

Water, Water Everywhere – When the Storm Water Flows

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Introduction

In May 1988, the Beluga, a Greenpeace flat-bottomed river vessel, was transported across the Atlantic Ocean from Germany to Montreal to begin a four-month boat tour of toxic hotspots in the Great Lakes and St Lawrence River. That summer the Beluga visited 36 ports of call – also known as Areas of Concern under the Great Lakes Water Quality Agreement.

I was the leader of that campaign. We called it Water for Life. I was understandably anxious about the tour going well when we began to motor through the St Lawrence/Great Lakes on May 5, 1988. The Greenpeace team had done its homework; we had made local connections in each of the areas of concern and had carefully researched the issues. Our goal was to highlight the environmental problems across the basin on both sides of the border in hope of political action to reduce pollution.

When the tour began in Montreal in May, the captain and I were very worried. We weren't sure there was going to be enough water in the Mississippi River, the second part of the Beluga's North American tour, to get the boat down the river. Would we find similar shallow waters in the five Great Lakes that might impede our movements?

The summer of 1988 was the start of a significant drought, which ranks among the worst episodes of drought in the United States. It caused about \$60 billion in damage across the country. That year, Milwaukee set records for the lowest monthly precipitation and the longest interval between measurable precipitation events of 55 days. What followed by mid-summer were concurrent heat waves that ultimately killed thousands of Americans. Canadians felt it too. As we floated through the glorious lakes, we experienced the drought first hand. But en route, we also experienced one of the scariest thunderstorms I've ever witnessed in St. Ignace, Michigan. What we were observing was the start of dramatic weather pattern changes that would ultimately be known as climate change.

So, does this matter now?

Fast forward to May 2019.

Ontario is blessed with water

The province fronts onto four of the five magnificent Great Lakes. We have over 250,000 freshwater lakes and over 100,000 kilometers of rivers in the province. We have deep and generous aquifers, which have sustained us for hundreds of years. Ontario has plenty to draw on for our drinking water, agriculture, commercial and industrial uses, recreation and other needs.

Ontario has 444 municipal governments which own the lion's share of the province's water and wastewater infrastructure systems. More than 14 million Ontario residents rely on these services, as most of the population is served their potable water through a system of pipes. There are some small communities in Ontario which rely on individual wells, particularly in northern and remote parts of the province. As has been widely discussed, many remote Indigenous communities do not have a safe and secure supply of drinking water despite years of political promises. At the time of writing this Paper, at least 44 drinking water advisories remain in Ontario communities.

In April and May 2019, a significant number of Ontario municipalities, including the nation's capital, experienced severe flooding, two years after the 2017 floods, considered by meteorologists to be "the flood of the century" or the "one in a hundred year" flood.

In the current era of climate change, where water resources are being affected by changing weather patterns, are we using and treating our abundant water resources to their highest and best uses? Could we be managing our water systems more effectively? Are we getting our best return on investment?

This Paper will explore the various ways that Ontario municipalities can better protect their water resource, keep it abundant and relatively inexpensive to deliver to families and businesses, all under the lens of climate change predictions for the province.

Climate Change

The climate is changing globally and most environmental leaders and politicians recognize that while we may no longer be able to stop the overall planetary warming trend, we can learn to adapt to the changing conditions we are beginning to face now and will face in the coming years. Climate change is affecting all natural systems including weather patterns, our soils, the amount of rainfall we receive and when, wildlife, the salinity of the oceans and the nature and temperature of our freshwater resources. The warnings are not new.

Remember the summer of 1988.

A recent report released by the federal government outlines the state of Canada's climate and concludes that we are warming faster than other nations, particularly in the north.

"Extreme precipitation amounts accumulated over a day or shorter are projected to increase; thus, there is potential for a higher incidence of rain-generated local flooding, including in urban areas." (www.changingclimate.ca, 4.3, 6.2) As our climate warms, our language and connection around water will need to change. Put simply, one can start to think about our available water three different ways: too much water, too little water and the wrong kind of water. The purpose of this paper is to primarily examine the Too Much Water problem and what could be done to help change the situation.

Too Much Water

Having too much water in the system leads to flooding, a problem that municipalities have faced for decades. But with the predicted extreme weather and even heavier rainfall when storms do occur, problems for municipalities managing storm water will increase. Of course communities want and need rain – it recharges aquifers and provides the opportunity for crops to flourish, but intense rainfall without methods of managing it is a challenge for communities not just now, but in the future.

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In April and May 2019, a significant number of Ontario municipalities, including the nation's capital, experienced severe flooding, two years after the 2017 floods, considered by meteorologists to be "the flood of the century" or the "one in a hundred year" flood. Bracebridge, along with other cottage country communities, such as Minden and Huntsville, have declared states of emergency in 2019. The cities of Ottawa and Montreal have done the same. The Toronto Islands are once again threatened, as in 2017. Lake Ontario is now at its highest point in recorded history.

Ontario Premier Doug Ford was quoted as saying, "They say it's 100-year storms – well it's a few years later and we're back in the same boat." Those 100-year storms are the "new normal." At the same time, the province of Ontario has announced that they would be cutting 50% of the flood protection budget for Ontario's conservation authorities – the agencies that manage floodplains and watershed oversight for 95% of Ontario's population.

Storm water runoff has the potential to carry pollutants into our lakes and rivers and can cause significant flooding and serious erosion, not to mention the displacement of residents and businesses and causing insurance claims and insurance rates to skyrocket.

According to the Environmental Commissioner of Ontario's (ECO) November 2016 report, while managing storm water is largely a municipal responsibility, it is an under-funded one.

"Inadequate funding has created a \$6.8 billion storm water infrastructure deficit in Ontario. This financial gap could get even bigger in the future as population growth leads to the creation of more impermeable surfaces and consequently worsens runoff." (Executive Summary, Urban Storm water Fees: How to Pay for What We Need, November 2016, Environmental Commissioner of Ontario.)

There will be additional costs to upgrade or replace existing storm water infrastructure to handle increased storm events, but most Ontario municipalities don't have the money to do what is needed now, let alone in the future. According to the ECO, storm water management monies have traditionally been gleaned from property taxes, but there's not enough money to pay for all that is required. Generally, homeowners don't want to pay any more tax. So – how can we improve the situation? Clearly a different approach needs to be taken, one that emphasizes prevention not clean up, and one that includes the property owner in decisions that focus on limiting the damaging effects of too much water. Knowing that there is a funding gap and a federal water and wastewater infrastructure deficit to the tune of approximately \$6 billion, a third of that in Ontario, what can be done?

Return on Investment

The economic concept of seeking a “return on investment” is a sound tool but it's a simplistic one when it relates to long-term environmental issues. Municipalities make spending and investment decisions every month. Incorporating a triple bottom line approach – taking into account financial, social impact and environmental responsibility at the same time – is an effective way to ensure that future climate impact considerations are baked into investments.

When it comes to decision-making, this aligns perfectly with the facts of climate change, as we now know them.

Large Municipalities vs Small Municipalities

It's true that large municipalities have more resources to pay for the needs of their populations, even with the myriad of issues and problems that larger municipalities encounter. But as urbanization increases in Ontario, the movement of people away from small communities to larger places creates two problems. Larger municipalities have to plan for increasing water and wastewater capacity as their populations increase and small municipalities need to continue to invest in their infrastructure even while their tax base shrinks.

The town of Bancroft is a classic example of a small municipality with a significant cottage-owner summer population but a steady or shrinking residential population on the tax base, which is responsible for maintaining the water and wastewater system. My parents had a cottage for years south of Bancroft. In over 40 years, the welcome sign announcing Bancroft has had the same listed population number. The tax burden on Bancroft's residents is significant. In 2016, the town approved a whopping 53% increase in municipal water rates to pay for new infrastructure. This is a town where incomes average around \$33,000, or 30% below the provincial income average. When the new water rates hit, local food bank usage went up 300%.

There are a series of cascading reasons for this massive increase, including provincial government changes to requirements to deal with septage; adjacent communities pulling out of agreements when these requirements changed, leaving the permanent residents on the hook to meet financial commitments to a plant now too large for the town itself. The province agreed to a redesign when

the neighbouring communities pulled out of the agreement, but that redesign cost even more money and at the end of that process, the new plant cost 10% more than originally projected.

...the province and municipalities could save precious money by planting more trees, encouraging the development of green roofs, green walls, bio-swales, rain gardens and other natural methods of keeping the rain out of the drain and instead directing it back into the ground.

Because it's against the law for Ontario municipalities to carry deficits for operational costs, Bancroft was forced to take out two long-term bank loans.

The City of Toronto, the largest municipality in Ontario, is in an entirely different situation. The city has already created an ongoing funding approach within the City's \$13+ billion operating budget and a 10-year \$40 billion capital budget. All of that money is still largely to maintain the current system allowing for some expansion, but not necessarily to introduce innovation. And managing storm water is still a giant issue in a city where combined sewers and their inevitable overflows into the Don and Humber Rivers are still way too common.

Turning Grey Infrastructure Green

Infrastructure is the stuff of our towns and cities. It is the connection, mostly unseen, between our homes and businesses – roads, sewers, water mains, gas and electric utility equipment, for example. Traditionally, the province and the federal government helped fund this type of infrastructure because it's essential to our common way of life. But Ontario is already in a significant deficit when it comes to paying for these types of investments. And good investments they are because once the money is spent, the pipes, the roads, the bridges etc., tend to last for decades until either they fail or there is a need to expand capacity as populations grow.

While this type of infrastructure, sometimes called “grey” infrastructure, is critical to sustaining the health of our communities, a different kind of infrastructure has emerged as equally critical. Sadly, it is even more under-funded or ignored entirely by government, and is somewhat misunderstood as a concept.

“Green” infrastructure emphasizes the use of natural biological systems. According to the 2014 Provincial Policy Statement, green infrastructure: “means natural and humanmade elements that provide ecological and hydrological functions and processes. Green infrastructure can include components such as natural heritage features and systems, parklands, storm water management systems, street trees, urban forests, natural channels, permeable surfaces, and green roofs.” (Provincial Policy Statement, under the Planning Act, 2014. P.42)

According to a report released by Green Communities Canada, entitled ‘Ready Set Rain’, green infrastructure can reduce flood risk by:

- Preserving and/or enhancing existing wetlands, forests, and meadows can ensure that communities downstream are at reduced risk of flooding.
- In areas with undersized sewers, reducing runoff volumes can take pressure off and reduce the risk of surcharging.
- Retrofitting existing built up areas to manage rain where it falls and reduce impervious surface can reverse the negative trends of urbanization, ultimately reducing flood risk downstream (when done at scale).

Ready, set, rain! Apr. 2019, p. 16

As espoused by Green Infrastructure Ontario (GIO), a 40-member coalition of organizations ranging from Conservation Ontario (which represents the province's conservation authorities), Forests Ontario, Ontario Parks Association, Ontario Association of Landscape Architects, Landscape Ontario, Green Roofs for Healthy Cities, Green Communities Canada, LEAF and others, the province and municipalities could save precious money by planting more trees, encouraging the development of green roofs, green walls, bio-swales, rain gardens and other natural methods of keeping the rain out of the drain and instead directing it back into the ground to recharge aquifers.

Sometimes embracing what was once popular leads us back to the future. The expansion of natural systems makes so much sense in communities where impervious surfaces mean that water flows to the lowest point, rather than the highest use. Every time it pours in communities with paved surfaces and without much green infrastructure, there is storm runoff and that rain finds itself in the sewer system, which can't cope with the overflow and overland flooding occurs.

As noted on GIO's website:

"Many municipal water supply, wastewater and storm water infrastructure systems across Ontario are approaching the end of their planned service life. Replacing or rehabilitating these systems will require major investments. Implementing green infrastructure solutions, however, can deliver significant savings through:

1. Reduced capital costs;
2. Reduced flood damage costs; and
3. Lower costs associated with maintaining storm water systems over their lifespan.

Properly scaled and sited green infrastructure systems can manage runoff as effectively as conventional storm water infrastructure at a comparable or lower cost. Green infrastructure can be anywhere from 5 to 30% less costly to construct, and approximately 25% less costly over its life cycle, than traditional infrastructure that performs comparably." (www.greeninfrastructureontario.org)

No More Walkertons

In 2000, Ontarians were stunned to hear about the contamination of Walkerton's water supply with *E. coli* and *Campylobacter jejuni* bacteria. Two thousand people got sick and seven people died. Eventually two brothers plead guilty to mismanagement of the town's water supply. Millions were

spent, a public inquiry was held and new provincial rules came into play. But the question still remains in many communities, could Walkerton happen again? According to the Ontario Water Works Association (OWWA), the answer is a maybe, as existing financial tools for water and sewer plant maintenance are unsustainable – there's more demand than cash available.

According to Michele Grenier, the Executive Director of OWWA, while there is a lot of concern among Ontario municipalities about fixing and maintaining the infrastructure, little innovation has actually occurred in the way grants are managed.

In the 1990s, when I worked in office of the Minister of Environment, I helped guide the funding for water and sewer infrastructure provincially. We processed hundreds of grants, but one in particular really stood out for me. While this does not relate directly to flooding, it does speak to the lack of an overall cohesive approach to community grants to protect our water.

The City of Barrie was seeking funding to expand their sewage treatment plant capacity to the tune of \$41 million primarily because the largest user in the city was looking to expand. That expansion involved adding once-through cooling lines for beer production. Once the water was used for cooling purposes, it was to be disposed of directly into the sewer system. This seemed wasteful to us at the time, so we proposed to work with the Barrie officials to ensure that the end result was met – that the beer company could expand and that the city had enough capacity in their wastewater plant. We suggested, and the large user eventually agreed, that a once-through cooling line was indeed a waste of water and that they could install instead a different kind of system that involved a close-loop approach. A lot of water and money could be saved and the appropriate user paid.

Additionally, we proposed that the City of Barrie could be a provincial leader in installing six-litre toilets, which at the time were still relatively rare. Crane Toilets, before they merged with American Standard in 2008, had a manufacturing facility in Peterborough and we helped introduce the two players. Almost 9000 households took part in Barrie's water conservation program which cost the city about \$3 million to run, but saved almost \$19 million in deferred construction and expansion costs at the sewage plant. This approach created 825 more jobs than a straight capital expansion of the plant and Barrie households that took part saw the benefit of lower water costs. As part of the project, the city of Barrie installed an ultra-violet disinfection system and reduced the amount of chlorine going into the receiving water of body – Lake Simcoe.

Room for innovation

While innovation has been in short supply, Grenier did mention some helpful pointers that homeowners could take at the lot level and which are encouraged by municipal governments:

- Disconnect the downspouts
- Install a rainbarrel
- Install backflow valves
- Have the roof leaders flow away from foundations

These are all fairly simple, low-cost fixes.

As community resource water managers, operators could install inflow infiltration controls and ensure that all the staff is up to date on training and operational excellence. Ensuring that all community members have installed mandated six-litre water-efficient toilets, as they have been required for new and retrofit construction under the Ontario Building Code since 1996, is an important municipal responsibility but not all the necessary conversions have happened.

Grenier also questions whether there needs to be a different service level standard for different size municipalities. Of course, municipal water systems need to meet minimum standards, but no model currently exists for small communities and treatment requirements in a community of 1000 are the same as a city of over two million. This is a financial, technical and personnel problem, which the province needs to and can address.

While innovation is not evident in today's granting programs, some municipalities see the need to apply their own solutions to too much water. One solution that some communities have implemented is a storm water user fee for property owners.

Ontario communities with Storm water User Fees

Community	Type of Storm water Fee
London	Fee based on Property Size
Aurora	Flat Rate (per unit)
St. Thomas	Flat Rate
Kitchener	Single Family Residential Unit (SFRU)
Markham	Residential / Non-residential flat rate*
Mississauga	Single Family Residential Unit (SFRU)
Newmarket	Development Intensity & Property Size
Waterloo	Tiered Flat Rate
Richmond Hill	Tiered Flat Rate
Guelph	Equivalent Residential Unit (ERU)

Adapted from Smart Prosperity Institute: <https://institute.smartprosperity.ca/canadian-storm-water-user-fees>

The municipality of Mississauga instituted a storm water user fee (suf) for all property owners in 2016. This was in response to more storm water in the system and the need to manage it and treat it before it flows into Lake Ontario. Mississauga's storm water user fee is based on the amount of impervious (hard surface) ground you have on your property and the size of your lot. Large buildings would pay more, for instance, because there are more hard services – roofs, parking lots, courtyards – for example.

The program has a built-in incentive to reduce storm water runoff by allowing for a storm water credit, by application, that requires the property owner to demonstrate that they have invested in

storm water reduction measures, many of the same aspects proposed by Green Infrastructure Ontario. The revenue from the program has led to the creation of a storm water fund, which among other things, has invested in a storm water pond in the Cooksville area of Mississauga capable of reducing the 100-year predicted storm flow by 80 per cent. This is water management with our climate future in mind.

Grenier also points to a successful collaboration between the Town of Alliston and Honda, their largest industry, to reduce the car company's water usage enough to forestall further taxpayer investments at the sewage plant. This kind of collaboration is critical for both – so that the company can act as a good corporate citizen, and for the municipality to provide the best and most reasonably priced services to their citizens. While this kind of collaboration can result in a struggle and sometimes threats by companies to pull out of communities if they're asked to "do too much", it's important to remember that climate change affects everyone no matter where they clock in to work every day.

The rain and snow will continue to fall on Ontario communities. Climate projections say that we will experience more storms of greater intensity. The farther north you live the more climate disruption you are likely to experience.

Backflow prevention bylaws are in place in many larger communities in the province including London, Kitchener and St. Catharines and smaller communities are beginning to put these requirements in place. More progress needs to be made to push for this relatively simple requirement.

Speaking from personal experience, after wading through a flooded basement, installing a backflow preventer has saved me from subsequent flooding. It's an easy fix and could prevent not only the obvious water intrusion, but also the subsequent rise in insurance claims, not to mention the heartache of dealing with wet and damaged belongings.

Municipalities deal with a large range of issues on behalf of their citizens. Storm water management is often seen as a transportation issue as rainwater and snow melt does affect roads, road safety and future planning, but it's so important to remember that climate-smart policies need to be instituted across the entire municipal corporation and that departments must work together to ensure the highest and best use of taxpayer dollars. Storm water is a very real wastewater issue across Ontario and it's time it was recognized as such.

Consideration for Municipalities

Some measures that could be implemented regardless of the size of community include:

- Aligning municipal government decision making and investments, across the corporation that don't negatively affect another aspect of what municipalities are responsible for. In other words, continuing to require black, impervious surfaces that promote runoff is not helpful for those in the environment or water department who are trying to ensure that a local water body remains safe for recreation, and/or a source for drinking water (if applicable).
- Implementing a bylaw requiring backflow prevention valves. This will save money over the long term.
- Implementing a storm water management fee on all properties and use the revenue to create rain gardens and other green infrastructure technologies.
- Asking the provincial and federal government to update floodplain maps for your area, which are significantly out of date
- Communicating with your residents about water conservation approaches (low-flow toilets and showerheads, rain barrels etc.)
- Actively promoting a conservation first / prevention first approach
- Looking to other municipalities who have initiated successful programs to encourage the reduction of water use and who have effectively managed storm water.
- Eliminating all cross-connections within the wastewater system to reduce combined sewer overflows
- Following Intact Insurance's excellent advise on how to reduce homeowner flooding and insurance risks – www.intactcentreclimateadaptation.ca
- Become familiar with the non-profit Ontario Mutual Insurance Association. They partner with Intact and other insurers to deliver insurance products exclusively for smaller communities in Ontario. They are also advocating for provincial building code improvements particularly related to flooding. As OMIA's CEO John Taylor said in 2018, 2017 was "the year of the flood claim." Water risk models are changing and there will no doubt be an impact on municipal insurance rates as we continue to experience more water than the infrastructure can effectively handle. www.omia.com
- Calling for the reinstatement of flood prevention monies to the province's conservation authorities. These agencies are critical to the delivery of effective programs at the watershed level.
- Calling for a reinstatement of funding to the Ministry of Environment and to grants and loan programs in the Ministry of Infrastructure to support best practices in our water and wastewater facilities. We are beyond time where deficits for infrastructure are acceptable public policy.

Starting with the summer of 1988, climate change has been upon us in Ontario. Yet not enough recognition has been given to this massive global problem at the local level. This paper has only looked at one important aspect of our anticipated future – too much water.

The rain and snow will continue to fall on Ontario communities. Climate projections say that we will experience more storms of greater intensity. The farther north you live the more climate disruption

you are likely to experience. The sooner all Ontario elected and public officials start to work together to implement proven approaches and embrace innovative ideas to managing storm water, the better prepared our population will be at becoming climate smart citizens. The more we invest up front, the less money municipalities will pay in the long run. It's a win-win approach. Now that's a positive return on investment.

For further reference and reading:

Why Sewers are Overflowing Across Ontario, by Andrew Autio,
www.tvo.org April 1, 2019.

"Welcome to Bancroft, Ontario where residents are charged \$2400 Water Bills" by Zi-Ann Lum,
Politics Reporter, Huffpost Canada, March 20, 2019

Canada's Changing Climate Report,
https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/Climate-change/pdf/CCCR_ExecSumm-EN-040419-FINAL.pdf, April 5, 2019

Environmental compliance reports. Annual summaries for all regions on: air emissions;
municipal/private sewage discharges; and industrial sewage discharges –
www.ontario.ca/data/environmental-compliance-reports

Municipal treated wastewater effluent – www.ontario.ca/data/municipal-treated-wastewater-effluent

Conservation Authorities protect people and property from flooding, www.conservationontario.ca

Northern Perspective: Water, Water Everywhere - When the Storm Water Flows

Hilary Hagar

Climate change has various impacts on human, aquatic and terrestrial life. In Northern Ontario, these impacts range from increased flooding in Far North Indigenous communities, to damaging the Boreal forest, to dwindling aquatic species in lakes (Huff and Thomas 2014; Khalafzai, McGee, and Parlee 2019).

In particular, climate change impacts water – whether too much, too little or the wrong kind of water, as McLean puts it. In terms of too much water, Northern Ontario has felt the impacts. For the Kashechewan First Nation near James Bay, spring ice melting is not a usual event. However, the timing and extent of the flooding has been changing so much so that between 2004 and 2018, the community has been evacuated 12 times (Khalafzai, McGee, and Parlee 2019).

In Sudbury, increased winter precipitation and the subsequent application of road salt results in high sodium and chloride levels in nearby waterbodies. Over time, this has potentially damaging effects for aquatic ecosystems and the citizens who consume drinking water from these water sources (CBC News 2018). As well, in Timmins, a recent report from the Environmental Commissioner of Ontario (ECO) revealed that the City's sewage system bypassed treatment and discharged directly into Porcupine Lake (ECO 2018, 70). The City uses a combined sewer system that mixes waste water and storm water, leading to the over capacity of the sewage treatment plant during times of high precipitation, with the potential to cause untreated water to flow into water bodies (Autio 2019; ECO 2018, 62). This problem is likely to worsen with climate change as the risk of a “combined sewage overflow is compounded by more intense precipitation” (ECO 2018, 66).

Because of this potential for environmental harm, the province has prohibited any municipality from installing new combined sewer systems since 1985, though there are still 57 operating combined systems across the province that were installed before 1985 (ECO 2018, 64). While the City of Timmins has started to update its system³, the work was delayed because of ground settling and legal issues with the contractor working on the site (MECC 2017, 5).

Regardless, these important issues need lasting solutions, particularly in the context of climate change. While tragic, the Walkerton crisis paved the way for the Clean Water Act, which made

³ A provincial inspection, conducted in 2008, resulted in a Provincial Officer's Order with 11 recommendations (MECC 2017, 2). Part of this Order was to update the existing pumping stations and construct new storm water retention tanks (MECC 2017, 3).

watershed-based source water protection plans mandatory in areas with a Conservation Authority (CA) (Ontario 2007). However, more than 400,000 people remain outside of any source protection area, most of whom are in the north (ECO 2018, 38). In fact, “while nearly all of Southern Ontario is covered by source protection areas, most Northern Ontario communities are not” (ECO 2018, 38). Nonetheless, the province has at least “some responsibility to protect sources of drinking water for all Ontarians” including northern and First Nation communities (ECO 2018, 39).

Areas without CAs are also areas with smaller municipalities. The five CAs in the north surround the five largest cities – North Bay, Timmins, Sudbury, Sault Ste. Marie and Thunder Bay (Conservation Ontario n.d.). This could be a problem for sustainable investments because as McLean writes, “small municipalities need to continue to invest in their infrastructure even while their tax base shrinks”. For areas without both a CA and large tax base, economically and environmentally sustainable efforts to preserve water bodies can be hindered. Green infrastructure, as suggested by McLean, poses a solution to these challenges. Relying on natural biological systems to absorb, slow, filter and store run-off can reduce the number of combined sewer system overflows (ECO 2018, 68). While grey infrastructure comes with costly updates, green infrastructure is a renewable resource that can cut costs in the long run, as described by McLean. These sustainable efforts are even more necessary as the amount and variability of precipitation changes with climate change.

Examples of green infrastructure are popping up in Northern Ontario. Notably, the Municipality of Wawa, which is not under the jurisdiction of a CA, is generating efforts in green infrastructure to preserve and improve water quality. The municipality is implementing the Boreal Forest Eco-Walk Rejuvenation Project which involves the construction of bioswales, natural landscaped features to slow, collect and filter storm water, along the shoreline of Wawa Lake (Municipality of Wawa 2019). Presently, storm water is collected through street side gutters and catch basins that flow directly to water outfalls into Lake Wawa without cleaning or treating the discharged water (Municipality of Wawa 2019). The bioswale is meant to manage pollution from storm water, while addressing “an infrastructure deficit in the maintenance and replacement needs of concrete outflows” (Municipality of Wawa 2019). Other added benefits of the Eco-Walk include preserving the Lake’s natural beauty for tourism and providing a recreation area for residents and visitors to utilize the beach and learn about boreal forests (Municipality of Wawa 2019).

Solutions such as implementing green infrastructure ought to be seriously considered in Northern Ontario, especially in smaller municipalities without CAs or that lack sustainable environmental policies. In the context of climate change and increased precipitation, integrating economic, social and environmental perspectives will ensure the health and sustainability of the north, both now and for future generations.

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