Assessment of Standards and Systems for Quality and Risk Management for Stormwater Infrastructure in light of Existing and Future Climate Change Impacts

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Contents

1 EXECUTIVE SUMMARY

Those responsible for stormwater planning and management in Ontario are experiencing growing challenges. Increased severe rainfall and flooding combined with aging infrastructure, increasing urban densification and reduced permeable surfaces are pushing stormwater systems beyond their limits. While today's stormwater management systems are generally designed based on historical climate trends, climate change projections suggest that history may no longer adequately guide stormwater planning, investment, and management.

Special Characteristics of Stormwater Systems

- Total assets are often not well understood by owner municipality
- Infrastructure crosses public and private ownership lines
- Responsibility for planning and management is shared among many provincial ministries, municipal departments and sometimes conservation authorities with no clear lead
- Does not lend itself to a uniform level of service applicable to all systems and locations

In Ontario, responsibility for stormwater infrastructure design, construction, operation, maintenance, and monitoring is distributed across provincial authorities, local municipalities and conservation authorities (CAs), often fragmented with no clear leader. Decision-makers operate under a patchwork of laws, policies, and regulations concerning erosion, water quality, and floodplain management. Municipalities and CAs are faced with managing older infrastructure in need of repair and upgrading, ensuring new infrastructure will be resilient to future climate conditions and understand how to obtain and use data on possible changes to future volumes, frequency and types of stormwater. Additionally, no standards or methods exist for municipal staff, engineers and other relevant decision-makers to determine acceptable levels of risk associated with stormwater management systems or set appropriate levels of service.[1] While there are national standards for drinking water and wastewater effluent with federally defined levels of service, similar standards for stormwater do not exist.

As changes in climate occur and potential impacts on municipal stormwater systems become better understood, the law can provide valuable guidance on standards of practice and diligent decision-making in light of climate-adjusted information. The law can be an important driver to adapt as it establishes duties, and responsibilities on a range of actors involved in water management and flood prevention—from the government to conservation authorities, to developers and individual homeowners.

A variety of agencies have been sued in negligence cases around major flood events and systemic flooding issues. Defendants have included municipalities, conservation authorities, provincial governments, developers and construction companies among others. Plaintiffs have argued that such defendants were negligent in the following ways:

- Negligent in the design and construction of stormwater systems
- Negligent in the approval of development plans and failure to enforce building code
- Negligent for failing to conduct an adequate inspection of the construction
- Negligent for failing to maintain and improve stormwater management systems
- Negligent for failing to enforce a bylaw
- Negligent for failing to adequately supervise systems (i.e. ignoring alarms)

[1] Amec Foster Wheeler and Credit Valley Conservation. 2017. National Infrastructure and Buildings Climate Change Adaptation State of Play Report. Prepared for the Infrastructure and Buildings Working Group, part of Canada's Climate Change Adaptation Platform.

A better understanding of potential legal liabilities can assist municipalities and others involved to ensure thoughtful and diligent stormwater management practices.[2]

Standards offer municipalities a structured approach to reduce risks of infrastructure failure and related damages, reduce liability associated with potential negligence lawsuits and regulatory non-compliance and support continual improvement within municipal operations.

In recognition of the risks climate change may pose at the regional level, the City of Brampton, City of Mississauga, Town of Caledon, Credit Valley Conservation (CVC), Toronto and Region Conservation Authority (TRCA) and the Region of Peel (Partners) formed the Peel Climate Change Partnership (PCCP) in 2009 to develop an intergovernmental climate change strategy (the Strategy). The purpose of the PCCP is to identify those areas where combining efforts will have a larger impact. The PCCP has developed a five-year plan and the following four strategies:

1. Low carbon communities to reduce greenhouse gas emissions.
2. Flood resiliency to reduce flood risk in high-risk areas.
3. Green natural Infrastructure to increase canopy cover in high-risk areas.
4. Public education and awareness initiatives.

Stormwater management is a shared responsibility among various provincial ministries, municipalities and conservation authorities. These actors are all charged with working together to ensure that stormwater systems are properly functioning and adequately adapting to a changing climate.

Source: Ministry of the Environment and Climate Change. Policy Review of Municipal Stormwater Management in the Light of Climate Change. 2016. URL: https://www.ontario.ca/page/policy-review-municipal-stormwater-management-light-climate-change

Senior representatives of the PCCP identified CVC as the lead for the Flood Resiliency Strategy (FRS) as each Partner has been assigned a lead on one or more strategies stemming from the PCCP. It should be noted that while the Strategy focus is on flooding, there is Partner recognition that stormwater management also provides water quality, erosion, and water balance controls.

In March 2017, Partners defined goals for the FRS based on the recommendations from the Cooksville and Peel Water Infrastructure Vulnerabilities studies conducted in 2016 and 2017, respectively. These studies identified the need for developing a framework (or common method/standard to address staffing, data, management, and processes related to stormwater management). The Region of Peel shared their success with Drinking Water Quality Management Standards in identifying gaps and barriers and providing a framework for documenting processes and decisions, as well as seeking to demonstrate the applicable standard of care was met. Building on these lessons, the Region of Peel provided CVC with Clean Water and Wastewater Fund (CWWF) funding to investigate the feasibility of developing a Municipal Stormwater Risk Management Framework (MSW-RMF) to inform the Flood Resiliency Strategy.

This report assessed existing standards for applicability to stormwater and their ability to integrate flood resiliency and climate change solutions with the aim to support Partners in building stormwater system resilience. A range of existing standards related to environmental systems, risk management, water, sustainable communities, and climate change adaptation was reviewed as part of this study to offer helpful direction of elements to be incorporated into a future MSW-RMF to address common gaps and barriers identified by Partners.

Although the study proposes that 20 elements be incorporated into an MSW-RMF, not all elements could be completed as part of the Flood Resiliency Strategy due to budget, resources and time constraints (five

[2]From CVC stormwater liability report.

years). To prioritize key elements, this study conducted a legal risk assessment to identify priority gaps to be addressed within the five-year workplan as part of the FRS.

The following Vulnerabilities has been initiated under the PCCP FRS :

- Determine a feasible level of service for existing and future development in light of climate change (2018-2019).
- Better evaluate priority risk areas against adaptation measures and their return on investment (2018-2020).
- Build climate change considerations into decision-making and reduce the risks of flooding through updated and new policies, as well as by-law enforcement (2018-2019).
- Design, operate and maintain stormwater systems in a standardized way that meets regulatory requirements, emphasizes thoughtful policy decision-making and helps to demonstrate a high standard of care (2018-2022).
- Support continual improvement within municipal stormwater operations, maintenance, and monitoring in light of climate change (2018-2022).
- Update the Development Charges Backgrounder to include stormwater infrastructure and low-impact development (2018-2022).

This workplan marks the first steps towards an MSW-RMF.

This report serves as a baseline document for recommending elements that should be considered by municipalities in order to evaluate risk and incorporate climate change into stormwater management, and determine a feasible level of service for existing and future development in light of these changes. It is hoped that this study can be a resource for other municipalities in Ontario and across the country, and can support the improvement of stormwater management both today and far into the future.

2 INTRODUCTION

This project has been supported through the PCCP. The need for this study was identified through the *Integrated Peel Water Infrastructure Vulnerability Assessment (2017)* and the *Integrated Climate Change Vulnerability Assessment: Water, Wastewater and Stormwater Infrastructure in the Cooksville Creek Watershed (2016)*. The Cooksville Creek watershed study was established to identify those components of the water infrastructure (municipal drinking water, wastewater, stormwater and stream systems) that are at risk of failure, damage, and loss of service, and/or deterioration in the watershed and nearshore Lake Ontario. The study identified the need to ***"apply a framework for action to improve resiliency comprised of key considerations regarding data, staff, and management"*** to address gaps and barriers in stormwater management. Although management of the water systems within Cooksville Creek watershed falls under different departments and organizations, having a common framework for action can provide a cohesive approach to improving resiliency to current and future climate realities. This report is intended to provide a Risk Management Framework for Stormwater to identify risks/gaps in municipal stormwater programs and provide a format in which to document decisions.

Standards offer municipalities a way to reduce risks of infrastructure failure and related damages, reduce liability associated with potential negligence lawsuits and regulatory non-compliance, and support continual improvement within municipal operations. While there are provincial and national standards for drinking water and wastewater effluent with federally defined levels of service, similar standards for stormwater do not exist. Indeed, there are no standards or methods for municipal staff, engineers and other relevant decision-makers to determine acceptable levels of risk associated with stormwater management systems or set appropriate levels of service.[3]

This project seeks to understand the role and scope of an MSW-RMF to assist municipalities and CAs in designing, approving, operating, maintaining and continuously improving stormwater management systems—both today and in light of a changing climate. This project is intended to inform the PCCP's FRS workplan for 2018-2022.

A literature review, scan of best practices and select interviews with relevant stakeholders were conducted to:

- Understand the current state of stormwater planning and management and how it may be vulnerable to climate change.
- Review literature of various quality and risk management standards available for municipal services and operations.
- Evaluate existing standards and systems for their applicability to stormwater systems and ability to address climate change impacts.
- Complete a technical and legal case study assessment for a Partner municipality, which involved a review of existing municipal policies and by-laws related to stormwater systems and provided questions to help municipalities determine regulatory compliance.
- Propose elements to be included in an MSW-RMF and prioritize elements to be completed as part of the Flood Resiliency Strategy over the next five years.

[3] Amec Foster Wheeler and Credit Valley Conservation. 2017. National Infrastructure and Buildings Climate Change Adaptation State of Play Report. Prepared for the Infrastructure and Buildings Working Group, part of Canada's Climate Change Adaptation Platform.

3 CHALLENGES IN STORMWATER MANAGEMENT: TODAY AND TOMORROW

Communities of all sizes are struggling to define and maintain levels of service, cover costs of replacing aging infrastructure and ensure current stormwater systems can handle the inputs they receive. The following are current challenges being observed with respect to stormwater management:

- **Varying level of service for stormwater**. Currently, there is no consistent understanding of what "level of service" means in the context of stormwater and no standard for how to assess appropriate levels of service and risk. Some municipalities adopt targets, while others do not.

- **Lack of a sustainable funding mechanism**. Other water systems such as drinking water and wastewater have strict federal regulations, resulting in political will on part of councilors and senior municipal managers to develop dedicated funding mechanisms. Stormwater, on the other hand, does not have similar clear policies or regulations that would drive a dedicated fund. While development charges for greenfield development cover water and wastewater upgrades, they do not cover stormwater management system upgrades. Therefore, most municipalities do not have dedicated stormwater funding or financing and instead must rely on the general tax base.

- **Addressing existing / historical infrastructure and systems**. Existing stormwater infrastructure is not built to handle the frequency of intense storms we see today (before we even layer on future climate change impacts).[4] A large portion of the infrastructure is aging and reaching the end of its service life.[5] The table graphic below shows the characteristics of various extreme rainfall events in Ontario (in red) and how these events had higher rainfall intensities compared to Hurricane Hazel and the 100-year storm (in blue).

Extreme Rainfall Event	Total Rainfall Amount (mm)	Duration (hr)	1 Hr Max. Intensity (mm/hr)
Peterborough (Trent U), July 14-15, 2004	250.0	16.5	87.2
Toronto (Finch Ave), August 19, 2005	153.4	12.5	116.6
Hamilton (Stoney Creek), July 25-26, 2009	135.5	35.0	60.8
Mississauga (Cooksville), August 4, 2009	68.0	1.0	68.0
Westcentral GTA (Pearson), July 8, 2013	126.0	3.0	96.0
Hurricane Hazel, 15 October, 1954	285.0	48.0	52.5
100 Year Design Storm	118.0	24.0	50.0

In July 2013, the GTA experienced its most severe storm event in 60 years. Nearly five inches (126 mm) of rain fell in a two-hour period. In comparison, during Hurricane Hazel (a devastating event in 1954 where 81 lives were lost) the two-hour maximum precipitation was 91 mm and over two days was 285 mm. Conventional municipal drainage systems could not carry stormwater away fast enough. Roads and highways were overcome with floodwater, closing major transportation corridors.

Source: Toronto Star (2013). Monday's storm vs. Hurricane Hazel. Available at URL: http://www.thestar.com/opinion/letters_to_the_editors/2013/07/14/mondays_storm_vs_hurricane_hazel.html

- **Increasing urbanization, intensification, and densification.** Intensification and densification in urban areas reduce surface storage area and permeable surfaces as well as increase pressure on aging stormwater systems. Urban intensification can pose a risk because it exacerbates existing SWM issues, but an opportunity exists to build in SWM considerations to adapt to the changing urban form.

[4]Stakeholder interviews
[5]Stakeholder interviews

- **Politics.** Political issues can create challenges. Councilors must balance the conflicting interests of their constituent base, including those constituents who demand similar levels of attention regardless of their neighborhood's actual risk profiles.
- **Shared responsibility of service for sanitary and stormwater systems.** Many municipalities have a shared service model whereby sanitary services are administered by the upper-tier or regional municipality and stormwater services are administered by the lower-tier municipality. This shared model contributes to a lack of clearly defined roles and responsibilities related to stormwater management systems.[6]
- **Shared responsibility of service for riverine flooding including floodplain management and flood warning.** Municipalities and CAs share roles and responsibilities with respect to riverine flood and hazard management. This shared model can lead to confusion with respect to the division of responsibility for emergency management services and stormwater.[7]

Many of these challenges may be further exacerbated by future climate changes. While today's stormwater management systems are generally designed based on historical trends; climate data and projections suggest that history can no longer adequately guide stormwater planning, investing and management. Further climate-related challenges in the context of stormwater planning and management include:

- **Uncertainty around how to incorporate climate change** into the design capacity of culverts, storm and sanitary systems, asset life and functionality of components and systems.
- **Uncertainty as to how emergency management** and public health may need to prepare for more frequent short-duration high-intensity storm events.

Those responsible for stormwater are seeking guidance on evaluating risk, incorporating climate change uncertainty into stormwater management, and determining a feasible level of service for existing and future development in light of these changes. Decision-makers need to move beyond a reactive approach and forge a proactive plan to improve the resilience of our infrastructure.

4 WHY A MUNICIPAL STORMWATER RISK MANAGEMENT FRAMEWORK?

4.1 Filling Gaps in Existing Guidance and Practices

There are currently major gaps in existing standards, guidelines and best practices related to stormwater management. A literature review and stakeholder interviews revealed the following key gaps:

- **Lack of understanding around what "level of service" means.** A high priority gap in current practices is that there is no consistent understanding of what "level of service" means in the context of stormwater—particularly with respect to stormwater *quality*. Many municipalities appear to be using the 100-year-flood event for major systems and a 2- to 5-year flood event as the level of service for minor systems. Beyond that, the following questions could be answered, among others:
    - What is level of service? Is it the flooding level of service? Normal drainage level of service? Emergency management level of service?

[6]Green Communities Canada. 2016. Final Report to Places to Grow Implementation Fund Roads and Runoff: Implementing Green Streets in the Greater Golden Horseshoe. URL: https://www.placestogrow.ca/content/ggh/Roads_and_Runoff_Final_Report_web.pdf
[7]Green Communities Canada. 2016. Final Report to Places to Grow Implementation Fund Roads and Runoff: Implementing Green Streets in the Greater Golden Horseshoe. URL: https://www.placestogrow.ca/content/ggh/Roads_and_Runoff_Final_Report_web.pdf

- What are the level of service guidelines or goals for any aspect of SW (quality, erosion control, ecological health, aquatic health, etc)? How can we use in-stream targets to form the basis of a level of service for stormwater? What parameters should water quality targets include (e.g. nutrients, suspended solids, metals, pathogens, and organic chemicals)? What should in-stream flow targets consider (e.g. preserving natural hydrology of a receiver, providing a certain amount of base flow to a stream, etc)?[8]
- Would a level of service focus on quality of receiver? Swimming quality? Ability to navigate? Aquatic health? Riparian vegetation health? Drinking water quality? Geomorphology? Some combination?

- **Limited best practices in operation and maintenance standards.** Assumption (i.e. standard inspection protocols for municipalities before they take ownership of stormwater management systems from developers), operation, and maintenance requirements for existing stormwater infrastructure are not well-understood.[9] Guidance exists for basic operation, maintenance, and inspection needs, but there are no strict requirements set out to drive rigorous practices.

  In Ontario, the Province issues a Certificate of Approval (C of A) or an Environmental Compliance Approval (ECA) for all stormwater works; however, each approval is different and there is no consistency around operations and maintenance (O&M) or reporting. Moreover, approaches to inspect, operate, maintain and assume stormwater infrastructure are not standardized.[10] Stakeholders indicated that lack of stormwater management regulations and lack of enforcement of stormwater policies and by-laws has placed less priority and emphasis on the need for inspection, improved operations and maintenance and continuous monitoring. In contrast, drinking water and wastewater have dedicated resources and reporting as a result of clear regulations and enforcement.

  O&M is better understood for sewers and catch basins, but less understood for stormwater infrastructures such as ponds, wetlands and other low-impact development (LID) practices. This is partially due to the lack of guidance on inspection and maintenance protocols and asset management (i.e.: costs for long term maintenance); as such, municipalities have not fully invested in operations and maintenance despite the heightened awareness post-Walkerton for the need to be vigilant around O&M, and the responsibilities and accountability that come with C of A / ECA issues. For a long time, consequences for failure to maintain stormwater systems did not exist due to a lack of reporting requirements and enforcement. However, recent case law has shown that courts are now willing to step in (discussed in Section 7, 'Overview of Risks').

- **No early warning / alarm systems.** Climate change may increase the frequency of short duration high intensity (SDHI) events. Unlike hurricanes, the abrupt nature of SDHI events make them difficult to forecast and issue preparation warnings to impacted community. In existing urban areas where rivers / creeks respond very quickly to SDHI events, there is added stress on emergency management services and little time to warn and evacuate flood-prone areas (i.e. riverine and urban overland flood areas). More guidance and best practices on the use of early warning systems is required.

- **Best practices in emergency response standards.** Best practices need to be investigated during- and post- extreme flood events. Best practices may include evacuation plans that take into account flooding hazards (as opposed to just fire hazards) and a methodology to complete

[8] Credit Valley Conservation. 2016. Grey to Green Enhanced Stormwater Management Master Planning: Guide to Optimizing Municipal Infrastructure Assets and Reducing Risk. URL: https://cvc.ca/wp-content/uploads/2016/01/ORGuide.pdf
[9] Stakeholder interviews

detailed forensic accounting that captures the true direct and indirect costs / risks associated with flooding to inform future investments.

- **Lack of guidance around coordinating watershed targets with SW management.** Discussions around stormwater planning and management rarely feature water quality issues. Best practices need to be investigated where tablelands and in-stream targets are balanced to support watershed services. Watershed services may include water supply, reduced wastewater bypass, reduced erosion, and protection of aquatic habitats.

- **Limited best practices related to financing stormwater management.** Understanding best practices and options for sustainably financing stormwater management is poor, but may be addressed through a national standard.

- **Goals and objectives related to ecosystem health and management.** Municipalities are unsure of their roles and responsibilities related to ecosystem health and biodiversity, and how these issues interact with climate risk, stormwater management, and drinking water and wastewater systems.

- **Lack of documentation and a formal policy articulating an approach to stormwater management.** Although some municipalities take a progressive approach to address climate risks and integrate climate change considerations into stormwater management, they lack a formal policy or standard to document their approach. Without a policy, they are vulnerable to legal liability and lack support to justify decision-making to council and the public.

- **Lack of guidance and understanding around how to best use climate information and address climate risk.** A standardized process is needed to bring climate change information to a local level in order to understand the risks to stormwater systems and to meaningfully integrate this data into design parameters.

4.2 Benefits of a MSW-RMF

A standardization process in the form of an MSW-RMF would provide a consistent structure for decision-makers responsible for the design, operation, maintenance, and management of stormwater systems. It could help address several challenges and gaps described above, propagate best practices and enable consistency of stormwater management across physical and political borders. Potential benefits of an MSW-RMF include.

- **Builds climate change considerations into decision-making and reduces the risks of flooding**. Could provide a step-by-step process to build climate change considerations into decision-making and reduce the risks of flooding. It could help define roles and responsibilities, identify check-in points for environmental risks and mitigate environmental and health-related disasters.
- **Provides a structured approach to SW management, problem-solving and better decision-making.** Could help: (i) identify and manage risk based on context- and location-specific economic, technical / engineering and legal considerations; (ii) identify potential gaps and vulnerabilities in the SW management system; and (iii) determine the appropriate level of service based on these factors. Applying a standard could also offer an economic perspective to approaching problems and better understanding opportunity.

- **Helps justify decision making to council and the public**.[11] Could provide clarity, transparency, and justification for decisions. Municipalities would benefit from being able to point to a standardized, established policy or approach that is not personal or political when communicating decisions to the public.
- **Provides the business case for sufficient resource requirements (financial and personnel).**[12] Municipal staff have a tool to engage, educate and gain commitment from their councils and higher levels of government for investment (as well as enhanced engineering, operations, and management practices) in these infrastructure systems.
- **Provides a process to clearly define roles and responsibilities around stormwater management**.[13] Municipalities shared that it would be helpful to have an articulated standard or strategy to provide clarity and consistency on a policy / approach across staff (which can sometimes range in the tens of thousands of individuals) and ensure a consistent understanding of expectations. A standard could also create an implementation / operational plan.
- **Works towards consistency across the country**.[14] Level the playing field among municipalities across the country and encourage municipalities that are "holding out" to upgrade their systems and practices. This type of consistency could help reduce the potential for expensive mistakes, increase efficiency and provide assistance to engineers and other professional practitioners in preparing systems to be resilient in a changing climate.
- **Fill gaps in existing guidance and promote best practices**. Provide a process to enhance understanding of system operations and identify opportunities for improvement. The tool could help with sharing best practices to inform development of standards for professional practice.
- **Addresses stormwater quality issues.** A number of municipalities highlighted that water quality issues are not discussed, and no advanced thinking has gone into addressing these issues. A standard could make this topic a priority and provide clarity around best practices and relevant levels of service.
- **Help address discussions with the public and development community**.[15] Communicate the importance of stormwater-related issues, set mandatory minimums and diffuse the "stand-off" between municipalities and developers.
- **Demonstrates diligence in decision-making, conscious policy decisions and a high standard of care to protect against legal liability**. Provide a standardized guiding process to design, operate and maintain, inspect and assume stormwater systems to meet regulatory requirements, emphasize thoughtful policy decision-making, and demonstrate a high standard of care. It could provide a tracking protocol to ensure all changes and decisions made in policy, operations, and budget are well documented and identify steps for municipalities to internally audit the MSW-RMF.
- **Motivates action and promote proactive management.** Move conversations to action.
- **Supports adaptive improvement within municipal stormwater operations, maintenance, and monitoring in light of climate change**.

5 ASSESSING EXISTING STANDARDS

5.1 No Existing Risk Management Framework or Standard for Stormwater Level of Service

[11] Stakeholder interviews
[12] Stakeholder interviews
[13] Stakeholder interviews
[14] Stakeholder interviews
[15] Surrey, Calgary

Unlike the Ontario Drinking Water Quality Management Standard[16], there are no legislated requirements or comprehensive prescriptive guidance with respect to the level of service for stormwater in Ontario. Generally, stormwater management systems are governed by provincial approvals, which may not always include prescriptive requirements and ongoing monitoring and maintenance obligations. The Ontario Ministry of Environment (MOE) released a manual in 2003 that provides guidance on planning, design, and review of stormwater management practices, including guidance for stormwater management sewage works approvals under Section 53 of the *Ontario Water Resources Act*. The Ministry of Environment, Conservation and Parks (MECP) grants Environmental Compliance Approvals (ECAs; outline monitoring and reporting requirements) to municipalities, businesses and private owners that acquire stormwater infrastructure. ECAs were formerly known as Certificates of Approval (C of As), which did not outline any monitoring or reporting requirements. The MECP is currently updating this manual and developing further guidelines around low-impact development techniques.

Municipalities are seeking guidance on incorporating climate change into stormwater management to evaluating risk, , and determine a feasible level of service for existing and future development. In the absence of provincial and federal standards, mitigating increasing legal risks requires proof that a municipality met the appropriate standard of care. A MSW-RMF seeks to fill this gap by acting as a "how-to" document that can be used by small, medium and large municipalities to address the commonly-faced risks in a structured, coordinated, and standardized way by providing a process for documenting decision making and consistent methodology.

5.2 What Standards Do We Currently Have?

While we do not yet have a stormwater quality or risk management standard, we do have a variety of standards from which we can learn from and build upon. For this study, a group of relevant standards was selected to review, assess and pull best practices from. These standards relate to drinking water, wastewater, environmental systems, risk management and/or sustainable development. They are as follows:[17]

- ISO 14001, Environmental management systems — Requirements with guidance for use
- ISO 19011, Guidelines for auditing management systems
- ISO 31000, Risk management — Principles and guidelines
- ISO 14031, Environmental management — Environmental performance evaluation — Guidelines
- ISO Guide 73, Risk management — Vocabulary
- ISO 24510, Activities relating to drinking water and wastewater services—Guidelines for the assessment and for the improvement of the service to users
- ISO 24511, Activities relating to drinking water and wastewater services — Guidelines for the management of wastewater utilities and for the assessment of wastewater services
- ISO 37120 - Sustainable development of communities on city indicators for service delivery
- Nutrient Management Strategy
- Drinking Water Quality Management Standard
- Hazard Identification Risk Assessment (HIRA)
- CEN-CENELEC Guide 32 - Guide for addressing climate change adaptation in standards
- Growth Plan for the Greater Golden Horseshoe

[16] Under section 10 of the Safe Drinking Water Act, SO 2002, c 32 s 10, drinking water must meet the requirements of the drinking water quality standards prescribed by regulation (O Reg 169/03 s 2(1)) [*Drinking Water*].
[17] Other standards that could be considered in the future include: ISO 37101:—Sustainable development and resilience of communities —Management systems — General principles and requirements and ISO 22301 — Business continuity management.

5.3 Applicability of Current Standards to Stormwater and Climate Change

Risk and quality management standards are helpful in general, but may not adequately address some of the features unique to water resources. Water-related standards such as the Ontario Drinking Water Quality Management Standard (DWQMS) offer municipalities a way to reduce liability associated with regulatory non-compliance and support adaptive improvement within municipal operations. But water and wastewater standards are not directly applicable to stormwater due to some important differences:

- Public and private water and wastewater systems are separate and do not interact, whereas stormwater crosses over physical and political, public and private system boundaries.
- Water and wastewater have standards of performance whereas there is no prescribed "level of service" for stormwater because these systems are watershed specific. Furthermore, the level of service for stormwater varies depending on the age of development (e.g. areas built prior to the 1970s may not have stormwater control), unlike wastewater and water which have consistent levels of service regardless of the age of development.
- Water and wastewater operate in closed systems (i.e. treatment, distribution and collection), whereas stormwater is not in a contained system, and is decentralized (multiple systems across a municipality, which are dependent upon watershed and meteorological conditions).

With respect to the applicability of existing standards to climate adaptation, climate change risk management is different from traditional risk management due to the uncertainty around climate change and its impact on municipal stormwater infrastructure. There is uncertainty around the frequency and severity of climate change, the timeframe within which changes will occur and the effectiveness of adaptation solutions currently available. While climate science and modeling continue to improve, they still face limitations in making precise predictions about the future, especially for short-duration-high-intensity rainfall events.

Given the uncertainties, appropriate adaptation strategies must be rooted in risk management for an uncertain future rather than precise projections for optimal decisions.[18] Literature and subject experts caution standard writers from being too prescriptive and instead recommend focusing on risk assessment and objective/outcome-based approaches. They emphasize that climate change risk management should be a flexible and adaptive process in to manage uncertainty and allow for course corrections. Climate change risk management also requires adaptive reviews and updates to incorporate the latest climate science, and continuous monitoring to re-evaluate adaptation options as information and conditions change.

Tools such as vulnerability assessments and scenario planning are helpful in planning for uncertainty. Vulnerability assessments consider possible exposures to risk under a range of possible future trends and conditions. Meanwhile, scenario planning explores alternative futures and assesses strategies for reducing vulnerability in a range of different futures, allowing an organization to be prepared as conditions change.

With these concepts and this guidance in mind, criteria was developed to determine: (i) the applicability of existing standards to stormwater, and (ii) their ability to address and incorporate climate change risks and/or considerations. Here is a description of each criterion:

- **Flexible.** The standard will allow for flexibility in approach and favour process- and risk-based elements over prescriptive requirements. It will also be applicable in a range of environments. The standard must consider geography, logistical challenges and limitations, climate, environmental conditions and cultural considerations of small, remote communities, and communities with limited

[18] Wilbanks T.J. (2014) Implications for Future Risk Management Strategies. In: Wilbanks T.J. (eds) Climate Change and Energy Supply and Use. NCA Regional Input Reports. Island Press, Washington, DC

financial capacity and competing priorities. It will also allow for adaptive review, assessment and improvement.

- **Process-based.** Sets out a decision-making process and points of insertion for climate considerations.
- **Risk management.** Takes a risk management approach. Nearly every credible source indicates that an appropriate adaptation strategy is rooted in risk management for an uncertain future, rather than precise projections for optimal decisions. Climate change risk management requires developing strategies that perform well in multiple possible future scenarios (resilience). [A critically important step towards developing such strategies is conducting a vulnerability assessment that considers possible exposures to risk under a range of possible future trends and conditions].
- **Science and data-based.** Standards are based on data and methods informed by the best available, actionable [climate] science. This includes a plan, program or methodology for data compilation and analysis.
- **Future-oriented.** Relies on future projections rather than historical data (in terms of flood risk). Uses scenario planning to prepare for alternative plausible futures.
- **Auditable**. Provides structure with distinct elements and/or clear auditable steps
- **Water-related.** Developed in relation to water planning, management and systems.

The selected standards were reviewed and evaluated against the criteria defined above. Table 1 provides a summary of the assessment.

Table 1: Assessment of Existing Standards for Applicability to Stormwater and Ability to Address Climate Change

Criterion → **Standard ↓**	**Flexible**	**Process-based**	**Risk Management**	**Science and Data-based**	**Future-oriented**	**Does it provide clear, auditable steps?**	**Does it Relate to Water**
ISO 14001	✓	✓	✓	✓	×	✓	×
ISO 19011	✓	✓	✓	×	×	✓	×
ISO 31000	✓	✓	✓	✓	✓	✓	×
ISO 14031	✓	✓	✓	✓	✓	✓	×
ISO 24510	✓	✓	×	✓	×	✓	✓
ISO 24511	✓	✓	✓	✓	×	✓	✓
ISO 37120	✓	×	×	✓	×	×	✓
NMS	✓	×	×	✓	×	×	✓
DW QMS	✓	✓	✓	✓	×	✓	✓
HIRA	✓	✓	✓	✓	×	✓	✓
CEN-CENELEC Guide 32	✓	✓	✓	✓	✓	✓	×
Growth Plan	✓	✓	✓	✓	✓	×	✓

6 RECOMMENDATIONS FOR ELEMENTS OF A MSW-RMF

Drawing on stormwater challenges, gaps, and existing standards identified, the following elements of an MSW-RMF are recommended. The MSW-RMF elements can be rearranged to best suit the municipality or CAs workplans and priorities.

1. **Set the Scope and Context.** Element defines the scope of the MSW-RMF, and provides scientific and evidence based justification for implementing MSW-RMF.
2. **Policy Statement.** Element requires crafting a policy that states and memorializes the partner's commitment to the proposed stormwater and watershed management strategy, through the implementation of an MSW-RMF.
3. **Goals and Objectives.** Element allows partners to define their goals and objectives for the stormwater system within a watershed context. The goals and objectives would be focused on the integration of related services, including but not limited to watershed protection, reduced riverine and urban overland flooding, reduced sanitary flooding due to infiltration/inflow, improved surface water quality, reduced erosion, improvements to public health, enhanced emergency management services, and/or planning and opportunities for increased groundwater recharge.
4. **Leadership Commitment and Endorsement.** Element makes clear that senior decision-makers/top officials are aware of and committed to the adoption, implementation, maintenance, and continual improvement of the MSW-RMF as approved by Council.
5. **Define Roles, Responsibilities and Authorities.** Element requires the definition of clear roles, responsibilities and accountability among partners as they relate to stormwater and watershed management.
6. **Compliance Obligations.** Element allows partners to determine compliance obligations as they relate to stormwater and watershed management, and allows these obligations to be incorporated into the MSW-RMF. Compliance obligations are generally dictated from Certificate of Approvals / Environmental Compliance Approvals, Stormwater Master Plans, Watershed Plans etc.
7. **Resource Planning.** Element ensures that the appropriate human and financial resources needed to establish, implement, maintain, enforce and continuously improve the MSW-RMF are determined and allocated for.
8. **Documentation of Decision-Making and Record Retention.** Element calls for a tracking protocol or standard operating procedure for documenting decision-making and retaining clear, updated records of all plans, strategies and documents in a registry.
9. **System's Description and Operational Plan.** Element would identify what stormwater infrastructure a municipality has under existing and new developments and what flood forecasting, warning and watershed management activities a CA has. This will allow partners to define the current level of service to feed the risk assessment (element 10). This element will assist CAs in assessing their existing level of service for flood forecasting/warning and watershed protection.
10. **Risk Assessment.** Element calls upon the partners to identify, analyze, evaluate, and prioritize risks through a vulnerability assessment of stormwater systems (including riverine and urban overland flooding, sanitary flooding due to I/I) and watershed systems under climate change and future growth scenarios. Findings from the vulnerability assessment and any new data available would initiate a risk assessment update.
11. **Risk Management.** Element selects appropriate risk treatment options for the priority risks identified in the Risk Assessment Element (10).
12. **Implementation Plan.** Element sets out specific tasks, targets, timelines and resources required to achieve policy goals and objectives, including additional capacity needs such as new development design and watershed standards.
13. **Training Education, Certification and Competencies.** Element sets out standards for expected training and competency for those responsible for carrying out the actions in the Risk Management and Implementation Plan.

14. **Communications and Disclosure.** Element establishes internal and external communications and reporting mechanisms.
15. **Performance Evaluation and Metrics.** Element identifies and selects metrics to monitor, evaluate, report on and improve performance against goals and objectives. Municipalities and CAs can define "triggers" with respect to performance parameters for infrastructure and watershed monitoring that would initiate an update to the Risk Assessment with new findings and recommendations.
16. **Inspections, Maintenance, Repair and Rehabilitation.** Element identifies maintenance, inspections and repair practices for stormwater infrastructure to ensure goals and objectives are achieved. Goals and objectives are informed by Performance Evaluation and Metrics developed to meet statutory requirements (such as O'Reg 588/17).
17. **Data Collection, Monitoring and Analysis.** Element identifies methods for stormwater data collection, monitoring and analysis.
18. **Emergency Management.** Element develops a list of potential emergency situations/service interruptions, processes for emergency response and recovery, and an emergency communications protocol. This element is related to stormwater induced flooding event emergencies.
19. **Audits.** Element defines an internal and external audit program. Audits are generally performed annually.
20. **Adaptive Management.** Element establishes a process for the review, evaluation, and update of the MSW-RMF. This element offers adaptive improvements where "Performance Evaluation and Metrics" are cross-checked with "Goals and Objectives", and any non-compliance or deficiencies in the system are identified. Corrective actions would be assigned to overcome the non-compliance issues or deficiencies through adjusted "Inspections, Maintenance, Repair, and Rehabilitation". Continuous "Data Collection, Monitoring, and Analysis" will confirm that the system is up to compliance standards and the "Goals and Objectives" are sufficiently met.

More details on how these elements address gaps and barriers to mitigate risk is found in Appendix B.

7 OVERVIEW OF RISKS

Governments, developers, engineers and other professional practitioners make decisions, investments and policies that have a direct impact on the safe and effective management of stormwater. Climate change is posing increasing risks to the systems and potentially new liabilities for those who manage them. Historical practices may no longer adequately protect people and infrastructure from harm. The following subsections detail some of the risks decision makers face if stormwater is not properly managed in light of a changing climate.

7.1 Legal Risks

The rise in extreme weather events across the globe is putting strain on municipal infrastructure and has brought attention to stormwater management from a legal risk perspective. Recent class action lawsuits against municipalities, conservation authorities and the Province of Ontario for flooding—both after extreme rainfall events and on a recurring basis due to alleged systematic problems—have highlighted partner roles and responsibilities. In the absence of a clear set of best practices or standards across the Province, our consultations indicate that municipalities, conservation authorities, the Province, among others, have important unanswered questions about the appropriate level of service that should be provided. The uncertainty is further complicated by increased development and climate change, more extreme events may create new technical and cost challenges for existing systems.

As changes in climate occur and potential impacts on municipal stormwater systems become better understood. The law can provide guidance on standards of practice and diligent decision-making

considering climate-adjusted information. The law can be an important driver to adapt, as it imposes duties, responsibilities, and accountability on a range of actors involved in water management and flood prevention—from government, conservation authorities, developers, and individual property owners. A better understanding of potential legal liabilities can assist municipalities and others involved in stormwater management to ensure thoughtful and diligent stormwater management practices.[19]

A variety of agencies have been sued in negligence cases around major flood events and systemic flooding issues. Defendants have included municipalities, conservation authorities, provincial governments, developers, construction companies, among others. Plaintiffs have argued that such defendants were negligent in relation to:

- Failure to draw down water levels in provincial ministry dams and/or effectively manage water levels
- Poor repair, inspection and maintenance of wastewater treatment plants
- Lack of diligent operation and supervision during flooding (including an allegation that alarms were ignored)
- Catch basins not installed in accordance with the construction design details prepared by the civil engineer
- Defendants were aware the area was flood-prone, and failed to act even after the plaintiff raised the issue
- Houses were not waterproof to code, despite the municipality's inspection, review and issuance of permits
- Construction failure, faulty workmanship and design, failure to inspect basements for leaks and failure to repair leaks as requested.

A few examples of stormwater management and flood-related lawsuits in Canada and the United States are presented in Table 2. While courts are generally required to follow precedents set in applicable jurisdictions, decisions from other jurisdictions are still instructive and worth reviewing to understand how plaintiffs are constructing their legal arguments.

[19]From CVC stormwater liability report.

Table 2: Examples of Stormwater Management and Flood-Related Lawsuits in Canada and the U.S.

Case Name (Year)	**Description** (damages, cost and settlement amounts have been included where available)	**Nature of Negligent Act**
Cerra v. City of Thunder Bay (2013), CV-12-0253	This **$300M** class action seeks damages and other relief for the class as a result of alleged negligence by the defendant, The Corporation of the City of Thunder Bay, in the repair, inspection, and maintenance of the Atlantic Avenue Water Pollution Control Plant, as well as the operation and supervision of the Plant during the May 28, 2012 rainfall event in Thunder Bay (alarms were allegedly ignored). The trial is expected to commence in early 2018.	Negligent repair, inspection, maintenance and supervision (i.e. ignoring alarms) (alleged[20]).
McLaren v. Stratford (City) (2005) 2005 CanLII 19801	A major flood in the City of Stratford after severe rainfall in 2002 left many with sewage in the basement. The plaintiffs claimed negligence in design, construction operation and maintenance of the system. Class certified by the court in 2005.[21] Settled in 2010, 8 years after the flood. Stratford settled for **$7.7M**, after already spending **$1.3M** in emergency relief and then upgraded the system to a 250-year storm standard.	Negligent design, construction, operation, maintenance (alleged).
Lissack v Toronto, [2008] OJ No 5563	The City's storm sewer backed up following a heavy storm and flooded the plaintiff's basement. The plaintiff brought an action in negligence for damages against the City of Toronto. The Court found that the City breached its duty of care by failing to maintain and improve stormwater management systems.	Negligence for failure to maintain and improve stormwater management systems (ruling[22]).
Strata Plan NW 3341 v. Canlan Ice Sports Corp., [2001] B.C.J. No. 1723 (SC), aff d [2002] B.C.J. No. 2142 (CA).	The plaintiff sued the City of Delta, a developer, contractor, and engineer for approximately **$3M** after rot from water leakage was found in the structural framing of the condo a year after it was built. The plaintiffs alleged negligent approval of the application for the building permit, a negligent inspection of construction, and negligent issuance of the permit. The court found the defendant municipality negligent, by improperly approving faulty development plans that did not meet Building Code requirements and by not enforcing all parts of the Code in its inspections.	Negligent approval of development plans, failure to enforce Building Code (ruling)

[20] "Alleged" indicates that the legal claim was settled, withdrawn or still ongoing, meaning there has been no formal finding of negligence by a court.
[21] Class certification refers to a court's finding that a group of individual plaintiffs can be recognized as a "class" because the issues they are bringing before the court are common enough to be decided together.
[22] "Ruling" indicates a formal finding of negligence was made by a court.

Ingles v Tutkaluk Construction Ltd., [2000] 1 SCR 298, 2000 SCC 12	The appellant hired a contractor to renovate his basement. The required building permit was not obtained prior to construction. Inspector relied upon the contractor's assurances that the underpinnings were properly constructed, without verifying this information, except for an examination of the concrete. The appellant began to experience flooding and hired another contractor, who determined that the underpinnings were completely inadequate and failed to meet the standard prescribed in the Building Code Act. The appellant sued the first contractor for a contractual breach and the City of Toronto for negligence. Even though the owner consented to the construction without a permit, the City was also found negligent for failing to conduct an adequate inspection and ended up paying **$185,000** in costs and rewards.	Negligent for failing to conduct an adequate inspection of construction (ruling).
Oosthoek v. Thunder Bay (1996) 1996 CanLII 1530 (ONCA)	Plaintiffs' basements flood due to a storm in Thunder Bay. They brought an action alleging that the City knew of problems and acted negligently in failing to address them. The problem of basement flooding had been identified in a 1965 engineering report, which found that increased development and reduction of absorptive soils had increased water movement to sewers. The report also identified rainwater leaders and weeping tiles discharging into sewers from homes were a contributing factor to increasing flood risk. The report recommended, among other things, the construction of storm relief sewers and the disconnection of rainwater leaders. In or around 1987 the City passed a bylaw requiring downspout disconnection. The City was found liable for the flooding caused by the overloaded combined sewers. The City's negligence was based on its failure to enforce the by-law it passed requiring downspout disconnection from the sewage system.	The court held Thunder Bay was negligent for failing to enforce a bylaw that required downspout disconnection.
Farmers Insurance Group et al. v. The Metropolitan Water Reclamation District of Greater Chicago et al (2013) Case number 14CH06608 in the Circuit Court of Cook	Floods in April of 2013 led to significant damage in cities in the greater Chicago area. Insurers sued over 100 municipalities in a class action, alleging that damage could have been prevented by more proactive management in light of known and foreseeable flood risks and climate models. The action was withdrawn by Farmers before trial in order to pursue more productive conversations with municipalities to address flood risk management. This case demonstrates the types of arguments plaintiffs – whether insurers or homeowners with flooded basements – might make in court where there is a failure to	Negligent failure to proactively manage in light of foreseeable risks (alleged). **Note that in this case the action was withdrawn in favour of discussions outside of the legal*

County, Illinois	address known risks in light of climate change.	*system.*
Scarborough Golf & Country Club v. Scarborough (City) (Ont. C.A.) 66 O.R. (2d) 257 [1988] O.J. No. 1981	The plaintiff golf course sued the City of Scarborough and CA in negligence, nuisance and violation of riparian rights for damage caused by flooding. The plaintiff alleged that the City and CA's actions caused a creek within the course to become twice as wide and twice as deep, eroded the banks, and resulted in the flooding of large parts of the course during heavy rainfall events. The plaintiff's claim against the CA was dismissed, as the court determined that CA's actions did not cause the flooding and erosion. The City, on the other hand, was found liable for negligence. The court found that the storm sewer facilities and urbanization of the lands owned by the City were the cause of the golf course flooding and erosion. It also held that the City knew of the consequences its system would have on the plaintiff golf course when planning and constructing its system and its drainage was unreasonable.	The City was found negligent for failing to implement reasonable drainage practices.
Other golf course cases (various years)	A series of other lawsuits have been brought by golf courses against municipalities, conservation authorities and provincial governments for damages related to flooding, erosion and ice jams, alleging negligence in managing upstream stormwater systems and/or decisions around planning and constructing infrastructure. Many of these have been settled out of court so limited information is available.	These lawsuits were settled out of court.

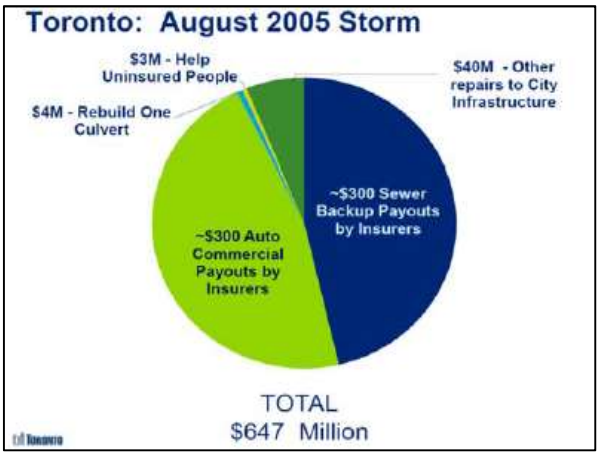
TThese lawsuits, if successful, could result in costly awards or settlements. A deeper analysis of relevant negligence principles is included in the legal risk assessment below and in Appendix A.

An MSW-RMF that provides a structured process to build climate change considerations into decision-making and reduce the risks of flooding can help ensure statutory and common law requirements are being considered, and a high standard of care in key infrastructure decision-making steps (e.g. design, permitting, construction, maintenance, repair, inspection, by law enforcement, etc.) is met.

7.2 Economic Risks

In addition to legal risks, improper stormwater management can have significant economic impacts. The Bank of Canada issued a recent statement, calling climate change "one of the biggest challenges facing Canada and the world in the 21st century", estimating the cost of inaction could be $21- 43 billion per year by 2050.[23] In 2013, losses related to catastrophic events increased to a record-breaking $3.4 billion, largely due to flooding in Calgary and Toronto.[24] With increased severity and frequency of flood and water-related events in recent years, water damage claims are becoming common. It is estimated that the Canadian insurance industry pays $1.7 billion each year in claims due to water damage.[25]Where coverage is not offered through private insurance, government disaster relief programs have provided relief to some provinces and individuals. As a result of catastrophic events over the last few years, Federal Disaster Financial Assistance Arrangements (DFAA) paid out $673 million for flood damage, representing 75% of their weather-related expenditures.[26]

These costs will be born in a variety of ways, including impacting municipal infrastructure. Extreme rainfall on August 19, 2005 in Ontario was the catalyst for the collapse of a Finch Avenue West section in Toronto. Over three hours, 153 mm of rain fell causing 78 m of Finch Avenue West to crater, a Black Creek culvert collapsed, and a 48 m section of trunk sanitary sewer was lost; releasing raw and uncontrolled sewage into Highland Creek for three days. Basement flooding in private residences was unprecedented. The cost to replace the failed Finch Avenue culvert was less than the total costs associated with event. The damages associated with this event rank as one of the most expensive natural disasters in the province's history, with private insurance payouts approaching $740 million[27].



Source: City of Toronto, 2013

Stormwater runoff from urban areas often contains contaminants including total suspended solids, heavy metals, nutrients and road salt, which eventually end up in water bodies, impacting aquatic habitat and species along with drinking water sources and municipal water treatment facilities. Climate change is

[23] http://www.bankofcanada.ca/2017/03/thermometer-rising-climate-change-canada-economic-future/
[24] Facts of the Property and Casualty Insurance Industry in Canada 2017, IBC, 2017 <http://assets.ibc.ca/Documents/Facts%20Book/Facts_Book/2017/Fact-Book-2017.pdf>
[25]"Water damage is on the rise", Insurance Bureau of Canada, accessed April 1, 2016. http://assets.ibc.ca/Documents/Brochures/Water-Damage-on-the-Rise.pdf
[26]"Estimate of the Average Annual Cost for Disaster Financial Assistance Arrangements due to Weather Events", Office of the Parliamentary Budget Officer, February 25, 2016, p. 3.
[27]http://assets.ibc.ca/Documents/Facts%20Book/Facts_Book/2016/Facts-Book-2016.pdf

expected to increase the number and frequency of extreme rainfall events, and higher in-stream pollutant concentrations, intensifying problems associated with untreated urban stormwater.

For example, the warmer winter in 2012, coupled with high nutrient concentrations contributed to an increased growth of algae in the Credit River and Lake Ontario. On June 1, 2012, seasonal climate conditions—combined with a 37.4 mm rainfall event and strong easterly winds—resulted in an algae bloom at the intake of a water treatment facility that clogged several screens, damaged 27 intake baskets (right), and temporarily shutdown of one of the pumps. According to Peel staff, the event cost an estimated $350,000. The future climate will likely be warmer, particularly in winter and spring months, creating more suitable conditions for algae and a higher potential to impact water treatment facilities. Areas where stormwater quality controls do not exist will increase the vulnerability of receiving waters to water quality impacts. Approximately 57% of the urbanized area in the Region of Peel is without stormwater controls, with most end-of-pipe controls (ponds) designed to standards less relevant today.[28] This highlights the need for a standard process to account for direct and indirect risks on a watershed basis when assessing stormwater level of service.

An intake basket from the Lorne Park water treatment plant that was removed from service due to algae clogging. (Source: Region of Peel)

Climate hazards can directly impact a municipality's assets and services described above and lead to indirect economic impacts such as making it more difficult for a municipality to attract capital and access financing. For instance, credit rating agencies are starting to incorporate climate change factors into credit ratings for sovereign bonds. Moody's recently acknowledged that a lack of action on climate change adaptation puts cities and states at greater risk of default, which warrants downgrade in ratings. Historical experiences with and damages from flooding and extreme weather events were among the climate change indicators the rating agency considered.

Source: Credit Valley Conservation

8 LEGAL RISK ASSESSMENT

Although the study proposes that 20 elements be incorporated into a MSW-RMF, not all elements could be completed as part of the Flood Resiliency Strategy due to budget, resources and time constraints (i.e. five years). To prioritize key elements, this study conducted a legal risk assessment to identify priority gaps to be addressed within the five year workplan for the FRS. Legal risks were identified as the most relevant for this prioritization exercise. The risk assessment considered both legislative risks and common law negligence risks.

See Appendix A for more detail and a list of targeted questions to determine potential exposure to each risk.

[28] Peel Water Vulnerability Study, p18

8.1 Legislative

Stormwater management is a shared responsibility among various provincial ministries, municipalities, and conservation authorities. These actors are all charged with working together to ensure stormwater systems are properly functioning and adequately adapting to a changing climate. While Ontario does not have a regulation specifically for stormwater management, there are various policies and legislations applicable to the matter. This subsection sets out some of the most relevant policies, plans and guidelines, highlighting select provisions that could inform an Ontario municipality's risk analysis and MSW-RMF development. These include:

- *Ontario Water Resources Act*, 2011
- *Environmental Protection Act*, 1990
- Provincial Policy Statement, 2014
- *Planning Act*, 1990
- Growth Plan for the Greater Golden Horseshoe, 2017
- Greenbelt Plan, 2017
- Oak Ridges Moraine Conservation Plan, 2017
- Niagara Escarpment Plan, 2017
- *Infrastructure for Jobs and Prosperity Act*, 2015
- *Water Opportunities and Water Conservation Act*, 2010
- Ontario Climate Change Strategy 2016-2020

Some key questions a municipality could consider in assessing exposure to legal risks arising from provincial laws and policies include:

- **Have ECAs been issued where required?**
- **Are the requirements of current ECAs being tracked?**
- **Are stormwater systems operated and maintained in accordance with existing ECAs (e.g. maintenance reporting, pollution violations, etc.)?**
- **Does climate risk increase the potential to violate ECAs?**
- **Is the municipality's Official Plan updated in line with the 2014 PPS in ways that relate to stormwater and climate change?**
- **Is the municipality's Official Plan updated in line with the amended *Planning Act*, Growth Plan and Greenbelt Plan in ways that relate to stormwater and climate change?**
- **Is the municipality allocating growth and development away from hazardous areas, such as flood-prone areas, in its land-use planning?**
- **Is the municipality, in partnership with conservation authorities, ready to conduct watershed planning before settlement area expansions, or major developments?**
- **Have municipal policies and bylaws been updated to incorporate watershed plan recommendations? Have budget requests been allocated and approved to implement these recommendations? Has a monitoring plan been implemented to ensure watershed plan recommendations are being met?**
- **How often do watershed plans need to be renewed and/or updated?**
- **Will stormwater management plans and climate change vulnerability risk assessments be conducted when planning or replacing infrastructure?**
- **Will climate change resiliency be incorporated into future infrastructure planning and construction?**

Table 1 of Appendix A sets out a more detailed account of select provincial laws and policies relevant to stormwater and climate change, provides insights into applicability to stormwater and climate change issues

and poses specific questions a municipality can ask to assess potential liability risk and better prepare for climate change.

Other potentially relevant legislation and policy instruments at the provincial level include:

- *Great Lakes Protection Act, 2015*
- Lake Erie Management Plan (Domestic Action Plan)
- 2003 MOECC Stormwater Management Planning and Design Manual
- MOECC Low Impact Development Stormwater Management Guidance Manual
- *Building Together* and Build ON 2017 Infrastructure Update
- *Lake Simcoe Protection Act, 2008*, Lake Simcoe Protection Plan and associated regulations
- Canada Ontario Agreement Respecting the Great Lakes Basin
- *Ontario Building Code Act, 1992*

Other policies and plans relevant to stormwater and climate change that could be considered include those created at the regional and municipal level.

The questions outlined in Tables 1 and 2 of Appendix A are a starting point for consideration in developing a regulatory compliance process to better manage stormwater risks.

8.2 Common Law (Negligence)

As noted above, a variety of actors, including municipalities, provincial governments and conservation authorities could be sued in negligence for harm caused by a flooding event. Under tort law, a party being sued (i.e. a defendant) may be found negligent if the plaintiff demonstrates:

- the defendant owed the plaintiff a duty of care
- the defendant breached the relevant standard of care
- the plaintiff suffered harm; and
- the defendant's act or omission caused or contributed to the harm suffered.

If a defendant is found negligent, they may be required to compensate for the plaintiff's damages.

This section provides a deeper dive into the elements of negligence and makes links to potential liability around stormwater management and flooding.

Duty of Care

In a negligence claim, the court will first ask whether the defendant owed the plaintiff a "duty of care." The answer to this question depends on:

- whether there was a sufficiently close relationship between the parties such that the defendant would owe some sort of responsibility to the plaintiff (e.g. neighbor to neighbor, company to consumer, government to citizens); and
- whether the harm suffered by the plaintiff was a reasonably foreseeable consequence of the defendant's act.[29]

For government defendants, case law shows that courts will generally determine it is reasonably foreseeable that citizens may be harmed by a particular governmental decision related to the provision of

[29]From ECO report

services and that there is sufficient proximity between citizens receiving services and the governmental provider of these services.

Changing information, including as related to climate change, could increase the number and size of lawsuits against municipalities, as those who are owed a duty (i.e. residents who have an expectation a municipality will manage stormwater) become more vulnerable, particularly if the potential impacts of climate change that could be avoided are reasonably foreseeable.

Even if a court determines that a government owes a duty of care to its citizens, the court may decide that certain policy decisions are exempt from claims of negligence. Government defendants are subject to a special test under the negligence analysis to determine whether or not the government decision in question is shielded from liability.

A valid governmental *policy* decision will generally not attract liability in the context of a negligence claim.[30] This "protection" of certain decisions is based on recognition that governments must be free to act in the best interest of public policy without having to be concerned with the potential for negligence claims. The Supreme Court of Canada has described policy decisions as involving a weighing of social, political and economic factors. Courts have found the following types of decisions to be policy decisions: the development of a by-law and a decision to inspect or not inspect infrastructure. Budgetary decisions are also, generally speaking, policy decisions protected from suit. Municipalities therefore do not need to change all possible standards and processes and upgrade all of their infrastructure in light of climate change information; it is acceptable, after considering the risks, to determine that a particular action or investment is not worth the cost (i.e. have a considered policy).

Municipalities are advised to consider key issues and make clear, documented and defensible policy decisions to protect themselves from liability rather than opting for a "head in the sand" approach.

Government decisions that are *operational* in nature, on the other hand, are still exposed to liability in negligence. Operational decisions are decisions made practically implementing policy decisions on the basis of administrative direction, professional judgment and technical considerations. Courts have found the following types of decisions to be operational, and subject to claims in negligence: highway safety inspections; electric utility systems to receive incoming calls related to repairs; and city officials' failure to enforce a bylaw passed to address flooding caused by sewer backup.

Unfortunately, the distinction between policy and operational decisions is not always clear. Municipalities are therefore advised to consider key issues and make clear, documented, and defendable policy decisions to protect themselves from liability rather than opting for a "head in the sand" approach.[20]

Standard of Care

The most significant aspect of the negligence test in many cases is whether the defendant breached the standard of care. Determinations of the appropriate standard of care are fact- and case-specific; however, some guiding principles have emerged to help courts determine the applicable standard of care. For instance, a court may consider the following factors:[31]

- statutory requirements and guidance
- industry codes of practice
- general industry/sector custom and practice

[30] One exception to this general rule is that government policy decisions will not be protected if they were made in bad faith.
[31] *Ryan v Victoria (City),* [1999] 1 SCR 201 at para 28; *Vizbaras v Hamilton (City)* 2005 CanLII 49207at para 58 (Ont Sup Ct J).

- actions of other, similarly situated, authorities

It is important to note that while all of these factors *inform* the applicable standard of care, none of them are determinative indicators of the applicable standard of care.

Industry standards and standard practices can assist in dispelling a negligence claim by showing the defendant had followed the general practices of those in similar situations. Therefore, an important tool for showing that the standard of care has been met is demonstrating that a municipality has met the standard of practice followed in other, similarly situated municipalities. Coordination between municipalities could thus assist in mitigating risk by setting a clear industry standard.

Standard is Reasonableness, Not Perfection

Municipalities do not need to change all possible standards and processes and upgrade their entire infrastructure in light of climate change information to avoid liability. It is acceptable, after considering the risks, to determine that a particular action or investment is not worth the cost (i.e. have a considered policy). To minimize risk, however, municipalities should at least "turn their minds" to stormwater related standards, processes and infrastructure; if information suggests that there may be increased risk to persons or property from those standards, process, or infrastructure.

That said, industry practices will only be helpful in informing the standard of care when these practices themselves are not inherently risky. In other words, following industry standards may help prevent liability, but the standards themselves will need to be reasonable in the circumstances. If the standards themselves are "fraught with obvious risks", a court may not see following them as evidence the standard of care was met.

Applying the principles outlined above to stormwater management and climate change, it is possible that standards applicable to water management that do not take into consideration climate change-adjusted data and other known threats could be found to be "fraught with obvious risks". An important tool for showing that the standard of care has been met is demonstrating that a municipality has met the standard of practice followed in other, similarly situated municipalities. It may be prudent for managers of municipal water systems to work together to define clear industry standards that utilize available climate change-adjusted information to help mitigate potential liability."[32]

Acts and omissions giving rise to potential negligence are judged against a standard of care applicable at the time the act or omission was made. This means that design and construction decisions are generally subject to the standard of care applicable at the time of the design. It is common misconceptions that negligence is most frequently claimed in relation to these design/built decisions. In actuality, inspections, maintenance, repairs, and other process decisions are more likely to be the types of acts that attract negligence claims. These ongoing practices are likely to be judged against a currently applicable standard of care, which may include considerations of changing information. Relying on outdated standards or processes could therefore be negligent if new information suggests that they should be reconsidered, even if the standards and processes were not negligent before the new information came to light.

[32]From Legal Drivers Report.

Some key questions municipalities could consider in assessing exposure to common law-related risks include:

- **Is your municipality doing less than what other, similarly situated municipalities are doing around stormwater system design, operation, maintenance or enforcement (i.e. such that a court could find it is failing to meet the applicable standard of care)?**
- **Have certain "policy" decisions, such as budgetary allocations or the creation of by-laws, been created to negate the duty element in a negligence claim?**
- **Have updated climate projections been incorporated into stormwater infrastructure investments, planning and design to ensure the municipality is prepared for reasonably foreseeable risks?**
- **Are inspection and maintenance schedules around stormwater been set out and are these schedules adequate to deal with existing and projected climate conditions? Are municipal officials adequately following inspection and maintenance schedules?**
- **Is the municipality adequately enforcing their stormwater-related by-laws, plans, and guidelines it currently has in place?**
- **Are permitting authorities adequately informed of climate change projections and their potential impacts on stormwater systems?**
- **Are development and approval decisions in line with the policies set out in the municipalities Official Plan?**

Table 2 of Appendix A sets out a more detailed assessment of common law related risks to municipalities in the context of flooding and climate change.

9 RISK PRIORITIZATION

Given resource, budget and time constraints, not all elements can be performed within the five-year Flood Resiliency Strategy. As such, elements of the proposed MSW-RMF were identified in consultation with Partner municipalities. To share lessons learned amongst Partners, a template was developed identifying the common gaps and barriers found in the process of stormwater management. This Risk Prioritization template is presented in Appendix B and can be used as a guide for municipalities to identify their risks and workplan priorities. The template links the gaps and barriers with relevant statutory and common law requirements where appropriate, allowing the municipality to prioritize and rank overall risk exposure. The municipality can indicate whether a gap and/or barrier is currently in the municipal workplan and its progress, along with the overall risk factor such as High, Medium or Low. The template helps to collate various challenges and develop the business case for budget and resource needs. Lastly, the template identifies which element(s) within a MSW-RMF address a particular gap/barrier to help identify priority elements to be completed first through a workplan.

Common barriers and gaps in stormwater management may include:

- A standard mechanism or tool for inspecting, monitoring, maintaining, tracking and documenting municipally-owned stormwater management systems to ensure compliance with ECAs and C of As. As C of As and ECA requirements are generally unique to each stormwater management feature or site, a method for tracking, documenting and implementing, monitoring, inspection and maintenance has been identified as challenging. There is also a gap in understanding how inspection, monitoring and maintenance may need to be adjusted for climate change predictions, and how that may impact budget and ability to meet those requirements.

- Implementing a storm sewer-use by-law as means to regulate, enforce and recuperate clean-up costs associated with spills/illicit discharges entering the storm sewers and water courses.
- Lack of training and defined roles for inspection, maintenance and monitoring of stormwater features. The proposed updates to the MOE 2003 Manual further increases risk exposure of municipalities and CAs with the implementation of LID without sufficient training and defined roles for inspections, particularly for LIDs approved on private property.
- Lack of standard methodology for determining level of risk within existing urban areas and assessing a feasible level of service in light of climate change.
- Current emergency plans are focused around fire only and need to be updated to incorporate extreme flood events alongside proper training, particularly for short duration high intensity events.
- The need to review policies, by-law enforcement and permitting approval processes to ensure consistency with Provincial and Federal legislation, and in consideration of legal trends (i.e. review basement apartment approvals in flood prone areas, enforcement of downspout disconnect by-laws, sewer-use by-law, etc.).
- Need to update development charges to include LID in light of MECP's update to the 2003 Manual.
- Need for Council and Commissioner support for sustainable stormwater financing to support infrastructure investment, policy update and enforcement, ongoing inspection/monitoring and maintenance, and staff training.
- Develop a mechanism to track, measure and report on key performance indicators (KPIs) around watershed study recommendations when reviewing and approving development applications.
- Develop a comprehensive data management and data sharing system that stores monitoring data (i.e. real time stream flow, quality, and precipitation data) with a proper QA/QC protocol.
- Develop a system to update models in a timely manner to ensure that the latest information is available for partners (i.e. floodplain mapping, flood forecasting, spills etc.).
- Comprehensive data management system that stores CA data such as the real-time stream flow and quality data that can be efficiently disseminated to partner queries.

Section 10 presents the FRS workplan that incorporates and takes the first steps towards achieving these priorities.

10 NEXT STEPS

Drawing on the findings of this report, the Partners will move forward with next steps in the development of the PCCP FRS.

10.1 Pilot Workplan as part of the Flood Resiliency Strategy, Peel Climate Change Partnership for 2018-2022

In context with the risks identified and in Appendix A and B, the PCCP FRS has proposed several key priorities over the next five years. Outcomes from pilot work conducted on these projects will be shared amongst Partners to support capacity building across Peel. Key deliverables for 2018-2022 include:

- **Element 2: Policy Statement**
  - 2018-2022: Under the PCCP, and as part of the FRS, planning policies have been identified as a key component of the MSW-RMF. As part of the partnership, this will be accomplished through comprehensive partnership review of the updated Official Plan. The review will include any policy or bylaw-related recommendations stemming from this study.

- **Element 3: Goals and Objectives**
  - 2019-2022: Through the PCCP FRS, a common methodology will be developed amongst partners for defining stormwater levels of service and defining risk within existing urban areas. Partner tools will be used in pilot areas to help build our understanding of feasible levels of service and optimizing the suite of management options.

- **Element 4: Leadership Commitment and Endorsement.**
  - 2018-2022: Staff will continue to inform and prepare educational material for new councilors in 2019 to support endorsement of the FRS.

- **Elements 10, 11 and 12: Risk Assessment, Risk Management, Implementation Plan.**
  - 2018-2019: The Town of Caledon will conduct a climate change risk assessment.
  - 2018-2022: CVC/TRCA as part of the Flood Resiliency Strategy will develop a common methodology for risk mapping to support emergency management.
  - 2019-2022: CVC will run the Risk and Return on Investment Tool to identify high priority areas, help inform level of service under climate scenarios and optimize management decisions based on return on investment and full cost accounting for municipal risks.

- **Elements 16 and 17: Inspections, Maintenance, Repair and Rehabilitation; and Data Collection, Monitoring and Analysis.**
  - 2018-2020: Through interviews with Peel Partners, further investigation of gaps associated with tracking and data management of ECA requirements will be examined to design/refine existing tools to support, track, inspect, and maintain stormwater practices.
  - 2018-2020: With CWWF funding, stormwater facility inspection and monitoring protocols will be developed. Development of protocols will also include a literature review, and survey of leading municipalities and the ministry to demonstrate duty of care.
  - 2018-2020: Implementation of protocols in select locations to assess and evaluate use of protocols and frequency/need for maintenance to inform asset management planning and budget projections.

- 2020 and beyond: On-going inspection/maintenance/monitoring will help inform adaptive management and the feasibility of meeting ECA requirements in light of predicted climate change.
- Long-term: review and refine TRCA/CVC's LID monitoring strategies to ensure key performance questions from Partners are addressed in light of climate change.

- **Element 18 Emergency Management**
  - 2018-2022: An emergency planning workshop in November 2018 was held with CAs and member municipalities to review past events, identify lessons learned, share stormwater highlights and identify gaps and barriers to inform future work in 2019-2022.

11 CONCLUSION

This report serves as a baseline document for recommending elements that should be considered by municipalities in order to evaluate risk and incorporate climate change into stormwater risk management and determine a feasible level of service for existing and future development in light of these changes. We hope this study can be a resource for municipalities in Ontario and across the country, and support the improvement of stormwater risk management today, and many generations into the future.

12 REFERENCES

Asset Management Saskatchewan. (2014). Asset Management Getting Started Guide. Asset Management Saskatchewan: http://assetmanagementsk.ca/+pub/document/pdfs/Asset%20Mgmt%20Getting%20Started%20Guide_web.pdf.

FCM (2002). Developing Levels of Service - A Best Practice by the National Guide to Sustainable Municipal Infrastructure. Federation of Canadian Municipalities and the National Research Council: https://www.fcm.ca/Documents/reports/Infraguide/Developing_Levels_of_ Service_EN.pdf.

Health Canada (2008). Human Health in a Changing Climate: A Canadian Assessment of Vulnerabilities and Adaptive Capacity. Ottawa: Health Canada. http://publications.gc.ca/collections/collection_2008/hc-sc/H128-1-08-528E.pdf

Hutto et al., (2015). Climate Change Vulnerability Assessment for the North-central California Coast and Ocean, Hutto, S.V., K.D. Higgason, J.M. Kershner, W.A. Reynier, D.S. Gregg. Available at URL: http://sanctuaries.noaa.gov/science/conservation/pdfs/vulnerabilityassessment- gfnms.pdf

Intergovernmental Panel on Climate Change (IPCC), (2014). Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

International Council of Local Environmental Initiatives (ICLEI), (2012). Glossary of Key Terms. Available from Resilient Cities Series: Annual Global Forum on Urban Resilience and Adaptation: http://resilient-cities.iclei.org/resilient-cities-hub-site/resilience-resourcepoint/ glossary-of-key-terms/ , Accessed on November 15, 2016.

Prasad et al, (2009). Climate Resilient Cities: A Primer on Reducing Vulnerabilities to Disasters, Prasad, N., Ranghieri, F., Shah, F., Trohanis, Z., Kessler, E., & Sinha, R. Available from Open Knowledge Repository: https://openknowledge.worldbank.org/handle/10986/11986Accessed on November 15, 2016.

United Nations Office for Disaster Risk Reduction (UNISDR), (2007). Terminology. August 30, 2007. Available from The United Nations Office for Disaster Risk Reduction: https://www.unisdr.org/we/inform/terminology, Accessed on November 15, 2016.

United States Agency of International Development, USAID (2016). 4.2. Vulnerable Populations and the Value Chain Approach. Available at: https://www.microlinks.org/good-practicecenter/value-chain-wiki/vulnerable-populations-and-value-chain-approach

WGACR, (2016). Final Report, Working Group on Adaptation and Climate Resilience. Available via URL http://www.climatechange.gc.ca/Content/6/4/7/64778DD5-E2D9-4930-BE59-D6DB7DB5CBC0/WG_Report_ACR_e_v5.pdf

13 APPENDICES

Appendix A: Legal Risk Assessment - Sources of Potential Liability and Questions to Consider Potential Exposure

To prioritize key elements, this study conducted a legal risk assessment to identify priority gaps. The risk assessment considered both legislative/regulatory risks as well as common law negligence risks.

Legal Landscape

As changes in climate occur and potential impacts on municipal stormwater systems become better understood, the law can provide valuable guidance on standards of practice and diligent decision-making in light of climate-adjusted information. Similarly, the law can be an important driver to adapt, as it imposes duties and responsibilities on a wide range of actors involved in water management and flood prevention—from government, to conservation authorities, to developers, and down to individual homeowners. A better understanding of potential legal liabilities can assist municipalities and others who are involved in stormwater management to ensure thoughtful and diligent stormwater management practices.[33]

Legislation

In common law jurisdictions like Ontario, the legal obligations related to stormwater management are derived from two main sources:

1. Legislation (federal, provincial, municipal); and
2. The common law (or "judge-made" law) developed by the courts.

Other "soft" instruments such as codes, policies, plans, standards and guidelines also play a role in delineating and informing the duties and responsibilities outlined in legislation and the common law.

Legislation includes statutes, regulations, and municipal by-laws. These laws govern activities the government has deemed worth regulating.

A statute (or an act) is a formal written law passed by a legislative body that governs a country, province/state or city. Statutes are prescriptive and clearly require or prohibit certain actions. A party who violates a provision of a statute could be prosecuted and exposed to penalties such as fines or imprisonment. Other mechanisms to ensure statutory requirements are met include instruments such as permits, approvals, and inspections.

Regulations are enacted under statutes and provide specific rules meant to carry out the provisions of its parent statute. Regulations are usually enforced by a regulatory agency formed to carry out the purpose or provisions of the parent statute.

Common Law

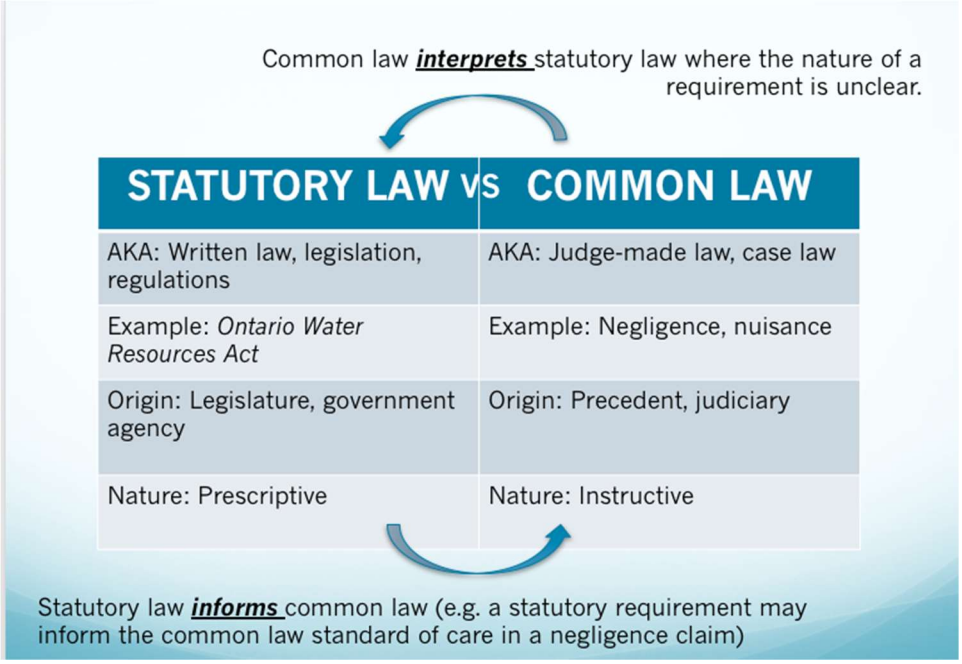
[33] From CVC stormwater liability report.

How statutes are interpreted and applied is often clarified through the common law. Common law refers to the body of law that is derived from court decisions as opposed to statutes. It is also known as "judge-made law". Types of common law include tort law, contract law, criminal law, and family law.

In addition to serving an interpretive function, the common law can impose legal requirements where a statute does not specifically deal with an issue. Income cases, courts have even decided that common law requirements exceed statutory requirements, meaning that compliance with legislation is not always enough to ensure protection against liability. Common law legal requirements are not as clearly prescribed as statutory requirements and will depend on the elements of the offence alleged and the circumstances of each case. There is always a risk that a person or government will be subject to a challenge based not only on legislation but also on the common law (for example, by way of a negligence or nuisance claim).

Tort law is an area of common law that allows plaintiffs to seek compensation for harms caused by the unlawful acts of others. The law of negligence, which refers to careless conduct that causes loss to another, is the most common and arguably the most important field of tort law as it governs most activities of modern society. To be found negligent, a plaintiff must establish that the defendant owed it a duty of care and breached the relevant standard of care (see below for more discussion on standard of care). The plaintiff must also show that the defendant's act or omission caused or contributed to the harm suffered, resulting in damages to the plaintiff.

The figure below illustrates the relationship between statutory and common law, demonstrating that they are two different streams of law that can sometimes interact.



Other Instruments

Codes, policies, plans, standards and guidelines are also part of the system of instruments that govern stormwater management in Canada. While most of these "soft" instruments are not legally enforceable in and of themselves, they can be given legal force when referenced in legislation or through other legal

instruments. Two key roles that these instruments play related to legal responsibilities and potential liability include:

- Providing technical guidance on how to meet legislative requirements
- Informing the standard of care a defendant may be held to in a negligence claim

See the call out box below entitled *"Other Key Definitions*" for more detail regarding these instruments and how they are used.

Other Key Definitions

Policy: A course or principle of actions adopted and declared by a government. A policy may or may not be legally enforceable depending on how it is referenced by legislation or considered by a court.

Code: A set of rules that specify the standards for a particular sector or type of activity (e.g. building codes, electrical codes). Often those operating under a code will be required to prove that they have met the standards prescribed before receiving an approval or permit.

Standards: Technical or performance specifications related to a product, service or process. Standards are often voluntary and should be distinguished from performance or technical specifications that are required by law.

Guideline: A rule or instruction that describes how something should be done. For instance, a guideline may provide instruction on how to satisfy a legal requirement or meet a standard. Guidelines are not generally legally enforceable.

Codes of practice: A set of written regulations issued by a professional association or an official body that explains how those working in that profession should behave. Codes of practice may or may not be legally enforceable.

Legal Risk Analysis

The following tables consider the legislative and common law risks a municipality could face as a result of inadequate stormwater management.

Table 1: Select Provincial Policies Relevant to Stormwater and Climate Change

Policy/Legislation	Relevance to Stormwater and/or Climate Change	Potential Risk	Questions to Consider Potential Exposure
Ontario Water Resources Act *Environmental Protection Act*	A 2010 review of provincial policy relevant to stormwater concluded that the OWRA and the EPA offered broad authority and the flexibility to generally address climate change adaptation for municipal stormwater management, through approvals, general	Failure to obtain, update or comply with ECAs	Have ECAs been obtained where required? Are the requirements of current ECAs being tracked?

	prohibitions, orders, penalties and regulation making authority for environmental protection. Persons in Ontario (including municipalities and other public actors) may be subject to potential regulatory liability related to stormwater under these Acts.		Are the stormwater systems being operated and maintained in accordance with existing ECAs (e.g. maintenance reporting, pollution violations, etc.)?
	Under OWRA Section 53, stormwater infrastructure (a 'stormwater sewage works') requires an Environmental Compliance Approval (**ECA**) for its establishment, alteration, extension and replacement unless an exemption applies.[34] It appears that stormwater management is not consistently addressed in ECAs for sewage works, although further research is warranted on this point. It is possible that activities not historically subject to an ECA—for instance, the flow of water across properties—may indeed fall within the regulatory definition of sewage works.[35]	Potential violation of EPA/OWRA ECA requirements	Do risks around climate change increase the potential to violate ECAs? Have climate conditions changed such that activities not historically subject to an ECA—for instance, the flow of water across properties—could potentially be hazardous and/or fall within the regulatory definition of sewage works?

[34] *Ontario Water Resources Act*, R.S.O. 1990, c. O.40 at s.53

[35] *A recent review of ECAs for two Toronto wastewater treatment plants by the Ministry of the Environment and Climate Change ("Ministry" or "MOECC") brought increased attention to the interaction between the regulation of sewage works and stormwater management, resulting in the potential for further conditions to be placed on sewage works35. The Ministry review of Toronto Sewage Works ECA found that:*

- *During severe storm events water often does not infiltrate into the soil due to sheer volume. This is particularly true in urban environments due to the amount of paved surface area. A lack of water infiltration into the soil can cause excess water to move across the landscape (surface water) into the storm sewers or directly into tributaries and lakes.*
- *The scientific and public health communities acknowledge that all surface water contains a variety of bacteriological and chemical contaminants and that surface water quality declines following storm events*
- *Surface water that sweeps across the landscape will pick up contaminants, bacteria and nutrients present. Sources of contaminants can include contaminated sites resulting from industrial practices. Sources of bacteria can come from animal wastes, both from local wildlife, farm animals and pets. Sources of nutrients can include applications from agricultural practices to grow crops.*
- *During storms, high volumes of surface water directed to the waste water treatment plants through storm sewers can cause capacity issues and result in bypasses into the receiving waterbody. Bypasses prevent sewage backups and system overflows. Depending on the waste water treatment system, the effluent bypasses may go through primary treatment and/or be combined with fully treated effluent to minimize impacts to the receiving waterbody.*

These findings have prompted the Ministry to both explore opportunities to ensure public awareness of surface water quality after severe weather events and to continue to explore legal options to more proactively managing and increasing transparency related to bypass events.

This review shows that the ministry is well-aware that stormwater can be potentially hazardous and the increased frequency and duration of extreme weather events should be factored into future planning and management.

	Additionally, the prohibitions related to releases of contaminants and discharges to the environment in Ontario environmental legislation are sufficiently broad to potentially impose regulatory liability on those that release stormwater in contravention of Ontario's environmental legislation. The EPA prohibits discharges of a contaminant into the natural environment that causes or may cause any adverse effect. Discharges that are authorized by the *OWRA* (e.g. under an ECA for sewage works) are exempted from this prohibition but only if the discharge does not cause and is not likely to cause an adverse effect.[1] Those who manage stormwater under an ECA could potentially be charged under s. 14 of the EPA if an approved discharge causes or is likely to cause an "adverse effect".[36]Similarly, while our research has not identified a case in which stormwater was considered a contaminant; courts have consistently interpreted the definition of contaminant broadly.[37]		During severe storm events, does water often not infiltrate into the soil? Does surface water flow overland and pick up contaminants from industrial practices, contaminated sites, animal wastes, or other sources? Has the increased frequency and duration of extreme weather events been factored into future planning and management?
Provincial Policy Statement (PPS) 2014	The PPS is a statement on the government's policies on land use planning and provides province-wide policy direction for land use planning and development. Decisions affecting planning matters must	Failure to update Official Plan in line with PPS	Have Official Plan's been updated to align with the 2014 PPS in ways that relate to stormwater and climate change? Or are there

36 This prohibition and the resulting regulatory liability could be interpreted quite broadly as courts have been very permissive in what constitutes an adverse effect. In one recent case, the Supreme Court of Canada determined that property damage to a house and car constituted an "adverse effect".36 As a result, it appears that a flood or release of contaminated water resulting from an over-stressed stormwater management system or other sewage works could trigger s. 14 of the EPA. This ruling further suggests that there are potential avenues for the Ministry to charge stormwater managers under this, and other sections of the EPA.

[37]Courts have found that, when a substance is altered from its natural state, it may be viewed as a contaminant. In 2013 the Supreme Court of Canada confirmed that stray fly-rock from a blasting operation that damaged neighbouring property was a reportable spill (of a contaminant) under s.15 of the EPA.[37] This case confirmed that a wide range of materials could be seen as contaminants and, as a result, the Ministry may broadly utilize the jurisdiction provided by the EPA to address releases into the environment.

	"be consistent with" the PPS under section 3 of the *Planning Act*.[38]Municipalities must therefore use the PPS to develop their official plans and to guide and inform decisions on other planning matters.[39]The current PPS came into effect on April 30, 2014, replacing a PPS from 2005. The new PPS places emphasis on incorporating climate change mitigation and adaptation considerations into planning decision processes, particularly relating to five key areas: (a) land use planning for efficiency and resiliency, (b) infrastructure and public utilities, (c) long-term economic prosperity, (d) energy conservation, air quality and climate change and (e) protection of public health and safety through management of natural hazards.		plans to do so? If so, how?
Planning Act Growth Plan for the Greater Golden Horseshoe, 2006 Greenbelt Plan Oak Ridges Moraine Conservation Plan Niagara Escarpment Plan	The Government of Ontario also issues regional plans that guide official plans at the municipal level under the *Planning Act*. These provincial plans include the *Growth Plan for the Greater Golden Horseshoe, 2006*, the *Greenbelt Plan, 2005*, and the *Niagara Escarpment Plan*. The Plans were updated in 2017 to better incorporate climate change considerations. Highlighted changes relevant to stormwater and climate change include:[40] • Requiring that municipality's complete watershed planning before planning settlement area expansions,	Failure to update Official Plan in line with Growth Plan, Greenbelt Plan, etc.	Have Official Plan's been updated to align with the amended *Planning Act*, Growth Plan and Greenbelt Plan in ways that relate to stormwater and climate change? Or are there plans to do so? If so, how? Are climate change policies included in Official Plans? Is growth and development being directed away from hazardous areas, such as known flood-prone areas?

[38]*Planning Act*, RSO 1990, c P.13, s 3.

[39] Ministry of Municipal Affairs and Housing, "Provincial Policy Statement" (2015), online: http://www.mah.gov.on.ca/Page215.

[40]http://www.mah.gov.on.ca/Page10882.aspx

	infrastructure or major developments that could affect those watersheds. • Requiring municipalities in the Greater Golden Horseshoe to include climate change policies in their official plans. • Requiring municipalities to develop stormwater management plans and conduct climate change vulnerability risk assessments when planning or replacing infrastructure. • Directing growth and development away from hazardous areas. • Based on Watershed Planning recommendations, providing direction integrated water, wastewater, and stormwater master planning. All decisions on planning matters must conform or not conflict with the four plans. Municipalities are expected to review and update their official plans to conform to the updated plans.		In partnership with conservation authorities, are plans in place to conduct watershed planning before settlement area expansions, or major developments projects? Will storm water management plans be completed, along with climate change vulnerability risk assessments when planning or replacing infrastructure? Have municipal policies and bylaws been updated to incorporate watershed plan recommendations? Have budget requests been allocated and approved to implement these recommendations? Has a monitoring plan been implemented to ensure watershed plan recommendations are being met? How often do watershed plans need to be renewed and/or updated?
Infrastructure for Jobs and Prosperity Act	IJPA requires public sector entities to carry out infrastructure planning and investment in a way that considers certain principles, such as: minimizing impact on the environment, helping maintain ecological and biological diversity and ensuring that infrastructure is designed to be resilient to the effects of climate change. No performance measures or	Building infrastructure resilient to climate change as per IJPA	Is climate change resiliency being incorporated into infrastructure planning and construction?

	indicators for "resilience" are provided and no penalties are prescribed for those public sector entities that fail to take such principles into account.		
Water Opportunities and Water Conservation Act	The WOA enables Cabinet to make regulations requiring all municipal service providers to prepare "municipal water sustainability plans" for their municipal drinking water, waste water and stormwater services. It provides that such regulations *could* require the assessment of climate change-related risks and a strategy to address those risks. As of September 2017, Cabinet has not yet created these regulations.	N/A	N/A
Ontario Climate Change Strategy 2016-2020[41]	Commits to a "climate-resilient Ontario" by 2030. Pledges to help municipalities, public utilities and the broader public sector identify their vulnerabilities and prioritize their response to the risks posed by climate change. The strategy will be to bring together the necessary scientific information, as well as clear land use planning policies to enable decisions and action to adapt to, manage the risks of, and build resilience to a changing climate. The province will also integrate climate considerations into infrastructure decision-making, guiding investments so that these decisions properly consider the potential impacts of a changing climate.		

Other potentially relevant legislation and policy instruments at the provincial level include:

- Great Lakes Protection Act
- Lake Erie Management Plan (Domestic Action Plan)
- 2003 Stormwater Management Planning and Design Manual
- MOECC Low Impact Development Manual Update
- *Building Together* and Build ON 2017 Infrastructure Update
- *Lake Simcoe Protection Act, 2008*, Lake Simcoe Protection Plan and associated regulations.

[41] https://www.ontario.ca/page/climate-change-strategy

- Canada Ontario Agreement Respecting the Great Lakes Basin
- Ontario Building Code

Table 2: Common Law Risks

Potential Risk	Questions to Determine Potential Exposure
Failure to meet standard of care	Is your municipality doing less than what other, similarly situated municipalities are doing around stormwater system design, operation, management or enforcement? For instance, do other municipalities have stormwater standards and/or sewer use bylaws? Is your municipality meeting the statutory obligations that inform its standard of care? (see analysis in chart above)
Inability to rely on negation of duty through a "policy" decision	Have certain "policy" decisions been made, such as budgetary allocations or the creation of by-laws that could be relied on to negate the duty element in a negligence claim? If so, are these decisions adequately documented? If not, are there plans to make and document such policy decisions?
Potential for "operational" decisions to be found negligent (e.g. design, inspection, maintenance, enforcement)	Has you municipality incorporated updated climate projections into its stormwater infrastructure investments, planning, and design? If not, does it have plans to do so? Has your municipality set out inspection and maintenance schedules around stormwater? Are these schedules adequate to deal with existing and projected climate conditions? Are municipal officials adequately following inspection and maintenance schedules? Are the stormwater-related bylaws, plans, and guidelines currently in place being adequately enforced?
Failure to consider and prepare for what was "reasonable foreseeable"	Are policies and plans being updated to incorporate existing and known climate projections? If not, are there plans to do so?
Potential for permitting and approval decisions to be found negligent	Are climate change considerations being incorporated into permitting and approval processes? Are permitting authorities adequately informed of climate change projections and their potential impacts on stormwater systems? Are development and approval decisions in line with the policies set out in your municipalities Official Plan (see above)?

Appendix B: Process Risk Prioritization Template

#	Barrier and/or Gap	Statutory	Common Law	Progress Complete In Progress Not Initiated	Risk Factor H – High M – Medium L - Low	In Workplan? Yes or No	MSW RMF Elements
1.	No formal process and lack of by-in from decision makers to implement a stormwater quality management standard (or similar).		●				• Leadership/Commitment/Endorsement
2.	Lack of proper education and awareness amongst decision makers as to the impacts of climate change on existing stormwater infrastructure, and the potential liability and risks associated with those impacts.	●	●				• Goals and Objectives • Leadership/Commitment/Endorsement • Communications and Disclosure • Training, Education, Certification, Competencies
3.	There are many stakeholders (municipalities, regions, conservation authorities, Ministries) involved in stormwater, with a lack of clearly defined roles and responsibilities associated with reducing risks. This creates confusion with respect to delivering resilient, cost effective stormwater management to support multiple watershed functions.	●					• Set the Scope and Context • Define Roles, Responsibilities and Authorities
4.	If a sewer-use bylaw does not exist, this limits a municipality's ability to regulate, enforce, and recuperate clean-up costs associated with spills/illicit discharges entering the storm sewers and watercourses.		●				• Compliance Obligations • Risk Assessment
5.	Enforce stormwater-related provisions of applicable by-laws sufficiently.	●					• Compliance Obligations • Resource Planning • Documentation of Decision-Making/Record Retention • Communications and Disclosure
6.	Erosion and sediment control measures are currently enforced through development agreements, however, there is a gap in development agreements with respect to inspections being performed during construction (i.e. 1.5 years' gap from registration) when most of the sediment is disturbed. The inspection frequency needs to be clearly outlined and should be performed on a regular basis and after major storms.	●					• Compliance Obligations • Communications and Disclosure • Documentation of Decision-Making/Record Retention
7.	Building Permit process does not consider the correlation between increases in building footprint and subsequent increase in stormwater volumes in existing urban areas. Municipalities are currently assuming risks without compensation for increased stormwater volumes.		●				• Compliance Obligations • Inspection, Maintenance, Repair and Rehabilitation • Data Collection, Monitoring and Analysis • Risk Assessment • Risk Management
8.	Should a "safety factor" resulting from increases in building footprint be incorporated into new developments to accommodate for future increases in stormwater volume? Can amendments to Building by-laws or new regulatory requirements that affect Building Permits be developed to address increases in impervious cover? Can a standard method be created to track changes in impervious cover?		●				• Compliance Obligations • System's Description/Operational Plan • Documentation of Decision-Making/Record Retention

#	Barrier and/or Gap	Statutory	Common Law	Progress Complete In Progress Not Initiated	Risk Factor H – High M – Medium L - Low	In Workplan? Yes or No	MSW RMF Elements
9.	Update monitoring, inspection and maintenance programs for stormwater management features that were issued a "Certificate of Approvals", as these features historically did not require monitoring and inspection.	●					• Compliance Obligations • System's Description/Operational Plan • Performance Evaluation/Metrics • Inspections/Maintenance/Repair/Rehabilitation • Data Collection, Monitoring and Analysis
10.	There are no dedicated assumption protocols for new stormwater management features. This could result in premature failure of assumed stormwater management features, which may put the municipality at risk.	●					• Compliance Obligations • Resource Planning • System's Description/Operational Plan • Performance Evaluation/Metrics • Inspections/Maintenance/Repair/Rehabilitation • Data Collection, Monitoring and Analysis
11.	Municipal stormwater management features are inspected through Development and Subdivision Agreements; however private ponds do not have a mechanism in place to enforce inspection through their Development Agreement.	●	●				• Compliance Obligations • Resource Planning • System's Description/Operational Plan • Performance Evaluation/Metrics • Inspections/Maintenance/Repair/Rehabilitation • Data Collection, Monitoring and Analysis
12.	There is no standard mechanism for implementing, tracking, and documenting approved Environmental Compliance Approvals (ECA) for stormwater management features assumed by a municipality.	●					• Compliance Obligations • Documentation of Decision-Making/Record Retention • System's Description/Operational Plan • Performance Evaluation/Metrics • Inspections/Maintenance/Repair/Rehabilitation • Data Collection, Monitoring and Analysis
13.	Operation and maintenance requirements are different for each SWMP as outlined in the ECA, and proper procedures need to be enacted by the municipality to ensure compliance.	●					• Compliance Obligations • Resource Planning • Documentation of Decision-Making/Record Retention • Performance Evaluation/Metrics
14.	Have operations, maintenance and monitoring requirements been adjusted to reflect climate change impacts to avoid ECA violations.	●					• Compliance Obligations • Risk Assessment • Implementation Plans • Performance Evaluation/Metrics • Inspections/Maintenance/Repair/ Rehabilitation • Adaptive Management
15.	Consider low impact development in the municipal Development Charge By-law		●				• Compliance Obligations • Resource Planning

#	Barrier and/or Gap	Statutory	Common Law	Progress Complete In Progress Not Initiated	Risk Factor H – High M – Medium L - Low	In Workplan? Yes or No	MSW RMF Elements
16.	Capital budget allocated through the tax base may not be sufficient to sustain stormwater management capital works.	●					• Resource Planning • System's Description/Operational Plan • Risk Assessment • Risk Management • Implementation Plan • Inspections/Maintenance/Repair/ Rehabilitation
17.	Despite lack of clarity from the Federal and Provincial Government with respect to Climate Change Preparedness, municipalities are trying to implement climate change mitigation and adaptation measures. As such, there are inconsistent methodologies posing a challenge for municipalities looking for clear direction.		●				• Goals and Objectives • Leadership, Commitment and Endorsement • Define Roles, Responsibilities and Authorities • Implementation Plan
18.	The pending MOECC LID Guidance Manual requires runoff volume control targets for redevelopment/intensification and for instances where a development is exempt from acquiring an ECA but must meet MOECC LID Guidance Manual requirements. Have these changes been considered and how will they be enforced?	●					• Compliance Obligations • Documentation of Decision-Making/Record Retention
19.	Has an increase in the frequency and duration of extreme weather been factored into future planning and management	●					• Goals and Objectives • Resource Planning • Risk Assessment • Risk Management • Implementation Plan • Emergency Planning
20.	Update Official Plan to align with the Provincial Policy Statement (2014) policies, amended Growth Plan for the Greater Golden Horseshoe, Greenbelt Plan, Oak Ridges Moraine Conservation Plan, and the Niagara Escarpment Plan specifically related to stormwater management and climate change. Implement actions of policies related to climate change in the Official Plan.	●					• Goals and Objectives • Compliance Obligations • Leadership, Commitment and Endorsement
21.	Under land use planning policies, is growth and development directed away from hazardous areas, such as flood-prone areas?	●					• Goals and Objectives • Compliance Obligations • Risk Assessment • Implementation Plan
22.	Development and approval decisions are in line with policies set out in the Official Plan.	●					• Goals and Objectives • Compliance Obligations • Leadership, Commitment and Endorsement

Appendix C: GLOSSARY

Adaptation

The process of adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderate harm or exploit beneficial opportunities (IPCC, 2014), (UNISDR, 2007), (Prasad et. al, 2009). Various types of adaptation exist; e.g., anticipatory and reactive, private and public, and autonomous and planned. Examples are raising river or coastal dikes, the substitution of more temperature shock resistant plants for sensitive ones, etc.

Climate Change

A change in the state of the climate that can be identified by changes in the mean and/or variability of its properties and that persists for an extended period, typically decades or longer (IPCC, 2014).

Climate Change Impact

The effects of climate change or hazardous events on built, natural, and human systems. Potential impacts are all impacts that may occur given a projected change without considering adaptation. Residual impacts are those impacts that would occur after adaptation (ICLEI, 2012).

Extreme Weather Event

Extreme weather includes unexpected, unusual, unpredictable severe or unseasonal weather; weather at the extremes of the historical distribution—the range that has been seen in the past.

Level of Service

Generally customer levels of service outline the overall quality, function, capacity and safety of the service being provided. Technical levels of service outline the operating, maintenance, rehabilitation, renewal and upgrade activities expected to occur within the municipality (Asset Management Saskatchewan, 2014). Many municipalities develop a triple-bottom-line approach for water, wastewater and stormwater level of service that considers financial, environmental, and social/ community/organizational perspectives (FCM, 2002). By doing so, the resulting levels of service “reflect social and economic goals of the community and may include any of the following parameters - safety, customer satisfaction, quality, quantity, capacity, reliability, responsiveness, environmental acceptability, cost and availability” (FCM, 2002).

Mitigation

Technological change and substitution that reduces resource inputs and emissions per unit of output. Although several social, economic and technological policies would produce an emission reduction, with respect to climate change, mitigation means implementing policies to reduce greenhouse gas emissions and enhance sinks (ICLEI, 2012).

Risk

The product of hazard and vulnerability; the likelihood or probability of occurrence of hazardous events, or trends multiplied by the harmful consequences resulting from exposure to the hazard (ICLEI, 2012).

Risk Assessment

A methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend (UNISDR, 2007).

Riverine Flooding

Caused by extreme events or a combination of extreme events such as excessive rainfall, hurricanes, snowmelt events, mixed precipitation events or ice jams. Such extreme events cause the river water levels to rise and overtop and spill into the floodplain zone.

Standardization / standards

Standardization is the development and application of standards publications that establish accepted practices, technical requirements, and terminologies for products, services, and systems. Standards help to ensure better, safer, more resilient methods and products, and are an essential element of technology, innovation, and trade. (WGACR, 2016).

Vulnerability

The definition of vulnerability from the Intergovernmental Panel on Climate Change (IPCC) in 2014, states vulnerability as “the propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt”.

Vulnerability Assessment

Science-based effort to identify how and why focal resources (habitats, species, and ecosystem services) are likely to be affected by climate change (Hutto et al., 2015).

Vulnerable Population

Vulnerable populations are defined as groups of people who are typically excluded, disadvantaged or marginalized based on their economic, environmental, social, or cultural characteristics (USAID, 2016). These population groups are most vulnerable to effects of climate change including flooding, extreme heat and air pollution. They include seniors and those in institutions, such as residential care homes; Infants and young children and asthmatics; people with chronic diseases, particularly cardiovascular and respiratory illnesses, renal disease, diabetes and obesity, as well as those taking certain medications; and people of lower socio-economic status and those living in densely populated urban neighbourhoods (Health Canada, 2008).

Water Systems

Water systems refer to all three levels of municipal water services: drinking water, wastewater, and stormwater.