NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

New York State Water Resources Institute
Cornell University

Assessing Green Infrastructure: Kingston Uptown Parking Lots

Emily Vail

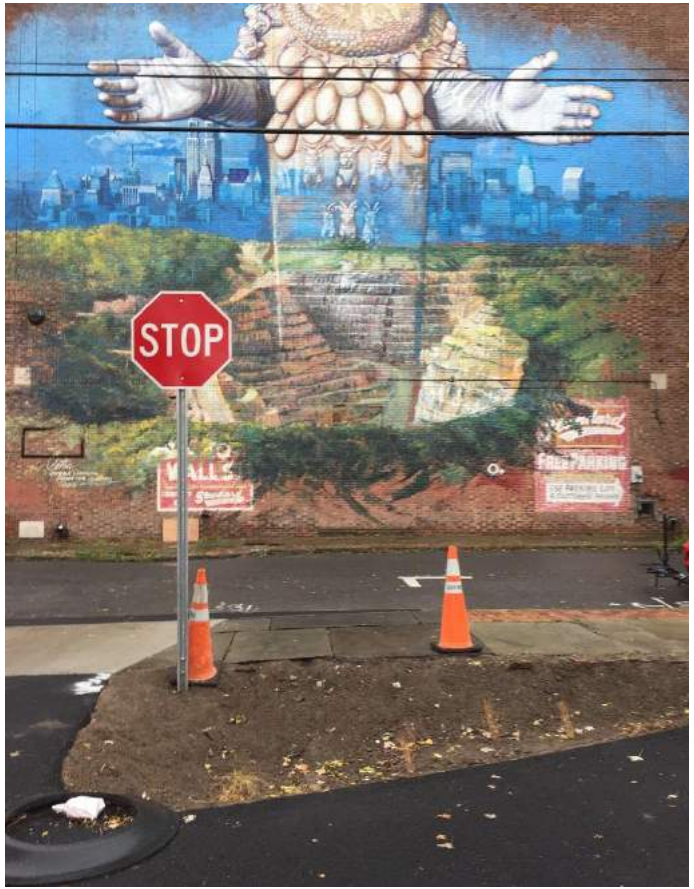
Hudson River Estuary Program,
NYS Department of Environmental Conservation
NYS Water Resources Institute at Cornell University

Cornell Soil & Water Lab

October 18, 2017

Presentation Outline

- Background
- Stormwater retrofits at Uptown Parking Lots
- Research:
  - Quantitative assessment
  - Qualitative assessment
  - Historical context for restoration
- Next steps



Kingston Uptown Parking Lots - bioretention

Hudson River Estuary Program

Six Benefits:

- Clean water
- Resilient communities
- Vital estuary ecosystem
- Estuary fish, wildlife, and their habitats
- Scenic river landscape
- Education, river access, recreation, and inspiration

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

Background

- August 2015 – grad school (MS in Natural Resources at Cornell University)
- July 2016 – started research on Uptown Parking Lots
- November 2016 – began monitoring

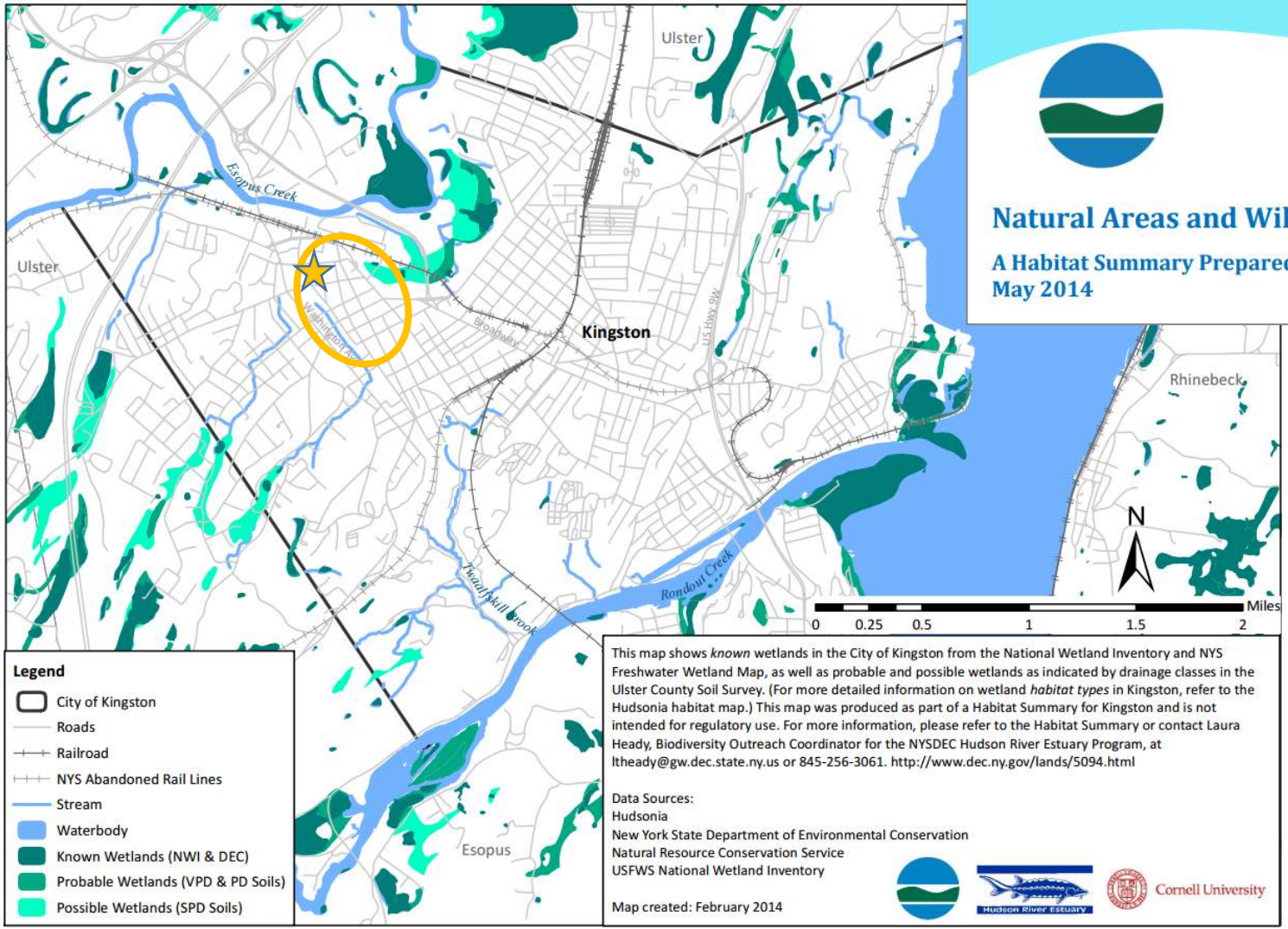
Background

- Focus on water quantity
- Implications for
  - Stream health,
  - CSOs
  - Flooding
  - Extreme storms

Stormwater Retrofits in Kingston

Natural Areas and Wildlife in Your Community

A Habitat Summary Prepared for the City of Kingston
May 2014



This map shows *known* wetlands in the City of Kingston from the National Wetland Inventory and NYS Freshwater Wetland Map, as well as probable and possible wetlands as indicated by drainage classes in the Ulster County Soil Survey. (For more detailed information on wetland *habitat types* in Kingston, refer to the Hudsonia habitat map.) This map was produced as part of a Habitat Summary for Kingston and is not intended for regulatory use. For more information, please refer to the Habitat Summary or contact Laura Heady, Biodiversity Outreach Coordinator for the NYSDEC Hudson River Estuary Program, at ltheady@gw.dec.state.ny.us or 845-256-3061. http://www.dec.ny.gov/lands/5094.html

Data Sources:
Hudsonia
New York State Department of Environmental Conservation
Natural Resource Conservation Service
USFWS National Wetland Inventory

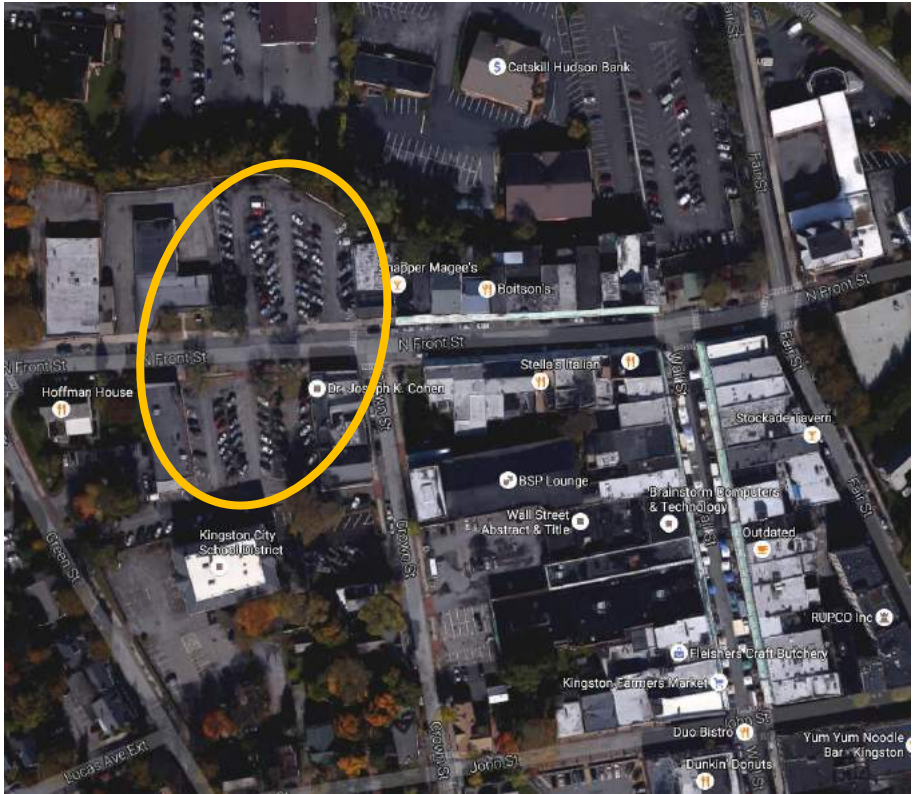
Map created: February 2014

Hudson River Estuary

Cornell University

Uptown Parking Lots

- 2 municipal parking lots on N Front St
- Lower Esopus watershed
- Not part of combined sewer system
- Funded by DEC's Water Quality Improvement Program
- Designed by Barton & Loguidice



Uptown Parking Lots

- Construction
  - South Lot: Aug-Sept 2016
  - North Lot: Sept-Oct 2016

South Lot – Pre-Construction

North Lot – Pre-Construction

South Lot

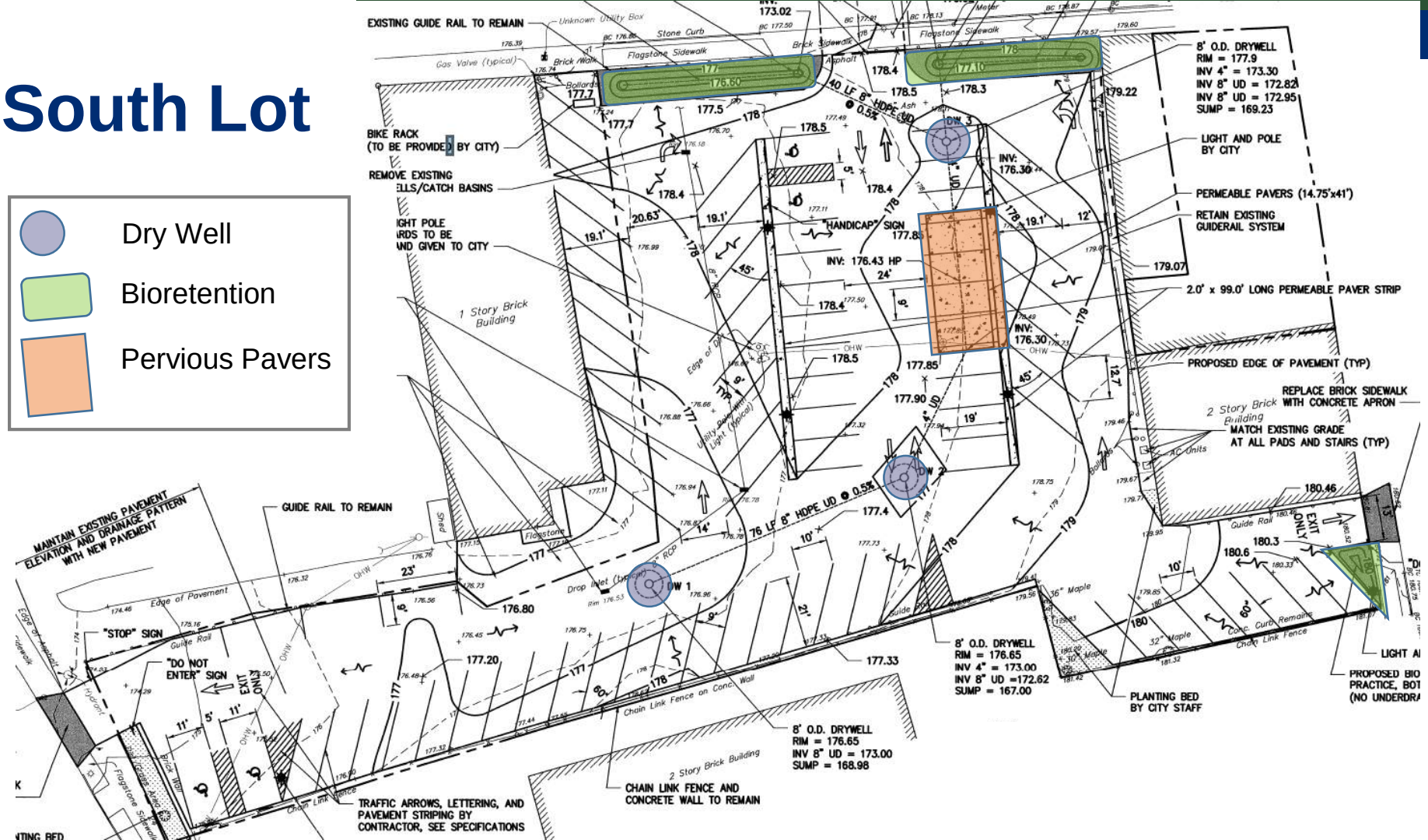
- 3 dry wells
- 3 bioretention areas (1 w/o underdrain)
- 1 section of pervious paving

North Lot

- 2 dry wells
- 2 bioretention areas (1 w/o underdrain)
- 2 sections of pervious paving

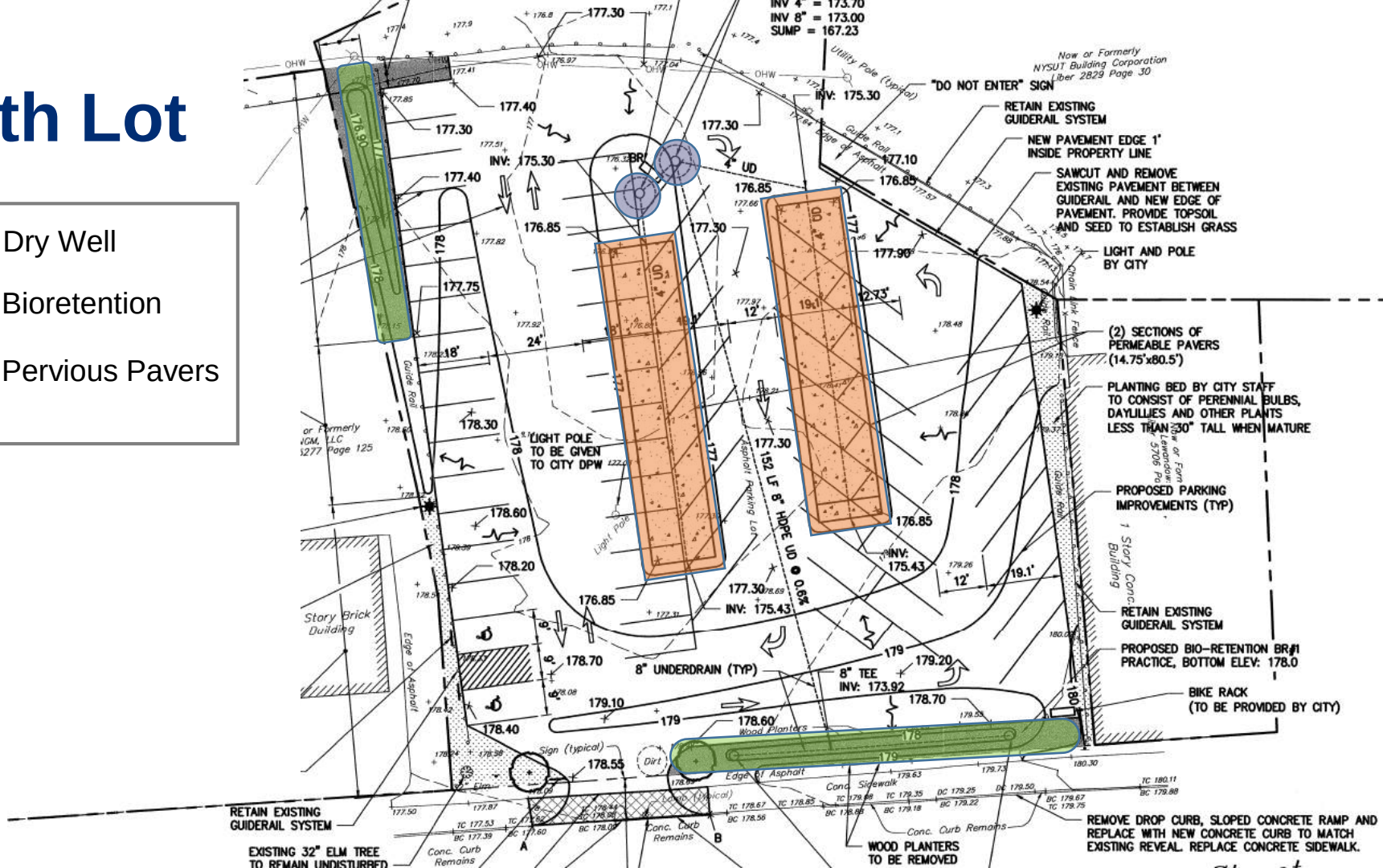
South Lot

- Dry Well
- Bioretention
- Pervious Pavers



North Lot

- Dry Well
- Bioretention
- Pervious Pavers



Bioretention Areas – with underdrain

Bioretention Areas – without underdrain

Dry Wells

Dry Wells

Pervious Pavers

Pervious Pavers

Green Infrastructure Research Questions

1. Quantitative assessment
2. Qualitative assessment
3. Historical context

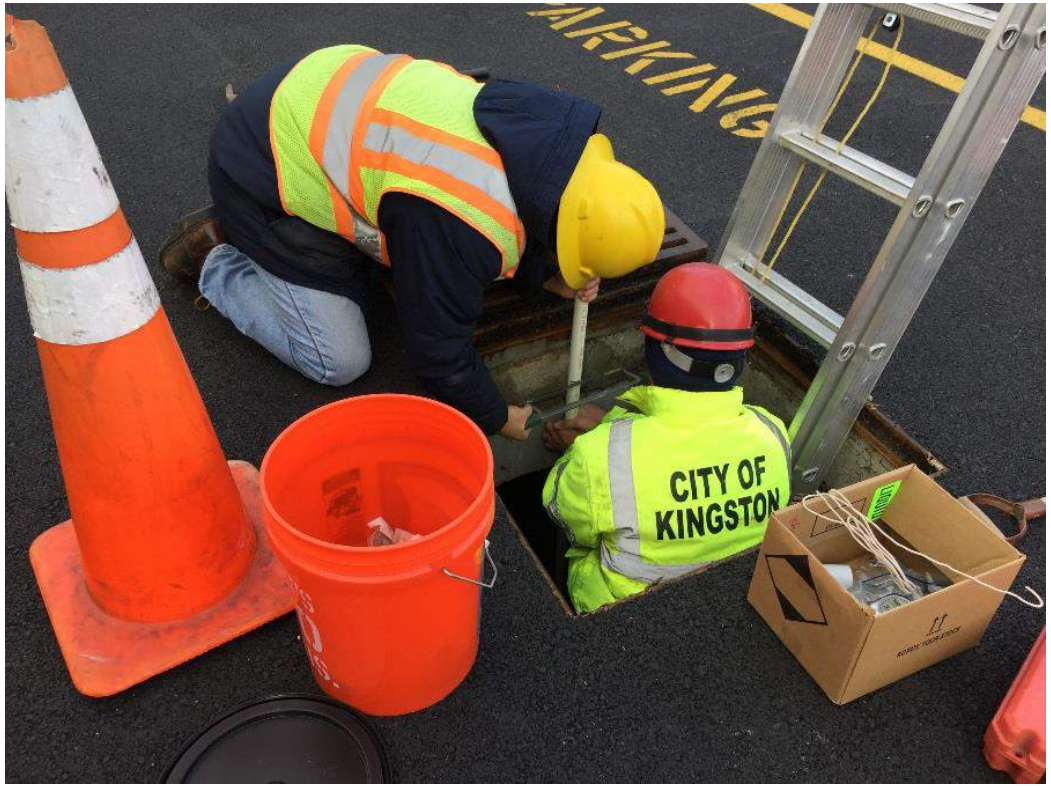
1. Quantitative Assessment

1. Quantitative

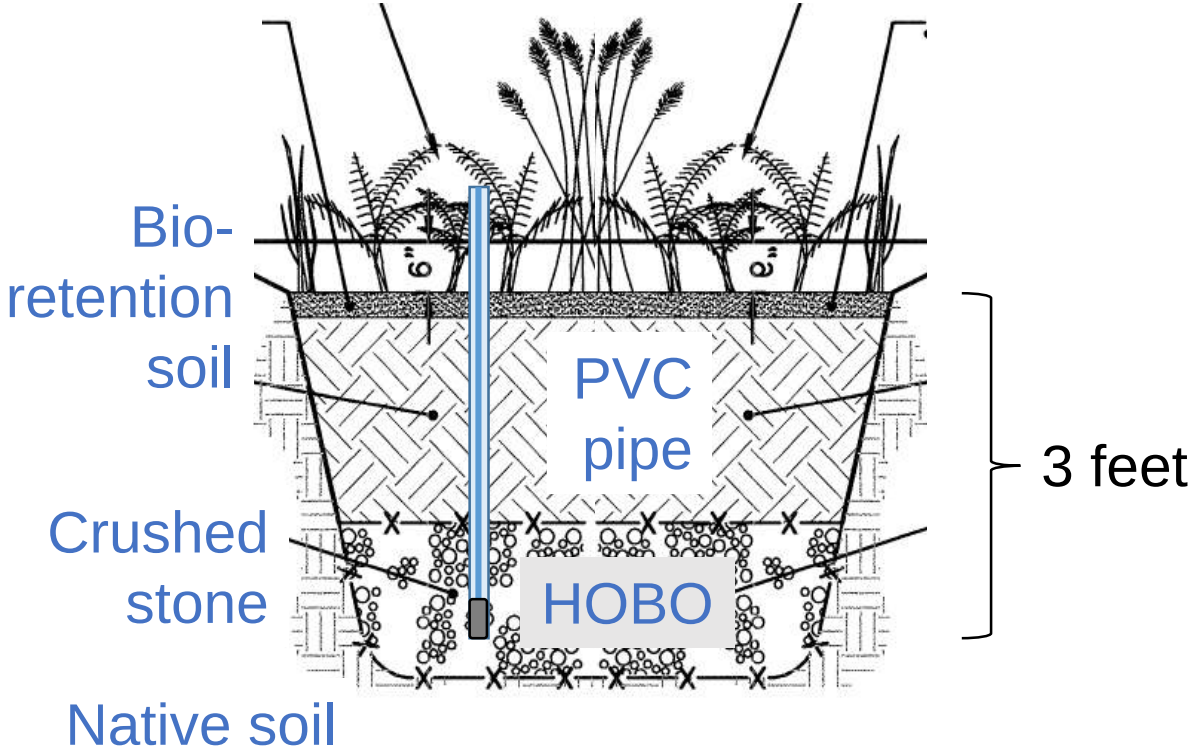
- What is the site’s water budget?
- Do the practices meet runoff reduction goals?
- How might these results scale up? (catchment, municipality, watershed)

Measuring Runoff Reduction

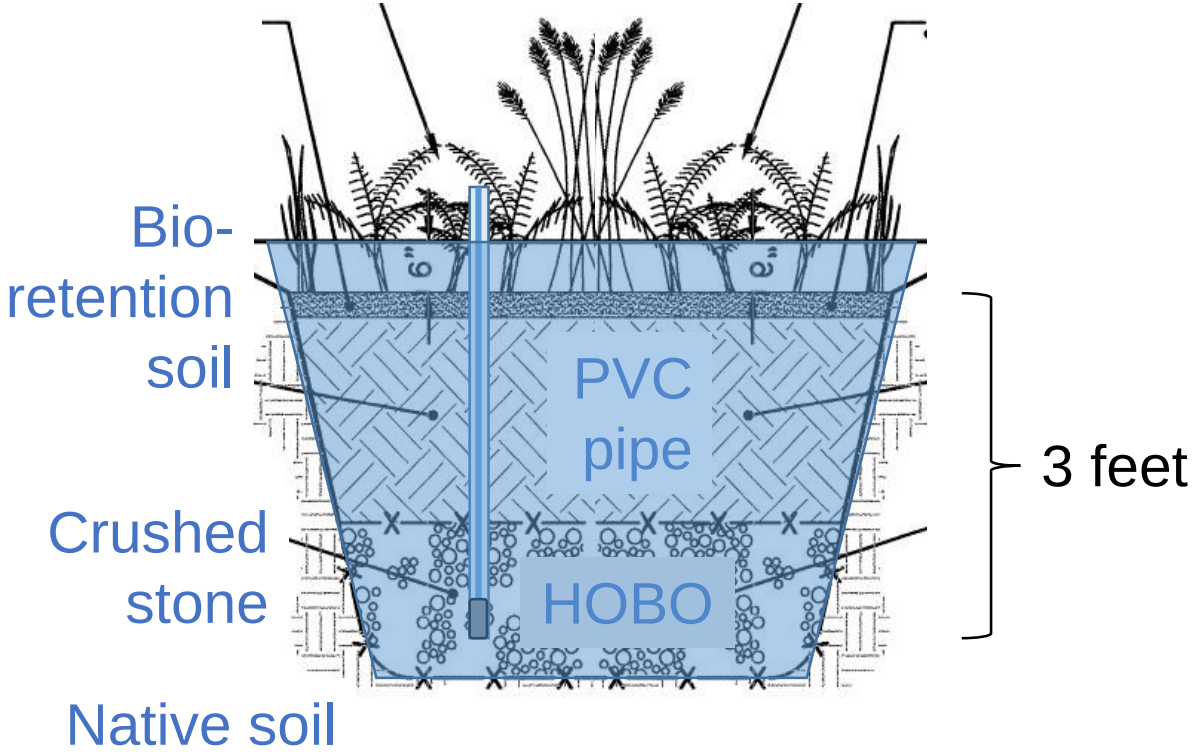
- HOBOs to measure water level in 5 dry wells and 5 bioretention areas (installed Nov 2016)
- Rain gage (installed May 2017)
- Have HydroCAD models for various storm sizes



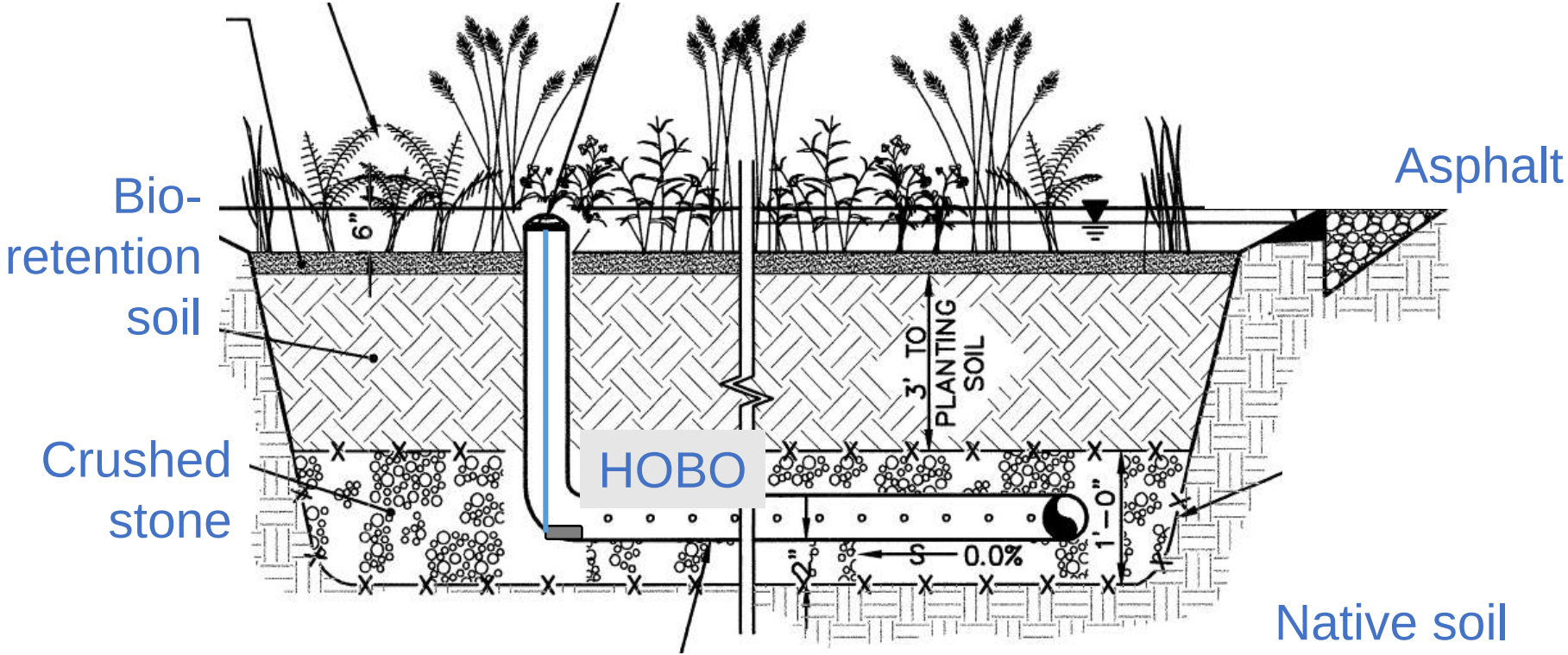
HOBOs in Bioretention Areas, no underdrain



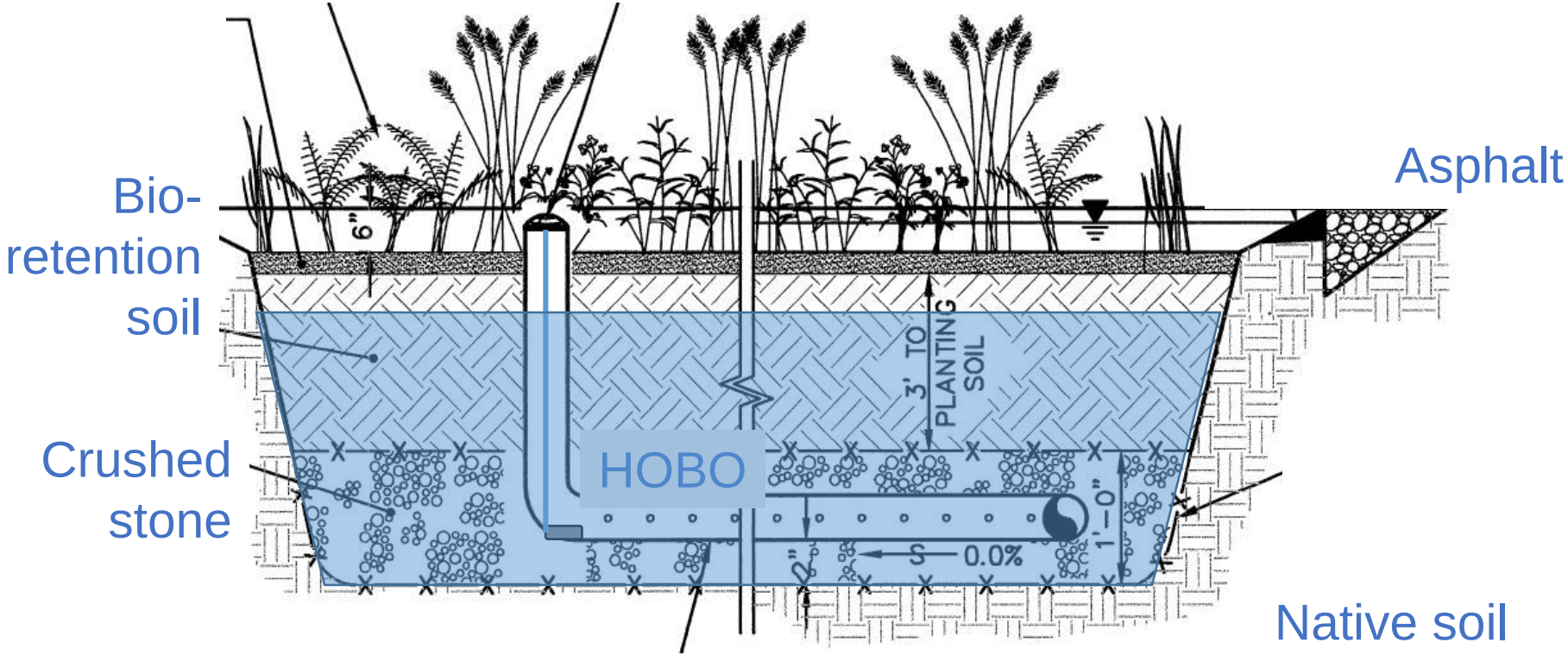
HOBOs in Bioretention Areas, no underdrain



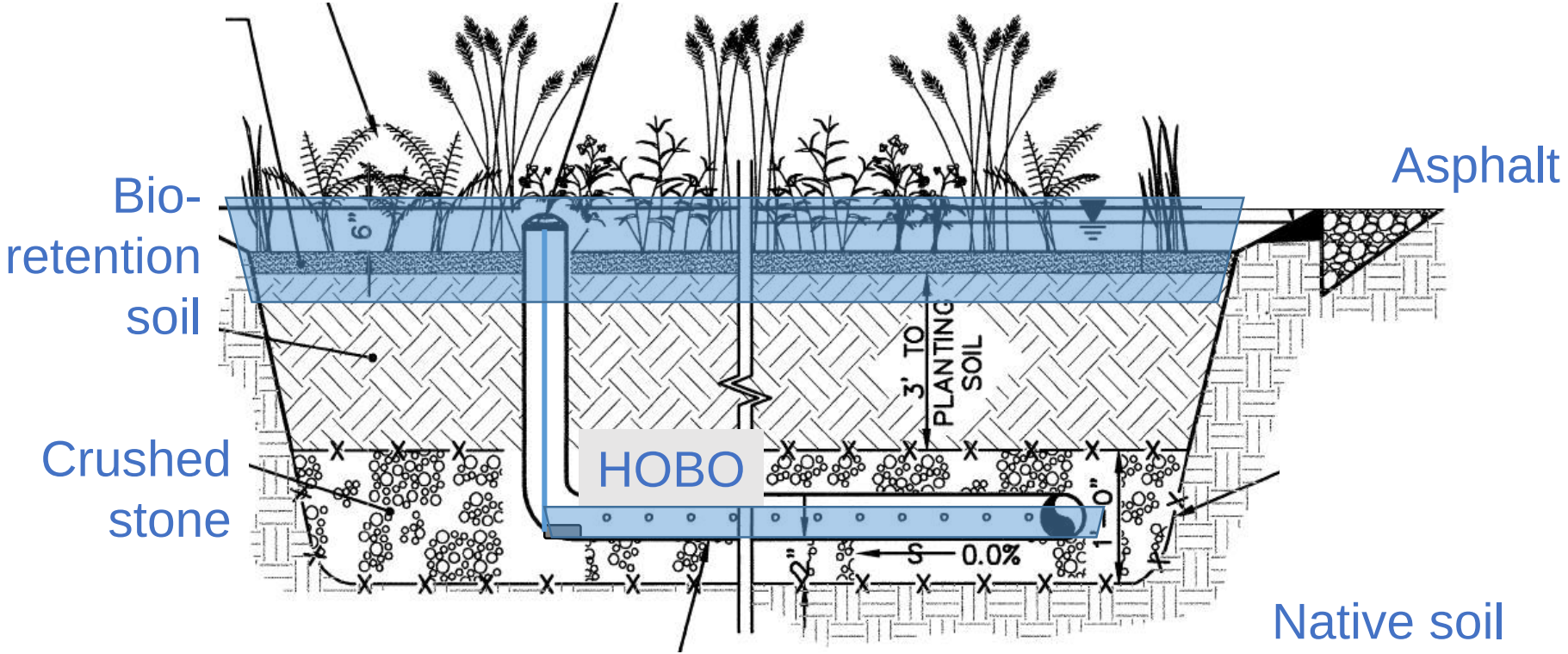
HOBOs in Bioretention Areas, underdrain



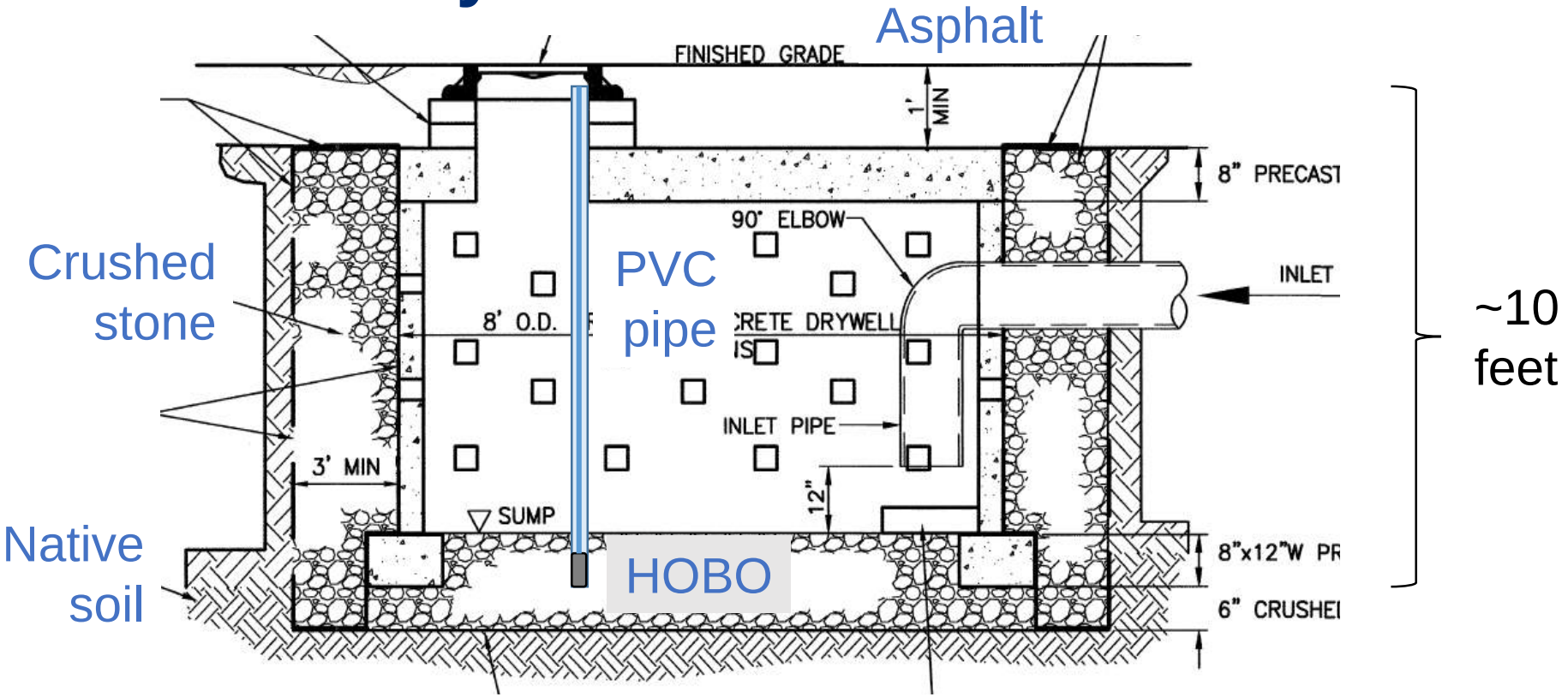
HOBOs in Bioretention Areas, underdrain



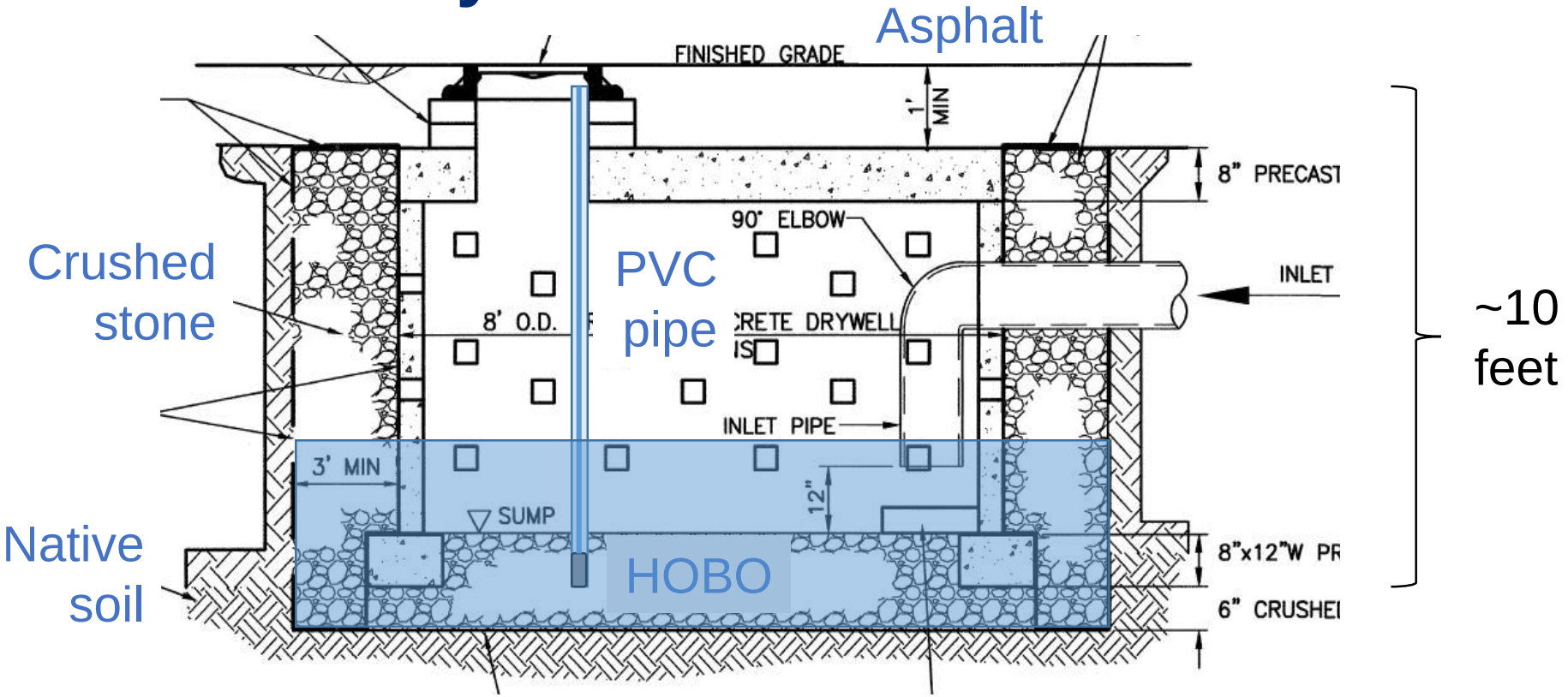
HOBOs in Bioretention Areas, underdrain



HOBOs in Dry Wells



HOBOs in Dry Wells



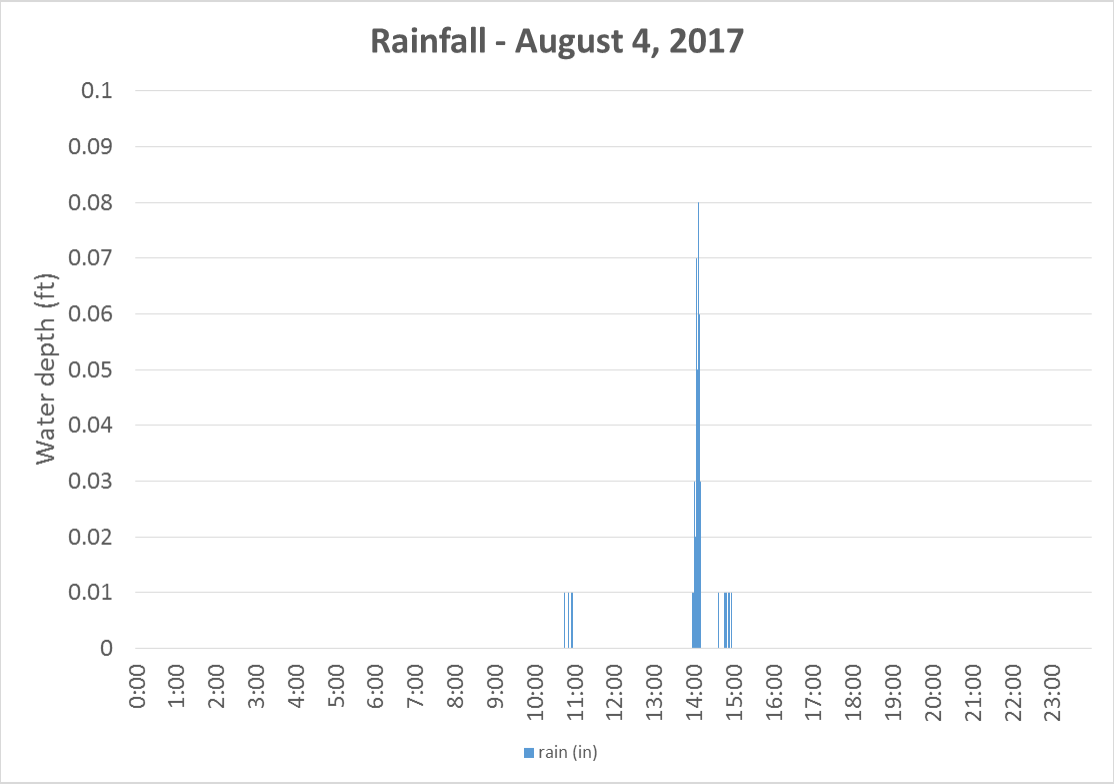
Measuring Runoff Reduction

PVC pipe for HOBO in dry well

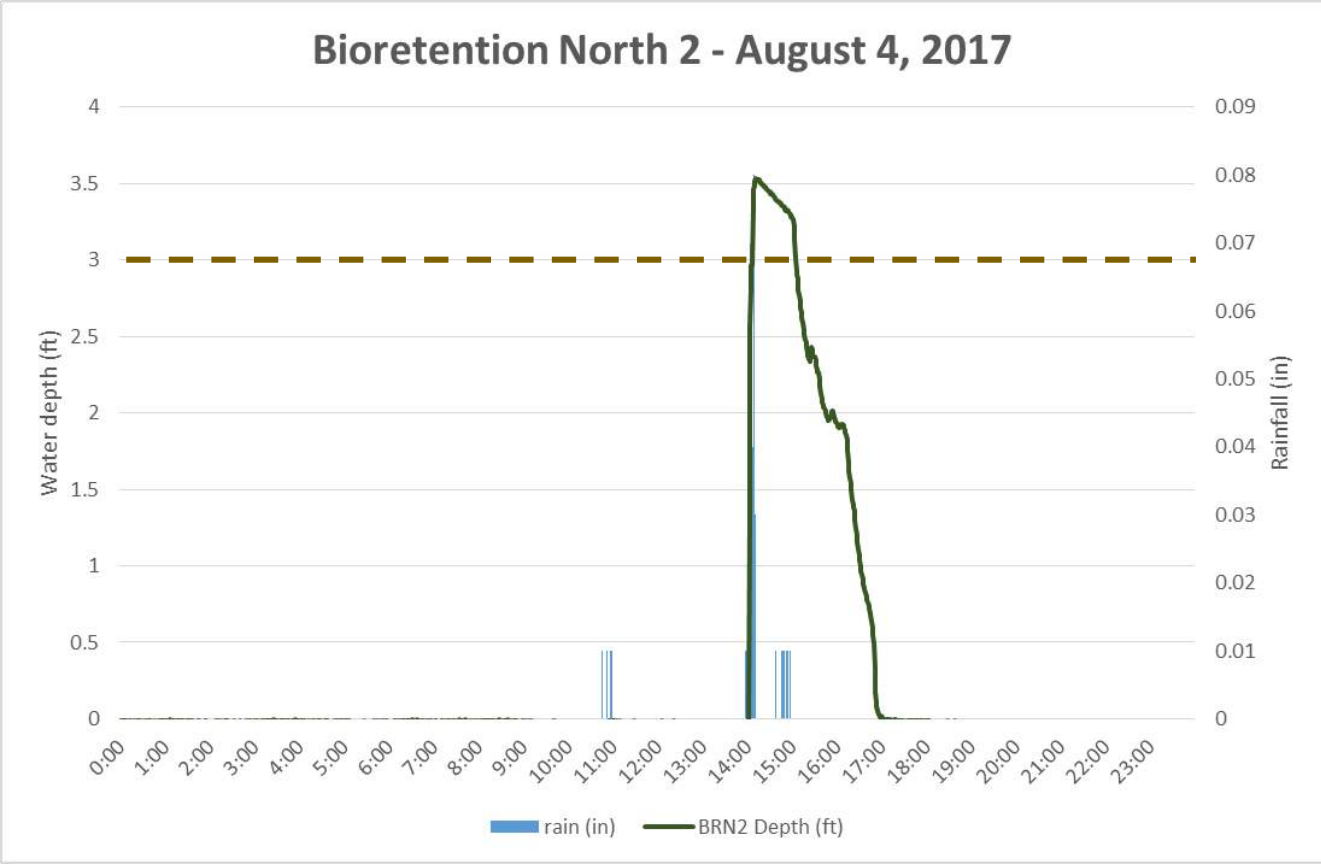
HOBO in bioretention underdrain

Preliminary Data – Storm on August 4, 2017

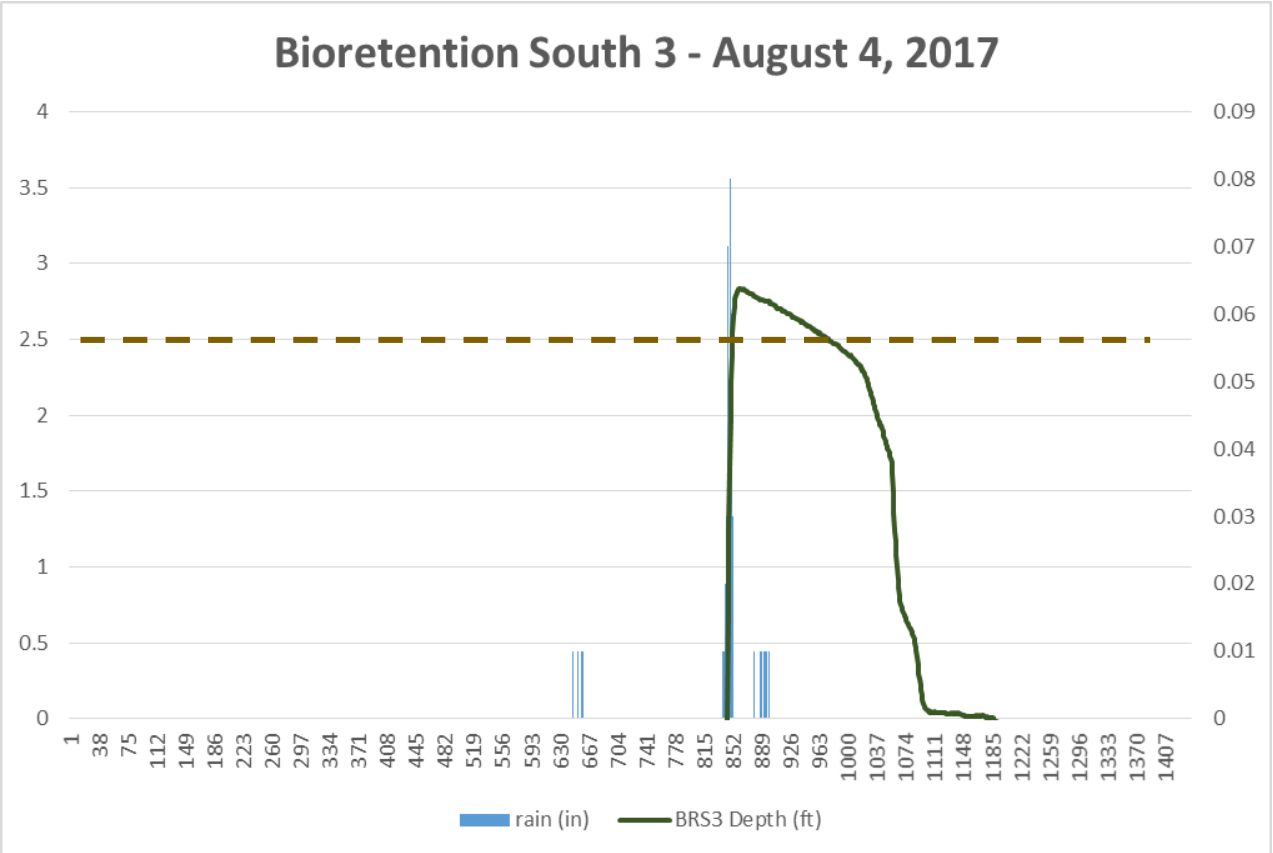
- Intense storm
- Rained 0.62 inches
- Most of rain fell in 15 minutes (1:58 to 2:11 PM)



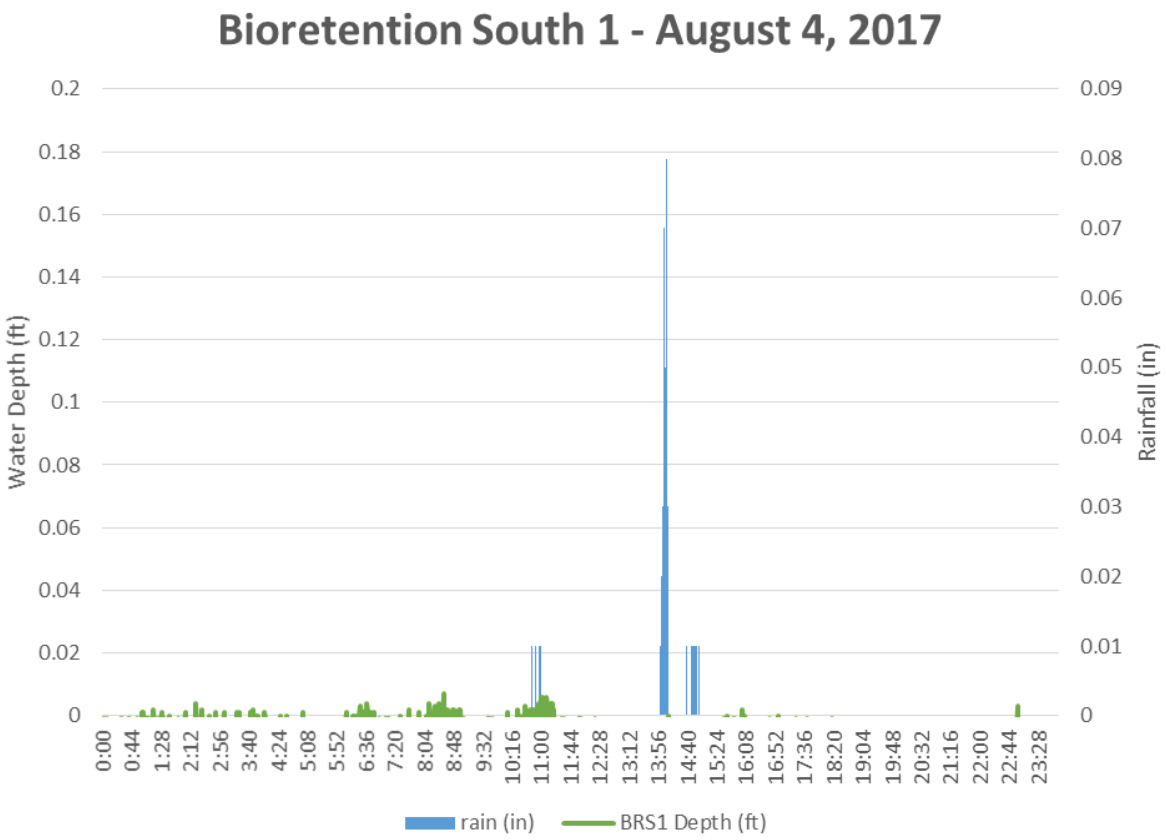
Bioretention Areas without Underdrain



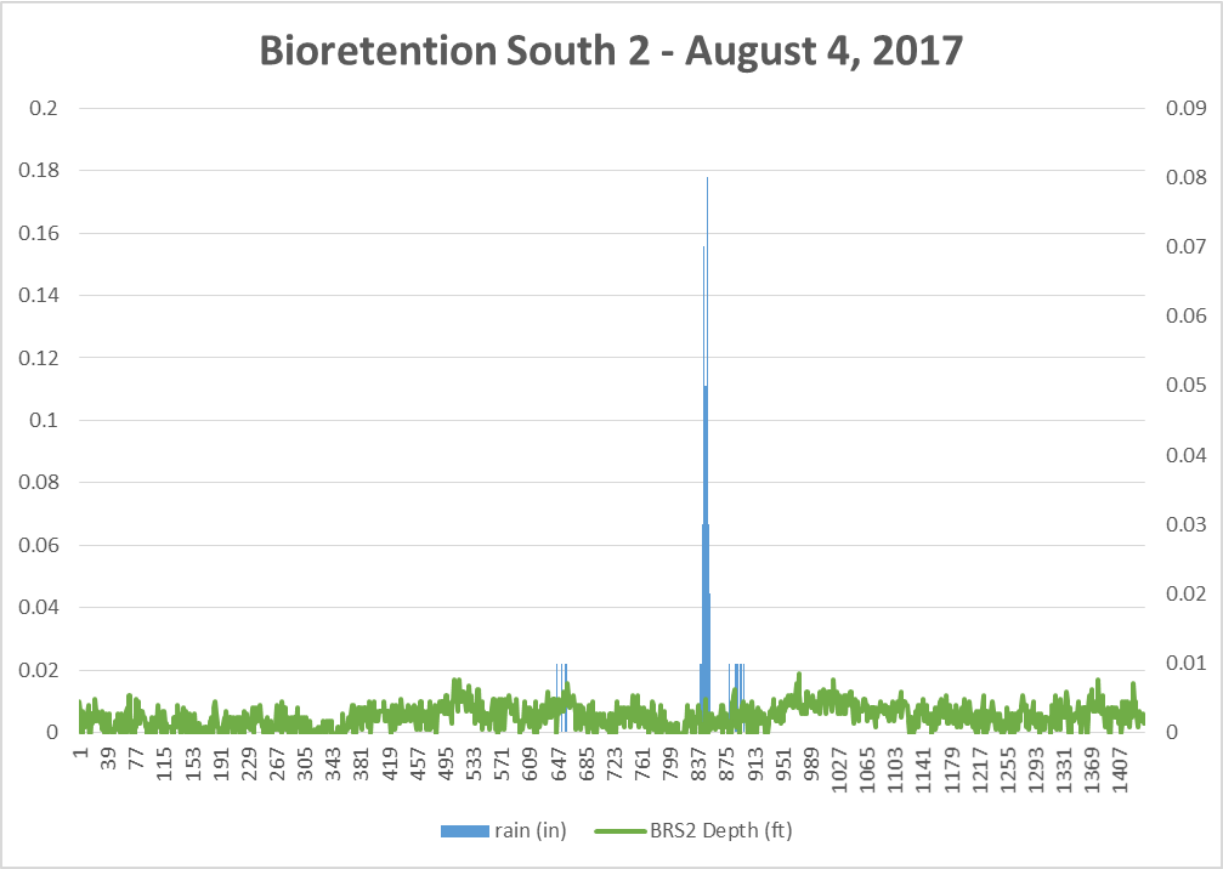
Bioretention Areas without Underdrain



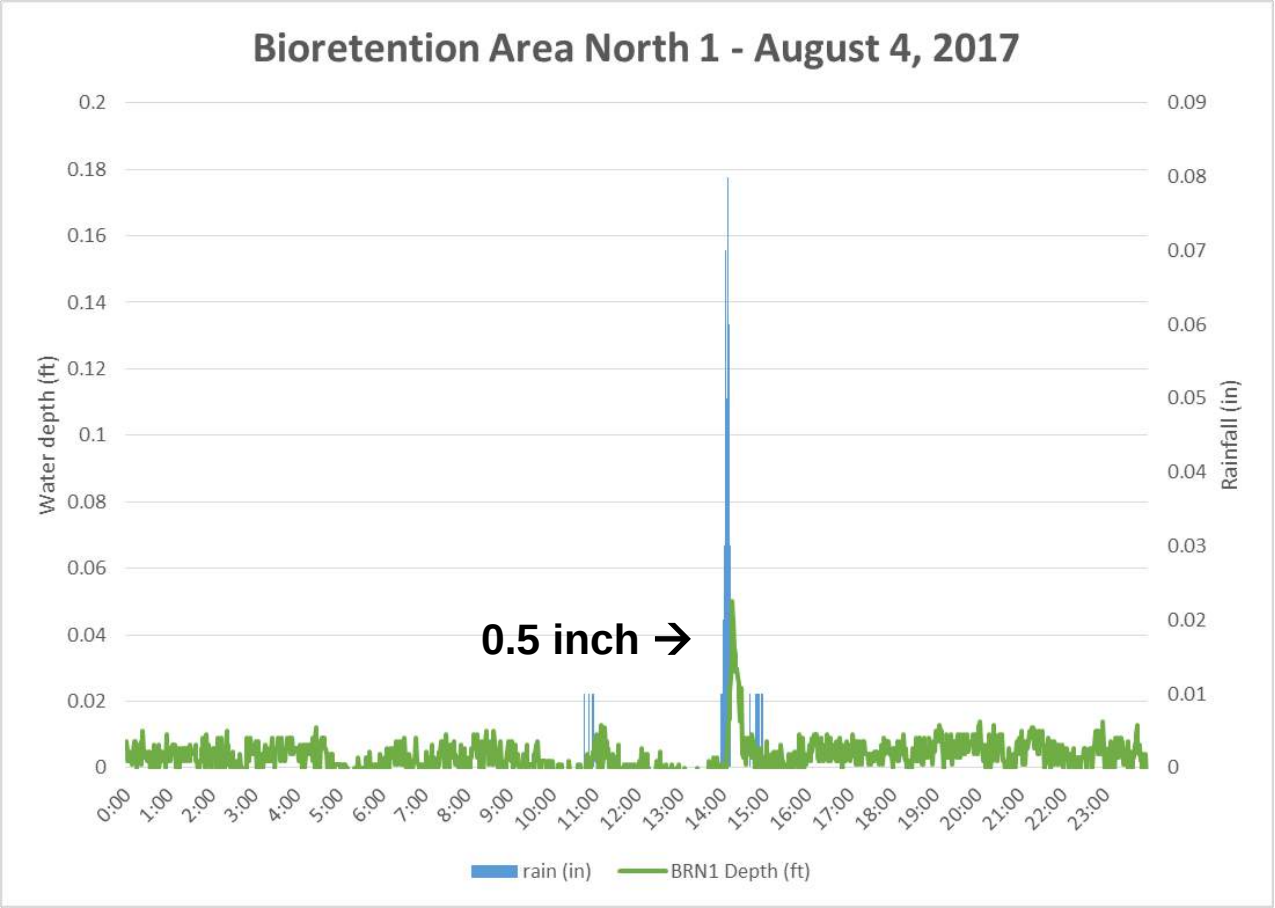
Bioretention Areas with Underdrain



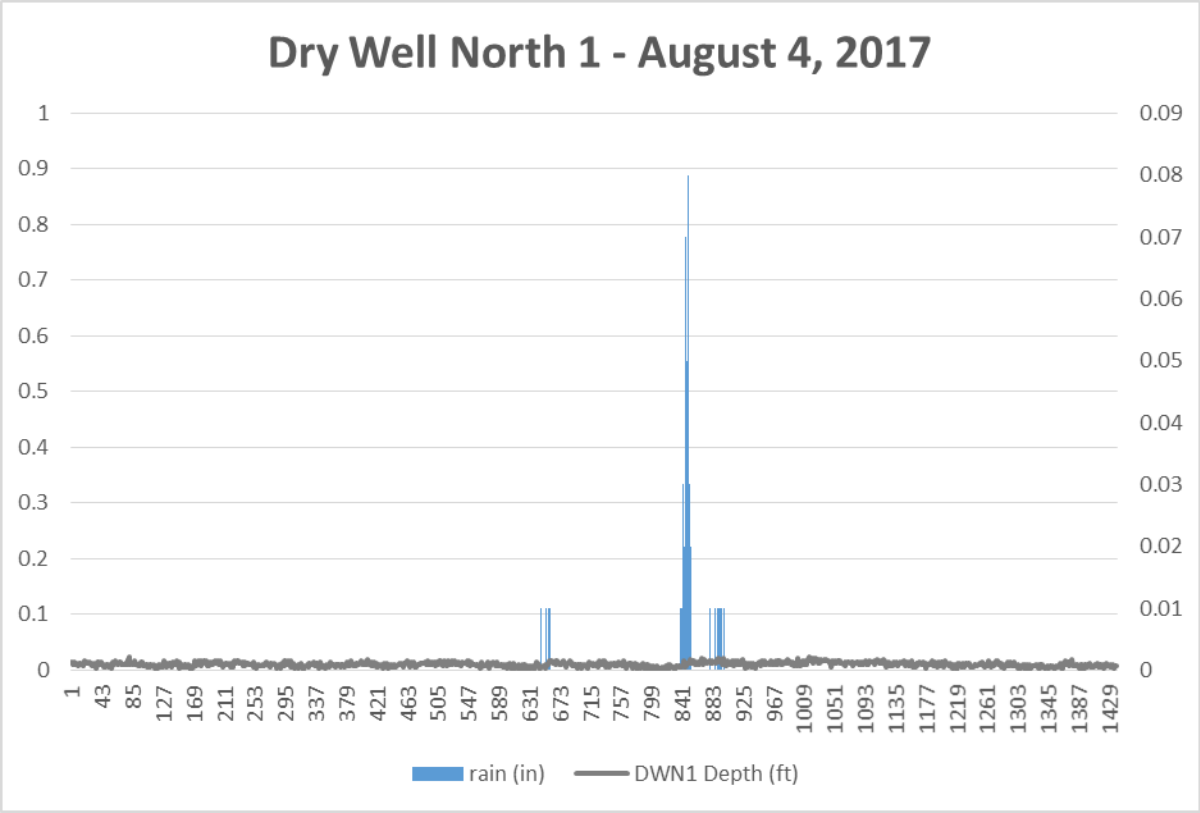
Bioretention Areas with Underdrain



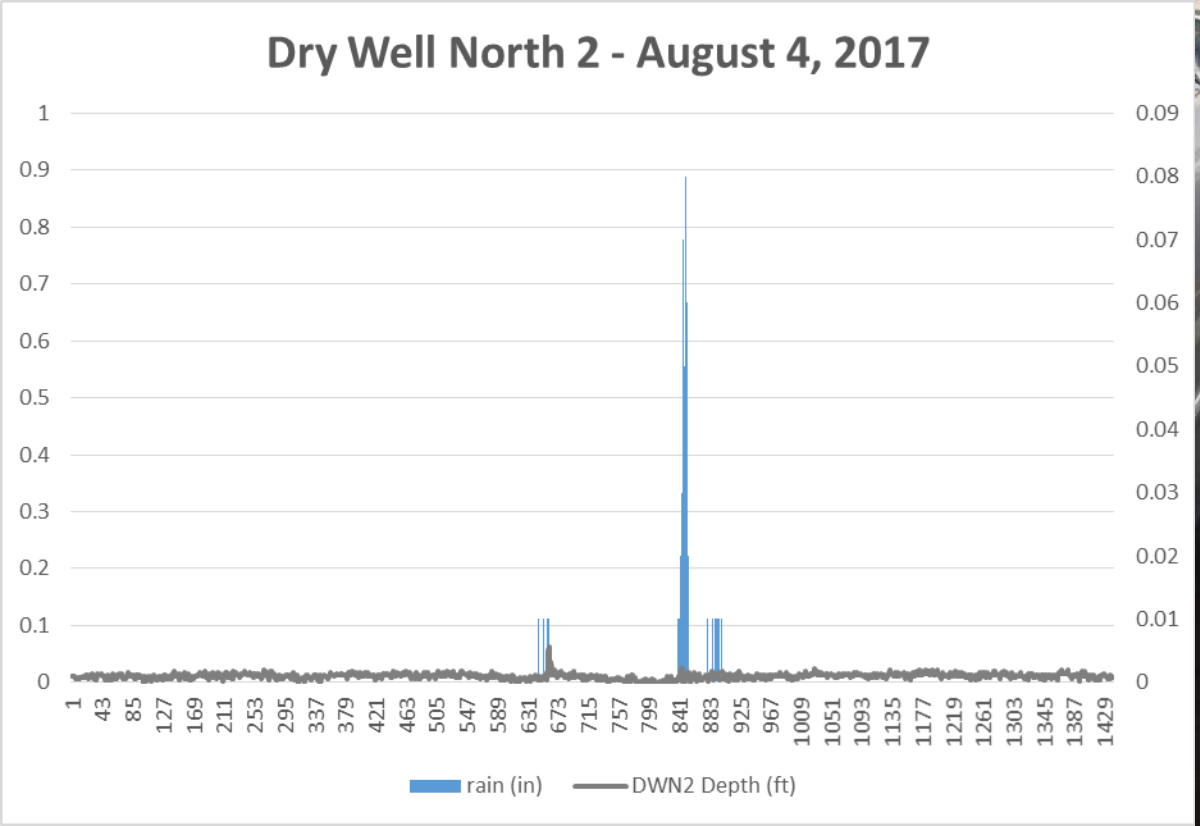
Bioretention Areas with Underdrain



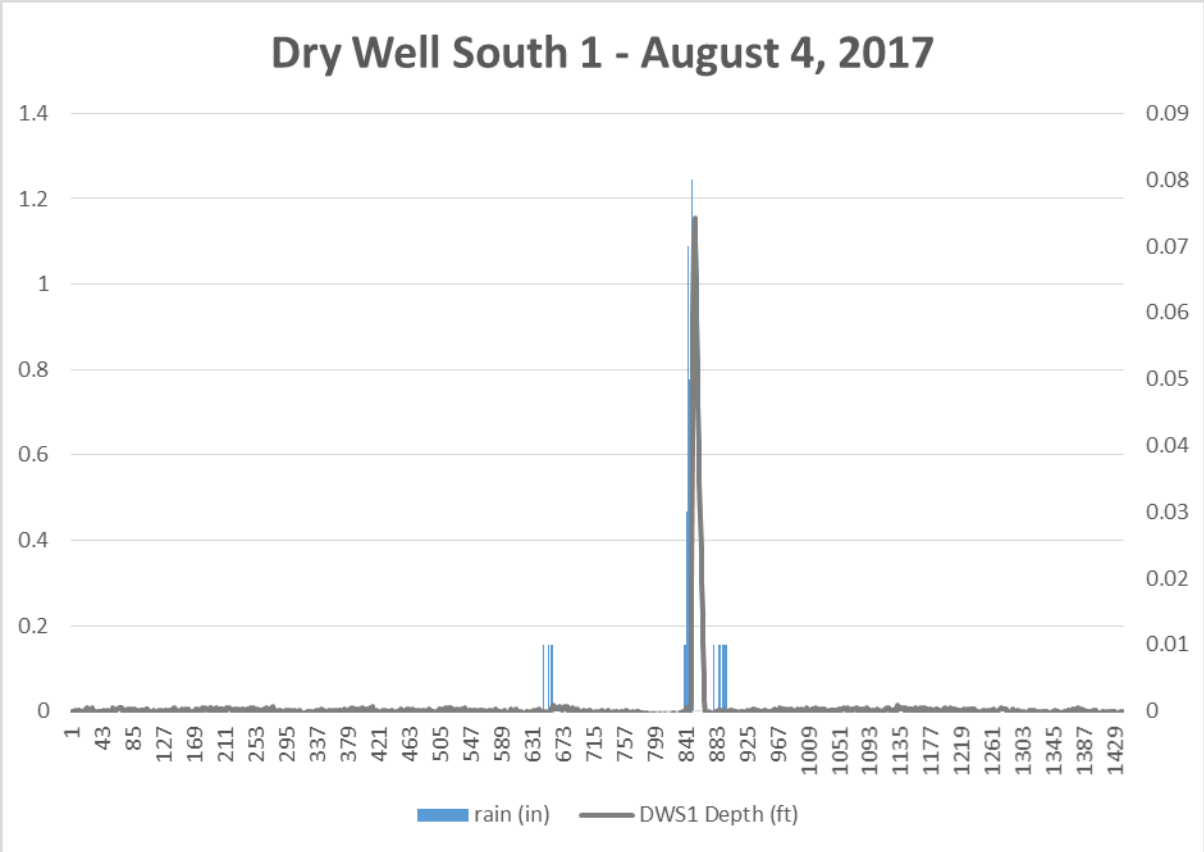
Dry Well


Dry Well North 1 - August 4, 2017
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1 43 85 127 169 211 253 295 337 379 421 463 505 547 589 631 673 715 757 799 841 883 925 967 1009 1051 1093 1135 1177 1219 1261 1303 1345 1387 1429
rain (in)
DWN1 Depth (ft)

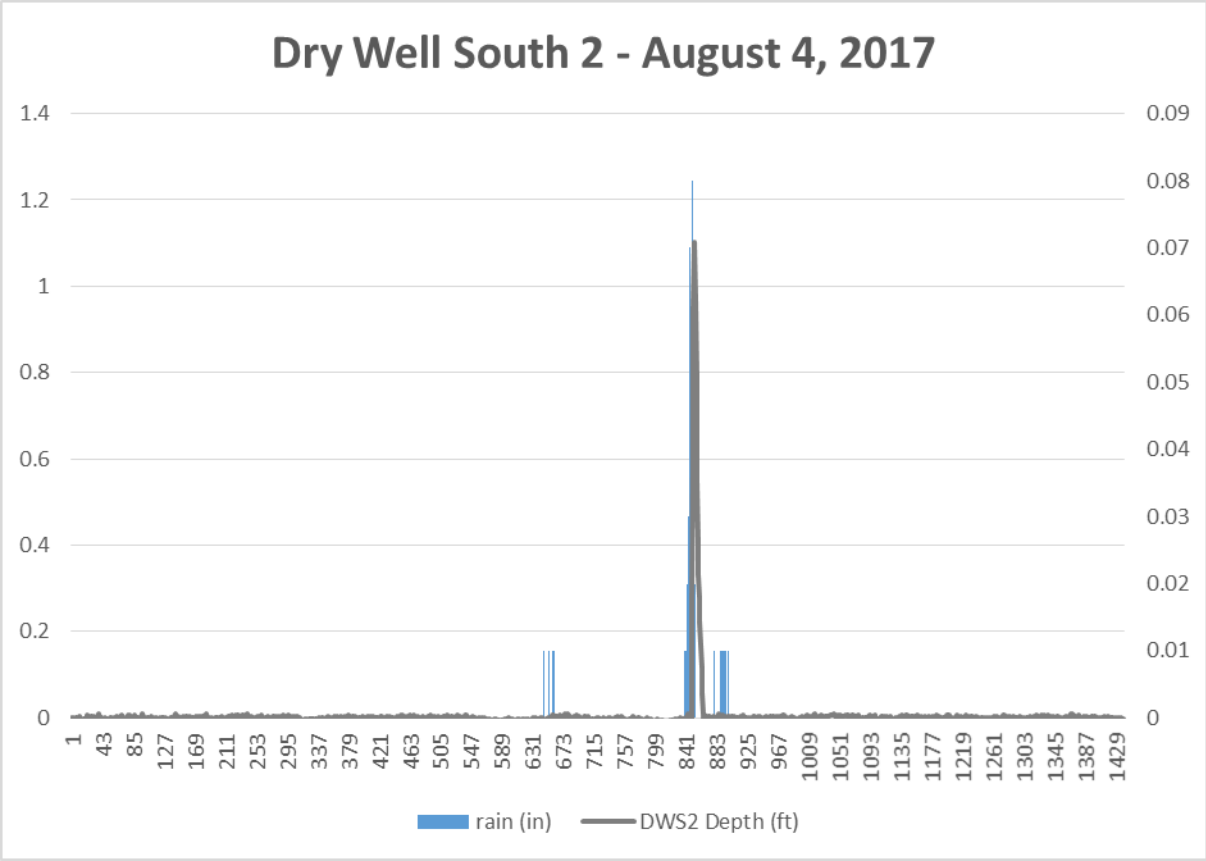
Dry Well


Dry Well North 2 - August 4, 2017
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1 43 85 127 169 211 253 295 337 379 421 463 505 547 589 631 673 715 757 799 841 883 925 967 1009 1051 1093 1135 1177 1219 1261 1303 1345 1387 1429
rain (in)
DWN2 Depth (ft)

Dry Well


Dry Well South 1 - August 4, 2017
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1 43 85 127 169 211 253 295 337 379 421 463 505 547 589 631 673 715 757 799 841 883 925 967 1009 1051 1093 1135 1177 1219 1261 1303 1345 1387 1429
rain (in)
DWS1 Depth (ft)

Dry Well


Dry Well South 2 - August 4, 2017
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1 43 85 127 169 211 253 295 337 379 421 463 505 547 589 631 673 715 757 799 841 883 925 967 1009 1051 1093 1135 1177 1219 1261 1303 1345 1387 1429
rain (in)
DWS2 Depth (ft)

Quantitative Assessment – Summary

- Storm intensity matters
- Practices infiltrate runoff
  - Only one bioretention area with an underdrain responded
- Ponding in South Lot dry wells, but not North Lot (they have ponded during other storms)

2. Qualitative Assessment

2. Qualitative

- How well does the design work? Adaptive management?
- How does site performance change over time?
- Observations and other details that may be valuable lessons-learned

Traffic Flow

- Cars kept driving through bioretention areas
- Installed fences with reflective tape along 4/5 bioretention areas to prevent this

Bioretention Area North 1

Walkways through Practices

October 22, 2016

January 1, 2017

Walkways through Practices

January 6, 2017

July 14, 2017

Grading

- Too steep (Dry Well South 2)
- Water bypassing dry well (Dry Well South 1)

Dry Well South 1 – May 20

Dry Well South 1 – May 5

Vegetation

- Only one practice has mulch – weed growth, maintenance
- Snow removal, mowing has damaged some trees


December 7, 2016


August 17, 2017

Potential for Clogging

September 14, 2017

September 5, 2017

Potential for Clogging

November 6, 2016

September 1, 2017

September 14, 2017

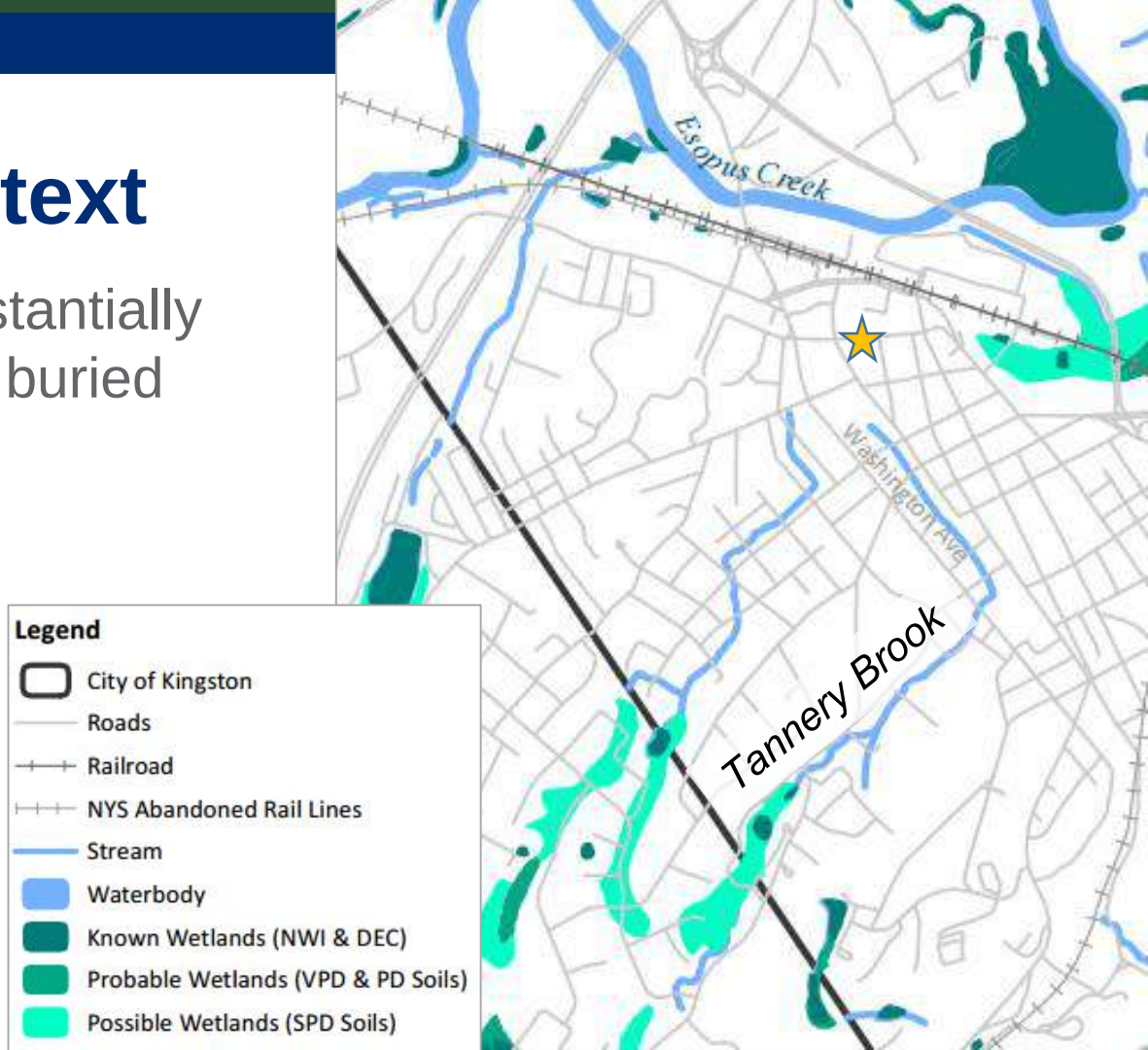
Qualitative Assessment – Summary

- Practices should be designed for urban areas (consider drivers and pedestrians) – can help reduce costs of adding features later
- Proper installation is important (grading)
- Maintenance to ensure the practices work over time (vegetation, prevent clogging)

3. Historical Context for Restoration

3. Historical Context

- Natural flow paths substantially altered, Tannery Brook buried
- Context for restoration practices (green infrastructure or stream daylighting)
- What should be the baseline?



Tannery Brook

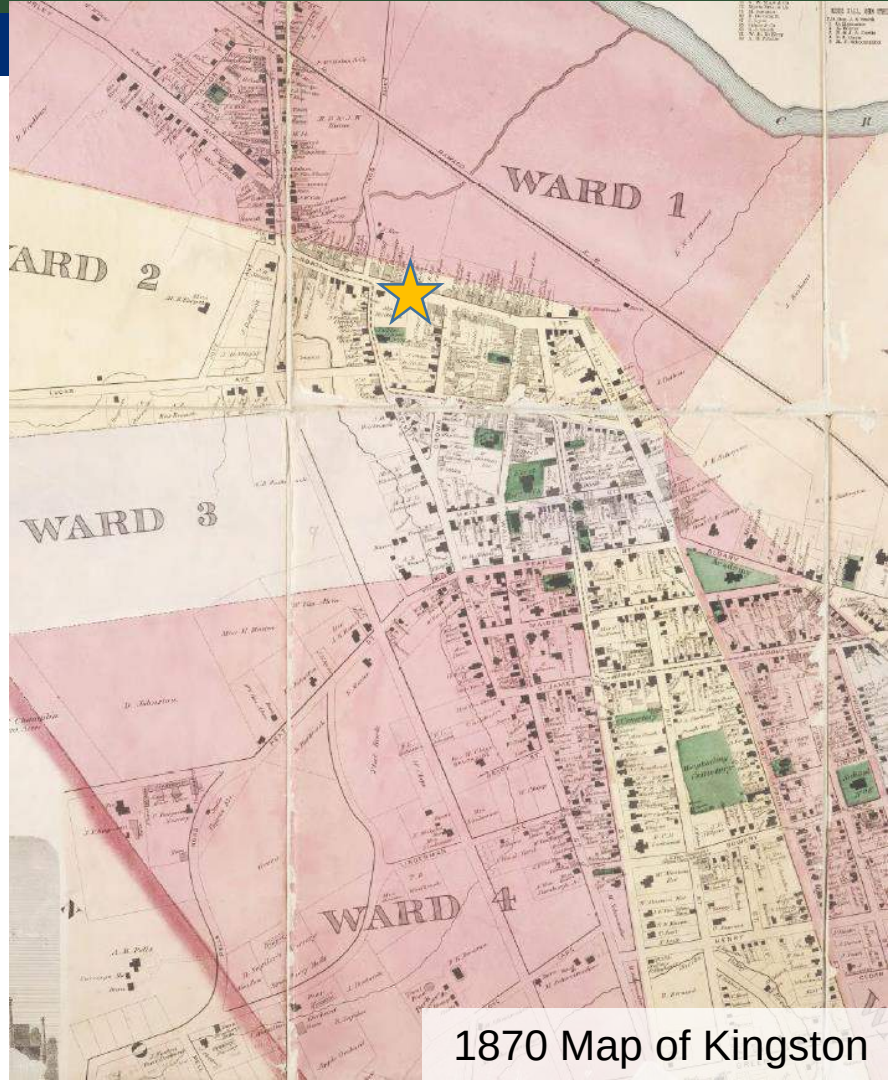
Main St.

Lucas Ave.

Dutch Village Apts.

Tannery Brook

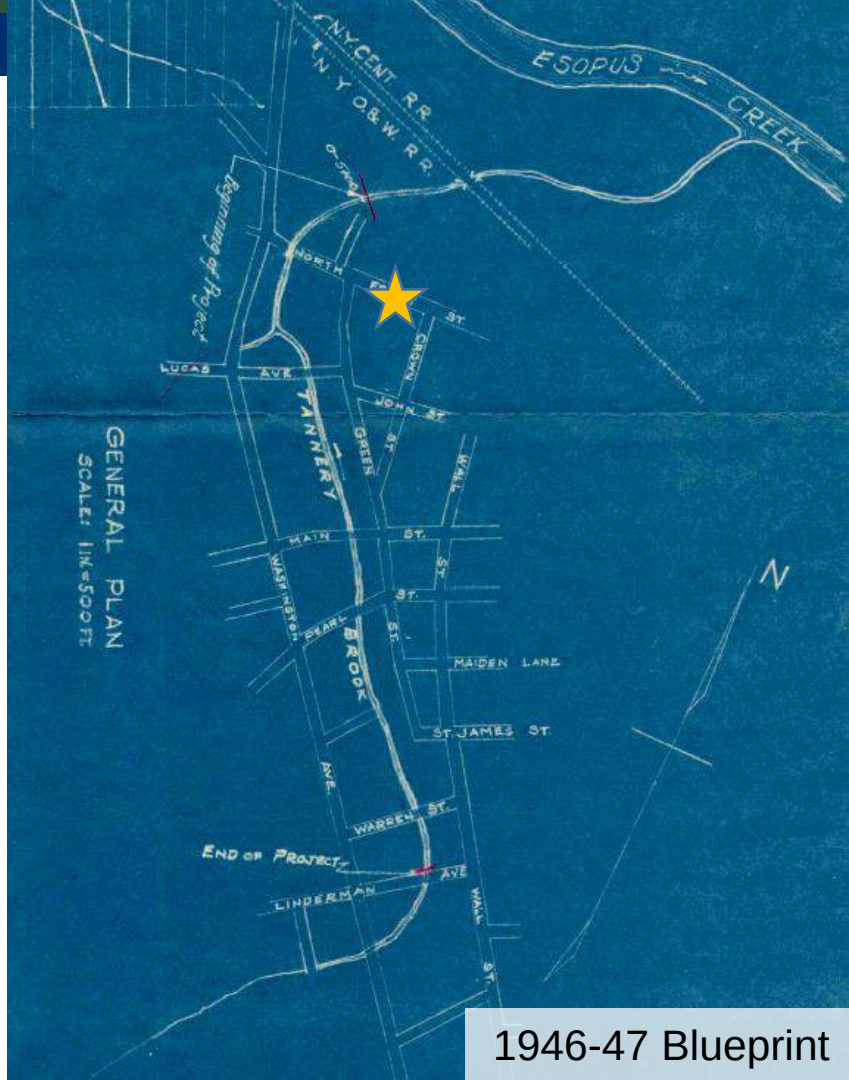
- Dutch settled in the area in 1652
- Ecosystem services:
  - “Drinking” water
  - Fire control
  - Mill power for industries
  - Recreation
  - Conduit for waste



1870 Map of Kingston

Tannery Brook

- Management decisions
  - Public health
  - Flooding
  - Water quality concerns
- Relationship with water in cities has changed dramatically over time!



1946-47 Blueprint

Learning Assessment

- Based on preliminary data, how well do bioretention areas and dry wells reduce runoff in the study area?
- What kinds of factors can influence the performance of green infrastructure practices in urban areas?
- What design elements are useful to consider in an urban context?
- What information can history provide?

Summary

- Bioretention areas, dry wells are reducing runoff very quickly
- Performance could change over time
- Adaptive management lessons to improve design in urban areas
- Tannery Brook watershed history provides context for present-day restoration

Next Steps

- Continue collecting data, review different storm types, statistics
- Document lessons learned
- Mapping the Tannery Brook watershed over time, including changes in land use and uses

Thank You!

- City of Kingston – Engineering, Parks & Recreation, Department of Public Works
- Dr. Todd Walter & Cornell University's Soil & Water Lab
- NYS Water Resources Institute at Cornell University
- Hudson River Estuary Program staff

Thank You!

Emily Vail

Watershed Outreach Specialist

Hudson River Estuary Program

emily.vail@dec.ny.gov

(845) 256-3145

Connect with us:

Facebook: www.facebook.com/NYSDEC

Twitter: twitter.com/NYSDEC

Flickr: www.flickr.com/photos/nysdec

Cornell Soil & Water Lab

New York State Water Resources Institute
Cornell University

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation