lead role in Source Water Protection Plans;

- Regulation of development in, or adjacent to, watercourses, wetlands and hazardous lands (as per Section 28 of the *Conservation Authorities Act* and Generic Regulations);
- Designated authority to advise on fish habitat protection (as per the *Fisheries Act*)⁵;
- Designated authority for septic system inspections and approvals (under the *Ontario Building Code*);
- Advice to municipalities on land use planning and development related to wetlands, river and stream valleys, woodlands, fish habitat, hazard lands, hydrogeology etc.;
- Emergency planning and response, including flood forecasting and warning, and low water response;
- Assessment of climate change impacts and risks, and development and implementation of adaptation and watershed resilience strategies
- Monitoring and reporting on watercourse condition and subwatershed health;
- Stewardship programs that engage landowners and residents through education, technical advice and/or incentives in waterway clean-ups, tree planting, shoreline naturalization, erosion control and water quality protection;
- Construction and operation of measures to protect or restore fish and wildlife habitat, restore shorelines, reduce water pollution, and protect property from natural hazards such as flooding, drought and erosion; and
- Management of Conservation Areas, including public education programs.

Provincial and Federal Agencies

Government of Ontario

Ministry of Agriculture and Food (OMAF)

- Drainage Act (1990) - regulates Municipal Drains⁶.
- Nutrient Management Act (2002) and promotion of best management practices to protect rural land and water resources, including Environmental Farm Plans

Growing Forward 2 - a comprehensive federal-provincial-territorial framework aimed at encouraging innovation, competitiveness and market development in Canada's agri-food and agri-products sector. It includes cost-share grants for environmental initiatives and is delivered by the Ontario Soil and Crop Improvement Association in Ontario.

Ministry of Environment (MOE)

MOE regulates activities to protect air, land and water to ensure healthy communities, ecological protection and sustainable development. The Ministry is responsible for providing and/or regulating the provision of safe drinking water and protecting fresh water resources from pollution.

MOE's water-related regulatory responsibilities include:

- *Clean Water Act* (2006) - protects drinking water at the source and safeguards human health and the environment;

- *Ontario Water Resources Act* (1990) - regulates sewage disposal and 'sewage works', prohibits the discharge of polluting materials into water supply, regulates permits to draw water from ground or surface water sources, approves and regulates wells and water works;
- *Water Opportunities Act* (2010) – encourages the creation and export of innovative clean water technology, promotes water conservation, attracts economic development and creates jobs;
- *Environmental Protection Act* (1990) – promotes sustainable development through pollution prevention and the protection of the environment and human health;
- *Environmental Assessment Act* (1990) – requires an environmental assessment of any major public sector undertaking that has the potential for significant environmental effects (including public roads, transit, wastewater and stormwater installations);
- *Safe Drinking Water Act* (2002) – protects human health through the control and regulation of drinking-water systems and drinking-water testing;
- *Nutrient Management Act* (2002) – provides a comprehensive nutrient management framework for agricultural industry, municipalities and other generators of materials containing nutrients, including clear environmental protection guidelines. MOE monitors and enforces the Act;
- *Pesticides Act* (1990) - reduction and elimination of harmful pesticides, lessening the impact on the environment and on human health.
- *Great Lakes Protection Act (draft 2013)* – protects and restores the ecological health of the Great Lakes-St. Lawrence River Basin, and creates opportunities for individuals and communities to become involved.

MOE coordinates key programs such as:

- Source Water Protection Program – Development and implementation of collaborative, locally-driven, watershed-based drinking water source protection plans founded on sound science to effectively protect drinking water sources (lakes, rivers and aquifers);
- Provincial Water Quality Monitoring Network – a partnership of 36 CAs, municipalities and parks that collects information on stream water quality from over 400 locations across Ontario;
- Provincial Groundwater Monitoring Program - a partnership of 36 CAs and 10 municipalities (in areas not covered by a CA) that collects and manages baseline groundwater levels and quality information from key aquifers across Ontario;
- Ontario Drinking Water Stewardship Program - financial assistance to farmers, landowners, and small or medium businesses for activities that reduce threats to local drinking water sources;
- Permit to Take Water Program - approves permits to take water from lakes, rivers, streams or groundwater sources to ensure access to a clean, safe sustainable supply of water;
- Ontario Great Lakes Strategy (2012) and Great Lakes Guardian Community Fund
- Stormwater Management Planning and Design Manual (2003);
- Showcasing Water Innovation Program - funds leading edge, innovative and cost-effective solutions for managing drinking water, wastewater and stormwater systems.

Ministry of Municipal Affairs and Housing (MMAH)

MMAH has regulatory responsibility for the:

- *Municipal Act* (2001) – governs the establishment and authority of municipalities.
- *Planning Act* (1990) - provides the legislative framework and tools for municipal land use planning and development. Requires that municipal planning be consistent with the Provincial Policy Statement (PPS), which includes policies related to the wise use and management of resources, and protecting public health and safety. Proposed changes to the 2005 PPS were released for consultation in 2012 as part of the PPS’s regular review.

Ministry of Natural Resources (MNR)

MNR strives to maintain a healthy environment that is naturally diverse and supports a high quality of life through sustainable development of natural resources, including water. With respect to water, it ensures the integrated and sustainable management of surface waters and their hydrological functions; supports sustainable use of water resources (e.g. hydropower and dams); and protects people, property and natural resources from water-related hazards (floods, droughts and erosion).

MNR has regulatory responsibility for the:

- *Conservation Authorities Act* (1990) - empowers CAs to establish and undertake programs designed to further conservation, restoration, development and management of natural resources (other than gas, oil, coal, and minerals) through a watershed approach;
- *Lakes and Rivers Improvement Act* (1990) – regulates the management, protection, preservation and use of the waters of the lakes and rivers of Ontario;
- *Endangered Species Act* (2007) – protects species at risk and their habitats; and
- *Public Lands Act* (1990) – regulates Crown land use planning, lands management, sales, development.
- *Invasive Species Act (draft 2014)* - supports the prevention, early detection, rapid response and eradication of invasive species in the province.

MNR coordinates key programs such as:

- Surface Water Monitoring Centre – monitor, assess and report on surface water flows and levels;
- Provincial Flood Emergency Response Plan;
- Low Water Response - co-ordinates provincial efforts and supports local responses in the event of low water conditions or a drought (via Conservation Authorities);
- Water Resources Information Program (WRIP) - works with a variety of partners to support the collection, management and use of digital information about water;
- Natural Heritage Information Centre (NHIC) - compiles, maintains and distributes information on natural species, plant communities and spaces of conservation concern in Ontario;
- Ontario Wetland Evaluation System –determines whether a wetland should be considered ‘provincially significant’ under the Provincial Policy Statement;
- Establishing and maintaining protected areas in Ontario.

- Land Stewardship and Habitat Restoration Program – supports organizations to undertake land stewardship and habitat restoration for biodiversity conservation.
- Species at Risk Farm Incentive Program and Stewardship Fund
- Conservation Land Tax Reduction Program - supports the long-term private stewardship of provincially significant conservation lands by providing property tax relief to landowners who agree to protect the natural heritage values of their property; and
- Guidance and policies on watershed planning, ecosystem restoration, natural heritage protection, water quantity and flows, the management of shorelines, stream corridors and natural hazards (including flooding and erosion), as well as water control infrastructure.
- Researching potential impacts of changes in temperature and precipitation on forests, fisheries, wildlife, invasive species and species at risk and creating an online interactive map that demonstrates potential changes to Ontario's climate.

Federal Government

Environment Canada

Environment Canada sets national policies and standards for environment and health and undertakes water resource quantity and quality monitoring and data/information programs in cooperation with its provincial and territorial counterparts.

Fisheries and Oceans Canada (DFO)

The federal *Fisheries Act* (1985) aims to maintain or enhance the ecological integrity of aquatic ecosystems notably through the prohibition of harmful alteration, disruption or destruction (HADD) of fish habitat. CAs are frequently the delegated authority for DFO in Ontario, and depending on their level of delegation, review projects and recommend measures to mitigate any impacts to fish habitat. The *Act* was amended in 2012, yet policies and regulations have yet to come into force.

Parks Canada (PC)

PC manages and protects National Parks, Marine Conservation Areas and Historic Sites including the Rideau Canal, designated as a Canadian Heritage River. The Rideau Canal National Historic Site of Canada Management Plan outlines steps to manage water levels in the Canal and protect the ecosystem. PC's 2013 Rideau Corridor Landscape Strategy looks at a coordinated approach to protecting the Rideau Corridor.

National Capital Commission (NCC)

The NCC owns and manages 168 km² of land within the City's boundaries (6% of our total area) through the Federal Land Use Plan, Greenbelt Master Plan and Plan for Canada's Capital.

Transport Canada

The *Navigable Waters Protection Act* (1985) was designed to protect the public's right to navigation and marine safety in Canada's navigable waters. Amendments in 2012 limit the *Act's* application to works in certain navigable waters (three oceans, 97 lakes and 62 rivers).

Interprovincial Agencies

Quebec

In recognition of our shared stewardship of the Ottawa River, the City engages in discussions with the City of Gatineau on a regular basis, at both the staff and Council level, on a number of initiatives that affect the Ottawa river. .

The Phase 1 Water Environment Strategy has focused on Ontario watercourses that flow through the City of Ottawa's boundaries, many of which run into the Ottawa River. Phase 2 of the Water Environment Strategy will include a more detailed analysis of the roles, responsibilities and planned actions of the relevant Quebec agencies with respect to stewardship of the Ottawa River.

Agencies that will be engaged as part of Phase 2 may include:

1. City of Gatineau/ Ville de Gatineau
2. Les Collines-de-l'Outaouais Regional County Municipality (includes Cantley, Chelsea, L'Ange-Gardien, La PêcheNotre-Dame-de-la-Salette, Pontiac, Val-des-Monts)
3. Quebec Ministry of Sustainable Development, Environment, Wildlife and Parks
4. Agence de bassin versant des 7 (Agency of 7 Watersheds) – covers the Gatineau River, part of the Outaouais river as well as the Blanche, Quyon, Noire, Coulonge et Dumoine Rivers

Canadian Council of Ministers of the Environment (CCME)

CCME is a minister-led intergovernmental forum that develops national strategies, norms, and guidelines that each environment ministry across the country can use, including for example:

- Canadian Environmental Quality Guidelines (an updated version of the Canadian Water Quality Guidelines);
- National water quality index as a means to provide consistent procedures for Canadian jurisdictions to report water quality information to both management and the public;
- Agreement to prohibit the export in bulk of water from Canadian watersheds;
- National action plan to encourage municipal water-use efficiency;
- Policy on the Management of Toxic Substances;
- Multi-barrier approach to the protection of drinking water for Canadians.

Current issues being examined include by the CCME are: biosolids management; water monitoring adaptation needs arising from climate change; framework for sustainable groundwater management; inter-jurisdictional collaboration on nutrients; improved capacity of jurisdictions to apply integrated watershed resource management; managing municipal wastewater effluents; water quality guidelines and protocols; and intergovernmental approaches to water issues in Canada.

¹ The *Fisheries Act* was amended in June 2012 and policies and regulations are under development. The effect on Section 35, which regulates the harmful alteration, disruption or destruction of fish habitat, has yet to be seen.

² The Provincial Policy Statement defines surface water features as water-related features on the earth's surface including headwaters, rivers, stream channels, inland lakes, seepage areas, recharge/discharge areas, springs, wetlands and associated riparian lands. Ground water features are water-related features in the earth's subsurface including recharge/discharge areas, water tables, aquifers and unsaturated zones.

³ <http://www.mah.gov.on.ca/AssetFactory.aspx?did=10463>

⁴ *Green infrastructure* can include components such as natural heritage features and systems, parklands, stormwater management systems, street trees, urban forests, natural channels, permeable surfaces, and green roofs.

⁵ As per previous note, the effects of 2012 changes to the Fisheries Act have yet to be seen as policies and regulations have not yet come into force.

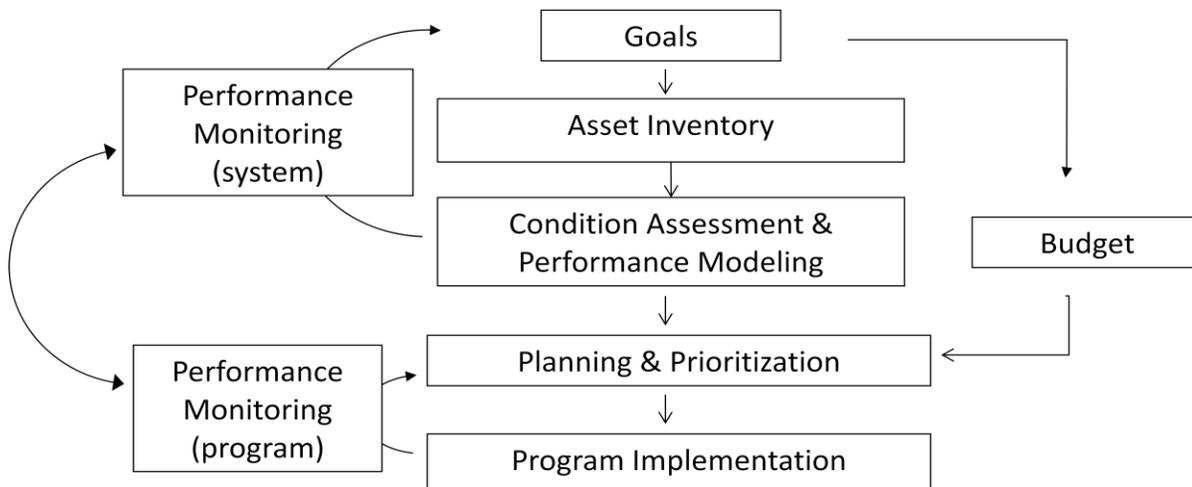
⁶ Approximately 25% of the City's 4,500 km of streams are Municipal Drains

Annex 3: Applying Asset Management to Natural Systems

Asset Management is a well accepted approach for managing infrastructure “to efficiently allocate generally insufficient funds amongst valid and competing needs”¹ (Figure 1).

According to the City’s Comprehensive Asset Management Program “the objective of asset management is to apply “the right intervention, on the right asset, at the right time”, in a manner that considers affordability and risk”².

Figure 1: Asset Management System³



The City’s Comprehensive Asset Management approach requires the City to define the:

- Inventory and value of the assets needed to support delivery of services;
- Asset condition and expected remaining service life;
- Level of service expectations, costs, and what needs to be done to achieve those levels;
- Required interventions and when these are most appropriate to sustain the service;
- Cost to acquire, operate, maintain and renew while maintaining an acceptable level of risk;
- Appropriate investment levels to ensure long-term affordability.

To date asset management has focused on ‘built’ infrastructure. The application of asset management to natural systems is relatively new, but uses the same principles to value and invest in natural assets (or natural capital⁴) to protect the services they provide. Watershed asset management would guide priority-setting for Ottawa’s water environment (streams, rivers, wetlands and associated lands) through acquisition (or securement), protection through zoning and land use policies, maintenance, remediation or restoration.

The *Characterization of Ottawa’s Watersheds* provides the asset inventory for the City’s watersheds. Site-specific information is collected by numerous sources (e.g. baseline monitoring done through the City’s Water Environment Protection Program, provincial, federal and Conservation Authority data etc.), and consolidated in a shared information management system that can be used to guide planning and prioritization across the corporation and watersheds.

There are several key differences when applying asset management to natural systems as compared to built systems. First, understanding how natural systems function and assessing their condition is complex, multi-faceted, and requires interdisciplinary analysis. Second, determining the value of natural assets is challenging, since it is difficult to measure all the benefits. Third, environmental assets do not need to be replaced or disposed of; with proper management the value of these assets and the services they provide, increases.

Ottawa can learn from the experience of other local governments. Councils in Australia are starting to use asset management to manage creeks, streams and other waterways in part out of recognition of their stormwater drainage and conveyance services⁵. The City of North Vancouver is considering integrating natural capital valuation into its Official Community Plan to assist in the management of ecosystem services⁶.

A key concept of asset management is understanding asset value. The direct benefits of safe, adequate supplies of water are known, and governments invest heavily in infrastructure to test, treat and distribute clean drinking water. However, the value of the broader water environment is less apparent, and, as a result, often not as well resourced⁷.

Water Assets in the City of Ottawa include

- 4,500 km of creeks, streams and other watercourses (incl. 1,200 km of municipal drains)
- 2,900 km of drinking water pipes, 2 purification plants and 5 communal wells
- 2,700 km of sanitary sewers and 1 treatment plant
- 2,500 km of storm sewers, 5,680 culverts and
- 150 stormwater management ponds

Healthy aquatic ecosystems provide a host of services that protect and support the City's residents, property and infrastructure. Wetlands, streams, rivers and their surrounding land improve water quality, reduce flooding and excessive soil erosion⁸, recharge groundwater aquifers, and provide habitat for fish and wildlife.

Healthy ecosystems can also reduce the demands on City infrastructure and services (stormwater systems, drinking water purification and wastewater treatment for example), raise property values, boost tourism income, sustain food production and build a vibrant quality of life for residents.

Finally, the goal of asset management is to guide decision-making and actions. This requires a decision framework or priority setting process that systematically builds on the best available information to get the best 'bang for the buck' from scarce resources. This is particularly challenging for natural systems given the complexity of information, disciplines and jurisdictions. The proposed asset management system will therefore be built incrementally, through manageable steps and ongoing adaptive measures.

Valuing Natural Systems

- Ottawa's urban forests provide an equivalent of four million m³ of stormwater storage per year, with an estimated value of \$19 million annually. The forest's contribution to removing air pollutants was valued at \$4 million annually, in addition to carbon storage and sequestration .
- Using modeling to predict the cumulative effects of wetland loss, a hydrological study in the Rideau Valley estimated that wetlands in the watershed reduce the 1:100 year flood by roughly 10% .
- The value of the services provided by the Lake Simcoe watershed has been estimated at a minimum of \$975 million dollars annually and by the Credit River Watershed at least \$371 million per year . These services include water supply, nutrient cycling and atmospheric regulation and many others.
- Studies in Guelph, Vancouver, Philadelphia and Portland found that green infrastructure that captures rainwater at the source can be considerably more cost effective than conventional stormwater approaches.

¹ U.S. Department of Transportation (1999) *Asset Management Primer*
www.fhwa.dot.gov/infrastructure/asstmgt/amprimer.pdf

² [2012 State of the Asset Report \(Draft Comprehensive Asset Management Program\)](#)

³ Adapted from U.S. Department of Transportation (1999) *Asset Management Primer*

⁴ Natural capital includes natural areas such as streams, forests and wetlands that provide ecological goods and services, whereas 'green infrastructure' typically refers to built systems such as green roofs or rain gardens that mimic ecological services.

⁵ www.urbanwater.info

⁶ <http://www.cnv.org/CityShaping/papers/Discussion%20Paper%20-%20Sustaining%20Our%20Natural%20Capital.pdf>

⁷ Typically organizations invest 2-4% of the replacement value of capital assets in their annual operations and maintenance. A low estimate of the value of Ottawa's creeks and streams is \$3 billion, which would suggest an annual operating and maintenance budget of \$50 million (*Adaptive Management of Stream Corridors in Ontario*. Ontario Ministry of Natural Resources, 2001. pp.12-3).

⁸ Erosion is a natural process that enables sediment and nutrient transfer and supports aquatic habitat; the problem occurs when excessive run-off interferes with the natural functioning of the ecosystem.

Annex 4: Learning from Best Practices

The Water Environment Strategy was informed by a review of best practices and experience across Canada and globally. Integrated Watershed Management and similar multi-stakeholder, locally-driven and ecosystem-based approaches are increasingly being used to address complex environmental issues and promote community safety, prosperity and sustainability¹.

Examples of Strategies, Plans and Programs that reflect best practices in integrated approaches to managing and protecting the water environment are summarized in Table 1 below.

Trends in Integrated Watershed Management (IWM)

In Ontario, Conservation Authorities (CAs) have been operating for more than 60 years providing leadership and mobilizing stakeholders to manage and protect water resources. A 2010 study conducted by Conservation Ontario (representing 36 CAs), the Ministries of Environment and Natural Resources, and the Department of Fisheries and Oceans Canada reviewed the practice of IWM and recommended ways to strengthen a more consistent approach to IWM in Ontario and effectively manage climate change, population growth, urbanization and aging infrastructure.

“Integrated Watershed Management is managing human activities and natural resources in an area defined by watershed boundaries aiming to protect and manage all natural resources and their functions today and into the future”²

Global shifts from traditional policy perspectives to Integrated Watershed Management³	
FROM	TO
Sectoral management	Integrated management
Top-down change	Stakeholder and demand-responsive change
Supply fix	Demand management
Command and control	More Cooperative or distributive governance
Closed, expert-driven management organizations	More open, transparent and communicative bodies

Evolution of Key Watershed Issues in Ontario

1960s & 1970s	water quantity and flooding of property
1980s	stormwater management, erosion and sediment control from development, aquatic habitat, water quality
1990s	aquatic habitat, water temperatures, baseflow, riparian systems, natural infrastructure (woodlands, wetlands) and watershed management plans
2000s	impacts of climate change, need for social marketing, green infrastructure, sustainable watershed assessment tools
2010s	effective collaboration, better governance, shared responsibilities and sustainable outcomes

Issues, Challenges and Strategic Shifts

Key barriers and gaps that limit the effective implementation of Integrated Watershed Management in Ontario include:

- data gaps (or lack of data access);
- insufficient resources (time, funding, expertise);
- ever-emerging provincial legislation that was/is single issue or sector based;
- social and economic science linkages; and
- sustained public and political support.

The Conservation Ontario paper called for several strategic shifts to address these gaps and challenges including:

Shifts in Integrated Watershed Management Scientific Assessment

- to fill key gaps, including to increase understanding of economic, social and environmental integration;
- to focus on the implementation of watershed plans (as opposed to their creation) together with regular monitoring, evaluation and reporting to measure progress against goals, objectives and targets;

Shifts in Governance

- adopting an Adaptive Co-Management approach which recognizes the complementary roles of organizations in water management and associated natural resources and includes the following elements:
 - learning by doing;
 - information sharing;
 - collaboration and shared decision-making;
 - partnering at regional and national levels; and
 - flexibility in management approaches.

A 2012 Conservation Ontario discussion paper reiterated these challenges and spoke to issues of provincial funding and policy support and interpretation.⁴

Non-governmental organizations such as the Canadian Water Resources Association, Polis and Pollution Probe echo the need for improved inter-agency coordination, as well as shared responsibility and engagement with the broader watershed community.

Table 1: Examples of Water Environment Strategies, Plans and Programs

Strategy/ Plan/ Program	Description	Relevance
<p>Great Lakes Strategy (2012), proposed Great Lakes Protection Act (2013) and Great Lakes Guardian Community Fund</p>	<p>Ontario's Great Lakes Strategy aims to protect and restore the ecological health of the Great Lakes-St. Lawrence River Basin. It includes more than 100 actions to achieve 6 long term goals:</p> <ul style="list-style-type: none"> • engaging and empowering communities; • protecting water for human and ecological health; • improving wetlands, beaches and coastal areas; • protecting habitats and species; • enhancing understanding and adaptation; and, • ensuring environmentally sustainable economic opportunities and innovation <p>The Strategy strengthens coordination and collaboration amongst provincial agencies, and with municipalities, Conservation Authorities, aboriginal communities, and other stakeholders, and promotes community engagement.</p> <p>The Great Lakes Guardian Community Fund provides grants to help communities take action to protect and restore and the Great Lakes and St. Lawrence Basin.</p> <p>The proposed Great Lakes Protection Act⁵ would provide authority to create a multi-stakeholder Great Lakes Council to guide the Strategy's implementation, set targets and identify priorities, create opportunities for individuals and communities to become involved, and ensure the Strategy is updated on a regular basis.</p>	<ul style="list-style-type: none"> • Includes the Ottawa River and its subwatersheds • Integrated ecosystem approach • Multi-stakeholder/ inter-agency approach • Community Grants Fund to support action • Renewal based on ongoing monitoring of strategy implementation and watershed health
<p>Actions for Watershed Health - Portland</p>	<p>A 5 year plan to plan, protect and restore the city's natural resources as vital assets similar to roads, pipes and other city infrastructure. Portland Watershed Management Plan</p>	<ul style="list-style-type: none"> • Integrated Watershed Management • Asset

Strategy/ Plan/ Program	Description	Relevance
Watershed Management Plan (2012-2017)	<p>Healthy watersheds seen as the solution to many urban problems including stormwater management, flooding, air pollution and urban heat effects and promote community safety, prosperity and sustainability.</p> <p>Rolling 5 year plans are based on a Framework for Integrated Management of Watershed Health which includes a comprehensive watershed inventory and condition assessment and clear goals and objectives. Plans are implemented by several City departments and with close collaboration with the community.</p> <p>Portland's Community Watershed Stewardship Program engages residents, naturalize streams and provide incentives for more residential stormwater management.</p>	<p>Management</p> <ul style="list-style-type: none"> • Inventory of watershed condition • Inter-agency and inter-department approach • Active community stewardship programs • 'Green infrastructure'/ natural urban stormwater management
<i>Clean Water Act</i> (2006) and Source Protection Plans	<p>The Walkerton drinking water crisis in 2000 prompted a re-thinking of how water resources must be protected and managed. An independent review commissioned by the Government of Ontario called for a series of strategic shifts to: strengthen government-wide leadership; adopt a place-based or watershed approach with a focus on environmental outcomes; include both regulatory and non-regulatory tools and incentives; and share responsibility amongst governments, NGOs, the public and the scientific community.</p> <p>One result was the Clean Water Act and the Drinking Water Source Protection Program that takes an integrated, multi-stakeholder approach to protecting drinking water. Investing in healthy watersheds and protecting aquifers, rivers and lakes from contamination or overuse complements water monitoring, treatment and distribution. Watershed-based Source Protection Committees guide the development of local plans based on environmental science.</p>	<ul style="list-style-type: none"> • Local, integrated watershed approach • Government-wide leadership and enhanced stakeholder collaboration • Science-based plans

Strategy/ Plan/ Program	Description	Relevance
<p><i>Lake Simcoe Protection Act</i> (2008) and Plan (2009)</p>	<p>The <i>Act</i> was the first legislation in Canada to focus on a watershed.</p> <p>Building on consultation with citizens and expert advice from scientists, the plan sets a new standard for environmental protection of a watershed and provides a roadmap for helping to restore and protect the health of Lake Simcoe.</p>	<ul style="list-style-type: none"> • Ecosystem and subwatershed approach to determine priorities • Adaptive management • Shared responsibility
<p>Vancouver Greenest City 2020 Action Plan</p>	<p>As part of the clean water goal under the Greenest City 2020 Action Plan, the City of Vancouver includes the development of integrated rainwater management plans, reflecting a shift from conventional stormwater management approaches to one where rainwater is valued as a resource. Actions promote rainwater capture and infiltration, to recharge natural systems and reduce the amount of water and sediment in the stormwater sewer system.</p>	<ul style="list-style-type: none"> • Rainwater/ stormwater management
<p>Sustaining Natural Capital, North Vancouver</p>	<p>The City of North Vancouver is considering integrating natural capital valuation into its Official Community Plan to assist in the management of ecosystem services. Discussion Paper (2011)</p>	<ul style="list-style-type: none"> • Asset Management for natural systems • Valuation of natural assets
<p>Water Sensitive Urban Design in Australia</p>	<p>Councils in Australia are starting to use asset management to manage creeks, streams and other waterways in part out of recognition of their stormwater drainage and conveyance services. www.urbanwater.info</p>	<ul style="list-style-type: none"> • Asset Management for natural systems
<p>Fraser Basin Council and Strategic Plan</p>	<p>The Fraser Basin Council is a collaboration of four orders of government (federal, provincial, local and First Nations) along with those from the private sector and civil society that works to find solutions to longstanding issues and conflicts and take advantage of opportunities to advance sustainability in the Fraser River Basin.</p> <p>The Fraser Basin Strategic Plan focuses on the following outcomes:</p>	<ul style="list-style-type: none"> • Long-term collaborative partnerships

Strategy/ Plan/ Program	Description	Relevance
	<ul style="list-style-type: none"> • Climate Change and Air Quality: fewer greenhouse gas and other emissions, improvement in air quality, and community adaptation to a changing climate; • Healthy Watersheds and Water Resources: improved water quality, water supply or water conservation; and • Sustainable and Resilient Regions and Communities: local sustainability and improved regional and community resilience; 	

¹ Bakker, Karen. (2007) *Eau Canada: The Future of Canada's Water*. UBC Press: Vancouver

² Conservation Ontario (2010), *Integrated Watershed Management: Navigating Ontario's Future* pp. 6

³ Conservation Ontario (2010), *Integrated Watershed Management: Navigating Ontario's Future*

⁴ Conservation Ontario (2012), *Watershed Management Futures for Ontario*

⁵ The proposed Great Lakes Protection Act 2012 did not proceed due to prorogation of the Legislature; it was reintroduced in 2013.