

# Proving 'urban karst' as mechanism for basement infiltration

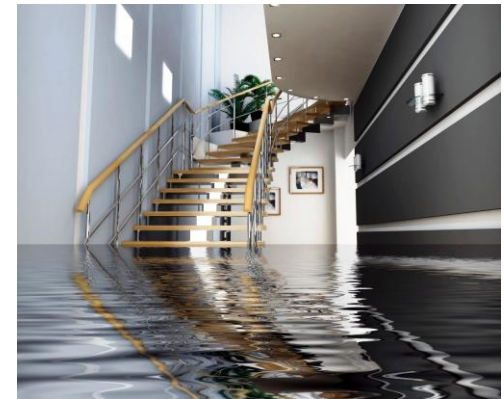
Lisgar District, City of Mississauga, Ontario, Canada

Martin Shepley & Nick Schmidt (Hamilton Office)

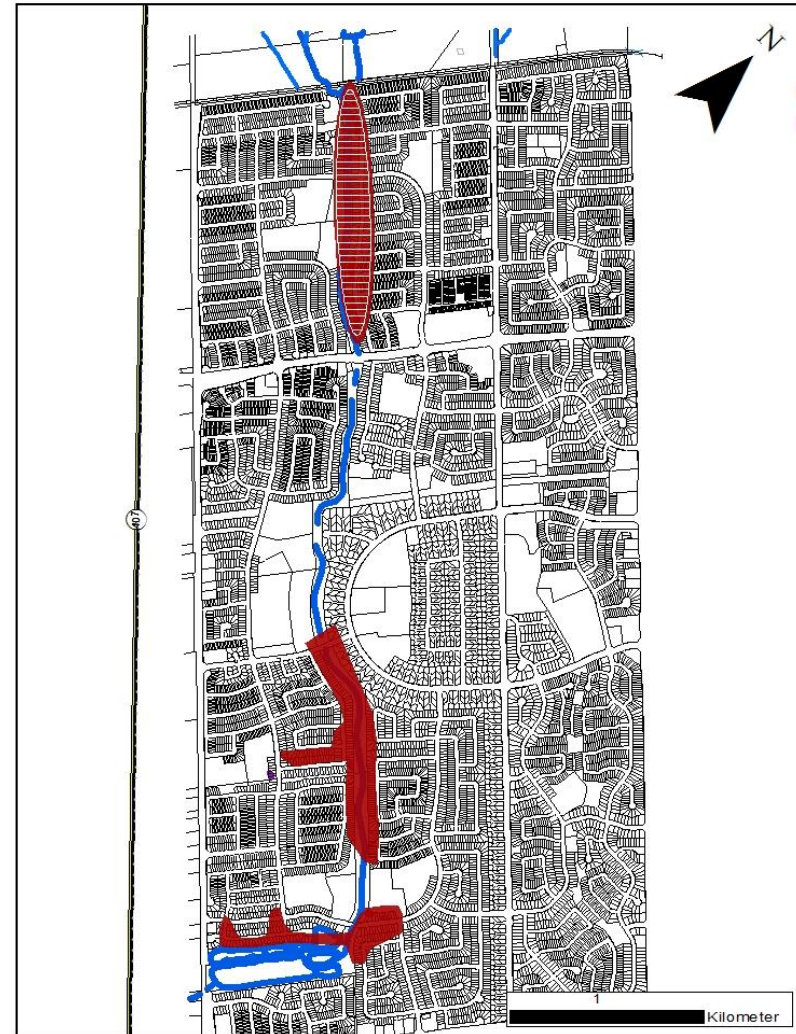
Ron Scheckenberger & Matt Senior (Burlington Office)

Steve Worthington (Worthington Groundwater)

Jerry Pinchak (City of Mississauga)



# The Lisgar District of Mississauga



# Potential causes

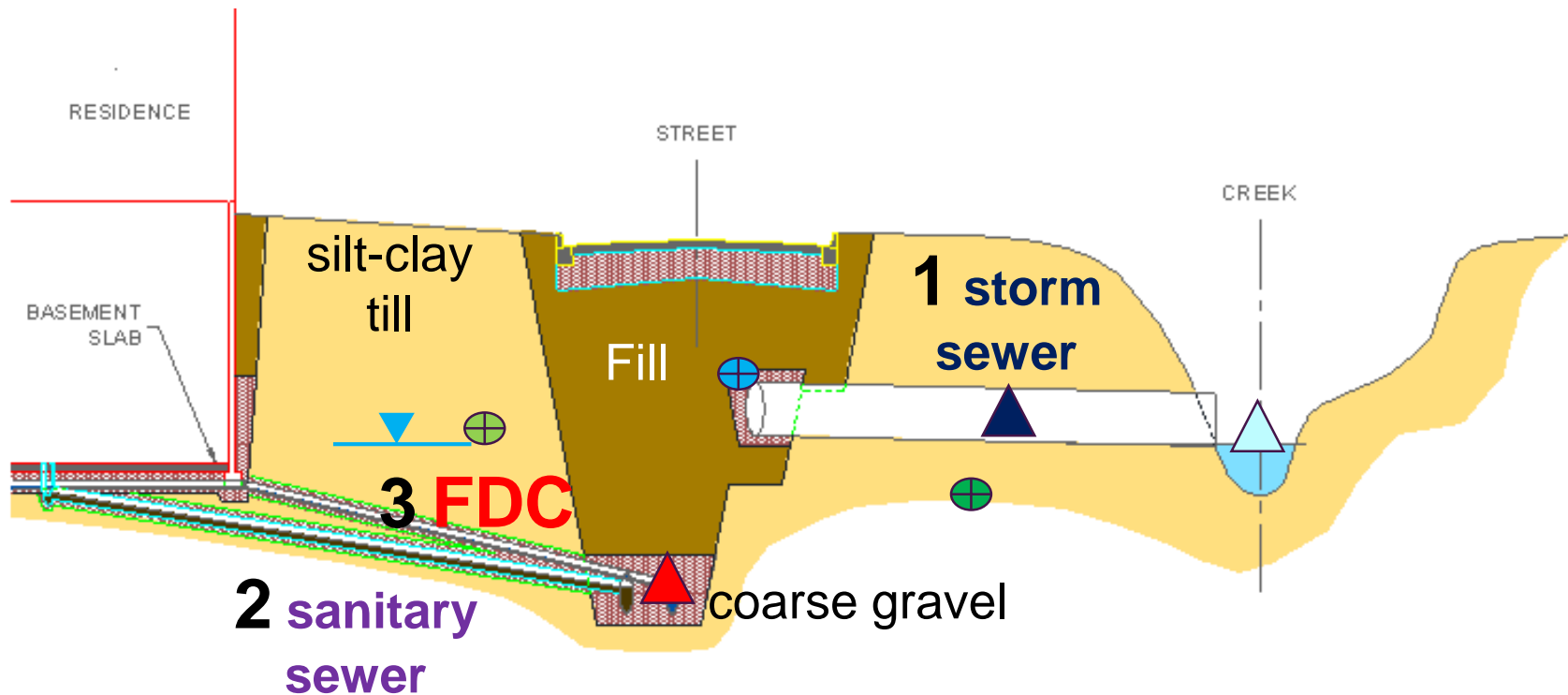
## A long list

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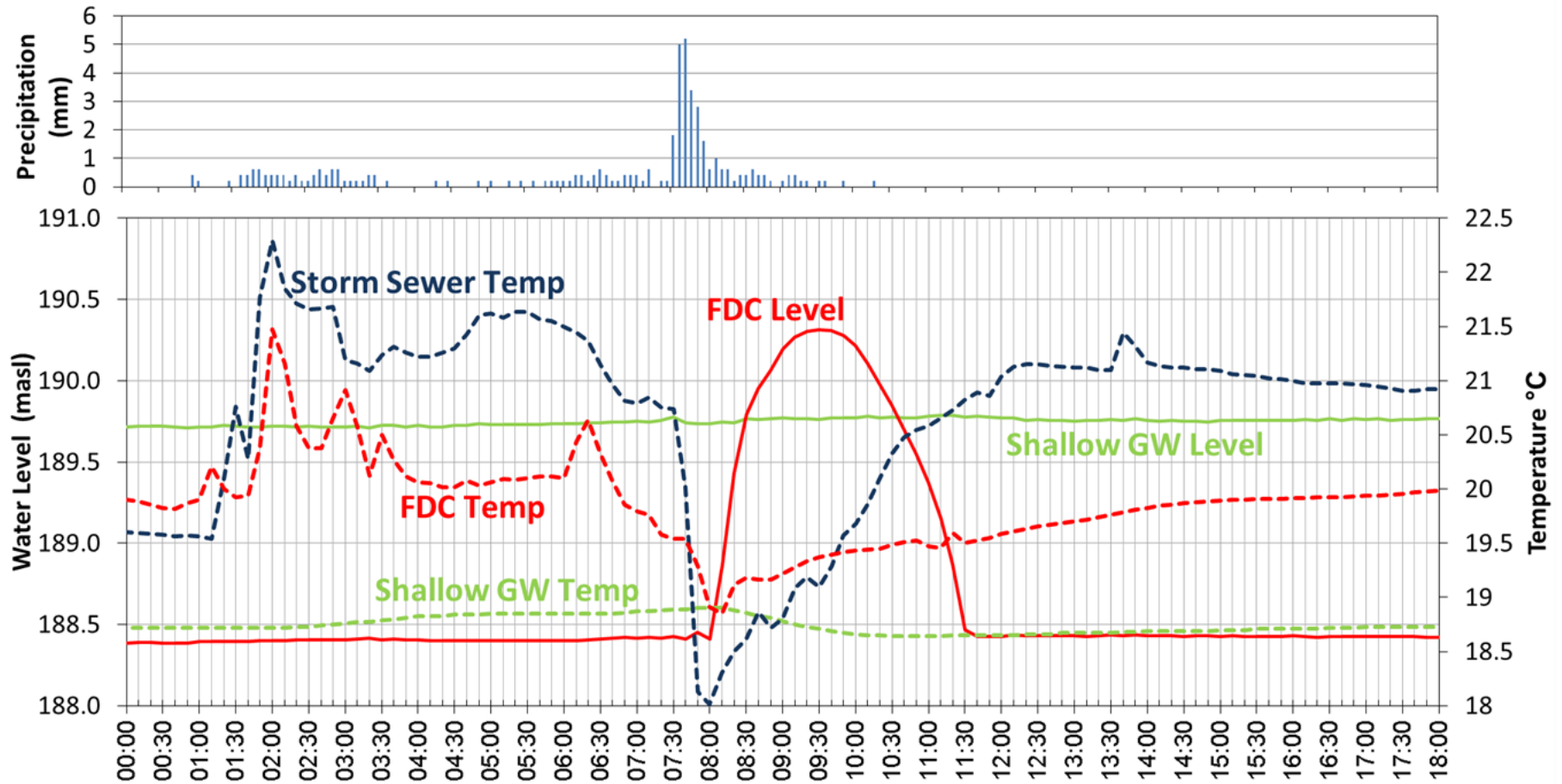
- ▶ Climate
- ▶ Additional development
- ▶ Higher creek levels due to maturing with vegetation
- ▶ Stormwater management facility
- ▶ Changes to homes/properties (lot grades, basement walkouts)
- ▶ Aging basement walls and foundations
- ▶ Sanitary sewer system
- ▶ Private weeper system (condition and cross-connections)
- ▶ Groundwater
- ▶ Aging infrastructure
- ▶ Foundation drainage collector (FDC)

# The three pipe system

## Foundation Drainage Collector (FDC) draining by gravity



# The September 8, 2012 event

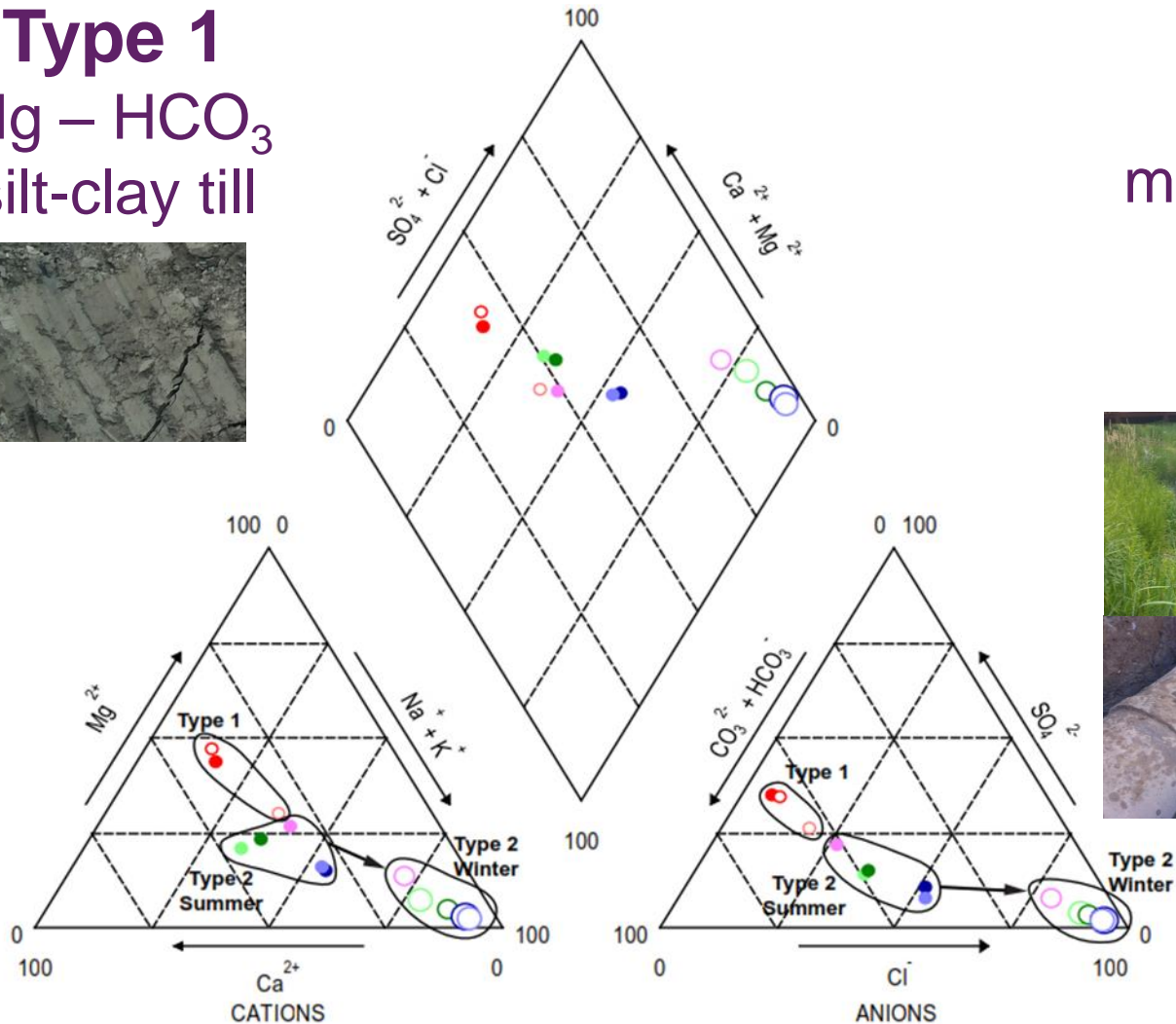




# Water chemistry

## Type 1

Mg – HCO<sub>3</sub>  
silt-clay till



## Type 2

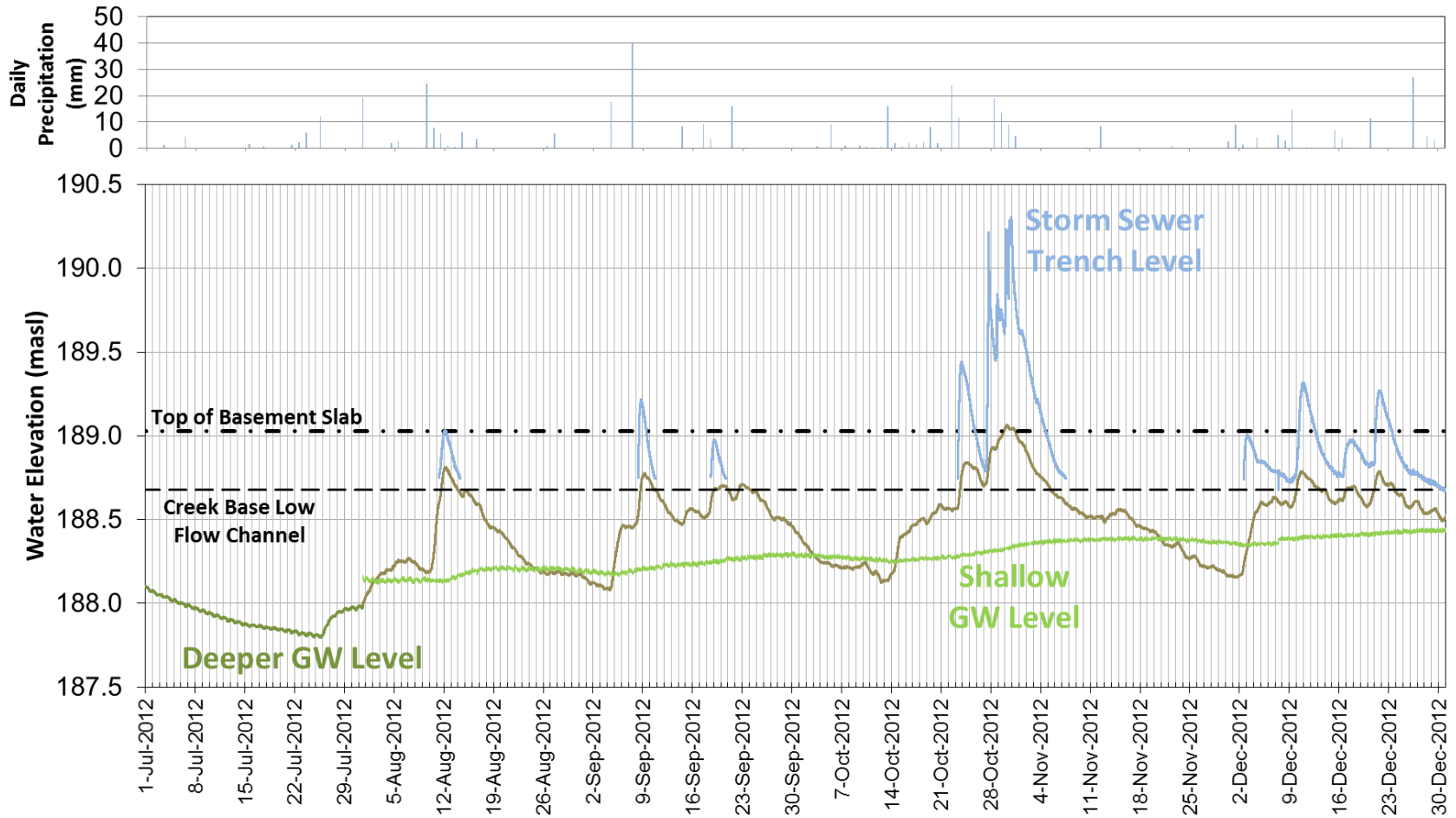
Summer  
moderate NaCl

Winter  
high NaCl





# Leaking storm sewers affecting groundwater



# Testing for 'Urban Karst' – Part 1

## The Alderwood Trail Test, July 2013

### The starting hypothesis



### Dye tracing; the classic Karst investigation method

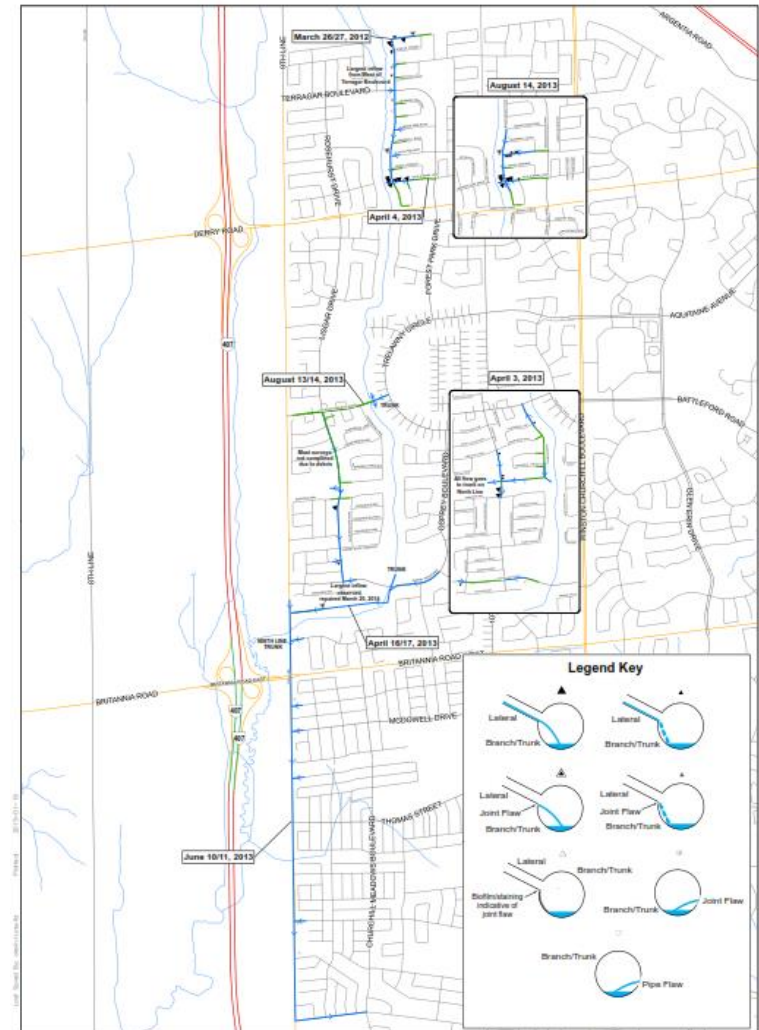
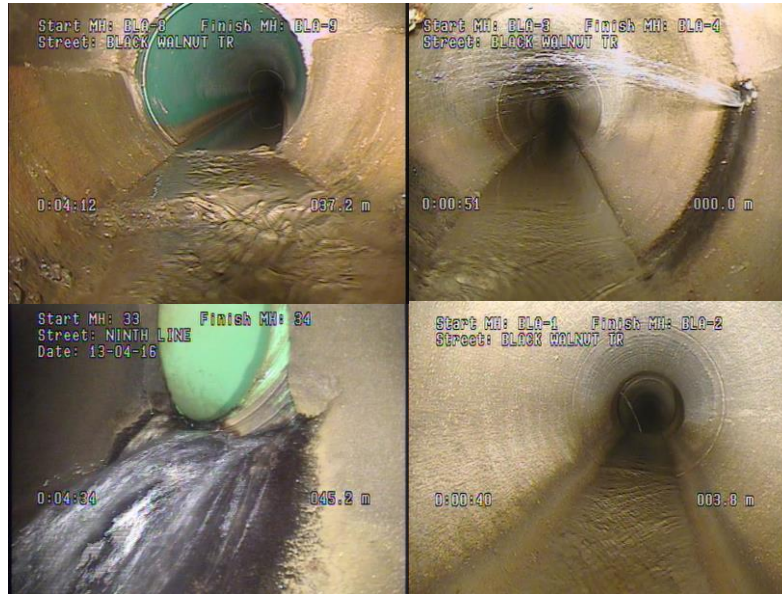
- ▶ Adjacent to property inundated five times
- ▶ Adjacent to FDC showing anomalous temperature and surcharging behaviour





# The extra mile

## Detailed Review of ~ 8 km of FDC CCTV Footage



# Testing for 'urban karst' – part 2

## The Black Walnut Trail tests – October 2013

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### Alderwood Trail

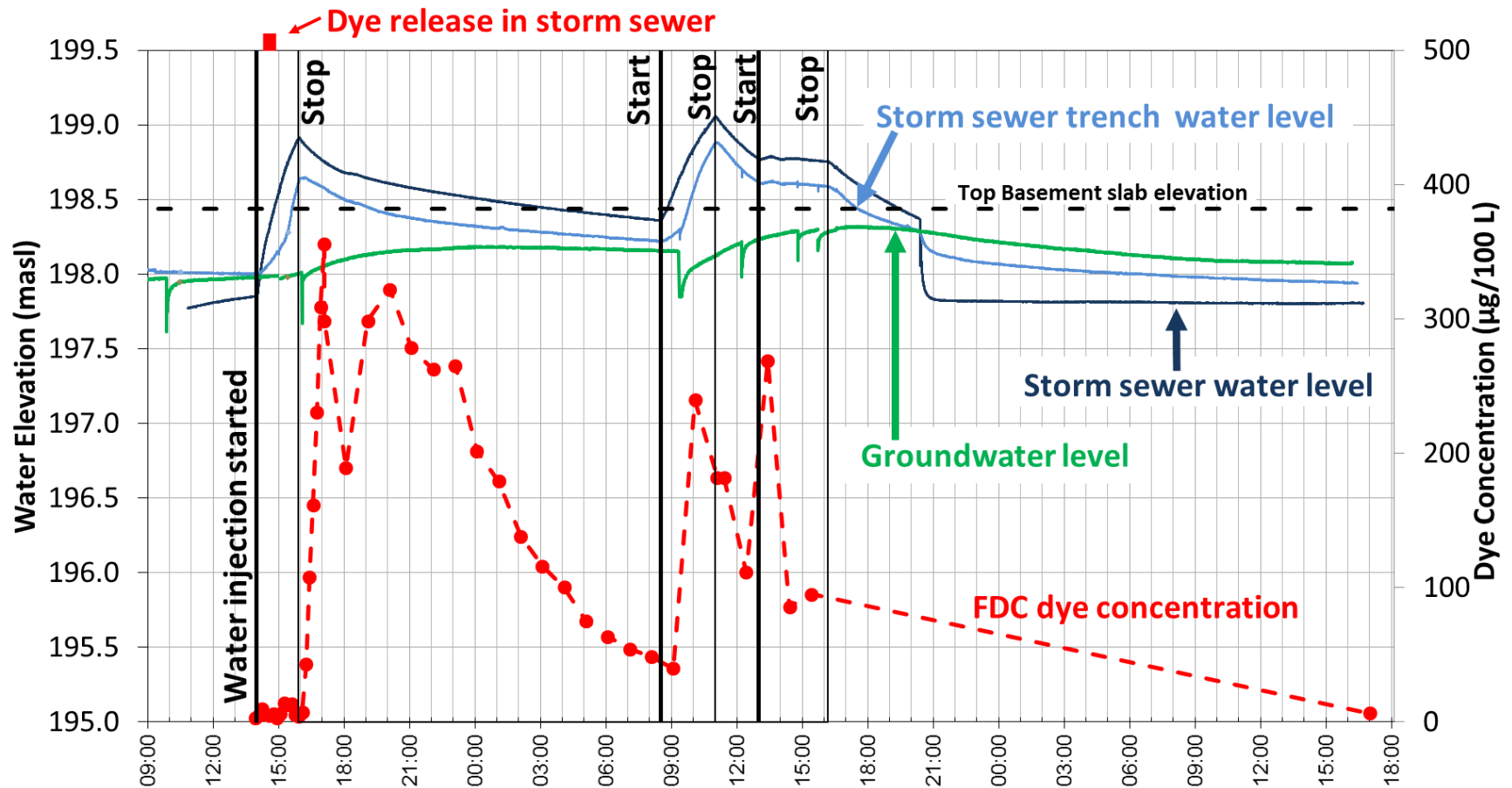
- ▶ 1 storm sewer, 90 m<sup>3</sup> from 1 hydrant
- ▶ 4 hours
- ▶ 100 m of storm sewer
- ▶ Filled~ 70% capacity

### Blackwalnut Trail

- ▶ 2 storm sewers, 740 m<sup>3</sup> from 7 hydrants
- ▶ 24 hours
- ▶ 200 m + 450 m of storm sewer
- ▶ Fully surcharged

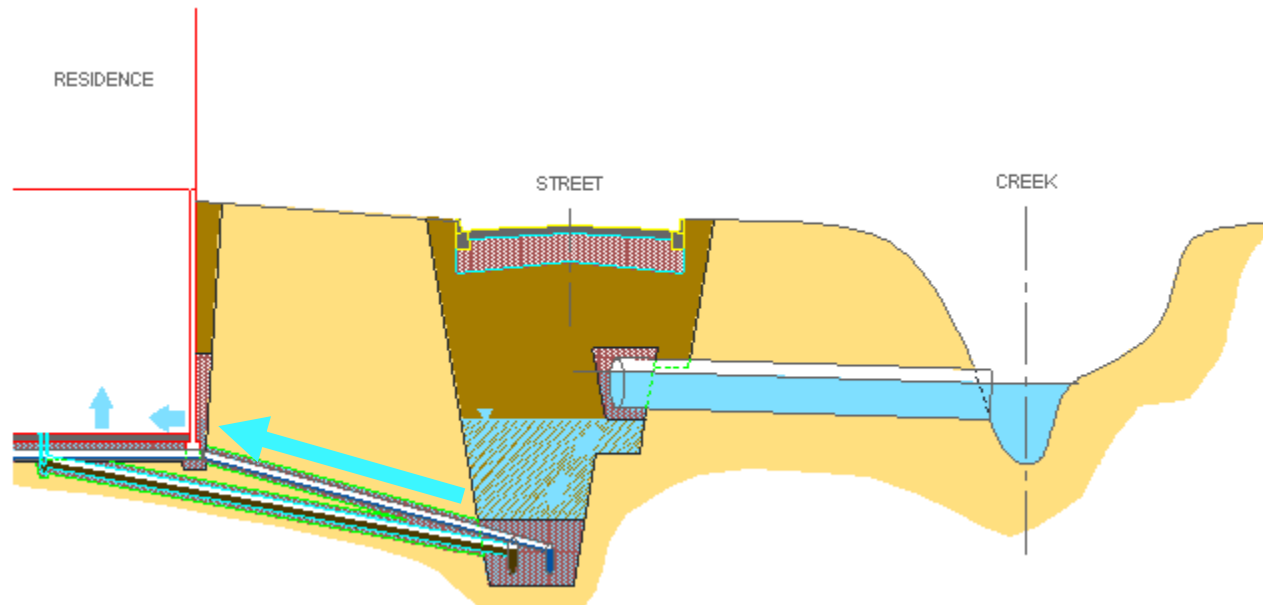
# Testing for 'urban karst' – part 2

## The results – Black Walnut Trail & Scotch Pine Gate



# The three pipe system

## FDC draining by gravity the storm sewer trench



- ▶ Storm trench to FDC - controlling factors
  - ▶ Storm sewer leaking to trench
  - ▶ Relative elevation
  - ▶ Low permeability silt-clay till
- ▶ What about the other potential causes?



# The conclusion (to the forensic work)

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- ▶ Hydrologic and hydraulic modelling calibrating to field data
- ▶ Remedial measures proposed and approved by City
  - ▶ Sewer trench dewatering system (pilot system 2017)
  - ▶ Storm sewer lining (now to 2017)
- ▶ Not hydrogeology; not surface water engineering

Thank you!

Questions

