



# Stormwater Infrastructure Asset Management

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# Agenda

- **Managing Assets / Asset Management**
  - ISO 55001
  - WERF
  - US EPA
- **Asset Management System Framework**
  - ISO 55001
  - Establishing Alignment
- **Enabling Technology**
  - Asset Register / Inventory
  - Life-Cycle Performance and Costing
  - System Performance
  - Life-Cycle Modeling
- **Long-Term Strategic Planning**
  - Asset Investment Planning
  - Digital Asset Management Plans

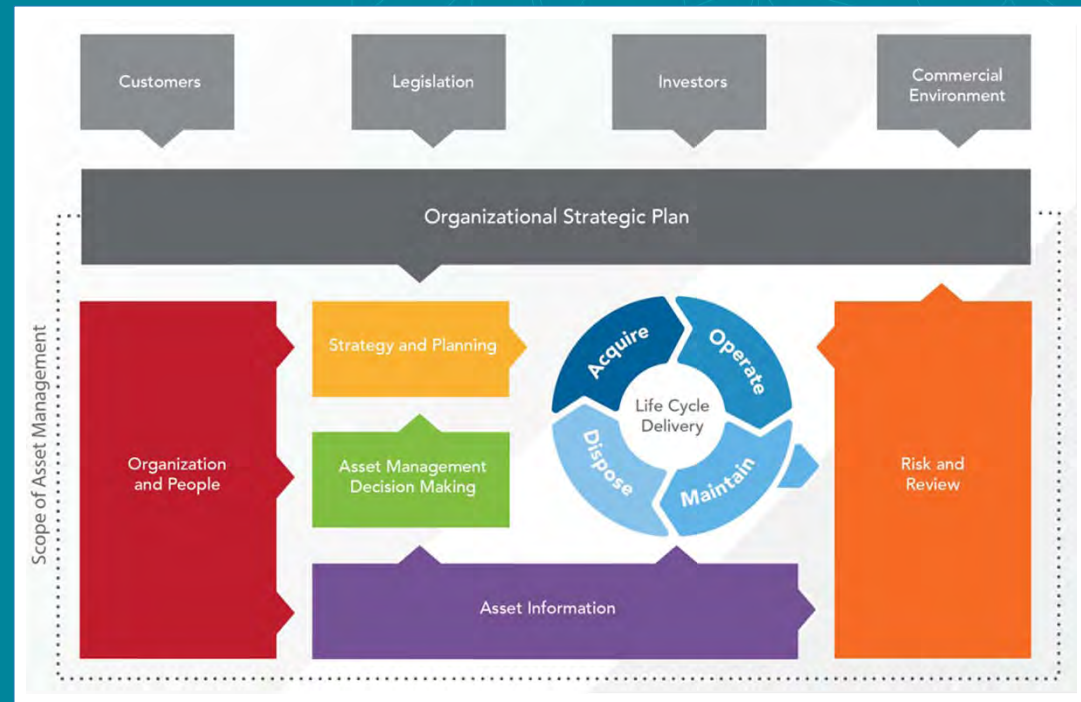
# Managing Assets versus Asset Management (ISO 55001)

## Managing Assets

- The things you do to assets
- Life-cycle delivery (O&M, CIP)

## Asset Management

- Establishes alignment across the organization (Line of Sight)
- Focus is on delivering value
- Manages risk and optimizes life-cycle delivery

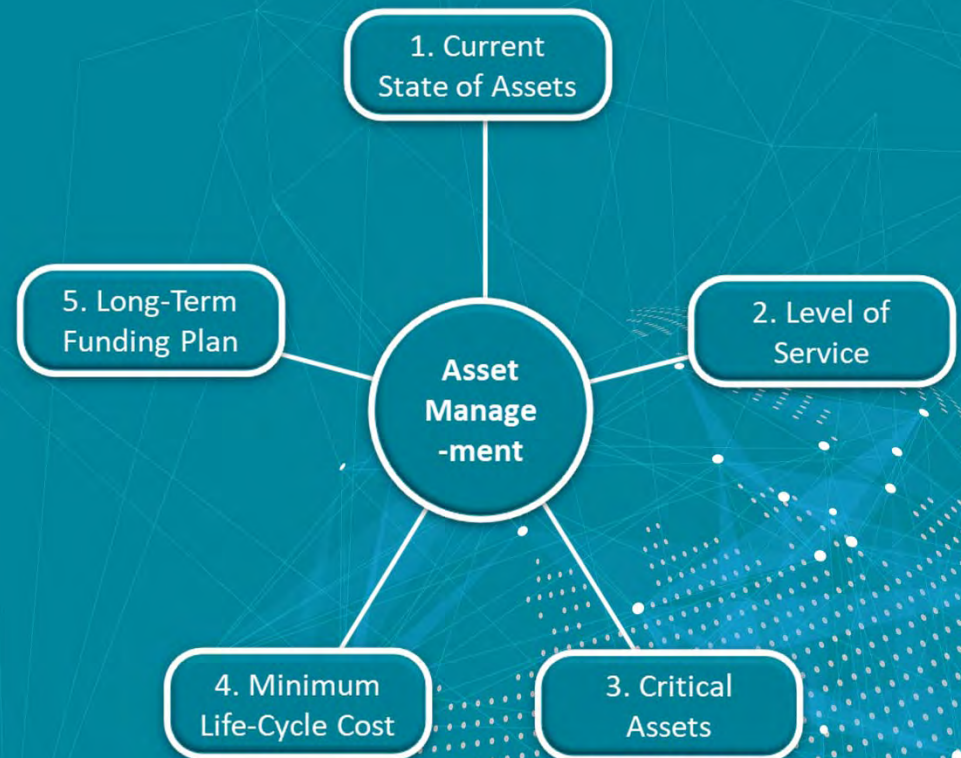


From the Anatomy of Asset Management – the IAM

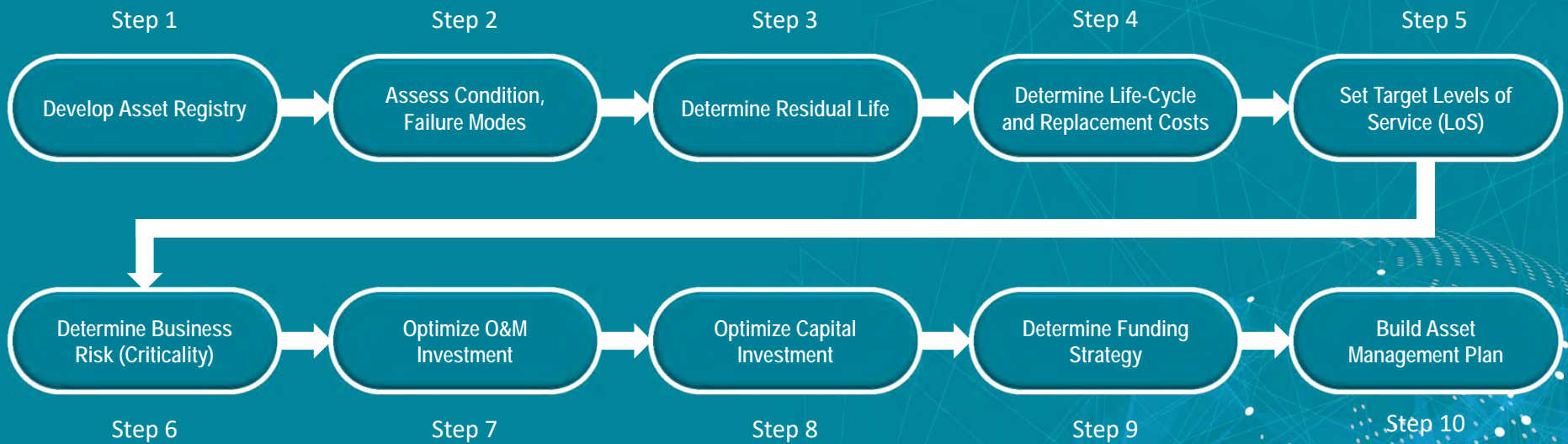
## US EPA Components (Managing Assets)

What are the elements of asset management practice?

1. What is the current state of my assets?
2. What is my required “sustainable” level of service?
3. Which assets are critical to sustained performance?
4. What are my minimum life-cycle costs?
5. What is my best long-term funding strategy?

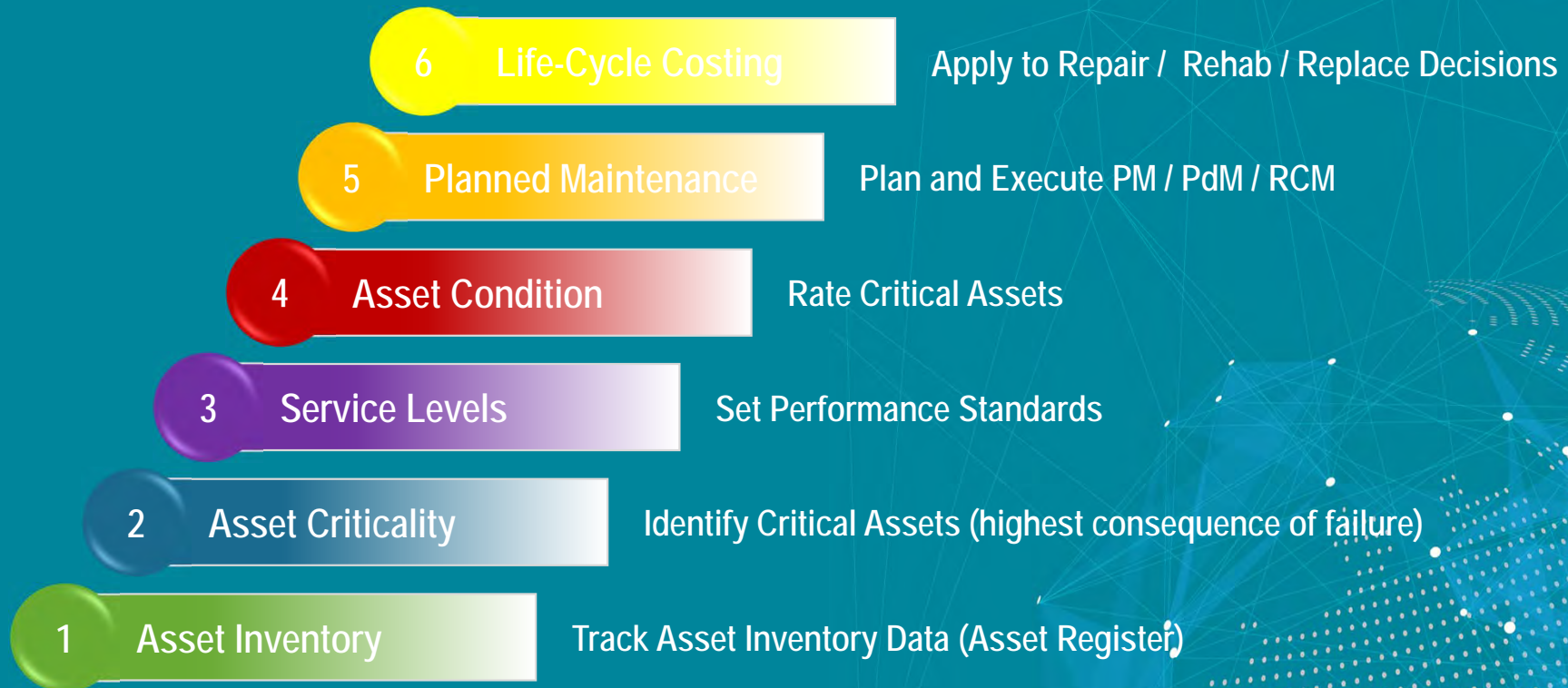


# WERF Workflow (Managing Assets)



*Ten Core Steps to Developing an Asset Management Plan - WERF SIMPLE*

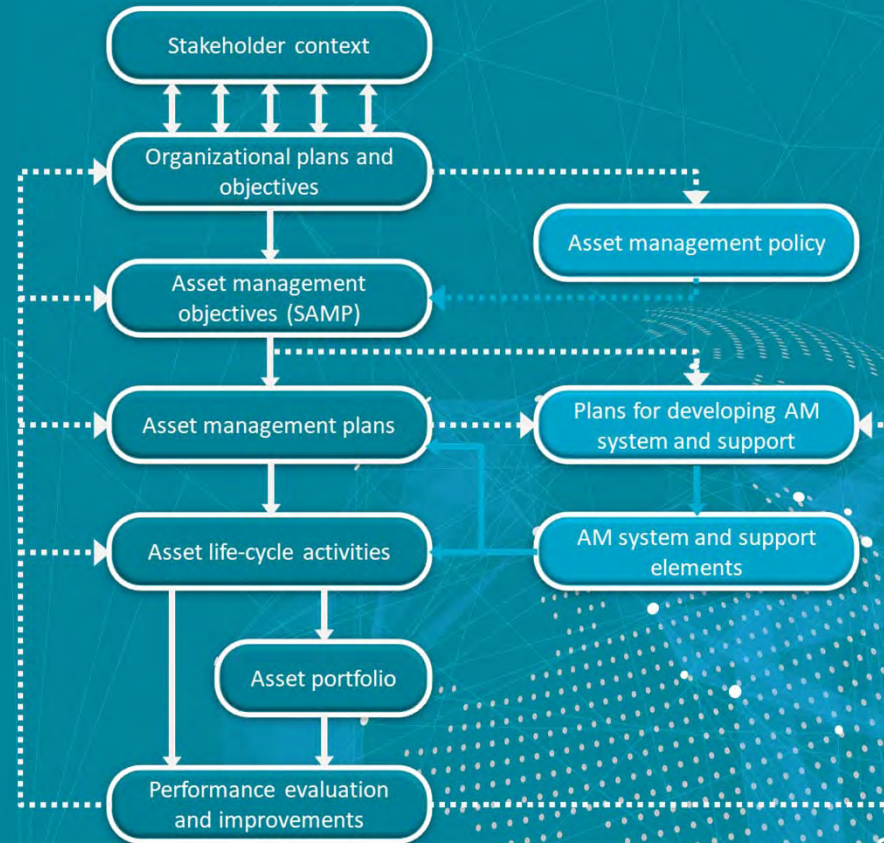
# Asset Management Building Blocks (Managing Assets)



# Asset Management Establishes Alignment

A good Asset Management Program should:

- Be strategically aligned with the organization's underlying strategy and objectives
- Be enterprise-wide, avoiding silos
- Apply to asset owners, managers, contractors, suppliers, customers, and regulators
- Balance cost, risk, and performance on varying timescales
- Apply to both tangible (physical) and intangible (i.e. public perception) assets



# Asset Management System Framework

## Asset Inventory

- GIS – Physical Asset Register
- ERP / CRM – Financial Asset Register

## Life-Cycle Performance and Costing

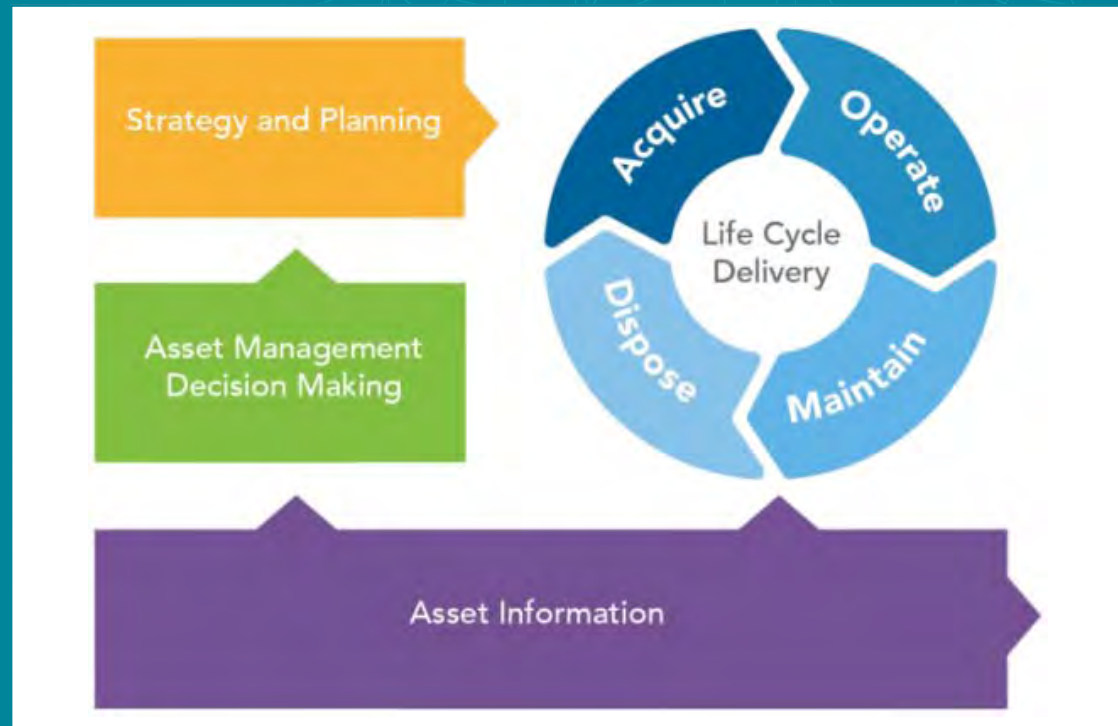
- Computerized Maintenance Management System

## System Performance

- Engineering / Hydraulic Models

## Long-Term Strategic Planning

- Life-Cycle Performance Modeling

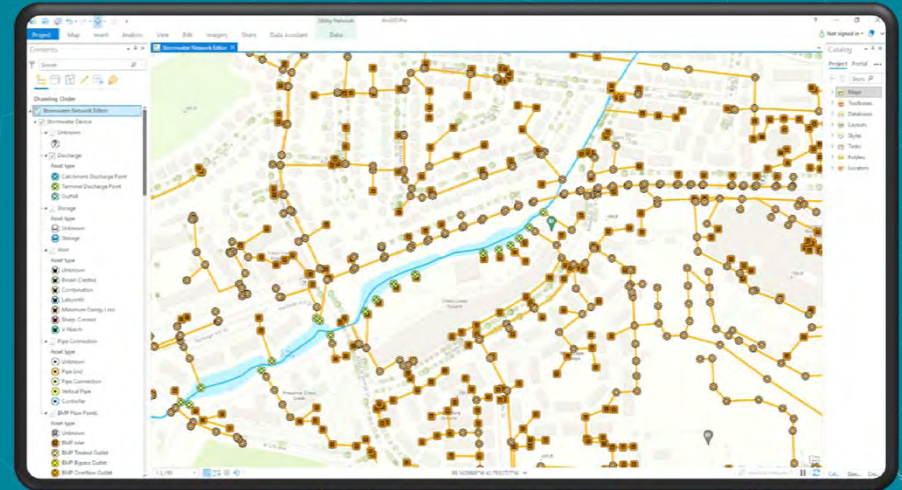




# Asset Inventory (Asset Information)

A robust GIS should be the basis of any asset management system

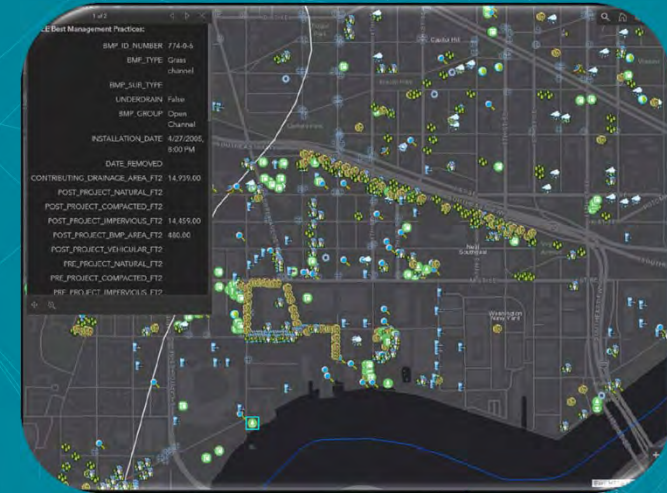
- Asset register
- Integrate multiple business intelligence applications
- Enable business workflows
- SMART City benefits



# Asset Inventory (Asset Information)

## GIS Features and Functions

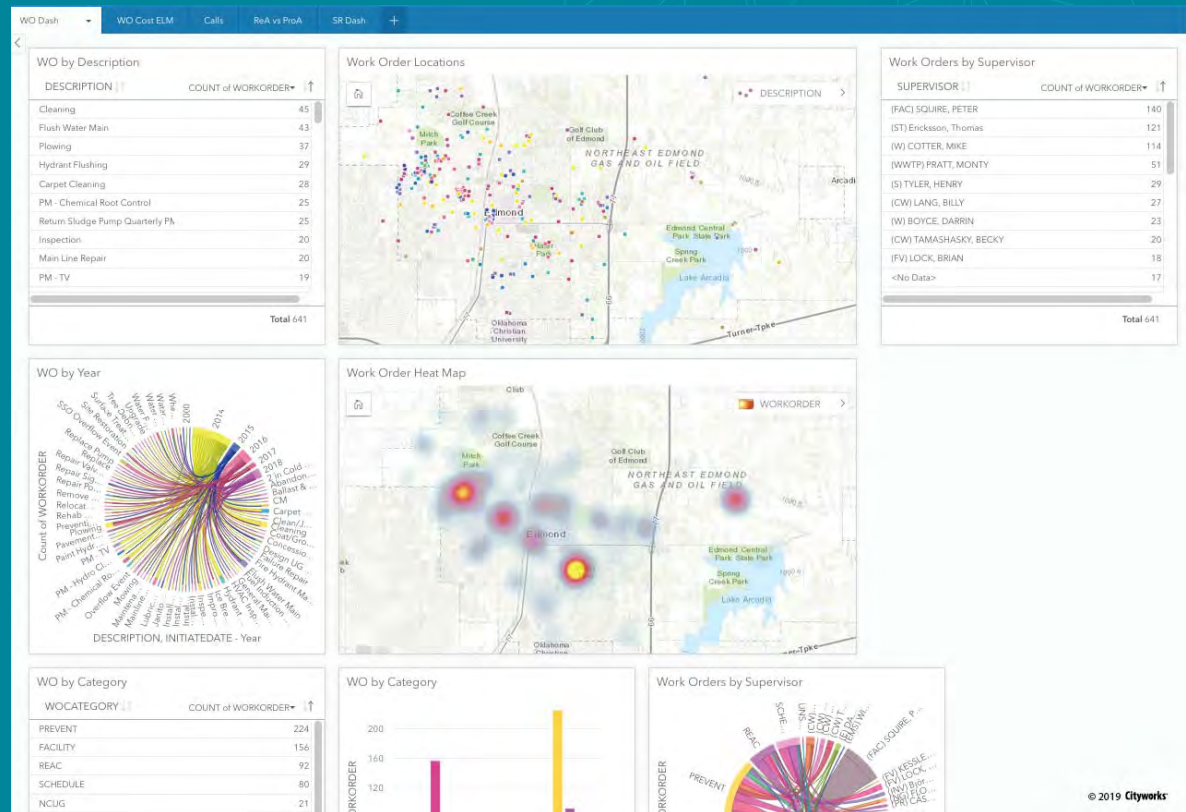
- Business Workflows
  - Back office
  - Field services / mobile
  - Customer engagement
  - Dashboards (operational, management)
- Spatial Analysis
  - Land use
  - Land cover
  - Soils
  - Demographics
  - Etc.
- Visualization
- Data Analytics
- System Integrations
  - CMMS
  - AMS
  - Mobile
  - Customer / Citizen engagement
  - Engineering models



# Life-Cycle Performance and Costing (CMMS)

## Work and Performance Management

- Citizen Service Requests
- Work Orders
- Inspections
- Life-Cycle Costing of Asset performance and maintenance
- Workflow Management
- Some asset management



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# Life-Cycle Performance and Costing (CCTV)

## Inspection / Condition Assessment

- NASSCO Standards
- Other Standards
- Inspection Programs
- Asset Criticality / Risk Management
- 12 – 36 Month O&M Plan

Condition data feeds other analysis systems and informs CIP strategies

The screenshot displays the 'pipes' software interface. At the top, there are tabs for 'Assets', 'Observations', 'Inspections w/ Scores', and 'Inspections'. The main window is divided into three sections:

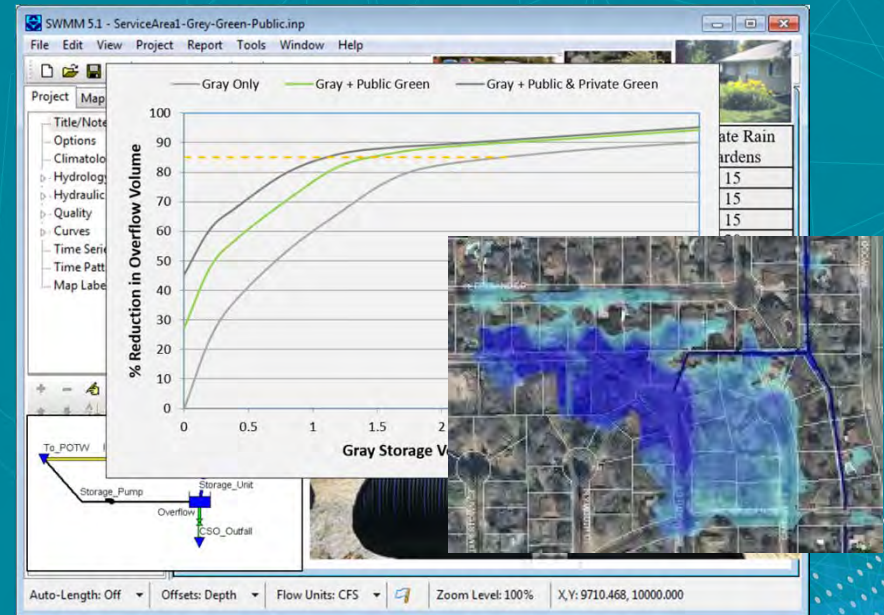
- Data Table:** A table listing pipe segments with columns for Pipe Segment ID, Project, Upstream MH, DS Manhole, Date, Direction, Height, and Material.
 

Pipe Segment	Project	Upstream MH	DS Manhole	Date	Direction	Height	Material
PI007270	ZOO CREEK	IN005172	IN005171	06/08/2017 12:00 AM	Upstream	36	Reinforced Concrete Pipe
PI007273	ZOO CREEK	MH004424	IN005174	06/08/2017 12:00 AM	Upstream	36	Reinforced Concrete Pipe
PI007268	ZOO CREEK	IN005171	IN005170	06/08/2017 12:00 AM	Downstream	36	Reinforced Concrete Pipe
PI007249	ZOO CREEK	MH004423	MH004421	06/08/2017 12:00 AM	Downstream	48	Reinforced Concrete Pipe
PI007250	ZOO CREEK	MH004421	MH004418	06/07/2017 12:00 AM	Upstream	48	Reinforced Concrete Pipe
- Map:** A geographic map showing the layout of the pipe network with various colored lines and markers representing different pipe segments and manholes.
- CCTV Inspection Window:** A video feed from a camera inside a pipe. The text overlay reads: "Obstacle Intruding Thru Wall", "USMH: MH004463", "DSMH: MH004463A", and "201.4 ft.". Below the main video are four smaller thumbnail images showing different views of the pipe interior.

# Engineering Models (System Performance)

## Stormwater Modeling

- HEC-HMS
- HEC-RAS
- EPA SWMM
- XPSWMM
- InfoICM
- PCSSWMM
- ICPRv3 & v4
- Hydraflow
- Civil 3DSSA
- InfoWorksSD
- MikeUrban
- GeoHECRAS



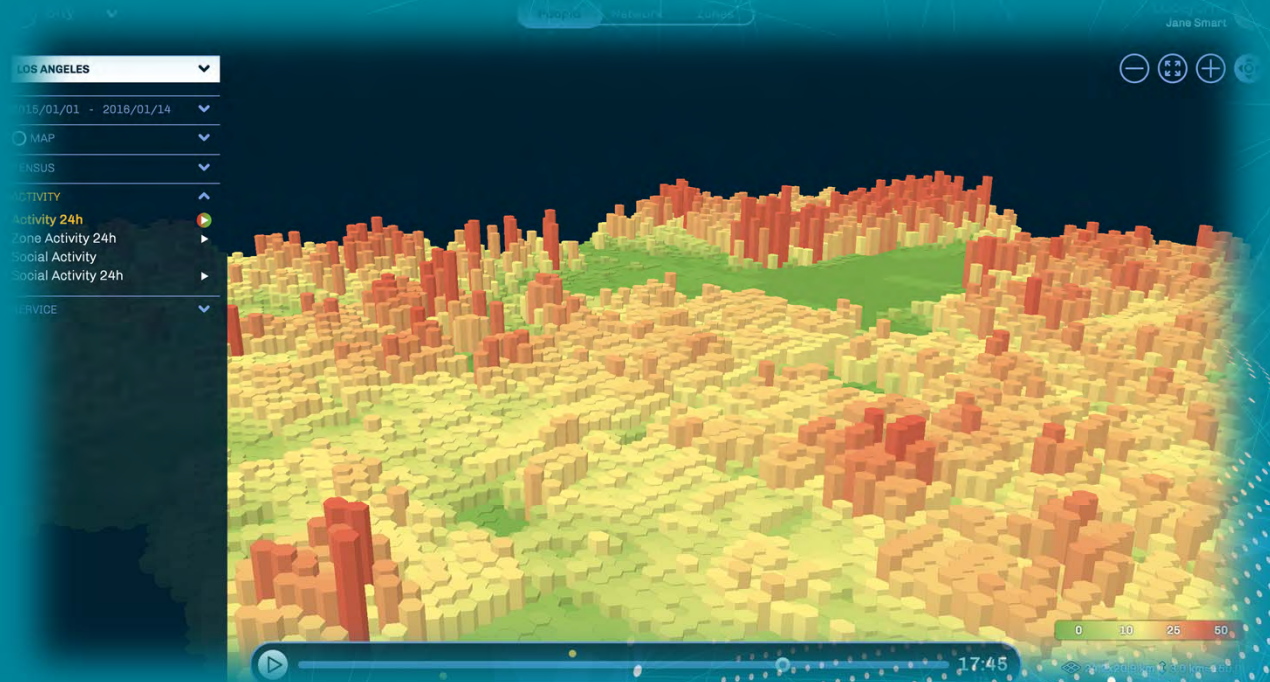
# Engineering Models (Machine Learning / Artificial Intelligence)

## AI / ML

- Recent significant technology advancements
- Beginning to be able to accurately predict failures – when, where, type



baseform



# Life-Cycle Performance Modeling (Long-Term Strategic Planning)



 <a href="http://www.assetic.com">www.assetic.com</a>	 <a href="http://www.cosmotech.com/solutions/asset">www.cosmotech.com/solutions/asset</a>	 <a href="http://www.powerplan.com">www.powerplan.com</a>
 <a href="http://www.copperleaf.com">www.copperleaf.com</a>	 <a href="http://www.deighton.com">www.deighton.com</a>	 <a href="http://www.seamsltd.com">www.seamsltd.com</a>

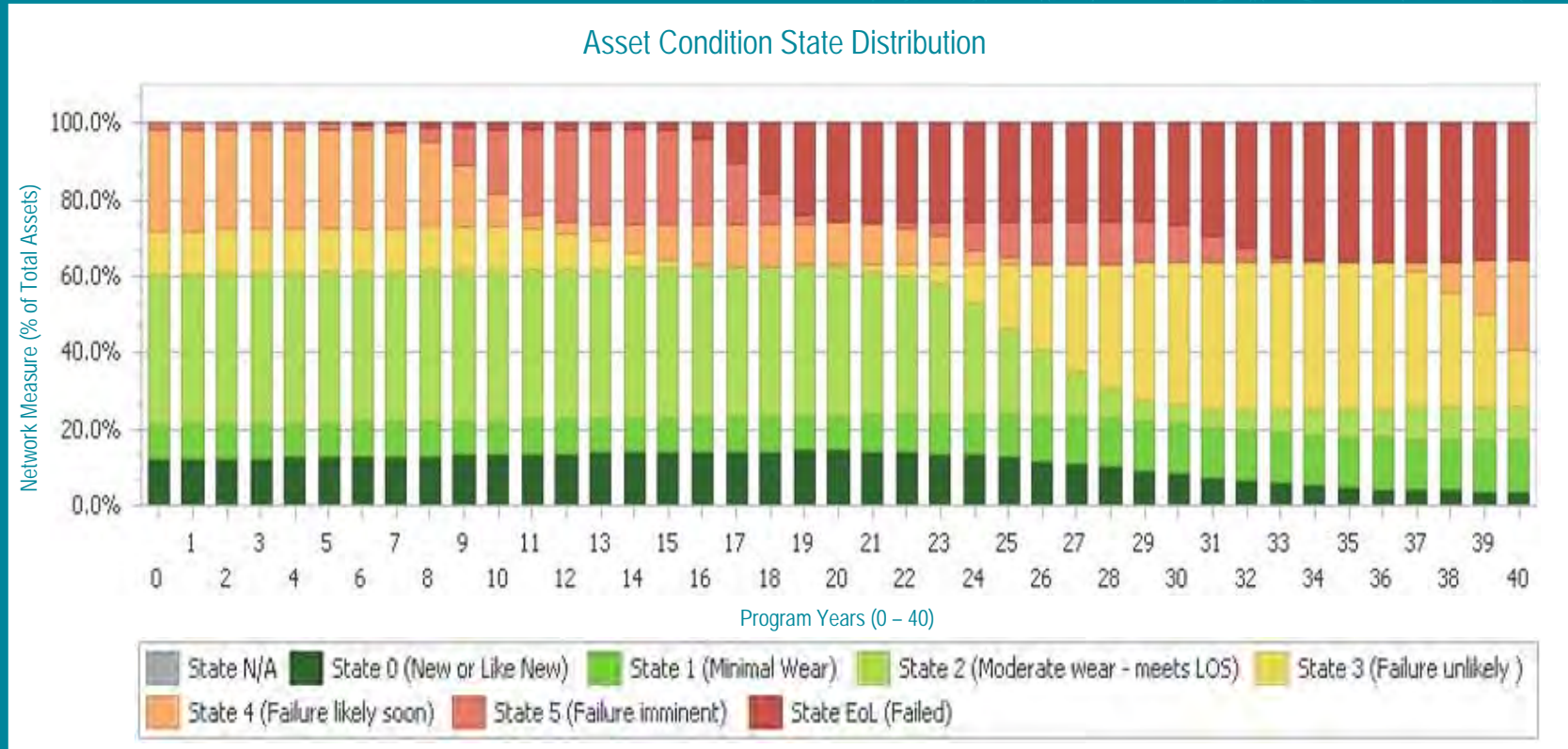
## A Peek Into Your Future

- What will my asset stock look like (condition, performance) in 10, 15, 20 years?
- What level of funding is required for an established Level of Service?
- How will our service delivery be impacted by decreased funding?
- Etc.

# Long-Term Strategic Planning

## Current Budget

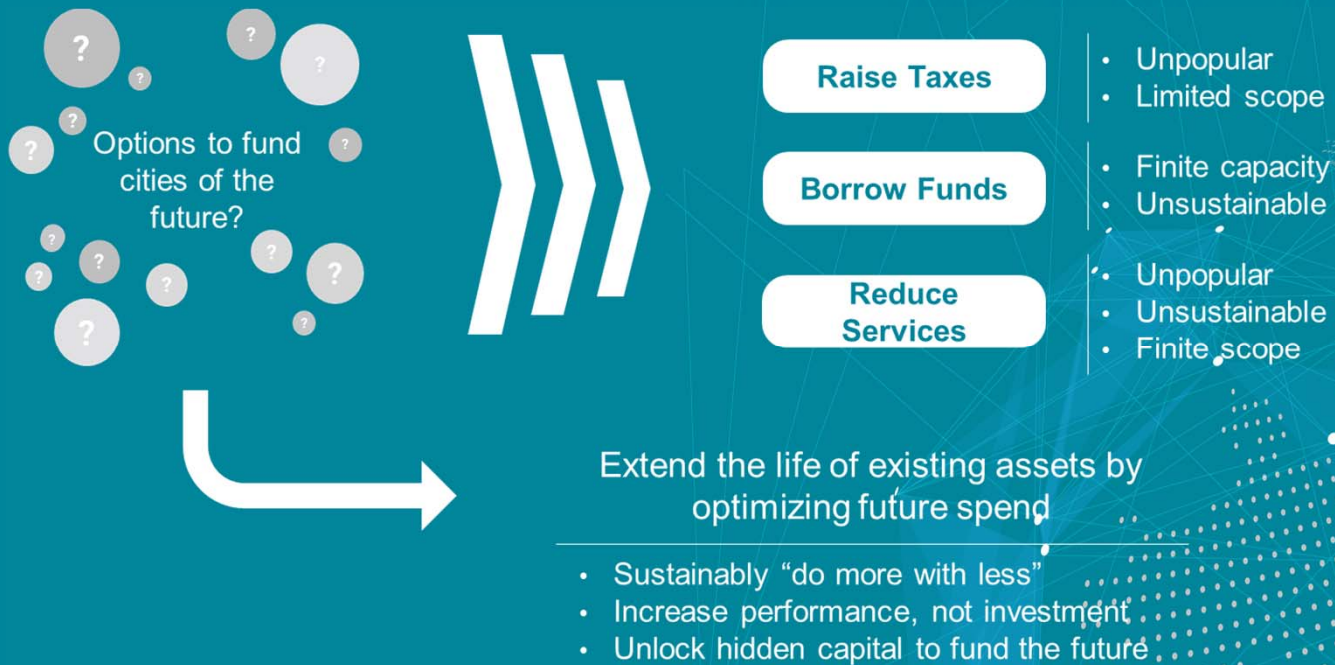
- ≈\$100,000 annually
- No Strategy
- 40% system failure within 30 years





# Asset Investment Planning Solutions (Decision Support Systems)

Infrastructure Managers Must Implement Strategic Asset Management to Optimize Performance of Existing Assets



# Decision Support – Long-Term Strategy

### Traverse City Storm Water - Scenario Comparison

An Assetic Story

**1** Current Budget - About \$100K annually

**Condition State Distribution**

**Failure Imminent or Failed**

[Traverse City, Michigan - A Case Study](#)

# Digital Asset Management Plans

DETROIT METRO WILLOW RUN  
WAYNE COUNTY AIRPORT AUTHORITY

### Investment and Service State Forecast for Bridge Assets

Powered By  
**assetic** predictor

**Life Cycle Simulation**

\$1M Budget with Decision Model No C...

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**Bridge Assets**

Select all

- 12734 Steel Bridge
- 13364 Culvert
- 13365 Steel Bridge
- 13366 Concrete Bridge
- 13367 Concrete Bridge
- 13368 Concrete Bridge
- 13369 Concrete Bridge
- 13370 Steel Bridge
- 13371 Steel Bridge
- 13372 Steel Bridge
- 13373 Steel Bridge
- 13374 Concrete Bridge
- 13375 Culvert

Treatment Name: Bridge Repl... Deck Replac... Deep Over... Deep Over... Epoxy Ove...

Risk Profile: Number o... High Criticality Assets Low Criticality Assets

**Time Frame (years)**

100

**\$25.76M**  
Estimated Total Cost

Asset Name	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
12734 Steel Bridge						\$52,720.9868										\$326,000.00
13364 Culvert							\$940,908									
13365 Steel Bridge										\$626,177.5939						
13366 Concrete Bridge		\$89,972.2														
13367 Concrete Bridge		\$158,014.24														
13368 Concrete Bridge		\$24,091.9842										\$80,507.58				
13369 Concrete Bridge		\$17,793.775										\$59,460.4				
13370 Steel Bridge		\$54,980.9713										\$367,181.9489				
13371 Steel Bridge						\$171,500.5604										
13372 Steel Bridge						\$37,930.1799										\$233,000.00
13373 Steel Bridge						\$88,373.8885										
<b>Total</b>		<b>\$344,853.1705</b>				<b>\$350,525.6156</b>	<b>\$940,908</b>			<b>\$626,177.5939</b>		<b>\$507,149.9289</b>				<b>\$559,750.00</b>

## Wrap-Up

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