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Toronto RainCAP Pilot Project
RiverSides Foundation

Project Summary
Part I. Description

Participating organizations

- RiverSides Foundation
- Project Neutral
- RainGrid Inc

Background or problem statement
The sustainable growth of urban environments depends heavily on their ability to provide municipal infrastructure. Some of the most critical and expensive infrastructure that facilitates the growth of cities is the supply of clean water to and the treatment of the resulting wastewater and sewage.

Originally, underground sewers drained directly to lakes, rivers and oceans with little or no treatment. As residents of these cities experienced the human health impacts, environmental damage and loss of recreational uses associated with this type of pollution. Local governments with assistance from senior levels of government began to build the infrastructure that would transport and treat this sewage and wastewater. The hydrology of a modern city, where concrete sidewalks, asphalt roads, driveways and roof surfaces dominate and there is and ever diminishing permeable surfaces leads to large volumes of rainwater flowing to the underground sewers and mixing with the sanitary sewers.

Consequently, stormwater damage is now the single largest urban hazard. Since 2005, stormwater damage has cost 20 billion dollars in Canada. Climate change driven extreme storms threaten the infrastructure of our urban environments. Our project was carried out to test the effectiveness of Automated Rain Barrels as a residential stormwater solution that captures and stores stormwater on site, preventing pollution and reducing the risk of residential flooding.

General description of the project

We field tested 15 ARBs in real-world conditions to gage their collection and storage capacity, their durability and the overall user experience.

The ARB (automated rain barrel) system, an traditional meets-cutting-edge, game changing solution that combines a sturdy Canadian made and tested barrel with user-friendly wireless technology. The ARB system anticipates storms, and allows users to remotely monitor and empty barrels to their wishes. The system is set up to allow lot-level storage, use, and treatment of stormwater by diverting it off rooftops and naturally filtering it through gardens and lawns.

The ARB system tested over 5 months during the 2016 pilot project. The ARB system has received enthusiastic feedback from citizens using it now … and its potential is yet to be fully exploited. It works because it is effective, intuitive, and easy to use. Our pilot project demonstrated that urban householders are enthusiastic and sustained supporters, eager to become “stormwater stewards”.

RiverSides was able to provide a foundation of practical experience and information ton which to facilitate the expansion ARB Systems into urban communities. Deliver in-the-field technology testing to improve the hardware and software platforms for mass production. Gather information on thecustomer/householder experience so as to gage commercial viability and value proposition. As well as establish baseline estimates of stormwater collection and storage capabilities.

Description of outcomes and follow-up
Project Outcomes

1) Provided a foundation of practical experience and information to facilitate the expansion ARB Systems into urban communities, including a publicly accessible summary report, factsheet for participating householders and outreach agencies, customer survey, five case studies, virtual tour of installations, and a final report that facilitates pilot repeatability for other groups.

2) Provided in-the-field technology testing to improve the hardware and software platforms for mass production. Publish a 10 point ARBs improvement suggestion.

3) Gathered information on the customer/householder experience so as to gage commercial viability and value proposition, through focus groups, individual householder interviews and survey.

4) Established baseline estimates of stormwater collection and storage capabilities, verifying collection metrics of 10 - 20,000 litres per season per installation.

Project Summary
Part II. Analysis

Successes
The ARB system is set up to allow lot-level storage, use, and diversion of stormwater from rooftops and naturally filtering it through gardens and lawns. It's a cost-effective alternative to the current high-cost city stormwater-treatment systems, standard rain barrels, or downspout disonnects that dump water over property surfaces and onto city roads, collecting further contaminants to flow with the water into sewers.

The ARB system is a stand-alone residential unit that can also be scaled up to expand into a targeted local network. Either way, it’s a community-based solution that is lower cost and simple. The ARB system has received enthusiastic feedback from citizens using it now Our pilot project demonstrated that urban householders are enthusiastic and sustained supporters, eager to become “stormwater stewards.” They liked simply, conveniently, and remotely redirecting stormwater from their roofs to use in their own gardens and yards while saving tapwater costs. At the same time, our first-of-its-kind pilot’s participants reduced their city’s water-treatment costs, supported the existing urban stormwater infrastructure, and contributed to the health of their local watershed.

This summary report shares the key findings from our pilot project, in hope that you will be as interested and enthusiastic about implementing this system in your city.

RiverSides was successful:
1. Demonstrating proof of concept for Automated Rain barrels.
2. Verifying a minimum and maximum range of collection and storage metrics
3. Testing householder uptake and satisfaction
4. Documenting prototype weakness and solutions for next prototype iteration
5. Establishing community network for possible expansion.
6. Documenting results and potential for stormwater management.
7. Establishing pilot project protocols for other communities, groups or governments to build on.

Challenges
1. Installation Optimization:
There were missed opportunities to maximize stormwater collection that were revealed as we identified (and addressed) the following issues.
a. Storm-surge overflow (we designed and installed storm funnels to ensure full collection and minimize overflows during stormwater surges)

b. Filter clogging due to roof debris or inadequate cleaning (we sent out email reminders about filter maintenance)
c. Incorrect maintenance instruction

2. Internet Connectivity:
Intermittent connectivity between ARBs and householders' internet during storm events was the most challenging aspect of our project, mainly due to the time it took our supplier to identify the weaknesses in the prototype design and their inability to fix the issue during our data-collection phase. We immediately saw that during rain events—the most critical time for monitoring and controlling the ARBs—our contact with many dashboards was lost. We spent much time with those householders investigating why this happened. Regular non-functionality sometimes led to loss of householder confidence in their connection's stability and security, and a loss of significant collection data, reducing our ability to record the full amount of collection. It was not always sufficient to maintain communications between the outdoor RB and the indoor plugin modem during rain-induced interference.

3. Drought and Low Rainfall Year:
2016 was the 4th driest year in Toronto since 1992 with a total of 517mm of rainfall, of which only 267mm fell during the 5-month collection period (see: http://toronto.weatherstats.ca/charts/rain-1year.html and http://toronto.weatherstats.ca/metrics/precipitation.html). This meant far fewer opportunities to test ARBs in extreme rain events or under flood conditions, and therefore fewer opportunities to test the ARB's top-end collection potential.

Lessons Learned
For decades the humble rain barrel has been a mainstay of community based residential stormwater management and water conservation initiatives. Municipal rain barrel give-away and subsidy programs are popular across North America. In our experience we have found.

1. Rain barrels are often too small to be effective on any significant level. In an effort by municipal programs to maximize the number of participants that can receive RB giveaways - programs seek to minimize per capita costs. Often choosing to offer and promote smaller (150 – 300 liter) designs, which are less expensive options. Homeowners also look to install the smallest possible RB to minimize visual impact and address space considerations. Smaller, cheaper RBs overflow, do not collect from a large enough roof area to be effective in peak storm situations and often do not have adequate filters or bypass options.

2. Once a RB has filled with water. It has no capacity to further collect storm water. So they are only as effective as they are regularly drained and prepared for the rainfall. Consequently, if do emptied they are full when they are most needed and so are ineffective when storms do occur.

3. The homeowners quality of experience with small, cheaper RB options is not good. Regular overflows, short product life spans, inadequate filters creating silt issues and mosquito habitat, difficult seasonal maintenance and the need for regular manual drains before every rain fall are key reasons for concern.

4. When a municipality invests in a RB program they want to be able to quantify results. Due the inability to ensure that the RB’s are being used and maintained properly this undermines the capacity of the local authority to asses its value.

While ARB systems we tested were able to address these key limitations, their effectiveness to do so was dependant on establishing an enforceable maintenance contract with the supplier.

What Next? What will you do and what should others do?
Now that a first-of-its-kind prototype has been ground-tested in real world situations and a proof-of concept has been successfully established, RiverSides will use the pilot results, associated reports and implementation experience to:

1. Promote and circulate the results of this pilot to interested parties across the Americas. RiverSides will be meeting with and making presentations to WaterTAP, Toronto Water, Toronto Regional Conservation

Authority, the Region of Peel, Ministry of Environment and Climate Change, professional associations and publications involved in stormwater issues.

2. Disseminate information and meet with flood vulnerable local communities, environmental groups and environmental community networks like Project Neutral and Green Communities. With the goal of building and expanding community based ARB networks.

3. Assist in the improvement of the ARBs technology by building a multi-disciplinary network of developers, universities, users, funders and manufactures to support the open source and commercial development of the technology.

4. Approach Foundations and Great Lakes funders to support expansion

5. Encourage ARBs as viable municipal pollution prevention stormwater management tool. RiverSides believes the time has come for householders, communities, municipalities, insurance companies, real-estate developers, architects, and urban planners to consider how this preventative stormwater infrastructure can be tested, refined, and incorporated into the "toolbox" of options designed to meet the challenge of urban climate change adaption.

Householders:

• visit www.riversides.org to see our report and virtual tour to consider how an ARB system could be used on your property

• begin with the installation of a standard rain barrel. Once it is installed, conversion to an ARB system is the next step.

• ask your local and municipal political representatives if they support or consider ARB technology in their stormwater planning

For more information about the project please contact:

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