Infrastructure Management Practices

Case Study: Oklahoma City Water Utilities Trust

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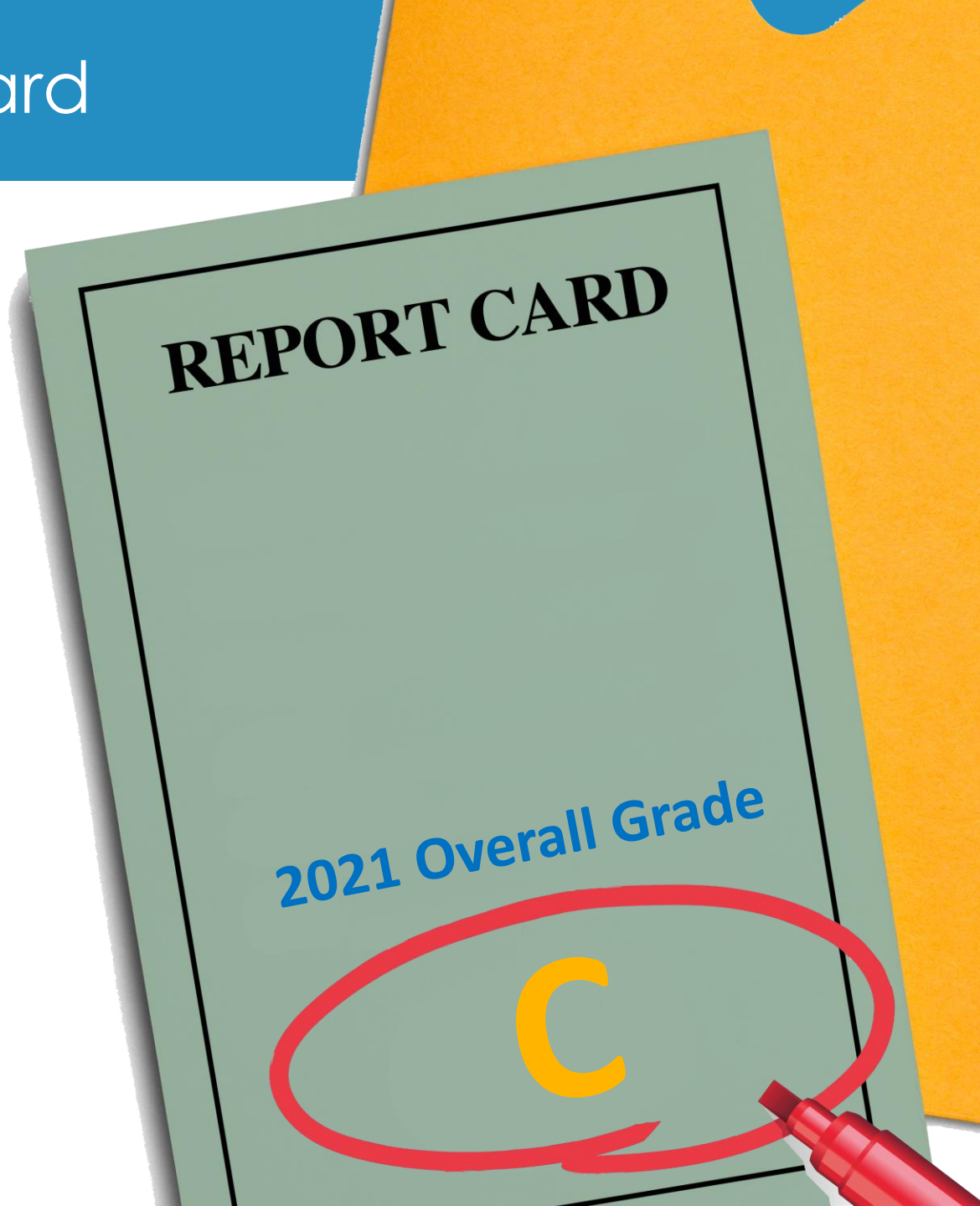
Asset Management Builds Resiliency

Build your resiliency plan on a solid infrastructure framework

ASCE 2021 Florida Report Card

Infrastructure Type	Grade
Stormwater	**C-**
Drinking Water	**C**
Wastewater	**C**
Bridges	B
Roads	C+
Dams	D-
Ports	B
Aviation	C+
Energy	C+
Solid Waste	B+



ASCE Infrastructure Recommendations

Asset	ASCE Recommendations
Drinking Water	Investment, Asset Management
Wastewater	Adequate future funding, Asset Management
Stormwater	Funding, Assess systems

Why Change?

The first rule of business, protect your investment.

- Etiquette of the Banker 1777

Why Change?

Benefits of Asset Management

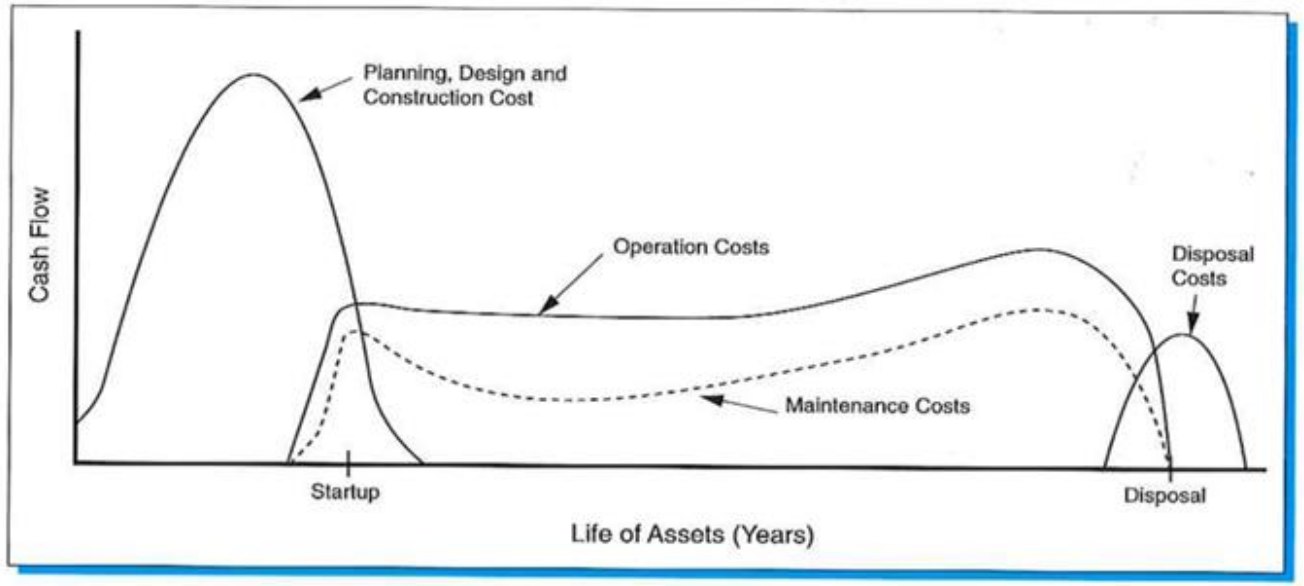
Stormwater: growing annual funding gap of *$8 billion* just to comply with current regulations.

Wastewater: …the total gap will grow to more than *$434 billion* by 2029.

Water: *only 21%* of all U.S. utilities report being able to fully cover the cost of providing drinking water services.

"2021 Report Card for America's Infrastructure"
– American Society of Civil Engineers

Benefits of Asset Management



Life Cycle Costs occur over all phases

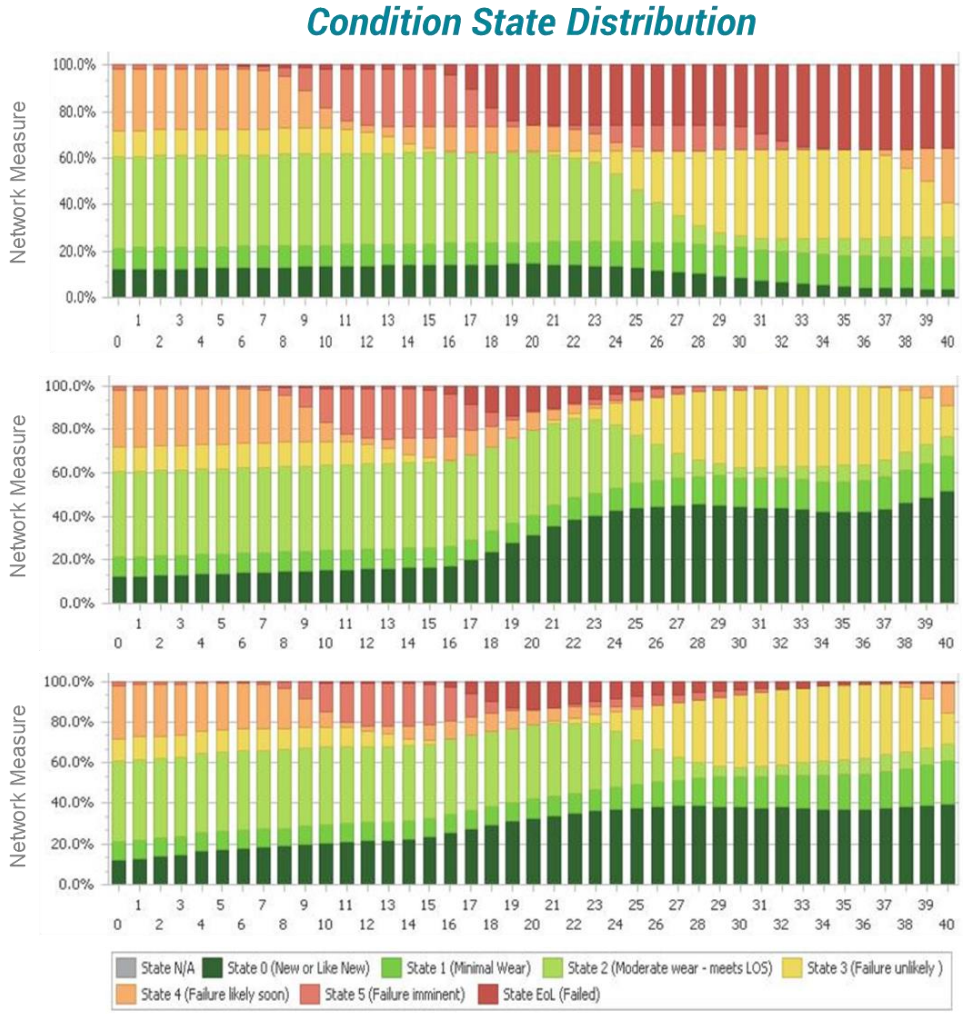
60% - 80% of life cycle costs in "Use Phase"

Longest and most costly phase

"Financial accounting may suggest a 1-2 percent amount annually of the entire pipe network valuation as a total cost of condition assessment and risk mitigation activities."

- Greg Baird, President of the Water Finance Research Foundation

Benefits of Asset Management

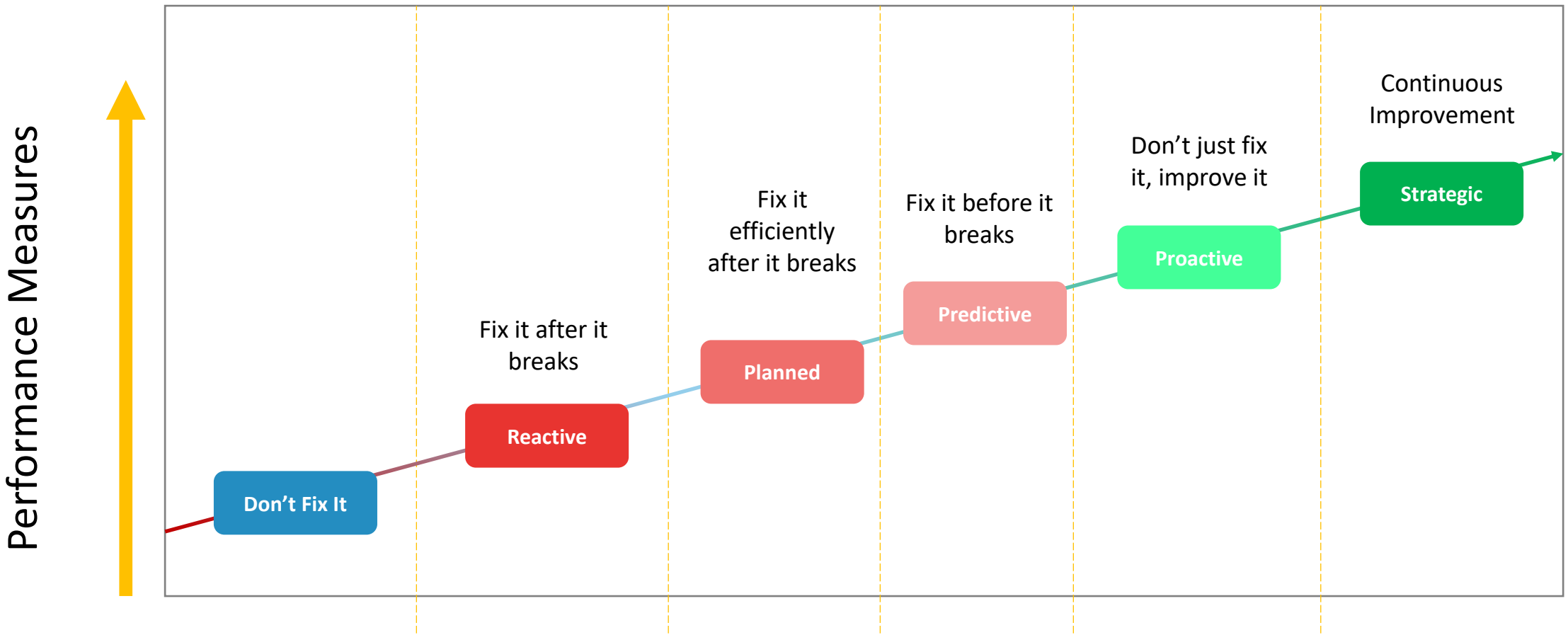


Assetic Predictor (Brightly) Graphic

- "Our team has delivered an average ROI on ISO 55000-based asset management programs well in excess of 25 percent".

- Asset management delivers the ROI through improved levels of service

Benefits of Asset Management



Rewards:	Short Term Savings	Overtime Heroes	No Surprises	Quality of Life	Best in Class
Motivator:	Meet Budget	Emergency Repairs	Avoid Failures	Functional	Growth
Behavior:	Decaying	Responding	Org. Discipline	Org. Learning	Innovation

Benefits of Asset Management

Documented benefits

- Economic sustainability
- Resilience to natural hazards
- Well defined costs and budgets
- Higher levels of service
- Maximization of the value of assets
- Mobilization of resources and political will to act
- Effective communication
- Environmental sustainability
- Improved credit ratings
- Government transparency
- Social equity

"Managing Infrastructure Assets for Sustainable Development"

- United Nations

What is Infrastructure Management?

1. Stakeholders

    - Engineering
    - Operations
    - Management
    - Information Technology
    - Finance
    - Human Resources
    - Public Outreach
    - Customer Service

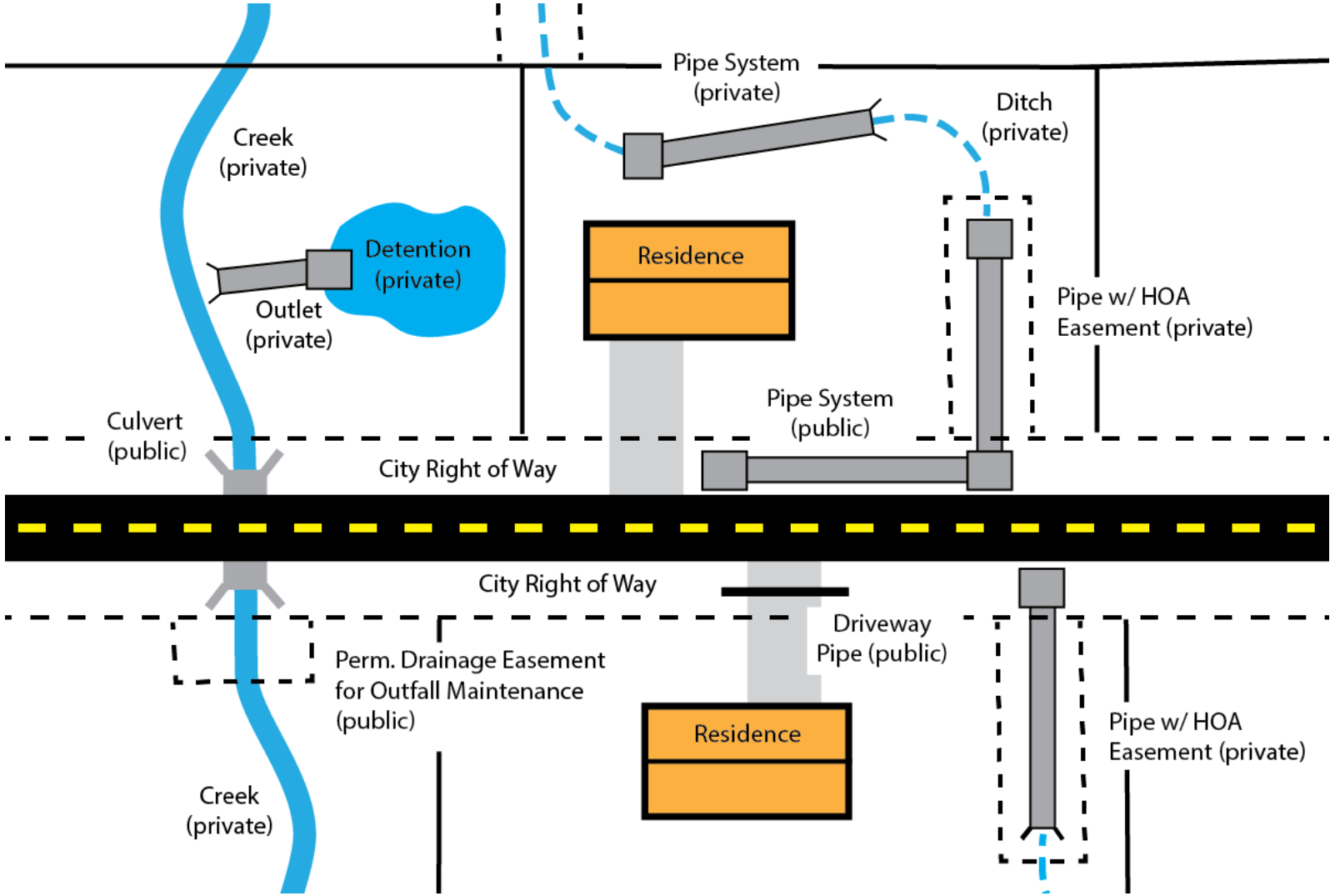
What is Infrastructure Management?

2. Asset Registry

   what you own and maintain

   where infrastructure is located

   infrastructure attributes (e.g., dimensions, material, capacity)



What is Infrastructure Management?

3. Condition Assessment

- Structural condition
- Maintenance condition
- Remaining Useful Life

What is Infrastructure Management?

4. System Value

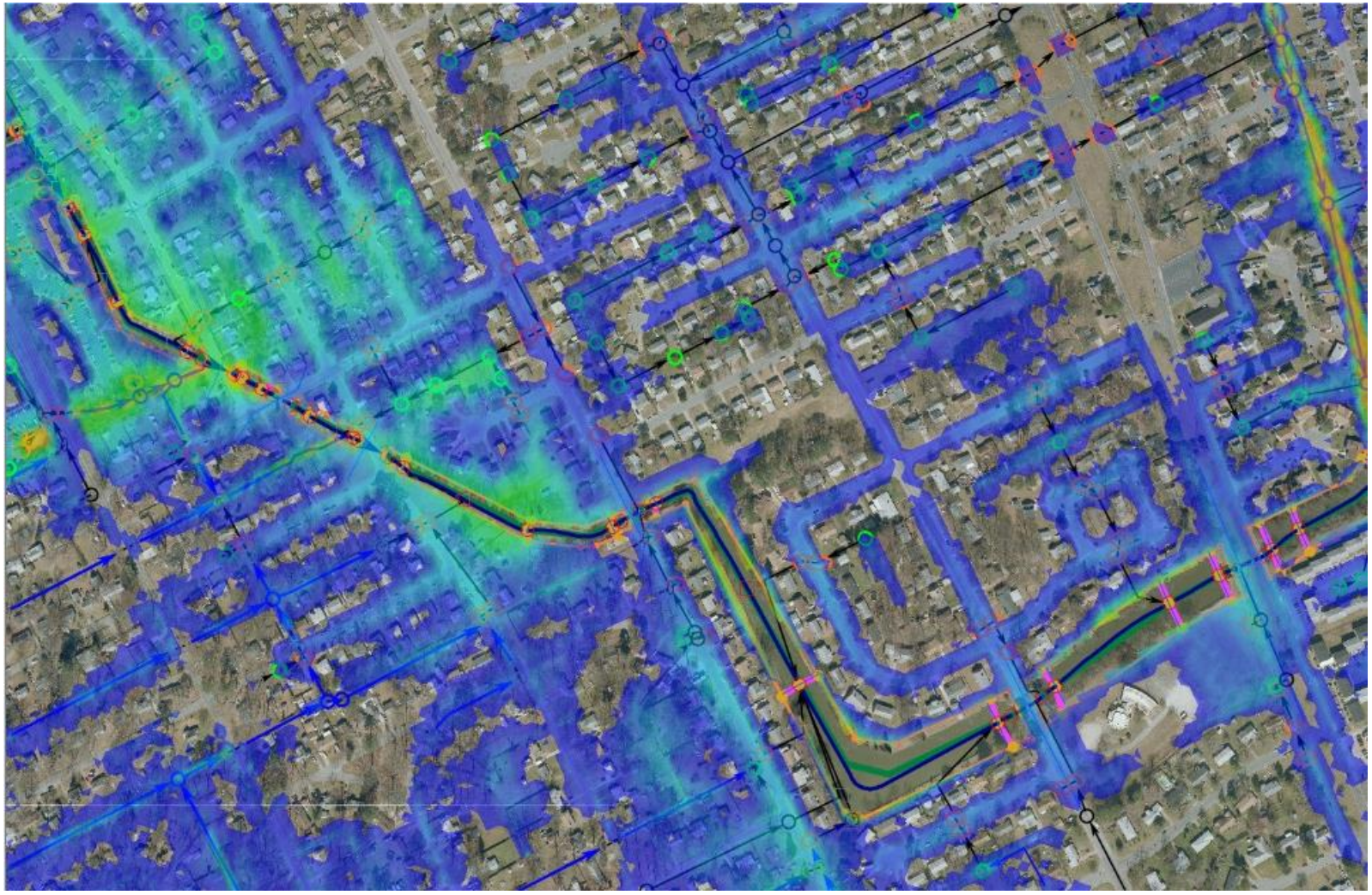
- Replacement value
- Life Cycle costs

What is Infrastructure Management?

5. Level of Service Goals

   Program Goals

   System Goals
   - Strategic / Operational
   - Tactical / Maintenance



What is Infrastructure Management?

6. Failure Modes

Capacity/Level of Service

- The system cannot convey the design flows

Structural

- The system fails due to poor condition

Maintenance

- The system is filled with sediment/debris, valves are not operable

Financial

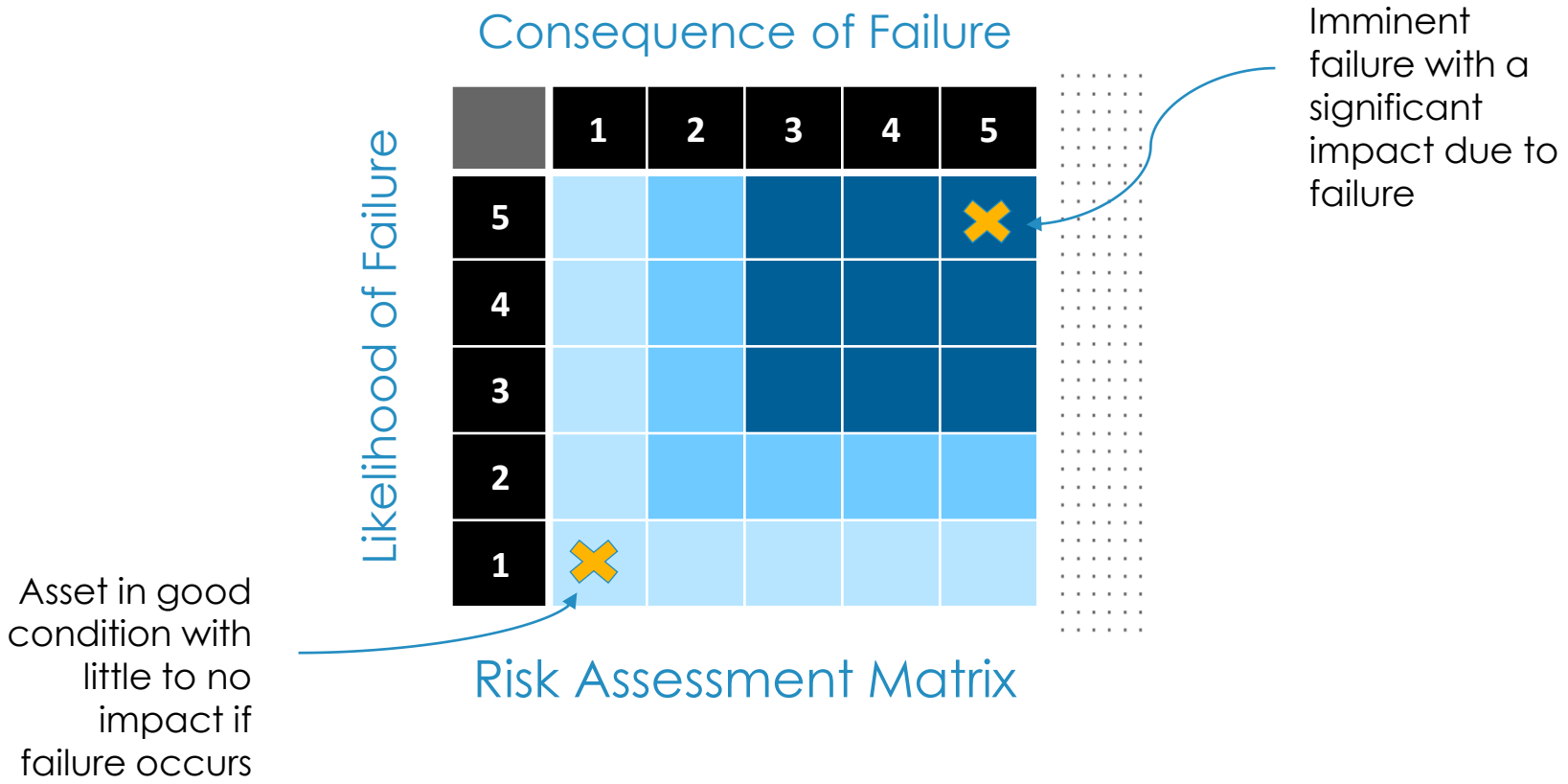
- System replacement is more cost effective than leaving in service or failure carries a very high consequence

What is Infrastructure Management?

7. Risk-based decision-making

Likelihood of Failure
- Condition
- Age
- Material

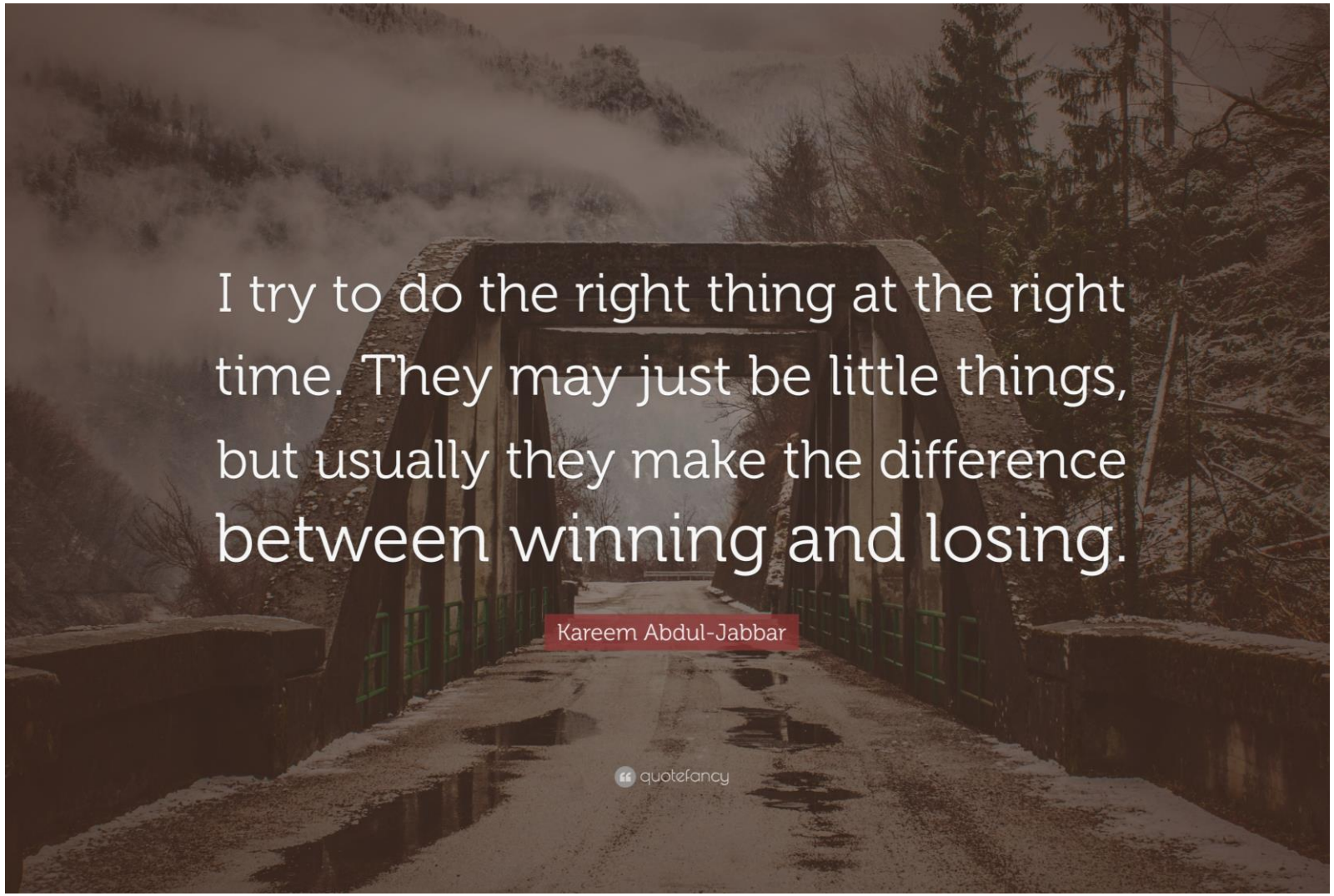
Consequence of Failure
- Proximity to roads and structures
- Proximity to waterways
- Line size



What is Infrastructure Management?

Simply put, infrastructure management is

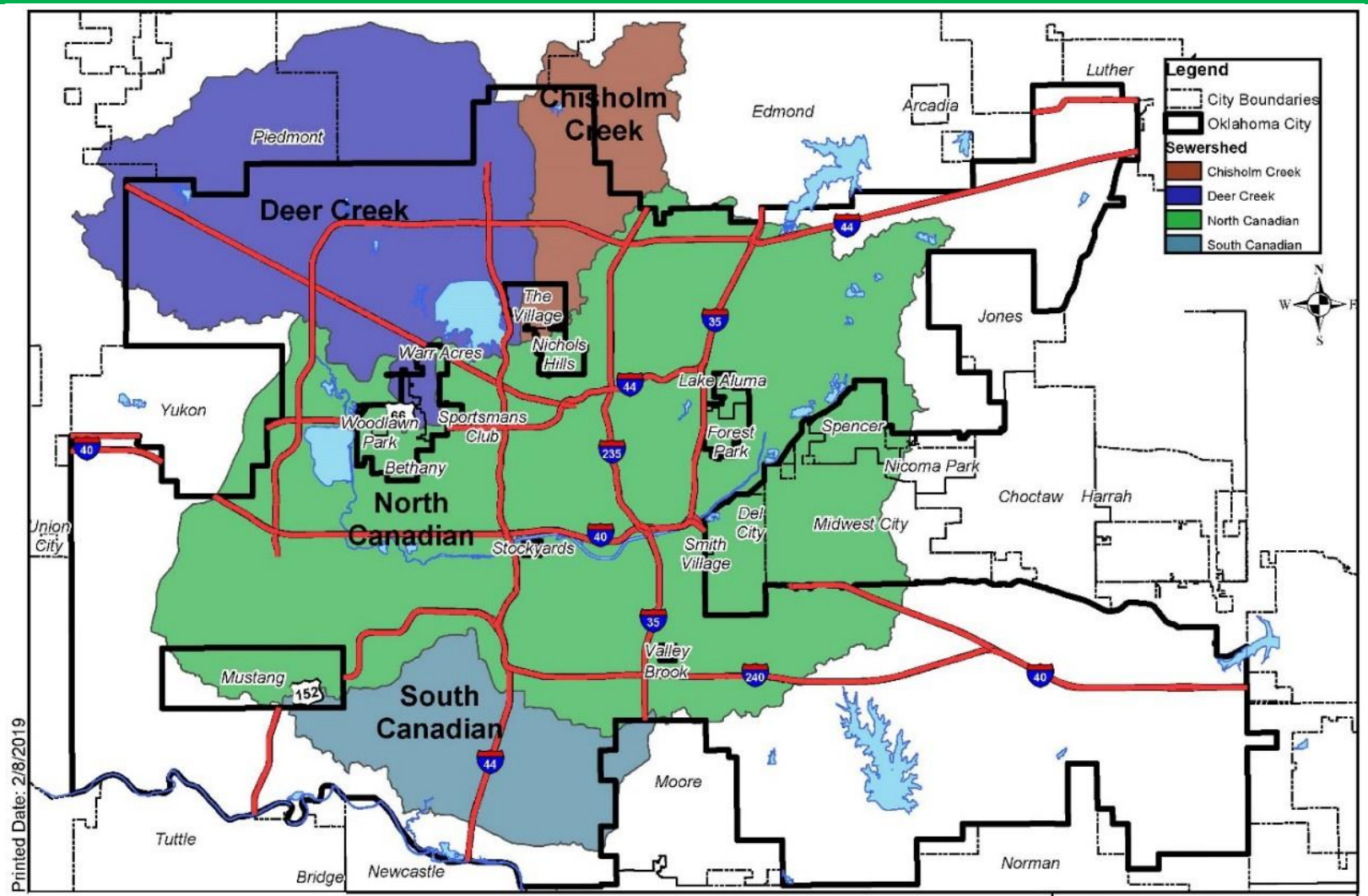
- Doing the right things—at the right times—for the right reasons— to the right parts of the system.
- Planned repair and replacement of infrastructure based on risk



Oklahoma City Water Utilities Trust
Asset Management Program

Oklahoma City Water Utilities Trust

OCWUT Sanitary Sewer System



The City of OKLAHOMA CITY Utilities Department

CITY OF OKLAHOMA CITY
SEWERSHEDS

Issues

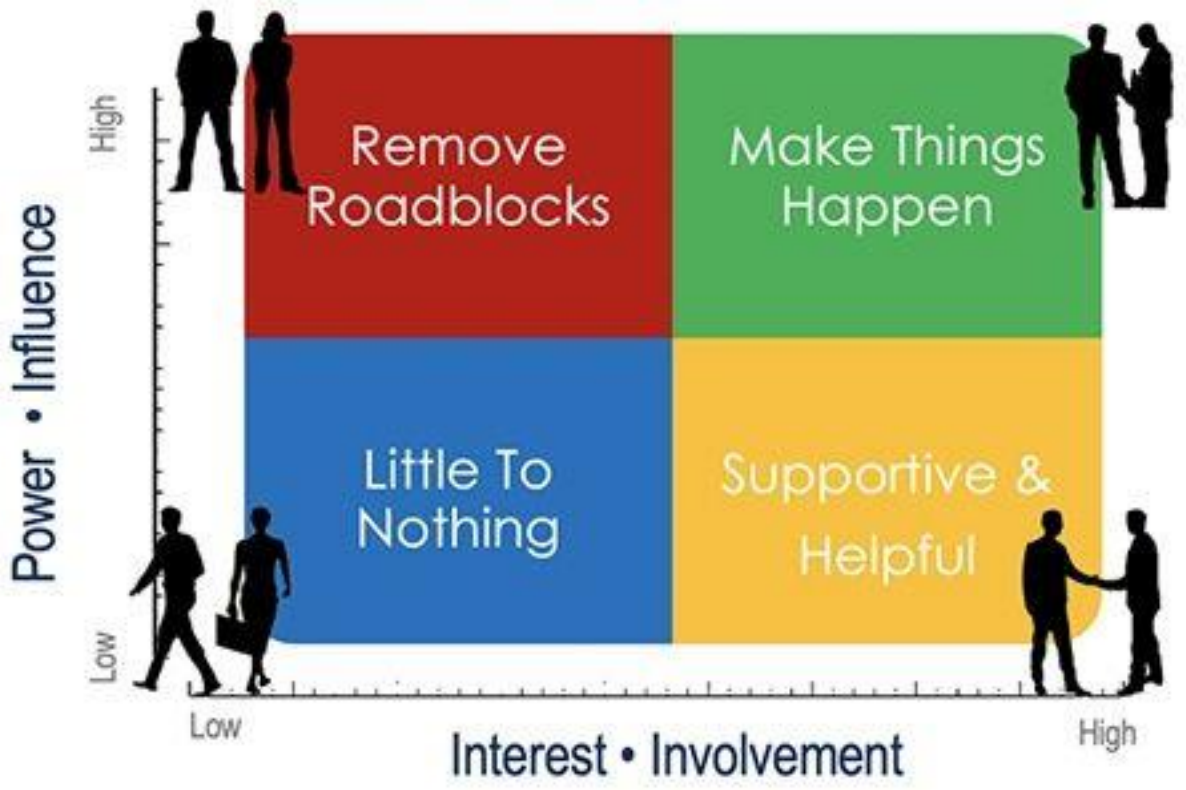
1. OCWUT Stakeholders

Primary:

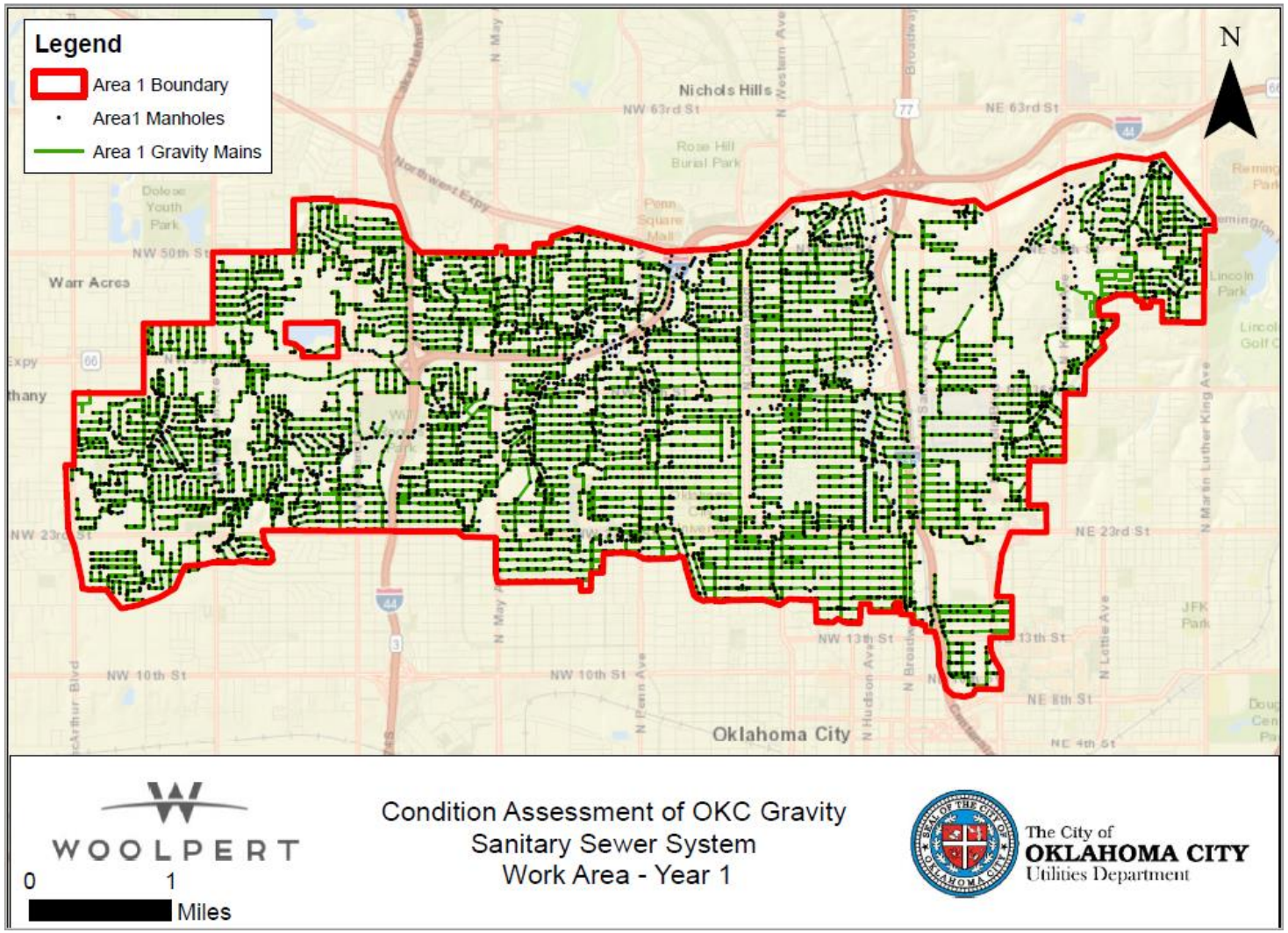
- Management
- Engineering
- Line maintenance
- Information Technology
- Public Outreach

Secondary:

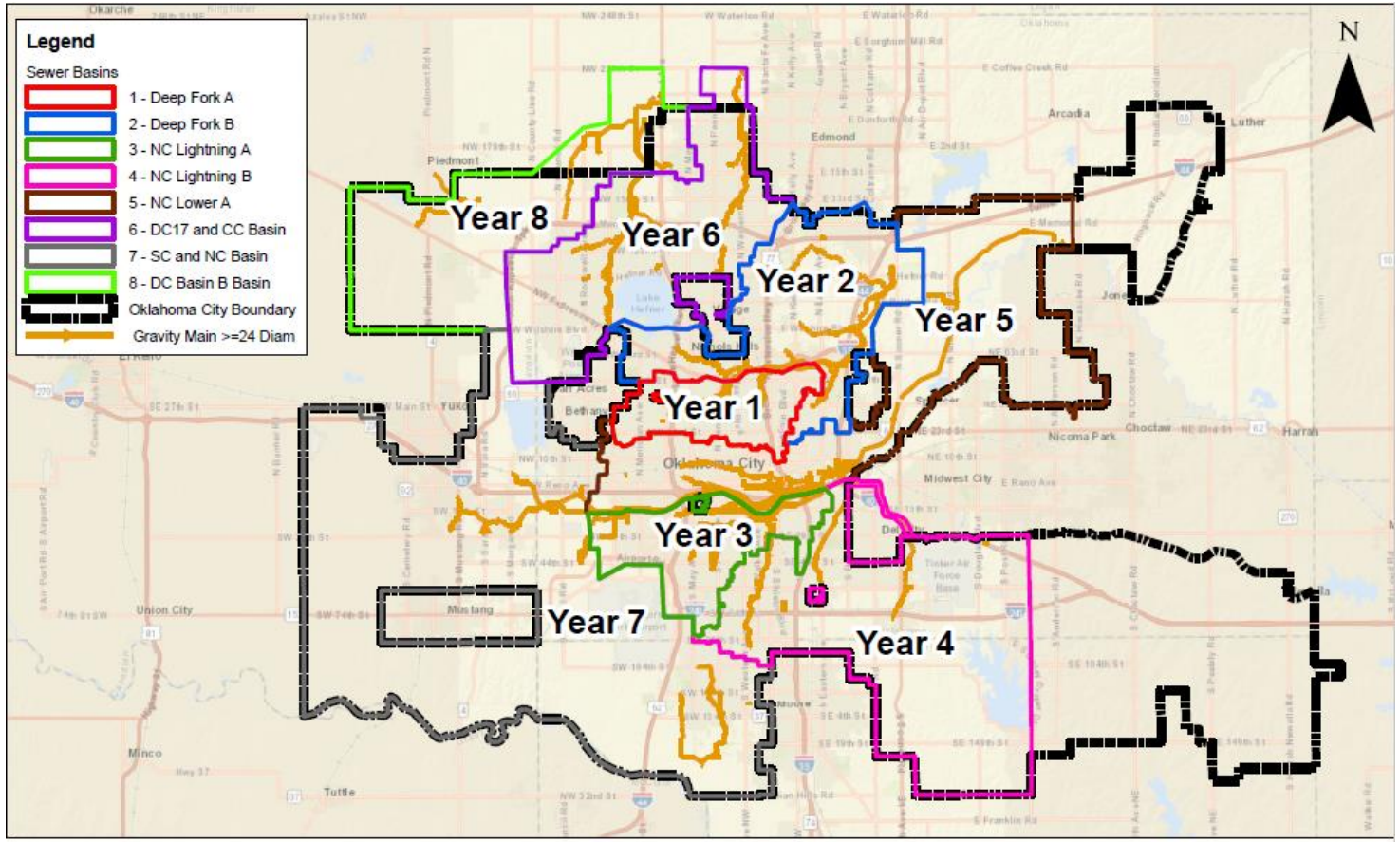
- Finance
- Customer Service
- Board of Trustees
- Customers



2. Asset Registry & 4. System Value



3. Condition Assessment



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Condition Assessment of OKC Gravity Sanitary Sewer System Annual Work Areas

The City of OKLAHOMA CITY Utilities Department

5. Level of Service Goals

Strategic System Goal	Short-term (years 1-5)	Mid-term (years 6-8)	Long-term (years 8+)
Maintain regulatory compliance	Maintain compliance with state and federal regulations	Maintain compliance with state and federal regulations and employ “Best Practices”	Maintain compliance with state and federal regulations and be recognized as an industry leader
Reduce Sanitary Sewer Overflows (SSOs)	No increase in SSOs annually over the previous 5-year period average (baseline average) or Do not exceed 8 SSOs per 100 miles of pipe	Reduce SSOs by 25% annually over the baseline average or Do not exceed 6 per 100 miles of pipe	Reduce SSOs by 50% annually over the baseline average or Do not exceed 4 per mile of pipe
Provide quick response time for service calls	Initial response to service calls within 1 hour	Initial response to service calls within 1 hour	Initial response to service calls within 1 hour
Reduce number of backups due to OCWUT assets	No increase in backups annually over the previous 5-year period average (baseline average)	Reduce backups by 25% annually over the baseline average	Reduce backups by 50% annually over the baseline average
Reduce infiltration/inflow and/or increase system capacity	No Increase over 5-year period over the previous 5-year period average (baseline average)	Reduce by 5% annually over the baseline average	Reduce by 10% annually over the baseline average

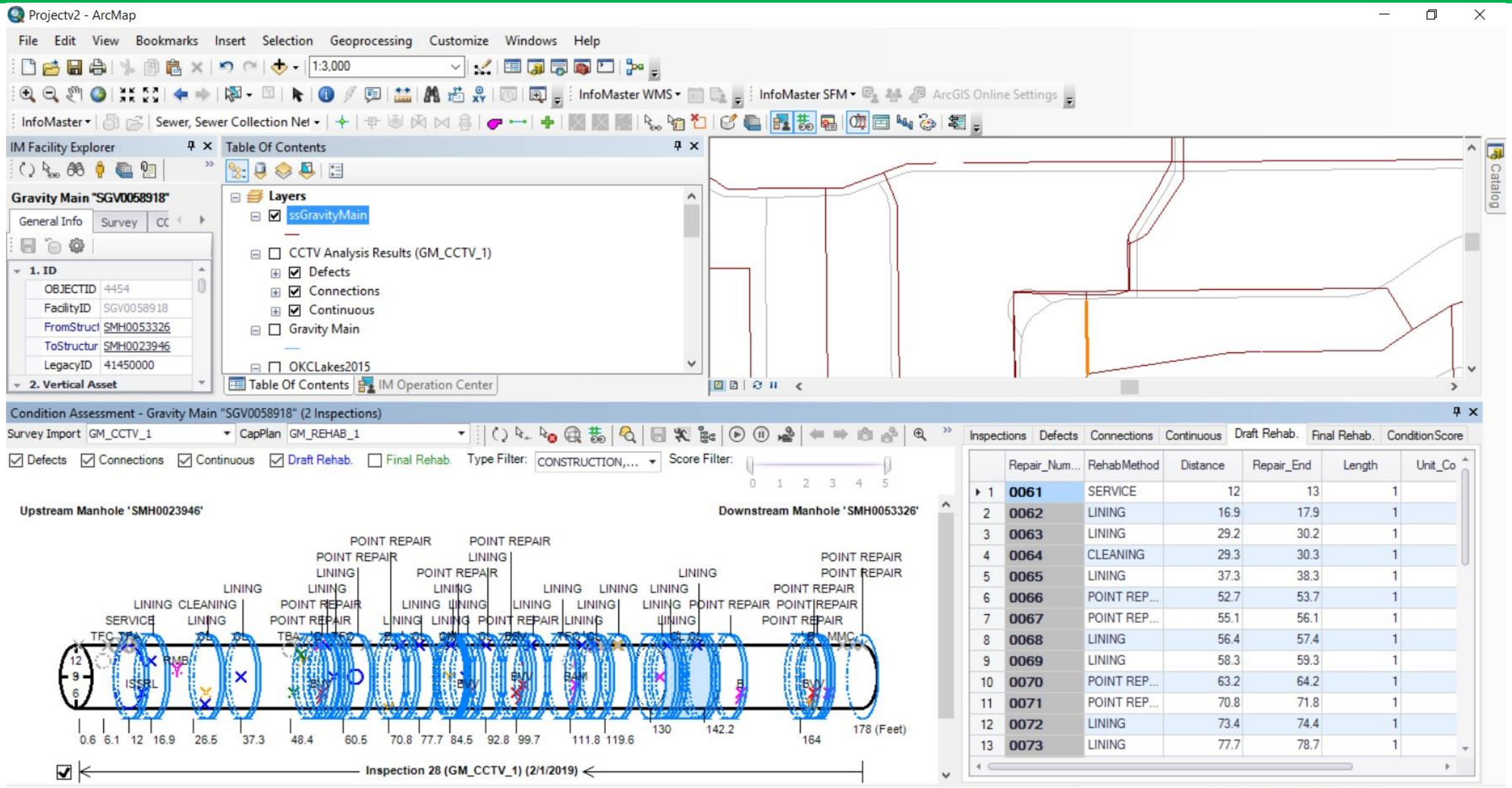
System Level of Service Goals

5. Level of Service Goals

Strategic Program Goal	Short-term (Year 1)	Mid-term (years 2-8)	Long-term (years 8+)
Inspect or assess collection system	Inspect or assess all assets within the Year 1 Area (approximately 10% of the total system)	Inspect or assess all assets within the Year 2 - 8 Areas (approximately 10% of the total system, annually)	Establish and follow inspection and assessment schedule for entire system
	Acquire and configure tools necessary to effectively analyze condition data	Refine configuration of analytical tools to effectively analyze condition data	Annually review, refine, and acquire tools necessary to effectively analyze condition data
	Establish and implement protocols for risk-based decision making	Review and revise protocols for risk-based decision-making prior to end of mid-term period	Annually review and revise protocols for risk-based decision-making
	Create Annual O&M Work Plan and CIP Report	Create and implement Annual O&M Work Plans and CIP Reports	Continue to create and implement Annual O&M Work Plans and CIP Reports
Complete identified operation and maintenance actions		Clean the most critical lines identified in the Annual O&M work plan	Evaluate Year 1 – 8 cleaning goals and achievements and establish long-term goals
		Remove roots in the most critical lines identified in the Annual O&M work plan	Evaluate Year 1 – 8 root removal goals and achievements and establish long-term goals
		Treat grease in the most critical lines identified in the Annual O&M work plan	Evaluate Year 1 – 8 grease treatment goals and achievements and establish long-term goals
		Perform point repairs on the most critical lines identified in the Annual O&M work plan	Evaluate Year 1 – 8 point repair goals and achievements and establish long-term goals
		Perform maintenance actions on the most critical manholes identified in the Annual O&M work plan	Evaluate Year 1 – 8 manhole maintenance goals and achievements and establish long-term goals
Complete identified Capital Improvement Projects		Rehabilitate the most critical lines identified in Annual CIP Report	Evaluate Year 1 – 8 line rehabilitation goals and achievements and establish long-term goals
		Replace the most critical lines identified in the Annual CIP Report	Evaluate Year 1 – 8 line replacement goals and achievements and establish long-term goals
		Rehabilitate / replace the most critical manholes identified in the Annual CIP Report	Evaluate Year 1 – 8 manhole rehabilitation/replacement goals and achievements and establish long-term goals

Program Level of Service Goals

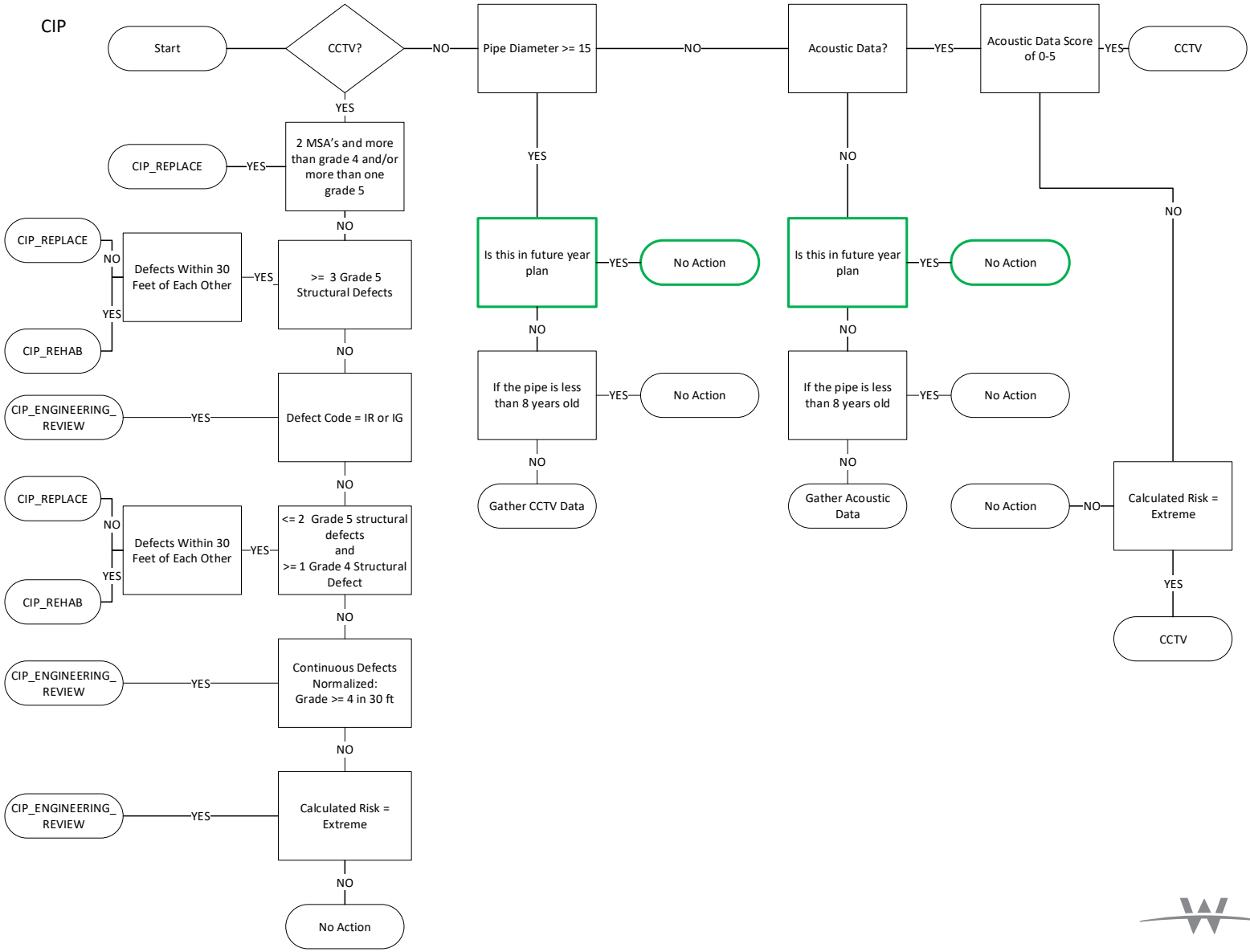
6. Failure Modes



	Repair_Num...	Rehab Method	Distance	Repair_End	Length	Unit_Co
1	0061	SERVICE	12	13	1	
2	0062	LINING	16.9	17.9	1	
3	0063	LINING	29.2	30.2	1	
4	0064	CLEANING	29.3	30.3	1	
5	0065	LINING	37.3	38.3	1	
6	0066	POINT REP...	52.7	53.7	1	
7	0067	POINT REP...	55.1	56.1	1	
8	0068	LINING	56.4	57.4	1	
9	0069	LINING	58.3	59.3	1	
10	0070	POINT REP...	63.2	64.2	1	
11	0071	POINT REP...	70.8	71.8	1	
12	0072	LINING	73.4	74.4	1	
13	0073	LINING	77.7	78.7	1	

6. Failure Modes

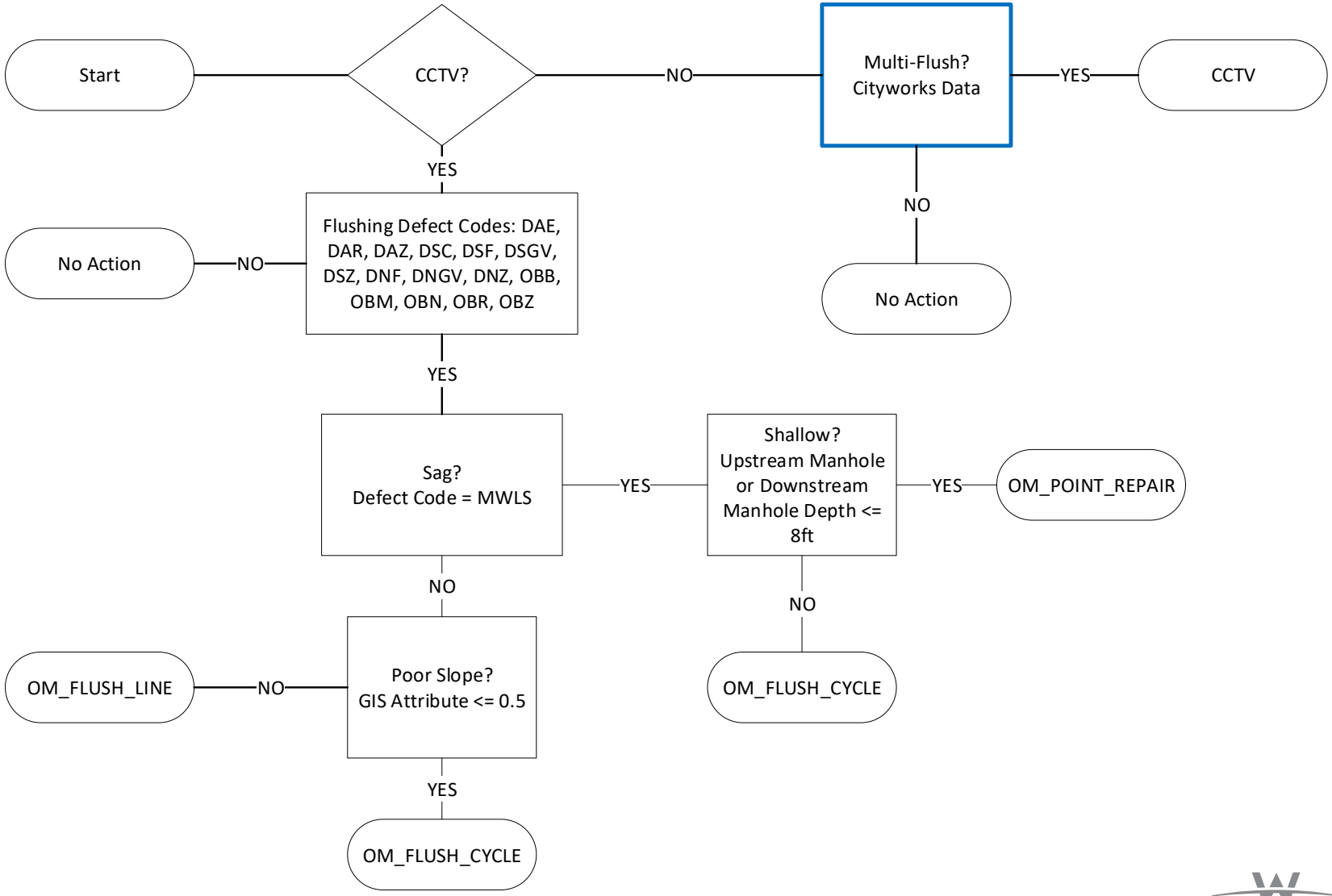
Gravity Sewer **CIP** Decision Tree



6. Failure Modes

Flushing

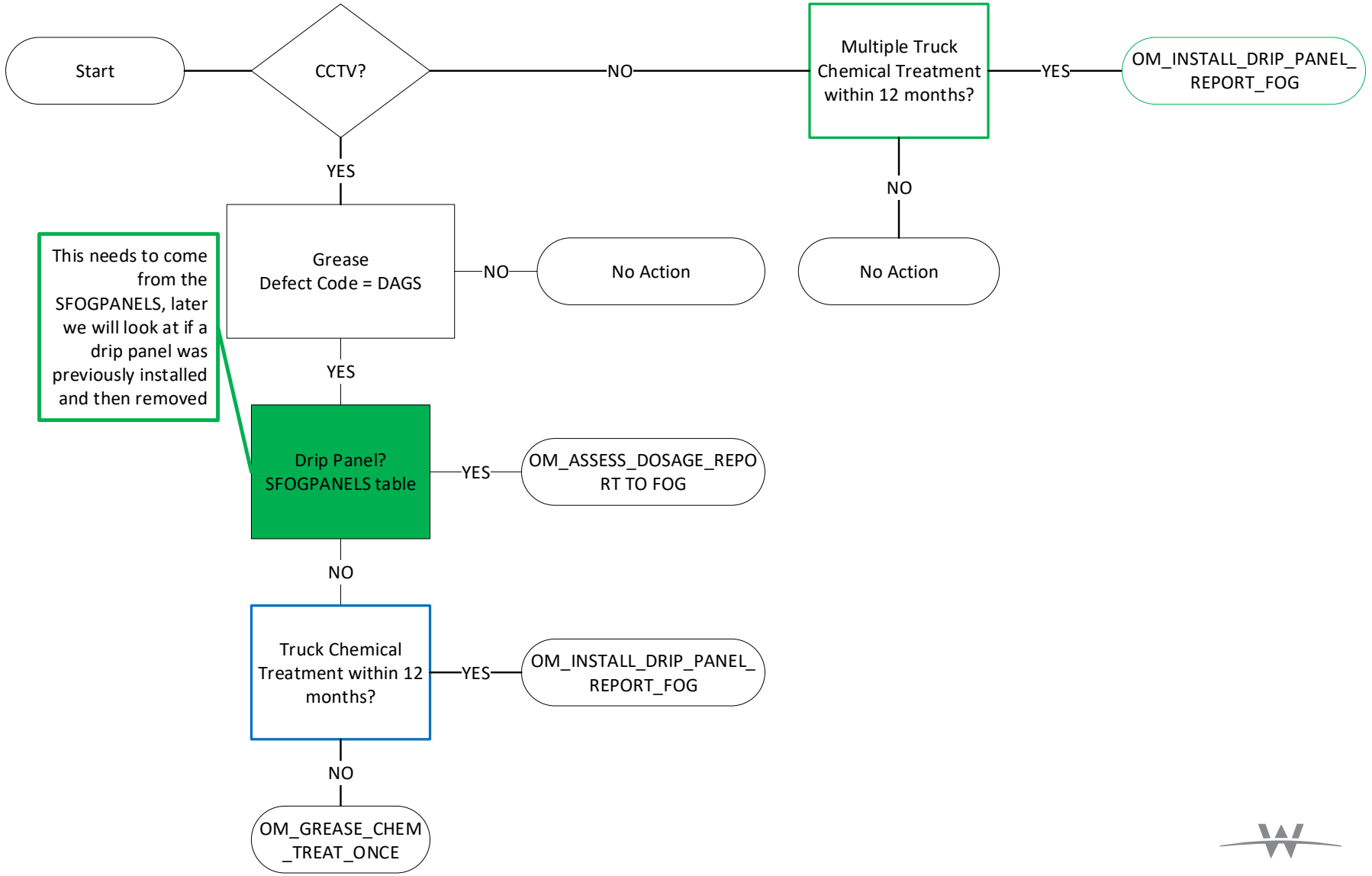
Gravity Sewer
Flushing
O&M
Decision Tree



6. Failure Modes

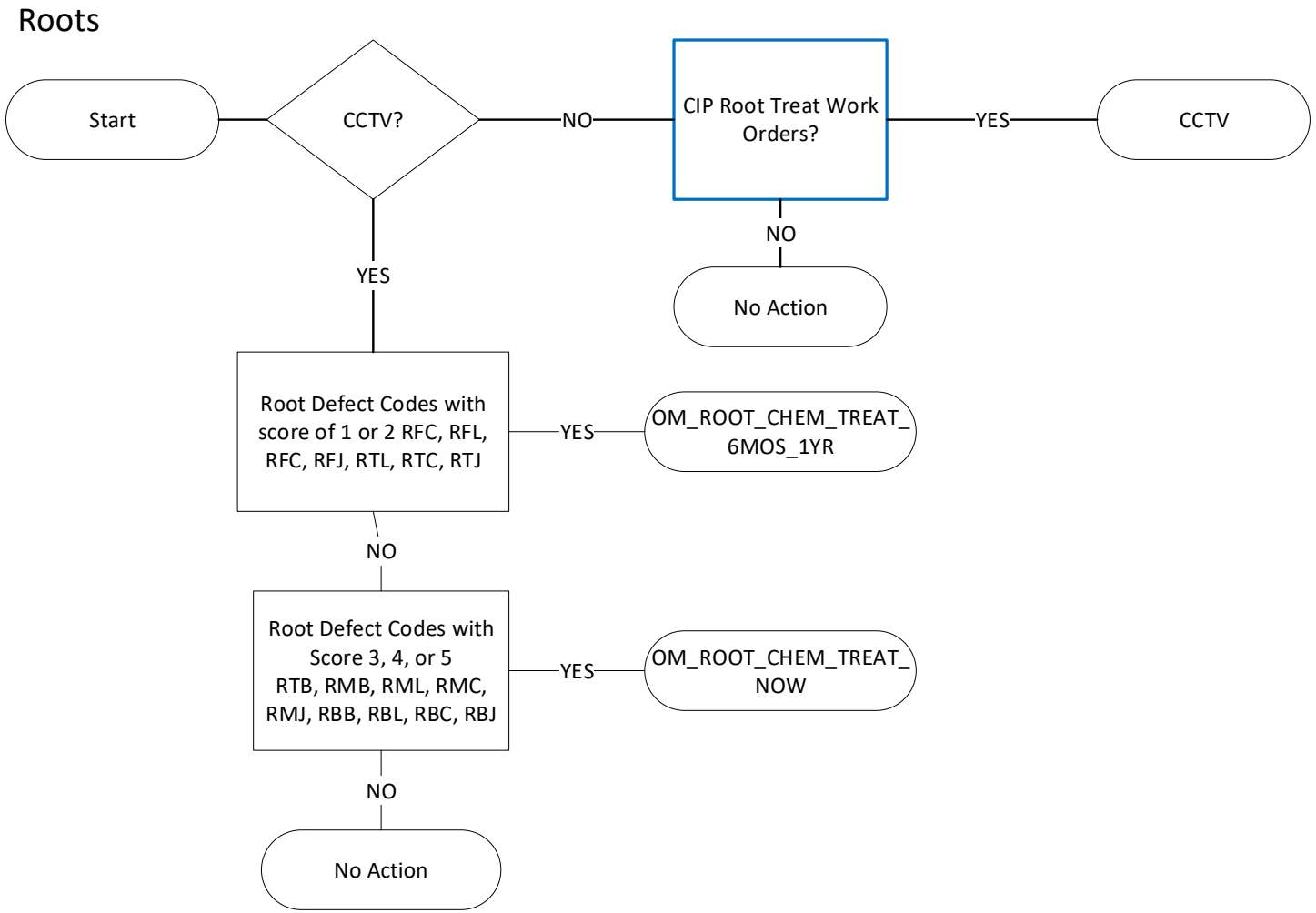
Gravity Sewer **Grease** O&M Decision Tree

Grease



6. Failure Modes

Gravity Sewer **Roots** O&M Decision Tree



7. Risk Based Decision Making

	LOF - Low	LOF - M. Low	LOF - Medium	LOF - M. High	LOF - High
COF - High	Medium	High	High	Extreme	Extreme
COF - M. High	Medium	Medium	High	High	Extreme
COF - Medium	Low	Medium	Medium	High	High
COF - M. Low	Low	Low	Medium	Medium	High
COF - Low	Negligible	Low	Low	Medium	Medium

7. Risk Based Decision Making

Gravity Sewer Likelihood of Failure Categories

Category	%	Driver
PACP Structural Score	50	Social
PACP O&M Score	15	Cost
Acoustic Inspection	15	Cost
Work Order History	10	Cost
Age	5	DEQ
Material	5	Cost
Aerial Crossing *	0	DEQ
Total	**100**	

* Not scored at this time

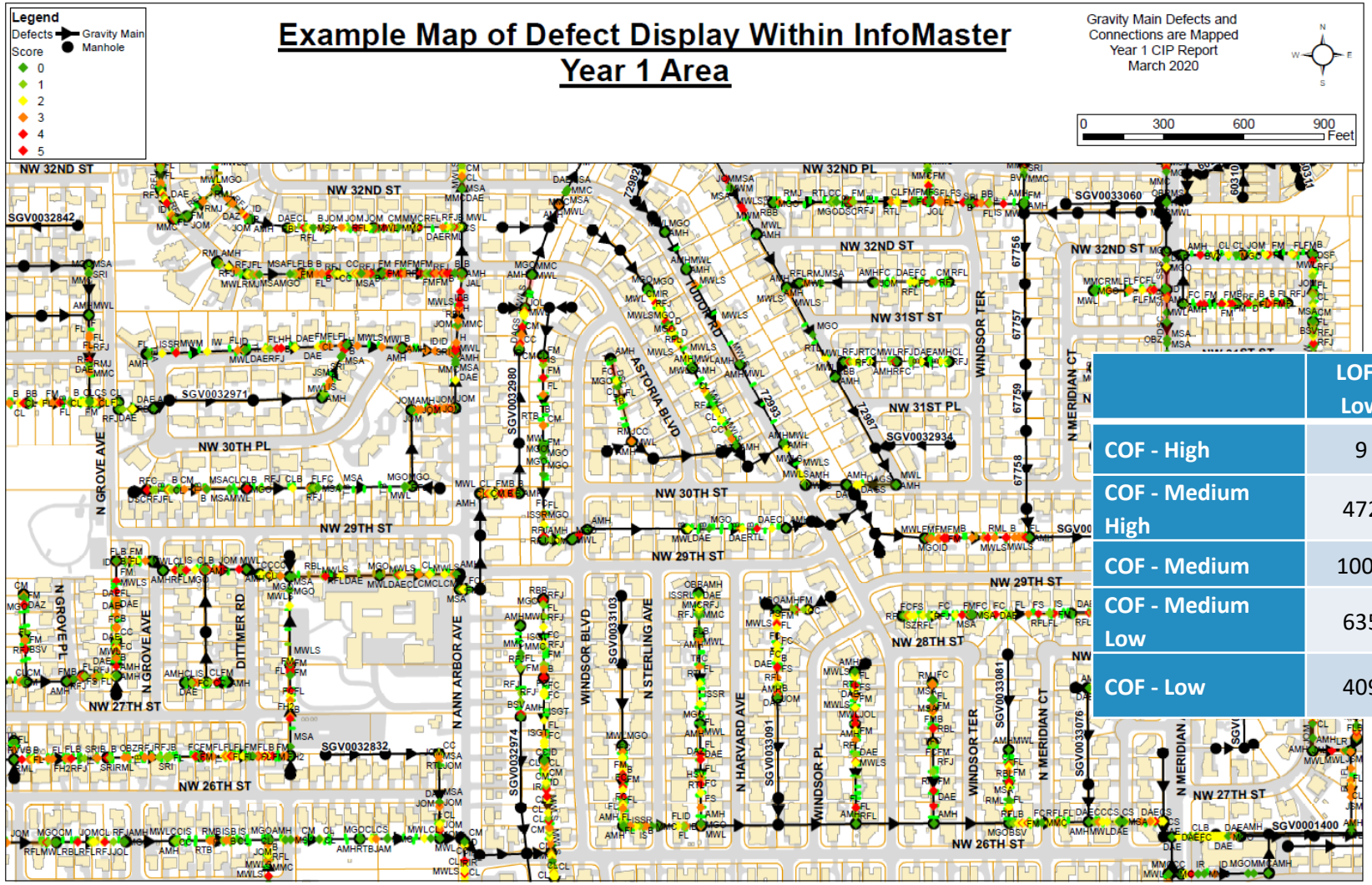
7. Risk Based Decision Making

Gravity Sewer Consequence of Failure Categories

Category	%	Driver
Prox to Lakes	15	DEQ
Prox to Buildings	13	Cost
Prox to Rivers	12	DEQ
Prox to Streetcars	10	Social
Prox to Bridges	9	Cost
Prox to Highways	9	Cost
Prox to Railroads	8	Cost
Depth of Flow	7	Cost

Category	%	Driver
Pavement Type	5	Social
Depth of Pipe	4	Cost
Prox to Parks	3	Social
Pipe Diameter	2	Cost
Prox to Section Line Road	1	Social
Prox to Standard Streets	1	Social
Zoning	1	Social
Total	**100**	

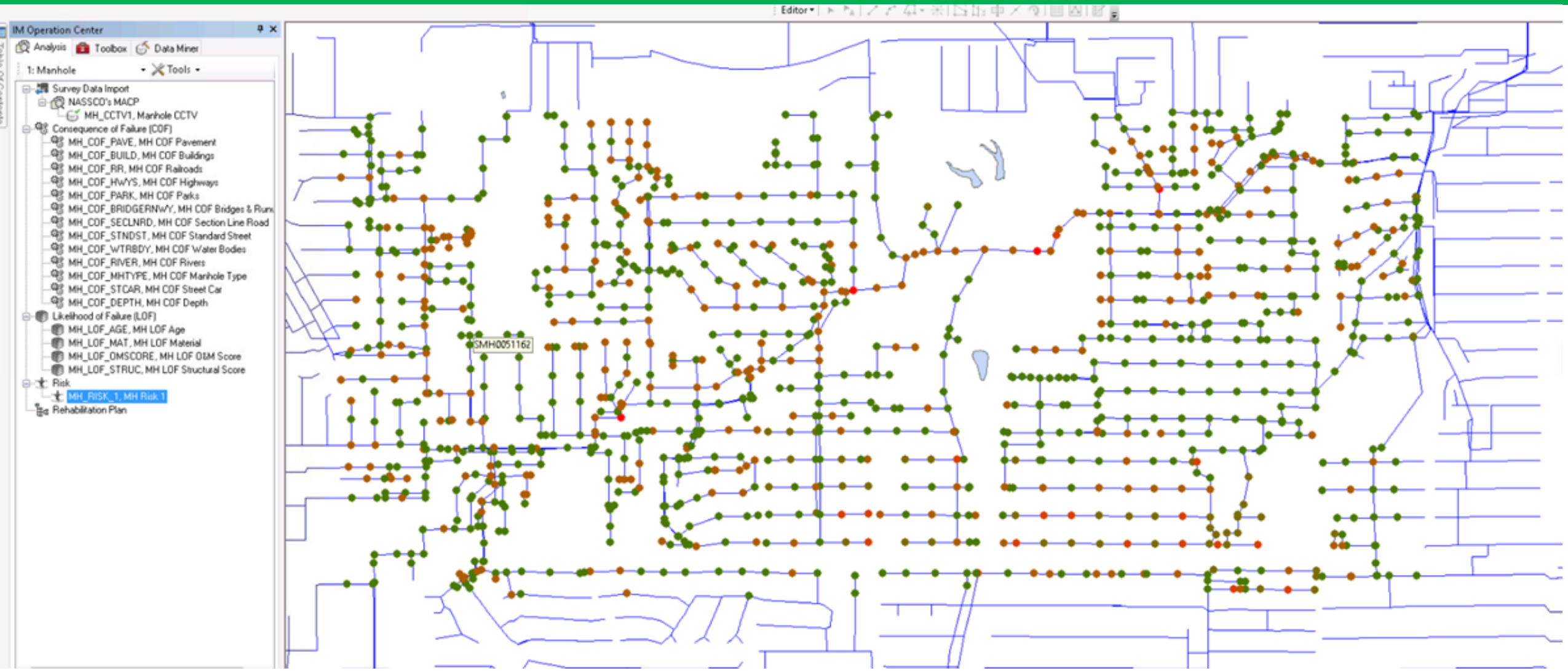
7. Risk Based Decision Making



Number of Gravity Mains within Each Risk Combination

	LOF - Low	LOF - Medium Low	LOF - Medium	LOF - Medium High	LOF - High
COF - High	9	12	5	4	0
COF - Medium High	472	630	221	109	16
COF - Medium	1002	1257	312	155	33
COF - Medium Low	635	704	247	102	21
COF - Low	409	420	100	35	3

7. Risk Based Decision Making



Manhole Risk Map

7. Risk Based Decision Making

Summary of O&M Recommendations

O&M Recommendation[1]		Count of Assets	Sum of Length (LF)
Pipe Activities	Flushing-Related	1,151	299,755
	FOG-Related	428	107,055
	Root-Related	1,466	390,619
	Additional Inspection	1,529	325,724
	No O&M Action	3,241	636,346
Manhole Activities	Manhole Cleaning-Related	415	---
	Install I&I Preventer	1,456	---
	Additional Inspection	1,541	---
	No O&M Action	4,009	---

Note 1: Some assets have recommendations for multiple types of O&M activities.

OCWUT Benefits

Long Term	Lower overall lifecycle cost of the sewer gravity system
Mid Term	Reduction in the number of service disruptions and ad hoc infrastructure failures
Mid Term	Reduction of sanitary sewer overflows
Long Term	Increased available capacity from existing infrastructure
Short Term	Finding “unanticipated” issues (cross connections, sink holes, etc.)

OCWUT Lessons Learned

Needed O&M is probably more than you expect – think dollars

- More routine maintenance than anticipated
- Value in routine cleaning

Don’t put your head in the sand – include all items in plan

- Educate leaders early on
- Be aware of “sticker shock”

Don’t over complicate on your first run with decision trees

- Keep them accurate, but simple
- Refine as you go

Resources are still a challenge

- The move from reactive to proactive maintenance requires time and resources
- May need to outsource catch up work

Father Guido Sarducci's Five Minute College

1. **Protect** your investment
2. There is a better way
3. It may be complex, but it isn't complicated
4. There are ways to control implementation costs
5. There is a return on your investment with every step

Thank you!

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