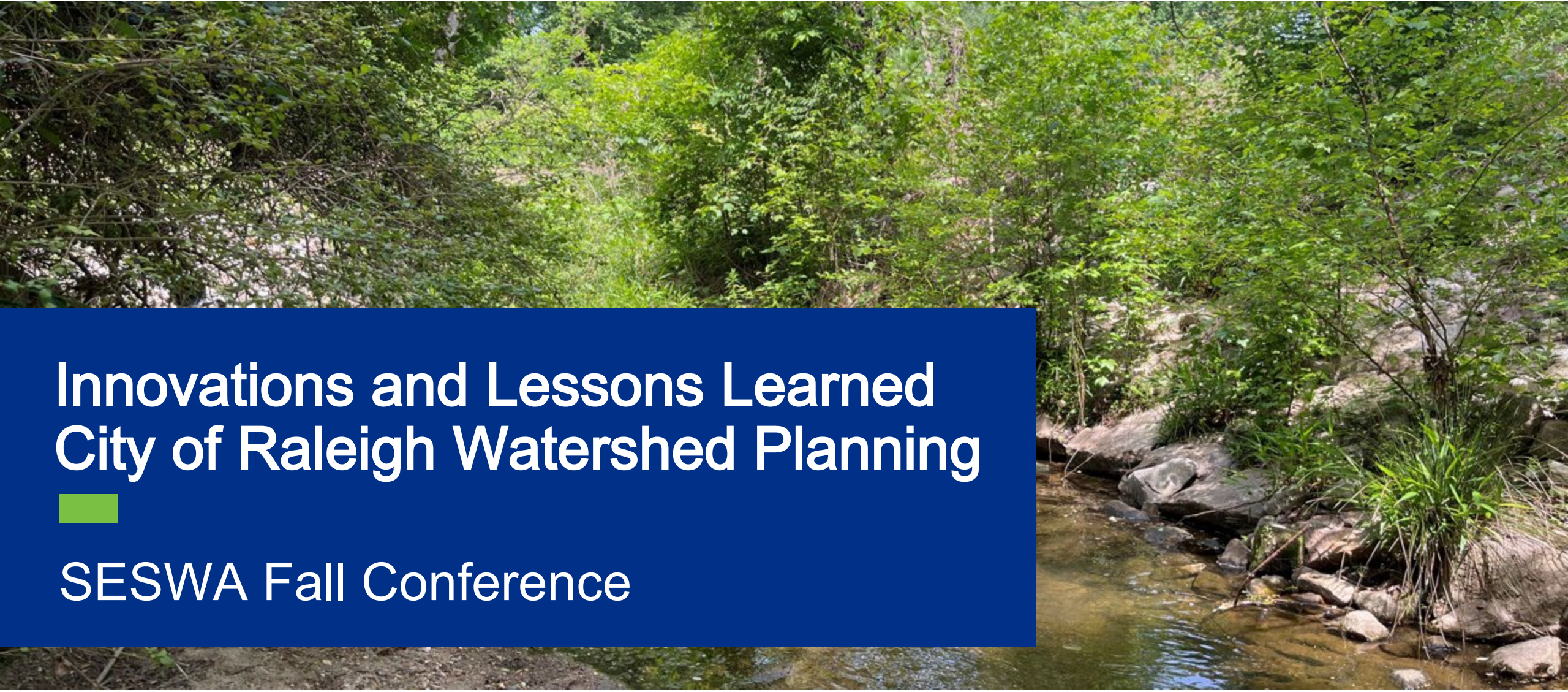

Innovations and Lessons Learned City of Raleigh Watershed Planning

SESWA Fall Conference

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City of Raleigh

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CDM Smith

October 10, 2024

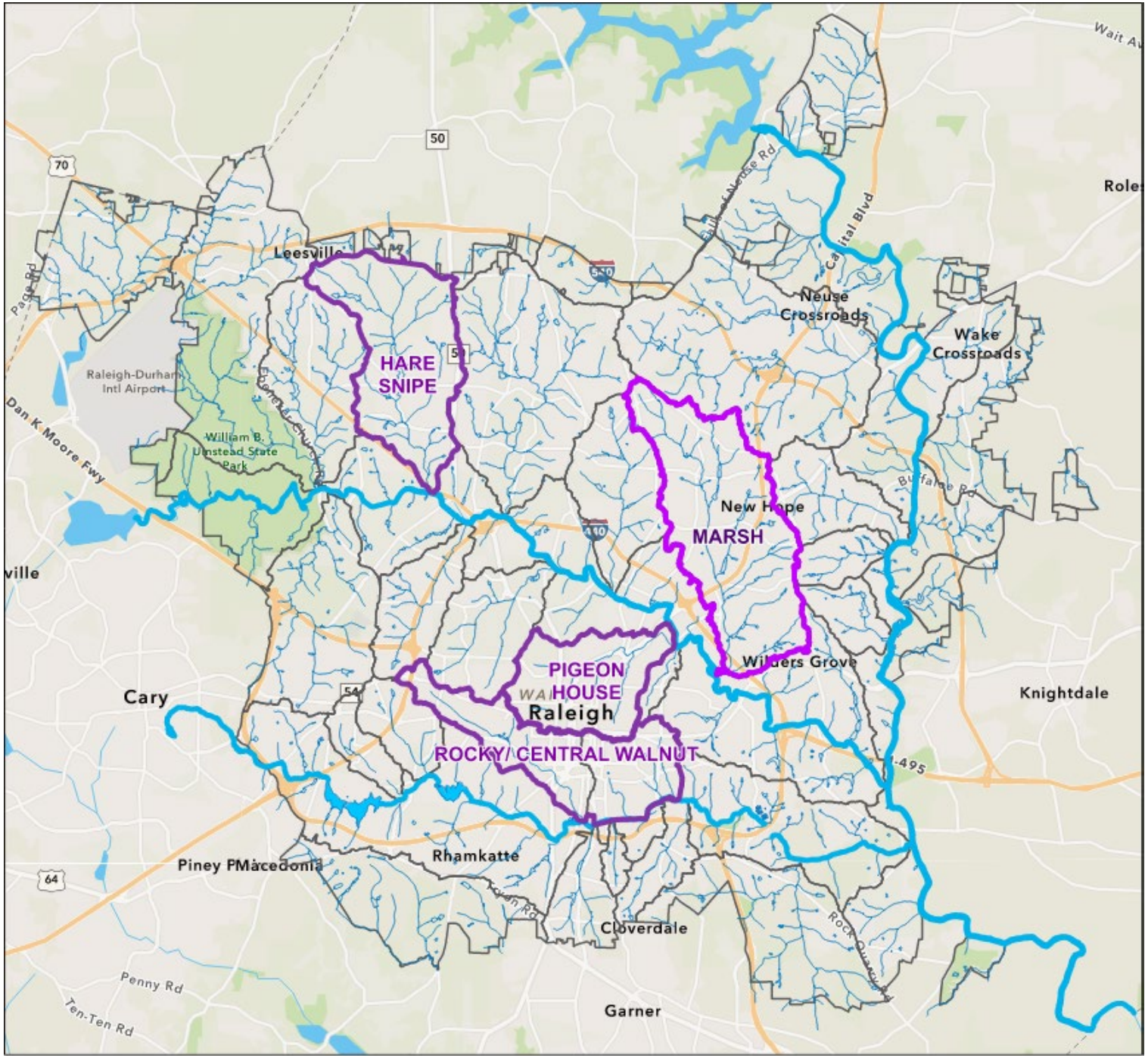
Agenda

- Introduction
- Watershed Planning Steps
  - Data Collection
  - Analysis
  - Projects and Implementation Planning
- Key Takeaways and Parting Thoughts…

- Population ~488,000
- 148.5 square miles
- Neuse River Watershed (HUC6 030202)
- Piedmont ecoregion
- NPDES MS4 Phase 1
- Stormwater Utility established in 2004

City of Raleigh

Raleigh Watersheds



Watershed Planning Program

Goal - strategically improve stormwater conditions for our residents

Flood Hazard Mitigation

Stream Stabilization

Asset Renewal

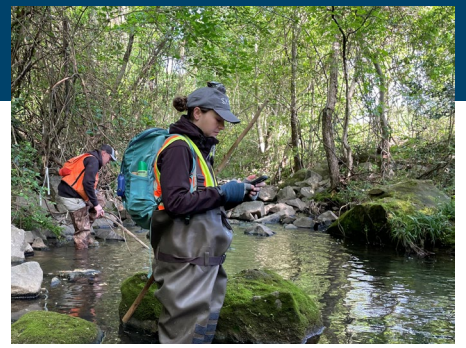
Water Quality

Conveyance

Watershed Planning Process

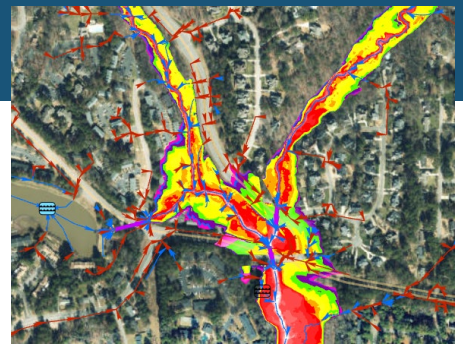
Data Collection

- Asset Survey
- Infrastructure Condition
- Stream Condition
- Watershed & Community Needs



Analysis

- Hydraulic Modeling
- Water Quality Modeling
- Alternatives Analysis



Define Projects

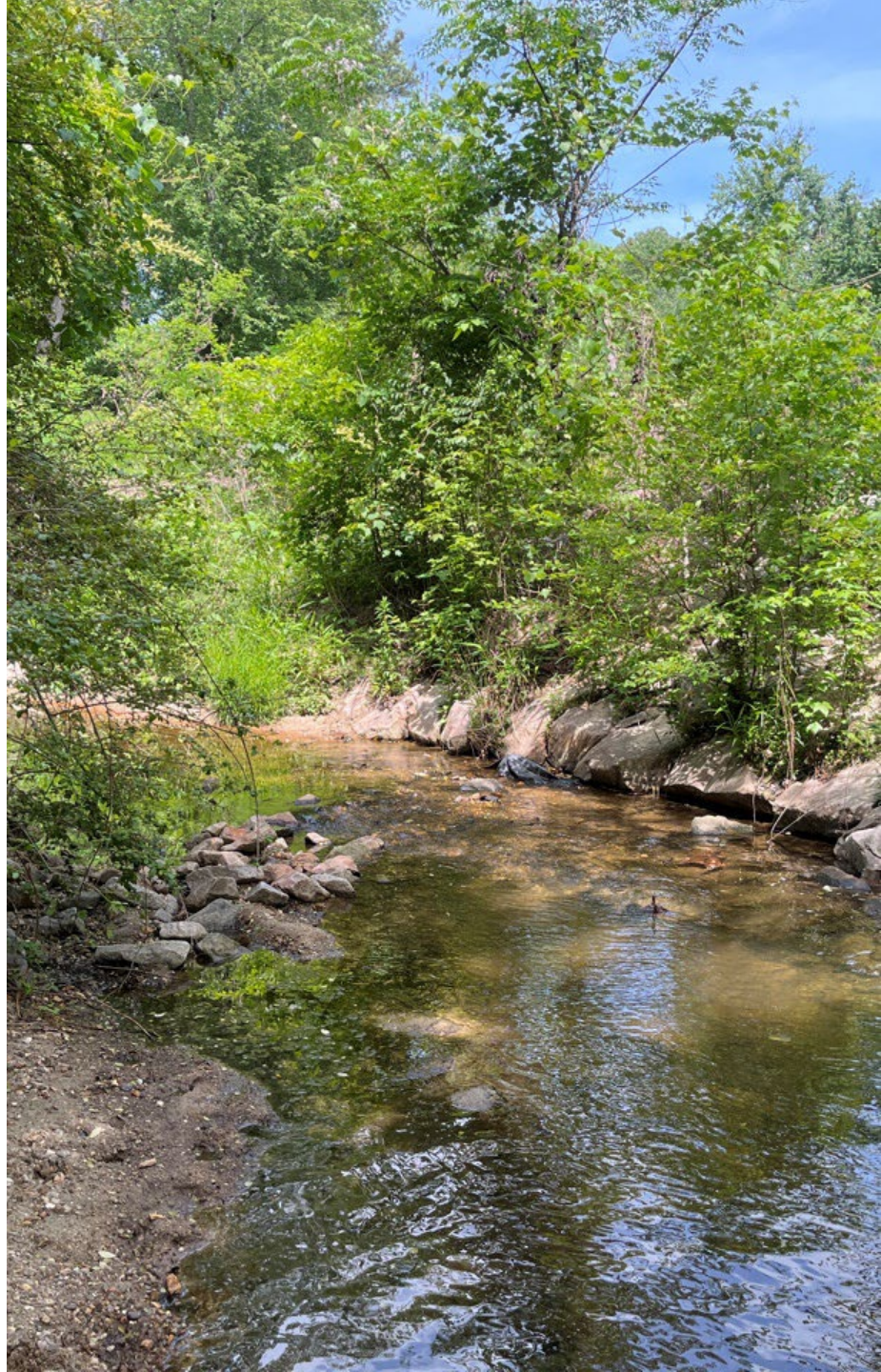
- Feasibility
- Priorities
- Opportunities
- CIP Planning

Innovations and Lessons Learned in Watershed Planning

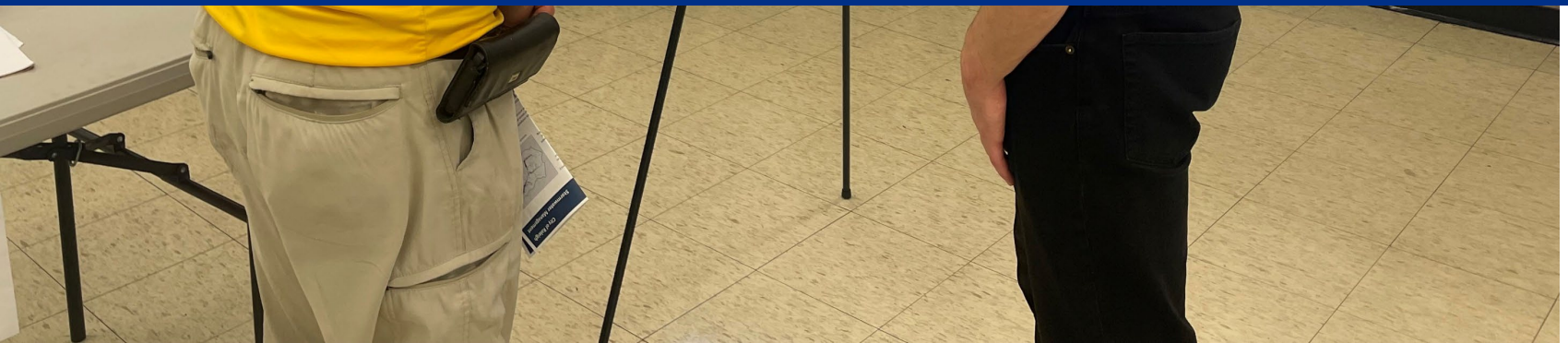
- Extracting highlights from the key steps of the planning process
  - Data Collection
  - Analysis
  - Project Definition/ Implementation
- Focusing on

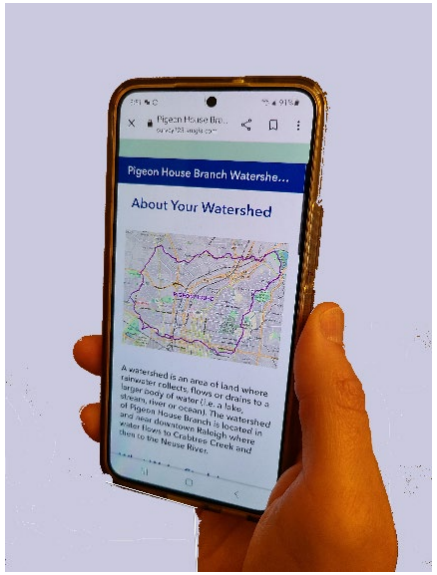
<u>Innovations</u> – new methods, new ways to apply existing methods

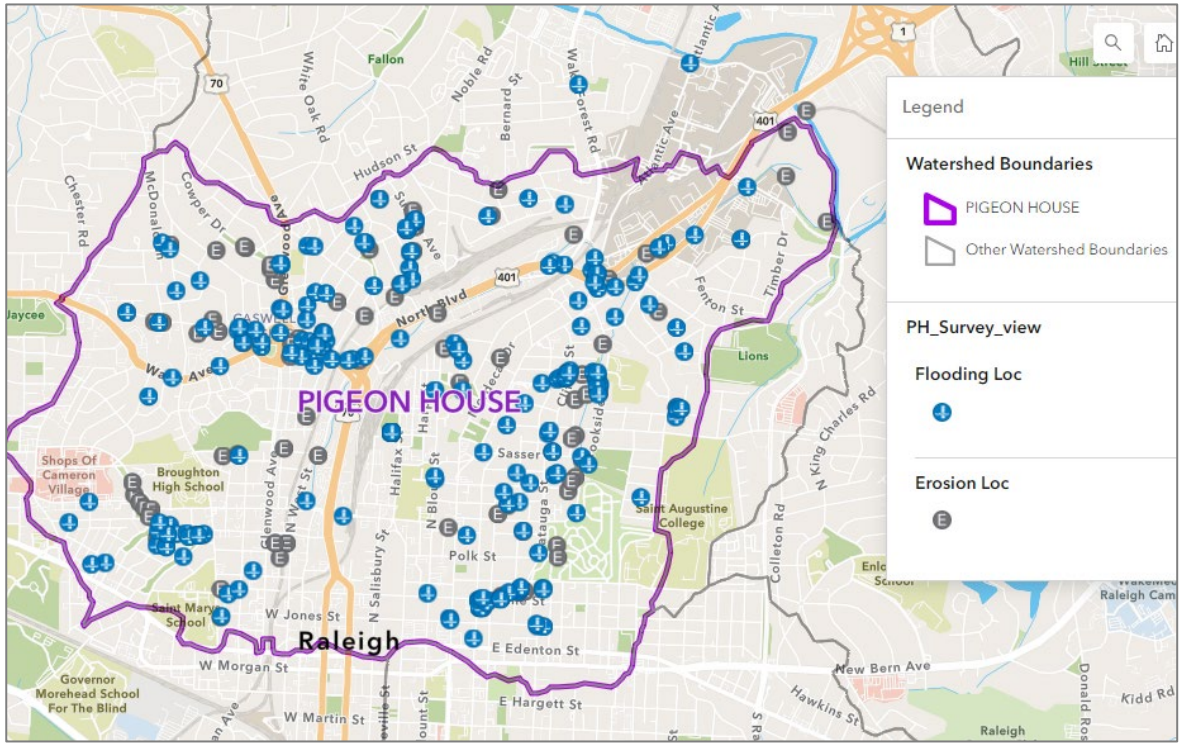
<u>Lessons Learned/ Multi-benefit approach</u> – refining the process based on previous experiences, looking for better ways to do things, leveraging existing data and resources, looking for way to achieve multiple benefits with little or no additional effort.



Stakeholder & Public Engagement





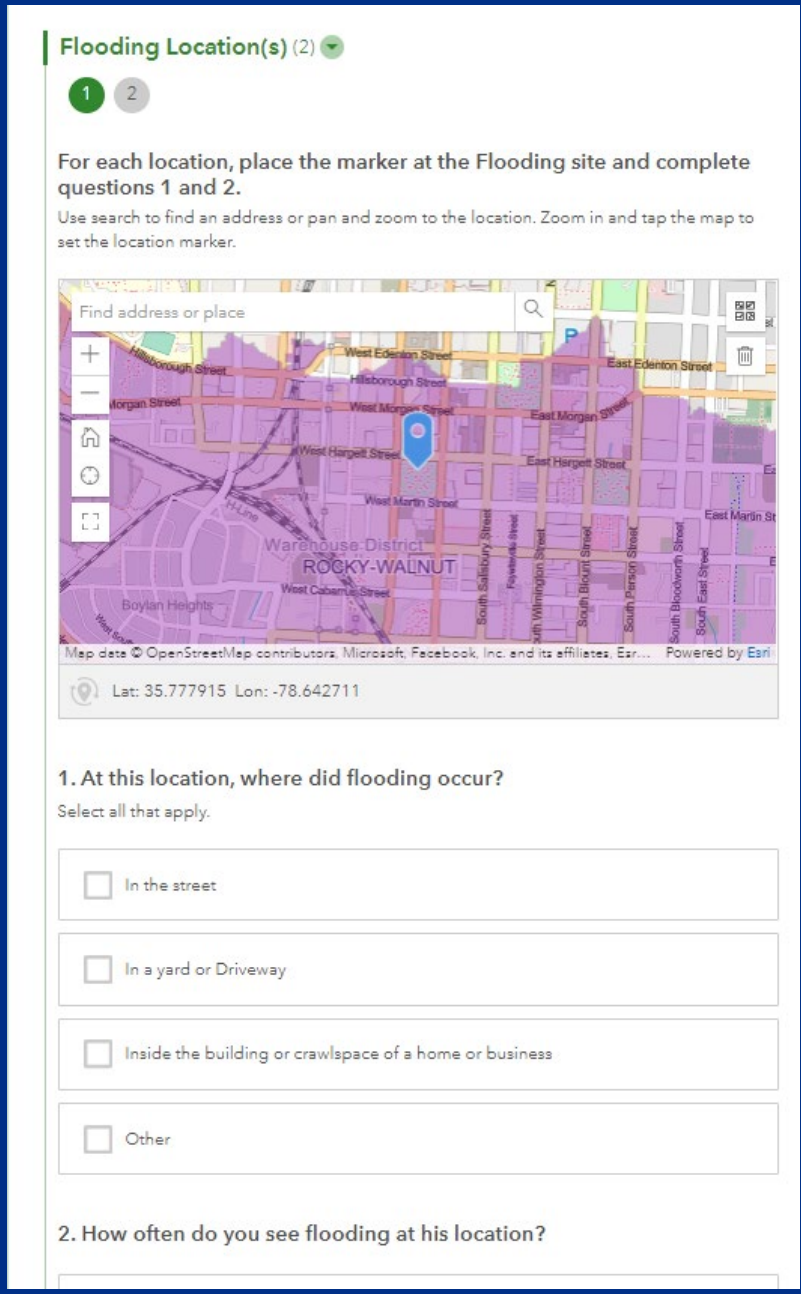


Public Survey

- Questions related to:
  - Flooding Issues
  - Erosion Issues
  - Stormwater Infrastructure
  - Awareness of city programs to address pollution
  - Ranking of watershed concerns
  - Demographic info (optional)
- Respondents drop pin of the location of flooding/ erosion concerns and upload videos or photos
- Results of survey in online map

Public Survey

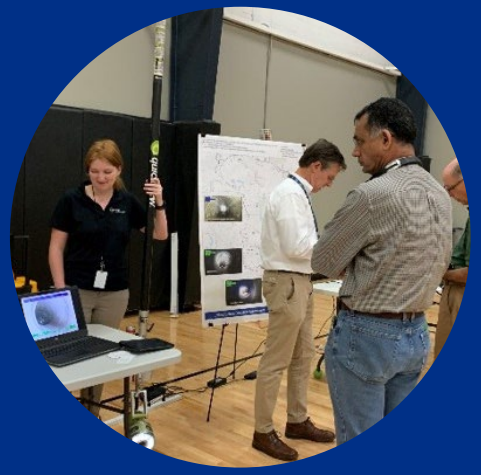
- Responses from the first public survey provided important feedback that shaped subsequent surveys
  - Need for basic stormwater education
  - Show photos and examples
- Added optional demographic questions to better understand the audience reached through the survey
- Changed format of some questions to get more helpful feedback (water quality)
- Follow up/ make sure people feel heard



Drop-in Meetings

- Meeting set up with stations with open house/ drop-in format
- Large Maps and some computer/ monitors for interactive review
- Include Other Stormwater Programs
  - Watershed Planning
  - Stormwater Maintenance
  - Drainage Assistance & Stream Stabilization
  - Buffer Builder Bag
  - Raleigh Rainwater Rewards
  - Volunteer Opportunities
  - Green Stormwater Infrastructure

Format allows community to be informed and consulted meeting objectives of the PEP and allows for education and engagement with a range of programs showing how the City can help and ways the community can be involved.



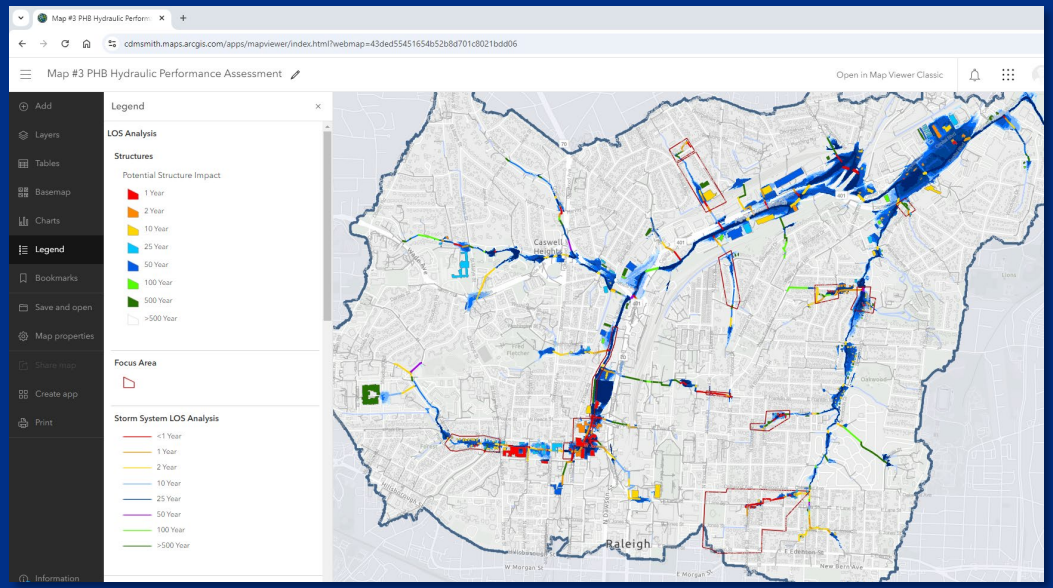
Internal Stakeholders

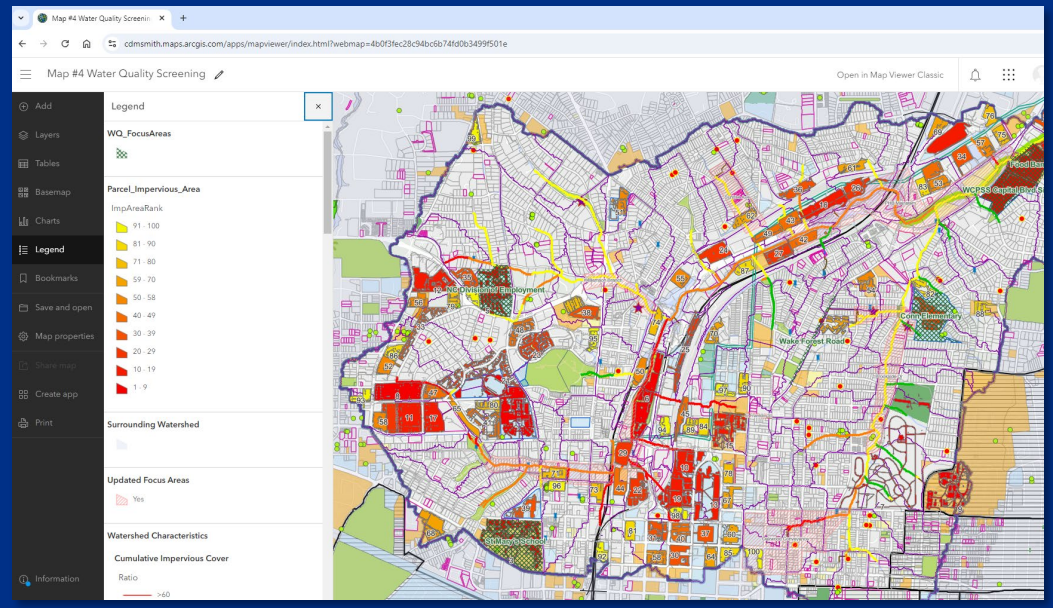
- Keeping internal stakeholders informed and getting their feedback is critical to project success
- Watershed studies may impact several groups in Raleigh Stormwater
  - Water Quality
  - Maintenance
  - Asset Management
  - MS4
  - Drainage Assistance
  - CIP Management
- Representatives from key groups attend project status meetings to stay informed and provide feedback
- Coordinated with other Raleigh Departments that may have overlapping projects or aligned interests
  - Transportation
  - Parks
  - Raleigh Water

Data Collection

AGOL Collaboration

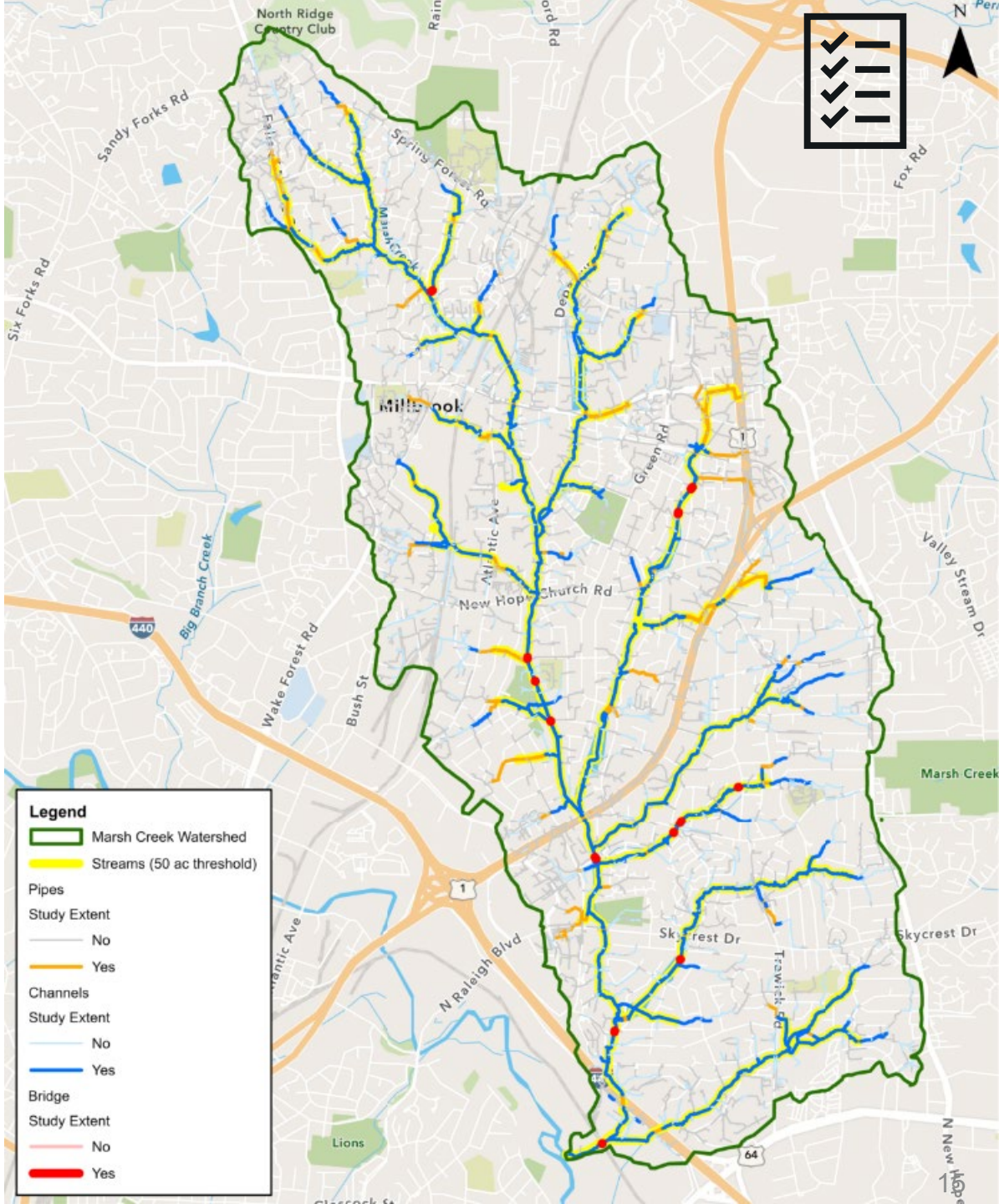
- COR established a collaboration site on AGOL
- Maps developed for key steps in the study process
  - Public Survey and known flooding concerns
  - Stream Assessment Results
  - Model parameterization and results
  - Hydraulic capacity assessment
  - Water Quality screening
- City and consultant team share and leverage the data throughout the project





Developing Study Extents

- Determine study extents during scoping
  - Primarily applied to water quantity model development
  - Balance detail with study needs and budget
  - Allow for potential reduction on survey cost
- Include allowance for additional detail
  - Additional needs may arise as a results of modeling results and public input



Stormwater Asset Condition

- Asset Management for Stormwater infrastructure started in parallel with initial watershed studies
  - City completes the condition assessment for city owned stormwater infrastructure.
  - Considering pilot program to inspect private stormwater infrastructure.

Moving forward asset condition collected ahead of the study to allow for better integration of repair and renewal needs into the watershed study

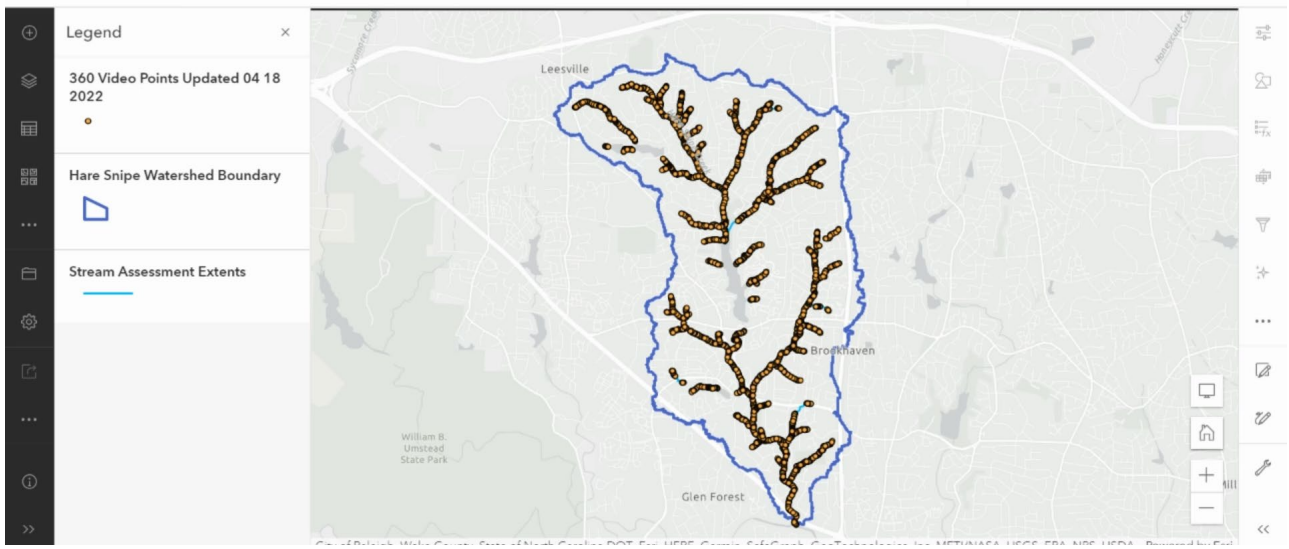
Stream Assessment Data Collection Protocol

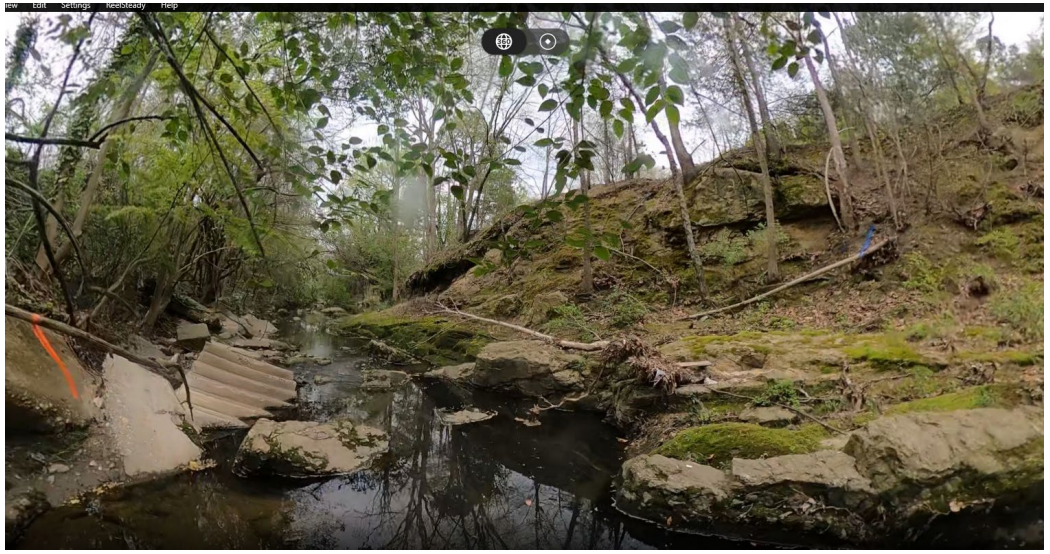
- Leverage stream walks to collect additional useful information that benefits other programs
- Examples
  - Locations for trash traps
  - NPDES MS4 items - potential illicit discharges
  - Stormwater infrastructure condition

Stream Assessment 360

- 360 video used to capture stream conditions resulting in a 'Google street view' for streams
- Output includes GIS points at selected intervals along the stream linked to 360 video
- Provide full documentation of baseline conditions also helpful for model development and review of site conditions during project development.

Online GIS with stream data points

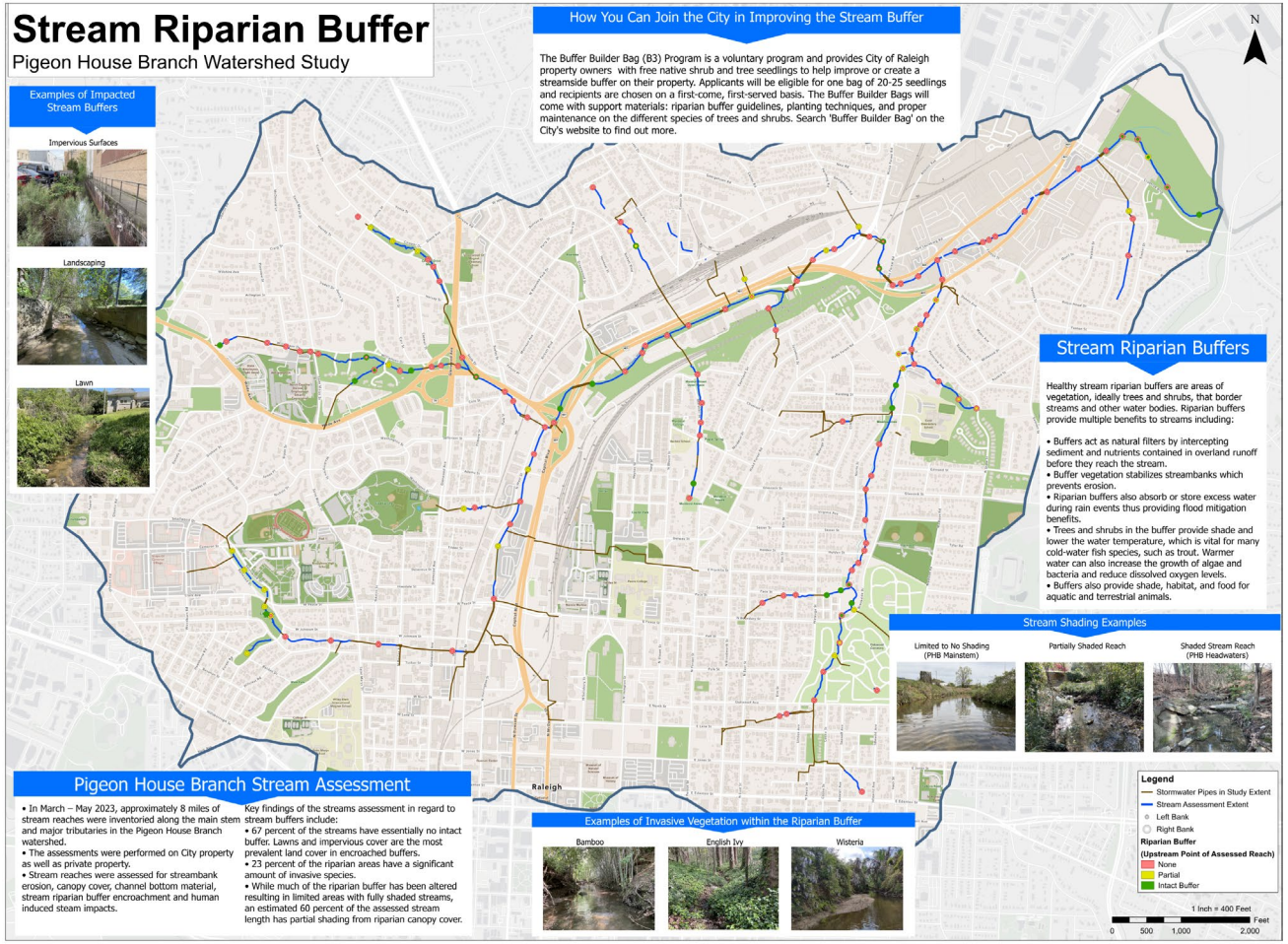


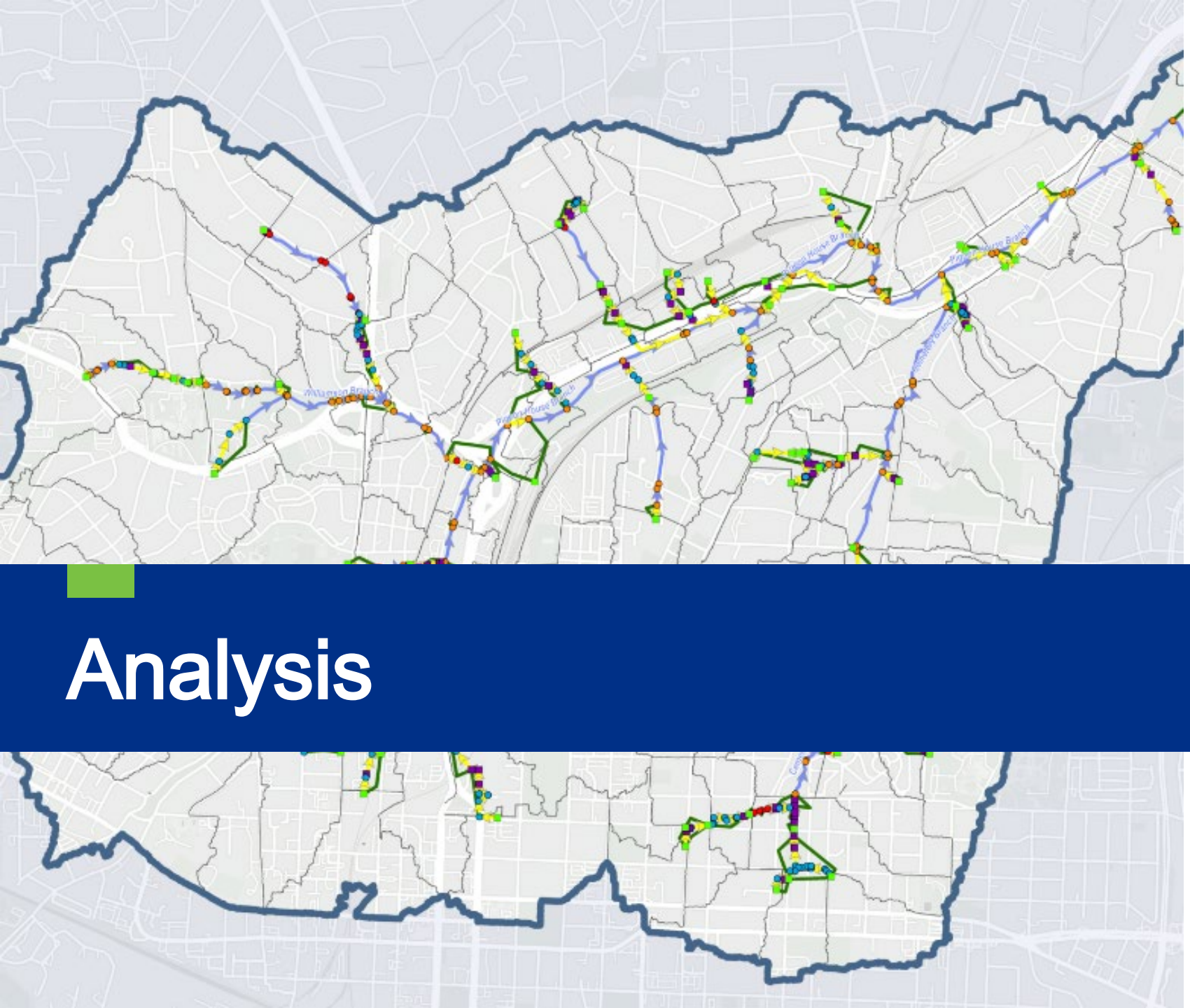


Linked to 360 video

Stream Assessment Watershed Story

- Each watershed is different. As a result, key takeaways vary and should be used to craft recommendations and the implementation plan
- Example
  - Pigeon House Branch has heavily impacted stream buffers
  - Consider increasing outreach for programs such as Buffer Builder Bag
  - Work with City departments such as parks to enhance buffers



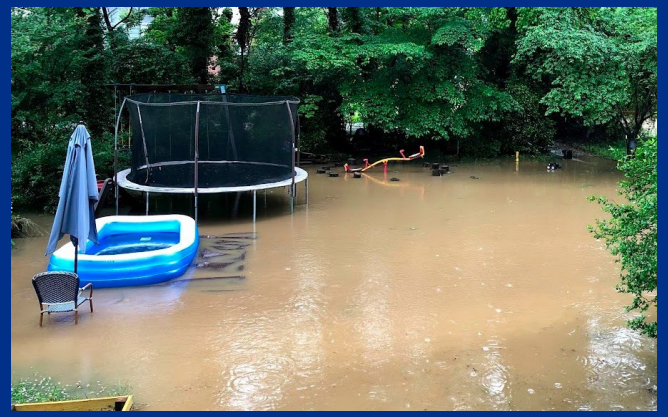


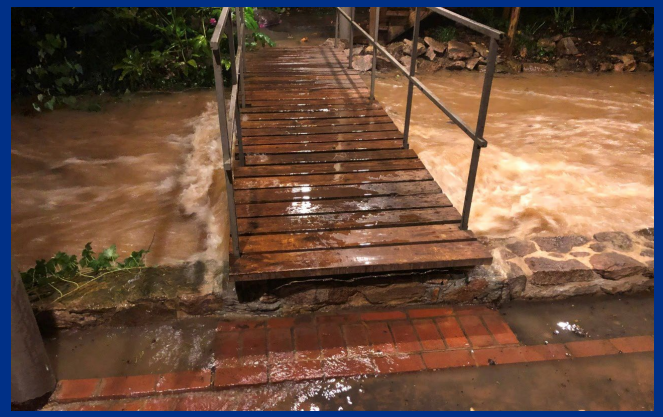
Analysis

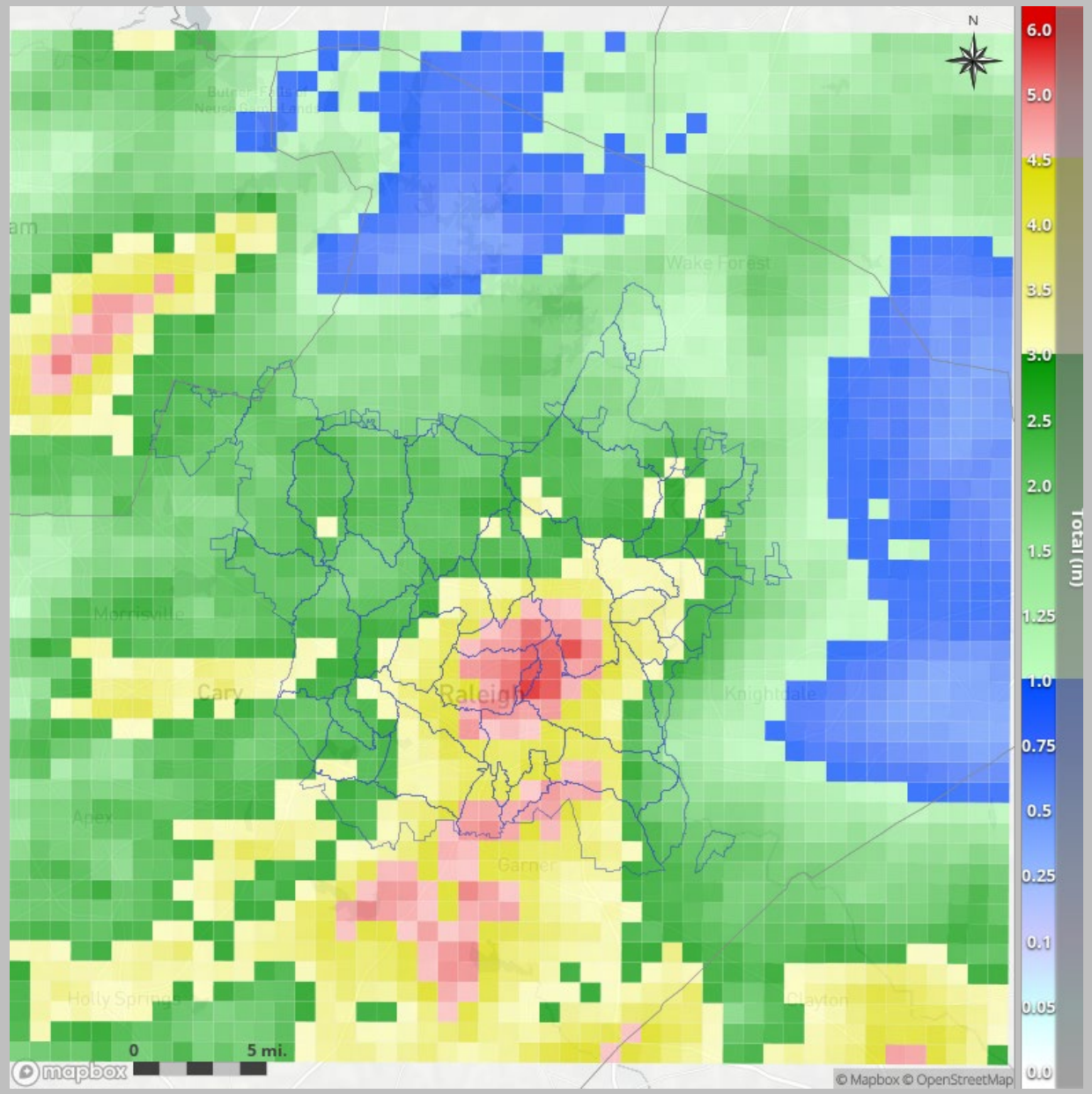
Public Survey and Model Validation

- Public feedback from survey aided selection of validation dates/ events
- Photos and videos used for model validation

Examples of Photos from the Public Survey





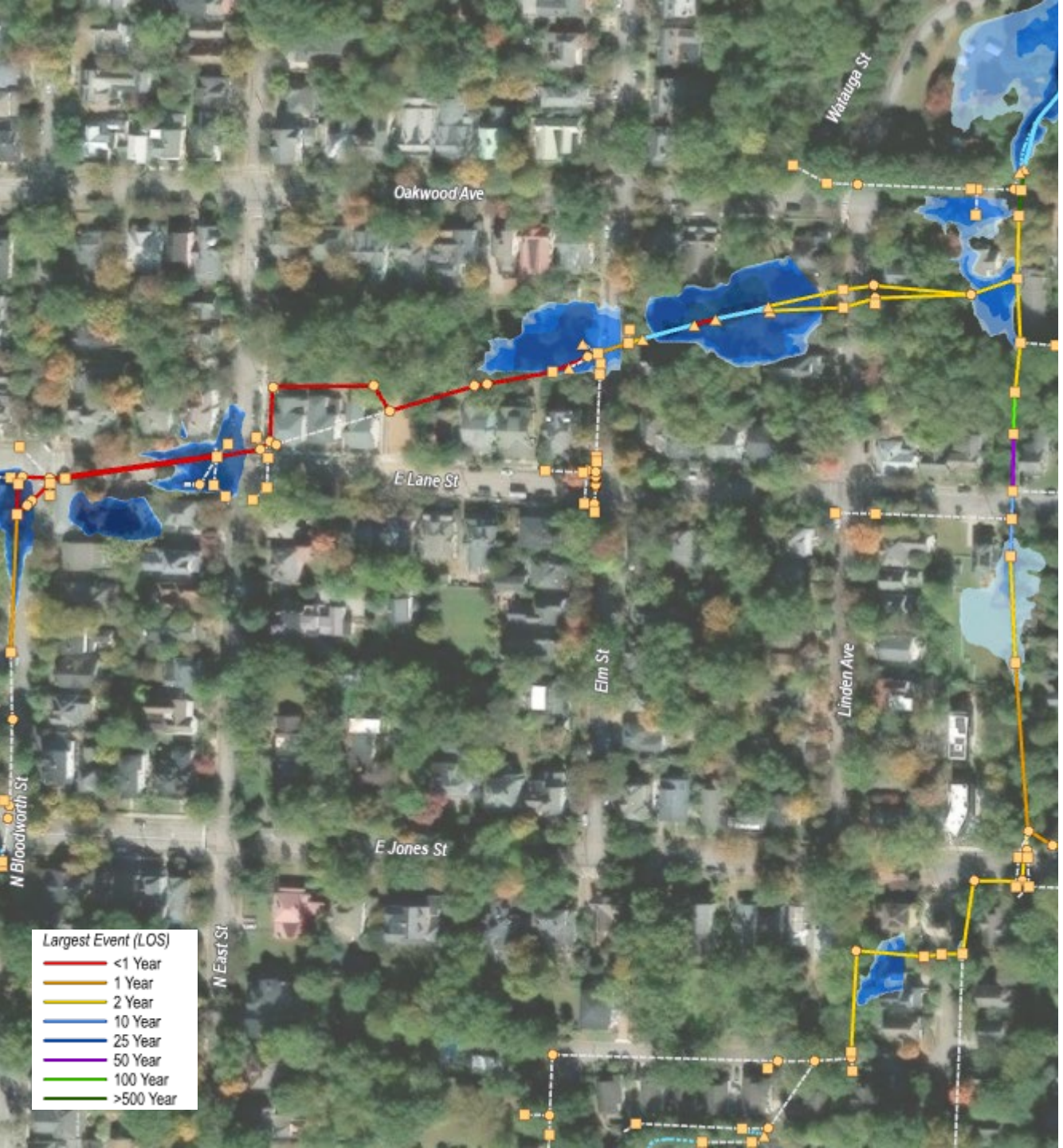


Raleigh Watersheds and GARR Grid

Rainfall Depths for 8/31/2020

GARR Data for H&H Model Calibration and Validation

- The City of Raleigh has gauge adjusted radar rainfall (GARR) data as part of the Flood Early Warning System
- This data was used for model calibration and validation

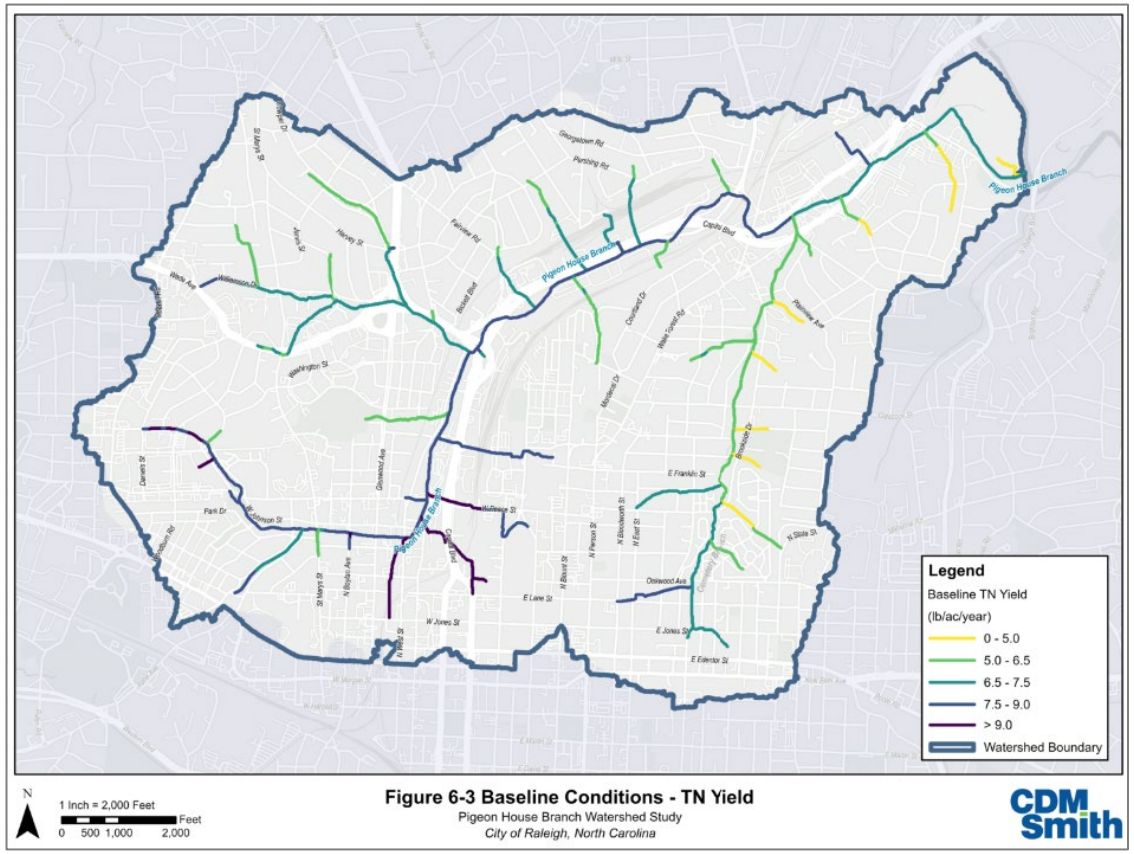


Level of Service

- Stormwater Manual/ UDO specifies for development
- Used similar approach in watershed studies and noted as 'Desired LOS'
- Hydraulic capacity analysis performed as part of watershed study
- Older areas may be significantly undersized
- Consider adjustments to LOS
  - Example, pipe HGL

Leverage Staff Expertise – Water Quality Modeling

- Water quality model was developed by consultant for first watershed study
  - GIS based planning level model
  - City of Raleigh has strong GIS resources within Stormwater
- City staff trained with consultant and are taking over the development of the water quality model development for the second watershed
- Provides City with the ability to analyze potential project impacts to WQ after the watershed study is complete.



Define Projects

Locating Projects

- Green stormwater infrastructure (GSI) can be located in a range of locations throughout the watershed
- Raleigh has historically completed projects on City property such as parks
- In an effort to explore new partnerships, single parcels with multiple opportunities for GSI were identify and conceptual plans developed.
- These will be leveraged to start new partnerships.
- This approach may vary by watershed.

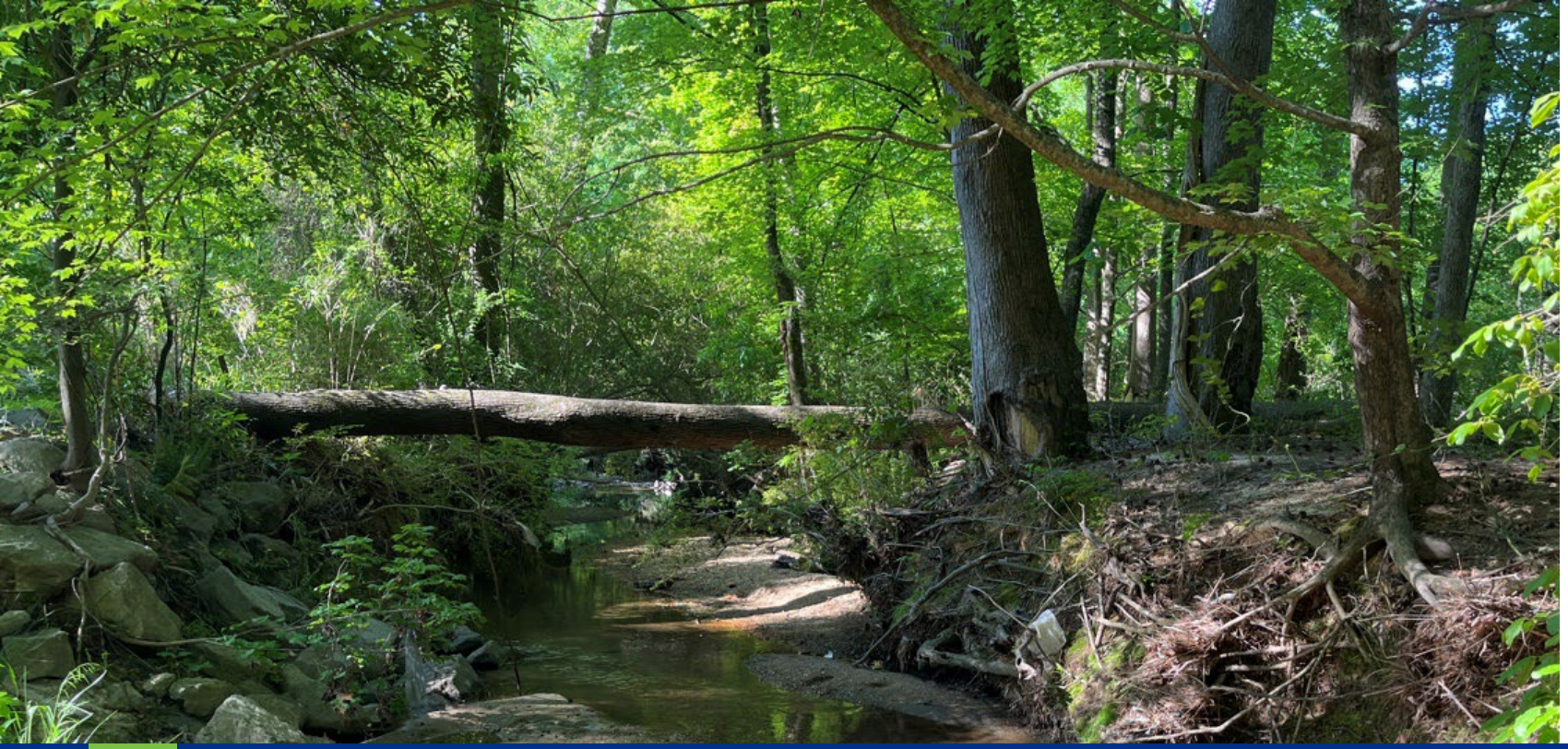
Evaluating Projects

- The Integrated Stormwater Management Project Prioritization Model that is used to rate potential capital improvement projects
- The Prioritization Model includes nine prioritization criteria and 31 sub-criteria.
  - Can be difficult to complete all criteria for planning level projects and not appropriate for comparing alternatives
  - Full criteria populated as the project progresses and is more fully defined.
- Developed Scorecard Evaluation Method
  - Easily compare alternatives
  - More simplistic but captures several key items form the city's prioritization model

Business Case Evaluation of Alternatives					
Criteria		Alternative 1		Alternative 2	
		Score*	Rationale	Score*	Rationale
Project Economics	Diference in Alternative Project Costs (% Lower (+) or Higher (-) than Average)	4.4	77%	0.6	-77%
	O&M Considerations	4	(e) Relatively simple and infrequent maintenance that can be performed in-house	1	(b) Unique maintenance needs compared to typical city stormwater features
	Property/Easement Acquisition	5	(f) Alternative doesn't require additional land	0	(a) Alternative requires more than 3 acres.
	Subtotal	13.40		1.60	
	Weighted Subtotal	***30.37***		***3.63***	
Hazard Reduction Benefits	Street Flooding Prevented in LOS Event (%)	1	22%	3	53%
	Structure Impact Prevented in 100-year Event (%)	1	12%	1	19%
	Emergency Access Restored (x% of Properties)	0	0%	0	0%
	Reduced Risk of Infrastructure Failure	5	4.0	4	3.5
	Subtotal	7.00		8.00	
	Weighted Subtotal	***11.55***		***13.20***	
Water Quality/Watershed Mgmt	TN Load Reduction Benefits	0	0%	0	0%
	TSS Load Reduction Benefits	0	0%	0	0%
	Percent of Floodplain/ Riparian Area Restored	0	0%	0	0%
	Affect on Natural Hydrologic Conditions and Habitat (in stream velocity)	2	-2%	3	1%
	Subtotal	2.00		3.00	
	Weighted Subtotal	***3.30***		***4.95***	
TOTAL SCORE		Alternative 1		Alternative 2	
		45.22		21.78	

Implementing Projects

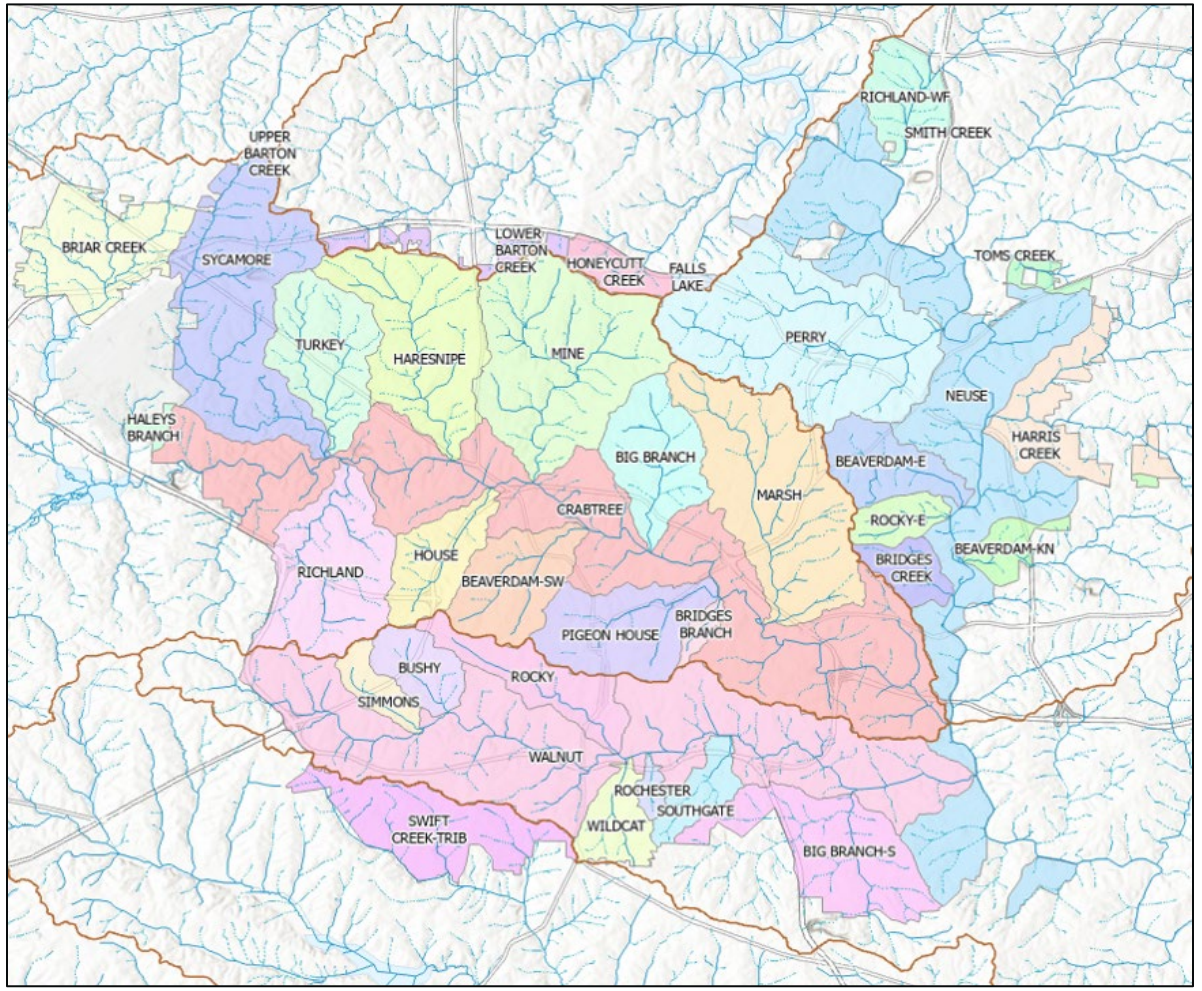
- Projects identified in the watershed studies transition from planning level projects to real projects implemented by City's CIP group, WQ group or Asset Management group
- Having these groups involved in project development and review is a key aspect to moving projects from paper to reality.
- SWMM model developed for watershed study provides multiple benefits in this process
  - Design team has an initial model to start with for project design
  - Understand downstream impacts



Watershed Study

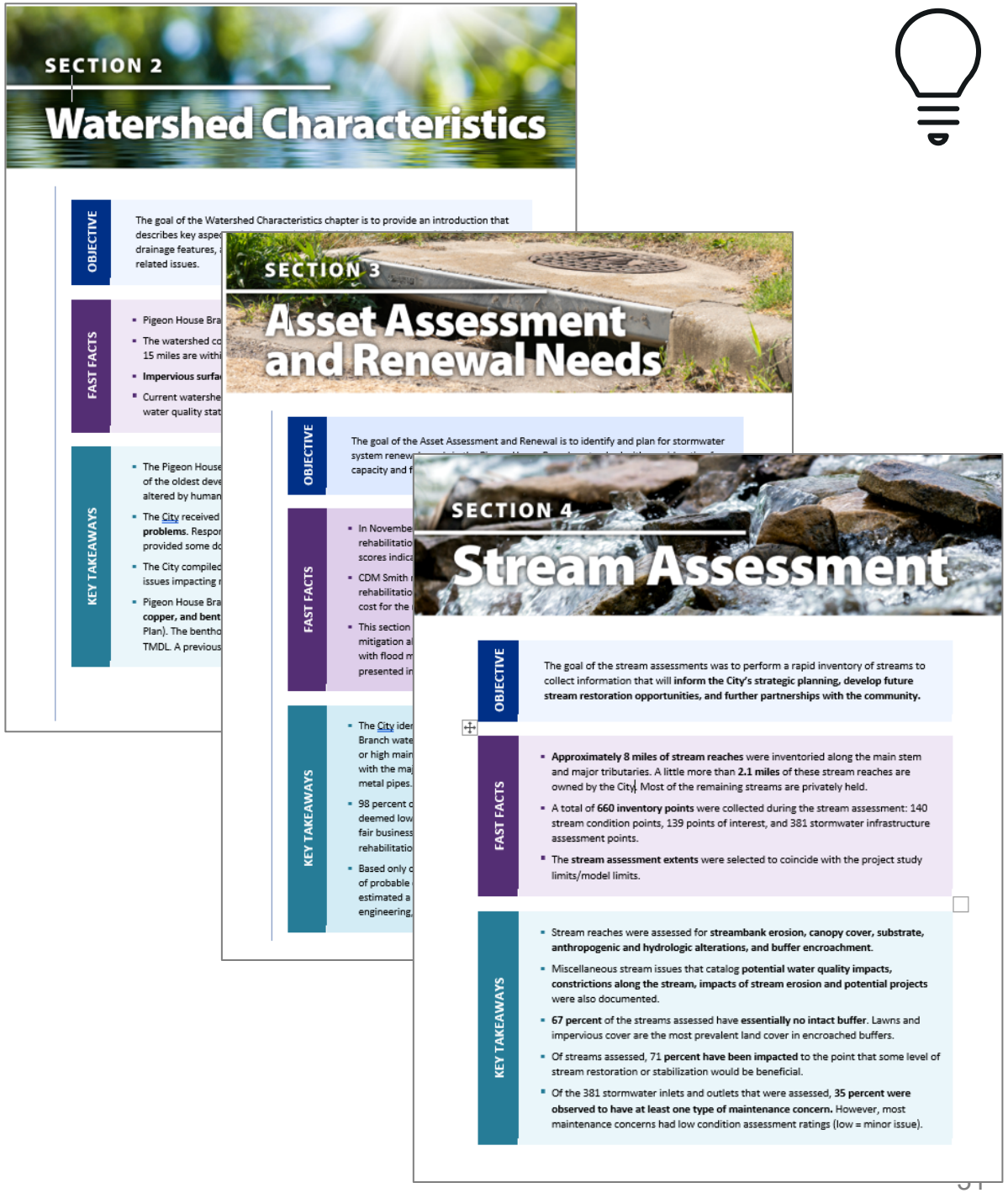
Standardizing Watershed Study Methods

- Watersheds studies are completed by different consultant teams
- The City developed a "Methods" document as part of the first watershed study.
- This guidance is used for all subsequent studies.
- Revisions can be made if needed, but the overarching process is consistent from watershed to watershed.



Progressive Report Development

- Project schedule typically spans 14-16 months.
- Instead of one 'big' report at the end of the project draft chapters are developed as the task is completed
- Prevents surprises at the end of the project and potential rework
- Make sure everyone is on the same page as the project progresses

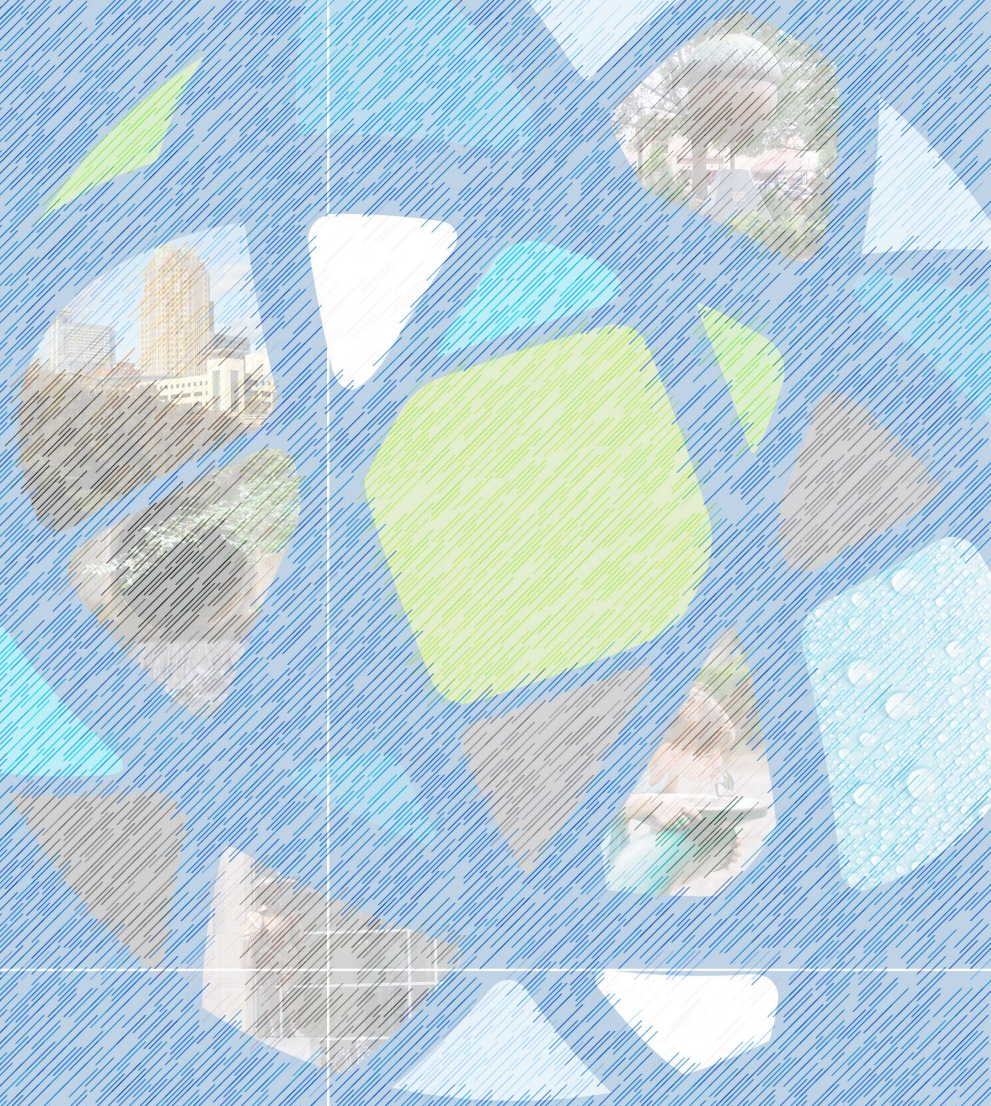


Leverage Watershed Study Deliverables

- Data from other programs used to benefit/ develop the watershed study
- Look for ways to use the data generated by watershed study for other programs and uses.
- In addition to the Watershed Study Report key deliverables include:
  - AGOL maps
  - Project Fact Sheets
  - Model files
  - GIS files
- Examples
  - Inundation maps will be used in the City's Flood Risk Prioritization Tool
  - AGOL maps and other report information will be used to generate a story map for public education
  - Model used as starting point for project design team

Key takeaways and parting thoughts…

- Look for ways leverage things you are already doing
- Collaboration is key
- Assess and change methods as needed



Thank you!

Questions?