FLOOD RISK IN CANADA – MOVING FORWARD

- NATIONAL FLOODPLAIN MANAGEMENT FRAMEWORK
- ADVANCEMENTS IN URBAN FLOODING

Institute for Catastrophic Loss Reduction

October 10, 2014

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OUTLINE OF PRESENTATION

- Flood Risk Primer
- National Floodplain Management Framework
- Urban Overland Flooding

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FLOOD RISK PRIMER

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TYPES OF FLOODING

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RIVERINE FLOODING

- Calgary 2013, Toronto 1954, Winnipeg 2011
- Canada-wide Hazard Mapping
- Until now, Risk not typically defined
- The focus of the new federal flood management initiative

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HAZARD MAPPING VERSUS RISK MAPPING

Hazard Mapping

- Limits of hazard
- Used for regulating land use in floodplain

Risk Mapping and Database

- Frequency, depth, duration
- Consequence

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RIVERINE FLOODING - ICE

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URBAN OVERLAND FLOODING

- Two types:
  - Urban only(pluvial)
  - Riverine/urban hybrid
- Typically caused by intense summer storms
- Capacity of storm sewers and road network is exceeded

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BASEMENT FLOODING

- Generally caused by sewer backup
- Risk can be determined but costly to assess
- Can be remedied through conveyance improvements and disconnects

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COASTAL FLOODING

- Generally caused by high winds, but along lake shores can also be caused by high water levels
- Shoreline hazard mapping existing for many lakes across Canada but relatively few coastlines

KEY STEPS IN CREATING FLOOD HAZARD MAPPING

- Base Mapping
- Hydrology – the estimate of peak flows
- Hydraulics – the calculation of flood elevations
- Flood Plain Mapping – Mapping of lines and elevations

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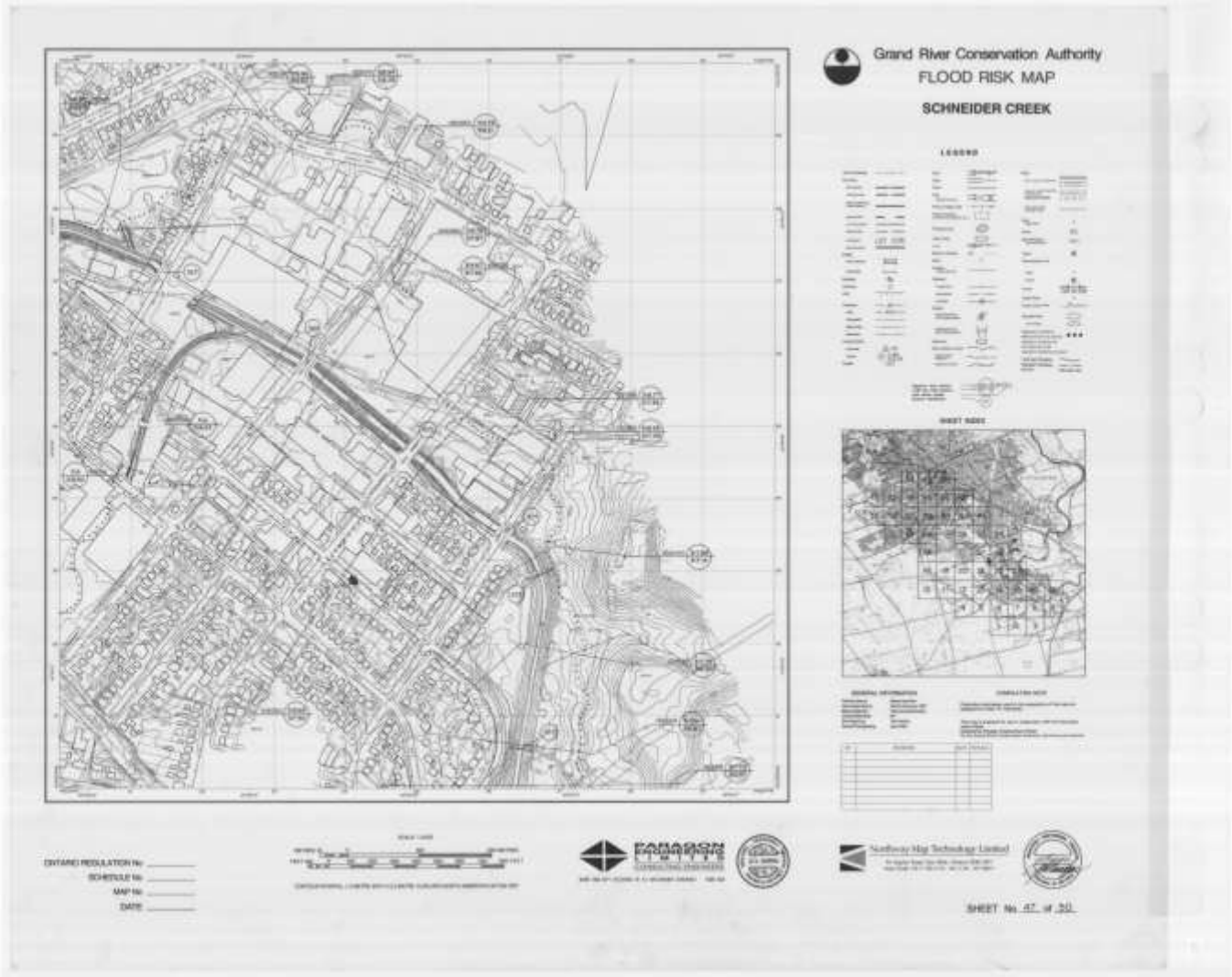
TYPICAL FLOOD HAZARD MAP



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TYPICAL FLOOD HAZARD MAP

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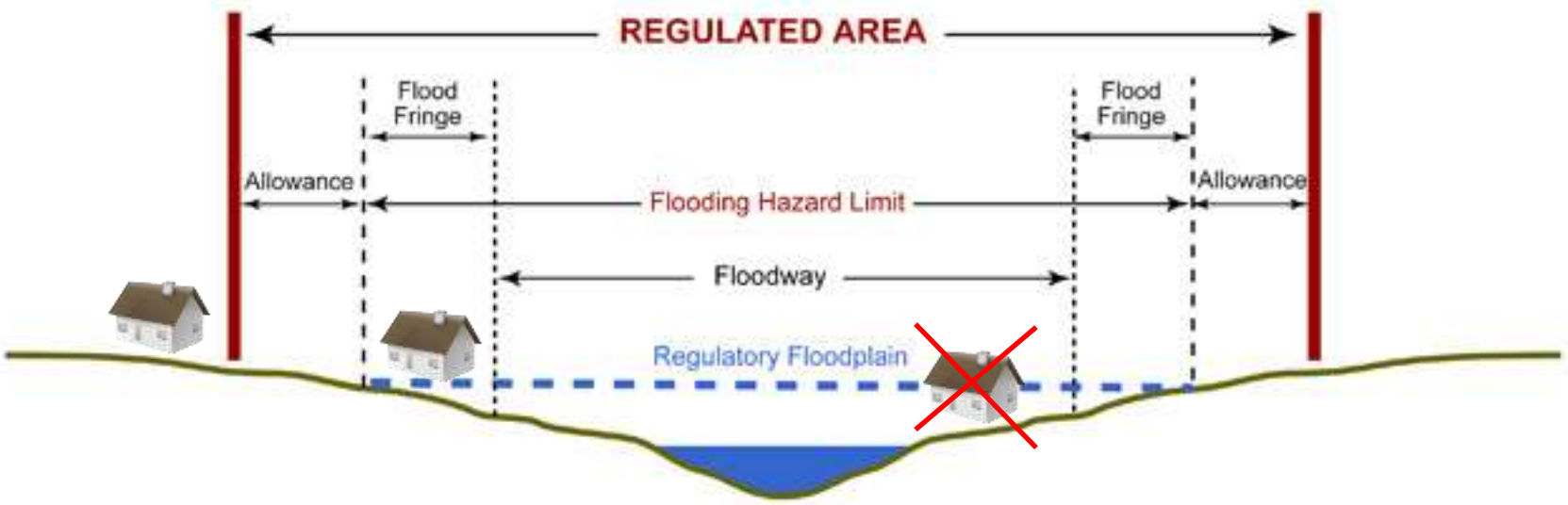
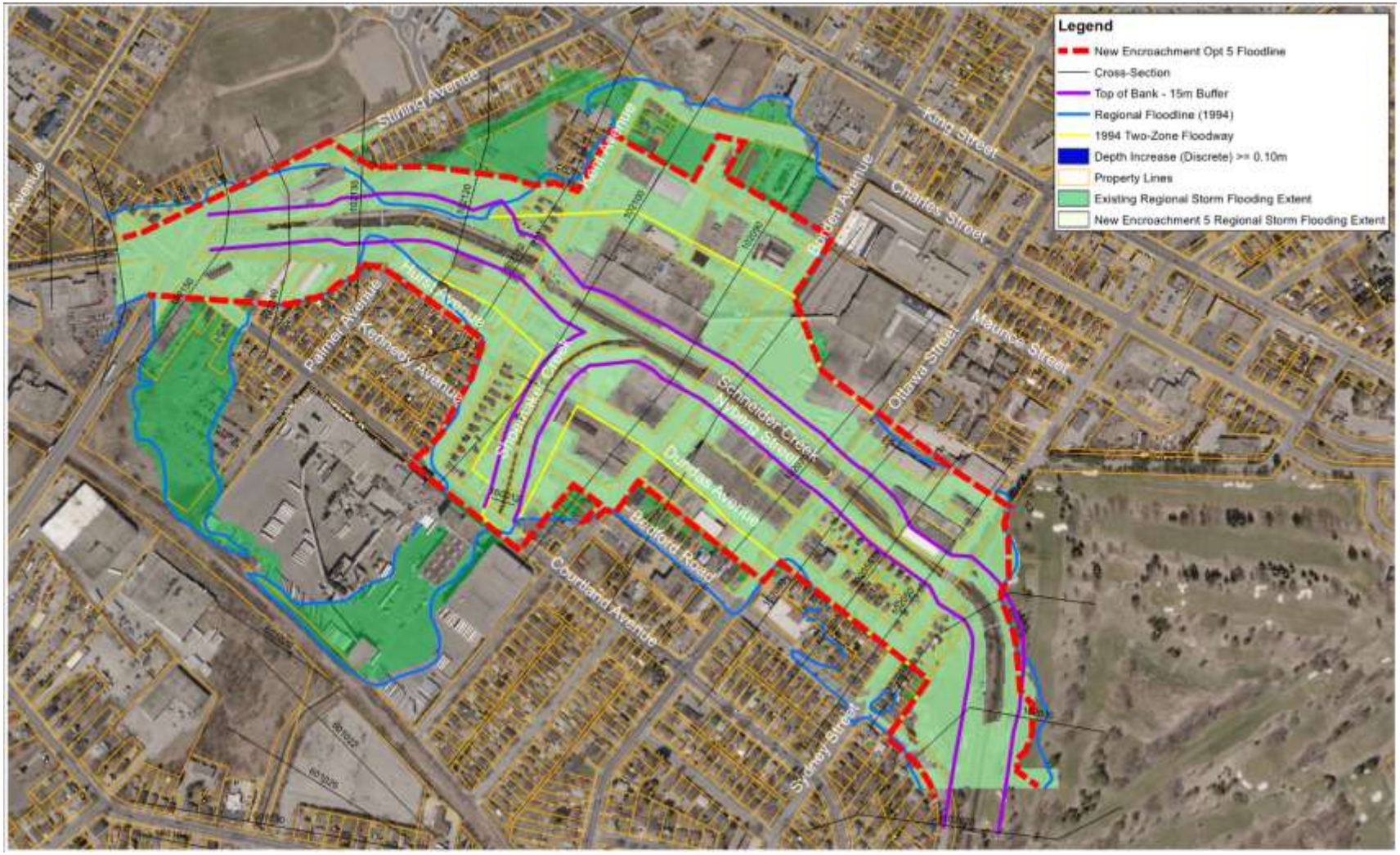
REGULATING FLOOD PLAINS ACROSS CANADA



Floodway and Flood Fringe Development



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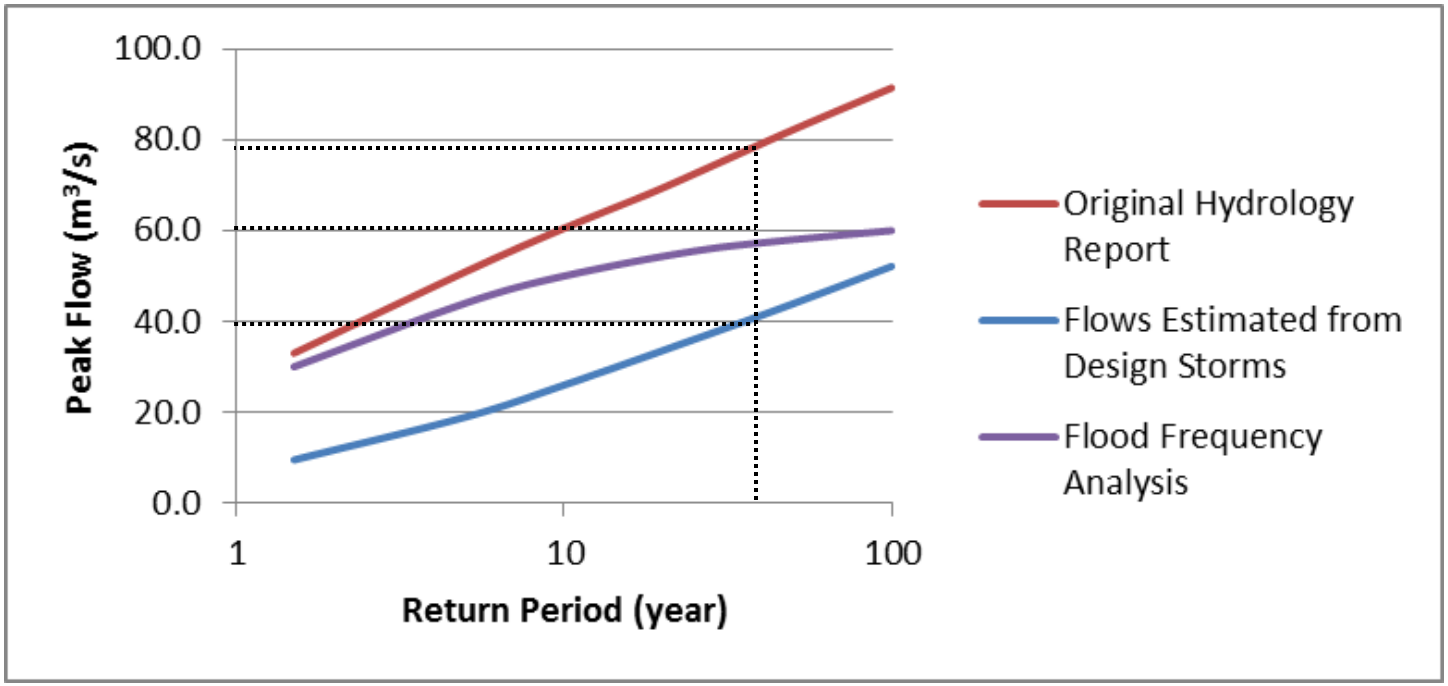
HOW ACCURATE IS CURRENT MAPPING?



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How Often will it Flood?

SINGLE SITE

Return Period (years)	Annual Probability (%)	Probability in next 10-years	Probability in next 50-years	Probability in next 100-years	Probability in next 250-years
2	50%	100%	100%	100%	100%
25	4%	34%	87%	98%	100%
100	1%	10%	39%	63%	92%
500	0.2%	2%	10%	18%	39%
1000	0.1%	1%	5%	10%	22%

10 INDEPENDENT SITES

Return Period (years)	Annual Probability (%)	Probability in next 10-years	Probability in next 50-years	Probability in next 100-years	Probability in next 250-years
2	50%	100%	100%	100%	100%
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100	1%	63%	99%	100%	100%
500	0.2%	18%	63%	86%	99%
1000	0.1%	10%	39%	63%	92%

National Floodplain Management Framework

Will serve as a guiding document in managing and reducing flood risk across Canada through the development of state-of-the art flood risk mapping.

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NATIONAL FLOODPLAIN MANAGEMENT FRAMEWORK

- Project Scope
- Project Rationale
- Key study tasks
- Findings and Recommendations
- Next Steps

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PROJECT SCOPE

- Review of International and Provincial Best Practices

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- Assess state of Mapping across Canada

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- Assess state of Mapping across Canada
- Recommend Standards Framework

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PROJECT SCOPE

- Review of International and Provincial Best Practices
- Assess state of Mapping across Canada
- Recommend Standards Framework
- Identify implementation requirements including cost

National Floodplain Management Framework

PROJECT RATIONALE

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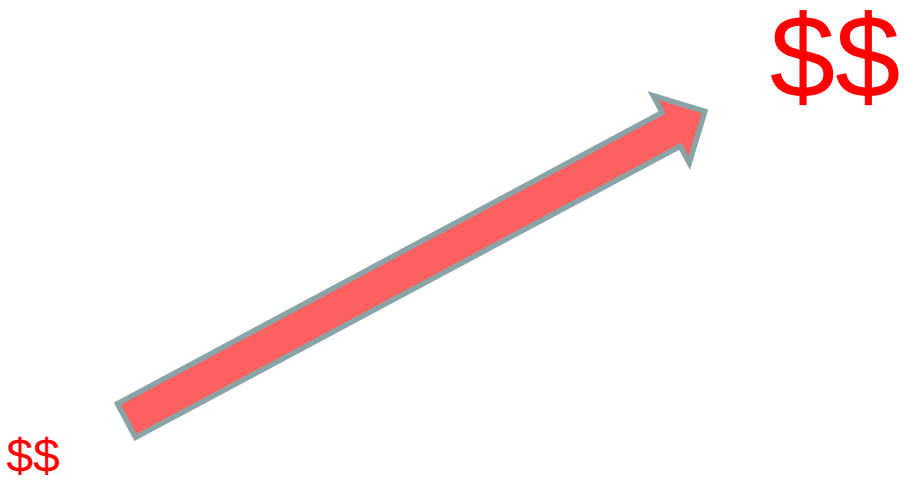
PROJECT RATIONALE

- Notable increase in flooding in the past decade with annual damages exceeding $1 billion



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PROJECT RATIONALE

- Notable increase in flooding in the past decade with annual damages exceeding $1 billion
- No national initiative since completion of FDRP in 1995

Where to Find It

The Globe and Mail

Sunny, Cool
High Here 55

111th Year. No. 32,713. Final Edition * TORONTO, MONDAY, OCTOBER 18, 1954. 5 Cents Per Copy 40 PAGES

17 Pages of Flood Pictures, Reports

54 DIE: 69 LOST

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- Notable increase in flooding in the past decade with annual damages exceeding $1 billion
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- Public Safety Canada is the lead federal agency responsible for national disaster mitigation

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- Notable increase in flooding in the past decade with annual damages exceeding $1 billion
- No national initiative since completion of FDRP in 1995
- Public Safety Canada is the lead federal agency responsible for national disaster mitigation
- There is no residential overland flood insurance program in Canada

National Floodplain Management Framework

FUNDAMENTAL CHANGE

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RECOMMENDING FUNDAMENTAL CHANGES

- Continue to develop Flood Hazard Maps
- Will be supplemented by a Flood Risk Data Base and Flood Risk Mapping
- Nationally coordinated data base that is accessible

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RECOMMENDING FUNDAMENTAL CHANGES

- Continue to develop Flood Hazard Maps
- Will be supplemented by a Flood Risk Data Base and Flood Risk Mapping
- Nationally coordinated data base that is accessible

Will lead to:

- Reduction in flood damage
- Availability of flood insurance

National Floodplain Management Framework

GUIDING PRINCIPLES

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GUIDING PRINCIPLES

- **Technical Accuracy**
- Effective in assessing and Managing Risk
- Accessible to the User
- Information is Current

One foot = 0.3048 metres

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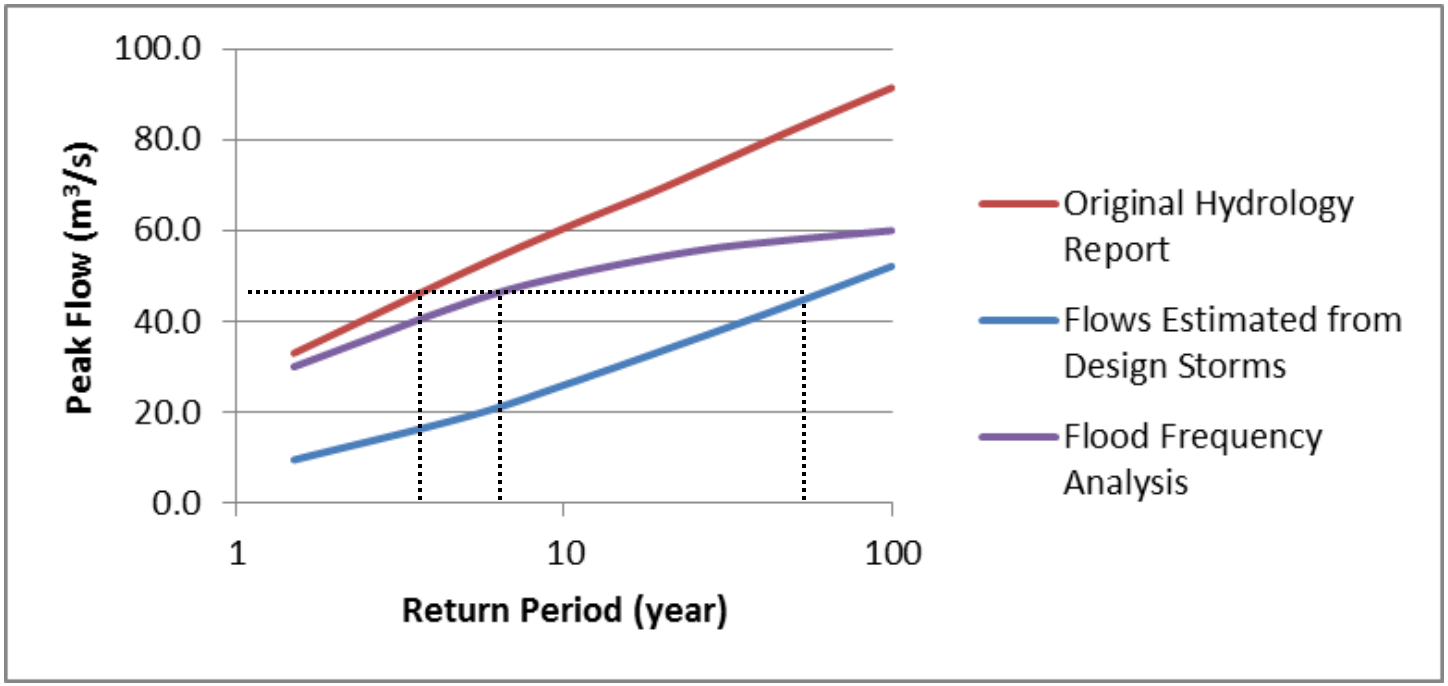
Technical Accuracy

And Hurricane Hazel?



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National Floodplain Management Framework

INTERNATIONAL

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INTERNATIONAL BEST PRACTICES

What can we learn from practices in other countries, most specifically:

- EU: France, Switzerland, Germany
- United Kingdom
- United States
- Australia
- New Zealand

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INTERNATIONAL BEST PRACTICES

What we learned

- 20 years ago we were among the leaders but we have been surpassed in some respects
  - National leadership
  - More emphasis on integrating hazard mapping and flood risk data
  - Accessibility
- Hurricane Hazel as a Regulatory event is the mist stringent noted

National Floodplain Management Framework

VARIATIONS ACROSS CANADA

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Differences:

- Regulatory events

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VARIATIONS ACROSS CANADA

Differences:

- Regulatory events
- Governance models
- Approach to building in floodplains including SPAs
- Challenges

National Floodplain Management Framework

EXPERT OPINION

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OPINIONS OF PROVINCIAL EXPERTS

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OPINIONS OF PROVINCIAL EXPERTS

- **Move beyond hazard mapping to consider risk**
- The 1:100-year event is not sufficient
- Expand and Update mapping
- Address governance and capacity limitations
- Accessibility

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OPINIONS OF PROVINCIAL EXPERTS

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National Floodplain Management Framework

STATUS OF MAPPING

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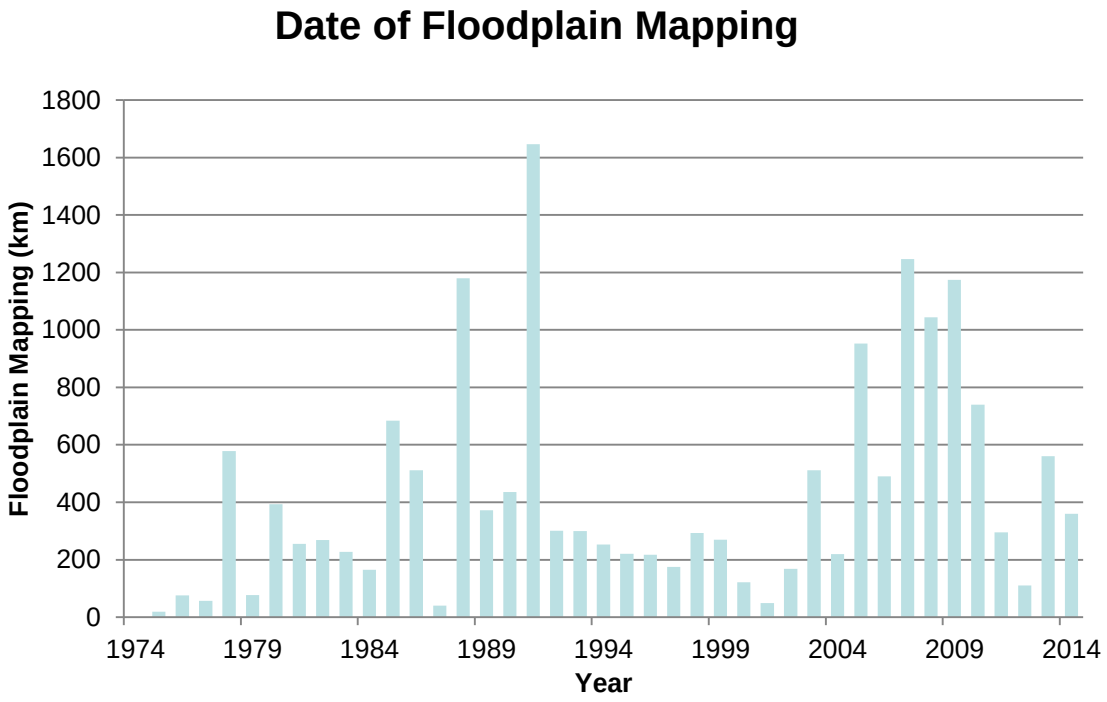
STATUS OF MAPPING ACROSS CANADA



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STATUS OF MAPPING ACROSS CANADA

TABLE 1: AGE OF EXISTING MAPPING				
Period	**Total (%)**		**Percentile**	**Year Completed**
1970-1979	7		25	1987
1980-1989	24		50	1996
1990-1999	22		75	2006
2000-2009	39			
2010-2013	8			
TOTAL (km)	28,100			

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STATUS OF MAPPING ACROSS CANADA

TABLE 2: MAPPING SUMMARY					
	Total Length (km)	Urban (km)	Rural (km)	Urban (%)	Median age
British Columbia	2,656	369	2,286	14	1989
Alberta	960	472	488	49	2007
Saskatchewan	253	98	155	39	1989
Manitoba	363	126	237	35	1993
Ontario	16,675	4,500	12,175	27	2002
Quebec	5,800	4,345	1,450	75	2003
New Brunswick	<500	132	368	26	1992
Prince Edward Island	<50	25	25	50	--
Nova Scotia	<500	132	368	26	1980
Newfoundland and Labrador	228	60	168	26	1990
Yukon	-	--	--	--	--
Northwest Territories	110	--	110[1]	--	1986
Nunavut	-	-	-	---	--
CANADA	28,100	10,300	17,800	35%	1996

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FIGURE 2: MAPPING COVERAGE ACROSS CANADA

Province/Territory	Existing (km)	Additional (km)	Bar Chart Showing Current and Proposed Coverage (%)
			0 20 40 60 80 100
British Columbia	2,656	2650	
Alberta	960	770	
Saskatchewan	253	125	
Manitoba	363	185	
Ontario	16,750	500	
Quebec	5800	10000	
New Brunswick	<500	250	
Prince Edward Island	<50	25	
Nova Scotia	<500	250	
Nfld. & Labrador	228	115	
Yukon	-	260[1]	
Northwest Territories	110[2]	30	
Nunavut	-	130[3]	
TOTAL	**28,100**	**15,300**	

Existing

Proposed

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THE FRAMEWORK

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FRAMEWORK SCOPE

		Framework Scope:
Guidelines		Identifies purpose and general content
Performance Standards		Identifies key standards that help define risk
Technical Standards		Recommends proposed standards that contribute to accuracy
Initiatives		Identifies purpose and general content

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GUIDELINE DOCUMENTS

- Base Mapping and Field Survey
- Hydrology
- Hydraulic Analysis
- Coastal and Shoreline Flooding
- Policy Framework
- Flood Risk Assessment and Mapping
- Geo-referenced Database and National Portal

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SAMPLE STANDARDS

- **Base Mapping**
  - Vertical accuracy of 0.15 m
- **Hydrology**
  - Estimate flow rated for 1:2 to 1:1,000 years
- **Policy Framework**
  - Minimum Regulatory event should be 1:350 year event
  - Minimum Floodway return period should be 1:50 year event

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NEXT STEPS

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NEXT STEPS

- **Money**
- Complete a National Risk Assessment to help establish mapping priorities
- Develop Guidelines and refine the Technical Standards
- Develop Framework for the Flood Risk Database
- Determine the delivery model for preparing mapping and the data base
- Prepare Federal-Provincial/Territorial Agreements

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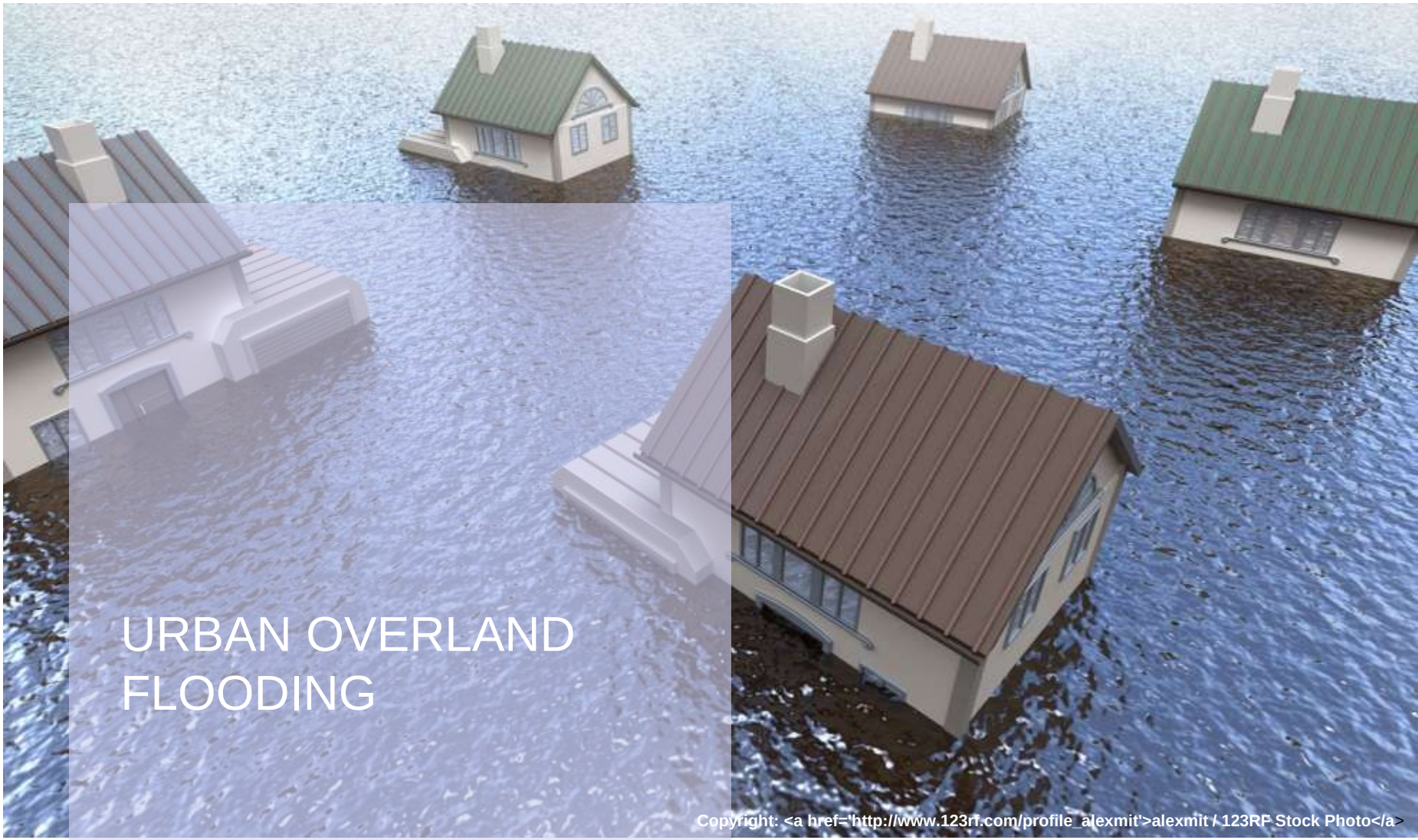

URBAN OVERLAND FLOODING

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URBAN OVERLAND FLOODING

- Review Types
- Example of hybrid flooding
- Advances in assessing urban overland flooding

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URBAN OVERLAND FLOODING

- Two types:
  - Pure urban
  - Riverine/urban hybrid
- Typically caused by intense summer storms and poorly defined overland flow routes (pre 1975 in Ontario)

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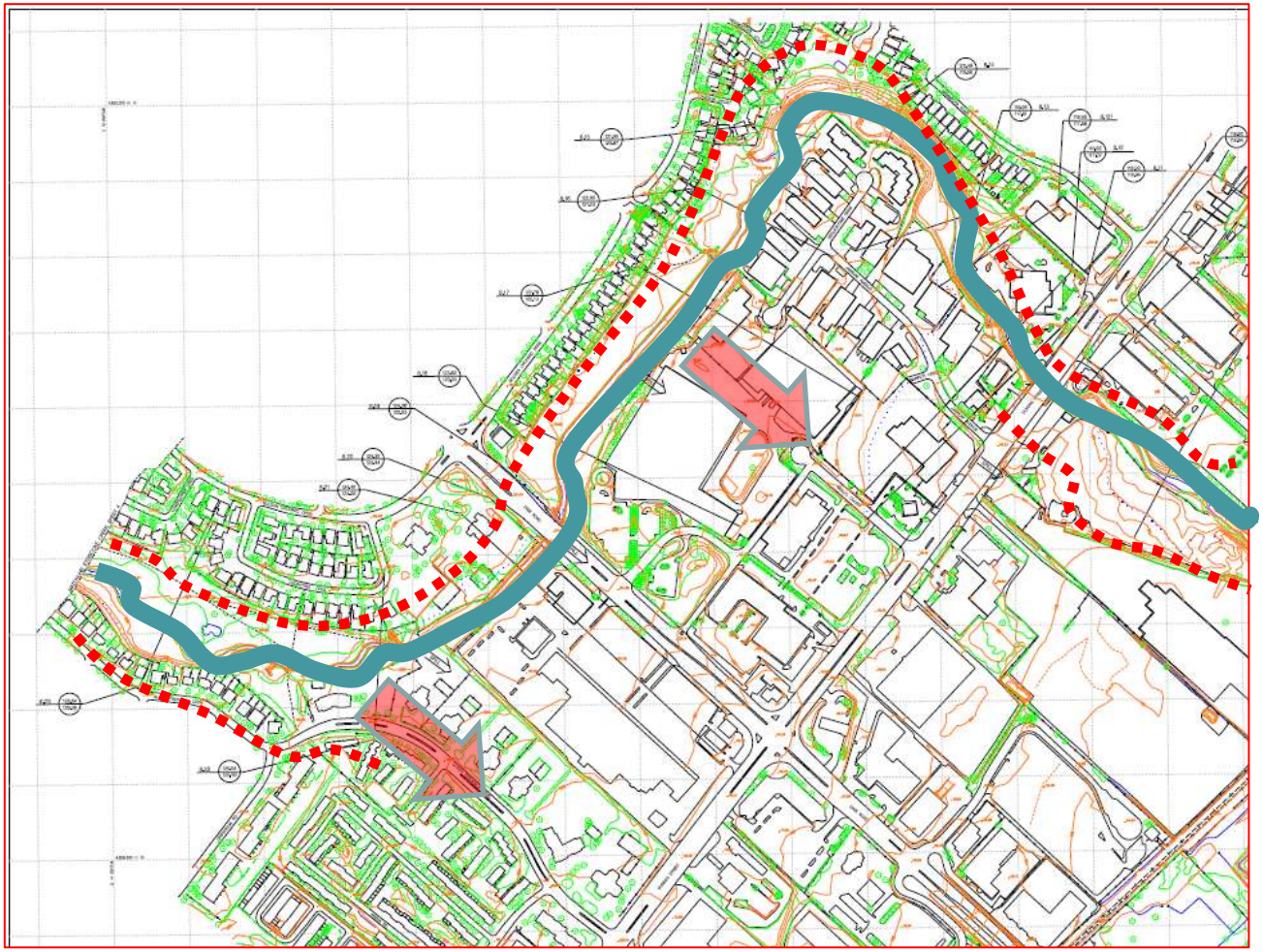
URBAN OVERLAND FLOODING

- Minor/Major design concept significantly reduces risk
- **Flood prone areas rarely defined**

HYBRID RIVERINE/URBAN OVERLAND FLOODING

Reasons flood prone areas rarely defined

- Technology to assess (1D versus 2D models)
- Relative priority
- Governance
- Frequency



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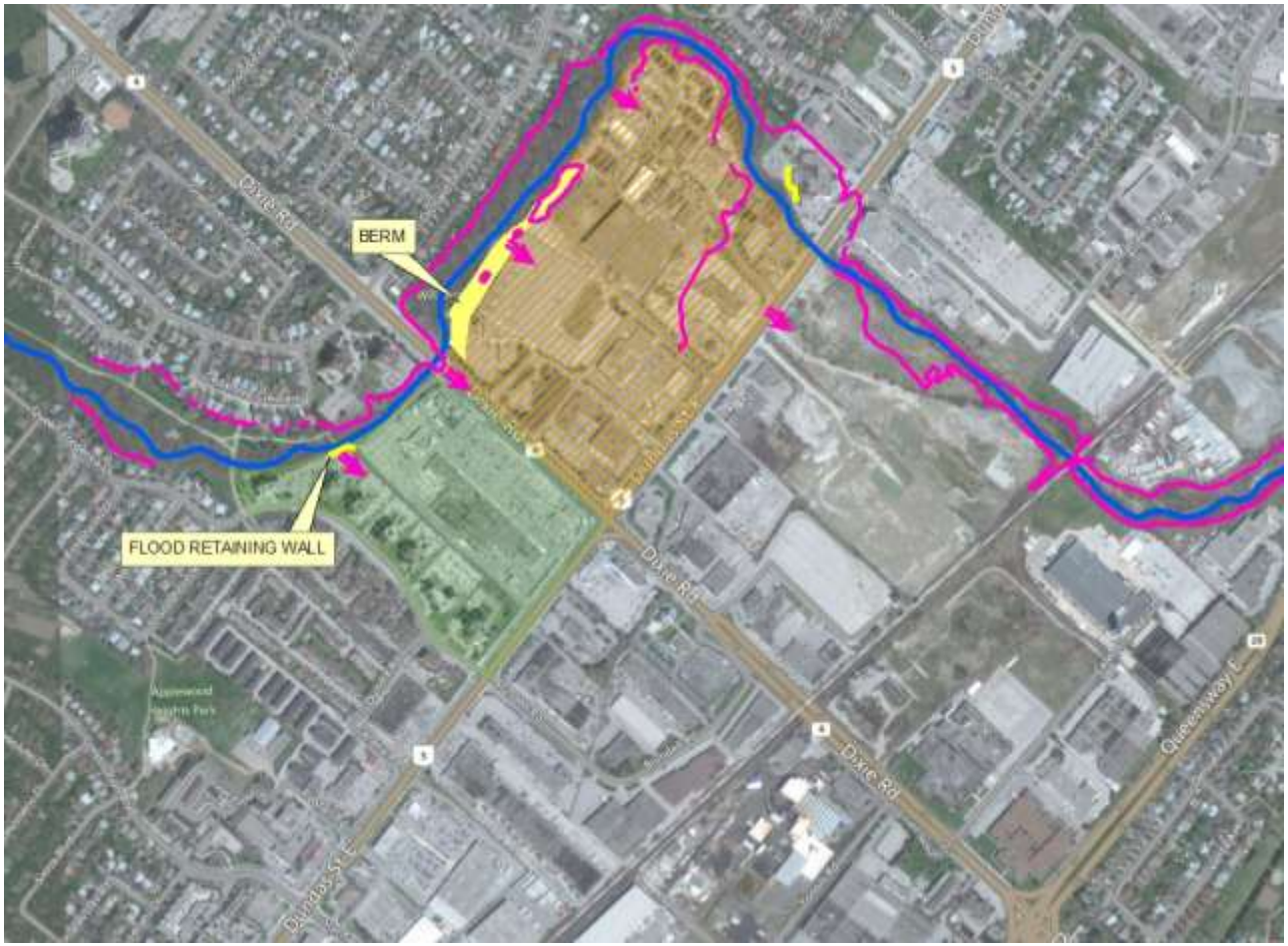

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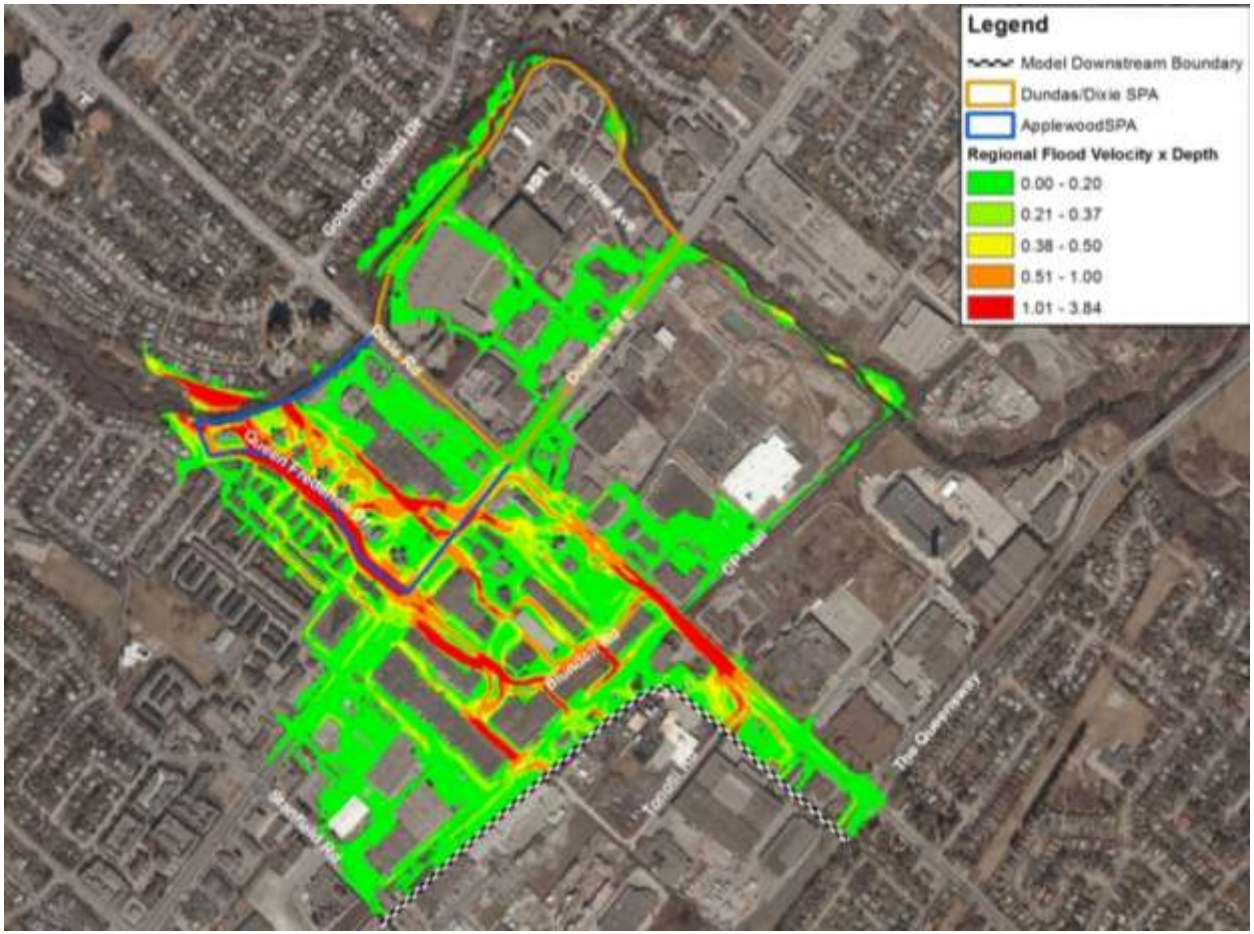

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ASSESSING URBAN OVERLAND FLOODING

- Topographic Map Review
- Complex Modelling
- Screening Method

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OVERLAND FLOODING – Topographic Map Review

- Primary areas of concern can be identified
- Difficult to define risk or extent of flooding

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OVERLAND FLOODING – Complex modelling

- Simultaneous modelling of runoff, sewer flow and overland flow
- Data and Labour Intensive
- Provides understanding of risk and can be used for assessing mitigation measures

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OVERLAND FLOODING – Screening Methods

- Use to screen areas that may be flood prone
- Effectiveness a function of base mapping accuracy
- Provides understanding of risk and can be used for assessing mitigation measures
- Option of applying Complex Modelling for key areas of concern

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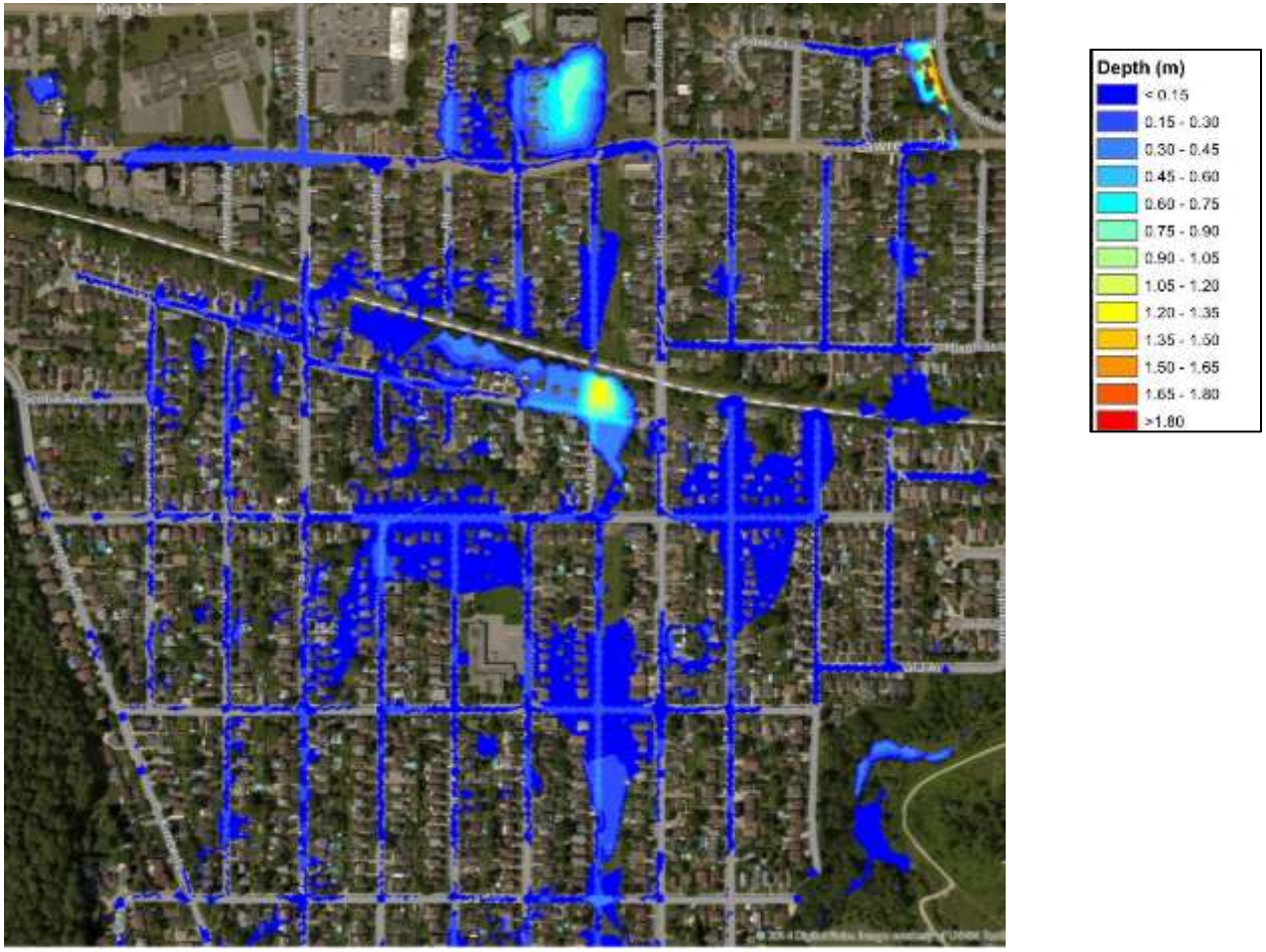
Example: Flood Depths based on Complex Modelling



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Example: Flood Depths based on Screening Method

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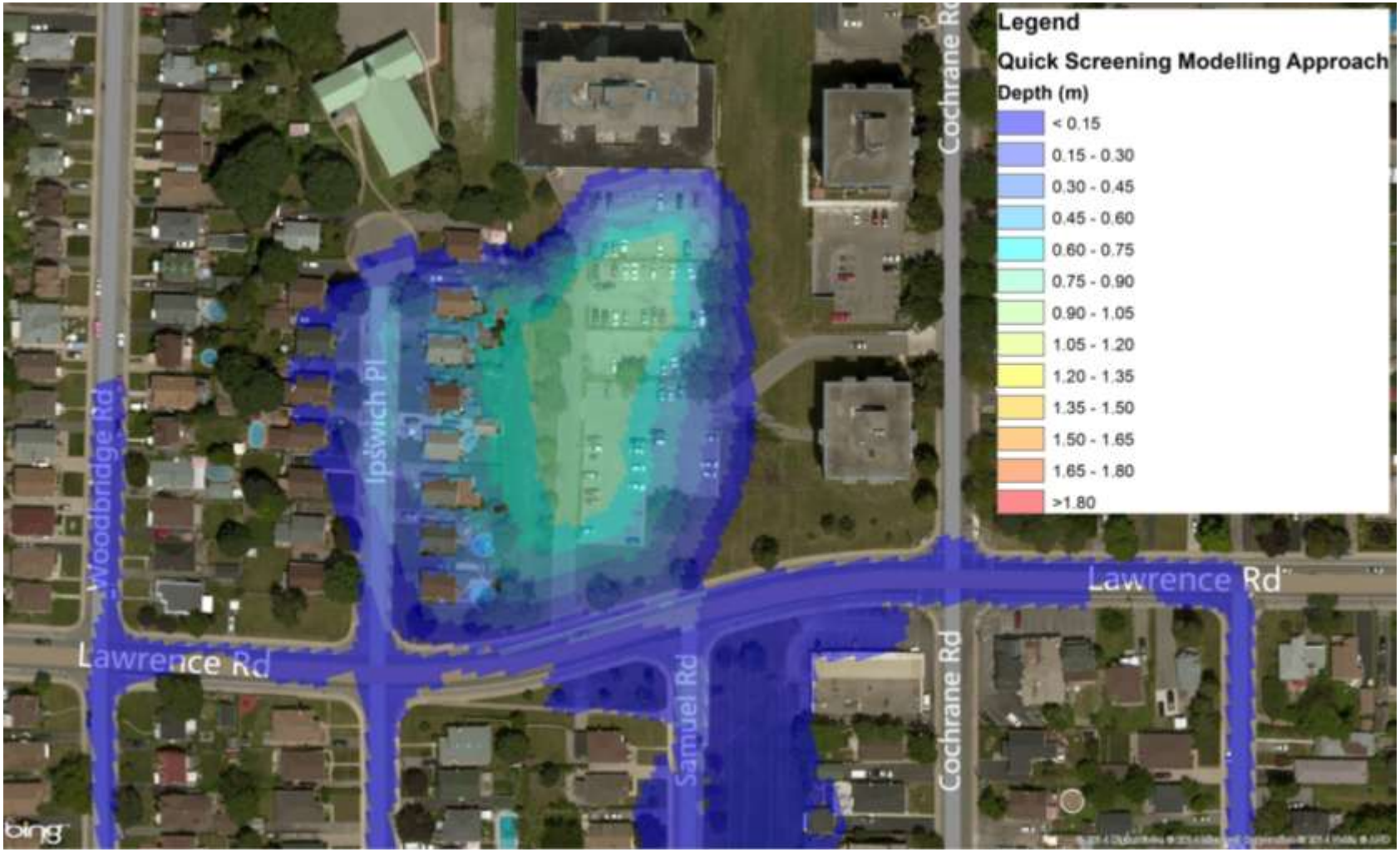

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Questions?

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