# 2016 FloodNet AGM



# **Project 1-5:** Spatial changes to flood prone areas in urban environments

McMaster University

2016 update



#### 19-20 September 2016

## Introductions

#### **Dr. Andrew Binns**

• School of Engineering, University of Guelph



#### Dr. Slobodan Simonovic; Tommy Kokas

• Civil and Environmental Engineering, University of Western Ontario

#### Dr. Yiping Guo

• Civil Engineering, McMaster University







#### **Presentation overview**

- 1. Introductions
- 2. Background
- 3. Project 1-5 goal and approach
- 4. Project schedule
- 5. Black Creek subwatershed case study



## Background

- The effects of changing flows due to climate change pose threats to rivers in dense urban environments (Ashmore and Church 2001)
  - Changing seasonal patterns
- Intensifying development in these environments
  - Produces greater rates of stormwater runoff (Bledsoe and Watson 2001)
  - Increases risk of exposure to extreme precipitation events







#### Damages associated with floods

- This results in greater economic losses associated with flood events, including:
  - Basement flooding
  - Damage to infrastructure (e.g., culverts, dams, bridges)
  - Erosion, river instability and loss of land





## Background

- It is important to be able to predict how future flooding events will impact Canadian urban environments as:
  - Cities grow (changing landuse, infrastructure and waterways)
  - Precipitation patterns change
- This will allow us to design, propose and install measures to reduce the risk of flooding







## **Project goal**

• **Objective:** to investigate spatial changes to flood prone areas in urban environments as a result of changing environmental and hydrological factors

Environmental	Hydrological
Changes in land-use (i.e., urbanization)	Changing distribution of precipitation
Modification to fluvial systems	Changing magnitude of precipitation events

• Investigate measures to reduce the effect of these changes on the extent of flooding



## **General approach**

- Assess how urban landscape has been changing in Canadian cities of varying levels of urbanization
   – Toronto (ON), Hamilton (ON), Edmonton (AB)
- Assess how changes in land use (and associated changes in impervious area) have affected the extent of flooding
- Characterize patterns of development more resilient to floods
- Evaluate effectiveness of stormwater management features to mitigate extent of flooding

Historical

land-use

images

Modeling

Comparison

Modelina

## **General approach**

#### Historical approach

- GIS mapping techniques to assess changes in land use over time
- Hydrologic and hydraulic modeling
- What if scenarios

#### Future simulations

 Can we apply lessons learned from historical modeling to improve our decision making for implementation of flood mitigation (stormwater management) in the future



#### **Project 1-5 schedule**

#### Two Master's (MSc) projects:

Project	2014- 2015	2015- 2016	2016- 2017	2017- 2018	2018- 2019
MSc #1 (Kokas)	Western	/ Guelph			
MSc #2 (TBA)			МсМа	aster	



#### Master's Project #1 Update

- Master's student: Tommy Kokas
  - Undergraduate degree: Civil
    Engineering at Western (2014)
  - Began Master's degree at Western in Fall 2014
- Progress update:
  - Presentation at 69th National Conference of the Canadian Water Resources Association (CWRA) in May 2016
  - Water Resources Research Report (June 2016) on water resources modeling and decision-making





## **Next Steps**

- Completion of first Master's project
  - Case study site: Black Creek in Toronto, Ontario
  - To be wrapped up Fall 2016
- Recruitment of Master's student to start at McMaster in 2016 with Dr. Yiping Guo
  - Case study site: Edmonton, Alberta



Source: edmontonlocal.ca





#### **Expected contributions**

#### The outcomes of this project aim to include:

- 1. Understanding relationship between flooding and landuse in urban environments
- 2. Provide guidance for future urban development
- 3. Assist in planning and development of appropriate flood mitigation measures (i.e., stormwater management features)

