



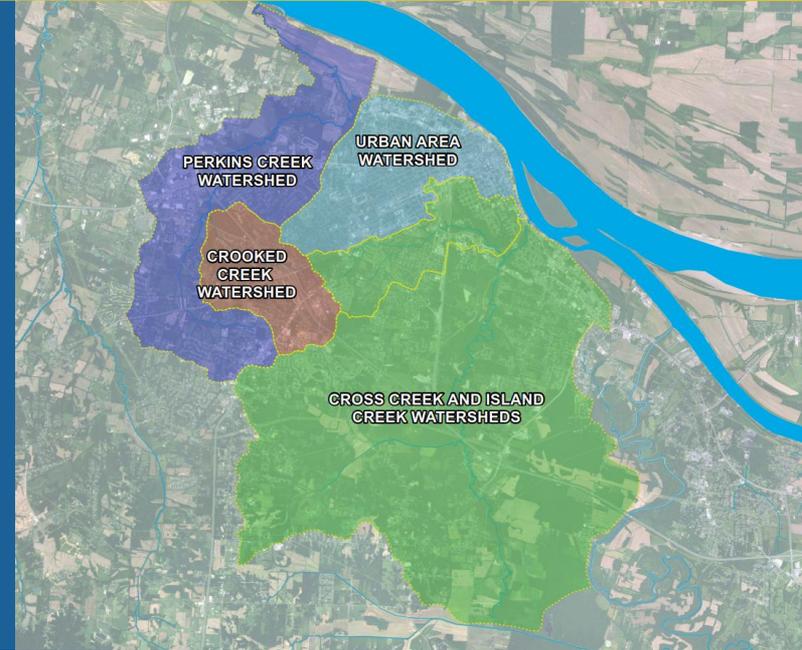
# CITY OF PADUCAH

Comprehensive Stormwater Master Plan

## City Commission Meeting No. 3

Project Update

Tuesday, July 10<sup>th</sup>, 2018  
5:30 p.m.

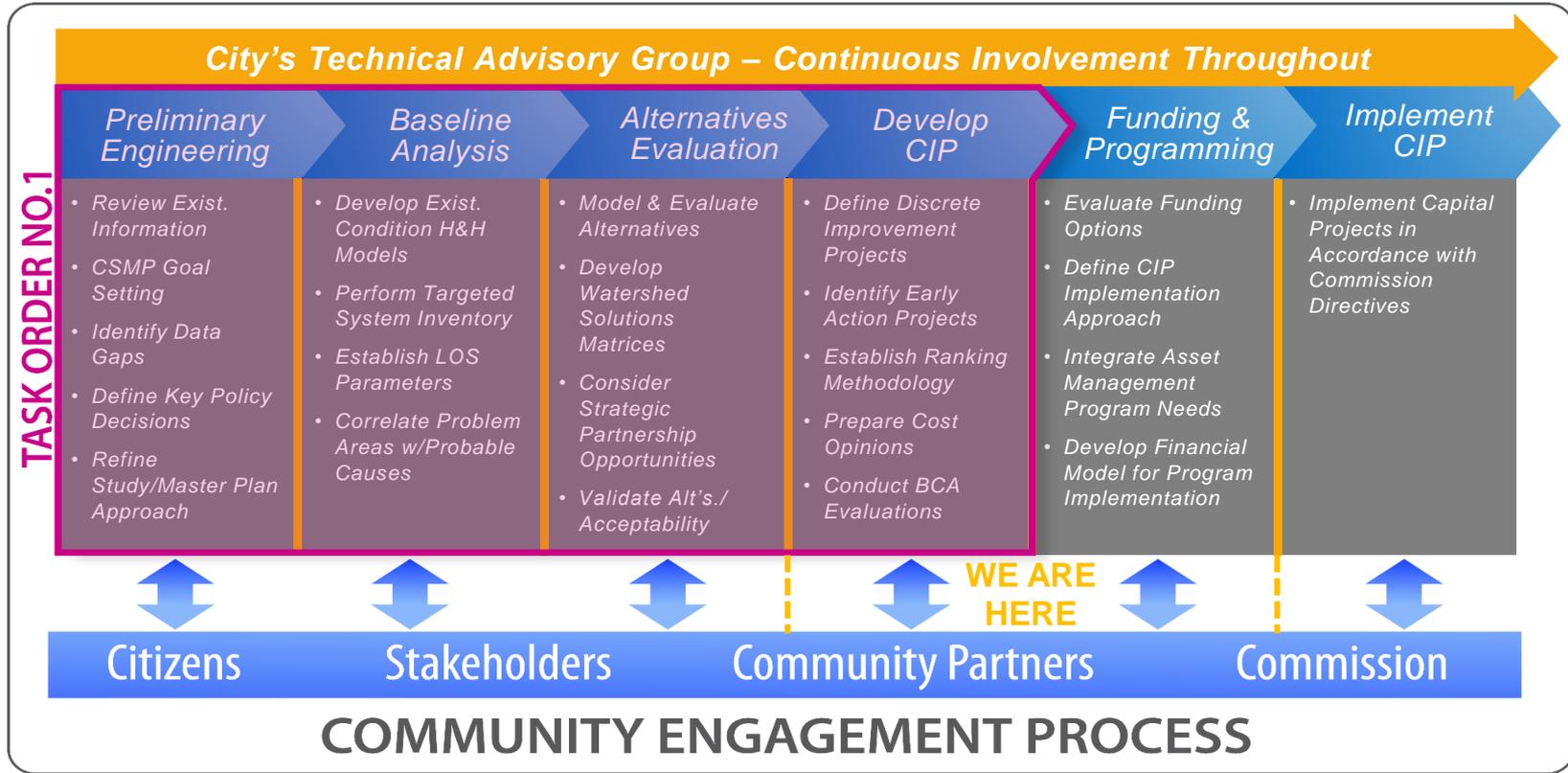


# City Commission - Meeting No. 3

## Agenda

- Public Involvement Update
- Level of Service Determination
- Review of Project Alternatives
- Funding Stream Development

# Project Implementation Overview

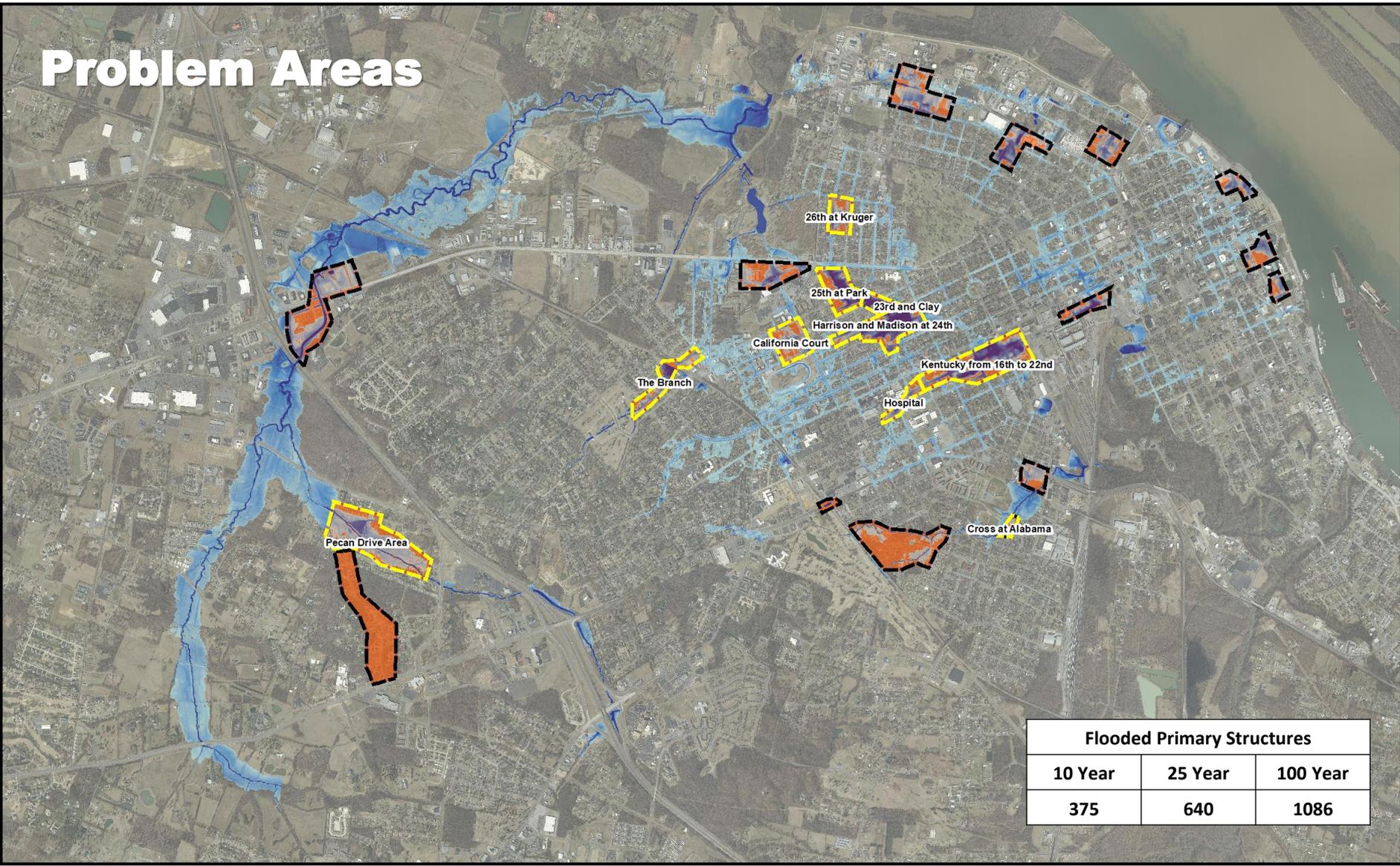


# Task 11 – Flood Mitigation Alternatives Development and Evaluation

## Task Outline

- Develop Alternatives Matrix
- Use Model Tools to Evaluate Alternatives
- Present Preliminary Alternatives to SWAC
- **Refine Alternatives and Present to SWAC**
- Present Alternatives to Public ← **We Are Here**
- Reduce and Further Refine Alternatives
- Present Final Recommendations to City Commission
- Continue with Task Order 2 to Evaluate Funding Opportunities

# Problem Areas



Flooded Primary Structures		
10 Year	25 Year	100 Year
375	640	1086

# Preliminary Analysis

## How are Alternatives Developed and Evaluated

- Number of Primary Structures Impacted
- Reduced or Eliminated Flooding
- Projected Damage Reduction Benefit
- Rough Order of Magnitude Cost (ROM)
- Benefit-Cost Ratio



# Urban Area 100 Year (1% Chance) Analysis Results

Magnitude of Design	Madison Sag	6' x 6' with Storage	Madison/Cali Through Park	Madison Overland	Madison Overland with Cali Ct	Kentucky Avenue Areas	Kentucky Avenue with Madison/Cali	Kruger at 26th	Kruger at 26 <sup>th</sup> with Mildred Relief	Branch Pipe and Storage	Branch Open Channel
Structures with Reduced Flooding	107	132	115	185	146	144	77	58	42	104	104
Structures with Eliminated Flooding	60	43	24	129	161	81	201	11	20	47	47

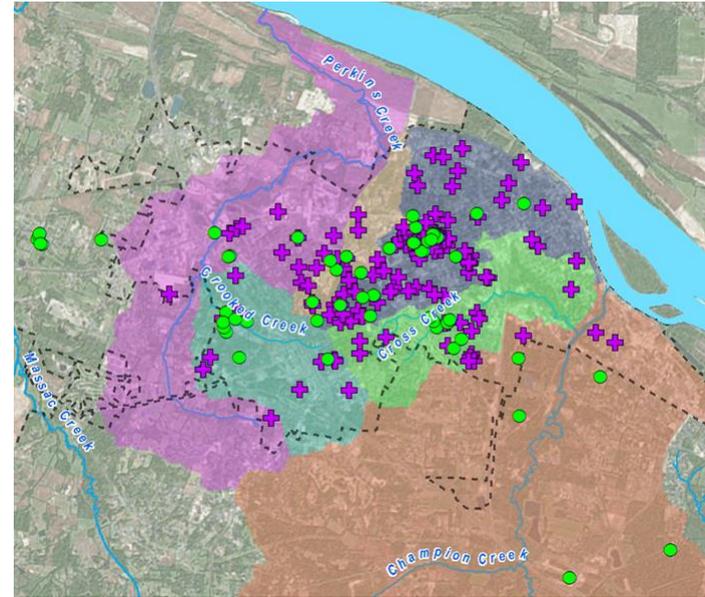
Combined ROM Project Cost - \$43.1 - \$47.6 Million

Benefit-Cost Ratio - 0.79 - 1.07

# Challenges

## Why does it cost so much?

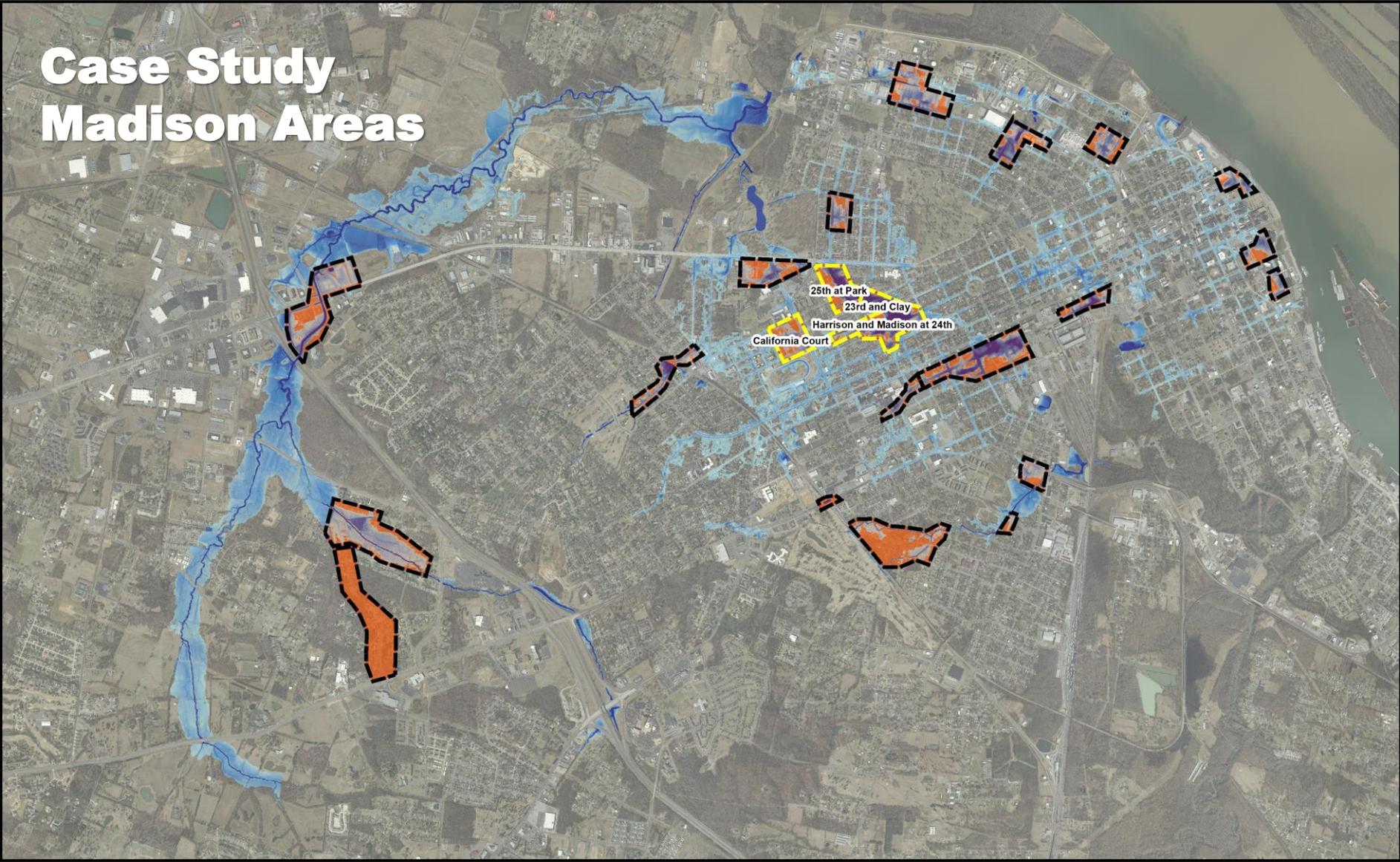
- History of Widespread Flooding
- Combined Sewer System
- Floodwall Impact
- Coordination with other Agencies
  - FEMA, USACE
  - JSA, McCracken County
  - KYTC, Railroads



### Legend

- 2017 Drainage Questionnaire
- ✚ Drainage Complaints (2007 - 2016)

# Case Study Madison Areas



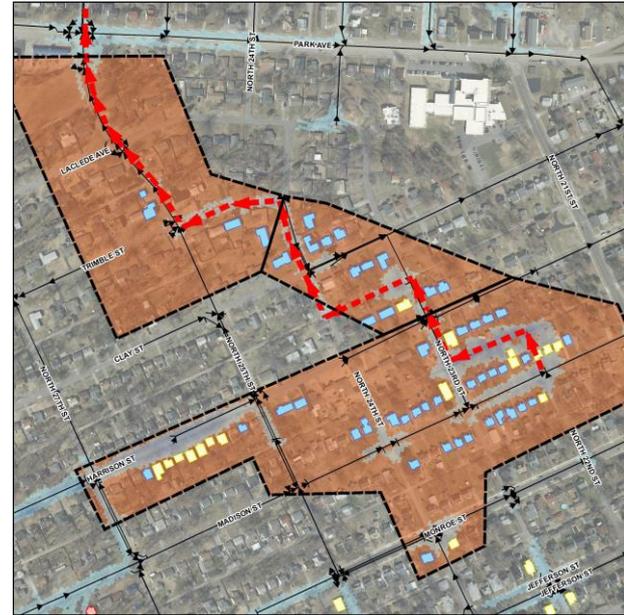
# Level of Service Comparison– 26<sup>th</sup> to Madison

## Case Study Information

- Conveyance Only Sizing
- Rough Order of Magnitude (ROM) Cost
- Annualized Base Line Benefit Analysis

## Findings

- Alternative Downsizing does not Necessarily Sacrifice Benefits
  - Reduce from 100 to 25 year Design
    - 26% Reduction in Cost,
    - 2% Reduction in Benefit
  - Reduce from 100 to 10 year Design
    - 40% Reduction in Cost
    - 13% Reduction in Benefit



Storm Event	Scenario	Estimated Lifetime Benefit (Millions)	ROM Project Cost (Millions)
10 year	6' x 6'	\$13.5	\$12.6
25 Year	6' x 9'	\$15.4	\$16.0
100 Year	7' x 12'	\$15.6	\$21.8

# Conclusion for Case Study Analysis

Magnitude of Design	Lifetime Benefit Range	Alternative Cost Range	BCR Range	Primary Structures Removed from Flooding in 100 Year Event	Primary Structures with Reduced Flooding Risk in 100 Year Event
<b>100 Year BCR (1% Chance)</b>	\$37.6 - \$46.2	\$43.1 - \$47.6	0.79 - 1.07	270-300	240-265
<b>25 Year BCR (4% Chance)</b>	\$36.8 - \$45.3	\$32.8 - \$36.2	1.02 - 1.38	160-180	275-310
<b>10 Year BCR (10% Chance)</b>	\$32.7 - \$40.2	\$25.9 - \$28.6	1.14 - 1.55	105-120	300-330

# Level of Service Defines Alternative Design Basis

Magnitude of Design	Lifetime Benefit Range	Alternative Cost Range	BCR Range	Primary Structures Removed from Flooding in 100 Year Event	Primary Structures with Reduced Flooding Risk in 100 Year Event
100 Year BCR (1% Chance)	\$37.6 - \$46.2	\$43.1 - \$47.6	0.79 - 1.07	270-300	240-265
25 Year BCR (4% Chance)	\$36.8 - \$45.3	\$32.8 - \$36.2	1.02 - 1.38	160-180	275-310
10 Year BCR (10% Chance)	\$32.7 - \$40.2	\$25.9 - \$28.6	1.14 - 1.55	105-120	300-330

← Selected

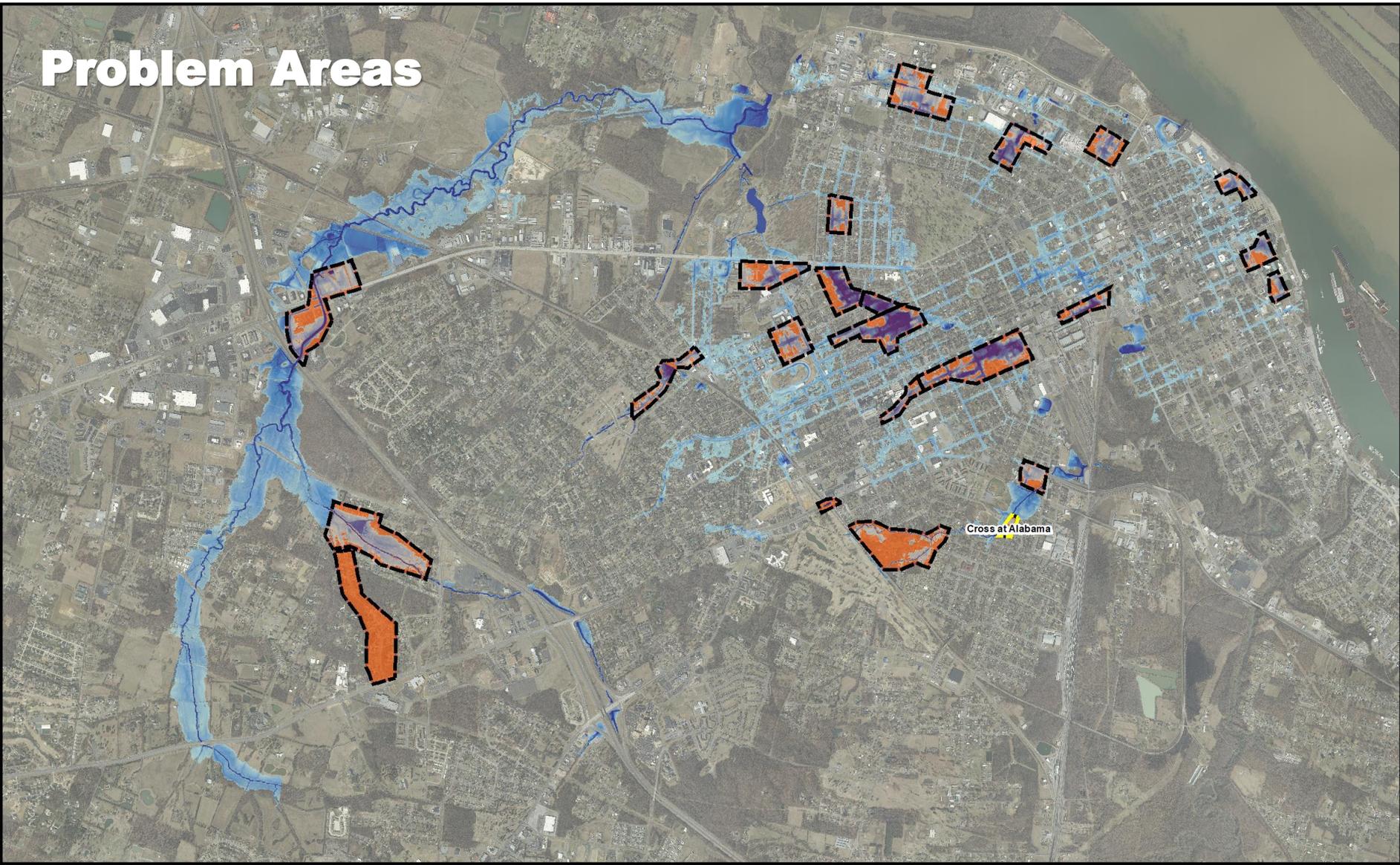


# 25 Year Level of Service Determination

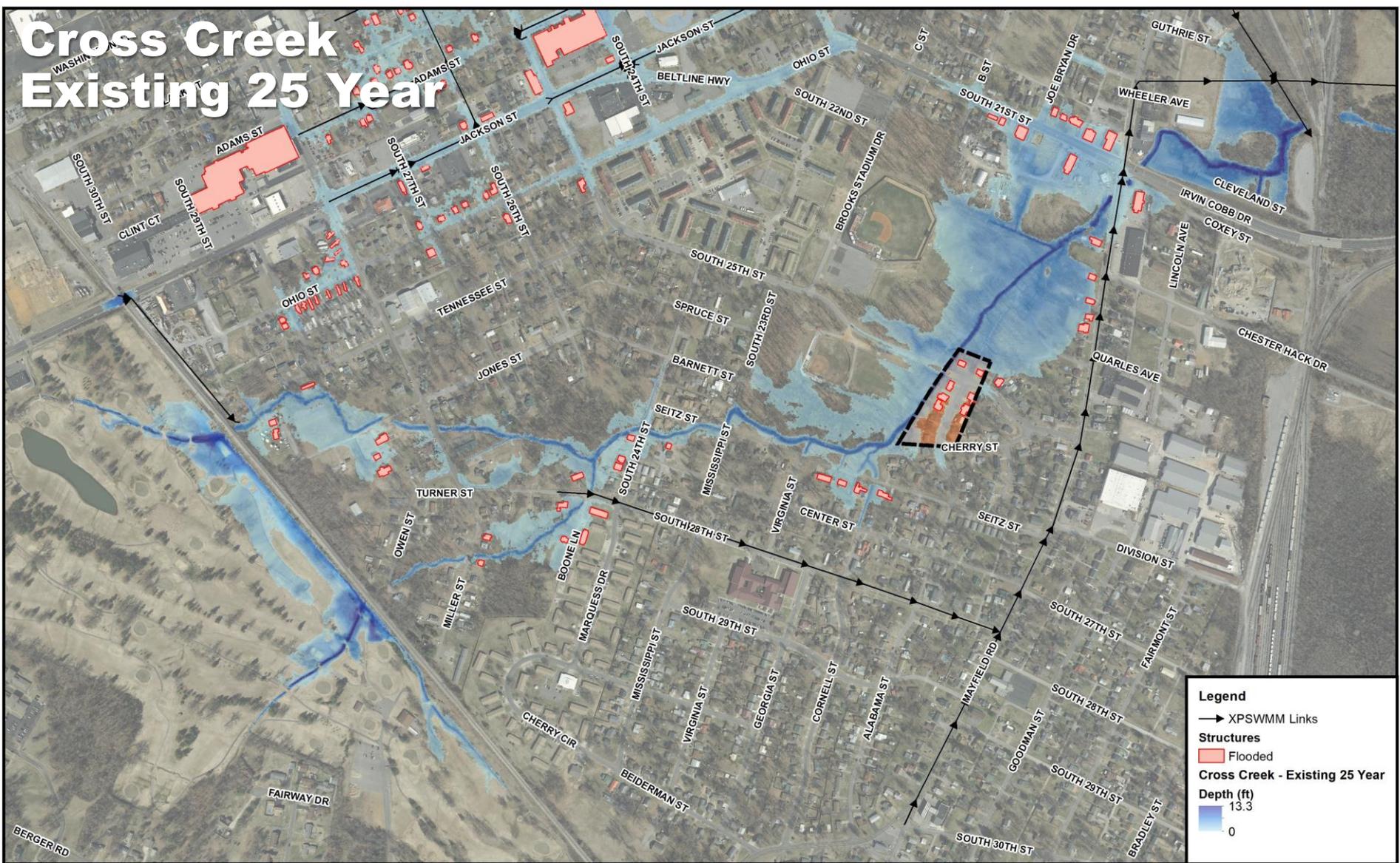
## Stormwater Advisory Committee Feedback

- I was/am leaning toward the 25 year target. Given the flooding of this morning and last Friday it just proves this is a dynamic problem.
- My short answer is 25 year BCR is a good place to start. However, I don't believe there is one specific answer for all the projects that you will evaluate.
- I originally thought the 10 year Level of Service would be my choice but now, after hearing further discussion at the meeting, I feel the 25 year level would be better, aiming higher to allow some headroom.
- Based on what I saw at the last presentation, and with my firm belief that climate change is affecting the intensity and frequency of rain totals in storms in our area, I think that we need to opt for the highest level of service (100 year/1% chance).

# Problem Areas



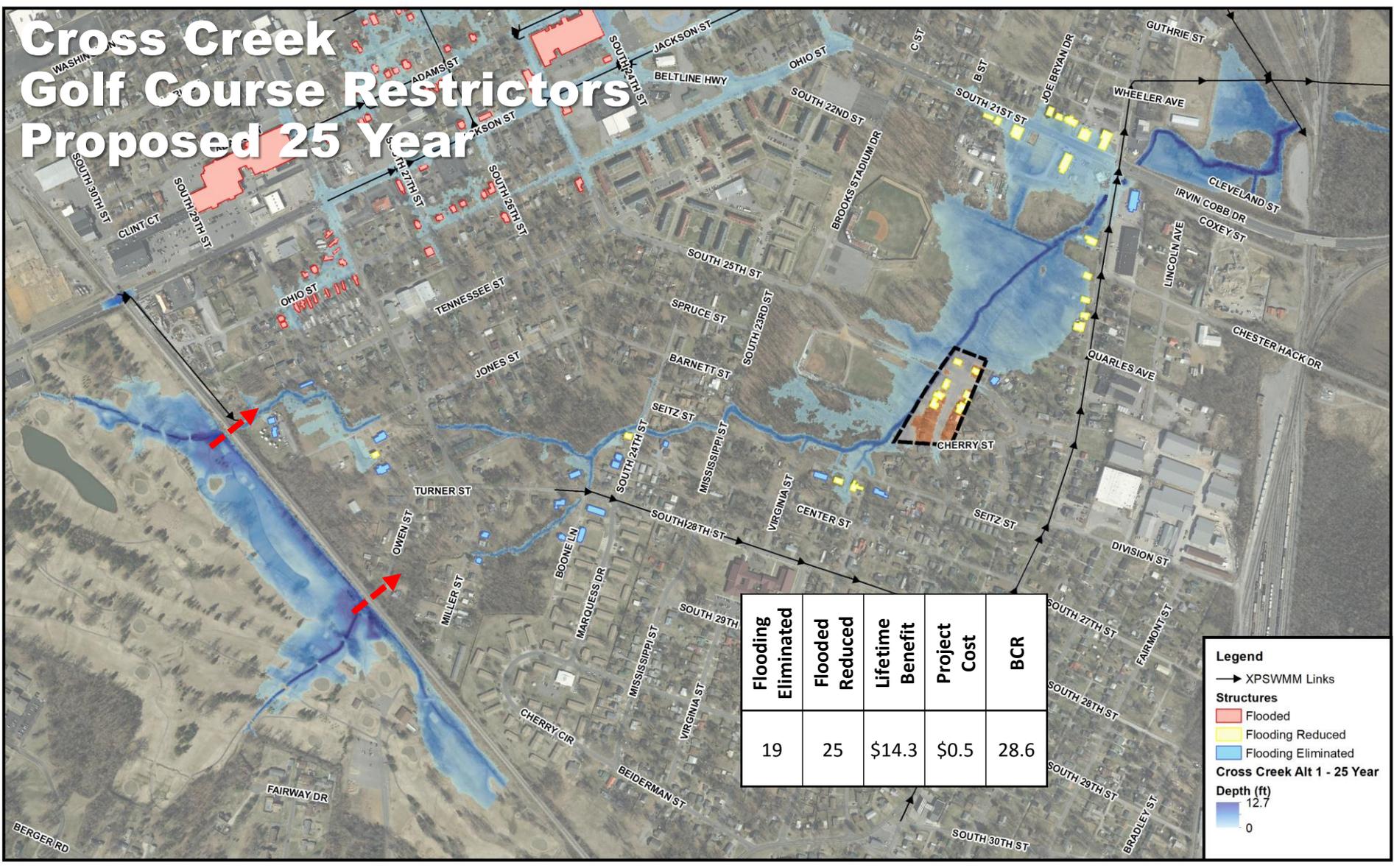
# Cross Creek Existing 25 Year



**Legend**

- XPSWMM Links
- Structures
- Flooded
- Cross Creek - Existing 25 Year
- Depth (ft)
- 13.3
- 0

# Cross Creek Golf Course Restrictors Proposed 25 Year

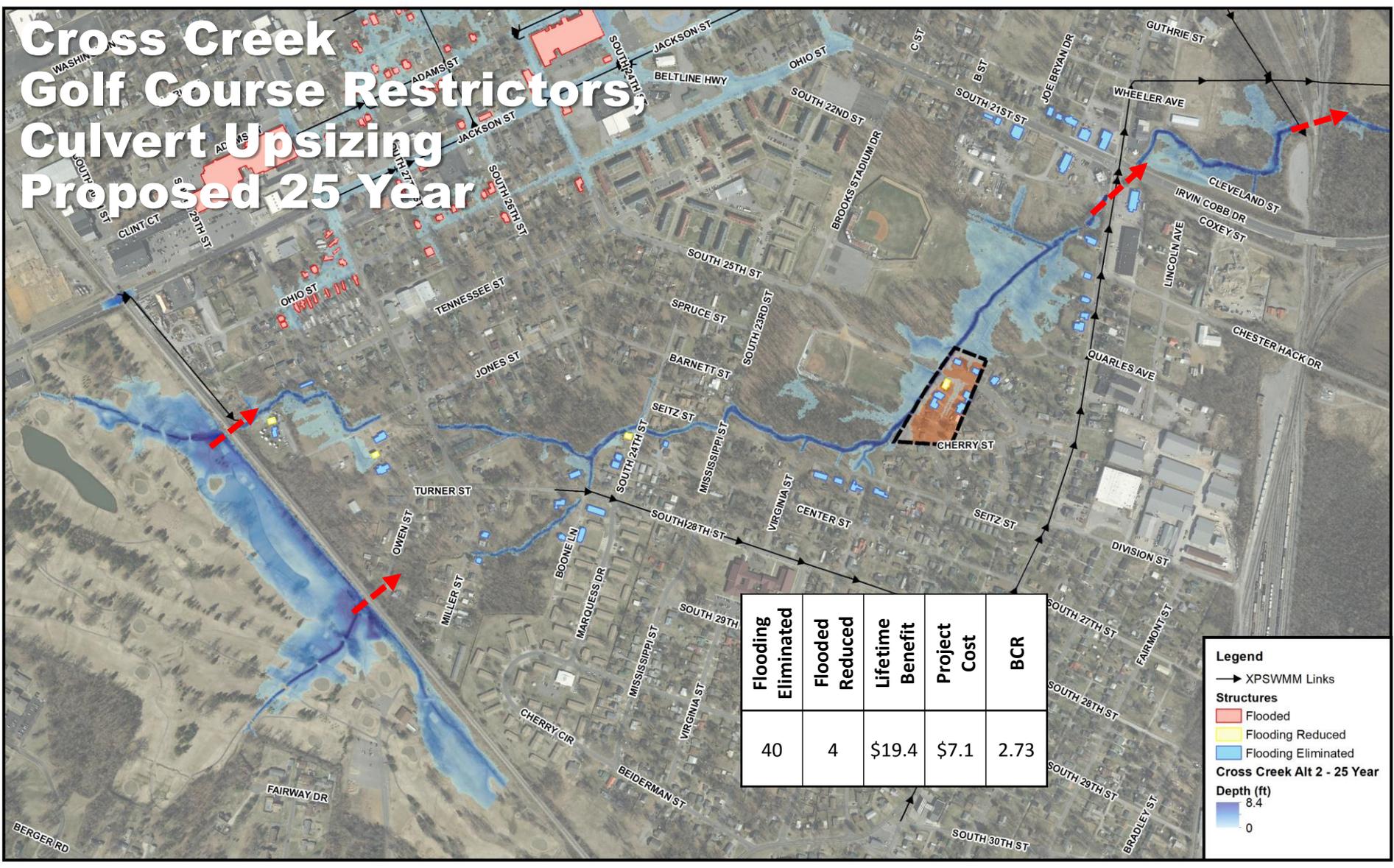


Flooding Eliminated	Flooded Reduced	Lifetime Benefit	Project Cost	BCR
19	25	\$14.3	\$0.5	28.6

**Legend**

- XPSWMM Links
- Structures**
- Red: Flooded
- Yellow: Flooding Reduced
- Blue: Flooding Eliminated
- Cross Creek Alt 1 - 25 Year**
- Depth (ft)**
- 0
- 12.7

# Cross Creek Golf Course Restrictors, Culvert Upsizing Proposed 25 Year



Flooding Eliminated	Flooded Reduced	Lifetime Benefit	Project Cost	BCR
40	4	\$19.4	\$7.1	2.73

**Legend**

- XPSWMM Links
- Structures**
  - Flooded
  - Flooding Reduced
  - Flooding Eliminated
- Cross Creek Alt 2 - 25 Year**
- Depth (ft)
  - 8.4
  - 0

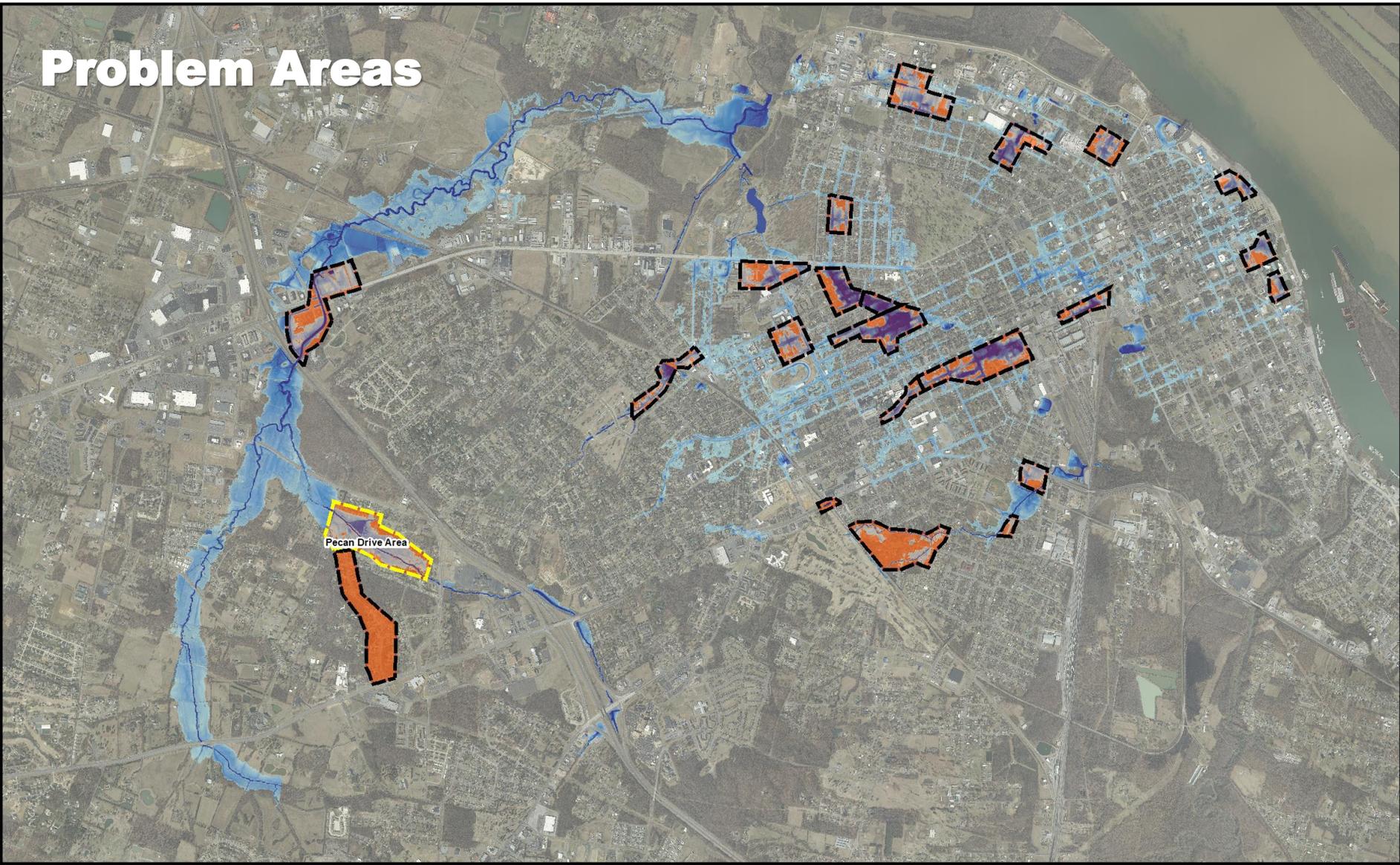
# Cross Creek Alternatives

Scenario	25 Year Design (4% Chance)				
	Flooding Eliminated	Flooded Reduced	Lifetime Benefit	Project Cost (Millions)	Structure Only BCR
Golf Course Restrictions	19	25	\$14.3	\$0.5	28.6
Add Parallel Culverts	40	4	\$19.4	\$7.1	2.73

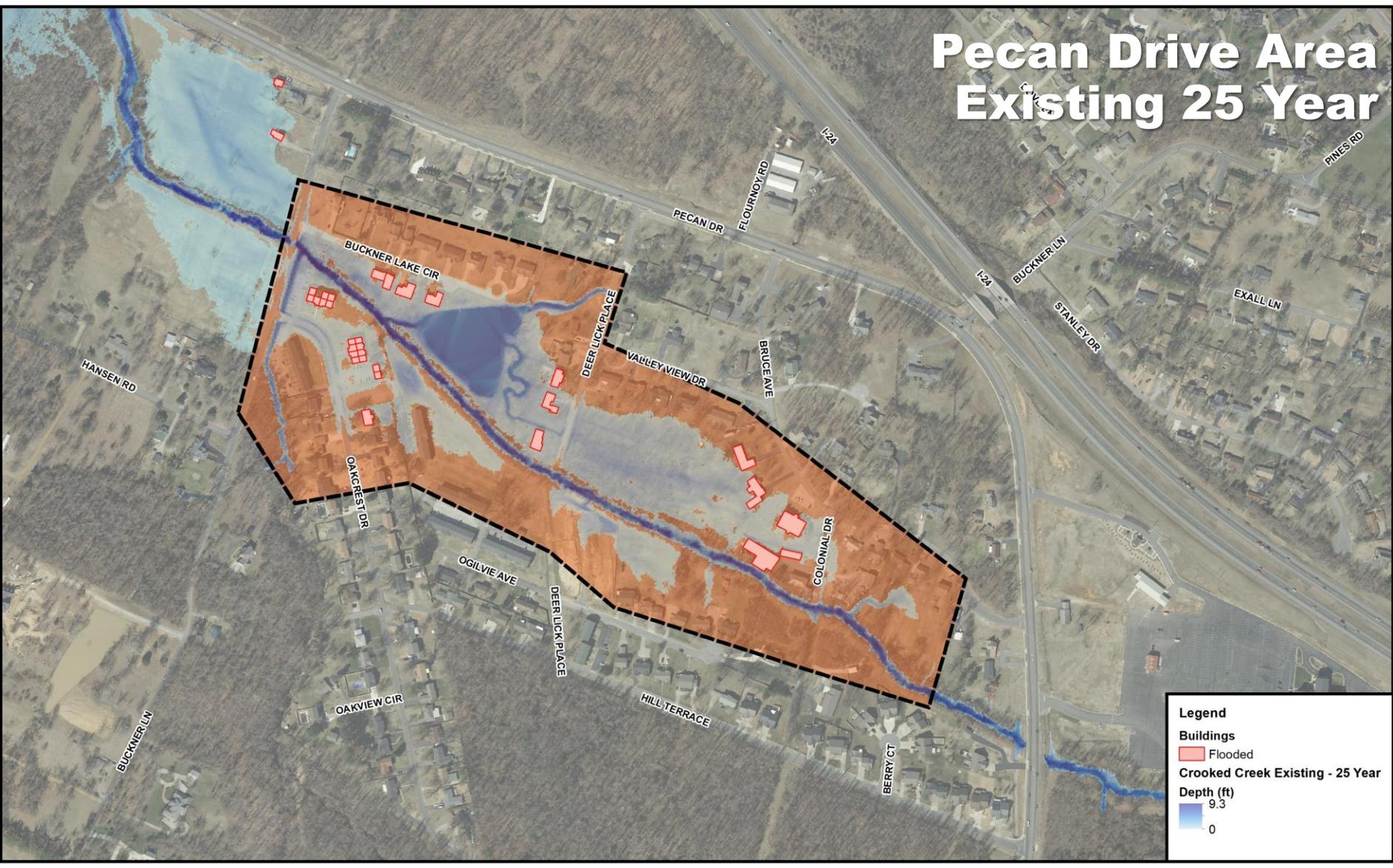
BCR – Benefit Cost Ratio  
ROM – Rough Order of Magnitude



# Problem Areas



# Pecan Drive Area Existing 25 Year



**Legend**

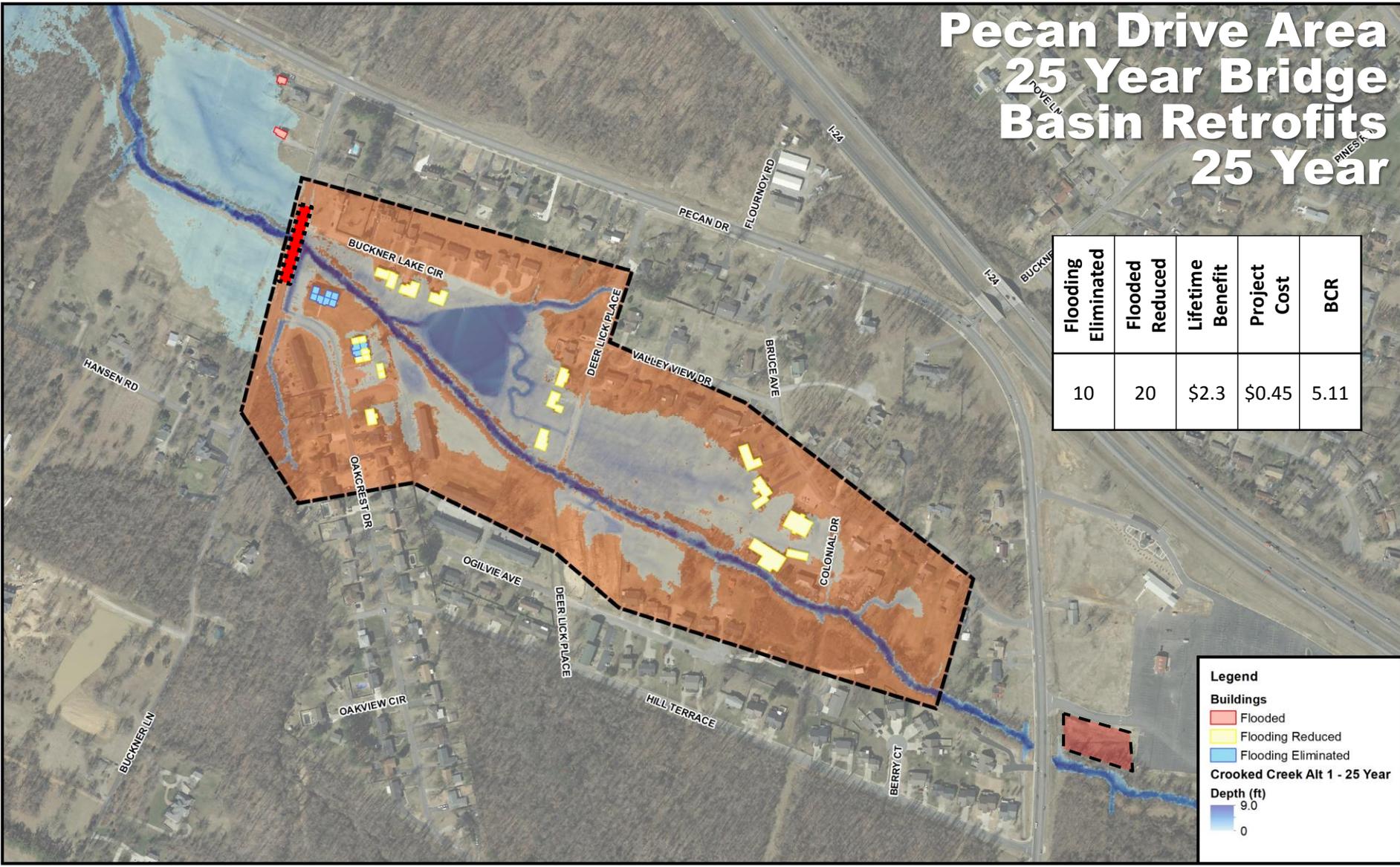
- Buildings**
  - Flooded
- Crooked Creek Existing - 25 Year**
  - Depth (ft)
    - 9.3
    - 0

# Pecan Drive Area 25 Year Bridge Basin Retrofits 25 Year

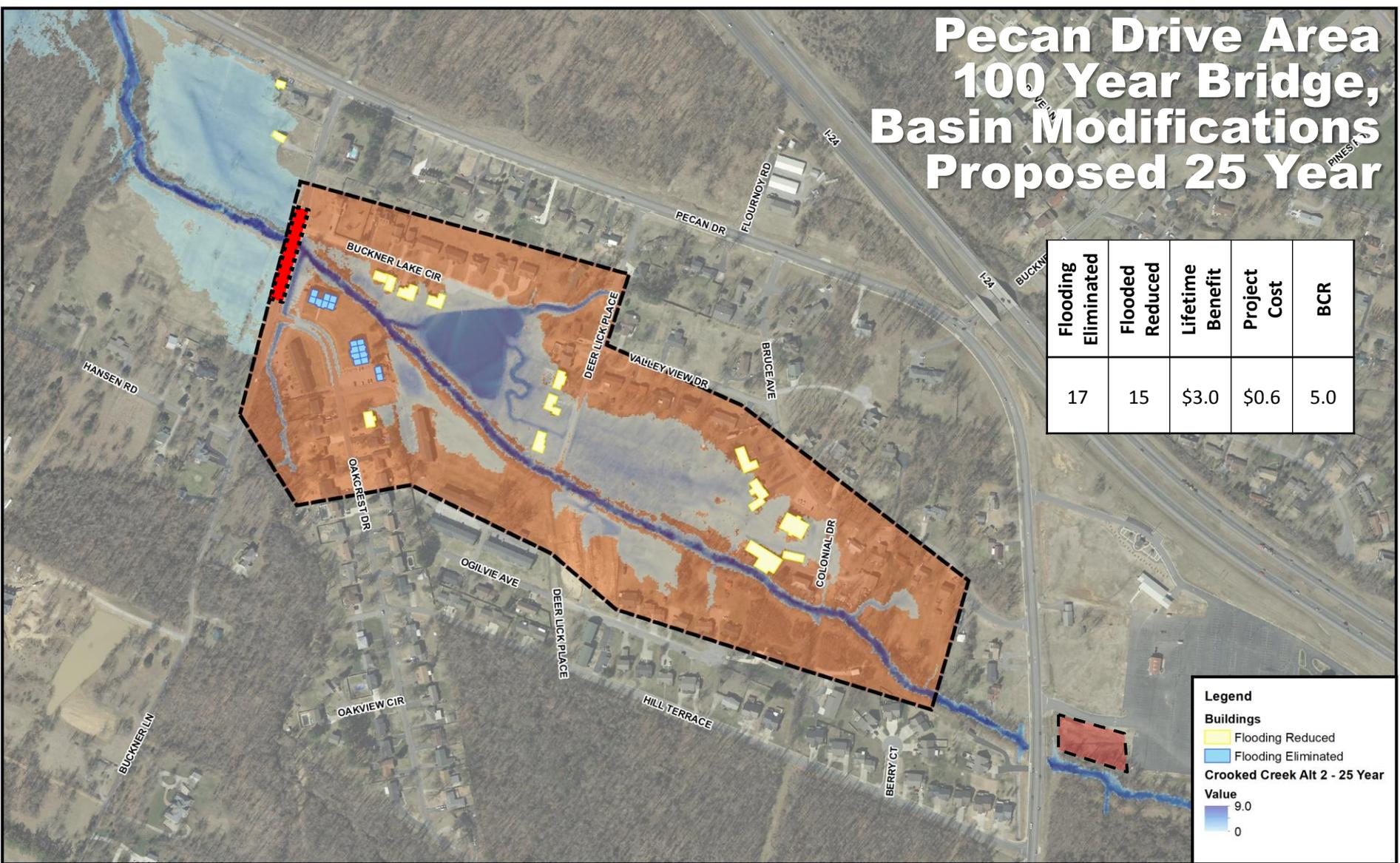
Flooding Eliminated	Flooded Reduced	Lifetime Benefit	Project Cost	BCR
10	20	\$2.3	\$0.45	5.11

**Legend**

- Buildings
  - Flooded
  - Flooding Reduced
  - Flooding Eliminated
- Crooked Creek Alt 1 - 25 Year**
- Depth (ft)
  - 9.0
  - 0



# Pecan Drive Area 100 Year Bridge, Basin Modifications Proposed 25 Year



Flooding Eliminated	Flooded Reduced	Lifetime Benefit	Project Cost	BCR
17	15	\$3.0	\$0.6	5.0

**Legend**

**Buildings**

- Flooding Reduced (Yellow)
- Flooding Eliminated (Blue)

**Crooked Creek Alt 2 - 25 Year**

**Value**

- 9.0 (Red)
- 0 (Blue)

HANSEN RD

BUCKNER LAKE CIR

PECAN DR

FLOURNOY RD

DEER LICK PLACE

VALLEY VIEW DR

BRUCE AVE

OAKCREST DR

Ogilvie Ave

DEER LICK PLACE

COLONIAL DR

OAKVIEW CIR

HILL TERRACE

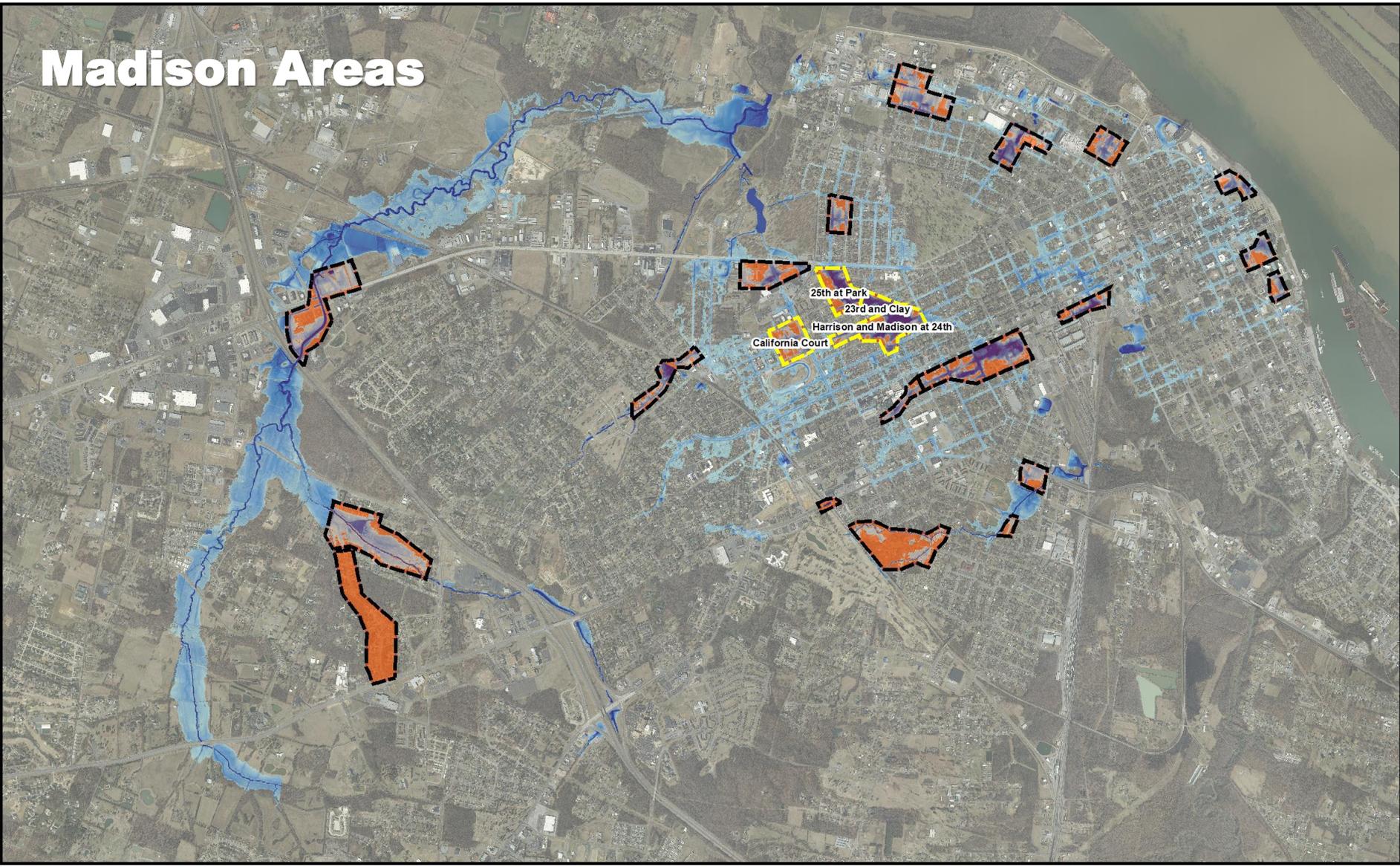
BERRY CT

BUCKNER LN

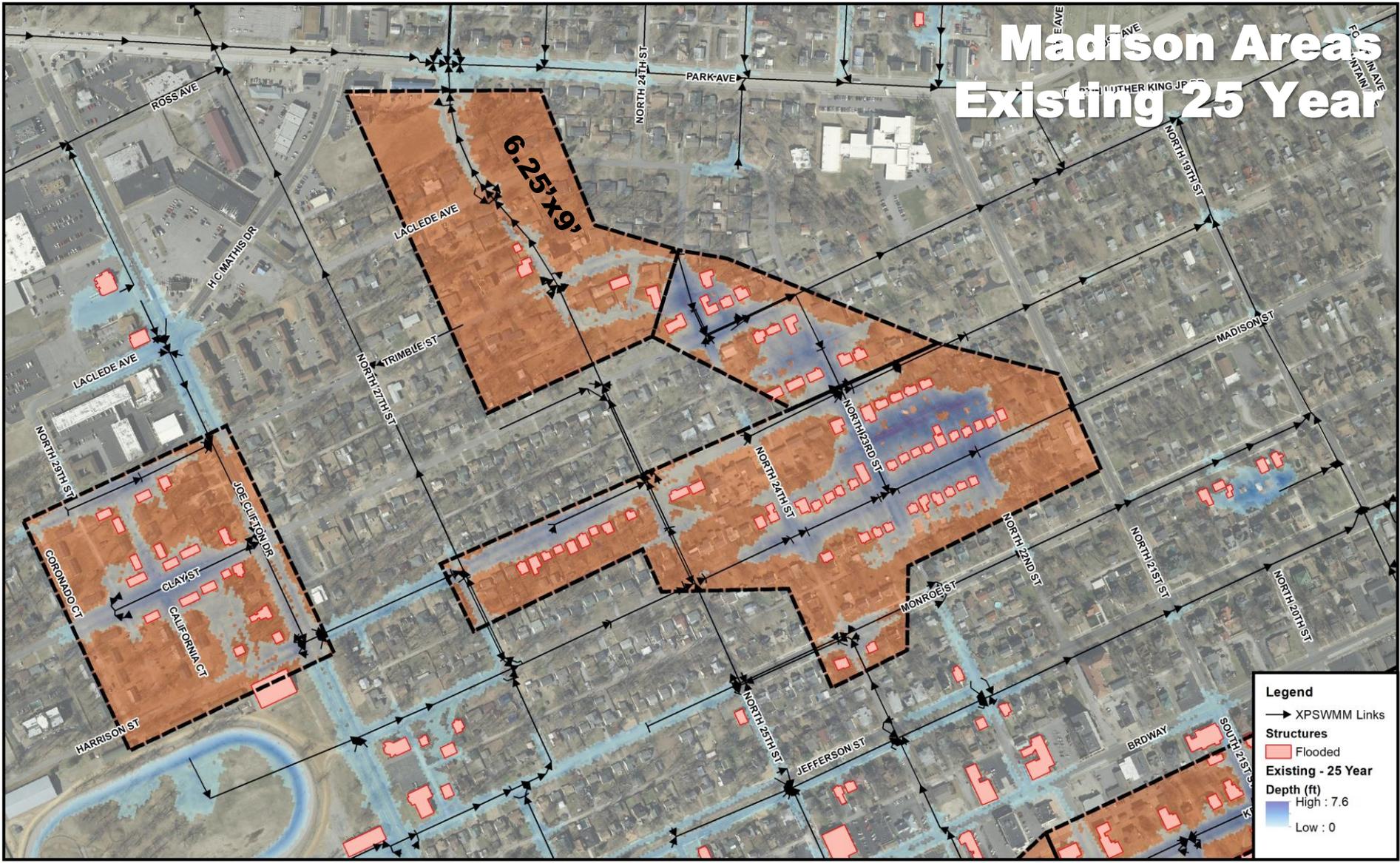
# Crooked Creek Alternatives

Scenario	25 Year Design (4% Chance)				
	Flooding Eliminated	Flooded Reduced	Lifetime Benefit	Project Cost (Millions)	Structure Only BCR
Bridge Replacement/ Culvert Installation	10	20	\$2.3	\$0.45	5.11
Additional Building Acquisition, Flood Fringe Modifications, Basin Retrofits	17	15	\$3.0	\$0.6	5.0

# Madison Areas



# Madison Areas Existing 25 Year



**Legend**

- XPSWMM Links
- Structures**
- Flooded
- Existing - 25 Year**
- Depth (ft)**
- High : 7.6
- Low : 0

# Madison Areas Sag Relief 25 Year

Flooding Eliminated	Flooded Reduced	Lifetime Benefit	Project Cost	BCR
60	93	\$23.8	\$17.7	1.29

**Legend**

-  Proposed Infrastructure
-  XPSWMM Links

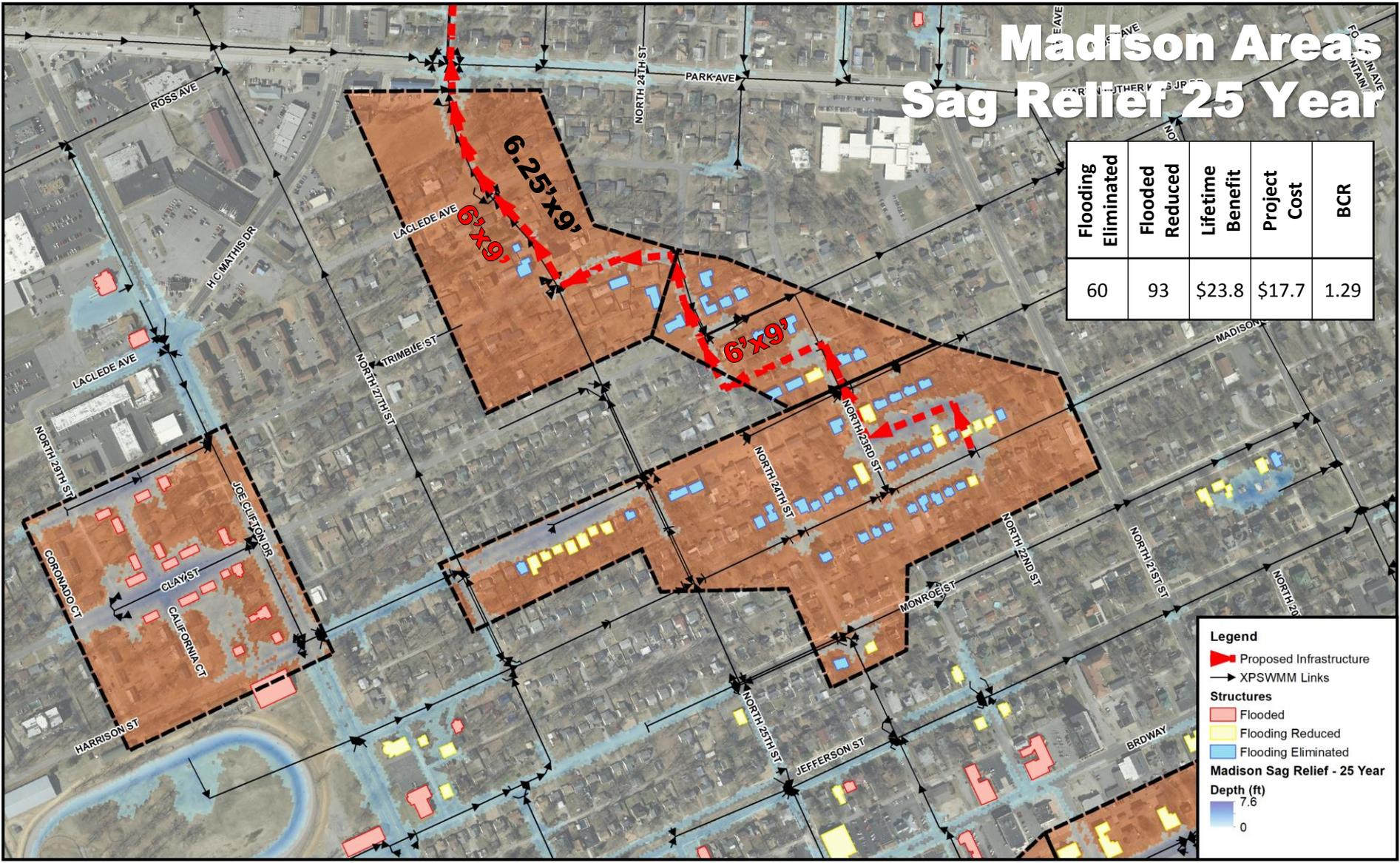
**Structures**

-  Flooded
-  Flooding Reduced
-  Flooding Eliminated

**Madison Sag Relief - 25 Year**

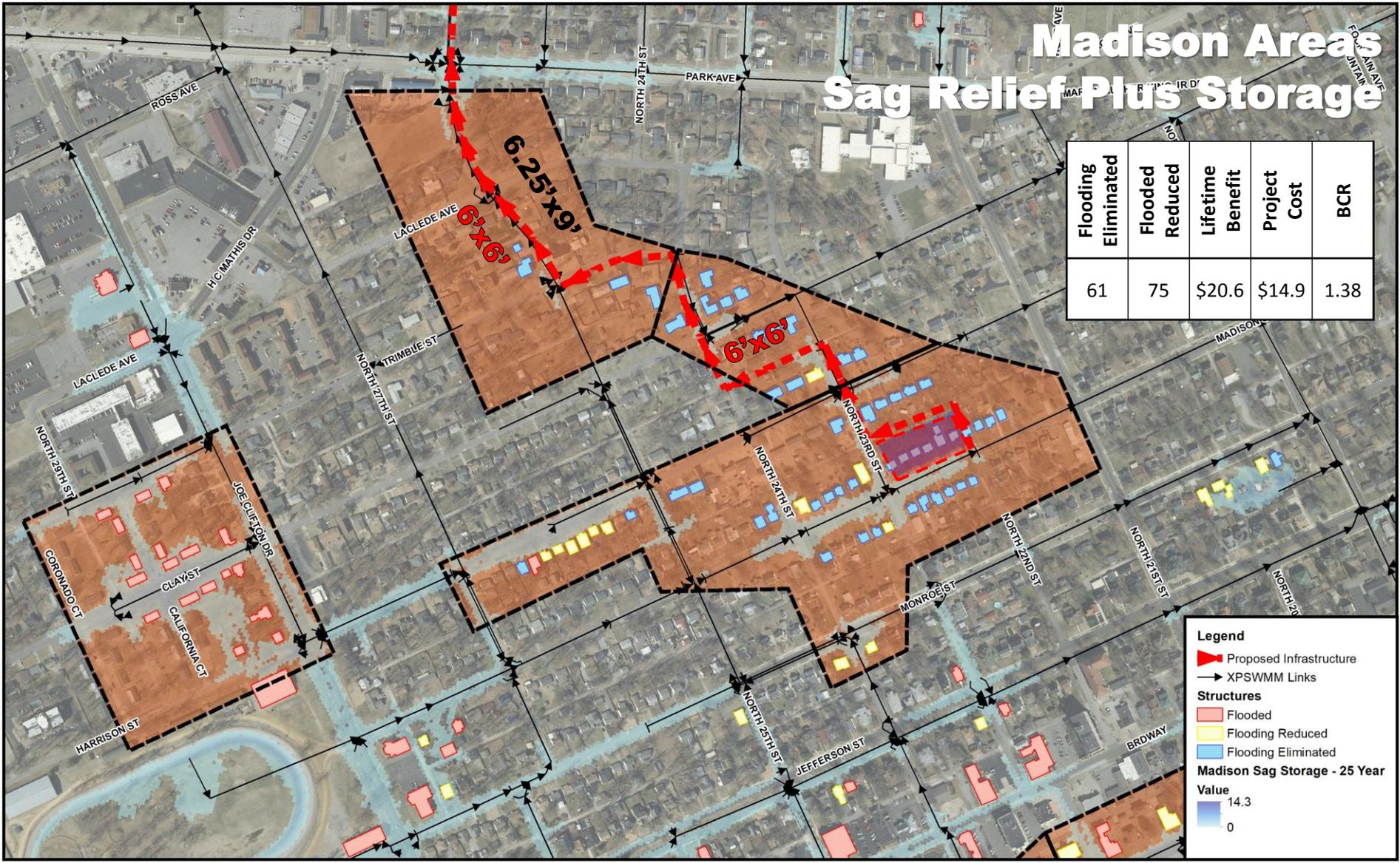
**Depth (ft)**

-  7.6
-  0



# Madison Areas Sag Relief Plus Storage

Flooding Eliminated	Flooded Reduced	Lifetime Benefit	Project Cost	BCR
61	75	\$20.6	\$14.9	1.38



**Legend**

- Proposed Infrastructure
- XPSWMM Links

**Structures**

- Flooded
- Flooding Reduced
- Flooding Eliminated

**Madison Sag Storage - 25 Year Value**

- 14.3
- 0

# Madison Areas Sag Relief/Storage with California Ct Through Park 25 Year

Flooding Eliminated	Flooded Reduced	Lifetime Benefit	Project Cost	BCR
94	118	\$35.4	\$20.1	1.76

**Legend**

- Proposed Infrastructure
- XPSWMM Links

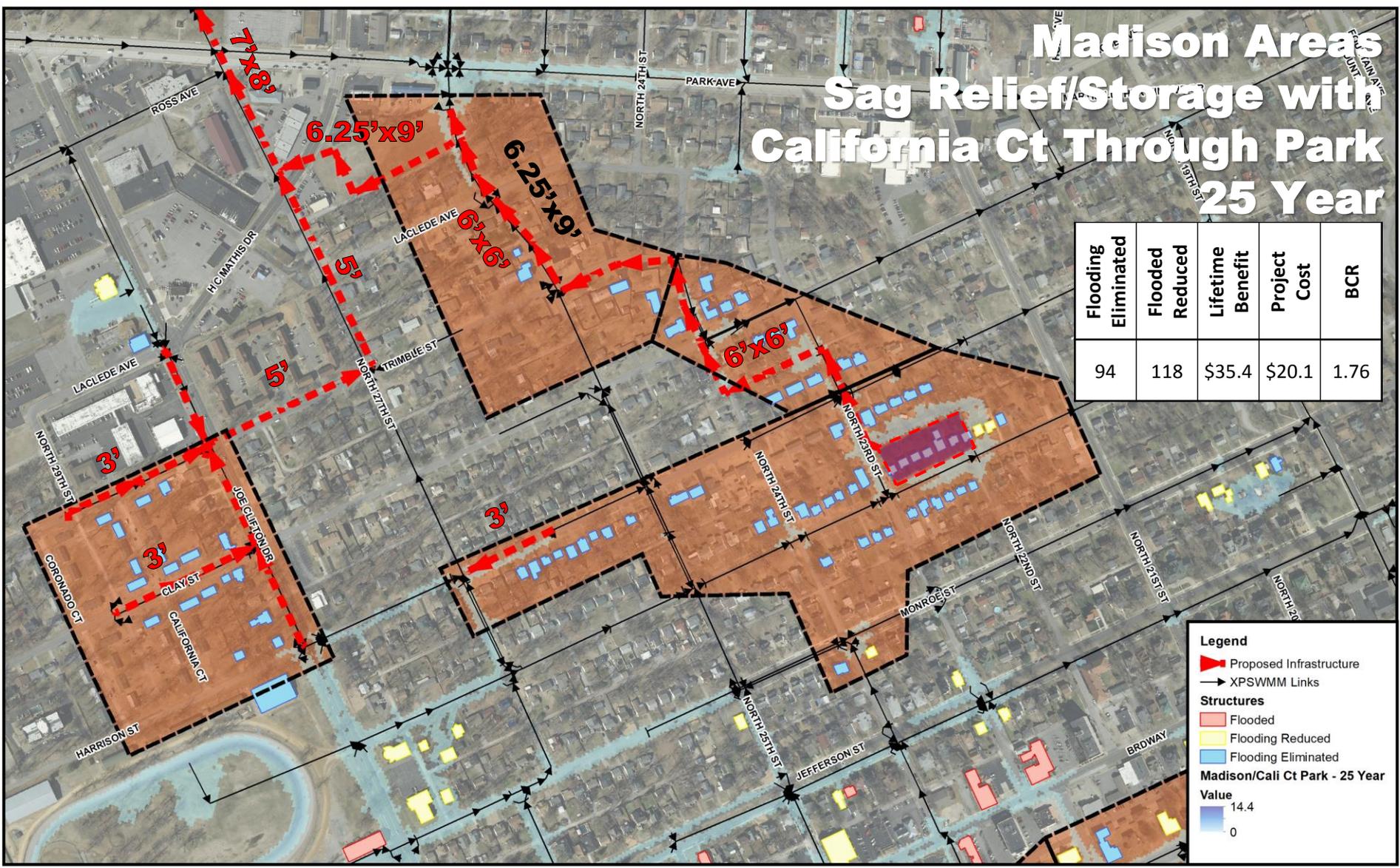
**Structures**

- Flooded
- Flooding Reduced
- Flooding Eliminated

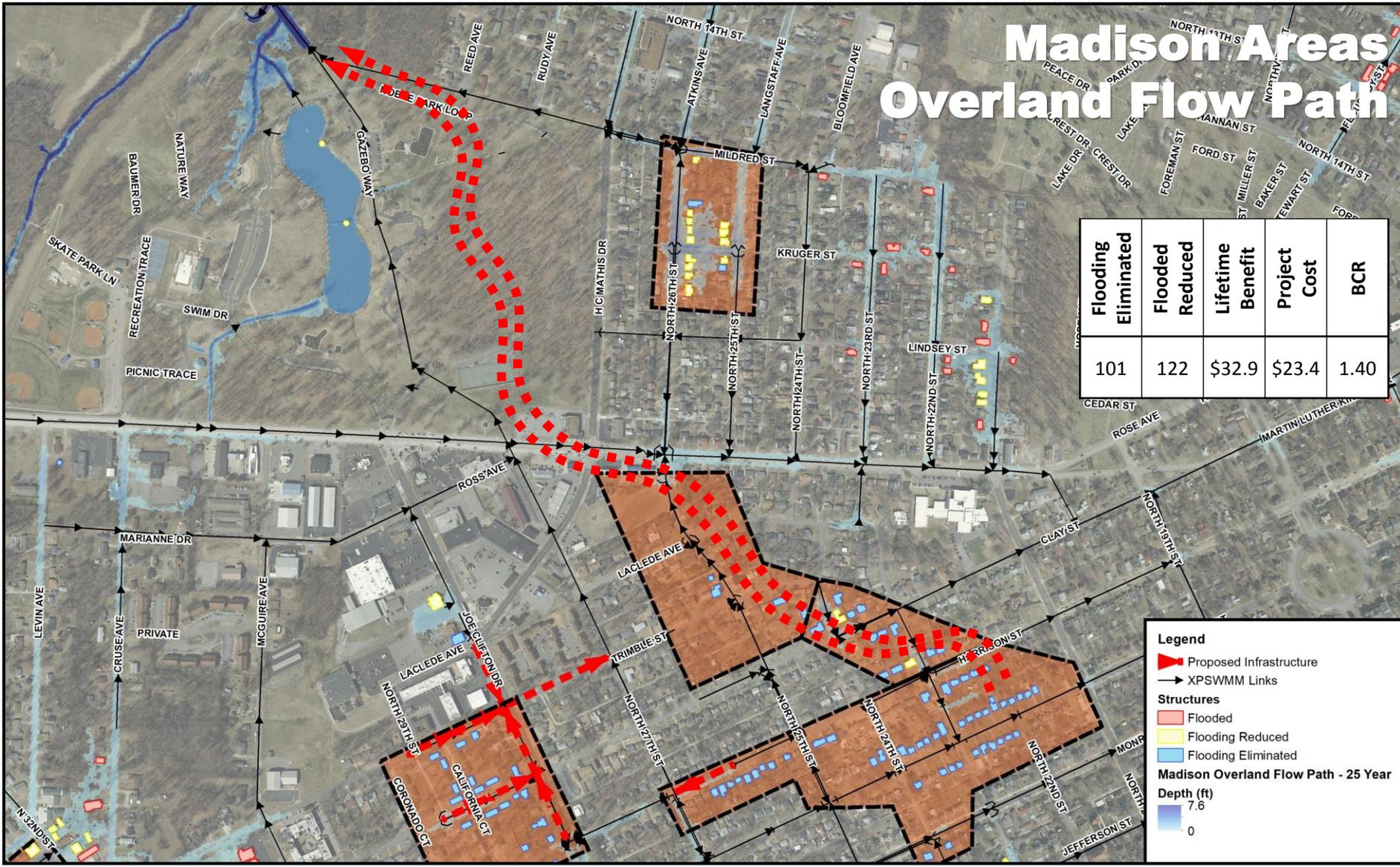
**Madison/Cali Ct Park - 25 Year**

Value

- 14.4
- 0



# Madison Areas Overland Flow Path



Flooding Eliminated	Flooded Reduced	Lifetime Benefit	Project Cost	BCR
101	122	\$32.9	\$23.4	1.40

**Legend**

- Proposed Infrastructure
- XPSWMM Links
- Structures**
- Flooded
- Flooding Reduced
- Flooding Eliminated

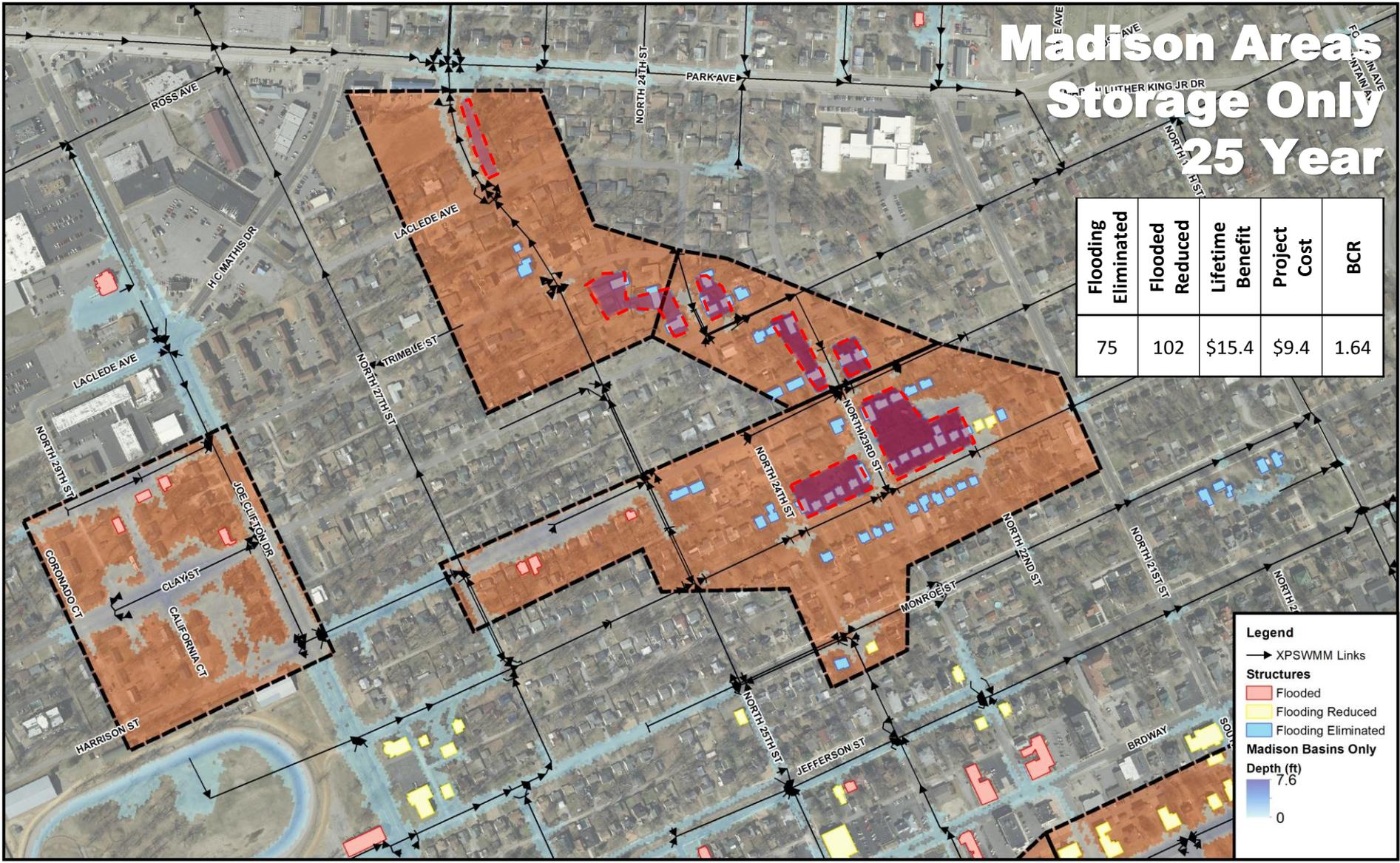
**Madison Overland Flow Path - 25 Year**

Depth (ft)

- 7.6
- 0

# Madison Areas Storage Only 25 Year

Flooding Eliminated	Flooded Reduced	Lifetime Benefit	Project Cost	BCR
75	102	\$15.4	\$9.4	1.64



**Legend**

- XPSWMM Links
- Structures**
- Red box: Flooded
- Yellow box: Flooding Reduced
- Blue box: Flooding Eliminated
- Madison Basins Only**
- Depth (ft)
- Blue gradient: 7.6
- White box: 0

# Madison Areas Alternatives

Scenario	25 Year Design (4% Chance)				
	Flooding Eliminated	Flooded Reduced	Lifetime Benefit	Project Cost (Millions)	Structure Only BCR
Madison Sag Relief	60	93	\$23.8	\$17.7	1.29
Madison 6' x 6' with Storage	61	75	\$20.6	\$14.9	1.38
Madison 6' x 6' with Storage with California Ct Through Park	94	118	\$35.4	\$20.1	1.76
Madison Overland w/ Cali Ct	101	122	\$32.9	\$23.4	1.40
Madison Storage Only	75	102	\$15.4	\$9.4	1.64



# Level of Service Defines Alternative Design Basis

Magnitude of Design	Lifetime Benefit Range	Alternative Cost Range	BCR Range	Primary Structures Removed from Flooding in 100 Year Event	Primary Structures with Reduced Flooding Risk in 100 Year Event
100 Year BCR (1% Chance)	\$37.6 - \$46.2	\$43.1 - \$47.6	0.79 - 1.07	270-300	240-265
25 Year BCR (4% Chance)	\$36.8 - \$45.3	\$32.8 - \$36.2	1.02 - 1.38	160-180	275-310
10 Year BCR (10% Chance)	\$32.7 - \$40.2	\$25.9 - \$28.6	1.14 - 1.55	105-120	300-330

← Selected



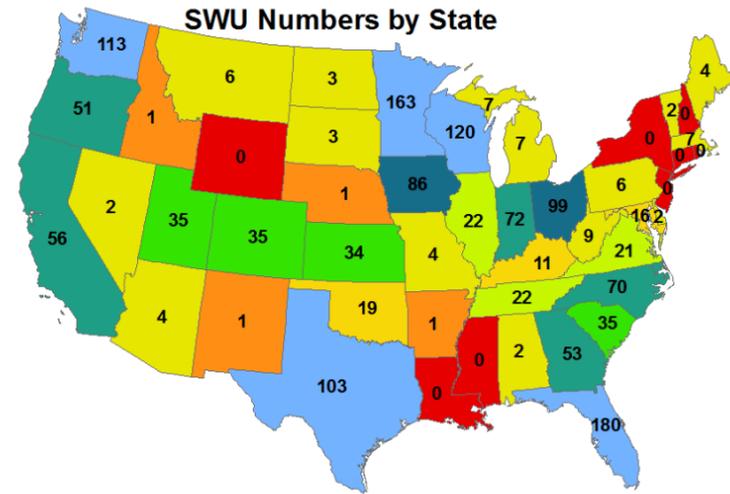
# Options for Funding Stormwater Management Projects

- General Fund
- Taxes
  - Property Taxes
  - Ad Valorem Taxes
  - Sales Tax
- Fees
  - Permitting and Fees
  - New Development Impact Fees
- Grants
- Stormwater Utility (User Fees)

## Stormwater User Fee vs. Tax

# National Averages

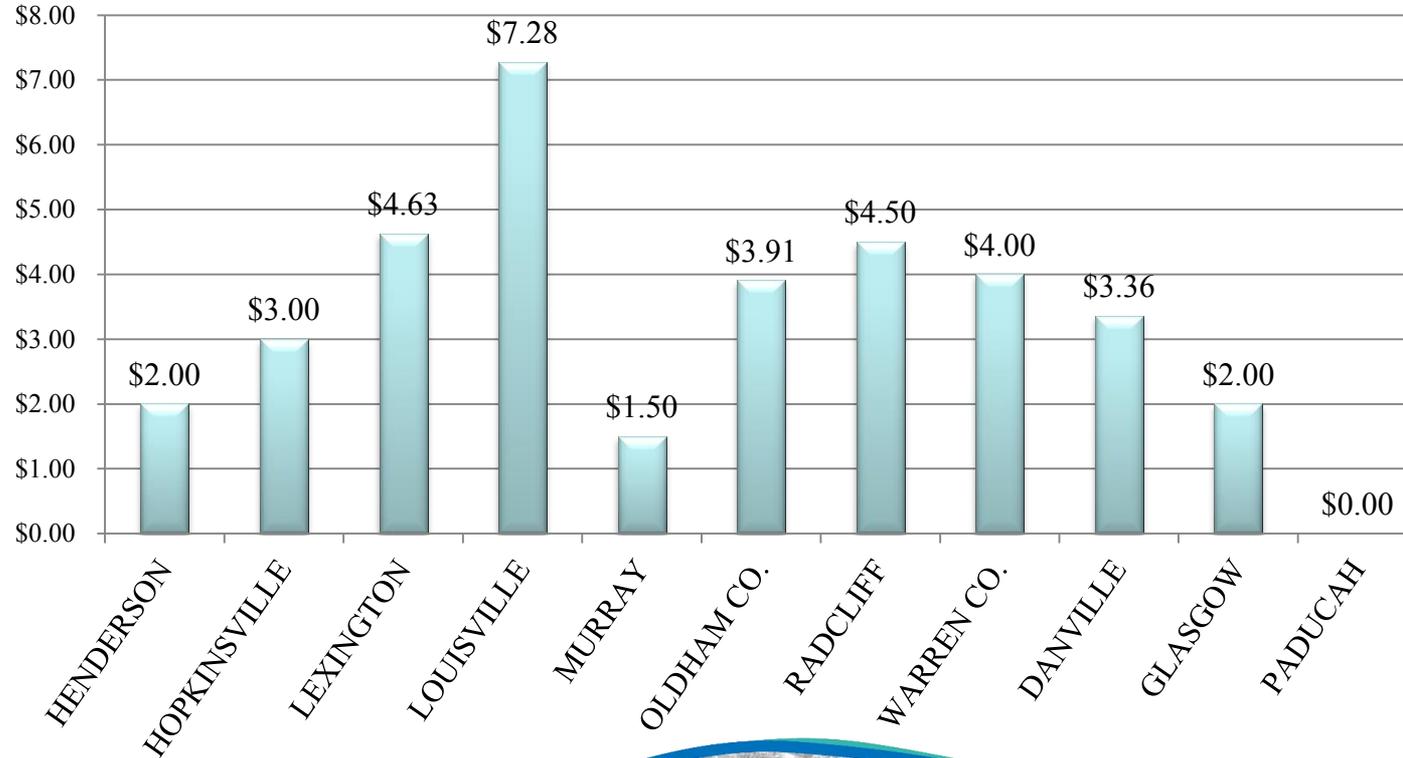
- 1491 Storm Water Utilities in the United States
- Median monthly storm water utility fee is \$3.50 for those communities using the equivalent residential unit (ERU) system
- Median ERU is 2842 square feet impervious



# Stormwater Program Funding in Kentucky

- 12 Stormwater Utilities
  - 8 are ERU based
  - 2 are two level system (residential/commercial)
  - 1 is tier based ERU for commercial only
- Bowling Green – General Fund – 1% increase in Occupational Tax
- Owensboro – tax applied to occupational/net profit tax
- Elizabethtown – General Fund

# Equivalent Residential Unit



# Stormwater Utility Mission Statement

Develop and implement a comprehensive, city-wide storm water management program funded through an equitable and sustainable funding mechanism.



# Guiding Principles

- Provide adequate and sustainable funding for the program.
- Plan, construct, acquire, regulate, operate and maintain, in a cost-effective manner, a public storm water drainage system to perform within an established level of service within our authority.
- Comply with the Kentucky Pollutant Discharge Elimination System (KPDES) municipal separate storm sewer system (MS4) requirements.

# Program Elements

## Authorized Elements Including But Not Limited To:

### CIP/Project Related Elements

- Capital improvement plan and engineering
- Capital improvements
- Debt service
- KPDES compliance costs
- Professional services
- Plan review

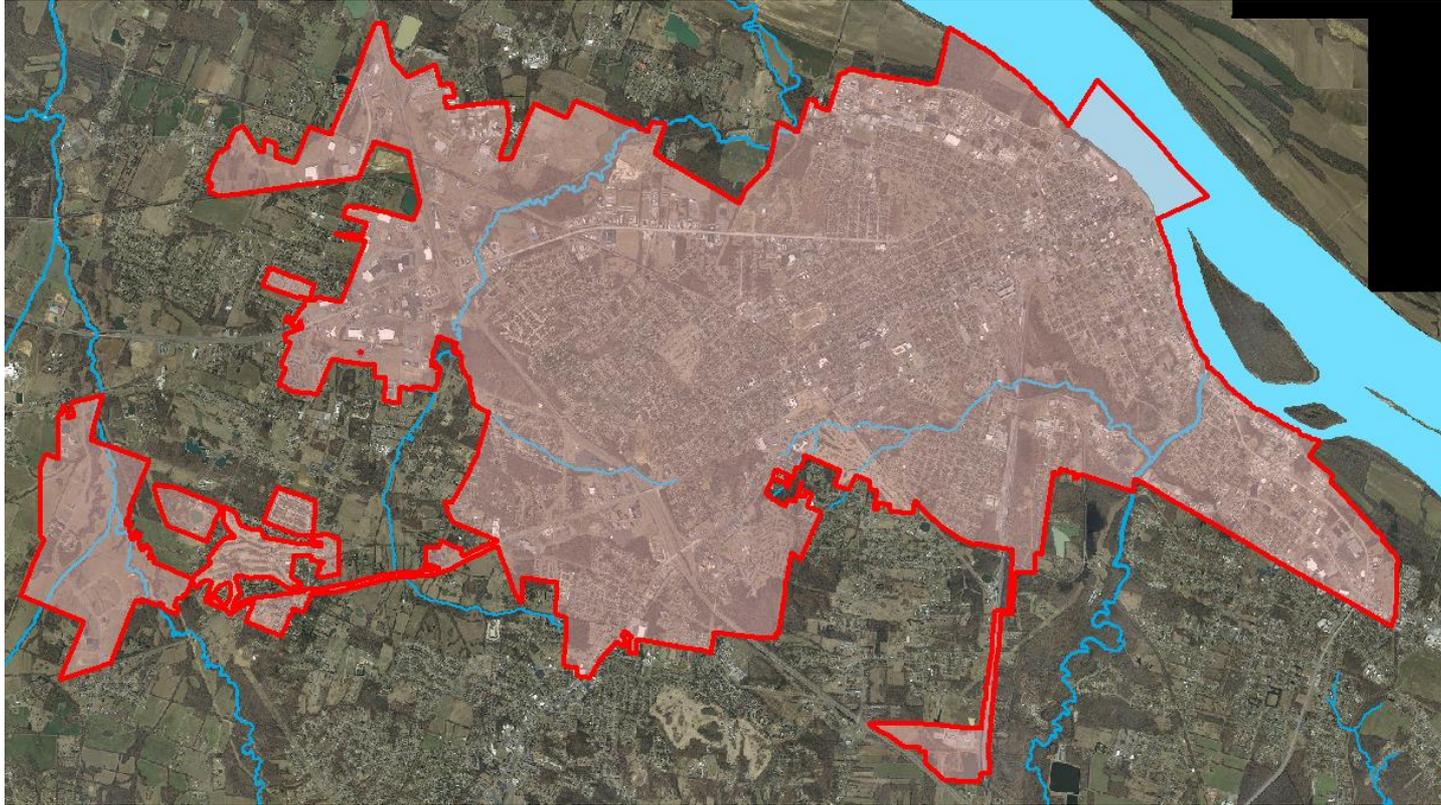
### Daily O&M Related Elements

- Flood protection system
- Catch basin and storm sewer cleaning, repair and replacement
- Vehicles/equipment
- Maintenance of publicly controlled channels
- Maintenance of detention/retention basins
- Maintenance and repair within the City's rights-of-way
- Staffing/program administration
- Street sweeping

# Key Components of a Stormwater Utility

- Mission Statement
- Guiding Principals
- Program Elements
- Service Area
- Public vs. Private System
- Impervious Area Rate Methodology
- Residential vs. Non-Residential Parcels
- Cost of Service
- Billing Mechanism

# Service Area – City Limits



# Public Versus Private System

City is responsible for operating and maintaining any separate storm sewer system including pipes, catch basins and drainage ditches within the City's authority.

- Note that several subdivisions that maintain their own PRIVATELY owned roads and infrastructure. The City does not assume any ownership or maintenance of these systems.
- Vast majority of stormwater management facilities (detention/retention basins) are owned and maintained by private property owners or subdivision associations.
- Streams, swales, ditches and other storm sewer systems outside the City's operation and maintenance responsibilities located downstream of publicly operated storm sewers are NOT the City's responsibility to own or maintain. They are however, within the City's authority to regulate.

# Rate Methodology

City has Selected the Impervious Area Rate Methodology as the Basis for the Stormwater Utility Billing



# Impervious Area Definition

Impervious areas are surfaces that prohibit or significantly restrict the passage of water into the soils beneath the surface. These types of areas include but are not limited to:

- All rooftops
- Concrete and asphalt surfaces such as roads, sidewalks, drives, and parking lots
- Compacted gravel surfaces such as roads, drives, paths, patios, and inventory/lay down storage lots

# Residential and Non-Residential Parcel Definition

- A residential property is defined as one single-family detached home or duplex occupying real estate on one parcel in which the inside and outside of the structure is owned by the same entity.
- Non-residential properties include all other parcels such as condominiums, multi-family dwellings of three families or greater, commercial, industrial, and institutional facilities.

# Cost of Service Analysis

## Historic Program Spending

- \$60,000 – City Stormwater Budget
- \$600,000 – Flood Protection System Budget

## Calculated Cost of Service

- Recommended O&M and Life Cycle Replacement
  - GIS Analysis – size, age, and material of existing infrastructure
- Capital Improvements
- Personnel/Equipment
- Regulatory Compliance Efforts
- Debt Service
- Other Program Components

# Phase II Next Steps

- Complete Impervious Area Evaluation
  - Develop Paducah specific equivalent residential unit (ERU)
  - Calculate impervious area on all non-residential properties
- Complete a Cost of Service Analysis
- Develop Credit Policy
- Review and Update Current Regulations
- Prepare Utility Summary Report
- Conduct Outreach and Engagement Efforts
  - Commission Meetings
  - SWAC Meetings
  - Public Meetings

# Project Schedule

Major Task	2018										2019	
	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	
Kick-Off Meeting	★											
ERU Development	⚙️											
Cost of Service Evaluation			★									
Credit Policy			◆		⚙️							
Drainage Manual					⚙️							
Utility Summary Report					★							
Public Engagement					◆			★	⊙			
Final Utility FAQs									◆	⊙		

⚙️ Team Teleconference   ★ Meeting with City   ◆ City Council/SWAC Meeting   ⊙ Public Meeting

- Overall project schedule
- Approval of utility fee by Council impacts



*City of Paducah Comprehensive Stormwater Master Plan*



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