Framework for Asset Management

SESWA Conference – Chattanooga, TN

October 9, 2019

History

Sanitary Sewer Inventory

- Began in 2012
- 9,156 manholes surveyed to date (96%) of system
- ~342 miles of collection system

Dedicated Stormwater Survey Team – late 80's, early 90's

- Captured stormwater information (creek x-sections every 50')

~2014 established criteria for "Stormwater 2.0"

Stormwater 2.0 - Asset Management Approach

Fundamental Shift from Reactive to Predictive Management

- Develop a true understanding of the system operations and critical points
- Consistent approach to evaluating system needs

4 Parts

- Asset Inventory
- Condition Assessment
- Expenditure
- Spending Analysis
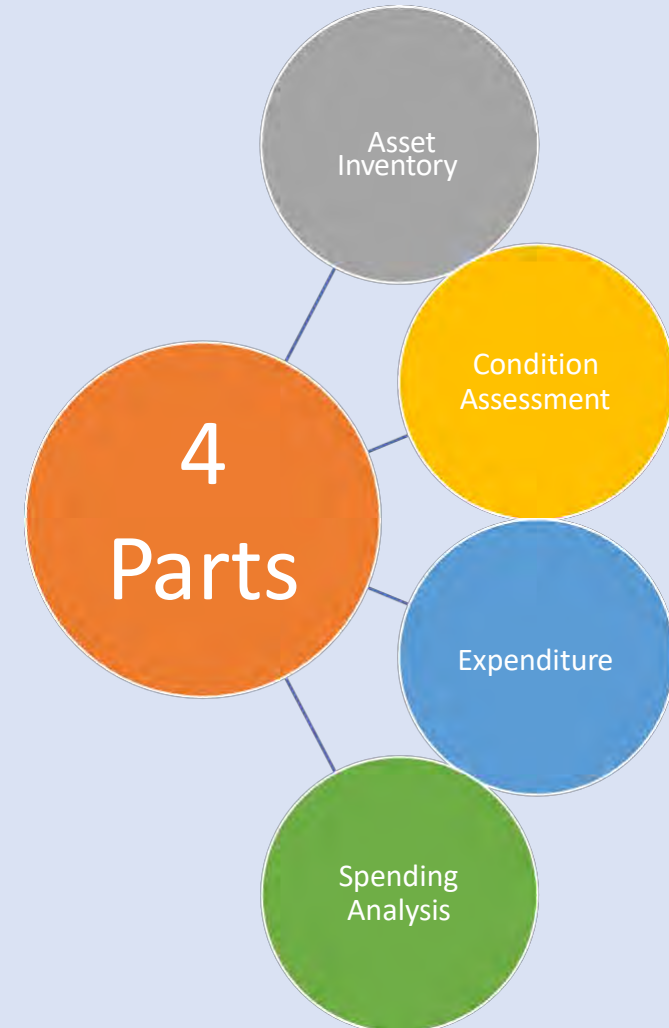
Stormwater Asset Management Framework

Asset Management Program Elements

➢ **Policy statements**

- ▪ **Asset Management Policy**
- ▪ **Extent of Service Policy**
- ▪ **Level of Service Policy**

➢ **Strategy documents**

- ▪ **Asset Inventory**
- ▪ **Condition Assessment (pipes and streams)**
- ▪ **Individual asset plans**
- ▪ **Repair and replacement strategy**
- ▪ **Capital planning strategy**
- ▪ **Standard Operating Procedures**

Stormwater Asset Management Framework

Extent of Service Policy

➢ Defines what we own, operate, and maintain

➢ Describes where the City's system is located
- Right of Way
- Easements
- City Property

➢ Special Circumstances & Emergency Maintenance
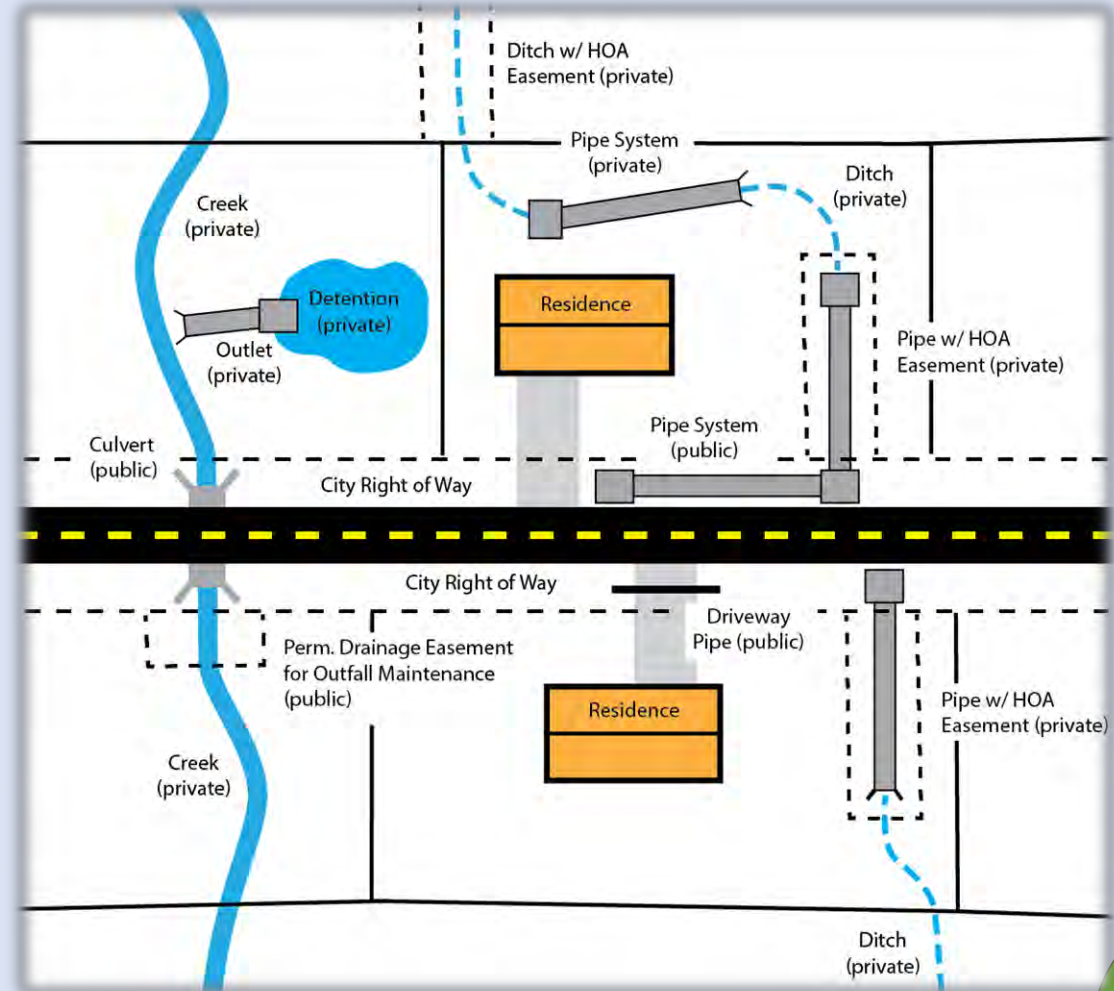
Stormwater Asset Management Framework

Level of Service Policy

➢ *Defines Strategic and Operational Goals*

- Citizen safety and welfare
  - All pipes convey 10 year design storm
  - For collector/arterial roads, convey 25 year
  - Critical facilities accessible during 500 year event
- Flood damage reduction
  - Remove insurable structures from floodway
  - Insurable structures 2' above Base flood elevation
  - Reduce repetitive losses
  - Minimizes increase in BFE due to new development

Stormwater Asset Management Framework

Level of Service Policy – Tactical (Operational) Goals
- ➢ Short Term
  - ▪ Reactive to proactive
  - ▪ Leverage existing data for decision making
  - ▪ Additional system data collection
  - ▪ 5 year implementation period
- ➢ Desired
  - ▪ Proactive approach
  - ▪ Optimizes system performance
  - ▪ Minimizes operational costs
  - ▪ Utilizes business risk and condition assessment for decision making
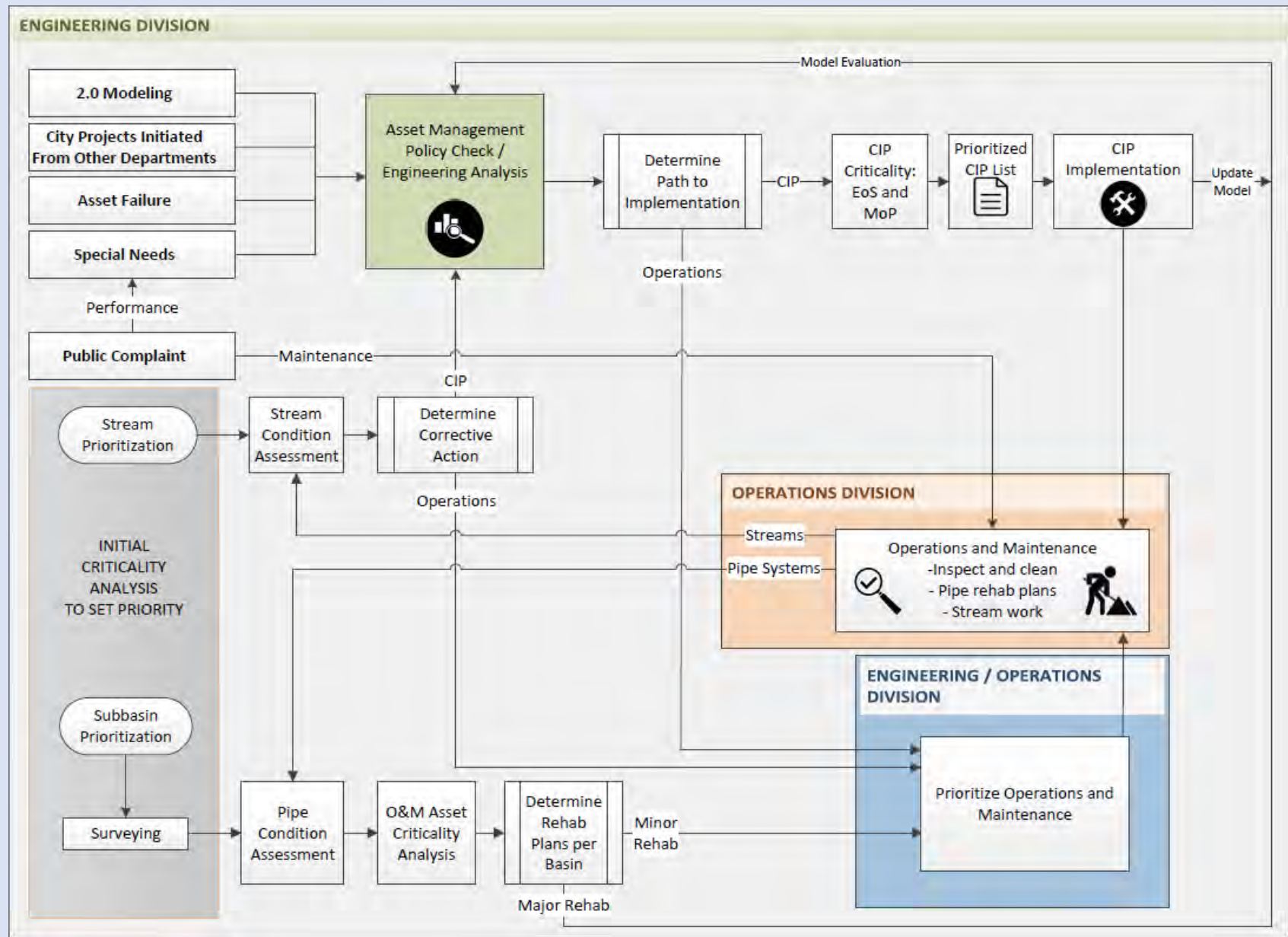 - ▪ Defined funding levels

Short Term Level of Service → **Desired Level of Service**
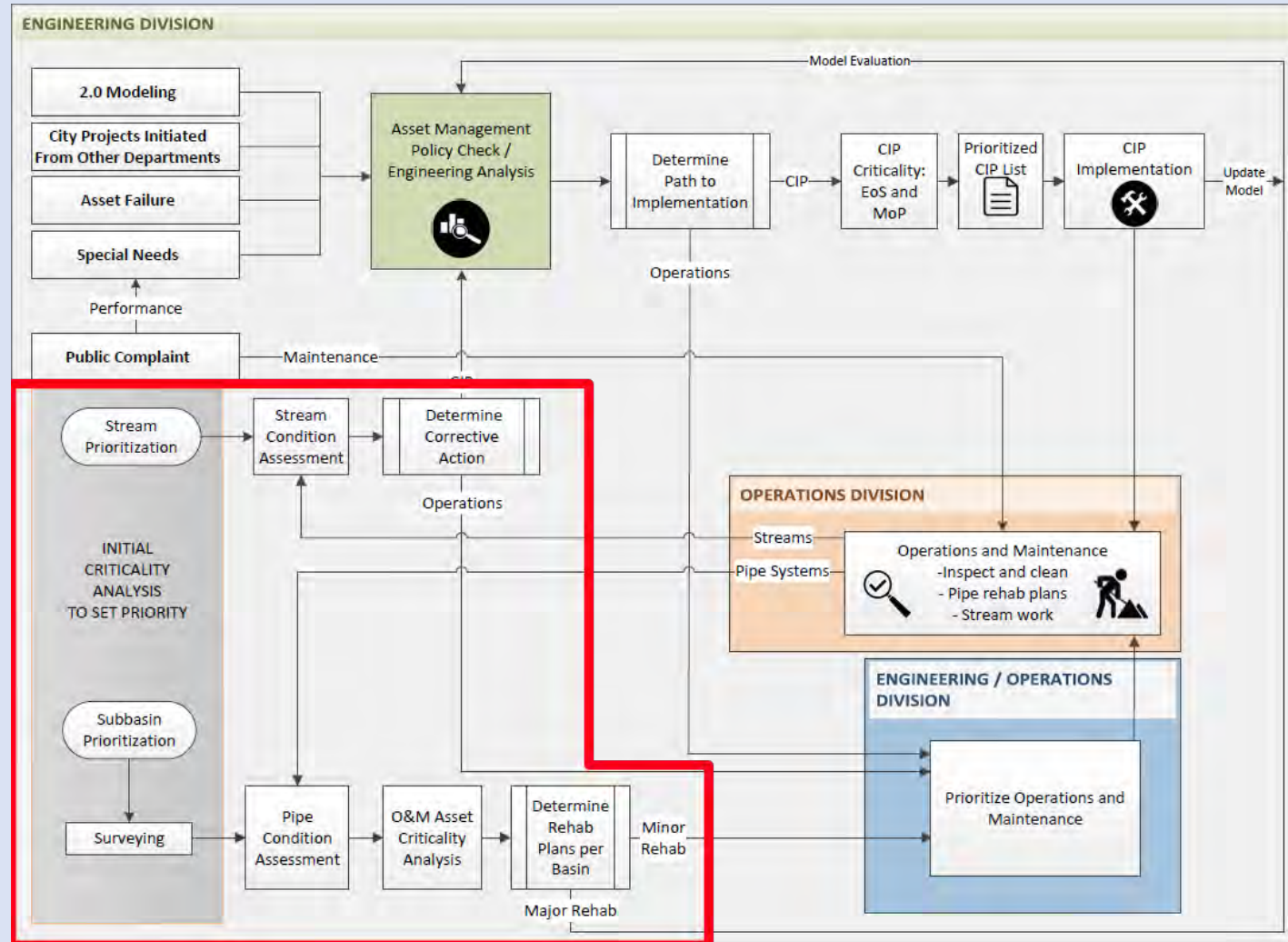
Stormwater Utility Operational and Capital Program

Stormwater Utility Prioritization Process

Asset management begins with assessment of condition and risk

Stormwater Asset Management Planning

Consequence of Failure

Risk Assessment Matrix

Likelihood of Failure

	1	2	3	4	5
5					✖
4					
3					
2					
1	✖				

Imminent failure with a significant impact due to failure

Asset in good condition with little to no impact if failure occurs

Consequence of Failure

Considers:

- Critical Facilities

- City Street Culvert Crossings

- Utility and City Pipe Crossings

- City Pipe Size

- Development Density

City of Greenville - Stormwater 2.0
COF Subbasin Rating Criteria

COF Rating Parameters		Subbasin Rating System
Critical Facilities	5	Greater than two critical facilities
	3	Two critical facilities
	1	One critical facility
City Street Culvert Crossings	5	Five or more crossings
	4	Four crossings
	3	Three crossings
	2	Two crossings
	1	One crossing
Utility and City Pipe Crossings	5	> 30 crossings
	4	16 – 30 crossings
	3	8 – 15 crossings
	2	3 – 7 crossings
	1	1 – 2 crossings
City Pipe Size	5	Greater than 500' of Pipe >= 36"
	4	151 – 500' of Pipe >= 36"
	3	51 – 150' of Pipe >= 36"
	2	0 – 50' of Pipe >= 36"
	1	Pipe < 36"
Development Density Based off of Zoning Scoring* (Area Weighted)	5	Business Use/ High Density (50)
	4	(31- 49)
	3	Medium Density (26- 30)
	2	(11-25)
	1	Low Density (10)

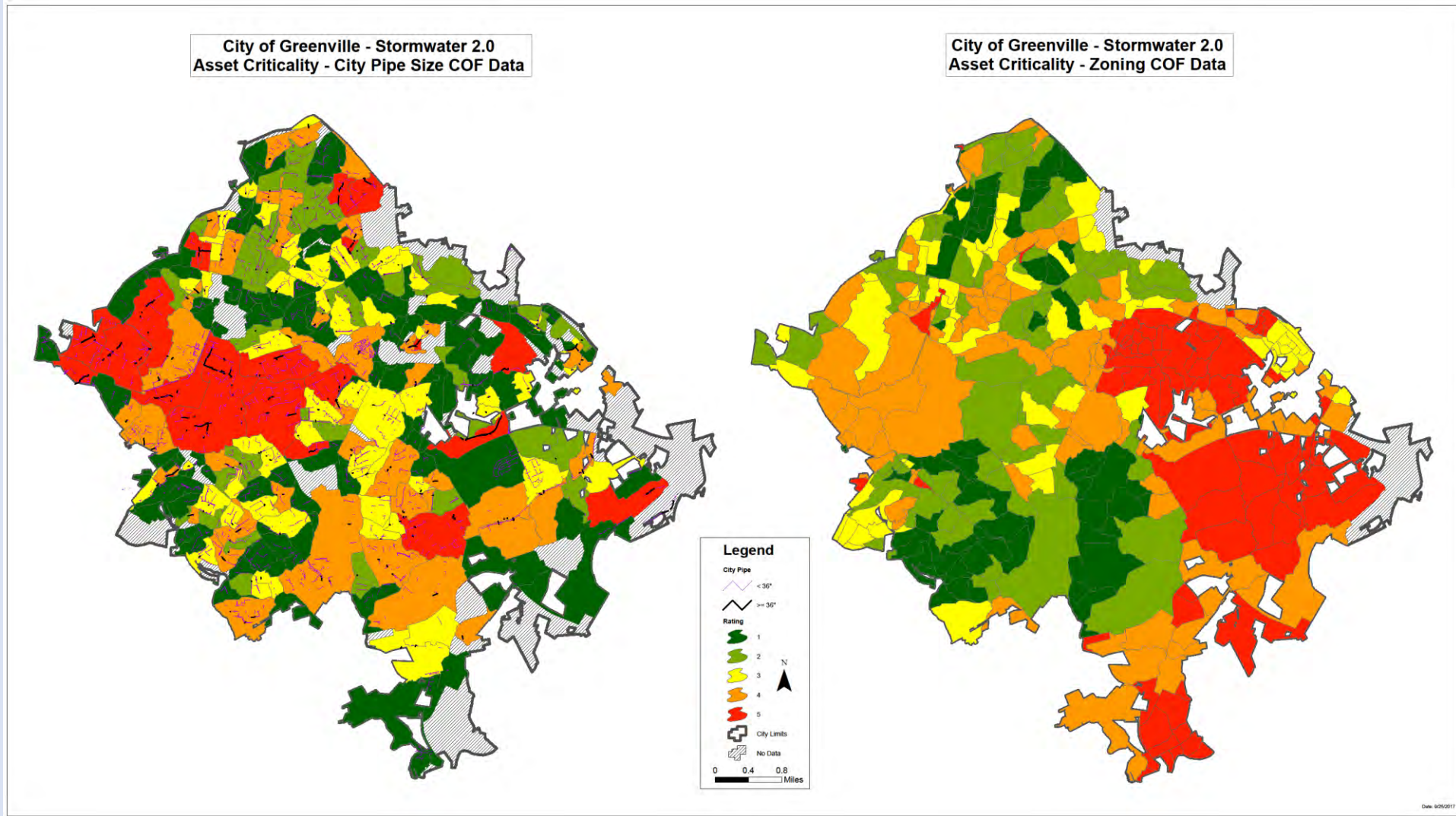| *Zoning Scoring	10	R-10, R-12, R-20, R-6, R-7.5, R-9, R-S, RR-ROW, UNZONED
	30	OD, RDV, R-M, R-M10, R-M16, R-M20, RM-1, RM-1.5, RM-2, RM-3
	50	I-1, S-1, PD, POD, C-1, C-2, C-3, C-4

Likelihood of Failure

Considers:

- Complaints, Areas of Concern, Trouble Spots

- Age of Development

- Pipe Type

City of Greenville - Stormwater 2.0
LOF Subbasin Rating Criteria

LOF Rating Parameters		Subbasin Rating System
Complaints	5	One high priority complaint or three or more medium or unknown priority complaints
	3	Two medium or unknown priority complaints
	1	One medium or unknown complaint
Areas of Concern	5	Greater than one area of concern
	3	One area of concern
Trouble Spots	5	Greater than two trouble spots
	3	Two trouble spots
	1	One trouble spot
Age of Development (Area Weighted)	5	1920s- 1950s
	4	1960s
	3	1970s
	2	1980s
	1	1990s
Pipe Type Based off of Material Scoring* (Length Weighted)	5	Short life cycle (30-33)
	4	(20- 29)
	3	(13- 19)
	2	(11-12)
	1	Long life cycle (10)

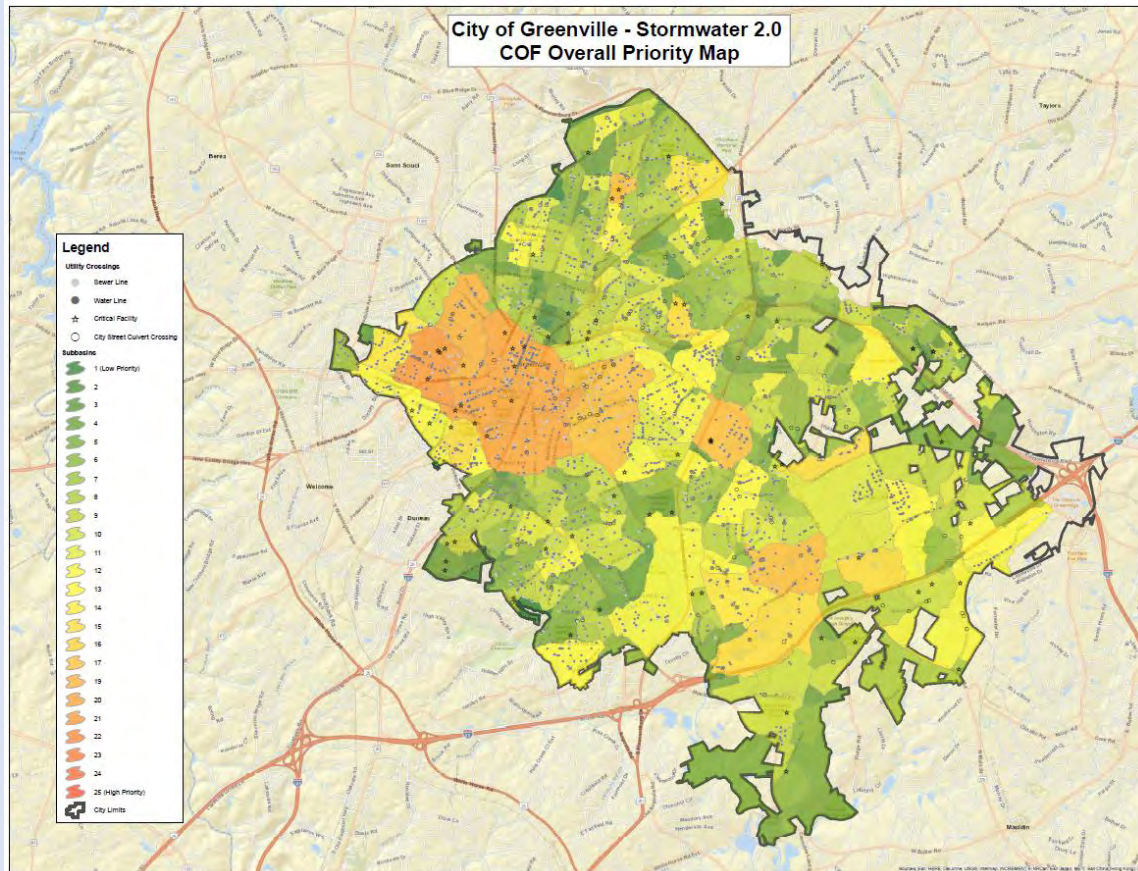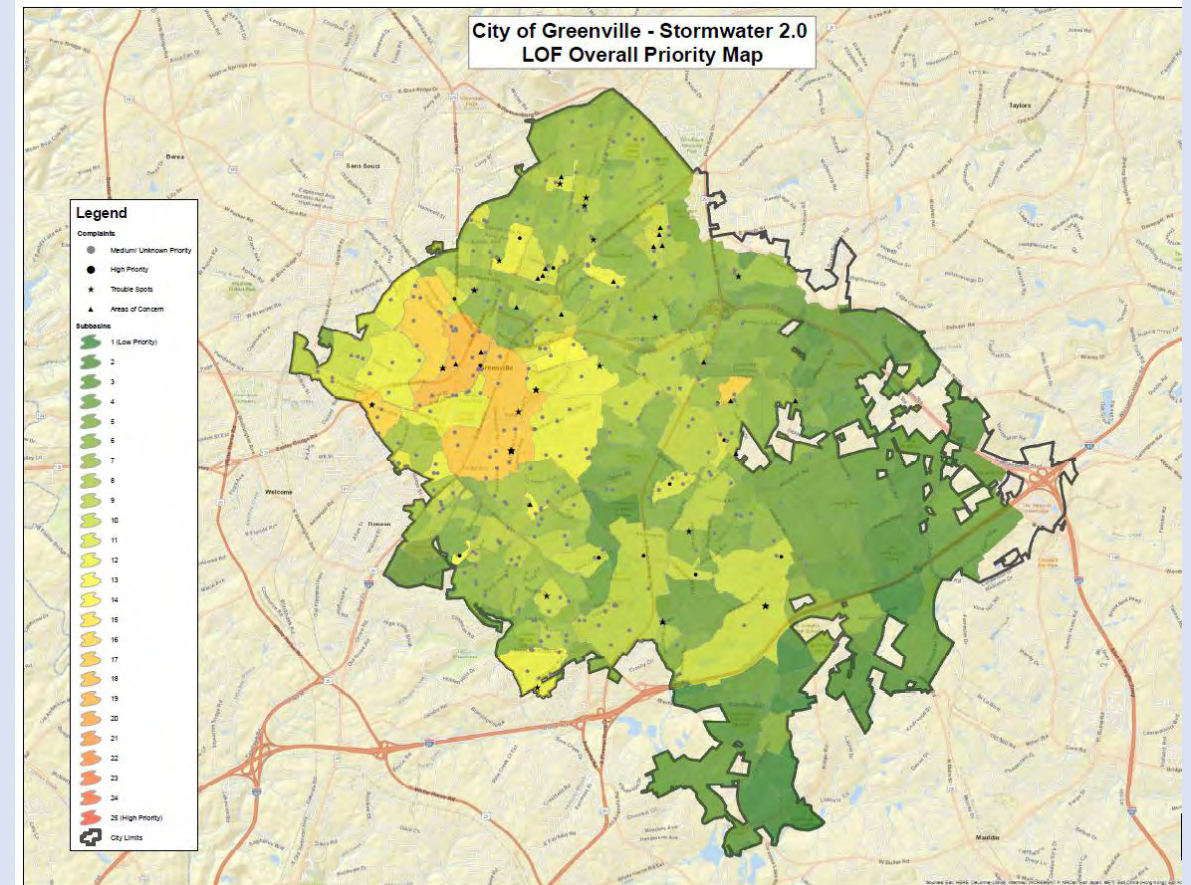| *Pipe Type Material Scoring		
	50	TCP/ VCP/ CLAY/ BRK
	40	PVC
	30	CMP/ CIP
	20	HDPE/ DIP
	15	UNK/ NODAT/ OTHR/ blank
	10	STEEL/ RCP/ ROCK

9/25/2017

Example Results

Criticality Analysis Results

Score and rank based on drainage basins.

Consequence of Failure Priority Map

Likelihood of Failure Priority Map

Criticality: Where do we start with asset management?

Overall Priority
Score = CoF x LoF
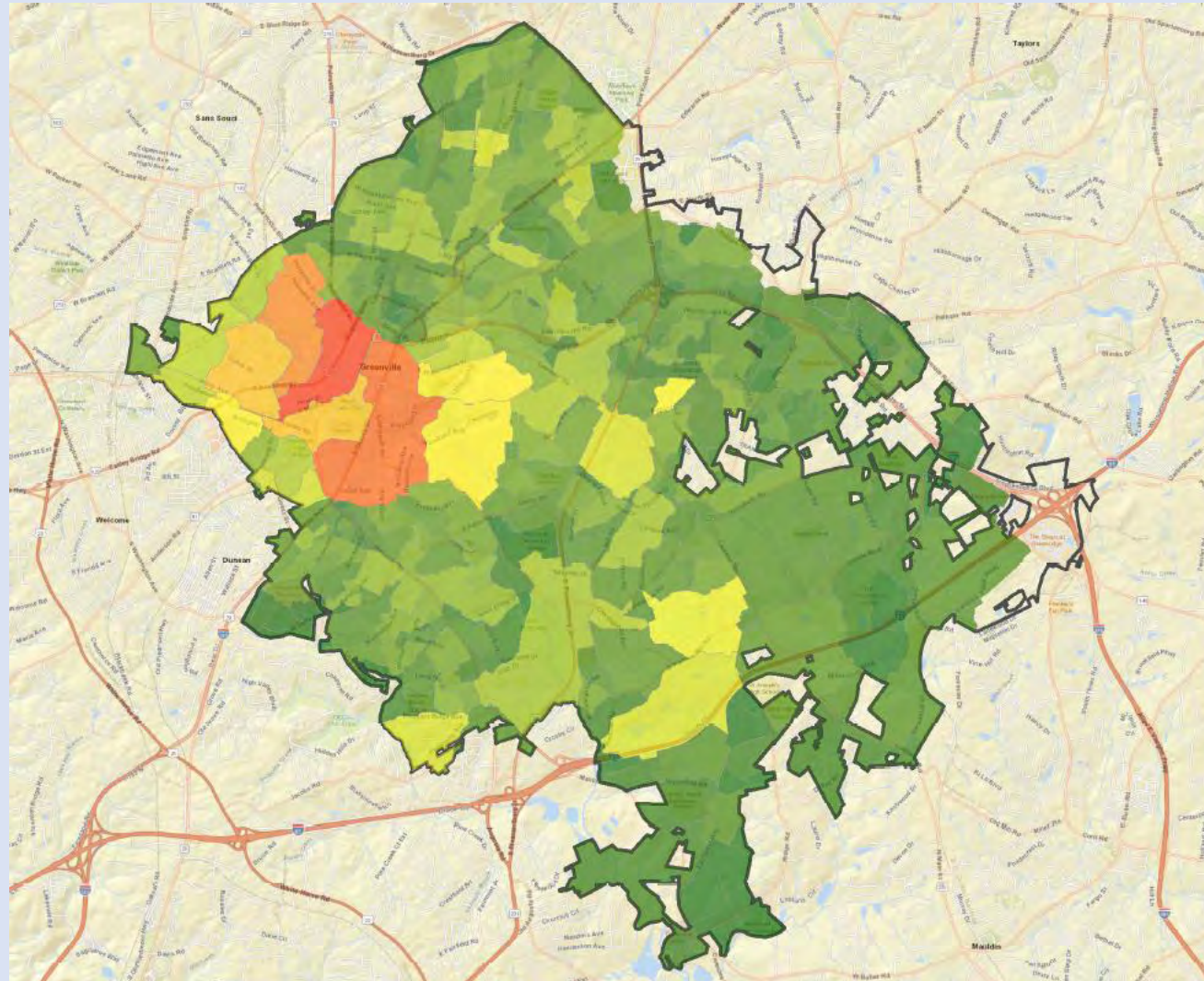
Highest risk

Medium risk

Lowest risk

Multi-year effort
to
collect system and
condition data on
assets citywide

Stormwater 2.0 - Capital Project Prioritization

Defensible Projects

- Identify all problems
- Address the most pressing problems first

Fiscal Responsibility

- Address most pressing problems
- Efficient use of limited funds
- Defend the budget

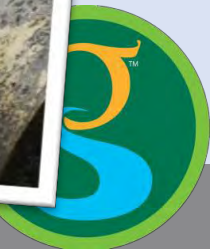# CIP Tool – Project Types

- Water Quality BMPs
- Flood Control
- Combination water quality and flood control
- Stream bank stabilization / stream restoration

- Culvert Upgrade/Replacement
- Closed Pipe System Upgrade Replacement
- Structure Acquisition

Magnitude of Problem

- Water Quality

- Flooding

- Safety

- Risk to Infrastructure

- Public Inconvenience

- Community Concern

Problem Description	Magnitude of Problem Score					
	5	4	3	2	1	0
TMDLs / Impairments	> 1 TMDL	TMDL and Water Quality Impairment	TMDL	>1 Water Quality Impairment	Water Quality Impairment	No Impairment
Streambank Erosion	> 1,500 feet of eroded bank	Between 500 and 1,500 feet of eroded bank	Between 100 and 500 feet of eroded bank	---	---	No bank erosion
Relative Ranking for Pollutants	Watershed with highest nutrient load	Watershed with second highest nutrient load	Watershed with third highest nutrient load	Watershed with fourth highest nutrient load	Watershed with fifth highest nutrient load	N/A
Structural Damage Due to Flooding	One or more repetitive loss structures	Damage to one or more critical facilities or multiple structures with substantial damage	Multiple structures with > $1,000 damage or single structure with substantial damage	Single structure with > $1,000 damage	Nuisance/localized flooding of properties	No adverse flooding impacts
Road Level of Service Class 1 – Alley, Low Volume Residential, High Volume Residential (10 year design storm) Class 2 – Collector, Arterial (25 year design storm)	Class 1: LOS < 2 year Class 2: LOS <10 year	Class 1: LOS > 2 year, < 5 year Class 2: LOS > 10 year, < 25 year	Class 1: LOS > 5 year, < 10 year	---	Class 1: LOS > 10 year, < 25 year Class 2: LOS >25 year, < 50 year	Class 1: > 25 year LOS Class 2: > 50 year LOS
Impact on other City assets, services, or properties	Causing damage to other City assets or property	Causing impact to City services	Failure will cause damage to other City assets or property	Failure will cause impact to City services	---	No known impact to other City assets, properties, or community services
Safety / Emergency Response Issues	Known injury associated with flood event	Significant potential of injury associated with flood event	Emergency response to critical facility required by flood event	Emergency response required by flood event	N/A	Poses little to no potential risk of injury
Pipe System Level of Service	< 2 year LOS	< 5 year LOS	< 10 year LOS	< 25 year LOS	< 50 year LOS	> 50 year LOS
System Maintenance Frequency	Before and/or after every rain event	At least weekly	At least monthly	At least every other month	At least annually	No visits to asset
Asset Condition (BRE Score)/Basin Criticality Score	20 - 25	16 - 20	11-15	6-10	1-5	New asset, not assessed
Inconvenience to public caused by problem	Road closure with >1/2 mile detour or 5 minute delay or public facility closed for > more than a day	Road closure with detour less than 1/2 mile or 5 minute delay for a day	Lane closure or reduced access to public facility (after significant rain events) for more than two hours.	Lane closure or reduced access to public facility after significant rain events for less than two hours.	Minor inconvenience to public (Includes road closure with detour less than 1/4 mile or minor delay)	No perceived inconvenience to public
Community Concern	All citizens aware of and concerned with the problem	Most citizens aware of and concerned with the problem	Limited number of citizens aware of and concerned with the problem.	Citizens affected by the problem are aware and concerned.	N/A	No citizens are aware of the problem

Effectiveness of Solution

- Reducing Pollutants

- Improving System Performance

- Removing Safety Concerns

- Decreasing Flooding

- Addressing Concerns of the Public

Problem Category	Problem Description	5	4	3	2	1	0
Effectiveness of Solution Score							
Water Quality Solutions	Pollutant Reduction	Reduction of pollutant at regulatory compliance point	Reduction of pollutant at subbasin	Reduction of pollutant at discharge point	N/A	No change in pollutant load	Increases pollutant load
	Increases/ protects riparian buffer	Improves large (> ½ acre) existing riparian area	Protects large (> ½ acre) existing riparian area or Improves small (< ½ acre) existing riparian area	N/A	Protects small (< ½ acre) existing riparian area	Neither protects nor damages riparian area	Damages riparian area
	Restores/ protects wetland areas	Creates new wetland area	Improves large (> ½ acre) existing wetland area	Protects large (> ½ acre) existing wetland area or Improves small (< ½ acre) existing wetland area	Protects small (< ½ acre) existing wetland area	Neither protects nor damages wetland area	Damages wetland area (mitigation required)
	Repairs/ stabilizes stream banks	Stabilizes eroding bank, > 1,500 feet	Stabilizes eroding bank between 500 and 1,500 feet	Stabilizes eroding bank, < 500 feet	Protects existing stream bank	Neither protects nor damages stream bank	Requires hard armoring of stream bank
	Improves stream habitat	Creates new stream habitat	Improves > 500 feet of stream habitat	Improves < 500 feet of stream habitat	Protects existing stream habitat	Neither protects nor damages stream habitat	Adversely impacts stream habitat
Flooding Solutions	WSE decreases (LOS design storm)	> one foot of WSE decrease with no significant increases in project area	Between ½ and one foot of WSE decrease with no significant increases in project area	< ½ foot of WSE decrease with no increases in project area	< 1/4 foot of WSE decrease with no increases in project area	No change in WSE in project area	Significant increase in WSE in project area
	Decrease in runoff rate	Decrease in runoff rate significantly improves available system capacity (e.g., moves from 2 year LOS to 5 year LOS)	N/A	Decrease in runoff rate slightly improves available system capacity (e.g., moves from 2 year LOS to 3 year LOS)	N/A	Minor decrease in runoff rate, little impact on stream	No change in runoff rate
	Decrease in runoff volume	Decrease in runoff volume significantly impacts stream	N/A	Decrease in runoff volume slightly impacts stream	N/A	Minor decrease in runoff volume, little impact on stream	No change in runoff volume
	Removes/ reduces flood damage risk critical facilities	Removes critical facility from 10 yr floodplain	Removes critical facility from 25 yr floodplain	Removes critical facility from 50 yr floodplain	Removes critical facility from 100 yr floodplain	Removes critical facility from 500 yr floodplain	No damage reduction to critical facilities
	Removes/ reduces flood damage risk to other structures	Removes structure(s) from 10 yr floodplain	Removes structure(s) from 25 yr floodplain	Removes structure(s) from 50 yr floodplain	Removes structure(s) from 100 yr floodplain	Removes structure(s) from 500 yr floodplain	No damage reduction to structures
	Decrease in road closures	Eliminates multiple road closures at 10 year storm event	Eliminates one road closure at 10 year storm event or multiple road closures at 25 year storm event	Eliminates one road closure at 25 year storm event or multiple road closures at 50 year storm event	Eliminates one road closure at 50 year event or multiple road closures at 100 year storm event	Eliminates one road closure at 100 year storm event	No change in number of flood related road closures
	Improves access to critical facilities	Improves access to multiple critical facilities where there is only one way in/out	Improves access to one critical facility where there is only one way in/out	Improves access to multiple critical facilities where there are multiple ways in/out	Improves access to one critical facility where there are multiple ways in/out	Neither harms nor improves access	Decreases access
	Addresses safety or health concern	Removes existing health or safety concern	N/A	Partially addresses existing health or safety concern	Addresses potential health or safety concern	N/A	Does not address potential or existing safety or health concern
Public Level of Service Solutions	Inconvenience to public caused by project	No perceived inconvenience to public	Minor inconvenience to public (Includes road closure with detour less than 1/2 mile or 5 minute delay)	Lane closure or reduced access to public facility for <30 days	Lane closure or reduced access to public facility for > 30 days	Road closure with >1/2 mile detour or 5 minute delay or public facility closed for <30 days	Road closure with >1/2 mile detour or 5 minute delay or public facility closed for > 30 days
	Community Support	Project generally acceptable to all citizens	Project accepted by most citizens, except those with direct negative impact	Citizenry generally equally split by opposition and acceptance	N/A	Project opposed by most citizens, except those with direct positive impact	Project generally opposed by all citizens

CIP Prioritization

Capital Improvement Prioritization Tool

➢ **Total Project Score = Magnitude Score** (MoP) x **Solution Score** (EoS)

➢ **Project Cost per Total Project Score**
- Project Cost ($) / Project Score (MoP x EoS)

➢ **Project Ranking based on:**
- Highest overall score
- Lowest cost per Combined Benefit Score

❖ CIP Plan developed based on Project Ranking with consideration of other City initiatives. CIP priority ranking revisited annually to account for changing system conditions and new projects.

Project Scoring

Project ID	Project Name	Project Type	Watershed Name	EOS Score	MOP Score	Total Score	Total Score Rank	Project Cost	Points/$100k	Benefit/Cost Rank
1	Laurel Creek (R-01-17)	Stream Stabilization	Laurel	24	6	144	17	$476,000	30	13
2	Laurel Creek (R-01a)	Stream Stabilization	Laurel	27	9	243	10	$863,000	28	14
3	Laurel Creek (R-01b)	Stream Stabilization	Laurel	26	8	208	14	$1,176,000	18	16
4	Richland Creek (R-27-02)	Stream Stabilization	Richland	24	11	264	8	$582,000	45	9
5	Richland Creek (R-27-06-02-1)	Stream Stabilization	Richland	25	9	225	11	$500,000	45	10
6	Spero Property	Acquisition/Prop Rehab	Richland	27	8	216	12	$400,000	54	6
7	Laurens Road Area Flooding	Drainage	Laurel	23	33	759	1	$1,300,000	58	4
8	Stone Lake Dam Outlet Stabilization	Outlet Stabilization	Richland	33	17	561	2	$500,000	112	1
9	Verdae Creek Realignment	Stream Stabilization	Laurel	29	12	348	5	$1,000,000	35	11
10	White Oak Area	Varies	Richland	24	20	480	3	$4,500,000	11	17
11	N. Scarlett St	Culvert/Bridge Replacement	Lower Reedy	26	15	390	4	$477,000	82	2
12	Robin Hood Rd	Culvert/Bridge Replacement	Lower Reedy	20	13	260	9	$525,000	50	8
13	Hillside Cir	Culvert/Bridge Replacement	Richland	18	11	198	15	$307,000	64	3
14	Lockwood Ave	Culvert/Bridge Replacement	Richland	19	10	190	16	$380,000	50	7
15	Fisher Dr	Varies	Richland	17	16	272	7	$786,000	35	12
16	Greenland Dr to Dera St	Detention Pond	Richland	18	12	216	12	$935,000	23	15
17	Pinehurst Dr	Culvert/Bridge Replacement	Richland	19	17	323	6	$587,000	55	5

Inputs

- Project Id, name, and type
- Watershed name
- EOS & MOP Score
- Project Cost

Calculated

- Total Score
- Total Score Rank
- Benefit Points per $100k
- Benefit / Cost Rank

Lessons Learned

1. Establish goals and policy early is key

2. Consider tool maintenance

3. Be careful, you might get what you ask for (consider planning period)

4. Evaluating projects and getting good data is key to this tool

5. Field data collection:
   - Contractor procurement and bid format is key
   - Collecting new system data is preferable to merging new data with old data

Moving Forward
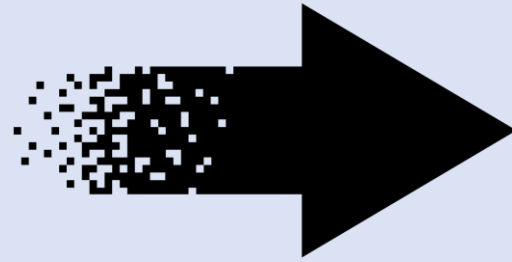
1. Tool will grow as new projects are identified and data comes in
2. Establish a calendar with appropriate and set deadlines
3. Re-educate Council on intent of the tool and how it works (revised with new projects and data)
4. Show only annual budgets
5. Integrate into other department's planning processes

Questions and Contact Information

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