



# WASTEWATER MANAGEMENT

## Stormwater Runoff and Sewer Overflows

*What happens when it rains?*

GREAT LAKES FACT SHEET



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## Background

Much of the current sewage treatment infrastructure in the Great Lakes region was built in the years immediately following the signing of the 1972 Great Lakes Water Quality Agreement (GLWQA). This agreement between Canada and the United States focused on issues related to sewer overflows and discharges and, in particular, the relationship between phosphorus overloading in the lakes and the growth of harmful algal blooms. The sewage treatment infrastructure built as a result of the GLWQA greatly reduced the amount of untreated sewage discharged into the lakes, but many of these systems are now aging.

Despite the challenges that sewer overflows can pose for water quality, cities around the Great Lakes continue to have some of the safest drinking water in the world. In a 2008–2009 report on drinking water quality, the Ontario government stated that 99.87 per cent of tests from municipal residential drinking water systems met provincial drinking water standards.

The cost of replacing existing sewer infrastructure often far exceeds the cost of implementing management strategies that improve the efficiency of treatment facilities and reduce overflows and harmful discharges to the lakes. The City of Guelph has demonstrated how creative approaches to wastewater management strategies can reduce the costs associated with infrastructure upgrading. Guelph is expected to grow by up to 50 per cent by 2030. The city estimated that its sewage treatment plant would require a \$20 million upgrade to accommodate this growth. Before committing the \$20 million, Guelph underwent a systems optimization analysis on its existing facilities and discovered that some of the existing problems, such as high ammonia and chlorine concentrations in treated effluent, could be altered by adjusting treatment processes. The optimization process was so successful that the facility increased its efficiency enough to accommodate the estimated future growth of the municipality – and avoided the projected \$20 million bill.



## WHAT ARE STORMWATER RUNOFF AND SEWER OVERFLOWS?

Each year, billions of litres of raw sewage ends up in the Great Lakes. Periods of heavy rainfall or snowmelt can cause the water volume reaching sewer systems to exceed their capacity, resulting in the release of untreated wastewater directly into the Great Lakes. Discharges of partially treated or untreated sewage can contain pathogens, phosphorus and harmful pollutants, with potentially devastating impacts on human health and the environment.

Impermeable surfaces such as sidewalks and streets do not allow water to be absorbed easily into the ground. During storms, water runs off surfaces, collecting oils, road salt, pesticides, fertilizers and other potentially hazardous materials as it moves across land, eventually ending up in nearby bodies of water. Combined sewer systems collect and transport this stormwater runoff to treatment plants in the same pipes that carry domestic sewage and industrial wastewater. During extreme weather, the volume of water accumulated commonly exceeds the capacity of the sewer system. When this happens, sewage mixed with stormwater is redirected through a bypass and released directly into the nearest body of water. This release of sewage into local waterways is known as a combined sewer overflow (CSO).

Sewage treatment plant bypasses also discharge partially treated or untreated wastes when the capacity of a plant is overwhelmed by extreme weather. To prevent possible upstream issues, such as basement flooding, some of the sewage flow is deliberately redirected into local waterways. Bypasses can also occur if a treatment plant is temporarily out of service during routine maintenance activities or if the power fails.

While overflows do occur, there are significant efforts to purify and clean water before it enters the Great Lakes. Ontario's water quality standards require extensive treatment of water to remove solids, micro-organisms and potentially harmful pollutants. However, sewage continues to be among the top pollution sources for the lakes. The number of sewage discharges is not likely to be reduced without a significant investment in infrastructure – a need that will grow more urgent as population density increases and climate change results in more frequent and extreme storms capable of overwhelming existing sewer systems.

## HOW DO STORMWATER RUNOFF AND SEWER OVERFLOWS AFFECT THE GREAT LAKES?

Stormwater runoff and sewer overflows ...

- **contain harmful pollutants:** Municipal wastewater can contain toxic and harmful pollutants, including pharmaceuticals, flame retardants and heavy metals such as cadmium, lead, mercury, silver and zinc. When sewer overflows occur and these pollutants get into the lakes, they can pose serious risks for human health and the environment, particularly as some of them do not break down easily into less harmful substances in the Great Lakes environment. These persistent substances can pose a significant challenge for remediation and, in some cases, remain in the environment long after their use has been discontinued.
- **affect water quality and human health:** In addition to harmful pollutants, overflows can contain human and pet wastes carrying bacteria and viruses that cause disease. These pathogens have the potential to compromise water quality in the lakes, increasing the burden on drinking water treatment facilities and rendering the water unsuitable for recreational activities. Exposure to contaminated water while swimming can lead to human health effects, such as hepatitis, gastric disorders and swimmer's ear.
- **threaten aquatic life and habitat:** Pathogens, phosphorus, debris and harmful pollutants discharged into the Great Lakes from sewer overflows and wastewater treatment plant bypasses can have devastating effects on the ecosystem. Fish and shellfish may concentrate pathogens in their tissue, in turn causing illness in other aquatic organisms that rely

on them as a food source. Effects from harmful pollutants on wildlife include developmental deformities, shell thinning in bird eggs and tumours in fish. Debris entering the Great Lakes from the sewer system also threatens shorelines and estuaries.

- **contribute to algal blooms:** Excess levels of phosphorus found in the Great Lakes as a result of sewer overflows can contribute to harmful overgrowths of algae. These harmful algal blooms can disrupt the aquatic ecosystem, produce toxins, threaten fisheries and increase the costs of water treatment and shoreline maintenance.
- **have economic costs:** Wastewater infrastructure can be costly to build and repair. In addition, sewer overflows can seriously impair the quality of life associated with the Great Lakes, with significant socio-economic impacts. Beach closures are often linked to stormwater and sewage overflows and may result in costly cleanup for the area as well as the loss of revenue from recreation and tourism. Property values decrease as a result of contaminated water, beaches and nearshore areas.

## CHALLENGES AHEAD

While the amount of stormwater runoff and untreated sewage discharged into the Great Lakes has been greatly reduced, there are some very real challenges ahead.



**Aging infrastructure:** Most of the wastewater infrastructure in the Great Lakes region was constructed 40 to 60 years ago and has begun to show signs of failure. Many older combined sewer systems do not meet current standards and may not be able to prevent stormwater runoff discharges into the environment during severe storms. A significant portion of the cost of infrastructure maintenance falls to municipalities, which may not have adequate financial resources for repairs or replacement.



**Population growth and urbanization:** If the capacity of sewer systems is not increased in accordance with the rate of population growth and urbanization, more sewer overflows will occur because the infrastructure will not be able to cope with the additional volume of raw sewage and stormwater runoff. Population growth is also associated with urban sprawl, which makes infrastructure development and maintenance more

expensive because of the distances involved in providing services to low-density populations.



**Climate change:** Sewer overflows are strongly influenced by climatic factors governing stormwater runoff, particularly the form (rain or snow), the amount and the intensity of precipitation. Climate change is expected to increase the frequency and severity of storms and flooding, putting greater demands on wastewater infrastructure. Repairing existing infrastructure and building new infrastructure capable of handling new

climatic conditions will be a significant financial and logistical challenge in the Great Lakes region.

## WHAT IS BEING DONE?

There are a number of initiatives in place to address stormwater runoff and sewage overflows in the Great Lakes. The following are some examples of these strategies:

### International Collaboration

- » **Great Lakes Water Quality Agreement (GLWQA):** Many credit the 1972 GLWQA for helping to drive a new generation of water pollution controls and massive investments in sewage treatment in the Great Lakes. The agreement was amended in 2012 to address ongoing threats to the lakes, including changes in the flows, levels and distribution of pollution, and the implications of these developments for wastewater systems and human health.

### Federal Initiatives

- » **Wastewater System Effluent Regulations:** Introduced in 2012 under the *Fisheries Act*, these regulations are intended to protect ecosystem health, fisheries resources and human health by decreasing the level of harmful substances deposited into waterways from wastewater effluent and to phase out the dumping of untreated and undertreated sewage. These regulations are Canada's first national standards for wastewater treatment and were developed to help fulfill a commitment under the *Canada-Wide Strategy for the Management of Municipal Wastewater Effluent*, which was endorsed by the Canadian Council of Ministers of the Environment in 2009.

### Federal-Provincial Collaboration

- » **Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA):** This agreement, ratified in 1971 and currently being updated to reflect recent amendments to the GLWQA, makes provision for federal, provincial and municipal governments to work together to further the development of wastewater treatment and stormwater management technologies.

### Provincial Initiatives

- » **Ontario Water Resources Act:** Introduced in 1990 and amended most recently in 2009, this act provides for the conservation, protection and management of Ontario's waters and for their efficient and sustainable use. The act regulates sewage disposal and prohibits the discharge of any materials that can impair water quality. It also protects the province's water resources by preventing industrial and commercial users from drawing out more water than the lakes can sustain.
- » **Water Opportunities Act (2010):** This act provides a framework for improving the efficiency of municipal infrastructure, including storm and wastewater management and drinking water systems, and for setting municipal water conservation targets.

### Municipal Initiatives

- » **Toronto Wet Weather Flow Master Plan (2003):** The goal of this plan is to reduce and ultimately eliminate the negative impacts of wet weather on stormwater runoff. The 25-Year Implementation Plan outlines key programs and projects to provide solutions for stormwater pollution, including remediating stream erosion, reducing algal growth along waterfronts and restoring aquatic habitat.
- » **Toronto Mandatory Downspout Disconnection (2011):** This Toronto bylaw makes it mandatory for property owners to disconnect their downspouts, allowing stormwater to seep directly into surrounding soil or to be collected in rain barrels. This diverts rainwater runoff from the municipal sewer system, helping to prevent the overflows that can release polluted water into local waterways during periods of heavy rainfall.



## WHAT CAN YOU DO?

- **Reduce or eliminate the use of fertilizers:** Fertilizers containing phosphorus often end up in runoff and sewage systems and can be discharged into the Great Lakes through overflows. Use natural fertilizers, such as compost, instead.
- **Help reduce stormwater overflows:** To reduce runoff, connect your downspout to a rain barrel or allow it to drain into your garden.
- **Choose permeable surfaces for driveways and walkways:** Permeable surfaces allow rainwater to be absorbed directly into the ground, minimizing flash flooding as well as reducing stormwater runoff and the need for stormwater treatment infrastructure. Choose materials such as gravel, wood chips or porous forms of concrete for your driveway or walkway.
- **Clean up after your pets:** Animal waste can end up in sewer systems and contribute to *E. coli* counts in the lakes. Properly dispose of pet waste both at home and when out for a walk.
- **Get involved:** Look for opportunities to get involved in public consultations on important issues such as water quality and conservation and on agreements and legislation related to the Great Lakes. Urge government, businesses and other organizations to take action on Great Lakes issues.



## SELECTED RESOURCES

For more information on wastewater and the Great Lakes, consult the following resources:

Canadian Council of Ministers of the Environment. Canada-wide Strategy for the Management of Municipal Wastewater Effluent. [http://www.ccme.ca/ourwork/water.html?category\\_id=81](http://www.ccme.ca/ourwork/water.html?category_id=81)

City of Toronto. Green Roofs. <http://www.toronto.ca/greenroofs/>

Environment Canada. Wastewater Management. <http://www.ec.gc.ca/eu-ww/default.asp?lang=en&tn=0FB32EFD-1>

Government of Canada. Wastewater Systems Effluent Regulations. <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2012-139/FullText.html>

Ontario First Nations Technical Services Corporation. Water & Wastewater Program. <http://www.ofntsc.org/water-wastewater>

Ontario Ministry of the Environment. Ontario Water Resources Act. [http://www.ene.gov.on.ca/environment/en/legislation/ontario\\_water\\_resources\\_act/index.htm](http://www.ene.gov.on.ca/environment/en/legislation/ontario_water_resources_act/index.htm)

Ontario Ministry of the Environment. Stormwater Management. [http://www.ene.gov.on.ca/environment/en/subject/stormwater\\_management/index.htm](http://www.ene.gov.on.ca/environment/en/subject/stormwater_management/index.htm)

Ontario Ministry of the Environment. Water Opportunities Act. [http://www.ene.gov.on.ca/environment/en/legislation/water\\_opportunities/index.htm](http://www.ene.gov.on.ca/environment/en/legislation/water_opportunities/index.htm)



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Back cover: Backyard compost bin. © Solyunafamilia