


Tackling Combined Sewer Overflows: A Toolkit for Community Action



Ottawa RIVERKEEPER®
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In collaboration with:  OUR LIVING WATERS

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Chapter 1: Purpose

Introduction

This toolkit is intended to assist communities in reducing the combined sewer overflows to their local waterbodies. The work by the City of Ottawa and Ottawa Riverkeeper to reduce waste discharges to the Ottawa River is used as a case study to understand the steps and essential elements to take action. Although each community and each local waterbody is unique, there are themes and solutions that can be adapted across a wide range of situations.



Why reduce CSOs?

Combined sewer overflows convey untreated wastewater and stormwater directly into waterbodies. This water typically contains untreated human sewage, industrial wastes, toxic substances and debris from sanitary sewage and street rubbish. Possible consequences of combined sewer overflows include human health risks when beach users and recreational water users are exposed to contaminated water. Aquatic life can also be affected by combined sewage when habitat quality declines, for example by reducing the dissolved oxygen levels that are essential in water for fish and other life-forms. Sediments along the river or lake bottom can become contaminated and provide a source of on-going toxic effects even when overflows are not occurring. Plastics, fuel slicks and other debris can also harm aquatic animals and their habitats. The aesthetic quality of rivers and lakes is reduced by floating debris. Repeated overflows can affect community revenues from recreational facilities, tourism, and commercial and recreational fisheries. Reduction or elimination of combined sewer overflows provides benefits to communities and aquatic ecosystems.

Overview of the Toolkit

The toolkit has eight chapters, including this introduction to the purpose of this document. Subsequent chapters are:

- **Chapter 2:** Combined Sewer Overflows: What are they? Since there are numerous on-line resources about combined sewers, including diagrams and videos, Chapter 2 provides a brief overview of combined sewers along with links to other resources to find out more.
- **Chapter 3:** Why has this problem not been solved already? This chapter outlines key challenges that community members should be aware of with respect to combined sewers, not to discourage but to be fully prepared so effective action can be taken.
- **Chapter 4:** Who is responsible for solving the problem? Chapter 4 provides an overview of the responsibilities of municipalities, including record-keeping and reporting to senior government levels on CSOs.
- **Chapter 5:** A Roadmap Overview. The eight steps in the roadmap to addressing CSOs are described in this chapter.
- **Chapter 6:** The City of Ottawa Case Study. The City of Ottawa's CSO story provides a case study on how the roadmap steps rolled out to mitigate the effects of overflows on the Ottawa River.
- **Chapter 7:** Summary of Tools and Resources. This chapter provides information on tools or resources that may be adapted to other regions in Canada to address CSOs.
- **Chapter 8:** Beyond Combined Sewers: Emerging Concepts in Water Management. Chapter 8 briefly raises other water environment issues, in addition to CSOs, that may be of interest to motivated voices for urban water environment protection.

Chapter 2: Combined Sewer Overflows

What Are They?

Combined sewer overflows (CSOs) only occur in urban centers with sewer infrastructure that was built at a time when the effects of waste discharge on water were not well-understood. Combined sewer systems are a legacy from decades past, left for present day communities and their municipal leaders to address. Combined sewers are no longer built; in Ontario, combined sewers have not been allowed by the provincial government since 1985. Many municipalities discontinued the practice of building combined sewers well before the mid-1980s.

More recent subdivisions are instead opting for systems with two separate sets of pipes to carry wastewater:

- 1) **Storm sewers** to carry rain water or other precipitation, such as melted snow, from streets and properties; and,
- 2) **Sanitary sewers** to carry sewage from building plumbing systems, including toilets, sinks, showers, washing machines, industrial processes, laboratories and any other wastes carried by water in plumbing systems.

The storm sewers carry their contents to a stormwater treatment facility before being discharged to a nearby waterbody (i.e. a creek, river, lake or ocean). In older subdivisions with separated sewers, storm sewers carry their contents directly to a nearby waterbody. The sanitary sewers carry sewage to a wastewater treatment facility, except in rare cases where communities have no treatment infrastructure, in which case the sewage is discharged directly to a waterbody.

Combined sewer systems carry a combination of storm and sanitary wastewater. Instead of two separate sewer systems, there is one sewer system. When it rains, the capacity of the single pipe system to carry the storm and sanitary wastes to a wastewater treatment facility can be exceeded. Rather than allowing sewage to back up into basements and other low points in the city, the combined sewer system discharges the waste to a nearby waterbody. This discharge is called a **combined sewer overflow** or CSO (or combined sewage overflow).



Resources

Many resources are available online to more fully understand combined sewer overflows and sewer systems more broadly. Here are some examples:

- [Wikipedia](#) has a good overview of combined sewer systems and a range of mitigation techniques.
- The [City of Toronto](#) has a short video demonstrating when CSO conditions occur and [Winnipeg](#) provides diagrams to explain its combined sewage system. Winnipeg also provides a [YouTube video](#) illustrating the system operation and providing an overview of methods to reduce CSO events.
- Other countries also have CSOs. For example, the Henderson Water Utility, Kentucky, has a [flash animation](#) of combined sewers operating under dry and wet conditions. The Metropolitan Sewer District of Greater Cincinnati has a [YouTube video](#) explaining the difference for houses connected to a separate system versus a combined sewer system. The Regional Sewer District of Cleveland has a [short animation](#) of combined sewer operation. Wessex Water in the United Kingdom provides [footage of its control room](#) where CSOs are monitored.

Text Box 1: Terminology

There are many components to sewer infrastructure in addition to pipes that carry the sewage. This [animated video](#) from Richmond Virginia explains terms including inflow, infiltration, regulators or gates that prevent and release flows, diversion structures and retention basins. Other terms include:

Real time control - This term refers to computerized monitoring and control of flows in sewers as the flows change, for example in response to a rain storm. This [video](#) by the Metropolitan Sewer District of Greater Cincinnati provides an overview of its real time control system. The complexity of a real time control system depends on the size and complexity of the sewer system.

Source control - This term refers to pollution prevention, at the source, before pollutants can be released to the sewer system (or elsewhere to the environment). Street sweeping is an example of a source control measure that can reduce the amount of pollution running off streets, especially in the springtime when salt deposits remain on streets from winter snow operations. [Capital Regional District](#) in Victoria BC has a video on source controls for the household. The [City of London Ontario](#) has a video on source control for storm sewers. [CCI Safety](#) in Cleveland Ohio has a video on source control at construction sites and for outdoor storage of materials. The [Canadian federal government](#) has a website with links to a range of pollution prevention resources.

Floatables - This term refers to debris and materials that float on the water surface, such as plastic bags and other street litter. Floatables are removed at wastewater treatment facilities, but are released to waterbodies when combined sewage overflows without treatment. The [United States Environmental Protection Agency](#) identifies some technical solutions to reduce floatables. The ideal prevention measures are source controls so these materials do not enter the sewage system in the first place.

Sewer separation - This term refers to construction projects to replace the single combined sewer pipe with two sewers, one for sanitary sewage and one for stormwater. The choice to separate sewers versus other measures to reduce CSOs depends on many factors, including cost-benefit and technical feasibility. The [City of Vancouver](#) has a website that explains their rationale for separating sewers.

Green infrastructure - This term is used for a wide variety of measures that may or may not pertain to water management. Within combined sewer areas, green infrastructure refers to measures that reduce the amount of rainwater flowing into the sewers. The [City of Vancouver](#) has a video on green infrastructure that goes beyond combined sewage and provides a broader vision for the use of rainwater as a resource.

Dry weather overflow - This term refers to overflows that occur in the absence of precipitation or snow melt; these flows may include both sanitary wastewater and infiltration and inflows, for example groundwater entering sewers from connected foundation drains. Groundwater is normally clean and it takes up space in the sewer pipes that should be reserved for sewage. Dry weather overflows are potentially more harmful than those during rainstorms because they occur when there is less flow in rivers to assimilate the contaminants.

Regulator - This term means a physical structure that directs sewage flows to a wastewater treatment facility or to a waterbody.

Chapter 3: Why is this still a problem?

The problem of CSOs is not new, so why have they not been eliminated already? It is important to appreciate some of the barriers to addressing CSOs in order for communities to undertake effective action plans. There are four key issues to keep in mind: the lack of public awareness; limited technical expertise; high costs; and, long timeframes for planning and implementation.

The first of these challenges is public awareness, or rather a lack thereof. Sewers are buried infrastructure, so they are not top-of-mind in the way roadways or parks are. In addition, when CSOs occur (typically during rainstorms), the sewage discharges to waterbodies may not be easily visible from shore. This lack of public profile typically reduces political support to establish municipal budgets to tackle the CSO problem. Similarly, low public awareness makes it more difficult for champions of the issue to gain traction in public meetings, whether they are within a municipality or outside. However, as described in the Case Study (Chapter 6), the necessary public awareness can be built.

A second challenge can be the technical nature of both the problem and the potential solutions. In order to assist in goal setting, community representatives need to understand the origin of the problem and basic sewer system configurations. While combined sewer systems are conceptually straight-forward, the details of sewer design and operations can be confusing and rife with technical jargon, unfamiliar place names for pumping stations or trunk sewers, and meetings with specialists who do not frequently interact with the public. In smaller communities with combined sewers, the municipality may need to rely on external expertise to obtain advice on potential solutions, so municipal staff members may also need to build their capacity to understand the full nature of the issue and solutions. This Toolkit provides resources to understand the essential technical elements and questions to ask municipal representatives. Useful information may also be available on Municipal websites, for example on unique aspects of local sewer systems.

A third challenge is the high cost of solutions. One factor is the location of sewage pipelines underground.

Typically, they are deeper than other utilities (e.g. potable water lines, gas lines, and power and telecommunications cables) which must be removed, protected and/or tunnelled under for sewer work to proceed. Another factor in the urban core is the narrow street widths, making digging and surface replacement more time consuming, expensive and disruptive. To exacerbate matters, many Canadian communities already face infrastructure deficits and have numerous competing

Text Box 2: Canadian Municipal Infrastructure Deficit

According to the [Canadian Infrastructure Report Card](#), almost 60% of Canada's core public infrastructure (including water, wastewater, roads, and transit) is owned and maintained by municipal governments. These assets are estimated to be valued at \$1.1 trillion dollars, or about \$80,000 per household.

Municipalities responding to a 2016 survey assessed 35% of wastewater infrastructure, including sewers, wastewater treatment plants, and pumping stations, to be in fair, poor or very poor condition. The replacement value of wastewater infrastructure in poor or very poor condition in Canada is estimated to be \$26 billion, while assets in fair condition are valued at an estimated \$56 billion. The replacement value of municipal wastewater infrastructure overall is estimated to be worth \$16,380 per Canadian household.

Current reinvestment rates for wastewater infrastructure will result in a decline over time since less money is being reinvested in repairs and replacements than is needed to maintain the system in perpetuity. This forecast for wastewater infrastructure is not unique among municipal infrastructure assets. Potable water, stormwater, bridges, and sports and recreation facilities were also assessed to have lower rates of reinvestment than needed to prevent future decline in their condition.

priorities for municipal revenues (see Text Box 2).

A fourth factor to keep in mind is the long planning horizon required to fully implement CSO mitigation plans. Once a plan is devised, it can take many years for the system to roll out due to the need for detailed engineering designs, implementation of monitoring and

control devices, complex construction projects, and staff training. During this time, champions for systems improvement must maintain interest in the project.

Chapter 4: Who is Responsible?

In tackling the issue of combined sewer overflows, it is important to recall that the municipality does not generate the combined sewage. The sewage discharged is a combination of sanitary sewage and rainfall generated by the community and weather patterns. Pollutants in the stormwater and sewage come from sources within the community, including anything put down a drain in a household, institution or industry in the community, and substances washed off streets and properties during rainfall. Having said this, municipalities are responsible to manage combined sewers and they do so with funding provided through sewer surcharge rates on water bills and other funding sources available from municipal, provincial/territorial, and the federal governments. Provincial/territorial governments and the federal government also have responsibilities, which are also outlined in this chapter.

Municipalities have some authority to regulate substances deposited by industries and individuals into sewers through a municipal **Sewer Use Bylaw**. However, often the authority to control a pollutant rests with another level of government. For instance, municipalities do not have the authority to regulate consumer products, so when the problem of micro-bead plastics in lakes and rivers was identified, it was up to the federal government to ban these substances from toothpaste and other personal care products. Also, provincial and federal governments regulate the discharges of industrial facilities to waterbodies. It is difficult for municipalities to establish more stringent requirements for industrial discharges to sewer systems under municipal **Sewer Use Bylaws** since it could make the community more expensive relative to other 'competing' locations.

Municipalities also have delegated authority from provincial/territorial governments to approve some land

development projects which, in turn, affect the amount of rainfall running from streets and roofs into sewers. As part of this authority, municipalities are responsible to inspect the infrastructure built for new subdivisions and infill developments (as well as existing sewer systems). Inspections can reveal poor construction practices, such as illegal connections of foundation drains to combined sewers.

Municipalities also have the authority and responsibility to maintain sewer systems; these duties can have a direct influence on the amount of sewage flowing in sewers. For example, cracked sewer lines can increase CSOs because groundwater may flow into the cracks, generating unnecessary flow volumes (see **Dry Weather Overflows** in Text Box 1). Similarly, poorly maintained sewage pumps, flow regulators, or other equipment, can lead to failures that result in sewage bypassing available treatment processes and flowing to a waterbody. Monitoring CSOs and related sewer flow levels by municipalities is important for proper management and assessment of issues and options.

Street maintenance practices can also play a role in protecting the water environment. For example, municipal street sweeping can prevent some road pollutants from entering sewers, especially in spring before road salts from winter operations can get swept into the sewer system (see **Source Controls** in Text Box 1).

Municipalities are responsible to build and replace sewers, regulators, pumping stations and wastewater treatment plants. As communities grow or change, municipalities are responsible to ensure sufficient foresight is brought to capital budget planning so the infrastructure will accommodate future conditions.

Although municipalities have the authority to identify capital budget projects and to set sewer rates, they are required to comply with design practices and other rules stipulated by provincial/ territorial governments and the federal government. Provincial/ territorial governments may establish minimum requirements for CSOs. For example, the province of Ontario sets out requirements for [control and treatment of combined sewer overflows](#).

The federal and provincial/territorial laws governing municipal wastewater management in Canada are not

simple and it is not necessary to understand all the complexities or requirements for communities to take action on CSO management. However, it is very useful to figure out what reports on CSOs the municipality is required to send to senior government levels (i.e. the provincial/ territorial authorities and/or the federal government) and to obtain copies (discussed further in Step 2 of the Roadmap, Chapter 5 following).

Reporting on CSOs is required under a federal government *Fisheries Act* regulation called the [Wastewater Systems Effluent Regulations](#) (WSER). Note that some provinces and territories have agreements with the federal government that affect how the WSER is administered in the province/ territory (See Text Box 3). When reports are submitted to the federal government, Environment and Climate Change Canada (ECCC) is the department responsible for collecting and storing this information. Three **reporting** requirements under WSER are of potential interest:

Text Box 3: Administration of the Federal Fisheries Act Wastewater Systems Effluent Regulation (WSER)

The federal government has created two types of bilateral agreement with provinces/ territories to implement the WSER:

1) Administration Agreement: the province deals directly with municipalities with respect to some of the WSER requirements to prevent duplication. Both the provincial regime and the federal regime remain in place and WSER reports are submitted by the municipalities to ECCC. Two provinces have these agreements in place: New Brunswick and Saskatchewan.

2) Equivalency Agreement and Order-in Council: Where the requirements of a provincial or territorial government are the same (i.e. equivalent) to those of WSER, a bilateral equivalency agreement is put in place and an Order in Council is made declaring that the WSER do not apply in the province or territory. Yukon Territory has this type of agreement in place.

A third arrangement is also noteworthy in that several regions are exempt from the WSER. Exempt provinces, territories and regions include facilities in: the Northwest Territories; Nunavut; Newfoundland and Labrador; and north of the 54th parallel in Quebec (roughly north/west of James Bay).

Note that negotiations between the federal government and provincial jurisdictions are on-going, so additional bilateral agreements with other provinces may be finalized in the coming years.

- 1) Shortly after the regulations were implemented, municipalities were required to identify “the number of overflow points for each of the combined sewers and sanitary sewers of the wastewater system and the latitude and longitude of each of those overflow points”(WSER 18(1)g). This information was sent to Environment and Climate Change Canada (ECCC).
- 2) For each calendar year, municipalities must report “the average daily volume, expressed in m³, of effluent deposited via the wastewater system’s final discharge point “(WSER 18(1)i).
- 3) For some combined sewer systems, operators are required to have a plan “that describes the modifications to be made to the wastewater system, and any other measure to be taken, to reduce... the quantity of deleterious substances [as prescribed in the regulations] in the effluent deposited via overflow points of a combined sewer and a schedule for implementation of the plan” (WSER 25(s)).

The information reported to the federal government department Environment and Climate Change Canada (ECCC) is available upon request through access to information. However, Ottawa Riverkeeper and Swim Drink Fish Canada are working to have ECCC make CSO data publically available without this formal process.

There are additional *record-keeping* requirements under WSER making the municipality responsible to keep records for each overflow point, specifically a record of: each day there is an overflow; the duration or estimated duration of the overflow; the volume of the overflow for each day and for each month; and, the number of days in each month when there was an overflow. The municipality is required to keep the information gathered each year in its records for 5 years.

Text Box 4: Public Right to Know about CSO Events

Ottawa Riverkeeper and Lake Ontario Waterkeeper are proposing that a set of formal sewage alert requirements be implemented by Ontario municipalities because the public has a right to know when waterways and beach quality have been potentially compromised due to combined sewage overflows or other sewage treatment bypass episodes. In addition to environmental protection, CSOs are a public health and safety issue. The alert system ensures transparency to the public about CSOs in the community.

Ottawa Riverkeeper and Lake Ontario Waterkeeper have developed a model CSO alert to guide implementation of public notification and reporting by municipalities. The model alert includes provisions for physical signage indicating outfalls, maps of outfall locations made available to the public, notification of overflow events when they happen, and public notification of monthly and annual trends in CSO events. The suite of measures also includes making the long-term plans of the municipality for CSO mitigation publically available, and consulting with the public on tailoring the alert measures to meet any unique community needs.

Alerts are communicated through available tools, such as text or email to subscribers of the alerts. Kingston and Sudbury are two communities in Ontario that provide an alert service on CSOs to their residents.

See Appendix A for the text of the model alert. The model is written for Ontario municipalities but it also provides useful elements for other jurisdictions.

Other reporting requirements for municipalities pertain to spills to the environment. In Ontario, combined sewer overflow events must be reported to the provincial [Spills Action Center](#) in accordance with Ontario's *Environmental Protection Act*. Although required to report to Ontario's Spills Action Center, this information is not necessarily made public (See Text Box 4).

Many sewer projects must be submitted by municipalities to provincial governments for approval before work can begin. Some municipalities have delegated authority to approve smaller projects on their own. Provincial/territorial and federal governments also frequently contribute funding to large municipal projects. The federal government also supports research and development programs, for example through grants to university researchers to develop or assess technological approaches to control or treat water pollutants. This involvement of senior government levels in project funding, approvals and research means that multiple levels of government are potential sources of information on each community's combined sewer system.



An example of a real-time alert system

Chapter 5: A Roadmap

How can combined sewer overflows be addressed?

The roadmap to CSO solutions entails eight essential elements, described in this chapter. The Case Study of the City of Ottawa (Chapter 6) elaborates on how each of these elements was incorporated into developing a solution to CSOs for Ottawa. A summary of the suite of tools that can be deployed to achieve positive outcomes in other communities is provided in Chapter 7.

Note that progression through these eight elements will not be strictly sequential. In other words, some parallel and some iterative progression should be expected. For example, development of goals, technical options and budget may require several iterations to identify feasible solutions for community-supported goals. Building awareness and public support to address CSOs is an on-going element.

Step 1: Awareness and Public Support

The decision to take action to better manage CSOs rests ultimately with the political leadership of a municipality since municipal councils are responsible for approving budgets and oversight of infrastructure management. An informed and motivated public is key to spurring political engagement on CSOs. The media can also play an important role in drawing attention to CSOs and in keeping the issues in the minds of the public.

To formulate an approach to building awareness and public support, consider the following questions:

- 1. Is there a local politician (at the municipal, provincial/ territorial or federal level) who will champion the issue of CSOs?**

A committed political leader can network with other politicians to raise awareness and discuss the need for budgetary commitments. Community members may need to initiate conversations with

local politicians to identify a political champion. If there is no champion at this level, senior municipal staff could be approached, such as the City Manager, Chief Administrative Officer, Town Clerk, Commissioner of Public Works or similar positions. In the absence of a political or senior management champion, grassroots engagement with the general public will be needed to increase the perceived priority of the issue among this group of municipal leaders.

- 2. Are there local amenities that are potentially affected by CSOs and poor water quality in the waterbody?**

There are numerous potential effects of CSOs, but members of the general public may relate most easily to one or two specific effects that impair their use of the waterbody. Frequent beach closures, the loss of quality boating opportunities or compromised fishing habitats might be attributable to CSOs. Some research may be required to ensure the validity of any stated associations between CSO frequency and a suspected effect. Care is required to ensure the effects identified are based on credible measurements and processes. For example, most municipalities in Canada have rigorous testing protocols for tap water; claims that CSOs have an effect on drinking water quality will likely be readily refuted by municipal potable water testing results.

- 3. Is there a reporter or news media correspondent with an interest in CSOs and their effects?**

Conventional media sources, bloggers and people with a social media following can bring attention to CSOs, help build understanding, and sustain interest in the issue over time.

- 4. Consider organizing activities that raise awareness about the river or lake.**

The more people enjoy and access the water, the greater their appreciation for its beauty and recreational potential. If people are not connected with the water, it is easy for a municipality to simply post signage warning the public to stay away from the

water during CSO events. Activities could include an annual public swim day, a kayaking day, a fishing derby, a sand castle contest or other sporting and artistic events. Also, identifying and promoting viewpoints where members of the public can sit to appreciate the beauty of the water can rekindle peoples' natural inclination to love rivers and lakes.

Step 2: Familiarization

In order to bring about change in the management of CSOs, community members must be familiar with the scope of the problem. Becoming familiar with CSOs in general, along with any particular local features, will build the credibility of community members. It will also help ensure that meaningful public consultation takes place and that an optimum solution can be developed. See Chapter 2 for some resources to become familiar with the terminology and functioning of combined sewer systems. Familiarization includes: A) speaking with municipal contacts; and, B) accessing reports and records that municipalities are required to develop under the law.

A) Familiarization through municipal contacts

As elaborated in the next step, municipal staff plays a pivotal role in CSO management, so developing a collaborative relationship with them is very important. Following are some questions to ask municipal officials to become familiar with local conditions:

1. Is a map of the combined sewer system available to the public?

A map will provide the geographic extent of combined sewer collection system in the community as well as the outfall locations where the overflows to the waterbody occur. Note that combined sewer outlets are typically submerged below the water surface, so mapping is important to be able to identify where the combined sewage enters the waterbody. (The sewer grates that can be seen above the water line along a shoreline are most likely storm-water outfalls.)

2. What plan is currently in place to manage CSOs? What are the primary goals of the plan? When is the plan scheduled to be fully implemented? Has adequate budget been allocated to meet this timeline?

Plans may include both capital and operating budget activities. Activities may include: inspection and maintenance of existing infrastructure; construction of new or replacement infrastructure; monitoring and/or modelling to better understand when CSOs occur and how they can be mitigated. If there is no identifiable plan in place, addressing this gap will be a priority. Under federal regulation, some municipalities are required to have a plan to manage CSOs (See Chapter 4 above). Alternatively, if sufficient budget has not been allocated to implement the plan, funding will need to be addressed. Ask further questions to assess whether the plan is appropriate to achieve stated goals. Assess whether the goals match those of the community. Note that municipal sewer system plans have different names across the country. For example, in Ontario, such plans are often called Municipal Pollution Prevention and Control Plans whereas in British Columbia, the plan may be called a Liquid Waste Management Plan.

3. How are the timing and volume of CSOs estimated by the municipality?

Estimates of CSO volumes may be developed through monitoring and/or computer simulated modelling of the sewer system. Modelling is typically needed to simulate the sewer system flows under various rainfall patterns to predict the rainfall conditions that are likely to result in CSOs. If there is no monitoring or modelling in place, addressing this gap will be a priority in order to come up with options to reduce CSOs. (Also, ask follow-up questions on how the municipality complies with reporting requirements under the WSER - See Chapter 4 above).

4. Do CSOs occur when there is no rainfall (i.e. are there dry weather overflows)?

If CSOs occur during dry weather, it indicates that repairs and maintenance are needed on the sewer system. Sewer repairs may provide a relatively inexpensive way to reduce some of the CSO volume.

5. What other sources of contamination are there to the waterbody?

Identifying other sources of contamination to the waterbody is important in order to engage in discussions on priorities to protect the water environment. Possible other contamination sources include: other municipalities with CSOs to the same waterbody; urban stormwater; agricultural runoff; industrial activities discharging directly to the waterbody (i.e. not connected to the municipal sewer system); municipal wastewater treatment plant releases that do not meet effluent quality standards; other municipal operations (such as landfill leachate or water purification plant waste streams).

6. What public amenities are affected by CSOs? How are they affected?

The location of the combined sewer outfalls along the waterbody may affect the provincial/ territorial requirements for CSO management where the outfalls are upstream of areas used for recreation (beaches, boating, fishing). A map of the CSO outfalls will assist in identifying public beaches, fishing spots, and popular areas for recreational water craft use that are downstream of CSO outfalls. This information on the amenities affected can be used to raise public awareness and to promote implementation of a public notification system (See Appendix A for a model CSO alert).

7. What steps has the municipality taken to promote reduction of pollutants at source?

Source protection measures within the municipality's authority include installing traps in combined sewer area catch basins to reduce floatables from entering the sewer system. Street sweeping and a Sewer Use Bylaw are two of the other measures municipalities can implement for source control.

B) Records kept and reports to senior government levels on CSOs

As discussed in Chapter 4, municipalities are required to keep records on CSO events and to submit reports to senior government levels on the combined sewer system and overflows. Following are some potential sources of information on CSOs in the municipality:

1. Spills Reporting

In Ontario, CSOs must be reported to Ontario under Ontario's *Environmental Protection Act*. What are the responsibilities of the municipality to report CSO events as spills to the environment in your jurisdiction?

2. Wastewater Systems Effluent Regulation (WSER)

Administration of the WSER requirements (described in Chapter 4) varies somewhat among provinces and territories, so some investigation will be required to figure out which government agency has the required reports. That said, most Canadian municipalities must provide reports to the federal department of Environment and Climate Change Canada (ECCC) to comply with the WSER.

When making a request to ECCC for data, one tip is to request the file in Excel or .csv format so it can be analyzed in a spreadsheet.

The first two pages of a response to a request for information from ECCC are provided in Appendix B to demonstrate the type of information that can be expected. The request for this information was submitted to ECCC as follows (in part):

"All Annual Combined Sewer Overflow Reports filed by all wastewater treatment plants located in the cities of Ottawa and Gatineau for the year 2016. These are filed through the Effluent Regulatory Reporting Information System (ERRIS) and are required to be filed under the Wastewater Systems Effluent Regulations."

This sample response provides information on the City of Ottawa's wastewater system (Robert O. Pickard Environmental Centre). In the sample report, all CSO locations have the same System Name (see column 3, Appendix B). The various CSO locations are identified by the latitude and longitude columns (columns 6 and 7 in the report). Municipalities must

report CSOs by month (numbered from 1 to 12 in column 8) so where there has been no overflow in a given month, the report indicates False (column 9) and zero for the number of days and volume of discharge (columns 10 and 11). On page 2 of the sample report, there were oneday overflow events in both August and September of 91 and 49 cubic meters respectively, at a CSO located at 45.4078 latitude and -75.6727 longitude.

In addition to reports to senior government levels, the WSER also requires municipalities to keep records on CSO events, as described in Chapter 4. Requests to the municipality can be made for these records, using access to information mechanisms, if required.

3. Other Information Sources

Depending on the activities of the municipality, there may be a range of other potential information sources. For instance, municipal construction projects are subject to environmental assessments; there may be water quality assessments documented as part of project planning for sewer works. Beach water quality reports may be available through municipal or provincial departments of health. Ducks Unlimited or other science-based organizations may have reports on water quality or habitat features requiring protection.

In 2016, just under 60% of municipalities filed reports to ECCC as required under WSER. Municipalities not reporting may still have the required records in their own files. Municipal officials should be able to answer the following questions:

- Is the municipality reporting as required under WSER to the federal government (or, for municipalities in the Yukon, to Yukon Territory, which has an equivalency agreement)?
- If not, why is the municipality not reporting?
- If not reporting, is the municipality keeping records as required under WSER? These records can be requested, either informally through municipal contacts or formally through an Access to Information request.

Step 3: Collaboration

Collaboration with others is needed to broaden the influence of the community and to bring in expertise and interests of others who can assist in all elements of the work to better manage CSOs. Identify allies in like-minded organizations, among community leaders, and among neighbours. Consider potential contacts in:

- Environmental Non-Government Organizations (ENGOs), such as the Waterkeeper Alliance, Swim Drink Fish Canada, and Canadian Freshwater Alliance
- Neighbouring municipalities and other stakeholders in the watershed
- Local water sports clubs, including sailing, rowing, canoeing, surfing, paddling, swimming, fishing and others
- The artistic community, including musicians, visual artists, performance artists
- Media
- Politicians
- Teachers and school administrators
- University researchers and professors
- Business organizations
- Industrial and other employers
- Health care community representatives
- Municipal staff

Collaboration with municipal staff members is particularly helpful since they know the system and are the most likely source of data on the system's operation. Some members of the municipal staff may already have been raising the issue of CSOs internally. An informed public can help to reinforce the need for capital expenditures to manage CSOs and can ask questions of politicians that may be awkward for municipal staff. For instance, the public can re-raise issues that staff members have raised in the past but that have not been adequately addressed. For example, internal requests for increased budgets to manage CSOs may have been made but not approved. Many municipal wastewater professionals have dedicated their careers to improving water environment protection and take pride in what they do to contribute to this objective. Start with an assumption that they do not want to pollute the water and work to build a collaborative relationship to develop solutions.

Also, bear in mind that it takes courage for municipalities to be transparent about what is happening with its combined sewer system since public reaction to sewage releases is invariably negative. As discussed above, negative public reaction is a precursor to funding approvals to make changes. It is vital that information on CSO events be made public. Municipalities that are being progressive and transparent by providing data and information on sewage releases need to be supported. For instance, community organizations can publically thank the municipality for making CSO information public. They can support sewer rate changes that will fund CSO mitigation infrastructure. Communications from a community organization about the CSO situation may have more credibility with the public than municipal press releases. If you are located in a progressive municipality, investigate how you might assist the municipality in moving forward with CSO a reduction strategy. If your municipality is not taking action, seek out allies among municipal staff members.

Step 4: Goals

What are the goals for protecting the waterbody? Setting goals for CSO management is an iterative process that involves the community and that also takes into consideration many factors, including technical and budgetary issues. Considerations, for instance, include other sources of contamination to the waterbody, the overall cost of various options and identifying the optimal solution in terms of the cost per cubic meter of combined sewage. Goal setting depends on the priorities and problem definition for the sewer system and the receiving water body.

Although goal-setting is iterative, it is a reasonable minimum expectation that dry weather overflows will be prevented. Local conditions will determine whether or not it is desirable to establish an ultimate goal of stopping all combined sewer overflows from entering the river at any time. The size and condition of the waterbody, other stressors (such as the condition of the wastewater treatment facility, stormwater, agricultural sources, and institutional/ industrial pollutants) and other community investment needs will come into consideration. The uncertainty around rainfall patterns in the future as climate change progresses is also a factor in developing an appropriate approach to pro-

tecting waterbodies.

Goal-setting for projects on the scale of combined sewer system rehabilitation warrant public consultations funded by the municipality. Municipalities must meet the minimum requirements but have the discretion to exceed legislated or provincial/ territorial/ federal requirements. As the Ottawa case study shows (Chapter 6), elimination of all overflows was not the ultimate goal established for that community.

Step 5: Planning and Technical Solutions

Step 5 is largely in the hands of the municipal staff and the experts they may engage to model and design solutions. This step is inter-dependent with Step 4 Goals and Step 6, Money. It may be preceded by a period of data collection. Data are needed to properly assess technical solutions. In some cases, the municipality may not have sufficient information on the frequency or volume of combined sewage discharged to local waterbodies. Obtaining this information requires expertise and budgeted resources to monitor and model the system. Further, the nature of the CSO volumes may change from one rainstorm to another, depending on the configuration of the sewer system and the pattern of rainfall as a storm moves through the municipality.

There are a couple of roles community groups can play during this step:

1. Keep up public interest so the process does not stall and the funding is not cut or reallocated to other priorities.
2. Request that options be developed with associated cost estimates so that the public consultation phase (Step 7) can engender meaningful dialogue on the pros and cons of potential solutions. At least one option should include going beyond the regulatory requirements for CSO management.
3. Provide feedback on the clarity of material for public communications. If an option or its rationale is not clear to community members who have become familiar with the issues, communications materials will need revision in order to fulfill a public communications function.

Step 6: Money

A final decision on how much money to allocate to combined sewer system improvements is the responsibility of municipal politicians. However, prior to budget approval, several iterations of budget estimates are developed. High level (rough) cost estimates are developed as part of the engineering design process in Step 5. These estimates are revised as options are refined and further developed as more detailed engineering designs are completed.

Money is identified as a separate step because it is a point of public discussion. As mentioned under Step 3, Collaboration, a community organization can assist in communicating with the public on costs associated with various options and, potentially, a need for rate increases to fund the selected option. Community organizations can also lobby politicians at senior government levels on the need for funding support from provincial/territorial and federal governments.

Step 7: Public Consultation on Options

In this step, the municipality hosts public consultation sessions on options, associated costs and benefits for each solution to improve CSO management. In the City of Ottawa (see Chapter 6, Case Study), three options were presented for during public consultations.

Community organizations can promote participation in the public consultation process through their networks. They can also provide considered input on which of the options they support and the rationale for this support.

Step 8: On-going Attention

After a choice is made and an option has been approved by municipal council, it can take years for the full plan to be implemented. On-going attention is important to ensure the original budget commitments are maintained, even as newly elected municipal councils come into office. It is also important to ensure the public continues to be informed about combined sewage overflows and potential effects on beaches and other water amenities. Also, ongoing events to inspire public ap-

preciation for the local waterbody can continue to be organized and hosted. Connect to the rivers and lakes!

Chapter 6: City of Ottawa Case Study

In 2006, a prolonged sewage release from a City of Ottawa sewer to the Ottawa River occurred due to a malfunctioning sanitary sewage control structure (a regulator stuck open). Two years later, that release and the broader issue of CSO releases to the Ottawa River came to public attention and spurred the revision of existing plans and upgrades to the City's sewer system. In the previous decades, as early as 1958¹, the City of Ottawa had taken steps for the reduction of CSO releases to the Ottawa River. These steps included sewer separation in conjunction with road rehabilitation work. This earlier plan was updated in 1993² to meet more stringent provincial requirements to capture and treat 90% of wet weather flows in an average year. (For information on province of Ontario requirements for CSOs, see [Procedure F-5-5](#).) Public consultations were conducted as part the finalization of the 1993 plan, which featured an engineered storage tunnel to reduce the volume of CSOs. As plans were further developed for the tunnel, the cost estimates were revised and were much higher than originally anticipated. A more advanced computer-control system was being developed as a less expensive alternative, at about one-third the cost of the tunnel system. The City had undertaken monitoring and modelling of the sewer system in preparation for this more advanced management technique and had determined that it could meet the existing provincial targets using an advanced sewer flow management system (or "real time control", as discussed below). However, the City's entire approach to CSOs was reconsidered when the 2006 spill came to public attention.

The following summary presents the development of the City of Ottawa's CSO control program in response to public outrage at the news that sewage was released on a regular basis to the Ottawa River from the city's sewer infrastructure. Detailed information on the resulting [Ottawa River Action Plan](#) can be found on the City's websites and elsewhere in local announcements and news stories.

¹ *Ottawa Sewerage Scheme, Interceptor and Outfall Tunnel Sewers* for the Corporation of the City of Ottawa, June 1958. De Leuw, Cather & Company of Canada Limited, Consulting Engineers. Ottawa

² Combined Sewer Area Pollution Control Planning Study Prepared for the City of Ottawa and the Ontario Ministry of the Environment, May 1993. R.V. Anderson Associates Limited, Ottawa.



Step 1: Awareness and Public Support

As indicated in the introductory paragraph, the City of Ottawa was working to reduce CSOs and had defined a long-term plan for management of the issue. City Council was aware that combined sewage was being discharged into the Ottawa River and requested that staff report to Council when combined sewer overflows occurred. When the prolonged spill became known, information on spills was already in the public domain, albeit without broad public dissemination of the information. When political leaders expressed concern that the large spill had not been reported in a timely manner, news outlets, including local and community-wide print media, local radio channels, as well as provincial and national news reporting agencies, picked up the story. One print media reporter in particular was committed to keeping public attention on CSO management in the City after interest ebbed following the initial media response to the spill.

Prior to "Sewergate", as the spill came to be called, Ottawa Riverkeeper had been working with members of the community who were concerned about CSOs. For instance, one of the overflow points into the river is immediately upstream of a kayaking training location. A parent had contacted Ottawa Riverkeeper about sewage spills because he was concerned about his child's health while paddling in that location. Also, a

public beach had recently been opened at the downstream end of the City. This beach, at Petrie Island, was closed more frequently than other community beaches due to poor water quality. Beach closures provided Ottawa Riverkeeper the opportunity to communicate about water quality in a tangible way that was readily understood by the public.

Ottawa Riverkeeper communicated about CSOs through the media and its network of contacts to help with public awareness before and after the news of the large spill. Other local organizations, such as Ecology Ottawa, also disseminated information to their networks. As the plans for CSO management were revised by the City, Ottawa Riverkeeper committed to understand how the City was proceeding and what the implications were for various options being developed. Ottawa Riverkeeper also continued to organize recreational events on the river to engage citizens with the river and to raise awareness of the value of the Ottawa River to the community.

Intense media scrutiny brought about more dramatic action by the City to address CSOs, but this benefit had a double edge: a plan was developed within a shorter timeframe than would have been ideal. The Environmental Commissioner of Ontario commented that the City had not effectively communicated the work it was already doing on CSO management, causing a more extreme public reaction due to a perception of neglect.

Step 2: Familiarization

In Ottawa Riverkeeper spent considerable time becoming familiar with the City's combined sewer system, and the policy and legislative frameworks governing CSOs at municipal, provincial and federal levels. The governance framework was in a state of flux at the time due to the federal initiative to regulate municipal wastewater under the *Fisheries Act*. Also, the addition of a City beach downstream of combined sewer outfalls changed the provincial requirements for the City of Ottawa's management of CSOs because beach protection requires a more stringent standard of care.

The City had the advantage of having very knowledgeable staff and had invested about \$1M to collect monitoring data to understand the pattern of sewage flows within the sewer network under various storm condi-

tions. The City had also already done substantial work on CSO planning and engineering design.

Step 3: Collaboration

A collaborative relationship developed between the City and Ottawa Riverkeeper as the City developed its revised approach to CSOs. City staff took time to answer questions by Ottawa Riverkeeper on a range of technical issues and the decision-making process. City management recognized that the public and media trusted Ottawa Riverkeeper as a source of information on CSOs.

The media turned to Ottawa Riverkeeper for information on the health implications of CSO releases. To access the appropriate expertise, Ottawa Riverkeeper built relationships with public health officials, academics specializing in public health, and fisheries biologists. Through the media and its own network, Ottawa Riverkeeper asked members of the public to contact City public health officials if they experienced illness or ear infections after a swim. The public health implications of CSOs continue to present gaps in scientific understanding and communications by public health officials.

Step 4: Goals

A City Councillor representing one of the eastern municipal ridings was a strong proponent for the Petrie Island beach, a location downstream of the urban core (where the combined sewer system is in operation). The commitment to a downstream beach was a key driver in setting goals for CSO management. The beach represented a broader aspiration for the river to be accessible to residents throughout its stretch along the City of Ottawa's northern boundary.

Another influence on goal setting for CSO management was consideration of stormwater quality. Full separation of combined sewers into separate storm and sanitary systems would result in a net increase in stormwater (which contains many of the same contaminants as CSO, in some cases at similar concentrations) entering local waterways because, most of the time, combined sewers transmitted storm and sanitary sewage to the wastewater treatment plant. As such, in some cases, separation can increase the overall pollutant load,

unless the stormwater is treated before discharge. Also, most of the City is serviced by separated sewers and it was becoming increasingly evident that stormwater pollution would also need to be addressed more effectively than had been the case with stormwater infrastructure design practices from the 1960s through to the 1990s. Both stormwater and sanitary sewer investments are currently funded from the same pool of money, so stormwater management upgrades or retrofits compete for City funding with sanitary sewer improvements.

Requirements of senior government levels for water quality also clearly played an important role in setting goals for CSO management. A key question emerged: Should the City simply meet the minimum policy and legislative requirements stipulated by senior government levels or should it exceed the requirements? If it should exceed the requirements, exceed by how much? Ultimately, should the City aim to virtually eliminate combined sewage from entering the Ottawa River? These questions were answered through the public consultation phase.

Step 5: Planning and Technical Solutions

The City was well-positioned to respond to demands for reconsideration of the CSO management plan. It had collected data on the combined sewer flows in preparation for a “real time control” (RTC) system. Typically, storms track through the municipality in a way that drops a lot of rainfall in certain regions while other regions have lighter rainfall. The sewers in areas that receive heavier rainfall fill up while those in areas with lighter rainfall still have space to carry more water. The way the sewer system fills up and overflows depends on pipe sizes, pipe slopes, settings for overflow at outfall regulators, and the patterns of rainfall. An RTC is a system that includes both data collection technologies and sewer system infrastructure. Data collection includes weather tracking to measure rainfall amounts and to predict storm patterns, as well as to measure sewer flow levels throughout the system to know where pipes are close to capacity and where they still have room to accept more flow. Infrastructure for an RTC includes replacing regulators with ones that can be operated remotely through automated controls. It is called a “real time” system because the information

is needed as changes occur in weather and in sewer flows; regulator adjustments are made as each storm passes through. The costs of an RTC are off-set somewhat by making the best use of existing infrastructure - rather than putting in bigger pipes, existing pipes can be used to full advantage. However, to meet the more rigorous requirements for a downstream beach, the City’s revised plan also included a new combined sewage storage tunnel. See Text Box 5 for some advice on the recommended sequence of sewer system modifications.

During the planning for the RTC, staff members recognized that they did not have in-depth experience in optimizing the use of the sewer system or for real-time control of flows during rainstorms. The City retained an advisor to provide assistance with an assessment of its combined sewer operations during intense rainstorms. A review of sewer flow monitoring data showed that the sewer system was not being used to its full capacity during most storms. Very quickly and with very little effort or sophisticated calculations, the city realized it could reduce the volume of sewage overflows by changing the fixed settings for regulators at the locations of most frequent overflows. Regulator settings were causing constrictions of a sort in the sewer network, resulting in sewage releases even when there was storage capacity left elsewhere within the system. Some of the regulators had settings that were too aggressive in terms restricting flow into the main interceptor sewer, and this led to frequent and voluminous overflows at those locations. Meanwhile other regulators had settings that were so high that the incoming sewage very rarely reached the overflow threshold. In short, too much capacity was given to some regulators, and not enough to others. At the time of combined sewer overflows, the monitoring showed that there had been capacity available in related sewers about 60% of the time. By raising the setting of the overflow regulators at these locations, while lowering the setting by an equivalent amount at other locations where overflows were rare, sewage could be directed to other pipes instead of the river. It is important to note that this type of change can only be made while taking into consideration the complete sewage system since an error could result in basements filling with combined sewage.

This initial change would not have involved any technology other than changing the fixed settings at the problematic regulators (e.g. raising a fixed weir, or changing

an orifice plate). The optimized regulator settings would have resulted in significant reductions in CSO volumes with very inexpensive changes, although these changes would not have been sufficient to meet the provincial target at that time. For this reason, the City proceeded with the RTC system. With RTC, between 2003 (when the last RTC site was completed) and 2011, combined sewage overflows were reduced by two-thirds at a cost of about \$100 per cubic meter of CSO reduction per year. Implementation of the RTC system included significant reconstruction of the combined sewer regulators as well as the technologies to monitor and control operations. However, the improvements with RTC were not sufficient to meet provincial requirements to protect a downstream beach since the frequency of CSO releases, not just the volume of sewage released, had to be reduced. Options were developed that included sewer separation, a central sewage storage tunnel and/or several smaller engineering improvements.

The technical considerations also included other pollution sources to the Ottawa River. Modelling was done to assess the potential effect on water quality of sewage releases from Quebec communities on the other side of the Ottawa River. Model results indicated that releases from the City of Gatineau and other Quebec communities tracked along the Quebec shoreline, only mixing across the river downstream of the City of Ottawa. Stormwater from the City of Ottawa is also an on-going source of pollution to the river. Modelling indicated that water discharged from creeks flowing into the Ottawa River would result in beach closures under some storm conditions due to stormwater pollution, even if all CSOs were eliminated.

Given the need for public consultation on goals for CSO mitigation (see Step 4), the City developed three options, representing three different levels of CSO control:

- A) Meet the minimum provincial requirements;
- B) Do better than simply meet the minimum requirements but not fully eliminate CSOs; and,
- C) Virtual elimination of overflows.

High level cost estimates for each option were also developed.

The three options varied in the degree of sewer separation, with Option C having full separation and no remaining CSO pipes. Options A and B entailed some separation and building additional storage capacity in

the system for neighbourhoods that would not be separated. It was recognized that Option B may still result in beach closures due to CSOs during intense rainstorms because the engineering design is based on the average rainfall in a year. (In communications, the City uses the terminology 'design' year instead of 'average' year to avoid potential confusion and public expectations arising from the statistics of weather events.) However, even with the additional expense and time of Option C (see Step 6), the beach could still be closed due to untreated stormwater runoff from creeks. Further, the additional funding demands of Option C would impose on the resources available to address stormwater and other sewer infrastructure needs.

The resulting Ottawa River Action Plan was control option B, and was presented to Council with the [recommended option and objectives](#):

- 1) Achieve and sustain compliance with regulatory requirements, with a focus on CSO control;
- 2) Optimize recreational use and economic development of the river, with a focus on reducing beach closures; and,
- 3) Maintain a healthy aquatic ecosystem, with a focus on addressing challenges presented by existing infrastructure.

The City developed metrics to assess the performance of the sewer system, including measures of the volume of CSO reduced and the changes in the frequency of overflows.

Step 6: Money

In 2009, Option A was estimated to cost of \$40-\$60 million and to require four to five years to implement. The estimate for Option B was \$95-\$140 million with an implementation timeframe of five to six years. The estimate for Option C was \$1.3-\$2.2 billion to be implemented over 30 to 50 years. The long timeframe for Option C was due to the need to separate all combined sewers throughout the core urban area of the city. Sewer separation is also the reason the costs for Option C are so much higher than the other options.

The negative publicity associated with CSOs in Ottawa prompted political representatives elected by Ottawa residents to other levels of government, i.e. at the fed-

Text Box 5: Advice from Municipal Technical Experts

Based on the experience of CSO management, City of Ottawa's technical experts have some advice for other municipalities getting started with this issue.

- Start by looking at optimizing the static operation of the sewer system. In other words, look at the locations with the most frequent overflows and assess whether or not the regulators can be adjusted.
- CSO control measures aim to control frequent storms that occur every year, not major events that occur rarely. Therefore multi-year monitoring campaigns are not essential: about a year of monitoring data will be sufficient to figure out the system's pinch points and flow patterns during storms.
- If static adjustment of regulators is not enough to meet the community's goals, consider a real time control system to maximize the potential of the sewer system.
- If full optimization of the existing system through real time control is still not enough, only then consider new infrastructure such as new sewers or storage tanks.
- Figure out costs per-cubic-meter of sewage for each option. Implement the more favorable ones first, and quickly.
- Talk to field staff with extensive experience to incorporate their knowledge of the sewer system's strengths and weaknesses.
- Hire an outside advisor if needed to supplement in-house expertise.
- Consider convening a panel of external reviewers, such as peers from other municipalities, to comment on draft plans.
- Identify a champion in the municipality who is senior enough to see the project through the planning and approvals phase. This person need not be directly responsible for all aspects of the project, but does need to be senior enough to have influence across engineering, operations, and other municipal functions that must work in tandem for success.
- For larger systems, be prepared to designate a staff member full time to the combined sewer system through the commissioning and start-up phases of CSO control measures.
- Build relationships with community organizations that are also committed to a beneficial resolution of CSO problems.
- Invite construction contractors to comment during the planning phase, for example firms with experience in tunneling operations, especially if it is new to the municipality.
- Keep staff informed on progress through regular communications and develop training programs on new systems and technologies.
- Look at the whole picture, including the combined system, stormwater, the treatment plant(s) and the watershed scale.
- Have a good model of the receiving water to be able to evaluate scenarios and options.
- Be careful in developing performance indicators. Focus on volumes reduced. Indicators that can be influenced by freak weather events or external factors, such as beach closures caused by goose droppings, can create a perception that efforts are not successful.
- Expect plans to change and assume that each step will take longer than originally estimated! Full implementation of combined sewer system improvements will likely take decades.

eral and provincial levels, to also engage in resolution of the problem since it was clearly important to their constituents. This engagement by senior government politicians helped the City negotiate funding support from the federal and provincial levels for CSO infrastructure investments.

Step 7: Public Consultation on Options

In the fall of 2009, the City hosted four Open Houses, created a dedicated web page, and conducted an on-line questionnaire to gather public input on the three options.

Ottawa Riverkeeper was consulted by the City before the public consultation. Taking into consideration the timeframe, costs and other pollution sources to the river, Ottawa Riverkeeper endorsed Option B and communicated frequently with media and through network contacts to explain the rationale for this choice. Although complete elimination of CSOs is a theoretical ideal, the cost, disruption and timeframe to fully separate the combined sewers would potentially detract from other work needed to protect the river, for example from stormwater impacts.

A taxpayer's association was also consulted prior to the public consultation. An affordability assessment was undertaken by the City following guidelines recommended by the U.S. Environmental Protection Agency. The community's ability to pay for rate increases, in particular the bottom 20% of income earners, received attention by the City during option development. During the planning and environmental assessment phases, the City's Economic Advisory Committee was also consulted by staff representatives.

Over 75% of questionnaire respondents endorsed Option B.

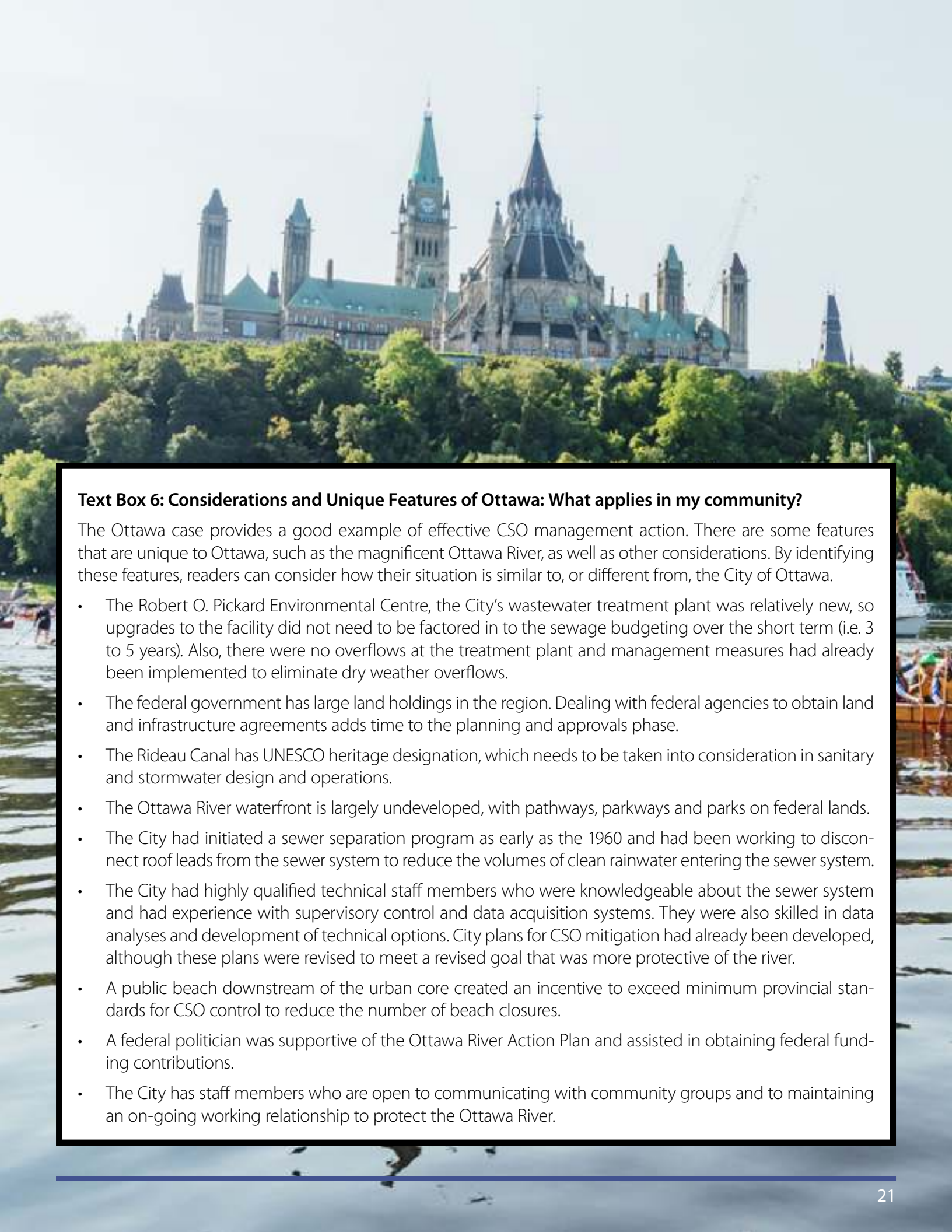
Based on the feedback during the public consultation, City staff also developed a longer-term Water Environment Strategy for Council approval. Public input to the strategy included: 1) addressing stormwater pollution; 2) the need for a communications initiative about pollution source control by residents and businesses; and, 3) taking a watershed approach to ensure the full range of pollution sources and impacts are addressed.

Step 8: On-going Attention

Ottawa Riverkeeper continues to keep in touch with City of Ottawa staff on progress with CSO management. And, the City of Ottawa staff continues to provide expertise that assists Ottawa Riverkeeper. For example, City of Ottawa provided expertise to the [2018 Aquahacking Challenge](#). This challenge is an annual competition to develop technology solutions to water issues affecting the Great Lakes and St. Lawrence Basin. In 2018, the challenge was to develop apps to assist municipalities in implementing real time public notification of combined sewer overflows. City of Ottawa experts helped the teams to better understand the challenges.

The City of Ottawa has also agreed to implement a CSO Alert system (see Appendix A). Ottawa Riverkeeper continues to connect citizens to the river, through organizing public events, such as swimming across the river and regular communications. The City is also continuing to collect information on sewer operations and overflow events. The benefits of CSO control plans build up over time as the various measures are implemented and begin to work together. Also, it can take several years of storm data to assess the performance of the measures since weather events and prevailing seasonal conditions can vary dramatically from year to year.

The City of Ottawa Case Study has elements that can inform communities across Canada. There are also some unique features of the situation that led to the Ottawa River Action Plan. See Text Box 6 for some considerations when deciding how to apply the experience from this case to other locations.



Text Box 6: Considerations and Unique Features of Ottawa: What applies in my community?

The Ottawa case provides a good example of effective CSO management action. There are some features that are unique to Ottawa, such as the magnificent Ottawa River, as well as other considerations. By identifying these features, readers can consider how their situation is similar to, or different from, the City of Ottawa.

- The Robert O. Pickard Environmental Centre, the City's wastewater treatment plant was relatively new, so upgrades to the facility did not need to be factored in to the sewage budgeting over the short term (i.e. 3 to 5 years). Also, there were no overflows at the treatment plant and management measures had already been implemented to eliminate dry weather overflows.
- The federal government has large land holdings in the region. Dealing with federal agencies to obtain land and infrastructure agreements adds time to the planning and approvals phase.
- The Rideau Canal has UNESCO heritage designation, which needs to be taken into consideration in sanitary and stormwater design and operations.
- The Ottawa River waterfront is largely undeveloped, with pathways, parkways and parks on federal lands.
- The City had initiated a sewer separation program as early as the 1960 and had been working to disconnect roof leads from the sewer system to reduce the volumes of clean rainwater entering the sewer system.
- The City had highly qualified technical staff members who were knowledgeable about the sewer system and had experience with supervisory control and data acquisition systems. They were also skilled in data analyses and development of technical options. City plans for CSO mitigation had already been developed, although these plans were revised to meet a revised goal that was more protective of the river.
- A public beach downstream of the urban core created an incentive to exceed minimum provincial standards for CSO control to reduce the number of beach closures.
- A federal politician was supportive of the Ottawa River Action Plan and assisted in obtaining federal funding contributions.
- The City has staff members who are open to communicating with community groups and to maintaining an on-going working relationship to protect the Ottawa River.

Chapter 7: Summary of Data Resources

This chapter provides a quick summary of resources to gather information on combined sewer systems. In the spirit of building a relationship with municipal experts, consider discussing potential data sources in person. Access to information requests can always be used if necessary.

A sewage alert system may be in place within the municipality. If so, subscribe to the alerts. If there is no alert system in place, contact the municipality about implementing one. See Appendix A for a model alert (drafted for Ontario but adaptable to other provinces or territories).

Make a request to the provincial/ territorial spills action center for data on CSOs reported by the municipality.

Contact the Federal Department of Environment and Climate Change Canada (ECCC) for all reports it has from the municipality that have been submitted per

the requirements of the Wastewater Systems Effluent Regulations (WSER) under the Fisheries Act. Currently, an Access to information request is needed but the information may be more readily available to the public in the future. If your organization's plans to analyze the data, request that it be delivered to you in Excel or .csv format.

Make a request to the municipality for its records on CSO events. Records must be kept by municipalities under the WSER and must be retained for 5 years subsequent to the year of record.

Research pollution issues within the watershed to understand CSOs in context of other challenges.

Chapter 8: Beyond Combined Sewers

As indicated throughout this toolkit, many issues pose challenges to waterways. Raw sewage releases via combined sewer overflows are clearly a challenge. However, as demonstrated by the City of Ottawa Case Study, virtual elimination of CSOs may not be the optimal solution if it means money will not be spent to also address other challenges. This chapter provides a glimpse into considerations beyond CSOs that might affect priorities and plans for a comprehensive approach to water environment protection.

Key words representing the challenge or issue are bolded in the following text. Community organizations can use these key words to explore the applicability of these other challenges within their municipality.

This [TEDx talk](#) provides a range of ideas for reduction of water volumes running off cityscapes during storms. **Low impact development** (LID) is a range of techniques to reduce the volume of stormwater and to im-

prove its quality. Two of Ontario's Conservation Authorities have developed a [guide to LID](#).

All government levels are responsible for elements of pollution **source control**. If a pollutant is entering a waterway from a consumer product, such as a perfume or shampoo, municipalities have no authority to stop it. Similarly, municipalities are limited in their authority over control of pollution from agricultural operations and industrial processes.

A proportion of pharmaceuticals ingested by the population are later secreted and conveyed to the wastewater treatment facility. The efficiency of wastewater treatment plants to treat **pharmaceuticals and personal care products** varies by chemical.

Increasingly, wastewater is not seen as a 'waste' but a resource for nutrients, energy and water. As part of an approach to a **circular economy**, phosphorus may be

recovered from the wastewater stream and turned into a fertilizer; energy can be generated from methane and recovered water used in industrial processes. The City of Edmonton has a pilot facility with a Canadian technology, Ostara, to demonstrate the potential for **resource recovery from wastewater**. Plumbing codes are developed to install potable and non-potable plumbing in homes so water can be reused, for example water used to wash hands can then be used to flush toilets. The plumbing system for recirculated water has **purple pipes** under the code to ensure it is not confused with the potable water. The [challenges](#) to make water servicing more efficient have been taken up around the world.

Stormwater was not traditionally one of the water services of focus by municipalities. With the scientific evidence mounting that stormwater pollution and volumes pose serious environmental concerns, creative approaches to **stormwater infrastructure financing** have been developed. Halifax and Toronto are two examples of municipalities that have proposed new approaches.

Climate change is altering precipitation patterns as well as air temperatures. Building storm sewers to ac-

commodate flows is a challenge and may not be feasible in terms of cost and/or size of pipe for some highly paved urban centers. **Climate change adaptation** for extreme precipitation events is an imperative and one that governments at all levels will need to include in strategic planning for protection of people, properties and the environment.



Appendix A: Model Public Sewage Alert

Introduction and summary of the Ontario model public sewage alert

Sewage discharges in Ontario are regulated both federally and provincially by Environment and Climate Change Canada (ECCC) and the Ontario Ministry of Environment, Conservation and Parks (MECP). Federal regulations (namely the *Wastewater Systems Effluent Regulations*) and provincial laws and guidelines (primarily the *Ontario Water Resources Act* and MECP *Procedure F-5-5*) determine allowable sewage discharge limits and require specific records be kept and reported by municipalities and/or municipal agencies who own and operate sewage infrastructure.

However, discharges from sewage treatment plants are held to a higher standard than other types of sewage discharges. While sewage treatment plant discharges (including bypasses) are subject to provincial licence conditions and federal and provincial regulatory emissions limits, discharges of sewage into local waterways upstream from treatment plants are effectively exempt from many of these regulatory requirements. This is despite the fact that these non-treatment plant discharges are responsible for releasing billions of litres of raw sewage into the Great Lakes and their tributaries each year.

This model alert is intended to focus on the release of **all untreated sewage from points upstream from wastewater facilities**. These include: combined sewer overflows (CSO) which release a combination of sanitary sewage and stormwater; overflows at pumping stations and wastewater collection systems; and other sewer malfunctions or capacity problems that result in the discharge of sewage into local waterbodies. At the same time, in order to understand the cumulative impacts of all sewage spills to local waterways, sewage treatment plant bypass reporting has also been included in real-time and monthly reporting. This alert is meant to inform the development of provincial regulations or municipal bylaws for the proactive public reporting of all sewage discharges in Ontario. The model alert also contains appendices illustrating how alerts and reports could look.

The alert requires three stages of sewage release reporting: real-time, monthly, and annual to provide members of the public with an understanding of the occurrence and impacts of sewage release events. Three stage reporting is currently being proposed in a new US Environmental Protection Agency regulation concerning CSO reporting and supported by existing federal and Ontario record-keeping requirements of sewage system owners and operators. In addition to public alerts, this document also requires physical signage and maps of all sewage outfalls to raise public awareness of the sewer infrastructure in their communities.

Below is a brief summary and explanation of each provision in the model alert. When presenting the model alert to government agencies or other authorities, this introduction and summary section should be omitted.

Provision 1: Physical signage of all sewage outfalls is required. Physical signage must contain: the name of the sewage pipe operator and a phone number at which they can be reached; a description of the wastewater in the pipe; warnings about health consequences of coming into contact with raw or partially treated sewage, and instructions for how members of the public can receive real-time sewage release alerts.

Rationale: to help prevent members of the public from coming into contact with raw/partially treated sewage. It will also raise public awareness of sewer infrastructure and the waters affected by sewage release events.

Provision 2: Maps of all sewage outfalls must be made publicly available. These maps must contain: all combined sewer system (CSS) outfall locations; all sewage treatment plant discharge points; all discharge points from sewage collection systems and pumping stations; any other sanitary sewer outfalls; and all waterbodies and public recreational beaches that receive wastewater from these outfalls.

Rationale: to give members of the public a bigger-picture understanding of sewer infrastructure in their communities and the scale of potential cumulative impacts of CSOs and other types of sewage releases.

Provision 3: Public must be notified of all sewage release events in real-time. This involves two real-time alerts: one for the commencement of a release event, and another at the cessation of the event. Alerts must be distributed immediately (or at least within 4 hours) online, via emails or text (to members of the public who subscribe), and on local radio stations. These alerts must contain: the location of release events, the names of identified receiving waters and any potentially affected public recreational beaches; the date and time of the commencement and cessation of the event and its total duration; and warnings for the public to avoid contact with contaminated waters for at least 48 hours after the cessation of the event. If known, the cause and total volume of the event must also be disclosed.

Rationale: to ensure that members of the public can make informed decisions about whether they can safely use local waterbodies for recreation.

Provision 4: Public must be notified of monthly trends in sewage release events. These reports must distinguish between the different types of release event and contain: the location of all sewage release events that occurred that month, the names of receiving waterbodies and affected public recreational beaches; dates, times, and durations of each sewage spill event; measured or estimated volumes of discharges for each release event; the level of treatment the discharge received; and the cause of the event. If sampling was taken of sewage discharges or receiving waters after a release event, the results must be disclosed. If flow rates in sewage pipes were measured or modelled, those results must also be disclosed.

Rationale: to allow members of the public to see shorter-term trends in sewage releases and have more timely access to the results of any water quality testing or other information about specific release events that may not be available in real-time reports.

Provision 5: Public must be notified of annual trends in sewage release events. These reports must contain: the total monthly volume of CSO releases; total number of days each month on which CSO events occurred; total volume of non-CSO releases; measurements or modelling of CSS flow rates in response to weather conditions; updates concerning the implementation of Pollution Prevention and Control Plans; and summaries of the year's monthly sewage release reports.

Rationale: to allow members of the public to see longer-term trends in sewage releases. Information requirements for annual reports also ensure accountability of CSS owner/operators, requiring them to report on ways in which they actively minimize the occurrence of, and mitigate the impacts of, CSO events.

Provision 6: Municipal Pollution Prevention and Control Plans must be made publicly available.

Rationale: these plans detail municipalities' long-term plans to eliminate CSOs. Releasing these plans and reporting on the plans' implementation in annual reports ensures greater municipal accountability and can increase the political will to address CSS and other sewage infrastructure failures.

Provision 7: Public consultation is required in the development of local sewage release alerts.

Rationale: as each municipality's sewer infrastructure and administrative capacity will differ significantly, the success and appropriateness of local sewage alert protocols would be best ensured by involving input from local community members who can tailor protocols to distinct local needs and realities.

Provision 8 contains a glossary of relevant terms.

It is important to note that the information gathering requirements in this alert are not more onerous than information already required by federal or Ontario regulations. For the most part, owner/operators of sewage systems are required to keep most of the abovementioned information in their own records and within the same timeframes specified in this model alert. The main difference between current legal requirements and this model alert is the added requirement for information to be collected on all types of sewage release (not just sewage treatment plants and CSOs) and that it be publicly disclosed in a timely manner. The appendices in this alert are meant to help facilitate and support proactive public disclosure, thus assisting agencies with implementation.

For more information about CSO reporting specifically and ways to mitigate the impacts of CSOs, please see:

- Alliance for the Great Lakes, "Reducing Combined Sewer Overflows in the Great Lakes: Why Investing in Infrastructure is Critical to Improving Water Quality", online: https://greatlakes.org/wp-content/uploads/2016/08/AGL_Reducing_CS0_14_FINAL-1.pdf; and
- Ecojustice, "Green Cities, Great Lakes: Using Green Infrastructure to Reduce Combined Sewer Overflows", online: <https://www.ecojustice.ca/wp-content/uploads/2014/11/Green-Cities-Great-Lakes-2008.pdf>.

Model Public Sewage Alert for Ontario

1. Clear signage required in the vicinity of all sewage outfalls*

For all sewage outfalls (both exposed and submerged) there must be clear signage identifying the outfall and its contents to the public.

a. Signage must be clear and visible to members of the public

For exposed outfalls, signs must be in close proximity to the discharge point. For submerged outfalls, signs must be located along the shoreline closest to the outfall.

b. Mandatory contents of signage:

- i. Name of sewer pipe owner/operator;**
- ii. Phone number for CSS owner/operator;**
- iii. Description of effluent (e.g. sewage/human waste and stormwater);**
- iv. A notice that members of the public should avoid contact with wastewater;**
- v. A notice that members of the public should avoid recreation in local receiving waters around the outfall for at least 48 hours after the cessation of any wastewater discharges;**
- vi. A notice that sewage release events are publicly reported in real-time online and on local radio stations;**
- vii. Instructions for how members of the public may subscribe to real-time public sewage release alerts; and**
- viii. Any further information sewage system owner/operators deem necessary.**

The website and radio stations on which these reports are made must be provided.

This must be determined with public consultation.

*See Appendix I for a template for physical sewage outfall signage.

2. Publicly accessible online maps of sewage outfall locations required

All sewage system owner/operators must make a map of all sewage outfall locations available to the public online. Copies of these maps must also be available at designated municipal buildings or civic centres.

a. Mandatory contents of sewage outfall maps:

The map must clearly label:

- i. All CSS outfall locations within the municipality (both exposed and submerged);**
- ii. All sewage plant discharge points within the municipality;**
- iii. All collection system outfalls within the municipality;**
- iv. All potential outfalls from sewage pumping stations;**
- v. Any other types of sewage outfall other than those mentioned above;**
- vi. All waterbodies that receive wastewater from identified sewage outfalls;**
- vii. All public recreational beaches within the municipality;**
- viii. Any further information sewage system owner/operators deem necessary**

This must be determined with public consultation.

3. Real-time sewage release event reporting required

All sewage release events must be reported by the owner/operator of sewage infrastructure in real time so that members of the public may make informed decisions about whether to swim, drink, or fish in local waterways. Public alerts must be made at the commencement and end of all release events.

a. Reporting at the start of a sewage release event*

- i. Reporting must be immediate;**
Public notifications must be made immediately, or at least within four hours of the commencement of, awareness of, or reason to suspect the commencement of a release event;
- ii. Public alerts must be electronic and posted online;**
- iii. Once posted, real-time release event commencement reports must remain online permanently (e.g. in publicly accessible online archives);**
- iv. Sewage system owner/operators must provide text message or email alerts for members of the public who have registered for real-time alerts;**
Members of the public must be able to subscribe to receive real-time sewage release alerts. The

subscription process must be simple and clearly communicated online. These emails or text messages must also be sent immediately, or within four hours of the commencement of, awareness of, or reason to suspect the commencement of a release event.

v. Public alerts must also be made via local radio;

These radio alerts must be made within four hours of the commencement of, awareness of, or reason to suspect the commencement of a release event.

vi. Additional public alerts via television and/or social media are recommended;

vii. Contents of public real-time release event commencement alert must include:

- 1. The location of overflowing sewage outfalls;**
- 2. The names of identified receiving waterbodies that may be affected;**
- 3. The names of identified public recreational beaches that may be affected;**
- 4. The date and time of initial release event occurrence;**

If the owner/operator of the sewage outfall does not know the exact time at which the release event began, the notice must include the time at which the event was first discovered or suspected. This notice must specify whether the commencement time is verified or an estimate;

- 5. A warning of adverse human health impacts caused by contact with untreated or partially treated sewage;**
- 6. A warning for the public to avoid recreational uses of receiving waterbodies while the alert is in effect, and at least 48 hours after the release event ends;**
- 7. The cause of the release event, if known (e.g. wet weather, severe storm, maintenance work, blockage, equipment failure, snow melt, etc.);**

If the cause is not yet known the alert must note that it will be disclosed either when the event cessation alert is issued, or else when the next monthly sewage release report is issued. The webpage URL where members of the public can find the posted alerts must be provided. **and**

- 8. Any further information sewage system owner/operators deem necessary.**

This must be determined with public consultation.

*See Appendix II for a real-time alert template for commencement of a sewage release event.

a. Reporting at the end of a sewage release event*

i. Reporting must be immediate;

Public notifications must be made immediately, or at least within four hours of the end of, or expected end of, the release event.

ii. Public alerts must be electronic and posted online;

iii. Once posted, real-time release event cessation reports must remain online permanently (e.g. in publicly accessible online archives);

iv. Sewage system owner/operators must also provide text message or email alerts for members of the public who have registered for real-time alerts;

These emails or text messages must also be sent immediately, or within four hours of the end of, or expected end of, the release event.

v. Public alerts must also be released via local radio;

These radio alerts must be made within four hours of the end of, or expected end of, the release event.

vi. Additional public alerts via television, and/or social media are recommended;

vii. Contents of public real-time release event end alert must include:

- 1. The location of overflowing sewage outfalls;**
- 2. The names of identified receiving waterbodies that may be affected;**
- 3. The names of identified public recreational beaches that may be affected;**
- 4. The date and time of initial release event occurrence and the date and time of the end of the event;**

If the exact time at which the release event ended is not known the notice must include the time at which the event was expected of have ended. This notice must specify whether the

end time was verified or an estimate;

5. **The total duration of the event;**
6. **A warning of adverse human health impacts caused by contact with untreated or partially treated sewage;**
7. **A warning for the public to avoid recreational uses of receiving waterbodies at least 48 hours after the release event ends;**
8. **The cause of the release event, if known (e.g. wet weather, severe storm, maintenance work, blockage, equipment failure, snow melt, etc.);**

If the cause is not yet known, the alert must note that it will be disclosed when the next monthly sewage release report is issued. The webpage URL where members of the public can find the posted alert must be provided.

9. **Measured volume or estimated volume of the sewage discharge, if known;**

The alert must specify if this is an actual measurement or an estimate. If measurements or estimates are not yet known, the alert must note that it will be disclosed when the next monthly sewage release report is issued. The webpage URL where members of the public can find the posted alert must be provided. **and**

10. **Any further information sewage system owner/operators deem necessary.**

This must be determined with public consultation.

*See Appendix III for a real-time alert template for end of a sewage release event.

4. Monthly sewage release event follow-up reporting required*

More detailed reports must be made publicly available on a monthly basis to allow members of the public to assess the severity of previously reported sewage release events. These monthly follow-up reports would also help members of the public to identify short-term trends in release events and allow individuals to make more informed decisions about using local waterbodies for recreation.

- a. **Sewage release event follow-up reports must be prepared and publicly disclosed monthly;**
- b. **Monthly reports must be electronic and posted online;**
- c. **Once posted, monthly reports must remain online permanently (e.g. in publicly accessible online archives);**
- d. **The use of machine-readable formats (e.g. HTML, RDF, XML, JSON, etc.) for monthly reports is strongly recommended;**
- e. **Mandatory contents of monthly public sewage release follow-up reports:**
 - i. **The type of release event must be specified (e.g. sewage bypass, CSO, collection system overflow, pumping station overflow, etc.)**
 - ii. **The location of all sewage outfalls that overflowed during the reported month;**
 - iii. **The names of identified receiving waterbodies potentially affected by each reported sewage release event;**
 - iv. **The locations/descriptions of public recreational beaches potentially affected by each reported sewage release event;**
 - v. **The date and time of initial occurrence and end of each reported sewage release event;**

The report must specify whether the commencement and end times were verified or estimates;
 - vi. **The duration of each reported sewage release event;**
 - vii. **The measured or estimated volume of discharge, expressed in m³, for each reported sewage release event;**

The report must specify whether the volume of each reported release event was measured or an estimate;
 - viii. **The level of treatment received for each reported sewage release event (e.g. no treatment, primary treatment, or secondary treatment);**
 - ix. **The cause of each reported sewage release event (e.g. precipitation event, snow melt, maintenance work, blockage or equipment failure, etc.);**
 - x. **The results of any water quality sampling conducted of sewage release effluent or receiving waters after the occurrence of each reported sewage release event;**
 - xi. **The results of any measured flow rates in sewer infrastructure during sewage release events;**

and

xii. Any further information sewage system owner/operators deem necessary.

This must be determined with public consultation.

*See Appendix IV for a monthly sewage release report template.

5. Annual sewage release trend reporting required

Annual sewage release trend reports must be available to the public documenting trends in the response of sewage infrastructure to external weather events. This report must also include CSS evaluations required by Ministry of Environment and Climate Change's Procedure F-5-5, as well as updates by owner/operators of CSSs concerning measures taken to ensure the good operation of CSSs and minimization of CSO events.

- a. Sewage release trend reports must be prepared and publicly disclosed annually;**
- b. Annual reports must be electronic and posted online;**
- c. Once posted, annual reports must remain online permanently (e.g. in publicly accessible online archives);**
- d. The use of machine-readable formats (e.g. HTML, RDF, XML, JSON, etc.) for annual reports is strongly recommended;**
- e. Mandatory contents of annual sewage release trend reports:**
 - i. The total monthly volume (or estimated volume) of the year's CSO events;**
The report must specify whether these volumes were measured or estimated;
 - ii. The total number of days each month in which CSO events occurred over the year;**
 - iii. The total volume (or estimated volume) of each type of sewage release other than CSO events;**
The report must specify whether these volumes were measured or estimated;
 - iv. Measurements or modelling of trends in wastewater flow in sewer infrastructure (especially CSSs) over the year compared with precipitation trends and how they impacted peak wet and dry weather sewage flow rates;**
 - v. Confirmation of the public availability of municipal Pollution Prevention and Control Plans required by Ministry of Environment and Climate Change's Procedure F-5-5 and a description of any changes made to these plans over the reported year;**
 - vi. A summary of any developments in the implementation of the municipal Pollution Prevention and Control Plans;**
 - vii. The inclusion of, or inclusion of a summary of, monthly sewage release reports; and**
 - viii. Any further information sewage system owner/operators deem necessary.**
This must be determined with public consultation.

6. All municipalities must make their Pollution Prevention and Control Plans publicly available online.

7. Local community feedback mechanisms required

Members of the public must be able to periodically provide feedback, and have their feedback considered by sewage system owners/operators, concerning the contents of local public alert protocols and the need for any improvements.

8. Definitions

- a. Combined Sewer System (CSS):** The physical infrastructure that collects and carries both raw sewage and stormwater for treatment at sewage treatment plants. When wastewater flow rates are high, CSSs are designed to divert wastewater directly into receiving waterbodies without receiving treatment, or only receiving partial treatment. Some CSS outfalls are exposed on the shorelines of receiving watercourses, while others are submerged underwater along lakebeds or riverbeds.
- b. Sanitary Sewer System (SSS):** The physical infrastructure that collects and carries raw sewage for treatment at sewage treatment plants. When flow rates are high, raw or partially treated sewage can be discharged into local waterways from SSSs via sewage treatment plant bypasses, sewage pump or collection overflows, or other types of diversions upstream from treatment plants. Sewage treatment plant bypasses are the most regulated form of sewage release.
- c. Combined Sewer Overflow (CSO):** When raw sewage and stormwater are diverted away from receiving full treatment at sewage treatment plants, and discharged into receiving waterbodies. CSOs tend to be more common during precipitation events or snow melts as these occurrences increase flow rates of wastewater

in CSSs. This type of sewage release is regulated less than sewage treatment plant bypasses.

- d. Sewage treatment plant bypass:** When raw or partially treated sewage is released from water treatment plants, or redirected away from water treatment plants and discharged into local waterbodies. Generally, bypasses occur when the volume of wastewater exceeds the capacity of the plant at that time.
- e. Sewage pump station overflows:** When sewage pump stations release sewage into local waterways rather than directing the wastewater to sewage treatment plants.
- f. Collection system overflow:** When sewage collection systems release sewage into local waterways rather than directing the wastewater to sewage treatment plants.
- g. Other types of upstream sewage release event:** Depending on the municipality, discharges may occur from sanitary sewers upstream from treatment plants without being considered treatment plant bypasses, CSOs, or collection system or pumping station overflows. To address these types of discharges (that can otherwise fall through regulatory cracks), the alert includes reference to, and applied to, these other types of sewage releases or sewage release events.
- h. Sewage release event:** The occurrences of distinct sewage release events can be difficult to determine, especially when their duration can depend on ongoing external conditions such as storms or snow melts. For the purpose of this model alert, sewage release events will be considered distinct, and have to be reported separately, if there are at least 4 dry hours without any discharge between overflows.
- i. Raw or untreated sewage:** Sewage that has not received any physical screening or other treatment.
- j. Primary treatment:** A level of wastewater treatment that involves mechanical processes (namely physical screening and/or the use of sediment tanks) to remove suspended solid waste and reduce the biochemical oxygen demand (BOD) in wastewater. Primary treatment may also include the chlorination of wastewater.
- k. Secondary treatment:** A level of treatment that occurs after wastewater receives primary treatment. It involves biological processes (namely the use of specialized microorganisms) to further remove organic matter and BOD missed by primary treatment.
- l. Sewage system owner/operators:** Owners and operators of sewage systems tend to be local municipalities and/or municipal water treatment agencies.

APPENDIX 1: Physical sewage outfall signage template

For exposed outfalls:

CAUTION:

This pipe contains [“raw or partially treated sewage” OR “a mixture of stormwater and raw or partially treated sewage”, depending on the contents of the pipe]. Avoid contact with any wastewater being discharged from this pipe.

Members of the public are advised to avoid recreational uses of the water around this discharge point for at least 48 hours after any discharge ceases.

Individuals who have come into contact with this wastewater and experience mild gastrointestinal discomfort, rash, or other symptoms should inform [insert local public health authority] by calling [insert phone number of local public health authority]. If symptoms are serious, individuals should immediately consult a medical professional.

All wastewater discharges from these sewer pipes are publicly reported online at [insert webpage URL where reports are posted] and over local radio on [insert radio station]. If you would like to receive immediate notification of discharges/overflows within the municipality via email or text message, please subscribe online at [insert link to webpage where public can subscribe].

Owner/operator of this pipe: [insert name of owner/operator]

Contact information for over/operator: [insert phone number of owner/operator]

For submerged outfalls:

CAUTION:

X meters from this shoreline is the submerged outfall of a pipe carrying [“raw or partially treated sewage” OR “a mixture of stormwater and raw or partially treated sewage”, depending on the contents of the pipe]. In certain circumstances (e.g. wet weather and snow melts), this wastewater is discharged directly into the lake/river.

Members of the public are advised to avoid recreational uses of the water around this discharge point for at least 48 hours after any discharge ceases.

Individuals who have come into contact with this wastewater and experience mild gastrointestinal discomfort, rash, or other symptoms should inform [insert local public health authority] by calling [insert phone number of local public health authority]. If symptoms are serious, individuals should immediately consult a medical professional.

In order to know whether this submerged outfall is discharging wastewater, please visit [insert webpage URL where reports are posted] where all wastewater discharges from these sewer pipes are publicly reported.

Discharges are also reported on local radio at [insert radio station]. If you would like to receive immediate notification of discharges/overflows within the municipality via email or text message, please subscribe online at [insert link to webpage where public can subscribe].

Owner/operator of this pipe: [insert name of owner/operator]

Contact information for over/operator: [insert phone number of owner/operator]

APPENDIX II: Real-time public sewage release event commencement alert template

At [insert time] today, the [insert name of municipality] discovered or has reason to believe that a sewage release event began. Recreational water users should avoid the [insert receiving waters] until further notice. Potentially affected public recreational beaches include: [insert beaches].

Members of the public are advised to avoid recreational uses of affected waterbodies for 48 hours after the end of the release event.

[Insert name of municipality] has called a sewage release alert to make recreational water users in the municipality aware of risks of water pollution near [insert receiving waterbodies]. The alert is in effect until further notice.

[If the cause is known:] This release event was caused by [insert cause, e.g. wet weather, severe storm, maintenance work, blockage, equipment failure, snow melt, etc.]. [If the cause is not yet known:] The cause of this release event is not yet known. Once known, it will be reported in this release event's cessation report, or else the next monthly sewage release trend report and posted online at [insert webpage URL].

During a Sewage Overflow Alert:

- Members of the public are advised to avoid contact with [insert receiving waterbodies].
- Individuals who have come into contact with contaminated water and experience mild gastrointestinal discomfort, rash, or other symptoms should inform [insert local public health authority] by calling [insert phone number of local public health authority]. If symptoms are serious, individuals should immediately consult a medical professional.

An alert is called when sewage releases are occurring, or are likely to occur, at one or more of the municipality's sewage outfall locations. For a map of all outfall locations in the municipality, see this online map: [insert link to online sewage outfall map for the municipality]. Sewage discharges may contain bacteria, chemicals, and other contaminants that pose a risk to human health. An alert remains in effect for 48 hours after the after the end of the sewage release event.

[insert media contact]

APPENDIX III: Real-time public sewage release event cessation alert template

The reported sewage release event from [insert time and date of the commencement or suspected commencement of the release event] has now ended.

At [insert time] on [insert date], the [insert name of municipality] discovered or had reason to believe that a sewage release began. Recreational water users were advised to avoid the [insert receiving waters] until further notice. Potentially affected public recreational beaches include: [insert beaches].

The total duration of this release event was [insert hours and minutes].

[If cause is known:] This release event was caused by [insert cause, e.g. wet weather, severe storm, maintenance work, blockage, equipment failure, snow melt, etc.]. [If cause is not yet known:] The cause of this release event is not yet known. It will be reported in the next monthly sewage release trend report. This report will be posted online at [insert webpage URL].

[If total discharge volume is known:] X [insert amount] m³ of wastewater was discharged into receiving waters as a result of this release event. [If total discharge volume is not yet known:] The total volume of wastewater discharged during this release event is not yet known. Once known, it will be reported in the next monthly sewage release trend report and posted online at [insert webpage URL].

While the sewage release event has now ended, members of the public are still advised to avoid recreational uses of affected waterbodies for an additional 48 hours to allow for dissolution and dispersion of the wastewater in receiving waterbodies.

For the next 48 hours:

- Members of the public are still advised to avoid contact with [insert receiving waterbodies].
- Individuals who have come into contact with contaminated water and experience mild gastrointestinal discomfort, rash, or other symptoms should inform [insert local public health authority] by calling [insert phone number of local public health authority]. If symptoms are serious, individuals should immediately consult a medical professional.

An alert is called when sewage releases are occurring, or are likely to occur, at one or more of the municipality's sewage outfall locations. For a map of all outfall locations in the municipality, see this online map: [insert link to online sewage outfall map for the municipality]. Sewage discharges may contain bacteria, chemicals, and other contaminants that pose a risk to human health. An alert remains in effect for 48 hours after the after the end of the sewage release event.

[insert media contact]

APPENDIX IV: Monthly sewage release report template

Type of spill ¹	Date of spill	Spill start and end times	Total duration (in hrs) and whether this value is a measurement or estimate	Spill location	Receiving waters	Affected public recreational beaches	Total CSO volume (m ³) and whether value is a measurement or an estimate	Cause ² of the event	Level of treatment ³ received by wastewater	Results of contaminant testing, ⁴ if sampled	Results of any flow rate monitoring, if measured

1. For example: CSO, collection system overflow, pumping station spill, sanitary sewer overflow.
2. For example: maintenance work, blockage, wet weather event, severe storm, snow melt, etc.
3. For example: raw/untreated, primary treated, secondary treated.
4. Results must be provided for all contaminants that are being monitored and sampled. This may include: *e.coli*, carbonaceous biochemical oxygen, suspended solids, unionized ammonia, ammonia, and pH values.

Appendix B: Sample WSER Report Information

Document Released Under the Access to Information Act / Document divulgué en vertu de la Loi sur l'accès à l'information.

Reporting Year	Owner Name	System Name	City	Province	CSO Point Latitude	CSO Point Longitude	Month	Was effluent discharged from this CSO point during month?	Number of days of effluent was deposited in month	Volume of effluent in cubic metres (m ³) deposited via CSO point in month
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3658	-75.7969	1	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3658	-75.7969	2	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3658	-75.7969	3	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3658	-75.7969	4	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3658	-75.7969	5	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3658	-75.7969	6	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3658	-75.7969	7	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3658	-75.7969	8	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3658	-75.7969	9	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3658	-75.7969	10	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3658	-75.7969	11	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3658	-75.7969	12	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3898	-75.6801	1	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3898	-75.6801	2	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3898	-75.6801	3	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3898	-75.6801	4	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3898	-75.6801	5	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3898	-75.6801	6	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3898	-75.6801	7	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3898	-75.6801	8	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3898	-75.6801	9	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3898	-75.6801	10	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3898	-75.6801	11	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.3898	-75.6801	12	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.4049	-75.7165	1	False	0	0
2016	City of Ottawa	Robert O. Pickard Environmental Centre	Gloacester	Ontario	45.4049	-75.7165	2	False	0	0

