



GTA

**PARTNERS IN
PROJECT GREEN**

A PEARSON ECO-BUSINESS ZONE

THE BUSINESS CASE FOR NATURAL INFRASTRUCTURE

How corporations can invest in
nature for climate resilience

A program of:



Toronto and Region
Conservation
Authority

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Executive Summary



Flooding is a critical challenge facing the Greater Toronto Area (GTA) that will only become more challenging as we experience the continued effects of climate change. A recent Council of Canadian Academies (CCA) report quotes damage to physical infrastructure from consequences of extreme weather as Canada's top risk (2019), and for the first time in history, the Bank of Canada listed climate change as one of six vulnerabilities to Canada's financial system (Bank of Canada, 2019). In addition, many municipalities across Ontario, including Brampton and Mississauga, have declared climate emergencies, indicating the need for timely and effective action. Considering that climate change is one of the top vulnerabilities of Canada's financial system, and that extreme weather, including floods, is our primary risk, stormwater and flood management is a key strategy for enhancing climate change resiliency.

Why Businesses Should Care About Flooding Due to Climate Change

The need to consider the effects of climate change, including flooding, also extends to businesses. Risks can be both local and global. Physical damage to assets and local infrastructure, employee absenteeism and mental health issues, supply chain risks, threats to water quality, and the implementation of stormwater charges can all result in unexpected costs or disruptions to business operations.

Natural Infrastructure as a Solution

A valuable method of reducing stormwater runoff and lowering flood risk is natural infrastructure; a strategy that incorporates natural land features in development and reintroduces these features into urban areas to allow water to infiltrate into the ground rather than run into storm sewers. Natural infrastructure can range from conserving naturally occurring features like wetlands to implementing permeable pavements to allow water to soak into the ground.

The Opportunity: Natural Infrastructure on Private Lands

The public sector has been active in promoting some natural infrastructure on public lands, but even so, a large percentage of land in a municipality is privately owned. The prevalence of private land, particularly industrial and commercially owned, has led experts in the field to stress the importance of private sector involvement in natural infrastructure propagation; however, this has generally been difficult to achieve. In addition to a lack of understanding in the business sector as to the causes of urban flooding, and minimal awareness of natural infrastructure as a solution, financial concerns around implementation, limited spatial availability, and traditional development practices have, up until now, been limiting factors on the predominance of natural infrastructure on corporate lands.

There are a host of benefits to natural infrastructure implementation on private lands. Not only can it lower flood risk and improve water runoff quality, natural infrastructure has been shown to provide



energy savings, increase property values, and can be used to gain municipal stormwater charge credits. This also provides the opportunity to contribute to climate resilience in one's community and demonstrate corporate social responsibility to consumers, employees, and investors. In fact, climate resiliency is becoming an increasingly important metric of environmental, social, and governance (ESG) criteria utilized by businesses and evaluated by many investors.

The Path Toward Natural Infrastructure Adoption

Toronto and Region Conservation Authority's Partners in Project Green (PPG) program is valued in the industrial, commercial, and institutional (ICI) community as a trusted advisor on environmentally friendly business practices in the GTA. PPG's Water Stewardship performance area seeks to promote best practices in stormwater management and flood resiliency, and has seen multiple successful implementations of natural infrastructure projects on corporate properties. PPG's position as a reliable liaison between the conservation community and the private sector presents a unique opportunity to provide information for businesses on the current state of flooding issues in the GTA, educate on the multiple benefits of natural infrastructure, and to support the business case for companies to act, which will improve climate change resiliency and flood mitigation not only for the participating company, but the surrounding community as well.



Introduction and Problem Statement

“Hell and high water”

(Mann, 2019)

“Toronto under shoreline hazard warning as lake water edges closer to 2017 levels”

(CBC, 2019)

“Hundreds of millions of dollars flowing for flood mitigation in the GTA”

(Toronto Star, 2019)

“Get used to being disrupted: Expert warns of the financial implications of climate change”

(CBC Radio, 2019)

The abundance of news headlines referring to an increased risk of floods in the Greater Toronto Area (GTA) is impossible to ignore, and rightly so—the area has seen a significant increase in flooding over the past ten years, coinciding with rising average temperatures. The GTA has seen six 100-year storms in the past twenty years (Mann, 2019). The Insurance Bureau of Canada (IBC) has reported that insured losses from severe weather in Ontario reached \$1.3 billion in 2018 – a new record after exponential increases in insured losses since the early 1980s, when average insured losses were only \$400 million per year for all of Canada (IBC, 2019).

One of the main causes of urban flooding is the abundance of concrete, asphalt, and other hard surfaces in cities. These impermeable areas prevent water from seeping into the ground as it should naturally, forcing it to flow overland into storm sewers, many of which are old and have limited capacity. It therefore stands to reason that introducing permeable features like plants and soil to soak up water would help protect cities from floods -- almost like re-establishing the power of the forest or wetland that once stood where our cities do now. This is natural infrastructure; the use of vegetated systems to manage stormwater and restore some of the hydrological functions of natural areas (Green Infrastructure Ontario, 2019). A recent study demonstrated that even a small number of natural infrastructure features in an area can be effective

at absorbing excess rainwater (University of Maryland, 2019). The concept of natural infrastructure has gained traction worldwide, particularly in parts of Asia which are highly susceptible to projected flood risk due to sea-level rise (Muggah, 2019). Termed “sponge cities”, countries are increasingly stressing the importance of permeable land; China’s climate change resiliency planning requires that 80% of urban land function to absorb or recycle rainwater (Muggah, 2019). In addition to providing protection against flooding, natural infrastructure has other benefits, such as providing cleaner air, sequestering carbon from the atmosphere, reducing energy costs for buildings and homeowners, and even increasing property and rental values (Clements, St. Juliana and Davis, 2013). In short, natural infrastructure helps to build resilience to the effects of climate change, as well as more livable, attractive communities and business areas (ICF, 2018).

With so many advantages and such a high risk of flooding in the GTA, why then do we not see more natural infrastructure in our region? As a newer concept with limited awareness and data, building with natural infrastructure in mind is a new way of operating, which people can be reluctant to adopt (Bertule et al, 2014). Additionally, given that the majority of land within a municipality is privately owned, governments can only do so much (Fortin, Gauley and Patterson, 2018). If municipalities are to address climate resilience, the key issue of flooding would be difficult to fix without collaborating with private landowners. Moreover, working with private corporate landowners is particularly important given that businesses typically have a much higher footprint of impervious area compared to other types of private property, such as residences.

The business community is therefore a key stakeholder in addressing the issue of flooding and climate vulnerability in the GTA. Yet flood mitigation is often not a high priority expenditure



for the business community. Paradoxically, it has been found that the majority of the private sector are not adequately estimating or addressing their climate risks (ICF, 2018). As such, this white paper seeks to explain the issue of regional flooding and provide guidance to support the business case for acting on urban climate resilience through natural infrastructure and to collectively take the GTA to a place where nature and urban lands symbiotically exist.

Background: Flooding and Climate Change in the GTA



Figure 1: Floodplains of Etobicoke Creek (left), Mimico Creek (middle) and Humber River (right) in Mississauga and Toronto (TRCA, 2019).



Why does the GTA flood?

There are many reasons why the GTA sees so many instances of flooding and the associated property damage. Older neighbourhoods were constructed in floodplains, built before riverine flooding, was acknowledged as a constraint to land development (Figure 1). The topography of the region includes low-lying areas prone to flooding, simply due to the nature of how water flows. However, three important factors are the main drivers of increased flooding of urban areas within the GTA.

More precipitation with climate change

IBC reported in 2019 that flooding has become the most expensive type of natural disaster that has occurred nationwide in the past decade (IBC, 2019). Climate change has contributed significantly to the prevalence and expense of floods. When the temperature of the atmosphere increases, it can hold more moisture, which results in higher amounts of precipitation (IPCC, 2012). It has been demonstrated that Canada is especially affected by climate change as our average temperatures have increased by approximately 1.7°C in the past seventy years, about twice as much as the global average (Council of Canadian Academies, 2019). Additionally, Environment Canada has reported that annual mean precipitation by volume across Canada has increased and is expected to continue to increase over the next century. It is also projected that extreme precipitation events are likely to increase as well (Bush and Lemmen, 2019).

An increasing abundance of concrete, asphalt and other impermeable surfaces

In urban areas, where impermeable surfaces like asphalt and concrete are most prevalent, rainwater pools on the surface and flows overland into storm sewer systems. This is in contrast to the flow of water in natural areas, where water can seep into the ground. If development progresses as it has in a large urban area like the GTA, there will be even fewer surfaces that can allow rainwater to infiltrate into the ground or be absorbed by plants. Roads, parking lots, sidewalks and buildings are in increasing demand by a growing city population, and as a result of these impervious surfaces, water has nowhere to go but to storm sewer systems. Impermeable surfaces occur on both public and privately-owned land, which has an effect on solutions to the issue (Moudrak and Feltmate, 2019).

Mississauga's Pearson Eco-Business Zone is 13,858 hectares in area. 9,822 hectares or 71% of the region are impermeable, hard surfaces. (Figure 2) (D'Souza, 2019).

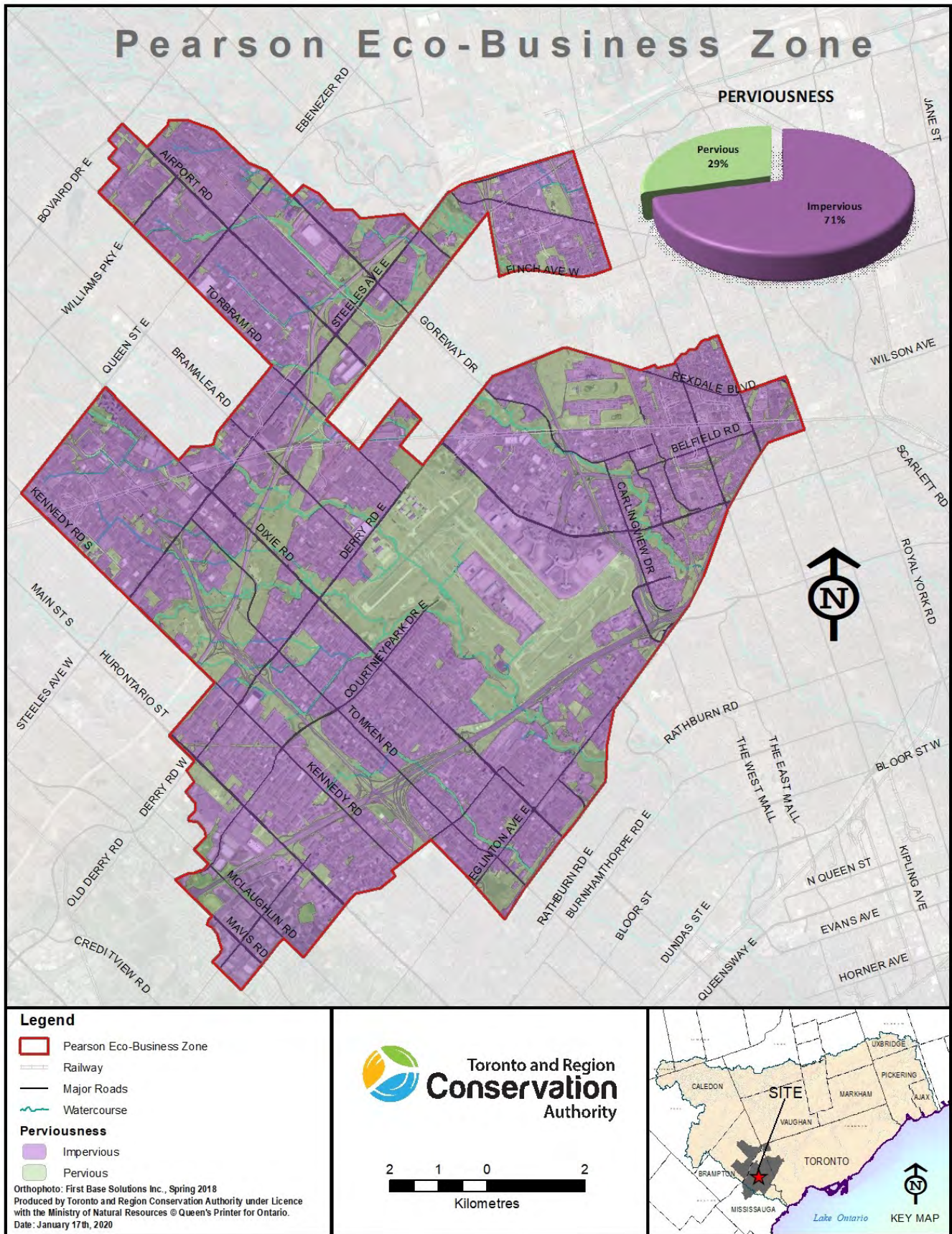


Figure 2: Permeable surfaces in the Pearson Eco-Business Zone (Toronto and Region Conservation Authority, 2020)

Aging and insufficient infrastructure

As increased rainfall runs off a growing number of impermeable surfaces into storm sewers, the systems' capacity is not always sufficient to handle that volume of water. This is an issue particularly in older cities like the GTA, where many sewer systems were designed without considering overland stormwater runoff or heavier precipitation levels (Moudrak and Feltmate, 2019). Degrading infrastructure or sediment and debris build-up can further reduce the capacity of the system to handle the increasing amount of runoff, which can result in overloading of the storm sewer system, back-ups or overland flooding. When this occurs, we can then see water flowing into streets, mixing with contaminants like sewage, oil and grease, flooding basements, stranding cars, and damaging infrastructure.

Large rain events in the GTA such as the events in July 2013 and August 2018 are expected to become more frequent. More development is occurring throughout the region, increasing the imperviousness of the city, and although GTA municipalities such as Toronto and Mississauga are investing in upgrading stormwater infrastructure, this is an extremely costly and time-consuming endeavour (Mann, 2019). A recent CBC Radio program on the financial implications of climate change had one expert noting that the projected cost of repairing cities after flood events combined with the cost of upgrading outdated infrastructure will ultimately fall to the taxpayer (CBC Radio, 2019). Therefore, it can be said that the repercussions of climate change can be felt on all levels, from global to individual. Whether felt directly through property damage and health implications, indirectly through higher taxes, or through one of the other projected effects on society, this is a collective problem to solve.



Why Businesses Should Care About Flooding Due to Climate Change

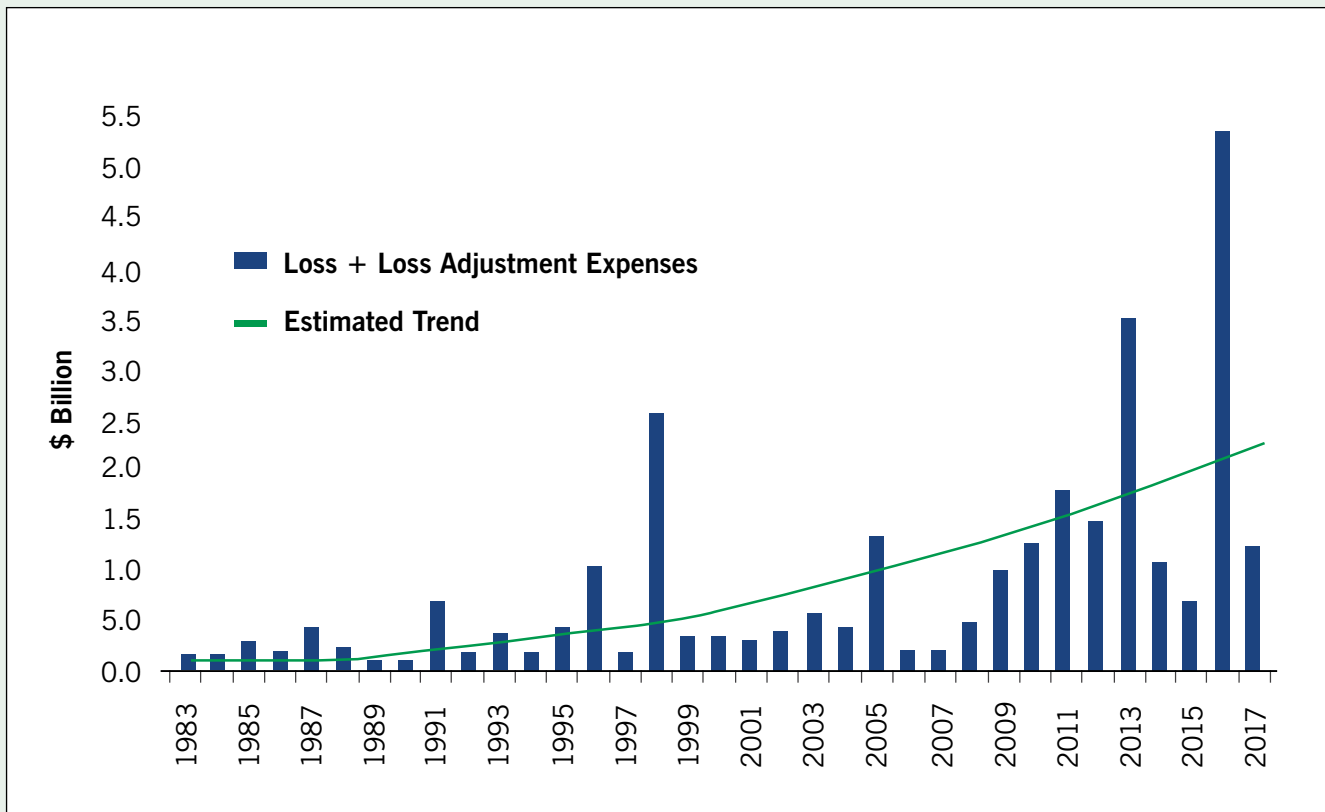


Figure 3: Catastrophic insured losses from natural disasters in Canada (1983 – 2017) (IBC, 2018)

In 2019, for the first time in history, the Bank of Canada listed climate change as one of six vulnerabilities to Canada's financial system, which stresses the need to explore detailed analysis of how a warming climate can present risk to all aspects of the economy, including the business community (Bank of Canada, 2019). Identifying and acclimatizing operations to climate risks is an important part of developing resilient business, but the private sector can also take a leadership role in creating resiliency in their communities (Cameron, Harris and Prattico, 2018). Flooding and climate change have trickle-down consequences, from a systemic, global level to the scale of the individual employee.

Risk of Physical Damage

In the private sector there is potential for direct flood damage to a company's assets (office buildings, warehouses, fleets, inventory, etc.). In addition, there are consequences to consider from damage to local public infrastructure including flooded roads or impaired bridges, which can impair the efficiency of, or entirely disrupt, transportation, goods movement and accessibility. These factors are vital to the operations of virtually all businesses across all sectors. Experts warn that Canada has a national infrastructure deficit – a discrepancy between the cost of repairing deteriorating infrastructure and the investments actually made - of on average between \$110 billion and \$270 billion, with a significant portion (30-50%) of assets requiring imminent repair (Boston Consulting Group). IBC has stated that damage as a result of flooding is the costliest of extreme weather events, and the yearly cost of insured losses from extreme weather has been exponentially increasing in the past few decades (2019), posing significant cost risk.

Employee Absenteeism and Mental Health

In addition to damage to a physical workplace, residential flooding has severe consequences on productivity from an employee perspective. The Intact Centre on Climate Adaptation at the University of Waterloo found that over half of people with flooded houses took time off work, with an average of seven days off – 10 times the Ontario average in normal conditions (Feltmate and Decent, 2018). A 2013 study found that absenteeism cost the Canadian economy \$16.6 billion in 2012, concluding that increasing amounts of time-off-work for growing flood risks has the potential to be highly expensive to employers (Conference Board of Canada, 2013). Additionally, there is rising concern among researchers of the

effect of flooding on a population's mental health. The Intact Centre found that people dealing with a flooded residence had significantly higher worry and stress within 60 days of the flood occurrence (Feltmate and Decent, 2018). This has the potential to further influence absenteeism, or cause difficulties in employee performance (Feltmate and Decent, 2018). These indirect effects of flooding are new research areas and are not yet fully understood; however, results so far have found significant costs associated with employee absenteeism and mental health concerns. It has been projected that around 1.7 million Canadian residences, or 19% of the national population, are at risk of flooding, indicating a potentially enormous cost to businesses (Feltmate and Decent, 2018).

Stormwater Charges

Businesses can also expect to receive financial costs from government, as more municipalities are implementing stormwater fees to address rising flood risk. The City of Mississauga implemented their Stormwater Charge in 2016, and several other municipalities are currently looking into the feasibility of stormwater financing. These municipalities are part of a larger, growing trend across Ontario and Canada of communities that are funding their stormwater services with a user fee model. With the goal of generating funds to manage stormwater, many municipalities are attempting to reduce growing infrastructure shortcomings that will worsen with climate change (Zhao, Fonseca and Zeerak, 2019). The City of Brampton, for example, has stated an annual stormwater infrastructure deficit of \$16 million (Frisque, 2019). Therefore, businesses and residences are being charged based on impervious area and other factors, to help fund stormwater management in the city.



Risks to the Supply Chain

Businesses face potential risk from flooding and climate change not only in their own operations, but across their entire supply chain. According to a Business for Social Responsibility (BSR) report, supply delays due to flooding in Thailand in 2011 resulted in disruptions to over 14,500 businesses worldwide, including large multi-nationals like HP and Toyota (Wei and Chase, 2018). There are multiple stages in a supply chain where climate change can have an effect. Raw material availability and quality, changes in cost, labour issues, shipping and delivery disruptions are all examples of how the supply chain is vulnerable to the consequences of a warming climate (Wei and Chase, 2018). A key crop could fail, or the quality of the crop could change with climate variations; the cost of materials could increase due to availability or production issues; perhaps a shipping corridor is suddenly unavailable as a result of a flood – all of these outcomes could have a potential effect on the ability of a business to function or to remain profitable. BSR's report on Climate and Supply Chain remarks how even policy and legal changes in response to climate change on a global scale have the potential to disrupt supply or shape consumer demand, both of which could change profitability (Wei and Chase, 2018). With a globalized, interconnected economy, the risk of disruption is significant.



Threats to Water Quality

From an environmental perspective, there are also contamination implications from urban flooding that can affect our drinking water sources. Heavy metals, bacteria, chloride from road salt, oil and grease are commonly found in rivers and lakes near urbanized areas from sources such as tire wear, industrial spills or pavement deterioration (Toronto and Region Conservation Authority, 2018 and Ontario Ministry of the Environment, 2019). When an urban area floods, more potentially toxic contaminants get washed off roads, construction sites or industrial areas and end up in our rivers and lakes, damaging aquatic ecosystems, killing wildlife and making water bodies and beaches unsafe for recreation. Credit Valley Conservation water monitoring sites in the GTA have even recorded chloride levels (from road salt) in local rivers at over 20,000 mg/litre, which is saltier than seawater (Dunn, 2018).

Among the most severe consequences of heavy rainfall are combined sewer overflows (CSOs). Certain older areas of the GTA were built with combined sewers, where one pipe carries both rainfall and sewage together (City of Toronto, 2019). When intense rainfall overloads the capacity of combined sewers, this mix of raw human sewage and contaminated stormwater is diverted past treatment, directly into surrounding rivers and Lake Ontario (City of Toronto, 2019). This happens, on average, 1-3 times per month at each of Toronto's two largest water treatment plants (Humber and

Ashbridge's Bay), increasing in frequency with higher levels and rates of rainfall (Lake Ontario Waterkeeper, 2017). City of Toronto is currently developing the Don River and Central Waterfront Wet Weather Flow System to address the issue of CSOs, which will include the Coxwell Bypass Tunnel, a 10.5 km-long underground tunnel system which can capture and store overflow for later treatment (City of Toronto, 2019).

Additional contamination concerns also exist around plastic waste, as urban runoff is said to be one of the largest sources of plastic pollution entering the Great Lakes (Rochman, 2019). A recent report from the International Association for Great Lakes Research summarized how cleanup efforts in heavily polluted regions of the Great Lakes has resulted in significant economic growth from new development and associated tax revenue, as well as a rise in recreation, creation of jobs, tourism and fishing (Hartig et al, 2019). The opposite would be true for increasingly polluted waters as a result of high levels of contaminated runoff. For example, a recent study projected that algal blooms in Lake Erie, which frequently occur as a result of excessive nutrient concentrations in runoff from land sources, could cost the Canadian economy \$5.3 billion over 30 years, with an annual loss of \$110 million in the tourism industry alone (Smith et al, 2019). As an economic catalyst and a critical source of drinking water, pollution in the Great Lakes from stormwater runoff is a major concern.

Natural Infrastructure as a Solution



Flooding and other consequences of climate change are well established as an increasing risk to business. By identifying and understanding the potential impacts to employees, physical assets, operations and the supply chain, businesses can begin to envision the universal nature of the issue and take steps to manage those risks accordingly. Understanding one's own risks is important, but a widespread problem like climate change points to the need to also think about resiliency at the societal and community level.

A 2018 report from BSR reasoned:

“When pursued at scale, the actions of climate-resilient business lead to a resilient world, composed of people, an economy, and natural systems able to rebound quickly in the face of adversity”

(Cameron, Harris and Prattico, 2018).

Fostering a resilient society means building resiliency among all its parts, including residential homes, industry and public infrastructure. If businesses and the economy at large function as interconnected systems, adapting to thrive through climate change in the private sector benefits the broader society.

From the GTA perspective in which flooding is a key risk, an effective and recognized method to build resilience takes inspiration from the way natural land functions. Natural infrastructure is a strategy that

incorporates and conserves nature in development and land use planning and seeks to reintroduce natural features into urban areas to provide protection from natural hazards like flooding (Brooke, O'Neill and Cairns, 2018). This functional role of nature has been termed “ecosystem services” wherein natural features such as wetlands, forests and grasslands provide environmental services in the form of flood mitigation, water purification, clean air, cooling and more (Brooke, O'Neill and Cairns, 2018). These natural features, brought back into urban areas for the purpose of providing ecosystem services, are acting as infrastructure that supports our communities, homes and businesses.

Not only do these natural features provide infrastructure-like services, they can also do it at a lower cost. A study found that conserving and restoring wetlands and forest systems in the Catskill Escarpment watersheds, which collectively provide drinking water to New York City, cost significantly less (over \$1 billion in savings) than building a water treatment plant in the same area (Kennedy and Wilson, 2009). For private companies, protecting and restoring natural infrastructure can reduce the risk of flood damage at the building and community level, provide a wide variety of co-benefits that benefit employees and the environment, and enhance a company's reputation as a socially responsible organization, contributing to climate resiliency in the region, and a more livable community.

Types of Natural Infrastructure

The types of natural infrastructure vary from naturally occurring landscapes to more engineered technology (see Appendix A). Typically, the term is used somewhat interchangeably with “green infrastructure” or “low impact development (LID)” (Scott et al, 2018 and STEP, 2019). Natural infrastructure can include:

- Wetlands
- Urban forests
- Grasslands
- Gardens and native landscaping (rain gardens, urban agriculture containing native species)
- Mangrove forest restoration (coastal regions)
- Green roofs
- Blue roofs
- Bioswales
- Bioretention areas
- Soakaways
- Riparian buffers
- Permeable pavements
- Rainwater harvesting vessels



Permeable Pavement



Bioretention Area

The Opportunity: Natural Infrastructure on Private Lands

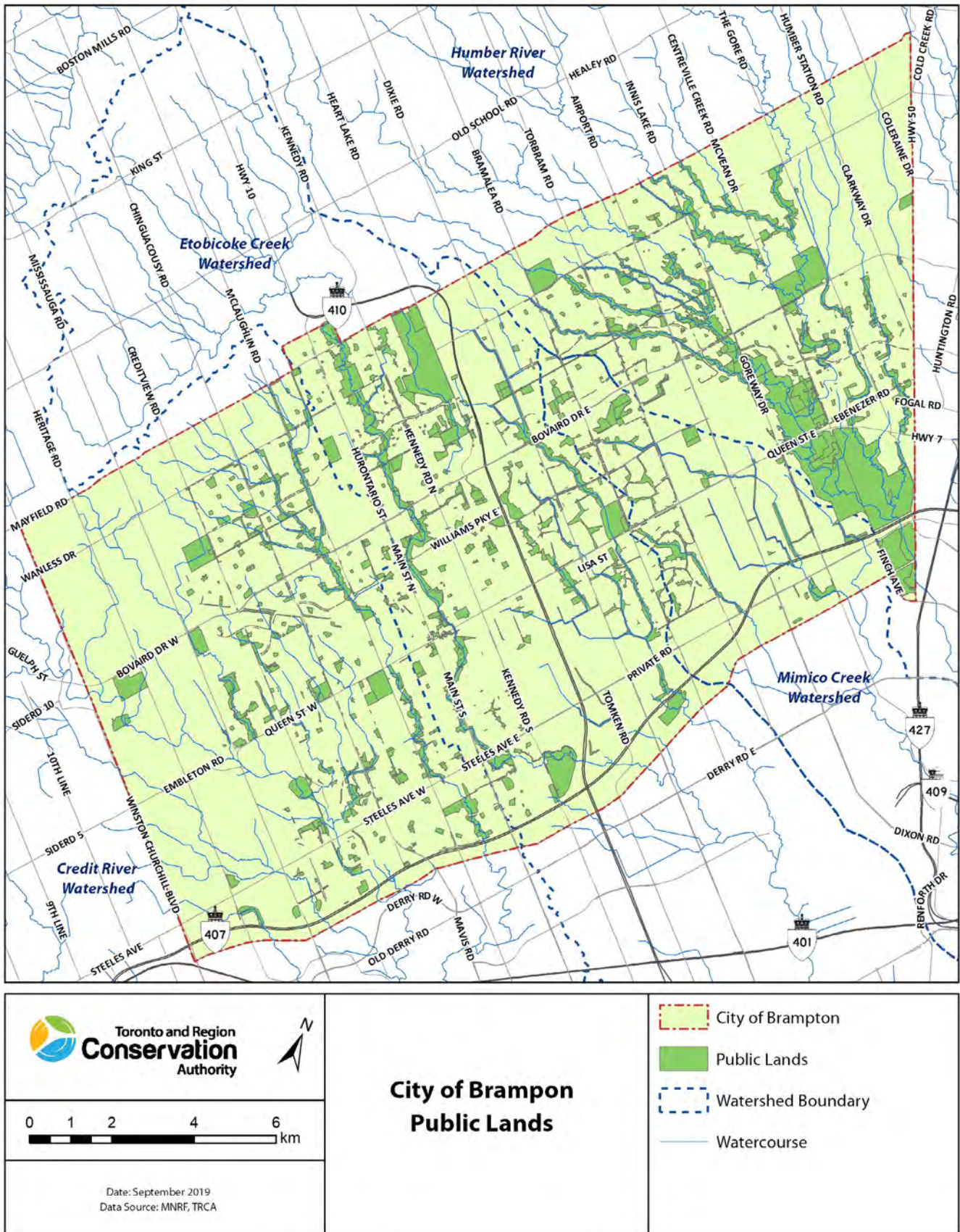


Figure 4: City of Brampton publicly owned greenspace (TRCA, 2019)

Why Private Lands?

Natural infrastructure is one strategy to mitigate flood risk through the increase in permeability of urban surfaces, which creates a variety of benefits for landowners and the surrounding communities. Natural infrastructure is not widely implemented for a variety of reasons, one of which is the availability of land, and the nature of land ownership.

Although natural infrastructure can be found on public lands and greenspace, most land in a municipality is privately owned (Fortin, Gauley and Patterson, 2018). For example, of all impermeable surfaces in Brampton's jurisdiction, 56% are industrial, commercial, institutional or multi-family residential lands. This indicates a huge potential for private land owners to become involved in the enhancement of greenspace systems by incorporating natural infrastructure to augment that which is publicly owned. As seen in Figure 4, publicly owned green space in The City of Brampton comprises only 14.6% of the jurisdiction (TRCA, 2019).

This highlights the importance of educating private landowners about the benefits of natural land and infrastructure, and involving them in the conversation about the implementation and management of natural infrastructure as assets to build resilient communities. An ecosystem does not respect arbitrary property boundaries. Every action or change in how we manage land can have positive or negative cascading consequences on the environment. It is therefore important to remember that business involvement in the proliferation of natural assets has the potential to positively affect their local watershed and ultimately convey climate resilience and flood protection to communities.

Benefits of Natural Infrastructure

The pervasiveness of impermeable, paved surfaces in modern cities is detrimental to natural system function because it disrupts the natural water balance (the natural movement of water from land to oceans to

atmosphere) of the whole watershed - the region from which all water flows to a particular river or lake – by preventing infiltration (STEP, 2019). Natural infrastructure seeks to restore the water balance closer to its natural state and as a result, the benefits of natural infrastructure to managing water resources include (Bertule et al, 2014):

Urban Resilience and a Healthy Water Balance

- Decrease in the rate and volume of stormwater runoff, reducing pressure on storm sewer systems and decreasing overland flood risk
- Decreased riverine flood risk
- Increased infiltration and recharge of groundwater aquifers
- Reduced drought
- Water purification, through the removal of contaminants during infiltration
- Erosion control
- Lower water temperatures
- Coastal flood protection

Community and Commercial Co-Benefits

Natural infrastructure also provides numerous co-benefits – ancillary outcomes that support overall sustainability. Particularly when located in urban areas, the addition of natural features has been proven to positively impact the surrounding neighbourhood and its residents.

Co-benefits to the surrounding community include (IBC, 2018):

- Habitat creation (pollinators, wildlife, plants)
- Reduction of urban heat island effect
- Air filtration
- Recreation and aesthetic improvement
- Community pride and cohesiveness

One study found that shopping areas with plenty of natural features like street trees and landscaping has a positive effect on shoppers, who will spend more on products and spend longer or more frequent amounts of time shopping (Wolf, 2013).

A report from the Natural Resources Defense Council (NRDC) found that commercial properties that incorporated natural infrastructure on their own lands not only contributed to community improvement and improved overall water management, but also found a host of co-benefits, including cost savings. In the City of Mississauga, for example, adding natural infrastructure to revegetate land resulted in a significant reduction to one property owner's stormwater charge (Kramkowski, 2018). Particularly for the commercial real estate sector, natural infrastructure has proved advantageous to bottom line results through the following ways (Clements, St. Juliana and Davis, 2013):

- Energy savings through temperature control
- Reduced water bills
- Reduced flood damage
- Higher rent potential and property value increase
- Improved employee pride and job satisfaction
- Improved employee health
- Reduced crime
- Local tax credits
- Stormwater charge credits

It was found that the presence of street trees in Portland, Oregon added approximately \$8,870 to residential property values (Scott et al, 2018; Donovan and Butry, 2010).

Corporate Social Responsibility

In addition to the environmental benefits natural infrastructure can provide, investing in resilience for one's community is an opportunity to showcase corporate social responsibility (CSR). Standards for a company's social license to operate are increasing from public, investor and employee perspectives (Kenton, 2019). Environmental and water issues are particularly top of mind for stakeholders of all kinds including customers, suppliers, consumers, and investors. In fact, Principles for Responsible

Investment recently identified that climate change was the primary environmental, social and governance (ESG) concern of investors in 2019 (Reynolds, 2019).

From a local perspective, where climate resiliency stipulations are largely related to flooding, investing in natural infrastructure is a method of addressing ESG concerns. The NRDC reports that commercial investment into green infrastructure practices is becoming a "quality benchmark for the private sector" by fostering an image of investment in sustainable practices and community improvement (Clements, St. Juliana and Davis, 2013). An example of this type of initiative occurred in Maryland where property managers Corvias Solutions partnered with the Prince George County municipal government to form The Clean Water Partnership, which plans to retrofit 4000 acres of impervious land while promoting mandates to create social value and community resiliency through their work (The Clean Water Partnership, 2019) (See Appendix B). The project received recognition from the White House and EPA for this innovative example of CSR (Corvias, 2015).

Businesses are also increasingly joining coalitions like Business for Water Stewardship and Business Alliance for Water and Climate (BAFWAC) to demonstrate their social conscience and cultivate an environmentally responsible image. Large corporations like Unilever have signed on to BAFWAC to pledge commitment to sustainability. These corporate investments in natural infrastructure practices contribute to community and urban climate resilience, and by demonstrating a commitment to CSR, businesses can enjoy multiple environmental benefits it provides while improving attraction and retention of employees. Additional benefits may include improved customer trust in their brand, and enhanced investor confidence as a socially responsible organization that contributes to a green economy.

Case Study:
Calstone Inc



This Toronto steel furniture manufacturer installed a system of LID rainwater harvesting tanks with overflow ponds that retain and infiltrate water into the ground. As well as diverting 1.8 million litres of rainwater from the storm sewer system annually, the ponds also function as a recreational area for employees (Meliton, 2015) (See Appendix B).

“Calstone has a responsibility to support the community in which they operate, whether it be taking pressure off an aging sewer system or providing outdoor learning space for a local school. Calstone will always manufacture with as little impact on the environment as possible and as a good corporate citizen”.

– Jim Ecclestone, President and CEO

Overcoming Commonly Encountered Barriers to Private Sector Adoption of Natural Infrastructure

Limited awareness of the advantages to natural infrastructure (both on and off-site) among the business community is a large factor to its current lack of prevalence, but there are other commonly encountered considerations to natural infrastructure implementation that may produce hesitation among stakeholders.

Financial Concerns

An analysis undertaken by Credit Valley Conservation on the barriers to LID implementation on private lands found that most common hesitations are due to economic concerns (Fortin, Gaulin and Patterson, 2018). High upfront costs and low return-on-investment (ROI) were listed among the top barriers (Fortin, Gaulin and Patterson, 2018). As certain LID installations like permeable pavements can cost around \$100,000 to install, with additional yearly maintenance fees (Van Seters et al, 2013), it is understandable how C-suite executives would hesitate to implement natural infrastructure, if the current fiscal year is top priority.

However, with analysis of cost to benefit ratios on a long-term basis, along with inclusion of environmental and social factors, this triple bottom line perspective changes the equation. There are cost effective, low-maintenance options to reduce upfront investment, and the long-term co-benefits of natural infrastructure, while difficult to ascribe a specific dollar value, can outweigh those of traditional infrastructure (Scott et al, 2018). Green roofs, for example, in some cases, can double the life span of a traditional roof, while providing co-benefits like reducing energy expenses (Scott et al, 2018). The World Business Council for Sustainable Development has also stressed the importance of including considerations to ecosystem services in business cost evaluation by releasing a report that emphasizes how all commerce is directly or indirectly linked to the health of nature and that ecosystem degradation has a negative impact on business performance, profits and license to operate

(World Business Council for Sustainable Development (WBCSD), 2011)

Taking environmental considerations into investment analysis may justify natural infrastructure as a more cost-effective option (World Business Council for Sustainable Development (WBCSD), 2011). For example, an economic analysis conducted by Pricewaterhouse Coopers (PwC) Canada on behalf of Metrolinx in the GTA found that a parking lot design that incorporated green infrastructure had a much larger benefit-to-cost ratio based on a “Total Economic Value (TEV)” approach that included environmental, social and financial considerations (IBC, 2018). Assigning a monetary value to ecological services for the benefits they can provide can help rationalize the business case by putting them on a measurable scale for decision-making (IBC, 2018). Experts in the field commonly encounter this hesitation towards natural infrastructure and are therefore a valuable resource to evaluating the cost-to-benefit elements of any site.

In a joint study, PwC and Metrolinx found that the Net Present Value (NPV) of the green infrastructure parking lot with a TEV approach was a positive **\$225,777.00**. Under normal analysis, NPV came to **-\$2,337,420.00** for the green design versus **-\$2,320,355.00** for a traditional grey design.





Site Limitations

Site limitations, the inability for a physical space to incorporate natural infrastructure, are often a concern. Densely populated urban areas can be a particularly challenging environment to implement natural infrastructure due to a lack of available space. Tightly compacted infrastructure like sidewalks, gas lines or watermains may also present limitations. Often parking lots, a large contributor to stormwater runoff, are valued assets that some owners may be reluctant to change. Each site is unique and has its own considerations, but fortunately, knowledgeable industry experts are available to assist businesses in making an environmentally responsible choice that balances their needs and budget.

Traditional Property Development Practices

Development, as it has typically been practiced has yet to incorporate natural infrastructure as a common part of the design process. With a rapidly expanding urban population like that of the GTA and a coincident need for housing and amenities, we are losing the ability to build urban infrastructure to incorporate natural elements. As urban areas rapidly develop, natural areas like forests and grasslands are lost to construction and because these practices don't regularly incorporate engineered natural infrastructure, traditional "grey" infrastructure becomes more prevalent. The IBC reported that 72% of wetlands in southern Ontario have been lost to development (IBC, 2018). These traditional practices are detrimental to the environment but may also prove to be expensive should building

standards change and require costly future retrofits. Development is a necessary component of social and economic progress; however, the loss of natural features also decreases a community's resilience to natural hazards, as previously discussed (IBC, 2018). It would therefore be a best practice to take an integrated approach to development that incorporates natural features, rather than sacrificing one for the other.

Disconnect between Nature and People in Canada

There have been many international examples of private corporations getting involved in natural infrastructure. Volkswagen in Puebla, Mexico, led and funded an effort to plant native trees and install soakaway zones on a 750-hectare area near their production facility to offset groundwater extraction used in manufacturing processes (Scott et al, 2018) (See Appendix B). Parts of Mexico rely heavily on groundwater, so public perception as wise stewards of water resources was key to Volkswagen. Canada, in general, is resource-abundant, which may partly explain why this type of corporate conservation arrangement is rare in Canada. ALUS Canada, an organization that facilitates payments to farmers and ranchers for the restoration and maintenance of ecologically beneficial features on their lands, has noted a "disconnect" in Canada to the need for investment in conservation because of the abundant nature we have (Ellis, 2019).

Residents of Canada are not immune to natural risk, and business decision-makers may not understand the critical relationship between the loss of nature, land use changes, a disrupted water balance and disasters like urban flooding, particularly in rapidly growing urban regions of the country, such as the GTA.

The Path Toward Natural Infrastructure Adoption

While there are a number of barriers to overcome the widespread adoption of natural infrastructure on privately owned land, the biggest hurdle is breaking the status quo. After years of research and pilots, we know natural infrastructure has a wide range of benefits and is the most effective way to develop climate resilience (UN Environment, 2019). The Insurance Bureau of Canada is even advising communities to take urgent action to incorporate natural infrastructure to lower flood risk (Westcott, 2018). Because natural infrastructure is a different approach to property development in Canada and the GTA, it will require education, resources, and other supports to help communities and businesses become more comfortable with the concepts and utilizing natural infrastructure as a consistent approach.

However, change is on the horizon and the public sector continues to lead the way. Municipal and regional governments like the Region of Peel are including natural features and LID technologies in transportation infrastructure planning. The City of Toronto and York Region have also begun to include natural infrastructure considerations in planning and operations decision-making. There is also a shift towards viewing natural infrastructure as “assets,” just like grey infrastructure. The Municipal Natural Assets Initiative (MNAI) is working with municipalities across the country (Region of Peel included) to tabulate the equivalent monetary value that natural assets provide in infrastructure services like flood protection, to equate to engineered infrastructure which would further support the business case for natural infrastructure by tying specific dollar amounts to savings and benefits.

Municipalities in Ontario are also starting to explore best practices for incorporating natural infrastructure - like rivers, wetlands and urban forests - into their existing asset management plans. Proponents of natural infrastructure and LID have also developed resources for businesses dedicated to addressing common barriers such as comprehensive costing tools, land planning best practice suggestions like



incorporating natural infrastructure implementation as part of scheduled infrastructure renewals (i.e., paving), peer collaboration groups and training opportunities (see Appendix A).

Though there are positive steps being made in the field of natural infrastructure, experts continue to stress the need for the private sector to become more involved. MNAI's 2018 report entitled *Towards a collaborative strategy for municipal natural asset management: Private Lands* expressly states, “effective management of a natural asset cannot be done in bits and pieces” (Brooke, O’Neill and Cairns, 2018). IBC, on behalf of the insurance industry, has also proclaimed support for a “whole of society approach” to flood management (Lofsky, 2019). Businesses implementing on-site natural infrastructure on their lands have the potential to more thoroughly incorporate natural assets into urban areas. See Appendix B for case studies of businesses who have invested in and benefited from natural infrastructure and emerged as environmental leaders in their communities.

Considering the benefits of and need for natural infrastructure, a conscious and proactive organization may now want to contribute to community climate resilience, yet may be unsure how to proceed with investment in and/or implementation of natural infrastructure on commercial lands. Fortunately, Partners in Project Green can provide guidance.



Partners in Project Green

Partners in Project Green (PPG), a program of Toronto and Region Conservation Authority, is in the unique position of convening municipalities, the not-for-profit sector and the business community to identify and implement sustainability solutions. With one of four specializations being water stewardship, PPG is a trusted expert in the field of private sector engagement in flood resiliency and natural infrastructure best practices and implementation.

This white paper is intended to provide PPG's valued business network with the background of why we are seeing these flood events and the knowledge of how natural infrastructure can help protect you and your community to enable smart, responsible business decision-making. The vision is to help foster a region of well-informed, prepared, socially and environmentally conscious corporations that can thrive in the face of climate change by employing nature to work for them.

PPG's Water Stewardship program can help your business benefit from natural infrastructure by providing customized guidance on your options from on-site implementation support to sponsorship of ecosystem services in the region.

Ways we can help

Membership

Joining PPG's network of leading businesses in the GTA provides access to our water stewardship industry experts who can provide support to assist you with natural infrastructure implementation options, tailored to your organization and facility. The following resources are available to support unique needs:

- Financing self-assessment tools
- Educational resources
- Alternative options for natural infrastructure sponsorship
- Available incentive programs
- Vendor network

Aside from project support, PPG members can learn from and share their progress, success, ideas or challenges with sustainability leaders within the GTA. Access to networking events, facilitated peer introductions, and customized publications further enhances your business' public sustainability profile.

Pilot Regional Green Infrastructure Leadership Lab

PPG is creating one or more regional working groups in GTA municipalities where private sector businesses will become early adopters of natural infrastructure, fostering a climate-resilient community. Membership is open to businesses who are interested in learning from industry experts, sharing best practices among like-minded leaders, facilitated natural infrastructure site design, and an implementation stipend.

Conclusion

A well-functioning environment works as a system, with trees, soil, rivers, valleys and peaks, each playing a role in the water cycle. A well-functioning urban water cycle must also have multiple collaborators, each playing their part. In order to address the issue of flooding in the GTA, the private sector must play a role in, and benefit from, the solution. Leveraging the support of PPG's Water Stewardship program to get involved in natural infrastructure is a simple way of growing your business into an attractive, marketable, and environmentally and socially responsible organization, resilient to the effects of climate change and prepared for the future.



Appendix A: Resources on Natural Infrastructure

Resource

STEP: Low Impact Development Stormwater Management Planning and Design Guide

Description and Link

Sustainable Technologies Evaluation Program (STEP)'s comprehensive guide to various LID/green infrastructure technologies as well as best practices in design, costing, maintenance and site assessment

https://wiki.sustainabletechnologies.ca/wiki/Main_Page

Greenbelt: Green Infrastructure: A Key Resource for Improving our Communities

Ontario Greenbelt's informational page on green infrastructure

https://www.greenbelt.ca/green_infrastructure

Green Infrastructure Ontario Coalition

An alliance of organizations dedicated to promoting understanding and implementation of green infrastructure

<https://greeninfrastructureontario.org/>

'Greening' Surface Parking Lots

City of Toronto design guidelines which developers, designers, etc. can use to help meet environmental performance targets of the Toronto Green Standard

<https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/design-guidelines/greening-surface-parking-lots/>

Guide to Eco-Business Zone Development

Toronto and Region Conservation Authority (TRCA) and Town of Caledon's guide to implementing business zones that foster both economic growth and environmental health

<https://www.partnersinprojectgreen.com/resources/guide-to-eco-business-zone-planning-development/>

Appendix B:

Case Studies of Natural Infrastructure Implementation by the Private Sector

Calstone Inc.

Toronto, Ontario

Calstone is a Scarborough-based steel furniture manufacturer that has been a long-time leader in corporate social and environmental responsibility initiatives and giving back to the community. After receiving a small grant of \$5000 from the City of Toronto to install a rain garden and rainwater harvesting tank, Calstone decided to invest in scaling up the project to almost \$100,000 to influence replication among corporations in the area and emerge as a leader in environmental stewardship. (Meliton, 2015).

Project

- A system of LID rainwater harvesting tanks were installed in a small area beside Calstone's manufacturing facility.
- These tanks overflow into four connected ponds that retain and infiltrate water into the ground.
- Roof downspouts were disconnected from the storm sewer system to flow into the tanks.

Outcome

- project diverts 1.8 million litres of rainwater from the storm sewer system annually.
- The ponds also function as a recreational area for employees.
- Calstone has won numerous awards and recognition for their environmental stewardship initiatives.
- Calstone recently won the 2019 Nature Inspiration Award from the Canadian Museum of Nature for their sponsorship of a rain garden at Tom Longboat School in Scarborough. (Canadian Museum of Nature, 2019).

Corvias Solutions

Prince George County, Maryland

Corvias Solutions is a property management company that entered into an innovative, 30-year partnership with Prince George County municipal government to form the Clean Water Partnership. The goal of the partnership is to engage the community and businesses in creating large natural infrastructure retrofits to manage stormwater runoff (The Clean Water Partnership, 2019).

Project

- In this novel public-private partnership, the County will delegate green infrastructure projects to Corvias Solutions to act as project managers and hire subcontractors.
- Corvias Solutions was also hired to retrofit 2000 acres of impervious services for the first three years.

Outcome

- Corvias has committed to hiring local contractors, benefitting economic development in the county.
- Corvias has proclaimed that private sector involvement in developing resiliency for the county, rather than government alone, has resulted in "Efficiency" and "Social Value Creation" by stimulating the local economy.
- The partnership has received recognition from the White House and EPA as an innovative new program that supports the local economy while improving environmental sustainability.

CRH Canada

Mississauga, Ontario

CRH Canada is a national building materials manufacturing and construction company, supplying cement, aggregate and concrete. In 2015, to assist with environmental sustainability mandates, they installed 5.4 acres of migratory bird habitat at their Mississauga facility, along the shores of Lake Ontario (Credit Valley Conservation, 2015).

Project

- Entitled the Flyway Habitat Stewardship Project, hundreds of native tree and plant species were planted on-site by employees with assistance from Credit Valley Conservation.
- The site provides food and protection to birds and pollinators in a heavily urbanized area.

Outcome

- Species such as Peregrine Falcons nest in the area and are monitored by employees.
- Employees manage the garden and use it as a recreational area.
- This effort contributed to CRH being recognized as one of the GTA's Top 100 Employers.

FedEx Express

Chicago, Illinois

In 2011, FedEx Express opened a cargo facility at Chicago O'Hare International Airport with the largest green roof in the Chicago area. The green roof was a project implemented by FedEx in accordance with their mandate for environmental sustainability, but additionally provides cost savings in reduced energy requirements (FedEx, 2011).

Project

- A roughly 175,000 square foot green roof was installed on the facility.
- This was part of an ongoing effort to "green" O'Hare airport and contributed to the pursuit of LEED certification of the building.

Outcome

- The green roof was projected to lower energy costs by 35 percent and captures almost two million gallons of stormwater per year.
- Green roofs also double the average life of a roof and reduce air pollution and greenhouse gases, improving environmental sustainability.

Volkswagen

Puebla, Mexico

This large car manufacturer has its second largest production plant outside Puebla, Mexico on a 740 acre lot. The extensive use of groundwater in operations, in an already water-scarce region, prompted Volkswagen to partner with the national park service of Mexico to implement natural infrastructure as a solution (Scott et al, 2018).

Project

- Almost 500,000 native trees were planted in the watershed.
- Soakaways and other natural infrastructure features were installed to promote infiltration.
- funded by the company with additional local industrial partners.

Outcome

- estimated 4 million additional cubic metres of water are infiltrated to the aquifer.
- Reduced erosion and land degradation have also been reported, along with carbon sequestration.
- Volkswagen has replicated similar green infrastructure projects at other facilities.

Glossary



Natural infrastructure (NI)

Natural, vegetated features (i.e., trees, wetlands, grass, etc.) providing hydrological function

Low Impact Development (LID)

Engineered features and/or technology designed to provide natural hydrological function (i.e., permeable pavements, green roofs, etc.)

Riverine flooding

Riverine flooding occurs when the amount of water flowing through a river or stream exceeds the normal amount. Water will flow over the riverbanks and submerge the surrounding area (Intact Centre, 2019). This type of flooding can be caused by heavy rainfall, melting snow or an ice or debris jam that causes a back-up (Intact Centre, 2019).

Overland or urban flooding

Overland or urban flooding occurs when rainwater that cannot infiltrate into the ground runs-off into the storm sewer system at an amount that exceeds the sewer's capacity (Intact Centre, 2019). This results in the excess water back-flowing onto streets, properties and into buildings.

Floodplain

The area that is typically underwater during a riverine flooding event is called a floodplain, and this can be accurately predicted by hydrologists and engineers.

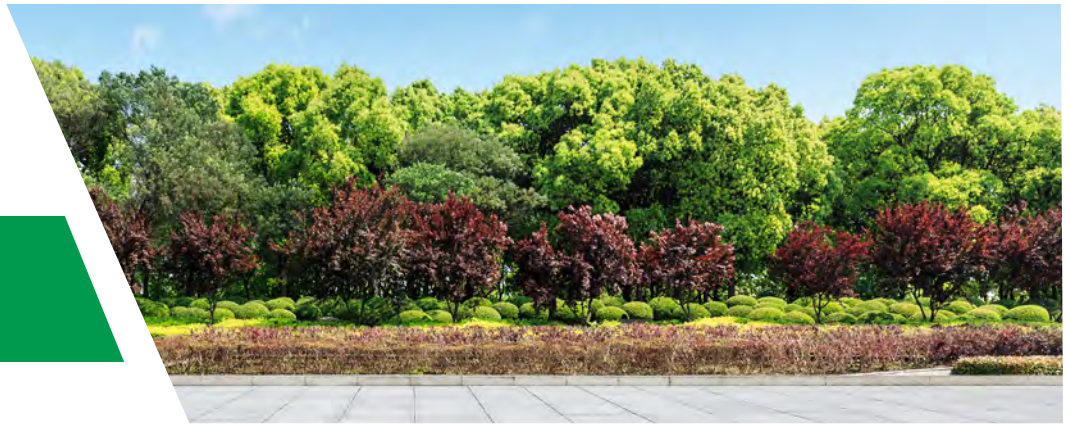
Climate resiliency

The ability to predict, prepare for, and rebound from hazards related to climate change (Centre for Climate and Energy Solutions, 2019)

Urban heat island effect

The effect in which developed, urban areas are hotter than rural areas (US EPA, 2019)

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Contact Us



Partners in Project Green

Toronto and Region Conservation Authority (TRCA)
101 Exchange Avenue, Vaughan, ON L4K 5R6
416.661.6600

partnersinprojectgreen.com

In collaboration with:

