Review of Residential Stormwater Information and Incentive Programs in Canada and USA

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1. Summary

In response to water quality and quantity concerns, stormwater management programs are becoming increasingly common including programs promoting and financially incentivizing lot-level practices for residential private properties. This report examines and characterizes 51 Canadian and 24 American programs and examined the practices that they promoted and incentivized. A summary of the major practices is included and provides analysis relevant to the establishment of an incentive and engagement program in Ottawa gleaned from the research as well as conversations with program staff from relevant Canadian programs.

Many municipalities and organizations in Canada and the US offer some information, but not all make incentives available for residents (see Appendix I, pg. 39). The most advanced programs are integrated, offer more than one incentivized practice, include significant promotion and have a self-contained program identify (branding). This report looks at practice-specific issues such as failure to empty rain barrels that affects their overall performance and identify best practices that have contributed to the programs' success.

Finally, the report makes recommendations on the style and substance of a future home rainwater management program in Ottawa. It recommends a program that:

- Includes a rebate incentive for a range of rainwater management practices including, rain gardens, downspout disconnection, permeable pavement and soakaway pits/trenches,
- Shares costs between residents and the City of Ottawa,
- Leverages contractors as agents of program promotion and practice installation through training,
- Establishes a home visit program to support residents who choose to design and install practices on their own, and seek an external organization to run this program, and
- Includes significant promotion of home rainwater management practices through effective communications and working with local groups and organizations

2. Introduction

Urban run-off resulting from storm events has a serious negative effect on the quality of receiving waters (Tsihrintzis & Hamid, 1997). Run-off picks up pollutants such as oils, pesticides, and fertilizers from terrestrial sources and transports them to aquatic environments. Increased temperature of run-off (van Buren et al., 2000) and the added energy from increased peak flows (Poff et al., 2006) compound the issues of water quality and habitat-degradation respectively. Residential and lot-level implementation of stormwater control measures have promise for reducing the negative effects of stormwater by managing rain 'where it falls'. These smaller-scale interventions also provide a cost-effective management solution when compared to 'end-of-pipe' solutions such as stormwater treatment facilities and even stormwater settling ponds (Thurston, 2006). Thus, municipalities across North America, including Ottawa, are seeking ways to promote lot-level stormwater management.

In 2010, Council approved the Ottawa River Action Plan which included recommendations to undertake two retrofit studies in the Pinecrest Creek – Westboro neighbourhood and the Eastern Subwatersheds area of Ottawa and implement them. The Pinecrest Creek – Westboro, and the Eastern Subwatersheds Retrofit Plans studied and identified measures that would help ameliorate negative consequences of insufficiently managed stormwater. These measures include downspout redirection, rain barrels, rain gardens, infiltration trenches and porous driveways for residential properties in addition to City-led infrastructure projects such as the Baseline – Woodroffe Stormwater Pond and retrofit measures in City rights-of-way.

The Staff Report to Environment Committee (June 18, 2019) and Council (June 26, 2019) regarding the Eastern Subwatershed outlined the preferred retrofit scenario to ameliorate negative water quality issues. The preferred scenario includes some form of lot-level rainwater management at 30% of homes in the area over 50 years. Specifically, the staff report recommends that the first five years be dedicated to a lot-level-focused engagement plan that "include[s] a combination of education, incentives, demonstrations and building capacity of local organizations" to encourage "typical lot-

level measures" including rain barrels or cisterns, rain gardens, the use of various pervious or permeable materials for the construction of driveways and parking lots.

Ambitious 50-year targets were also set for the Pinecrest Creek / Westboro area including the installation of:

- two rain barrels at 4,712 households (total 9,425 barrels);
- downspouts redirected from impervious to pervious surfaces at an additional seven percent of households (over existing conditions);
- 48 hectares of pervious pavement/concrete on driveways, parking lots and sidewalks (21% of all existing pavement);
- 20 kilometers of side-lot infiltration trenches; and
- rain gardens at 1,885 households

This report reviews North American residential stormwater management programs, synthesizes their practices, policies, strengths and weaknesses. It also characterizes different types of programs, gleans best practices, and makes recommendations for a future residential stormwater management program in Ottawa.

3. Methodology

The study involved a systematic scan of municipal and organizational programming that targets residential property owners and is designed to reduce issues associated with urban (and suburban) stormwater management such as combined stormwater overflows (CSO), erosion of streams and rivers, pluvial flooding (overland flooding), and basement flooding caused by sewer backups.

With the expectation that larger towns and cities are more likely to have dedicated stormwater management programs, a list of the top 50 Canadian and 25 American towns and cities by population was compiled to guide the search. Search terms including the name of each town or city as well as stormwater associated terms such as "stormwater management", "rain gardens", "stormwater incentives", "home flood protection", and "stewardship" were used. For each set of search terms, program details were input into a spreadsheet via a form including program name, authority, geographic area, age of program, practices involved, available incentives, reported results and contact information for follow-up.

Results of the systematic scan were supplemented with prior research conducted focusing on well-developed programs in Canada and elsewhere. Often these programs were included as part of the systematic scan, but on occasion they were additional. These paper resources were input into the same spreadsheet database as the electronic findings. Quantitative summary statistics were prepared based on the program details (*e.g.* program types, and number of programs featuring each incentive) as well as a qualitative assessment of the body of programs in North America, both of which are presented in this report.

Interviews were conducted with staff members of well-developed programs regarding some of the unpublished successes and challenges in running the programs. Starting with familiar contacts, a 'snowball' method was used where one staff member connected us with another contact, either at the same organization or another organization. Focussing mostly on jurisdictions in Southern Ontario, 24 program staff members were interviewed including consultants, municipal staff, Conservation Authority (CA) Staff, volunteers, landscape professionals and stormwater utility company staff. The interview style was unstructured, and notes were taken for each interview which were then reviewed to further inform the qualitative analysis for the program review.

4. Results and discussion

In total, 75 stormwater management programs were investigated which varied in their structure, and style. Among Canadian programs, most (43/51) focused on outdoor interventions such as rain gardens, and rain barrels. Two programs focused solely on indoor interventions like backwater valves and sump pumps (2/51) and the remainder had elements of both (6/51). All American programs focussed on outdoor interventions. Programs from across North American often focus on a single technology (7 Canadian, and 11 American programs), most frequently rain barrels, while others were highly integrated and offered support for many technologies for indoors and outdoors. For the purpose of this report integrated programs are defined as program that offer more than one incentivized practice, include significant promotion and have a self-contained program identify (branding).

Table 1. Program types (note that percentages may not add to 100 due to multi-incentive programs that did not meet 'integrated' criteria - usually lacking a program identity or having a drought focus)

Program	Integrated Programs	Incentives	No Incentives
Canadian (48)	10 (20.8%)	23 (47.9%)	24 (50.0%)
American (28)	9 (32.1%)	23 (82.1%)	4 (14.3%)
Overall (76)	20 (26.3%)	46 (60.5%)	28 (36.8%)

Almost two-thirds of the programs reviewed included financial incentives. Programs varied in their endorsement of different home rainwater practices and provided different incentives levels for those practices (Table 2). Rain barrels – a cheap and popular technology – were the most common practice with about a third of programs providing incentives for them. Rain gardens were close behind with only one fewer program incentivizing their use. Permeable paving, backwater valve, and downspout disconnection incentives were less common. American programs were more likely to incentivize all practices except backwater valves and downspout disconnections which were slightly more common in Canada. See Appendix 1 for a complete table of the programs reviewed and which practices were included in each.

Table 2. Inclusion rates of different incentive practices for all programs included in this study separated into Canadian and American programs.

Program	Downspout Disconnect	Rain barrel Incentives	Rain Garden Incentives	Permeable Paving	Backwater valves
Canadian (48)	10 (21%)	13 (27%)	11 (23%)	9 (19%)	7 (14%)
American (28)	4 (14%)	17 (61%)	17 (61%)	7 (25%)	1 (4%)
Overall (76)	14 (18%)	30 (40%)	29 (38%)	16 (21%)	8 (11%)

4.1. Practices

The following sections analyse incentive levels and best practices for each home rainwater management practice. Preliminary recommendations for inclusion or exclusion from the program are made. More detailed programmatic recommendations are made in the Program Considerations section.

4.1.1. Rain barrels and cisterns

Most single-incentive programs focus on rain barrel distribution and provide a discount on rain barrels. Rain barrel programs are typically either rebates where residents purchase barrels and submit receipts, or a municipal sales and distribution model where residents can purchase a rain barrel at a City facility for a reduced price (e.g. $44 for a rain barrel in Barrie, ON, compared to retail prices of $65-120). Barrie, Hamilton, and Kingston Ontario, as well as Richmond, BC run municipal distribution models, whereas Markham, and Toronto, Ontario run rebate programs. Results are rarely published, but Richmond claims to have distributed 1247 barrels in 2016 alone (0.6% of the 216,000 population).

Rain barrel-related programs are common in the US including in jurisdictions where water conservation is a much greater concern than stormwater management such as: San Jose, CA, San Diego, CA; Los Angeles, CA; Fort Worth TX; and Phoenix, AZ. These programs often have incentive structures like Canadian programs with some offering municipal subsidies (Fort Worth, TX), some offering rebates (LA, CA) and some with no incentives (Phoenix, AZ), but a general promotion scheme for rain barrels. Burlington, VT even offers a small incentive for decorating rain barrels to make them fit into their surroundings better and create an aesthetically pleasing barrel.

The City of Ottawa facilitated the distribution of almost 2,100 free rain barrels in the summer of 2011 in response to the failure of the Woodroffe Avenue transmission watermain which limited the drinking water supply to 10-20% of normal capacity. One hundred fifty thousand dollars was approved for the purchase of the rain barrels and they were limited to one per household in the communities of Barrhaven, Manotick, and Riverside South. These programs and events show that rain barrels are popular and can be effectively distributed at a city scale.

Program staff interviewed as part of this research indicated that rain barrels are popular with residents and this is reflected in the fact that they are often incentives as part of home rainwater management programs. The downside of rain barrels is that they are rendered ineffective if they remain full before a rain event. Without excess capacity to detain rainwater, they simply overflow at the rate that the rain falls. Education programs about the benefits of rain barrels are common. For instance, there are many videos online (including from rainbarrel.ca) showing the steps to installation, maintenance, and winterization, but proper operation of rain barrels remains a barrier to their effective utilization for stormwater mitigation. An additional barrier is that the majority of these videos are in English only. An alert system that makes residents aware of rain in the forecast and reminds them to empty their rain barrels would help solve this problem.

Rainbarrel.ca is a large, national organization that distributes and sells rain barrels. They have a sophisticated operation that runs on a fundraising model whereby community groups host rain barrel sales and keep some of the profits from each sale. The specific barrels sold through rainbarrel.ca are food import barrels that are cleaned and retrofitted to be used as rain barrels. Each barrel is sold for $55 CAD and includes all required fittings and a mosquito screen. The fundraising group that makes the sale gets to keep $10 from the purchase price. An Ottawa-based Scouts group runs an active rain barrel campaign through rainbarrel.ca and has sold 600 rain barrels so far in 2020. Rainbarrel.ca also features instructional videos on rain barrel installation, maintenance and winterization. The videos are utilitarian without a high production quality. There is a similar program in the US called the Great American Rain Barrel Company that works with municipal governments to offer discounted barrels to residents.

Recommendation: Allow rainbarrel.ca and its local partners to continue selling and distributing rain barrels in the Ottawa area. The City should forgo financial incentives for rain barrels and instead focus on improving rain barrel performance (ensuring they are emptied between rain events) through education and outreach. The City of Ottawa should prepare a support package, available to fundraisers at rainbarrel.ca to deliver resources on rain barrel use and promote the purchase of a second rain barrel. The City

should also investigate an app-based alert system to help residents properly use and maintain their rain barrels.

4.1.2. Rain gardens

Municipalities across Canada and the US run programs that support and incentivize rain gardens. While programs in places like Victoria, BC are run entirely by the municipality, it is much more common for programs to be run in partnership with Conservation Authorities (where they exist) and environmental NGOs. Thunder Bay, Guelph, and Kitchener-Waterloo are good examples of such programs (Table 3). In each of these three programs, residents are required to get a home visit where a program staff member assesses the suitability of the resident's property for a rain garden. During the home visit, residents are given important information about siting, sizing, building, and maintaining their future rain gardens for the purpose of improving the long-term functioning of the gardens as home rainwater management practices. Guelph and Kitchener-Waterloo have both partnered with REEP Green Solutions (a local non-profit organization) to deliver the home visits associated with their respective programs. While the initial consultation is led by the non-profit, the resident submits the application to the municipality who administers the incentive program.

The Guelph program has been running since 2019 after the implementation of a stormwater charge introduced in 2017. In its first year Guelph contracted REEP Green Solutions to conduct 31 home visits which resulted in 16 installed rain gardens; outperforming its goal of 10. Incentive funds were capped at $2000 per application but averaged $750-800 (not including the costs of the home visit which represents an additional program cost for Guelph). Incentives were calibrated to the rainwater management capacity ($0.50/L) of the constructed rain garden which was based on the roof area draining to the rain garden. Guelph residents are required to attend a training workshop before a consultant is sent to their house which provides basic information on what a rain garden is, how they are constructed, and their purpose in a stormwater context. REEP provides the opportunity for subsequent home visits during the construction phase that focus on plantings and garden design aesthetics. If all three

available home visits were conducted, REEP Green Solutions was paid a consultation fee of $500 by the City of Guelph.

In Thunder Bay, residents are also required to enrol in a training (2.5-hours), followed by a home visit, both of which are delivered by local ENGO, EcoSuperior. After installation of a rain garden, residents make applications for incentive funds ($500 maximum) directly through EcoSuperior. Since 2013, the EcoSuperior rain garden program has created about 100 rain gardens. In recent years the program has been capped at $10,000 per year in incentive funds, and thus about 20 rain gardens are built per year. Some incentive amounts are a little less than the maximum of $500, so program administrators can expand the number of rain gardens that are funded to use any residual funds.

The most programs with the highest incentives are Toronto's PollinateTO program and the LSRCA's SNAP Program at Lake Wilcox. They offer grants of $5,000 and $10,000 ($5,000 in second year) respectively. PollinateTO's program is aimed at creating community pollinator gardens but includes language that allows for rain gardens. The funds also allow for many expenditures related to community building such as food and drink for volunteers and event promotion. High incentive levels were set in the Lake Wilcox SNAP in part because program administrators wanted to create gardens that were showcases for attractive and interesting garden elements. These included decorative rocks, small bridges, and seating that added to the appeal of gardens but didn't provide stormwater benefits. The elimination of decorative elements from the eligible expenses was part of the justification for reducing the grant size from $10,000 to $5,000 between the first and second year of the program.

There have also been instances where organizations promoting rain gardens have formed on an *ad hoc* basis. Rain Gardens United is one such example that formed out of a 2015 community action campaign called *100 in 1 day* which was designed to promote a flurry of small actions. After this 'one-off' event, organizers pursued $10,000 in grant funding to support the construction of 10 small rain gardens in the East York neighbourhood of Toronto. Working at a neighbourhood scale and promoting rain garden practices 'neighbour-to-neighbour', organizers and enthusiastic residents

constructed almost 20 rain gardens over the span of two years. In the Puget Sound area, *12,000 Rain Gardens* works with 12 counties to promote and incentivize rain gardens. Each participating county offers rain garden incentives and the program has spurred 6,000 installations since 2011. Programs such as Rain Garden United show the power of grassroots organization and enthusiasm and show that neighbourly interactions can be the best way to promote positive home rainwater management actions.

Table 3. A selection of stormwater programs including rain garden program details.

Program Name	Locality	Organization	Home visits & training	Rain garden incentive
Rain Garden Rebate Program	*Guelph, ON*	REEP Green Solutions	Yes, plus training	Up to $2000 rebate
RAIN Smart Homes	*Kitchener & Waterloo, ON*	REEP Green Solutions	Yes	20-45% annual rebate of stormwater charge based on volume reduced
Rain Garden Rebates	*Thunder Bay, ON*	Eco Superior	Yes, plus a 2.5-hour training	$500 max.
Stormwater Stewardship Grants	*Hamilton, ON*	Conservation Hamilton	Yes	50% up to $2,500
Lake Wilcox SNAP	*Oak Ridge, ON*	TRCA, LSRCA	Yes	Year 1: 80% up to $10,000 Year 2: 65% up to $5,000

PollinateTO	*Toronto, ON*	City of Toronto (PollinateTO)	No	$5,000 max.
Fusion Landscaping	*Peel and York Regions*	Peel Region, York Region, Credit Valley Conservation	Training for landscape professionals	$500 for design $1,500 for installation Maintenance incentive as well (unknown amount) ** All Fusion incentives go to landscape professionals not residents
Rainwater Rewards	*Victoria, BC*	City of Victoria	No	10% stormwater credit
Rain Garden Rebate Program	*Winnipeg, MB*	Seine Rat River Conservation District	Work sheet	$500 max.
Stormwater Management Credits	*Saskatoon, SK*	City of Saskatoon	No	Up to 100% stormwater credit
Rain Check	*Philadelphia, PA*	Philadelphia Water Department	Yes	$16/sqft up to $2,000
Rain Check	*Prince George's County, MD*	Prince George's County, Chesapeake Bay Trusts	Yes	$10/sqft up to $4,000

Clean River Rewards	*Portland, OR*	City of Portland	Yes	67% of stormwater charge credited for managing all roof run-off
RainReady	*Chicago, IL*	Center for Neighborhood Technology	Yes	50% of costs up to $1,300 (requires $200 deposit)

Peel Region and others have taken a markedly different approach to the standard rain garden rebate program. After intensive social market research, Peel region – in conjunction with Credit Valley Conservation – found that environmental justification for rain gardens was not a significant motivating factor for their installation. Instead, homeowners in the Mississauga area were focused on their homes as a tranquil space and a sanctuary away from the rest of life. CVC and Peel Region used this research to develop the Fusion Landscaping model. Fusion Landscaping is water efficient landscaping that promotes infiltration and native plants but places an emphasis on aesthetics and increasing the value of home through increased ‘curb appeal’. Peel Region offers a free home consultation with a certified “Fusion Landscape Professional” who has been trained on the Fusion concept and techniques and can guide the homeowner through garden design and rainwater management (see more details on the role of landscaping industry in section 4.2.8). The emphasis on aesthetics and contributions to house value appeal to many homeowners. However, the lack of emphasis on the value of managing stormwater on the natural environment may detract from the education value of the projects and likely don’t contribute as much to the normalization of gardening with rainwater in mind. Many residents may be completely unaware that their garden is contributing positively to the natural environment. Worse, homeowners may get a Fusion consultation and choose to install a conventional garden because the two are not significantly different from an aesthetic standpoint.

Recommendation: Rain gardens should be incentivized under the City of Ottawa's home rainwater management program. Incentives should be based on estimated rainwater management capacity determined by the size of the garden and the size of the directly connected impervious area (which should be used to calculate garden size). Incentive and program structure should ensure that residents have a choice between installing the rain garden themselves or hiring a contractor.

4.1.3. Downspout disconnections

In some areas, downspouts are commonly directly connected to storm and combined sewers while in other places the issue is related to downspouts draining to impermeable surfaces which drain to storm or combined sewers. In both cases the ideal situation is to have the downspout drain to a permeable surface where rain can infiltrate into the ground. For the purpose of this research both were considered as downspout disconnection opportunities.

Programs that focus on reducing stormwater infrastructure burden often prioritize downspout disconnections because they are considered one of the lowest cost interventions. Downspout programs are most often municipally run, but not exclusively, as in the case of the LSRCA encouraging downspout redirection in the Kidd Creek area of Barrie, ON and various SNAP programs around Toronto.

Toronto has a mandatory disconnection program where homeowners can face fines if they don't disconnect their downspouts from municipal stormwater or combined sewers. Exceptions exist for homeowners who do not have suitable options for downspout disconnection based on their lot. Some programs are incentivized rather than mandatory and offer incentives from $25/downspout (maximum $100) in Peel Region to 80% (maximum $500) in Markham which can cover costs associated with downspout redirection. Toronto, with its mandatory disconnection program, is the exception. Most other programs are voluntary or incentivized. Portland, OR even goes as far to describe their disconnection program as 'volandatory'.

In terms of results, in the Black Creek neighbourhood of Toronto, 64 downspouts were disconnected from storm sewers through the local SNAP program. SNAP programs have also supported municipally mandated downspout disconnection and redirection programs elsewhere. A SNAP program in the Kidd Creek area near Lake Simcoe delivered a targeted program in a small geographic area that redirected 24 downspouts with costs varying between $100 (‘easy fix’), and $1400 which involved cutting driveway and installing a French drain.

Recommendation: Ottawa should aggressively pursue downspout disconnection as it represents a low-cost intervention and can be the easiest first step for a homeowner to take. Costs associated with redirecting downspouts should be eligible for rebates and any other rebates (for rain gardens, permeable pavement etc.) should be conditional on downspout disconnection. The City of Ottawa should invest in outreach and education to show residents that they can make a positive impact by redirecting their downspouts. Identifying downspout disconnection opportunities remains a challenge as this research found no jurisdiction that had successfully identified these opportunities at scale. Ottawa should seek to address this challenge through the innovative use of technology.

4.1.4. Soakaway pits / French drains

Only 2 out of 75 programs included soakaway pits or French drains as an incentivized practice. The search found no dedicated programs for soakaway pits and they were rarely spotlighted as a primary practice.

Through the Hamilton Watershed Stewardship Program, the local Conservation Authority, Conservation Hamilton operates a multi-incentive stormwater retrofit program called Stormwater Stewardship Grants. Following a home visit by Conservation Hamilton staff, residents can apply for up to 50% of costs to a maximum of $2500 for soakaway pits. Kitchener Waterloo allows any practices that results in a measurable retention or detention of stormwater to be eligible for a stormwater credit.

Soakaway pits are effective but lack the co-benefits of rain gardens including improved aesthetics and habitat provision. Soakaway pits are low maintenance options and do not require any additional work (e.g. weeding and watering required for rain gardens); only infrequent checks for functionality.

Recommendation: The City of Ottawa should include soakaway pits and trenches as an incentivized practice especially for areas between houses in full shade, but program promotion efforts should emphasize practices with higher co-benefits.

4.1.5. Permeable paving and pavement removal

Several technologies exist to increase the permeability of hard, durable surfaces. Permeable asphalts and concretes offer a continuous surface with uniform or near uniform permeability throughout. Other systems such as interlocking pavers offer permeability via the cracks or seams between the pavers. Additionally, some systems use an open structure to hold a naturally permeable substrate in place such as crushed stone. The distinction between these types of technologies is not highlighted in any of the programs found in this report. There are different costs and infiltration capacities associated with each technology, making them difficult to incentivize in a standard way.

Permeable paving holds great promise as a stormwater management technology because they simultaneously eliminate impermeable area (where they are replacing conventional paved surfaces) while providing a potential drainage area where excess rain from other impermeable surfaces can be directed. Sixteen programs (three such programs are harmonized and operate in the same locations [Kitchener, Waterloo, REEP Green Solutions]) offer incentives for permeable pavement as part of their incentive packages (Table 2). Permeable paving was not the central focus of any of the Canadian programs or the seven American programs that offered permeable pavement incentives. Instead, permeable pavements are listed as an eligible practice with a total grant amount, that is cost-shared between residents and the program authority.

For example, the City of Victoria offers an incentive of 50% of project costs up to $3,950 (Table 4). Other jurisdictions allow permeable pavement installations to contribute to a reduction in stormwater peak flows and calculate the incentive accordingly. For instance, Saskatoon’s program, designed for multi-residential and non-residential customers, has a complex calculation according to how the practice meets the following criteria:

- Based on the proportion of storm water directed through a quality control infrastructure that meets the minimum standards of 80% total suspended solids removal for particle sizes 50 micron or larger.
- Based on the proportion of storm water for a standard 1-in-2-year rain event held onsite and released slowly to the City's storm water system. The Credit is equal to 0.4 multiplied by the peak flow reduction up to 75%.
- Based on 2% per millimeter of storm water up to 25 mm that is retained onsite and not released to the City's storm water system.

The RainCheck program in Prince George's County Maryland offers a flat incentive of $15 USD/sqft of permeable pavement installed. They also offer $6 USD/sqft for removing concrete and asphalt. From the programs included in this research, this is typical of American programs which are much more likely to have a rebate system rather than a stormwater credit system. In Canada the stormwater credits systems are the most complicated and least accessible programs for average residents. For instance, in Halifax a resident would be required to apply to be billed as a commercial customer with the utility, seek an engineer's stamp for their permeable paving project, and have it recertified annually in order to receive a credit of 50% where the highest residential stormwater charge is $81 per year. For this reason, uptake of this program in Halifax has been nil since 2017 when it was established. From a municipal standpoint, the Halifax program and the Kitchener-Waterloo program included permeable paving as part of a suite of practices eligible for stormwater credit and expectations of wide-spread uptake were low.

Table 4. Select programs with permeable paving incentives

Name Location	**Organization**	**Permeable paving**
Stormwater Stewardship Grants Hamilton, ON	Conservation Hamilton	50% to $2,500
Stormwater Credit Program	Cities of Kitchener and Waterloo and	Tiered credit from 25-

Kitchener & Waterloo, ON	REEP Green Solutions	45% of stormwater charge
Rainwater Rewards Credits Victoria, BC	City of Victoria	50% up to $3,950
Stormwater Credits Halifax, NS	Halifax Water (utility)	Tiered credit from 30-50% of stormwater charge
Stormwater Management Credits Saskatoon, SK	City of Saskatoon	Tiered credit up to 100% of stormwater charge
Let it Rain Burlington, VT	Winooski Natural Resources Conservation District and UVM Lake Champlain Sea Grant	$1/sqft
Rain Check Prince George's County	Chesapeake Bay Trust	$12/sqft
Rain Check Philadelphia, PA	Philadelphia Water Department	$15/sqft up to $2000
Rain Ready Chicago, IL	Center for Neighborhood Technology`	50% up to $1300
Rice Creek Watershed District Cost-Share Grant Program Minnesota	Rice Creek Watershed District	50% up to $5000

Recommendation: In order to increase accessibility to residents, incentives for permeable paving should be offered as a one-time incentive as opposed to an on-going credit against the stormwater charge. Presumably, for most residents it is the upfront cost of permeable paving project that prevents uptake, and thus a one-time incentive is well suited for addressing this barrier. Because no homeowner will pursue permeable

paving as a do it yourself project, conforming the incentive to the billing method used by contractors is the best practice.

The City of Ottawa should pursue permeable paving as an incentivized practice but limit incentives by relating them to amount of run-off that is effectively managed. Further, permeable paving incentives should be used in instances where alternatives are not feasible such as properties where space limitations preclude the use of rain gardens and soakaway pits, or where the homeowner wants to maintain a paved surface. The amount of stormwater managed can be calculated by using the area of permeable pavement installed and the infiltration rate for the technology chosen. Permeable paving is expensive and a cap on the funds available for this practice should be established in-line with programs goals including run-off reduction. Local Improvement Charges (LICs) also offer a potential way to reduce barriers to implementation, where the cost of installation could be offered as a loan to residents and loan repayments (principle and interest) is added to the tax bill for the property.

4.1.6. Green roofs

Green roofs were not commonly included as part of incentivized stormwater management programs. Saskatoon was the only Canadian jurisdiction that included green roofs in their stormwater credit program. Saskatoon's program is designed to target multi-residential properties and is not geared towards single residential homeowners. Prince George's county, MD included green roofs as eligible practices for incentives but has yet to receive a claim for a green roof project.

In Canada, Toronto has a green roof by-law that mandates green roofs for new buildings (industrial commercial, institutional, and residential) and new additions that are 2,000m^2 and larger. Toronto's green roof by-law is an independent program not driven by stormwater management and includes no incentives. The research in this report did not explicitly look at standalone green roof programs.

Recommendation: The City of Ottawa should not pursue incentives for green roofs at residential properties at this time.

4.1.7. Trees

The stormwater benefits that come from increased tree cover are well-defined, but few programs offer incentives to plant trees as a stormwater management practice. Jurisdictions including Ottawa provide a range of grants and incentives for tree planting, often administered by local Conservation Authorities. In the US, Prince George's County offers a dedicated incentive of $150 USD per tree planted. Other programs simply include them as eligible expenses within total incentive amounts (Kitchener, Waterloo, Toronto, Portland).

Recommendation: Many municipalities have urban forestry departments that have sophisticated tree planning, planting, and maintenance operations which are better equipped to provide guidance for tree planting incentives and activities within the urban environment. The decision to include trees in a City of Ottawa residential stormwater program should be made in close collaboration with forestry services

4.2. Program considerations

This section discusses important program considerations gleaned from program details available online and interviews with key program staff from other jurisdictions.

4.2.1. Encouraging widespread adoption

The theme that arose most often in interviews was the difficultly surrounding encouraging enough residents to take action to meet stormwater objectives and targets. Despite sophisticated promotion, effective community organizing, and lucrative incentives, jurisdictions have not yet been able to encourage implementation at the scale required to reduce the negative impacts of stormwater. A significant challenge is residents' understanding of stormwater issues and basic concepts relating to how stormwater affects urban and natural environments. Interviewees were understanding of residents' incomplete knowledge, in part because of the concealed nature of stormwater infrastructure (buried underground) and a lack of emphasis on natural systems, especially in the urban environment. Other programs have skirted this issue by avoiding environmental language and instead appealing directly to what concerns residents most; house value, aesthetic appeal, and maintenance requirements. This comes from extensive social market research that investigated motives in Peel Region and found

that environmental concerns and flooding concerns were secondary to home values and aesthetics.

No program has ‘cracked the code’ of widespread home rainwater management implementation, but examples of best practices arose in discussions with program staff and are discussed in subsequent sections. Individual programs have seen significant adoption of rain gardens such as EcoSuperior’s program which has built about 100 rain gardens since 2012 and Guelphs nascent program which installed 16 rain gardens in its first year. At the city-scale, uptake rates for programs that are well-designed, incentivized, and moderately promoted range between 5 and 10% of resident households (e.g. Kitchener-Waterloo stormwater credit rebate system). Programs that focus on neighbourhood level interventions have produced slightly better results (e.g. 12% within the neighbourhood for the Lake Wilcox SNAP program). Between the two years that the Lake Wilcox SNAP was active, 25 rain gardens and 384 eco-landscaping (unclear what is included under this definition) project were installed, a 12% implementation rate. Philadelphia’s well-regarded and long-standing program has encouraged action from Philadelphia residents since its inception in 2012. Even as the program budget was reduced from $1.1 mill USD to $475,000 USD, a focus on low-cost/high-value projects such as rain gardens over high-costs projects like planter boxes allowed the program to achieve good results (Table 1). (Table 5).

Table 5. Program results from Philadelphia for 2019 and 2020.

Practices installed	2019 ($1,100,000 budget)	2020 ($475,000 budget)
Rain gardens	4	11
Rain barrel	444	376
Planters	97	65
Permeable paving (sqft)	7,498	9,323

Most programs do not make details on program uptake or budgets publicly available (although all would be subject to freedom of information legislation). An exception is Detroit’s Stormwater Hub which is not a stormwater incentive program in and of itself but does track and report the number of green infrastructure projects installed in the

Detroit area. As of the writing of this report they report 204 green infrastructure projects completed and 1.3 billion litres of stormwater managed. Recommendations regarding encouraging widespread adoption are covered in the remaining sections.

4.2.2. Incentive levels

An often-cited barrier to participation was installation costs. Subsidies related to rain garden installation and rain barrel use were helpful in encouraging program participation in all the programs discussed in interviews. Incentive amounts impact who can afford to install a given practice, which has implications on the fairness and equity of the overall program. For many residents a modest incentive amount may be enough to encourage program enrolment, however, others may be deterred by even small costs. For other residents, accessing upfront capital to cover the costs of implementation may be a significant barrier to program enrollment. The structure and level of incentives varied significantly from program to program, from $500 to $10,000.

In year one, the Lake Wilcox SNAP offered a large incentive for rain garden installation – 75% up to $10,000 for two showcase rain gardens. In order to enrol, residents were required to open their gardens during demonstration events for the public. In the following year the incentive was reduced to 60% up to $5,000, but the requirement to be a demonstration garden was also removed. Program administrators thought that the requirement to be a demonstration site was a disincentive for some homeowners. Enrollment remained high between the years, showing that non-monetary factors in program design can influence enrollment. At the conclusion of the program, 25 rain garden projects and 384 total eco-landscaping projects were installed in the neighbourhood; a 12% implementation rate.

EcoSuperior’s rain garden rebate of $500 generates about 20 requests per year, maximizing their $10,000 annual incentive budget. In summer 2020, as the organization has been forced to deliver training program in a webinar format, they have been able to reach a higher number of people and the program is currently over-subscribed for the season with a waitlist being generated. This suggests that in the right circumstances, even a small incentive can generate significant interest.

In Guelph, incentives are capped at $2,000 per rain garden project, but actual rebates are much lower. On average, rain garden incentives are $750-800. These incentive amounts are calculated by REEP Green Solutions, a community environmental organization that is contracted to conduct home visits and incentive assessments. This process gives homeowners an assurance of the incentive amount and allows them to make purchasing decisions with full knowledge of the rebate that will be administered.

Recommendation: The City of Ottawa should offer incentives that adequately reduce barriers to rain garden construction but share costs between residents and the municipality.

4.2.3. Stormwater credits versus rebates

Stormwater credits perform a different function than stormwater rebates. Whereas a rebate provides a one-time reduction in the financial barriers to installing a home rainwater management practice, a stormwater credit provides an annual reduction in a resident's payment for stormwater services. Of the programs reviewed that provide financial incentives, 7 of the programs used a credit system (6 Canadian and 1 US), 36 provided rebates (16 Canadian, 20 US), and 1 used a combination (Victoria, BC).

Most stormwater credit programs were initially created to serve institutional, commercial and industrial (ICI) users who generally have higher bills and occupy larger properties where potential impacts of implementing beneficial practices is large. Some credit programs were extended to residential users in who wanted a way to reduce their stormwater charges or who had already taken steps to reduce stormwater run-off on their properties but were being charged the same as residents who had not. In this sense, stormwater charges were put in place to create fairness in a system that didn't otherwise account for the positive actions that some resident were taking. Unfortunately, most residential stormwater charges are low enough that even a complete elimination of the charge doesn't reduce the financial barriers to implementation experienced by residents. For instance, in Kitchener and Waterloo, if a resident were to install a cistern or rain garden that allowed them the maximum allowable stormwater credit (45%), that resident would only save a hundred dollars or so each year. The project required to receive that credit would likely cost well into the thousands. This creates little incentive

for a person not already motivated to take action to install positive stormwater practices which is born out in the data from programs like Halifax, who have yet to see an application from a residential user. Additionally, the administrative burden to process reductions of residential stormwater charges with relatively small impacts on stormwater is high compared to large ICI users. The integration of stormwater charges in municipal utilities also make contracting out the administration of these credit programs difficult.

Rebates provide a lump sum incentive which may reduce barriers to installation sufficiently that even a person with only marginal interest in installing a given practice would go ahead with the project. However, because the incentive is a lump sum, that resident is still required to pay the same stormwater charge as any other resident which may be perceived as unfair because they are using less stormwater services and creating less stormwater burden for their respective municipality. This requires disciplined communications to make clear that municipalities require the stormwater charge in order to provide service to the city at-large, and the rebates provided are in lieu of a reduction in the stormwater charge that keep administrative costs low and thus provide better value to all residents.

For the purpose of this research incentives were considered a subsidy when a product or service was offered for less than market value at the point of purchase. This was most common for programs that offered discounted rates on rain barrels sold at municipal offices. If a partial refund was offered after purchase of a rain barrel, that was not considered a subsidy.

In the case of rebates and credits, program administrators interviewed thought that financial incentives alone are unlikely to spur the kind of collective action required to address the stormwater challenges of major Canadian and American cities. For this reason, finding innovative ways to communicating the importance of and encouraging the uptake of lot-level action is also required.

Recommendation: The City of Ottawa should pursue a rebate-style incentive for residential properties and forego a stormwater credit program. Additionally, the City should communicate that incentive are in lieu of a reduction of the stormwater charge that helps provide efficiencies in municipal government that benefit all residents. A

credit program for Industrial, Commercial and Institutional is beyond the scope of this report and any recommendations herein apply only to residential properties, not ICI properties.

4.2.4. Program integration versus single incentive programming

For the purpose of this report, an ‘integrated’ program is one that offers incentives for more than one practice, includes promotional elements, and has a self-contained program identity. In the jurisdiction analysis there were several programs that included some of these elements but not all. In these cases, discretion was used in labelling them ‘integrated’ programs or not (see Table 1 for a summary and Appendix I for a complete listing of programs reviewed).

In all areas of the analysis, integrated programs were the exception. In Canada, the City of Victoria, the SNAP (Toronto Region Conservation Authority, Lake Simcoe Conservation Authority, and Credit Valley Conservation), the City of Toronto (2 programs), the City of Windsor, Conservation Hamilton, and the Seine Rat River Conservation District had integrated programs that supported multiple practices, included promotion, and had an independent program identity.

The *Rainwater Rewards Credit* program, run by the City of Victoria represents a good example of an integrated program by offering a mix of rebates to reduce the barriers to implementation and credits against the municipal stormwater charge to reward those who help reduce the municipal stormwater burden. Rain barrels, cisterns, rain gardens, and permeable paving are all eligible practices. Incentives of up to $3,950 are possible depending on the mix of practices used and a stormwater credit of up to 50% is possible. The City also has a map-based planning tool that helps residents envision potential stormwater credits resulting from practices implemented.

The Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation Authority (CVC) have run the Sustainable Neighbourhood Action Program in several neighbourhoods in the Greater Toronto Area in partnership with local organizations, municipalities (towns and cities), and consultants. SNAP was developed by TRCA as an approach that could be applied to many jurisdictions at a neighbourhood level. At the outset of a SNAP program, the needs of the community are identified. For instance, if

the community lacks tree canopy cover, or experiences pluvial flooding, or lacks green space generally, those practices can be prioritised for promotion and incentivization. In most cases, a SNAP coordinator is hired to administer the program and consultants may be hired to conduct promotional activities and implement individual projects. The SNAP model has been implemented across the jurisdictions of the TRCA (Bayview Glen, Black Creek, Bramalea, Burnhamthorpe, Country Court, Thornhill, and West Bolton), LSRCA (Lake Wilcox) and CVC (Fletcher's Creek, Hungry Hollow). SNAP programs are the quintessential 'integrated program' and address multiple sustainability objectives beyond stormwater management, since no single intervention (rain gardens, LED lights, planting trees) is going to be sufficient to prove the business case but together may provide value to funders of the projects.

SNAP programs are tailored to the needs of each neighbourhood, but usually promote and incentivize a wide suite of environmental practices inside and outside the home. SNAP staff are 'cross-trained' to recommend home sustainability improvements from planting trees, to insulating houses, to installing rain gardens. The programs are multi-objective with 'one-window delivery' leading to potential synergies between municipal departments and utility providers through streamlining program delivery. Additionally, the integrated programs allow for the sharing of costs between municipal departments, utility companies and others. Funding arrangements are made on an ad hoc basis and negotiated for each SNAP project between stakeholders involved. These stakeholders also bring value through their organizational capital (financial administration capacity, summer workforces, community connections and reputation).

Due to the small geographic areas, door-to-door visitations are effectively employed as part of many SNAP programs to achieve program goals. The Lake Simcoe Region Conservation Authority led a SNAP program for the Lake Wilcox area which resulted in the installation of 25 residential rain gardens over two years along with 384 total eco-landscaping projects. The program was designed to improve water quality entering Lake Wilcox which is a small eutrophic lake surrounded by suburban neighbourhoods. In the Black Creek neighbourhood, 375 rain barrels were also installed, 64 downspouts were disconnected from storm sewers, and 140 trees planted through the program. SNAP

programs have also supported municipally mandated downspout disconnection and redirection programs.

Integrated programs provide opportunities that boost enrollment and help encourage increasingly bold actions from participants. The SNAP programs have shown that the first action taken by a resident is not always the one with the largest impact. For example, a resident may plant a tree in their front yard to help increase canopy cover and reduce run-off. If that experience is positive, they may be inclined to take a more involved action such as installing a rain garden. If these programs were separate, the connection between actions is less clear and the goal becomes simply planting a tree (simple limited commitment) rather than improving the sustainability of their neighbourhood (long-term commitment and subsequent actions). Integrated programs can also maintain communications with program participants through email or social media and direct targeted messages to those who have previously taken actions.

SNAP programs require engaged and trained staff to administer and deliver. All SNAP programs are recommended to have a minimum of one dedicated Project Manager, and one Program Coordinator. Usually one staff is an employee of the municipality and the other is an employee of the Conservation Authority, although staff can be employed jointly for longer-term operation. Because the programs rely on person-to-person contact, often with home visits and customized guidance, they are staffing intensive. Core SNAP budgets are provided by the municipality and expanded through grant opportunities which can, in instances, increase budgets four-fold. Beyond salary, benefits, and expenses for staff, typical budgets include contracted services (design, web, translation, etc.), travel and event expenses, travel and event expenses, communications, and seed money to leverage grant funding. Incentives for installing practices is additional to these core budget requirements and is often provided as part of established municipal programs.

Philadelphia is one the most well-regarded examples of an integrated program from the US. Since 2012, the Rain Check program has been operating in Philadelphia and has helped residents install rain gardens and permeable pavement. Uniquely, Rain Check promotes planter boxes that are designed to manage rainwater form downspouts. This

is partially a response to the small and sometimes non-existent permeable surfaces in Philadelphia neighbourhoods. In 2019, Rain Check conducted 45 workshops with 618 attendees, reaching wide swathes of Philadelphia. They conducted 98 whole-house assessments and 265 practice-specific consultations. Four hundred forty-four rain barrels, 97 planter boxes, and four rain gardens were installed. Forty-two permeable paving projects wee completed and three projects sought to remove paved areas. This was completed with a total program budget of $1.1 million USD. In 2020, program results remained steady despite a reduction in budget to $475,000 USD. This is partially because the program had significant 'momentum' form being well-established and long-running. The program administrators also focused on lower-cost practices and reduced the incentives available from $2,000 to $1,5000 to ensure a similar number of projects could be implement on a reduced budget.

Recommendation: The City of Ottawa should seek to establish an integrated program with a self-contained program identity, that promotes and incentivizes multiple residential stormwater practices, and offers 'one-window-delivery' for those incentives.

4.2.5. Communications

Five of the programs reviewed offer information about stormwater management without incentives on a purely educational basis For instance, Calgary's Yard Smart program, Okanagan-Similkameen Rain Garden Guide Book, Oakville Green's Rain for Rain program, Vaughan's Project Blue, and the North shore Rain Gardens project all provide information to residents that are interested in rain gardens and other home rainwater management practices. None of these program track installations of rain gardens or other practices making it difficult to assess their effectiveness. Other programs had simple webpages with information, but there was no investment into active education campaigns. Information is readily available at many jurisdictions and if a resident can't find information from their municipality or a local group, it's likely that a neighbouring community offers the relevant information. Residents seeking information about all sorts of stormwater issues need only to do a quick internet search. However, encouraging action is about more than just providing information. Environmental decision-making relies on a complex suite of factors that lead to adoption of practices such as rain

gardens and creating attractive messaging and compelling delivery models is only a small part of it.

A limiting factor for information dissemination is the accessibility of that information. In an increasingly digital and video-based world, plain text web pages with copious information are not an effective means of communication. Several programs excelled in communications by producing video content (Simon Fraser University, City of Detroit, Philadelphia, Coquitlam), offering map-based tools for residents to explore stormwater options (Victoria, Philadelphia, 12000 Rain Gardens), making good use of social media (Thunder Bay), and having well-presented information (Prince George's County, Philadelphia, Rain Gardens United, Calgary). Others displayed poor communications practices such as hosting information in PDF format only (Portland, OR) or presenting information without graphics or images. Some municipalities may be limited by accessibility requirements.

Several programs (Guelph, Kitchener, Waterloo, Thunder Bay etc.) also facilitated in-person training events where a short 'Rain Gardens 101' course delivered an overview of important information. This is a good technique for getting people interested and involved. Education events may not attract significant numbers of residents alone, but when paired with the potential for financial incentives, the proposition of learning about rain gardens in a classroom or online setting becomes more attractive. These events also lend credibility to the program. Program administrators from LSRCA and TRCA both suggested that it is good to require something – financial or otherwise – of residents, as it makes them more committed to the program.

Green Communities Canada offers a "Rain Garden Masterclass" that offers a certification in rain garden design and installation. It requires residents attend six online lectures, complete homework related to rain garden design, and pass simple quizzes. Students must also build a rain garden within 12 months of the course in order to receive certification. Registration costs are $200 and include a book on rain gardens. This program offers a good balance between accessibility and commitment to the course.

Interviews with program staff emphasized the importance of making communications products very accessible and avoiding complex concepts and jargon – even for terms which are commonplace in the industry such as *stormwater* and *watershed*. Effective communication uses language and themes that resonates with residents while also advancing their understanding of the core stormwater issue. For instance, Fusion Landscaping chose to lead with messaging around how Fusion Gardening (rain gardens) could add to property values. That messaging resonates with homeowners, but it doesn't take the next step to educate residents about the added stormwater benefits of this type of gardening.

Recommendation: The City of Ottawa should develop a sophisticated communications plan to support the overall program delivery. The plan should focus on video content, motion graphics (words moving over images), and highly 'shareable' content. The strategy should focus on producing novel content to generate excitement for home rainwater management. Existing content can be easily repurposed, combined, and reused (with permission) in order to avoid duplicating efforts. Additionally, the communication should focus on hyper-local applicability, for instance, suitable plants lists should be based on Ottawa's climate and soil conditions.

4.2.6. Home visits

For simple projects like the installation of a rain barrel, most programs required little or no contact with residents. This streamlined the simple actions and freed up contractor or municipal resources to be dedicated to more involved practices like rain gardens. As project complexity increased, so did the interaction between residents and program staff. For instance, EcoSuperior's Thunder Bay-based rain garden program requires residents to attend a 2.5 hour in-person (webinar during Covid oubreak) training about sizing, siting and trouble-shooting a rain garden. After the training, a home visit was conducted by EcoSuperior staff where the final details or siting and sizing were approved. The residents then had a reserved 'spot' in that year's program and could complete the construction of their rain garden within 12 months.

Most other programs that offered incentives for rain gardens required a home visit where trained staff could assess the rain garden opportunity and ensure project

feasibility. For example, in Guelph, 31 home visits were completed, resulting in 16 rain garden installations. In Philadelphia, consultations were delivered based on the practice, with 150 whole-home visits, 400 rain garden/masonry visits, 175 downspout planter visits which were cost-shared between residents ($25) and Philadelphia Water ($300 for whole-house, $200 for rain gardens/masonry, and $150 for downspout planter visits). Program administrators outside of Philadelphia also suggested that a small charge to ensure some level of 'commitment' from residents can be beneficial in boosting engagement.

Home visits serve a dual purpose of forming relationships with residents and training them on the best practices related to rain gardens (or other program practices). Interviewees largely agreed on the benefits of personal interaction or "hand-holding", where program staff guide residents through their respective programs. This practice lowers barriers to participation especially for those who lack the knowledge or confidence to build a garden on their own. It is also a good way to communication the work involved and provide homeowners with information to decide whether to hire a contractor or not.

While rain gardens are not complex, they need to be built according to certain specifications to be effective rainwater management tools. A trained resident or a trained contractor is entirely capable of building an effective rain garden however, if a resident chooses to hire a contractor, the training of that resident becomes redundant and a barrier to program uptake.

Recommendation: Simple actions such as rain barrel installation should be undertaken by residents without necessary involvement of the municipality or a consultant organization. Training should be dedicated only to people who are engaged in the building of a rain garden, either a contractor or a resident. Landscape Professional training is discussed in the following section. Residents who wish to build their own rain garden should be required to get a home visit where the sizing, siting, and design of the rain garden are mutually agreed upon between the resident and a consultant organization. This design should be used for quality assurance and approval for the release of the incentive funds. Home visits should be funded by the City of Ottawa.

4.2.7. Contractor training

Several programs included elements of landscape professional training including the Lake Wilcox SNAP and the Fusion Gardening Program at Peel and York Regions. Administrators at several of the programs included in this research shared their frustration with a lack of expertise related to rain garden construction and permeable pavement installation. REEP Green Solutions (on behalf of the City of Guelph), LSRCS (Lake Wilcox SNAP program) and Peel Region (Fusion Landscapes[1]) collaborated with Landscape Ontario to train landscape professionals on the specifications of rain gardens and permeable pavement.

Program promotion is put in the hands of the landscape professionals themselves along with the opportunity to generate income which provides additional incentive to promote the program and any associated home-owner incentives.

In the Lake Wilcox SNAP program, a similar landscape professional training program was delivered through Landscape Ontario resulting in almost 30 trained landscape professionals. Timing of landscape professional training is crucial because of the highly seasonal demands for installation and maintenance work. Interviewees suggested early January as the most appropriate time for a training course because it avoids busy working seasons and common vacation seasons. For SNAP, residents were required to get multiple quotes from landscape professionals to be eligible for their incentive. The landscape professionals in the area charged for these quotes, and because at least two quotes were required, one would essentially ‘go to waste’, creating a barrier to program uptake.

However, with the responsibilities of promotion, design, and installation all residing with landscape professionals, the ability to track projects, measure success, and refine the program further is limited. Despite this, the program is favoured by some municipalities for its hands-off approach and ‘mainstreaming’ rain garden construction in the private sector.

[1] The Fusion Landscape program is discussed in detail in section 4.2.8.

Contractor training is an important step in engaging and training the business community and encouraging them to promote home rainwater management practices. If done correctly, contractors can do enormous amounts of program promotion and are equipped to install many practices. Additionally, contractors can provide on-going maintenance for practices such as rain gardens.

Recommendation: The City of Ottawa should develop a 'contractor stream' for rain garden construction, in addition to the resident stream described above. The contractor stream should include extensive training delivered through Landscape Ontario (landscape professional industry association) delivered in January of each year, which provides certification of that contractor and entitles that contractor to be listed as trained on the City of Ottawa website.

4.2.8. The Fusion Model

Peel Region developed the Fusion Landscaping program in partnership with CVC in response to low residential uptake of rainwater management programs. After extensive market research, consultants found that there was a messaging gap between the environment and water focus of the regions messages and what homeowners cared about. The consultants that conducted the market research found that messages around aesthetics, home values, calmness, tranquility, and creating a sanctuary resonated better with the general populous in Peel Region. The Fusion Landscaping program was built around these findings and centers landscape professionals as the driver behind delivering Fusion Landscapes in Peel Region, York Region.

Fusion Landscape training is available to members of Landscape Ontario and was co-developed with Peel Region, CVC, and Landscape Ontario. CVC administers the two-day training programs on behalf of Landscape Ontario which includes an examination. Training is free to members of Landscape Ontario that operate in participating regions – York and Peel. Ultimately, training costs are covered by the regional municipalities. In the past, Fusion training has been offered, at a cost, to landscape professionals outside of York and Peel regions, but this has been limited and was at the request of a small group of landscape professionals in Kitchener/Waterloo. Certification lasts three years, at the end of which the landscape professional must demonstrate that they have further

developed their training and actively designed, installed or maintained Fusion Landscapes.

Through the Fusion Landscaping programs, regional municipalities offer incentives directly and solely to landscaping professional who are certified under the program. Incentives are divided into three categories and designed to encourage Fusion Landscape Professionals (FLPs) to work with other FLPs thereby encouraging enrollment in the Fusion program.

Incentives are available for Fusion Landscape design, installation, and maintenance and are paid by Peel and York Regions, allowing them to keep records of projects installed. FLPs are entitled to an incentive based on the creation of a landscape design and delivery to a customer. There is a further incentive for the FLP landscape designer if that design is built by the same or a different FLP. The design incentive totals $500. Additionally, there is an incentive for building the Fusion Landscape of around $1,500, and there is an incentive for maintenance of an undisclosed amount. Maintenance is required for two years after installation and most FLP include the cost of maintenance in the construction price. Maintenance-specific landscape professionals are then contracted by the builder who receives the maintenance incentive upon completion of the maintenance. Program administrators said that division of work is very common between the design, build and maintenance phases of the program and no single contractor has claimed all incentives despite it being possible within the program.

This is a radically different approach than most incentive programs which offer incentives to the end user of the home rainwater management practice (rain garden, permeable paving etc.). Some landscape professionals may choose to share the incentives with homeowners, but this is not required. The existence of incentives is not transparent to members of the public but does create motivation for landscape professionals to install Fusion Gardens over conventional gardens.

4.2.9. Protective plumbing

Indoor programs offer financial rebates that can be used to install backwater valves to reduce the risk of basement flooding. While not part of the outdoor rainwater practices

proposed for inclusion in an Ottawa program, protective plumbing programs were reviewed to determine lessons for homeowner engagement.

Some programs including in Ottawa, Toronto, and London Ontario offer generous subsidies for plumbing work and provide a detailed breakdown of covered costs and resident requirements to be eligible for subsidies. These include incentives of 80%, 90%, and 100% for Toronto, London, and Ottawa respectively up to $3,400 (Toronto and London) and $5,480 (Ottawa). All programs require the work to be conducted by a certified plumber and verified by Closed Circuit Television (CCTV). Halton, Sudbury, Barrie, Windsor, and Portland (OR) also have backwater valve rebate programs. Ottawa and Toronto both have programs to incentivize the purchase of sump pumps with a back-up power source that were funded by the Federal Government. Funding of 80% to a maximum of $1,750 was available for materials, labour, permits and taxes (total costs).

Despite the program's generosity, uptake at the City of Ottawa for backwater valve installation is considered low by staff. A similar uptake problem occurred at the City of Mississauga throughout a pilot backwater valve program in a target neighbourhood. However, the program eventually saw a huge increase in uptake to the point where the program was oversubscribed because local plumbing businesses interested in the potential subsidized business model began to promote the program with a targeted mail campaign. The exact dynamics that led to this increased uptake are not known, but this suggests that effective promotion from the right stakeholder may be important to generating adequate interest from residents.

Homeowners are unlikely to draw a distinction between basement flooding, pluvial flooding, and riverine flooding. Although they have different drivers and are best addressed through different means, homeowners are likely to label all of them as water issues. For this reason, there is a compelling reason to market these activities (backwater valves, rain gardens, sump pumps, and rain barrels) together. Additionally, homeowners who are likely to seek retrofits to their sewer lines are probably more likely to seek a retrofit to their property which includes a rain garden.

Recommendation: The City of Ottawa should pursue programming that allows the cross-promotion of various retrofit opportunities that deal with water on private properties.

5. Lessons and Recommendations

The City of Ottawa can learn from successes and challenges in other jurisdictions. All programs struggle with program uptake and no program has yet 'cracked the code' for encouraging home rainwater management actions. Ottawa will have to employ best practices from other regions (as they apply to Ottawa) and more in order to meet the challenge of addressing stormwater issues. Ottawa will have to employ practices and techniques that have never been used at a municipal level and remain adaptive in order to capitalize on strategies that work and avoid those that do not work. The research conducted here suggest that an Ottawa program should integrate the following considerations:

- Seek to establish an integrated program with a self-contained program identity that promotes and incentivizes multiple practices and offers 'one-window-delivery' for those incentives
- Consider rebate style incentives for:
    - Downspout disconnection/redirection costs
    - Rain garden design and installation
    - Permeable paving design and installation
    - Soakaway pits/trenches design and installation (where appropriate)
- Support existing rain barrel distribution models such as rainbarrel.ca and partner with them to:
    - Distribute additional messaging about incentivized practices
    - Improve rain barrel use by encouraging users to empty them between rain events
    - Encourage residents to get a second rain barrel to increase rainwater storage capacity
- Do not pursue a stormwater charge credit system

- Provide cost sharing incentives that reduce financial barriers for residents and includes options for residents with modest budgets and limited access to upfront cash
- Create a dual-stream program, with one stream for professional landscape professionals and one for residents
    - Offer dedicated training to landscape professionals that allows them to effectively design and install program practices that make their resident customers eligible for financial incentives
        - Leverage existing training programs and expertise within Landscape Ontario to offer training for landscape professionals
    - Require that residents who choose to design and install program practices on their own seek:
        - An initial home visit that includes; explanation of program details, design services, determination of a pre-approve rebate amount, and future support if required
        - A follow-up visit to confirm the release of financial incentives
- Seek a trusted consultant organization to implement the home visit program for residents and potentially administer financial incentives
- Develop a sophisticated communications plan to support the overall program delivery including a focus on:
    - Highly shareable content including video and motion graphics (words moving over images)
    - Producing novel content to generate excitement for home rainwater management repurposing, combining, and reusing (with permission) existing content in order to avoid duplicating efforts
    - Hyper-local content (*e.g.* suitable plants lists should be based on Ottawa's climate and soil conditions)

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Appendix I – Programs and practices included

Ref. No.	**Program Name (**outdoor, indoor, indoor and outdoor**)** *Host organization (* indicates that an interview was conducted)* Location	Downspout Disconnection	Rain Barrels	Raingardens	Permeable Paving	Backwater valves	Rebate / Stormwater Charge Credit / Subsidy	Integrated Program (rationale)
	Canadian Programs – Ontario							
1.	**Front-yard Makeover** *Sustainable Neighbourhood Retrofit Action Plan under Lake Simcoe Region Conservation Authority** Lake Wilcox, Richmond Hill	0	1	1	1	0	Rebate	Yes
2.	**Stormwater Stewardship Grants** *Hamilton Conservation Authority* Hamilton Area	1	1	1	1	0	Rebate	Yes
3.	**Stormwater Credit Program** *City of Kitchener** Kitchener	0	1	1	1	0	Credit	No (no program identity)
4.	**Waterloo Stormwater Management** *City of waterloo* Waterloo, ON	0	1	1	1	0	Credit	No (no program identity)
5.	**RAIN Smart Homes** *REEP Green Solutions* Kitchener / Waterloo	0	1	1	1	0	Credit	Yes
6.	**Downspout Disconnection Financial Assistance Program** *Region of Peel*	1	0	0	0	0	Rebate	No (single incentive)

Ref. No.	**Program Name (**outdoor, indoor, indoor and outdoor**)** *Host organization (* indicates that an interview was conducted)* Location	Downspout Disconnection	Rain Barrels	Raingardens	Permeable Paving	Backwater valves	Rebate / Stormwater Charge Credit / Subsidy	Integrated Program (rationale)
	Brampton, Mississauga, Caledon							
7.	**Water Smart Peel – Fusion Landscaping Consultation Program** *Region of Peel** Brampton, Mississauga, Caledon	0	0	0	0	0	None	No (consultation only)
8.	**York Region Fusion Gardening** *York Region* York Region	0	0	0	0	0	None	No (no incentives)
9.	**Water and Environmental Services Programming** *City of Toronto** Toronto	1	0	0	0	1	Rebate	Yes
10.	**PollinateTO Community Grants**[2] *City of Toronto* Toronto	0	1	1	0	0	Rebate	Yes
11.	**Greening Your Grounds** *Toronto and Region Conservation Authority* Toronto and Region	0	0	0	0	0	None	No (no incentives)
12.	**Basement Flooding Protection Subsidy Program** *City of Toronto* Toronto	1	0	0	0	1	Rebate	No (indoor only)
13.	**Basement Flooding Grant Program - City of London** *City of London* London, ON	0	0	0	0	1	Rebate	No (single incent./indoor)
14.	**Halton Region Flood Prevention Program** *Halton Region* Halton Region (Burlington, Oakville)	1	0	0	0	1	Rebate	No (indoor only)
15.	**Preventative Plumbing Devices for the Residential Inflow and Infiltration Subsidy Program (RIISP)** *Greater Sudbury* Sudbury	1	0	0	0	1	Rebate	No (indoor only)
16.	**Your Green Yard** *Credit Valley Conservation* Mississauga and Brampton	0	0	0	0	0	None	No (no incentives)
17.	**Depave Paradise** *Green Communities Canada* Various locations, Canada	0	0	0	0	0	None	No (no incentives)
18.	**Low-impact Development - Stormwater Management | City of Hamilton** *City of Hamilton* Hamilton	0	0	0	0	0	None	No (no incentives)
19.	**Raingers** *Bay Area Restoration Council* Hamilton	0	0	0	0	0	None	No (no incentives)
20.	**Downspout Disconnection Program** *City of Markham* Markham, ON	1	1	0	0	0	Rebate	No (single incentive)

[2] PollinateTO grants are integrated with biodiversity measures such as creating pollinator habitat, but do not include other stormwater measures.

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21.	**Project Blue** *City of Vaughan* Vaughan, ON	0	0	0	0	0	None	No (no incentives)
22.	**Stormwater Management - Richmond Hill** *City of Richmond Hill* Richmond Hill, ON	0	0	0	0	0	None	No (no incentives)
23.	**Ready for Rain** *Oakville Green Conservation Association* Oakville, ON	0	0	0	0	0	None	No (no incentives)
24.	**Barrie Water Conservation** *City of Barrie* Barrie, ON	1	1	0	0	1	Rebate	No (no program identity)
25.	**Reducing Combined Sewer Overflows - Niagara Region** *Niagara Region* Niagara, ON	0	0	0	0	0	None	No (no incentives)
26.	**Rain Garden Rebate Program** *City of Guelph* and REEP Green Solutions* Guelph, ON	0	0	1	0	0	Rebate	No (single incentive)
27.	**Rain Barrel Program - Kingston** *City of Kingston* Kingston, ON	0	1	0	0	0	Subsidy	No (single incentive)
28.	**Groundbreakers** *Red Squirrel Conservation*, GreenUp, EcoSuperior* Kingston, Peterborough, Thunder Bay, ON	0	0	0	0	0	None	No (no incentives)
29.	**Rain Garden Rebate Program - Eco Superior** *EcoSuperior** Thunder Bay, ON	0	0	1	0	0	Rebate	No (single incentive)
30.	**Windsor Flooding Prevention Program** *City of Windsor* Windsor, ON	1	0	0	0	1	Rebate	Yes
	Canadian Programs – Outside of Ontario							
31.	**Storm drain marking program** *City of Yellowknife* Yellowknife, YK	0	0	0	0	0	None	No (no incentives)
32.	**Rainwater Rewards Credits** *City of Victoria* Victoria, BC	0	1	1	1	0	Credit	Yes
33.	**North Shore Rain Garden Project** *Simon Fraser University** North Vancouver, BC	0	0	0	0	0	None	No (no incentives)
34.	**Stormwater Management** *City of Surrey* Surrey, BC	0	0	0	0	0	None	No (no incentives)
35.	**UniverCity Stormwater Management** *SFU Community Foundation* Burnaby, BC	0	0	0	0	0	None	No (no incentives)
36.	**Stormwater Management - Abbotsford** *City of Abbotsford* Abbotsford, BC	0	0	0	0	0	None	No (no incentives)
37.	**Stormwater Management - Coquitlam** *City of Coquitlam* Coquitlam, BC	0	0	0	0	0	None	No (no incentives)

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38.	**Rain Barrel Program** *City of Richmond* Richmond, BC	0	1	0	0	0	Rebate	No (single incentive)
39.	**Okanagan Homeowner's Guide to Using Rain as a Resource** *Okanagan Basin Water Board* Okanagan Similkameen Vallies, BC	0	0	0	0	0	None	No (no incentives)
40.	**Stormwater Management - Saanich** *Saanich* Saanich, BC	0	0	0	0	0	None	No (no incentives)
41.	**Yard Smart** *City of Calgary* Calgary, AB	0	0	0	0	0	None	No (no incentives)
42.	**Change for Climate** *City of Edmonton* Edmonton, AB	0	0	0	0	0	None	No (no incentives)
43.	**Stormwater Management Credits** *City of Saskatoon* Saskatoon, SK	0	1	1	1	0	Credit	Yes (lacks a strong program identity)
44.	**Naturalized Storm Water retentions / Rain Gardens** *Seine-Rat River Conservation District* Winnipeg, MB	0	1	1	0	0	Rebate	Yes
45.	**Storm Drainage** *City of Regina* Regina, SK	0	0	0	0	0	None	No (no incentives)
46.	**Stormwater - Ville de Sherbrooke** *Ville de Sherbrooke* Sherbrooke, QC	0	0	0	0	0	None	No (no incentives)
47.	**Ruelles Vertes** *Ville de Montréal* Montréal, QC	0	0	0	0	0	None	No (no incentives)
48.	**Stormwater Credits Program** *Halifax Water** Halifax, NS	0	0	0	1	0	Credit	No (barriers too high)
	US Programs							
49.	**Rain Check** *Philadelphia Water Department* Philadelphia, PA	0	1	1	1	0	Rebate	Yes
50.	**Rain Check** *Prince George's County** Prince George's County, MD	0	1	1	1	0	Rebate	Yes
51.	**Clean River Rewards** *City of Portland* Portland, OR	1	0	1	1	1	Credit	Yes
52.	**RainReady** *Center for Neighborhood Technology* Chicago, IL	1	0	1	1	0	Rebate	Yes
53.	**Rice Creek Watershed District Cost-Share Grant Program** *Rice Creek Watershed District* Minnesota	0	0	1	1	0	Rebate	Yes
54.	**Let it Rain Stormwater Program** *Winooski Natural Resources Conservation District and UVM Lake Champlain Sea Grant*	1	1	1	1	0	Rebate	Yes

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	Burlington, VT							
55.	**Private Property Retrofit Incentive Program - NYC** *New York City* New York City, NY	0	1	1	0	0	Rebate	No (lacks program identity)
56.	**SoCal Water Smart** *SoCal WaterSmart / Los Angeles Department of Water and Power* Los Angeles, CA	0	1	1	0	0	Rebate	Yes
57.	**Sustainable Backyard Program: RAIN BARRELS** *City of Chicago* Chicago, IL	0	1	0	0	0	Rebate	No (single incentive)
58.	**Stormwater Management - Houston** *City of Houston* Houston, TX	0	1	0	0	0	Rebate	No (single incentive)
59.	**Stormwater management - Phoenix** *City of Phoenix* Phoenix, NV	0	0	0	0	0	None	No (no incentives)
60.	**Rainwater Harvesting - San Antonio** *San Antonio Water System* San Antonio, TX	0	1	1	0	0	Rebate	Yes
61.	**Sustainable Landscapes Incentive Program** *San Diego County Water Authority* San Diego County, CA	0	1	1	0	0	Rebate	No (drought focus
62.	**Rainwater Harvesting Residential / Commercial Rebate** *Austin Water* Austin, TX	0	1	1	0	0	Rebate	No (drought focus)
63.	**Santa Clara Valley Water District Conservation Rebates** *Santa Clara Valley Water* San Jose / Santa Clara Valley, CA	0	1	1	0	0	Rebate	No (drought focus)
64.	**Jacksonville Rain Barrel Make'n'Take** *City of Jacksonville* Jacksonville, FL	0	1	0	0	0	Subsidy	No (single incentive)
65.	**Spring Rain Barrel Sale - Fort Worth** *Botanical Research Institute of Texas and Fort Worth* Fort Worth, TX	0	1	0	0	0	Subsidy	No (single incentive)
66.	**Central Ohio Rain Garden Initiative** *Central Ohio Rain Garden Initiative* Ohio	0	1	0	0	0	Rebate	No (single incentive)
67.	**Rain Guardians** *San Francisco Water Power Sewer* San Francisco, CA	0	0	0	0	0	None	No (no incentives)
68.	**Urban Cost Share Program** *Mecklenburg County* Charlotte, NC	0	0	1	0	0	Rebate	No (single incentive)
69.	**Monroe County Stormwater Partnership Program** *Monroe County* Monroe County, IN	0	0	1	0	0	Rebate	No (single incentive)

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70.	**12000 Rain Gardens** *Stewardship Partners & Washington State University Extension* Puget Sound, WA	0	0	1	0	0	Rebate	No (single incentive)
71.	**RiverSmart Homes** *DC Department of Energy and Environment* Washington, DC	0	1	1	1	0	Rebate	Yes
72.	**Rain Action in Neighborhoods (RAIN)** *Earthwatch / Franklin Park Zoo* Boston, MA	0	0	0	0	0	None	No (no incentives)
73.	**The Great American Rain Barrel Company** *The Great American Rain Barrel Company* Northeast US	0	1	0	0	0	Subsidy	No (single incentive)
74.	**Detroit Stormwater Hub** *City of Detroit and 11 other organizations and departments* Detroit, MI	0	0	1	0	0	Rebate	No (single incentive)
75.	**Clean Water Nashville Overflow Abatement Program** *Government of Nashville Tennessee* Nashville, TN	0	1	0	0	0	Rebate	No (single incentive)
76.	**Sustainable Shelby Memphis** *Memphis-Shelby Office of Sustainability* Memphis, TN	0	0	0	0	0	None	No (no incentives)