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Re: **Preventing disaster before it strikes: developing a Canadian standard for new flood-resilient communities**

The Green Infrastructure Ontario Coalition (GIO) fully supports the need for a standard to ensure that new residential developments are built to be resilient to flooding. The report "Preventing Disaster Before it Strikes: developing a Canadian standard for new flood-resilient residential communities" explains many impacts (economic, social, environmental) of flooding in Canada and makes a strong case for the need for a standard for new development. GIO wants to ensure that any such standard puts adequate emphasis on the flood prevention ecosystem services provided by green infrastructure (both natural and engineered).

There is ample evidence for the preservation of natural infrastructure in urban watersheds for reducing flooding. In fact, a recent study by the Intact Centre itself highlights the benefits wetlands provide – leaving wetlands intact showed projected damage reductions of 38% compared to paving them over.[1] Forests also provide significant flood reduction services. A report from the European Environment Agency estimates that watersheds with 30% forest cover retain 25% more water than those with only 10%. [2] In order to reduce flood risk in new communities and downstream, watershed planning must be the basis for decisions about new development, and the ecosystem services provided by wetlands and forests must be preserved.

Increasingly, across Canada and in other parts of the world the need for a treatment train approach to stormwater management is being recognized – one which treats rain as a resource to be managed as close as possible to where it falls[3]. This approach, using green infrastructure and low impact development (LID) measures, maintains the water balance and reduces water pollution and erosion. A standard for new residential development should promote stormwater management practices that provide the best possible level of service for all rain events, from smaller storms up to extreme events. Green infrastructure and LID must be an integral part of these standards.

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[1] Moudrak, N, Hutter, A., Feltmate, B. (2017). *When the big storms hit: the role of wetlands to limit urban and rural flood damage*. Intact Centre on Climate adaptation. http://www.intactcentreclimateadaptation.ca/wp-content/uploads/2017/07/When-the-Big-Storms-Hit.pdf

[2] European Environment Agency (2015). *Water-retention potential of Europe's forests*. https://www.eea.europa.eu/publications/water-retention-potential-of-forests

[3] See for example, Ontario Ministry of Environment and Climate Change Interpretation bulletin re: stormwater management at http://www.raincommunitysolutions.ca/wp-content/uploads/2015/07/MOECC-interpretation-bulletin-re-stormwater-management.pdf

LID can be designed to manage stormwater from the vast majority of rainfall events – projects are commonly sized to accommodate 90% of annual rainfall, often eliminating virtually all runoff from these events. For extreme events, overflow systems ensure excess water flows safely away from vulnerable public infrastructure and private property and is detained before discharging to waterbodies.

There are several examples of communities that are using LID to reduce the risk of flooding. When implemented on the ground, many of these measures are performing even better than their designs would suggest they should. Here are a few examples:

- Lakeview neighbourhood retrofit in Mississauga which, in three years of monitoring from 2012 to 2015 reduced peak flows from 74% to 100% for storms from the 2 to 10 year return period, and eliminated virtually all runoff from events less than 30mm.[4]
- Elm Drive right of way bioretention in Mississauga, which, during monitoring from 2011 to 2015, reduced peak flows by 88-90% for events between a 10 and 50 year return period. During the July 8, 2013 storm, which far exceeded the 100 year storm, in which 105mm of rain fell over 5 hours, the installation reduced runoff volumes by 30%, reduced peak flows by 60%, and delayed peak flow by 20 minutes, taking pressure off of downstream systems, despite not being designed for a storm of this magnitude.[5]
- Elmer Avenue neighbourhood retrofit in Los Angeles, in which a green infrastructure retrofit designed to improve water quality solved a flooding problem, as well as improving quality of life in the area.[6]
- Rain Garden Reserve, Cuyahoga Falls, Ohio in which four frequently flooded properties were bought up and turned into a pocket park with rain gardens, with funding from FEMA. When four inches of rain fell on the city in 2014, no damages were reported in the neighbourhood around the rain gardens.[7]

In creating a national standard for flood resilient communities we must not limit ourselves to the stormwater systems of the past. New developments must preserve watershed health and reduce flood risk in the development itself and downstream, and the only way to do this is by managing rain where it falls with green infrastructure.

GIO offers the following recommendations on the flood-resilient community standards:

1. Consider the watershed scale impacts of new developments.

Watershed planning should be the basis for decisions about where and how new developments are built. We support the standards that disallow development in floodplains and flood fringes and require the preservation of riparian buffer zones (DR1, PNF1). We also support standard DR3, that new development

[4] See Lakeview Low Impact Development Infrastructure Performance and Risk Assessment, May 2016, Credit Valley Conservation http://www.creditvalleyca.ca/wp-content/uploads/2016/06/TechReport_Lakeview_Final.pdf
[5] See Elm Drive Low Impact Development Infrastructure Performance and Risk Assessment, May 2016, Credit Valley Conservation http://www.creditvalleyca.ca/wp-content/uploads/2016/06/TechReport_Elm_Drive_Final.pdf
[6] See case study on the Elmer Ave Neighbourhood Retrofit at https://landscapeperformance.org/case-study-briefs/elmer-avenue-neighborhood-retrofit
[7] See case study on the Rain Garden Reserve in Cuyahoga Falls, OH at http://nrcsolutions.org/cuyahoga-falls-ohio/

should not increase flood risk for new communities. However, these standards should be part of larger watershed-scale planning. Studies by the Toronto and Region Conservation Authority have shown that conventional stormwater management, even when designed to preserve pre-development peak flow rates, increases flood risk downstream and has impacts on waterbodies downstream (erosion, water quality).[8] Flood-resiliency cannot be implemented on a site by site basis, but must be planned at a watershed scale.

2. **Prioritize the ecosystem services provided by natural infrastructure.**

Flood-resilient community standards must take into account the role of wetlands, forests, and other natural areas (not just riparian buffers, as referenced in PNF1) in holding back water upstream and reducing flood risk for those downstream. Standards related to greenfield development should ensure that all natural areas and the ecosystem services they provide are retained to the fullest extent possible, and particularly those natural areas that are known to provide a significant flood mitigation service. In addition, strong consideration should be given to restoring natural areas on-site and/or in other areas of the watershed if, for example, wetland loss or deforestation occurs as a result of new development. Further, decision-making around conservation of natural areas/infrastructure should also consider the many co-benefits provided by natural infrastructure (eg. climate mitigation, recreation/well being, biodiversity, etc.) that traditional infrastructure for flood control does not normally provide. Therefore, we recommend that a new standard should require that all natural areas such as wetlands and forests be retained to fullest extent possible during greenfield development, and opportunities to restore natural features (on-site or elsewhere) should be given strong consideration. This new standard would also provide strong support to standard DR3, ensuring new development should not increase flood risk for existing communities.

3. **Emphasize runoff volume control as a first priority.**

It is not feasible to eliminate runoff from all rain events – extreme events will always generate runoff, and soil conditions and geography play a role in how much rain can be retained on site. But new developments should set a target of capturing and treating all regular rain events as close as possible to where it falls – new standards being developed in Ontario will require 90% of annual rainfall events. The standards as written explicitly go against this principle by allowing downspouts and weeping tiles to be connected to the storm sewers (ST01, SAN2). Standards should require that downspouts and foundation drains be disconnected from all sewer systems and the water be directed to a permeable area or harvested and used on site, at a safe distance and downgrade from the foundation. This minimizes flood risk by eliminating the possibility of storm sewer backup into homes and eliminates the need for backwater valves on storm sewer connections. Concerns about icing and algae growth can be addressed by good design practices which channel water into areas where it will not pose a hazard. While the standard PNF2 does state that runoff should be minimized, it must include a hard target and be prioritized ahead of other standards in order to be effective.

[8] See Rouge River Watershed Plan (2007) or Humber River Watershed Plan (2008)

4. LID should be the first option for minor stormwater systems.

The standards as written assume the conventional use of storm drains and pipes for minor systems conveying up to the 5 year rain events to stormwater ponds. LID can and should be used to manage these smaller events, and there is a possibility that these standards as written could limit this practice by requiring storm drains where they are not needed. See, for example, a development in Boulder Hills, New Hampshire, which used permeable pavement and other low impact development to eliminate the need for traditional storm drains.[9] The town of Langley, British Columbia is also standardizing the use of roadside rain gardens instead of traditional storm drains on non-arterial roads.[10] The Category 2 standards (ST01, ST02, and ST03) all assume the use of conventional storm drains and pipes and may limit these innovative green infrastructure practices.

Next Steps

Damaging and costly floods are occurring more and more frequently across Canada. A flood resiliency standard for new development is just one tool for reducing risk and damages from flooding. Any such standard must value the contributions of green infrastructure, as detailed above. In order to reduce flood risk for all Canadians, not just those living in new single family residences, other policy avenues beyond standards will be necessary. Action at the federal, provincial, and local level will all be required, with buy in and cooperation from the private sector, academia, and the general public. A Canadian flood risk reduction strategy, created with broad stakeholder consultation, would help to prioritize and coordinate action. The Green Infrastructure Ontario Coalition would be pleased to provide input on such a strategy.

Green Infrastructure Ontario Coalition Background

The Green Infrastructure Ontario Coalition (GIO) is an alliance of organizations from many different sectors across the province that have a common vision of a healthy, green Ontario where the economic, social, environmental and health benefits of green infrastructure are fully realized. Over the last eight years the GIO Coalition has been successfully promoting the implementation of 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 green infrastructure we promote includes both natural systems and green technologies that support natural systems located in urban, suburban and rural areas.

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[9] Roseen, R. (2011). Forging the link: linking the economic benefits of low impact development and community decisions. Page 3-4. https://www.unh.edu/unhsc/sites/unh.edu.unhsc/files/docs/FTL_Resource%20Manual_LR.pdf
[10] See case study by the Partnership for Water Sustainability in BC. *Green infrastructure innovation in Langley Township*. http://waterbucket.ca/cfa/files/2017/10/Green-Infrastructure-Innovation-in-Langley-Township_Oct-2017.pdf