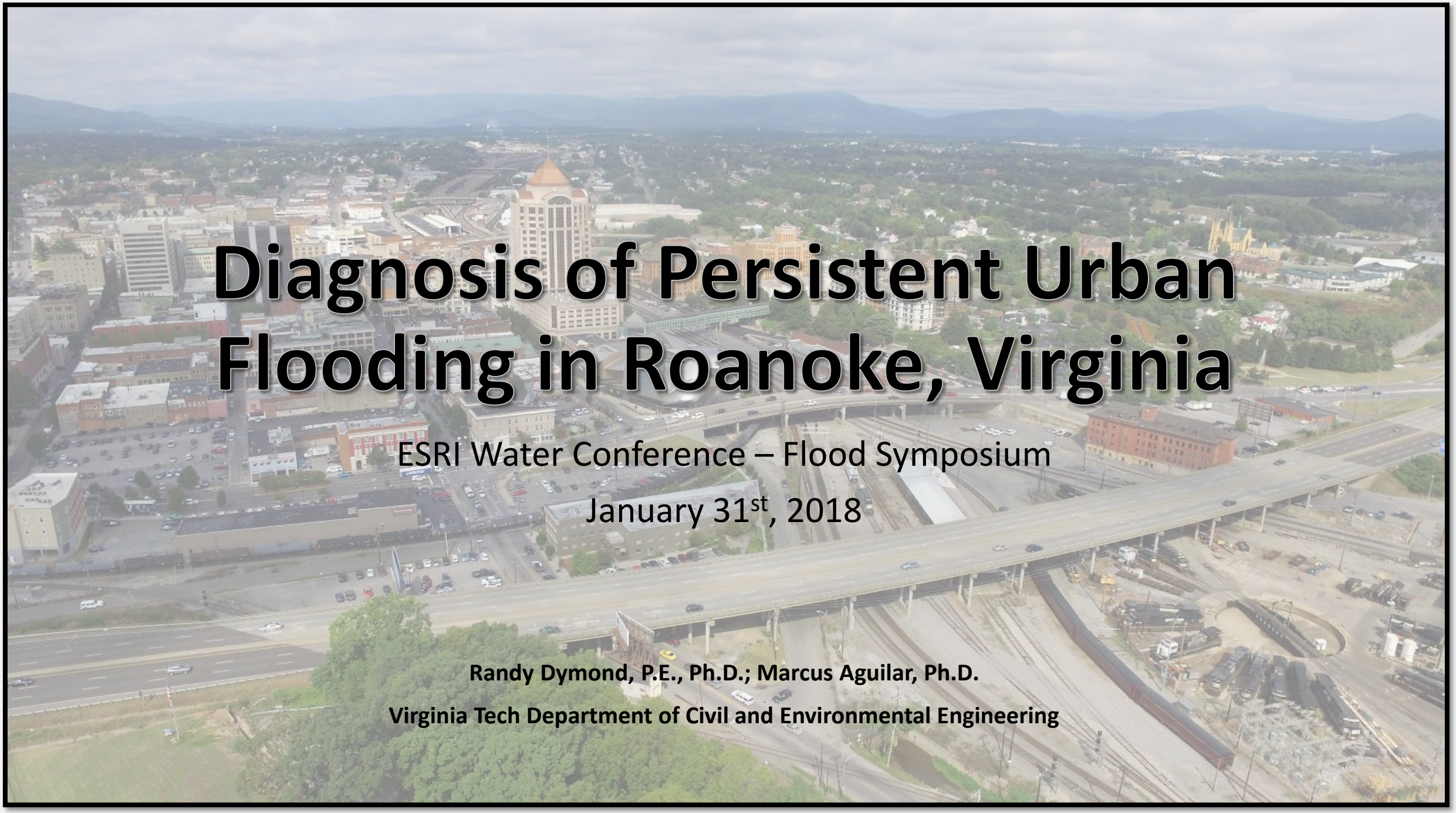


Diagnosis of Persistent Urban Flooding in Roanoke, Virginia

ESRI Water Conference – Flood Symposium

January 31st, 2018

Randy Dymond, P.E., Ph.D.; Marcus Aguilar, Ph.D.

Virginia Tech Department of Civil and Environmental Engineering

CUAHSI's 2018 Winter Cyberseminar Series:
Urban Stormwater Hydroinformatics

- **February 7**

  Developing and Utilizing Stormwater's "Big" Dataset

  Randy Dymond (Virginia Tech)

- **February 14**

  Enabling "Smarter" Urban Watersheds

  Branko Kerkez (University of Michigan)

- **February 21**

  Urban Hydrology and the National Center for Infrastructure Modeling and Management (NCIMM)

  Ben Hodges (University of Texas)

- **February 28**

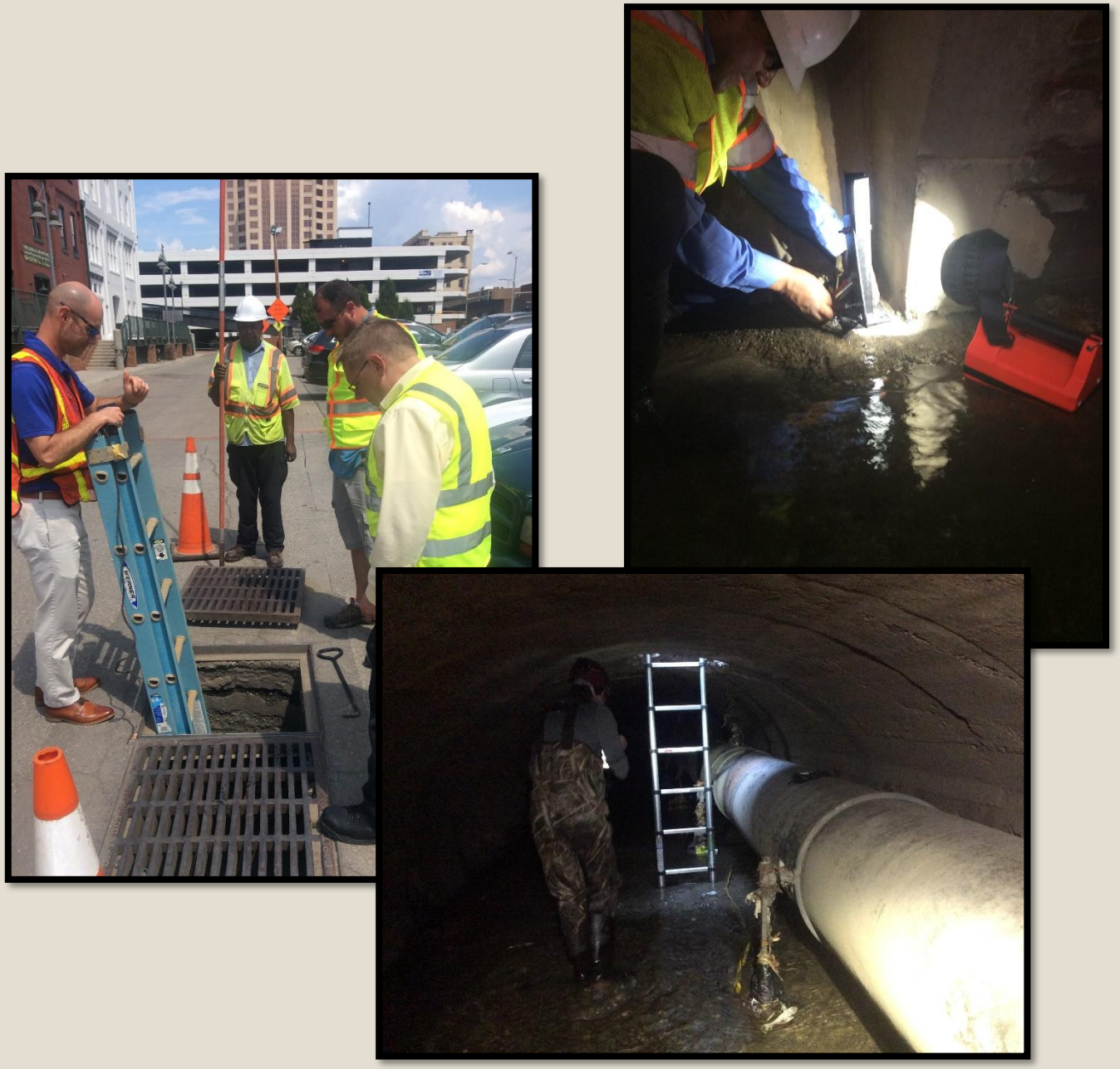
  Watershed-scale Effectiveness of Green Infrastructure

  Aditi Bhaskar (Colorado State University)

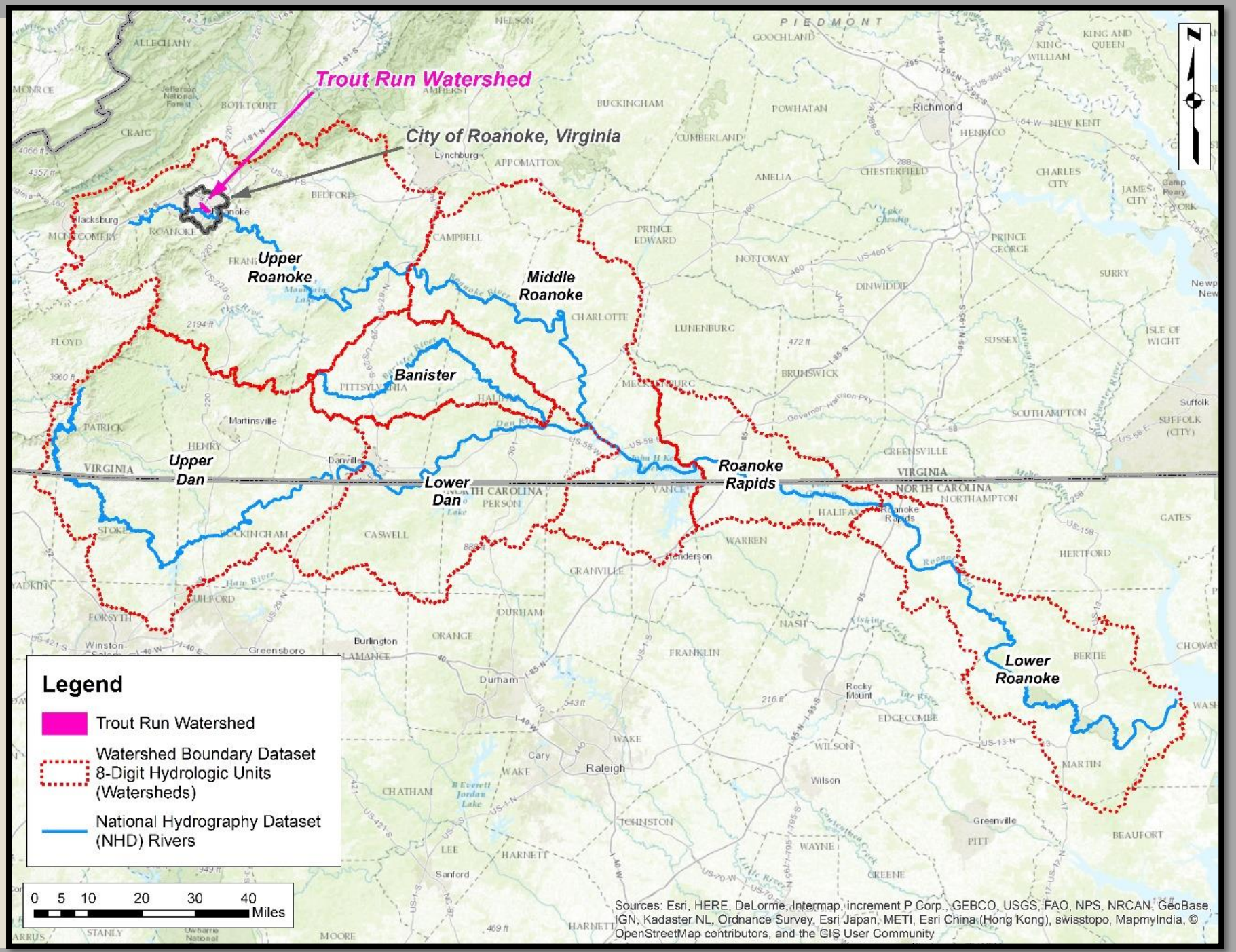
If you have a question or comment during the webinar, please send a message through the "Question/Chat Box" and we will read it during the Q&A session at the end.

Agenda

- Introduction
- History
- Mapping
- Monitoring
- Conclusion/Discussion



Introduction



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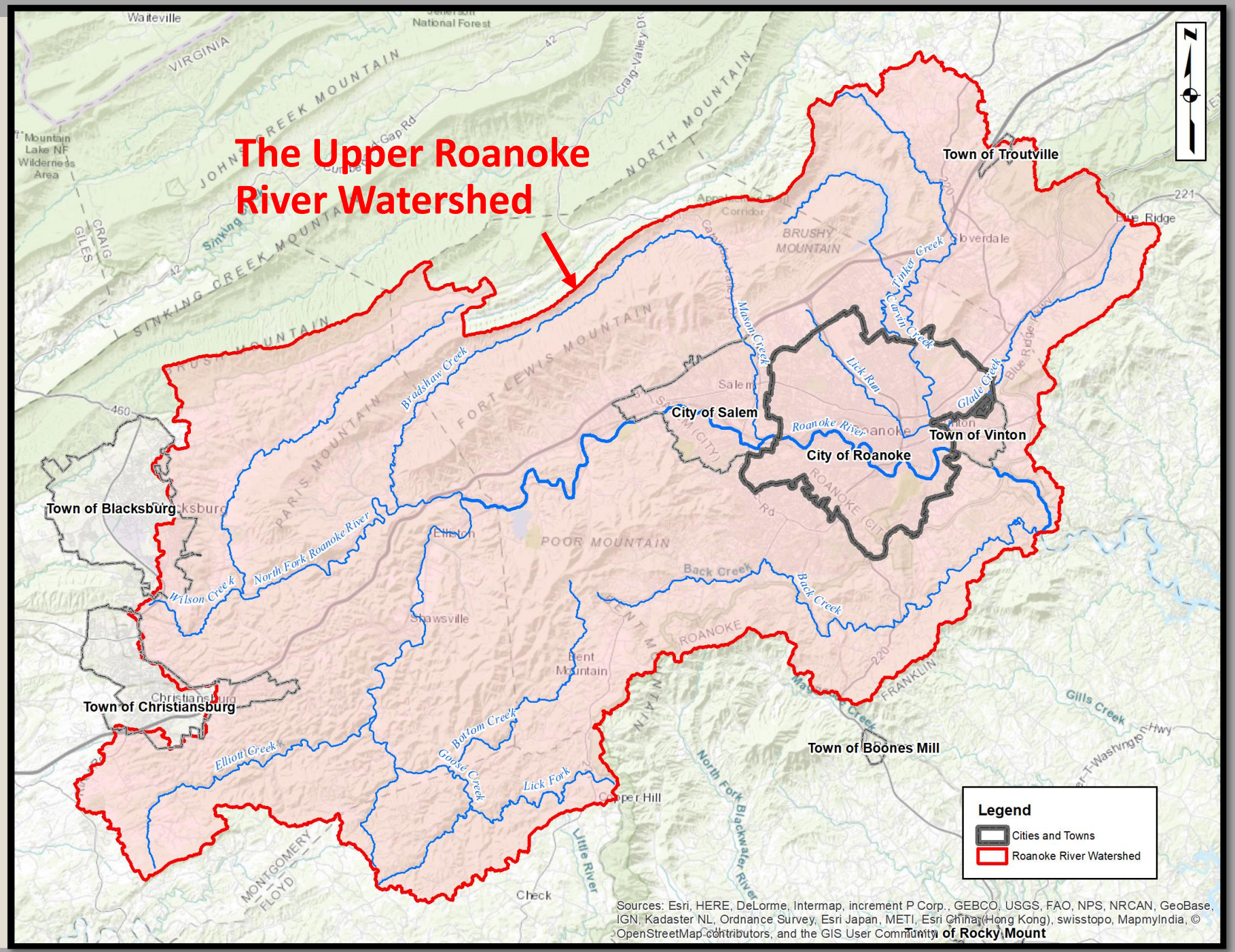
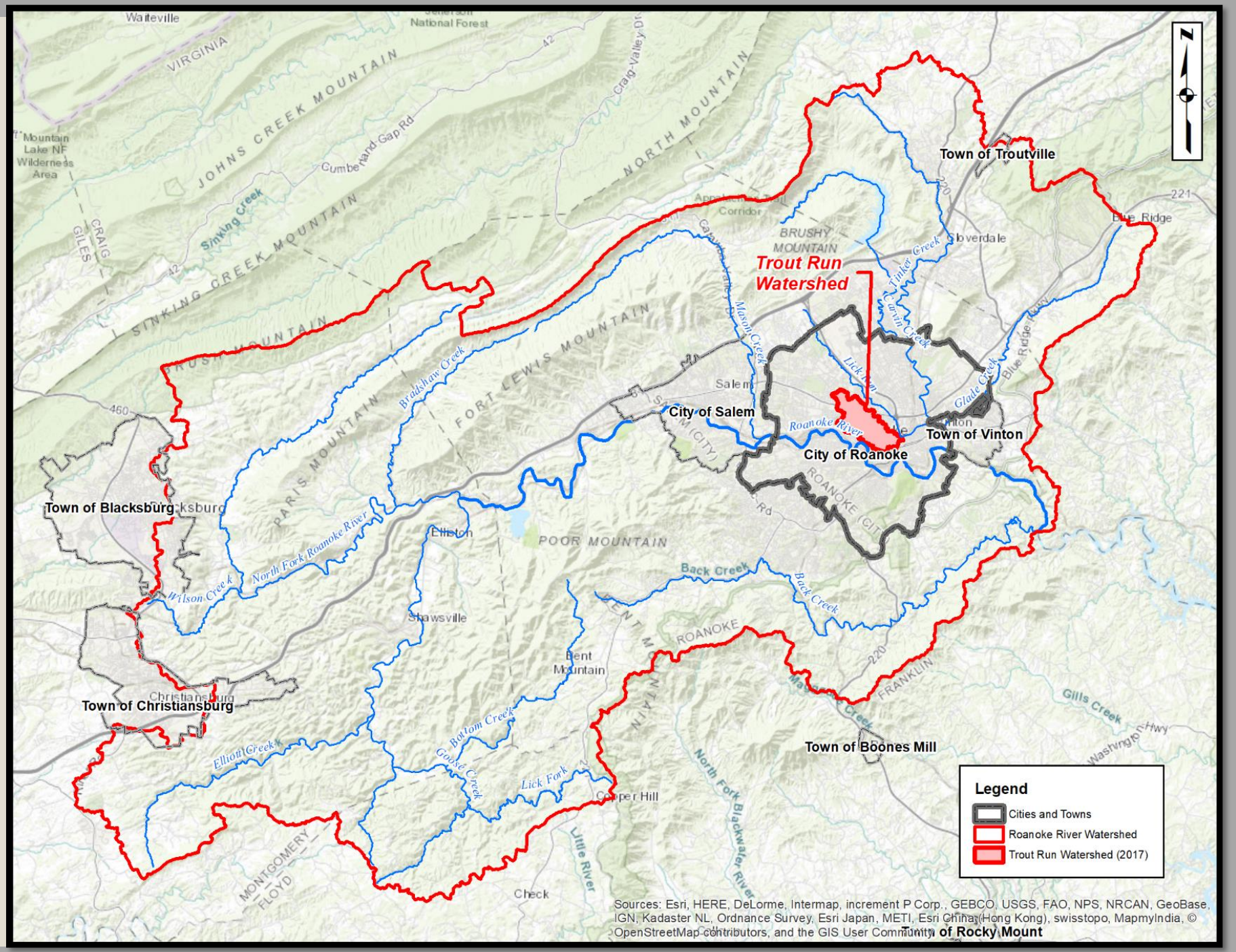


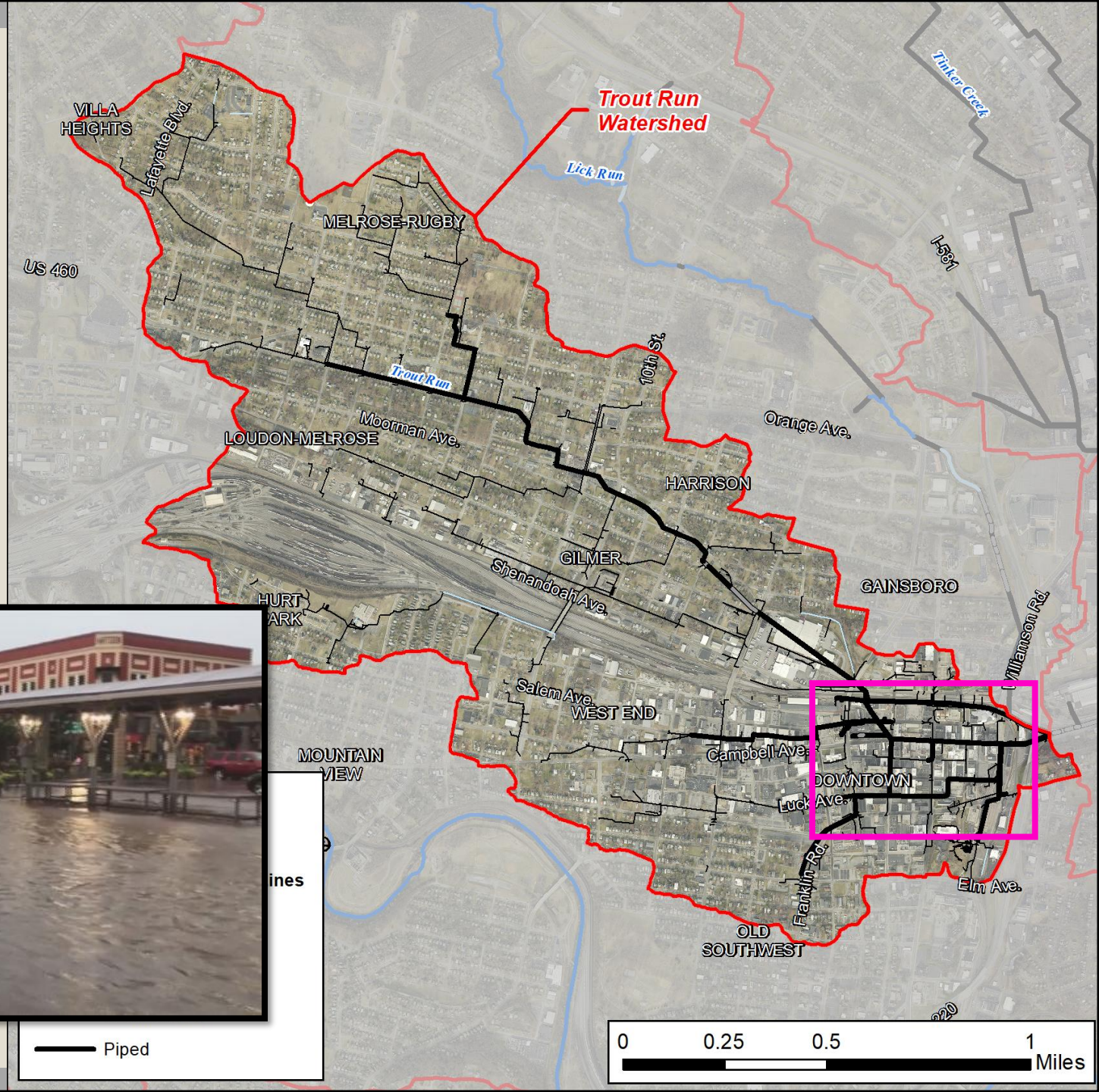
Introduction



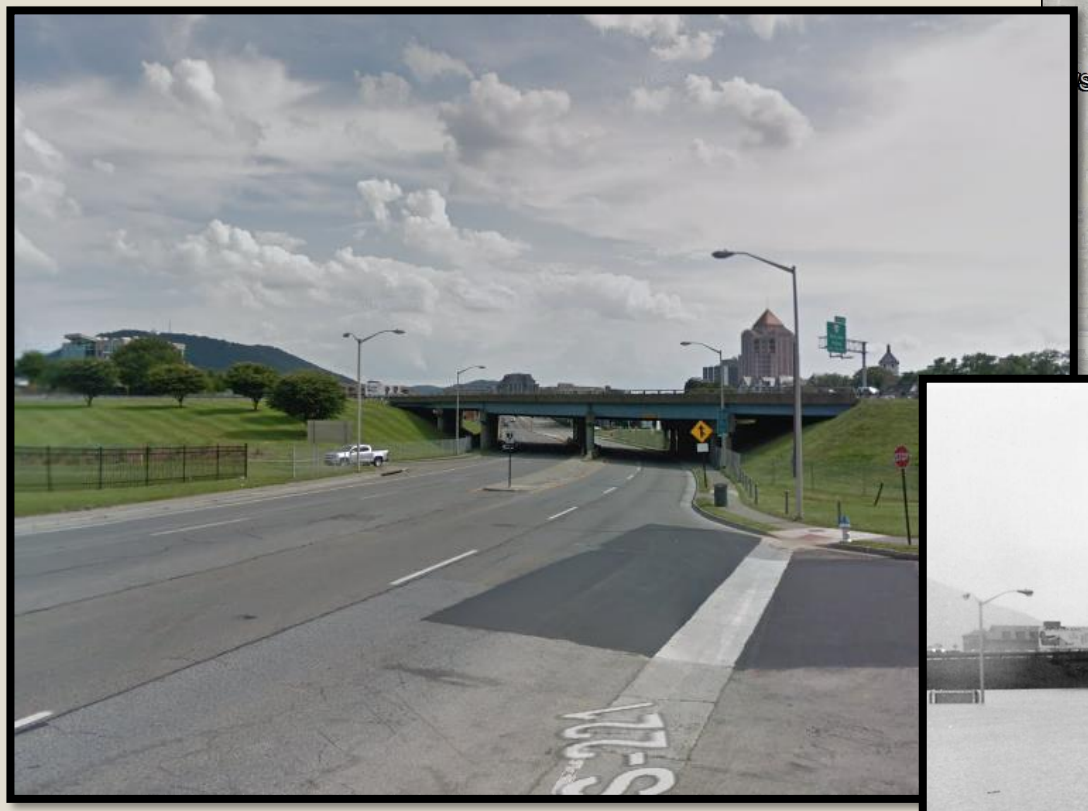
Introduction

Market Square Downtown - 1927

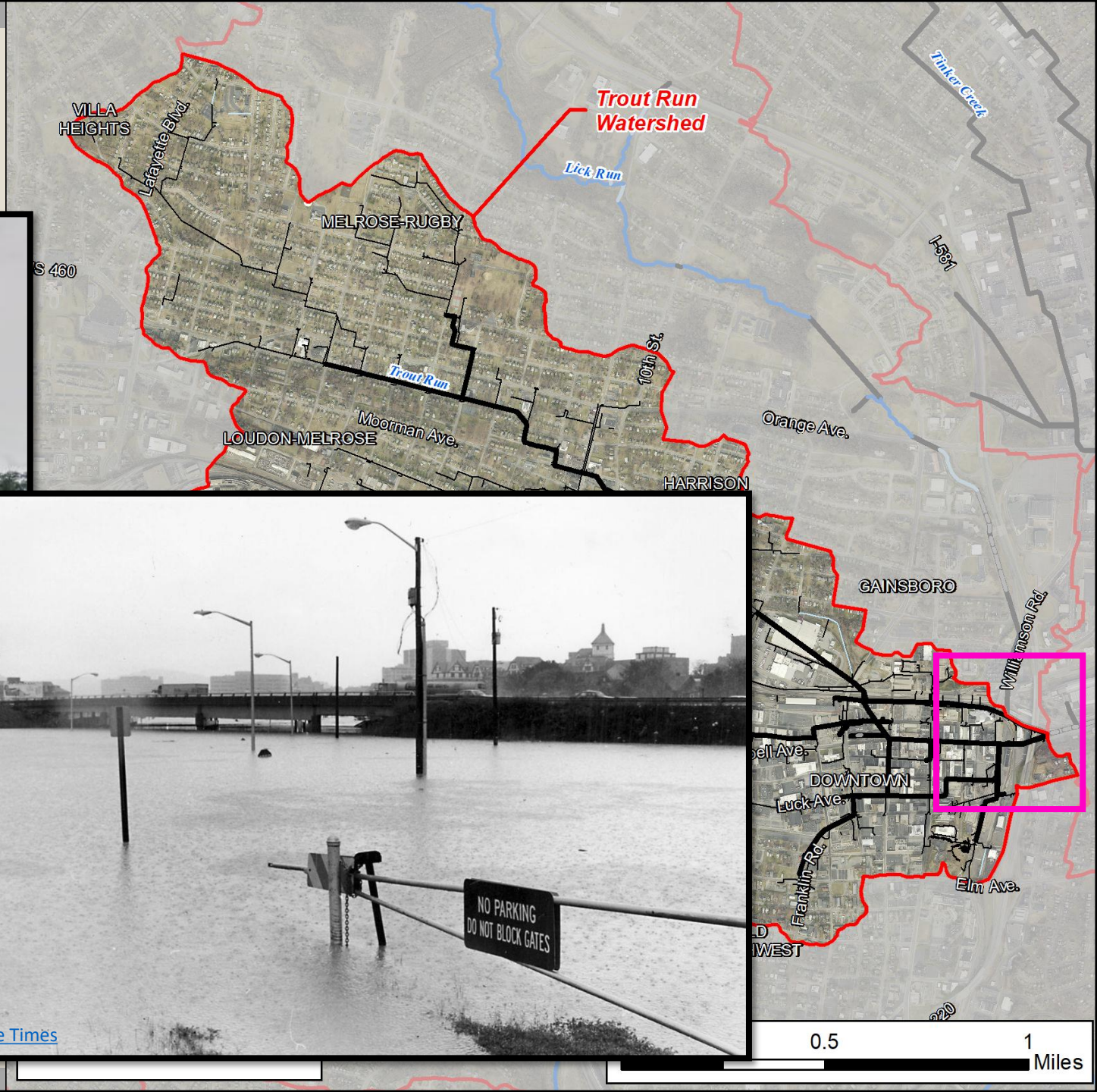
Market Square Downtown - 2016



Introduction



Roanoke Times



Data Collection

Historical Research

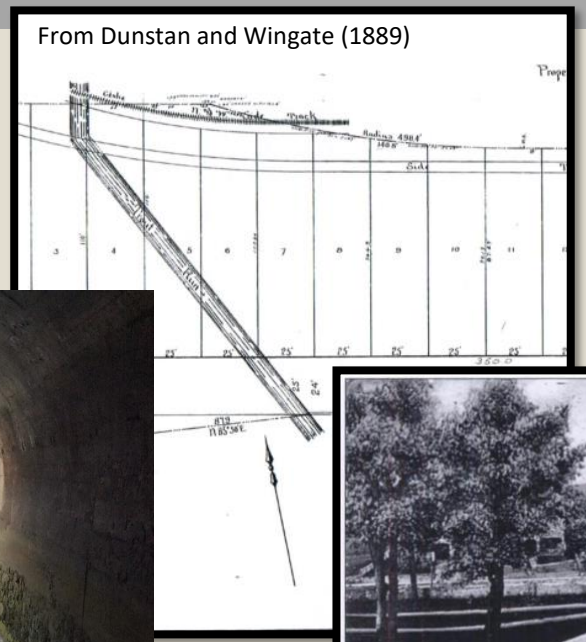
- Roanoke History
- Historical Plats and Maps

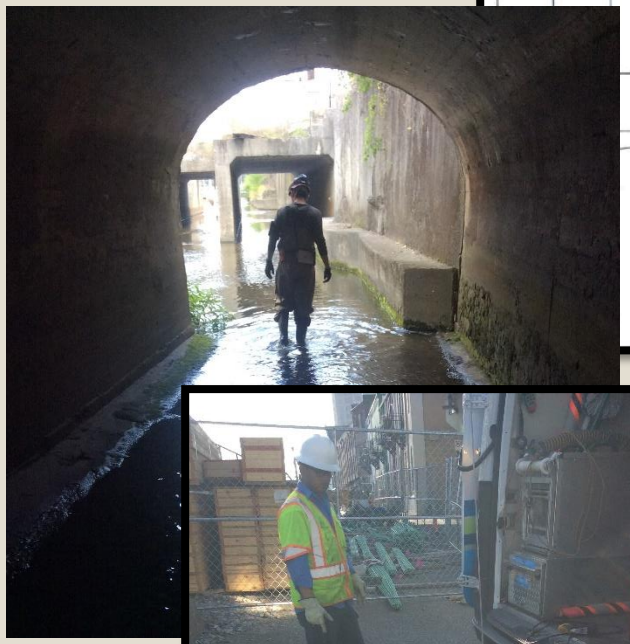
Mapping

- Tunnel Survey
- Storm Drain Asset Inventory

Monitoring

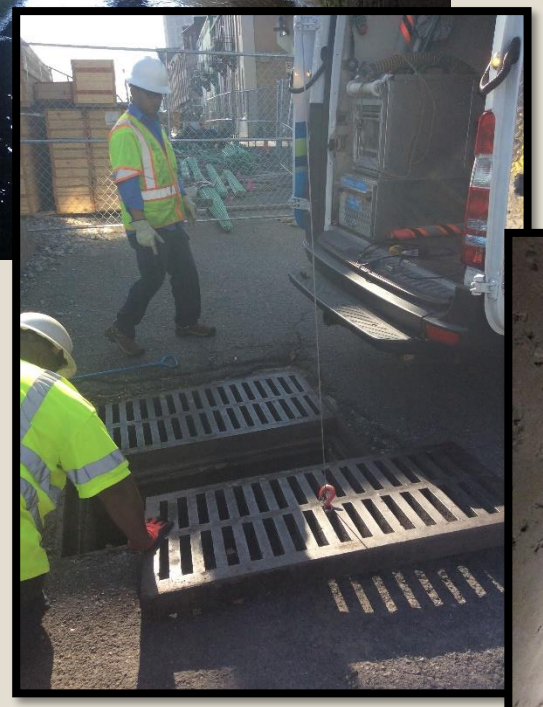
- Water Level Loggers


From Dunstan and Wingate (1889)



SPRING IN ELMWOOD PARK, 1913. Elmwood Park, Roanoke's oldest municipal park, once contained a spring-fed pond bordered by an intricate, wrought-iron fence.

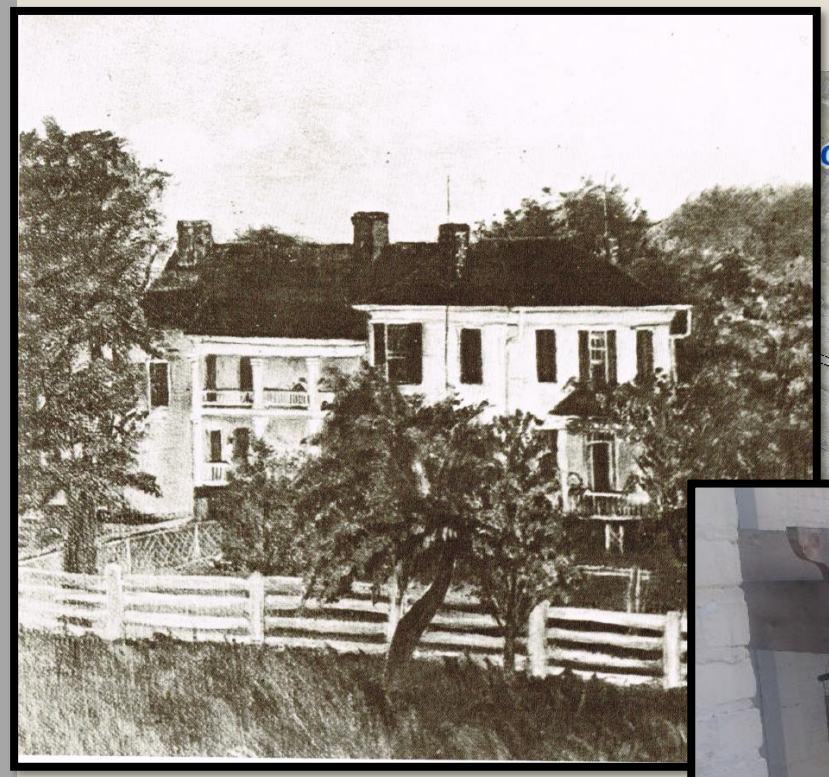
From Harris (2012)



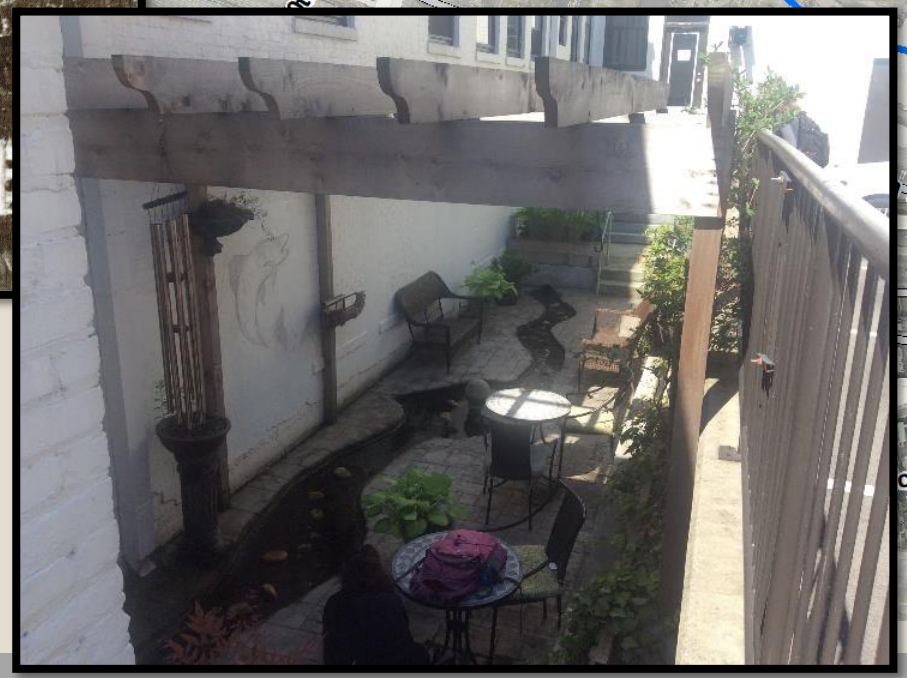
Historical Research

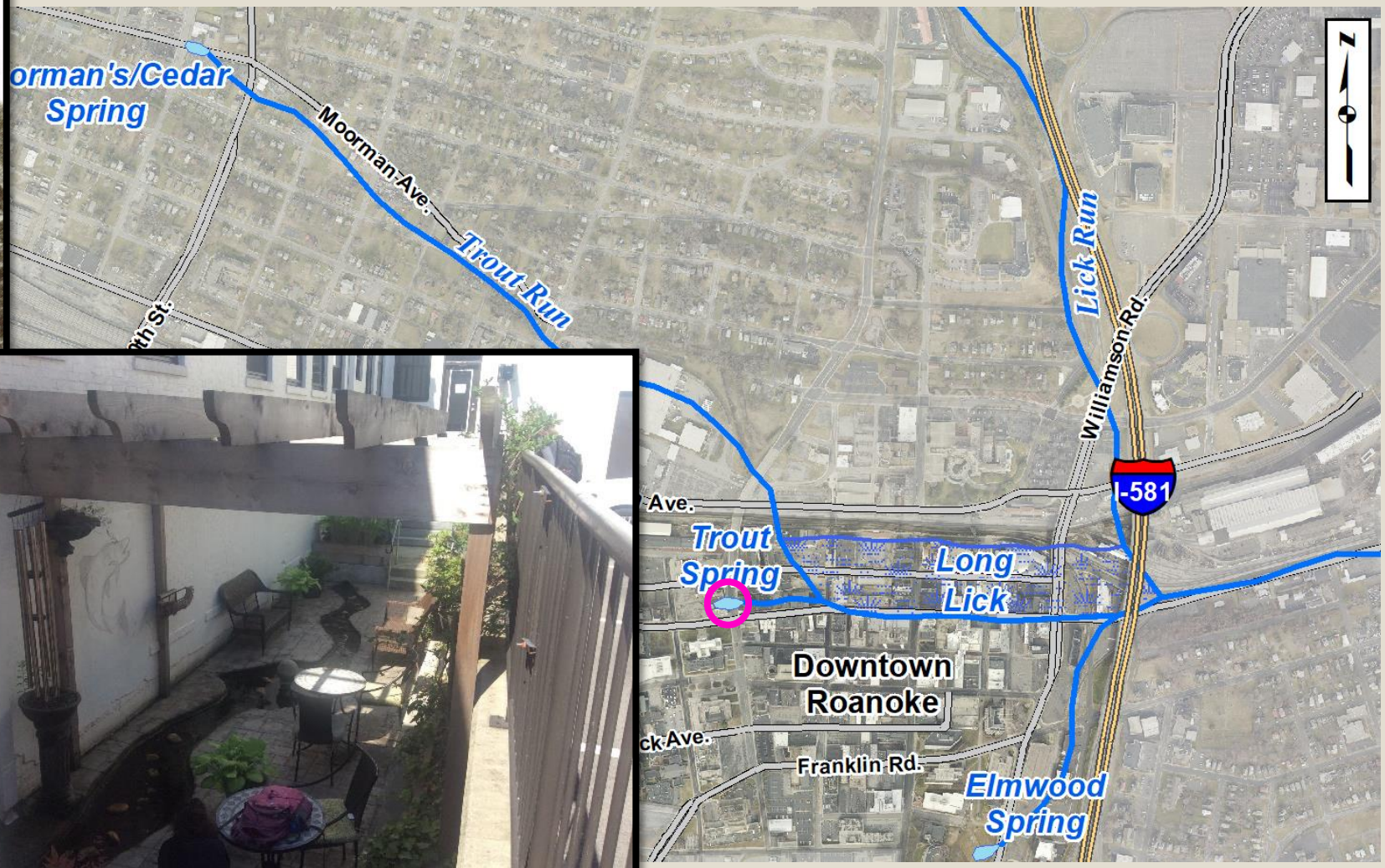
Moorman's Spring. From City Planning Comm. (1928), Courtesy Roanoke Public Libraries

Historical Research

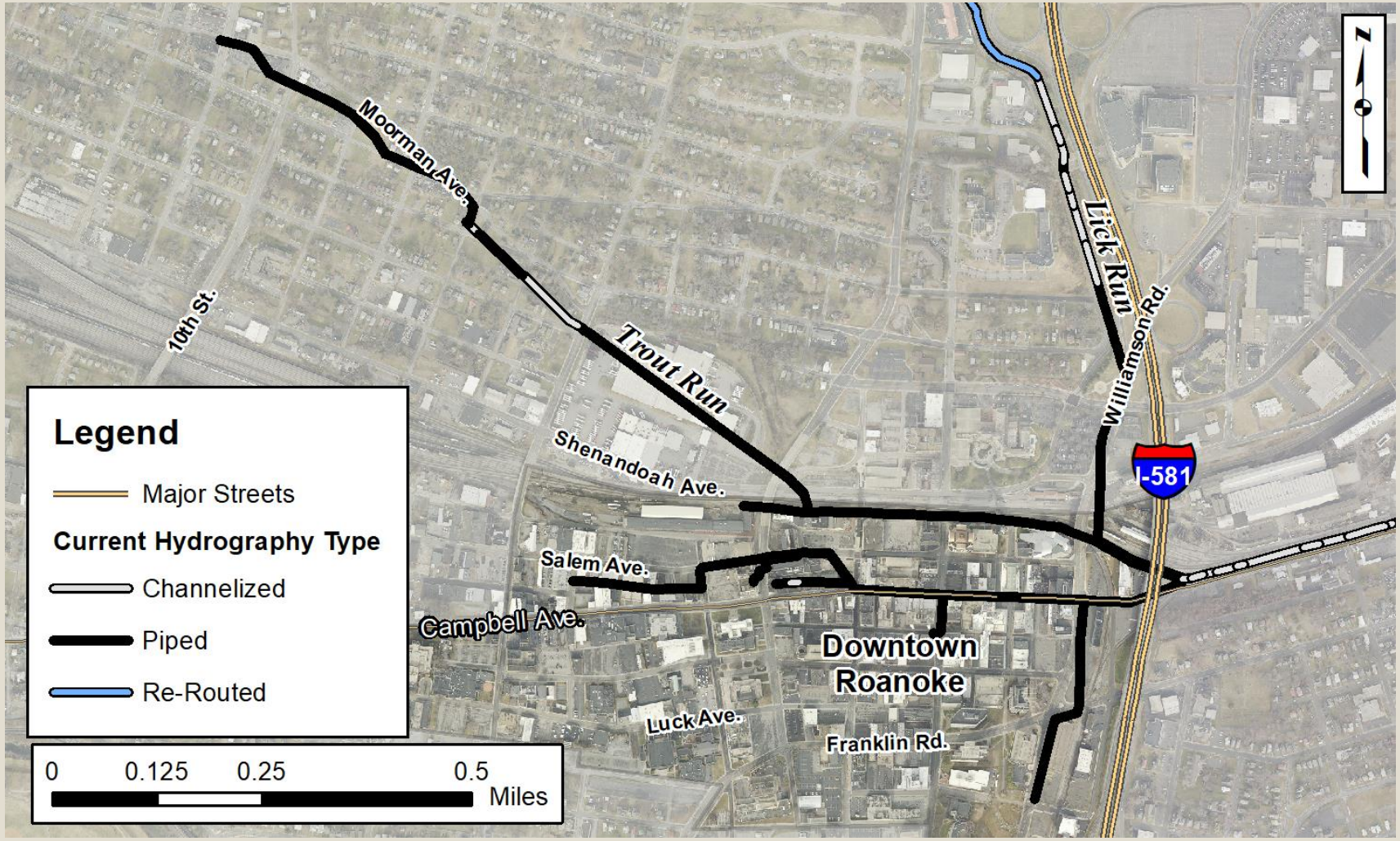


Trout House c. 1840. From Roanoke Valley Chamber of Commerce in Bruce (1942)





Historical Research



Mapping

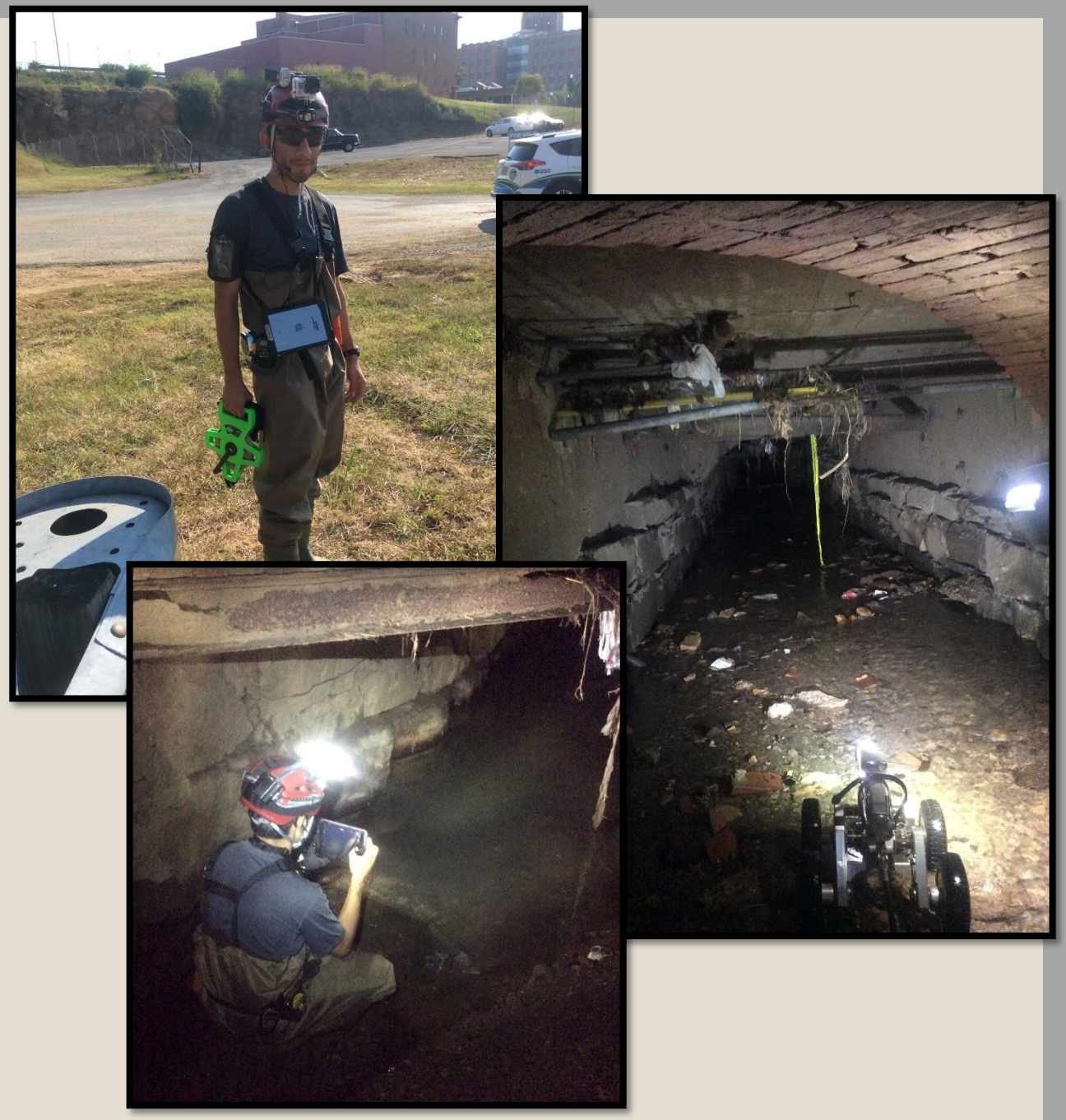
Data Collection Issues

- Confined Space Entry
- Heavy Traffic
- No 4G, Wi-Fi, GPS
- Invert Conditions

Mapping

Data Collection Methods

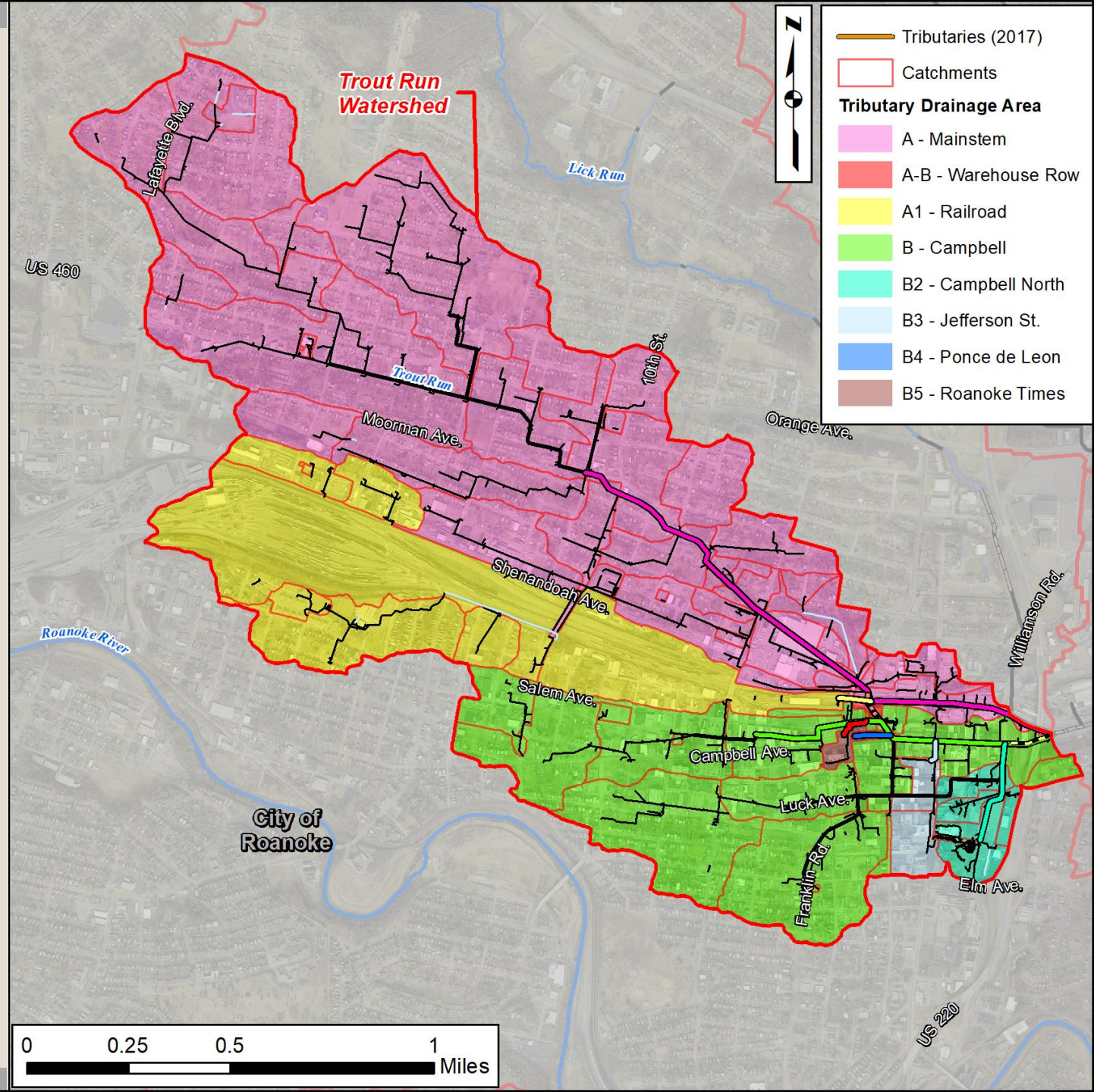
- iPad with ArcGIS Collector (local)
- Closed Caption Pipe Camera System
- GoPro Helmet Camera
- Post-Processing



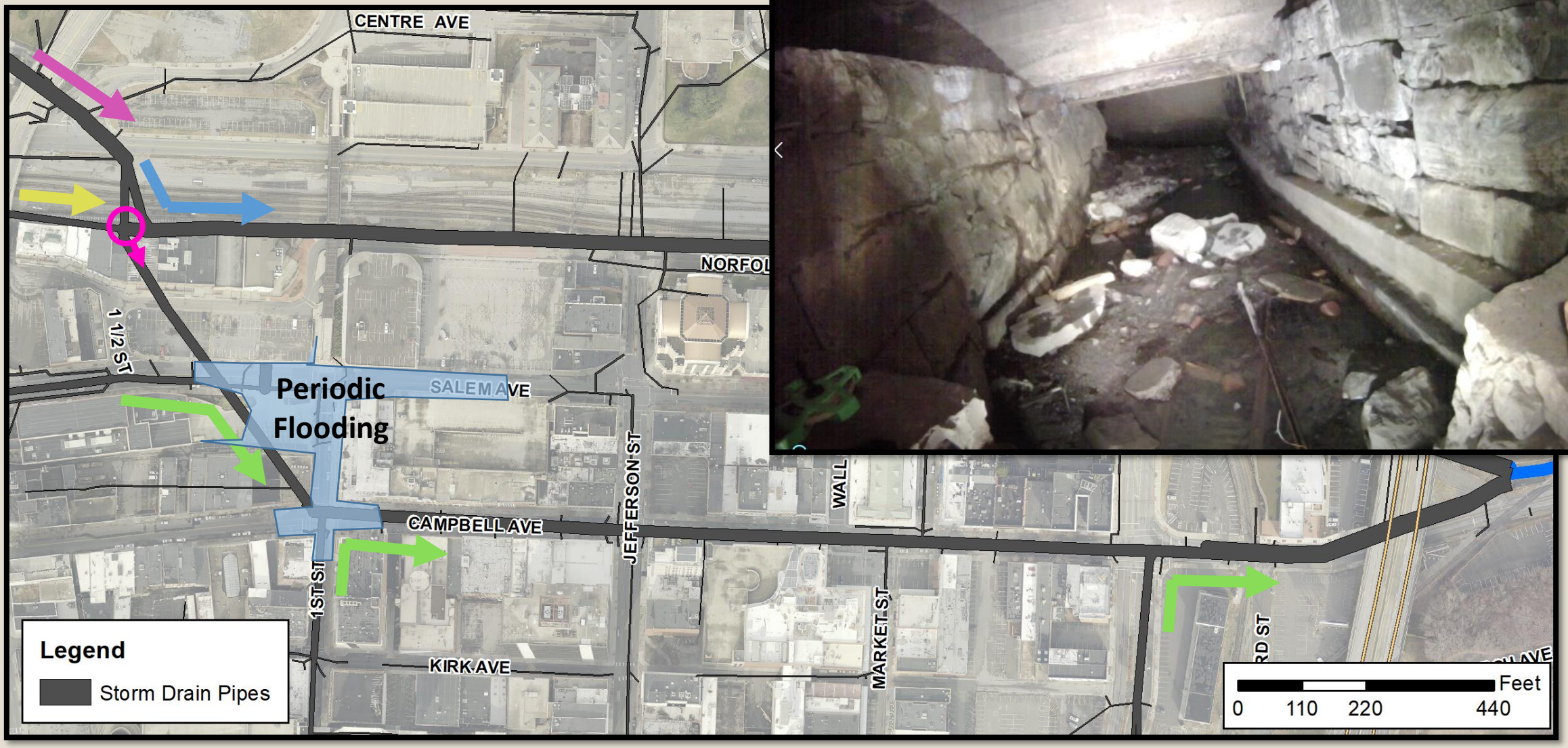
Mapping

Watershed Delineation

- Topography (2015 LiDAR)
- Tunnel Survey
- Asset Inventory



Mapping


CENTRE AVE
NORFOL
1 1/2 ST
Periodic Flooding
SALEM AVE
JEFFERSON ST
WALL
CAMPBELL AVE
1ST ST
MARKET ST
KIRK AVE
RD ST
Legend
Storm Drain Pipes
Feet
0
110
220
440

Mapping

CENTRE AVE
NORFOLK AVE
SALEM AVE
CAMPBELL AVE
KIRK AVE
1 1/2 ST
1ST ST
JEFFERSON ST
WALL ST
MARKET ST
I-581
Periodic Flooding
Legend
Storm Drain Pipes
Feet
0
110
220
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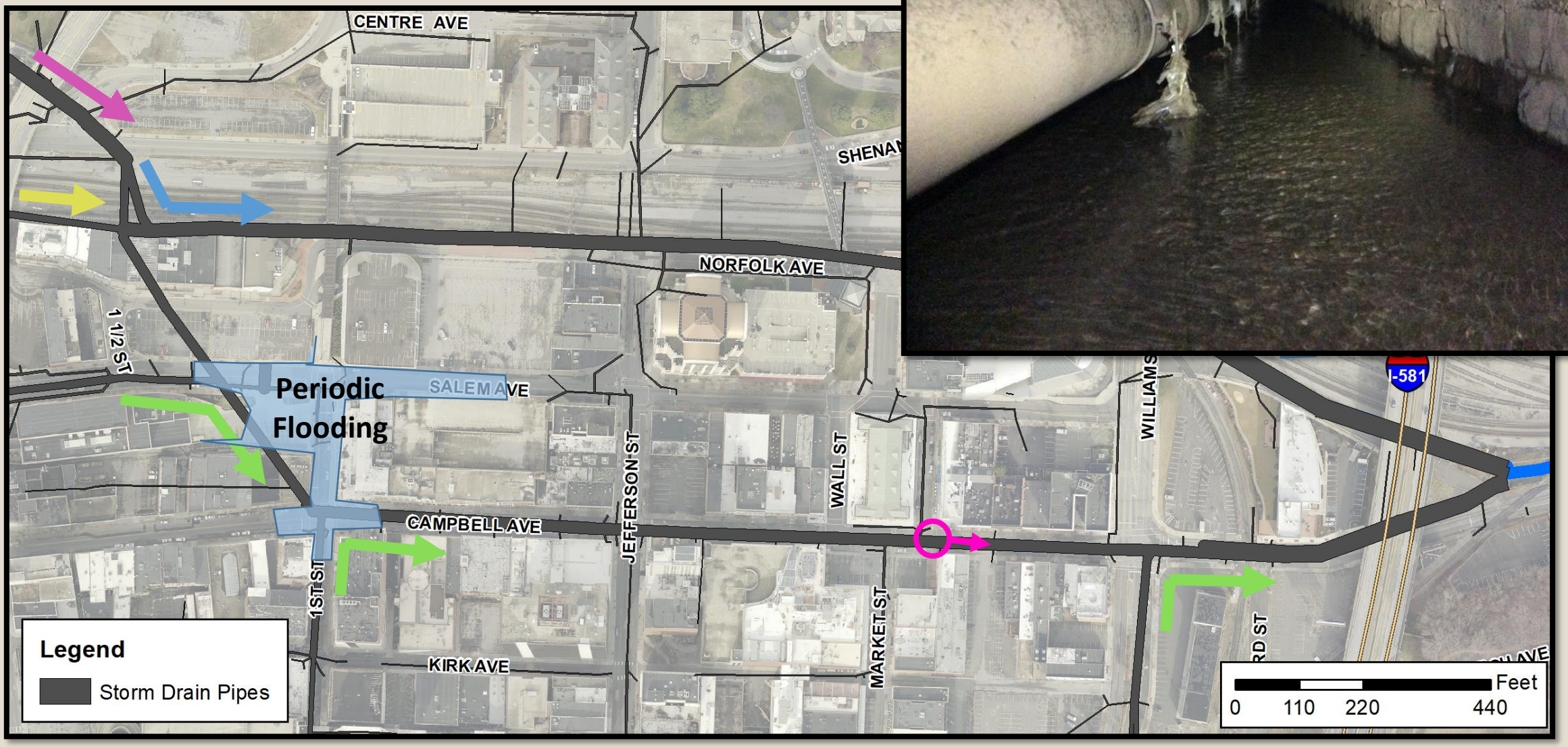
Mapping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WALL ST
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WILLIAMS
I-581
Periodic Flooding
Legend
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Feet
0
110
220
440

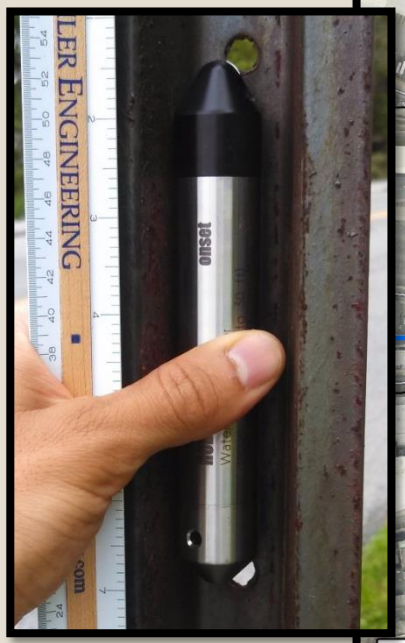
Monitoring

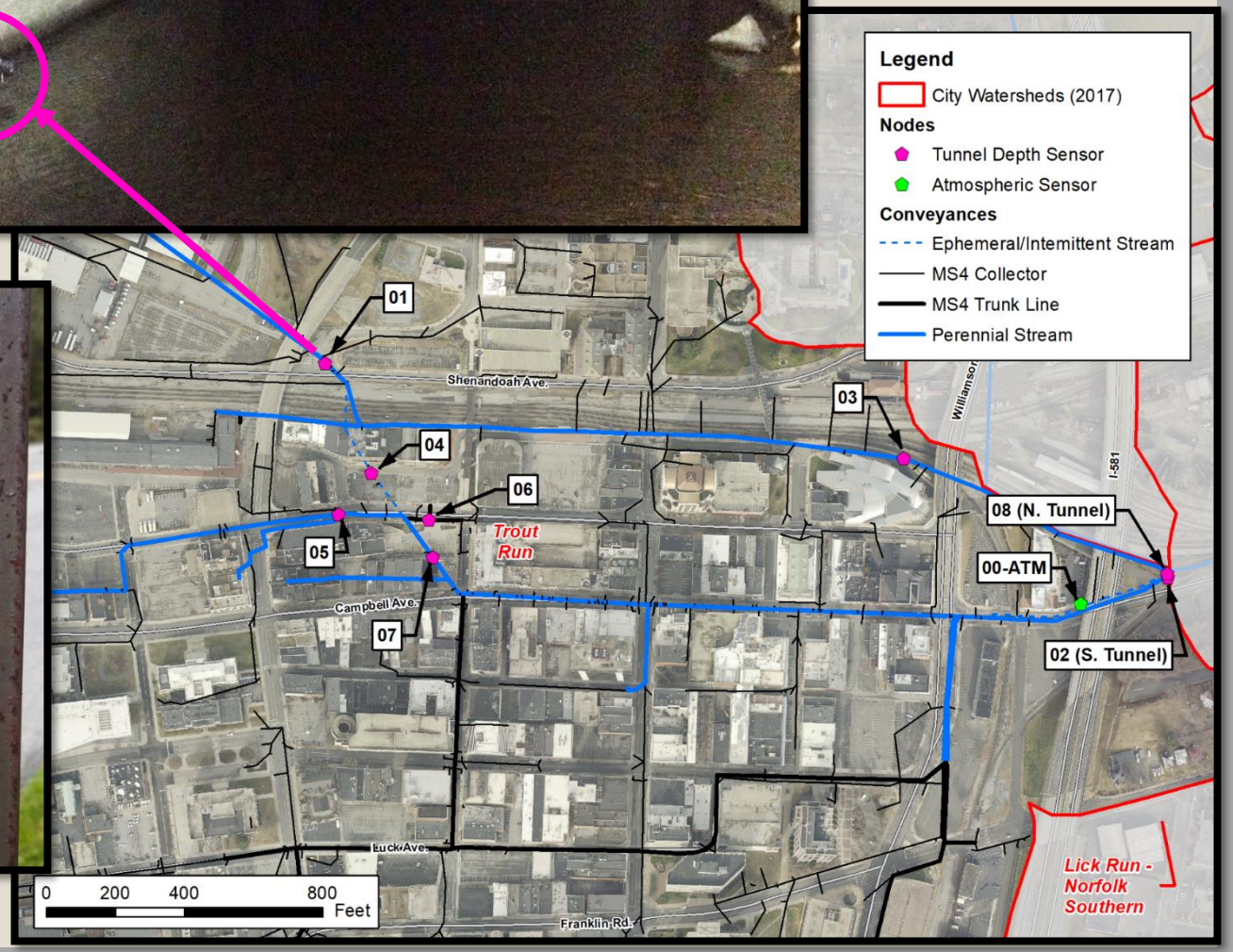
8 Depth Sensors

- 5 minute intervals
- 11 storm events

Rainfall

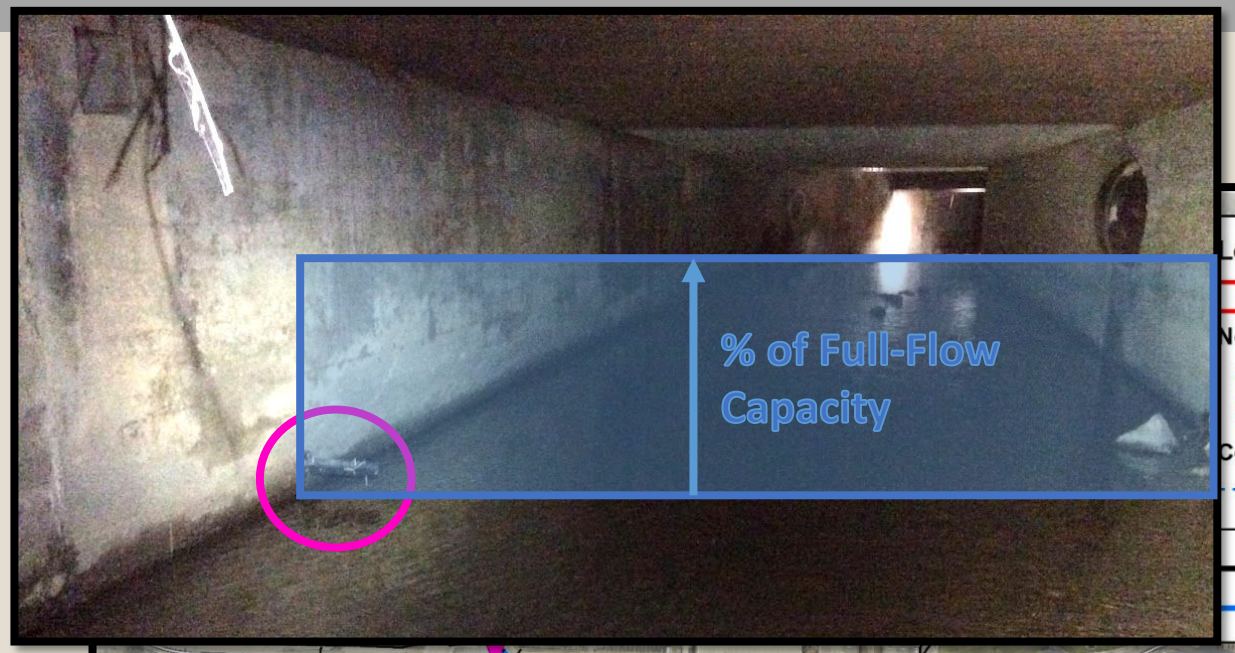
- Airport Gage (NOAA)
- 9 New Gages (USGS)

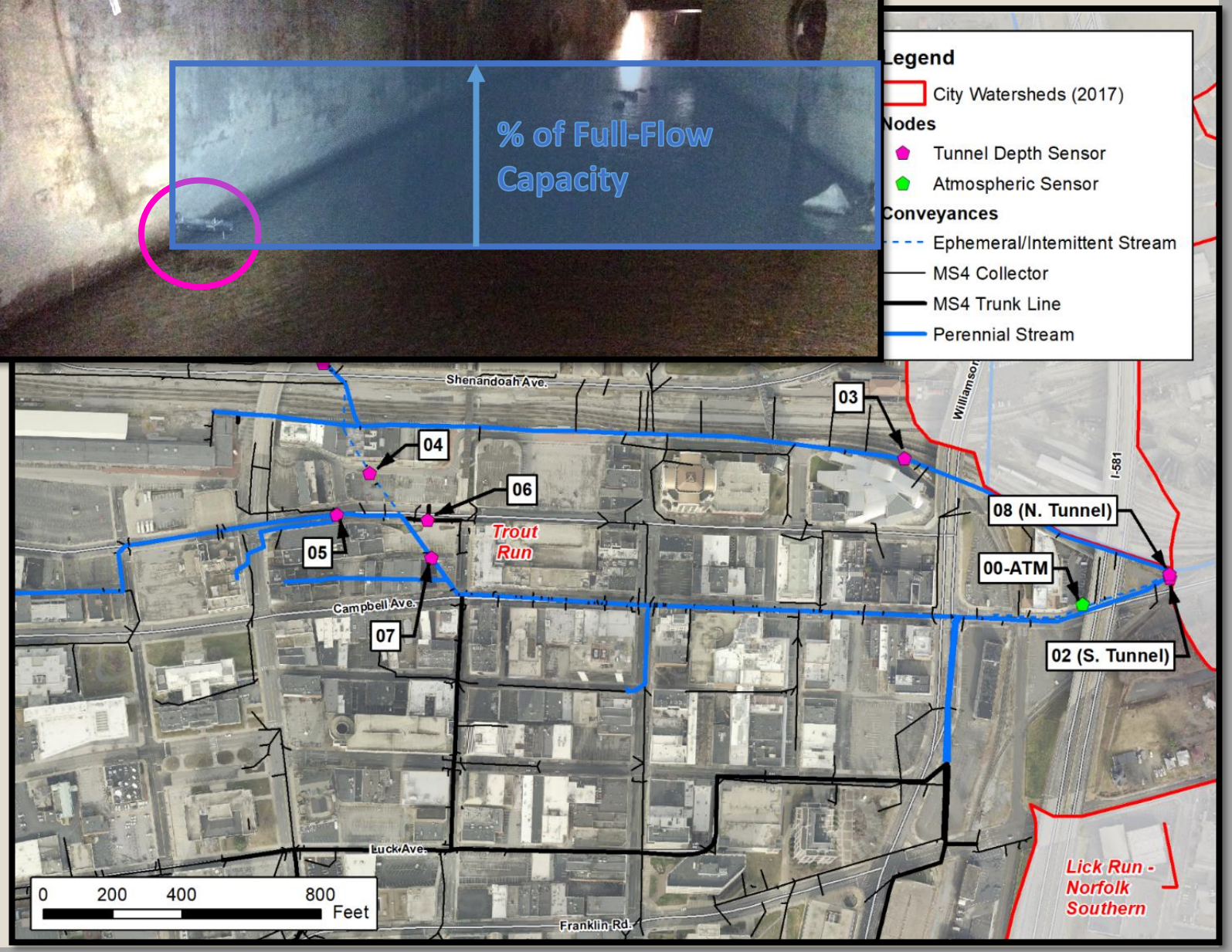




Monitoring

- Largest Event
  - 0.68” in 12 min.
  - 2 - 3 yr. event
- Runoff Response
  - Peak flow/total capacity
  - Maximum depth



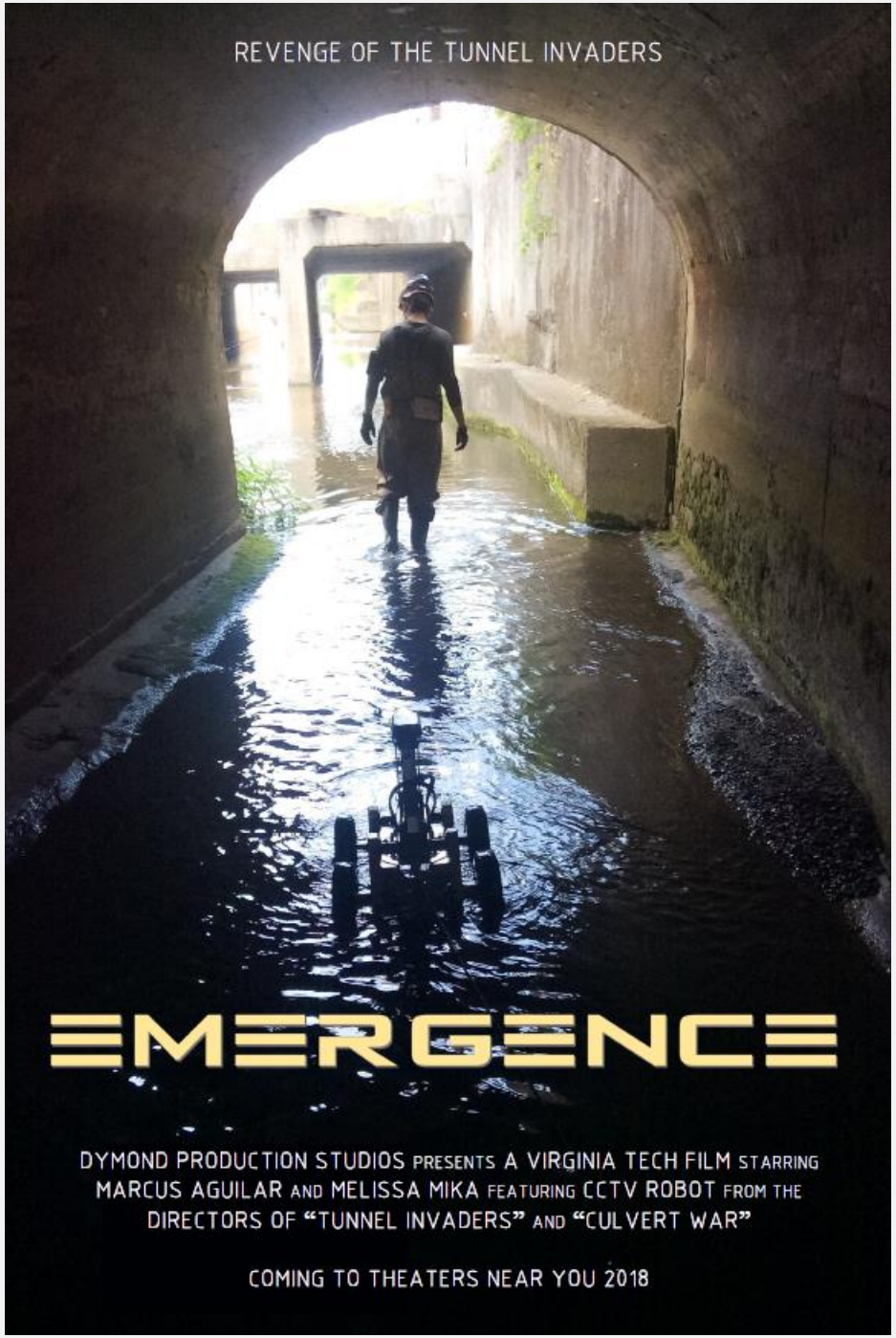


Conclusion/Discussion

- History + Mapping + Monitoring = Decision Making
- Next Steps –
  - H&H Modeling
  - Flood Warning
- Buried Streams – Disappearing Ecosystems
- Better ideas for spatial data collection underground?

Roanoke Times

SOMETHING LURKING BENEATH THE STREETS
TUNNEL INVADERS
DYMOND PRODUCTION STUDIOS PRESENTS A VIRGINIA TECH FILM STARRING
MARCUS AGUILAR AND MELISSA MIKA FEATURING CCTV ROBOT FROM THE
DIRECTORS OF "STORM CHASERS" AND "COPIOUS RUNOFF"
COMING TO THEATERS NEAR YOU 2017


REVENGE OF THE TUNNEL INVADERS
EMERGENCE
DYMOND PRODUCTION STUDIOS PRESENTS A VIRGINIA TECH FILM STARRING
MARCUS AGUILAR AND MELISSA MIKA FEATURING CCTV ROBOT FROM THE
DIRECTORS OF "TUNNEL INVADERS" AND "CULVERT WAR"
COMING TO THEATERS NEAR YOU 2018