

# Soak It Up! Toolkit

*How your community can save money and protect the environment by implementing green stormwater infrastructure across the urban landscape.*

A SELECTION OF LOCAL PROGRAMS AND POLICIES FOR DECISION-MAKERS, PRACTITIONERS,  
AND INFLUENCERS.

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# Credits



THE SOAK IT UP! Toolkit was written and researched by Clara Blakelock and Clifford Maynes of Green Communities Canada. See [www.greencommunitiescanada.org](http://www.greencommunitiescanada.org), and our rain-related websites, including [www.raincommunitysolutions.ca](http://www.raincommunitysolutions.ca) and [www.depaveparadise.ca](http://www.depaveparadise.ca). The first edition of Soak it Up! was published February 2016. Feel free to quote or excerpt with credit.

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We enthusiastically welcome further comments and suggestions, in particular examples from across Canada. Email [info@raincommunitysolutions.ca](mailto:info@raincommunitysolutions.ca). To keep in touch, subscribe to our [Umbrella Stormwater Bulletin](#) and contribute your updates.



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# Contents

THIS PUBLICATION identifies tools for integrating green stormwater infrastructure across the urban landscape. Each section contains an overview, examples from real-world experience, and insights from practitioners about what works best—and what doesn't.

- **Plan for green stormwater infrastructure.** Adopt high-level commitments, policies, strategies, and implementation targets.
- **Engage the community.** Secure buy-in and participation.
- **Build capacity.** Develop skills, knowledge for practitioners and decision-makers.
- **Use green infrastructure for new developments.** Make them shine.
- **Use green infrastructure on public lands.** Parks, road rights-of-way, school yards, etc. are opportunities to implement functional green infrastructure.
- **Support your urban forest.** Trees provide many benefits beyond stormwater management.
- **Charge user fees for stormwater services.** Create a sustainable and fair funding source for stormwater infrastructure, both grey and green.
- **Manage rain on private property.** Developed residential and commercial properties comprise the majority of the land base. Leverage implementation on private properties with programs, credits, and incentives.

# Transforming the urban landscape

**I**N A FOREST, most of the rain that falls is intercepted by trees and other vegetation or soaked into the ground. Very little—less than ten per cent—eventually runs off into rivers and streams. But when a forest turns into a city, everything changes. With the loss of vegetation and the increase in impervious surfaces—buildings, roads, parking lots, shallow soils—a majority (if not most) of the rain that falls rapidly becomes stormwater runoff, a polluted and sometimes destructive urban waste product. [See more.](#)

[Climate change](#) worsens the runoff problem by increasing the frequency and severity of extreme weather events.

[Consequences](#) of these combined factors include flooding, business interruptions, infrastructure damage, erosion, runoff pollution, sewage system overflows, sewer backup, health effects, increased reliance on treated water for irrigation, and loss of groundwater recharge. Vulnerable and lower income households are especially hard hit.

## A WORD ABOUT TERMINOLOGY

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WE USE the term **green stormwater infrastructure** to highlight the real value of the ecosystem services provided by nature, such as flood-risk reduction, habitat, and cooling. Other terms for the measures and approaches described in this publication include low impact development (LID), best management practices, stormwater innovations, source controls (“managing rain where it falls”), sustainable urban drainage systems, [better site design](#), infiltration landscapes, and water-sensitive urban design. To communicate effectively, you will need to tailor your choice of language to your audience.

Conventional stormwater and flood management solutions on their own are unable to keep ahead of these problems. In densely populated urban areas, space is limited and land is prohibitively expensive.

For these reasons many communities—including a number of northern US cities—are turning to green infrastructure as a priority for managing rain. They are taking steps to maintain, restore, and imitate natural ecosystem services, including infiltration and evapotranspiration. In short, they are making the modern city landscape more like a natural landscape, reducing runoff volumes and pollution, and protecting property and the environment.

[Measures](#) (also known as low impact development) include rain gardens, bioswales, permeable pavement, infiltration galleries, green roofs, the urban forest canopy, and rainwater harvesting and reuse. These proven effective technologies manage rain where it falls and heal the urban water cycle.

[Benefits](#) include:

- flood-risk reduction, climate change adaptation
- water quality protection (natural filtration is restored)
- [infrastructure savings](#) (green infrastructure combined with grey is cheaper than grey on its own)
- improved tourism and recreation
- increased public health, livability, walk friendly communities
- increased property values
- urban heat island mitigation
- [see more](#).



## Municipal action for green infrastructure

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GREEN INFRASTRUCTURE is coming to Canada. For example, Ontario's Environment and Climate Change minister Glen Murray has vowed to make "green infrastructure the new normal." Green infrastructure is supported by provincial land-use policies, regional planning legislation, the Great Lakes Strategy, and the Climate Action Strategy. An environment Ministry [interpretation bulletin](#) identifies source controls to reduce runoff as the top priority for stormwater management. An LID Guidance Manual being prepared in 2016 is expected to include stormwater volume reduction targets, i.e., specific requirements for reducing stormwater through onsite infiltration and other measures.

Meanwhile, responsibility and authority for making green stormwater happen is largely municipal. To help meet the challenge of effective local implementation, we have prepared the *Soak it Up! Toolkit*, a compendium of practical strategies for activating green stormwater infrastructure at a community scale, across the urban landscape.

The toolkit provides an overview of policies and programs for municipalities. It is deliberately brief, to provide a bird's eye view of the options. It's a "getting started" document, with links to more information. Target audiences include:



- decision-makers, such as municipal councillors and managers—anyone with responsibility for shaping stormwater policies and practices
- influencers, including community and environment groups, researchers, and other champions of green stormwater infrastructure

## Developing a local strategy

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THIS TOOLKIT includes softer approaches, like community engagement and pilot projects; it also includes more vigorous strategies like programs, policies, and incentives designed to achieve systemic change and make green infrastructure the “new normal.”

This document should help you identify the elements that belong in an action strategy that works for your community—based on local issues and priorities, where your community is at, where you are headed, and a rough timeline for getting there. Your strategy will likely need to be multi-layered, promoting change from multiple angles, responding to opportunities as they arise.

Your strategy needs to be long-term. Green stormwater infrastructure is a new paradigm: it’s about absorbing rain into the urban landscape rather than expediting runoff, about working with nature rather than relying exclusively on hard engineering solutions. It’s about a change in culture, and a transformation in the marketplace of knowledge, goods, and services.

## KEEP IN TOUCH

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WE WELCOME your comments and contributions, especially your insights into the application of various tools and examples from outside our home base of Ontario. Contact us at [info@raincommunitysolutions.ca](mailto:info@raincommunitysolutions.ca).

Keep in touch with our free monthly newsletter, the Umbrella Stormwater Bulletin. [Subscribe](#) on our website, [www.raincommunitysolutions.ca](http://www.raincommunitysolutions.ca). Be sure to send us news from your community or organization so we can share it with others.

And take a look at the community engagement services we provide at [www.raincommunitysolutions.ca](http://www.raincommunitysolutions.ca). We’d be happy to discuss a customized strategy tailored to your community involving local partners.

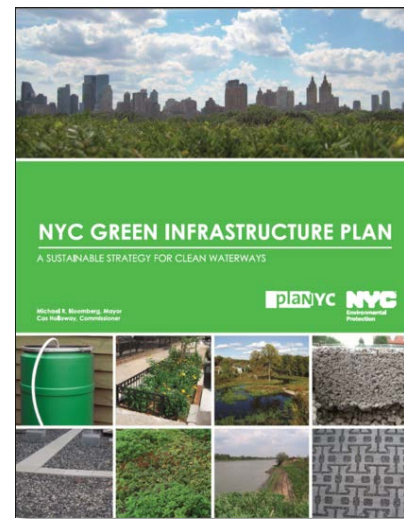
# *Incorporating green infrastructure in local plans*

**M**UNICIPALITIES and other local water-related bodies (e.g., Conservation Authorities) should adopt a high-level policy commitment to maintaining, restoring, and imitating natural ecological processes as a top priority for stormwater management. More detailed policy commitments and targets should be outlined wherever appropriate.

A high-level policy commitment sends a clear message to everyone concerned— municipal departments, developers, landscapers, property owners—that green stormwater infrastructure is “the new normal.” It sets the stage for cross-departmental cooperation and community partnerships.

This commitment can take many forms. The notion of “resilient communities” has broad appeal and resonates where climate adaptation is a goal. [Blue-Green City](#) captures the idea of integrating water, nature, and the urban landscape. You can also talk about restoring and imitating the natural water cycle. Maintaining [water balance](#). Or managing rain where it falls.

In October 2015, the Obama White House issued a landmark [memorandum](#) directing all federal agencies to incorporate the value of natural infrastructure and ecosystem services in their decision-making. The memorandum cites the contribution from nature “to our economic prosperity, protect the health and



safety of vulnerable populations, and help build more resilient communities,” an often overlooked contribution valued at many billions of dollars.

Commitments to green stormwater infrastructure and implementation strategies should be incorporated where opportunities in municipal and related documents such as the following:

- **Stormwater management master plans.** These plans should identify implementation sites and strategies. For example, [Thunder Bay’s stormwater master plan](#) identifies 600 sites for possible LID installations. The Town of Okotoks, AB [Stormwater Management Master Plan and Flood Mitigation Plan](#) identifies the potential for LID despite low-infiltration soils.
- **Green infrastructure strategies.** Strategies focused on green infrastructure implementation [can identify and value existing green infrastructure](#), and opportunities to do more. See examples from [Milwaukee](#), [New York](#), and [Seattle](#). See London U.K. [task force](#) recommendation for a Commissioner of Green Infrastructure.
- **Infrastructure plans and asset management.** Green stormwater infrastructure should be incorporated into infrastructure capital investment and maintenance plans. A tool is currently being developed by Credit Valley Conservation to assist municipalities in asset management.

## ONE WATER

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MOST MUNICIPALITIES manage drinking water, wastewater, and stormwater as three distinct systems. However, a “one water” approach ([integrated water management](#)) recognizes that all three systems are part of the same water cycle, and impact each other. For example, wastewater and stormwater both discharge into waterbodies that are drinking water sources (often for other communities downstream); stormwater can recharge aquifers for drinking water if it is absorbed; rainwater can be harvested for irrigation to conserve potable water; and stormwater runoff reduction helps keep combined sewers from exceeding capacity. [Integrated planning and management](#) of all three systems enables local governments to work together to deliver clean, safe drinking water, prevent flooding, and protect aquatic habitats, and achieve money-saving synergies.



- **Official land-use plans.** See [Markham's](#) commitment to green infrastructure as part of its requirement for stormwater management in all development and redevelopment.
- **Watershed plans.** See for example the [Lynde Creek Watershed Plan](#), which directs the creation of an urban stormwater retrofit LID plan and an imperviousness report card.
- **Source water protection plans.** Contaminants in stormwater runoff are a threat to source water for drinking. Sudbury's [source water protection plan](#) calls for green infrastructure to reduce runoff pollution.
- **Water conservation plans.** Green infrastructure, including harvesting and reuse, reduces consumption of treated potable water for irrigation. Further, communities that depend on groundwater for drinking water need green infrastructure to facilitate groundwater recharge.
- **Flood reduction plans.** The City of Peterborough's [Flood Reduction Master Plan](#) recommends disconnecting downspouts and foundation drains from the sewer system. The City of Toronto [recommends green infrastructure](#) be considered as part of basement flooding environmental assessments.
- **Sustainability plans.** Green stormwater infrastructure address all dimensions of sustainability - environmental, economic, health, social - and should feature prominently in sustainability/healthy community plans. See for example [Imagine Calgary](#), which sets a target to reduce impervious areas to 30% of total land area, or the City of Mississauga [Living Green Action Plan](#), which includes a commitment to incorporate LID into all existing and new city projects.

## TARGETS FOR INSTALLATION OF GREEN INFRASTRUCTURE

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CITIES USE different ways to determine how much rainfall to manage with green infrastructure when setting targets for their plans and visions. Types of targets include:

- volume of rainfall managed with green infrastructure—annually, or per storm event, by geographic area, watershed, or subwatershed
- area or percentage of impervious surface in a city that has its runoff (up to a certain level of storm) managed via green infrastructure
- total annual runoff or pollutant loadings to streams and lakes

- **Climate adaptation plans.** Damaging increases in stormwater volumes and peaks are a major impact of climate change. Green stormwater infrastructure can help to reduce strain on existing municipal systems during extreme events. Nova Scotia provides [a guide for municipalities](#) to assist in climate adaptation planning. [Adapt-action](#) is an online tool providing resources for Alberta municipalities to adapt to flooding and water scarcity.

## What's happening?

### SEATTLE

- In 2013, Seattle council resolved to manage 2.6 million m<sup>3</sup> (700 million gallons) of runoff annually by 2025 through green infrastructure—the culmination of years of work in implementing successful projects.
- A 2015 draft strategy identified opportunities to accelerate green infrastructure retrofits, classifying them by type, and setting an interim goal of managing 1.5 million m<sup>3</sup> (400 million gallons) of runoff annually by 2020.

### MILWAUKEE

- In 2010, the Milwaukee Metropolitan Sewerage District established a vision for 2035 of zero combined sewer overflows, zero basement sewer backup and improved stormwater management. The goal is to capture the first 1.27 cm (half inch) of rainfall across the district, or 2.8 million m<sup>3</sup> (740 million gallons) of water with every rainfall.
- In 2013, a [regional green infrastructure plan](#) classified impervious areas by type across seven watersheds, and identified targets for the volume of rainwater to be managed by each type of green infrastructure technology.
- The plan uses a [Green Infrastructure Portfolio Standard](#), an approach borrowed from the world of renewable energy, in which annual targets are established for each watershed or geographic area. The aim is to gradually ramp up installation capacity without creating bottlenecks or price escalation.

### MARKHAM

- [Markham's official plan](#) includes a commitment to Low Impact Development and innovative stormwater management.
- The plan directs the creation of a Stormwater Management Retrofit Master Plan to identify and prioritize opportunities for improved stormwater

management on existing developed properties, with a focus on restoring natural hydrologic function.

#### NEW YORK CITY

- The 2010 [NYC Green Infrastructure Plan](#) sets a goal of managing 10% of runoff from impervious areas in the combined sewer region through infiltration and on-site detention by 2030. Progress is reported annually.
- Elements include priorities for green infrastructure implementation, grant programs, a [co-benefits calculator](#), and standard designs for GSI in rights-of-way.

#### BRITISH COLUMBIA

- The [Stormwater Planning Guidebook](#) recommends municipalities set watershed targets to capture 90% of annual rainfall in order to maintain pre-development hydrology.
- The Partnership for Watershed Sustainability publishes the “[Beyond the guidebook](#)” series providing examples and advice for local implementation.

## Take away

- ➔ *When communicating your vision, put practical benefits front and centre, e.g., reducing flood-risk and saving money on infrastructure. Tie into local priorities.*
- ➔ *Feature and quantify co-benefits. (Milwaukee estimated property value increases of \$667 million after full implementation of the plan. New York developed a [co-benefit calculator](#) for individual projects.)*
- ➔ *Form an interdepartmental task force to help ensure implementation. (The City of London, UK established a Green Infrastructure Task Force following the publication of its infrastructure plan.)*
- ➔ *Adopt specific targets and requirements to give teeth to general commitments.*

# *Building community support, participation*

**M**OST PEOPLE *don't know much about stormwater, including flood risks, runoff pollution, types of sewers, treatment, costs, and climate impacts. Most of us are also unaware of actions we can take on our own property or in our local community to reduce these problems.*



Property owners need to be engaged to build awareness, buy-in, and participation in implementing green stormwater infrastructure.

Effective engagement reaches out to property owners through

trusted channels, where they live and work, helps them understand personal risks, and provides practical guidance and assistance in taking action.

Successful community engagement programs have included several of the following elements:

- **Partnerships.** Work with community organizations, faith communities, employers, and others.
- **Accessible information.** Offer videos, fact sheets, brochures, websites, and social media with plain language information about stormwater problems, solutions, and available programs.

- **Demonstration projects.** Install rain gardens, permeable paving, or other green infrastructure projects in high profile locations with interpretive signage. Involve volunteers in construction and maintenance.
- **Site-specific advice.** Offer one-on-one home or commercial/institutional visits with property owners to help them understand the path of runoff on their properties and opportunities to solve drainage problems such as wet basements, and ponding. See examples - [Riversmart Homes in Washington D.C.](#) the [RAIN Home Visit](#) and [Greening Corporate Grounds](#).
- **Depaving.** Partner with property owners to organize community projects in which [unused pavement is torn up by hand](#) and replaced with green space—a highly effective way to draw attention to the issue of urban runoff and impervious surfaces.
- **Community outreach.** Offer presentations, tables, and workshops that teach community members how to install and operate rain barrels, design, and build rain gardens, build pet waste composters, [landscape with native plants](#), etc.
- **Recognition.** Give awards to property owners who demonstrate green stormwater management. Recognize them through public ceremonies, online profiles, lawn signs, etc.
- **Incentives.** Attract early adopters by providing small rebates to property owners who install rain gardens, rain barrels, or other green



infrastructure. The City of Thunder Bay gives [rebates of \\$500](#) to homeowners who attend a training session and install a rain garden. Many cities provide free or discounted rain barrels. For widespread management of stormwater on private property, larger grants or rebates will be required (see *Incentives*, below).

- **Online tools.** Offer tools to help property owners see how green infrastructure could fit onto their property and how much rainwater it would capture. If credits are available, use the tool to show available savings/incentives. See Philadelphia's [Credits Explorer](#) or Victoria's [Rainwater Management Planner](#). Note: other online tools are more suitable for design professionals (see the [Water Balance](#) tool, the [Minimal Impact Design Standards](#) tool from Minnesota or the [USEPA National Stormwater Calculator](#)).
- **Consultation.** Engage community members in developing the policies and programs cited elsewhere in this toolkit. Invite suggestions and feedback about potential projects.
- **Design competitions.** Elicit submissions from design teams of professionals or students for retrofits of specific sites. Offer cash prizes and the chance to see designs become reality. Examples: [EPA Campus Rainworks Challenge](#), and the [Soak it up! Green infrastructure design competition](#).
- **Tours and maps.** Highlight existing green infrastructure by offering organized or self-guided tours of project sites. See examples of tours in [Portland, Oregon](#), and maps produced by [Credit Valley Conservation](#) and the [Toronto and Region Conservation Authority](#).

## Take away

- ➔ *High visibility demonstration projects get attention from media, politicians, and residents. They showcase possibilities and inspire further action.*
- ➔ *In Kitchener and Waterloo, there was less success with door-to-door campaigns (cold calls). Engage people when they show an interest, e.g., at community events.*

# *Bringing practitioners and decision-makers up to speed*

**P**LANNERS, APPROVALS STAFF, *engineering consultants, builders, contractors, landscapers, gardeners, and others often lack practical knowledge and experience in the implementation of green infrastructure, and it is outside their comfort zone. This is a serious barrier to progress.*

To help make green infrastructure “the new normal”—as a complement to grey infrastructure— decision-makers and practitioners involved with rainwater management need to be engaged, oriented, and trained. Private contractors need to see green stormwater infrastructure as a major new business opportunity.

## SIMPLIFIED HOW-TO GUIDES

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Cities can provide guidance to contractors and property owners who are installing green infrastructure on private lands. This is essential where green infrastructure is required or incentivized. While every site is different, guides can provide simplified instructions for less complex projects that do not require the involvement of consulting firms or project engineers. See the City of Victoria’s [Rainwater Management Standards](#) or the City of Atlanta’s guides for green infrastructure at [single family residences](#) or [small commercial developments](#).

For some types of green infrastructure, like [green roofs](#) and [permeable pavement](#), there are recognized training and certification systems. Less so for other landscape-based solutions like bioswales and rain gardens, although there may be local programs.

There is a need for more [standardization of training programs](#) across the country. Meanwhile, local solutions must be found to close the gap.

## ONTARIO

- The Toronto and Region Conservation Authority, Lake Simcoe Region Conservation Authority, and Credit Valley Conservation Authority offer [training programs](#) in LID design, construction and maintenance, in-person and online. These trainings are also available outside Ontario.
- [Landscape Ontario](#) offers training in rain garden design and construction for landscape professionals.

## WASHTENAW COUNTY, MICHIGAN

- The [Master Rain Gardener](#) program run by Washtenaw County trains volunteers in the design and construction of rain gardens.





- Participants attend five classroom sessions and design a rain garden to achieve certification. Community members share knowledge with their neighbours.

## UNIVERSITY OF WASHINGTON

- Online course and certificate in [Green Stormwater Infrastructure Design and Management](#) targets engineers, planners, landscape architects and other professionals interested in green infrastructure.

## Take away

- *“Stackable” certifications allow people to progress from basic to advance levels.*
- *Some agencies offer training but exempt experienced contractors—see the [Rainscaping program](#) of Lake Simcoe Region Conservation Authority. Others require all contractors to be certified, for example, Seattle’s [Rainwise](#).*



## JOB CREATION AND GREEN INFRASTRUCTURE

STUDIES, LIKE this one from [New York City](#), have found that green infrastructure is less expensive than grey and less energy intensive, but more labour-intensive. That’s good news for job creation. Green infrastructure maintenance can be a viable career opportunity for low- or semi-skilled workers. See training programs in [Ohio](#) and [New York](#). See [Green for All](#) reports.

# *New build—creating a shining example*

**N**EW DEVELOPMENT *and redevelopment projects must meet standards in any municipality. This is an opportunity to ensure that these properties lead the way by managing stormwater onsite.*

Policies differ in the amount of rainfall that must be retained or infiltrated, the size of project covered, and the primary objective—reducing peak flows or volumes.



# What's happening?

## WASHINGTON, D.C.

- Development and redevelopment projects [trigger a requirement](#) to manage either the 38mm (1.2 inch) or 20mm (0.8 inch) storm, depending on project specifications. Generally, projects that create more than 465m<sup>2</sup> (5,000 ft<sup>2</sup>) of impervious area, or disturb an area of this size, must manage stormwater onsite—through infiltration, harvesting, or evapotranspiration.
- Once they have met 50% of the requirement for managing rainfall onsite, property owners can meet the rest of the requirement by paying a fee in lieu or purchasing privately traded [Stormwater Retention Credits](#) (SRCs—[see more](#)).

## ATLANTA

- Development projects must [treat the first 25mm \(1 inch\) of rainfall](#) with green infrastructure.
- Additions or disturbances of more than 93m<sup>2</sup> (1000 ft<sup>2</sup>) for single family homes must also meet the stormwater management requirement.
- See [simplified guides](#) for installation on residential and small commercial properties.



## TORONTO

- The [Toronto Green Standard](#) requires 5mm (¼ inch) of infiltration in all new development. However, projects that meet a voluntary stretch target under the Green Standard (10 mm infiltration) are eligible for a refund of some development charges.

## LAKE SIMCOE REGION CONSERVATION AUTHORITY

- A [model by-law](#) and [guidelines](#), adapted from Minnesota's Minimum Impact Design Standards, have been developed for use by local municipalities. Goals are to preserve and restore open space, reduce impervious cover, distribute and minimize runoff, reuse runoff, and control erosion and sedimentation during construction. Guidelines recommend management of the first 25mm (1") of runoff on-site for any major development project that creates or reconstructs 0.5 hectares of new impervious surface. They include flexible treatment options for sites with restrictions.

## Takeaway

- ➔ *Offer flexibility for properties that can't meet targets onsite—including payments in lieu or off-site installations. However, onsite infiltration is preferred and should be required where possible.*
- ➔ *Ensure approvals staff are trained in innovative stormwater management.*
- ➔ *Adjust infiltration standards according to soil conditions—minimum standards for soils with poor drainage, and higher standards where conditions are more favourable to infiltration.*

# Making green infrastructure attractive for developers

**S**OME CITIES provide incentives to developers to manage stormwater using green infrastructure. Incentives may be used instead of regulations, or in addition to them. Incentives can help developers overcome lack of familiarity and reluctance, until they become aware of the potential benefits: reducing or eliminating ponds and increasing land available for building lots.

Development incentives can take the form of:

- design consultation between city staff and developers focusing on green infrastructure and its advantages
- accelerated approvals processes
- floor-area bonuses

## What's happening?

### YORK REGION

- The Region piloted an [accelerated approvals process](#) for a project in the Town of Newmarket.
- To qualify, the project had to meet stormwater requirement (25 mm infiltration) and other targets beyond current standards. Review agency staff and project consultants met regularly as part of an integrated design process designed to expedite approvals.

- The development (under construction in 2015) includes rain gardens, bioswales, exfiltration systems, improved soil management practices, and an engineered wetland along with an underground storage tank instead of a traditional stormwater pond.

#### LAKE SIMCOE REGION CONSERVATION AUTHORITY

- The LSRCA offers early consultation in the form of a design charrette (see [Rainscaping](#)) with developers to assist them in defining objectives, opportunities and constraints for LID implementation. .

## Take away

- ➔ *Developers are focused on the bottom line. Incentives that save time in the approvals process and/or increases land available for development will be taken seriously.*
- ➔ *Developers are learning that green infrastructure like rain gardens can boost property values and curb appeal.*
- ➔ *Early adopters of the LSRCA's design charrette process found that it reduced the number of submissions required to reach final draft plan approval.*

### GREEN ROOFS AND BLUE ROOFS—MAKING THEM HAPPEN

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SOME CITIES require or incentivize green roofs. Examples include the City of Toronto's [Green Roof Bylaw](#) and the City of Portland's [Ecoroof floor area ratio bonus](#). Green roofs can be designed with stormwater management in mind, or with a focus on other [co-benefits](#) (reducing urban heat island effect, carbon sequestration, energy savings, improved air quality and increased amenity spaces). Blue roofs incorporate rainwater harvesting. While beneficial in very dense areas with little available land, green roofs are one of the most expensive forms of green infrastructure. They manage runoff only from the roof area, and buildings must be designed to hold the weight of a green roof, making retrofits problematic.

## *Nurturing healthy soils to soak up rain*

**S** OIL QUALITY and quantity significantly influence how much water is absorbed by the landscape. Topsoil is commonly removed during construction, stored in mounds for six months or more, and then re-applied thinly over highly compacted soils. This results in lawns and other vegetated areas which act like impervious surfaces.

If instead a sufficient depth—approximately 30 cm—of un-compacted compost-amended topsoil (the exact percentage of organic matter may vary according to region) is re-applied to disturbed areas during construction and landscaped, vegetated areas are able to retain as much as [50% more runoff](#) than compacted



soils. This also improves soil quality for gardening and landscaping, and results in healthier lawns and gardens that require less watering.

Municipalities can enact policies for the treatment of topsoil in their own development projects (parks, municipal buildings, etc). In areas where there is new development, cities can regulate topsoil through urban design standards, land use plans, development permits, runoff bylaws, soil renewal bylaws, or landscaping bylaws. See resources for [British Columbia](#) and [Ontario](#) on topsoil guidelines.

## What's happening?

### TOWN OF OKOTOKS, ALBERTA

- [The Lot Grading bylaw](#) requires that topsoil depth be at least 30.48 cm (12 inches) on all newly landscaped areas in new developments.

### CONSERVATION HALTON

- For plans of subdivision, Halton Conservation requests soil management plans in accordance with the [Toronto and Region Conservation Authority's guidelines for topsoil management](#).

## Take away

- ➔ *Deep healthy topsoil is the lowest maintenance form of green stormwater infrastructure.*
- ➔ *The best regulatory option for implementation may be urban design standards governing new build and redevelopment projects.*
- ➔ *Developers normally have to pay to remove topsoil, so they should be happy to consider using more of it on-site.*
- ➔ *Construction plans should address on-site storage, amendment, protection from compaction and contamination, and grading.*
- ➔ *[Studies under way](#) by the Toronto and Region Conservation Authority will determine the infiltration capacity of vegetated areas with amended topsoil.*



# Building green infrastructure in rights-of-way

**R**OADS ARE leading sources of urban runoff—more than 60% depending on the community, and as much as 80% of stormwater pollution. But roads can also help to solve the problem they create. City-owned rights-of-way provide opportunities to incorporate onsite rainwater management during new construction and reconstruction.

[Green Streets](#) policies systematically incorporate green stormwater management practices, including urban trees, permeable paving, bioswales, bioretention, stormwater planter boxes and infiltration galleries.

## What's happening?

### PORTLAND, OREGON

- A 2007 policy mandates [Green Streets](#) for all city-funded new development and redevelopment street projects.
- Stormwater must be infiltrated on-site where possible. If not, an off-site project or a management fee is required, which is used to pay for other Green Streets projects. [See examples.](#)

### WASHINGTON, D.C.

- D.C.'s regional transportation planning board adopted a [Green Streets resolution](#) in 2014, and promotes adoption of Green Streets policies by member jurisdictions.

- Regulations require infiltration for all major development and redevelopment projects, including street retrofits. [Green Infrastructure Standards](#) apply to all road projects.
- A 2014 [Greening D.C. Streets](#) guide summarizes green infrastructure opportunities and constraints for private as well as public road reconstruction.

#### MISSISSAUGA, ON

- A 2014 [City of Mississauga resolution](#) directs city staff to report on the feasibility of low impact development as part of capital road improvement projects.
- The resolution followed the success a pilot project (see [Elm Drive case study](#)), which provided major benefits during the July 2013 storm. Peak flows were delayed by 20 minutes, and no damage was sustained by bioretention installations.



## TORONTO

- Green Streets Technical Guidelines are in development, which will include an excel-based tool for recommending Green Streets solutions, guidance for integration with Complete Streets, description of techniques and implementation, performance specifications and construction guidance, operations and maintenance, and monitoring.

## BOSTON

- [Complete Streets guidelines](#) address on-site stormwater management, in particular street trees and vegetated stormwater management.

## SEATTLE

- [Right-of-way infrastructure retrofits](#) are funded in areas that drain to uncontrolled combined sewer outflows, or where or untreated stormwater discharges directly to small creeks.
- Projects can be integrated with redevelopment – for example, the [Swale on Yale](#), which treats stormwater from over 160 hectares (400 acres) of impervious surface that formerly discharged into an urban lake.
- One of the city’s first green streets, the 2001 [Street Edge Alternatives](#) project, reduced impervious surface on a street by 11%, added over 100 trees and 1100 shrubs, and reduced runoff by 99%.

## CALGARY

- Calgary’s 2014 [Complete Streets policy and guide](#) directs that green infrastructure be incorporated “whenever transportation corridors are planned, constructed, repaired or maintained.”
- Low Impact Development Technical Guidance in development will include design standards to be applied to roadways.

## INTEGRATING COMPLETE STREETS AND GREEN STREETS

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A [COMPLETE STREET](#) accommodates all users, regardless of age, ability, and mode of travel. This includes cyclists, pedestrians, and transit as well as cars and freight. Green stormwater infrastructure can be integrated with complete streets goals. For example, bump outs intended to slow traffic, making streets safer for pedestrians and cyclists, can also act as bioretention to absorb stormwater.

## Take away

- *For maximum impact, require Green Streets for all road retrofits and new development. Adopt design guidelines. Consider all right-of-way needs early in the planning process. See Credit Valley Conservation's [Guidelines for grey to green road retrofits](#).*
- *Require performance standards, e.g., infiltration of the 25mm or 1" storm. [Monitor performance](#).*
- *When site constraints prevent infiltration, require a fee or off-site projects within the watershed. Ensure on-site infiltration remains the preferred option.*
- *Integrate Green Streets with Complete Streets, to provide benefits to pedestrians and cyclists in addition to stormwater management, and to enable an integrated approach to implementation.*
- *Facilitate training and interdepartmental cooperation to build capacity for construction and maintenance of Green Streets.*
- *Engage neighbouring property owners to assist with maintenance.*
- *Develop agreements and funding mechanisms for ongoing maintenance.*

### PUBLIC- PRIVATE PARTNERSHIPS

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ST GEORGE'S County in Maryland has [a unique approach to the installation of green infrastructure](#) on public lands. It has contracted with a private company, Corvias, to manage runoff from 2000 acres of impervious surface. At the same time, the county will also work on managing another 2000 acres of impervious surface using its own staff. The goal is to determine which system is more efficient. In total, the county aims to convert 15,000 acres of impervious surface into land that can absorb and treat runoff.

# Managing rain in alleys

**M**ANY CITIES have networks of back alleys, some of which are used for parking and garbage collection, while others have fallen into disuse. Alleys often lack modern stormwater management and contribute to flooding.

[Green Alley programs](#) retrofit alleys to improve stormwater management and provide other community benefits - gathering and play spaces, reduced urban heat island effect, and increased neighbourhood safety, for example. See [design guidelines](#) from the National Association of City Transportation Officials.

One approach is city-driven: implement a coordinated city-wide plan, e.g., as part of a stormwater management plan, a street revitalization plan, or a dedicated green alley plan. The city leads the projects and conducts community outreach with residents.

An alternative approach is citizen-initiated. The city provides funds, design support, and construction for projects requested by residents. Often neighbourhood volunteers commit to maintenance of the projects.

## What's happening?

### MONTREAL

- The [Ruelle Verte](#) program is community driven: residents apply to the city for a design and retrofit. Volunteers maintain the alleys.
- The primary purpose is community-building—allowing residents to reclaim the space in the alleyways and improve urban life, while at the same time solving the problems often faced in alleys, including flooding, illegal dumping, and safety.
- About 100 projects have been completed. Most consist of removing pavement and replacing the area with gardens and community spaces.
- Projects are for residential not commercial alleys.

## CHICAGO

- The [Green Alley](#) program was started as a pilot in 2006. Since then, over 100 alleys have been retrofitted.
- Stormwater management includes improved grading and permeable pavement. High albedo pavement mitigates the heat island effect.
- Whenever an alley is resurfaced, it is transformed into a green alley. Residents are encouraged to install green infrastructure measures on their own properties.

## LOS ANGELES

- Alleys are included in the [Green Streets](#) program. Projects are prioritized to meet stormwater goals.
- Some projects incorporate community partners with goals beyond stormwater management.
- Some projects are funded in part by the business improvement district.
- Most projects address [networks of alleys](#) in a neighbourhood.

## Take away

- ➔ *Identify goals for alley greening programs, including stormwater management, security, green space, walkability, and urban heat island mitigation.*
- ➔ *Select an approach. City-driven programs can target neighbourhoods with stormwater concerns and create designs to minimize runoff. Community-driven projects maximize neighbourhood buy-in and volunteerism.*
- ➔ *Alleys can be proving grounds for green infrastructure technologies. In Chicago, the green alley program inspired larger projects. It also developed the market for permeable paving, and [costs decreased by two-thirds](#) in six months.*

# Greening up those unlovely parking lots

**S**URFACE PARKING lots generate significant runoff and often don't pay their way in managing the runoff they create. Municipalities and private lot owners can ["green" new and redeveloped parking lots](#) with policies and practices requiring permeable paving, trees, rain gardens, infiltration trenches, and other measures.

Parking lot makeovers to manage rain onsite can be combined with actions to improve pedestrian safety, facilities for cyclists, beautification, urban heat island mitigation and more.

## What's happening?

### TORONTO

- [Design guidelines](#) require surface parking lots to meet standards for on-site stormwater retention. Other requirements include shade, pedestrian and cycling infrastructure, landscaping, and trees.
- Applies to new development and redevelopment of city-owned lots. City lots are greened when they come up for reconstruction. Plans are in the works to retrofit 130 lots.

### NEW YORK CITY

- A [2011 program](#) requires lots not served by municipal water to pay stormwater management fees or demonstrate on-site management using green infrastructure.

# *Enhancing the ecological function of greenspace*

**G**REEN PARKS policies and programs mobilize installation of green stormwater infrastructure in city parks and other vacant lands. Parks already include green space, which provides some infiltration. Green infrastructure will improve infiltration rates.

Measures include rain gardens, enhancement of the forest canopy, permeable paving in parking lots or recreational facilities like basketball courts, irrigating sports fields or gardens.

Improving infiltration and rainwater harvesting can also help solve problems in parks like soggy soccer fields and icy pathways. Parks may be able to manage runoff from neighbouring streets and properties. See the section in Credit Valley Conservation's [Grey to Green guide for retrofits on public lands](#) on LID in parks.

Vacant lots are generally seen as a liability, detracting from neighbourhood safety and security and requiring maintenance. However, some municipalities are [turning publicly owned vacant lots into community assets](#)—using them to reduce flooding and water quality issues by installing low-cost green infrastructure, and turning them into temporary or permanent community spaces. See guide from [Pittsburgh](#) and [case studies from across the U.S.](#) for more on greening vacant lots.

## What's happening?

### PHILADELPHIA

- The [Green Parks](#) program finds opportunities in the City's 3650 hectares (9,000 acres) of parkland to treat runoff from city streets, parking lots, and paved recreation areas.



- A list of potential Green Parks is maintained with community input. 51 projects have been completed to date.
- An adopt-a-park program engages volunteer maintenance.
- The [Green Vacant Land](#) program finds additional opportunities for stormwater management.



## TORONTO

- [Corktown Common](#) was developed on an abandoned industrial site in a flood protection area, with features such as natural wetlands and native plants. Detailed [Organic Maintenance Guidelines](#) and staff training ensure proper maintenance.

## MISSISSAUGA

- [Lakeside Park](#) features several green infrastructure features including a pervious concrete parking lot, bioswales, and rain gardens. The projects were initiated by and are being monitored by Credit Valley Conservation.

## DETROIT

- A pilot project in Detroit's [Cody Rouge neighbourhood](#) transformed 10 vacant lots with green infrastructure, estimated to reduce runoff over a .5 hectare (1.2 acre) area by 30%. An [online tool](#) by Detroit Future City provides resources and guidance on greening vacant lots.

## NEW YORK CITY

- As part of the [Community Parks Initiative](#), \$36 million is committed for green infrastructure in parks in underserved neighbourhoods with combined sewers.

## Takeaway

- ➔ *Engage the community in identifying and designing parks to enhance their contribution to the neighbourhood.*
- ➔ *Coordinate responsibility for design, construction and maintenance between the parks department and the stormwater department. Establish interdepartmental collaboration between parks and engineering through trust-building and rules. See advice in the [parks section of Grey to Green](#).*
- ➔ *Vacant lots are generally impervious, since soil is compacted. They are prime targets for green infrastructure.*

# Soaking up rain and knowledge in schoolyards

**SCHOOLS OFTEN** have grounds that have been paved over or compacted, resulting in increased stormwater runoff and hot, unappealing play areas. The answer is to depave and implement infiltration landscaping, reducing runoff while providing [educational opportunities](#) for students, parents, and the broader community.

School grounds may provide some of the best opportunities for installing green stormwater infrastructure.

## What's happening?

### EVERGREEN

- National non-profit Evergreen provides [resources](#) for schoolyard greening, including small grants (up to \$3500), design assistance, and guidance manuals.
- Evergreen's 2008 guide [Planning and designing green school grounds](#) is designed to help Toronto's Catholic board comply with Toronto's Green Standard. Includes guidance on how to treat rain as a resource and absorb as much runoff as possible.
- An Evergreen design guide for [full day kindergarten play areas](#) advises on creating naturalized play areas that absorb runoff.
- Lesson plans and a stormwater report card are currently in development, to be released in spring 2016.

## PHILADELPHIA

- The Philadelphia Water Department collaborates with the school district on green infrastructure/schoolyard greening projects. The program supports projects initiated by the school district, community groups, or the Water Department.
- The PWD has also created an [urban water curriculum](#), a [guide for transforming schoolyards](#) to increase participation, and [videos that showcase completed projects](#).
- Educational signage promotes understanding of green infrastructure.

## CHICAGO

- The 2014 [Space to Grow](#) program greened four pilot schoolyards in 2014. [Six more are planned for 2015](#).
- Asphalt schoolyards are retrofitted with stormwater management infrastructure that also contributes to better play spaces for students and educational opportunities.

## NEW YORK CITY

- The City has partnered with the Trust for Public Land to [green NYC schoolyards](#), committing \$20 million over four years.
- As of 2015, six schoolyards have been completed, and nine more are in the works. Completed projects manage runoff from three acres.

## WASHINGTON, D.C.

- Under the [RiverSmart Schools](#) program, schools apply for project funding and outdoor classroom teacher training.
- Projects feature wildlife habitat, native plants, water conservation, and measures to reduce runoff and pollution.

## Take away

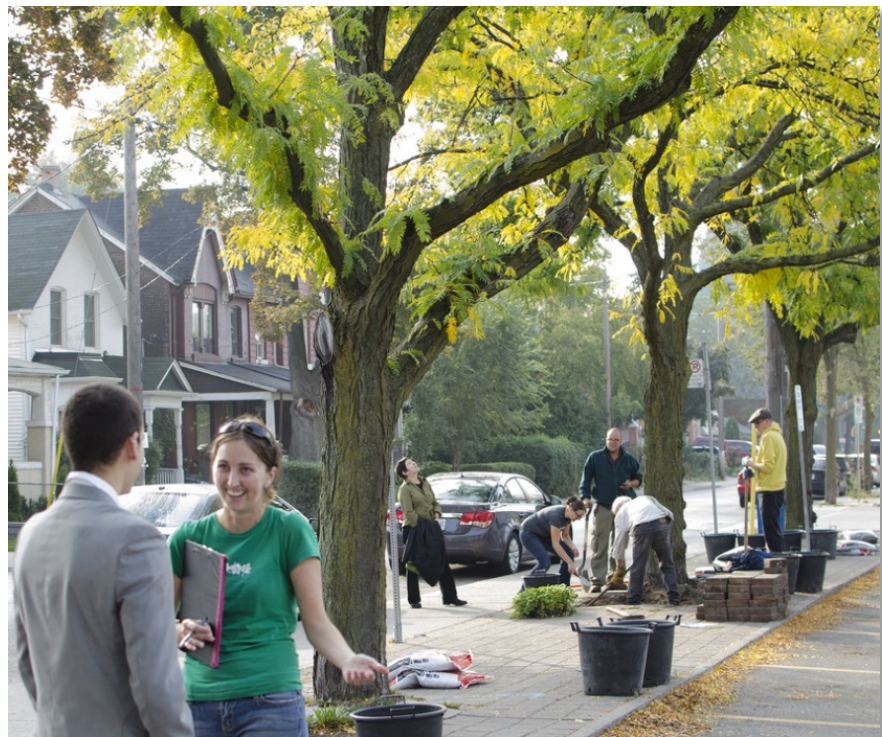
- ➔ *Invest time in developing a collaborative relationship with the school board and target schools.*
- ➔ *Plans for maintenance need when schools are closed over the summer— involve parent and community groups to help ensure gardens thrive when school staff are unavailable.*

# Creating multiple benefits with healthy trees

**A** **HEALTHY URBAN** forest makes a leading contribution to stormwater management. Trees intercept rainfall, release moisture into the atmosphere through transpiration, and help infiltrate moisture into the soil.

Mature urban trees provide the greatest stormwater benefits. Policies need to include measures to ensure survival to maturity—beyond the first 20 years of life. And trees need adequate soil, space, moisture, etc. to grow to their full size.

Soil volume is often the limiting factor in tree health—trees need at least 0.625 m<sup>3</sup> of soil for every m<sup>2</sup> of tree canopy. See B.C.'s [Tree Toolkit for Communities](#) and [Urban Forests: A Climate Adaptation Guide](#) for more on creating a healthy urban forest.



The urban canopy encompasses trees on public and private property. Municipal urban tree policies can include:

- targets, e.g., a 40% tree canopy is appropriate for a climate like Ontario
- planting and maintenance standards, including requirements for uncompacted soil quantities
- tree-cutting bylaws for private trees, and retention during development
- incentives and programs for tree planting and protection on private property

## What's happening?

### OAKVILLE

- Oakville is the first Canadian municipality accredited by the Society of Municipal Arborists for its urban forest program
- The [urban forest management plan](#) includes a private tree removal bylaw, and an urban forest health monitoring program.
- North Oakville, planned for development in the near future, has its own [strategic urban forest management plan](#) that includes soil volume requirements (15m<sup>3</sup> for small trees, 30m<sup>3</sup> for medium trees and 45m<sup>3</sup> for large trees) and a 40% tree cover target.

### TORONTO

- A [strategic forest management plan](#) was released in 2013 with a goal of 40% urban canopy cover, up from current levels of 26.6%-28%.
- Tree planting is required in all new development—at least one tree for every 66 square meters, or 40% tree cover on each site. Each tree must be provided with at least 30 m<sup>3</sup> of high quality soil.
- The [private tree bylaw](#) regulates removal of trees with diameter over 30 cm on private property. Unless the tree is diseased or dying, property owners must apply for a permit and obtain an arborist report.

### VANCOUVER

- The tree canopy is defined as green infrastructure in Vancouver's [urban forest policy](#).

- The policy permits tree removal on private property only if trees are hazardous, diseased, or interfering with infrastructure.
- The policy also limits tree removal for development, creates a framework for retention, and sets a goal of planting 150,000 trees on public and private property to increase the urban canopy from current levels of 18%.

## VICTORIA

- The 2013 [Urban Forest Master Plan](#) recommends actions to improve the urban forest on public and private land over the next 50 years
- The value of the urban forest to stormwater management is estimated at over \$2 million annually. Additional benefits include energy savings, increased property values.

## MINNESOTA

- The [stormwater manual](#) designates best practices for tree planting, incentivizing the higher cost by allocating stormwater credits for properly planted trees.

## Take away

- ➔ *In addition to stormwater management, promote tree benefits such as air quality, property values, beautification, tourism, heat island mitigation, energy savings, shade, and carbon sequestration.*
- ➔ *Emphasize the value of tree health, which is more important than the sheer number of trees planted.*
- ➔ *Avoid monoculture to reduce tree loss due to blight.*
- ➔ *Direct runoff to street trees to provide free irrigation and stormwater management.*
- ➔ *Use tree trenches and soil cells to ensure that trees have adequate access to uncompacted soil. Products include Silva Cells manufactured by [Deep Root](#) and Strata Cells manufactured by [City Green](#).*

# *Tying stormwater fees to runoff volumes*

**S**TORMWATER USER fees are a powerful tool for implementing rainwater management on private property. Stormwater user fees are user pay—what you pay depends on the impervious surface on your property (buildings, roads, parking, etc.) and therefore the volume of runoff you contribute and the cost of managing that runoff. User fees send a clear message to property owners about the cost of managing stormwater from their property.

Further—and this is a great advantage—municipalities can provide incentives to property owners who take action to reduce runoff by managing rainfall at the source.

User fees tied to impervious area and stormwater volumes are much fairer and more transparent than paying for stormwater management out of general property tax revenues, or from fees tied to potable water consumption. In practice, the amount of runoff created by, say, a large parking lot attached to a warehouse bears no relation to the taxes on the property or the water consumption. So stormwater user fees are more equitable.

A compelling benefit for stormwater managers is that user fees create a predictable and sustainable funding source for stormwater management. (See [approaches](#) that cities take to financing, and [resources](#) that describe these approaches.)



# What's happening?

## KITCHENER AND WATERLOO

- [Kitchener](#) and [Waterloo](#) have implemented user fees to address the infrastructure funding deficit for creek rehabilitation, sediment removal from stormwater ponds, and replacement of storm sewer pipes.
- Charges are based on impervious areas on the property. See [background reports to council](#) for more details on rate structure.
- The cities provide credits to residential and commercial property owners. (See below.)

## MISSISSAUGA

- A [stormwater charge](#) is rolling out in 2016, based on impervious area.
- Includes credits for non-residential and multi-residential properties, but not for single family residential properties, up to a maximum of 50% of the charge based on peak flow control, water quality treatment, runoff reduction and pollution prevention.

## PORTLAND, OREGON

- The City of Portland has charged a [stormwater management fee](#) since 1977.
- The Clean Rivers Rewards program provides a discount of up to 100% of the stormwater charge based on managing rainfall on-site, for residential and commercial properties

**OTHER EXAMPLES:** [Halifax](#), [Philadelphia](#), [Seattle](#), [Victoria](#), [Saskatoon](#).

## Take away

- ➔ *Some municipalities embrace the stormwater user fee model without incorporating incentives or credits for runoff reduction. This is a missed opportunity to reduce flooding and other damage, and reduce stormwater management costs.*

- ➔ *Funds collected through stormwater fees should be used for a combination of grey and green infrastructure, including grant programs.*
- ➔ *Some municipalities provide credits to the industrial-commercial-institutional sector, and exclude the single-family residential sector. The concern is ‘bang for the buck’: small lots individually have relatively small potential for runoff reduction. On the other hand the total runoff contribution of residential properties is high, and in less dense, suburban neighbourhoods there may be high potential.*

## MYTH-BUSTING THE “RAIN TAX”

EXPECT OPPONENTS to campaign against proposed stormwater user fees as a “rain tax.” Here are the counter-arguments to this well-worn gambit:

1. User fees are **not a new charge**—just a new way of paying. We already pay for stormwater management through our property taxes or water rates.
2. User fees **aren’t a tax**. They are a payment for services.
3. User fees are **fairer** because they reflect the actual cost of managing stormwater from a property. **Homeowners generally pay less** and those with large paved areas pay more.
4. If credits/incentives are provided, property owners can **reduce what they pay** by managing rain on-site.
5. User fees **encourage actions** that will **reduce the damaging impacts** of stormwater, including flooding, closed beaches, algae, and damage to sport fishery.
6. User **fees save money** by encouraging more efficient use of existing infrastructure (just like paying the true cost of energy or water encourages conservation).
7. User fees provide a **stable revenue stream** that enables more business-like management of stormwater infrastructure. It’s the responsible solution.

There needs to be informed, organized, and vocal community support for stormwater user fees done right. Voices should include economic as well as environmental interests.

*Also, residential credits are fair and have public education benefits. One option is to start with an ICI credit system and move to incentivising the residential sector over time.*

- ➔ *Volume-based user fees combined with credits and incentives are a step in the right direction, but inadequate on their own to mobilize city-wide action. The incentives are generally not high enough to pay for the full cost of implementing green stormwater infrastructure. See the mechanisms to spur action used by cities such as Philadelphia and Washington in Private property incentives*



# Keeping the rain out of sewer systems

**I**N MANY OLDER developments, downspouts and foundation drains were [connected to storm sewers](#), combined sewers, or sanitary sewers. While newer building codes do not allow this, existing connected downspouts, weeping tiles and sump pumps may be a major source of input to sewer systems during rain events. Storm sewers are often overwhelmed by the volume, resulting in street flooding, sewer backups, or combined sewer overflows.

Property owners should be required and/or encouraged to disconnect their downspouts and weeping tiles from the sanitary, storm, or combined sewer system and redirect them to a permeable area on their property.

Programs can be implemented through some combination of incentives and mandatory bylaws (sometimes applying only when the connection is to a sanitary sewer).

## What's happening?

### TORONTO

- Toronto's [mandatory downspout disconnect bylaw](#) was phased in over several years. Unless exempted, all downspouts must be disconnected from all types of sewers by December 2016.
- The City provides videos and resources but no incentives or individual assistance to property owners looking to disconnect their downspouts.
- Through the [Basement Flooding Protection Subsidy Program](#), the City offers subsidies of 80% of the cost of weeping tile disconnection and capping, up to

\$400. It also provides subsidies for sewer backflow prevention and sump pump installation.

### MARKHAM

- The City of Markham requires [downspout disconnection](#) from sanitary sewers (not storm sewers).
- Markham has conducted smoke testing to identify which downspouts need to be disconnected, and will provide rebates of up to 80% of the cost up to \$500, and 100% reimbursement for the cost of a rain barrel.

### REGION OF PEEL

- The Region offers [rebates](#) of \$25 per downspout for one or two downspouts disconnected, and \$100 for three or more downspouts disconnected from the sewer system (storm or sanitary).
- The open sewer line must be capped and downspouts redirected to a permeable area away from the foundation.

### PORTLAND, OREGON

- Portland disconnected over [56,000 downspouts](#) between 1993 and 2011, offering free work and incentives. The program closed after all downspouts in the combined sewer area were disconnected.

### LONDON, ONTARIO

- A [pilot program](#) in the City of London disconnected weeping tiles from the sanitary sewer system in a flood-prone neighbourhood.



- The City covered the entire cost of the work and gave property owners \$1,000 to pay for ongoing maintenance. The project resulted in far lower inputs to the sanitary sewer system during extreme rain events and none of the retrofitted homes experienced sewer backup.
- The City now offers [grants](#) for a number of basement flooding protection measures, up to 75% of the cost.

## HALIFAX, NOVA SCOTIA

- The [Stormwater Inflow Reduction Program](#) requires property owners in certain areas of the city to be inspected to see if they are discharging illegally to the wastewater system (downspouts, sump pumps). If violations are found, property owners are responsible for fixing the sources of discharge.

## Take away

- ➔ *Disconnecting downspouts may be one of the lowest cost, most accessible methods of decreasing runoff volumes in areas with many connected downspouts—especially in less dense areas with available permeable areas.*
- ➔ *Disconnecting downspouts can also be part of a public engagement campaign to encourage water conservation through rain barrel installation.*
- ➔ *Limiting programs to only those downspouts connected to the sanitary or combined sewer system will have a less widespread impact. Because of crossed connections and leaking pipes, even downspouts connected to the storm sewer system contribute to system overloading.*
- ➔ *Contractor training is very important to ensure that downspouts are redirected to permeable areas—redirecting to hard surfaces defeats the purpose.*

# *Mobilizing action on private property*

**P**PRIVATE PROPERTY *accounts for most of the land in an urban community, and must be included in a community-wide initiative to change the way rain is managed. In addition to targeted programs, municipalities should consider incentive for green infrastructure retrofits that reduce runoff volumes.*

[Incentives for retrofit action on private property](#) make particularly good sense in densely developed neighbourhoods where property is expensive and there are limited opportunities for stormwater management on public property.

In all cases, green infrastructure constructed on private property needs to be treated as infrastructure, subject to municipal maintenance or an enforceable agreement requiring owners to be responsible for maintenance.

Types of green infrastructure incentives include:

- **Grants.** Grants can be awarded to property owners directly, or to contractors who amalgamate a portfolio of projects (see Philadelphia example below).
- **Post-construction rebates.** Instead of providing up-front grants, municipalities can provide rebates for installed green infrastructure. The city may inspect the completed construction and require proof of maintenance.
- **Stormwater user fee credits.** Municipalities that have implemented impervious-area based charges for stormwater allow property owners to lower their rates through the installation of green infrastructure and/or pollution prevention activities.
- **Tradable stormwater retention credits.** Allowing properties that trigger infiltration standards for development or redevelopment to purchase credits from green infrastructure projects on private lands.

# What's happening?

## PHILADELPHIA

- The [Stormwater Management Incentive Program](#) (SMIP) provides grants for installing green infrastructure projects on non-residential properties. Grants to applicants may cover all or some of construction costs. Projects must absorb at least the first inch of rain. Projects that absorb more get preference.
- The [Greened Acre Retrofit Program](#) (GARP) relies on contractors to [aggregate and install](#) projects on multiple private non-residential properties. This eliminates the high cost for municipalities to market and manage multiple smaller-scale projects. It [harnesses the business interests](#) of contractors to get paid for building and maintaining the projects. The city pays the contractor up to \$100,000 per “greened acre” —an acre of land on which an inch of rainfall can be managed on-site.
- In both [SMIP and GARP](#), property owners sign 45-year maintenance agreements tied to the deed of the property. Installations are inspected annually.
- Philadelphia also offers [credits against its stormwater fees](#) for reductions in impervious area, and for the installation of green infrastructure practices, for non-residential properties. Managing runoff from one acre of impervious surface will save a property owner approximately \$4350 annually.

## RAINWATER HARVESTING

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RAIN BARRELS are promoted or incentivized in many cities because of their benefits for reducing outdoor water consumption. Rainwater harvesting can also be an important part of a stormwater management strategy, but some different messaging applies. People need to be encouraged to install more and larger rain barrels, collecting more water than the average gardener might use. It's also important that people empty their rain barrels before the next storm to reduce peak flows - a common tendency is to hoard the water until there is a drought. Overflows should be redirected to gardens or other permeable areas. And installation and maintenance support should be provided so that rain barrels don't contribute to basement flooding.



## SEATTLE

- Seattle's [Rainwise program](#) offers property owners in combined sewer areas rebates for installing rain gardens and cisterns, up to the full cost of construction, with rebates averaging \$4,000. Most property owners pay around 15-20% of the cost of the installation. Rain gardens and cisterns are installed by trained private contractors and inspected by Rainwise before rebates are issued. There is no reduction in stormwater fees for the installation of green infrastructure.
- The requirement for property owners to pay upfront costs was identified as a barrier to adoption. A current pilot provides loans to cover these costs.

## LAKE SIMCOE REGION CONSERVATION AUTHORITY

- In a pilot program in 2014-2015, the authority funded [75% of the cost of installing rain gardens](#) up to \$10,000 under the Landowner Environmental Assistance Program. As of fall 2015, 12 projects have been completed or are in progress.

## GUELPH

- For seasonal outdoor systems the City offers a [rainwater harvesting rebate](#) of 10 cents a litre harvested (up to \$400). For all-season indoor/outdoor systems the maximum is \$2000.

## KITCHENER AND WATERLOO

- Credits ([Kitchener](#), [Waterloo](#)) are provided to residential and commercial property owners of up to 45% of the stormwater fee for the installation of measures on private property.
- Residential property owners can apply online and receive a credit depending on the amount of water they manage on-site. They must agree to inspections.
- Industrial and commercial properties receive a credit based on water quantity control, water quality control and education of employees (up to 45%). Also subject to inspection.
- The [RAIN outreach program](#) in partnership with REEP Green Solutions uses a community-based social marketing approach to educate the public about stormwater issues and increase uptake of the credits.

## WASHINGTON D.C.

- [Riversmart rebates](#) are offered for the installation of rain barrels, trees, and infiltration landscaping elements on residential properties. Rebate values vary based on the amount of rainfall treated.
- Non-residential properties are offered grants of up to 60% of project costs, or full costs for projects in priority areas.

## Take away

- ➔ *Grants that cover construction costs get best uptake in areas that also have stormwater user fees and credits—so property owners do not need to cover costs up front for construction, but still benefit from credits over time. Credits or construction grants alone get less uptake.*
- ➔ *Targeting contractors and construction companies (e.g., GARP) creates the potential for economies of scale in construction, maintenance, and administration.*

## STORMWATER RETENTION CREDIT TRADING

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IN ORDER to achieve runoff reductions across a watershed, some cities turn to the market to help find efficient solutions. Washington D.C. requires runoff volume reductions through source controls when properties are developed or redeveloped. Property owners who find it difficult or expensive to meet the entire requirement onsite have the option of making up the difference by purchasing [Stormwater Retention Credits](#) (SRCs) from others in the same watershed. Each credit is equivalent to managing one gallon of runoff for a year. This system creates a business opportunity for other property owners who can more cost-effectively absorb rainfall onsite, above and beyond requirements. Prices for SRCs are determined by the market and can be [monitored online](#).

- ➔ *Maintenance is as important as construction. Educate property owners and managers about maintenance to ensure continued performance.*
- ➔ *Combine outreach and engagement with incentive programs in order to ensure uptake. Partner with community groups, including gardening and horticultural societies.*
- ➔ *If there is a shortage of skilled contractors, consider training and certification (see Capacity building).*
- ➔ *Clearly define program goals. For example, residential rebate programs may not manage large volumes of stormwater but help to build public understanding and acceptance for green infrastructure.*

## Get in touch



WE CAN offer support to local community engagement programs, working with local partners. See [www.raincommunitysolutions.ca](http://www.raincommunitysolutions.ca), and email [info@raincommunitysolutions.ca](mailto:info@raincommunitysolutions.ca).

Subscribe to our free monthly newsletter, The Umbrella Bulletin, at [www.raincommunitysolutions.ca/en/news](http://www.raincommunitysolutions.ca/en/news).

RAIN Community Solutions is a program of Green Communities Canada. See [www.greencommunitiescanada.org](http://www.greencommunitiescanada.org).

