Watershed Master Plans: Assessing Critical Infrastructure Assets

August 2023

WithersRavenel
Our People. Your Success.

Introductions

Amanda Hollingsworth, PE, CFM
Stormwater Project Manager

- Skilled in a variety of software platforms including PCSWMM, HEC-RAS, and more
- Oversight of six different master plan efforts in 2023
- Leads a group of engineers from the Raleigh area

Areas of Expertise

- **Watershed Master Planning**
- **Hydrologic and Hydraulic Modeling**
- **Floodplain Management**

David Perry, PE, CFM
Stormwater Senior Project Manager

- 25+ years of experience in stormwater management planning, design, permitting, and policy
- Municipal client focus grew out of previous employment by the City of Charlotte Storm Water Services group
- Leads WithersRavenel stormwater practice in Charlotte & western NC

Areas of Expertise

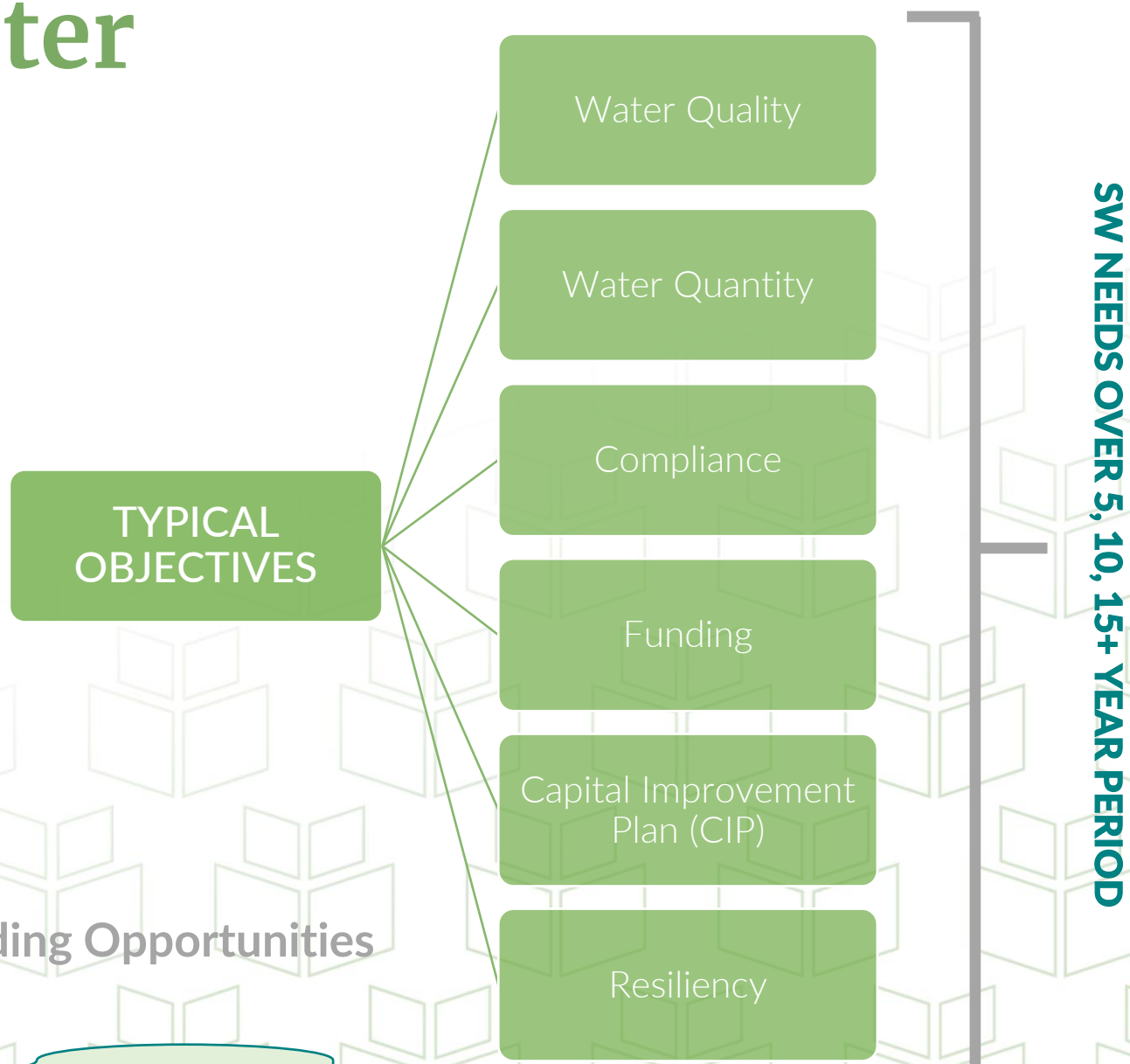
- **Watershed Master Planning**
- **Urban Stormwater Retrofit**
- **Culvert Replacement**

What is a Watershed Master Plan?

"The objective of watershed master planning under Section 452.b (WMP) is to provide the community with a tool it can use to make decisions that will reduce the increased flooding from development on a watershed-wide basis and address existing flood problems." – *National Flood Insurance Program (NFIP) Community Rating System (CRS) Coordinator's Manual*

WHY do I need a Master Plan?

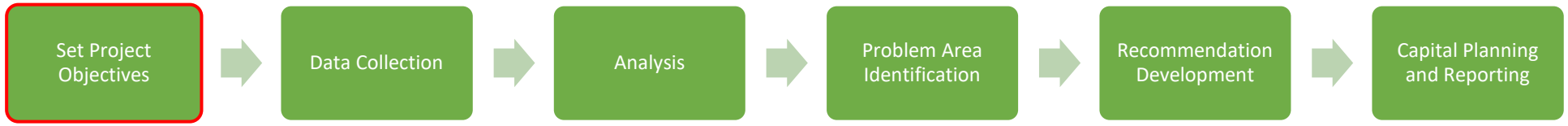
- **Identify Areas of Concern (AOCs)**
  - Water Quality & Flooding
  - Current and/or Future
- **Improves Asset Management**
  - Identify aging and/or undersized infrastructure or data gaps
- **Facilitate Regulatory Requirements**
  - NPDES MS4 Program - SWMP
  - Ordinance Review
- **Resiliency Based Planning and Design**
  - Capital Improvement Plan
- **Identify Funding Needs** ⇨ **Identify Funding Opportunities**
- **Proactive vs Reactive = Cost Savings**



See July 2023 DEQ WOW Stormwater Presentation on Restoration Action Plans by Jonathan Hinkle, PE

Master Planning Process

Set Project Objectives



- **Define Project Area and Scope**
  - Areas and Infrastructure of Interest
    - Entire Municipality
    - Single Watershed
    - Priority Areas
  - Storm Events/Level of Service
  - Model Selection/Hydrology
  - Data presentation and format in final deliverable
  - End Goals

Set Project Objectives

Set Project Objectives → Data Collection → Analysis → Problem Area Identification → Recommendation Development → Capital Planning and Reporting

Implementation Constraints

- Budget
- Time Constraints

Implementation Options

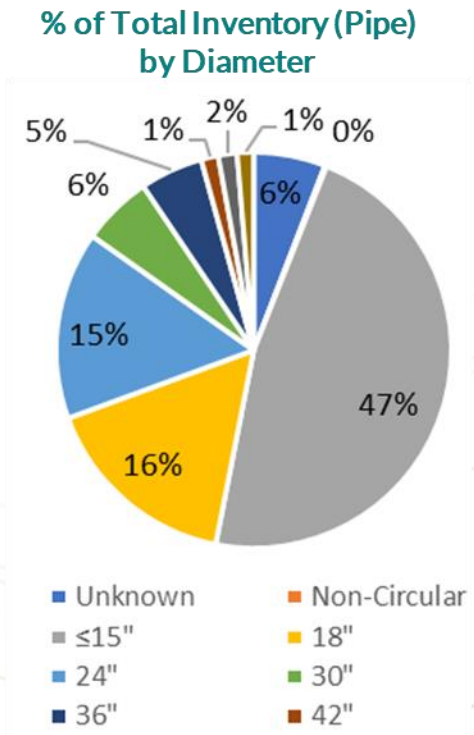
- Service Area (Sub-Catchment Size)
- Pipe Size
- High Priority Areas

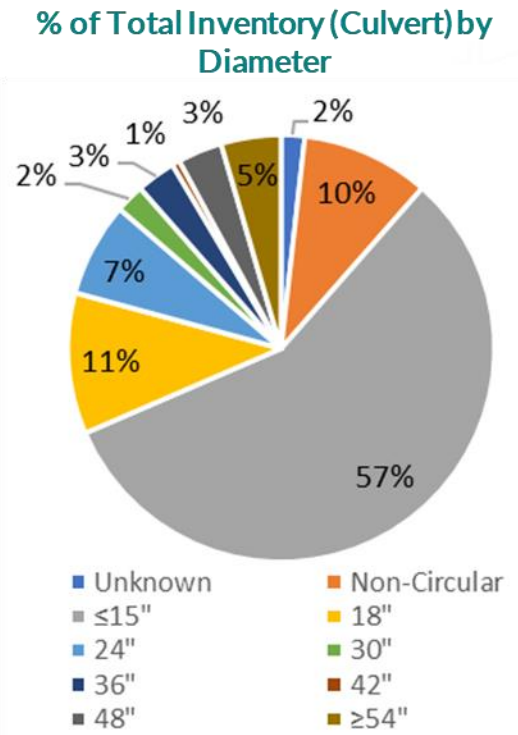
VS

Data Collection

Set Project Objectives → **Data Collection** → Analysis → Problem Area Identification → Recommendation Development → Capital Planning and Reporting

- **Data Preparation and Gaps Analysis**





Data Collection

Set Project Objectives → **Data Collection** → Analysis → Problem Area Identification → Recommendation Development → Capital Planning and Reporting

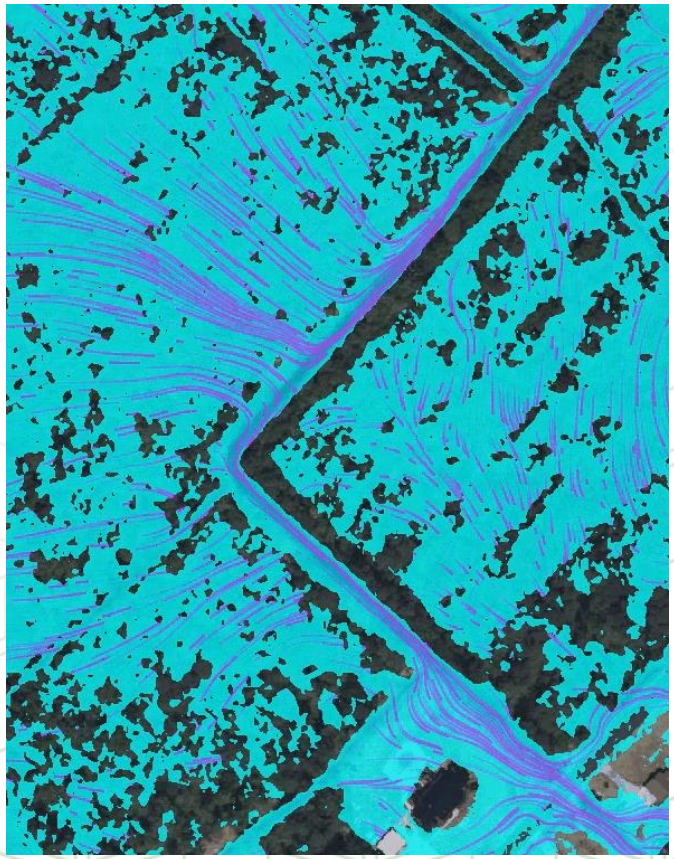
- **Field Work**

See May 2023 DEQ WOW Stormwater Presentation on Asset Management by David Perry, PE, CFM

Analysis

Set Project Objectives → Data Collection → **Analysis** → Problem Area Identification → Recommendation Development → Capital Planning and Reporting

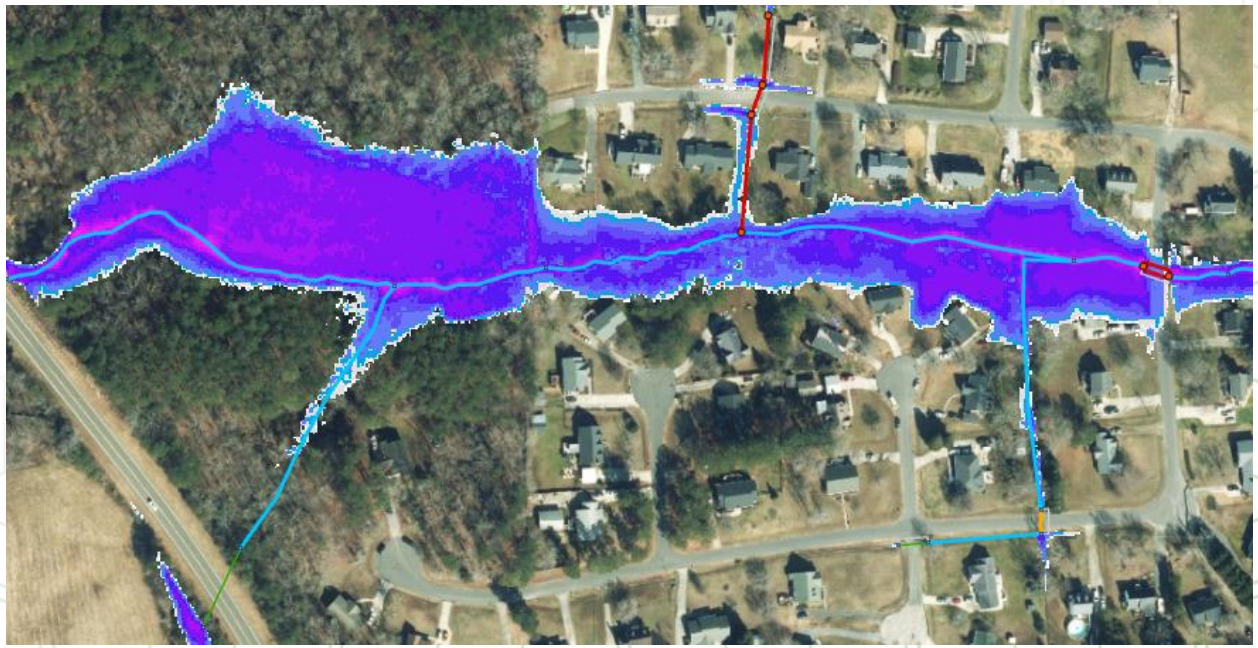
- **Model Selection**
  - HEC-RAS/HEC-HMS
  - SWMM
  - InfoWorks ICM
- **Hydrologic Characterization**
- **Network Limits**
- **Boundary Conditions**
- **Validation/Calibration**
- **Multiple Teams**



Problem Area Identification

Set Project Objectives → Data Collection → Analysis → **Problem Area Identification** → Recommendation Development → Capital Planning and Reporting

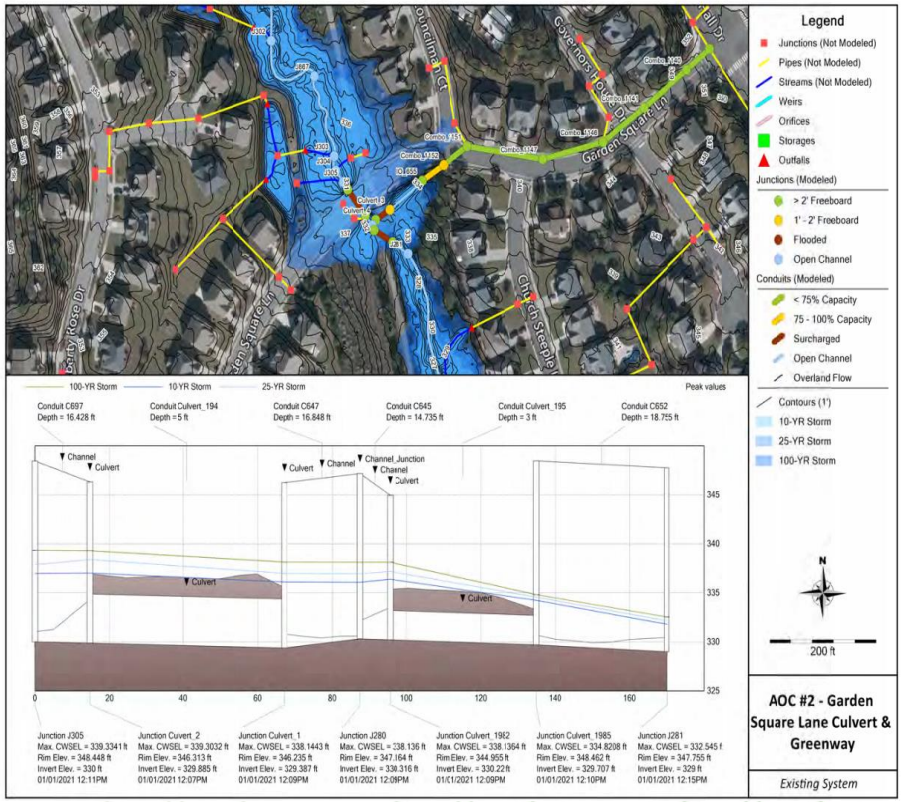
- **Level of Service**
  - Design Events
    - Pipe Systems versus Stream Crossings
- **Other Factors**
  - Structures Impacted
  - Emergency Vehicle Access



Recommendation Development

Set Project Objectives → Data Collection → Analysis → Problem Area Identification → **Recommendation Development** → Capital Planning and Reporting

Current Conditions



Improved Conditions

Recommendation Development

Set Project Objectives → Data Collection → Analysis → Problem Area Identification → **Recommendation Development** → Capital Planning and Reporting

Prioritization Scoring and Matrix

Prioritization Matrix	Weighted %	Area of Concern									
		8		*4*		*1*		*2*		*6*	
		Raw Score	Weighted Score	Raw Score	Weighted Score	Raw Score	Weighted Score	Raw Score	Weighted Score	Raw Score	Weighted Score
Age of Infrastructure	5%	50	2.5	60	3	80	4	50	2.5	80	4
Severity of Flooding	25%	100	25	55	13.75	30	7.5	50	12.5	35	8.75
Frequency of Flooding	20%	80	16	100	20	30	6	90	18	50	10
Capital Costs	15%	18	2.7	100	15	100	15	75	11.25	50	7.5
Jurisdiction	15%	50	7.5	90	13.5	100	15	100	15	83	12.45
Coincides with Proposed Improvement	20%	75	15	10	2	80	16	20	4	80	16
Total Weighted Score	100%	68.7		67.25		63.5		63.25		58.7	
CIP Priority Ranking	---	1		2		3		4		5	

Capital Planning and Reporting

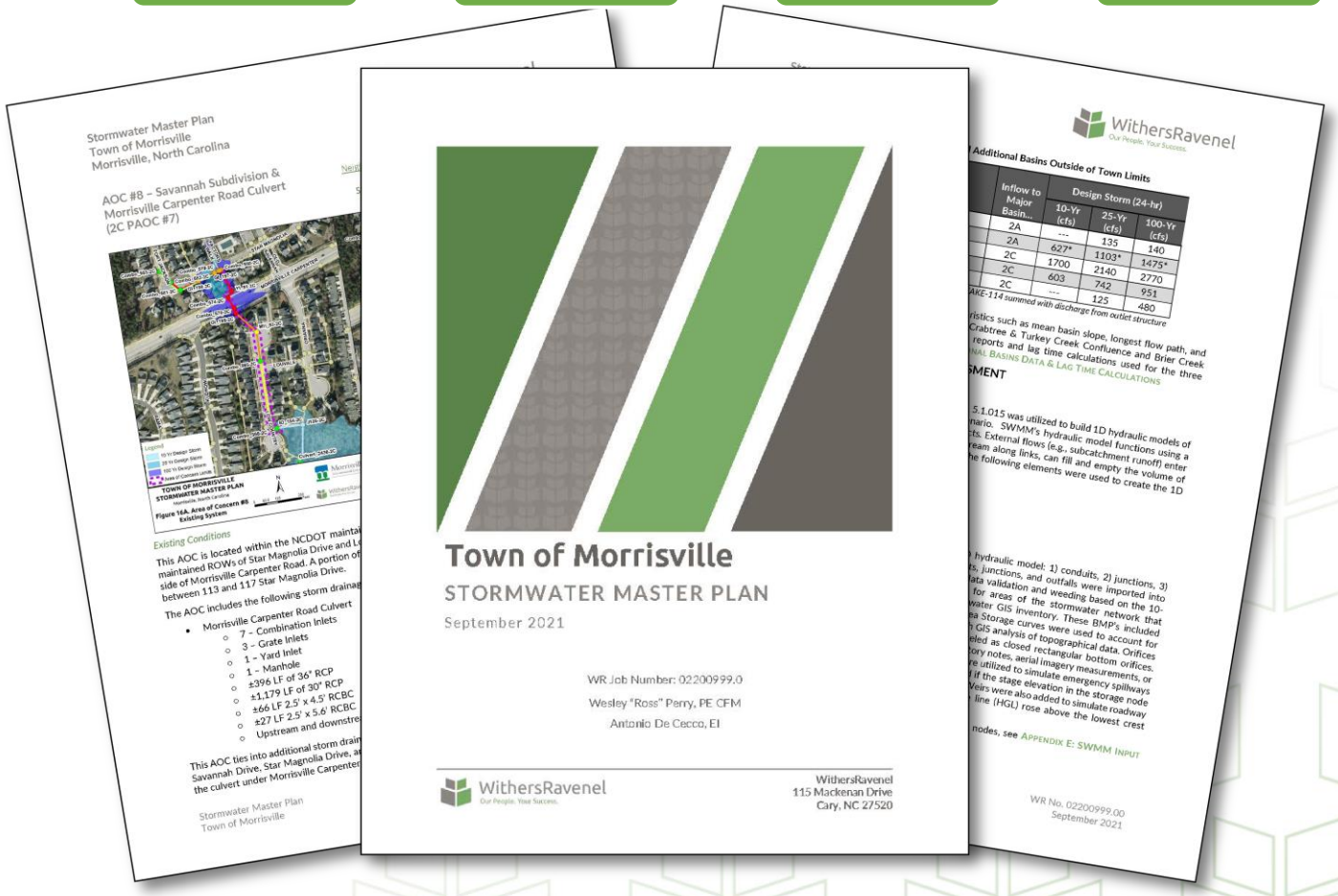
Set Project Objectives → Data Collection → Analysis → Problem Area Identification → Recommendation Development → Capital Planning and Reporting

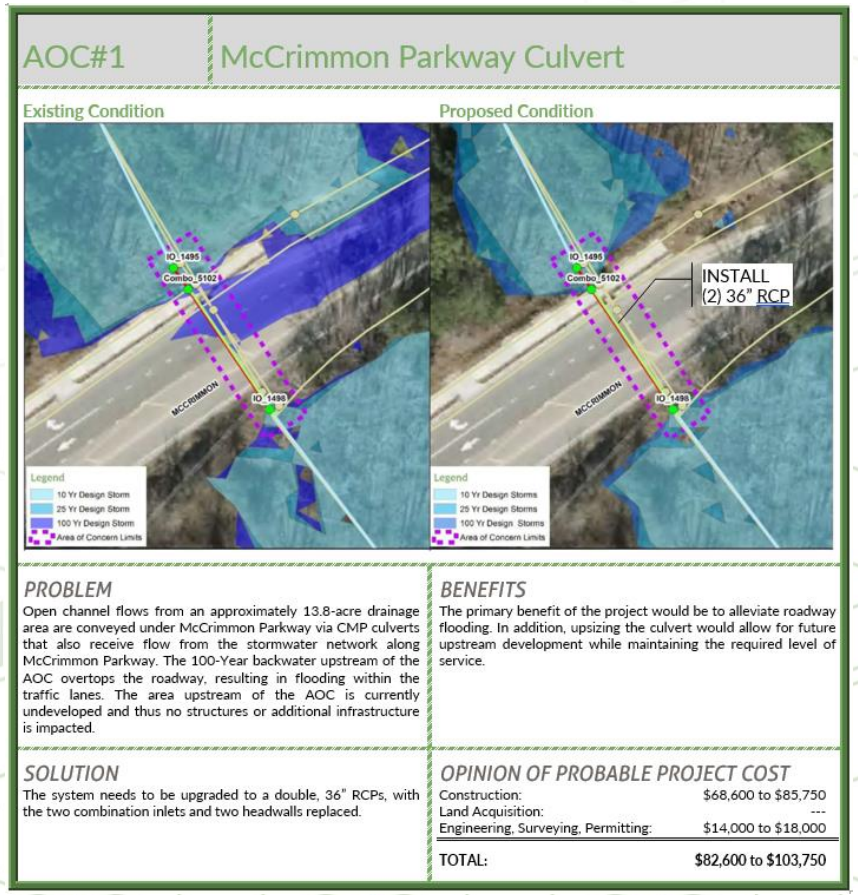
Capital Improvement Plan

Project Description	Cumulative Costs	Budget FY 2022	Budget FY 2023	Budget FY 2024	Budget FY 2025	Budget FY 2026	Budget FY 2027	Budget FY 2028	Budget FY 2029	Budget FY 2030	Budget FY 2031	Budget FY 2032+
		% Cost Escalation Factor										
		0%	2%	4%	6%	8%	10%	12%	14%	16%	18%	20%
Project Area A	**$1,374,600**	$150,000	$663,000	$561,600								
Project Area B	**$220,000**	$220,000										
Project Area C	**$180,000**	$180,000										
Project Area D	**$934,600**			$114,400	$604,200	$216,000						
Project Area E	**$966,800**				$84,800	$486,000	$396,000					
Project Area F	**$1,935,200**						$154,000	$1,120,000	$661,200			
Project Area G	**$2,236,000**								$114,000	$754,000	$708,000	$660,000
Project Area H	**$600,000**											$600,000
Project Area I	**$1,608,000**											$1,608,000
Project Area H	**$1,260,000**											$1,260,000
TOTAL	**$11,315,200**	$550,000	$663,000	$676,000	$689,000	$702,000	$550,000	$1,120,000	$775,200	$754,000	$708,000	$4,128,000

Capital Planning and Reporting

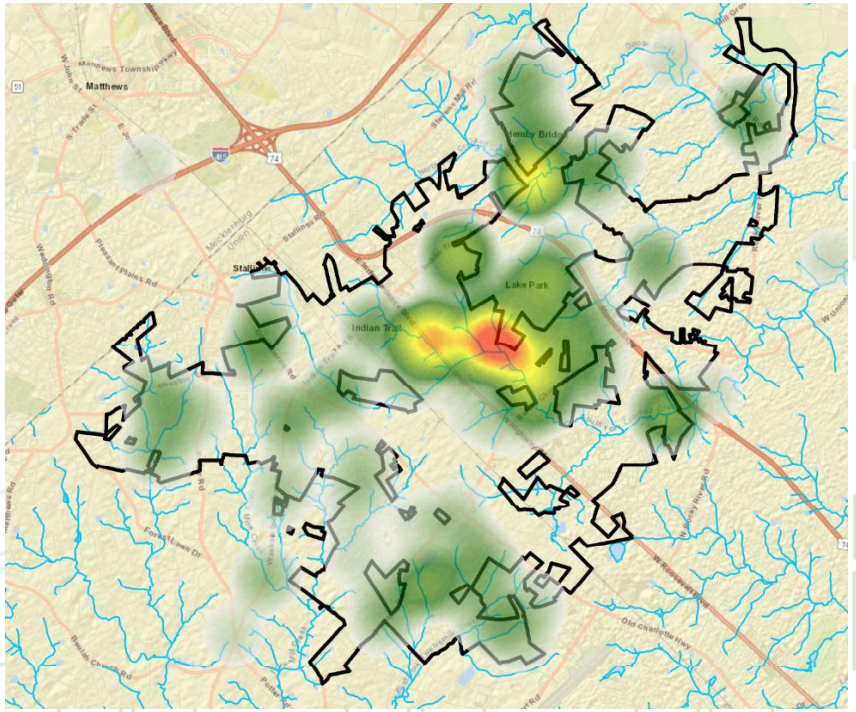
Set Project Objectives → Data Collection → Analysis → Problem Area Identification → Recommendation Development → **Capital Planning and Reporting**





Stakeholder Participation

- **Can be incorporated into multiple steps**
  - Data Collection
    - Identify Problem Areas
    - Gather Validation Data
  - Present Results
    - Existing Conditions
    - Proposed Concepts



See June 2023 DEQ WOW Stormwater Presentation on Communication by Annette Lucas, PE and Daniel Wiebke, PE, CFM

Additional Thoughts

- Downstream Impacts
- Based on the results, is there a need to change local regulatory requirements to meet long term goals

Now What?

Funding

Design

Construction

ANY QUESTIONS?

THANK YOU.

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