Office of the Auditor General of Ontario

Value-for-Money Audit:

Climate Change Adaptation: Reducing Urban Flood Risk

November 2022

Ministry of the Environment, Conservation and Parks;
Ministry of Natural Resources and Forestry;
Ministry of Municipal Affairs and Housing; Ministry of Infrastructure

Climate Change Adaptation: Reducing Urban Flood Risk

1.0 Summary

Urban flooding occurs when heavy rainfall overwhelms the capacity of drainage systems in developed areas to absorb, collect and carry away stormwater. This can lead to flooded streets and underpasses, resulting in dangerous road conditions, transit closures and power outages. Dirty stormwater, sometimes mixed with raw sewage, can also back up through sewer drains into homes or pour into basements, damaging property and potentially putting people at risk.

Urban flooding can happen in any developed community, large or small, independent of any overflowing river or lake, making it the most common form of flooding in Ontario. While less than 3% of Ontario's population live in a floodplain (the low-lying area next to a river; see **Appendix 1** for the Glossary), and is at risk of river flooding, all Ontarians who live in developed areas may be at risk of an urban flood.

Urban flooding can have serious economic, social and environmental impacts. For example, a record-breaking rainfall in Toronto in 2013 caused both urban and river flooding, resulting in 7,000 flooded basements, 900,000 households without power, and insured damage of $1 billion. While this flood was Ontario's costliest disaster, the impact of urban flooding has been felt across the province, including major urban flood events with insured losses over $80 million each in Thunder Bay (2012), Hamilton (2012), Burlington (2014), and Windsor and Tecumseh (2016 and again in 2017). Localized storms in smaller communities also result in sewer backups and basement flooding that are equally damaging and disruptive to those affected. Despite these impacts, urban flooding receives much less attention from the Province than river and lake flooding.

Three main factors contribute to an increased risk of urban flooding:

- development that results in the loss of green spaces and other pervious surfaces, which absorb water, and the expansion of hard surfaces (such as roads, parking lots and buildings), which prevent stormwater from being absorbed into the ground and increase stormwater runoff;
- inadequate or aging stormwater infrastructure, such as sewer drains, pipes and retention tanks, which can increase the risk of urban flooding; and
- climate change, which is resulting in more frequent high-intensity rain events.

While heavy rains cannot be prevented, measures can be taken to adapt to the projected increase in intense rain events due to climate change. Various

controls—both natural and built—can be used to absorb or redirect stormwater to reduce the risk of urban flooding resulting from future rain events.

There is no one government ministry assigned responsibility for co-ordinating measures to address urban flooding in Ontario. Rather, our audit identified four key provincial ministries—the Ministry of the Environment, Conservation and Parks (Environment Ministry), the Ministry of Natural Resources and Forestry (Natural Resources Ministry), the Ministry of Municipal Affairs and Housing (Municipal Affairs Ministry), and the Ministry of Infrastructure (Infrastructure Ministry)—as having significant responsibilities relating to urban flood management in Ontario. Generally, these responsibilities relate to protecting green spaces that can help control urban flooding (Natural Resources and Municipal Affairs Ministries); approving the construction of municipal stormwater infrastructure (Environment Ministry); setting out requirements for municipalities to assess, report on and develop financial plans for their stormwater infrastructure (Infrastructure Ministry); setting out building standards, which may include measures to reduce home flooding (Municipal Affairs Ministry); and providing guidance and education to municipalities and the public about adapting to the impacts of climate change (Environment Ministry).

Municipalities also have significant responsibility for reducing urban flood risk. While the Province generally sets the rules and provides some oversight and guidance, it is municipalities that are responsible for the actual planning, building, operating and funding of infrastructure to manage stormwater. Municipalities also make local planning decisions and approve local development in accordance with provincial land-use policies, which can affect urban flooding. Each municipality must also appoint a chief building official who is responsible for implementing provincial building standards within their municipality. In addition, homeowners and businesses play a role in taking steps to reduce impacts on their own properties as well as limiting stormwater runoff from their properties.

Our audit found that the Province does not have effective systems and processes to reduce the risk of urban flooding, nor to provide homeowners, municipalities and other decision-makers the guidance and information they need to reduce their risks of urban floods.

The Province is well aware of the need to do more to address this issue. No fewer than four reports and plans—including the Environment Ministry's 2018 Made-in-Ontario Environment Plan (Environment Plan), the 2019 report from Ontario's Special Advisor on Flooding, the Natural Resource Ministry's 2020 Protecting People and Property: Ontario's Flooding Strategy (Flooding Strategy), and the 2021 Advisory Panel on Climate Change report—have identified specific actions that need to be taken to help Ontario reduce urban flood risk. Yet the Province has never clarified provincial roles for addressing and co-ordinating actions needed to alleviate the risk of urban flooding, with the result that gaps in responsibility persist and actions and commitments have never been implemented.

The following are some of our most significant findings:

- **Many buyers of new homes are not protected from sewer backups due to lack of clarity in the Building Code.** Basement flooding, which includes flooding from sewer backups, has been reported as the most preventable climate-related damage to Ontario homes. Although Ontario's Building Code requires backwater valves for homes with drains that "may" be subject to backflow, ambiguity in the term "may" has hindered their widespread installation. In our survey of chief building officials, only 14 (27%) of the 52 respondents require installation of backwater valves for all new homes with basements in their municipalities. During construction, the cost to install a backwater valve is around $250. In comparison, the average cost to repair a basement following the 2013 urban flood in Toronto was $43,000. The Municipal Affairs Ministry is currently updating the Code and plans to file a new edition in early to mid-2023. However, at the time of our audit, the Ministry had not proposed changes to clarify requirements for backwater valves.

- **Municipalities are receiving contradictory provincial guidance and direction on using projected climate change data, and so many continue to rely on historical data.** Infrastructure and buildings designed based on historical climate data may not be able to withstand future precipitation patterns. Yet, we found that ministries are providing inconsistent guidance across different program areas on whether to use projected versus historical climate data. For example, the Province's Flooding Strategy commits to encourage municipalities to require new developments to use updated precipitation data in design standards, and to account for climate change in the design of drainage infrastructure. As well, the Provincial Policy Statement instructs municipalities to prepare for climate change impacts in land-use decisions. Conversely, the Municipal Affairs Ministry requires building authorities to use the climate design data set out in Ontario's Building Code, which is based on historical weather observations, when approving building designs. Accordingly, our Office's survey of chief building officials found that all 51 respondents to a question on data indicated that they relied on historical data. Further, the Environment Ministry requires municipalities to design sewers using the most recent historical precipitation data, but not climate change projections. In a separate survey we conducted of a sample of municipalities, when asked about the data used in designing stormwater infrastructure, 17 (57%) of 30 reported that they relied only on historical data.
- **Majority of municipalities we surveyed are unable to map urban flood risk areas.** Municipalities and the Province need to be able to identify areas vulnerable to urban flooding to inform land-use planning and determine where new or upgraded stormwater infrastructure is most needed to reduce risk. Flood risk maps are used to identify vulnerable areas for all types of floods, including urban floods. However, in response to our survey of municipalities, 23 (77%) of 30 indicated that they are unable to accurately map urban flood risk, noting gaps in datasets on stormwater infrastructure, the need for updated elevation or land cover data, and/or a lack of internal expertise, funding or staff resources to develop and run models.
- **Municipal assessment and reporting on stormwater infrastructure and flood resiliency is not standardized, with potential impacts on long-term planning and funding decisions.** Municipalities are now required by the Asset Management Planning for Municipal Infrastructure regulation to develop asset management plans that assess the condition and replacement costs of their infrastructure, as well as the resiliency of municipal properties and stormwater infrastructure to floods. However, a lack of detailed guidance from the Infrastructure Ministry is resulting in inconsistent and incomplete assessments and reporting, undermining effective decision-making and making it difficult to compare and prioritize municipal needs. Our review of 25 asset management plans found a range of differing approaches to assessing the condition of municipal stormwater infrastructure and flood resiliency. Our municipal survey similarly found a range of approaches, with 60% of respondents indicating that they did not consider urban flooding when assessing the flood resiliency of municipal properties.
- **Majority of municipalities do not have reliable sources of funding to finance stormwater infrastructure capital shortfall.** Several reports indicate that Ontario municipalities have been underinvesting in their stormwater infrastructure, resulting in a capital shortfall of several billion dollars. Of the 182 municipalities that incurred operating expenses relating to urban stormwater management in 2020, only 51 (28%) reported collecting revenue earmarked for urban stormwater systems. Federal and provincial grants for urban stormwater infrastructure varied annually over the past 10 years and

totalled just $187 million, substantially less than the billions of dollars needed. Under the Asset Management Planning for Municipal Infrastructure regulation, municipalities must now complete asset management plans; however, we found issues with the quality and consistency of these plans, which may limit their effectiveness in ensuring that municipalities are assessing and sustainably financing their stormwater infrastructure.

- **Nearly half of southern Ontario's remaining wetlands are unevaluated and risk being lost.** Between 2011 and 2015 (most recent data), southern Ontario lost an average of 1,825 hectares of wetlands per year—an annual rate of loss three times higher than the previous data period (2000 to 2011). The wetlands that do remain are at risk of further loss: only those wetlands that have been both evaluated and designated as provincially significant are granted formal protection under the Provincial Policy Statement. However, there is no requirement for a wetland to be evaluated before a municipality can approve land-use changes that may damage it, and many wetlands have never been evaluated. Between 1983 and 2022, a total of 2,257 wetlands in southern Ontario (comprising 52% of the wetland area) have been evaluated, but only 30 were evaluated in the past 10 years. Moreover, wetlands within urban areas are more likely to be smaller and more degraded and therefore may be less likely to achieve provincially significant status, despite their importance for flood reduction.
- **Province does not regulate the structural design of large purpose-built flood control facilities that are located away from lakes or rivers.** The Natural Resources Ministry issues approvals for flood control facilities, but only for those that are on lakes or rivers. The Environment Ministry issues approvals for municipal stormwater infrastructure to protect water quality. However, because flood control is not within its mandate, the Environment Ministry does not require these facilities to obtain an environmental compliance approval. As a result, there is a regulatory gap regarding the structural design of these facilities.

Overall Conclusion

Our audit concluded that the Province does not have effective systems and processes to reduce the risk of urban flooding in Ontario, or to support and encourage municipalities and property owners to reduce the risk of urban flooding.

We found that the Province has never clarified provincial roles for co-ordinating and managing urban flooding, resulting in gaps in responsibility. The Environment Ministry approves municipal stormwater infrastructure for the purposes of protecting water quality and preventing stream erosion, but does not consider flood control as part of this approval process, as it is outside its mandate; the Infrastructure Ministry is not providing sufficient guidance to support effective implementation of its municipal asset management regulation; the Municipal Affairs Ministry has not taken steps to increase the installation of backwater valves that help prevent basement flooding; and the Natural Resources Ministry has made little progress evaluating and protecting wetlands, which can provide important flood-reduction functions.

Finally, we found that the Province is not ensuring that information about the risks of urban flooding, including under future projected climate scenarios, is being shared with municipalities, government agencies, property owners and others to inform decision-making.

This report contains 16 recommendations, with 25 action items, to address our audit findings.

OVERALL ENVIRONMENT MINISTRY RESPONSE

The Ministry appreciates the Auditor General's observations and recommendations resulting from the value-for-money audit of Climate Change Adaptation: Reducing Urban Flood Risk.

The Province has already taken steps to improve our understanding of the impacts of climate change and to help municipalities prepare and protect communities, including public infrastructure. For example:

- undertaking Ontario's first-ever multi-sector provincial-level climate change impact assessment;
- building resilience through the Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health;
- developing and providing guidance on innovative stormwater management approaches—such as stormwater green infrastructure and low-impact development; and
- adopting the Consolidated Linear Approach for municipal sewage works infrastructure.

The Ministry will continue to work collaboratively with our partner ministries and other levels of government as it relates to each of our mandates so that the Province is better prepared for the impacts of climate change, including the potential risk of urban flooding in Ontario. Municipalities have a significant responsibility for reducing urban flood risk through local planning, building, operating and funding their stormwater infrastructure.

The Auditor General highlights various ways governments can work together and have effective policies and programs in Ontario, as well as help encourage actions by municipalities and property owners to reduce the risk of urban flooding.

We will consider the Auditor General's report and recommendation, which can help inform future provincial actions and help municipalities build resiliency and adapt to the impacts of climate change.

OVERALL NATURAL RESOURCES MINISTRY RESPONSE

The Ministry appreciates the Auditor General's observations and recommendations resulting from the value-for-money audit on Climate Change Adaptation: Reducing Urban Flood Risk.

The Natural Resources Ministry has made progress to ensure it is delivering value for money for the people of Ontario relating to its mandate in addressing risks associated with fluvial flooding (rivers, streams and lakes) from waterbodies including:

- investing in the creation, enhancement and dissemination of flood hazard mapping in Ontario through the Ontario Flood Hazard Identification and Mapping Program;
- providing flood-related information to the public on **Ontario.ca/floods**; and
- working across government to develop our approach to implementing the actions within the Flooding Strategy.

This report's recommendations will assist us in our efforts, including our work in implementing Protecting People and Property: Ontario's Flooding Strategy. The Ministry remains committed to working with municipalities and other partners to help manage flood risks in Ontario.

OVERALL MUNICIPAL AFFAIRS MINISTRY RESPONSE

The Ministry of Municipal Affairs and Housing thanks the Auditor General for her recommendations. The Ministry recognizes the importance of reducing the risks of urban flooding and will continue to provide support to those ministries with the expertise and mandates for addressing the concerns outlined in this report.

OVERALL INFRASTRUCTURE MINISTRY RESPONSE

The Ministry of Infrastructure would like to thank the Office of the Auditor General of Ontario for their work and appreciates the value of this audit. The Ministry accepts the recommendations directed to the Ministry of Infrastructure and will work to implement them on the timelines presented as well as taking into consideration all recommendations regarding best practices and opportunities for the Ontario Public Service relating to urban flooding.

2.0 Background

2.1 Overview

Flooding can occur in various ways due to different causes (see **Figure 1**). For example:

- River flooding occurs when heavy rain and snowmelt cause water to overflow the banks of a river, stream or creek. River flooding can create potentially dangerous conditions and cause major damage in low-lying areas near the overflowing river.
- Urban flooding occurs when heavy rain overwhelms the capacity of built and natural stormwater drainage systems to absorb or convey the water away. It is caused primarily by short-duration intense rainfall, rather than snowmelt.

Despite the name, urban floods can happen in any developed community, large or small, and far from any waterbody (although urban floods can overlap with river floods). While less than 3% of Ontario's population lives in a floodplain (the low-lying area next to a river or stream), where river flooding is a risk, all Ontarians who live in a developed area, regardless of proximity to a waterbody, may be at risk of urban flooding. Ontario is the most urbanized province in Canada, making urban flooding a bigger risk here than elsewhere in the country.

Urban flooding receives much less attention from the provincial government than river and lake flooding. Most of Ontario's current flood-related policies and programs grew out of the response to the disastrous Hurricane Hazel floods in 1954. Following Hurricane Hazel, Ontario empowered conservation authorities to regulate development in river floodplains and to take other measures to prevent rivers from overflowing. In the 68 years since, Ontario has continued to improve river and lake flood management. While some of these measures can also help address urban flooding to some degree, different factors contribute to urban floods, and therefore require different controls.

2.2 Impacts of Urban Flooding

Urban flooding can have a range of serious impacts, including economic, social, health and environmental effects. For example, street-level flooding can result in the disruption of public services, such as road and transit closures, and damage street-level equipment, like utility boxes and transformers, causing power outages. Water can enter basements and the lower levels of buildings, causing significant property damage to homes and businesses. Basement flooding can lead

Figure 1: Different Types of Floods

Prepared by the Office of the Auditor General of Ontario

Type of Flood	Waterbody	Description/Cause
Urban flood	Flooding is unrelated to the overflowing of any waterbody	Heavy rainfall, especially in a short time frame, overwhelms the capacity of natural and built stormwater drainage systems
River flood	River	Water levels in a river or stream rise and overflow the banks, due to high volumes of rain and/or snowmelt
Ice jam flood	River	River flow is blocked by the buildup of floating ice, causing the river to overflow
Structural failure flood	River	An engineered structure, such as a dam, levee or dyke, fails due to unusually high river flows and/or poor design, construction, operation or maintenance
Lake flood	Lake	Water is carried onto shore and low-lying land due to seasonal changes in the inflow and outflow of lakes, or by storms that cause an abnormal sudden rise in lake levels
Coastal flood	Ocean or sea	High winds or storms, often combined with high tides, carry coastal water onto shore

to the growth of mould, which can pose a serious health risk. Overloaded sewer systems from heavy rains can also result in stormwater, and sometimes raw sewage, backing up into homes, buildings and onto streets, as well as polluting waterbodies.

2.2.1 Economic and Social Impacts of Urban Flooding

The economic and social impacts of urban flooding are significant—for homeowners, tenants, governments and insurers. For example, the record-breaking rainfall during the 2013 Toronto flash flood, when 126 millimetres of rain fell in just six hours resulting in a combination of urban and river flooding, flooded 7,000 basements and left 900,000 households without power. The storm inundated cars commuting home and left 1,400 people stranded in a commuter train. While this flood was Ontario's costliest disaster—with insured damage of $1 billion—the impact of urban flooding has been felt across the province. See **Figure 2** for a list of the costliest urban flood events in Ontario from 2010 to 2020.

There is no data specifically on overall economic damage from urban flooding in Ontario; however, insured losses due to water damage (which includes damage from urban flooding among other water-related perils, such as river floods) have increased

Figure 2: Major Urban Flood Events in Ontario (2010–2020) with Insured Losses over $80 Million*

Prepared by the Office of the Auditor General of Ontario, with data from the Canadian Disaster Database and the Insurance Bureau of Canada

Date	Urban Flood Event
May 2012	**Thunder Bay** declares a state of emergency after almost 100 millimetres of rain fall in the city in a little less than six hours, flooding the city's sewage treatment plant, causing sewage backups and damage to thousands of homes. The rain also causes road closures and interferes with utility services. The storm results in $240 million in insured losses.
Jul 2012	**Hamilton** area receives 116 to 140 millimetres of rain in three hours, overwhelming the storm sewers and flooding basements. The storm results in $104 million in insured losses.
Jul 2013	**Toronto** receives 102 millimetres of rain in just two hours, and 126 millimetres in six hours, which results in a combination of severe urban flooding and river flooding. The storm results in $1 billion in insured losses making this one of the most expensive urban flood-related events in Canada's history. The City of Toronto paid a further $60 million in uninsured costs.
Aug 2014	**Burlington** receives up to 200 millimetres of rain in eight hours, which causes a combination of urban flooding and river flooding, as rivers and creeks throughout the city overflow, while clogged stormwater catch basins are inundated with water. Highways and roads are closed and thousands of basements are flooded, including through sewage backups. The damage from the storm in Burlington and the Greater Toronto Area results in $85 million in insured losses.
Sep 2016	**Windsor and Tecumseh** receive over 200 millimetres of rain in a few hours—a volume of rain well beyond the maximum capacity of the area's stormwater systems—resulting in flooded roads, fields and yards, and dirty sewer water in thousands of flooded basements. The storm results in $166 million in insured losses; 80% of these losses were attributed to residential sewer backup and water damage.
Aug 2017	**Windsor and Tecumseh** receive up to 285 millimetres of rain in less than 48 hours in some areas, overwhelming their stormwater systems for the second year in a row. The storm results in $178 million in insured losses, 70% of which are attributed to residential sewer backup and water damage. Between the 2016 and 2017 events, 11,000 households experienced flooding.
Aug 2018	**Toronto** is hit with 72 millimetres of rain in less than two hours. The intense rainfall results in a combination of urban and river flooding, causing havoc, such as sewage pipes backing up in streets and flooded streetcars, and resulting in $169 million in insured damages.

Note: 2020 is the most recent year with data available on insured losses. All losses are adjusted to 2020 dollars.

* Figure includes all flood events in Ontario from 2010 to 2020 that had insured losses over $80 million that were substantially or entirely due to urban flooding. Note, however, it is common for more than one type of flood (such as both a river and urban flood) to occur at the same time, and so some of the costs in the figure include damages caused by other forms of flooding as well as other forms of damage, such as lightning and wind damage.

dramatically, as shown in **Figure 3**. In the last 10 years (2012–21), insured losses from water damage in Ontario totalled over $3 billion. Although the data does not break out the losses by type of water-related peril, the Institute for Catastrophic Loss Reduction (an insurance-industry-funded research organization) reports that urban flood losses—including damage from both sewer backups and other losses due to extreme rainfall in urban areas—have been over 10 times greater than river flood damage in most years.

Moreover, the $3 billion total does not represent the full amount of losses. It only reflects catastrophic loss events over $25 million, which excludes the many smaller urban floods that hit communities across the province. Localized storms in smaller communities will typically not reach the threshold of a catastrophic event, but each flooded basement is still damaging and disruptive to those affected. The Intact Centre on Climate Adaptation reported that the average cost to repair a basement after the 2013 urban flooding in Toronto was $43,000. Further, the above estimate does not include losses by individuals who lack insurance or do not make a claim. Experts in the insurance industry estimate that for every dollar of losses covered by insurers, three to four dollars are covered by governments and home and business owners.

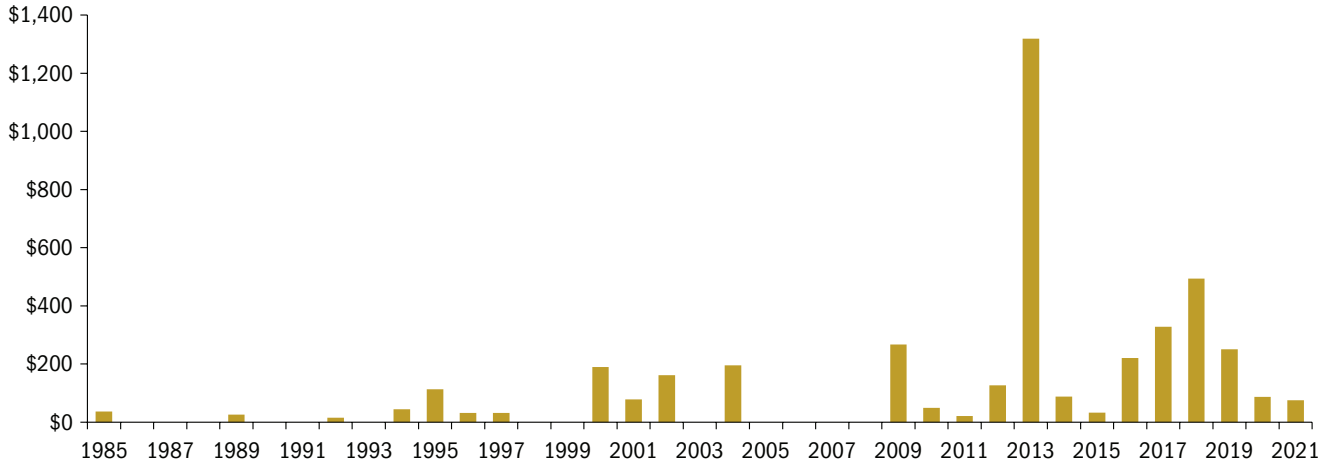
Urban flooding also presents a significant future cost risk to governments and taxpayers. In 2021, a report from the Financial Accountability Office estimated that impacts of three climate change hazards—extreme rainfall (including urban, but not river, floods), extreme heat and freeze-thaw cycles—on public buildings in Ontario will result in $66 billion in additional operating and maintenance costs from 2022 through to 2100. Of the three climate change hazards, the report noted that extreme rainfall would be the biggest factor contributing to these projected costs.

2.2.2 Health Impacts of Urban Flooding

Health Canada has reported on various health impacts that are associated with flooding. For example, flooding of homes can result in the growth of fungi, bacteria and mould. These can increase the risk of developing, or aggravating, skin, allergy and respiratory problems. Further, sewage backups may bring toxins, such as E. coli, into homes and negatively affect human health. These impacts are greater for those who live in basement accommodations. Health Canada also found that experiencing a flood, which can result in physical problems, personal loss and financial difficulties, can affect a person's mental health.

Figure 3: Insured Catastrophic Water Losses in Ontario ($ million)

Source of data: Insurance Bureau of Canada, with data from CatIQ



Note: Catastrophic water losses are insured losses greater than $25 million where the primary cause was flooding, water or rainstorms. Costs are adjusted for inflation and appear in 2021 dollars; 2021 data is preliminary.

2.2.3 Environmental Impacts of Urban Flooding

Urban floods can also have major environmental impacts. Heavy rains can wash an array of contaminants, such as fuel, pesticides and animal feces, directly into lakes and rivers. Moreover, 44 Ontario municipalities still have some combined sewer systems. These systems, which were mostly built in the mid-1900s, collect both sanitary sewage and stormwater in the same, combined pipe and take it to a wastewater treatment plant. When combined sewer systems are overloaded from heavy rains, raw sewage can back up into homes and other buildings, and onto streets. To reduce backups, the systems are designed to overflow the combined stormwater and raw sewage into lakes and rivers, polluting these waterbodies. According to federal data, from 2016 to 2020 (most recent data) at least 1,600 overflows have occurred across the province each year. Since 1985, municipalities are no longer permitted to build such systems, but they remain a legacy in many older urban areas in Ontario.

2.2.4 Provincial and Municipal Legal Liability Impacts

Ontario residents have increasingly been turning to the courts to seek compensation for urban flooding. Since 2005, several class-action lawsuits have been filed as a result of extreme weather events and flooding, including in Milton, Mississauga, Oakville, Stratford and Thunder Bay. In each, the plaintiffs have argued that municipal, and in some cases provincial, authorities failed in their duties to protect residential properties from flooding. The potential costs for municipalities are substantial. For example, the 2005 Stratford case was settled for $7.7 million in 2010, while the $375 million and $900 million claims in Thunder Bay and Oakville, respectively, are currently outstanding.

2.3 Adapting to Climate Change and Reducing Urban Flood Risk

Increasing concentrations of greenhouse gases in the atmosphere are causing the global climate to change. As a result, higher average temperatures are being experienced around the world. The warming atmosphere is also changing weather patterns and increasing both the frequency of extreme weather events and the intensity of rainfall. Natural Resources Canada data shows that the number of heavy precipitation days (greater than 10 millimetres) in Ontario has increased from 135 days in the 1950s to 158 days in the 2000s. The maximum one-day precipitation event in Ontario has also increased from 33 to 38 millimetres over the same period. Local precipitation events can be more extreme than these provincial averages. According to Environment and Climate Change Canada, both annual and extreme precipitation events are projected to continue to increase.

Climate change adaptation is the process of adjusting to the expected climate, such as more frequent and intense rain events, and taking action to reduce the negative impacts of such events. For example, while heavy rains cannot be prevented, various controls—both natural and built—can be used to absorb or redirect stormwater to reduce the risk of urban floods. Adapting to climate change, and future urban flood risks, can mean enhancing natural controls, as well as planning and designing built controls to not only handle current rain levels, but also withstand future expected rainfall events.

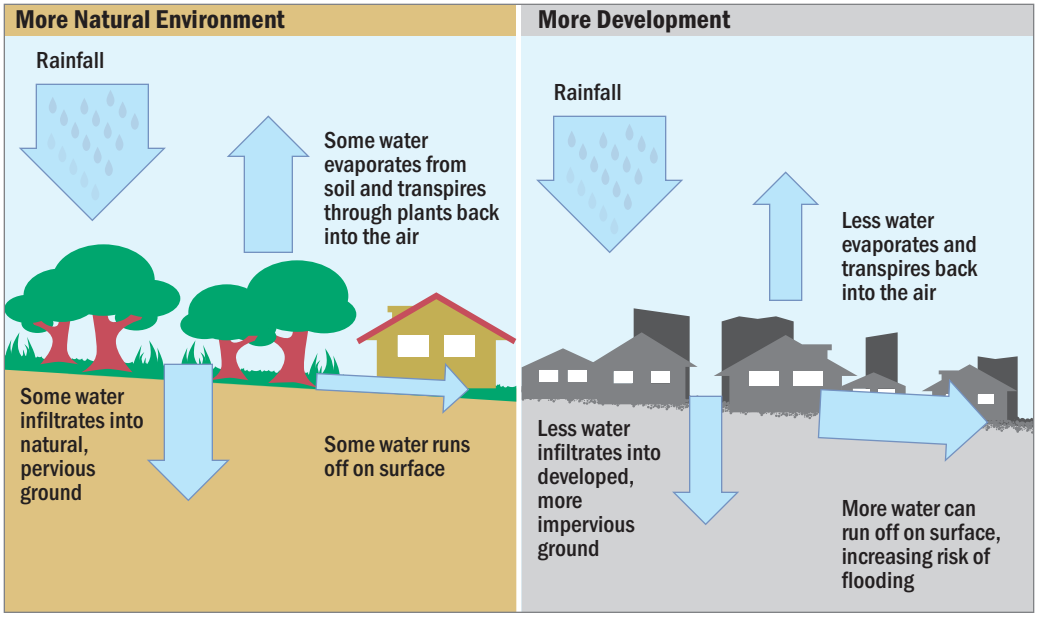
2.3.1 Green Spaces

Green spaces—which include natural features, such as wetlands, woodlands and meadows, as well as other spaces such as parks—can help reduce urban flooding (see **Figure 4**). These pervious surfaces absorb and retain rainwater where it lands, and therefore reduce the amount of stormwater runoff. For example, a 2020 study by researchers from Johns Hopkins University and the US Geological Survey found that when a city increases coverage of absorbent soil with impervious roads, pavements or car parks by 1%, stormwater runoff increases the annual flood volume in nearby waterways by 3.3%.

Wetlands are particularly beneficial in reducing flooding as they can act like sponges by providing

Figure 4: Example of Stormwater Runoff Levels on Natural vs Impervious Surfaces

Prepared by the Office of the Auditor General of Ontario



short-term water storage during times of peak stormwater runoff. A wetland as small as two hectares can retain water runoff from an area 70 times its size, significantly reducing flood damage. In 2017, the Intact Centre on Climate Adaptation at the University of Waterloo simulated a massive storm event (similar in size to Hurricane Hazel) and found that the financial costs of flood damage at the modelled urban site would be 38% lower ($84.5 million) if nearby wetlands were maintained in their natural state, compared to estimated flood damage of $135.6 million if the nearby wetlands were drained for agricultural development. The difference in flood damage costs would be even greater if the nearby wetlands were replaced with impervious surfaces, such as roads and parking lots, instead of converted to farm fields.

2.3.2 Built Stormwater Management Controls

Stormwater management refers to collecting and controlling the water runoff generated by rain and snowmelt. Stormwater infrastructure is typically designed and built to meet the combined goals of reducing flooding, minimizing erosion, and protecting water quality from pollutants (by collecting and treating stormwater rather than allowing contaminated stormwater to flow directly into water bodies).

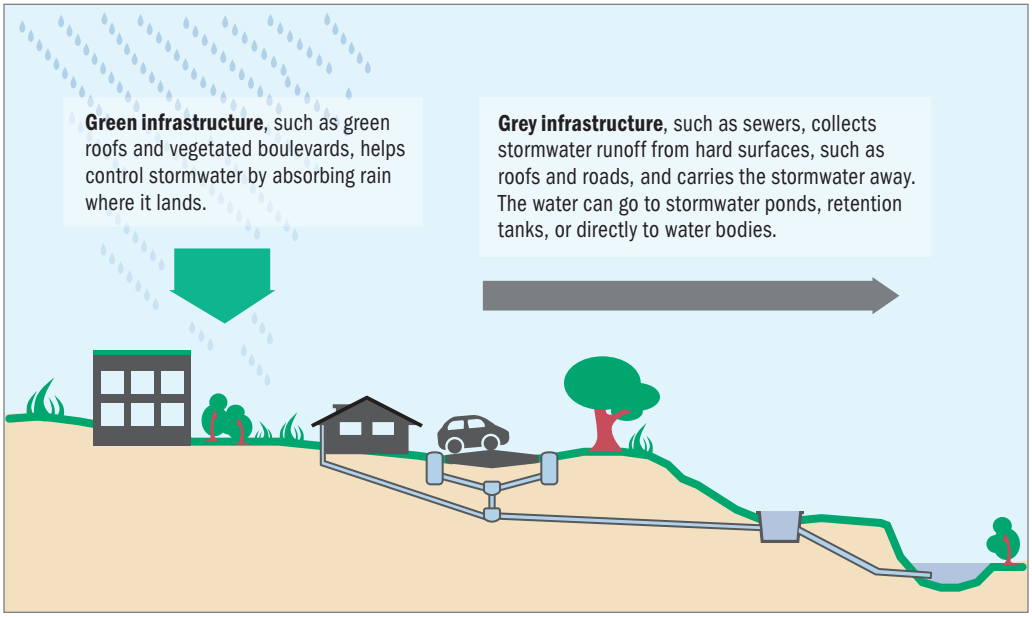
Stormwater management controls can generally be categorized into either:

- **grey stormwater infrastructure**, consisting of conventional elements like roadside catch basins, culverts, ditches and sewer pipes that collect and carry stormwater away. They are so called because they are usually built with concrete and metal; or
- **built green stormwater infrastructure**, also known as **low-impact development practices**, which are built elements that are designed to mimic the functions of nature in managing stormwater. Examples include green roofs, vegetated strips alongside roads, and pervious pavement (see **Appendix 2** for further examples).

Figure 5 illustrates how both grey and green stormwater infrastructure can be used together to manage stormwater.

Figure 5: Stormwater Management Controls via Green and Grey Infrastructure

Prepared by the Office of the Auditor General of Ontario



2.4 Roles and Responsibilities for Reducing Urban Flood Risk

There is no one government ministry that is fully responsible for addressing urban flooding in Ontario. Our audit identified four key provincial ministries—the Ministry of the Environment, Conservation and Parks (Environment Ministry), the Ministry of Natural Resources and Forestry (Natural Resources Ministry), the Ministry of Municipal Affairs and Housing (Municipal Affairs Ministry), and the Ministry of Infrastructure (Infrastructure Ministry)—that each have important responsibilities relating to urban flood management (see **Figure 6** for a brief description of their main roles). Generally, these responsibilities relate to protecting green spaces that can help control urban flooding; approving the construction of municipal stormwater infrastructure; setting out requirements for municipalities to assess, report on and financially plan for their stormwater infrastructure; setting out building standards, which may include measures to reduce home flooding; and providing guidance and education to municipalities and the public about adapting to the impacts of climate change.

For information on responsibilities for managing other flood hazards, such as river or lake flooding or flooding due to dam failures, see our audit on Management of Hazards and Emergencies in the Environment in this year's Annual Report.

Municipalities also have significant responsibility for reducing urban flood risk. While the Province generally sets the rules and provides some oversight and guidance, it is municipalities that are responsible for the actual planning, building, operating and funding of infrastructure to manage stormwater. Municipalities also make local planning decisions and approve local development, as well as issue building permits in accordance with the provincial *Building Code Act, 1992*. Conservation authorities conduct work that, while generally focused on identifying and managing natural hazards (e.g., flood risks from rivers and lakes), can overlap with urban flood management.

Lastly, property owners, such as homeowners and businesses, also play a role in taking steps to reduce impacts on their own properties and to limit stormwater runoff from their properties. All of these groups—municipalities, conservation authorities and property owners—require support, guidance and

Figure 6: Key Provincial Ministries and Their Responsibilities for Reducing Urban Flood Risk

Prepared by the Office of the Auditor General of Ontario

Ministry of the Environment, Conservation and Parks	• Lead, support and co-ordinate provincial resiliency efforts for climate change adaptation, including assessing climate change risks (such as from increased heavy precipitation) and providing guidance and education to municipalities and the public • Lead provincial efforts for environmental protection with respect to stormwater, including providing guidance and policy on stormwater management and low-impact development • Approve the construction of municipal stormwater management facilities (e.g., sewers, ponds, stormwater green infrastructure) for environmental protection under the *Ontario Water Resources Act* and the *Environmental Protection Act*
Ministry of Natural Resources and Forestry	• Lead flood hazard management in Ontario through policies and programs that address flood hazards from rivers, streams and lakes; while this role is focused on flood hazards from rivers, streams and lakes, Ministry actions to address these types of floods can overlap with and support actions to reduce urban flooding • Lead provincial programs to protect natural features, including wetlands, which can help with flood control • Provide guidance for flood hazard mapping of areas near rivers, streams and lakes
Ministry of Municipal Affairs and Housing	• Develop laws and policies (in partnership with other ministries) relating to land use and growth planning, including policies that require municipalities to plan for stormwater management as part of land use and growth planning, and policies to protect natural features • Set out building standards through the Building Code, which may include measures that reduce flooding to homes and buildings
Ministry of Infrastructure	• Oversee municipal asset management planning, including setting out requirements for municipalities to financially plan for the construction and maintenance of their stormwater infrastructure

direction from the Province in fulfilling their respective roles.

While the Province does not have a specific program, policy or strategy relating to urban flooding, it has released two key documents that are relevant. The Environment Ministry released the Made-in-Ontario Environment Plan (Environment Plan) in 2018, which covers a range of environmental issues and cross-ministry government commitments. Some commitments relate to climate change adaptation, including commitments to help communities prepare for climate change risks, such as increased flooding (see **Appendix 3**). The Natural Resources Ministry released Protecting People and Property: Ontario's Flooding Strategy (Flooding Strategy) in 2020, which sets out eight actions to manage flood risk, and 25 proposed activities to implement those actions. While most of the activities focus mainly on flood hazards from rivers and lakes, the Flooding Strategy includes several activities that relate directly or indirectly to urban flooding (see **Appendix 4**).

3.0 Audit Objective and Scope

Our audit objective was to assess whether the Environment Ministry, the Natural Resources Ministry, the Municipal Affairs Ministry, and the Infrastructure Ministry collectively have effective systems and processes to:

- ensure that the risks of urban flooding in Ontario, including the risks under future projected climate scenarios, are identified, shared with relevant parties, and used to inform decision-making; and

- reduce the risks of urban flooding, and support and encourage municipalities, government agencies, property owners and other relevant parties to reduce the risks of urban flooding, in accordance with legislation, regulations, policies and best practices.

In planning our work, we identified the audit criteria (see **Appendix 5**) we would use to address our audit objectives. These criteria were established based on a review of applicable legislation, policies and procedures, internal and external studies, and best practices. Senior management at each ministry reviewed and agreed with the suitability of our audit objectives and associated criteria.

The focus of our audit was on reducing the risk of future urban floods, not on managing or responding to them while or after they occur. For the purposes of the audit, urban flooding is defined as flooding caused by rainfall that overwhelms the capacity of built and natural stormwater drainage systems.

We conducted our audit between January 2022 and August 2022. We obtained written representation from each ministry's management that, effective November 23, 2022, they had provided us with all the information they were aware of that could affect the findings or the conclusions of this report. As part of our audit work, we:

- interviewed relevant staff from each of the four ministries;
- spoke with external stakeholders and subject-matter experts, including the Association of Municipalities of Ontario, Asset Management Ontario, CatIQ, Climate Risk Institute, Institute for Catastrophic Loss Reduction, Insurance Bureau of Canada, Intact Centre on Climate Adaptation, Doug McNeil (the Natural Resources Ministry's Special Advisor on Flooding), Tarion, Toronto Hydro, Metrolinx, and experts from the University of Toronto and the University of Waterloo;
- spoke with multiple municipalities and conservation authorities;
- toured municipal green and grey stormwater infrastructure projects;
- reviewed ministry and municipal documents, including all of the Environment Ministry's compliance reports for inspections of stormwater infrastructure from the last five years; a sample of 25 municipal asset management plans; and the 2011–2020 municipal financial information returns (the most recent and complete dataset);
- conducted a survey of the 245 chief building officials in Ontario; we received 52 responses (21% response rate), including 33 (77%) of the 43 members of the Large Municipalities Chief Building Officials group (who represent municipalities with populations over 50,000); overall our survey received responses from officials representing municipalities with a total population of 7.5 million and from locations across Ontario; and
- conducted a survey of a sample of 35 municipalities, representing a range of sizes and locations across Ontario, to seek information on various stormwater management issues. We received 30 responses (86% response rate) from municipalities representing a total population of 8.5 million.

We conducted our work and reported on the results of our examination in accordance with the applicable Canadian Standards on Assurance Engagements—Direct Engagements issued by the Auditing and Assurance Standards Board of the Chartered Professional Accountants of Canada. This included obtaining a reasonable level of assurance.

The Office of the Auditor General of Ontario applies the Canadian Standard on Quality Control and, as a result, maintains a comprehensive quality control system that includes documented policies and procedures with respect to compliance with rules of professional conduct, professional standards and applicable legal and regulatory requirements.

We have complied with the independence and other ethical requirements of the Code of Professional Conduct of the Chartered Professional Accountants of Ontario, which are founded on fundamental principles of integrity, objectivity, professional competence and due care, confidentiality and professional behaviour.

4.0 Detailed Audit Observations

4.1 Provincial Roles and Responsibilities

4.1.1 Lack of Clarity around Roles and Responsibilities Leaves Gaps in Ontario's Urban Flood Management

For over 15 years, the provincial government has been aware of gaps in assigned roles and responsibilities for urban flood management, and the need to clarify such responsibilities.

In 2007, the Natural Resources Ministry-led Provincial Flood Forecasting and Warning Committee raised concerns about the risks and management gaps of urban flooding. This warning followed a number of major urban flood events—including in Peterborough (2002 and 2004), Ottawa (2004), Toronto (2005) and Hamilton (2005).

In response to these concerns, staff from the Natural Resources, Environment, and Municipal Affairs Ministries, as well as experts from Conservation Ontario, the Association of Municipalities of Ontario and Environment Canada, formed an informal group to discuss the risks of urban flooding and how gaps in Ontario might be managed. The group drafted an internal report in 2010 that contained a preliminary gap analysis, noting various gaps in governance (including the lack of clarity in roles and responsibilities), public education, research and data (such as a lack of information to identify risk level) and funding. The report, however, was never finalized, and remains an internal draft.

In July 2019, in response to extensive spring flooding that year, the Natural Resources Minister appointed a Special Advisor on Flooding to review the Province's flood management framework and make recommendations. The Special Advisor submitted his report to the Ministry in October 2019. While the report focused primarily on river and lake flooding, he found that roles and responsibilities with respect to urban flooding were not clear, and recommended the Province establish a working group of all pertinent ministries to define their respective roles (see **Appendix 6** for urban flooding-related recommendations).

In March 2020, drawing on the Special Advisor's report, the Natural Resources Ministry released Protecting People and Property: Ontario's Flooding Strategy (Flooding Strategy) (see **Appendix 4** for the strategy's actions and activities). In the Flooding Strategy (which similarly focuses primarily on river and lake flooding), the Natural Resources Ministry acknowledged that gaps continue to exist with regard to roles and responsibilities for managing urban flooding. To address this, the Flooding Strategy commits the Province to establish an urban flooding working group with representatives from five ministries and select municipalities. The Flooding Strategy states that the priorities for the group are to "identify roles and responsibilities related to urban flooding, determine new or emerging urban flooding issues and develop a provincial framework for urban flooding policy."

In 2020, the Natural Resources Ministry drafted terms of reference and invitations to participate in the working group. However, at the time of our audit, no urban flooding working group had been created. The Natural Resources Ministry does not have a timeline for implementing this item. The Ministry has instead prioritized work on other areas of the Flooding Strategy that are more clearly aligned with its own responsibility for river and lake flood management.

As shown in the subsequent audit findings, the lack of clarity in assigned roles and responsibilities continues to result in gaps in urban flooding management.

RECOMMENDATION 1

To resolve gaps in roles and responsibilities, we recommend that the Ministry of Natural Resources and Forestry, the Ministry of the Environment, Conservation and Parks, the Ministry of Municipal Affairs and Housing, and the Ministry of Infrastructure develop a provincial framework for urban flooding that clearly identifies and assigns roles and responsibilities for urban flood management.

ENVIRONMENT MINISTRY'S RESPONSE

The Ministry of the Environment, Conservation and Parks, the Ministry of Natural Resources and

Forestry, the Ministry of Municipal Affairs and Housing, and the Ministry of Infrastructure will continue to work collaboratively consistent with each ministry's mandate.

Municipalities also play a major role in planning, building, operating/managing and funding their stormwater infrastructure.

NATURAL RESOURCES MINISTRY'S RESPONSE

The Natural Resources Ministry's mandate is limited to addressing risks associated with fluvial flooding (rivers, streams, and lakes).

MUNICIPAL AFFAIRS MINISTRY'S RESPONSE

The Ministry agrees that reducing the risks of urban flooding is an area that could benefit from more co-ordination. However, leading development of a provincial framework for urban flooding is not within the mandate of the Municipal Affairs Ministry. The Ministry notes that stormwater management, flooding and climate change adaptation fall under the mandates of the other ministries included in this recommendation. The Municipal Affairs Ministry will collaborate with other ministries and anticipates providing a supportive role on any initiatives resulting from this recommendation.

INFRASTRUCTURE MINISTRY'S RESPONSE

The Infrastructure Ministry agrees with the recommendation to clearly identify roles and responsibilities. The Ministry has responsibility for oversight of the asset management planning regulation, which pertains to the municipal infrastructure portfolio, including the full range of infrastructure assets. The Ministry has continued to partner with the municipal sector to deliver asset management planning tools and supports since 2018, including direct, in-person support from asset management professionals, detailed workshops on regulatory topics, and, beginning in 2022, has facilitated communities of practice in addition to continued one-on-one coaching and assistance and detailed workshops on regulatory topics.

The Ministry will ensure that these roles and responsibilities are clearly identified and communicated to the Natural Resources, Environment and Municipal Affairs Ministries.

AUDITOR GENERAL'S RESPONSE

While each of the four ministries indicated that it will continue to work within its own mandate, contrary to a recommendation made by the Special Advisor on Flooding and a commitment made in Ontario's Flooding Strategy, none agreed to develop a provincial framework that clearly identifies and assigns roles and responsibilities for urban flood management.

4.2 Provincial Help to Homeowners to Reduce Flood Risks

Homeowners are key players in reducing flood impacts on their own and neighbouring properties. For example, cleaning gutters and grading land can help direct water away from basements, while rain barrels can retain stormwater on-site and reduce runoff.

The Province has an important role in supporting property owners to take measures to reduce urban flooding on private property. This can involve educating the public about flood risks and prevention, providing incentives to adopt preventive measures, and regulating building construction to protect homeowners. Over the years, the Province has made several commitments to help homeowners reduce their risks from urban flooding. We found, however, that many of these commitments remain unfulfilled or have not been effectively implemented.

4.2.1 Buyers of New Homes Are Not Protected from Sewer Backups Due to Lack of Clarity in the Building Code

Backwater valves, which are installed in the main sewer pipe at the point the pipe exits a home, are

designed to allow water to flow in one direction only—out. Backwater valves can therefore decrease the risk of stormwater, or worse, raw sewage from combined sewer systems, backing up and entering basements through floor drains, toilets or other points during heavy rainfall events, when sewer systems become overwhelmed.

Proactively installing backwater valves during new construction is far more cost-effective than installing them as part of a retrofit after a problem arises. For new construction, the cost to install is around $250. Quotes obtained by our Office to install a valve in an existing home ranged from $2,800 to $4,800, not including the cost to repair any damage done to flooring to access the underground sewer pipe during installation. Proactively installing backwater valves can also potentially save significant costs in avoided damages. For example, the average cost to repair a basement following the 2013 urban flooding in Toronto was $43,000. Further, some insurance companies offer discounts to homes with backwater valves.

The Municipal Affairs Ministry is responsible for the administration of the *Building Code Act, 1992* and the Building Code (a regulation under the Act), which lay out rules for the construction of new, as well as renovations of existing, buildings. Municipal building officials are responsible for the Code's implementation. The Code states that backwater valves are required at the time of construction for drains that "*may*" be subject to backflow. A 2012 survey conducted by the Institute for Catastrophic Loss Reduction found that the Code's ambiguity in the term "*may*" hinders the widespread installation of these devices. One building official responded that "any drain 'may' flood, but there is little political will to force residents to spend money." Overall, only 26% of the building officials who responded to the 2012 survey reported that their municipalities required backwater valves in all or most new homes.

One of the commitments in Ontario's 2018 Made-in-Ontario Environment Plan (see **Appendix 3**) is to "modernize the Building Code to better equip homes and buildings to be better able to withstand extreme weather events." The Environment Plan suggested that an affordable way to do this would be to require backwater valves in new homes that are at risk of backflow. At the time of our audit, the Municipal Affairs Ministry was updating the Code on a range of topics, with plans to file a new edition in early to mid-2023 that would come into effect one year later. However, it did not propose any changes to the requirement in the current Code that a backwater valve be installed where a building drain "may" be subject to backflow.

In our Office's survey of chief building officials, we found that municipalities use differing criteria for determining whether drains "may" be subject to backflow. Fourteen (27%) of the 52 respondents reported that they require backwater valves for *all* new homes with basements within their municipality; 19 (37%) do not require *any* mandatory installation; and 19 require backwater valves for *some* homes with basements. For an estimate of some, 13 of the 19 officials provided an average estimate of 18%, while the others provided responses such as "unknown," "rarely" or "very small percentage." Officials that do not require backwater valves in all homes estimated, on average, that 11% of new homes *voluntarily* install backwater valves.

Of the 19 respondents that do not require backwater valves in any homes, 13 (68%) indicated that they would benefit from greater clarity on when backwater valves are required. As discussed in **Section 4.4** on flood risk mapping, municipalities, including chief building officials, may not have all the tools necessary to identify all high-risk areas. Furthermore, the Institute for Catastrophic Loss Reduction reports that, due to the unpredictable nature of extreme rainfall events, it is often impossible to identify which areas within a municipality will be exposed to sewer backup risk until widespread sewer backup events have occurred.

In contrast, the 2012 survey by the Institute of Catastrophic Loss Reduction found that the Alberta Safety Codes Council provided building officials with clear guidance for backwater valve installations, such that application of the requirements is more consistent. While building officials in Ontario are to make their own determination as to whether a drain "may" be subject to backflow, Alberta guidance states that every drain below street level is subject to backflow. The survey found that 81% of Alberta officials reported that backwater valves were required for all or most new homes.

RECOMMENDATION 2

To improve the flood resiliency of new homes, we recommend that the Ministry of Municipal Affairs and Housing review the requirements in Ontario's Building Code for the installation of backwater valves, and provide additional guidance to reduce ambiguity and increase uptake.

MUNICIPAL AFFAIRS MINISTRY'S RESPONSE

In 2015, the Building Code was amended in response to requests to clarify where backwater valves would need to be installed. The Ministry proposes to review those Code changes by working with building officials and associations in Ontario, to assess the level of understanding of the backwater valve provisions and take appropriate actions to enhance understanding and clarity if necessary.

4.2.2 Ontarians Have Unequal Access to Financial Incentives to Floodproof Their Homes

To help homeowners adopt measures to protect their homes against extreme weather events such as flooding, the 2018 Made-in-Ontario Environment Plan contained a commitment to consult on supportive tax policy options (see **Appendix 3**). In April 2022, the Ministry of Finance, which has lead responsibility for this commitment, confirmed that it has not undertaken consultations on tax policy options to support homeowners in adopting measures to protect their homes against extreme weather events.

Further, in 2021, the Environment Minister's Climate Change Advisory Panel submitted a report to the Environment Ministry, the lead ministry on climate change adaptation. The report noted that loss from basement flooding is the leading preventable climate-related damage to homes in Ontario, and recommended the Province support local governments that provide financial incentives to homeowners. However, at the time of our audit, the Province has not yet taken steps to implement this recommendation.

In the absence of provincial action, homeowners currently have uneven access to municipal flood-protection incentives, which may lead to greater vulnerability to home flooding in parts of the province. For example, while Toronto provides incentives of up to $3,400 for residents to install flood-protection devices (including up to $1,250 for backwater valve installations), many other municipalities do not provide any incentive. Our survey of a sample of municipalities found that 16 (53%) of 30 do not offer financial incentives for homeowners to take measures to prevent basement flooding, including some municipalities in which flooding has occurred.

RECOMMENDATION 3

To help homeowners adapt to climate change, and improve the flood resiliency of existing homes, we recommend that the Ministry of the Environment, Conservation and Parks work with the Ministry of Finance in consulting on how to incentivize flood-risk mitigation improvements by homeowners, and based on the outcome of the consultation, work with partner ministries to implement appropriate options as identified.

ENVIRONMENT MINISTRY'S RESPONSE

The Ministry is not currently pursuing options to incentivize flood-risk mitigation improvements, as many municipalities have programs to support resilient actions, such as disconnecting downspouts and installing backwater valves. Each municipality has different capacities and priorities, and consideration of incentive programs should reflect local need. Municipalities can also access various federal/provincial programs to support broader community resilience.

AUDITOR GENERAL'S RESPONSE

The Environment Ministry has not committed to consult on or work toward implementing ways to incentivize flood-risk mitigation improvements by homeowners, despite the commitment made in the 2018 Made-in-Ontario Environment Plan.

4.2.3 Province Not Educating Homeowners on the Increasing Risk of Flooding

Educating the public about flood risk could encourage homeowners to adopt important flood-protection measures, such as installing backwater valves. Accordingly, in the 2018 Environment Plan, the government committed to work with the real estate and insurance industries to raise awareness among homeowners of the increasing risk of flooding (see **Appendix 3**). The 2020 Flooding Strategy made a similar commitment (see **Appendix 4**).

In 2019, the Special Advisor on Flooding recommended that the Environment Ministry work with the University of Waterloo's Intact Centre on Climate Adaptation (which had previously led a home flood-protection pilot program in Burlington and Toronto) to inform homeowners about flood risk and protection. Further, in November 2021, the Climate Change Advisory Panel recommended that the Environment Ministry and Natural Resources Ministry work together to educate homeowners to improve their homes' resilience to basement flooding.

However, at the time of our audit, neither the Environment nor Natural Resources Ministry had implemented any of these commitments or recommendations.

RECOMMENDATION 4

To improve public awareness of flood risks and encourage homeowners to take steps to reduce the impacts of urban flooding, we recommend that the Ministry of the Environment, Conservation and Parks and the Ministry of Natural Resources and Forestry work with external stakeholders to promptly develop and implement a home flood-protection education campaign.

ENVIRONMENT MINISTRY'S RESPONSE

The Ministry of the Environment, Conservation and Parks will explore opportunities to work with other ministries regarding flood-protection public communications.

NATURAL RESOURCES MINISTRY'S RESPONSE

The Natural Resources Ministry has taken steps to increase public access to flood-related information. Updates were made to **Ontario.ca/floods** in 2020 to outline actions homeowners can take before, during, and after a flood emergency to help protect their homes from flooding from lakes and rivers.

The Ministry will consider opportunities to work with other ministries to further improve awareness of flood risks as they arise.

4.3 Guidance to Help Decision-Makers Understand and Apply Local Climate Data

As noted in **Section 2.3**, heavy precipitation events are increasing in both frequency and intensity across Ontario. Local precipitation events can be even more extreme than the provincial averages. For example, in August 2022, 100 millimetres of rain fell in Brampton within a 24-hour period, resulting in flooded roads and basements.

Infrastructure and buildings designed with historical climate data may not be able to withstand future precipitation patterns. Given that these assets typically have long life expectancies, the failure to consider future precipitation patterns—based on climate projections—when designing, constructing and replacing infrastructure and buildings could result in not only increased urban flooding, but also greater long-term costs due to potential damage, repairs, disruptions and replacement costs.

4.3.1 Municipalities Are Receiving Contradictory Guidance on Using Climate Change Data and Continue to Rely on Historical Rather Than Projected Data

In 2019, Ontario's Special Advisor on Flooding found that a lack of provincial guidance for considering climate change was a challenge to managing flood risk. We found that provincial ministries are

providing contradictory guidance on how to account for climate change.

For example, the Provincial Policy Statement instructs municipalities to prepare for the impacts of a changing climate in land-use planning decisions. Conversely, the Municipal Affairs Ministry requires that building authorities use the climate design data set out in Ontario's Building Code, which is based on historical weather observations, when approving building designs. In our survey of chief building officials, all 51 officials who responded to our question about climate data indicated that they relied on historical climate data rather than projected data when enforcing the Code.

Similarly, the Environment Ministry, which approves the design of municipal stormwater infrastructure, requires municipalities to design sewers using the most recent historical precipitation data, but not climate projections. In a separate survey we conducted of a sample of municipalities, 17 (57%) of 30 reported that they relied on historical precipitation data to design stormwater infrastructure.

Moreover, we found that the Province has not fully implemented commitments in its 2020 Flooding Strategy that would provide guidance to municipalities to account for climate change. For example, the Flooding Strategy (see **Appendix 4**) includes commitments to encourage municipalities to update their requirements for new development to mandate the use of updated precipitation data in design standards, and to account for climate change in the design of drainage infrastructure. While the Ministry of Transportation, in 2016, published projected precipitation data and directed provincial contractors to use this projected data in the design of highway drainage infrastructure, other parts of the commitments, including considering climate change in municipal drainage infrastructure, remain outstanding.

RECOMMENDATION 5

To improve the ability of municipalities to handle future projected rain events and reduce the risks of urban flooding, we recommend that the Ministry of the Environment, Conservation and Parks and the Ministry of Municipal Affairs and Housing provide consistent guidance and direction to municipalities regarding climate change information and the use of projected climate change data in accordance with the government's commitments in its Flooding Strategy.

ENVIRONMENT MINISTRY'S RESPONSE

The Ministry will work closely with the Ministry of Municipal Affairs and Housing and the Ministry of Natural Resources and Forestry (and other partner ministries) to support the sharing of guidance on climate projection information/data across ministries and with municipalities. The Ministry is exploring options to ensure the sharing of up-to-date climate projection data/information, including York University's Ontario Climate Data Portal data.

MUNICIPAL AFFAIRS MINISTRY'S RESPONSE

The Ministry agrees with the recommendation that projected climate data, where there is a high level of confidence, should be considered instead of historical climate data in the design of buildings. Under the Reconciliation Agreement on Construction Codes, Ontario has committed to increasing harmonization of Ontario's Building Code with the National Construction Codes.

The National Research Council is developing proposals for the 2025 National Construction Codes that (if approved) would change the methodology for developing climatic design data from historical patterns to future projections, where the confidence level is high. Once these proposals are available, Ontario will consider them for inclusion in its Building Code per its commitment to have a new provincial Code in force within 18 months of publication of the National Construction Codes.

Ontario has always harmonized with and depended on the National Construction Codes for its structural requirements. Those structural requirements rely, in part, on climate and seismic data from Environment Canada that the National Research Council uses to develop the design tables

that are brought into all provincial building codes to help to ensure that buildings can withstand expected wind, snowload, rainfall, temperature and seismic activity wherever that building is located. No province or territory has the research capabilities that the National Research Council possesses; hence it is most appropriate that Ontario continue to obtain this data from the national sources and harmonize it with the Ontario Building Code as it becomes available or is updated.

The Ministry notes that the Provincial Policy Statement, 2020 policies that require municipalities to prepare for the impacts of a changing climate fall under the mandate of the Environment Ministry. The Municipal Affairs Ministry would be prepared to provide a supporting role to the Environment Ministry on any initiatives relating to this recommendation.

4.3.2 As the Only Province without a Regional Climate Service Organization, Ontario Lacks Reliable Access to Climate Data and Tools

Climate service organizations in other jurisdictions assist decision-makers—such as municipalities, provincial ministries, government agencies, engineers and health authorities—to access and apply relevant local climate change information. Examples of climate services include visualization tools, modelling software, resource libraries of datasets, tools and guidance, training on finding, interpreting and using climate data, and a help desk with dedicated staff to provide support on the use of climate information in decision-making.

Several climate service organizations exist across Canada, including the Pacific Climate Impacts Consortium (British Columbia), ClimateWest (Alberta, Saskatchewan and Manitoba), Ouranos (Quebec) and CLIMATlantic (New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador). These organizations differ in terms of their structure (such as involvement of local universities, utilities, and/or environmental groups) and sources of funding (public and private). However, each receives support and funding from the federal government, through the Canadian Centre for Climate Services. By contrast, Ontario does not have an organization that provides climate services to the decision-makers that need them.

Our Office's survey of a sample of municipalities found that, in the absence of provincial data, 24 (80%) of the 30 respondents reported using consultants to analyze or provide climate change information, on which each municipality spent an average of $340,000 over the past five years. This risks an inefficient use of resources, as well as potential inequities across the province, as smaller municipalities may lack the resources to source and analyze climate information. For example, the municipalities that told us they did not use climate consultants had an average population of 50,000, as compared to an average population of 310,000 among municipalities that have used consultants.

Previously, the Environment Ministry recognized that it did not have sufficient internal capacity, nor the specialized expertise, to conduct climate modelling and to translate climate science into useful decision-making information for ministries, municipalities, Indigenous communities and the private sector. To address this gap, the Ministry signed an agreement with the University of Toronto in May 2018 to create a climate service organization. One of the goals for the organization was to avoid duplication and help address capacity and equity issues for smaller communities. The Climate Resilience Centre of Ontario was incorporated in June 2018. At that time, the federal government offered to assist with funding. However, in October 2018, before the organization began operating, the government of Ontario directed that the climate organization be wound down within a month.

Instead of a staffed, external climate service organization, the government's 2018 Made-in-Ontario Environment Plan made a commitment for the Environment Ministry to develop a user-friendly online tool. Such a tool would make practical climate change impact information available to the public and private sectors to help people understand the potential impacts of climate change in their communities. This tool would differ from the existing Ontario Climate Data Portal, whose creation and operation the Ministry has

funded since 2016. The Ontario Climate Data Portal is intended by the Ministry to be a source of detailed data for technical users (e.g., scientists and subject matter experts) and may not be practical for use by general decision-makers. None of the municipalities we surveyed used the Ontario Climate Data Portal to inform the design of their stormwater infrastructure.

At the time of our audit, the Ministry has not created an online tool, as staff are seeking direction on the scope of the commitment and guidance on creating the tool. Regardless, the online tool committed to in the Environment Plan may not provide all of the services offered by the regional climate services in other provinces, such as publicly accessible, knowledgeable staff to answer questions.

RECOMMENDATION 6

To improve Ontarians' understanding of local climate data, and help Ontario decision-makers, including those in municipalities, ministries and health authorities, prepare for a changing climate, we recommend that the Ministry of the Environment, Conservation and Parks:

- confirm potential funding opportunities with the federal government for a climate service organization; and
- make climate services available in Ontario for decision-makers with limited financial resources, such as smaller municipalities.

ENVIRONMENT MINISTRY'S RESPONSE

The Ministry is not pursuing a climate services organization, but is exploring various options and federal funding opportunities to build resilience and/or share information. The Provincial Climate Change Impact Assessment (once complete) could help inform future provincial actions and help municipalities build resiliency and adapt to the impacts of climate change.

In addition, some work has been supported through the Ministry's Great Lakes program. For example, Ontario has supported ICLEI Canada in the delivery of training sessions/workshops to local decision-makers (i.e., municipalities and conservation authorities) on assessing risks and adaptation planning. As well, the Ministry has supported the delivery of training sessions to municipalities (e.g., Thunder Bay) on quantifying climate risk to infrastructure.

4.4 Flood Risk Mapping

4.4.1 Many Municipalities Are Unable to Map Urban Flood Risk Areas

There are various ways municipalities map flood risks. For example, "flood hazard maps" are required under the Provincial Policy Statement to support identification of flood-prone areas near rivers, streams and lakes. In contrast, "flood risk maps," while not required for regulatory purposes, are used to identify areas vulnerable to all types of flood risk irrespective of proximity to water bodies, including urban flood risk. Further, flood risk maps incorporate information about the effect of stormwater infrastructure to assess risks to people and property. We found, however, that many Ontario municipalities are unable to accurately map urban flood risk due to a lack of data and/or resources to model urban flood risks.

Flood risk maps are frequently used for emergency management and flood forecasting and warning purposes, and can inform provincial and municipal land-use decisions. For example, flood risk maps can help municipalities identify areas of high urban flood risk as they plan for and approve new housing developments, roads and other structures. Flood risk maps can also help municipalities identify where new or upgraded stormwater infrastructure is most needed to reduce future urban flood risk. These maps can also provide other stakeholders such as building authorities, natural hazard departments, insurance companies and emergency responders with information to better manage urban flood risk.

To accurately map urban flood risk, various layers of foundational data need to be compiled and mapped over an area to determine how surface water flows over a landscape and where it is likely to pool and present a risk of flooding during a storm. Key types

of foundational data include elevation (of both the ground and buildings on it to identify high and low points); land cover (the surface cover on the ground, such as vegetation, bare soil or infrastructure); and soil type/depth (which affects water absorption). This data is then coupled with information on the capacity of stormwater infrastructure to retain and convey stormwater away from people and properties. Detailed modelling of these datasets is used to develop flood risk maps.

In our survey of a sample of municipalities, 22 (73%) of 30 indicated that they are unable to accurately map urban flood risk, and many have instead identified only areas vulnerable to river flooding. Reasons provided included gaps in datasets on stormwater infrastructure, the need for updated elevation or land cover data, and a lack of internal expertise, funding or staff resources to develop and run models to generate urban flood risk maps.

The Natural Resources Ministry is the lead ministry responsible for flood hazard mapping. Conservation authorities and municipalities, using guidance produced by the Ministry, have been mapping flood hazards for decades. While the Ministry has not been expressly assigned responsibility for mapping urban flood risks, much of the foundational data the Ministry collects and uses for flood hazard mapping can also support urban flood risk mapping.

Data Gaps

We found that key data to map urban flood risks is incomplete or outdated in much of the province, but that efforts are under way to collect and improve the information needed.

In response to our survey, many municipalities explained that they are limited in their ability to map urban flood risk primarily due to gaps in data on stormwater infrastructure, particularly below-ground sewer networks. This gap is intended to be addressed by new provincial requirements for municipalities to report on the state of their infrastructure (see **Section 4.5**).

Some municipalities also noted the need for updated elevation data. Ontario's 2020 Flooding Strategy includes a commitment to explore creating and maintaining elevation data for Ontario's populated areas (see **Appendix 4**). The standard technology for obtaining elevation data is a three-dimensional, laser-scanning method—Light Detection and Ranging (LiDAR). Currently, only 55% of populated areas in Ontario have been mapped through LiDAR. The remaining 45% of populated areas are using elevation data that is 30–40 years old and insufficient for flood mapping. As a result, several urban municipalities do not yet have access to LiDAR data (see **Figure 7**). In some cases, municipalities without LiDAR data are still relying on old, hand-drawn contour maps that are too crude for accurate flood mapping, and do not account for changes to the landscape, such as changes to ground levels during construction, or new buildings, which impact the way stormwater flows through an area.

Ontario lags behind most other Canadian provinces in developing an elevation data collection program, primarily due to resource constraints and competing Ministry priorities. Many other provinces have

Figure 7: Status of LiDAR Project Areas for Flood Mapping Data, August 2022

Source of data: Ministry of Natural Resources and Forestry

had robust and comprehensive LiDAR programs for years. For example, Alberta and Nova Scotia initiated LiDAR-based elevation programs in 2007 and 2010, respectively. New Brunswick started a LiDAR-based elevation program in 2015, and by 2019 achieved complete coverage.

However, the Province has made recent progress. In December 2021, the Natural Resources Ministry's Mapping and Geometric Services Section (the lead agency to manage and maintain elevation data) developed a multi-year Elevation Mapping Program. The Ministry plans to collect LiDAR data suitable for flood mapping over the next four years, and projects that by 2026 LiDAR data will have been acquired for approximately 95% of populated areas in Ontario.

Municipalities also need accurate data on wetland boundaries for flood risk mapping. The Natural Resources Ministry is responsible for maintaining wetland mapping data that shows the location and boundaries of all identified wetlands (see **Section 4.8** for discussion of wetlands). Wetland boundaries can change due to natural fluctuations or advances in mapping technologies. However, boundaries of previously evaluated wetlands are not regularly updated, and 91% of data on unevaluated wetlands was collected between 28 and 40 years ago.

Finally, municipalities need accurate data on land cover. The Natural Resources Ministry aims to provide province-wide land cover data every five years, but due to the time required to collect and synthesize the imagery data, the most recent data for southern Ontario is between seven and 11 years old. Land cover data for the rest of the province was last updated in 2011 and was collected at a lower resolution, making it less accurate for flood mapping.

Modelling

Even where the necessary data is available, 10 (33%) of the 30 municipalities in our survey stated they lack expertise, funding or staff resources to develop and run models to generate urban flood risk maps.

Ontario's Flooding Strategy includes a commitment to investigate other types of flood mapping formats to supplement flood hazard maps. This could include urban flood risk maps. However, at the time of our audit, the Natural Resources Ministry has not yet assessed additional mapping formats. The Ministry told our Office that it is prioritizing other Ministry commitments in the Flooding Strategy related to flood hazard mapping.

In the absence of provincial action, municipalities have been left on their own to determine how to map urban flood risks. While some municipalities, conservation authorities and other stakeholders have developed their own methods, others do not have access to such tools. For example, Credit Valley Conservation Authority and partners have developed the Risk and Return on Investment Tool for municipalities and other stakeholders to map flood risk areas. The tool enables users to incorporate whichever data they have available on both river and urban flooding to determine priority flood risk areas. However, due to funding limitations, this tool is not currently publicly available.

4.4.2 Information on Urban Flood Risk Not Shared with the Public in an Accessible Manner or at All

In our municipal survey, 26 (87%) of the 30 municipalities stated they do not provide the public with any information or maps of areas that are at risk of urban flooding. Reasons provided by municipalities included a lack of data, potential legal liabilities, and concerns over reducing home values in at-risk neighbourhoods. While municipalities often do not have complete and detailed data, sharing of even partial data (such as only some mapping layers) or proxy data (such as flood-complaint records, other data of historical flood events, or homeowners' use of basement-flooding rebates) can still be informative for assessing areas of flood risk.

The Natural Resources Ministry has committed to address some data gaps (see **Section 4.4.1**). Ontario's Flooding Strategy also commits to update policies, regulations and legislation as needed to ensure flood mapping information can be shared with other agencies and the public (see **Appendix 4**), and the Natural Resources Ministry has lead responsibility. However, municipalities are not required to share urban flood

risk information that they have with the Province, agencies or the public. For example, while the Infrastructure Ministry requires municipalities to report on flood resiliency (see **Section 4.5.1**), there is no requirement for these maps to be submitted or shared with other ministries or the public.

For the most part, municipalities that have mapped urban flood risk, based on either detailed modelling or proxy data, do not share the information in an accessible manner with the public or relevant stakeholders. Municipalities we surveyed that do provide information on urban flood risk do so in the form of static maps in online technical reports or upon request. In contrast, the City of Edmonton published flood risk maps in 2016, after severe storms in 2004 and 2012 overwhelmed the city's drainage system. Edmonton's online, interactive maps show where and how deep water might pool on the ground, as well as how full the city's stormwater drainage system might be after a severe four-hour rainstorm.

RECOMMENDATION 7

To enable municipalities to better identify and address urban flood risk areas, we recommend that the Ministry of Natural Resources and Forestry:

- review existing urban flood risk mapping tools to identify whether any could be effectively applied over a wider geographic area; and
- based on this review, make any identified effective urban flood risk mapping tool available to all municipalities.

NATURAL RESOURCES MINISTRY'S RESPONSE

This recommendation is consistent with commitments in Ontario's Flooding Strategy to investigate other types of flood mapping formats—including flood risk mapping. As noted by the Auditor General, the Natural Resources Ministry is currently focused on fulfilling ministry commitments relating to mapping flood hazards from rivers and lakes—including updating provincial guidelines and investing in the creation, enhancement and dissemination of river and lake flood hazard mapping through the Ontario Flood Hazard Identification and Mapping Program.

RECOMMENDATION 8

To inform the public of urban flood risk areas, we recommend that the Ministry of Natural Resources and Forestry develop and implement a plan for the Province and municipalities to share locations at potential high risk of urban flooding with the public, as appropriate, based on provincial foundational data and best available urban flood risk data or maps.

NATURAL RESOURCES MINISTRY'S RESPONSE

As noted by Ontario's Special Advisor on Flooding, the Natural Resources Ministry's mandate is limited to addressing risks associated with fluvial flooding from waterbodies (rivers, streams and lakes). The Ministry does not collect information about areas at potential high risk of urban flooding, and municipalities are not required to share urban flood risk information with the Province, provincial agencies or the public. The Ministry encourages municipalities to share any information or maps that they have identifying areas that may be at high risk of urban flooding with the public.

4.5 Municipal Asset Management Planning Process

Municipal asset management plans set out information on the current state of municipal infrastructure assets, as well as on how municipalities intend to manage these assets over the long term. They can help municipalities identify local infrastructure needs and potential funding shortfalls, and improve long-term financial planning for necessary upgrades. These plans can also help inform provincial and federal infrastructure

funding decisions. For stormwater infrastructure, asset management plans can provide important information on their capacity to handle major rainfall events, and therefore, municipalities' resilience to urban flooding.

The Infrastructure Ministry provides oversight of municipal asset management planning. In 2017, the Ministry filed the Asset Management Planning for Municipal Infrastructure regulation, under the *Infrastructure for Jobs and Prosperity Act, 2015*. The regulation requires all 444 municipalities to develop, and make publicly available, asset management plans for all core infrastructure, including stormwater infrastructure (see **Figure 8**).

According to the Ministry's asset management planning webpage, the goal of the regulation is to improve the way municipalities plan for their infrastructure, as well as bring consistency to the asset management planning process and the collected data. The Ministry's webpage notes that, in many parts of the province, infrastructure is degrading faster than it is being repaired or replaced, which puts critical municipal services at risk. The Ministry told us that, while 99% of Ontario municipalities already had some form of asset management plan, there was significant variation in the level of detail, and the quality of underlying data, within those plans.

4.5.1 Municipal Reporting on Stormwater Infrastructure and Flood Resiliency Not Standardized, with Potential Impacts on Planning and Funding Decisions

The Infrastructure Ministry informed our Office that it has prioritized work to assist municipalities in completing plans for the full range of all core municipal infrastructure assets by the July 2022 deadline, rather than providing detailed support for stormwater infrastructure asset planning. The Ministry has partnered with other organizations, such as the Municipal Finance Officers' Association and Asset Management Ontario, to provide various supports and guidance materials to assist municipalities in meeting the regulatory deadline.

The Infrastructure Ministry also informed our Office that during consultations in 2016, municipalities voiced concerns over the regulation being overly prescriptive, and requested that the Ministry instead

Figure 8: Phased-in Requirements for Municipal Asset Management Planning

Prepared by the Office of the Auditor General of Ontario

Date	Regulatory Requirement
July 1, 2019	All 444 municipalities are to have a finalized strategic asset management policy, outlining commitments to best practices and continuous improvement.
July 1, 2022	Municipalities must have an approved asset management plan for core infrastructure (roads, bridges and culverts, water, wastewater and stormwater infrastructure). Plans must include an inventory of all core assets and include information on: • number of assets in each category • total replacement value • average age and condition of assets in each category, and how condition information is gathered • current levels of service • annual costs over a 10-year period to maintain current levels of service • annual revenue over a 10-year period
July 1, 2024	Municipalities must include information for all other municipal infrastructure assets, including green assets that are not included in core infrastructure, in their asset management plan.
July 1, 2025	For all assets, municipalities must include proposed levels of service and a life-cycle management strategy (i.e., operations and maintenance) and outline the proposed amount of funding to be available each year.

provide guidance documents and additional guidelines on levels of service provided by assets as an addendum to the regulation.

To provide this guidance, since 2018, the Infrastructure Ministry has partnered with the Municipal Finance Officers' Association to deliver programming for municipalities on regulatory requirements, including one-on-one consulting and detailed workshops for municipalities on regulatory topics—including conducting condition assessments on assets and determining current replacement value of their asset inventory.

However, we found that a lack of detailed provincial guidance to support implementation of the asset management planning regulation, specifically as it relates to stormwater infrastructure, is resulting in inconsistent and incomplete reporting. Incomplete reporting can hinder the ability of municipal decision-makers to reliably forecast and prioritize investments for infrastructure maintenance and renewal, which may result in municipal councils underinvesting in stormwater infrastructure. A lack of consistent reporting may also undermine effective decision-making for provincial and federal funding programs that aim to provide infrastructure funding based on greatest need.

Asset Condition

The regulation requires municipalities to report on the current condition of their stormwater assets, stating that this should be based on engineering best practices. However, in the absence of detailed direction from the Infrastructure Ministry on how this information is to be collected and calculated, municipalities are reporting inconsistent and non-comparable information. Our review of a sample of 25 asset management plans (developed to meet the regulation's July 2022 deadline) found that these municipalities used a range of approaches to assess and rate the condition of their stormwater infrastructure, including direct observations, camera inspections, historical and current spending data, and infrastructure age. These methods vary greatly in accuracy and, therefore, make comparisons of asset condition difficult. The Infrastructure Ministry is aware of this challenge; in its initial review of municipalities' submitted asset management plans, Ministry staff found that the "condition data is incomplete and reported inconsistently, limiting [the data's] analytic value."

Replacement Value

The regulation also requires municipalities to report on the replacement cost of their infrastructure, which is the cost of restoring infrastructure to the same quality and utility as when originally acquired. Ministry staff informed our Office that, similarly to the asset condition data, the approaches taken to reporting data on current replacement value for infrastructure are inconsistent across municipalities. Municipalities themselves have expressed a concern regarding the guidance available to them. A 2021 survey conducted by the Association of Municipalities of Ontario found that municipalities lack standardized guidance on how to estimate replacement costs and quantify infrastructure funding gaps.

Flood Resiliency

The regulation requires municipalities to report on the current levels of service provided by their core infrastructure. Levels of service refers to how well particular assets perform their required function. For stormwater infrastructure, the regulation states that current levels of service include the municipality's flood resiliency, which must include a description of the areas of the municipality that are protected from flooding, as well as the level of protection provided by stormwater infrastructure. In describing flood resiliency, municipalities must include the following two metrics:

- percentage of properties in the municipality resilient to a 1-in-100-year storm; and
- percentage of municipal stormwater infrastructure resilient to a 1-in-5-year storm.

However, there is currently no guidance, either in the regulation or from the Infrastructure Ministry, as to how municipalities are to determine flood resiliency, nor is there any specification as to whether all types of floods (including urban floods) should be accounted for. The Ministry partnered with Asset Management Ontario, a non-profit organization whose mandate is

to strengthen asset management capacity within the public sector, to provide asset management tools for municipalities. Asset Management Ontario developed a catalogue in 2018 that identifies various types of metrics that municipalities can use, and includes potential data inputs for the metrics and recommended uses. However, the catalogue is high-level and does not provide detailed guidance on how metrics are to be interpreted or developed. The Infrastructure Ministry has clarified that municipalities are not required to use this information tool when developing their asset management plans.

In our survey of a sample of municipalities, we asked whether sufficient guidance and direction had been provided specifically on calculating the number of properties resilient to a 1-in-100-year storm. Eighteen (60%) of the 30 respondents indicated that further guidance is needed to help understand the reporting requirements. Municipalities told us that the metric was open to interpretation, that they had little or no direction from the Province in how to determine it, and that they would like to see more specificity for reporting on these metrics in order to standardize the approach across Ontario.

As a result, we found that it is not currently possible to reliably compare province-wide data to determine which municipalities are the most vulnerable to urban flooding. Based on our review of 25 asset management plans, we found that municipalities used a range of approaches to calculate the percentage of properties resilient to a 1-in-100-year storm, and that results were ultimately not comparable. For example, while Toronto estimated property resiliency considering both urban and river flooding, Milton considered only river flooding data and Kenora used only elevation data. Thunder Bay took yet a different approach. The city concluded that, as there are too many variables to be able to accurately assess resiliency, only properties that both are on high ground and have no basements would be deemed fully resilient. Based on this conservative approach, Thunder Bay reported that 0% of properties are resilient. In our municipal survey, 18 (60%) of the 30 municipalities reported that they did not include urban flooding in their calculation of flood resiliency or, in cases where they had not yet completed the calculation, do not anticipate including urban flooding in their flood resiliency calculation in their next asset management plan.

Resource and Data Constraints

We found that constraints on municipal staff and funding, which limit some municipalities' ability to undertake studies and acquire the data needed to complete asset management plans, may also be contributing to inconsistent reporting. A 2021 consultant's report, commissioned by the Infrastructure Ministry, found that not all municipalities have the quality of data needed to evaluate asset condition or the levels of service being provided. Further, in response to our municipal survey, 24 (80%) of 30 respondents reported that they were limited by a lack of stormwater infrastructure data and/or the staff and resources required to collect and maintain the underlying data needed for their asset management plans.

4.5.2 Municipalities Not Given Direction on How to Consider Projected Impacts of Climate Change on Their Stormwater Infrastructure

The 2017 Asset Management Planning for Municipal Infrastructure regulation requires municipalities, in the final phase of asset management plans due July 2025, to set out the proposed future levels of service that they intend to provide for their stormwater assets, and the associated costs. The regulation does not, however, specify what municipalities are to base their estimates of proposed future levels of service on. In particular, there is no direction to municipalities regarding how, or even if, they should consider future climate projections for increased rainfall events.

Climate change is projected to result in more frequent and intense rainfall events. As a result, municipalities may need to upgrade and expand their stormwater infrastructure to increase their flood resiliency to more extreme events. A failure to consider climate change impacts in future service levels may result in municipalities underinvesting in stormwater

infrastructure and increasing urban flood risks and/or underestimating future costs.

The Infrastructure Ministry advised our Office that it is up to each municipality to follow engineering best practices and assess local conditions when considering their infrastructure in asset management plans. The Ministry does not provide specific guidance on how to consider climate change in stormwater infrastructure asset planning. Asset Management Ontario informed our Office that municipalities are seeking guidance from the Ministry about how to consider climate change in estimating service levels and risks for their stormwater infrastructure. They are also seeking guidance on how to better integrate low-impact development into stormwater asset management planning (see **Section 4.9.1**).

RECOMMENDATION 9

To improve the quality and consistency of municipal stormwater asset management planning, we recommend that the Ministry of Infrastructure:

- in conjunction with its partners, provide additional guidance and direction to enable more standardized and comparable municipal reporting on asset condition, replacement costs, and the flood resiliency metrics for reporting on levels of service for stormwater infrastructure;
- assess data gaps in municipal asset management plans, and work with municipalities to develop approaches to obtain necessary data to improve stormwater asset management planning; and
- provide direction to municipalities regarding consideration of climate change when estimating future levels of service and associated costs for stormwater infrastructure.

INFRASTRUCTURE MINISTRY'S RESPONSE

The Ministry agrees with the Auditor General's recommendation and is planning to assess municipal asset management plans, including working with third-party quality assurance and advisory services, and will use the findings from this work to consult with the municipal sector on how to support municipalities in their asset management planning. Through this review, the Ministry will assess data gaps and review municipal reporting and metrics and revise or expand the guidance documents and the "AMP It Up" program already provided for the sector.

The Ministry will also consult with the municipal sector on the tools and support it might require to consider climate change when estimating future levels of service and associated costs for stormwater and other infrastructure.

4.6 Funding to Maintain and Upgrade Essential Municipal Stormwater Infrastructure

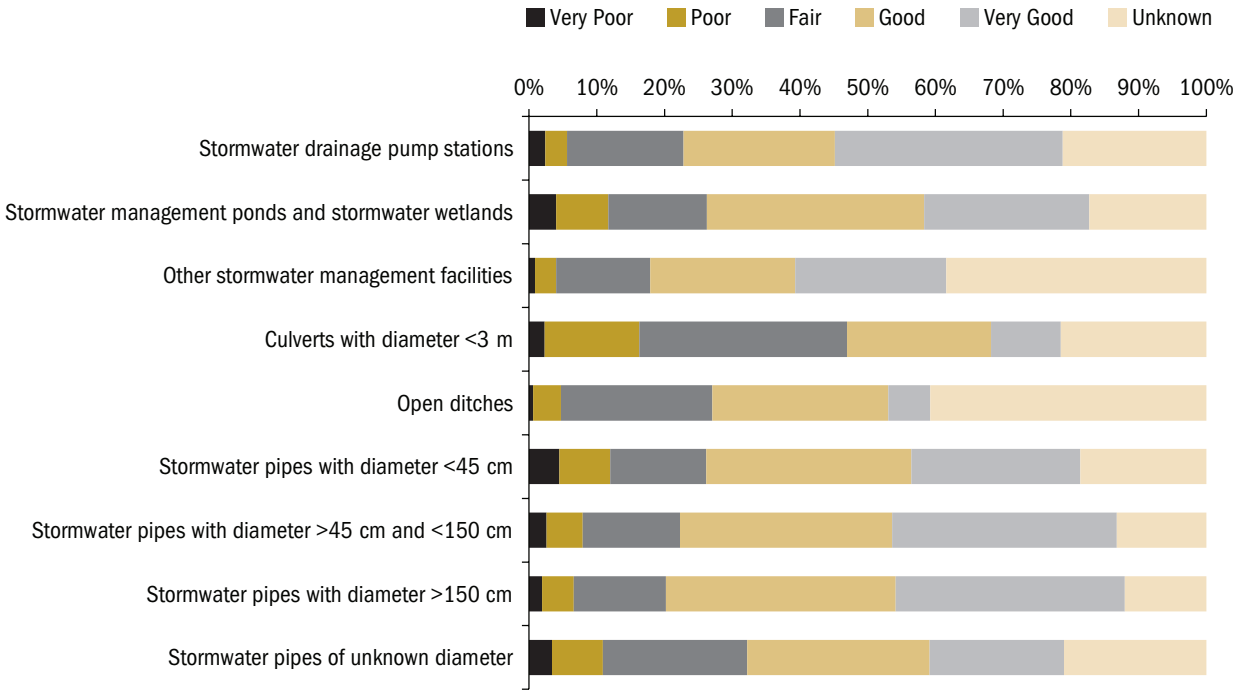
4.6.1 Billions of Dollars Are Needed Just to Bring Municipal Stormwater Assets into State of Good Repair, Let Alone Improve Them

Stormwater infrastructure is critical for managing rainfall and therefore reducing urban flooding. It is up to each municipality to financially plan for and fund their stormwater infrastructure and ensure that it effectively reduces the risk of urban flooding. However, estimates from several reports indicate that Ontario municipalities have been underinvesting in their stormwater infrastructure, resulting in a capital shortfall of several billion dollars.

In 2008, a joint report produced by the Province, the Association of Municipalities of Ontario and the City of Toronto found that there was a significant gap between then-recent investments and future needs for stormwater infrastructure. The report found it would take at least $788 million per year for 10 years to bring existing stormwater infrastructure to a state of good repair and accommodate population growth. However, we found, based on 2009–20 municipal Financial Information Returns, that capital investment in Ontario urban stormwater systems in the years after that report averaged about $457 million per municipal fiscal year.

Figure 9: Condition of Ontario Municipal Stormwater Assets, as Reported by Municipalities

Source of data: Statistics Canada, Inventory Distribution of Publicly Owned Stormwater Assets by Physical Condition Rating, 2020



Recent reports support our finding that the investment gap has not been closed. A 2018 report produced by the Ontario Sewer & Watermain Construction Association included stormwater data from 30 Ontario municipalities. For just these 30 municipalities, the report found that it would cost over $2.2 billion to replace stormwater assets that were determined to be in poor or worse condition. Further, in 2021, a report from Ontario's Financial Accountability Office estimated that $3.8 billion is required to bring all municipal stormwater assets up to a state of good repair from an engineering and cost-effectiveness perspective. Both estimates are based in part on municipalities' own assessment of the overall condition of their infrastructure as reported to Statistics Canada (see **Figure 9**). However, both reports noted the uncertainty of the condition data, observing that it is often based simply on the age of the assets rather than on direct assessments. Each report supplemented this data with other information to estimate the cost to bring the assets into good repair.

These estimates reflect only the cost of repair or replacement of current infrastructure. They do not account for future infrastructure needs, and the associated costs, due to pressures such as population growth (with the exception of the 2008 study); more intensive development; projected increased rainfall events resulting from climate change; or the cost to separate combined sewer systems. All of these pressures may require significant additional investments beyond the estimates cited above.

4.6.2 Municipalities Cannot Rely on the Current Level of Provincial and Federal Funding to Fill Stormwater Infrastructure Shortfall

The provincial and federal governments provide some funding for municipal stormwater infrastructure through a variety of funding and grant programs. For example, the Ontario Community Infrastructure Fund (OCIF) provides grants to small, rural and northern communities to address core infrastructure needs, including stormwater infrastructure projects and expenses related to asset management planning. Federal funding is provided through programs such as the Investing in Canada Infrastructure Program (ICIP)

and the National Disaster Mitigation and Adaptation Fund (NDMAF).

However, the funding available meets only a small fraction of the stormwater infrastructure needs of Ontario municipalities. To obtain a comprehensive total of funding that municipalities have received for urban stormwater systems, we reviewed the annual Financial Information Returns for all municipalities that reported receiving Ontario or federal grants over the past 10 years to 2020 (most recent full data). Total grants received either as conditional grants or for tangible capital assets over this 10-year period for urban stormwater systems were $187 million. Unless grants are increased by an order of magnitude, municipalities cannot rely only on grants to address the shortfall of billions of dollars for stormwater infrastructure. Further, as seen in **Figure 10**, funding levels are inconsistent from year to year as different funding programs begin and end, indicating that provincial and federal grants are not a reliable source of funding for building, maintaining and replacing municipal stormwater infrastructure.

4.6.3 Majority of Municipalities Do Not Have Reliable Source of Municipal Funding to Finance Stormwater Infrastructure Shortfall

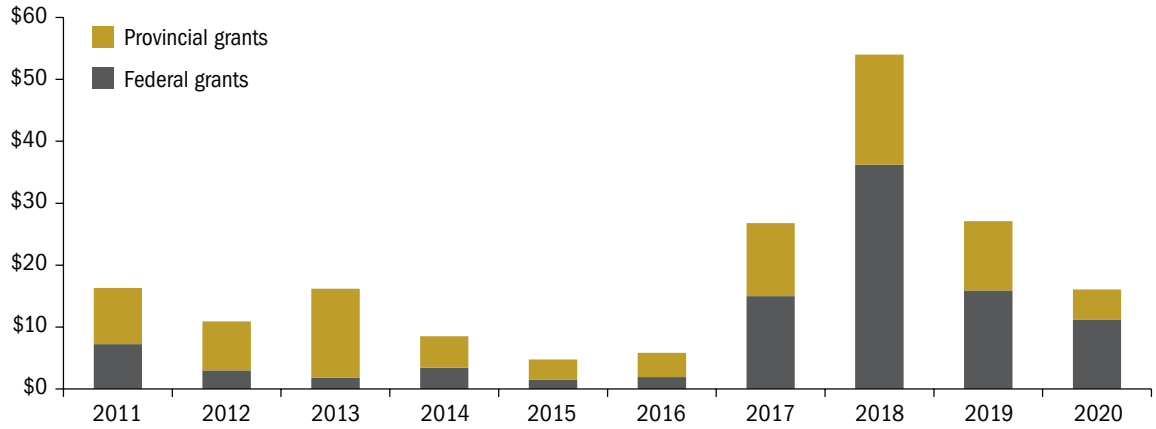
We found that only 28% of Ontario municipalities report collecting earmarked revenue to finance their stormwater management costs. Earmarked revenue, such as from a water charge or stormwater fee charged to municipal residents, can provide a reliable source of funding to finance needed municipal stormwater expenses, including the billions of dollars of capital costs needed to repair, replace and upgrade stormwater infrastructure.

We analyzed the 2020 annual Financial Information Returns (the most recent complete dataset) of all 182 Ontario municipalities that incurred operating expenses relating to urban stormwater management that year. Of the 182 municipalities, we found that, in 2020, most did not report collecting revenue that was earmarked for urban stormwater systems. In particular:

- 38 reported collecting some revenue to fund their urban stormwater services from a (non-tax) service charge, such as a general water charge for drinking-water, wastewater and stormwater services, or a more specific stormwater fee. This included three municipalities

Figure 10: Provincial and Federal Grants for Municipal Urban Stormwater Infrastructure ($ million)

Prepared by the Office of the Auditor General of Ontario based on data from Municipal Consolidated Financial Information Returns



Note: In 2016, the federal government announced a $120 billion investment in infrastructure over 10 years. This included a $2 billion Clean Water and Wastewater Fund to run from 2016 to 2019 for cost-shared projects such as stormwater infrastructure. In anticipation of federal funding programs, the Ontario government announced a $137 billion 10-year infrastructure plan in 2016. This included $300 million per year for the Ontario Community Infrastructure Fund, which could be used for stormwater infrastructure. In 2018, the federal government announced a $2 billion Disaster Mitigation and Adaptation Fund for projects including stormwater infrastructure. In 2019, funding for the Ontario Community Infrastructure Fund was reduced by $100 million.

that also reported revenues from a separate levy added to the property tax bill; and

- 16 reported collecting some revenue through a separate sewer and water service levy added to the property tax bill, which was used to fund drinking-water, wastewater and/or stormwater services.

The remaining 131 (72%) of municipalities did not report collecting any revenues that were earmarked for stormwater management services.

Water charges are typically split across all water-related services, and so while they provide more specific funding than general municipal revenues, they do not provide earmarked funding specifically for stormwater management. For example, in 2020 the City of Toronto collected $167 million in water charges from its residents, which was earmarked for its drinking water, wastewater and stormwater management costs.

We identified 14 Ontario municipalities (Aurora, Guelph, Kitchener, London, Markham, Middlesex Centre, Mississauga, Newmarket, Orillia, Ottawa, Richmond Hill, St. Thomas, Vaughan and Waterloo) that have a stormwater fee, which provides earmarked funding specifically for constructing, operating and maintaining stormwater infrastructure. The manner by which these fees are calculated varies. For example, the City of London has charged tiered flat stormwater fees since the mid-1990s, based on the property type and size. Newmarket's stormwater fee is based on both the permeability and size of a property. By tying the amount charged to the permeability of the property, the fee not only generates an earmarked source of revenue, but also incentivizes property owners to increase the permeability of their properties to reduce the amount they must pay. Stormwater fees have also been adopted in at least 14 other municipalities in Nova Scotia, Saskatchewan, Alberta and British Columbia.

Stormwater fee programs can be difficult for municipalities to develop for various reasons, including challenges persuading local residents of the need for such fees and determining how to bill for the services. Such programs require staff who are able to develop and administer them, which can present a barrier for smaller and lower-resourced municipalities. Absent earmarked funding, municipalities must rely on other, less dependable sources of revenue, such as grants (see **Section 4.6.2**) or general municipal revenues. Municipalities have multiple competing expenses to be funded out of general revenues—from road repairs to police services to new arenas—and municipal priorities may favour funding more visible and politically popular projects, limiting the funds available for stormwater infrastructure. Stormwater infrastructure is largely out of sight and out of mind, until a flood occurs.

4.6.4 Province Moving Forward to Ensure Municipalities Assess and Finance Stormwater Management Costs

After two decades of efforts to move Ontario toward full-cost recovery for municipal water-related services, the Infrastructure Ministry's Asset Management Planning for Municipal Infrastructure regulation of 2017 is an important step forward in ensuring that municipalities assess, financially plan for, and ultimately recover their full stormwater management costs to sustainably finance this critical infrastructure. However, as noted in **Section 4.5**, we found issues with the current reliability of municipal asset management plans, which may limit their effectiveness in meeting the regulation's goals.

Full-cost recovery refers to the concept of having reliable funding to recover the full costs of services—including operation, maintenance and administration costs, as well as future growth-related construction and capital expenditures—without a funding shortfall. Over the years, the Province has made various attempts to require full-cost recovery for municipal drinking-water, wastewater and stormwater services, but most were never implemented (see **Figure 11**). The asset management regulation, passed in 2017, now moves Ontario in this direction. The regulation (see **Section 4.5** for details) requires municipalities to develop asset management plans that identify all of their current stormwater infrastructure costs and revenue. In the next stage of asset management plans, due in 2025, municipalities must also identify their

Figure 11: Timeline of Provincial Attempts to Move toward Full-Cost Recovery

Prepared by the Office of the Auditor General of Ontario

Date	Municipal Infrastructure Covered	Steps Taken
2002	Drinking-water and wastewater	*Sustainable Water and Sewage Systems Act, 2002* is passed with the intention of making full-cost recovery of drinking water and wastewater mandatory. However, the Act was never proclaimed into force, and was repealed in 2012.
2007	Drinking-water only	Financial Plans Regulation under the *Safe Drinking Water Act, 2002* is passed, requiring municipalities to develop financial plans for drinking-water systems, but stops short of requiring full-cost recovery.
2010	Drinking-water, wastewater and stormwater	*Water Opportunities Act, 2010* is passed, which includes a requirement for municipalities to submit Municipal Water Sustainability Plans, which may include a financial plan, if prescribed by regulation. As part of their plans, municipalities would be required to assess the risk that climate change would pose to their stormwater systems, and outline a plan to deal with those risks. However, a regulation has not been made to implement this provision of the Act.
2012	Drinking-water and wastewater	*Sustainable Water and Sewage Systems Act, 2002* is repealed.
2015	Drinking-water, wastewater and stormwater	*Infrastructure for Jobs and Prosperity Act, 2015* is passed; it includes an authority to regulate municipal asset management planning.
2017	Drinking-water, wastewater and stormwater	Asset Management Planning for Municipal Infrastructure regulation, under the *Infrastructure for Jobs and Prosperity Act, 2015*, is passed, setting out requirements for municipal asset management plans, including requiring a full accounting of investment needs for municipal water, wastewater and stormwater, which is a partial step toward full-cost recovery.

proposed future stormwater management costs, including full life-cycle costs of assets, and their projected annual funding to cover those costs. Municipalities must also identify any potential funding shortfalls, and explain how they will manage the risks associated with not undertaking any activities as a result of that funding shortfall.

Further, the Environment Ministry has also recognized the need to assist municipalities with identifying reliable sources of funding for stormwater management. In January 2022, the Ministry posted a discussion paper on the Environmental Registry that, among other issues, sought feedback on financing mechanisms to assist municipalities achieve full-cost recovery for municipal wastewater, stormwater management and water conservation. Commenting on the discussion paper, the Toronto and Region Conservation Authority noted that provincially led initiatives to help municipalities overcome the substantial upfront costs of developing stormwater fee programs would lead to greater uptake sooner. As of October 2022, the Ministry had not decided next steps following this consultation, and no decision notice had been posted on the Environmental Registry.

RECOMMENDATION 10

To help municipalities sustainably finance necessary investments in stormwater infrastructure and effectively manage the risks of urban flooding, including under future projected climate scenarios, we recommend that the Ministry of the Environment, Conservation and Parks develop and share best practices and guidance to facilitate knowledge sharing among municipalities and assist municipalities in developing and implementing reliable funding models, such as stormwater fee programs.

ENVIRONMENT MINISTRY'S RESPONSE

The Ministry appreciates how important effective stormwater management is for protecting our communities and our waterways. Effectively managing stormwater also includes municipalities making effective financial decisions to appropriately manage and invest in this infrastructure. We look forward to working with other ministries to continue to promote stormwater management that is sustainable from both a financial and environmental perspective and share this knowledge with municipalities and the public.

4.7 Green Spaces

As noted in **Section 2.3.1**, green spaces—which include natural features (such as wetlands, woodlands and meadows) and other vegetated areas—are important for flood reduction as they are pervious surfaces that can absorb water. In this way, green spaces can reduce or delay the amount of stormwater that runs into sewer systems, onto roads and into homes, and therefore, reduce the risk of sewer backups and flooding. They also provide other benefits such as improving air quality, helping cool the urban environment, and providing habitat for wildlife and recreational areas for people.

4.7.1 Provincial Land-Use Planning Direction Insufficient to Protect Green Spaces That Guard against Urban Flooding

Despite the critical role that green spaces play to reduce the risk of urban flooding (and provide other benefits), we found that weak provincial land-use planning direction to protect green spaces is resulting in the continued loss of such spaces in urban areas across southern Ontario. According to Statistics Canada's analysis of 2021 satellite data, the percentage of urban land area classified as green has declined in 31 of 33 (94%) of Ontario's medium and large population centres over the past 20 years (see **Figure 12**). On average, land area classified as green has declined by 6% in these population centres, with the biggest declines in Windsor (18%) and Milton (22%).

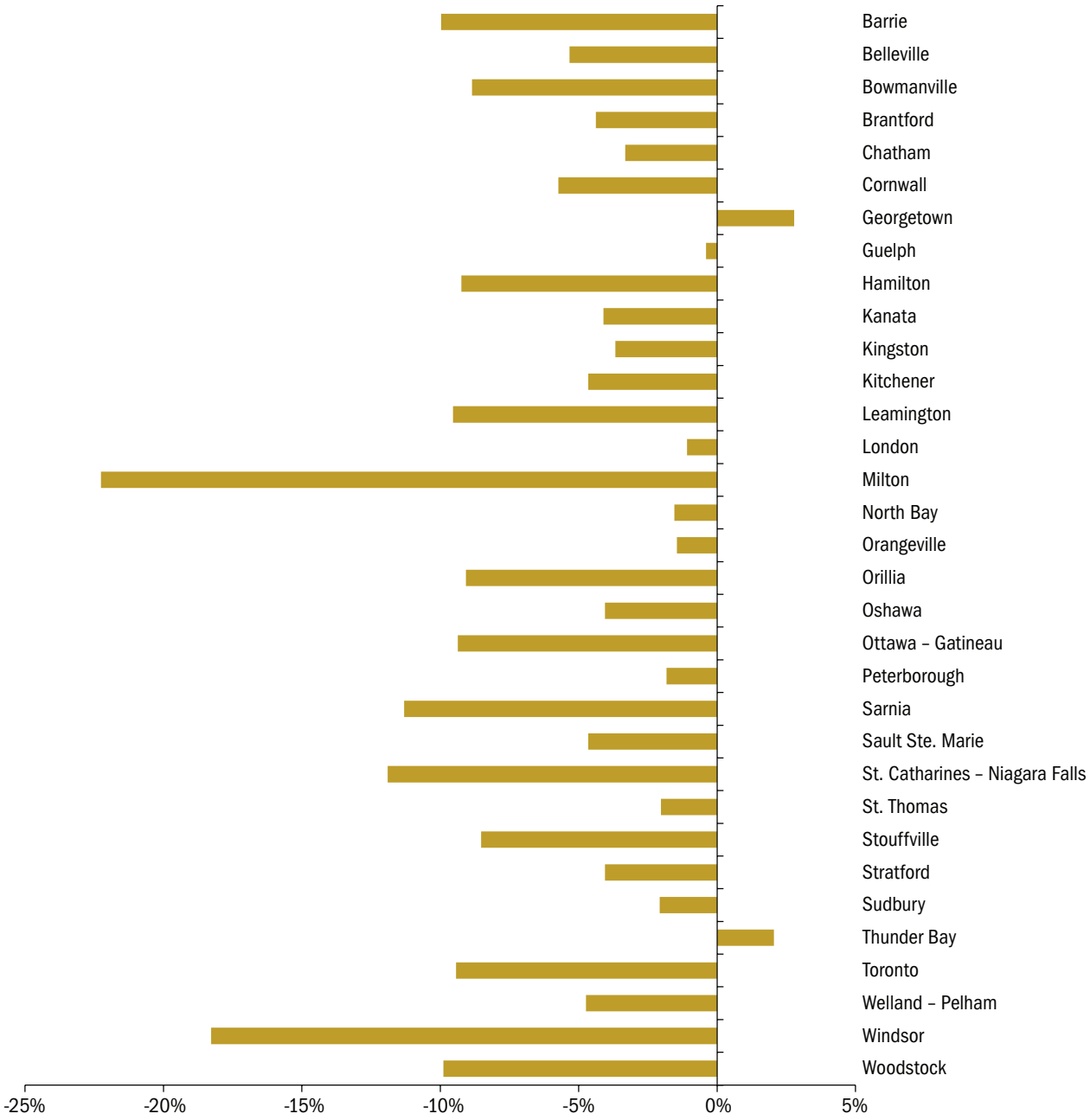
Working with other land-use ministries, the Municipal Affairs Ministry develops laws and policies on how land-use planning is to be conducted in Ontario. Municipalities must develop official plans and make decisions that are consistent with these provincial land-use policies. Of relevance to green spaces, the Ministry directs municipalities through the Provincial Policy Statement 2020, made under the *Planning Act*, to both protect "natural features and areas for the long term" and "maximize the extent and function of vegetative and pervious surfaces" when planning for stormwater management. However, the Provincial Policy Statement also directs municipalities to implement other provincial interests, such as to protect aggregate resources and increase housing supply mix, which can conflict with the direction to protect natural features and maximize pervious surfaces.

Similarly, the Municipal Affairs Ministry's Growth Plan for the Greater Golden Horseshoe (Plan) was developed to promote increased housing supply and economic growth while balancing other land-use planning goals, such as protecting agricultural land and natural features. The Plan aims to reduce sprawl through intensification in areas designated for growth and development, and direct growth away from natural areas that have been identified for protection due to their important ecological functions. However, the Plan still allows for some development within these natural areas, with limits on the total area that may be converted to impervious surfaces. Further, the Plan does not set specific targets or limits on the amount of green space that may be converted to impervious cover in areas outside natural areas identified for protection. Therefore, while the Plan may slow the amount of green space that is lost, it still allows for the overall continuing loss of green spaces in southern Ontario.

We also found that the Province may, in some cases, be undermining local efforts to protect important green spaces. As noted in our 2021 Land-Use Planning in the Greater Golden Horseshoe report, Minister's Zoning Orders (MZOs), which override municipal land-use decisions, have increased significantly in recent years.

Figure 12: Percent Change in Average Urban Greenness in Medium and Large Population Centres in Ontario, 2002–2006 to 2017–2021

Source of data: Statistics Canada



Note: The above data shows the percent change over the past 20 years, using five-year averages for the periods of 2002–06 and 2017–21. Urban greenness is a measure of vegetation presence, quantity and health, based on satellite imagery data of individual pixels within an urban population centre. A pixel was classified as green if it had an index value of at least 0.5, on a scale of −1 to +1. Urban greenness is the percentage of land area that is classified as green within a given population centre.

In the two-year period from March 2019 to March 2021, the Minister issued 44 MZOs; prior to this, an MZO was issued about once a year. Such MZOs have been used to support development that can result in the loss of natural features that enhance flood resilience.

For example, in 2020, the Minister issued an MZO for a new residential and commercial development project in Vaughan, which includes the removal of a provincially significant wetland area, as well as five unevaluated wetlands and other natural drainage features (see **Section 4.8** on wetland evaluation). Toronto and Region Conservation Authority staff were not consulted prior to the MZO request, but were required to issue the permit in accordance with the amended *Conservation Authorities Act*. Staff added several conditions to the permit to try to mitigate the impacts of the development. At the time of our audit, the planning process was still under way and the conservation authority anticipated that the developer would submit a request to the Natural Resources Ministry to delist parts of the provincially significant wetland.

In 2021, after the Minister issued another MZO, the Toronto and Region Conservation Authority reported that its board of directors was legally required, under duress, to permit development within a provincially significant wetland in Pickering. The developer eventually withdrew its application and the Minister amended the MZO to exclude the area with the provincially significant wetland. Nevertheless, this case generated considerable opposition from the public and environmental organizations, in part because it demonstrated that MZOs are not required to be consistent with the Provincial Policy Statement.

In addition, in October 2022, the Ontario government introduced Bill 23, the *More Homes Built Faster Act, 2022* to address housing supply issues. The bill includes proposed changes to the *Conservation Authorities Act* that would prevent conservation authorities from placing conditions on development applications for reasons other than controlling natural hazards or protecting public safety, thus limiting their role in conserving natural areas and protecting local ecology. The bill also creates mechanisms for the Province to override conservation authorities' decisions. Further, the Province is proposing to require conservation authorities to identify any lands that they own that could be sold or leased for housing development. At the time of this audit, the bill was still being considered; however, if passed, these proposals could potentially contribute to the further loss of critical green spaces, which may increase the risk of urban flooding in surrounding communities.

4.7.2 Province Is Not Tracking Loss of Green Space

In 2015, the Municipal Affairs Ministry identified the percentage of hardened/impervious surfaces, natural cover, wetlands and woodlands in the Greater Golden Horseshoe (the fast-growing region centred around the City of Toronto) as one of the performance indicators for the Growth Plan for the Greater Golden Horseshoe, 2006, the Province's framework for managing growth in this region. However, this is only an informational metric, not a specific target to maintain or increase natural cover.

As noted in our 2021 report, Land-Use Planning in the Greater Golden Horseshoe, the Ministry is not collecting or tracking data on this indicator, nor requiring municipalities to track and report on this indicator. In our survey of a sample of municipalities, 24 (80%) of the 30 respondents informed our Office that they are also not mapping or tracking changes in green spaces or pervious surfaces over time.

While Statistics Canada's satellite imagery data provides a rough indicator of the presence of green space (**Figure 12**), due to various limitations in the methodology it is not a substitute for more detailed and accurate municipal tracking of green spaces. For example, a lower value in Statistics Canada's data on green space may be attributed to either an actual loss of green space, or to a decline in vegetative health due to natural factors such as drought, insects or disease. More detailed and accurate tracking of green spaces could support better provincial and municipal protection of green spaces.

RECOMMENDATION 11

To reduce urban flood risk through provincial land-use planning that effectively balances the protection of natural features and green spaces with provincial needs for growth and housing supply, we recommend that the Ministry of Municipal Affairs and Housing:

- track and publicly report on the status of indicators of the percentage of area covered by pervious surfaces, natural cover, wetlands and woodlands in each municipality; and
- review the Ministry's land-use plans and policies and, as needed, include limits on impervious surface area that results from development, in order to improve performance on these indicators.

MUNICIPAL AFFAIRS MINISTRY'S RESPONSE

In October 2022, the Ontario government introduced the *More Homes Built Faster Act, 2022* and Ontario's newest Housing Supply Action Plan, More Homes Built Faster, the Province's plan to address housing. As part of this initiative, the Municipal Affairs Ministry is undertaking a housing-focused policy review of A Place to Grow and the Provincial Policy Statement, seeking input on how to create a streamlined province-wide land-use planning policy framework that enables municipalities to approve housing faster and increase housing supply. As part of this review, we will be working with our partner ministries, including the Natural Resources Ministry and the Environment Ministry, to determine what policies that fall under their mandates are needed to guide land-use planning in the future. We will consider the Auditor's recommendation going forward, as we look to our partner ministries to identify performance indicators and report on policies related to their mandates.

While the Ministry agrees that performance indicators are important, the Ministry notes that the scientific and technical expertise relating to the identification and protection of natural features such as wetlands and woodlands falls under the mandate of the Natural Resources Ministry, and that the technical expertise and mandate relating to stormwater management, climate change adaptation and low-impact development rest with the Environment Ministry. The Ministry also notes that the policies in the Provincial Policy Statement reflect the mandates of a number of provincial ministries, and are high-level and outcome-oriented, providing flexibility for implementation at the local level. Planning authorities may set their own rules relating to future development that are based on local conditions and informed through guidance provided by other ministries, including the Environment Ministry. As such, the Municipal Affairs Ministry anticipates providing a supporting role on any initiatives relating to this recommendation.

4.8 Wetlands

While all green spaces can help reduce the risk of urban flooding (**Section 4.7**), wetlands play a particularly important role, due to their ability to provide short-term water storage during heavy rains. Accordingly, Ontario's 2020 Flooding Strategy identifies specific activities related to maintaining and enhancing wetlands as part of the Province's strategy to reduce flood risk (see **Appendix 4**). These include developing policy tools and approaches to prevent wetland loss and integrating the economic value of wetland ecosystem services into decision-making.

Responsibility for protecting wetlands is a shared role. The Natural Resources Ministry is responsible for policies and programs to evaluate and protect wetlands. The Municipal Affairs Ministry is responsible for developing land-use plans and policies, which include wetland protections developed in collaboration with the Natural Resources Ministry. Under the Provincial Policy Statement, which guides municipal land-use decisions, a wetland is granted formal protection only if it has been designated by the local municipality as "provincially significant" (see **Figure 13** for the steps involved

Figure 13: Steps in Formally Designating a Wetland as Provincially Significant

Prepared by the Office of the Auditor General of Ontario

Step 1 — Identification of wetland locations and boundaries

- Staff from the Ministry of Natural Resources and Forestry (Ministry) use remote-sensing imagery to identify unevaluated wetlands.
- Trained individuals* conduct site visits to determine more precise boundaries of wetlands during evaluation.

Step 2 — Evaluation of a wetland

Trained individuals* evaluate and score the functions and values of a wetland using the Ontario Wetland Evaluation System to determine whether it meets the threshold to deem it provincially significant.

Step 3 — Approval of wetland evaluations

Ministry staff review and approve submitted wetland evaluation files.

Step 4 — Designation of wetland as provincially significant

If wetland is deemed provincially significant:

In accordance with direction in the Provincial Policy Statement, the municipality must designate it as provincially significant in its official plan. Once designated, municipalities and conservation authorities are directed not to permit any development or site alteration that would interfere with the wetland.

If wetland is not deemed provincially significant:

Each municipality and conservation authority individually determines to what extent it will provide protections to, or conversely permit activities in inland wetlands not deemed provincially significant (see **Section 4.8.3**). Under the Provincial Policy Statement, development and site alteration are not permitted in coastal wetlands not deemed significant, unless it can be demonstrated that there will be no negative impacts.

* Individuals who have been trained through the Ministry's Ontario Wetland Evaluation System course. The course is open to staff from provincial ministries, conservation authorities, municipalities, consultants, environmental groups and others who do work related to wetland evaluation.

in designating a wetland) or if it is a coastal wetland. The Provincial Policy Statement generally prohibits any development or site alteration in a provincially significant wetland. In addition, some area-specific land-use plans—including the Greenbelt Plan, the Lake Simcoe Protection Plan, the Oak Ridges Moraine Conservation Plan and the Niagara Escarpment Plan—require municipalities to provide additional protections for wetlands (including non-provincially significant ones) in those areas. However, certain development, such as for infrastructure, aggregates (gravel pits) and projects approved through MZOs, can override wetland protections in these provincial policies and plans.

Municipalities must develop official plans and make decisions that are consistent with the Provincial Policy Statement and land use plans, which includes designating and protecting provincially significant wetlands. For all other wetlands, municipalities may, at their discretion, permit development or activities within such wetlands.

Conservation authorities also play a role in protecting wetlands. Under the *Conservation Authorities Act,* each conservation authority is responsible for regulating activities within its conservation area, such as new development, that can change or interfere with a wetland. The Act does not specify how conservation authorities are to regulate activities that interfere with different types of wetlands (i.e., unevaluated versus provincially significant wetlands); instead, this is left to the discretion of each conservation authority.

4.8.1 As of 2015, Southern Ontario Had Lost Nearly Three-Quarters of Original Wetlands, Reducing Natural Flood Control in Urban Areas

Despite their important ecological and flood-mitigation roles, southern Ontario is continuing to lose wetlands. As of 2015 (the most recent data available), southern Ontario has approximately only 27% of its original wetland coverage remaining. The other 73% has been lost since European settlement began, primarily to agriculture and development. While the majority of wetland loss occurred in the 20th century, it still continues. Between 2011 and 2015 (the most recent data), southern Ontario lost an average of 1,825 hectares of wetlands per year. This annual rate of loss is three times higher than the previous data period (2000–11), in which an average of 615 hectares was lost per year. Overall, between 2000 and 2015, approximately 13,455 hectares (or 1.3% of remaining wetland cover) in southern Ontario were lost. Most of the loss has occurred in eastern Ontario.

Many urban areas have only a small fraction of their original wetland cover intact. As of 2002, only 1% of the original wetland area in Windsor remained, and only 3% of the area assessed in Toronto remained. Recent data shows that wetland loss is continuing in these areas. Between 2000 and 2015, an additional 2% of the already significantly depleted wetland area that remained in 2000 was lost in both the Toronto and Essex ecodistricts (which include Toronto and Windsor, as well as other urban municipalities).

4.8.2 Nearly Half of Southern Ontario's Remaining Wetlands Are Unevaluated and Risk Being Lost

The Provincial Policy Statement states that significance of some natural features "can only be determined after evaluation," and that significance is identified "using evaluation procedures established by the Province." For wetlands, the Natural Resources Ministry developed the Ontario Wetland Evaluation System to evaluate significance (**Figure 13**). Through this system, evaluators score wetland functions and values on four components: biological, social, hydrological (including flood-control functions) and special features (like breeding habitat or the presence of species at risk). A wetland is deemed to be provincially significant—which is how a wetland achieves formal protection—if it scores at least 600 points overall, or at least 200 points in either the biological or special features component.

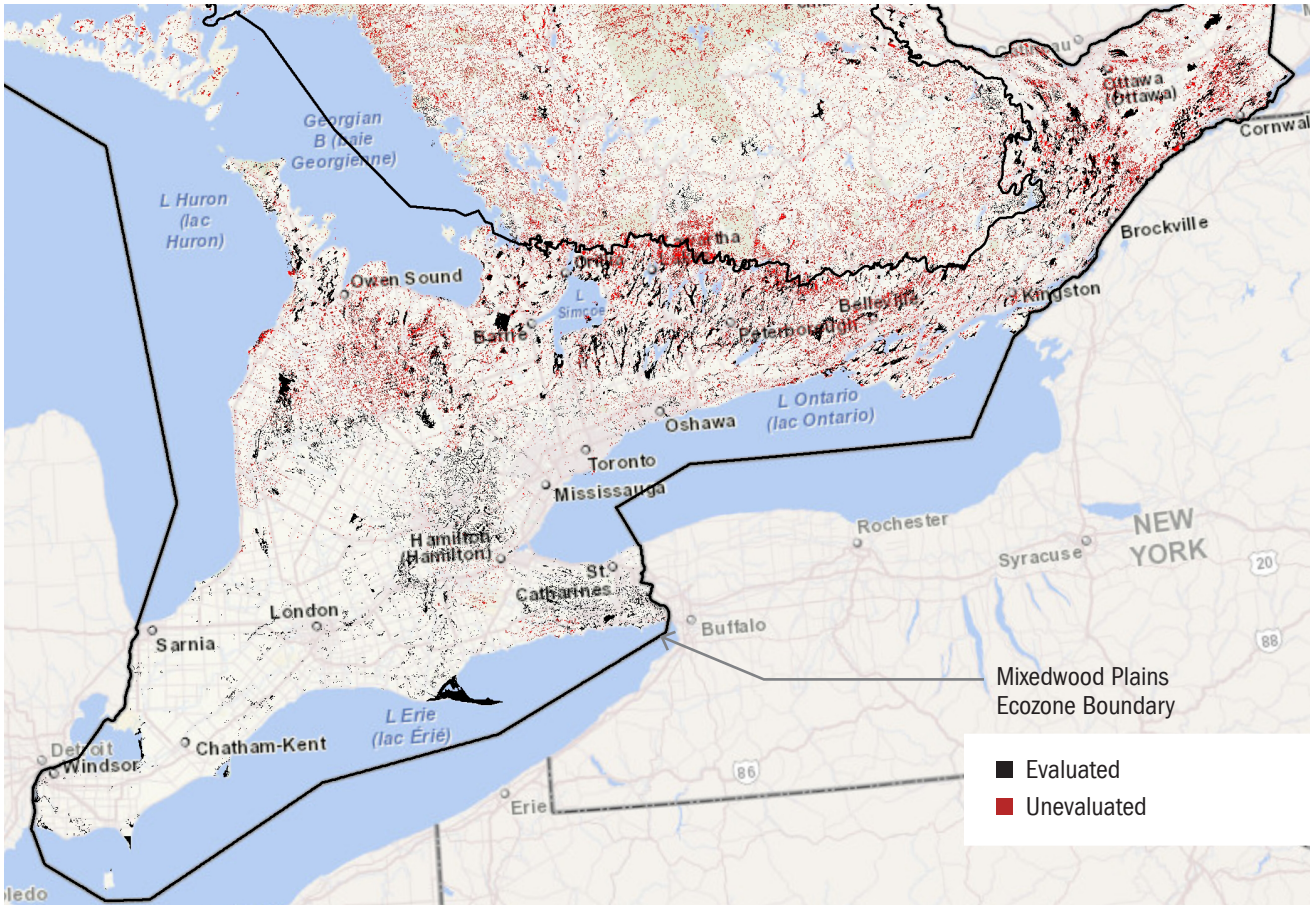
However, the Provincial Policy Statement does not require a wetland to be evaluated through the Ontario Wetland Evaluation System (OWES) before a municipality approves land-use changes that could damage or destroy it. In contrast, several other provinces protect all wetlands until their significance is formally evaluated. For example, in Nova Scotia and New Brunswick, before undertaking any activities that could alter the wetland functions, applicants must first hire a professional wetland evaluator to determine if the wetland is significant. Applicants must submit the evaluation in their wetland alteration approval application to the province for review.

Many wetlands in or near urban areas in southern Ontario have never been evaluated (see **Figure 14**), meaning that wetlands important for urban flood control are still vulnerable to being damaged or destroyed. Between 1983 (when the evaluation system was introduced) and May 2022, a total of 2,257 wetlands—comprising 52% of the wetland area in the southern portion of the province, known as the Mixedwood Plains ecozone—have been evaluated, with most conducted in the program's early years when Natural Resources Ministry staff conducted wetland evaluations themselves to pilot the system. There has been minimal recent progress in evaluating wetlands in this ecozone, with only 30 evaluations over the past 10 years. In the past year (May 2021–May 2022), only one wetland evaluation was completed.

There can also be substantial delays between the time a wetland is evaluated and when the file is approved by Natural Resources Ministry staff, during which time the official status of the wetland remains in limbo. For example, our review of wetland evaluation files from two Natural Resources Ministry district offices found that there was an average delay of three years between evaluation and approval in one district, and 12 years in another.

Figure 14: Wetlands Evaluated through the Ontario Wetland Evaluation System and Unevaluated Wetlands in the Mixedwood Plains Ecozone, August 2022

Source of data: Ministry of Natural Resources and Forestry



Historically, 90% of evaluated wetland area within the Mixedwood Plains—60% of all evaluations for this region—has been identified as provincially significant. This suggests that, if the 48% of this region's wetland area that has not yet been evaluated were to be evaluated under the current system, a large portion would likely similarly be deemed provincially significant.

Furthermore, there has been minimal progress re-evaluating wetlands that were evaluated decades ago. Wetland scores can change over time due to various factors, such as changes to the surrounding landscape or to the perceived value of different wetland functions, warranting re-evaluation. For example, if an upstream wetland is removed due to development, it can make the value of downstream wetlands more significant. We reviewed 30 wetland evaluation files from different areas in southern Ontario, and found that 85% of these wetland evaluations were completed before 2000 and have not been re-evaluated since.

4.8.3 Inconsistent Protection across Ontario for Wetlands Not Evaluated or Not Deemed Provincially Significant

We found that municipalities provide varying levels of protection to wetlands that have either not been evaluated nor deemed provincially significant. Our survey of a sample of municipalities found that, while 12 (40%) of the 30 municipalities go beyond provincial requirements by creating similar protections for all wetlands regardless of evaluation status (in some cases because they are required to by area-specific land-use plans), the other 18 (60%) are consistent with the Provincial Policy Statement in that wetlands that are unevaluated

or non-provincially significant are protected to a lesser extent than provincially significant or coastal wetlands.

For example, municipalities may permit development and activities in unevaluated or non-provincially significant inland wetlands if the negative impacts can be minimized, or if replacements of the wetland features and functions are to provided elsewhere. However, while some features, such as wildlife habitat, may be more readily replaced by constructing or restoring another wetland, other features, such as flood control, are complex and generally site-specific.

In the absence of specific direction in the *Conservation Authorities Act*, conservation authorities also provide varying levels of protection across the province for wetlands that have not been evaluated nor deemed provincially significant. Some conservation authorities told us they regulate activities that can interfere with any wetlands within their jurisdiction regardless of their status, while others stated that provincially significant wetlands receive more stringent protection than other wetlands. As a result, in at least some areas of the province, wetlands not evaluated or not deemed provincially significant are at risk of being lost despite having potentially important flood-mitigation features.

Even wetlands that have been evaluated and deemed provincially significant, but have not been officially designated, may be unprotected. For example, in 2005 and 2016 the City of Ottawa reassessed wetland boundaries within the provincially significant Goulbourn Wetland Complex near Ottawa, which increased the total area of identified provincially significant wetlands. However, due to landowner opposition and the city's decision to complete an additional study, most of these wetlands were not designated in Ottawa's Official Plan until 2020; some are still not designated. In 2009, the Rideau Valley Conservation Authority and the Mississippi Valley Conservation Authority (which have jurisdiction over this area) determined that they would regulate only the portions of the Goulbourn Wetland Complex that were designated in Ottawa's Official Plan. While the two conservation authorities reversed this decision in 2018 due to ongoing interference with the wetlands, at least 30 hectares of provincially significant wetland area were cleared, filled, drained or altered while the area was unregulated.

4.8.4 Wetlands May Not Achieve Provincially Significant Status despite Their Importance for Urban Flood Reduction

We found that wetlands within or near urban areas, and the importance of their flood-control properties, may be undervalued in the wetland evaluation process. Urban wetlands are more likely to be smaller and more degraded, and therefore may be less likely to reach provincially significant status despite their flood control benefits.

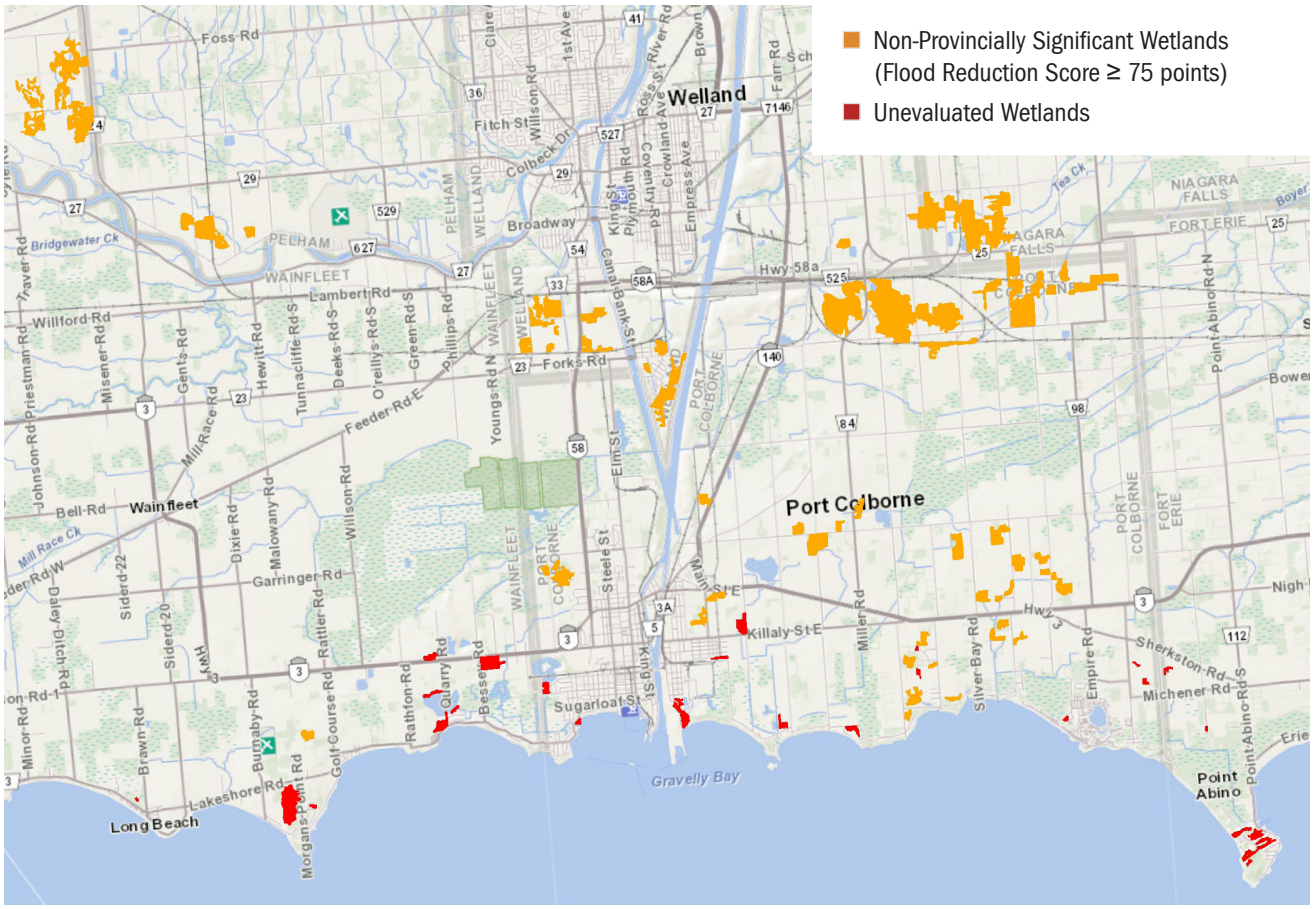
Of the 2,257 wetland evaluations that have been completed in the Mixedwood Plains, 909 (40%) did not achieve provincially significant status. Of these, 54 evaluations had digital data on the flood reduction score. We found that 27 (50%) of these 54 wetlands were considered to be particularly important for flood reduction, receiving a score of 75 points or more in this category. Moreover, 20 (37%) of these wetlands received the maximum score of 100 points for flood reduction benefits.

Despite their importance for flood reduction, these wetlands did not achieve provincially significant status. For example, in the suburban headwaters of Welland (in the Niagara Region) there are numerous evaluated wetlands that did not achieve provincially significant status but still scored 75 points or more on their ability to lessen flooding (see **Figure 15**).

In October 2022, the Natural Resources Ministry posted a proposal on the Environmental Registry to revise the Ontario Wetland Evaluation System, including revisions that could make it harder for wetlands to achieve provincially significant status. For example, the threshold for significance would remain the same in the proposed system, but wetlands would no longer score points for providing habitat for endangered or threatened species, which reduces the likelihood of some wetlands being deemed provincially significant. Moreover, wetland complexes, which are defined as groups of wetlands with interdependent biological, hydrological

Figure 15: Evaluated Non-Provincially Significant Wetlands with High Flood Attenuation Benefits and Unevaluated Wetlands near Welland, Ontario, August 2022

Source of data: Ministry of Natural Resources and Forestry



and/or social functions within 750 metres of one another, would no longer be evaluated and scored together as a complex. Wetlands formerly evaluated as being part of a complex could be re-evaluated as individual units. Evaluating wetlands as single units rather than complexes reduces their total size, which in turn reduces the points a wetland could score for various criteria, including the capacity to reduce flooding.

4.8.5 Province Is Reducing Its Role in Wetland Evaluation and Conservation

At the time of our audit there was no province-wide strategy, policy or framework to conserve wetlands, and former targets to reverse their loss were abandoned in 2018.

In 2017, the Natural Resources Ministry released A Wetland Conservation Strategy for Ontario: 2017–2030, which included targets to halt and reverse the loss of wetlands. The strategy recognized that, while there were existing programs and partnerships in place to protect wetlands, in the absence of additional action, wetland areas would face increasingly serious threats. It stated that shared commitment and co-operation at all levels of government are essential to conserving wetlands, and that the strategy would provide an integrated framework to help achieve this goal. In the 2020 Flooding Strategy, the Natural Resources Ministry subsequently committed to developing policy tools and approaches to prevent wetland loss and work toward a net gain of wetlands, focusing on areas where wetland loss has been greatest.

In August 2021, however, we noted that the wetland conservation targets were no longer in effect, and the strategy had been archived as the product of a previous government, following the change in government in

2018. The Ministry did not notify or consult the public on this decision through the Environmental Registry, as required under the *Environmental Bill of Rights, 1993* (see our 2021 report on the *Environmental Bill of Rights, 1993*).

Despite archiving the 2017 strategy, the Province has continued some wetland monitoring and stewardship work, as well as programs to promote wetland restoration and conserve wetlands on private land. For example, the Province has developed the Wetlands Conservation Partner Program, a five-year, $30 million project to restore wetland habitat across the province in rural and near-urban communities. The Province also promotes wetland stewardship on private land through the Conservation Land Tax Incentive Program, a voluntary program that offers landowners who protect certain natural features a 100% tax exemption on the eligible portions of their property. While these programs can help conserve individual wetlands on private land, the lack of an overarching strategy and targets increases the risk that wetlands that can reduce urban flood risk may continue to be lost or degraded.

In October 2022, the Natural Resources Ministry proposed changes to the wetland evaluation system to support the Province's commitment to streamline housing development. Under this proposal, evaluations would no longer be reviewed and approved by Ministry staff, and would instead be deemed complete once received by a "local decision-maker addressing a land-use matter." Removing provincial oversight in the wetland evaluation process creates further risk for inconsistencies in how wetlands are evaluated, and therefore protected, across the province.

RECOMMENDATION 12

To protect the flood-control benefits afforded by wetlands, to meet relevant goals in Ontario's Flooding Strategy, and to improve urban flood resiliency, we recommend that the Ministry of Natural Resources and Forestry:

- implement a Ministry service standard for approving submitted wetland evaluations within a reasonable time frame;
- develop and implement interim protections for unevaluated wetlands;
- assess options to protect wetlands that are not designated as provincially significant wetlands with high flood-reduction benefits, including potential improvements to the Ontario Wetland Evaluation System to better recognize flood-reduction values, and implement changes as appropriate; and
- develop and implement a strategic plan to protect, conserve and restore wetlands.

NATURAL RESOURCES MINISTRY'S RESPONSE

Wetlands are managed through a diverse array of policies, programs, ministries, etc. Any changes to wetland policies and programs would be considered within the scope of broader government direction.

AUDITOR GENERAL'S RESPONSE

The Natural Resources Ministry has not committed to any of the recommended measures to improve the efficiency of wetland evaluations or the protections for unevaluated wetlands or wetlands with high flood-reduction benefits. The Ministry also did not agree to developing a strategic plan to protect wetlands, despite numerous commitments made in the 2020 Flooding Strategy intended to help prevent new wetland loss in Ontario.

4.9 Guidance on Low-Impact Development

4.9.1 Environment Ministry's Delay in Developing Its Guidance Manual Has Affected Municipal Uptake of Low-Impact Development Practices

Low-impact development practices (see **Appendix 2** for examples) can help reduce the risk of urban flooding, as they can increase water absorption on-site and reduce or delay stormwater runoff. Many low-impact development practices provide other benefits, such

as protecting water quality and conserving water. Depending on the practice that is used, their upfront cost can be comparable to conventional infrastructure, but over their full life cycle, low-impact development practices are typically more economical. Site-specific constraints such as soil type or high groundwater levels, however, may make installation of a low-impact practice challenging. These complexities highlight the need for guidance on low-impact development to help municipalities, developers and others plan, design and implement new approaches to stormwater management. However, at the time of our audit the Ministry still had not finalized detailed guidance to support municipalities in implementing these practices.

Over the past two decades, the Environment Ministry has released a number of guidance documents for municipalities and developers on the technical and design aspects of stormwater management (see **Figure 16**). Early Ministry guidance focused on traditional grey stormwater infrastructure (e.g., sewer drains and pipes), but has evolved to include guidance on adopting low-impact development practices to manage stormwater in place. The Ministry first provided high-level guidance in 2003 on adopting low-impact development practices, and reinforced and clarified this guidance in 2015, but did not provide detailed guidance at that time.

In April 2007, a public request was made under the *Environmental Bill of Rights, 1993* for the Environment Ministry to review its municipal stormwater management policies in light of climate change. The Ministry agreed to conduct the review and formed a multi-agency working group to look at policies and best management practices to address stormwater. This review prompted work on a Low Impact Development Stormwater Management Guidance Manual (LID Guidance Manual), which has been under development since at least 2015 when a consultant was hired and a stakeholder review group was formed.

In 2017, the Environment Ministry posted two consultants' reports on the Environmental Registry, soliciting feedback to help the Ministry develop a

Figure 16: Key Environment Ministry Stormwater Management Guidance Documents

Prepared by the Office of the Auditor General of Ontario

1994 Stormwater Management Practices Planning and Design Manual
Provides guidance for the design of stormwater infrastructure. Developed in recognition that urbanization was changing stream hydrology, increasing pollution runoff, and harming local aquatic habitat.
2003 Stormwater Management Planning and Design Manual
An update to the 1994 Design Manual. Provides applicants with guidance when applying for a stormwater facility Environmental Compliance Approval. Provides detailed design guidance for some absorption practices, as well as for conventional end-of-pipe stormwater management practices, such as wet ponds and constructed wetlands.
2008 Design Guidelines for Sewage Works
Provides detailed design guidance for storm sewers; focuses exclusively on conveyance controls such as pipes.
2015 Interpretation Bulletin: Expectations Re: Stormwater Management
The Environment Ministry released this bulletin to clarify existing guidance. The bulletin reaffirms the Ministry's expectation that, as development occurs, a site's natural hydrology should be maintained and that source controls should be used to keep the rain as close as possible to where it falls. It also states that low-impact development best management practices are relevant to all forms of development.
2022 Draft Low Impact Development Stormwater Management Guidance Manual
The Environment Ministry posted this draft manual on the Environment Registry for 60-day public comment in January 2022. In March, the public comment period was extended 30 days. The goal is to better manage stormwater runoff and reduce entry of contaminants into waterways by managing rain where it falls and snow where it melts.

stormwater management guide. Following this consultation, the Ministry incorporated the received input in the development of an initial draft of the guidance manual in 2018. Multiple revisions of the draft were subsequently made based on comments from stakeholders and internal review by staff in the Environment Ministry and other ministries. In January 2022, the Environment Ministry posted the draft LID Guidance Manual on the Environmental Registry; public consultation closed in April 2022. At the time of our audit, however, the Ministry had not established a timeline for finalizing the manual.

The seven years that it has taken the Environment Ministry to develop and revise the manual has resulted in lost opportunities within municipalities to move forward with these practices. In our municipal survey, we found that while there has been a gradual adoption of low-impact development practices, 10 (33%) of the 30 respondents indicated that they are not currently implementing any low-impact development projects, nor had they completed any in the past, and that they have no requirements to implement such practices for new developments. Seven (23%) of the municipalities indicated that the Ministry's delay in releasing the draft LID Guidance Manual affected their ability or plans to implement low-impact development practices. One municipality indicated it would not require developers to adopt low-impact development practices until the manual is finalized. Furthermore, municipal staff told us that it can be difficult to convince senior management and municipal council to invest in low-impact development without evidence of its benefits. Smaller municipalities that do not have the resources to run their own pilot projects may have particular difficulty supporting these investments.

RECOMMENDATION 13

To increase the municipal uptake of low-impact development to improve urban flood resiliency, we recommend that the Ministry of the Environment, Conservation and Parks:

- promptly finalize the draft Low Impact Development Stormwater Management Guidance Manual; and
- facilitate pilot projects and knowledge sharing of best practices and project benefits to assist municipalities in developing low-impact development projects.

ENVIRONMENT MINISTRY'S RESPONSE

The Ministry expects that the final Low Impact Development Stormwater Management Guidance Manual will be posted on the Environmental Registry of Ontario in early 2023.

The Ministry is working on facilitating pilot projects and knowledge sharing of best practices and project benefits to assist municipalities. Currently, the Ministry is providing $15 million to 18 municipalities in the Lake Ontario basin to make improvements to their wastewater and stormwater management systems. Funding can be used to undertake low-impact development projects.

4.10 Oversight of Municipal Stormwater Management

Since 1972, all stormwater infrastructure built in Ontario has required an approval from the Environment Ministry under the *Ontario Water Resources Act*. The Environment Ministry is responsible for setting conditions of approval (such as requirements for design and maintenance) and for oversight and enforcement of these requirements.

The Environment Ministry is currently revising its approvals process for municipal stormwater infrastructure. In March 2021, following public consultation, the Ministry posted a notice on the Environmental Registry stating that it is moving forward with a new approach where all of a municipality's existing individual stormwater approvals will be combined into one new Consolidated Linear Infrastructure Environmental Compliance Approval (consolidated approval). The Ministry's new consolidated approvals process requires that municipalities provide comprehensive information on their stormwater infrastructure upon application, and sets various conditions that will be included in granted approvals (**Figure 17**). The new consolidated

approval will apply to all of a municipality's existing grey stormwater infrastructure, as well as its built green stormwater infrastructure. The Ministry anticipates issuing the first consolidated approvals to the majority of municipalities that have applied by the end of 2022.

Figure 17: Overview of the Province's Consolidated Linear Infrastructure Environmental Compliance Approval Requirements for Municipal Stormwater Management Systems

Prepared by the Office of the Auditor General of Ontario, with information from the Ministry of the Environment, Conservation and Parks

Information Municipalities Must Submit When Applying for Approval

- ☐ A list and map of stormwater infrastructure (including streets, storm sewers, ditches, culverts, low-impact development and pumping stations)
- ☐ A description of the stormwater management system
- ☐ List of previous approvals and associated unique system-specific conditions
- ☐ Status of any asset management plan
- ☐ Status and copy of any stormwater master plan, watershed plan or sub-watershed plan

Conditions to Be Attached to Approvals

Municipalities must:

- ☐ Develop an operations and maintenance manual
- ☐ Develop a monitoring plan that includes the frequency of maintenance and inspection
- ☐ Submit annual reports to the Ministry of the Environment, Conservation and Parks on their stormwater management activities, starting April 2024. Reports must include:
  - public complaints and steps taken to address them
  - alterations made to stormwater system
  - operating problems encountered
  - summary of inspections, maintenance and repairs made to major infrastructure
- ☐ Apply for a review of their Compliance Approval at regular intervals (i.e., every five years)

4.10.1 Changes to Environment Ministry's Approval Program Have Potential to Reduce Flood Risk through Flood-Control Performance Criteria

In accordance with the purpose of the *Ontario Water Resources Act*, the Environment Ministry's main goal when issuing approvals for stormwater infrastructure is to protect Ontario's water resources, which includes protecting water quality from the discharge of contaminated stormwater into lakes, rivers and creeks or preventing other environmental impacts such as stream erosion from high stormwater flows. The Act does not, however, direct the Ministry to consider flood control when approving stormwater infrastructure—for example, requiring that a stormwater management pond be designed and built to account for higher intensity storm events. As a result, the Environment Ministry has historically not included flood control as an explicit consideration when approving stormwater infrastructure.

The Ministry's new approach to its stormwater approvals program establishes a number of performance criteria that new or altered stormwater systems must meet. Flood control is one of these criteria. This means that municipalities will be explicitly required to consider flood risk in the design process of new or upgraded infrastructure. The new approvals framework will also require municipalities to consider low-impact development practices that absorb stormwater on-site, which can reduce the volume of stormwater runoff that contributes to flooding. These new stormwater approval criteria have the potential to help reduce the risk of flooding over time, as municipalities build or upgrade their stormwater infrastructure.

With many aging systems that are due to be replaced, and much new development planned, such requirements to consider flood risk are important to help ensure that new infrastructure is designed to better withstand urban flooding, particularly in light of projected climate patterns.

The importance of ensuring future-looking, resilient design when building stormwater infrastructure is demonstrated by the expensive legacy problem that many municipalities continue to face from their combined stormwater-sewage sewer systems. Municipalities were permitted to build these systems throughout most of the 20th century, even though their use can result in sewer backups and the discharge of raw sewage into lakes and rivers (**Section 2.2.3**). Replacing these problematic combined sewer systems is both challenging and expensive. For example, the City of Hamilton is examining options to increase its storm sewer capacity to reduce flooding, as well as replace its combined sewer systems. An August 2022 assessment (conducted by city staff and consulting engineers) estimated that the total cost over 20 years would exceed $1 billion, with $475 million required to separate the combined sewer systems.

RECOMMENDATION 14

So that the revised consolidated linear approvals process is effective in ensuring that new or altered stormwater infrastructure is built in a manner that meets all performance criteria and enhances environmental protection, we recommend that the Ministry of the Environment, Conservation and Parks undertake a formal evaluation of the approvals program on a timely basis and incorporate improvements as identified.

ENVIRONMENT MINISTRY'S RESPONSE

The consolidated linear infrastructure approvals (CLI-ECAs) contain new conditions for monitoring and reporting on the performance of municipal stormwater infrastructure, including the submission of annual performance reports, which will enable the Ministry to make informed decisions on future improvements to the approvals program. In addition, all CLI-ECAs will be reviewed during each renewal cycle (approximately every five years) and updated as needed to address identified risks.

4.10.2 Changes to Environment Ministry's Approval Program Have Potential to Increase Oversight of Municipal Stormwater Management

The Environment Ministry has historically provided little oversight of municipalities' operation and maintenance of their stormwater infrastructure, increasing the risk of improperly maintained infrastructure and, in turn, of urban flooding.

Older stormwater approvals, like those issued in the 1970s and 1980s, typically lacked any conditions. As a result, many municipalities, including Toronto, Hamilton, and Ottawa, have extensive stormwater infrastructure (often with combined sewer systems) that still lack maintenance and monitoring conditions. Further, approvals were historically issued piecemeal, such that thousands of approvals may have been issued for different components of a municipality's stormwater infrastructure. With so many approvals issued over the past 50 years, the Ministry does not have consolidated information on all municipal stormwater approvals.

The Ministry's new consolidated approvals requirements and conditions (**Figure 17**) have the potential to address several problems with the current approvals process. If implemented effectively, the new approach has the potential to increase municipal accountability and oversight for the operation and maintenance of municipal stormwater infrastructure:

- the requirement to list and map all municipal infrastructure should result in better information and inventories of municipal stormwater assets (and according to municipal staff we spoke with, already is having this effect);
- conditions attached to each approval should increase municipal accountability for maintaining, inspecting and monitoring stormwater infrastructure;
- requiring municipalities to submit annual reports on stormwater management activities, which the Ministry states will each be reviewed by technical staff within its Environmental Permissions Branch, should improve provincial oversight; and

- requiring municipalities to apply for a regular review of their consolidated approvals will allow the Ministry to amend and update conditions as needed.

The Environment Ministry had not, at the time of our audit, proposed any changes to increase the inspection and enforcement of municipal compliance with stormwater approvals. We found that the Ministry has historically provided minimal oversight or enforcement of municipal stormwater infrastructure, relying on municipalities to address issues themselves. Over the past five years, the Environment Ministry has conducted only 38 compliance inspections of municipal stormwater infrastructure across the province. The Ministry advised our Office that it does not typically conduct proactive compliance inspections for stormwater infrastructure, but rather generally conducts responsive or complaints-based inspections when an issue is brought to its attention. This is because the Ministry's water inspectors are mainly focused on water quality and therefore prioritize inspections of drinking water, and then sanitary sewer, systems. Unless water quality is affected, or complaints are received, stormwater systems are a lesser focus.

We reviewed the 38 inspection reports from the past five years and found that 17 (45%) of the stormwater facilities inspected by the Ministry had not been operated and maintained as required by conditions in their approvals.

RECOMMENDATION 15

So that the conditions in Environmental Compliance Approvals for stormwater infrastructure are adhered to and increase oversight and accountability of stormwater management, we recommend that the Ministry of the Environment, Conservation and Parks develop and implement formal procedures with regard to risk-based compliance inspections.

ENVIRONMENT MINISTRY'S RESPONSE

The Ministry will work to incorporate risk-based compliance inspections of stormwater infrastructure into the Ministry's annual inspection planning process.

4.11 Regional Flood Control Facilities

4.11.1 A Lack of Provincial Design Standards for Regional Flood Control Facilities May Put Nearby Residents at Risk

Provincial oversight and standards are lacking for the structural design of certain large flood control facilities. Although such facilities are increasingly being relied upon to control urban flooding, risks to communities from their increased use are largely unknown.

The Natural Resources Ministry distinguishes between two different types of flood control facilities:

- **Online facilities**: Built on a lake or river, these facilities are considered to be dams that require approvals under the Natural Resources Ministry's *Lakes and Rivers Improvement Act*.
- **Offline facilities**: Facilities that are built to hold water, but are not located on a lake or river. Because of their location, they do not require approvals under the *Lakes and Rivers Improvement Act*. Offline facilities can include traditional stormwater management ponds, or purpose-built regional flood control facilities.

Traditional stormwater management ponds are designed to collect and contain runoff from typical rain events, and primarily to protect water quality. As their role is to protect the environment, the Environment Ministry is responsible for approving these ponds under the *Ontario Water Resources Act*. In contrast, regional flood control facilities are much larger stormwater management ponds that are purpose-built to contain stormwater resulting from major rainfall events that exceed a 1-in-100-year storm. Because they are built to control flooding, and not to protect water quality, the Environment Ministry does not require these facilities to obtain an Environmental Compliance Approval. The Environment Ministry advised us that these facilities will also not be covered by Consolidated Linear Infrastructure Environmental Compliance Approvals (**Section 4.10**) as they are built for flood-control purposes only, and flooding does not lie within the Ministry's responsibility. Because neither the Environment Ministry nor the Natural Resources Ministry are approving these large facilities, there is a

gap in oversight with respect to their structural design. According to the Special Advisor on Flooding, many are being constructed larger than their original design specifications with the goal of holding back even larger volumes of water.

In November 2016, the Natural Resources Ministry commissioned an engineering consultant to conduct an inventory and preliminary site-specific hazard assessment of these facilities. The consultant surveyed a total of 46 municipalities, including all those within the Greater Golden Horseshoe, and six other municipalities across the province to determine the location and design details of these facilities. Conducted as a desktop exercise, the purpose was to evaluate the risk that downstream populations or properties may face in the event of structural failure and the release of a large volume of water.

At the time of the study, the number and characteristics of existing facilities was unknown, as there is no requirement for these facilities to have an environmental compliance approval. The consultant surveyed each of the above municipalities to obtain information about the age, location and design details of these facilities. Ten municipalities reported a total of 51 offline facilities within their boundaries (21 indicated they did not have any such facilities and 15 did not respond to the survey). However, there was sufficient information for the consultant to conduct a risk assessment of only 34 of those facilities.

Of the 34 facilities assessed, the consultant identified nine offline facilities (those not built on a lake or river) that appeared to pose a risk if they failed during extreme rain, based on pond configuration and location relative to populated areas. In most cases, risk of failure had not been considered by the host municipality, and the consequences of failure were not typically considered in the design of the ponds. The study also found that information on the maintenance and performance of these facilities was not generally available and did not appear to be kept as part of municipal monitoring programs.

In May 2019, the Environment Ministry conducted its own assessment to validate the risk concerns identified by the consultant. Of the nine offline facilities, the Ministry concluded that four were of medium concern based on, among other findings, the presence of residential areas downstream of the pond, and five were of low concern.

At the time, the Environment Ministry proposed several next steps, including obtaining more information from municipalities about the presence and condition of the offline facilities within their boundaries and then consulting with senior staff from both the Environment and Natural Resources Ministries to determine whether a multi-ministry regulatory approach should be initiated. However, during our audit, the Environment Ministry advised us that the proposed steps were never undertaken, as the lead staff on the project had all either retired or moved to different positions. No other staff were reassigned to continue this work.

In April 2022, the Natural Resources Ministry indicated that it was working with the Association of Municipalities of Ontario to conduct a municipal survey regarding the operation and maintenance of stormwater ponds, including large regional flood control facilities. The goal is to help inform any guidance or policy that the Ministry might develop on their use.

RECOMMENDATION 16

To address the regulatory gap that exists regarding the structural design of large regional flood control facilities, and to reduce the risks they may pose, we recommend that the Ministry of Natural Resources and Forestry and the Ministry of the Environment, Conservation and Parks identify clear roles and responsibilities, and collaborate as needed, on developing regulatory requirements for offline regional flood control facilities.

ENVIRONMENT MINISTRY'S RESPONSE

The Ministry does not have a role in the design of large regional flood control facilities.

The Ministry's mandate under the *Environmental Protection Act* is to protect Ontario's air, land and water from the discharge of contaminants. The Ministry does not have the mandate to address

flood hazards (e.g., flooding from rivers and lakes). The mandate for managing flood hazards rests with conservation authorities.

Regional flood control facilities are in place solely for the management of flood hazards and are not intended to address water quality.

NATURAL RESOURCES MINISTRY'S RESPONSE

Under Ontario's Flooding Strategy, the Natural Resources Ministry has committed to evaluating the strengths, weaknesses, opportunities and threats of using regional flood control facilities to mitigate risks posed by flooding and determine whether the Province should take steps to further regulate their use.

The Ministry has no legislative authority over the design and construction of offline stormwater management ponds or regional flood control facilities. As noted by the Auditor General, the Ministry has already taken steps to begin investigating the use of regional flood control facilities and has committed to working with municipal partners to determine whether additional policy or guidance governing their use should be developed.

Appendix 1: Glossary of Terms

Prepared by the Office of the Auditor General of Ontario

Term	Definition
1-in-100-year storm	Rainfall event of a certain depth (mm of rain) and over a certain duration (hours) that has a 1% chance of occurring in a location in any given year, based on historical data for that area.
Backwater valve	Device that can prevent municipal sewers from backing up into homes.
Built stormwater drainage system	The network of **grey stormwater infrastructure** and **low-impact development** features that manage **stormwater**. While grey stormwater infrastructure is typically built to meet the primary goal of protecting water quality from pollutants, it can also help reduce flooding risk. The built drainage system works in conjunction with the **natural stormwater drainage system**.
Combined sewer systems	An older form of infrastructure that was designed to carry both sanitary sewage (sewage from toilets, sinks and drains) and **stormwater** in the same pipe to a sewage treatment plant. During and after heavy rainfall, rain can overwhelm the capacity of the combined sewer system or sewage treatment plant, which can cause sewage to overflow untreated into lakes and rivers or back up into homes and businesses.
Conservation authorities	Local watershed management agencies that deliver programs to manage natural hazards within a particular watershed. There are 31 conservation authorities in southern Ontario, and five in Northern Ontario.
Flood hazard	Risk of flooding of areas adjacent to a shoreline or a river or stream not ordinarily covered by water. Includes shorelines of the Great Lakes and inland lakes. Flood hazard mapping identifies areas along rivers, streams and lakes that are at risk of flooding.
Floodplain	Area adjacent to a river, stream or small inland lake, which has been or may be subject to flooding.
Flood risk map	Used to assess risk of flooding from rivers, streams, shorelines, storm sewer backups or overland flow. Flood risk maps are based on the actual impacts of flooding, as they incorporate the effect of stormwater infrastructure features (e.g., sewers and culverts) in reducing flood risk by storing and conveying stormwater.
Green spaces	Areas that are partly or completely covered with grass, trees, shrubs or other vegetation. They include parks, grassy boulevards, community gardens, cemeteries and farm land, as well as **natural features**. While it is typically not their intended purpose, green spaces play an important role in **stormwater management**.
Green stormwater infrastructure	An umbrella term that includes both **natural features** that provide **stormwater management** functions, as well as built features that are designed to mimic the functions of nature in managing stormwater, known as **low-impact development**.
Grey stormwater infrastructure	Built structures, often made of concrete and metal, that provide **stormwater management** services (see **Appendix 2** for examples).
Impervious surface	Hardened surface where water cannot infiltrate, such as asphalt or concrete. Contrasts with **pervious surface**.
Land cover	Refers to the surface cover on the ground, such as vegetation, bare soil or infrastructure.
Locally significant wetland	A wetland that is considered by a municipality as having local significance, but does not meet the threshold for a **provincially significant wetland**.
Low-impact development	An approach to managing stormwater that aims to reduce stormwater runoff and pollutants by mimicking natural functions to absorb and treat rain where it falls (see **Appendix 2** for examples). This term is used to describe the built portion of **green stormwater infrastructure**.
Natural features	Natural elements, such as **wetlands**, **woodlands** and meadows, that can play an important role in **stormwater management**. Often referred to as natural heritage features.

Term	Definition
Natural stormwater drainage system	The network of **natural features** and **green spaces** that impact stormwater flow and absorption across the landscape.
Pervious surface	Surface where water can infiltrate, such as soil with plant cover. Contrasts with **impervious surface**.
Provincially significant wetland	A wetland area designated as provincially significant by the Province using evaluation procedures established in the Ontario Wetland Evaluation System.
Regional flood control facilities	Facilities that are designed to control flooding from large storm events. Depending on their proximity to a water course, they are classified either as online facilities (e.g., a dam in a river or lake) or offline facilities (e.g., a flood control pond not in a lake or river) and are regulated differently.
Sewer (storm sewer or sewer system)	System of catch basins and pipes designed to carry stormwater to treatment plants or ponds or directly to a waterbody.
Stormwater	Rainwater or melted snow, which can soak into the ground or run off along the ground into **sewers**, streams, rivers or lakes.
Stormwater infrastructure	All infrastructure related to the collection, conveyance, treatment, retention, absorption, control or discharge of stormwater. It includes both **grey stormwater infrastructure** and **low-impact development** (see **Appendix 2** for examples).
Stormwater management	The process of controlling **stormwater runoff**, with the goals to protect the environment (e.g., reduce erosion in receiving rivers, streams and lakes and protect their water quality from pollutants in stormwater), as well as reduce flooding.
Stormwater runoff	Rain that does not soak into the ground and runs over the land surface. Where the ground surface is **impervious**, a greater amount of runoff is generated compared to a natural surface such as grass.
Urban flooding	Flooding that is caused by rainfall and cumulative overland flow that overwhelms the capacity of **built** and **natural stormwater drainage systems**.
Watershed	An area of land that catches rain and snow and drains or seeps into a marsh, stream, river, lake or groundwater.
Wetlands	Lands that are often covered by shallow water or where the water table is close to the soil surface, which provide transitional habitat where land and aquatic ecosystems are connected.
Woodlands	Forested areas that provide environmental and economic benefits, such as erosion prevention and water absorption, to both the landowner and the general public.

Appendix 2: Examples of Built Green and Grey Stormwater Infrastructure

Prepared by the Office of the Auditor General of Ontario

Examples of Grey Stormwater Infrastructure	
Catch basin	Underground structure that typically captures rainwater and snowmelt from grate on the side of a road and routes it through underground pipes.
Culvert	A relatively short conduit (such as a pipe), typically made from reinforced concrete or corrugated metal, that can convey stormwater runoff under a road or embankment.
Open ditches	Narrow channels in the ground used to capture and convey stormwater runoff along roadways.
Sewer drain	A pipe that serves one building and transports water and wastewater away to a sewer.
Sewer pipes (or sewers)	Underground pipes that carry sewage, wastewater and surface water runoff from drains to treatment facilities or disposal points.
Stormwater retention tank	Large underground tank that retains stormwater.
Stormwater management pond	A pond located at the end of a storm sewer that holds stormwater runoff, which allows suspended solids to settle, before releasing the water in a controlled way into a waterbody. Can be either a dry or wet pond.
Stormwater pumping station	A facility that pumps large volumes of water and typically discharges it into a lake or river.
Examples of Built Forms of Green Stormwater Infrastructure (Low-Impact Development Practices)	
Bioswale/ Dry swales	Vegetated channel over engineered soil bed, with specific mix of sand and organic material. Gently sloping sides and modified geometry slow runoff flow-over. Rainwater runoff can be slowly filtered and absorbed into the ground more effectively through engineered soil bed.
Bioretention	Vegetated area over engineered soil bed. Rainwater can be stored temporarily and treated before being absorbed into the ground below.
Downspout disconnection	Roof downspouts disconnected from sewer system. Rainwater that would have gone directly into stormwater sewer system is redirected elsewhere, such as a backyard garden.
Enhanced grass swales	Vegetated channels over native soil, with gently sloping sides and modified geometry, such as a small dam, to slow runoff flow-over. They allow rainwater runoff to be slowly filtered and absorbed into the native soil.
Green roofs	Vegetation on roofs. Rainwater on roof can be drawn into plants, reducing the amount of runoff.
Perforated pipes	Pipes similar to stormwater pipes that carry water away, but with holes throughout. Rainwater that enters pipe can then escape and be distributed in surrounding area below ground.
Pervious pavements	Pavements that allow rainwater to pass through, such as porous asphalt, interlocking concrete blocks, or plastic grid pavers. Rainwater flows through pavement and into ground below.
Rainwater harvesting	Use of containers to collect rainwater, such as a barrel at downspout from a roof. Rainwater from relatively clean sources, such as a roof, is collected and stored for later use, such as watering plants.
Soakaways and infiltration trenches	Excavations in native soil lined with geotextile fabric and filled with clean granular stone. Typically, rainwater from a relatively clean source, such as a roof, is collected in the excavated area and allowed to infiltrate into the ground.
Tree best management practices	Range of urban forestry practices including tree conservation during and after construction, tree trenches, tree boxes and tree pits. Trees in urban areas can intercept and absorb rainwater.
Vegetated strips	Vegetated, gently sloping area located beside impervious area. Vegetation can include trees, shrubs and native plants. Used to filter and absorb rainwater runoff from impervious area into the ground.

Appendix 3: 2018 Made-in-Ontario Environment Plan Commitments Relating to Urban Flooding

Prepared by the Office of the Auditor General of Ontario

Commitment	Status at the Time of Our Audit
Establish a climate change advisory panel that would provide advice to the Environment Minister on further developing climate change actions and activities.	In November 2019, the Environment Minister appointed a 10-member panel with a two-year term. In November 2021, the panel submitted to the Minister its final report and recommendations. While the recommendations cover a range of policies and programs, they are focused primarily on land-use planning, natural infrastructure and flooding.
Develop a user-friendly online tool to make practical climate impact information available for the public and private sectors.	Environment Ministry staff have developed potential options and are awaiting further direction on this initiative.
Modernize the Building Code to increase the ability of homes and buildings to withstand extreme weather events, such as flooding.	The Municipal Affairs Ministry is updating the Building Code but is not currently proposing measures to increase the ability of homes and buildings to withstand flooding.
Consult on tax policy options to support homeowners in adopting measures to protect their homes against extreme weather events, such as ice and wind storms and home flooding.	The Ministry of Finance regularly considers tax policy options within the context of the government's priorities and fiscal plan. The Ministry of Finance has not consulted on tax policy options to support homeowners in adopting measures to protect their homes against extreme weather events.
Work with the real estate and insurance industries to raise awareness among homeowners about the increasing risk of flooding.	The Environment Ministry has not begun to work with the real estate and insurance industries to raise awareness about the increasing risk of flooding.
Update policies relating to municipal wastewater and stormwater to make them easier to understand, and consider how financing could be updated to improve investment.	The Environment Ministry is in the process of updating municipal wastewater and stormwater policies.
Protect vulnerable or sensitive natural areas such as wetlands through good policy, strong science, stewardship and partnerships.	The Natural Resources Ministry provided $455,000 to Ducks Unlimited Canada in 2021/22 for wetland conservation.

Appendix 4: Actions and Activities Identified in Protecting People and Property: Ontario's Flooding Strategy (2020)

Prepared by the Office of the Auditor General of Ontario

Actions	Proposed Activities (Including Sub-Activities Where Relevant)
Priority #1. Understand Flood Risks	
Enhance Flood Mapping (of hazard areas near rivers or shorelines)	Establish a multi-agency flood mapping technical team
	Develop a multi-year approach to updating flood mapping, including to: • create mechanisms to share, maintain, access and distribute data; and • make necessary updates to policies, regulations and legislation to ensure flood mapping information can be shared with other agencies and the public.
	Maintain flood-related foundational geospatial data
	Establish a provincial elevation mapping program
	Update provincial standards for flood mapping, including to: • investigate other types of flood maps (beyond floodplain maps), such as flood risk maps or flood awareness maps, that identify vulnerable areas based on additional factors, such as built and natural drainage systems
Increase Public Awareness and Education	Increase access to flood-related information, including to: • work with external partners to share best practices and raise awareness about the increasing risk of flooding
	Increase transparency around water management decisions
Priority #2. Strengthen Governance of Flood Risks	
Clarify Roles and Responsibilities	Clarify roles and responsibilities in identifying natural hazards
	Clarify roles and responsibilities for urban flooding, including to: • establish an Urban Flooding Work Group with representatives from the Natural Resources Ministry, Environment Ministry, Municipal Affairs Ministry, Infrastructure Ministry, Ministry of Transportation and select municipalities
Promote Sound Land-Use Planning Decisions	Update the Provincial Policy Statement to improve the linkages between land-use planning and natural hazard management
	Update existing natural hazard technical guidelines
	Review policy and ideological approaches of existing guidance, including to: • evaluate the use of regional flood control facilities in Ontario
	Maintain wetlands and pervious surfaces, including to: • improve wetland mapping and policy approaches to encourage wetland conservation; • develop best management practices for wetland creation and restoration; and • promote the use of pervious pavement
	Enhance the resiliency of provincial infrastructure and other built form, including to: • account for climate change considerations in the design and rehabilitation of drainage works; and • encourage municipalities to update their requirements for new development to mandate the use of higher intensity and duration storms in design standards
	Update existing policy, legislative and regulatory requirements, including to: • develop a new stormwater policy to improve the way stormwater is planned and managed; and • require municipalities to conduct flood vulnerability studies and develop resiliency plans

Priority #3. Enhance Flood Preparedness	
Enhance Flood Forecasting and Early Warning	Maintain flood forecasting and warning
	Enhance flood forecasting and warning
	Enhance science and research
	Enhance use of satellite imagery
	Maintain Ontario's road weather information system
Priority #4. Enhance Flood Response and Recovery	
Enhance Emergency Response	Enhance emergency response activities
Review Disaster Recovery Assistance	Review the results of the Municipal Disaster Recovery Assistance Pilot Climate Resilience Initiative
	Review the implementation of Disaster Recovery Assistance for Ontarians for spring 2019
	Support the development of federal flood insurance and relocation programs
Priority #5. Invest in Flood Risk Reduction	
Secure Funding for Flood Risk Reduction	Leverage existing funding programs

Shaded rows identify actions that relate directly to, or could help to, reduce urban flooding.

Appendix 5: Audit Criteria

Prepared by the Office of the Auditor General of Ontario

1.	The Province clearly defines the roles and responsibilities of all parties involved in reducing the risk of urban flooding.
2.	The Province facilitates the collection and sharing of timely and practical information about current and projected future precipitation patterns to help government ministries, municipalities and other relevant parties understand, assess and reduce the risk of urban flooding.
3.	The Province provides guidance and other support to help municipalities collect and analyze accurate information about the state and capacity of their natural and built stormwater drainage systems.* The Province also supports municipalities in developing and sharing information about urban flood risk areas.
4.	The Province provides guidance and best practices on stormwater management and low-impact development to relevant parties that incorporates climate change considerations. The Province has measures in place to encourage widespread adoption of stormwater management best practices.
5.	The Province regulates stormwater management systems in a manner that reduces the risk of urban flooding.
6.	The Province has oversight mechanisms to ensure municipalities have sufficient financial resources to sustainably operate, maintain and enhance municipal stormwater management systems to effectively reduce the risk of urban flooding, including under future projected climate scenarios.
7.	The Province has policies and programs to increase the adoption by property owners and developers of flood-proofing measures for homes.
8.	The Province has effective policies and programs to reduce the risk of urban flooding through the protection, restoration and construction of wetlands and other natural features.

Note: Urban flooding refers to the flooding that is caused by rainfall that overwhelms the capacity of built and natural stormwater drainage systems.

* The natural stormwater drainage system refers to the network of natural features and green spaces that impact stormwater flow and absorption across the landscape. The built stormwater drainage system refers to the network of grey stormwater infrastructure and low-impact development features that have been built to manage stormwater.

Appendix 6: Recommendations by the Special Advisor on Flooding (2019) Relating to Urban Flooding

Prepared by the Office of the Auditor General of Ontario

Recommendations Focused on Urban Flooding Prevention	
#26	That, due to the increased use of the **regional flood control facilities**, the Natural Resources Ministry review whether the Province should take steps to regulate the use of these structures or let municipalities decide their use.
#27	That the Province create a **working group** of all pertinent ministries to define their respective roles as they pertain to **pluvial [heavy rainfall] flooding**.
#28	That the Province consider whether it should take steps to **regulate drainage standards** in urban areas, such as the requirement to restrict runoff flows to pre-development rates and flood protection measures for private property, and if so, what is the most appropriate legislation.
#29	That the Environment Ministry reach out to the **Intact Centre on Climate Adaptation**, as part of their commitment to consult with the insurance and real estate industry under the 2018 Environment Plan, to work collaboratively to raise awareness among homeowners about the increasing risk of flooding and to **disseminate the basement flooding protection information** to homeowners.
#30	That the **Ministry of Infrastructure** ensure that the **Ontario Community Infrastructure Fund** supports municipalities in enhancing and implementing asset management plans (which includes stormwater management and consideration of climate change adaptation and mitigation activities), which will help municipalities make the best possible investment decisions for their infrastructure assets.
Other Recommendations That Indirectly Relate to Urban Flooding Prevention	
#4	That the Natural Resources Ministry **update floodplain mapping technical and implementation guidelines** recognizing new technology and approaches for flood hazard and flood risk mapping, and that the Natural Resources Ministry collaborate with conservation authorities on this initiative.
#5	That the Province update its technical guides pertaining to floods and natural hazards. This should include undertaking a review of the flood event standards (e.g., 1%, Timmins storm, Hurricane Hazel), with a view to providing for **current science and climate change**.
#6	That the Province establish a working group with provincial departments, conservation authorities and municipalities to prepare a **multi-year approach to floodplain mapping**.
#9	That the Province consider establishing a **provincial custodian for floodplain mapping information** and make the necessary updates to policies, regulations and legislation.
#14	That the Province consider new legislation to improve the existing flood policy framework by having a **lead minister** responsible for all flood-related policy, standards, regulations and legislation.
#17	That the Province support municipalities and conservation authorities to ensure the conservation, restoration and creation of **natural green infrastructure** (i.e., wetlands, forest cover, pervious surfaces) **during land use planning** to reduce runoff and mitigate the impacts of flooding.
#31	That **the Infrastructure Ministry** work specifically with the Natural Resources Ministry on the design of future intakes of the Green stream of the **Investing in Canada Infrastructure Program** to ensure flood-related projects are eligible.
#33	That the Province continue to issue **Green Bonds** in 2020 and beyond to help **finance extreme-weather resistant infrastructure**.
#46	That the Province have a **central website** for flooding issues that provides answers (for conservation authorities, municipalities and the public) to a myriad of typical and frequent questions, or at the very least, a link to the agency (provincial department, power company, etc.) that provides the answers to the questions.
#49	That the Province consider including a **"build back better"** component under the Disaster Recovery Assistance for Ontarians program.
#52	That the Province continue the dialogue with the **Insurance Bureau of Canada** and the federal government on the steps needed to make **flood insurance** more available to more Ontarians.

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