



Using Green Infrastructure to Meet Environmental Flow Needs

To Natural Channels Conference

September 27, 2016

Presentation done in partnership with Wolfgang Wolter



Outline

- Defining environmental flows
- History of environmental flow research in Ontario
- Urbanization, climate change, green infrastructure and environmental flows
- Case study example

Environmental Flows

The Definition

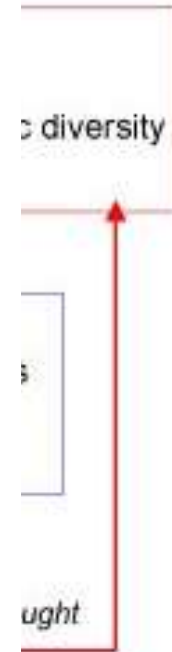
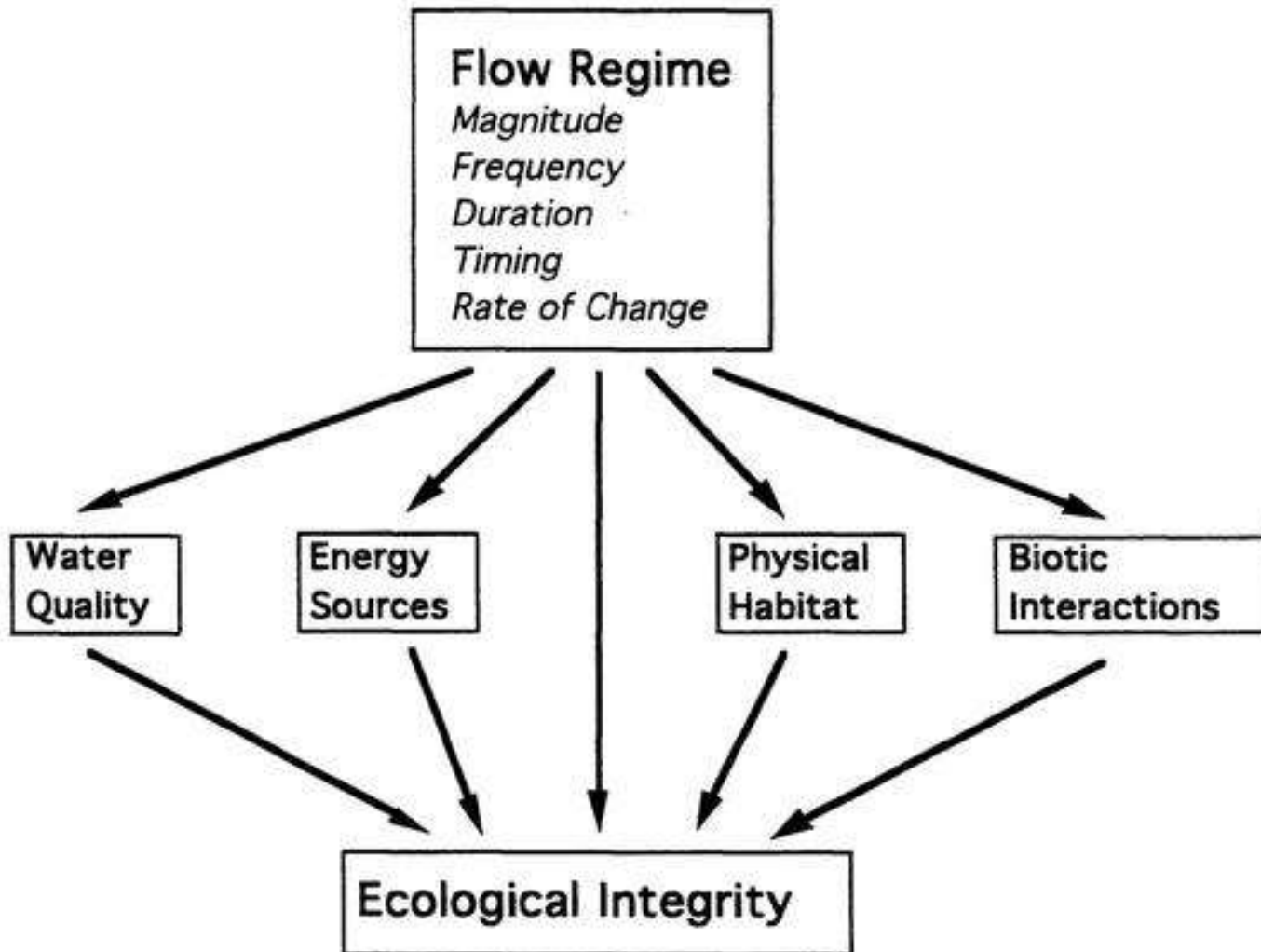
‘Environmental flows describe the quantity, timing and quality of water flows required to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend upon these ecosystems.’

(Brisbane Declaration, 2007)

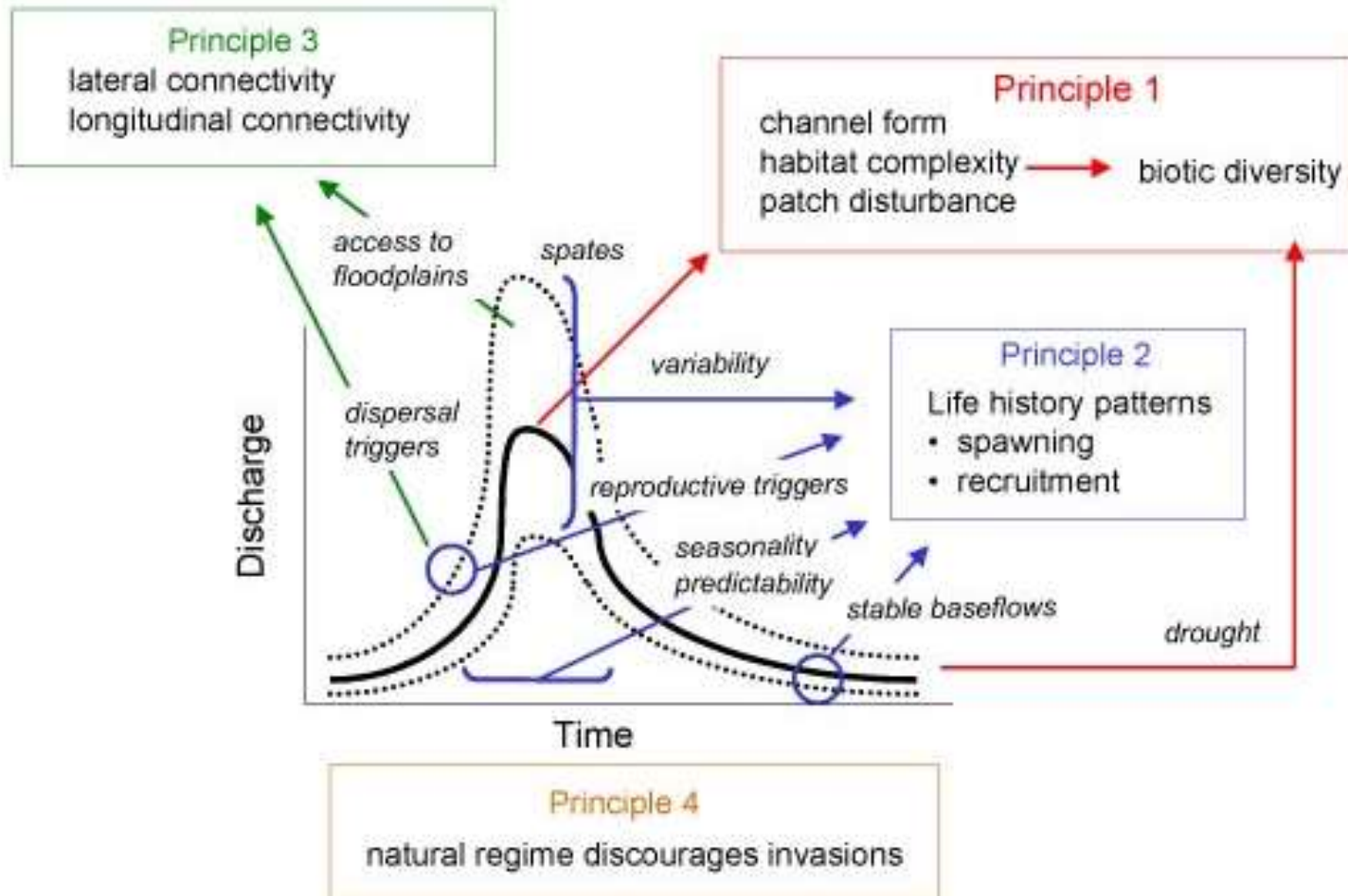
‘The scientific literature supports natural flow regimes as essential to sustaining the health of riverine ecosystems and the fisheries dependence on them. Riverine ecosystems and the fisheries they sustain are placed at increasing risk with increasing alteration of natural flow regimes.’

(Department of Fisheries and Ocean, 2013)

Clear relationship between dynamic flow regime and stream health



Clear relationship between dynamic flow regime and stream health



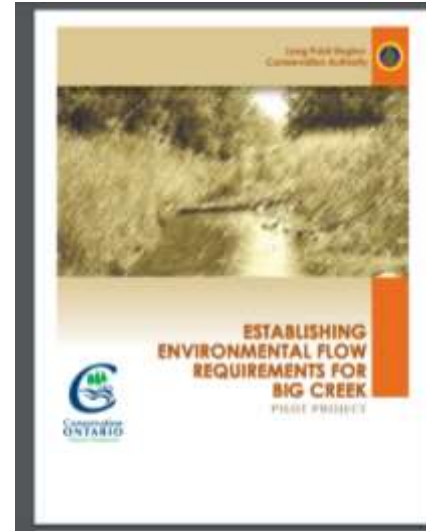
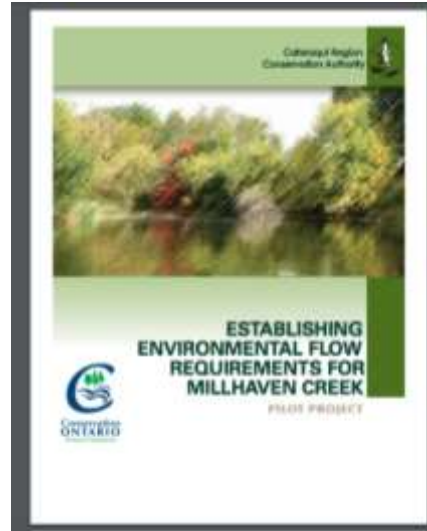
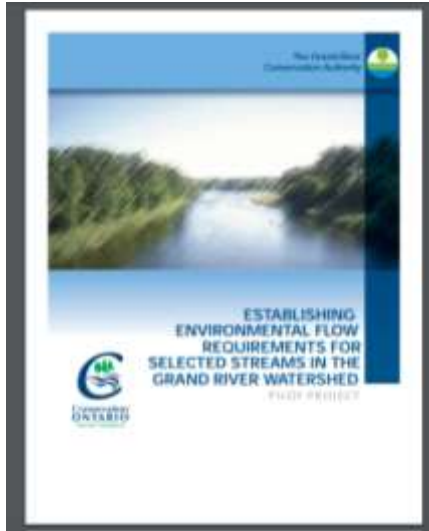
The Challenge

It is now widely recognized that a “dynamic, variable water regime is required to maintain the native biodiversity and ecological processes characteristic of every river and wetland ecosystem.”

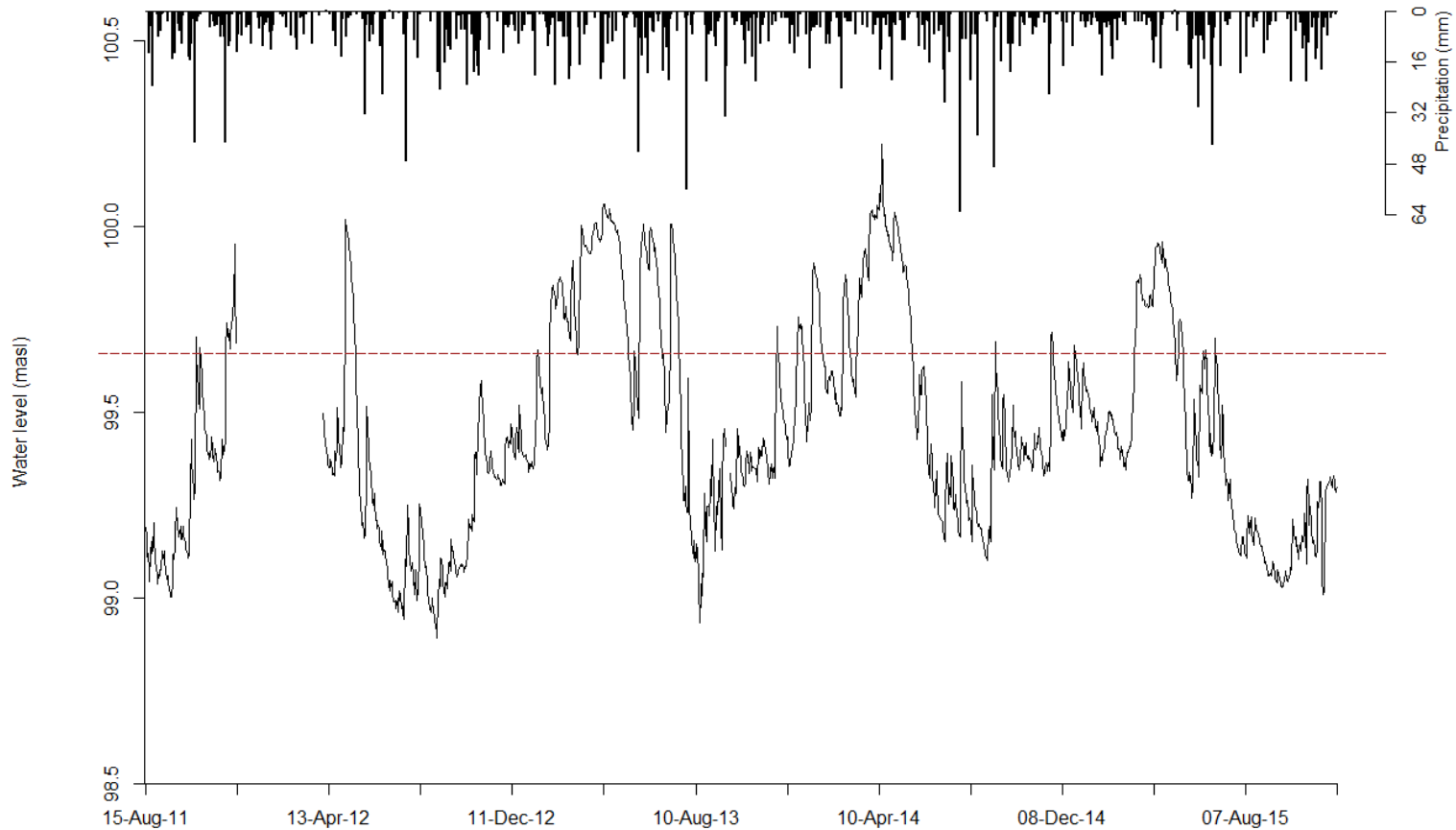
(Arthington et al. 2009)

Yet it remains a challenge to translate the “natural flow regime paradigm” into quantitative environmental flow specifications for individual river reaches and wetlands.

Environmental Flows in Ontario



Applies to woodlots, wetlands, and streams

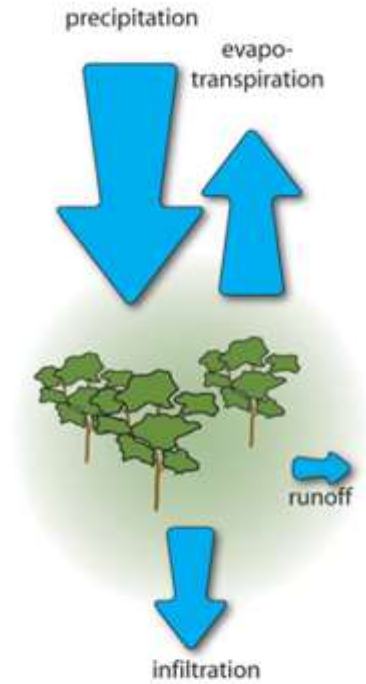


Hydrograph showing daily groundwater levels from the 10 m piezometer at the case study wetland from August 15 2011 to December 7, 2015. Daily precipitation amount is shown at the top of the hydrograph. Ground level is indicated by the dotted brown line.

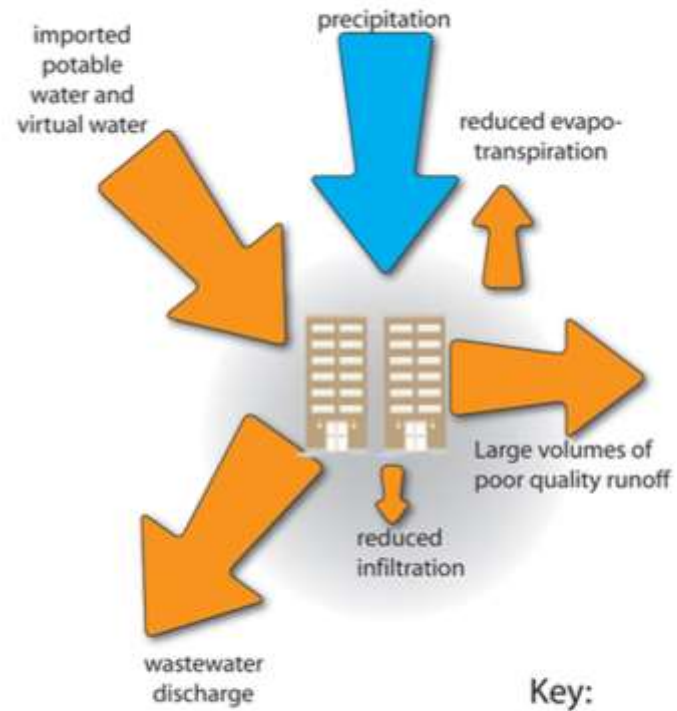
Urbanization and climate change are changing flows

1. Urban Influences on the Water Cycle

natural water balance



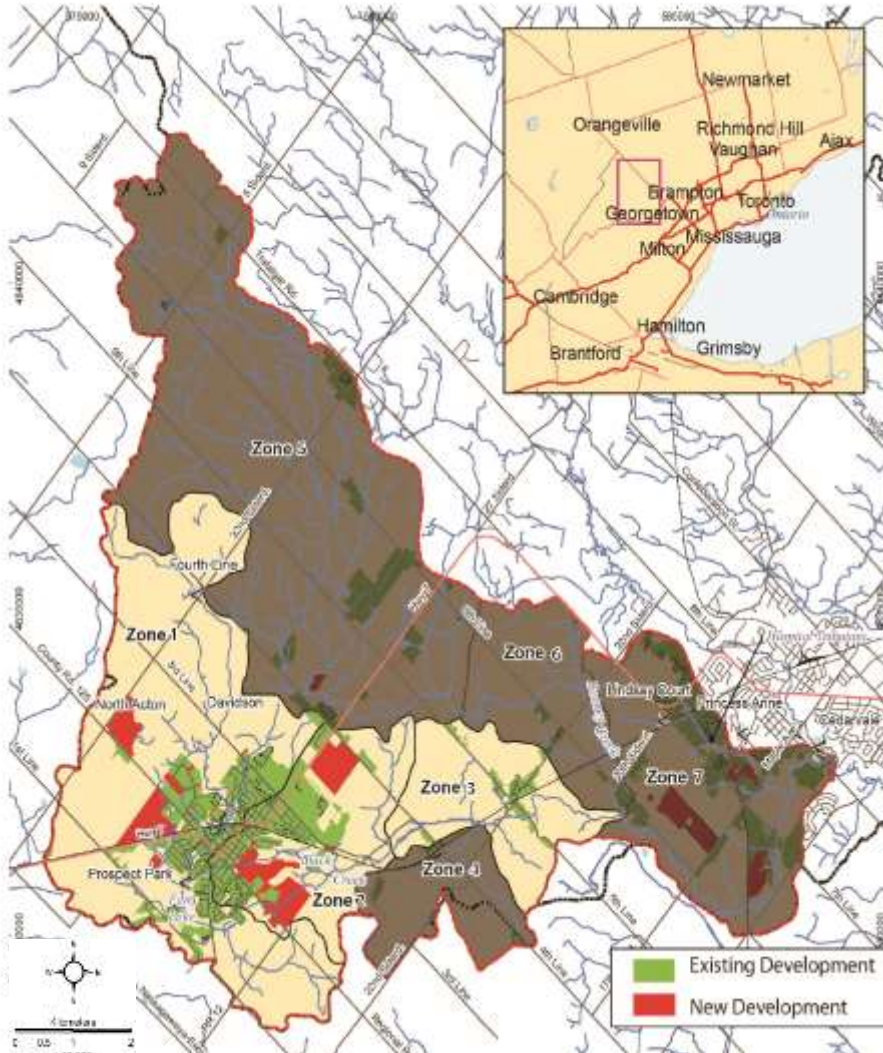
Urban water balance



Key:

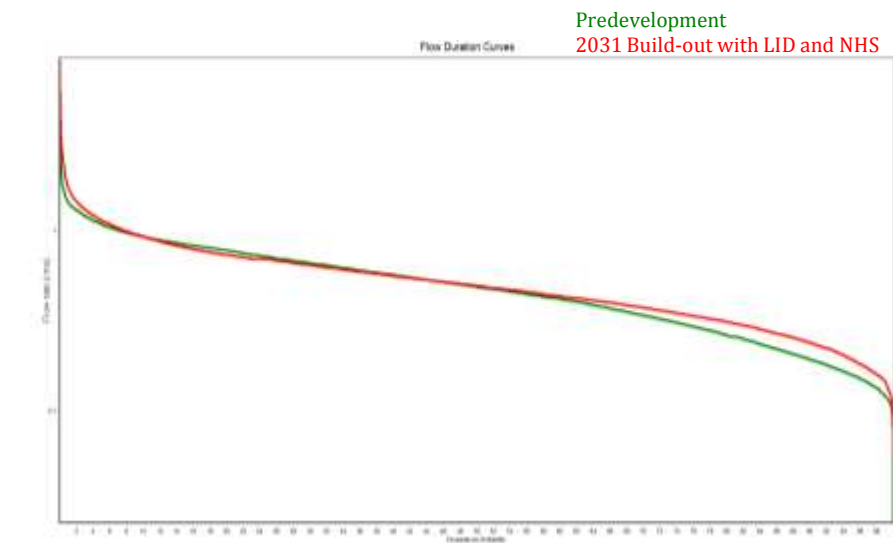
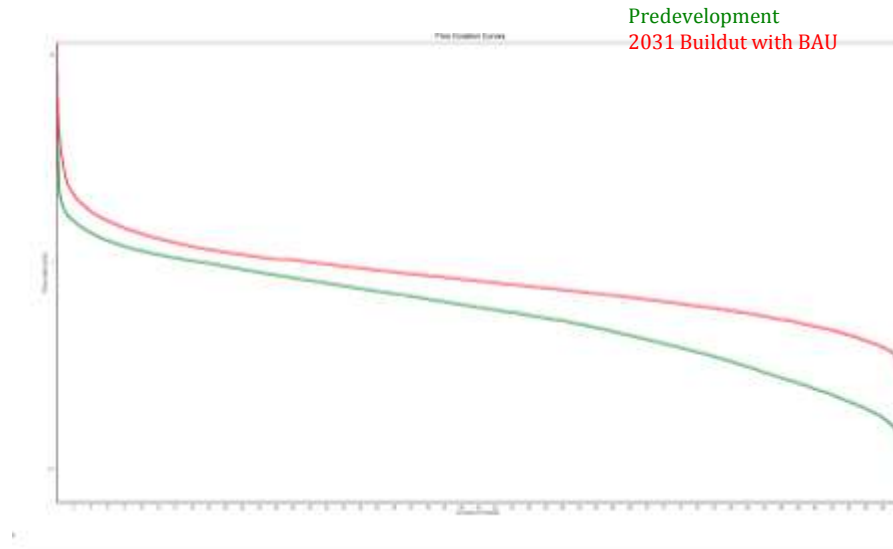


Example - flows are increasing in our urban areas



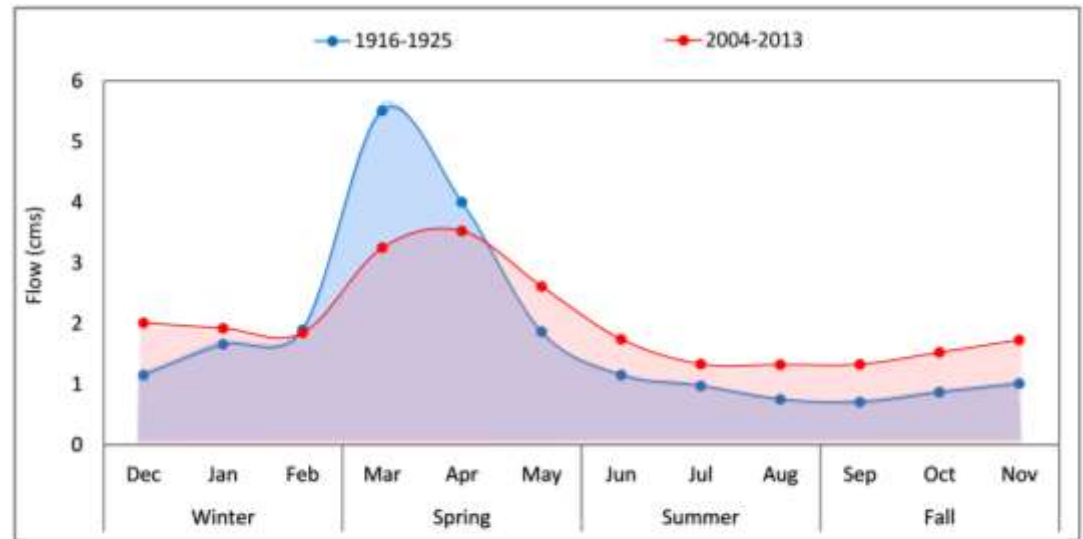
	Current Land Uses (2010)	Future Land Uses (2031)
Population	4050	9,700
Urban	15%	22%
Rural	3%	3%
Agriculture	38%	21%
Pumping Rate (m ³ /day)	3,362	5328
WWTP discharge (m ³ /day)	4,545	7,000

Example - Flows are increasing in our urban areas



2. Influence of climate change on flows

- Climate model projections indicate that the frequency and magnitude of hydrological extremes will increase in a future climate¹.
- Increase in precipitation depth will lead to high peak flows and will bring floods with higher inundation depths¹.
- Winter temperatures, particularly daily minimum temperatures have risen, which is shifting snowfall to rainfall and increasing winter surface runoff and infiltration²



Credit River at Cataract

Source:

¹ Dwight Boyd (2011) Presentation on Climate Change A Flood Management Perspective

² Dr. Trevor Dickinson and Dr. Ramesh Rudra (2014) Presentation on Climate Change & Development Have Changed our River Flows

Need to Go from Grey to Green



Industrial & Commercial Lands



Residential Lands



Road Right of Ways



Public Lands

Case Study

Kenollie P.S. Rain Garden



Kenollie P.S. Rain Garden



Kenollie P.S. Rain Garden



Kenollie P.S. Rain Garden



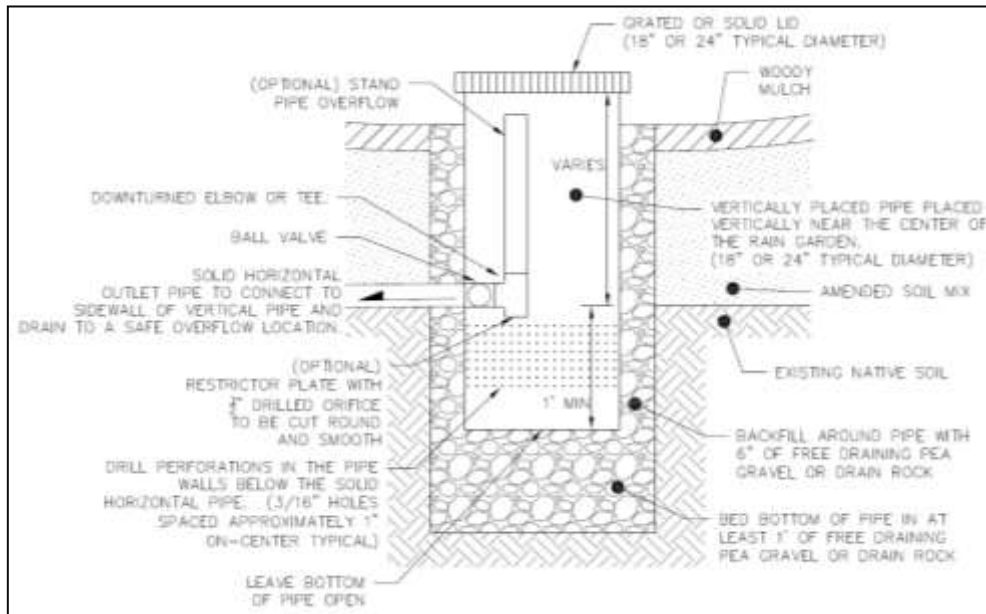
Subsurface drainage



Kenollie P.S. Rain Garden



Kenollie P.S. Rain Garden



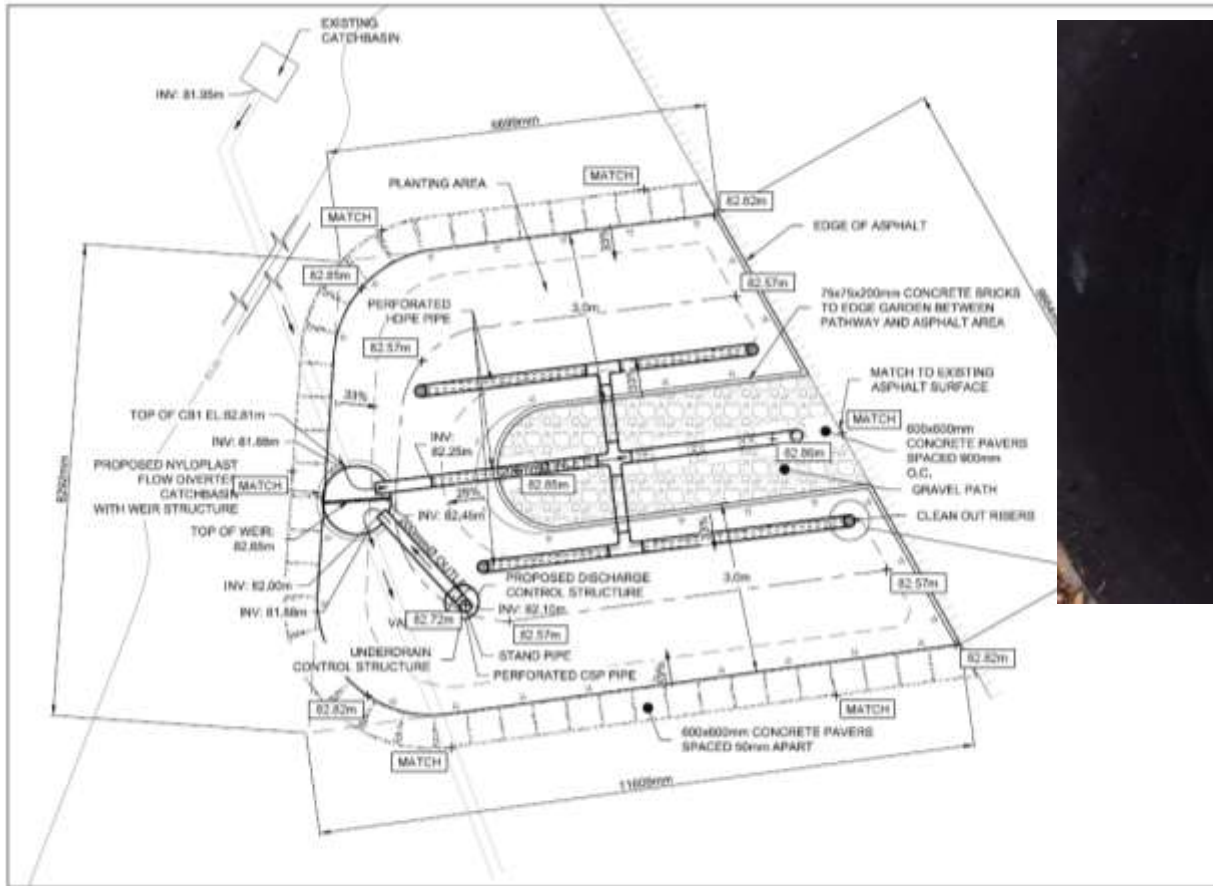
Vertical Underdrain



Kenollie P.S. Rain Garden

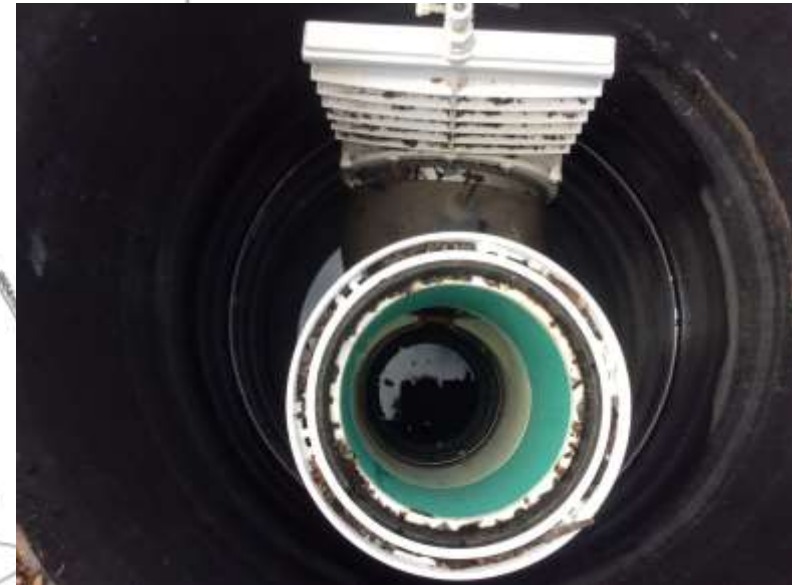


Kenollie P.S. Rain Garden



PLAN BIORETENTION FACILITY

SCALE: 1:75



Kenollie P.S. Rain Garden

- Video of project

Key Messages

1. Improving or preserving stream health requires further consideration of the variable flow needs of a river
2. Inclusion of green infrastructure within our existing urban areas improves management of streams flows where there currently lacks sufficient services
3. We must begin adopting adaptable infrastructure to mitigate the impacts of climate change
4. Flow-habitat-biota relationships remain uncertain. Use water balance hydrology as a surrogate for environmental flows remains a powerful tool

Project Partners



Credit Valley
Conservation



CLIMATE CHANGE
ADAPTATION PROJECT



RBC
Blue Water
Project™



peel District
School Board



Questions



*Together, it's our nature to conserve
and our future to shape.*
