New Solutions for Sustainable Stormwater Management in Canada

Report
September 2016

Sustainable Prosperity

About Sustainable Prosperity

Made up of business, environment, policy and academic leaders, Sustainable Prosperity (SP) is a national green economy think tank/do tank. We harness leading-edge thinking to advance innovation in policy and markets, in the pursuit of a greener, more competitive Canadian economy. At the same time, SP actively helps broker real-world solutions by bringing public and private sector decision-makers to the table with expert researchers to both design and apply innovative policies and programs. We believe that achieving the necessary innovation in policy and markets for a stronger, greener Canadian economy requires a new knowledge base and new conversations. SP's approach is to promote both by generating policy-relevant, expert knowledge to inform smart policy solutions and foster innovative conversations and connections.

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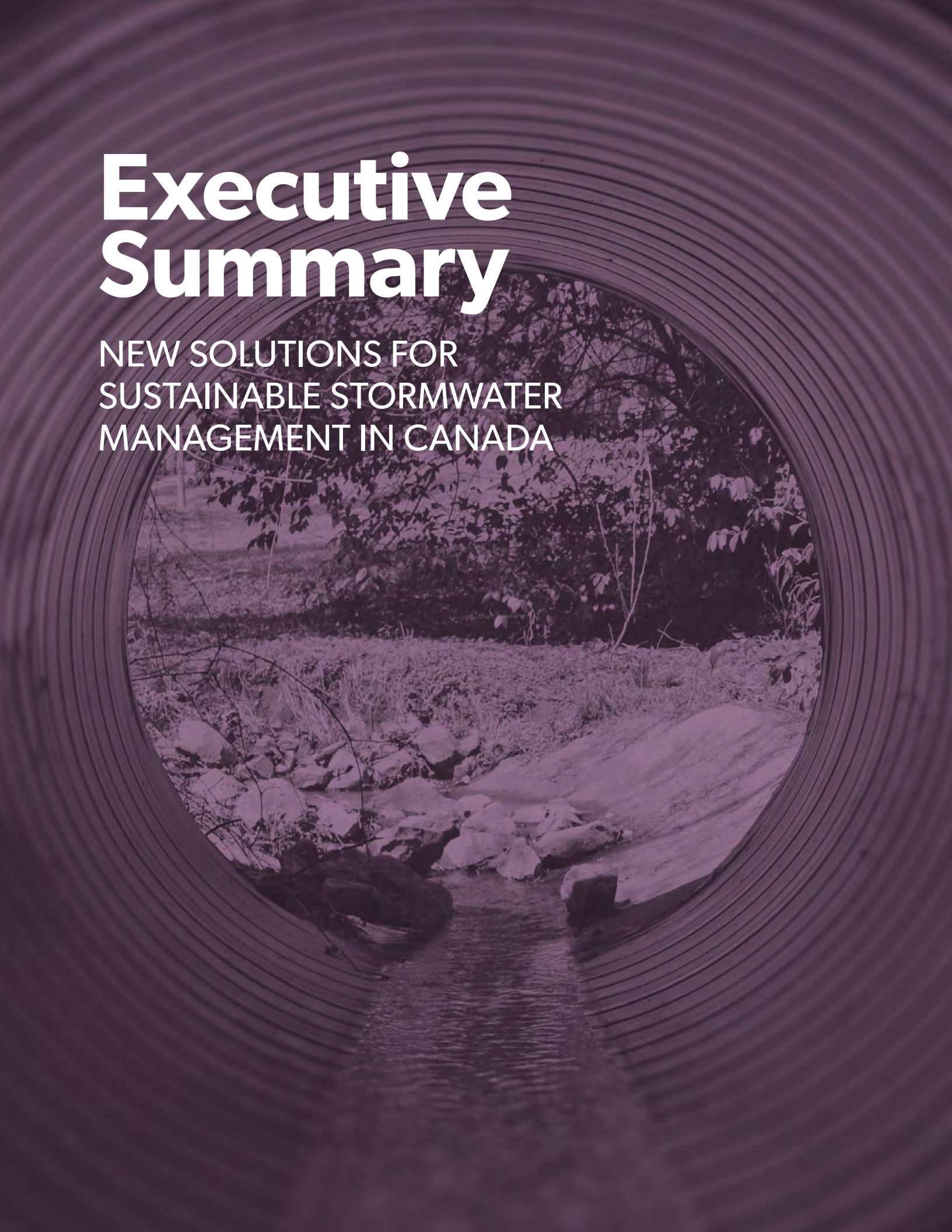


Stormwater management presents a unique challenge for many Canadian local governments.

Traditional grey infrastructure (pipes & culverts) is costly to maintain yet lacks dedicated and sustainable funding. Urbanization is creating more hard surfaces contributing higher volumes of stormwater runoff that is polluting our rivers, creeks and lakes and increasing urban flooding. Finally, changing weather patterns are overwhelming the capacity of existing infrastructure and putting people and property at risk.

Local governments, on the frontlines of the urban stormwater management challenge, face two key struggles: funding and flooding & pollution. The current funding mechanisms in place are flawed, and the traditional infrastructure system is not cost-effective and contributes to a number of urban stormwater pollution and flooding problems. Local governments are struggling to address these challenges and are in need of new solutions that are more financially sustainable, less polluting, and more resilient.

The two tools that are rising to the forefront of the local government toolkit are **stormwater user fees** and **green infrastructure**. Stormwater user fees have the potential to create a dedicated stormwater services funding stream on a basis that is transparent and fair to residents. Green infrastructure can be combined with traditional stormwater infrastructure to create a more resilient, less polluting and more cost effective stormwater management system. Together, the two solutions can help municipalities achieve better urban stormwater management overall.

Green Infrastructure

Most often refers to natural or human-made elements that provide hydrological functions and processes for managing rainwater. Includes natural heritage features and systems, parklands, stormwater management systems, street trees, urban forests, natural channels, permeable surfaces, and green roofs.

While thousands of local governments in the United States have implemented one or both of these new solutions, Canadian local governments have been slow adopters. The goal of this report is to provide all Canadian local governments with an introduction to stormwater user fees and to the various other tools that they can implement to take an integrated approach to better urban stormwater management through the use of green infrastructure. Case studies of Canadian jurisdictions such as Victoria, Mississauga and Kitchener, and of US jurisdictions such as Washington, DC, Philadelphia, and Prince George's County provide key lessons for implementing stormwater user fees and green infrastructure.

Stormwater User Fees – Key Messages

Many Canadian local governments finance stormwater services through property taxes or through water/wastewater billing. These models do not fairly assess individual contributions of stormwater and are not transparent or sustainable. While there are under two dozen Canadian municipalities that have implemented a stormwater user fee, over 1,500 local governments have done so in the United States, providing Canadian local governments key lessons to learn from.

The benefits of implementing a stormwater user fee include:	
Dedicated Revenue Stream:	Revenues collected through user fees are allocated back to providing the service for which they are charged, creating a dedicated revenue stream for funding the stormwater program. It no longer has to compete with other local government services for budget space and can better account for adaptation and renewal requirements as they arise.
Greater Awareness & Transparency:	A stormwater user fee shows property owners exactly how much they are paying for this service, creating greater awareness and understanding of not just each individual's contribution of stormwater to the system, but the overall system requirements in terms of capital and operations and maintenance costs.
Fair Assignment of Costs:	Charging each property owner based on the estimated amount of stormwater services used is a fairer assignment of cost than charges based on assessed property values or water consumption, which are unrelated to the amount of stormwater the site generates.
Economic Incentive:	Implementing stormwater user fees can also create a potential economic incentive for consumers to reduce their monthly costs by reducing the amount of stormwater runoff they generate.

The challenges some local governments have experienced in implementing stormwater user fees include:	
Public Perception:	User fees can mistakenly be perceived as a new charge or tax when in fact they shift an existing cost to a new financing model. Based on early adopter experiences (see Section 3), early and comprehensive public consultation and education will be key to addressing this challenge.
User fee design:	How a stormwater user fee is calculated determines the level of fairness, accuracy, and cost-effectiveness of the fee. But local governments must balance these factors with their resources and capacity to implement the fee. As outlined in Section 2, there are a number of ways in which a stormwater user fee can be designed and implemented. It will be up to each local government to determine the most appropriate method based on its unique context.
Cost shifts between stakeholders:	In Kitchener, 17.9% of costs for stormwater services were shifted from residential users to the non-residential sector.[1] In some cases, this can result in much higher bills to non-residential property owners, which can cause concerns and resistance to the user fee. Many municipalities have addressed this by phasing in the user fee over a period of time to allow property owners to budget for the costs. As well, many municipalities also provide a strong credit program for non-residential properties to encourage them to reduce the stormwater they generate and consequently their costs.

1 Kitchener-Waterloo, 2007, Kitchener-Waterloo Stormwater Management Program and Funding Review: Stormwater Funding Analysis; retrieved from: http://www.waterloo.ca/en/contentresources/resources/living/stormwater_report_feasiblity_study.pdf

Incentives for Green Infrastructure – Key Messages

Green infrastructure is proving to not only be a cost-effective addition to municipal stormwater services, but it provides many other social, environmental, and economic benefits as well. While municipalities can implement stormwater user fees and plan for green infrastructure projects on public lands, they also need to work with residents and businesses to offer incentives for green infrastructure on private land.

Some of the most common or innovative incentives used by local governments include:	
Credit/Discount Program	A credit or discount is applied to a stormwater user fee to reward property owners who implement green infrastructure best management practices that reduce their stormwater service requirements by reducing the amount of stormwater their site generates. *Ex: City of Mississauga credit program for non-residential properties*
Rebates	A one-time payment provided to property owners to assist with specific projects, such as the purchase and installation of a rain barrel. *Ex. City of Victoria, BC, Rainwater Rewards rebate program*
Stormwater Credit Trading	A market for stormwater management whereby an unregulated property owner can choose to create a stormwater retention credit (SRC) by managing stormwater on their site, then selling that credit to property owners who are required to meet specific stormwater management requirements (*i.e.* retention of volume of water). *Ex. Washington, D.C. stormwater retention credit trading system*
Development Cost Charges	Charge applied to new developments for the capital cost of stormwater services—may be reduced if green infrastructure is integrated into the development. *Ex. City of Penticton, B.C. development cost charge reduction for green infrastructure*
Public-Private Partnerships	An agreement between government and a private sector entity for the design, construction, and management of green infrastructure projects. *Ex. Prince George's County Clean Water Partnership*

New Solutions for Stormwater Management – Implications for Canadian Local Governments

The case studies reviewed in Section 3 of this report revealed a number of key findings or implications for Canadian local governments looking for new solutions for their stormwater management challenges.

USER FEES CAN PUT STORMWATER FUNDING ON A MORE FINANCIALLY SUSTAINABLE FOOTING

A dedicated revenue stream created through a user fee system will ensure that existing and future infrastructure requirements are not competing with other municipal services for resources. It will ensure that costs for stormwater services are open and transparent to residents, who will better understand their load on urban stormwater management systems, but also their ability to make positive changes through on-site stormwater reductions.

A COMBINATION OF USER FEES WITH GREEN INFRASTRUCTURE CAN PROVIDE AN INTEGRATED APPROACH FOR BETTER URBAN STORMWATER MANAGEMENT

While each of the tools described in more detail in Section 2 of this report can individually help local governments address growing stormwater management challenges, an integrated program, using multiple tools, is necessary to achieve ambitious goals. A variety of programs, combined with a strong emphasis on monitoring and assessment, will be required to find the right programs for each local government.

APPROACHES SHOULD BE COMMUNITY SPECIFIC

The approach taken to enhance the resiliency of a community through the use of green infrastructure should be tailored for each community based on the unique community context, political context, landscape characteristics, existing infrastructure, and future vision. Each of the six case studies examined used a different model for achieving natural stormwater management, reducing pollution, and increasing resiliency. There are many common factors, including the green infrastructure tools that are used, but the ways in which these tools are combined and implemented differs.

THE PRIVATE SECTOR CAN BE AN IMPORTANT PARTNER

The private sector can be an important partner that should be engaged early to determine how it could work with local governments to improve stormwater management. As the innovative approaches of stormwater credit trading and P3 partnerships gain momentum in the U.S., there is growing interest from the private sector in market instruments and collaborating with local governments for the benefit of all parties. Canadian local governments that are already looking for innovative solutions can harness this momentum.

Case Study Highlights

PHILADELPHIA, PA

Two key subsidy programs (SMIP & GARP) allow the private market to work with the City in accelerating green infrastructure projects and reducing stormwater volumes and pollution in a highly cost effective way, while also creating a new job market and industry within the city.

MISSISSAUGA, ON

The transition to stormwater user fees has created a fair, dedicated and transparent stormwater funding stream that helps the city provide better stormwater management services and provides a learning experience for all residents.

VICTORIA, BC

A comprehensive stormwater user fee combined with the Rainwater Rewards program provides incentives and support for private property owners wishing to reduce their costs and build a better community through green infrastructure projects.

KITCHENER, ON

A collaborative effort between the City of Kitchener and the City of Waterloo led to the development of a fair and transparent stormwater user fee system.

WASHINGTON, DC

Revised stormwater regulations requiring stormwater to be retained on site or through voluntary projects has created a market for trading stormwater retention credits (SRCs), which not only encourages more effective stormwater management but also a greater distribution of green infrastructure projects across the District.

PRINCE GEORGE'S COUNTY, MD

The first public-private partnership (P3) for stormwater management is demonstrating how local governments and private industries can work together to achieve ambitious sustainability goals.

Introduction

Water management is an essential service provided by local governments, but the intertwining stresses of local budgeting, infrastructure planning, environmental considerations, and climate change adaptation are changing the nature of how this service should be delivered.

Stormwater management – a component of local water management that addresses rain and melting snow – presents a unique challenge for many Canadian local governments. Traditional stormwater infrastructure, made up mainly of pipes and culverts, is costly to install and maintain yet, in all but a few jurisdictions, it lacks a dedicated and sustainable funding mechanism. Meanwhile, urbanization has increased the total area of hard surfaces contributing stormwater runoff, which has led to increased volumes of polluted waters reaching our rivers, creeks and lakes. Finally, changing weather patterns have increased the frequency of extreme storm events, sometimes overwhelming the capacity of existing stormwater infrastructure and putting people and property at risk.

Local governments are struggling to address these stormwater challenges and are in need of new solutions that are more financially sustainable, less polluting, and more resilient. Though there are a number of solutions to choose from[2], two in particular are rising to the forefront of the local government toolkit for stormwater management: **stormwater user fees** and **green infrastructure**. Stormwater user fees have the potential to create a dedicated stormwater services funding stream on a basis that is transparent and fair to residents. Green infrastructure, such as bioswales, rain gardens, urban forests, and green roofs, can be combined with traditional stormwater infrastructure to create a more resilient, less polluting and more cost effective stormwater management system. Together, the two solutions can help municipalities achieve better urban stormwater management overall.

While thousands of local governments in the United States have implemented one or both of these new solutions, Canadian local governments have been slow adopters. But the momentum is shifting and Canadian cities looking to make a change can learn from the U.S. experiences, as well as the experience of some early Canadian adopters such as Victoria[3], Mississauga[4], Vancouver[5] and Kitchener[6]. By implementing these solutions, local governments are making an important shift from viewing stormwater management as a purely engineering exercise in efficient removal of excess water from urban areas, to managing stormwater as a resource and an opportunity to advance sustainable community development.

2 See the Rain Community Solutions publication Soak it Up! Toolkit; available from: http://www.raincommunitysolutions.ca/en/toolkit/

3 City of Victoria, Stormwater User Fee; for more information see http://www.victoria.ca/EN/main/departments/engineering/stormwater/stormwater-utility.html

4 City of Mississauga, Stormwater Charge; for more information see http://www.mississauga.ca/portal/stormwater/charge

5 City of Vancouver, Administrative Report to City Council, dated March 30, 2016, Rainwater Management Plan and Green Infrastructure Strategy; retrieved from: http://council.vancouver.ca/20160419/documents/rr2.pdf

6 City of Kitchener, Integrated Stormwater Master Plan; retrieved from: https://www.kitchener.ca/en/livinginkitchener/StormwaterMasterPlan.asp

Report Overview

The goal of this report is to provide Canadian local governments with an introduction to stormwater user fees and to the various other tools that they can implement to take an integrated approach to better urban stormwater management through the use of green infrastructure. The report does not go in to detail on the green infrastructure projects themselves, but rather focuses on how local governments can encourage the development of green infrastructure projects through economic incentives.

THE INFORMATION IN THE REPORT IS BROKEN DOWN AS FOLLOWS:

Section 1

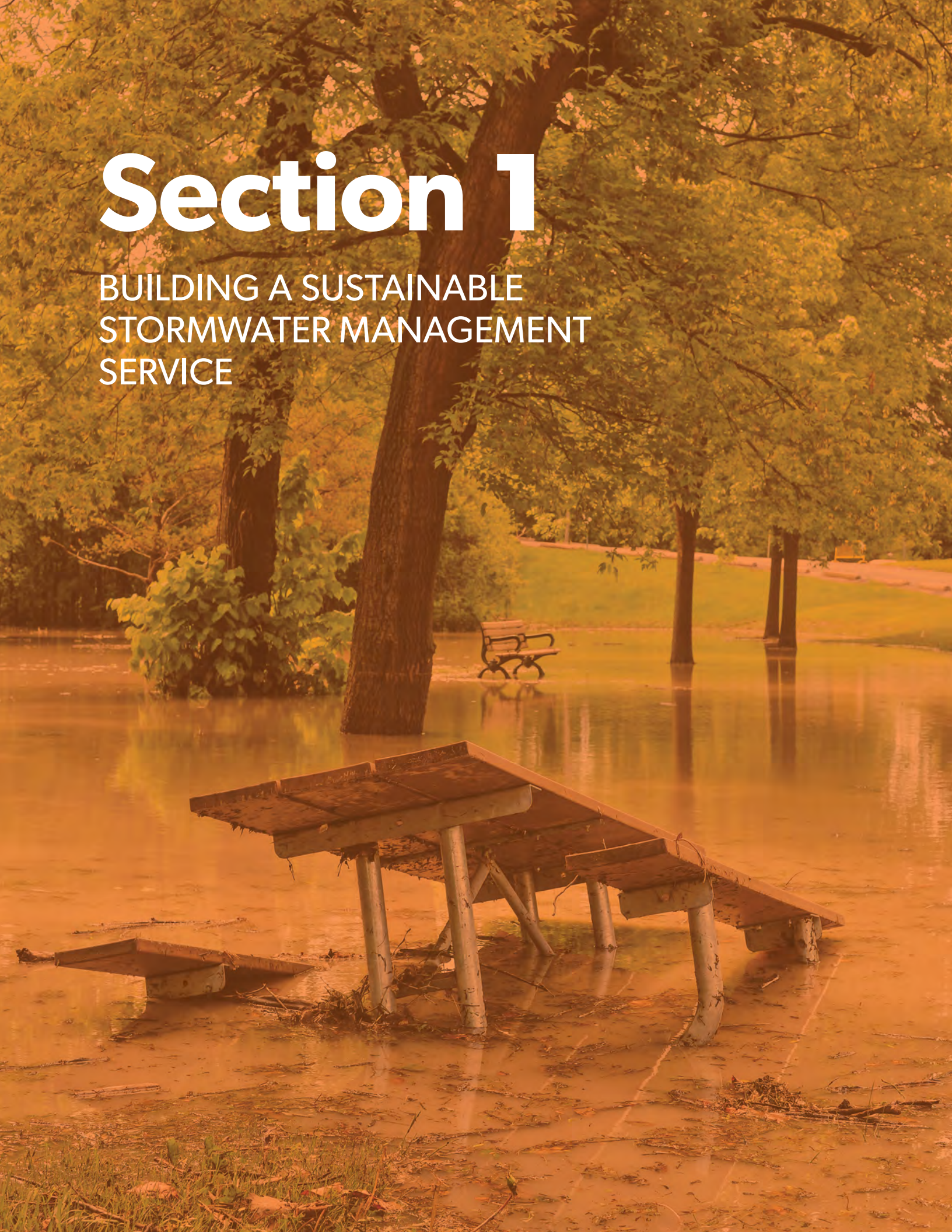
Reviews the key challenges of urban stormwater management, the Canadian context for green infrastructure as it compares to the United States, and the importance of user fees and economic incentives as tools for local governments. The section ends with a summary of key lessons learned and overall implications for Canadian local governments.

Section 2:

Presents a more detailed discussion of the tools for improving urban stormwater management, including more detailed treatment of the stormwater user fees and incentives introduced in Section 1 as well as sample case studies of where these tools are in use today.

Section 3:

Provides a number of case studies of cities in Canada and the U.S. that have implemented the new solutions for stormwater management and attempts to identify lessons learned for other municipalities looking to do the same.



Section 1

BUILDING A SUSTAINABLE STORMWATER MANAGEMENT SERVICE

Section 1.1: Urban Stormwater Management Challenges

Local governments, on the frontlines of the urban stormwater management challenge, face two key struggles: funding and flooding & pollution. The current funding mechanisms in place are flawed, and the traditional infrastructure system is not cost-effective and creates a number of urban stormwater pollution problems.

Challenge #1: Funding

For the past century, local governments have been building structurally engineered infrastructure, or ***grey infrastructure,*** for stormwater management. When the land is altered from its natural state to hardened impervious surfaces, the water that used to infiltrate into the soil or evaporate through vegetation must now be managed by infrastructure (See Figure 1). This infrastructure includes systems of pipes and culverts that collect stormwater from urban areas and convey it to nearby waterbodies.[7]

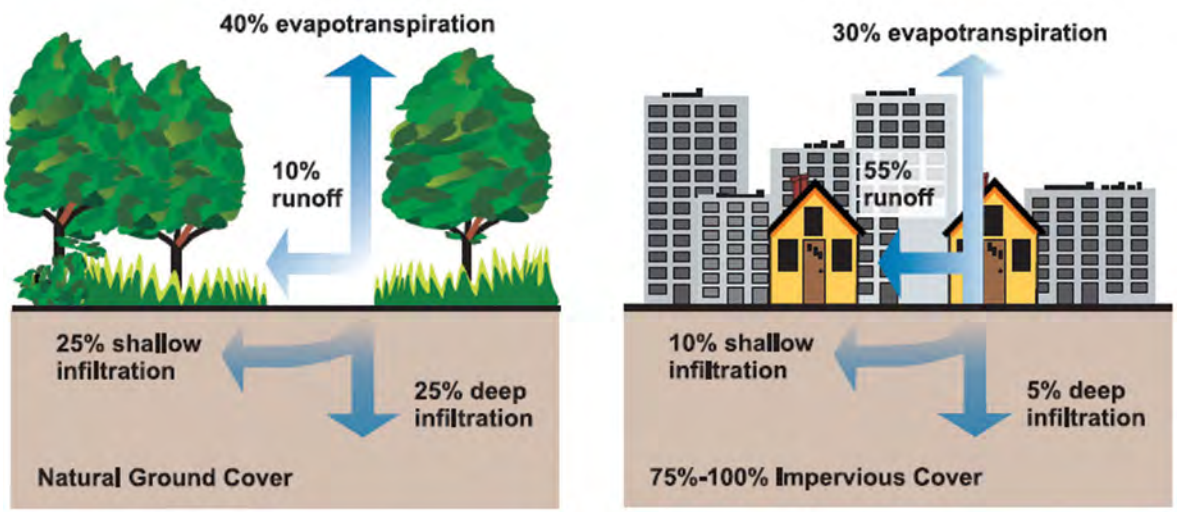


Figure 1: Change in water runoff volumes as a result of urbanization (Image credit: US Environmental Protection Agency, 2003, source: https://www3.epa.gov/npdes/pubs/nps_urban-facts_final.pdf)

Grey or "traditional" stormwater infrastructure is costly to maintain, upgrade and replace and these costs fall solely to local governments that are struggling to keep up. For example, the City of Mississauga's Stormwater Financing Study calculated that the City has $1.7 billion (in 2011) in Stormwater Infrastructure Assets, and that in 2012 they spent almost $15 million on capital improvement projects and operations and maintenance.[8] This investment, however, was not enough to fully fund the City's stormwater capital, operations and maintenance, and renewal requirements. To fully meet these program needs, the City would have had to spend nearly $40 million.[9] In many older neighborhoods, the stormwater infrastructure simply does not exist and must be built. In the City of Kitchener, for example, the older downtown

7 Peeling Back the Pavement: A Blueprint for Reinventing Rainwater Management in Canadian Cities (see Box 1); retrieved from: http://poliswaterproject.org/sites/default/files/Peeling_Back_highres_nov17.pdf

8 See City of Mississauga Stormwater Financing Study (April 2013); retrieved from: http://www7.mississauga.ca/Documents/TW/Environment/RPT_MississaugaStormwaterFinancingStudy_Apr2013_Final.pdf

9 *ibid*

neighborhood did not have stormwater management facilities and this contributed to sedimentation issues in Victoria Park Lake (see Case Study for more details).

This funding story is the same in many Canadian communities. According to the Canadian Infrastructure Report Card released in February 2016, of the estimated $134 Billion in stormwater infrastructure assets across Canada, approximately 22%, or $31 Billion in assets, are in fair to very poor condition, requiring replacement or upgrades in the near future.[10] Similar to the situation in Mississauga, the current levels of reinvestment in infrastructure by local governments across Canada are considered inadequate, meaning that without any changes, the overall condition of the infrastructure will worsen and cost Canadians more money in the long run.[11] With restricted powers to raise funds and with cost-conscious voters, local governments are struggling to keep that infrastructure in good working condition, putting existing services at risk and making our communities more vulnerable to service disruption and extreme weather events.

The challenge of stormwater funding lies not only in the overall costs of stormwater infrastructure, but also in ***how*** the service is funded. In many communities in Canada, stormwater services are funded through property taxes or as a portion of water/wastewater utility charges. The local government portion of property tax goes into a general fund and the stormwater management program is funded through this, along with all the other local government services that do not have dedicated funding. Through the water/wastewater bill, stormwater is generally calculated as a percentage of water consumption. There are a number of flaws with these funding mechanisms for stormwater management, including:

CHALLENGES WITH PROPERTY TAX FUNDING MECHANISM:

- ***No dedicated revenue for stormwater services:*** If part of the general revenue bucket, stormwater management competes for funds with all other essential local government services that also do not have dedicated funding.
- ***No transparency on stormwater service costs:*** Residents often do not know what portion of their property tax bill is for stormwater services;
- ***No fairness in amount charged:*** The property tax charge for stormwater services is not linked to the actual service requirements: property tax is based on the assessed value of the home, which has no connection to the amount of stormwater runoff the site generates. In addition, many properties exempt from property taxes, such as schools, places of worship, and hospitals, actually generate a significant amount of stormwater runoff.

CHALLENGES WITH WATER/WASTEWATER BILLING MECHANISM:

- ***No transparency on stormwater service costs:*** Residents may not know what portion of their water/wastewater bill is for stormwater services;
- ***No fairness in amount charged:*** The amount of water consumed per property has no connection to the amount of stormwater runoff the site generates.

10 Canadian Construction Association (CCA), the Canadian Public Works Association (CPWA), the Canadian Society for Civil Engineering (CSCE) and the Federation of Canadian Municipalities (FCM), 2016, Canadian Infrastructure Report Card: Informing the Future; retrieved from: http://canadianinfrastructure.ca/downloads/Canadian_Infrastructure_Report_2016.pdf

11 *ibid*

The prevalence of both mechanisms in local governments across Canada has contributed to the current state of stormwater financing where many stormwater management programs are underfunded and unsustainable over the long term, especially when adaptation and climate change resiliency costs are accounted for. Furthermore, these funding models provide no incentive for the users of stormwater services to understand their contribution to the system or reduce their demand on the infrastructure. This results in the continued need for costly infrastructure upgrades and expansion.

Potential solutions to the challenges of stormwater funding therefore lie in local governments identifying ways to reduce the overall cost of stormwater infrastructure and in creating a more financially sustainable funding source for stormwater services.

Challenge #2: Flooding & Pollution

Traditional urban stormwater management practices, based solely on the "pipe and convey" methodology and grey infrastructure, inadvertently turn rainwater into pollution. Water that falls on hard surfaces in our urban areas flows through a series of structured landscapes and pipes, increasing in volume and picking up various sediments and pollutants along the way until it reaches receiving waterbodies (see Figure 2). The stormwater that is released into nearby waterbodies has now become a major source of pollution. For example, a 2011 study by the Department of Ecology in the State of Washington found that surface runoff picked up so many chemicals of concern that it was the largest contributor of these chemicals to the Puget Sound.[12] The stormwater released into waterbodies also has a number of other negative impacts (see text box)[13], including contributing to increased urban flooding.[14]

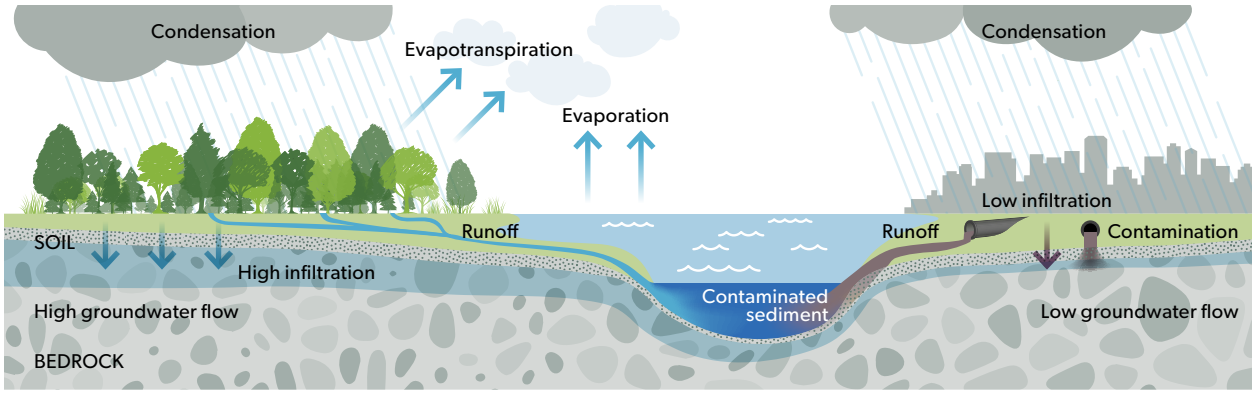


Figure 2: Change in water cycle as a result of urbanization

12 See Department of Ecology, State of Washington, 2011, Control of Toxic Chemicals in Puget Sound: Assessment of Selected Toxic Chemicals in the Puget Sound Basin, 2007-2011; retrieved from: https://fortress.wa.gov/ecy/publications/documents/1103055.pdf

13 Peeling Back the Pavement: A Blueprint for Reinventing Rainwater Management in Canadian Cities (see Box 1); retrieved from: http://poliswaterproject.org/sites/default/files/Peeling_Back_highres_nov17.pdf

14 See U.S. Geological Survey Fact Sheet 076-03, 2003, Effects of Urban Development on Floods; retrieved from: http://pubs.usgs.gov/fs/fs07603/pdf/fs07603.pdf

Unintended Impacts of Stormwater Runoff

DEGRADED STREAMS ECOSYSTEMS

Urbanization accompanied by traditional stormwater management systems degrades stream ecosystems in a number of ways that are interconnected. These impacts include increased frequency and intensity of flood flows, decreased groundwater levels, increased stream bank erosion, and increased loads of pollutants[15] with resulting multiple impacts on aquatic ecosystems.[16]

EROSION, SILTATION AND SEDIMENTATION

By expediting the flow of runoff to receiving bodies of water, traditional stormwater management often intensifies erosion, which leads to more sedimentation. Managing this sedimentation is expensive: The U.S. Army Corps of Engineers dredges approximately 83 million cubic yards of sediment linked to pollution sources each year at an annual cost of **US$180 million.**[17] The City of Kitchener project to restore Victoria Park Lake, which had become overloaded with sediment from the downtown area that lacked stormwater facilities, was estimated to cost **~$16 million**.[18]

WATER QUALITY

Urban runoff can also have a significant impact on drinking water supply. When polluted water infiltrates the drinking water supply, more money must be spent to treat that water before it is available for public consumption. For instance, New York's drinking water supply, the largest unfiltered supply in the U.S., was threatened by increased urbanization in the Catskill and Delaware regions. Instead of building a new drinking water treatment facility, they invested in protecting the lands around the watershed. This saved **US$6-$8 billion** for the construction of the filtration facility and **US$200-$300 million** in annual operation and maintenance costs.[19]

Many communities in Canada are also dealing with another significant stormwater pollution problem – that of combined sewers. A combined sewer is a system that collects sewage and stormwater together and transports it to a wastewater facility where it is treated before being released to a water body. The system fails during heavy rains when overflows, containing both stormwater and sewage, are discharged into waterbodies without any treatment. This overflow, called a Combined Sewer Overflow (CSO), is a primary pollution concern in the US where nearly 860 communities have combined sewer systems (CSS). In Canada, data on the number of communities with CSSs is unavailable, however most urban areas developed prior to the early 1940's are served by CSSs.[20] A 2006 study by EcoJustice found that in one year

15 Novotny, V., Olem, H., 1994. Water Quality: Prevention, Identification, and Management of Diffuse Pollution, Van Nostrand Reinhold, New York

16 Paul, M. J., and J. L. Meyer. 2001. Streams in the urban landscape. Annual Review of Ecology and Systematics 32:333-65; and Hatt BE, Fletcher TD, Walsh CJ, Taylor SL (2004) The influence of urban density and drainage infrastructure on the concentrations and loads of pollutants in small streams. Environ Manage 34: 112–124

17 See http://www.nrdc.org/water/pollution/storm/chap3.asp

18 City of Kitchener, no date, Victoria Park Lake Improvements – Public Information Centre; retrieved from: http://www.kitchener.ca/en/livinginkitchener/resources/portraitpanels_r1_lo.pdf

19 See UC Davis, Information Centre for the Environment, New York City; available at http://ice.ucdavis.edu/node/133

20 See Environment and Climate Change Canada (2013), Municipal Wastewater Status in Canada – Stormwater and Combined Sewer Overflows; retrieved from: https://www.ec.gc.ca/eu-ww/default.asp?lang=En&n=6E4ACEEE-1

potentially 92 billion litres of combined sewer overflows were released into the Great Lakes. [21] The 2013 update to that report found that, within Ontario cities, these overflows continue to be a major source of pollution.

To address the issue of combined sewer overflows, many local governments are building overflow tunnels that collect the additional water, which can then be slowly released and treated once the storm has passed. For example, the City of Ottawa is currently building two Combined Sewer Storage Tunnels, at a cost of $232.3 million, to hold up to 43,000 m^3 of combined sewer overflows.[22] The problem with this solution is that it is costly and doesn't treat the root problem – higher volumes of stormwater from our urban areas.

Potential solutions to the challenge of flooding & pollution of stormwater lies in local governments finding cost-effective ways to improve the quality of stormwater while at the same time reducing the quantity or volume of stormwater in order to protect our local waterbodies and reduce the negative impact of combined sewer overflows.

Section 1.2: New Solutions for Better Urban Stormwater Management

Faced with these multiple challenges, local governments require new solutions for managing urban stormwater, solutions that are more cost-effective, transparent, and sustainable. The two solutions explored in this report, stormwater user fees and green infrastructure, can be key components of a better urban stormwater management system. Alone, they each address important challenges currently faced by local governments as discussed in the previous section. Used in combination, they can help to shift the focus of stormwater management from being a purely engineering exercise in efficient removal of excess water from urban areas, to managing stormwater as a resource and an opportunity to advance sustainable community development.

Solution #1: Stormwater User Fees

Stormwater user fees can provide a dedicated and sustainable source of funding for stormwater management programs. Similar to water and wastewater utilities, stormwater user fees charge property owners a fee that is based on the estimated amount of stormwater runoff their property generates. This is also why they are sometimes referred to as stormwater utilities. The fees collected are then used to fund the stormwater management program thereby creating a dedicated revenue stream. User fees structured on a full cost recovery basis (accounting for short-term and long-term costs of capital, operations and maintenance, and renewal) better reflect the true costs of stormwater program services, more fairly assign those costs, and create incentives for reducing overall demand on the system. While Section 2 of this report goes into greater detail on the various designs and implementation methods of stormwater user fees, the following section outlines some of the key benefits and challenges associated with stormwater user fees.

21 EcoJustice, 2013, Great Lakes Sewage Report Card; retrieved from: https://www.ecojustice.ca/wp-content/uploads/2014/08/FINAL-The-Great-Lakes-Sewage-Report-Card-2013.pdf

22 See City of Ottawa, Combined Sewer Storage Tunnel Project Website, http://ottawa.ca/en/major-projects/combined-sewage-storage-tunnel-csst

BENEFITS OF USER FEES FOR FINANCIALLY SUSTAINABLE STORMWATER FUNDING

- ***Dedicated Revenue Stream:*** The revenues collected through user fees are allocated back to providing the service for which they are charged, creating a dedicated revenue stream for funding the stormwater program. It no longer has to compete with other local government services for budget space and can better account for adaptation and renewal requirements as they arise.
- ***Greater Awareness & Transparency:*** A stormwater user fee shows property owners exactly how much they are paying for this service, creating greater awareness and understanding of not just each individual's contribution of stormwater to the system, but the overall system requirements in terms of capital and operations and maintenance costs.
- ***Fair Assignment of Costs:*** Charging each property owner based on the estimated amount of stormwater services used is a fairer assignment of cost than charges based on assessed property values or water consumption, which are unrelated to the amount of stormwater the site generates. In Kitchener, for example, the stormwater user fee feasibility study determined that 17.9% of costs would be shifted from residential users to the non-residential sector, accounting for the greater contribution of stormwater from non-residential sites.[23]
- ***Economic Incentive:*** The pricing of drinking water by utilities based on consumption has been shown to provide an incentive for people to reduce their consumption in order to save money.[24] The same is true with consumption-based charges for electricity and natural gas. Implementing stormwater user fees can also create a potential economic incentive for consumers to reduce their monthly costs by reducing the amount of stormwater runoff they generate.

CHALLENGES FOR IMPLEMENTING STORMWATER USER FEES:

- ***Public Perception***: User fees can mistakenly be perceived as a new charge or tax when in fact they shift an existing cost to a new financing model. Based on early adopter experiences (see Section 3), early and comprehensive public consultation and education will be key to addressing this challenge.
- ***User fee design***: How a stormwater user fee is calculated determines the level of fairness, accuracy, and cost-effectiveness of the fee. But local governments must balance these factors with their resources and capacity to implement the fee. As outlined in Section 2, there are a number of ways in which a stormwater user fee can be designed and implemented. It will be up to each local government to determine the most appropriate method based on its unique context.
- ***Cost shifts between stakeholders***: As noted in the Kitchener example, 17.9% of costs for stormwater services would be shifted from residential users to the non-residential sector.[25] In some cases, this can result in much higher bills to non-residential property owners, which can cause concerns and resistance to the user fee. Many municipalities have addressed this by phasing in the user fee over a period of time to allow property owners to budget for the costs. As well, many municipalities also provide a strong credit program (See Section 2.2) for non-residential properties to encourage them to reduce the stormwater they generate and consequently their costs.

23 Kitchener-Waterloo, 2007, Kitchener-Waterloo Stormwater Management Program and Funding Review: Stormwater Funding Analysis; retrieved from: http://www.waterloo.ca/en/contentresources/resources/living/stormwater_report_feasiblity_study.pdf

24 See Environment Canada 2011 report on Municipal Water Pricing; retrieved from: https://www.ec.gc.ca/Publications/992156D4-2599-4026-9B4C-47855D26CCB8/2011MunicipalWaterPricingReport2009Statistics.pdf

25 Kitchener-Waterloo, 2007, Kitchener-Waterloo Stormwater Management Program and Funding Review: Stormwater Funding Analysis; retrieved from: http://www.waterloo.ca/en/contentresources/resources/living/stormwater_report_feasiblity_study.pdf

Stormwater user fees can address the challenges experienced by local governments using the current property tax or water/wastewater billing mechanisms by creating a dedicated, transparent and sustainable stormwater funding stream. They also begin to address the pollution challenge by creating an economic incentive for reducing the amount of stormwater each property creates, thereby reducing the overall volume of stormwater that needs to be managed. To reduce the stormwater produced by a site, many property owners look to green infrastructure, such as rain gardens, rain barrels, and permeable pavement. As discussed next, green infrastructure is not only a cost-effective addition to traditional stormwater management practices but it also provides a number of other social, environmental, and economic benefits.

Solution #2: Green Infrastructure for Stormwater Management

The term "green infrastructure" most often refers to natural or human-made elements that provide hydrological functions and processes for managing rainwater[26] (see Figure 3). The US EPA, for example, states that "green infrastructure uses vegetation, soils, and other elements and practices to restore some of the natural processes required to manage water and create healthier urban environments."[27] There are also many terms that can be used to refer to green infrastructure, including low impact development, rainwater management, or natural stormwater management.

In Canada, there are additional variations in how the term is applied. The Government of Canada, for example, has included clean energy in the definition of green infrastructure.[28] For the purpose of this report we will be focusing on green stormwater infrastructure, which generally aligns with the green infrastructure definition provided in the *Ontario Provincial Policy Statement 2015*, and "means natural and human-made elements that provide ecological and hydrological functions and processes. Green infrastructure can include components such as natural heritage features and systems, parklands, stormwater management systems, street trees, urban forests, natural channels, permeable surfaces, and green roofs."[29,30]

26 See West Coast Environmental Law, 2007, The Green Infrastructure Guide (available at: http://www.waterbucket.ca/gi/sites/wbcgi/documents/media/336.pdf) for a slightly different definition that includes "design with nature" principles

27 See US EPA website, What is Green Infrastructure?; retrieved from: https://www.epa.gov/green-infrastructure/what-green-infrastructure

28 The Government of Canada's 2016 Budget included a full section on Green Infrastructure that lists a much wider range of infrastructure for clean energy, asset management, and water and wastewater systems. See Government of Canada, Budget 2016: Growing the Middle Class (March 2016); retrieved from: http://www.budget.gc.ca/2016/docs/plan/budget2016-en.pdf. Infrastructure Canada also recently issued a statement via social media explaining that green infrastructure includes climate resilient infrastructure, clean energy, cleaning-up contaminated sites, and water/wastewater infrastructure. See Infrastructure Canada, Twitter Feed; retrieved from: https://twitter.com/INFC_eng/status/705121953749864448

29 Ontario Provincial Policy Statement 2014; retrieved from: http://www.mah.gov.on.ca/AssetFactory.aspx?did=10463

30 For additional explanation of green infrastructure elements see US EPA Green Infrastructure website; retrieved from: http://www2.epa.gov/green-infrastructure/what-green-infrastructure

Figure 3: Examples of Green Infrastructure

GREEN INFRASTRUCTURE AND STORMWATER POLLUTION & FLOODING

By mimicking or restoring the natural hydrology, green infrastructure is able to reduce the urban stormwater pollution that often results from traditional infrastructure. A 2009 study compared the stormwater runoff quality and quantity from traditional developments to low impact development (LID) watersheds that used practices such as grassed swales, rain gardens and permeable pavers.[31] The researchers found that the LID development reduced stormwater quantity and the export of several pollutants compared to the traditional development.[32]

TRIPLE BOTTOM LINE BENEFITS OF GREEN INFRASTRUCTURE

When used in combination with traditional grey infrastructure for stormwater management, green infrastructure is also proving to be a cost-effective addition. For example, in Maryland and Illinois it was found that a cost savings of US$3,500 to $4,500 per lot in new residential developments could be achieved when green infrastructure was used in addition to grey infrastructure for stormwater management. [33] The green infrastructure reduced runoff by preserving natural vegetation, which reduced overall site imperviousness. As a result, developments avoided the costs associated with grey stormwater infrastructure, paving and site preparation. Developers in these particular cases also noted that they are able to create more lots to sell by eliminating land-consuming infrastructure and these lots typically sold at higher prices because they are more natural looking.

31 See Bedan, E.S., & Clausen, J.C. (2009) ***Stormwater runoff quality and quantity from traditional and low impact development watersheds.*** Journal of the American Water Resources Association, DOI: 10.1111/j.1752-1688.2009.00342.x

32 See also US EPA website for additional references on green infrastructure and surface water impacts, available here: https://www.epa.gov/green-infrastructure/green-infrastructure-and-surface-water-impacts

33 Kloss, C. & Calarusse, C. (2006). ***Rooftops to Rivers: Green Strategies for Controlling Stormwater and Combine Sewer Overflows.*** Natural Resources Defence Council. Retrieved from https://www.nrdc.org/sites/default/files/rooftops.pdf (p.12)

In Seattle, the local water utility estimates that by using low impact development techniques costs can be reduced 24 to 45 percent in street redesign projects.[34] Similarly, Portland was able to save US$58 million (a savings of around 40%) by using green infrastructure instead of only grey infrastructure in its Brooklyn Creek Basin project.[35]

While each application will be site specific, there is also evidence in Canada of cost savings from combining green infrastructure with grey infrastructure for stormwater management. A 2013 study prepared by the Toronto and Region Conservation Authority assessed the capital and life cycle costs of low impact development stormwater management practices[36] over 50 years, taking into consideration local input costs, maintenance requirements, rehabilitation costs, and design scenarios relevant to Canadian climates. When they analyzed different treatment scenarios for an asphalt parking lot, the costs of the Low Impact Development (LID) practices, including the long-term costs to treat the water, were found to be between 35 and 77 percent less expensive when compared to traditional stormwater systems.[37]

Green infrastructure is also being shown to provide many other economic, social and environmental benefits for our communities. These benefits, some of which are depicted in Figure 4 and described in Table 1, are interconnected and contribute to healthier and more liveable communities.

To illustrate, in Pennsylvania, the cities of Lancaster and Philadelphia both conducted analyses of the economic, environmental and social benefits of using a percentage of green infrastructure instead of grey infrastructure.[38] Both cities found that overall, the value added to the community would be substantial in terms of air quality costs, climate resiliency, recreation values, human health, and more, in addition to the capital cost savings. Lancaster, for example, found that in addition to the 1 billion gallons of stormwater runoff diverted every year, the US$120 million in avoided grey infrastructure capital costs, and the associated US$661,000 in operations and maintenance costs each year, there was the potential for significant savings in energy, air quality, and climate change resiliency costs (see text box for details).[39]

34 Puget Sound Action Team. (n.d.). ***Low Impact Development: How Can We Protect Puget Sound as We Grow?*** Retrieved from http://ci.granite-falls.wa.us/media/pdf/stormwater/lid_brochure06_11x17.pdf

35 McGuire et. al. 2010. Reinventing Rainwater Management: A Strategy to Protect Health and to Restore Nature in the Capital Region. Environmental Law Clinic, University of Victoria; retrieved from: http://www.portlandoregon.gov/shared/cfm/image.cfm?id=238152

36 Practices included bioretention cells, permeable pavement, infiltration trenches and chambers, enhanced swales, rainwater harvesting and green roofs.

37 See Toronto and Region Conservation Authority, 2013, Assessment of Life Cycle Costs for Low Impact Development Stormwater Management Practices; retrieved from: http://www.sustainabletechnologies.ca/wp/wp-content/uploads/2013/06/LID-LCC-final-2013.pdf

38 For Lancaster, PA example see Text Box. For Philadelphia, PA example see http://www.phillywatersheds.org/ltcpu/Vol02_TBL.pdf

39 See The Economic Benefits of Green Infrastructure: A Case Study of Lancaster, PA (2014); retrieved from: http://www.epa.gov/green-infrastructure/economic-benefits-green-infrastructure-case-study-lancaster-pa

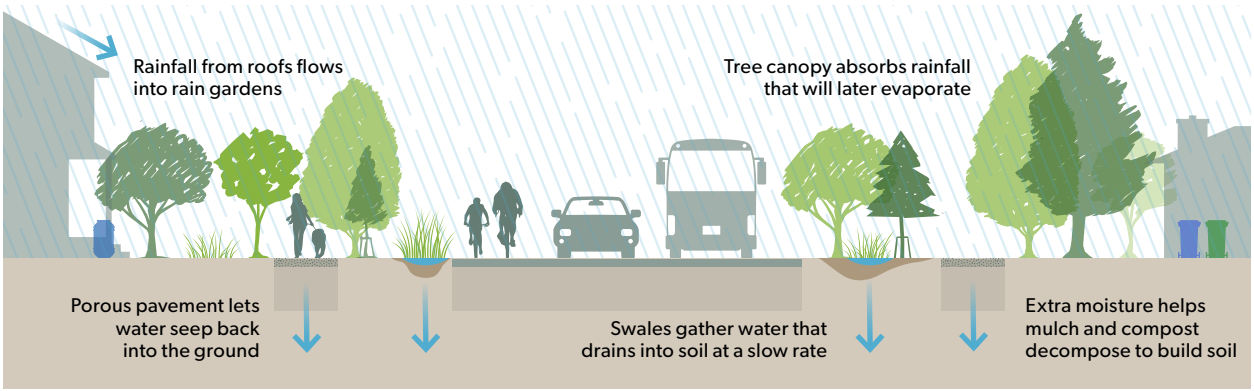


Figure 4: Benefits of Green Infrastructure

Table 1: Triple Bottom Line Benefits of Green Infrastructure[40]

Water Quality and Quantity	
GREEN INFRASTRUCTURE BENEFIT	EXAMPLE OF ECONOMIC IMPACT
Water Quantity & Treatment: Green infrastructure can reduce stormwater runoff volumes by retaining water on a site. It also filters and treats the water as it is slowly released through infiltration.	Philadelphia saved millions of dollars by using green infrastructure to capture rainwater and avoid building costly combined sewer overflow tunnels.
Flood Mitigation: Green infrastructure can mitigate flood risk by slowing and reducing stormwater peak discharges.	Using green infrastructure to reduce peak stormwater discharges by only 10% would reduce economic losses from flooding events by 39-46% in Great Lakes region (see Text Box for details)
Water Supply: Rainwater harvesting and infiltration-based practices increase the efficiency of our water supply system. Water collected in rainwater harvesting systems can be used for outdoor irrigation and some indoor uses and can significantly reduce community water use. Water infiltrated into the soil can recharge ground water, an important source of water in many communities.	Analysis of the total volume of rooftop runoff available for capture and storage in 8 U.S. cities[41] showed that if captured entirely, the rooftop runoff could supply between 21-75% of the annual water needs of each community's population.

40 Sourced from US EPA Benefits of Green Infrastructure Website; retrieved from: http://www2.epa.gov/green-infrastructure/benefits-green-infrastructure

41 NRDC, 2011, Capturing Rainwater from Rooftops: An Efficient Water Resource Management Strategy that Increases Supply and Reduces Pollution; retrieved from: https://www.nrdc.org/sites/default/files/rooftoprainwatercapture.pdf

42 See Health, Prosperity and Sustainability: The Case for Green Infrastructure in Ontario, published by Green Infrastructure Ontario Coalition and Ecojustice; retrieved from: https://www.ecojustice.ca/wp-content/uploads/2014/08/Health-Prosperity-and-Sustainability_The-Case-for-Green-Infrastructure-in-Ontario.pdf and also Peel Region Urban Forest Strategy, 2011; retrieved from: http://www.mississauga.ca/file/COM/2012eacagendapart2_june5.pdft

Air Quality	
GREEN INFRASTRUCTURE BENEFIT	EXAMPLE OF ECONOMIC IMPACT
Ozone & Particulate Pollution Reduction: Smog can lead to respiratory health problems. Vegetation can reduce smog by reducing air temperatures, reducing power plant emissions associated with air conditioning, and removing air pollutants. Trees, parks, and other green infrastructure features can reduce particulate pollution by absorbing and filtering particulate matter.	Urban forests in Region of Peel in Ontario, can remove 855 tonnes of air pollution annually, which is valued at just over $9 million in healthcare savings. Toronto's urban forest removes about 1,430 tonnes of air pollution annually, which is valued at $16.1 million in healthcare savings.[42]
Habitat and Wildlife	
GREEN INFRASTRUCTURE BENEFIT	EXAMPLE OF ECONOMIC IMPACT
Habitat Improvement & Connectivity: Urban forests, vegetation and green roofs in the urban environment provide habitat for birds, mammals, amphibians, reptiles, and insects but also provides connectivity between habitats in surrounding areas. By reducing erosion and sedimentation, green infrastructure also improves habitat in small streams and watersheds. Larger-scale green infrastructure, such as parks and urban forests, helps to facilitate wildlife movement and connect wildlife populations between habitats.	Urban biodiversity has been shown to maintain pollinator habitat, which is critical for urban food production.[43] In the Lake Simcoe region of Ontario, the average annual value of pollination services was estimated to be $98 million.[44]
Communities	
GREEN INFRASTRUCTURE BENEFIT	EXAMPLE OF ECONOMIC IMPACT
Local economic growth & green jobs: As demand for green infrastructure skills increases, a range of new training and certification programs is emerging.	Five years after the implementation of the Green City, Clean Water program in Philadelphia, the local green stormwater infrastructure industry represents at least US$146.8 million in annual revenue, with an annual economic impact of approximately US$57 million within the city, supporting 430 local jobs and generating US$1million in local tax revenues.[45]
Increased Property Values: Property values increase when they are located adjacent to natural spaces.	In Boulder, Colorado, each foot a property is closer to a natural park increases the value of the property by US$4.20.
	Residential properties with trees and vegetation are valued higher compared to properties without.[46]

43 See Econsult Solutions submission to Philadelphia Sustainable Business Network, 2016, The Economic Impact of Green City, Clean Waters: The First Five Years; retrieved from: http://www.sbnphiladelphia.org/images/uploads/Green%20City,%20Clean%20Waters-The%20First%20Five%20Years%281%29.pdf

44 Health, Prosperity and Sustainability: The Case for Green Infrastructure in Ontario, published by Green Infrastructure Ontario Coalition and Ecojustice; retrieved from: https://www.ecojustice.ca/wp-content/uploads/2014/08/Health-Prosperity-and-Sustainability_The-Case-for-Green-Infrastructure-in-Ontario.pdf

45 See Canadian Forest Service, 2015, The Social and Economic Values of Canada's Urban Forests: A National Synthesis; retrieved from: http://forestry.sites.olt.ubc.ca/files/2015/06/CFSreport_Final_Table5Edits_20150605-v7.pdf

46 See Wilson, Sara J., 2008, Lake Simcoe Basin's Natural Capital: The Value of the Watershed's Ecosystem Services (pg 27); retrieved from: http://www.davidsuzuki.org/publications/downloads/2011/Lake-Simcoe-GreenbeltNaturalCapitalJune%2020_2_.pdf

FLOOD MITIGATION COST SAVINGS

A study by the NOAA (***National Oceanic and Atmospheric Administration)*** Coastal Service Centre assessed the economic benefits of green infrastructure as a method of reducing the negative effects of flooding in the Great Lakes Region. Through a series of economic modeling they determined that implementing green infrastructure to reduce peak stormwater discharges by only 10% resulted in reduced economic losses from flooding events by 39-46%.[47]

Triple Bottom Line Benefits in Lancaster, PA[48]

Lancaster, Pennsylvania has a population of 60,000 people and is located within the Conestoga River watershed. The city has both a combined sewer system and a municipal separate storm sewer system. During intense storms the combined sewer overflows discharge approximately 750 million gallons of untreated wastewater into Conestoga River. To address this problem the City estimated that it would need approximately US$250 million in grey infrastructure.

With the help of city, county and state agencies, the Green Infrastructure Plan (GI Plan) was released in 2011 and identified opportunities for adding green infrastructure throughout the city within 5-year and 25-year timeframes. The GI Plan estimated that long-term implementation of green infrastructure could reduce the average annual stormwater runoff in the study area by 1.05 billion gallons per year. A further case study completed by the US EPA concluded that while the plan to implement green infrastructure allowed for a cost savings of US$120 million in avoided capital costs in grey infrastructure, it also would provide benefits in terms of energy benefits, climate change benefits, and air quality benefits (Figure 5).

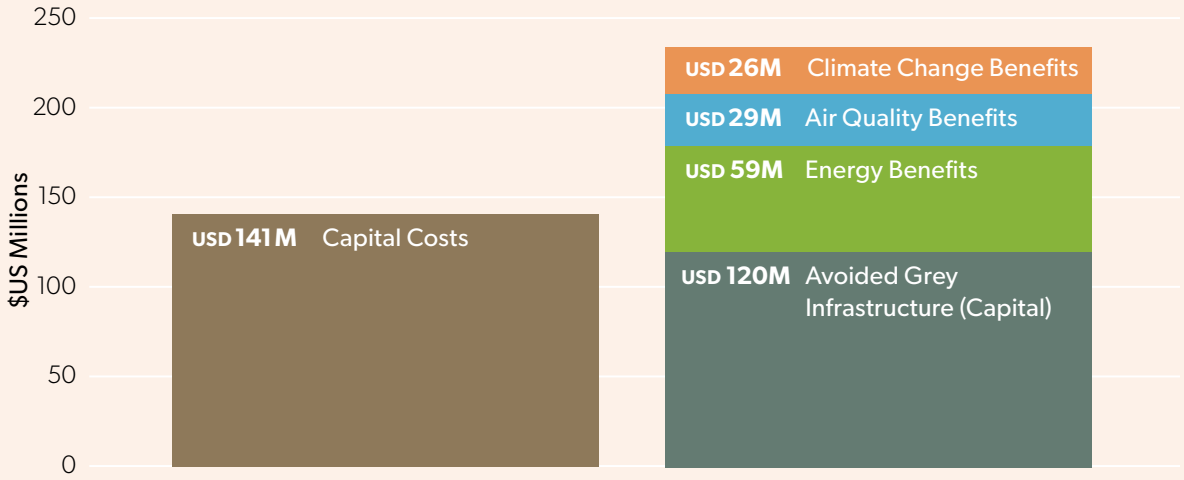


Figure 5: Costs & Benefits of Green Infrastructure in Lancaster, PA

47 NOAA, Eastern Research Group, Inc. (2014), Economic Assessment of Green Infrastructure Strategies for Climate Change Adaptation: Pilot Studies in the Great Lakes Region; retrieved from: https://coast.noaa.gov/data/digitalcoast/pdf/climate-change-adaptation-pilot.pdf

48 See The Economic Benefits of Green Infrastructure: A Case Study of Lancaster, PA (2014); retrieved from: http://www.epa.gov/green-infrastructure/economic-benefits-green-infrastructure-case-study-lancaster-pa

Section 1.4: An Integrated Approach to Implementing New Solutions

Stormwater user fees and green infrastructure are two potential solutions for local governments looking to make improvements to urban stormwater management as well as to climate change resilience and community health and liveability. But how is each of them best implemented? And how can local governments get optimal results through integrated implementation?

Implementing Stormwater User Fees

Although stormwater user fees are not yet common practice in Canada, over 1500 communities in the United States have implemented them.[49] While that number in Canada is less than two-dozen, it is growing. The three Canadian Case Studies included in Section 3 of this report illustrate the process through which local governments can implement stormwater user fees. Though each jurisdiction will go through a slightly different process, some implementation lessons can already be learned from the pioneering efforts of cities like Kitchener, Victoria, and Mississauga.

- ***Feasibility Study:*** An assessment of the existing stormwater management program and expected future requirements is key to determining the viability of the current method of financing and providing stormwater services. Mississauga, Kitchener, and Victoria all have recent examples of completed feasibility studies that point to stormwater user fees as the best funding option.
- ***Early & Meaningful Public Consultation and Engagement:*** There can be many misperceptions or misunderstandings about stormwater user fees, their rationale, and the impact on individuals and property owners. Local governments in all case studies held very comprehensive public consultation and engagement processes and noted that this was key to educating the public on the stormwater management service and getting the user fees adopted.
- ***Assessment of Resource Requirements:*** In many cases, upfront resource requirements were identified as a key consideration. Some programs required new (or newly dedicated) staff, while others required additional data in terms of aerial photography. The implementation of any new program will require resources, particularly in the early stages, and this needs to be considered early on.
- ***Consideration of timing, phasing, exemptions:*** The implementation of stormwater user fees has the result of re-distributing costs such that non-residential properties (commercial, institutional, industrial, etc.) will likely see a much larger bill or will be seeing a bill for the first time in the case of institutional properties. In many cases, local governments instituted a phased-in or delayed implementation schedule to allow property owners to adjust to the change. Exemptions generally are applied to very specific situations, such as properties that drain directly to the ocean in Victoria, BC.

49 Western Kentucky University, Stormwater Utility Survey; retrieved from: https://www.wku.edu/engineering/civil/fpm/swusurvey/

The design of the user fee rate structure and the inclusion of complementary credit programs are also important to the implementation of stormwater user fees. These are discussed in more detail in Section 2 of this report.

Incentives for Green Infrastructure – A Solution for Private Lands

The principal challenge for implementing green infrastructure for better urban stormwater management is increasing adoption of green infrastructure projects on private lands. While local governments can use tools such as stormwater master plans to promote green infrastructure projects on public lands, encouraging projects on private property requires a different set of tools. And these tools will be important for effective stormwater management, as a large portion of impervious surfaces within a community can be privately owned. For example, in Philadelphia, 55% of impervious surfaces are privately owned.[50] For better urban stormwater management, local governments need tools and incentives tailored to private landowners within their toolkit.

Incentivizing green infrastructure on private property, as well as being critical to community-wide stormwater management success, is also potentially more cost-effective compared to implementing projects on public property. In Philadelphia, it was found that implementing green infrastructure projects on private lands was as much as 67 per cent lower in cost, with private projects costing US$100,000 per greened acre[51] compared with US$250,000 – $300,000 per greened acre on public lands.[52] The higher cost of green infrastructure projects on public property is the result of requiring street closures, utility conflicts in public right-of-ways, managing competing needs for space, and coordination between multiple local government departments – none of which are as significant for private land projects.[53]

Incentives for green infrastructure on private properties have often been implemented alongside a stormwater user fee. They can also be implemented independently. The advantage of taking an integrated approach that includes stormwater user fees alongside incentives for green infrastructure on private lands is that the dedicated revenue stream created through the stormwater user fees can be plugged right back in to improving stormwater management and enhancing grey infrastructure with green infrastructure.

Section 2 of this report reviews in greater detail key incentives or tools that can be used to encourage green infrastructure projects on private property. A summary of these instruments is provided in Table 2.

50 Philadelphia Water Department, 2011, Green City, Clean Waters: The City of Philadelphia's Program for Combined Sewer Overflow Control Program Summary; retrieved from: http://www.phillywatersheds.org/doc/GCCW_AmendedJune2011_LOWRES-web.pdf

51 A "greened acre" is an acre of land that manages the first inch of stormwater runoff on site. See NRDC Issue Brief, 2015, Wanted: Green Acres – How Philadelphia's Green Acre Retrofit Program is catalyzing low-cost green infrastructure retrofits on private property; retrieved from: https://www.nrdc.org/sites/default/files/philadelphia-green-infrastructure-retrofits-IB.pdf

52 NRDC Issue Brief, 2015, Wanted: Green Acres – How Philadelphia's Green Acre Retrofit Program is catalyzing low-cost green infrastructure retrofits on private property; retrieved from: https://www.nrdc.org/sites/default/files/philadelphia-green-infrastructure-retrofits-IB.pdf

53 *ibid*

Table 2: Summary of Incentives and other Solutions for Green Infrastructure for Stormwater Management

Green Infrastructure Incentives	Description
Credit/Discount Program	A credit or discount applied to a stormwater user fee to reward property owners who implement green infrastructure best management practices that reduce their stormwater service requirements.
Rebates	A one-time payment provided to property owners to assist with specific projects, such as the purchase and installation of a rain barrel.
Stormwater Credit Trading	A market for stormwater management whereby an unregulated property owner can choose to create a credit by managing stormwater on their site, then selling that credit to property owners who are required to meet specific stormwater management requirements (*i.e.* retention of volume of water).
Development Cost Charges	Charge applied to new developments for the capital cost of stormwater services – may be reduced if green infrastructure is integrated into the development.
Public-Private Partnerships	An agreement between government and a private sector entity for the design, construction, and management of green infrastructure projects.

Section 1.5: Implementation in the Canadian Context

Canadian cities have been transitioning away from traditional stormwater management practices for a number of years. In British Columbia for instance, Integrated Stormwater Management Plans and Low Impact Development (LID) practices have been implemented in a number of communities.[54] Over 19 local governments and Metro Vancouver are part of the Water Balance Model partnership for British Columbia, which promotes the use of LID practices. The City of Vancouver developed a citywide Integrated Rainwater Management Plan (IRMP) that treats rainwater as a resource and includes a target to capture and treat 90% of Vancouver's average rainfall through green infrastructure.[55] The City of Toronto has implemented a wide range of tools to encourage green infrastructure, including a green roof by-law, Wet Weather Flow Master Plan, a Downspout Disconnection Program, an Eco-roof Incentive Program, and a Toronto Green Standard.

Although some Canadian cities are implementing stormwater user fees and are promoting green infrastructure as a new way to manage stormwater, they are not being implemented as widely as in the United States. Why?

The reason appears to be top-down regulations. In the U.S., it is unlawful under the Clean Water Act (CWA) to discharge any pollutant from a point source into navigable waters, unless a permit is obtained through the National Pollutant Discharge Elimination System (NPDES) permit program.[56] Individual homes that are connected to a sewer system or a municipal system do not require a permit, but any industrial, municipal or other facility does if it discharges directly to surface waters. Under the NPEDS, the US EPA also has a Combined Sewer Overflow (CSO) control policy that provides guidance to communities for how they can achieve CWA requirements and defines water quality standards.[57] Many of the U.S. leaders in implementing green infrastructure, such as Washington, D.C. and Philadelphia, are the cities that have had the worst CSO problems and have had to figure out the best way to meet strict CWA requirements.

The requirement to meet these strict discharge and water quality standards with limited financial resources has forced many cities in the U.S. to find innovative and efficient ways to manage stormwater. The case studies in this report on Philadelphia, Prince George's County, and Washington, D.C. showcase just a few examples. Canadian cities, on the other hand, do not have the same top-down regulatory requirement to act. However, they are just as pressured to find ways to be financially sustainable while also achieving environmental goals and improving stormwater infrastructure. They also face many similar challenges, including limited financial capacity, changing entrenched approaches, and overcoming obstacles to engaging private properties in green infrastructure programs.[58] There are also a number of cities that have continuing issues with combined sewer overflows. The opportunity therefore exists for Canadian cities to apply lessons learned from U.S. cities and achieve many of the same positive outcomes.

54 See Environmental Law Clinic, University of Victoria, 2010, Re-Inventing Rainwater Management: A Strategy to Protect Health and Restore Nature in the Capital Region; retrieved from: http://www.waterbucket.ca/rm/sites/wbcrm/documents/media/118.pdf

55 See City of Vancouver, Citywide Integrated Rainwater Management Plan, available at: http://vancouver.ca/home-property-development/city-wide-integrated-stormwater-management-plan.aspx

56 US EPA, 2015, Summary of the Clean Water Act; retrieved from: https://www.epa.gov/laws-regulations/summary-clean-water-act

57 US EPA, 2015, National Pollutant Discharge Elimination System (NPDES) – Combined Sewer Overflows (CSOs); retrieved from: https://www.epa.gov/npdes/combined-sewer-overflows-csos

58 See US EPA, 2010, Green Infrastructure Case Studies: Municipal Policies for Managing Stormwater and Green Infrastructure (Chapter 1); retrieved from https://www.epa.gov/green-infrastructure/policy-guides

Two Canadian reports have already articulated a need for better legislation and policy coordination to encourage the adoption of green infrastructure in our communities. The Green Infrastructure Ontario Coalition and EcoJustice released a report in 2010 on the case for green infrastructure in Ontario[59], while the POLIS Project and Environmental Law Clinic, both out of the University of Victoria, released a report in 2011 on a blueprint for reinventing rainwater management in Canada's communities.[60] Both reports identify provincial guidance, funding and coordination among provincial ministries as challenges for greater implementation of green infrastructure in Canada's communities.

This report does not provide in-depth analysis of how provincial legislation, or lack thereof, impacts the implementation of green infrastructure in Canadian communities. Further research will be required to identify the particular requirements within each provincial or territorial policy framework because it can have a significant impact on the cost-effectiveness of green infrastructure. If provincial or local government regulations and local standards do not acknowledge green infrastructure as a viable method for stormwater management, developers may be required to duplicate efforts with standard grey infrastructure just to comply, or experience delays in permitting approval processes, all of which will increase costs.

When green infrastructure was first being promoted by the US EPA, many communities argued that the Combined Sewer Overflow (CSO) and Municipal Separate Storm Sewer System (MS4) permitting process made it difficult to substitute green infrastructure as a method of meeting the requirements.[61] Since 2007, the US EPA's Office of Water has released a series of memos to support integrating green infrastructure into the National Pollutant Discharge Elimination System (NPDES) and CSO permitting requirements, making it easier for local governments.[62] Similar policy evolution may be required in the Canadian context.

59 Health, Prosperity and Sustainability: The Case for Green Infrastructure in Ontario, published by Green Infrastructure Ontario Coalition and EcoJustice; retrieved from: https://www.ecojustice.ca/wp-content/uploads/2014/08/Health-Prosperity-and-Sustainability_The-Case-for-Green-Infrastructure-in-Ontario.pdf

60 POLIS Project & Environmental Law Clinic, University of Victoria, 2011, Peeling Back the Pavement: A Blueprint for Reinventing Rainwater Management in Canada's Communities; retrieved from: http://www.polisproject.org/node/396

61 See page 7 of US EPA, 2010, Green Infrastructure Case Studies: Municipal Policies for Managing Stormwater with Green Infrastructure; retrieved from: https://www.epa.gov/green-infrastructure/policy-guides

62 See US EPA, Integrating Green Infrastructure into Federal Regulatory Programs; retrieved from: https://www.epa.gov/green-infrastructure/integrating-green-infrastructure-federal-regulatory-programs

Section 1.6: Implications for Canadian Local Governments

Local governments in Canada are in need of new solutions to manage urban stormwater in the face of increasing urbanization, aging infrastructure, a changing climate and limited financial capacity. The implementation of stormwater user fees can provide a dedicated, transparent and sustainable funding source while green infrastructure can reduce costs, minimize pollution, and lead to more liveable communities.

For local governments looking to make the change, this report highlights the following findings:

USER FEES CAN PUT STORMWATER FUNDING ON A MORE FINANCIALLY SUSTAINABLE FOOTING

A dedicated revenue stream will ensure that existing and future infrastructure requirements are not competing for resources. It will ensure that costs for stormwater services are open and transparent to residents, who will better understand their contribution to urban stormwater challenges, but also their ability to make positive changes through on-site stormwater reductions.

A COMBINATION OF USER FEES WITH GREEN INFRASTRUCTURE CAN PROVIDE AN INTEGRATED APPROACH FOR BETTER URBAN STORMWATER MANAGEMENT

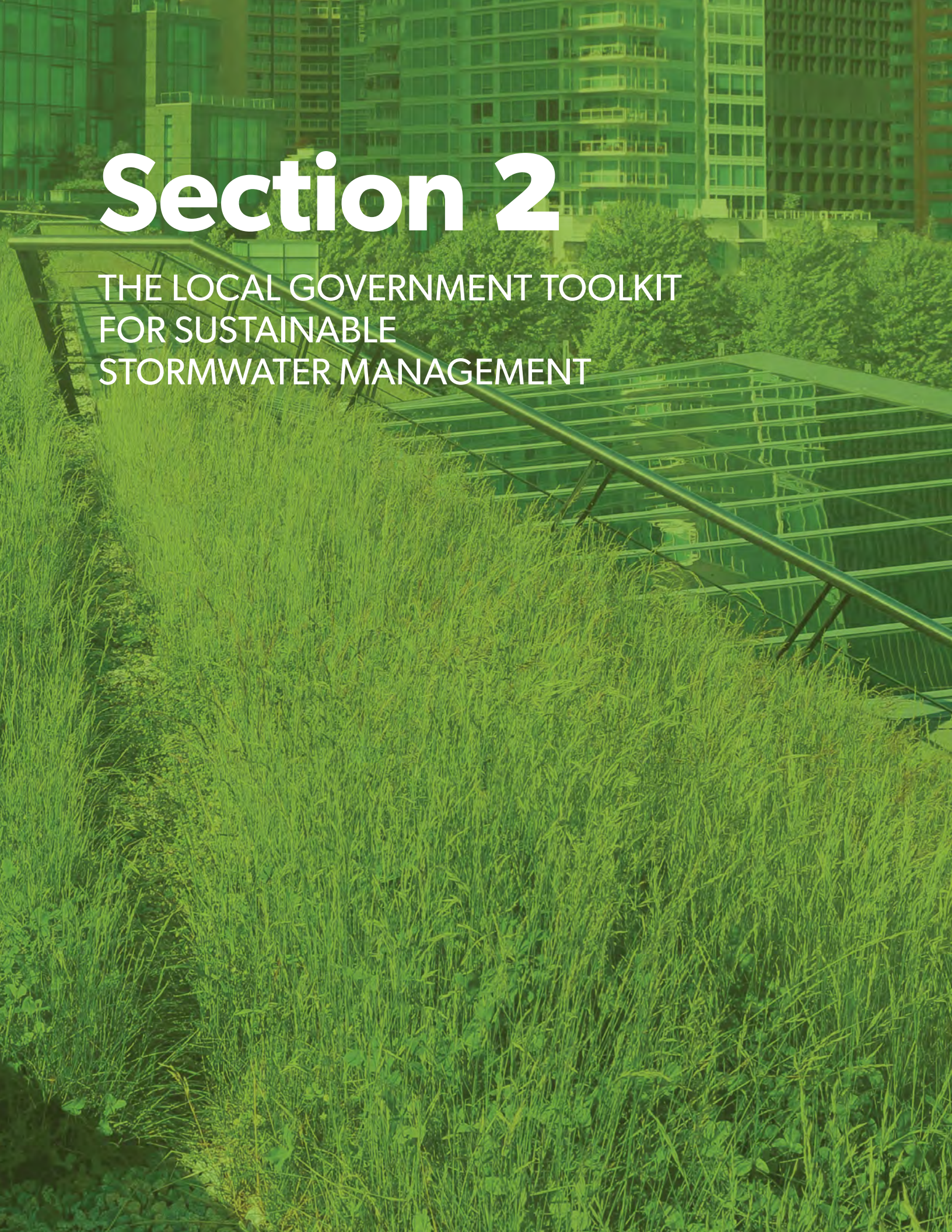
While each of the tools described in more detail in Section 2 of this report can individually help local governments address growing stormwater management challenges, an integrated program, using multiple different tools, is necessary to achieve ambitious goals. As described in the case studies, both Philadelphia, PA and Washington, D.C., have set very ambitious stormwater retention and management goals and have so far implemented a variety of incentive programs to achieve them. In their experience, a stormwater fee or regulation has proved a strong incentive for non-residential properties and new developments to incorporate green infrastructure, but has been less successful with residential properties. Residential property owners appear to be generally keen to implement green infrastructure but credit programs are sometimes not quite enough to overcome the up-front capital costs. A variety of programs, combined with a strong emphasis on monitoring and assessment, will be required to find the right programs for each local government.

APPROACHES SHOULD BE COMMUNITY SPECIFIC

The approach taken to enhance the resiliency of a community through the use of green stormwater infrastructure should be tailored for each community based on the unique community context, political context, landscape characteristics, existing infrastructure, and future vision. Each of the six case studies examined came to a different model for achieving natural stormwater management, reducing pollution, and increasing resiliency. There are many common factors, including the green infrastructure tools that are used, but the ways in which these tools are combined and used differs.

THE PRIVATE SECTOR CAN BE AN IMPORTANT PARTNER

The private sector can be an important partner that should be engaged early to determine how it could work with local governments to improve stormwater management. The investment by Prudential and the Nature Conservancy in the stormwater credit trading market in Washington, D.C. (see Section 3 case study) is a strong indication of the potential of private sector investment and partnerships. Similarly, Philadelphia found a 67% reduction in cost per greened acre by allowing private firms to 'bundle' green infrastructure across multiple private properties and Prince George's County is experiencing early successes through their P3 agreement. As the innovative approaches of stormwater credit trading and P3 partnerships gain momentum in the U.S., there is growing interest from the private sector in market instruments and collaborating with local governments for the benefit of all parties. Canadian local governments that are already looking for innovative solutions can harness this momentum.



Section 2

THE LOCAL GOVERNMENT TOOLKIT FOR SUSTAINABLE STORMWATER MANAGEMENT

Section 2.1: Tool #1 – Stormwater User Fees

Stormwater User Fees are charged directly to property owners and are based on the amount of stormwater runoff generated by the property. The approach is the same as how water and wastewater services are typically charged for by local governments, based on the actual consumption and production respectively by property owners. The stormwater user fee funding model moves towards a more equitable system because, in contrast to property tax, each and every property owner is charged based on individual usage of stormwater services.

The actual volume of stormwater produced by a site is difficult to measure because it does not come from a point source, like a water tap, but from non-point sources running off the land. Consequently, the volume of stormwater generated by a site, and in turn the level of stormwater service a site requires, depends on the characteristics of that site: How many structures are on the site? What is the area of impervious or hard surfaces? What kind of soil is present? Property owners themselves are likely unaware of how much stormwater their site generates.

Since the volume of stormwater running off a site cannot be directly measured or easily "metered", a proxy measure is generally used to estimate the volume. The method used most often is measuring or applying a metric for the amount of impervious surface on a site: impervious surface is the primary contributor of stormwater and this calculation method is seen as the most equitable way of estimating how much stormwater a site generates.[63] However, each community has a unique context and the stormwater volume calculation must be designed in a way that works within that context.

When designing a stormwater user fee, residential and non-residential properties are often treated separately because while residential properties are fairly similar, non-residential properties are so varied in size, land uses, and structure that it is difficult to compare or standardize. Residential properties, with the exception of size, are relatively comparable when it comes to structures and the area of impervious surfaces they contain.

There are a number of ways in which a stormwater user fee can be designed. The chosen design in the end will be dependent on the unique context of each community, its resources and capacity, land base, and the intended use of the funds (to provide a dedicated source of revenue, to encourage green infrastructure, or both). Table 3 gives a general description of the various methods for calculating stormwater user fees.

63 US EPA, 2010, Green Infrastructure Case Studies: Municipal Policies for Managing Stormwater with Green Infrastructure; retrieved from: https://www.epa.gov/green-infrastructure/policy-guides

Table 3: Summary of various methods for calculating stormwater user fee rates
(Adapted from: Kitchener-Waterloo Stormwater Management Program and Funding Review: Stormwater Funding Analysis – pg 29, source: http://www.waterloo.ca/en/contentresources/resources/living/stormwater_report_feasiblity_study.pdf)

SWU Fee Calculation Method	Description
Flat Fee:	A single fee is applied to all properties and does not vary according to usage of the property (*e.g.*, a charge of $5 per month per water meter account or $1000 per hectare of land)
Tiered Flat Fee:	A tiered flat fee is an extension of the flat fee that simply allows for various categories of the Flat Fee (*e.g.*, $5 per month per small residential property, $10 per month for a medium residential property, $15 per month for a large residential property)
Runoff Coefficient:	The runoff coefficient charge varies by property size and is based on an assumed coefficient that reflects stormwater runoff potential by property type (*e.g.*, residentially zoned properties are assigned a runoff coefficient of 0.4 and industrially zoned properties are assigned a runoff coefficient of 0.7).
Intensity of Development Factor (IOF):	The IDF is similar to the runoff coefficient billing method however adjustment factors are applied to account for the property's development status (*e.g.*, a factor of 0.0 for undeveloped properties, 1.0 for fully developed properties, and a factor between 0.0 and 1.0 for properties considered to be underdeveloped within their underlying zoning category).
Equivalent Residential Unit (ERU):	The ERU requires a statistical sampling of measured impervious area for residential dwelling units to be performed to determine the average ERU size (*i.e.*, square meters of impervious area). The average impervious area for all types of residential dwelling units becomes the base billing unit. Charges for residential properties are based on assigning one stormwater billing unit to each residential dwelling unit, regardless of density. Given the wide variability in impervious area statistics for non-residential properties, the impervious area for each non-residential property is measured. The charge for non-residential properties is determined by dividing the measured impervious area by the average ERU size.
Single Family Unit (SFU):	Similar to the ERU, a statistical sampling of measured impervious area for single-family detached homes only is performed to determine the average SFU size (*i.e.*, square meters of impervious area). The average impervious area for single-family detached homes becomes the base billing unit with one stormwater billing unit assigned to each single-family detached home and fractional billing units assigned to other residential property types. Multi-family residential properties such as apartments, condominiums, and townhouses have a smaller SFU size than single-family detached homes. The charge for non-residential properties is determined by dividing the measured impervious area by the average SFU size.
Tiered Residential Rate (e.g., Tiered SFU):	The Tiered SFU (or ERU) billing unit method extends the SFU (or ERU) method by accounting for the wide variability in impervious area among residential properties by assigning multiple tiers to single-family detached homes (*e.g.*, Small, Medium and Large). The number of categories for multi-family residential properties can also be extended to distinguish high-rise apartments and condos, for example.
Level-of-Service/ Geography Base:	The ERU and SFU billing unit methods can be extended to include separate rate structure calculations that vary by the level of service provided within distinct geographical boundaries (*e.g.*, a higher rate in urban areas that receive more frequent O&M activities and facilities that provide a higher level of flood protection than in rural areas).
Impervious Area Measurement	(Complete Coverage): the most accurate of all billing unit methods is to measure the impervious area of all properties within a given jurisdiction.

Each of these methods for applying stormwater user fees succeeds in creating a dedicated revenue stream for stormwater management. Where they differ is the accuracy with which they calculate the actual volume of stormwater runoff generated by a site (see Figure 6), and the related administrative burden. The flat rate, for example, requires a minimum amount of administrative effort but also does not calculate the volume of stormwater generated as accurately and fairly as a direct impervious area measurement.

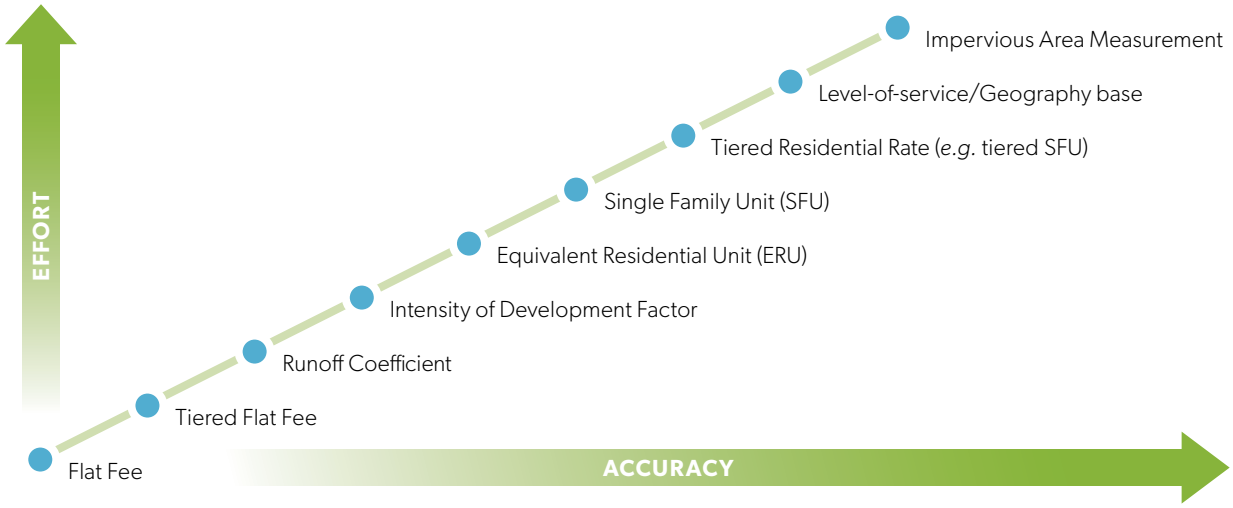


Figure 6: Differences in accuracy and effort for each of the stormwater user fee calculation methods

The most commonly used calculation methods (flat rate, equivalent residential unit (ERU), and amount of impervious surface area) and the pros and cons of each are discussed in more detail below.

CASE STUDY HIGHLIGHT:

In January 2011, the City of Kitchener implemented a stormwater user fee. The process began with a 2007 report on Stormwater Needs and Expenditures followed by a 2008 Stormwater Funding Analysis. The stormwater user fee provided a dedicated funding source, a fair and equitable distribution of costs, and the potential for a credit program to incentivize owners to reduce stormwater.

See the City of Kitchener Case Study in Section 3 for more details.

Stormwater User Fees in the United States

Since 2007, Western Kentucky University has been producing an annual inventory of jurisdictions across the U.S. that have stormwater utilities, including their respective designs and challenges.[64]

In the report, stormwater utility and stormwater user fee appear to be interchangeable terms. The latest inventory in 2016 has found over 1500 stormwater user fees located in 40 states and the District of Columbia (see Figure 7). It also identifies a total of 21 Canadian communities that have some form of stormwater user fee or flat rate (See Figure 8).

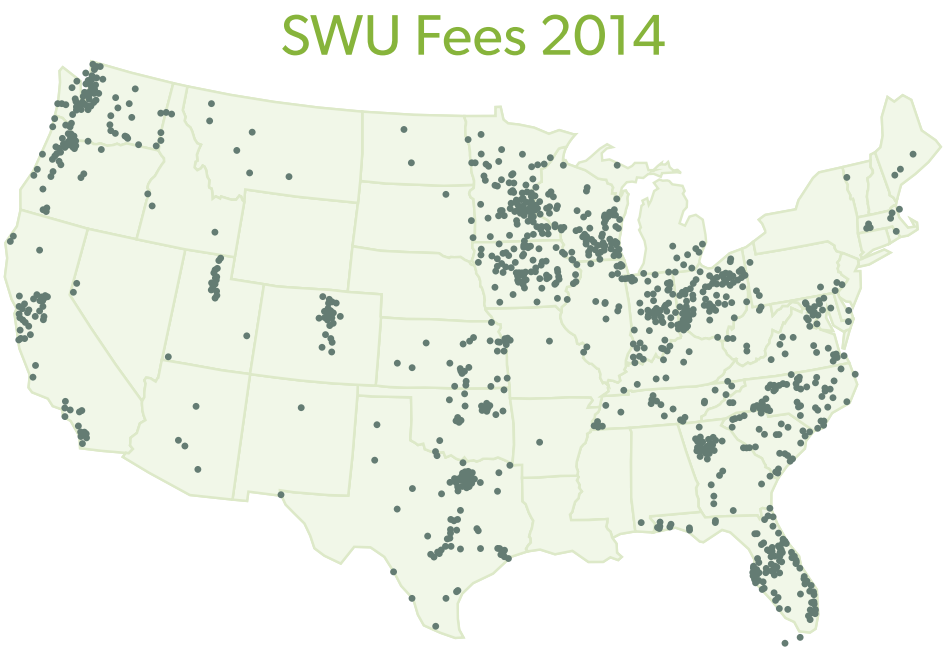


Figure 7: Distribution of Stormwater User Fees in the United States as of 2014
(Data credit: Western Kentucky University, 2016, source: https://www.wku.edu/engineering/civil/fpm/swusurvey)

64 Western Kentucky University, Stormwater Utility Survey; retrieved from: https://www.wku.edu/engineering/civil/fpm/swusurvey/

Stormwater user fees in Canada

No.	Community	Province	Type of Stormwater Fee
1	Halifax	Nova Scotia	Equivalent Residential Unit (ERU)
2	London	Ontario	Fee based on Property Size
3	Aurora	Ontario	Flat Rate (per unit)
4	Saint Thomas	Ontario	Flat Rate
5	Kitchener	Ontario	Single Family Residential Unit (SFRU)
6	Mississauga	Ontario	Single Family Residential Unit (SFRU)
7	Waterloo	Ontario	Tiered Flat Rate
8	Richmond Hill	Ontario	Tiered Flat Rate
9	Regina	Saskatchewan	Flat Rate (based on property size)
10	Saskatoon	Saskatchewan	Equivalent Residential Unit (ERU)
11	Calgary	Alberta	Flat Rate
12	Edmonton	Alberta	Intensity Factor & Runoff Coefficient
13	Saint Albert	Alberta	Flat Rate
14	Strathcona County	Alberta	Flat Rate
15	Langley	British Columbia	Stormwater Levy
16	Pitt Meadows	British Columbia	Flat Rate
17	Richmond	British Columbia	Flat Rate
18	Surrey	British Columbia	Flat Rate
19	Victoria	British Columbia	Impervious Area
20	West Vancouver	British Columbia	Tiered Flat Rate
21	White Rock	British Columbia	Runoff Factor & Annual Flat Rate

Figure 8: Adapted from University of Western Kentucky Summary of Canadian Communities with Stormwater User Fees as of 2016 (Data credit: Western Kentucky University, 2016, source: https://www.wku.edu/engineering/civil/fpm/swusurvey/swus2016.pdf)

Flat Rate

A flat rate charge for stormwater is a common starting point for many local governments because it is easy to administer and requires fewer resources to implement. It is a single rate that is applied to a group of properties. The key difference between a flat rate and an Equivalent Residential Unit (ERU), which is discussed in the next section, is that the flat rate is not based on any measurement of impervious area. Generally, it is calculated by dividing the total cost of the stormwater program by the total number of units that will be charged (or some variation on this).

ADVANTAGES OF THE FLAT RATE METHOD

The Flat Rate calculation method for a stormwater user fee is easy to administer compared to the other calculation methods. The local government will still need to understand the total costs for the stormwater program and the number of properties that will be charged, but the GIS resources, staff time and other processes required for the more detailed calculation methods are not necessary. Local governments that have a large number of residential properties can increase the equity of the charge by applying a tiered flat rate. This requires additional effort, as the residential properties must now be allocated into the appropriate tiers.

DISADVANTAGES OF THE FLAT RATE METHOD

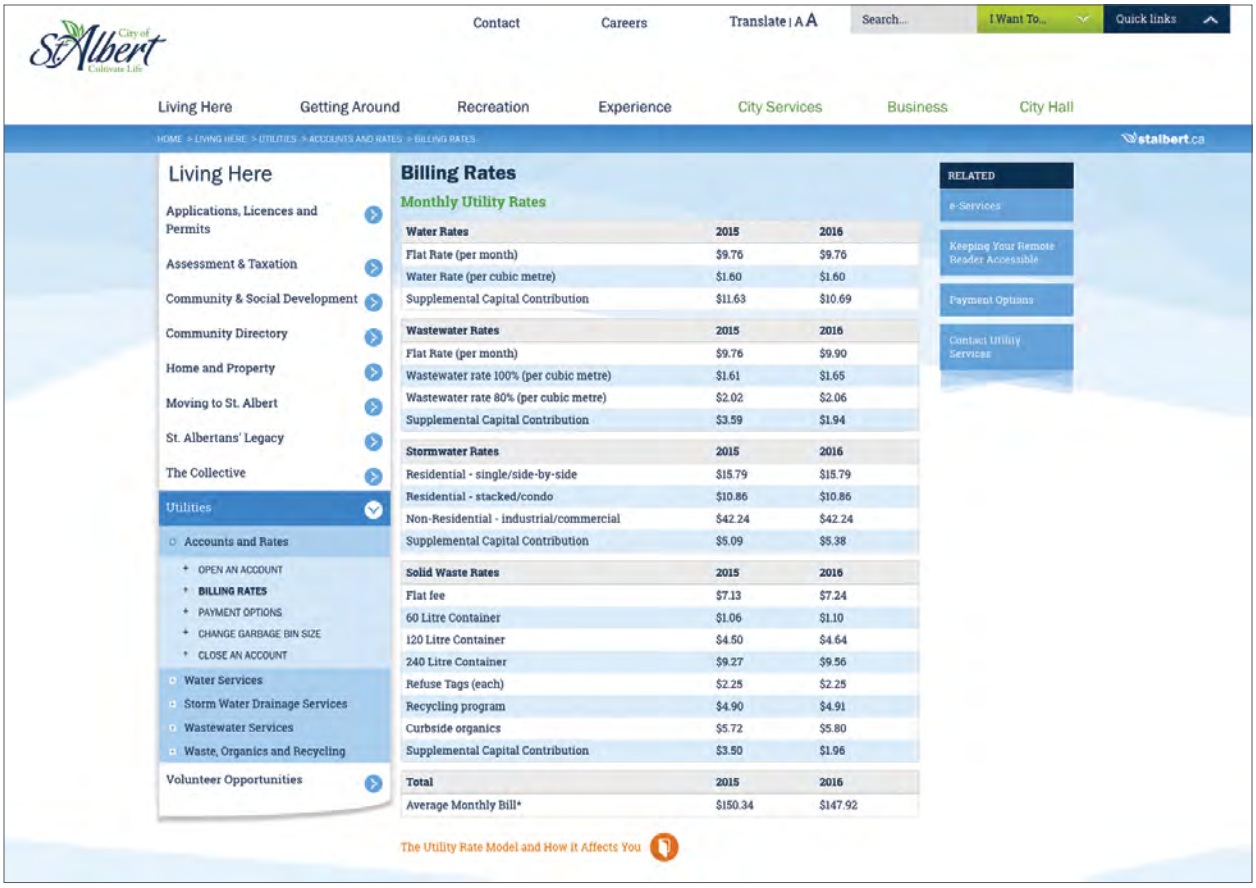
The Flat Rate stormwater fee generally does not achieve a greater level of fairness because each property is charged the same rate, regardless of the amount of stormwater runoff generated, making it similar to a property tax or water meter charge.

There is also concern that the Flat Rate approach is too similar to a tax. In the Kitchener-Waterloo Stormwater Funding Analysis, the Flat Rate calculation method was not evaluated as a potential option because it was noted that there is case law in the U.S. Supreme Court cases that determined that a flat rate method did not meet the requirement of charging for service provided.[65] The same could be argued within a Canadian law context as justification for a stormwater user fee that is supposed to be based on the ability of a local government to charge for services provided.

CANADIAN EXAMPLE

The City of St. Albert, Alberta has a tiered flat rate stormwater fee, as shown in Figure 9 from their website. There is a different monthly flat rate for residential (single), residential (condo), and non-residential (industrial/commercial), with rates ranging from $10.86/mth to $42.24/mth (2016 figures).

65 Kitchener-Waterloo, 2007, Kitchener-Waterloo Stormwater Management Program and Funding Review: Stormwater Funding Analysis; retrieved from: http://www.waterloo.ca/en/contentresources/resources/living/stormwater_report_feasiblity_study.pdf



Water Rates	2015	2016
Flat Rate (per month)	$9.76	$9.76
Water Rate (per cubic metre)	$1.60	$1.60
Supplemental Capital Contribution	$11.63	$10.69
Wastewater Rates	**2015**	**2016**
Flat Rate (per month)	$9.76	$9.90
Wastewater rate 100% (per cubic metre)	$1.61	$1.65
Wastewater rate 80% (per cubic metre)	$2.02	$2.06
Supplemental Capital Contribution	$3.59	$1.94
Stormwater Rates	**2015**	**2016**
Residential - single/side-by-side	$15.79	$15.79
Residential - stacked/condo	$10.86	$10.86
Non-Residential - industrial/commercial	$42.24	$42.24
Supplemental Capital Contribution	$5.09	$5.38
Solid Waste Rates	**2015**	**2016**
Flat fee	$7.13	$7.24
60 Litre Container	$1.06	$1.10
120 Litre Container	$4.50	$4.64
240 Litre Container	$9.27	$9.56
Refuse Tags (each)	$2.25	$2.25
Recycling program	$4.90	$4.91
Curbside organics	$5.72	$5.80
Supplemental Capital Contribution	$3.50	$1.96
Total	**2015**	**2016**
Average Monthly Bill*	$150.34	$147.92

Figure 9: Screenshot of the St. Albert Monthly Billing Rates for water, wastewater and stormwater (Source: https://stalbert.ca/living-here/utilities/accounts-and-rates/billing-rates)

Equivalent Residential Unit (ERU)/Single-Family Residential Unit (SFRU)

The Equivalent Residential Unit, or ERU, is the most commonly used method to calculate stormwater user fees. Of the over 1500 communities in the United States that have a stormwater user fee, over 80% of them use the ERU method.[66]

The ERU is calculated through a statistical sampling of measured impervious area for residential dwellings to determine the average ERU size (*i.e.*, square meters of impervious area). This average impervious area becomes the base billing unit against which all other charges are calculated. As a result, all other residential properties will be charged one billing unit and other properties (such as commercial and industrial) will be charged a factor of this base unit.

66 Western Kentucky University, Stormwater Utilities Survey; retrieved from: https://www.wku.edu/engineering/civil/fpm/swusurvey/

The Single-Family Residential Unit (SFRU) calculation method is the same as the ERU method except that only single-family residences are used to come up with the average impervious area.

As with a Flat Rate fee, the ERU and SFRU methods can be tiered to account for variation in residential property sizes. This increases the fairness of the overall calculation but also increases the effort required.

ERU ADVANTAGE

As a method for calculating stormwater user fees, the ERU method sits in the middle in terms of administrative requirements and accuracy. Because the ERU method does not require the measurement of the area of impervious surfaces for every single property, it can reduce the overall administration effort and costs. Accuracy can be increased by incorporating tiers into the residential groups, as the City of Kitchener has done in Figure 10. By acknowledging that a small residential property is likely to contribute less stormwater to the system overall compared to a larger residential property, the tiered ERU method provides a bit more flexibility.

ERU DISADVANTAGE

The ERU method still assumes that most residential properties are similar in the stormwater runoff they produce, even if a tiered system is used. Since two properties of similar size can in fact have very different stormwater runoff depending on lot properties, the ERU method is not the most accurate method. This reduces the fairness of the fee and also does not encourage property owners to assess and/or reduce their impervious surfaces, as they will not see a reduced charge (unless combined with a credit/discount program).

CANADIAN EXAMPLE – CITY OF KITCHENER, ONTARIO

The City of Kitchener, Ontario, uses a tiered SFU method of calculating stormwater user fees, though it is also described as a tiered flat rate in some City documents. Figure 10, taken from the City of Kitchener's Stormwater Rate website, lists the fee structure as of March 1, 2016. It illustrates how various property types, including non-residential properties, are charged.

Stormwater rate structure – City of Kitchener

Stormwater Classification Code	Basis for Charge	2016 Monthly Charge
Residential Single Detached – *Small*	Detached homes with building footprint* size of 105 m² or less	$6.86
Residential Single Detached – *Medium*	Detached homes with building footprint* between 106–236 m²	$11.44
Residential Single Detached – *Large*	Detached homes with building footprint* size of 237 m² or more	$15.04
Residential Townhouse/Semi-Detached	Per dwelling unit	$8.17
Residential Condominium	Per dwelling unit	$4.56
Multi-Residential duplex	Per building	$9.16
Multi-Residential triplex	Per building	$13.75
Multi-Residential four-plex	Per building	$18.30
Multi-Residential five-plex	Per building	$22.89
Multi-Residential (>5 units)	Per property (according to number of dwelling units)	$2.29
Non-Residential Smallest	26–1,051 m² of impervious area	$21.89
Non-Residential Small	1,052–1,640 m² of impervious area	$58.53
Non-Residential Medium-Low	1,641–7,676 m² of impervious area	$153.56
Non-Residential Medium-High	7,677–16,324 m² of impervious area	$447.68
Non-Residential Large	16,325–39,034 m² of impervious area	$1,085.03
Non-Residential Largest	39,035 m² or greater of impervious area	$2,329.31

Figure 10: The City of Kitchener Stormwater Rate Structure, as of March 1, 2016 is an example of a tiered SFU calculation method (Source: http://www.kitchener.ca/en/livinginkitchener/stormwater_utility.asp)

Impervious Area

The Impervious Area calculation method charges a fee to every property based on the total amount of impervious surface the property has. There is no average billing unit, as in the ERU or SFRU methods. Impervious Area calculations can differ in what surfaces are included and measured. Rooftops of all structures are generally included, but the treatment of driveways, sidewalks, and other hard surfaces can vary. Typically, the calculation is completed with the use of aerial imagery and GIS software, in addition to ground-level evaluations.

ADVANTAGES OF THE IMPERVIOUS AREA METHOD

The Impervious Area calculation is the most accurate method of determining the charge for stormwater user fees because each property is individually assessed. However, the data requirements of this method make it the most administratively complex method. How much effort this requires will depend on what type of information the local government already has. If the local government already has aerial imagery of every property that can easily be measured for impervious surface area, the overall effort will be much less compared to a local government that must start from scratch. Discrepancies between aerial imagery and existing site characteristics can be assessed on a site-by-site basis.

The Impervious Area calculation is the most fair of all methods because it does not assume that all residential properties are the same and it rewards properties that have maintained more natural stormwater assets with lower stormwater charges. Consequently, this method also has the potential to encourage more landowners to reduce the amount of impervious surfaces in order to reduce their costs.

IMPERVIOUS AREA DISADVANTAGES

A significant amount of staff time, GIS and aerial imagery capacity, and billing rate administration are required to start the program, and additional resources are also required to maintain the program. Aerial imagery must be updated fairly regularly to ensure that the accuracy of the charge is maintained for all properties.

CANADIAN EXAMPLE – CITY OF VICTORIA

The City of Victoria has implemented a stormwater user fee based not only on impervious area for each property, but also based on site-specific factors. The fee considers: Impervious Surface Factor (total area of all impervious surfaces), Street Cleaning Factor (based on street frontage of the parcel and classification of street), Intensity Code Factor (based on property classification), and Codes of Practice Factor (specific businesses subject to additional cost).

The City of Victoria also calculates the impervious area for each property based on all hard surfaces including roofs, driveways and other paved surfaces. The City of Kitchener, on the other hand, uses the SFU method and only measures the impervious surface of a residential property based on roof area (see Figure 11).

Delineation of the rooftops and sheds/garages on a number of residential properties.

Figure 11: Example of impervious surface area calculation from the City of Kitchener for residential properties (Source: http://www.kitchener.ca/en/livinginkitchener/resources/StormwaterFAQ_Nov_1_2011.pdf)

Structures outlined in blue are used to calculate impervious surface area.

Common Considerations for Stormwater User Fee Programs

While there are many different ways in which a stormwater user fee can be calculated, a number of common considerations are relevant to all programs.

APPEALS PROCESS

A common consideration is the inclusion of an appeals process. Although less likely to be used under a flat rate fee structure, the appeals process is very important for the impervious area calculation. The process allows property owners to confirm the information that the local government is using to calculate fees and to apply for changes if required. Philadelphia has developed an online mapping tool[67] that allows residents to search for a specific property and see how a stormwater charge was calculated. Figure 12 shows the impervious roof area (yellow), other impervious area (pink) and leaves all other areas and publicly owned lands (roads, etc.) untouched. This allows residents to see how they are being charged and make an appeal if they feel it is incorrect.

67 See Philadelphia Water Stormwater Billing Parcel Viewing available at: http://www.phila.gov/water/wu/stormwater/Pages/default.aspx

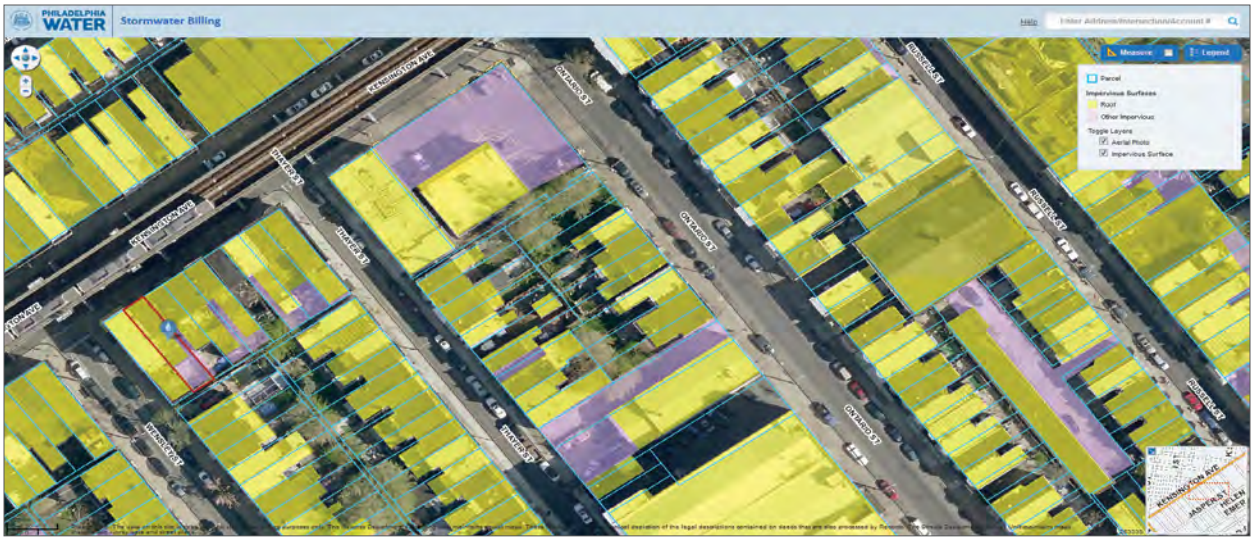


Figure 12: Example screen shot of the Philadelphia Water Stormwater Billing Online Tool (Source: http://www.phila.gov/water/swmap)

ASSISTANCE PROGRAM

Though the implementation of a stormwater user fee does not necessarily result in a higher overall payment by an individual property owner, in some instances it can. Some local governments maintain their property tax rates despite shifting stormwater services out of general revenue. Even where the user fee is implemented in a revenue neutral context, meaning that citywide property tax revenues are reduced to offset user fee revenues (as in The City of Victoria), this does not necessarily translate into revenue neutrality for ***individual*** property owners. Consequently, low-income families or seniors on fixed incomes may be particularly sensitive to implementation of stormwater fees.

EXEMPTIONS

In some cases, exemptions to the stormwater fee will be required, either for technical or political reasons. In the City of Mississauga, exemptions for the stormwater fee are granted to properties that drain directly outside of the City's jurisdiction, usually either draining into Lake Ontario or directly into another municipality.[68] The City of Mississauga also reduces or eliminates the stormwater charge for legal places of worship and veterans' organization properties, through the provision of a subsidy grant.[69] Mississauga is also in the process of developing a Stormwater subsidy for working farms, low-income seniors, and persons receiving disability benefits who live in single-family homes.

68 Personal conversation with City of Mississauga staff and The Corporation of the City of Mississauga, Stormwater Fees and Charges Bylaw 135-15; retrieved from: http://www7.mississauga.ca/documents/bylaws/Stormwater_Fees_and_Charges.pdf

69 See The Corporation of the City of Mississauga, Stormwater Fees and Charges Bylaw 135-15 (Section 13); retrieved from: http://www7.mississauga.ca/documents/bylaws/Stormwater_Fees_and_Charges.pdf

PHASED-IN TRANSITION

The implementation of a stormwater fee distributes the costs of stormwater management services more equitably among those who generate stormwater runoff. The side effect of this more equitable distribution is that properties that previously have been under-paying for stormwater services face cost increases. And in some cases that price increase can be significant. In order to alleviate the financial burden on these properties, a phased-in approach can be used. The City of Victoria is using a phased in a payment schedule for properties that were previously tax exempt.[70] For the first year, the fee payable is one-third the total amount, the second year requires two-thirds payment, and the full payment is due in the third year. Philadelphia included a similar transition for non-residential properties, phasing in the full payment over four years.

SETTING THE RATE

Regardless of how stormwater fees are calculated, if the fee is set too low then it will not cover the full program costs. For example, the City of St. Albert, AB, has had a Flat Rate stormwater fee in place since 2003, but in 2014 introduced an Updated Fiscal Policy and Utility Rate Model that now requires the City's utilities to be fully funded by utility consumers and to be sustainable in the future.[71] Consequently, the local government implemented supplemental capital contribution fees for each of water, wastewater, stormwater and solid waste services to replace grant funding for utility infrastructure replacement.

CREDIT/DISCOUNT PROGRAM

As discussed in the next section, the main consideration in developing a stormwater user fee program is the inclusion of a credit or fee discount program. Typically, all stormwater fee programs include a program that allows owners to reduce their charge through the implementation of best practices (these programs are discussed in more detail in the following section).

70 City of Victoria, 2015, Sanitary Sewer and Stormwater Utilities Bylaw, Bylaw No. 14-071 (section 10); retrieved from: http://www.victoria.ca/assets/City~Hall/Bylaws/Sanitary%20Sewer%20Stormwater%20Utilities%20Bylaw_14-071.pdf

71 See City of St. Albert, Utility Fiscal Policy Information Documents; available at: https://stalbert.ca/uploads/PDF-newsletters/Utilities_UtilityRateChanges_Factsheet2.pdf

Section 2.2: Tool #2 – Credit/ Fee Discount Programs

In order to further incentivize property owners to reduce stormwater runoff, local governments can complement stormwater user fees with credit or fee discount programs that reward best practices. These kinds of programs can reduce property owners' stormwater costs while also reducing the strain on the community's stormwater infrastructure.

The credits are typically defined as a percentage reduction in the monthly stormwater fee that is consistent with the level of implementation of one or more Best Management Practices (BMPs) for green infrastructure, such as a rain garden or rain barrel, permeable pavement, or downspout disconnection. This approach is different from a rebate (see Section 2.3) in that a credit program implies a continuous reduction on the monthly stormwater fee, whereas a rebate program is a one-time payment. The credit amount available (or the percentage discount permitted) and the eligible properties can vary greatly between cities (see Table 4).

Table 4: Examples of stormwater credit programs

City	Credit Program
Portland, Oregon	Through the Clean River Rewards Program, property owners can receive a 100% discount on their stormwater fee if they can demonstrate that they manage all stormwater on-site.[72] Both residential and non-residential properties are eligible.
Kitchener, Ontario	The Stormwater Credit Program allows for a maximum 45% discount on the fee for both residential and non-residential properties.[73] The credit program was approved in March 2012 and it is retroactive to when the stormwater fee went into effect in 2011.
Minneapolis, Minnesota	The City's Stormwater Credit Program provides incentives for water quality and for water quantity. Owners can receive up to 50 % credit (reduction) for management tools/practices that address water quality and 50 % or 100 % credit (reduction) for management tools/practices that address stormwater quantity. The maximum credit cannot exceed 100%.[74]
Victoria, BC	The Rainwater Management Credit Program provides credits to owners who either construct and maintain stormwater retention and water quality facilities on their property, or who provide educational programs on rainwater management. Low density residential owners can receive up to a 10% discount, while multi-family, civic/institutional, or commercial/industrial owners can receive up to 40% discount (or 50% if including an additional educational program).[75]

72 City of Portland, Clean River Rewards Program – Program Overview; retrieved from: https://www.portlandoregon.gov/bes/article/390568

73 See City of Kitchener, Stormwater Credits; retrieved from: http://www.kitchener.ca/en/livinginkitchener/Stormwater_credits.asp

74 City of Minneapolis, Stormwater Credit Program; retrieved from: http://www.ci.minneapolis.mn.us/publicworks/stormwater/fee/stormwater_fee_stormwater_mngmnt_feecredits

75 City of Victoria, 2015, Sanitary Sewer and Stormwater Utilities Bylaw, Bylaw No. 14-071 (section 10); retrieved from: http://www.victoria.ca/assets/City~Hall/Bylaws/Sanitary%20Sewer%20Stormwater%20Utilities%20Bylaw_14-071.pdf

Eligible Properties

A main consideration for a stormwater fee credit program is which property types are eligible. Most credit programs apply to non-residential properties because these are typically the properties that contribute the most stormwater to a system and have the greatest potential to impact significant runoff reductions through best practice implementation. Because of the comparatively smaller potential impact of residential properties, many local governments have elected to not include credit programs for residential properties. For example, Mississauga and Philadelphia have both opted to not include residential credit programs: the administrative effort to implement a residential credit programs was determined to be too high in comparison to the benefits that would be received from those properties implementing BMPs. As well, many local governments that offer credits are finding low uptake of the credit by residential properties.

In Mississauga, Ontario, the current credit program does not apply to residential properties, but the City did initiate a consultation process to determine how to encourage and recognize residential efforts to reduce stormwater impact.[76] As a result, Mississauga is currently developing a stormwater home visit program for residential properties in which property owners can have a stormwater professional conduct a visit to their home and provide site-specific recommendations for how the resident can implement BMPs that both reduce pressure on the City's Stormwater system and reduce the property's flood risk.[77]

Discount Percentage

As demonstrated in Table 4, the discount available through a credit program can also vary substantially. In Portland, residents are eligible for up to 100% discount on stormwater fees but in Victoria residents are limited to 10% or 50%, depending on property type.

There are generally two key factors to consider when determining the discount percentage:

- If the stormwater fee is to provide revenue for the entire stormwater management program, how much of a base fee is required to maintain a sustainable level of service given existing program requirements?
- If the goal of the credit program is to encourage green infrastructure, the fee reduction has to provide a financial incentive for installing the green infrastructure that overcomes the upfront capital cost.

The City of Kitchener, in their Credit Policy Development, determined through financial analysis that, given existing costs associated with replacing and maintaining the existing municipal stormwater infrastructure, a 45% maximum credit amount for all properties was appropriate.[78] Philadelphia, on the other hand, initiated an 80% credit program in order to encourage green infrastructure projects.

Impact of Credit Programs on Green Infrastructure Projects

The effectiveness of stormwater credit programs in actually encouraging the implementation of green infrastructure projects on private properties is not fully proven. In Philadelphia, for example, even though its stormwater fee was the

76 See City of Mississauga Newsroom media release, dated November 18, 2015 (http://www.mississauga.ca/portal/cityhall/pressreleases?paf_gear_id=9700020&itemId=5300806q) and also recent news article in The Mississauga News, dated April 14, 2016 (http://www.mississauga.com/news-story/6497248-stormwater-charge-credits-inch-closer-to-reality/)

77 Based on personal conversation with City of Mississauga staff

78 City of Kitchener – Credit Policy Development Memorandum #6, dated December 23, 2011; retrieved from: https://www.kitchener.ca/en/livinginkitchener/resources/SWCPFINALMemo6.pdf

highest in the U.S. and property owners were eligible for up to an 80% fee reduction for the installation of green infrastructure projects, the City did not see the results they were hoping for, largely because the transaction costs of participation were too large for individual property owners.[79] This prompted them to try an innovative approach through the Stormwater Management Incentives Program (SMIP) and the Green Acre Retrofit Program (GARP). Similarly, the City of Kitchener is not experiencing significant uptake of its new credit program, which has forced the City to re-examine its fee and credit program designs.

Education and Outreach Opportunities

Although the potential impact of stormwater credit programs on the implementation of green infrastructure projects on private property is not fully understood, other benefits are well documented. Many local governments, including Mississauga, Kitchener, Philadelphia, and Washington, emphasize that implementing the stormwater credit program along with their stormwater user fees, presents an invaluable opportunity to educate the public on stormwater management and green infrastructure. By encouraging community members to consider what a new stormwater fee means, why they are being charged, and what they can do to reduce their costs, local governments are ensuring that more people are aware of stormwater, what the stormwater system actually is, how their property is serviced by the system, and their own personal contribution to the system. This way, when other incentive mechanisms, like the ones discussed next in our report, are implemented, more people will understand why those incentives are being offered and how they can take advantage of them.

CASE STUDY HIGHLIGHT

The City of Victoria's stormwater user fee incentive program is called the Rainwater Rewards Program. Residential properties can obtain up to a 10% discount, while non-residential properties can obtain a maximum 40% discount, or 50% if they include an educational component.[80] The discount expires after five years, upon which time it must be renewed.

As part of the Rainwater Rewards program, residential properties are also eligible for one-time rebates to cover the up-front costs of installing green infrastructure.[81] The rebate program has a maximum fund of $75,000 per year. Each property can apply for multiple rebates but only for one of each project. For example, one property could apply for one rain barrel, one rain garden, and one permeable pavement, but not multiple rain gardens or multiple driveways.

Even though the stormwater user fee does not come into effect until the Fall of 2016, the City has already received 40-50 Rainwater Rewards applications.[82]

See The City of Victoria Case Study in Section 3 for more details.

79 NRDC Issue Brief, 2015, Wanted: Green Acres – How Philadelphia's Green Acre Retrofit Program is catalyzing low-cost green infrastructure retrofits on private property; retrieved from: https://www.nrdc.org/sites/default/files/philadelphia-green-infrastructure-retrofits-IB.pdf

80 City of Victoria, Sanitary Sewer and Stormwater Utilities Bylaw, Bylaw No. 14-071; retrieved from: http://www.victoria.ca/assets/City~Hall/Bylaws/Sanitary%20Sewer%20Stormwater%20Utilities%20Bylaw_14-071.pdf

81 See City of Victoria, Rainwater Management Standards, Do-It-Yourself for Your Home; retrieved from: http://www.victoria.ca/assets/Departments/Engineering~Public~Works/Documents/SWVictoria_DIY_Rainwater_Mgmt_Stds_June2015.pdf

82 Personal conversation with City Staff, April 2016

Section 2.3: Tool #3 – Rebates

Grants or rebates differ from credit programs in that they are a one-time payment. An example of a rebate program is the City of Guelph, Ontario Rainwater Harvesting System Rebate.[83] Under this program, installation of an approved seasonal outdoor rainwater harvesting tank qualifies for a one–time rebate of $0.10/litre of tank storage (to a maximum of $400). Purchase and installation of an approved all-season indoor/outdoor rainwater harvesting system qualifies for a one-time rebate payment of $2000. A similar rebate program is the City of Toronto Eco-Roof Incentive Program. Under this program eligible green roof projects will receive $75/square metre up to a maximum of $100,000 and eligible cool roof projects will receive $2-5/square metre up to a maximum of $50,000.

The advantage of a rebate program is that it can have fixed parameters to meet the unique needs and context of a community. The rebate program can set a maximum amount of funding available overall or as in the cases of Guelph and Toronto, for each project. It can also limit the eligible area of the program to target problem areas. The City of Seattle's RainWise program covers 100% of the cost of a rain garden or rain cistern for properties located within a targeted combined sewage overflow area (see Figure 13 for an example).[84]

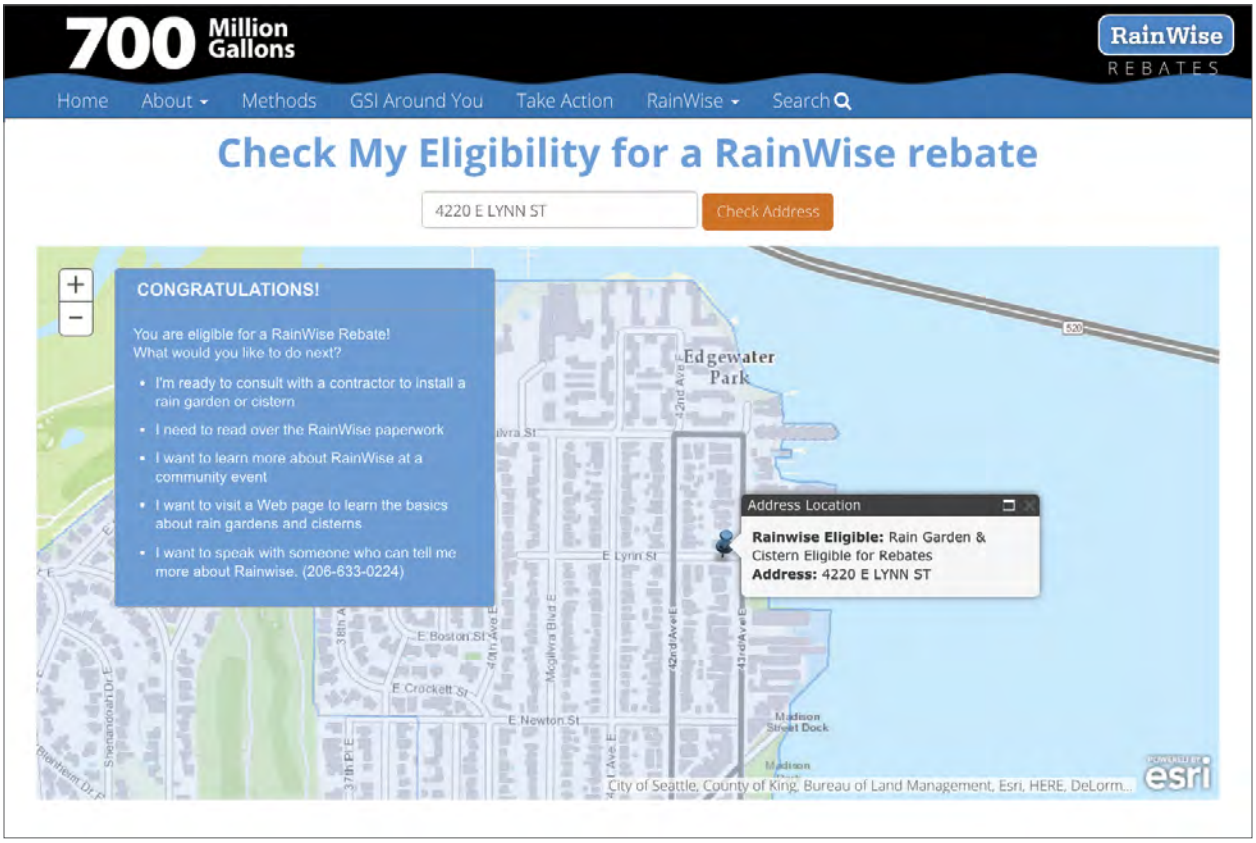


Figure 13: City of Seattle RainWise Rebate Program Eligibility Map (Source: http://www.700milliongallons.org/rainwise/eligibility-map)

83 City of Guelph, Rainwater Harvesting Program; retrieved from: http://guelph.ca/living/environment/rebates/rainwater-harvesting-system-rebate/

84 City of Seattle, RainWise Rebate Program; retrieved from: http://www.seattle.gov/util/EnvironmentConservation/Projects/GreenStormwaterInfrastructure/RainWise/Rebates/index.htm

CASE STUDY HIGHLIGHT

In Philadelphia, PA, two rebate programs (SMIP & GARP) have accelerated the implementation of green infrastructure projects.

See Philadelphia, PA case study for more details.

Section 2.4: Tool #4 – Stormwater Credit Trading

To date, much of the action on credit trading has focused on carbon cap and trade systems, such as those under the Western Climate Initiative (WCI)[85] or in the European Union Emissions Trading System (EU ETS).[86] But the model can also be applied for green infrastructure projects.

The goal of the Stormwater Retention Credit Trading system in Washington, D.C., is to manage more rainwater on-site through the establishment of a private market. In 2013, the District's Department of the Energy and the Environment (DOEE) finalized updated stormwater regulations that require any major land disturbance or major improvement project to incorporate water management capabilities for a 1.2-inch storm event. The regulation requires that the first 50% of the volume must be retained on site, *i.e.*, returned to natural pathways through infiltration or evapotranspiration, but the other 50% of the requirement can be met by purchasing credits from off-site projects. The off-site credits encourage private land owners that are not regulated to implement green infrastructure projects as they will not only be able to apply for a fee reduction on their Stormwater Fee and Impervious Area Charge, but they can also sell their credits to developers.

A stormwater credit trading system provides a financial incentive for private property owners to implement green infrastructure projects. However, like any market, those generating credits for sale must still pay the sometimes high up-front capital cost to create the credit. When the market is just starting out, as it is in Washington, there is uncertainty about whether a property owner will actually receive payment for that investment. It takes time for new regulated developments to get to the point of needing to purchase credits. As well, the demand for credits is dependent on how much new development is occurring. If new development stops or slows, a property owner investing in a green infrastructure project may not be able to sell credits.

Recognizing this market need as well as the need to accelerate the transition to green infrastructure, Prudential Financial partnered with the Nature Conservancy and Encourage Capital to invest US$1.7 million in green infrastructure projects.[87] The intention is that this investment will catalyze the Washington Stormwater Retention Credit market. The DOEE has also taken steps to catalyze the market, launching the SRC Purchase Agreement Program.[88] This program will give property owners who voluntarily install green infrastructure projects the option of selling their SRCs directly to the DOEE.

85 See Western Climate Initiative for more information (http://www.wci-inc.org/)

86 See European Union Emissions Trading System for more information (http://ec.europa.eu/clima/policies/ets/index_en.htm)

87 See The Nature Conservancy News Article, dated March 7, 2016, New Investment Model for Green Infrastructure to Help Protect Chesapeake Bay; retrieved from: http://www.nature.org/newsfeatures/pressreleases/new-investment-model-for-green-infrastructure-to-help-protect-chesapeake-bay.xml

88 See DOEE News Release: DOEE Announces US$12,750,000 for Innovative program to Incentivize Cost-Effective Green Infrastructure; available at: http://doee.dc.gov/release/doee-announces-12750000-innovative-program-incentivize-cost-effective-green-infrastructure

Stormwater Credit Trading in Canada

There is precedent for credit trading in Canada. Quebec launched its carbon cap-and-trade market on January 1, 2013[89] and linked its system with California the following year, creating the largest carbon market in North America. In Ontario, the South Nation Conservation Authority and the Lake Simcoe Region Conservation Authority have been implementing phosphorous and water quality trading programs since the early 2000s, again demonstrating that this type of model can work in a Canadian context.[90]

CASE STUDY HIGHLIGHT

In 2013, to comply with the National Pollutant Discharge Elimination System (NPDES) standards, Washington, D.C., updated its stormwater regulations to focus on on-site stormwater retention. The new regulations continue to apply to large construction projects that disturb 5,000 sq. ft. or more of soil, but now also apply to renovations to structures of 5,000 sq. ft. or more in size and which cost more than 50 percent of the pre-project value of the structure.

The two main innovations in the new stormwater regulations are the retention requirements and the creation of a private-market for trading stormwater retention credits. A regulated project would be required to retain the volume from the 1.2 or 0.8-inch storm, depending on the project type, and it must retain at least 50% of that volume on site.[91] The remainder of the volume can be retained through purchasing privately traded Stormwater Retention Credits (SRCs) on other sites or by paying an in-lieu fee to the District Department of Energy and the Environment (DOEE).

The first certification of credits took place in April 2014 and the first trade was approved in September 2014.[92]

See the Washington, D.C. case study for more details.

89 See Quebec, A Brief Look at the Quebec Cap-and-Trade-System for Emission Allowances; retrieved from: http://www.mddelcc.gouv.qc.ca/changements/carbone/documents-spede/in-brief.pdf

90 For more information see Conservation Ontario, Watershed Economic Incentives Through Phosphorous Trading and Water Quality Report, available at: http://conservationontario.ca/projects/pdf/reports/PHASE%20I/watershed_economic_incentives.pdf

91 Evan Branosky, District Department of the Environment (2015), From Gray to Green: Stormwater Trading in Washington, D.C.; retrieved from http://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/DC%20SRC%20trading_July%202015%20River%20Voices.pdf

92 *ibid*

Section 2.5: Tool #5 – Public-Private Partnerships

Public–private partnerships (P3s) are a long-term, performance-based approach to procuring public infrastructure.[93] They involve a contractual agreement between a public agency and a private sector entity that harnesses the expertise and innovation of the private sector and the incentives of capital markets to deliver public infrastructure projects.[94]

According to PPP Canada, P3s transfer a major share of the risk associated with infrastructure development (such as the costs associated with overruns, schedule delays, unexpected maintenance, and/or latent defects in the assets) from the public sector to the private sector through the contractual agreement that requires the private sector to cover the long-term operations and maintenance of the infrastructure. Governments do not pay for the asset until it is built and is operational, and only if it meets specific performance standards.

While to date most P3 projects have consisted largely of buildings and other hard infrastructure, Prince George's County in Maryland has implemented the first P3 agreement for a green infrastructure project. The County partnered with a private sector entity in Corvias Solutions to create the Clean Water Partnership, which would retrofit up to 4,000 acres (approx. 1,600 hectares) of impervious surfaces with green infrastructure.[95] The contract was signed in March 2015 and in October of the same year the first green retrofit project was completed for a 1-hectare area of land at Forestville New Redeemer Baptist Church.[96] The 30-year agreement requires the private partner to design, build, finance, operate, and maintain the urban stormwater infrastructure, allowing the County to meet its Municipal Separate Storm Sewer System (MS4) permit under the Clean Water Act.

The advantages of this P3 model to the County include:

- ***Cost savings to government:*** Prince George's County expects to save approximately 40% by using the P3 partnership compared to what it would cost to do the same amount of work purely through public funding. The cost savings are found in the private sector advantages in procurement, design, construction and maintenance.
- ***Accountability:*** The private sector entity designing and constructing the project is also responsible for operating and maintaining the infrastructure over its lifespan. Consequently, it is in the private sector entity's best interest to design and build the infrastructure to perform well and be as efficient as possible to keep operations and maintenance costs down over the long-term.
- ***Innovation:*** Because the private sector is not bound by standard practices, it can innovate to come up with a better way to meet the public requirements.

93 See PPP Canada website, About P3s; retrieved from: http://www.p3canada.ca/en/about-p3s/

94 For reference, see presentation by US EPA Region 3, Water Protection Division, The ABCs of P3s & the Role of Partnerships for Addressing Our Stormwater Retrofit Challenge in the Chesapeake Bay & Beyond; retrieved from: http://www.mde.state.md.us/programs/Marylander/outreach/Documents/EPA%20Region%20III_Better,%20Cheaper,%20Greener%20GI%20and%20P3.pdf

95 Prince George's County & Corvias Solutions – Clean Water Partnership Frequently Asked Questions; retrieved from: http://thecleanwaterpartnership.com/faqs/

96 See Water Environment Foundation's Stormwater Report, dated October 30, 2015, County Announces First Stormwater Project Completed Under Public-Private Partnership; retrieved from: http://stormwater.wef.org/2015/10/county-announces-first-stormwater-project-completed-public-private-partnership/

- ***Community economic benefit:*** The agreement to operate and maintain the infrastructure for the long term ensures that the private sector entity has a reliable source of revenue. In the Clean Water Partnership, the agreement has a goal of 30-40% of the total project scope utilizing the County's small, minority and women-owned businesses. The contract also includes incentive payments to Corvias for the number of these small businesses that are used, giving Corvias an economic incentive to increase local economic opportunities.

P3s for Green Infrastructure in Canada

The P3 model has yet to be utilized for green infrastructure projects in a Canadian community, but there are a number of other water-related P3 projects completed or underway in Canada demonstrating that it can work. The Safe Clean Drinking Water Project in St. John, NB is one example of a P3 project underway, where $57M dollars is being spent to build a new water treatment plant.[97] PPP Canada is the main agency in Canada that works with federal P3 projects and could begin to work with provincial, territorial and local governments to review how green infrastructure P3 projects would work in a Canadian municipal context.

Section 2.6: Tool #6 – Development Cost Charges

Local governments in Canada charge developers for the capital costs of public infrastructure, including stormwater systems, to service new developments. Some, such as the City of Penticton, will reduce the development charge for new developments that reduce demand for stormwater services through green infrastructure.[98] This tool targets new developments only, not stormwater on existing developed lots.

Development charges can be an effective way to incentivize green infrastructure in new developments. It can also be more easily implemented since the model is already commonly used by local governments and familiar to property developers and builders.

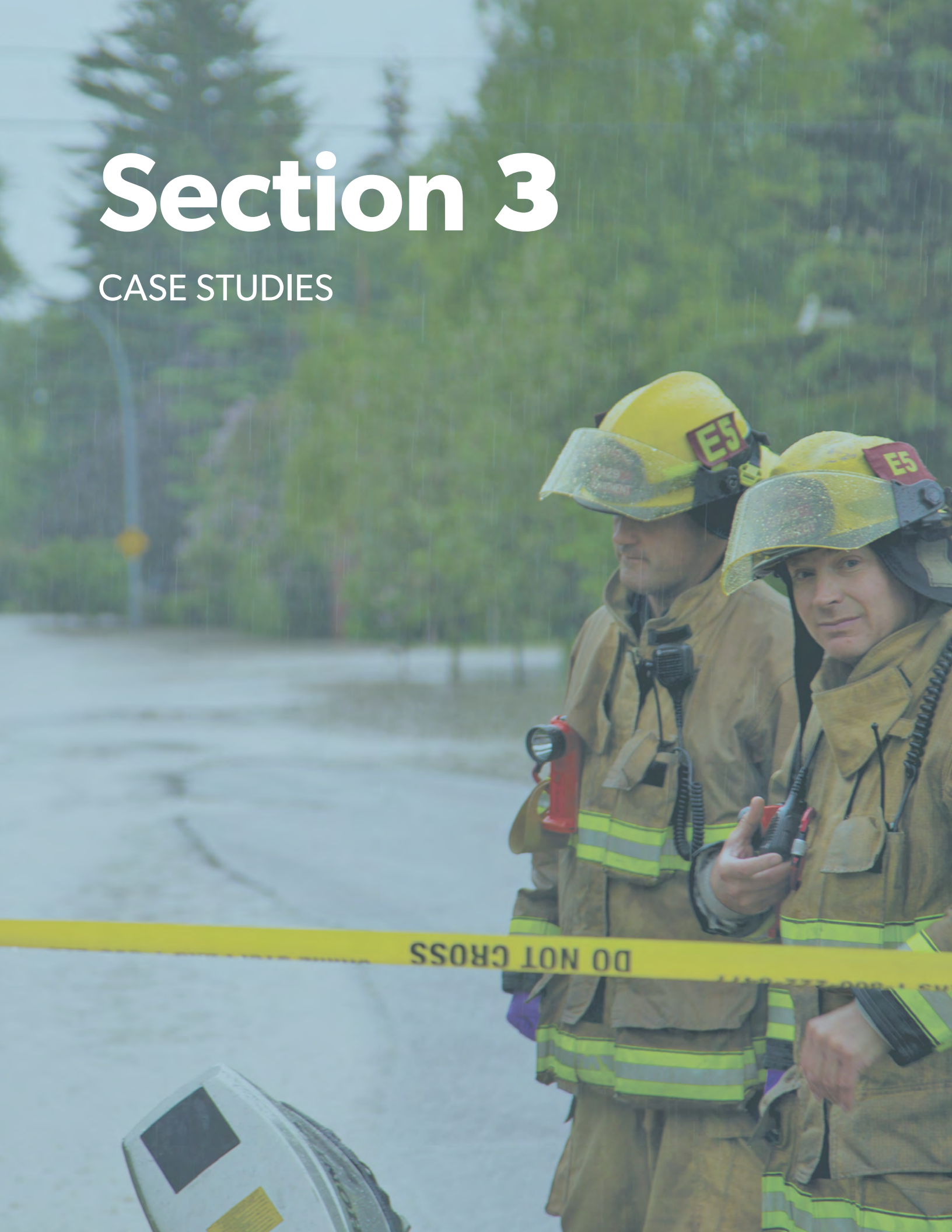
This tool is well suited to addressing the capital cost barriers to green infrastructure implementation. However, there are a number of challenges that make this incentive less than ideal, if implemented on its own. Development charges are only meant to cover the capital costs associated with new development and do not cover the long-term operations and management of the system. Because it is an up-front, one-time fee, there is no recourse for ensuring that the green infrastructure is maintained and doing its job over the long term. The P3 projects and the stormwater credit trading programs, in comparison, include mechanisms to re-qualify every 3 or 5 years, thus increasing the likelihood that the green infrastructure is operating effectively.

97 For more information on the Safe Clean Drinking Water Project see the PPP Canada site (http://www.p3canada.ca/en/about-p3s/project-map/saint-john-safe-clean-drinking-water/) or the St. John project site (http://www.saintjohn.ca/en/home/cityhall/sjwater/drinkingwater/safecleandrinkingwater.aspx)

98 See City of Penticton, Development Cost Charges Reduction Bylaw, No. 2010-11; retrieved from: http://www.penticton.ca/assets/City~Hall/Bylaws/Land~Use/Development%20Cost%20Charge%20Reduction%20(Bylaw%202010-11).pdf

Section 3

CASE STUDIES



Case Study: Philadelphia, PA

Summary

Philadelphia, like many U.S. cities, is dealing with the problem of combined sewer overflows. Their innovative approach to this problem has made them a leader in the use of green infrastructure for stormwater management through their implementation of a range of instruments including stormwater regulations, financial incentives and other non-regulatory approaches.

A long History of Integrated Watershed Planning

Philadelphia is a city of 1.5 million people in 134 square miles of land,[99] located along the Delaware River, at the confluence of the Schuylkill River. The City is highly urbanized with approximately 54% of the land considered impervious.[100] Similar to many other cities in the U.S., Philadelphia has a large number of combined sewer systems. Over 60% of the city is served by the combined sewer system[101] and there are 164 combined sewer overflow outfalls (See Figure 14). It is at these outfalls where stormwater and sewage are released during heavy rainfalls that overwhelm the capacity of the sewers.

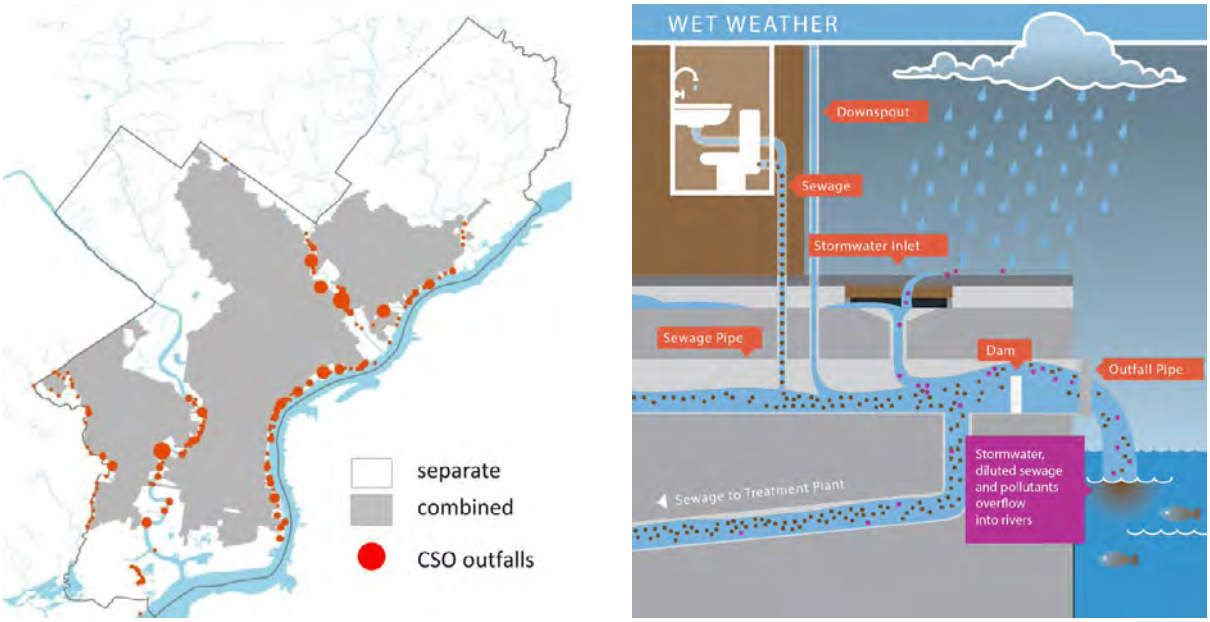


Figure 14: Depiction of area within the City of Philadelphia covered by CSSs and the location of CSO outfalls (Source: http://www.phillywatersheds.org/doc/Information%20Session%20Presentation_Web%20Version%20with%20Notes.pdf*)*

99 See http://www.census.gov/quickfacts/table/PST040214/42101

100 See PWD Frequently Asked Questions; retrieved from: http://www.phillywatersheds.org/watershed_issues/stormwater_management/faq#q13

101 US EPA (2010), Green Infrastructure Case Studies: Municipal Policies for Managing Stormwater with Green Infrastructure; retrieved from: https://www.epa.gov/green-infrastructure/policy-guides

The City adopted its first Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP) in 1997.[102] At the time the Philadelphia Water Department (PWD) undertook an infrastructure needs assessments for controlling the 16 billion gallons of combined sewer overflows that were reaching the rivers each year.[103] The infrastructure cost was estimated to be billions of dollars and would not address other critical issues such as eroded stream banks and poor aquatic habitat.[104] From that point PWD worked to create a watershed management approach that integrated stormwater management with other water resource protection programs.

The 2009 update to the CSO LTCP initiated the ***Green City, Clean Waters*** program, which aimed to integrate the control of combined sewer overflows within the integrated watershed management planning program. The vision for ***Green City, Clean Waters*** was to "unite the City of Philadelphia with its water environment, creating a green legacy for future generations while incorporating a balance between ecology, economics, and equity."[105] The 2009 update called for large-scale implementation of green infrastructure on public land, requirements and incentives for green infrastructure on private land, and a large-scale street-tree program, among other things.

Stormwater User Fee Evolution

Like many communities, Philadelphia originally charged its residents for stormwater services based on their water meter size. When it became apparent in the early 1990s that this method was no longer fair and equitable, the Philadelphia Water Department (PWD) convened a Citizens Advisory Council (CAC) to come together and make a recommendation for a more equitable way to charge for stormwater services.[106]Although in 1996 the CAC recommended a parcel based fee assessment method, PWD did not have the technology to make it happen at the time. The recommendation was finally implemented in 2002, but only for residential properties as the information was still lacking for the larger non-residential properties. The 2002 fee was based on a calculation of the average lot size and impervious area of all residential properties. Because there were over 450,000 residential properties within the City at the time, the CAC had recommended that all properties be charged equally as one land mass of a single land area and impervious area.

By 2010, PWD had enough information to also change the calculation of the stormwater fee for the non-residential properties.[107] Due to the potentially significant financial impact the new fee structure would have on large non-residential properties, the fee was implemented over a four-year period.

102 See Philadelphia Water Department, September 2009, Philadelphia Combined Sewer Overflow Long Term Control Plan Update; retrieved from: http://www.phillywatersheds.org/ltcpu/LTCPU_Section01_Introduction.pdf

103 Water Environment Research Foundation (2009), Implementing a Multi-Faceted Approach to Stormwater Management – Case Study: Philadelphia, Pennsylvania; retrieved from: https://www.werf.org/liveablecommunities/studies_phil_pa.htm

104 *ibid*

105 See Philadelphia Water Department, September 2009, Philadelphia Combined Sewer Overflow Long Term Control Plan Update; retrieved from: http://www.phillywatersheds.org/ltcpu/LTCPU_Section01_Introduction.pdf

106 *ibid*

107 *ibid*

Green City, Clean Waters Program

In 2011, the City updated its 2009 CSO Long Term Control Plan, and put in place the most ambitious green stormwater infrastructure program in the United States at the time.[108] The City committed to greening at least one-third of the existing impervious cover in the combined sewer system drainage area over the next 25 years.[109] The "Greened Acres" would filter and store the first one-inch of rainwater from every storm. The Program pledged to invest $2.4 billion in addition to a number of other already existing CSO program investments to total over $3 billion (Figure 15).

Figure 15: Vision for Philadelphia watershed protection and enhancement (Source: http://www.phillywatersheds.org/what_were_doing/green_infrastructure)

To meet its target, the PWD looked at three strategies: greening public property and rights-of-way, requiring green infrastructure for new development and redevelopment on private property, and encouraging voluntary retrofits on existing private property.[110] While greening publicly owned properties could be viewed as the easy route, the PWD has determined that, based on experience, it is more costly. A green infrastructure project on publicly owned property is estimated to cost between $250,000 and $300,000.[111] Requiring new or redevelopment projects to install green

108 See Natural Resources Defence Council (NRDC) Issue Brief, January 2015, Wanted: Green Acres – How Philadelphia's Green Acre Retrofit Program is catalyzing low-cost green infrastructure retrofits on private property; retrieved from: https://www.nrdc.org/sites/default/files/philadelphia-green-infrastructure-retrofits-IB.pdf

109 Philadelphia Water Department, Amended Green City, Clean Waters: The City of Philadelphia's Program for Combined Sewer Overflow Control Program Summary, June 1, 2011; retrieved from: http://www.phillywatersheds.org/doc/GCCW_AmendedJune2011_LOWRES-web.pdf

110 See Natural Resources Defence Council (NRDC) Issue Brief, January 2015, Wanted: Green Acres – How Philadelphia's Green Acre Retrofit Program is catalyzing low-cost green infrastructure retrofits on private property; retrieved from: https://www.nrdc.org/sites/default/files/philadelphia-green-infrastructure-retrofits-IB.pdf

111 *ibid*

infrastructure projects is also a good option, but it is dependent on the amount of new or redevelopment projects each year. The City has had in place stormwater regulations since 2006, whereby new development or redevelopment that disturbs 15,000 sq. ft. of soil or more is subject to the regulation and must retain the first 1" of rainfall. In 2015, the Stormwater Regulations were updated to now require the first 1.5" of rainfall to be managed and also to require a slower release of stormwater and higher water quality requirements.[112] If projects are not able to meet the requirement there is a pay-in-lieu program, but at the moment there is no credit trading available.

The third strategy was the most ambitious but had the potential for a large return in greened acres – encouraging voluntary retrofits of existing privately owned properties. Since, of the total impervious area within the City, the second and third largest contributors are residential (20%) and commercial/industrial (16%), it was clear that tools for encouraging green infrastructure projects on private properties were necessary.[113] The following section on SMIP and GARP outlines the City's main approach for private properties.

In addition to regulations, private property subsidies under the SMIP and GARP program, and City projects on public properties, the ***Green City, Clean Waters*** program also includes a number of other tools to encourage green infrastructure. Philadelphia offers a green roof tax credit for businesses and individuals who file a Business Income and Receipts Tax (BIRT).[114] The tax credit provides businesses a rebate for 50% (up to $100,000) for green roofs. The credit is not yet widely used but may increase with use in concert with the SMIP program. The City also provides two zoning incentives for green roofs associated with the Parking and Landscaping requirements and density bonusing.[115] Finally, the City's Rain Check rebate program, which is modelled after the RiverSmart program in Washington, D.C., helps residents manage stormwater at their homes.[116] Rain Check participants can access a free rain barrel and/or get a downspout planter, or they can install a rain garden or porous paving at a reduced price. The Rain Check program is funded by PWD and managed by the Pennsylvania Horticultural Society (PHS) in partnership with the Sustainable Business Network (SBN).

SMIP & GARP

To encourage green infrastructure projects on private properties, the City created an innovative incentive program that started with a simple stormwater fee credit program and eventually led to the Green Acre Retrofit Program (GARP).

Non-residential property owners are able to receive up to an 80% discount on their stormwater fee if they are able to manage the first inch of stormwater runoff. Though this appears to be a significant financial incentive, there was limited initial uptake due to the high upfront capital costs associated with some green infrastructure projects.[117]

112 See Philadelphia Water Department, Stormwater Regulation Update, Information Session Presentation; retrieved from: http://www.phillywatersheds.org/stormwaterregulations

113 Philadelphia Water Department, Amended Green City, Clean Waters: The City of Philadelphia's Program for Combined Sewer Overflow Control Program Summary, June 1, 2011; retrieved from: http://www.phillywatersheds.org/doc/GCCW_AmendedJune2011_LOWRES-web.pdf

114 See Philadelphia Water – Green Roofs; retrieved from: http://www.phillywatersheds.org/whats_in_it_for_you/residents/green-roofs

115 See Philadelphia Water – Green Roofs (zoning incentives); retrieved from: http://phillywatersheds.org/doc/Green%20Roof%20Zoning%20Incentives_2016%20Fact%20Sheet.pdf

116 See Philadelphia Water – Rain Check; retrieved from: http://www.phillywatersheds.org/whats_in_it_for_you/residents/raincheck

117 See Natural Resources Defence Council (NRDC) Issue Brief, January 2015, Wanted: Green Acres – How Philadelphia's Green Acre Retrofit Program is catalyzing low-cost green infrastructure retrofits on private property; retrieved from: https://www.nrdc.org/sites/default/files/philadelphia-green-infrastructure-retrofits-IB.pdf

A study by NatLab (the Natural Infrastructure Financial Laboratory), which is a collaboration of the Natural Resources Defence Council (NRDC), the Nature Conservancy, and EKO Asset Management Partners, recommended that Philadelphia could increase its uptake of private project green infrastructure projects by allowing projects to be aggregated and include a substantial subsidy.[118] The Stormwater Management Incentive Program (SMIP) was launched in 2012 as a green infrastructure subsidy program. Through the program, private property owners were given rebates on the upfront capital costs of installing green infrastructure projects. An operations & maintenance agreement is signed between the property owner and the City to ensure the City's investment is maintained over time.

Although the SMIP program would appear to address the upfront cost issues of the credit discount program, after the first three years of implementation, the program saw only 36 projects.[119] The main deterrents for the SMIP program, based on feedback from property owners, were that it was a burdensome process to go through an application for each project and third-party contractors were not permitted to be the primary executor of the agreements. The SMIP program did demonstrate, however, that the total cost of a greened acre is significantly less on private property compared to public property. Under the SMIP, the PWD was paying approximately $100,000 per greened acre, which is half of the cost of a greened acre on city-owned land.[120]

Because the SMIP program demonstrated that it is more cost-effective for the City and PWD to continue to promote green infrastructure projects on private property, PWD revised the SMIP and launched the GARP – the Green Acre Retrofit Program – in 2014. The GARP allows third-party contractors to apply for funding on behalf of property owners and it allows applicants to aggregate multiple projects in various locations under a single application. The aggregation of projects provides applicants a cost-savings through efficiencies in application time and bulk purchasing of materials and labourers. The GARP also requires a minimum overall project size of 10 acres to be eligible for the program, which encourages applicants to seek out projects. Similar to the SMIP, the GARP still requires a signed 45 year operations & maintenance agreement, but this has the advantage of giving the contractors an opportunity to maintain a more stable revenue source if they can offer long-term maintenance services to their clients in addition to the engineering and construction services.

Creation of a New Market

The Sustainable Business Network of Greater Philadelphia recently released a report analyzing the economic impact of the ***Green City, Clean Waters*** program,[121] and the results are promising. The actions taken under the ***Green City, Clean Waters*** program has created a Green Stormwater Infrastructure (GSI) industry within the City that "represents at least $146.8 million in annual revenues, and in turn has an economic impact of $57 million, supporting 430 additional

118 See NatLab Issue Brief: Creating Clean Water Cash Flows – Developing Private Markets for Green Stormwater Infrastructure in Philadelphia; retrieved from: https://www.nrdc.org/sites/default/files/green-infrastructure-pa-IB.pdf

119 See Natural Resources Defence Council (NRDC) Issue Brief, January 2015, Wanted: Green Acres – How Philadelphia's Green Acre Retrofit Program is catalyzing low-cost green infrastructure retrofits on private property; retrieved from: https://www.nrdc.org/sites/default/files/philadelphia-green-infrastructure-retrofits-IB.pdf

120 *ibid*

121 See Sustainable Business Network (2016), The Economic Impact of Green City, Clean Waters – the First Five Years; retrieved from: http://www.sbnphiladelphia.org/images/uploads/Green%20City,%20Clean%20Waters-The%20First%20Five%20Years%281%29.pdf

jobs and generating $860,000 in tax revenue for the City of Philadelphia."[122] Not only are there substantial economic gains occurring in the City as a result of the program, but the gains are also being felt throughout the City. The green infrastructure projects are allowing smaller scale businesses and individuals an opportunity to find employment through the contracts and the projects themselves are dispersed in relatively low-income neighbourhoods, bringing more social amenities and quality of life benefits.

Lessons Learned for Canadian Municipalities

As one of the leading cities for innovative stormwater management practices, Canadian cities can learn much from the Philadelphia example:

COMPREHENSIVE APPROACH:

The City has developed multiple programs to try to reach the majority of the community with potential stormwater reduction opportunities demonstrating that an overall integrated water management approach is best for making a paradigm shift from managing stormwater pollution to managing rain water as a resource.

REGULATIONS ARE IMPORTANT, BUT NOT EVERYTHING:

In Philadelphia regulations were important for stormwater management, but here they are not as important as in, for example Washington, because they do not have the same credit trading program. Philadelphia's approach to getting private property projects was to create a system that was beneficial for third-party contractors. The main advantage being that, through this process, the green infrastructure is decoupled from new development and/or redevelopment so it can proceed even if there is no development happening in the city, whereas the credit trading system relies on new regulated development being proposed and built. For cities that are not experiencing a high number of new developments, this type of approach may be more effective.

THE FIRST APPROACH MAY NOT BE THE BEST – TRY AGAIN:

A key lesson from the City of Philadelphia is that of adaptive management. The first program, the SMIP, in theory should have been very successful. When it was not producing the expected results, city staff went out to those working with the program directly to determine what was wrong, allowing them to create the GARP program. For any municipality attempting a new program, there are likely to be tools that work in some places but not everywhere and so the ability to implement, monitor, assess, and adapt will be key factors for success.

122 See page 31 of Sustainable Business Network (2016), The Economic Impact of Green City, Clean Waters – the First Five Years; retrieved from: http://www.sbnphiladelphia.org/images/uploads/Green%20City,%20Clean%20Waters-The%20First%20Five%20Years%281%29.pdf

Case Study: Mississauga, ON

Summary

The process to implement a stormwater user fee in the City of Mississauga spanned a number of years but was supported from the beginning by Mayor Hazel McCallion. The implementation of the fee was also spurred by a flooding event that occurred around the same time the implementation plan was brought forward to Council in 2013, providing a tangible example of the need for improved stormwater services. This brought stormwater issues to the forefront of the minds of Councillors and residents. The experience of the City of Mississauga showcases the potential of a stormwater user fee to provide a dedicated and fair source of revenue for stormwater management programs, but also demonstrates the importance of resident education and incentives.

Stormwater Financing Study

The City of Mississauga initiated the process to develop a dedicated stormwater user fee on September 14, 2011, following the approval of an August 2011 report by the Commissioner of Transportation and Works, which identified the need to find a new method to fund the stormwater management program.[123] It also came on the heels of the Cities of Kitchener and Waterloo adopting their stormwater user fee programs, with a similar approach being strongly supported by Mayor McCallion. A consultant team was hired to investigate the existing stormwater management program, evaluate program options, review potential stormwater financing options and prepare a recommended option and implementation plan.

The study found that the existing stormwater management program in Mississauga included over $1.7 billion in stormwater infrastructure assets and the City was spending close to $14,650,000 per year on capital improvement projects and operations and maintenance.[124] Although the City's stormwater pipe assets are relatively new at an average age of 30 years (compared to Victoria where many pipes are over 100 years old), the main repair investment in the City today is the stormwater management ponds and watercourses. The study found that although the current level of investment in the stormwater program was $14,650,000, a sustainable stormwater program, that would cover all required capital, renewal, and operations and maintenance costs, would actually need to be $34,490,000 per year.

The various financing options that were reviewed in the study included:

- Property tax
  - General Tax Fund
  - Dedicated Levy
- Development related charges & fees
  - Development Charges
  - Cash-in-lieu
- Stormwater rate

123 City of Mississauga, April 2013, Stormwater Financing Study; retrieved from: http://www7.mississauga.ca/Documents/TW/Environment/RPT_MississaugaStormwaterFinancingStudy_Apr2013_Final.pdf

124 *ibid*

Through the comparison of the various funding options, the stormwater rate was determined to be the most fair and equitable funding mechanism for the City because the costs are allocated based on relative amounts of stormwater generated by a property and it creates a dedicated and sustainable funding source for the program.

Calculation of Stormwater Rate

The City of Mississauga has a significant proportion of residential properties. Over 92% of the parcels in the City are a form of residential, with 45% of those being single-family detached homes.[125] Consequently, even though the most fair and equitable way to calculate the stormwater fee is to measure the total impervious surface areas of each individual property, the administrative costs of doing this in Mississauga was deemed to be too high. Instead, the City sampled 2000 residential properties and found that there was a reliable correlation between total impervious surface on a property and total roof area (including any secondary buildings such as sheds, gazebos, pool houses, etc.). Since the City already mapped roof area as part of their regular GIS processes, basing the stormwater charge for residential properties on total roof area was a logical course of action.

Based on the sampling of 2000 residential properties, the average amount of impervious surface on an average detached residential property in Mississauga was determined to be 267m^2. This number became the base billing unit for all fee calculations. Residential properties are broken up into five separate tiers, based on the area a range of roofprint areas, such that smaller roofprints are charged less compared to larger roofprints. Table 5 outlines the five different residential tiers.

Table 5: Generalized table demonstrating the residential property tiers for Stormwater Fee Calculation (Source: http://www7.mississauga.ca/documents/bylaws/Stormwater_Fees_and_Charges.pdf)

Tier	Properties Included	Roofprint range (m^2)	Stormwater Billing Units	Charge (# billing units × rate)
Smallest	Smallest 10% of all single-unit homes	26.7 – 99.9	0.5	$50.00
Small	Next largest 40% (10th to 50th percentile)	99.1 – 151.0	0.7	$70.00
Medium	Next largest 30% (50th to 80th percentile)	151.1 to 194.0	1	$100
Large	Next largest 15% (80th to 95th percentile)	194.1 to 242.0	1.2	$120
Largest	Largest 5% of all single-unit, separately owned homes	242.1 and above	1.7	$170
Green	Single residential properties with impervious area less than 26.7 m^2 or roofprint area less than 26.7m^2	0 to 26.6	0	$0

125 City of Mississauga, April 2013, Stormwater Financing Study (page 41); retrieved from: http://www7.mississauga.ca/Documents/TW/Environment/RPT_MississaugaStormwaterFinancingStudy_Apr2013_Final.pdft

Since multi-residential and non-residential properties are the minority of properties in Mississauga but comprise the majority of impervious surface, and since total roof area does not correlate with total hard surface on these properties, the City maps the total impervious area on each of these properties individually. The impervious area is then divided by the Billing Unit in order to determine the number of Billing Units for each non-residential property.

To help property owners understand how their stormwater charge is calculated, the City has developed an online tool (see Figure 16 for an example). The tool allows a property owner to enter their address and it will show the City's imagery of that property, the digitized roof area or impervious area on which the stormwater charge is based, and the roofprint area in square meters that was used to calculate the fee.[126] Property owners are allowed to submit an appeal to the City if they dispute the calculation of their fee based on the imagery used or if they believe that they may be exempt from the charge.

Figure 16: Example of Mississauga online stormwater fee estimator tool (Source: http://estimator.stormwatercharge.ca)

Stormwater Credit Program

The City of Mississauga originally opted to not include a residential credit program for the stormwater charge and instead developed a program that gives multi-residential or non-residential properties an opportunity to reduce their fee through the implementation of best practices.[127] These best practices are divided up into different categories: peak flow reduction, water quality treatment, runoff volume reduction, and pollution prevention. For each of the different categories there is a maximum percentage of credit that can be achieved with an overall maximum discount of 50%.[128] The credits expire after 5 years and must be renewed.

126 City of Mississauga Online Stormwater Charges Estimator can be accessed via http://estimator.stormwatercharge.ca/

127 See The Corporation of the City of Mississauga Stormwater Fees and Charges Bylaw 125-15 (page 4); retrieved from: http://www7.mississauga.ca/documents/bylaws/Stormwater_Fees_and_Charges.pdf

128 See The Corporation of the City of Mississauga Stormwater Fees and Charges Bylaw 125-15 (page 11); retrieved from: http://www7.mississauga.ca/documents/bylaws/Stormwater_Fees_and_Charges.pdf

The initial decision to not include a residential credit program was due to the fact that it would have been administratively onerous[129] and would not have contributed to a significant amount of stormwater runoff reduction since multi-residential and non-residential properties account for 70% of the hard surfaces within the City.[130] Instead, City Council passed a resolution in October 2015 to form a Working Group composed of Councillors and staff to look at various potential residential programs, including a residential credit program (Figure 17). Two public workshops were held in April 2016 and staff also collected public feedback through letters and emails. After reviewing the public feedback, Council supported the recommendation that a residential home visit program be developed in which residential property owners can request a visit from a qualified stormwater management professional who will review their property, make suggestions for how they can manage stormwater, and connect the home owner with relevant resources and information. The residential home visit program is currently being developed and will be launched in Spring 2017.[131]

Exemptions & Subsidies

One of the main concerns experienced through the implementation of the stormwater charge was properties that were previously exempt from property taxes or that City Council wished to relieve from paying the stormwater charge. To address this issue, the City included in its bylaw a subsidy for places of worship and Veteran's Organization properties, whereby a subsidy could be provided for part or all of the stormwater charge. The stormwater subsidy is also in progress of being extended to low-income seniors who reside in a single-family home, and working farms.

As well, there are a number of properties within the City that are technically or legally exempt from the charge. These include properties that partially or wholly drain directly out of the City's jurisdiction, such as into Lake Ontario or into another municipality, and properties not legally subject to municipal fees and charges.

Figure 17: Rain garden with diagrammatic signage (Source: http://www.raingardentour.ca/ontario.html)

129 Conversation with City Staff, April 2016

130 See City of Mississauga, Stormwater Credit Program; retrieved from: https://www.mississauga.ca/portal/services/credit-program

131 *ibid*

Lessons Learned

While the City is still in the early stages of implementation there are a number of lessons that can already be learned from the process.

EDUCATIONAL OPPORTUNITY

Even though most cities implementing a new stormwater user fee are likely to experience some negative feedback from residents, staff at the City of Mississauga noted that it was a good opportunity to educate the public on what stormwater is, how properties are serviced by the City's stormwater system, and how a property contributes stormwater runoff. Stormwater is often invisible to most residents because first, they are not directly charged for generating it and second, the services are unseen (underground pipes) or innocuous (ditches and watercourses). A strong response from residents, provided it is handled well, can provide an invaluable forum for public education and awareness.

ALTERNATIVES TO A CREDIT PROGRAM

In some instances, implementing a credit program for residential properties will be too administratively costly and the resources to manage the program may not be available. Cities can still recognize the efforts of property owners to reduce the stormwater they generate through other means. The home visit program that Mississauga is implementing is one way to reach out to property owners to not only inform but also to recognize home owners for their efforts.

COLLABORATION

The City of Mississauga is working closely with local Conservation Authorities to synthesize program delivery. The Conservation Authorities offer programs to meet with landowners for free to discuss landscaping and green infrastructure advice. They also have a program called Greening Your Corporate Grounds where they meet with multi-residential and non-residential property owners to provide advice. This program particularly meshes well with the City's current credit program, and has provided a service that supports property owners interested in implementing green infrastructure and achieving stormwater credits.

Case Study: Victoria, BC

Summary

The City of Victoria, B.C., located on the southern tip of Vancouver Island, has some of the oldest stormwater infrastructure in Canada, dating back to the early 1900's. Although staff initially suggested the idea of a stormwater utility as early as 2001, there was not enough support until about 2007 when discussions began again on a stormwater utility. Now the city is in the process of implementing one of the most detailed stormwater utilities in the country and looking towards a more progressive system of rainwater management that helps the city achieve its climate change adaptation goals.

History of Stormwater Management

The City of Victoria is within the Capital Region District (CRD), which includes 13 municipalities in total. The CRD implemented a Core Area Liquid Waste Management Plan (LWMP) in 2003 to comply with the BC Ministry of Environment, Lands and Parks requirements. As part of the Core Area LWMP, City of Victoria council made a number of commitments to protect the shoreline from the impact of urban contaminates, most often carried by stormwater.[132] The City has also committed to a number of projects as part of the 2002 Storm Water Quality Management Plan. All of these commitments have led to a significant capital requirement for stormwater that must be met.

In 2010, City staff made a presentation to council on the challenges and opportunities of the stormwater infrastructure. This presentation identified that while the $363 million of infrastructure assets within the city are adequate for the time being, the general condition was poor and would need replacement. In fact, 58% of the infrastructure was installed prior to 1920 and would require repair or replacement.[133]

In addition to the need to address infrastructure deficiencies was the keen desire by council to address climate adaptation and the anticipated rainfall changes the City would experience.

Stormwater Utility Development

Following the 2007 discussions on a potential stormwater utility and the 2010 presentation on infrastructure challenges and opportunities, Victoria City staff got to work collecting data and formed a number of working groups, including an internal subcommittee made up of staff from various City departments, and a stakeholder committee, composed of representatives from the public, university, regional governments, and businesses.[134] They also conducted a number of focus group sessions where members of the public were asked their thoughts on stormwater in general and a stormwater utility. Eventually staff were able to present a stormwater utility model to Council, and following a few amendments, the final model was endorsed in 2014.

The original intent was to roll out the stormwater utility in 2014 and the credit program the year after, but when City staff went out to the public to consult on a credit program along with the new stormwater fee, they heard a great need for time to budget from those who would be paying the most. In the end, this may have made the process better. Council

132 City of Victoria, Environment and Infrastructure Standing Committee Report, January 25, 2011, Subject – Stormwater Utility (pg 4 – Relevant Policy and Reports); retrieved from: http://www.waterbucket.ca/rm/sites/wbcrm/documents/media/180.pdf

133 City of Victoria, Environment and Infrastructure Standing Committee Report, January 25, 2011, Subject – Stormwater Utility (pg 11 – Project Charter for the Stormwater Utility Project); retrieved from: http://www.waterbucket.ca/rm/sites/wbcrm/documents/media/180.pdf

134 Personal conversation with City of Victoria Staff, April 2016

approved the delay to begin billing the stormwater fee in the fall of 2016. In the meantime, all property owners would be sent an estimated bill of what they would pay a year and a half in advance so that they can adjust accordingly. This change in timeline allowed staff to implement the credit program ahead of the stormwater fee, such that people could submit their applications early and be approved for credit by the time the fee took effect. It also brought to light other issues with the stormwater fee, including those properties that were not connected to the city stormwater infrastructure and drained directly to the ocean.

Stormwater Utility & Credit Program Design

While many communities in Canada that have recently or are in the process of implementing a stormwater fee or user charge have opted to go with either a flat rate, or a tiered flat rate for residential units, the City of Victoria has chosen to implement a fee based on the impervious area calculated for each individual site. While this method is common for industrial/commercial properties, it is not often the case for residential.

The calculation process for the City of Victoria's stormwater utility is more complicated compared to many other existing stormwater fees because they wanted to ensure it was the most fair and equitable process as possible. Although the most accurate and equitable method for calculating the stormwater fee is to physically measure the exact impervious area on every property, with over 14,000 properties, 10,000 of which are low density residential (less than 5 units), it just wasn't feasible for the city. With aerial imagery and building footprint data, staff would be able to measure the roof area for every property but they wouldn't be able to measure all other impervious surfaces, such as driveways and walkways. To include these other impervious areas in the calculation for each low-density residential property, staff took a sample of various residential properties and calculated the average percentage of "other" impervious surfaces and found that it was approximately 3% of total impervious area.[135] Therefore, to calculate the impervious surface for each low density residential property staff measure the amount of roofed area and then add 3% to account for other impervious surfaces. The impervious surface for all non-residential property types is measured individually.

The city also wanted to have the stormwater utility account for the total impact of the property on stormwater runoff, and determined that this included other factors such as road type and property type. Consequently, the stormwater utility for every property is calculated based on the following four factors:[136]

1. Impervious Surfaces Factor: this is based on the total area of all impervious surfaces on a parcel;
2. Street cleaning factor: this is based on the street frontage of the parcel and the type of street the parcel fronts on to;
3. Intensity code factor: this is based on the property classification (*i.e.* low density residential, multi family residential, civic/institutional, and commercial/industrial); and
4. Codes of Practice Factor: if a certain business type is listed (construction, auto operation, recreation facility, etc.) an additional factor is calculated.

135 Personal conversation with City Staff, April 2016

136 City of Victoria, Sanitary Sewer and Stormwater Utilities Bylaw, Bylaw No. 14-071; retrieved from: http://www.victoria.ca/assets/City~Hall/Bylaws/Sanitary%20Sewer%20Stormwater%20Utilities%20Bylaw_14-071.pdf

Rainwater Rewards Program

The stormwater utility incentive program provided by the City of Victoria is called the Rainwater Rewards Program. The incentive is available to all property types, with different levels of discount depending on whether you are a low-density residential property, other property, or have an educational component. Low-density residential properties can obtain up to a 10% discount, while other properties can obtain a maximum 40% discount or 50% if they include an educational component.[137] The discount expires after 5 years, upon which time it must be renewed.

As part of the Rainwater Rewards program, low-density residential properties are also eligible for one-time rebates to cover the up-front costs of installing green infrastructure.[138] The rebate program has a maximum fund of $75,000 per year. Each property can apply for multiple rebates but only for one of each project. So one property can apply for one rain barrel, one rain garden, and one permeable pavement rebate, but not multiple rain gardens or multiple driveway rebates (Figure 18).

Even though the stormwater utility is not yet in effect, the City has already received 40-50 rainwater rewards applications.[139]

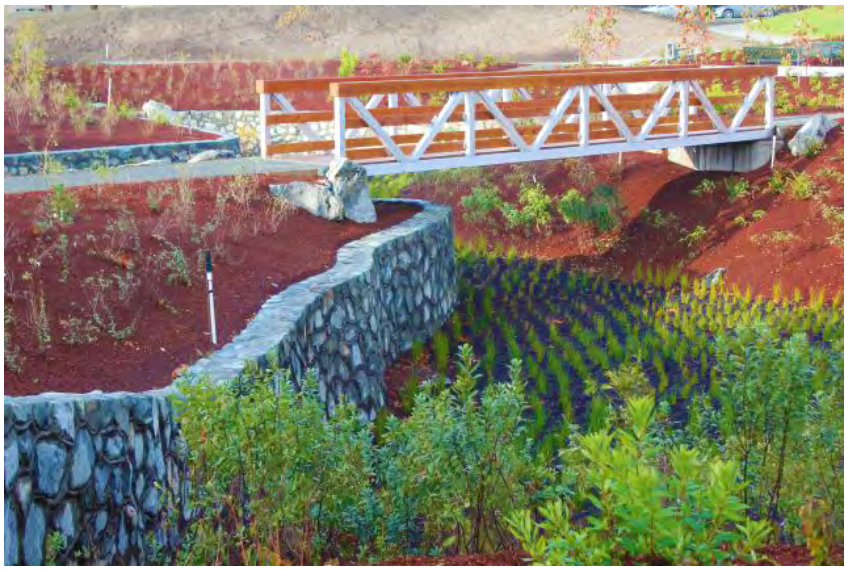


Figure 18: Fisherman's Wharf Park Rain Garden (Source: http://www.victoria.ca/EN/main/departments/parks-rec-culture/parks/improvements/fishermans-wharf-park.html)

137 *ibid*

138 See City of Victoria, Rainwater Management Standards, Do-It-Yourself for Your Home; retrieved from: http://www.victoria.ca/assets/Departments/Engineering~Public~Works/Documents/SWVictoria_DIY_Rainwater_Mgmt_Stds_June2015.pdf

139 Personal conversation with City Staff, April 2016

Community Engagement

The City of Victoria conducted a thorough engagement series where they asked residents to provide feedback on the stormwater utility and the proposed incentive program.[140] In the fall of 2013, Staff held 10 focused stakeholder meetings, three open houses and an online survey. Table 6 lists the main concerns staff heard through this engagement process and the staff actions to address those concerns. The main areas that residents wanted help with was the incentive program. Residents wanted to know exactly how much building green infrastructure on their particular property would cost and how much of a discount they would receive. They also wanted clear guidance on how to build green infrastructure projects.

Table 6: Stormwater Utility Engagement Feedback and City of Victoria Action (Source: http://www.victoria.ca/EN/main/departments/engineering/stormwater/stormwater-engagement.html)

What we heard:	What we've done:
Develop case studies and engage related associations.	20 case studies were completed for a range of property types. Property owner and neighbourhood associations helped to recruit properties. The information was used to finalize the Rainwater Rewards program.
Consider a rebate program.	A rebate program is now offered to help low density residential properties with the upfront costs of installing rainwater management methods.
Make the Rainwater Rewards program more flexible.	A sliding scale for credits has been developed for apartments, condominiums, institutions and businesses.
Make the Rainwater Rewards program simple and easy to use.	The numbers of permits required has been reduced, where feasible. No longer need to have more than one or two rainwater management credits in order to get a full credit. Full credit can be achieved by managing 90% of the rainwater on site, regardless of the number of methods used.
Consider phasing in properties with increases.	All Permissive Tax Exempt and School District 61 properties will be phased in. Additionally all property owners will be given over one year's notice with the Stormwater Utility Assessment Notice.
Consider adjusting the rate model to address some specific property types and situations.	Properties that don't have a connection to the stormwater system and instead drain to a rock pit or directly to the ocean will have their stormwater fee reduced by not paying for the impermeable areas on their property. A smaller portion of the bill relating to street cleaning services and the type of property, will still apply.
Create clear design standards for the Rainwater Rewards program: Do-It-Yourself options to reduce the cost when possible.	DIY design standards have been developed for low-density residential properties with 1-4 units.
Provide guidance and support to help owners with the Rainwater Rewards program. Continue to focus on education.	Three 'Ask an Expert' sessions are being hosted this year. The Stormwater Specialist is available to help homeowners map out rainwater options for their property. Industry training events will also be held. An online Rainwater Management Planning tool is also under development.
Consider giving property owners more time to budget for this change.	All property owners are receiving a Stormwater Utility Assessment Notice in Spring of 2015. Over one year later the first stormwater utility bill will be issued in the fall of 2016. This will also provide time to apply for the Rainwater Rewards program, before the first stormwater utility bill arrives

140 See City of Victoria, Stormwater Engagement; retrieved from: http://www.victoria.ca/EN/main/departments/engineering/stormwater/stormwater-engagement.html

Lessons Learned

The process taken by the City of Victoria in implementing the Stormwater utility can provide a number of very important lessons learned for other Canadian municipalities looking to do the same:

TRANSITION TIME:

Transition time can be a key component in the implementation of a new stormwater utility. Although this may delay the start, it can also provide a good opportunity to implement robust credit programs and work out kinks in the fee itself. The year and a half that the City gave property owners to adjust to the fee allowed issues, including those properties not connected to the stormwater system to be brought forward and amendments to the bylaw made. It also allowed time for property owners to get in place their discounts and understand how they can reduce their fee before it's even in place.

The City experienced a minimal amount of negative feedback during the implementation of the utility, and this mostly came from properties that would have been under the 3% other impervious area calculation and those who didn't pay a stormwater charge previously. To address the properties that were previously exempt, like many other cities, Victoria included a three-year transition phase.

MEANINGFUL ENGAGEMENT WITH FOLLOW UP ACTION:

City staff noted that during the consultation process, the key lesson they learned was that the format of the consultation proved to be very important in how they were engaging participants. They found that the best format was to provide a presentation and then breakout in to smaller focus groups where a staff representative could lead discussions in a more intimate setting, thereby allowing everyone the opportunity to speak and avoiding any one voice to overtake the discussion.

STREAMLINING THE PROCESS:

One of the main goals of the stormwater management program is to encourage green infrastructure projects on private properties. As such, one of the focus areas of the implementation of the stormwater utility for the City has been to make it as easy as possible for residents to install green infrastructure. Through the consultation process, staff learned that this requires specific case studies on how much it will cost for residents to build these projects and guidance on how to do it.

It also requires streamlining of the application process. The Official Community Plan for Victoria was amended to allow for a single application to be submitted for green infrastructure projects as opposed to the previous process, which required multiple applications. As well, even though engineering drawings are still required, because the City developed very detailed standards for the various green infrastructure projects, provided that an architect, landscape architect, or contractor can demonstrate they followed the guidelines, stamped engineering papers are not required for low density residential properties. This reduces the cost and process time for many common green infrastructure projects.

Case Study: Kitchener, ON

Summary

The City of Kitchener is located in southern Ontario with a population of 233,700.[141] The City covers 139 km² of land that is mostly residential; only 8% of its land base is agricultural and these lands are mostly located in the southwest corner of the City.[142]

One major issue for stormwater managers in the City is that currently less than 30% of the existing urban areas are covered by stormwater management facilities.[143] The areas serviced by stormwater infrastructure are mainly the newer developments outside of the urban core (Figure 19).

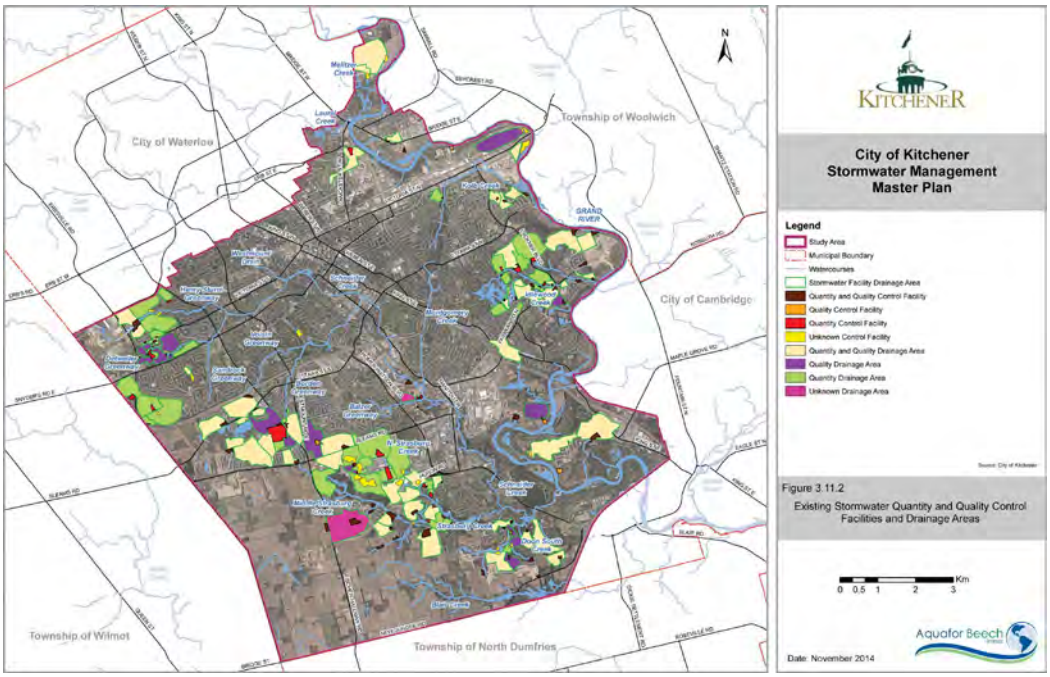


Figure 19: Figure depicting the large urban core area that is not covered by any SWM facilities (Source: http://www.kitchener.ca/en/livinginkitchener/resources/SWM_Images/INS_SWM_MP_-_Public_Open_House_1_boards_June_24_2015.pdf)

141 City of Kitchener (June 2014), Fun Facts About Kitchener; retrieved from: https://www.kitchener.ca/en/insidecityhall/resources/EDFastFacts.pdf

142 City of Kitchener, (2015), Public Open House on Stormwater Master Plan Update; retrieved from: (http://www.kitchener.ca/en/livinginkitchener/resources/SWM_Images/INS_SWM_MP_-_Public_Open_House_1_boards_June_24_2015.pdf

143 *ibid*

The City of Kitchener borders the City of Waterloo such that the boundary between the two can easily be missed. Due to the close link the cities embarked on the analysis of stormwater management needs, expenditures and funding options together. Though the initial studies were completed in collaboration, the path each City took was slightly different, showcasing the fact that each City, no matter how similar, will come up with its own unique solution for stormwater management.

Stormwater Utility

In January 2011, the City of Kitchener implemented a stormwater utility. The process began with a 2007 report on Stormwater Needs and Expenditures followed by a 2008 Stormwater Funding Analysis, both of which were completed in collaboration with the City of Waterloo. The purpose of the reports was to identify deficiencies in the current level of stormwater service and to develop an appropriate and dedicated funding system for a sustainable and equitable service. Due to the relatively new and evolving standards for stormwater, the Funding Analysis report notes that both cities recognize that many existing stormwater facilities do not meet current federal and provincial requirements and to achieve compliance both cities will have to increase the level of stormwater service they provide.[144] For the City of Kitchener, a sustainable level of stormwater service, whereby services are ramped up over a period of 25 years in order to comply with regulatory standards, would require $9.9 million/year or 12% of the City portion of property taxes.[145] In 2007, the stormwater management program was allocated only $4.5 million/year or 5.1% of the budget. In order to make up the difference the City reviewed various funding mechanisms including remaining within the current method of property taxes, development related charges/fees, and a stormwater rate.

Through the analysis it was recommended that a stormwater rate was the most appropriate funding system for Kitchener. Property taxes were not considered equitable or fair and provided no incentive for owners to reduce their stormwater contribution. Development charges are limited by the amount of new development and only apply to capital costs associated with that development. The Stormwater rate provided a dedicated funding source, a fair and equitable distribution of costs, and the potential for a credit program to incentivize owners to reduce stormwater. It was also recommended the stormwater rate charge be based on the amount of impervious area located on each property. This was the most efficient method, given the large number of residential units in the City and the method's balance between equitability and administrative requirements.[146]

The stormwater utility appears on the monthly utility bill and includes 16 different classifications that range in cost from $4.56 per dwelling unit per month for residential condominiums to $2,329.31 per month for non-residential properties with 39, 035 m^2 or greater of impervious area.[147] Residential properties are divided into small, medium and large categories, and the non-residential properties are divided up based on an increasing amount of impervious area.

144 City of Kitchener and City of Waterloo, 2008, Kitchener-Waterloo Stormwater Management Program and Funding Review: Stormwater Funding Analysis; retrieved from: http://www.waterloo.ca/en/contentresources/resources/living/stormwater_report_feasiblity_study.pdf

145 City of Kitchener and City of Waterloo, 2008, Kitchener-Waterloo Stormwater Management Program and Funding Review: Stormwater Funding Analysis (page 13, Table2-3a description); retrieved from: http://www.waterloo.ca/en/contentresources/resources/living/stormwater_report_feasiblity_study.pdf

146 City of Kitchener and City of Waterloo, 2008, Kitchener-Waterloo Stormwater Management Program and Funding Review: Stormwater Funding Analysis (page 60); retrieved from: http://www.waterloo.ca/en/contentresources/resources/living/stormwater_report_feasiblity_study.pdf

147 See City of Kitchener, 2016 Stormwater Utility Rates, retrieved from: https://www.kitchener.ca/en/livinginkitchener/Stormwater_Utility.asp

The impervious area of a property is calculated differently for residential and non-residential properties. For residential properties the roof area of any building, shed, or garage is measured either based on aerial photography or building surveys.[148]For non-residential properties, the areas of building roofs, parking lots, driveways, and sidewalks or walkways are all calculated by GIS staff to determine the total impervious area (m^2) on each property.

Stormwater Utility Credit Program

At the time the stormwater utility was implemented, it was mandated to staff to come up with a stormwater utility credit program, but the fee and credit programs were not implemented at the same time. The credit program came into effect in March 2012, a year and 3 months after the initial charge was first seen on customer utility bills, and applied to both residential and non-residential properties. Properties can receive a discount of up to 45% on their stormwater fee if they implement best management practices for stormwater.[149] Since its establishment, the city has issued more than 4,000 credits as part of its credit program for rain gardens, rain barrels, cisterns and permeable pavements.[150] According to the City, this treats the equivalent of 19 Olympic size swimming pools every time it rains.

The RAIN Program

In addition to the stormwater credit program, the City of Kitchener partnered with the City of Waterloo, Green Communities Canada, and REEP Green Solutions to provide the RAIN program, which is a stormwater education and action program aimed at supporting the implementation of the credit program.[151] In 2014, the City of Cambridge joined the partnership to promote stormwater best management practices within their city as well.

Public Support for the new Stormwater Rate

During the development of the stormwater utility, while there was some initial pushback, there was one significant motivating factor that allowed City residents to understand the need for the change – Victoria Park Lake restoration (Figure 20). Victoria Park Lake is a key amenity for Kitchener residents but because its drainage area mainly includes the older downtown core that does not have any stormwater management facilities, it was becoming overloaded with sediment. A Municipal Class Environmental Assessment was completed in 2009 and it was determined that a project to reconfigure the lake and manage incoming sediment would help restore the amenity.[152] The cost for the project was estimated at ~$16 million, which would need to be at least partially funded through the stormwater management program. As well, because the lake was in the current need of restoration as a result of the unmanaged stormwater, it provided a clear opportunity to address the problem with residents and garner support.

148 See City of Kitchener, Stormwater Utility, Frequently Asked Questions Document; retrieved from: https://www.kitchener.ca/en/livinginkitchener/resources/StormwaterFAQ_Nov_1_2011.pdf

149 City of Kitchener, 2016, Stormwater Credits; retrieved from: https://www.kitchener.ca/en/livinginkitchener/Stormwater_credits.asp

150 City of Kitchener, (2015), Public Open House on Stormwater Master Plan Update; retrieved from: (http://www.kitchener.ca/en/livinginkitchener/resources/SWM_Images/INS_SWM_MP_-_Public_Open_House_1_boards_June_24_2015.pdf

151 See City of Kitchener Education Partnership; retrieved from: http://www.kitchener.ca/en/livinginkitchener/Education-Partnership.asp

152 Based on personal conversation with City of Kitchener staff and reference: City of Kitchener, no date, Victoria Park Lake Improvements – Public Information Centre; retrieved from: http://www.kitchener.ca/en/livinginkitchener/resources/portraitpanels_r1_lo.pdf

Figure 20: Victoria Park Lake Improvement (Source http://kitchener.ca)

Stormwater Management in the City

The City of Kitchener developed their first Stormwater Master Plan in 2001. The purpose of that plan was to streamline stormwater management activities.[153] Following adoption of the plan there have been a number of changes to the regulatory framework within Ontario as well as the 2010 adoption of a Stormwater Utility for the City. Consequently, the City is currently in the process of revising the 2001 Stormwater Master Plan. The revised Integrated Stormwater Master Plan is looking to include various measure to increase the use of green infrastructure for stormwater, mainly through market based instruments building on the success of the recently adopted stormwater utility.[154]

Lessons learned for Canadian Municipalities

The City of Kitchener is a good example of a successful implementation of a stormwater utility in a Canadian context. The Victoria Park Lake restoration project helped provide a tangible example to help the public understand the benefits of a dedicated source of funding for stormwater and the need to upgrade facilities.

Kitchener is also a good example of how each city will decide its own course of action for stormwater funding and services. Even though the initial feasibility studies were completed in collaboration with the City of Waterloo, the cities set slightly different rate structures. Both cities have stormwater credit programs that allow up to 45% reductions and apply to both residential and non-residential properties. Not every credit program includes residential allowances and so these cities will both be important to monitor going forward to assess the long-term success of this approach.

153 City of Kitchener, 2016, Integrated Stormwater Master Plan; retrieved from: https://www.kitchener.ca/en/livinginkitchener/StormwaterMasterPlan.asp

154 *ibid*

Case Study: Washington, DC

Summary

Washington, D.C. is home to one of the most polluted rivers in the United States – the Anacostia River. Billions of gallons of combined sewer overflows and untreated stormwater were being discharged to the Anacostia and other surrounding rivers on a yearly basis. Through ambitious plans by DC Water and the Department of Energy and Environment (DOEE), the District is reducing the volume of stormwater runoff and pollution entering nearby waterbodies while improving local neighbourhoods at the same time.

Stormwater in the District

Washington, D.C. has a population of 672,228 as of 2015[155] in a land area covering 61.4 square miles (159 km²). The District is set at the confluence of the Potomac and Anacostia Rivers and is very urbanized with 43% of land area covered with impervious surface (ranging from 30-60% depending on the neighbourhood).[156] It has an average annual precipitation of 39.73 inches (including 17.3 inches of snow). In the past 30 years, the District has lost 64% of its heavily forested areas and at the same time seen a 34% increase in stormwater runoff.[157]

In Washington, stormwater management is controlled by two distinct entities: DC Water and the Department of Energy and the Environment (DOEE). DC Water is a separate legal entity, responsible for distributing water and collecting and treating wastewater.[158] The DOEE is the District authority on energy and environmental issues. While the drivers for the two entities are separate, with DC Water being responsible for addressing combined sewer overflows and the DOEE focusing on the municipal separate sewer systems, both have an overlapping goal of managing stormwater for the benefit of the District's residents.

Stormwater Management by Tunnels

Over one-third of the city is served by combined sewer systems (CSSs). In 2011, this system was resulting in an estimated 1.5 billion and 850 million gallons of sewer overflows being discharged into the Anacostia and Potomac rivers, respectively,[159] making the Anacostia one of the most polluted rivers in the United States. To address this problem, DC Water was required to prepare a Long Term Control Plan (LTCP) as part of their US EPA National Pollutant Discharge Elimination System (NPDES) permit. DC Water's LTCP was approved in December 2004 and renamed the Clean Rivers

155 Retrieved from http://www.census.gov/quickfacts/table/PST045215/11 (March 10, 2016)

156 See Water Environment Federation article, 2012, Making Stormwater Retrofits Pay; retrieved from: http://chesapeakestormwater.net/wp-content/uploads/downloads/2012/08/Making-stormwater-retrofits-pay-Aug12.pdf; also see Comey, J., C. Narducci, and P.A. Tatian (2010). "State of Washington, D.C.'s Neighborhoods 2010". Retrieved from http://www.urban.org/sites/default/files/alfresco/publication-pdfs/412333-State-of-Washington-D-C-s-Neighborhoods-.PDF (March 10, 2016);

157 See Natural Resource Defence Council (2006), Rooftops to Rivers: Green Strategies for Controlling Stormwater and Combined Sewer Overflows; Retrieved from: http://www.lowimpactdevelopment.org/lid%20articles/rooftops.pdf

158 See DC Water website; retrieved from https://www.dcwater.com/customercare/services.cfm

159 Natural Resource Defence Council (2011), Rooftops to Rivers II: Washington, D.C. – A case study of how green infrastructure is helping manage urban stormwater challenges. Retrieved from: https://www.nrdc.org/sites/default/files/RooftopstoRivers_WDC.pdf

Project in 2010.[160] The initial project approved in 2004/2005 entailed a significant infrastructure component, as well as smaller support programs for green infrastructure. The major infrastructure piece of the project was a plan to build three tunnels that would hold the combined sewer overflows after major storm events before they reached the rivers and send the combined waters to the Blue Plains treatment plant before being discharged (see Figure 21).[161] The Anacostia tunnel alone was estimated to reduce combined sewer overflows to the Anacostia River by 98% by the time it would be completed in 2022.[162] Digging of the first two tunnels, the Blue Plains tunnel and the Anacostia River Tunnel, began in 2013, with expected completion dates of November 2015 and November 2017, respectively. The later phase of the project includes smaller tunnels to control overflows to the Potomac River and Rock Creek. The total cost of the tunnels was originally expected to be $1.9 billion but is now estimated at $2.6 billion (Figure 21).[163]

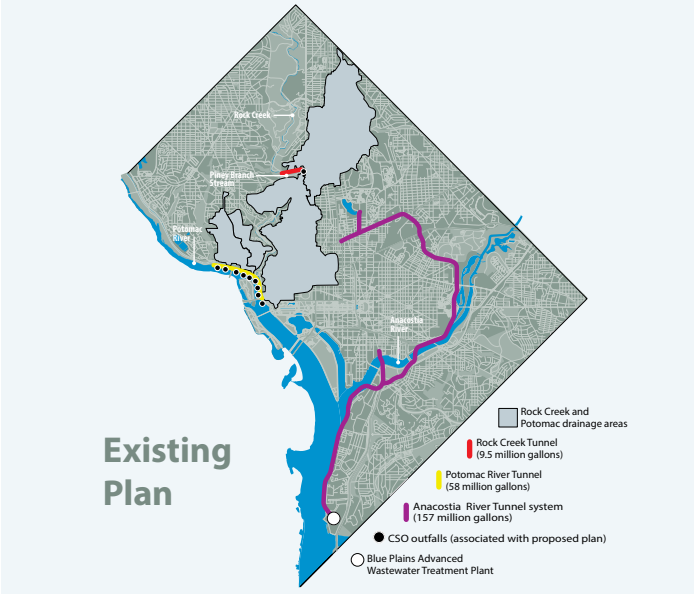


Figure 21: Original Clean Rivers Project Plan showing three major tunnel projects (Image credit: DC Water, 2015, source: https://www.dcwater.com/education/gi-images/maps_existing_updated.pdf)

Green Infrastructure in the Capital

At the time of the initial NPDES agreement in 2005, the tunnels were the major solution with green infrastructure accounting for only a small portion of the plan.[164] Today, thanks to additional work being done by the Department of Energy and Environment (DOEE), green infrastructure is playing a much larger role in the overall stormwater management program within the District.

160 See DC Water Clean Rivers Project; retrieved from: https://www.dcwater.com/workzones/projects/longtermcontrolplan.cfm

161 Natural Resource Defence Council (2011), Rooftops to Rivers II: Washington, D.C. – A case study of how green infrastructure is helping manage urban stormwater challenges. Retrieved from: https://www.nrdc.org/sites/default/files/RooftopstoRivers_WDC.pdf

162 See DC Water Biannual Report, April 2016: Combined Sewer Overflow (CSO) Control Activities, Clean Rivers Project News; retrieved from: https://www.dcwater.com/news/publications/DCWater_2014_annual_report.pdf

163 Natural Resource Defence Council (2011), Rooftops to Rivers II: Washington, D.C. – A case study of how green infrastructure is helping manage urban stormwater challenges. Retrieved from: https://www.nrdc.org/sites/default/files/RooftopstoRivers_WDC.pdf

164 DC Water Biannual Report, April 2016: Combined Sewer Overflow (CSO) Control Activities, Clean Rivers Project News; retrieved from: https://www.dcwater.com/news/publications/DCWater_2014_annual_report.pdf

Although the DC Water Clean Rivers Project only included $3 million for low-impact development retrofits at DC Water facilities as well as a rain barrel distribution program, more was being done to encourage green infrastructure through the DOEE.[165] The DOEE was adopting various green infrastructure programs to meet citywide water quality objectives, including green roofs, rain barrels, rain gardens, and pervious pavements. The D.C. Department of Transport was also provided funding to plant trees in public right-of-ways.

In 2007, the Green Build-Out Model, developed by Casey Trees and Limnotech, demonstrated the full benefits to the District of implementing green infrastructure throughout the city[166], and not just as a small secondary part of the Clean River Project. The study demonstrated that in a moderate scenario, increasing the tree cover in the city by 5% would prevent 311 million gallons of stormwater from entering the sewer systems and result in approximately 16 fewer CSO discharges per year.[167] The study noted that this greening could result in a saving to DC Water of between $1.4 and $5.1 million per year in annual operational savings in the combined sewer system (CSS) area due to reduced pumping and treatment costs. An updated study was completed in 2009 that added other green infrastructure practices such as rain gardens, rain barrels, permeable pavement and street bioretention cells and found an even greater reduction in stormwater and even more cost savings.

Permits & Regulations

In 2011 the District finalized a new MS4 permit, for those areas of the city not serviced by combined sewer systems, which focused more on the role of green infrastructure in managing stormwater. The MS4 permit included new performance standards that required the first 1.2 inches of stormwater be retained for all new development and redevelopment over 5,000 sq. ft. It also required the District to retrofit 18 million sq. ft. of impervious surfaces. These two standards also applied to the CSS areas within the District.

In 2013, the District updated its stormwater regulations to enforce the performance standards of the MS4 permit. Up until this point, the District's stormwater regulations focused on water quality requirements but in 2013, to comply with the NPDES standards, the regulations were revised and shifted the focus to on-site retention. Same as the previous regulations, the new regulations apply to large construction projects that disturb 5,000 square feet or more of soil. But now the regulations also apply to renovations to structures of 5,000 square feet or more in size and which cost more than 50 percent of the pre-project value of the structure.

The two main innovations in the 2013 stormwater regulations are the retention requirements and the creation of a private-market for trading stormwater retention credits. A regulated project would be required to retain the volume from the 1.2 or 0.8 inch storm, depending on the project type, and it must retain at least 50% of that volume on site.[168] The remainder of the volume can be retained through purchasing privately traded Stormwater Retention Credits (SRCs) on other sites or by paying an in-lieu fee to the DOEE.

165 Natural Resource Defence Council (2011), Rooftops to Rivers II: Washington, D.C. – A case study of how green infrastructure is helping manage urban stormwater challenges. Retrieved from: https://www.nrdc.org/sites/default/files/RooftopstoRivers_WDC.pdf

166 *ibid*

167 Casey Trees & Limnotech (2007), The Green Build-out Model: Quantifying the Stormwater Management Benefits of Trees and Green Roofs in Washington, DC; retrieved from: http://www.capitolgreenroofs.com/pdfs/Green_Infrastructure_Report.pdf

168 Evan Branosky, District Department of the Environment (2015), From Gray to Green: Stormwater Trading in Washington, D.C.; retrieved from http://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/DC%20SRC%20trading_July%202015%20River%20Voices.pdf

Stormwater Credit Trading Program

The main impetus for developing the stormwater credit trading program in Washington, D.C. was to provide flexibility to regulated projects but also to give private landowners throughout the District incentives for incorporating green infrastructure.[169] While the majority of the regulated projects would be occurring in the downtown area, through the voluntary SRC program more green infrastructure projects could occur in areas outside the downtown core that have lower land values and more open space available for projects. This makes it more financially viable for developers and does not affect opportunity costs in the space-limited downtown. For example, the developer will not have to choose between a green roof and a rooftop pool, which could be a barrier to their acceptance of the regulation. They can provide a building amenity and purchase credits for stormwater retention elsewhere. The voluntary credit program also works to increase the number of green infrastructure projects throughout the city in some of the more vulnerable areas, leading to greener communities and overall more efficient stormwater retention. If a downtown development were to be required to provide 100% of stormwater retention on site, they would only fully utilize that green infrastructure during major storm events. By spreading a greater number of smaller green infrastructure projects throughout the city, there is more uptake of stormwater during the smaller and more frequent storms, which tend to release the most pollutants into the system.[170]

DOEE is the authority that approves the SRC certification, trades, and use. Each approved SRC represents 1 year but is certified on a 3-year cycle. This ensures that not only are the projects maintained but it also provides a reliable stream of revenue, as the regulated sites must continually demonstrate volume retention requirements are being met. The first certification of credits took place in April 2014 and the first trade was approved in September 2014.[171]

Stormwater Credit Trading Program Early Stages

It takes time for a new market to get up and running, and the stormwater credit trading program is no different. As of today, only four trades have taken place since the program was launched in 2013, with more expected by the end of the year.[172]

On March 7, 2016, Prudential Financial, in collaboration with the Nature Conservancy and Encourge Capital, announced an investment of $1.7 million towards a pilot project to fund green infrastructure projects on private properties.[173] This initiative could help grow the market by alleviating the financial barrier of private landowners in participating in the credit program as they are given upfront funding and are not expected to be out of pocket for the expense while the market is developing. The DOEE has also taken steps to catalyze the market, launching the SRC Purchase Agreement Program.[174] This program will give property owners who voluntarily install green infrastructure projects the option of selling their SRCs directly to the DOEE.

169 Evan Branosky, District Department of the Environment (2015), From Gray to Green: Stormwater Trading in Washington, D.C.; retrieved from http://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/DC%20SRC%20trading_July%202015%20River%20Voices.pdf

170 See article by Citylab: Turning Stormwater Runoff Into Everyone's Business; retrieved from: http://www.citylab.com/cityfixer/2016/03/stormwater-runoff-credits-nature-conservancy-washington-dc/473700/

171 Evan Branosky, District Department of the Environment (2015), From Gray to Green: Stormwater Trading in Washington, D.C.; retrieved from http://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/DC%20SRC%20trading_July%202015%20River%20Voices.pdf

172 For up to date information on SRC trades and sale prices, check the SRC website at Http://doee.dc.gov/src to view the SRC registry

173 See new article by the Nature Conservancy: New Investment Model for Green Infrastructure to Help Protect Chesapeake Bay; retrieved from: http://www.nature.org/newsfeatures/pressreleases/new-investment-model-for-green-infrastructure-to-help-protect-chesapeake-bay.xml

174 See DOEE News Release: DOEE Announces $12,750,000 for Innovative program to Incentivize Cost-Effective Green Infrastructure; available at: http://doee.dc.gov/release/doee-announces-12750000-innovative-program-incentivize-cost-effective-green-infrastructure

Comprehensive Green Infrastructure Support Program

Washington, D.C. is not just a good example of a single innovative policy tool for implementing green infrastructure as they have developed a comprehensive program throughout the city that supports green infrastructure at many levels. The RiverSmart program, for example, provides a number of financial incentives to help property owners install green infrastructure (See Table 7, Figure 22).

Table 7: Summary of Washington, D.C. RiverSmart Programs

RiverSmart Program	Description
RiverSmart Homes	Provides outreach and education, design and construction assistance, materials and facilities and incentives for communities, businesses and homeowners. Homeowners receive up to $1,200 to adopt one or more of the following landscape enhancements: Shade Tree Planting; Rain Barrels; Pervious Pavers; Rain Gardens; BayScaping.
RiverSmart Communities	Offers incentives to condominiums, co-ops, and apartments, locally owned businesses and houses of worship that are interested in reducing the amount of stormwater pollution leaving their properties. RiverSmart Communities offers financial and technical assistance for property owners to install practices such as rain gardens, BayScaping, pervious pavement, and rain cisterns to control stormwater pollution.
RiverSmart Schools	In addition to installing new schoolyard green space, the program provides teachers with the training and resources they need to use their conservation site to teach lessons based on the DCPS Standards.
RiverSmart Rooftops (also known as the Green Roof Rebate Program)	The program began with a rebate of $3 per square foot and in 2015 the base funding has been increased to $10 per square foot, and up to $15 per square foot in targeted subwatersheds.[175]
RiverSmart Rebates	The RiverSmart Homes program offers a series of rebates when homeowners install their own trees, rain barrels, or rain gardens or remove impervious surfaces from their property. **Rain Barrel Rebate:** Rebates are issued as a direct reimbursement at a rate of $2 per gallon stored by the rain barrel or cistern. The minimum volume required is 50 gallons, which would provide a $100 rebate. **Tree Rebate**: District homeowners who purchase and plant an eligible tree on their property can receive a rebate. The rebate amount varies ($50 or $100) depending on the species of tree planted. Casey Trees administers the tree rebate on behalf of DOEE. **Landscaping Rebates**: District homeowners who install landscaping projects that reduce and/or treat stormwater runoff from impervious surfaces on their property are eligible for a rebate. The rebate amount is calculated based on the total square footage of impervious area that is treated as a result of the project (the treatment area). Rebates are issued as a direct reimbursement at a rate of $1.25 per square foot of treatment area. The minimum square footage that must be treated is 400 square feet, which would provide a $500 rebate. The maximum rebate is $1,200. The Alliance for the Chesapeake Bay administers the landscaping rebate on behalf of DOEE.
RiverSmart Program	**Description**
RiverSmart Rewards	District residents, businesses, and property owners can earn a discount of up to 55% off the DOEE Stormwater Fee when they reduce stormwater runoff by installing green infrastructure. DC Water also offers a similar incentive program for its customers to earn a discount of up to 4% off the Clean Rivers Impervious Area Charge (IAC). Residents can apply for both discounts with one application.

175 See DDOE, Green roofs in the District of Columbia; retrieved from: http://doee.dc.gov/greenroofs

WASHINGTON, D.C. HAS ALSO IMPLEMENTED A NUMBER OF OTHER PROGRAMS THAT SUPPORT GREEN INFRASTRUCTURE, INCLUDING:

- **Green Building:** By passing the Green Building Act of 2006, the District became the first in the U.S. to require green building certification for both public and private sectors.[176]
- **Clean and Affordable Energy Act of 2008**: This act requires the Mayor, through DOEE, to contract with a private entity to conduct sustainable energy programs on behalf of the District of Columbia.[177]
- **Green Area Ratio Requirements:** This is a zoning regulation that sets standards for landscape and site design to help reduce stormwater runoff, improve air quality, and keep the city cooler.[178]
- **Stormwater Fees:** Residents with the District of Columbia pay two separate stormwater fees, which are both collected by DC Water. DOEE charges a Stormwater Fee to support the implementation of its MS4 permit. DC Water collects the Impervious Area Charge (IAC) to fund the Clean Rivers Project. Both fees are calculated using Equivalent Residential Units (ERUs), where one ERU is equal to 1,000 square feet of impervious surface. In 2016, the stormwater fee was $2.67 per ERU and the IAC was $20.30 per ERU, for each of residential, multi-family, and non-residential.[179]

Figure 22: Green roofs, US Coast Guard HQ (Source: http://www.gsa.gov/portal/content/166443)

176 See DDOE, Green Buildings; retrieved from: http://doee.dc.gov/service/green-buildings

177 See DDOE, EnergySmart DC; retrieved from: http://doee.dc.gov/energy

178 See DDOE, Green Area Ratio; retrieved from: http://doee.dc.gov/GAR

179 See DC Water Approved 2016 Rates; retrieved from: https://www.dcwater.com/rates#approved_rates

Next Steps for Washington, D.C.

In an amendment to the 2005 consent, the Clean Rivers Project plan will include a larger portion of green infrastructure in the area that drains to combined sewer overflow CSO 049 (see Figure 23). This will allow the elimination of the previously planned Rock Creek tunnel.[180]

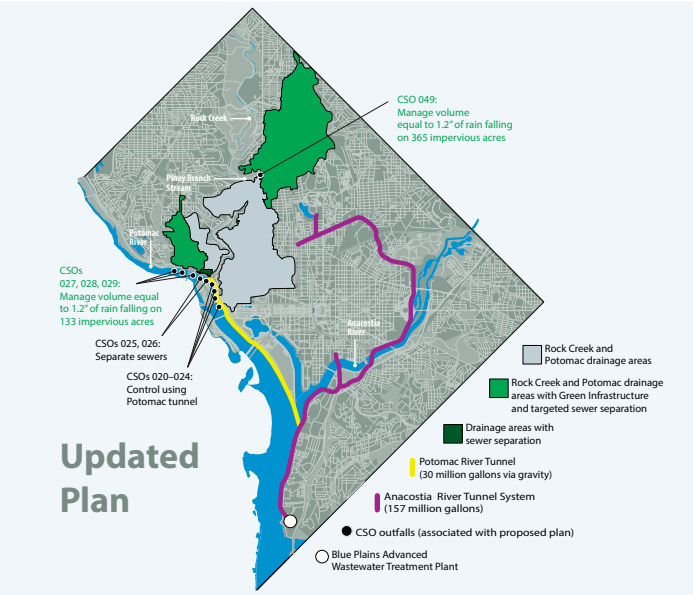


Figure 23: Updated Clean Rivers Project Plan for Washington, D.C.
(Image credit: DC Water, 2015, source: https://www.dcwater.com/education/gi-images/maps_existing_updated.pdf)

Lessons Learned for Canadian Municipalities

The experience of Washington, D.C. can provide a number of very useful lessons for Canadian municipalities looking to improve the use of green infrastructure for stormwater management:

REGULATIONS CAN DRIVE REQUIREMENTS

The change to the stormwater regulations for development is what drives the credit trading program. Without this it would be difficult to require developments to meet new stormwater retention requirements. The downside of this type of approach is that it is reliant on new or re-developments that are regulated to push the market. If the District is experiencing a high volume of development projects, then this will work but should the pace of development slow, the ability to encourage green infrastructure projects through this method will be negatively impacted.

180 DC Water Biannual Report, April 2016: Combined Sewer Overflow (CSO) Control Activities, Clean Rivers Project News; retrieved from: https://www.dcwater.com/news/publications/CSO_apr_2016.pdf

CREDIT TRADING PROVIDES INCENTIVE FOR SMALL GREEN INFRASTRUCTURE PROJECTS – AND MANY SMALL PROJECTS CAN HAVE A BIG IMPACT

The main advantage of the credit trading program is that it encourages smaller green infrastructure projects in areas where there may not be a large number of development projects that would allow for regulations to impact stormwater retention compliance. By incentivizing smaller projects the program is encouraging green infrastructure to be developed in more areas around the District, improving more neighbourhoods.

COMPREHENSIVE PROGRAM OF INTEGRATED WATER MANAGEMENT IS THE BEST OVERALL OPTION FOR SIGNIFICANTLY CHANGING STORMWATER MANAGEMENT PRACTICES

As has been seen in many of the case studies reviewed in this report, a comprehensive program that touches on many areas of development, different property types and owners, and different types of incentives, is the best for achieving ambitious stormwater management goals.

PRIVATE MARKET PARTNERSHIP MAY BE AN ASSET TO GET THE MARKET MOVING

As is the case in Prince George's County, partnering with the private market organizations can have many advantages for transitioning stormwater management practices and achieving ambitious goals that may not have been done through public investments alone. Engaging the private market also has the potential of reducing overall costs and encouraging local economic growth.

Case Study: Prince George's County, MD

Summary

Prince George's County, Maryland has tackled the challenge of cleaning up stormwater through the implementation of an innovative P3 partnership, the first of its kind in North America. Through this partnership the County is leading the way in establishing a new paradigm of how the public and private sectors work together – not as contractors and employees, but as partners. Although the program is still in the early stages and has yet to prove long-term success, the initial outcomes are positive and the partners are optimistic that they will achieve their ambitious goals. The White house and US EPA have formally recognized the County's efforts as among the most innovative in the United States.[181]

Clean Water Program

On December 29, 2010, the U.S. EPA established the Chesapeake Bay Total Maximum Daily Load (TMDL), which holds regions within the area accountable for actions to restore clean water in the Chesapeake Bay.[182] Following the new 2010 Clean Water Act requirements for better stormwater runoff pollution prevention, the Maryland Governor signed into law a House Bill (House Bill 987) that required nine Maryland Counties and the City of Baltimore to implement pollution prevention programs.[183] In 2013, in response to this mandate, the Prince George's County's Council passed two pieces of legislation: a bill to establish the Clean Water Program and legislation to establish a schedule of fees (The Clean Water Act Fee) to be collected to fund the Clean Water Program.[184] The fee, which is paid annually by all property owners (with some exemptions), is collected through their property tax bill.

Knowing that they were responsible for retrofitting approximately 3,240 ha of existing impervious surfaces by 2025 at a cost of approximately $1.2 billion, Prince George's County sought out a way to fund this beyond the Clean Water Act Fee.

Clean Water Partnership

The Clean Water Partnership is an agreement between Prince George's County and Corvias Solutions. Work on the P3 partnership began in 2011 but the two parties signed the formal agreement in March 2015.[185] The agreement is for the retrofit of up to 4,000 acres of impervious surfaces with green infrastructure, leveraging the private sector's best

181 See Prince George's County New Release, April 3, 2015, White House and EPA Recognize Prince George's County Stormwater Retrofit Public-Private Partnership (P3) Among Most Innovative in Nation; retrieved from: http://www.princegeorgescountymd.gov/ArchiveCenter/ViewFile/Item/707

182 See US EPA, 2015, Chesapeake Bay TDML Fact Sheet; retrieved from: https://www.epa.gov/chesapeake-bay-tmdl/chesapeake-bay-tmdl-fact-sheet

183 US EPA, 2014, Getting to Green: Paying for Green Infrastructure; retrieved from: https://www.epa.gov/sites/production/files/2015-02/documents/gi_financing_options_12-2014_4.pdf

184 Prince George's County, Stormwater Management, Clean Water Program; retrieved from: http://www.princegeorgescountymd.gov/289/Clean-Water-Program

185 Prince George's County, Clean Water Partnership, Frequently Asked Questions; retrieved from: http://thecleanwaterpartnership.com

practices and efficiencies in project management and delivery. The County has committed to investing $100 million during the first three years for 2,000 acres, with an option to add another 2,000 acres after the first three years of the agreement. Corvias manages the design, construction, and long-term maintenance of the infrastructure and is paid per acre of retrofitted land. The cost savings expected through this partnership is in the range of 30-40% of the originally estimated $1.2 billion.[186]

The advantages of the P3 model for this work include cost savings associated with leveraging the private sector's ability to save through bulk materials, contracts, design and permitting. It is also in the best interest of the private company to build a quality infrastructure project at a lower cost initially and over the long term since it is their responsibility to complete the project within budget and also to maintain the infrastructure over its lifespan.[187] The P3 model also allows flexibility in the project as the private sector is allowed to come up with an innovative solution to meet this criteria and is not subject to as much "red tape" as a project completely implemented by government.[188]

A prominent feature of the Clean Water Partnership is the requirement for the use of local businesses that are small, minority, or women-owned.[189] The agreement has a goal of 30-40% of the total project scope being contracted to these businesses, with economic incentives going to Corvias if they achieve this or greater percentages.

The first project under the Clean Water Partnership was completed in October 2015.[190] It was a 1 ha project at Forestville New Redeemer Baptist Church, which included the installation of pervious pavers, three rain gardens, an infiltration trench, and a bioswale. The latest news on the project is that a total of 1.9 ha has been retrofitted so far with another 1,450 acres and 400 installations in various stages of planning, permitting and design.[191]

186 Water Environment Federation, 2013, Stormwater Report: Financing Urban Retrofits via a Public-Private Partnership; retrieved from: http://stormwater.wef.org/2013/07/financing-urban-retrofits-via-a-public-private-partnership/

187 *ibid*

188 *ibid*

189 Prince George's County, Clean Water Partnership, Frequently Asked Questions; retrieved from: http://thecleanwaterpartnership.com/faqs

190 Water Environment Federation, 2015, Stormwater Report: County Announces First Stormwater Project Completed Under Public-Private Partnership; retrieved from: http://stormwater.wef.org/2015/10/county-announces-first-stormwater-project-completed-public-private-partnership/

191 Bay Journal, April 24, 2016, Public-Private partnerships expected to lower stormwater retrofit costs; retrieved from: http://www.bayjournal.com/article/public_private_partnerships_expected_to_lower_stormwater_retrofit_costs

Lessons Learned for Canadian Municipalities

One of the key lessons learned from the Prince George's County example is that the private sector can be a very important partner is addressing issues of stormwater management when the public sector is limited in resources and capacity. Canada has experience implementing P3 projects at the Federal Government level, though PPP Canada, with demonstrated success.[192] The P3 model has not been implemented to the same extent at the local government level compared to federal government in Canada, but the potential is there for further investigation in to this innovative model.

Figure 23: Stormwater infrastructure construction (Source: http://thecleanwaterpartnership.com)

192 See PPP Canada site for project details, available at: http://www.p3canada.ca/

This report is available online at: sustainableprosperity.ca/stormwater

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