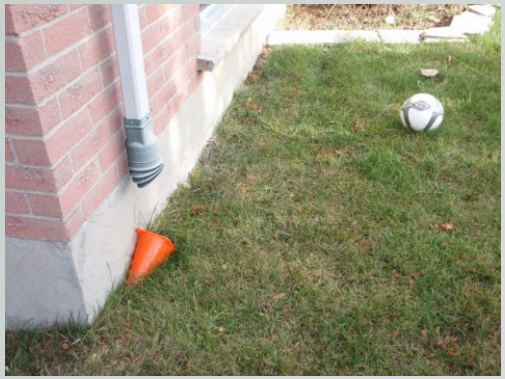
Weeping Tile Disconnection to Reduce the Impact of Basement Flooding

London, Ontario



September 19, 2013

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City of London

Environmental and Engineering Services Department

London CANADA

Today's presentation

- Document a pilot project involving weeping tile disconnection, initiated by the City of London
- Objective to decrease Inflow and Infiltration in the sanitary sewers to reduce the risk of basement flooding
- Project undertaken Summer 2013

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Outline

- Terminology
- Background:
  - What causes basement flooding?
- Pilot Project: Sherwood Forest Subdivision

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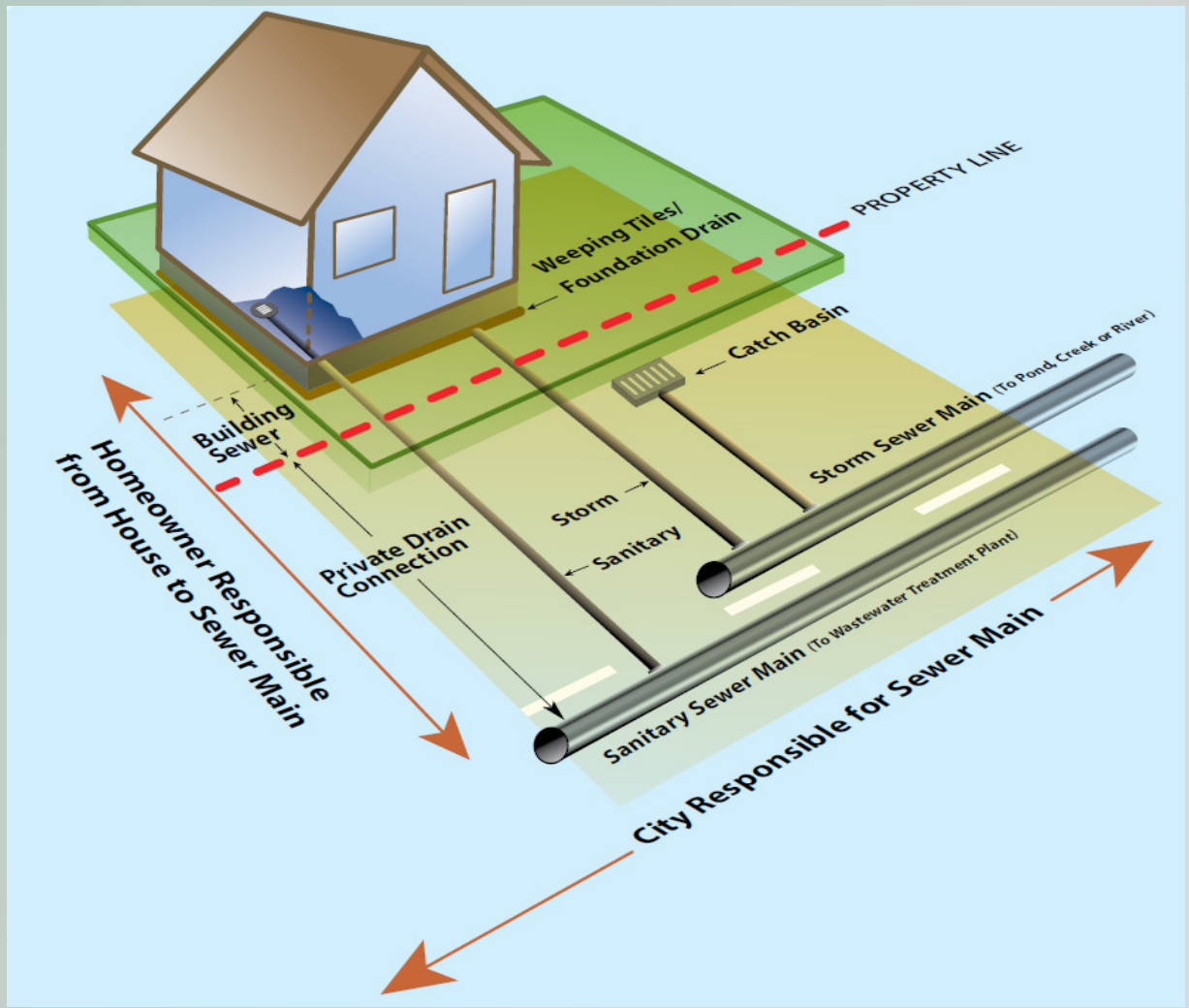
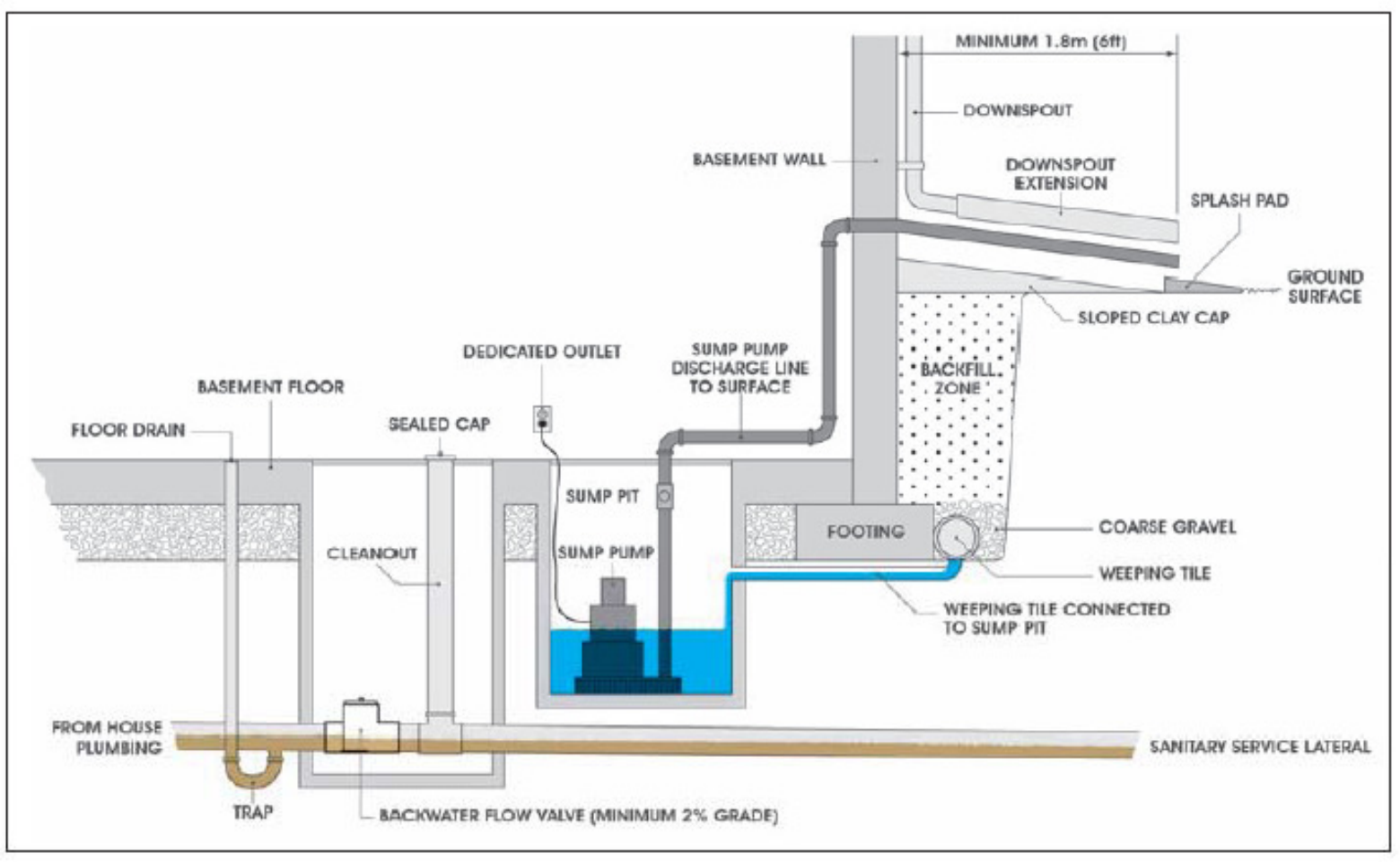
Terminology



Sump Pump Diagram



Courtesy of ICLR

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Basement Flooding

- What is Inflow/Infiltration (I/I)?
  - Stormwater and/or groundwater entering sanitary sewers

- Excessive I/I can lead to surcharged/overloaded sanitary main
  - Widespread issue, generally affects multiple homes on a street

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Sources of I/I

- Weeping tile connections
  - Lot grading sloped towards house
  - Downspout discharge location (at or near foundation wall).
  - Clay soils
- Combined sewers
- Old pipes, cracks, etc

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London's Weeping Tile History

- Prior to 1985:
  - weeping tile connected to sanitary sewer
- 1985-1995:
  - weeping tile connected to sump pit; sump pump discharge to surface
- 1995-present:
  - weeping tile connected to sump pit; sump pump discharge to storm sewer PDC

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Sherwood Forest Subdivision

- Subdivision developed late 1970s to early 1980s
- Historical basement flooding prone area

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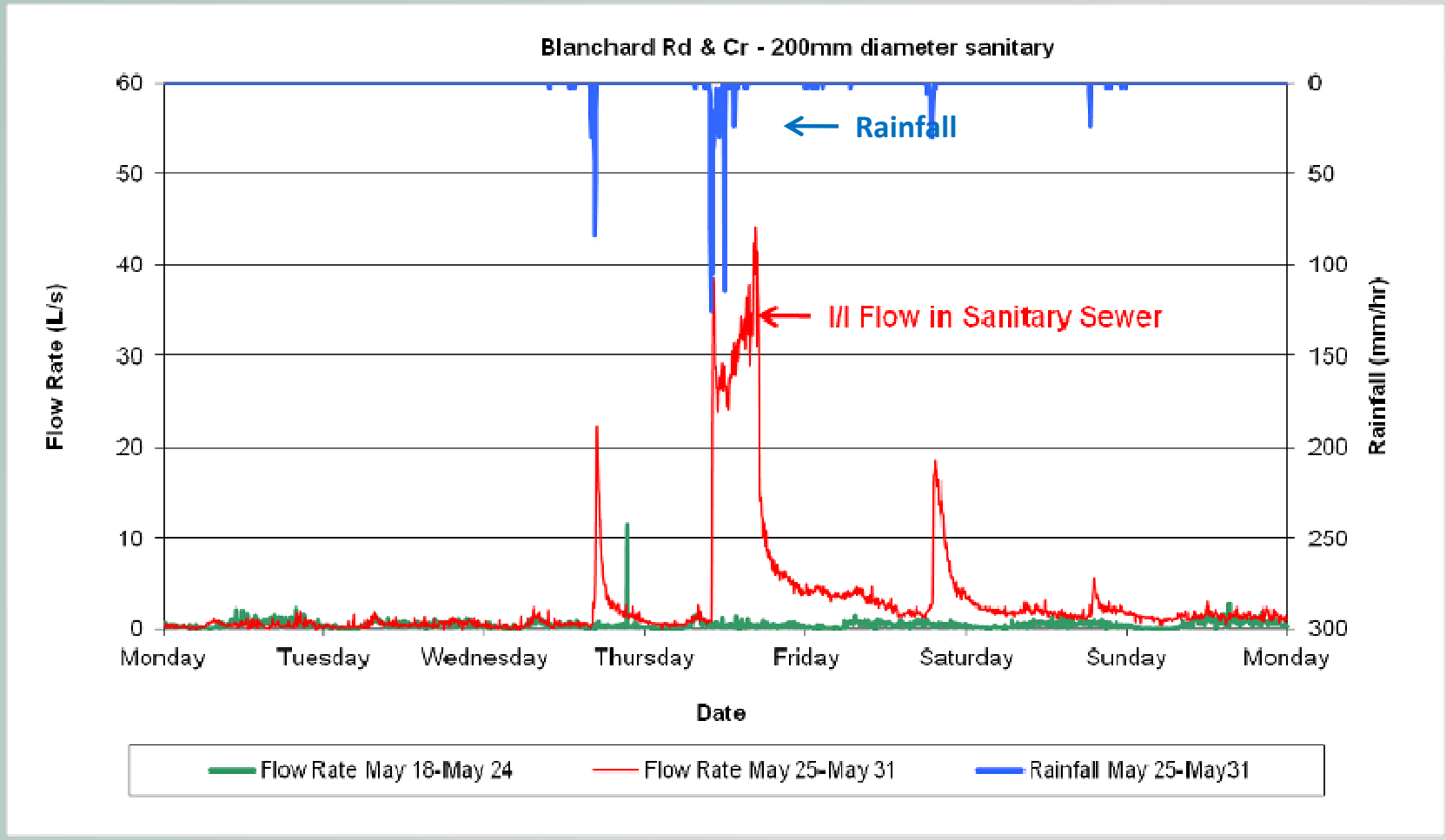
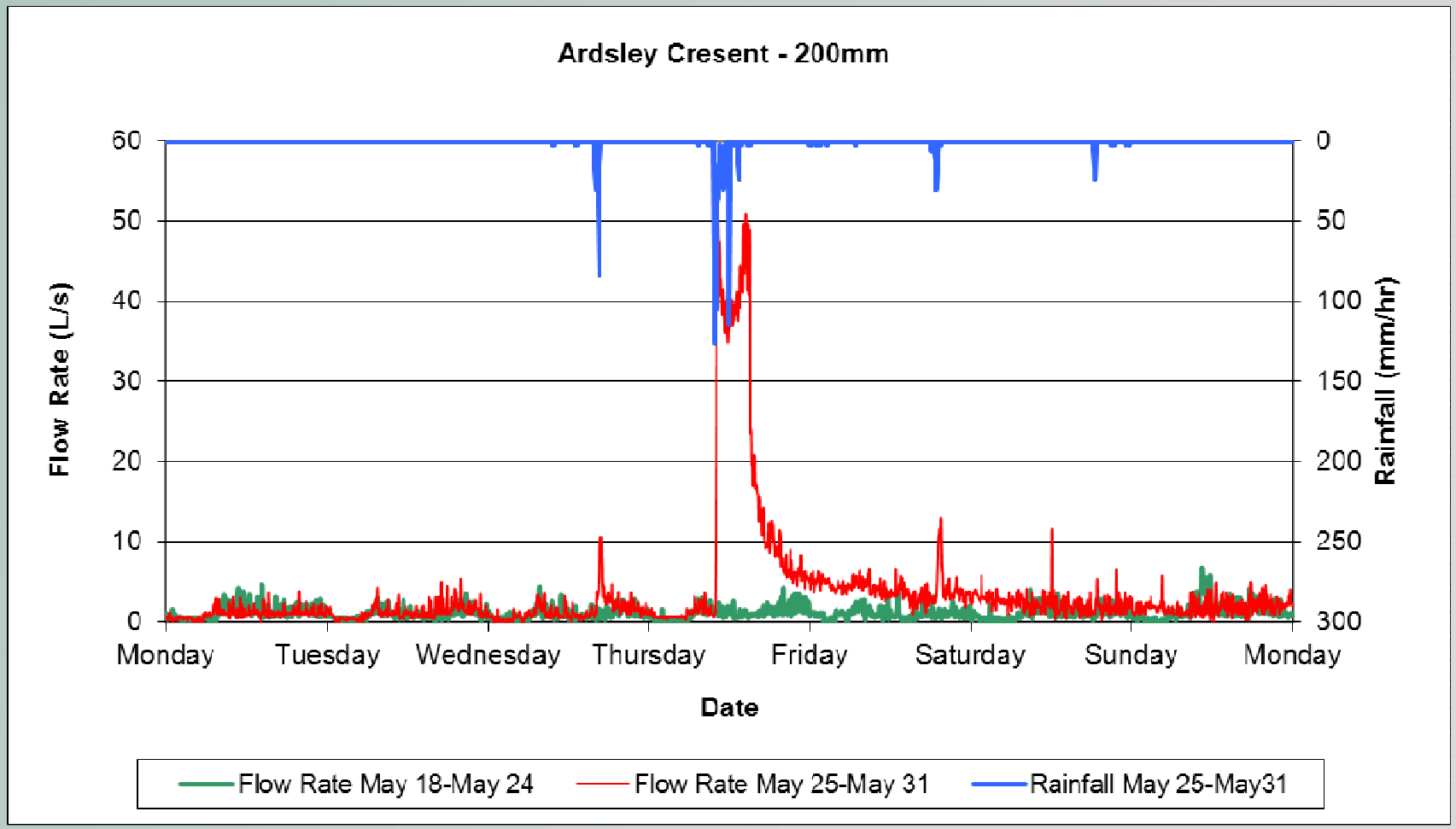
Flow Monitors

- Blanchard Crescent, May 2009



Flow Monitors

- Ardsley Crescent, May 2009



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What's Happening?

- **Weeping tile connected to sanitary** → most homes pre 1985
- **Clay soils** → do not absorb water
- **Lot grading** has settled over the years →
  - water falling from the sky is draining towards houses
- **Zero lot line** homes →
  - Closely spaced together = high % of roof and hard surface
- Poorly placed **downspout discharge** locations

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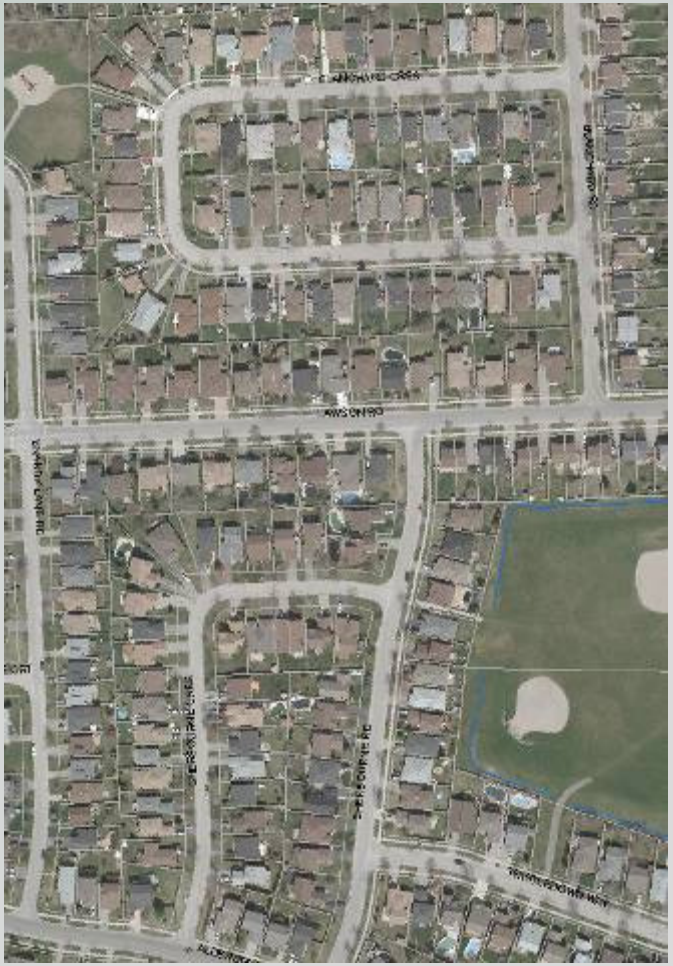
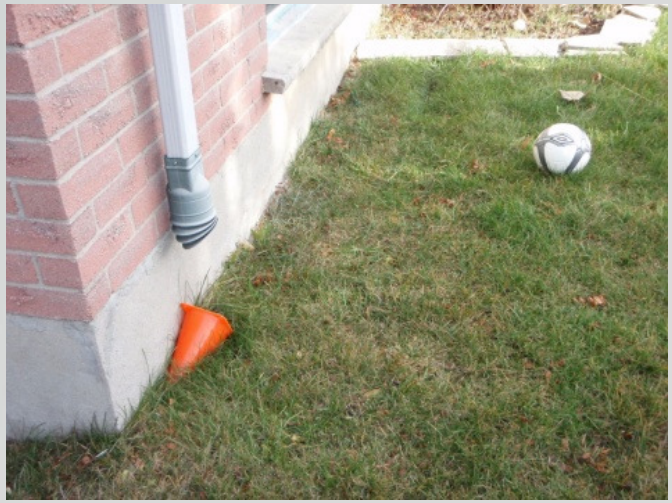
Aerial Photos



Downspouts



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Private Side Alternative: Advantages

- Disconnecting the weeping tile from sanitary:
  - Removes I/I at the source
  - Saves pumping and treatment costs
  - Reduces risk of overwhelming system with 'next big storm'
  - Significantly more cost effective:

    → only 20% of the cost of public side alternative

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Existing Grant Program

- Voluntary (Current Practice):
  - 75% Grant Program for Basement Flooding Protection (includes sump pump, backwater valve, weeping tile disconnection, storm PDC)
  - Very low uptake; ‘dry basement’ homeowners have no interest, even though they are contributing.

Proposed Pilot Project

- Pilot Disconnection on Blanchard (up to 65 homes)
- City pays 100% cost + provides additional $1,000 for future maintenance;
  - Includes disconnection of weeping tile, installation of sump pump, backwater valve, and private storm sewer lateral (PDC)

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Proposed Pilot Project

- Voluntary signup; 50% of homeowners participation required
  - Computer modeling determined that we needed 50% buy in to ensure that enough stormwater was removed from the sanitary system (to prevent basement flooding)

- Individual site visits to each home to determine retrofit feasibility

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Getting Buy In

- Homeowner Buy In
  - Public meeting to inform and educate homeowners; introduce them to our proposed solution
  - Initially had 27 homes signed up for full disconnection
  - Ended up with 32 home disconnections + 5 storm PDC installs

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Tendering Project

1. External works tender

- installation of storm PDCs from sewer main to house; included restoration, road resurfacing

2. Internal works tender

- Very unique tender from City prospective
- Included all items necessary for disconnection of weeping tile from sanitary, installation of sump pump, installation of backwater valve
- Tender items for electrical, laminate flooring removal and replacement, drywall, etc.

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Project Cost

External Works

- Tender bid $305,000 ($8,245 per house)

Internal Works:

- Tender bid: $172,000 ($5,375 per house)

Total = $477,000

Note:

- external works include asphalt resurfacing
- only one Internal bid received; interested capable plumbing contractors were not familiar with City contract bonding requirements

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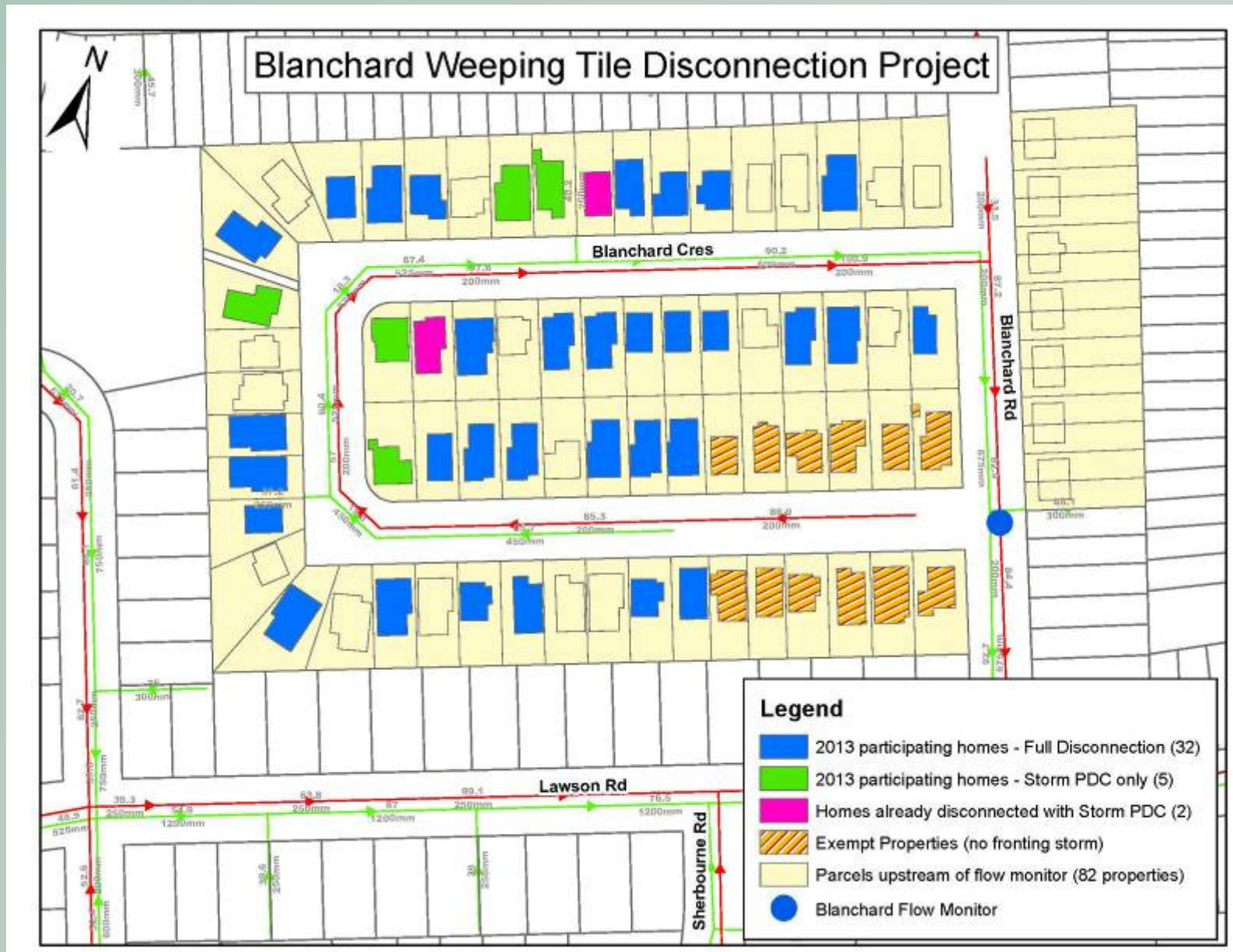

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Project Logistics

- Major difference from all other City led projects: we were proposing to undertake work on private property AND inside private homes!

- **Legal concerns:**
  - contractor required to have police records checks for all workers
  - Additional liability insurance
  - Comprehensive Dishonesty, Disappearance and Destruction Coverage ($20,000 per employee)

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Project Coordination

City's Building Division:

- Required to obtain building permits for each house (contractor's responsibility)
- Contractor needs to acknowledge that inspections can impact their schedule

Project Coordination

Homeowners:

- Consent to enter agreements from each homeowner
- Site visits before, during, and after project
- Contractor needed a flexible schedule to accommodate homeowner work schedule, appointments, etc.

External Works

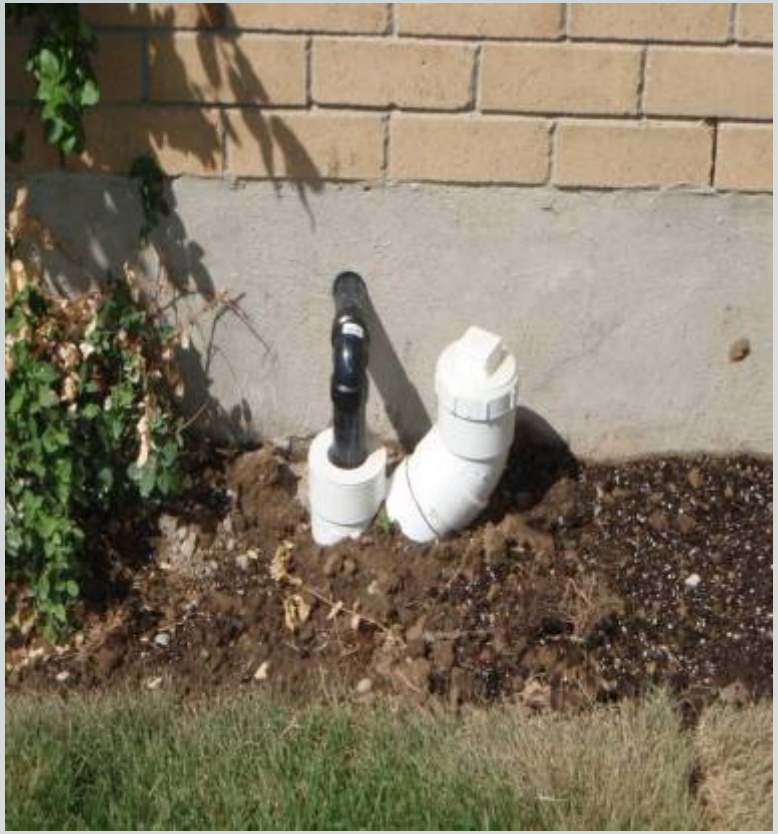
- Protect lawns
- Many PDCs installed using directional drilling method
- Minimized impact to lawns, gardens, etc

External Works – Tight work spaces

- Working in between fences

External works – landscaping considerations

- Storm PDC with cleanout
- Working beside nice rose bushes, other landscaping features important to homeowner



External Works

- Adjacent to gas meters, plants/shrubs

Internal Works

- Tight work spaces

Retrofit - Sump Pumps

Retrofit –
Sump Pump and Backwater Valve

Retrofit – sump pump and backwater valve

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Retrofit - Hardwood floors

Backwater valves

Homeowner Challenges

- Anticipated Challenges
  - Scheduling
  - Duration of work in house
  - Clean up
  - Late sign ups – people wanting to sign up only after construction began
  - Exempt fully finished basements; logistically too difficult to retrofit and restore

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Optics

- Some Concerns from Homeowners;
  - Why aren't you replacing the sidewalk/curb/driveway apron/road?
  - Some had the expectation that since "The City" was coming to do work, that the entire streetscape would be replaced to brand new
  - Reality: we were using sewer $ to fix a basement flooding issue; did not have the $ to focus on curb/sidewalk, etc.
  - What impact will the sump pump have on my home?
  - Are you installing a backup system?

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Post Construction

- To date, pilot project is a success; homeowners generally pleased with work
- Real test will be significant rain event
- Flow monitor in sanitary sewer directly downstream of project
- Ongoing monitoring will take place

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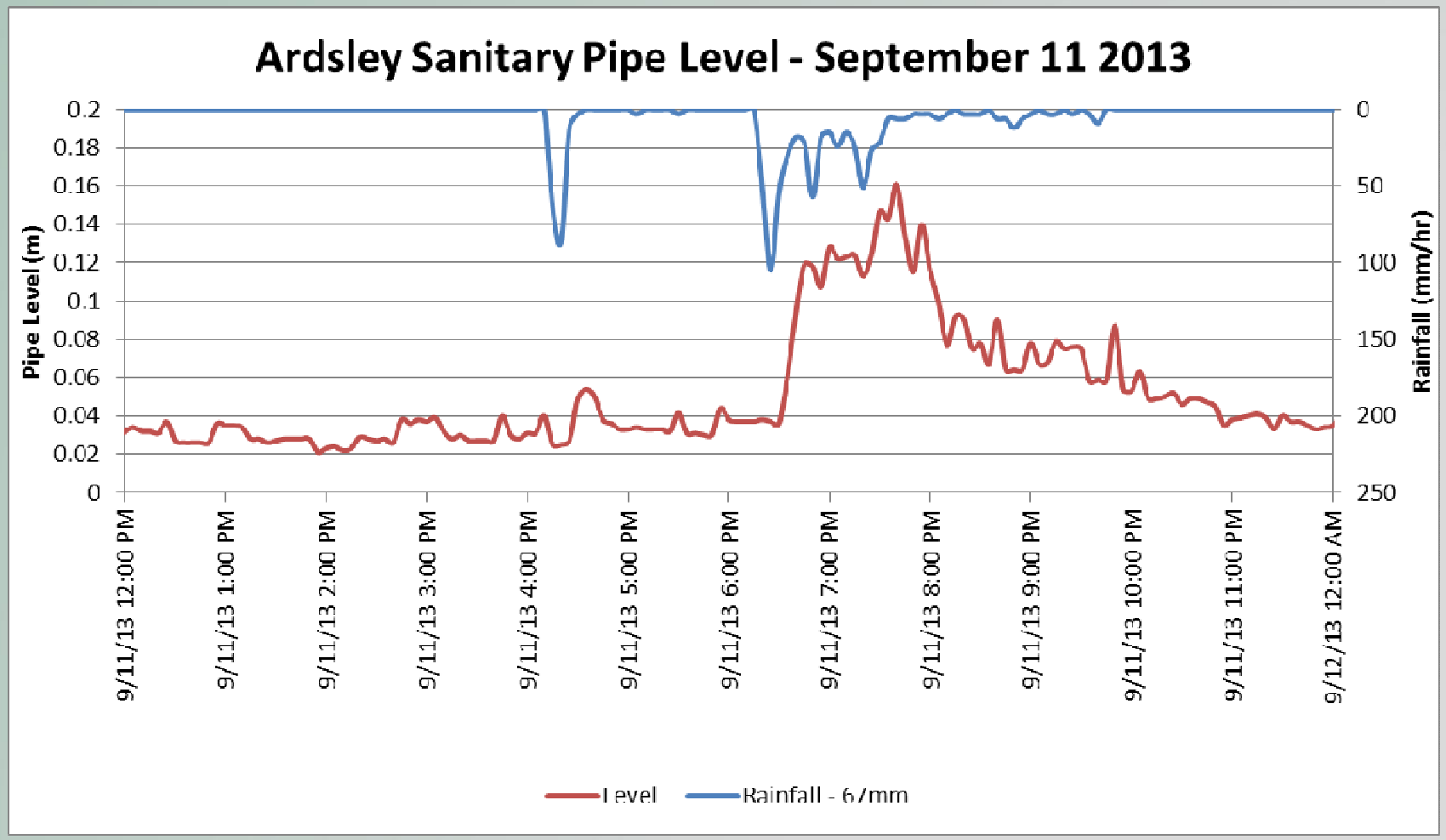
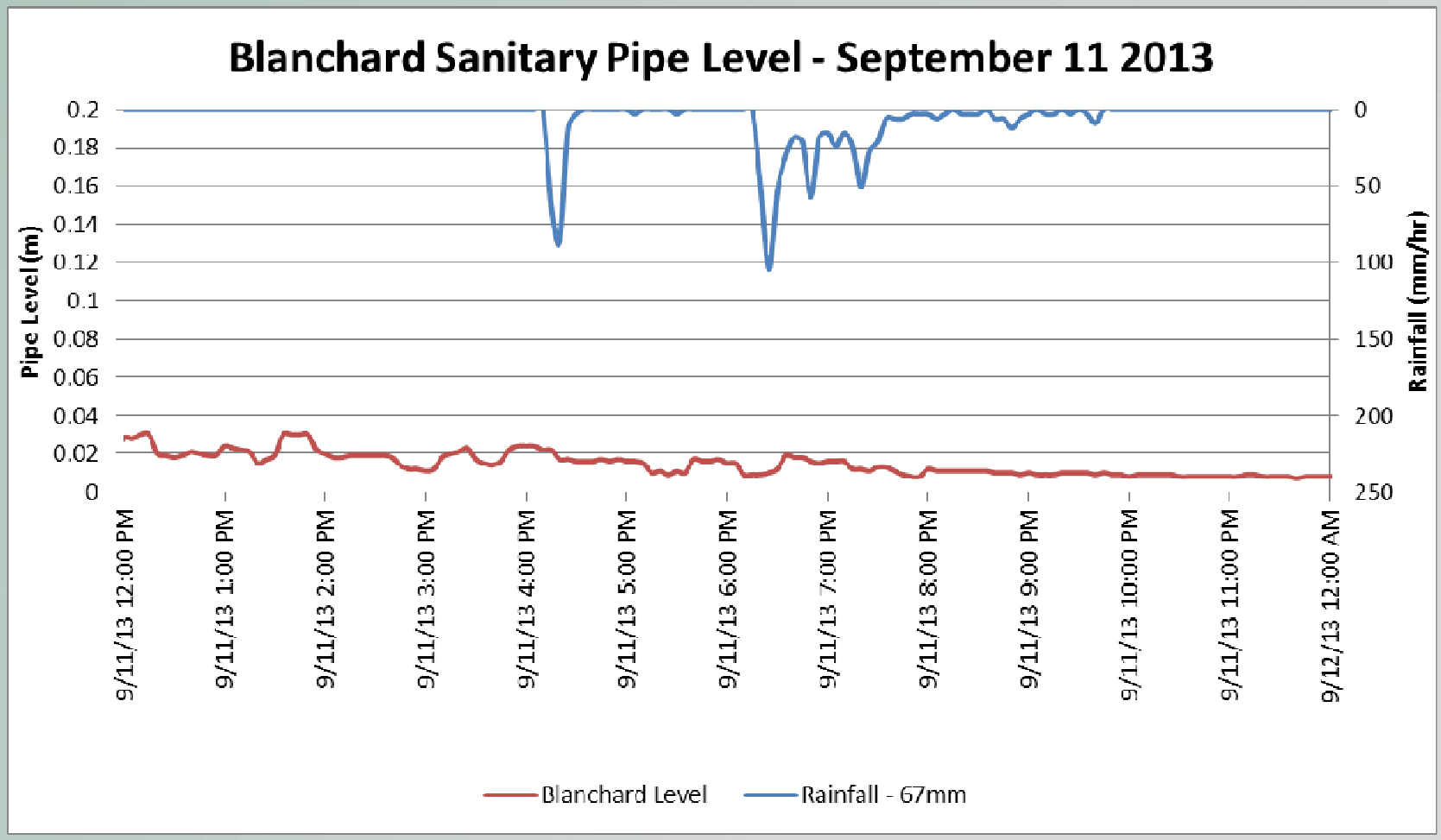
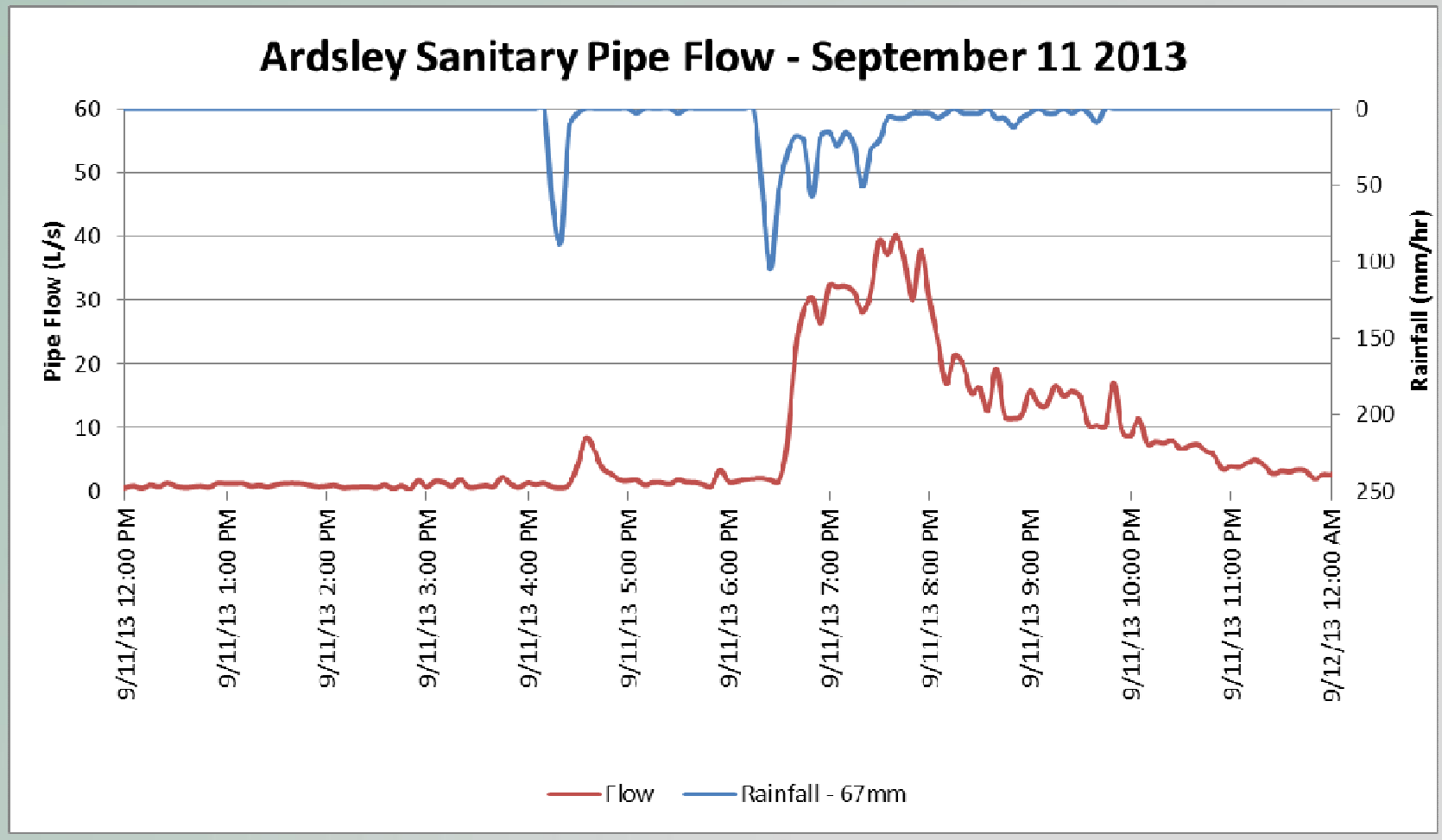
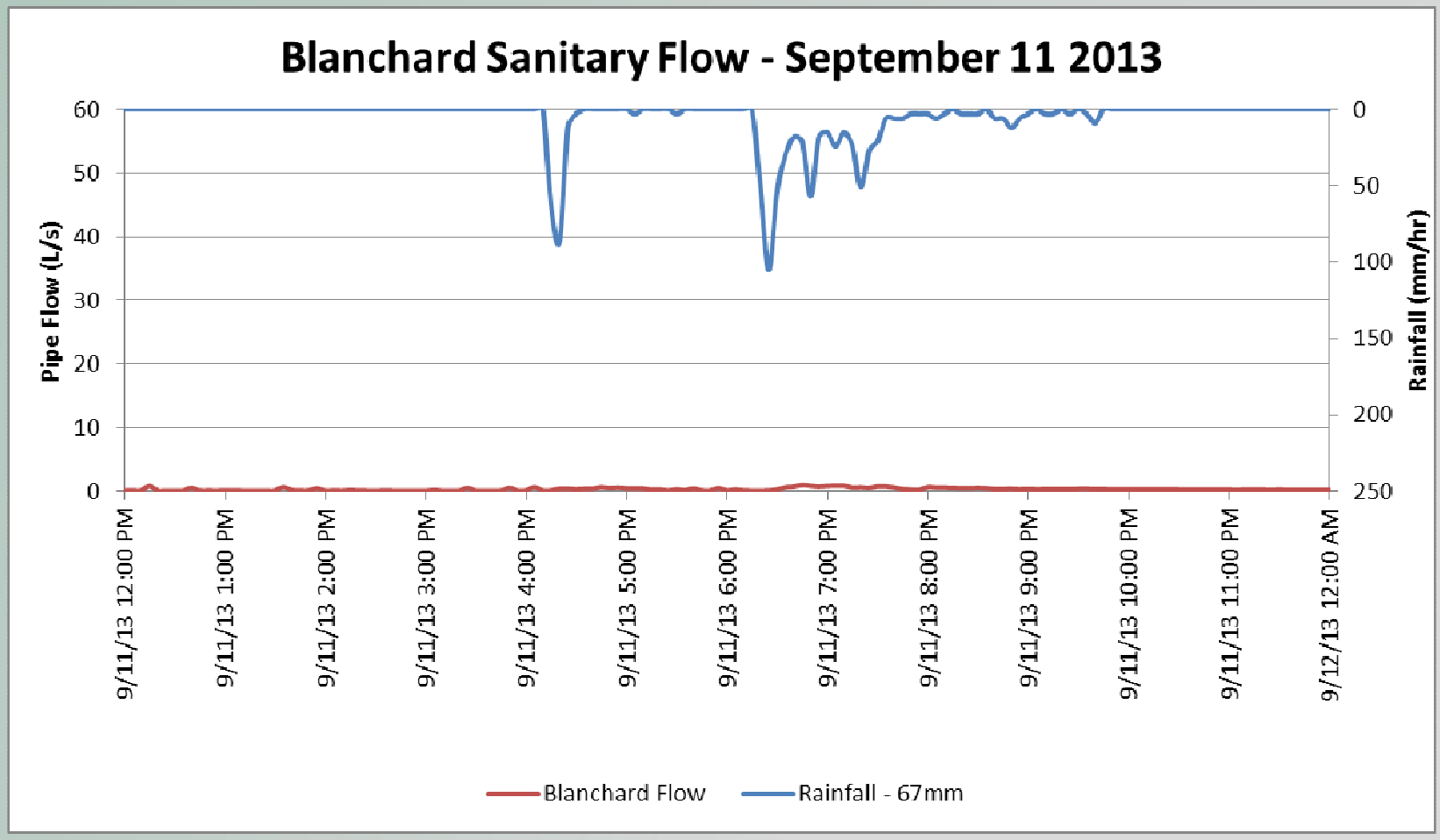
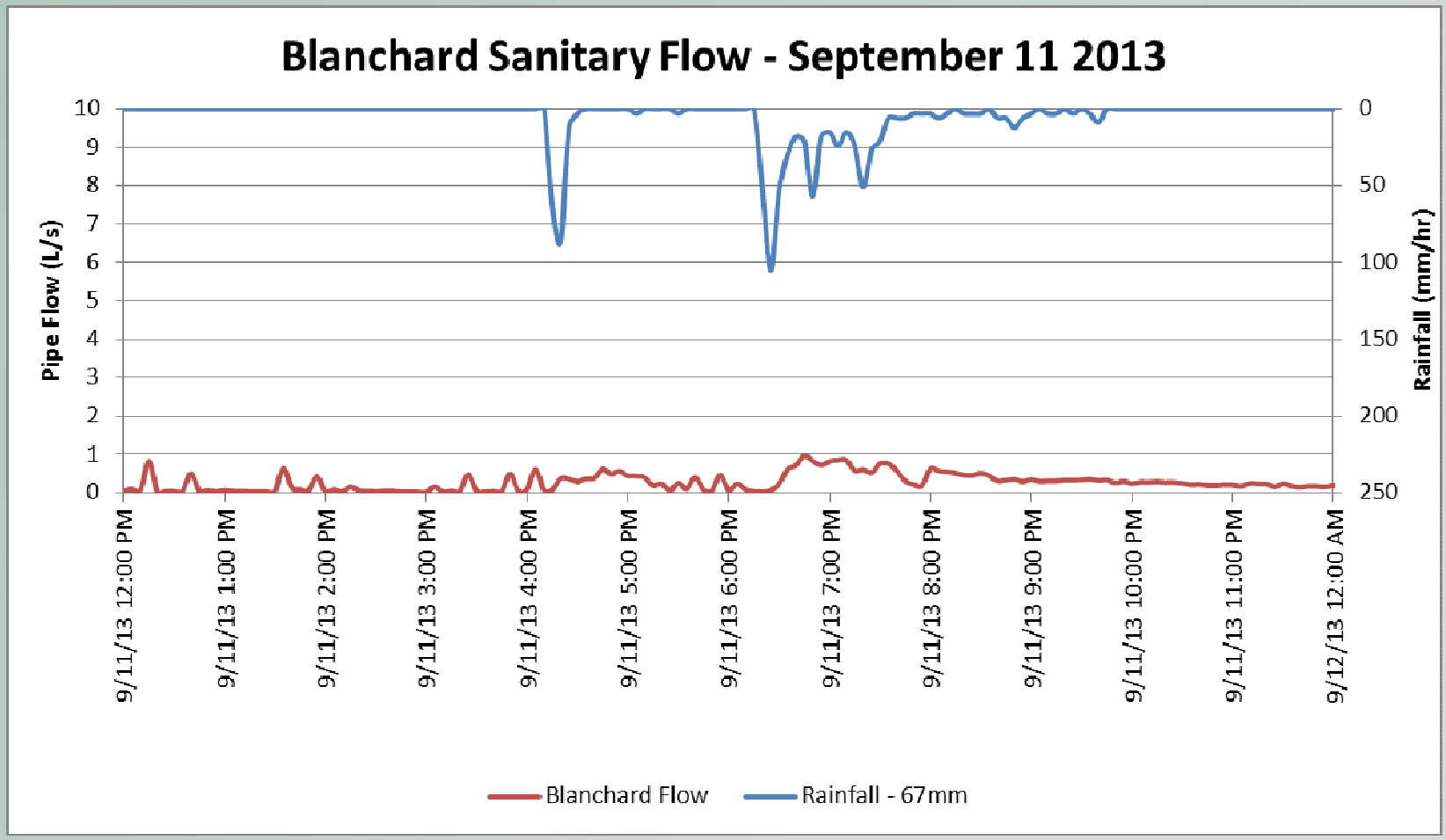

Ardsley Sanitary Pipe Level - September 11 2013
Pipe Level (m)
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Rainfall (mm/hr)
0
50
100
150
200
250
9/11/13 12:00 PM
9/11/13 1:00 PM
9/11/13 2:00 PM
9/11/13 3:00 PM
9/11/13 4:00 PM
9/11/13 5:00 PM
9/11/13 6:00 PM
9/11/13 7:00 PM
9/11/13 8:00 PM
9/11/13 9:00 PM
9/11/13 10:00 PM
9/11/13 11:00 PM
9/12/13 12:00 AM
Level
Rainfall - 6/mm

Post construction – Preliminary flow monitoring




Ardsley Sanitary Pipe Flow - September 11 2013
Pipe Flow (L/s)
Rainfall (mm/hr)
60
50
40
30
20
10
0
0
50
100
150
200
250
9/11/13 12:00 PM
9/11/13 1:00 PM
9/11/13 2:00 PM
9/11/13 3:00 PM
9/11/13 4:00 PM
9/11/13 5:00 PM
9/11/13 6:00 PM
9/11/13 7:00 PM
9/11/13 8:00 PM
9/11/13 9:00 PM
9/11/13 10:00 PM
9/11/13 11:00 PM
9/12/13 12:00 AM
Flow
Rainfall - 67mm


Blanchard Sanitary Flow - September 11 2013
Pipe Flow (L/s)
Rainfall (mm/hr)
60
50
40
30
20
10
0
0
50
100
150
200
250
9/11/13 12:00 PM
9/11/13 1:00 PM
9/11/13 2:00 PM
9/11/13 3:00 PM
9/11/13 4:00 PM
9/11/13 5:00 PM
9/11/13 6:00 PM
9/11/13 7:00 PM
9/11/13 8:00 PM
9/11/13 9:00 PM
9/11/13 10:00 PM
9/11/13 11:00 PM
9/12/13 12:00 AM
Blanchard Flow
Rainfall - 67mm


Blanchard Sanitary Flow - September 11 2013
Pipe Flow (L/s)
Rainfall (mm/hr)
10
9
8
7
6
5
4
3
2
1
0
0
50
100
150
200
250
9/11/13 12:00 PM
9/11/13 1:00 PM
9/11/13 2:00 PM
9/11/13 3:00 PM
9/11/13 4:00 PM
9/11/13 5:00 PM
9/11/13 6:00 PM
9/11/13 7:00 PM
9/11/13 8:00 PM
9/11/13 9:00 PM
9/11/13 10:00 PM
9/11/13 11:00 PM
9/12/13 12:00 AM
Blanchard Flow
Rainfall - 67mm

Preliminary Results

- No wet weather impacts appear for Blanchard Crescent in comparison to Ardsley Crescent, which had a large wet weather response
- Initial monitoring suggests the Blanchard disconnection program is a success

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Next Steps

- Present the project findings to homeowners
- Initiate another street of disconnections given our success
- Investigate geotechnical conditions to determine if more targeted weeping tile disconnections can be done; are soil conditions and groundwater levels only in certain pockets of a given street?

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Thank You

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