Background

The Green Infrastructure Ontario (GIO) Coalition applauds the Government of Canada's commitment to deliver significant new funding for infrastructure. In particular, we welcome your focus on funding for green infrastructure, which is a critical need in communities across Canada. As part of this funding plan we urge you to enhance support for the *living* green infrastructure that is essential to building healthy and resilient communities.

Over the last seven years the GIO coalition has been successfully promoting the implementation of living green infrastructure across Ontario. With over 140,000 people working full time in the industry, from nurseries to designers to contractors, GIO provides a united voice for the sector. The living green infrastructure we promote includes both natural vegetative systems and green vegetative technologies located in urban, suburban and rural areas. These include: urban trees, forests and woodlots; bioswales, wetlands, waterways and riparian zones; meadows and agricultural lands; green roofs and green walls; and parks, gardens and landscaped areas. These features of our buildings, yards and neighbourhoods play a fundamental role in the network of infrastructure that supports our quality of life in Canada. However, just as for any other infrastructure, this living green infrastructure requires support in the form of funding and active maintenance.

Summary

This memo outlines, first, the benefits of including living green infrastructure as part of federal infrastructure funding for resilient communities and second, a number of possible approaches to doing so.
Living green infrastructure plays an important role in reducing the impacts of a changing climate. By moderating the effects of storm surges and flooding, improving water quality, and cooling cities, vegetative systems and technologies add resiliency to communities and to other types of infrastructure. Investment in living green infrastructure is increasingly identified as an important element of climate change adaptation, such as in the Government of Ontario's recently issued Climate Change Strategy.[i]

Multiple approaches can be taken to incorporate living green infrastructure into infrastructure funding programs, including the following:

- allocating a percentage of infrastructure funding to living green infrastructure;
- requiring projects to include some elements of living green infrastructure as a precondition for infrastructure funding; and
- creating a dedicated Living Green Infrastructure Fund.

Living Green Infrastructure and Climate Resilient Cities

Living green infrastructure is an important and underutilized tool for increasing community resilience to the effects of climate change. It also helps governments make sensible infrastructure investments in the context of uncertainty and volatility of future climate conditions, as living green infrastructure provides multiple benefits and is adaptable to a variety of conditions. In this manner, it is a major element of the response to two of the major climate adaptation challenges facing Canada's communities: flooding and heat.

Traditional approaches to urban flood and stormwater management aimed to move runoff water rapidly away from developed areas into receiving watercourses using 'gray' infrastructure such as sewers, pumps, and treatment plants. These systems have proven expensive to build and maintain, use large amounts of energy, impact the natural environment, and in many cases actually increase the risk of flooding in downstream areas. These systems have also revealed themselves to be ill-suited to meet the demands of unpredictable weather and an increasing frequency of extreme rainfall. As a result, our cities are experiencing increased flooding and higher sewer overflows as the effects of climate change result in more frequent and intense storms.

In urban areas, the dense concentration of buildings, roads and other pavement that absorb and retain heat make cities much hotter than surrounding areas. The negative health impacts of higher air temperatures range from respiratory problems associated with smog and ozone formation to heat stroke and even death related to heat waves.[ii] Extreme heat and its associated effects are being exacerbated by climate change.

Living green infrastructure strengthens climate resiliency of communities by addressing:

- Flood protection: Many forms of living green infrastructure, including an emerging suite of technologies known as Low Impact Development, intercept and retain rainfall and runoff, lowering the chance of flooding from sewer overflows and reducing flood flows in rivers and streams.[iii]
- Water quality: By causing less water to make its way to sewers during heavy rain events, living green infrastructure helps reduce the amount of untreated runoff discharged into water bodies from combined sewer overflow systems. On site, it also filters pollutants, treating runoff before it even enters sewers and reducing the amount of surface runoff that carries toxic contaminants, oil and grease, organic material, and other substances into nearby waterways.[iv]
- Urban heat reduction: Green infrastructure reduces air temperatures through both shade and evapotranspiration, combating the 'urban heat island effect' and the ill health effects that go with it. It also reduces water thermal pollution by cooling water through the filtering process.[v]

Living green infrastructure solutions are flexible in terms of scale, as they can be integrated into buildings and neighborhoods but also implemented as a system of solutions across entire municipalities or watersheds. Further, co-benefits such as support to biodiversity and improvements to community aesthetics and the quality of public spaces[vi]make living green infrastructure a climate change strategy that has rapid, multifaceted and visible impact.

The Economic Case

Living green infrastructure can deliver cost savings to municipalities already facing infrastructure affordability challenges. Many water supply, wastewater and stormwater infrastructure systems are approaching the end of their planned service life. Municipal infrastructure requires major economic investment for rehabilitation or replacement.

In the context of water infrastructure, living green infrastructure has been found to provide economic benefits through two mechanisms: the decreased costs of flood damage, and the reduced cost of constructing and maintaining stormwater management and drainage infrastructure. Properly scaled and sited green infrastructure can deliver equivalent hydrological management of runoff as conventional stormwater infrastructure at comparable or lower costs. It has been estimated that green infrastructure is 5%-30% less costly to construct and about 25% less costly over its life cycle than traditional infrastructure of comparable performance.[vii]

Examples of Cost Savings

Many cities in the US are taking a fully integrated approach to stormwater management by making long term investments in both green and grey infrastructure.[viii] New York City and Lancaster, Pennsylvania are two of the leaders in this practice

New York City

The New York City Green Infrastructure plan estimates savings of $1.5 billion over 20 years by including both grey and green investments. This integrated approach also allows the City to leverage private investment in green infrastructure assets, whereas the grey only approach is borne entirely by the public purse. [ix]

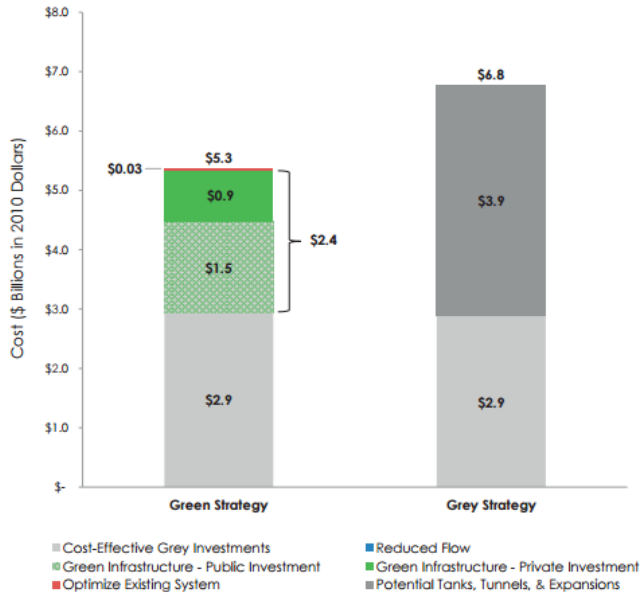

Figure 1: Green and Grey, vs. Grey Only Stormwater and CSO Strategy Scenarios in NYC Green Infrastructure Plan

Lancaster, Pennsylvania

Lancaster is a smaller city of 60,000. Relative to a traditional approach, their green infrastructure plan will reduce gray infrastructure capital costs by $122 million and reduce wastewater pumping and treatment costs by $661,000 per year, while also providing approximately $2.8 million in energy, air quality, and climate-related benefits annually.

Project-level savings

The economic benefits of living green infrastructure are evident when considering their impact on overall project costs. For example, the green streets initiative in Seattle required less pavement than a traditional approach would have, reducing project pavement costs by 49%.[x] Overall project savings can even extend into reduced opportunity costs and incentives for developers: the Wychwood development in Brampton, Ontario was able to develop and sell seven additional lots because green infrastructure features eliminated the need for traditional stormwater facilities on site.[xi]

How Infrastructure Funders Can Take Leadership

Approach	Description	Rationale
Allocate a percentage of infrastructure funding to living green infrastructure.	This approach would involve dedicating a share of overall infrastructure funding to living green infrastructure, including when it is a component of traditional infrastructure projects and stipulating that municipal funding be allocated to the required long term operations and maintenance needs. The total allocation would be averaged over all infrastructure funding. Proponents would report their anticipated spending on green infrastructure features and the government would need to consider green infrastructure's inclusion in proposal assessments. This approach gives the government discretion in allocating funding to projects in order to meet the target percentage.	The planning and design phase of infrastructure projects is the most opportune time to consider integrating green infrastructure. These approaches involve integrate green infrastructure into project proposals from the beginning, rather than as an afterthought. Incorporating controls during development and redevelopment is more cost-effective than managing stormwater as an after-the-fact problem. These approaches provide flexibility in design and implementation while encouraging adoption of green infrastructure across all infrastructure projects. Most public development or redevelopment projects, from road work to multi-billion dollar LRTs, have the potential to benefit from integrating green infrastructure, yet the vast majority do not consider its applicability. These approaches would require its consideration in all projects. Local officials are reluctant to invest in projects with longer payback periods without financing support and funding. Federal support for design
Require projects to include some elements of living green infrastructure as a precondition for infrastructure	In this approach a certain threshold of infrastructure funding for any given project would be required to go towards living green infrastructure. Similar to the approach above, proponents would be required to report their anticipated spending on	

funding.	green infrastructure. However, this approach would set a specific threshold for each project, as opposed to a total across all infrastructure funding. It would either require that all projects integrate living green infrastructure, or show that they have seriously considered integrating it and explain why it is not feasible to include.	and implementation of large-scale green infrastructure projects would help alleviate some of the perceived risk. Relevant agencies, such as transportation or water, view green infrastructure as "someone else's issue." Because it involves natural elements, projects tend to be pushed to environment departments rather than being funded and managed as key infrastructure assets. These approaches would address this issue.
Create a dedicated Living Green Infrastructure Community Fund	A Community Living Green Infrastructure Fund would provide earmarked long-term stable funding specifically for green infrastructure projects.	Many of the rationales provided above apply here as well. None of the funding distributed through the federal green infrastructure fund (2009 – 2014) went directly to living green infrastructure. A dedicated fund would promote green infrastructure as a form of municipal infrastructure and help communities invest in it.

The approaches outlined above are not mutually exclusive and could be adapted to fit specific policy contexts.

Conclusion

Living green infrastructure helps communities adapt to climate change while increasing livability and reducing the costs of retrofitting and building new gray infrastructure. The Government of Canada can demonstrate important leadership by incorporating living green infrastructure into federal infrastructure funding programs using one or more of the approaches described above. Green Infrastructure Ontario would be pleased to provide any additional information or input that could support this effort.

About Green Infrastructure Ontario and Contact Information

The Green Infrastructure Ontario Coalition is a collaborative alliance working to promote green infrastructure in Ontario. Its steering committee members include:

Conservation Ontario | David Suzuki Foundation | Evergreen |Green Communities Canada | Green Roofs for Healthy Cities | Landscape Ontario Horticultural Trades Association | LEAF (Local Enhancement and Appreciation of Forests) | Ontario Association of Landscape Architects | Ontario Parks Association | Toronto and Region Conservation | Forests Ontario
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[i] Ontario's Climate Change Strategy. Online: https://dr6j45jk9xcmk.cloudfront.net/documents/4914/climate-change-strategy-report.pdf

[ii] Heat Island Effect: Heat Island Impacts, US EPA. Online: http://www.epa.gov/heatisland/impacts/index.htm

[iii] Rooftops to Rivers. Green Strategies for Controlling Stormwater and Combined Sewer Overflows. Natural Resources Defense Council. Online https://www.nrdc.org/water/pollution/rooftops/rooftops.pdf

[iv] Ibid

[v] Putting Green to Work: Economic Recovery Investments for Clean and Reliable Water. American Rivers. Online: http://www.allianceforwaterefficiency.org/uploadedFiles/News/NewsArticles/American-Rivers-Putting-Green-to-Work-Sept2010.pdf

[vi] Living green infrastructure provides a multitude of additional co-benefits, including lowering greenhouse gas emission through decreased energy use for air conditions and water treatment, improved air quality, ground water recharge climate change mitigation, reduced noise pollution, habitat improvements for pollinators, creation of green jobs, aesthetic improvements, recreation opportunities, interaction with nature and associated psychological benefits, social cohesion, and improved quality of life. Source: U.S. EPA, Green Infrastructure Case Studies: Municipal Policies for Managing Stormwater with Green Infrastructure.

[vii] Green Infrastructure and Issues in Managing Urban Stormwater. Congressional Research Service. Online: http://nationalaglawcenter.org/wp-content/uploads/assets/crs/R43131.pdf

[viii] U.S. EPA, Green Infrastructure Case Studies: Municipal Policies for Managing Stormwater with Green Infrastructure. Online at: http://www.sustainablecitiesinstitute.org/topics/water-and-green-infrastructure/stormwater-management/green-infrastructure-case-studies-municipal-policies-for-managing-stormwater-with-green-infrastructure

[ix] 2010 NYC Green Infrastructure Plan: A Sustainable Strategy for Clean Waters. Online: Green Infrastructure and Issues in Managing Urban Stormwater.

[x] U.S. EPA, Reducing Stormwater Costs Through Low Impact Development Strategies and Practices., EPA 841-F-07-006. http://www.h-gac.com/community/low-impact-development/documents/Reducing-Stormwater-Costs-through-LID.pdf

[xi] Low Impact Development Discussion Paper. http://sustainabletechnologies.ca/wp/wp-content/uploads/2014/09/LID-Discussion-Paper_Nov-2012.pdf