

# Green Infrastructure in New York City

## Stormwater Source Control Performance

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Biohabitats

HydroQual

HAZEN AND SAWYER

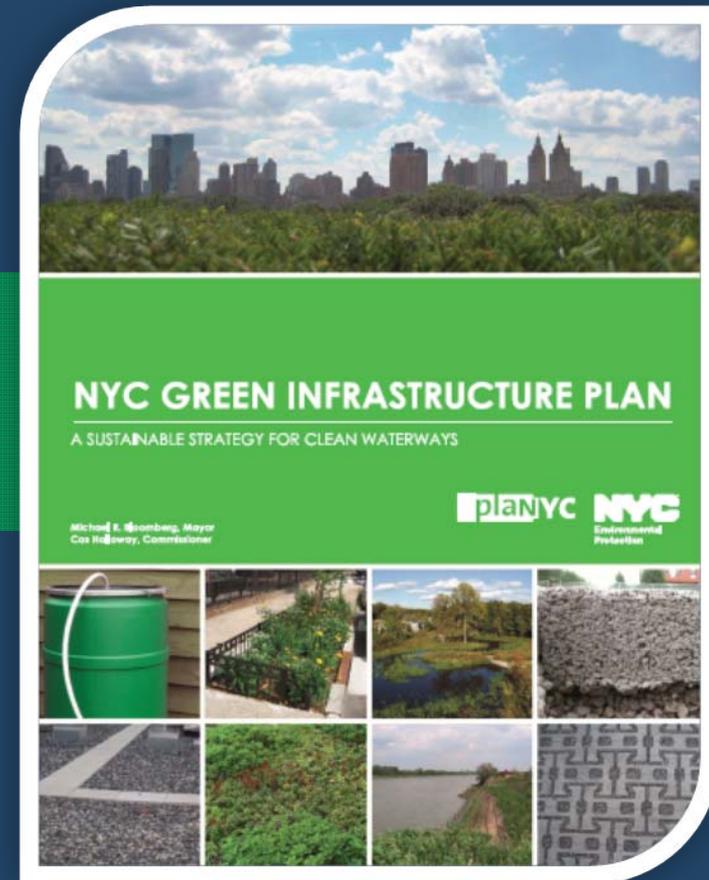


# Acknowledgements

- NYC DEP
- Horsley-Witten
- GeoSyntec
- Brooklyn College

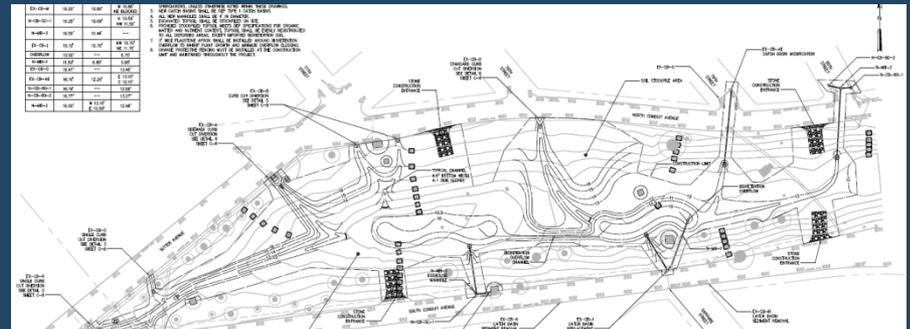
# NYC Green Infrastructure Plan

- 1 Build cost-effective grey infrastructure
- 2 Optimize the existing wastewater system
- 3 Control runoff from 10% of impervious surfaces through green infrastructure and other source controls
- 4 Institutionalize adaptive management, model impacts, measure CSOs, and monitor water quality
- 5 Sustain stakeholder engagement

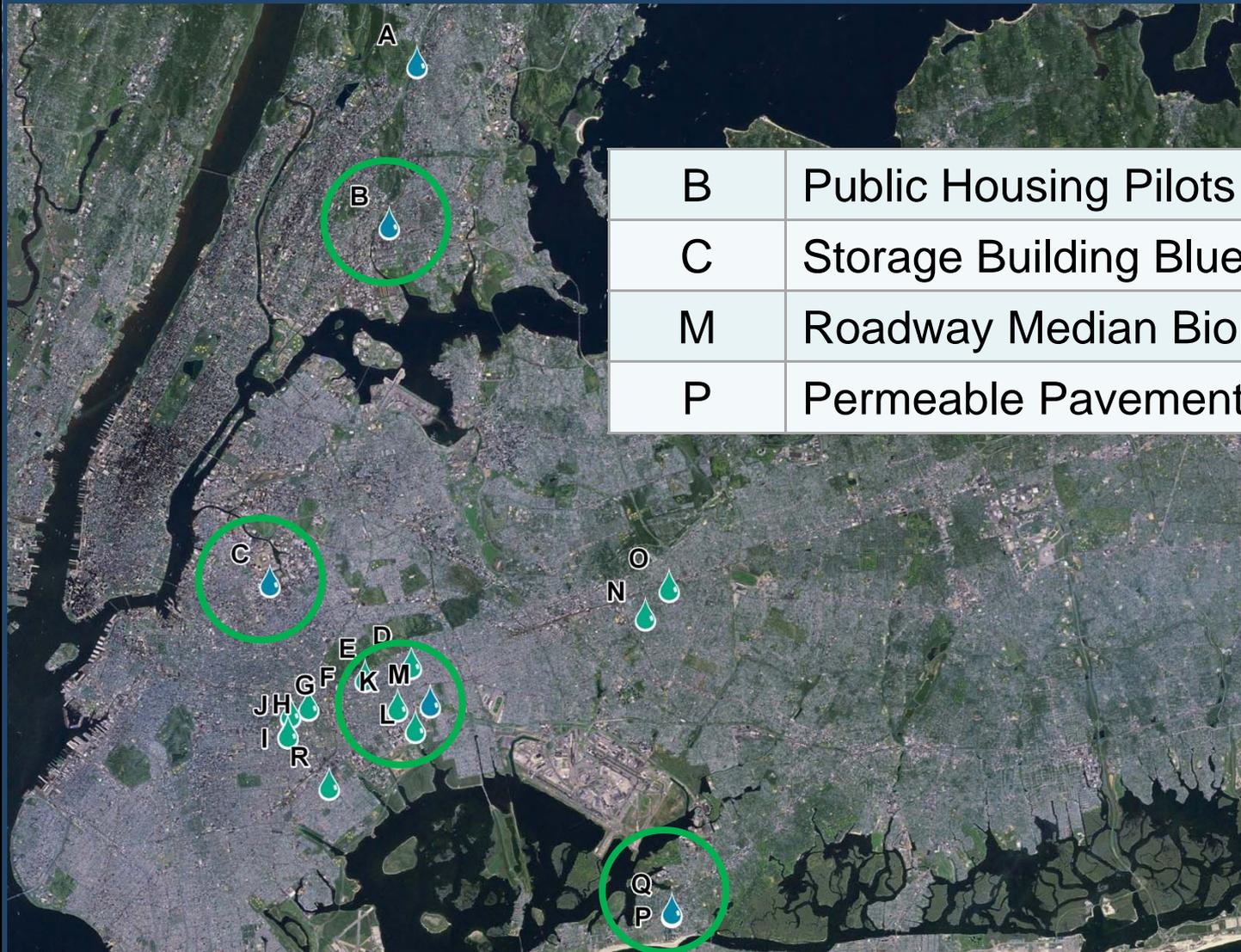


# Stormwater Pilot Study Objectives

- Develop stormwater pilot designs
- Construct and maintain pilots within NYC
- Evaluate pilot performance

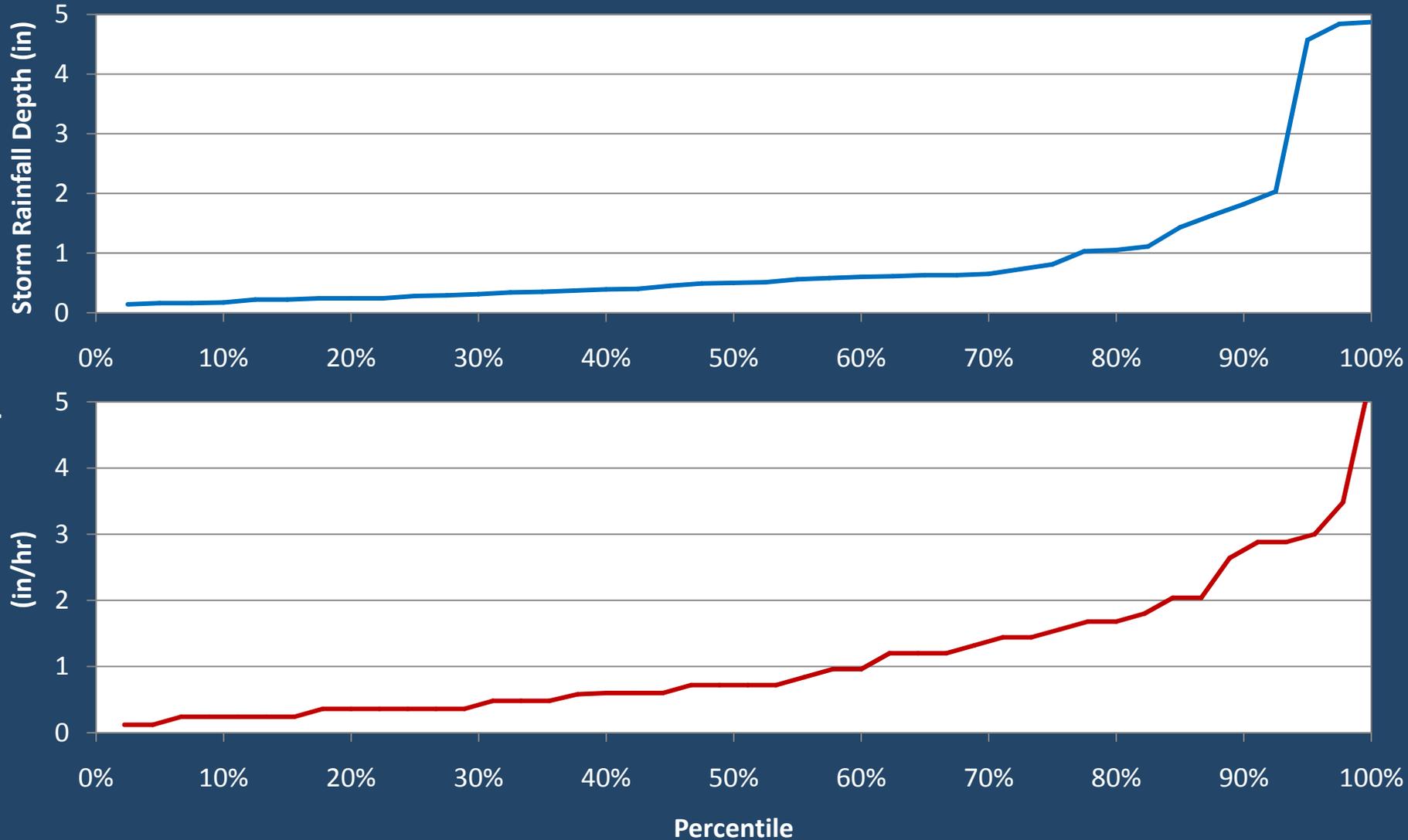


# Stormwater Pilot Highlights

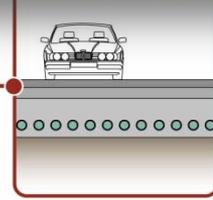


B	Public Housing Pilots
C	Storage Building Blue Roof
M	Roadway Median Bioretention
P	Permeable Pavement

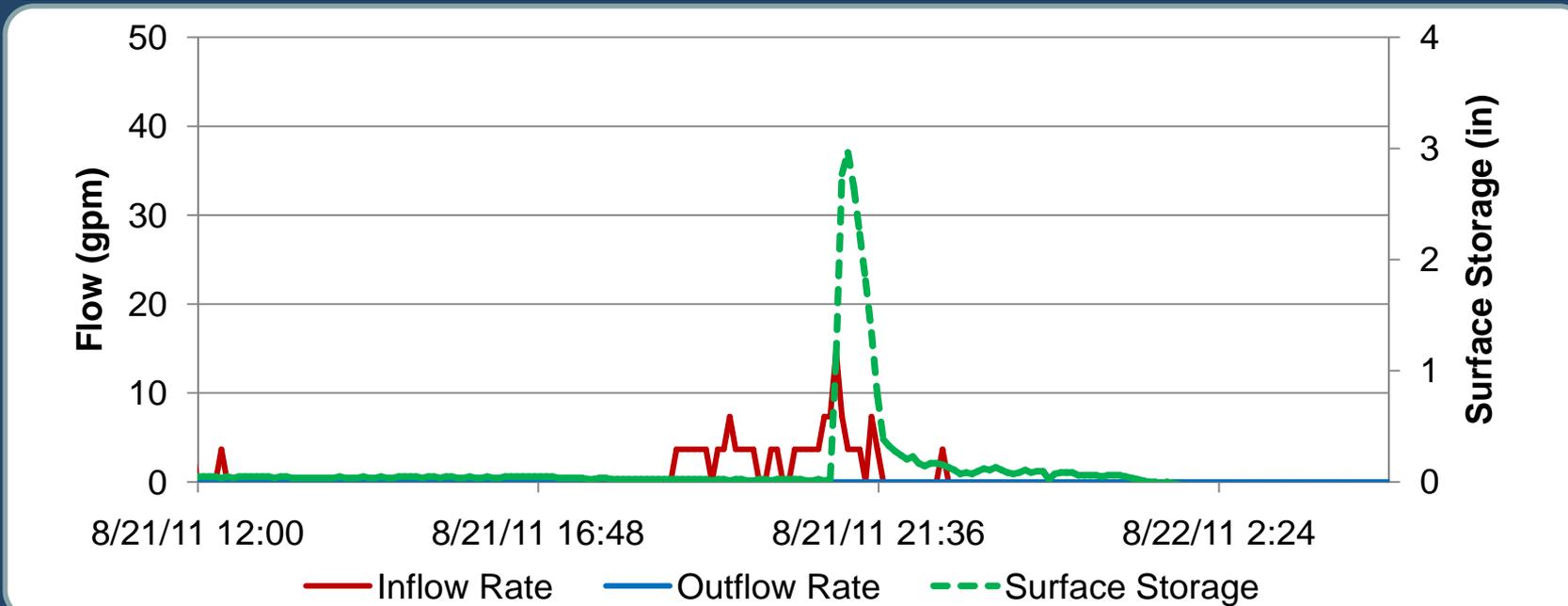
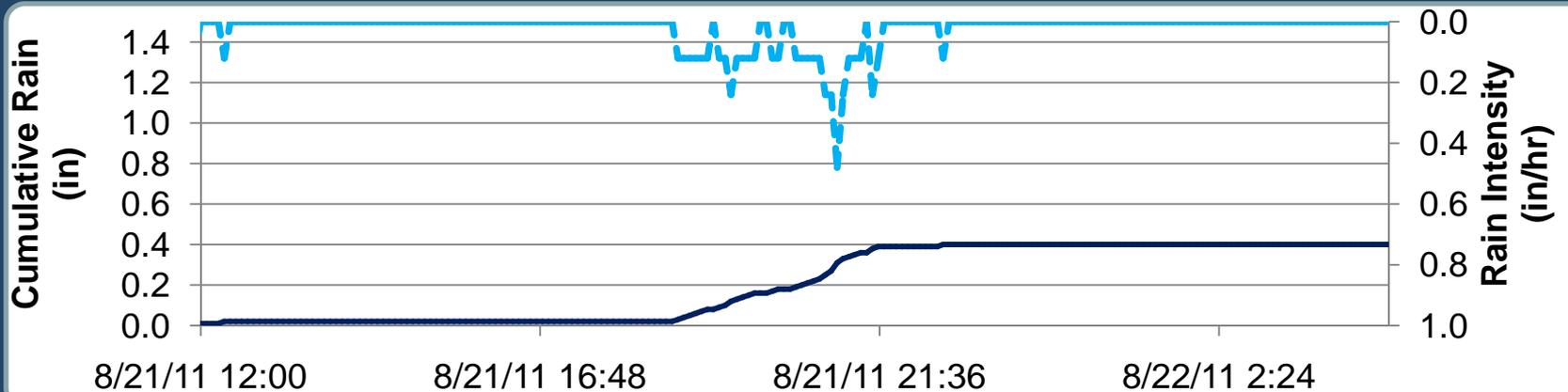
# 2011 Precipitation Patterns



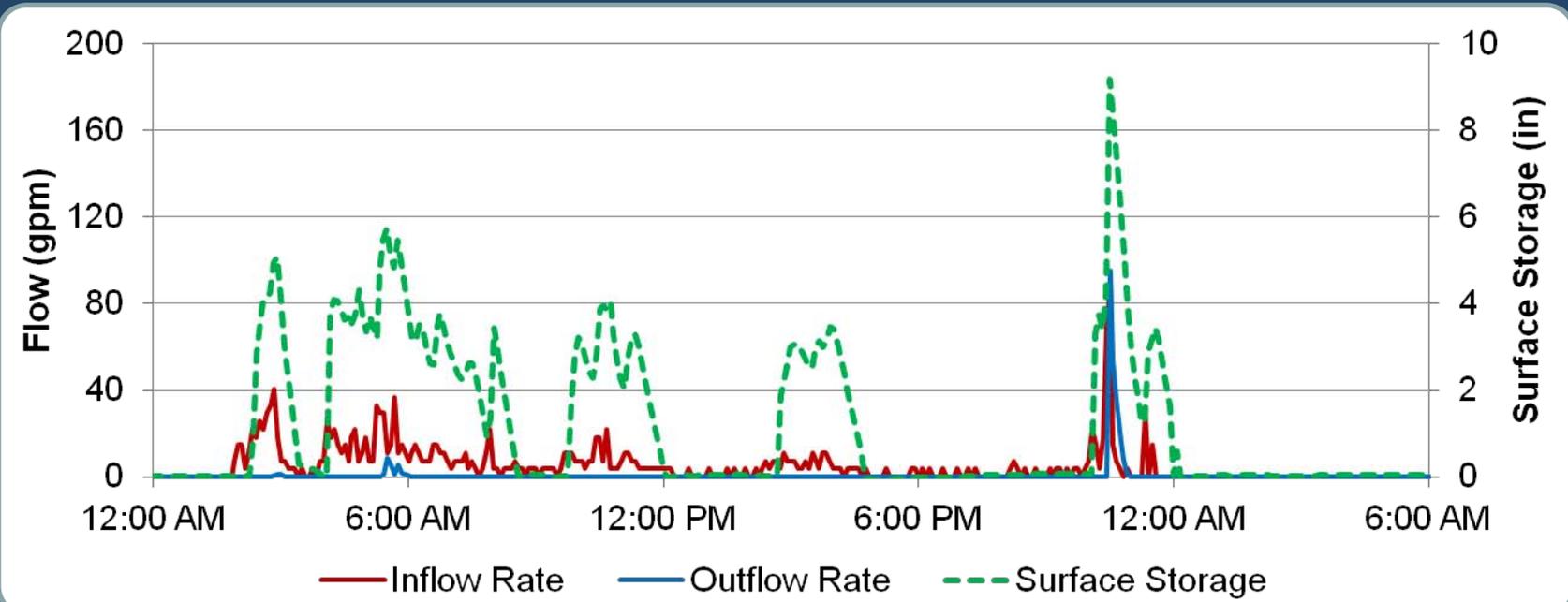
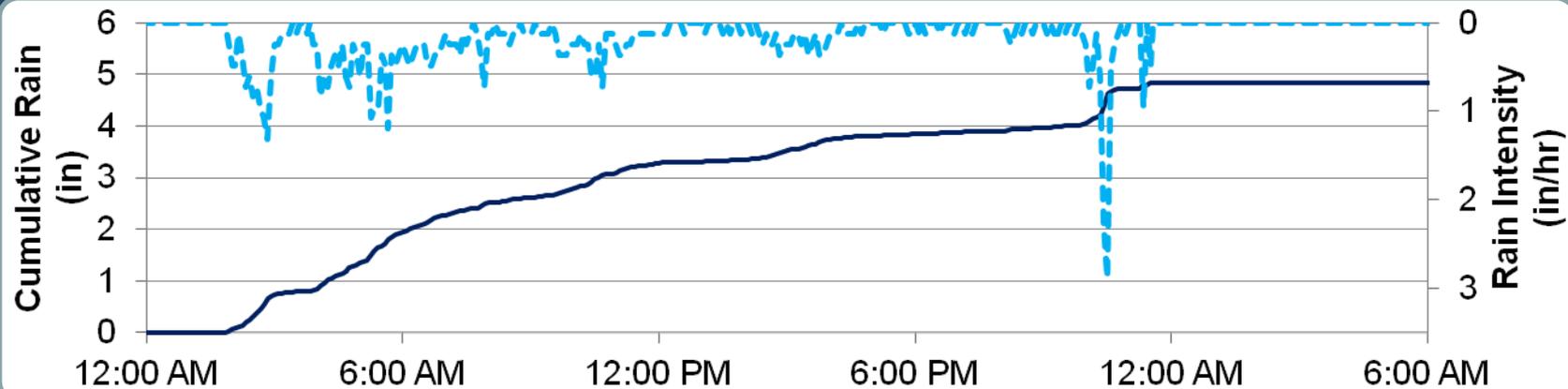
# Bioretention



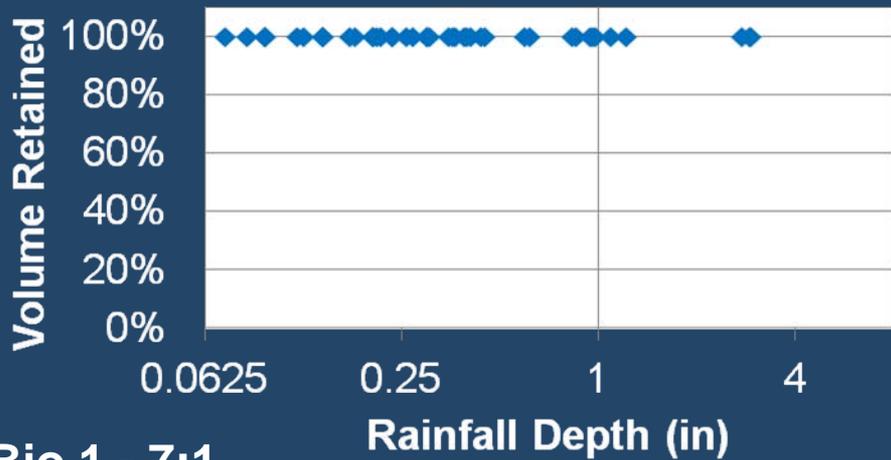
# Bioretention: Example 0.4" Storm



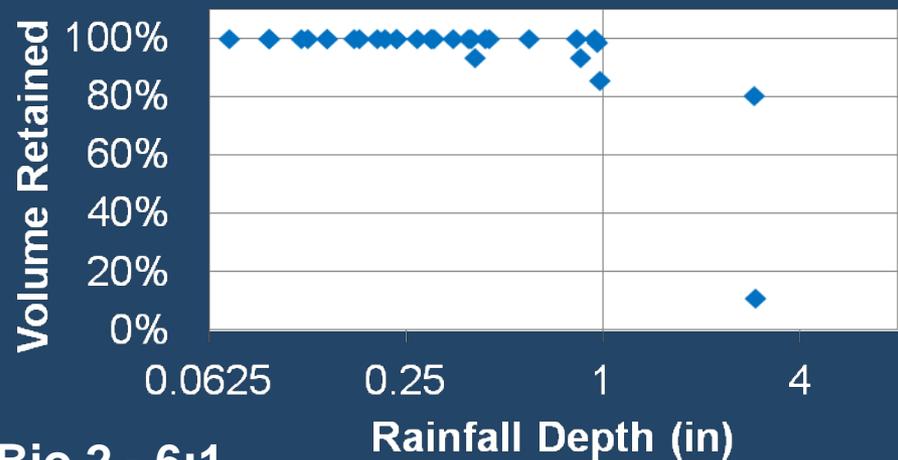
# Bioretention: Example 4.8” Storm



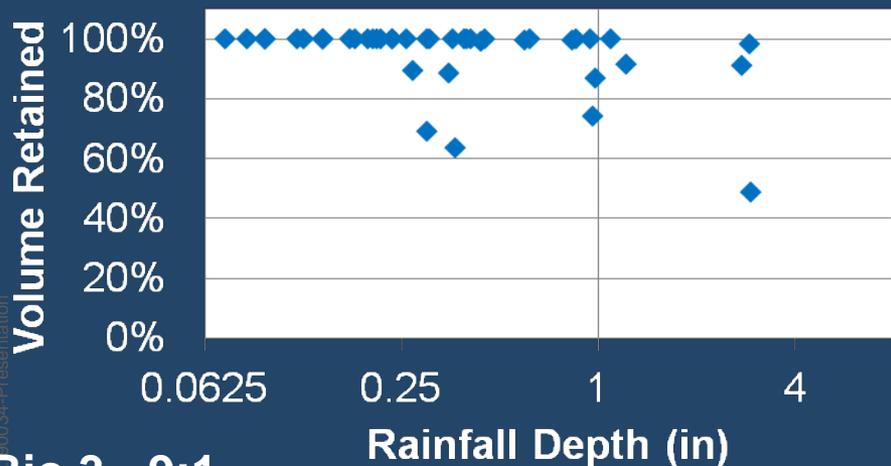
# Bioretention 1-4: Vol. Retained



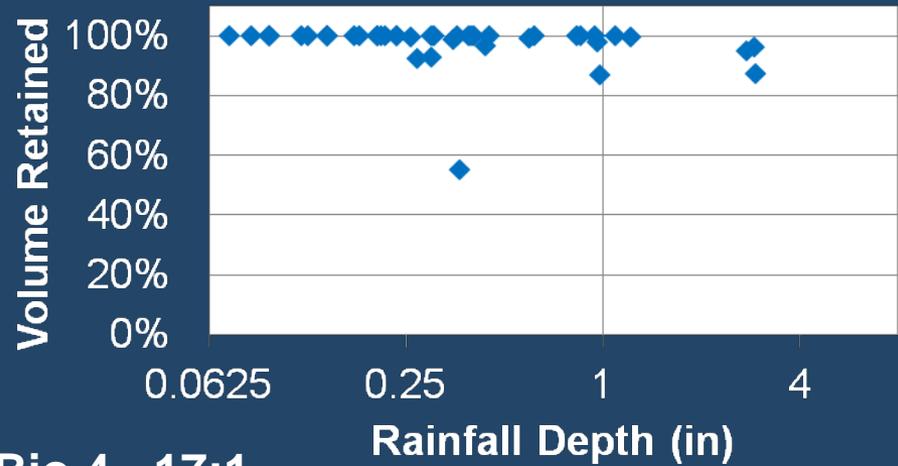
**Bio 1 - 7:1**



**Bio 2 - 6:1**



**Bio 3 - 9:1**

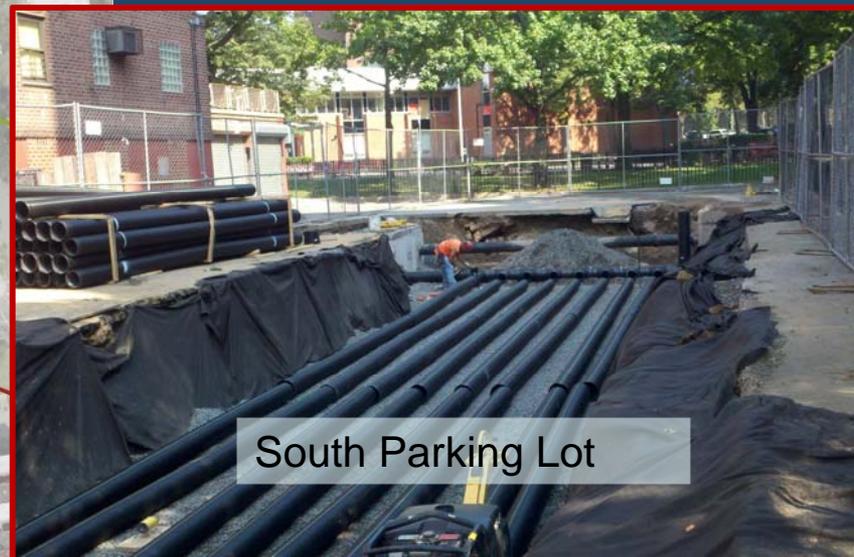


**Bio 4 - 17:1**

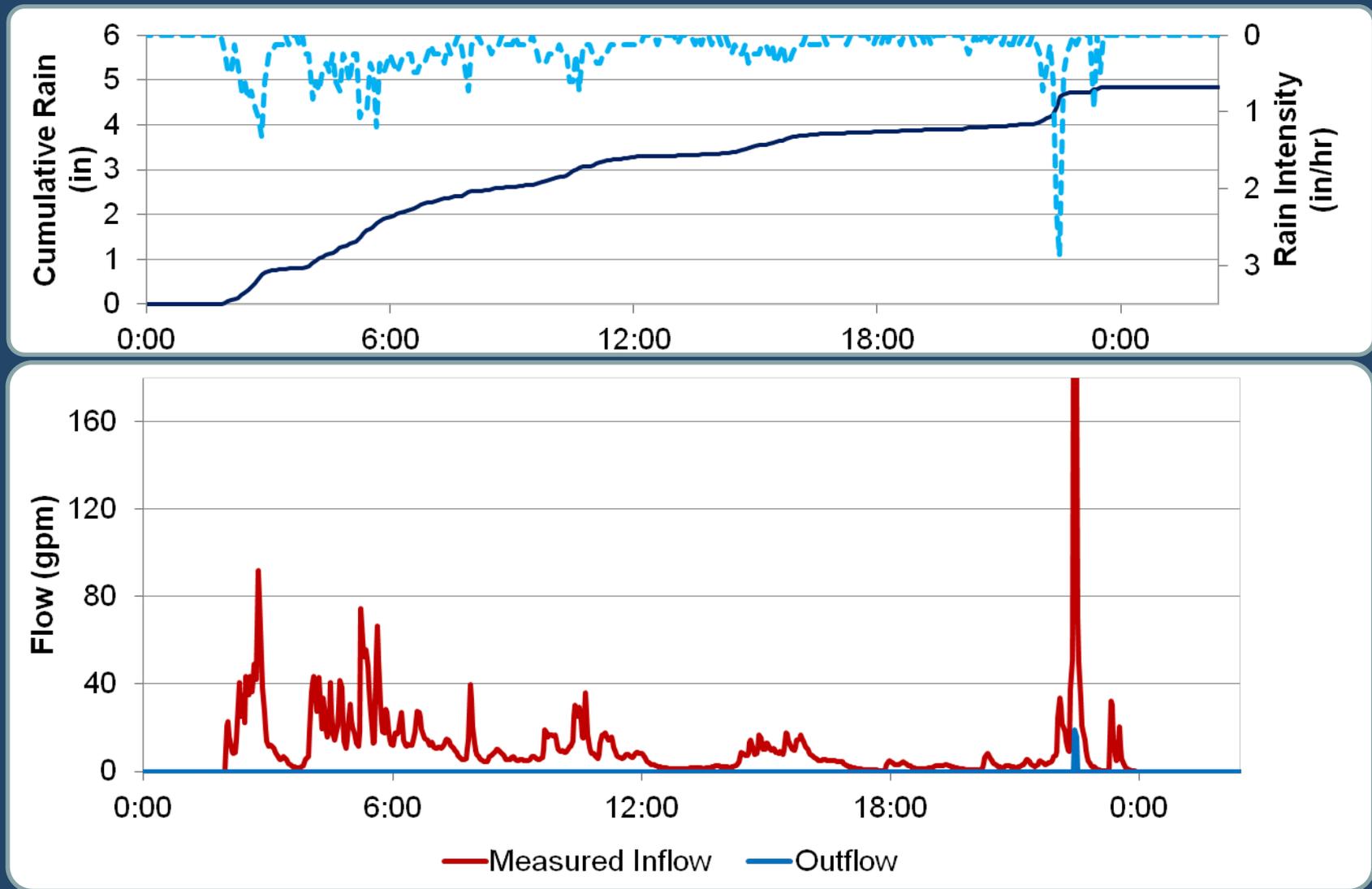
# Bioretention: Preliminary Observations

- Bioretention areas retaining much of the water they receive
  - Most outflow associated with storms  $>1''$
- Curb cuts are not 100% effective at runoff capture
- Leaf and litter pickup part of routine maintenance
- Community frequently comments on BMPs and are interested in project

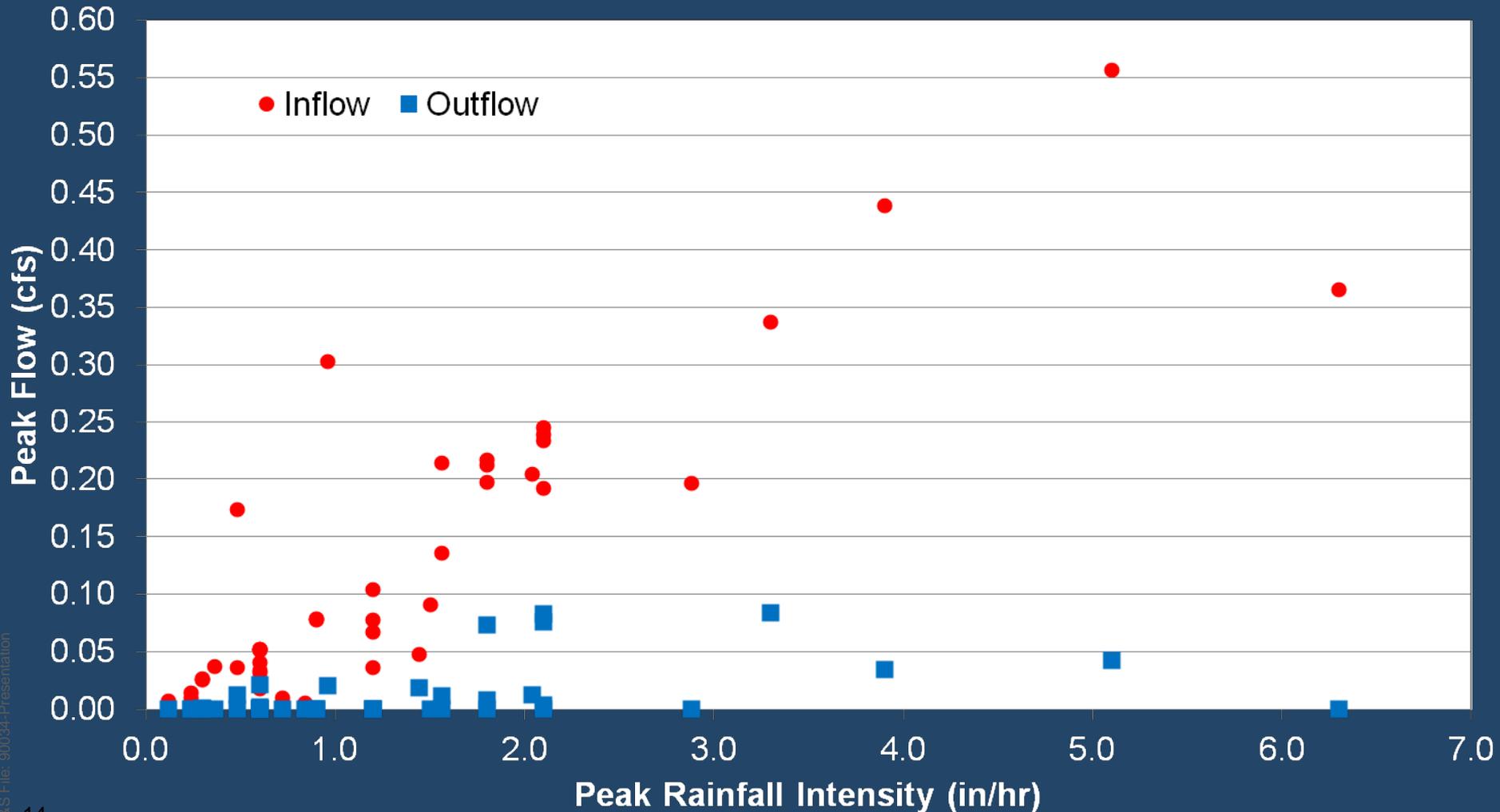
# Subsurface Detention & Infiltration



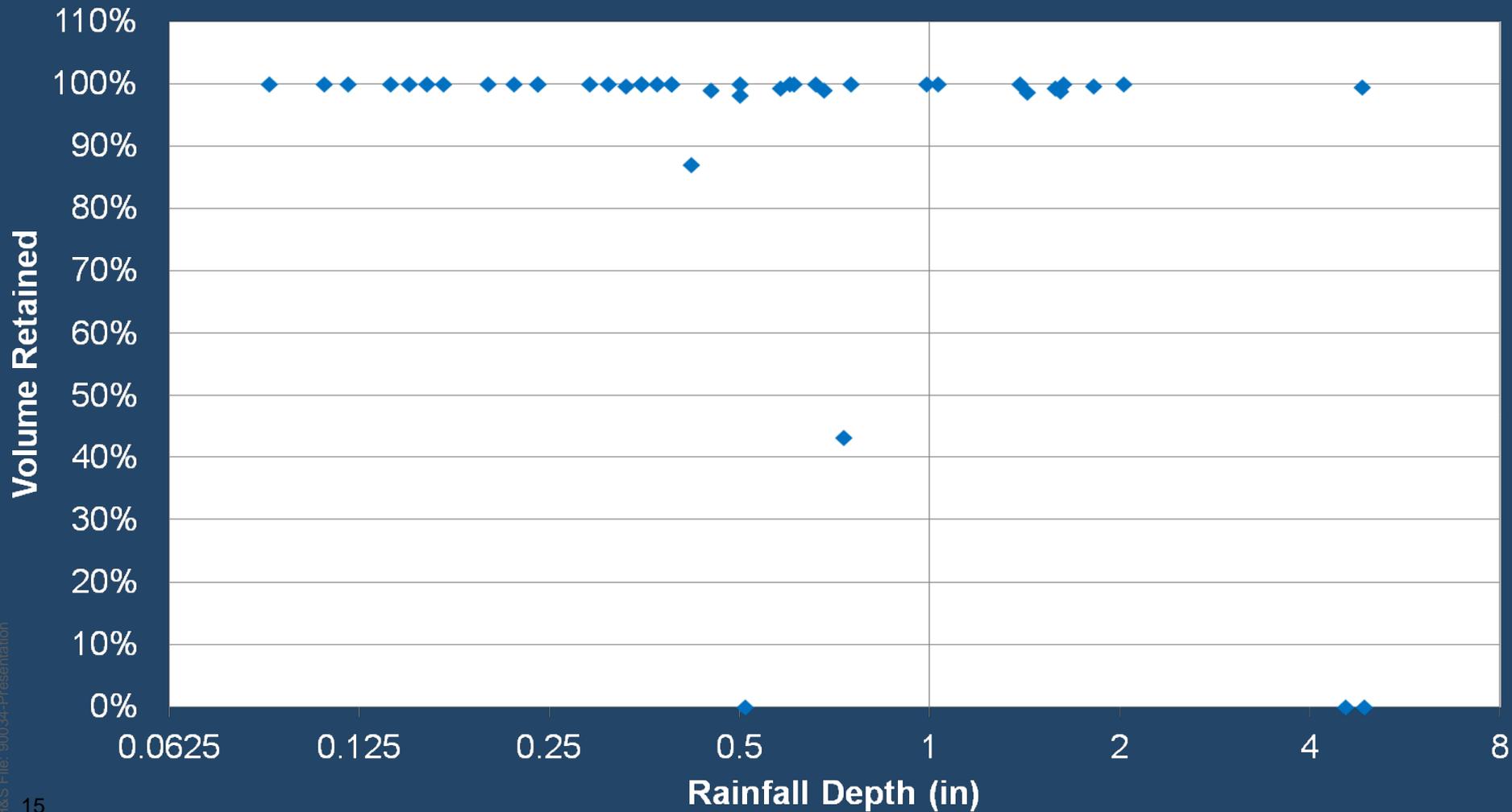
# Stormwater Chambers: Example 4.8” Storm



# Stormwater Chambers: Inflow and Outflow



# Stormwater Chambers: Volume Retained



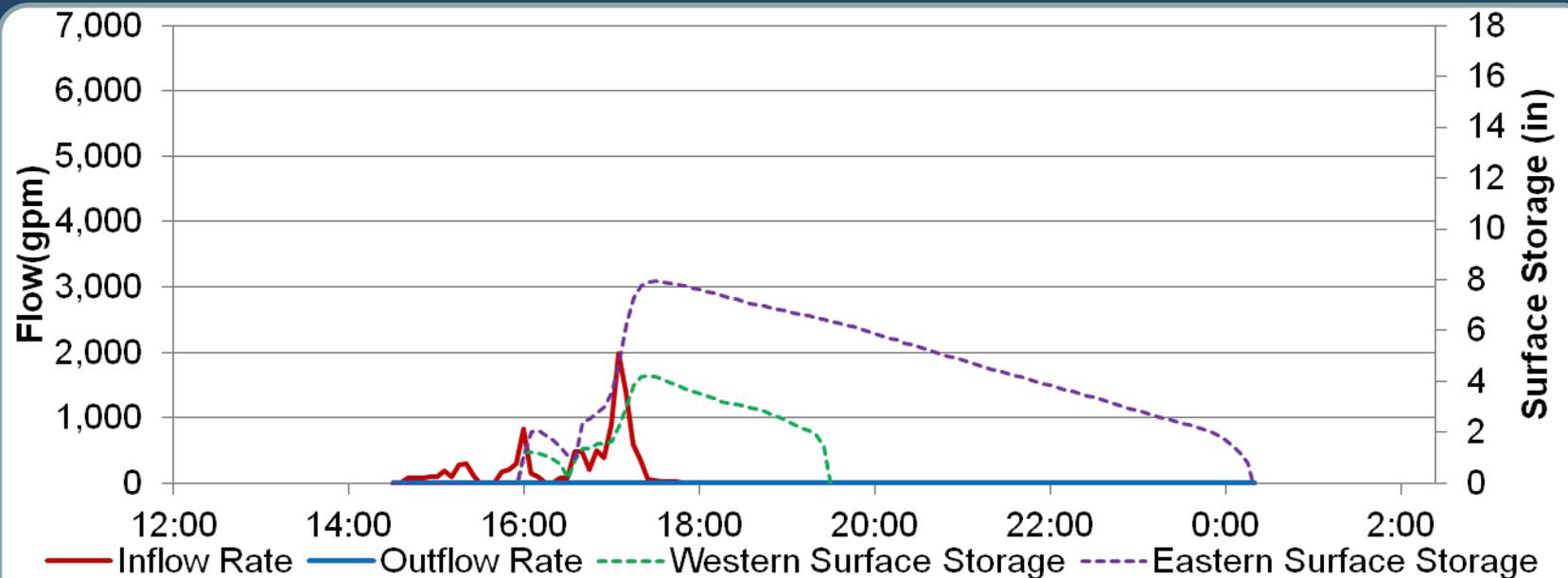
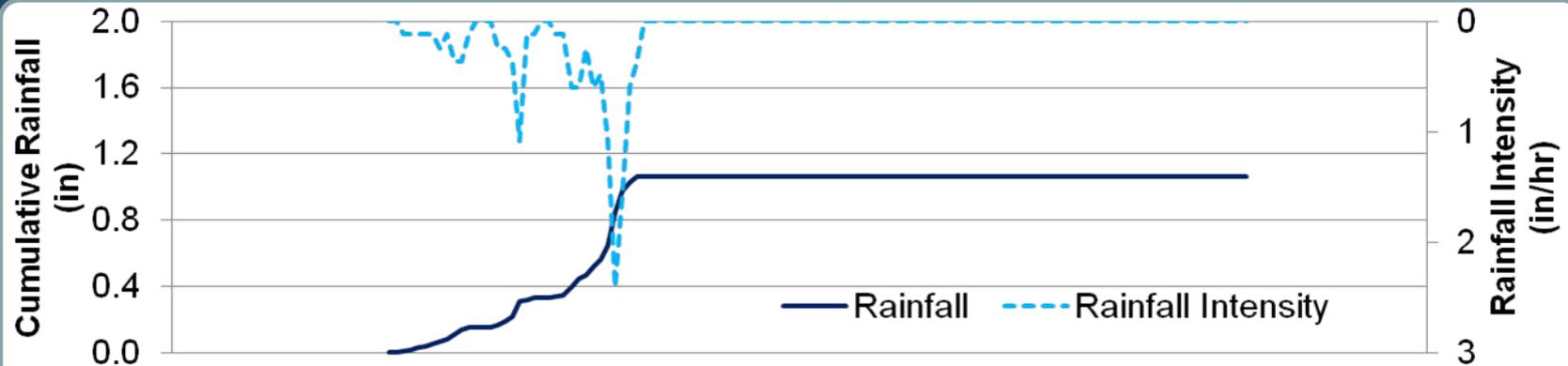
# Stormwater Chambers: Preliminary Observations

- Subsurface systems effective at capturing runoff (no bypass)
- Chamber system not generating consistent outflow
- Outflow rates have been below design target (0.25 cfs)
- No substantial maintenance needs

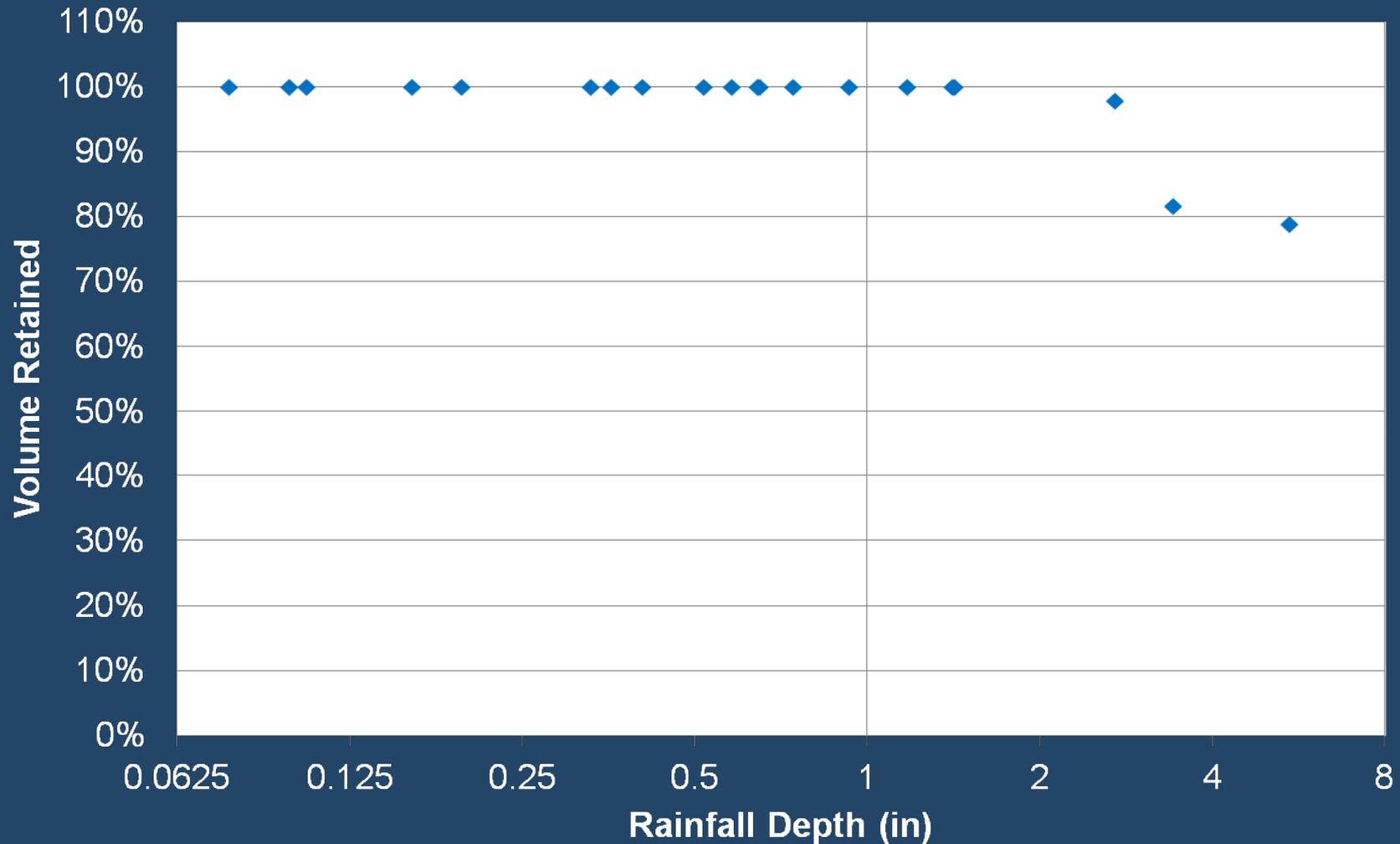
# Roadway Median Bioretention



# Median Bioretention: Example 1.1” Storm

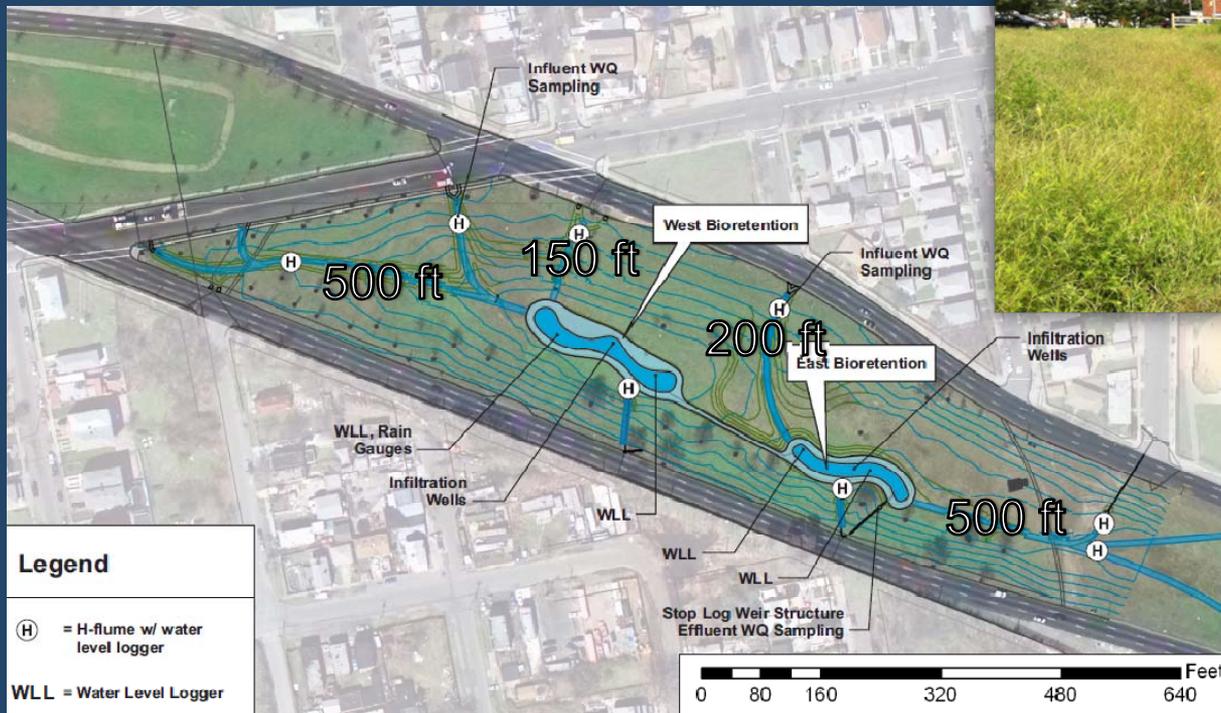


# Median Bioretention: Vol. Retained



# N&S Conduit Bioretention: Preliminary Observations

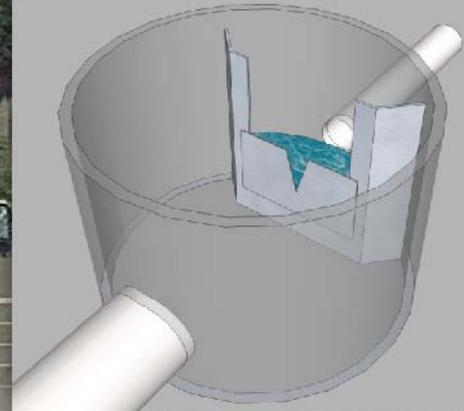
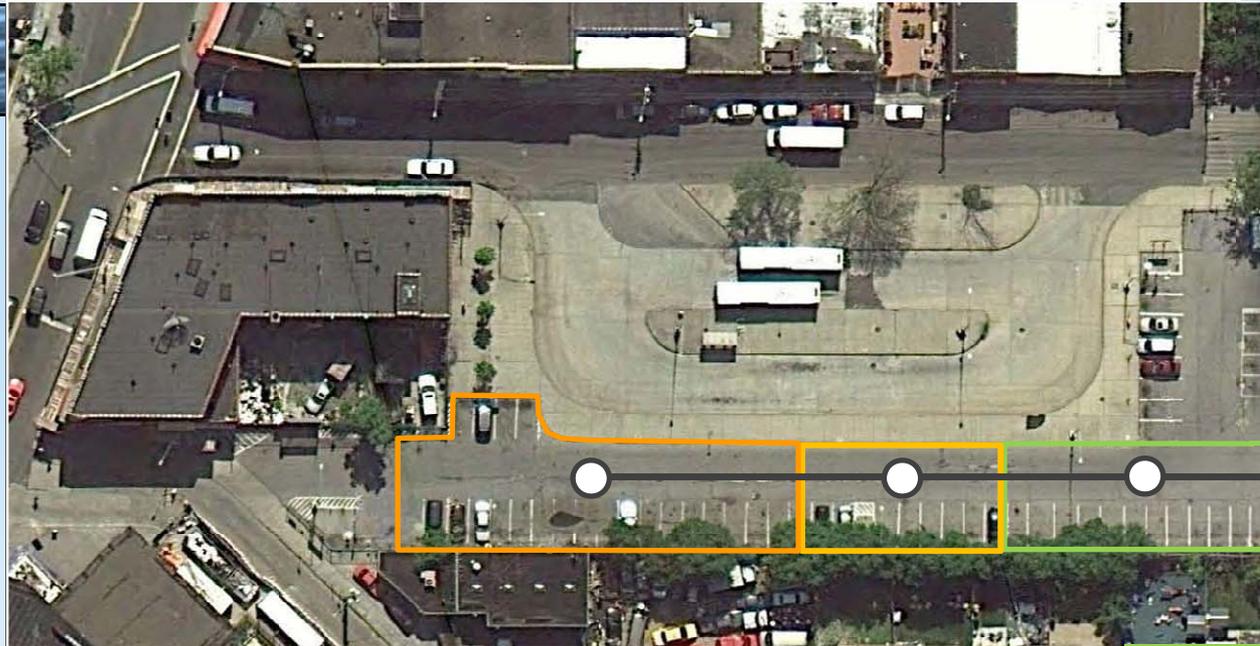
- Most storms have been fully retained
- Apparent infiltration losses along conveyance swales



# Permeable Pavement



# Permeable Pavement



Porous Asphalt

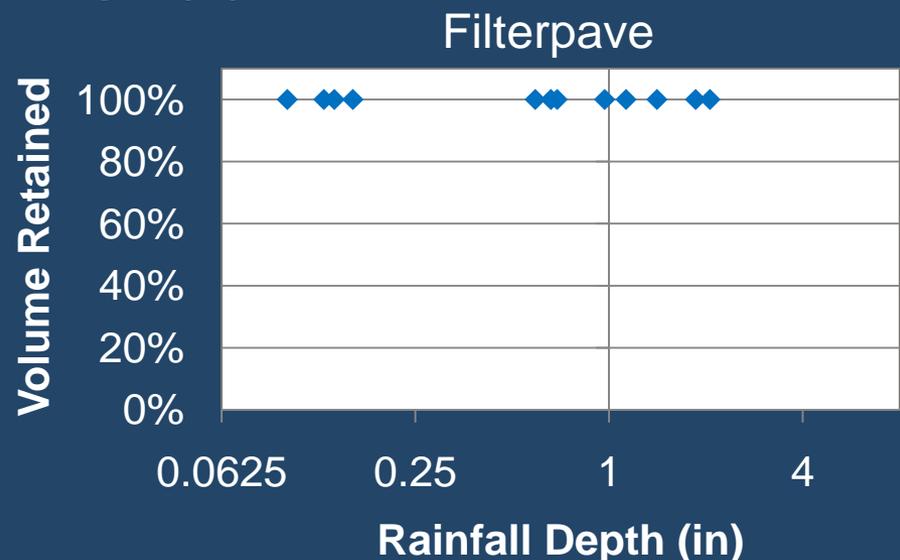
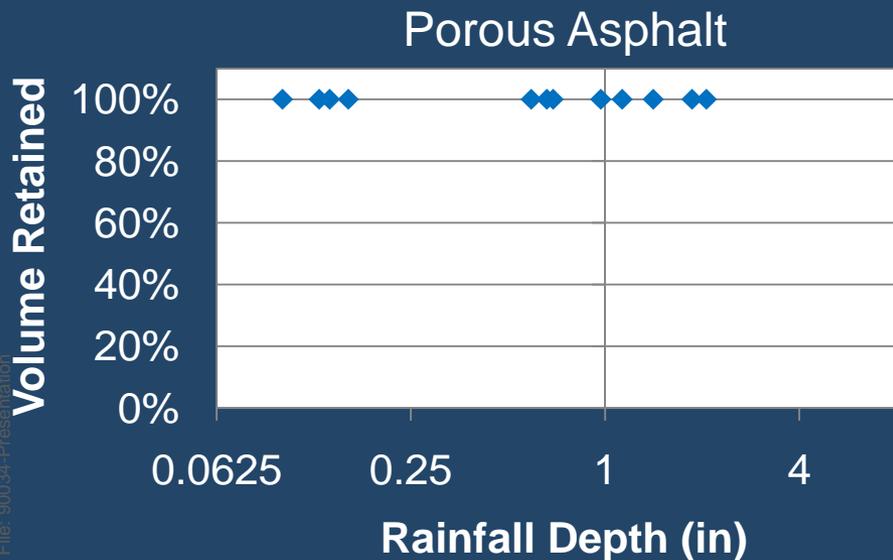
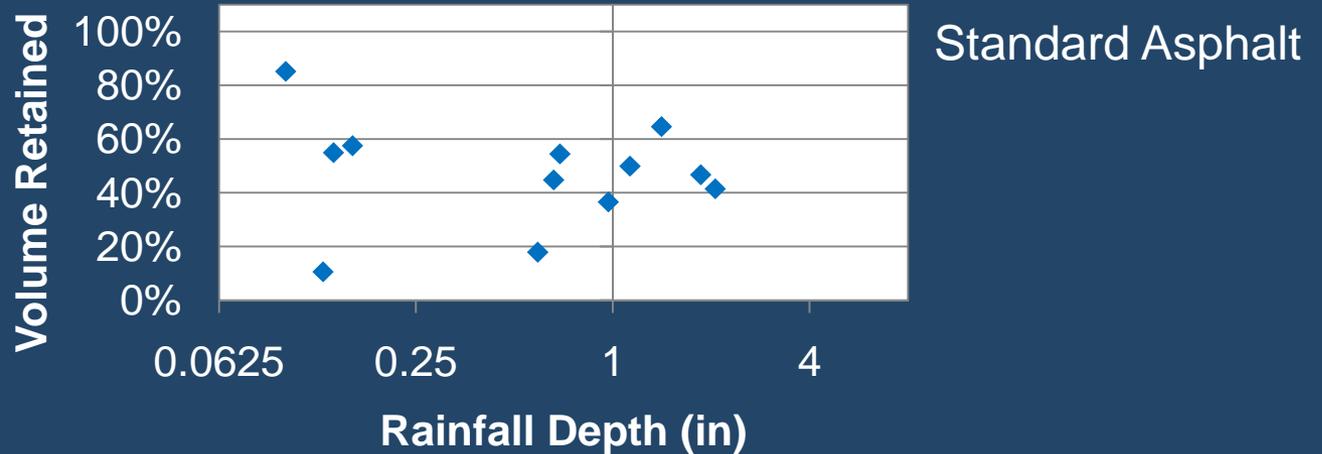


Standard Asphalt



FilterPave

# Permeable Pavement

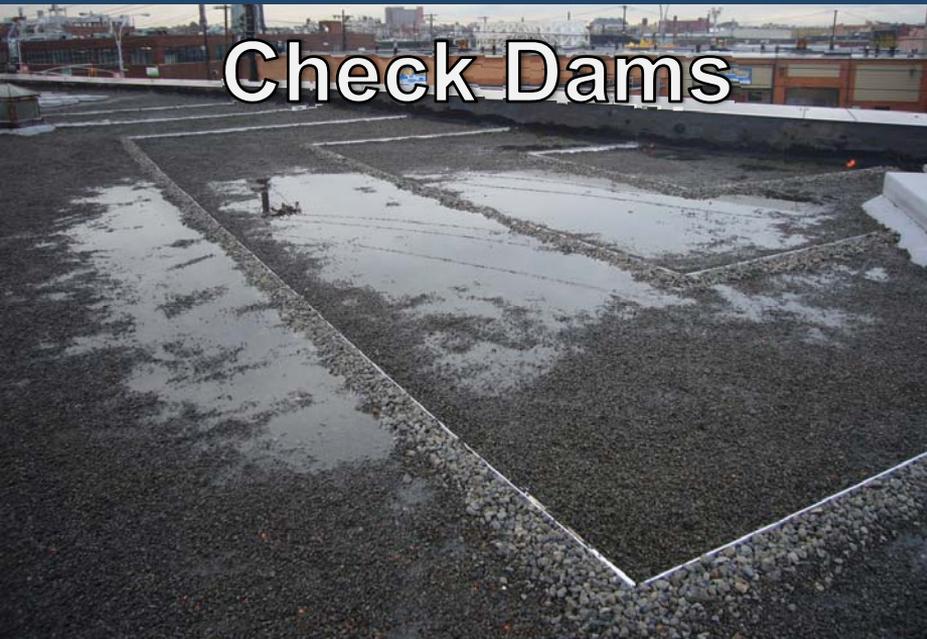
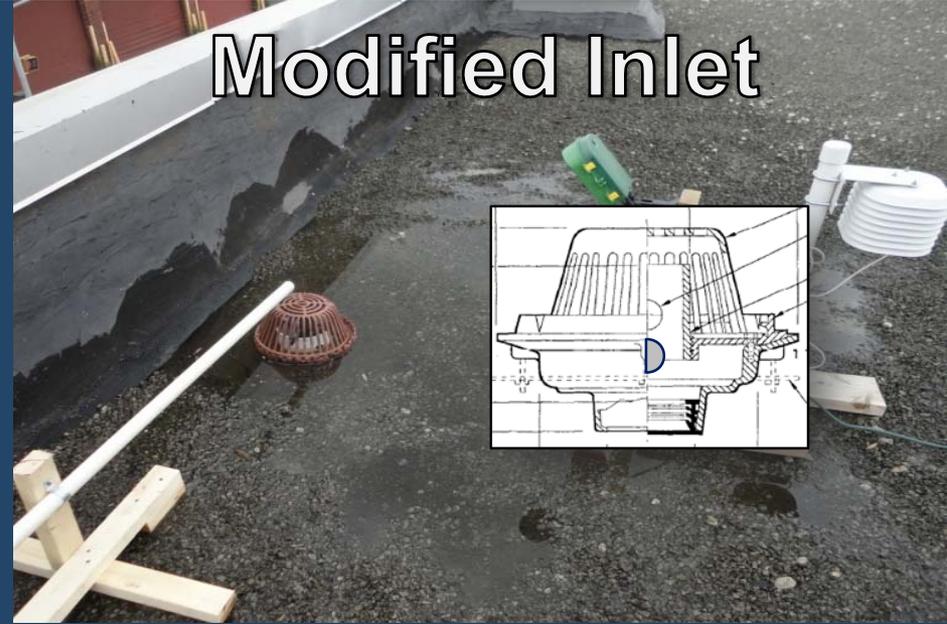
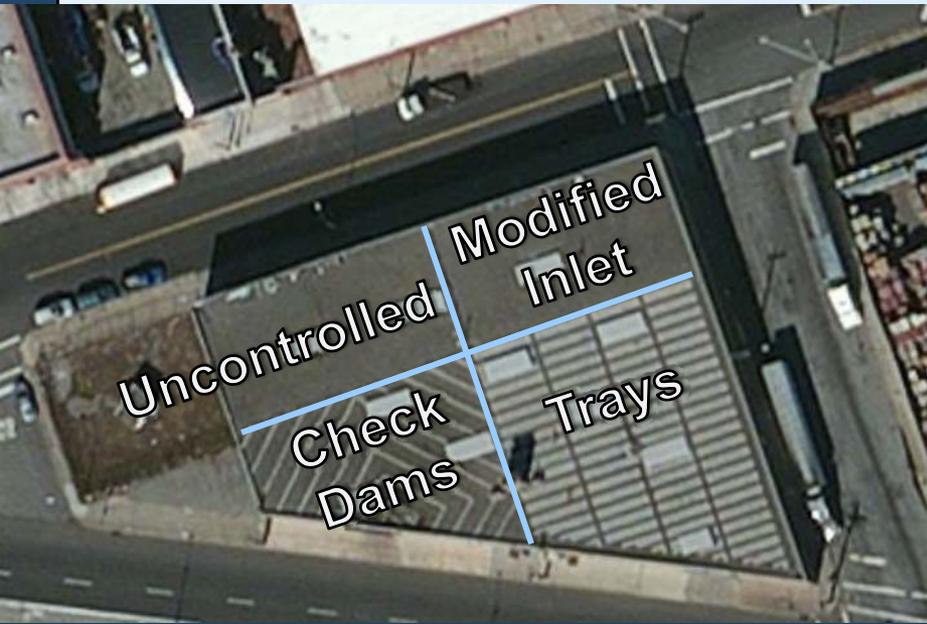


# Permeable Pavement: Preliminary Observations

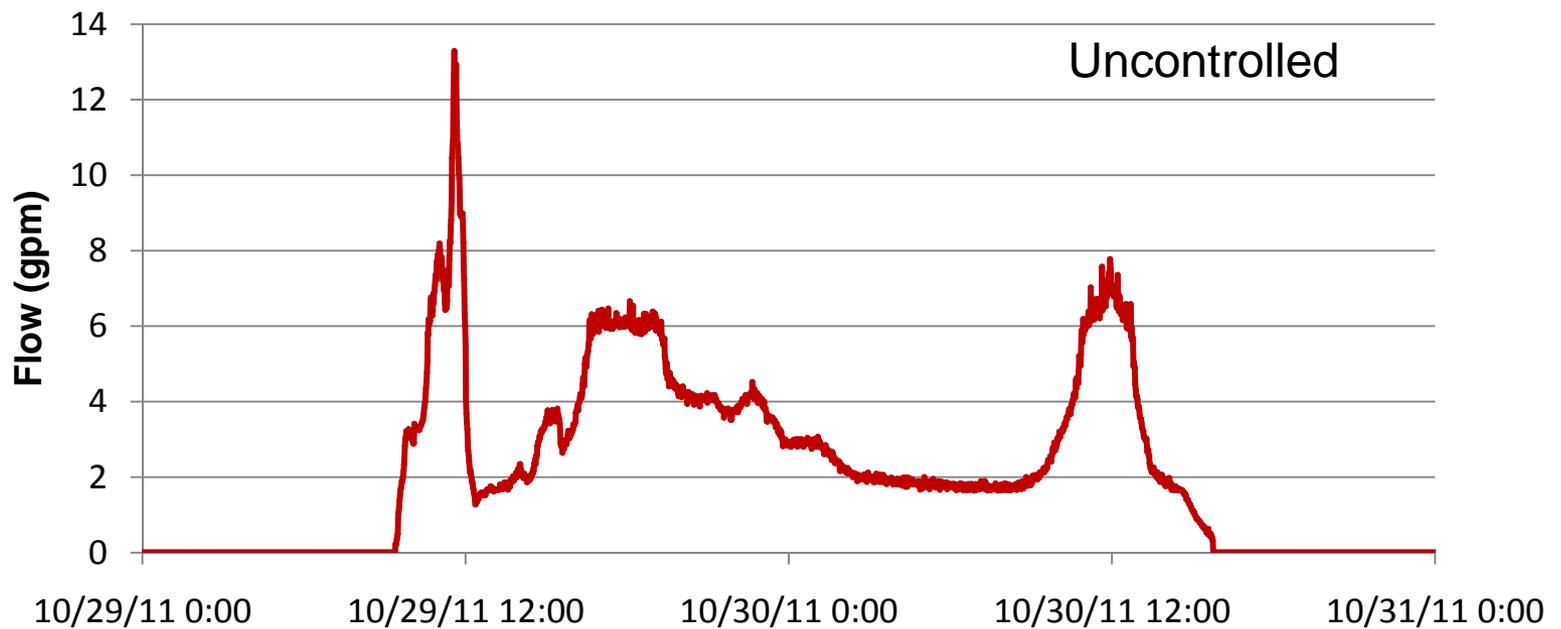
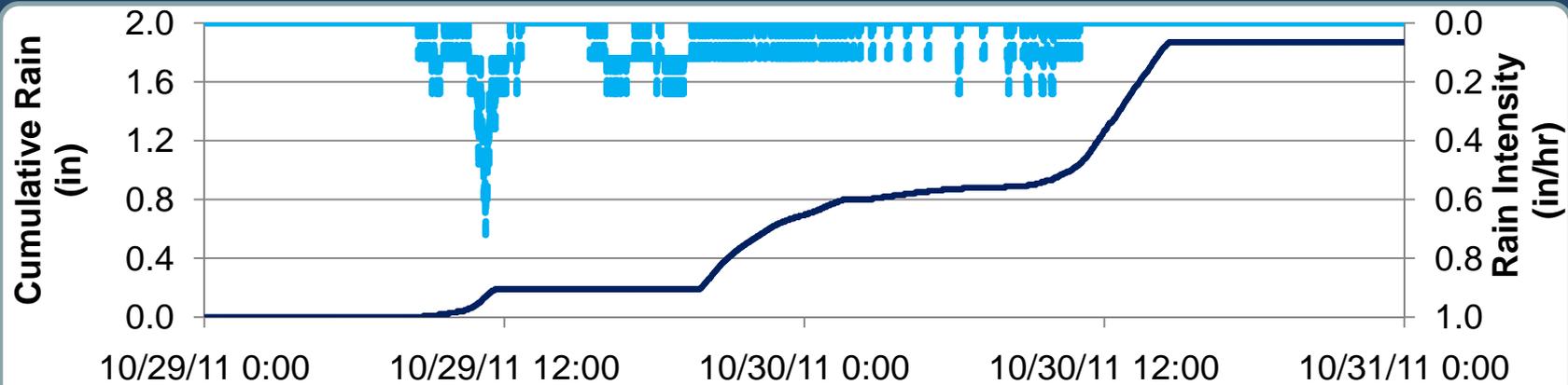
- No measured flow from filterpave and porous asphalt underdrains
- On-site tests suggest porous asphalt may be generating surface runoff



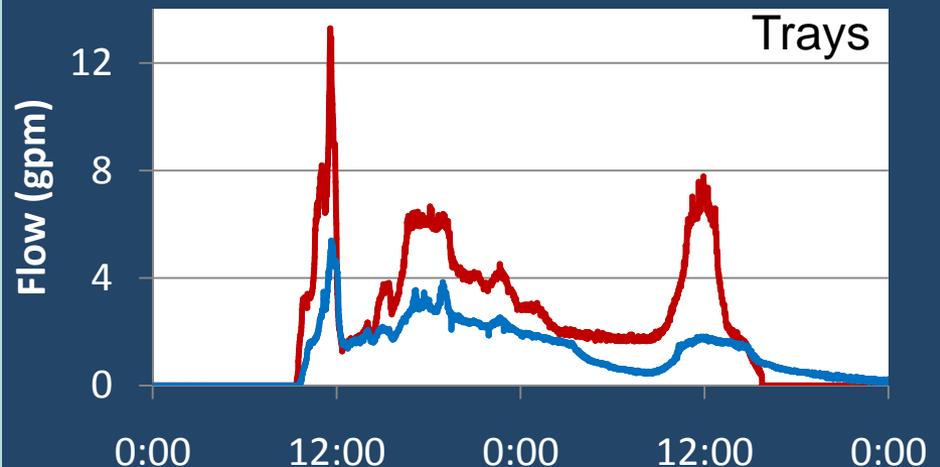
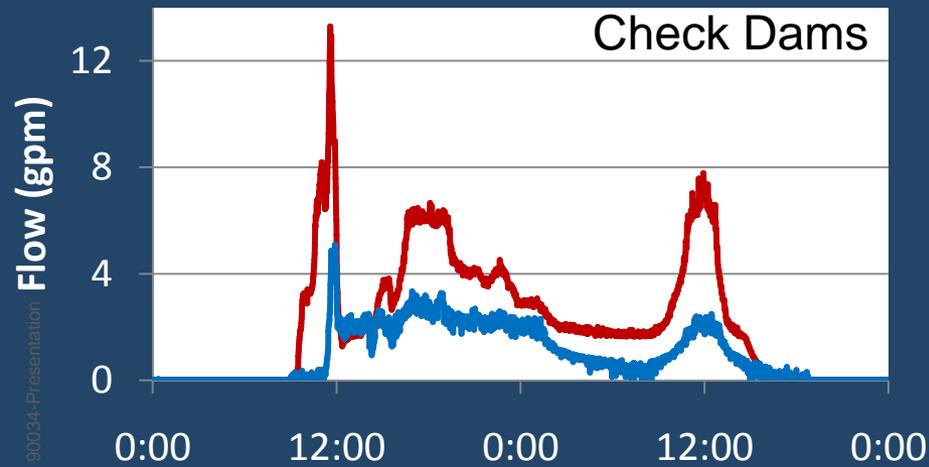
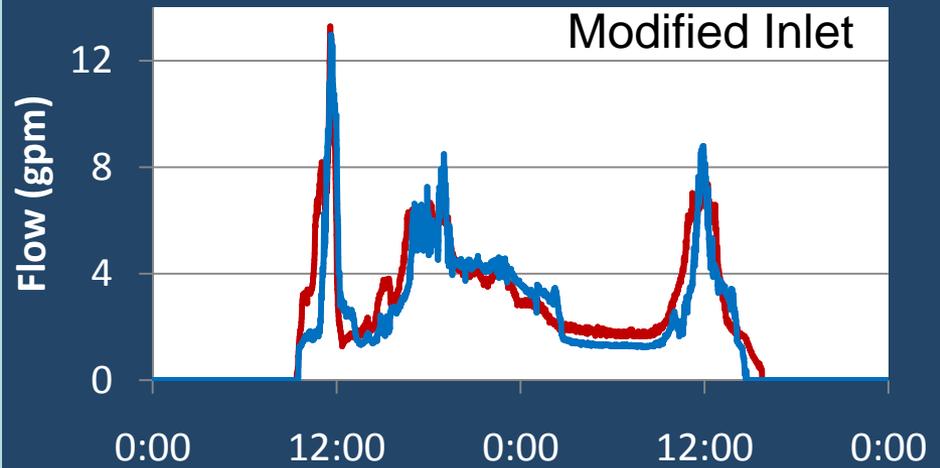
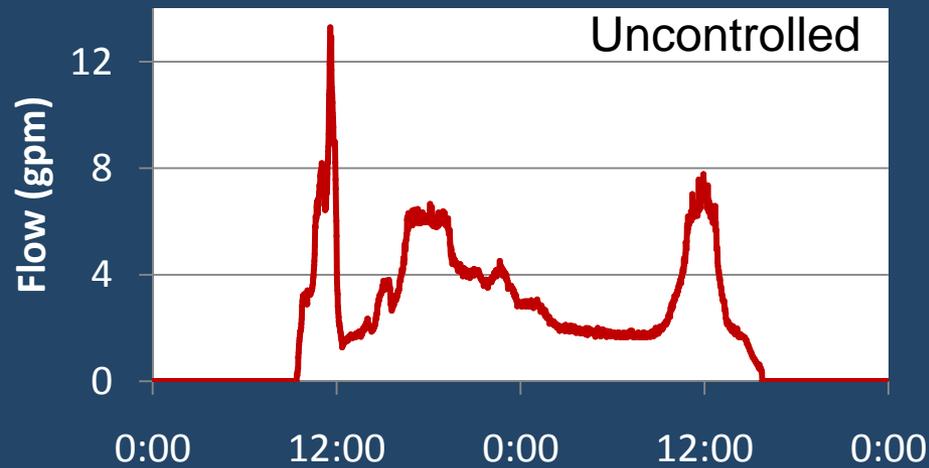
# Multiple Blue Roof Systems



# Blue Roofs: Example 1.9" Storm

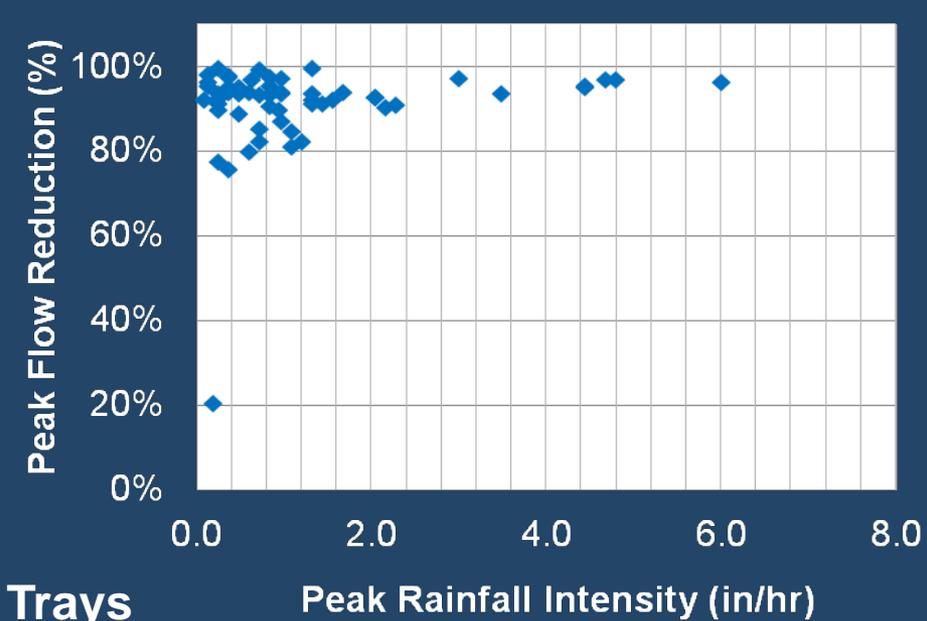
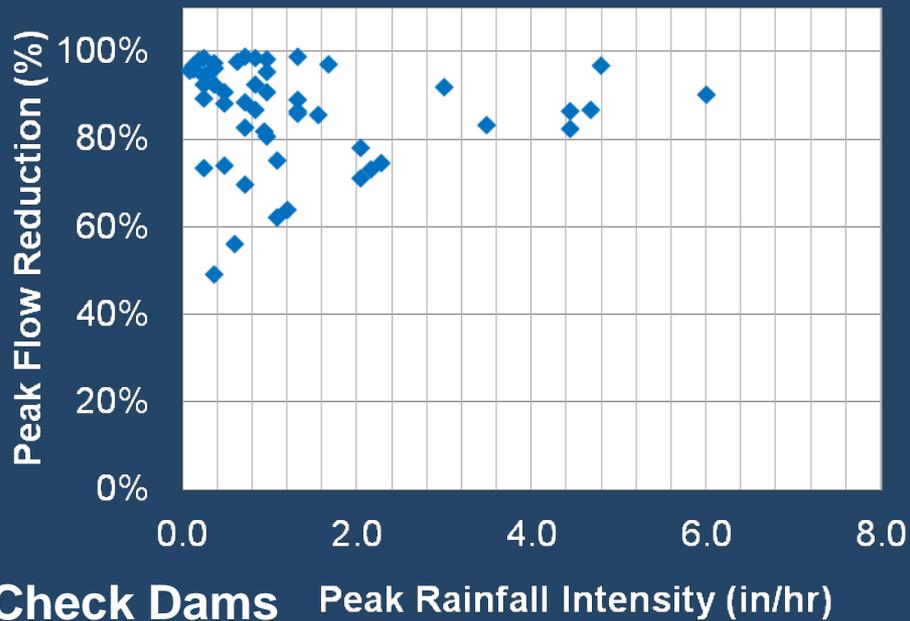
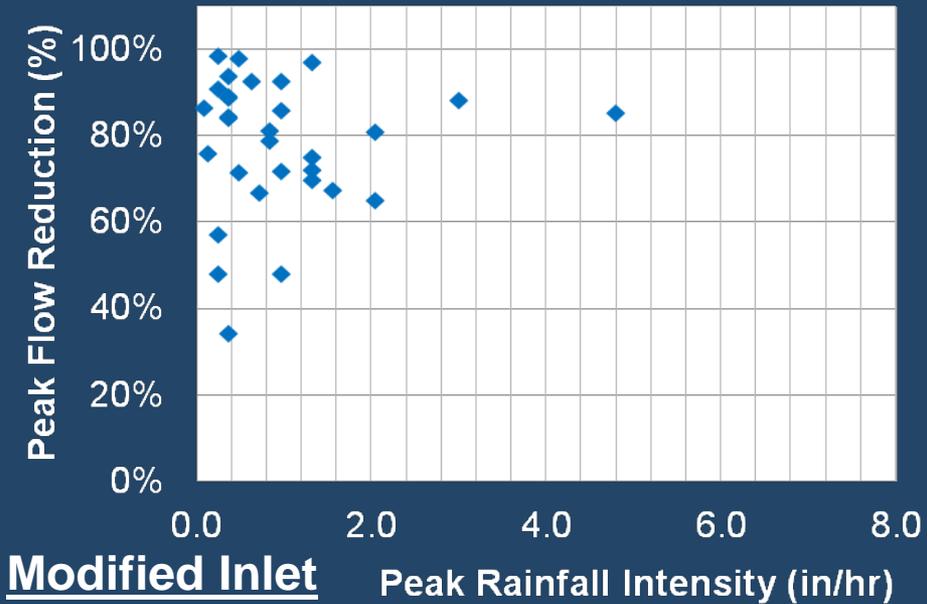
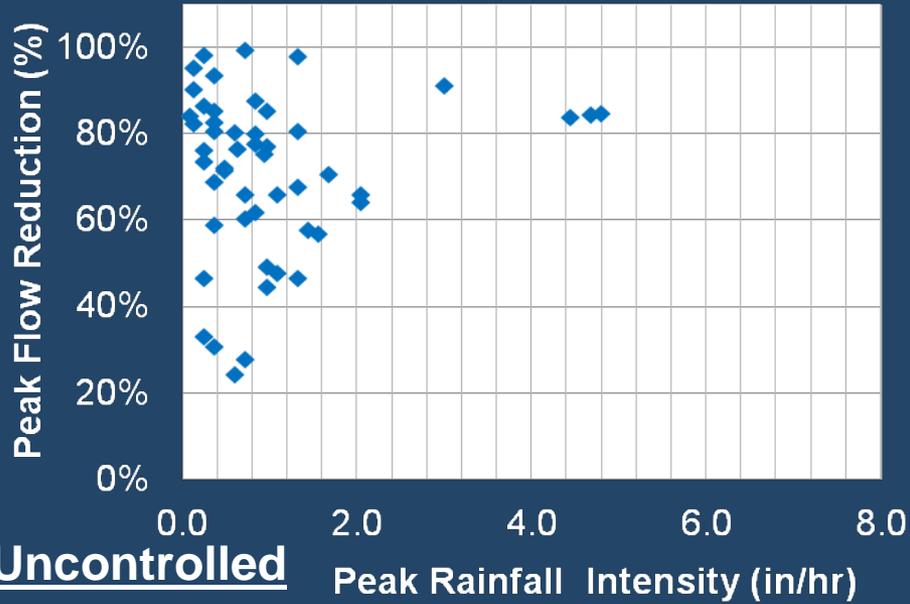


# Blue Roofs: Example 1.9" Storm

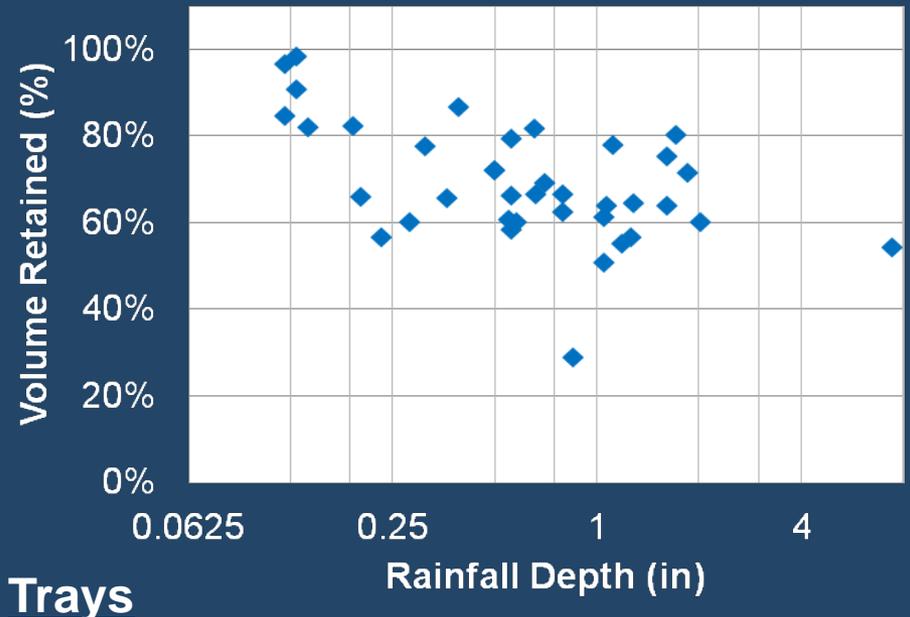
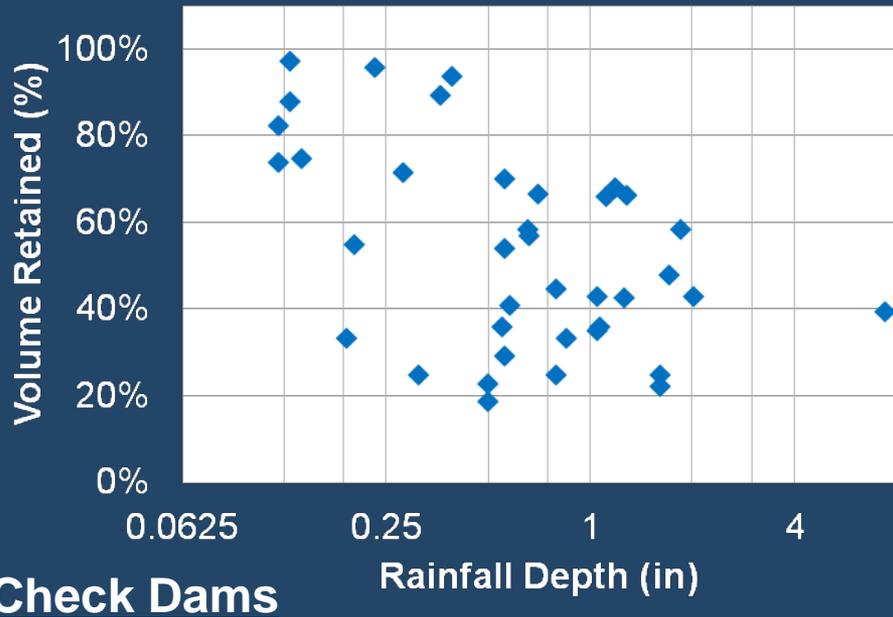
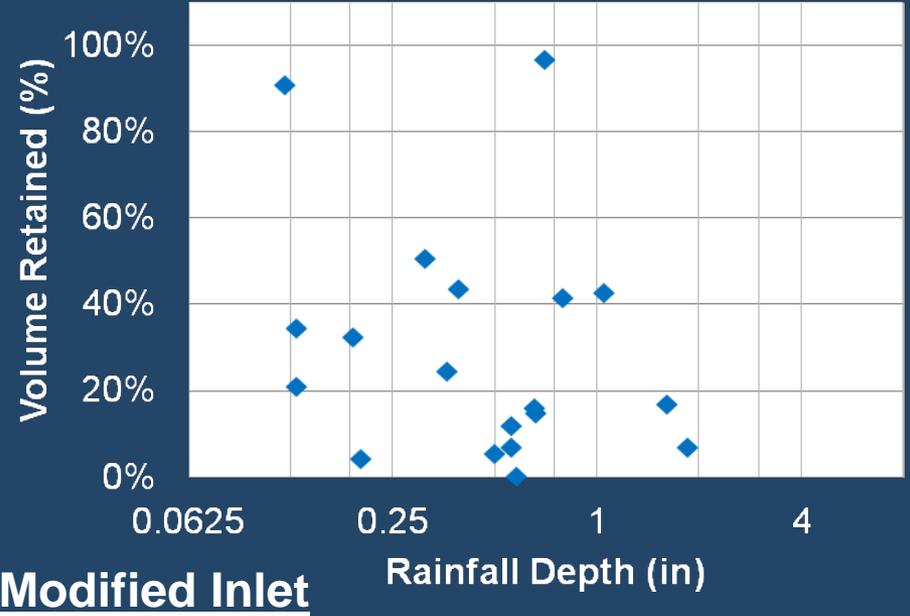
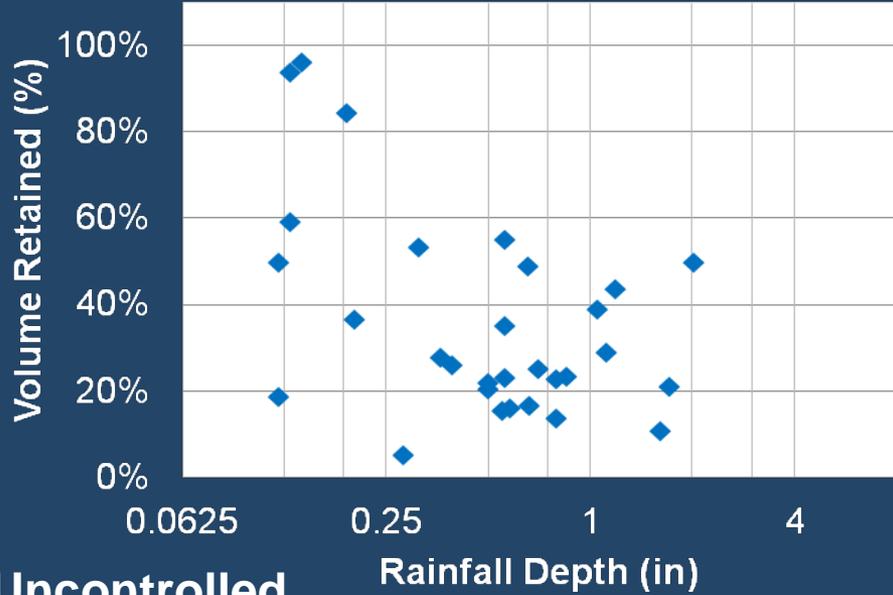


— Control — Trays

# Blue Roof: Peak Flow Reduction



# Blue Roof: Volume Retained



# Blue Roof: Preliminary Observations

- All roof types (including uncontrolled) providing some level of retention and detention
- Trays and check dams appear to be providing more detention than uncontrolled and modified inlet
- Modified inlet performance possibly inhibited by lack of available rooftop storage due to 2% roof slope

# Monitoring Study Summary

- Preliminary observations indicate pilots are providing benefits range of benefits
- Findings will be validated and expanded upon through further data collection and analysis
- Further data analysis and metrics will providing greater insight into CSO planning
- Information on maintenance needs and qualitative performance informing future implementation efforts

# Questions?

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NYC Green Infrastructure Plan:  
2011 Preliminary Pilot Monitoring Results  
UPDATE SUPPLEMENT



June 2012

[www.nyc.gov/html/dep/html/stormwater/index.shtml](http://www.nyc.gov/html/dep/html/stormwater/index.shtml)

