



2022

AAEES - Resilient Utility Management - Plan, Respond, Recover and Adapt

Combating Aging Infrastructure Risks

NJWEA Workshop

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Hazen and Sawyer

Hazen

Today's Agenda

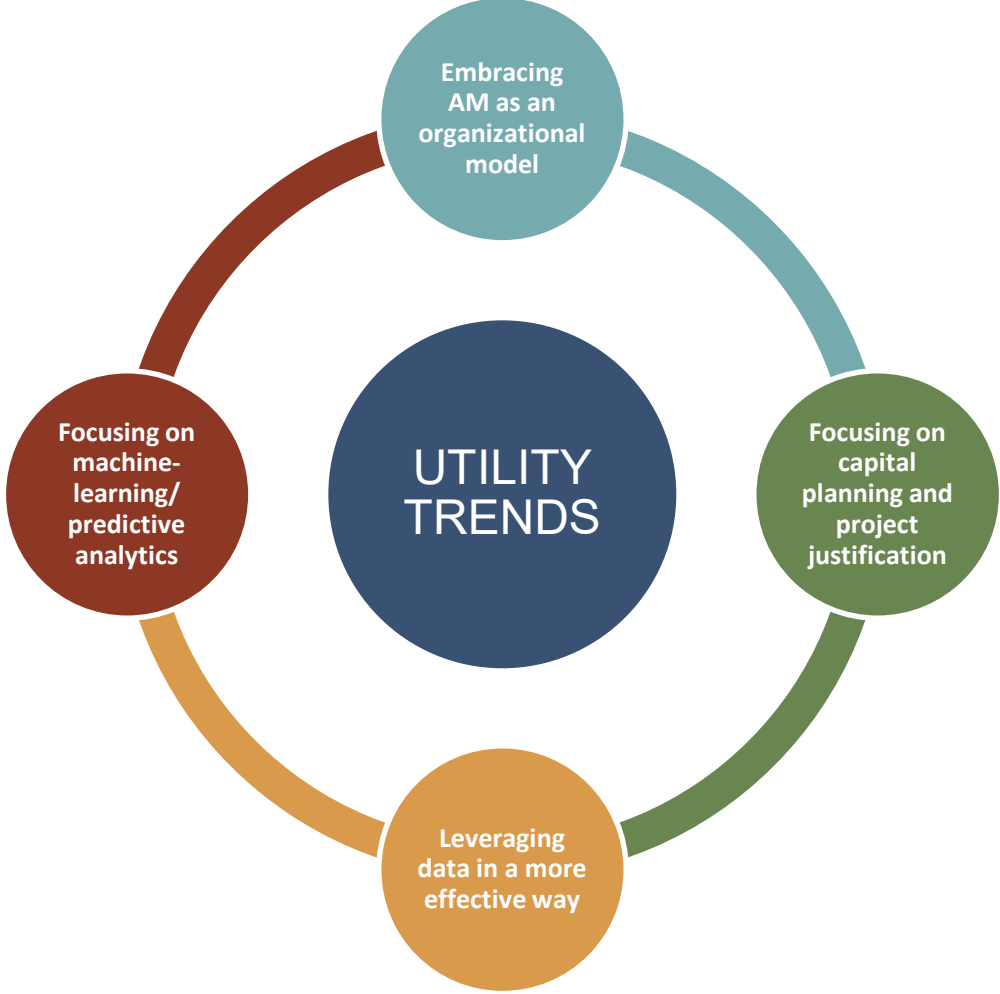
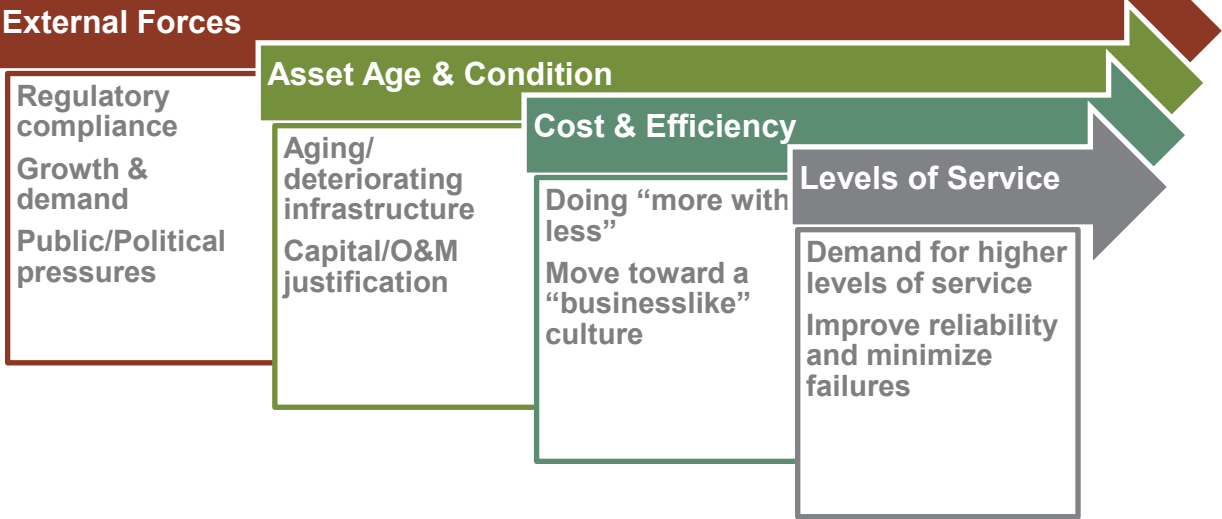
- Asset Management Background and Industry Trends
- Gap Analysis, Strategy & Levels of Service Development
- Business Planning
- Infrastructure Evaluation/Planning
- Financial Management/Planning
- Business Intelligence and Performance Reporting

Current Industry Asset Management Trends

CHALLENGES



DRIVERS



What is Asset Management?

Asset Management is not...

- a piece of software
- management of stocks and bonds
- synonymous with “construction management” or “managing assets”
- a project with a defined beginning and end

Asset Management is...

- a formalized approach to doing business
- management of a portfolio of physical infrastructure
- A broader focus than managing assets (things you do to assets)
- A journey of continuous improvement that optimizes the delivery of value for the City and its constituents



Asset Management is the art and science of making the right decisions and optimizing the delivery of value.

Institute of Asset Management

Outcomes and Benefits of Effective Asset Management

Transparency in government

- Knowledge of asset, system, and constituent needs
- Know where resources are allocated
- Understand the impact of financial investment

Ability to “do more with less”

- Optimize existing assets before constructing new
- Lower lifecycle costs of assets
- Work smarter, not harder
- Enhance existing workflows to be more effective and efficient
- Obtain more value for the same financial investment

Proactive management of physical infrastructure

Planned expenditures to ensure financial sustainability

Long-term customer service and regulatory **compliance**

Equitable and defensible decisions with widespread understanding and acceptance



A failure in the heart of the Boston's Financial District (Source: The Boston Globe)



Airline industry adopted better AM Practices in 1960s & 1970s

Before AM – 60 crashes per million takeoffs

After AM – 2 crashes per million takeoffs & 40% lower total maintenance costs

Typical Asset Management Initiatives



**Gap Analysis,
Strategy & LOS
Development**



**Business
Planning**



**Infrastructure
Evaluation/Planning**



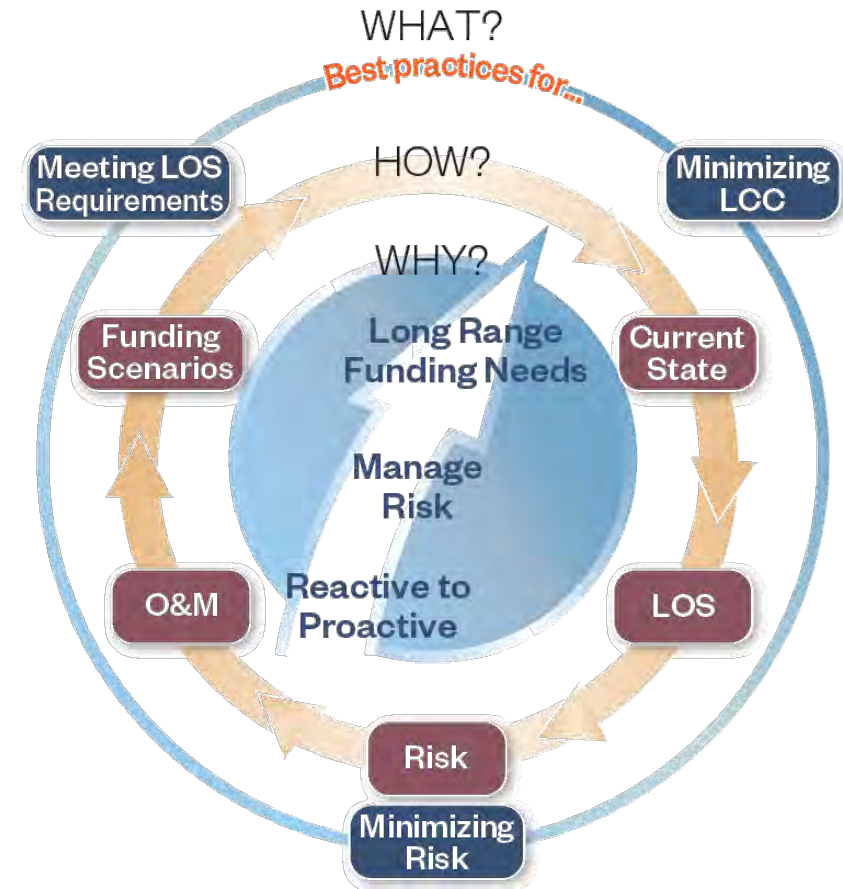
**Financial
Management/Planning**



**Business Intelligence
and Performance
Reporting**

Gap Analysis and Strategy Development

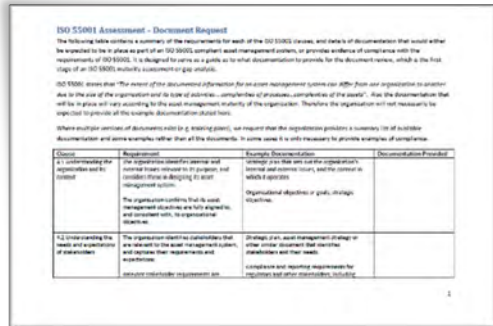
All Asset Management Frameworks Are Aimed at Optimizing Level of Service, Risk and Life Cycle Cost



Asset Management Framework Maturity Assessment

Institute of Asset Management Maturity Assessment

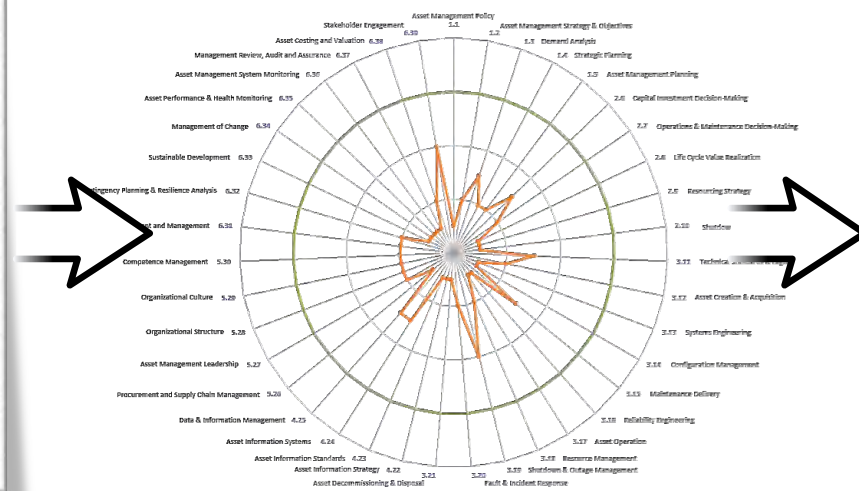
Data Gathering



Staff Interviews

Question ID	Objective	Sub-objective	Question
1	4	Understanding the organization and its context	How has the organization determined external issues relevant to its purpose that impact on its ability to achieve the intended outcomes of its asset management system?
2	4	Understanding the organization and its context	How has the organization determined internal issues relevant to its purpose that impact on its ability to achieve the intended outcomes of its asset management system?
3	4	Understanding the organization and its context	Are the asset management objectives, included in the strategic asset management plan (SAM), aligned to, and consistent with, the organization's objectives?
4	4	Understanding the needs and expectations of stakeholders	How has the organization identified the stakeholders that are relevant to the asset management system, and determined the requirements and expectations of these stakeholders with respect to asset management?
5	4	Understanding the needs and expectations of stakeholders	How has the organization taken into account stakeholder needs in determining the criteria for asset management decision-making?
6	4	Understanding the needs and expectations of stakeholders	How has the organization determined stakeholder requirements for recording financial and non-financial information relevant to asset management, and for reporting on a going concern and externally?
7	4	Understanding the scope of the asset management system	Has the organization established the scope of the asset management system?
8	4	Asset management system	What has the organization done to establish, implement, maintain and continually improve its asset management system?
9	4	Asset management system	Has the organization developed and documented a strategic asset management plan (SAM), also referred to as an Asset Management Strategy?
10	5	Leadership	How has top management demonstrated leadership and commitment in establishing the asset management system?
11	5	Leadership	How has top management demonstrated leadership and commitment to the asset management system by ensuring adequate resources are available?
12	5	Leadership	How has top management ensured that the approach used for managing job in asset management is aligned with the organization's approach for managing risk?
13	5	Policy	Has top management established an asset management policy that is appropriate to the purpose of the organization, provides a framework for setting asset management objectives, includes a commitment to satisfy applicable requirements, and includes a commitment to continual improvement of the asset management system?
14	5	Organizational roles, responsibilities and authorities	Has top management ensured that the responsibilities and authorities for relevant roles are assigned and communicated within the organization?
15	6	Actions to address risks and opportunities for the asset management system	What documented process(es) and/or procedure(s) does the organization have in place for the management of asset related risks and opportunities throughout the asset life cycle?
16	6	Actions to address risks and opportunities for the asset management system	How does the risk assessment methodology take into account the organization's internal and external issues, and stakeholder requirements?

Scoring



Validation

Group 1 - Strategy & Planning

- Asset Management Policy
- Asset Management Strategy
- Capital Plan
- Demand Analysis
- Asset Management Planning

Group 3 - Life Cycle Delivery

- Technical Standards & Legislation
- Asset Creation & Acquisition
- Systems Engineering
- Configuration Management
- Maintenance Delivery
- Reliability Engineering
- Asset Operations
- Resource Management
- Shutdown & Outage Management
- Fault & Incident Response
- Asset Decommissioning & Disposal

Group 5 - Organisation & People

- Procurement & Supply Chain Management
- Asset Management Leadership
- Organisational Structure
- Organisational Culture
- Competence Management

Group 2 - Asset Management Decision-Making

- Capital Investment Decision-Making
- Decision & Maintenance
- Decision-Making
- Lifecycle Value Realisation
- Resource Strategy
- Shutdowns & Outage Strategy

Group 4 - Asset Information

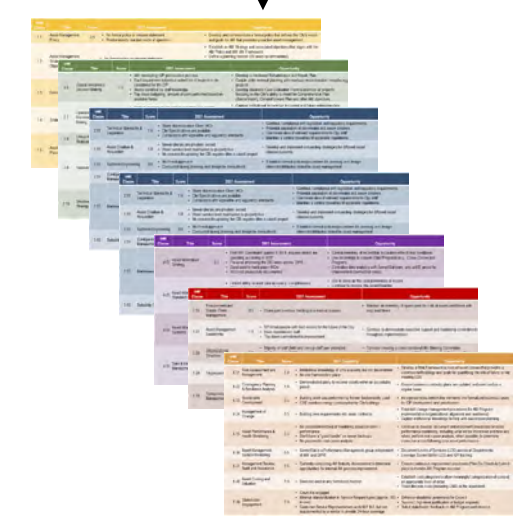
- Asset Information Strategy
- Asset Information Standards
- Asset Information Systems
- Data & Information Management

Group 6 - Risk & Review

- Risk Assessment & Management
- Contingency Planning & Resilience Analysis
- Sustainable Development
- Management of Change
- Asset Performance & Health Monitoring
- Asset Management System Monitoring
- Management Review, Audit & Assurance
- Asset Costing & Valuation
- Stakeholder Engagement



Maturity Level 0	Maturity Level 1	Maturity Level 2	Maturity Level 3	Maturity Level 4	Maturity Level 5
The City has not recognized the need for this requirement and/or there is no evidence of commitment to put it in place	The City has identified the need for this requirement and there is evidence of intent to progress it	The City has identified the means to systematically and consistently achieving the requirements, and can demonstrate that these are being progressed with credible and resourced plans in place	The City can demonstrate that it systematically and consistently achieves relevant requirements set out in the IAM Anatomy	The City can demonstrate that it is systematically and consistently optimizing its asset management practice, in line with the City's objectives and operating context	The City can demonstrate that it employs the leading practices and achieves the maximum value from the management of its assets, in line with the City's objectives and operating context



Implementation Roadmap Development Process

Identify and Validate Improvement Initiatives

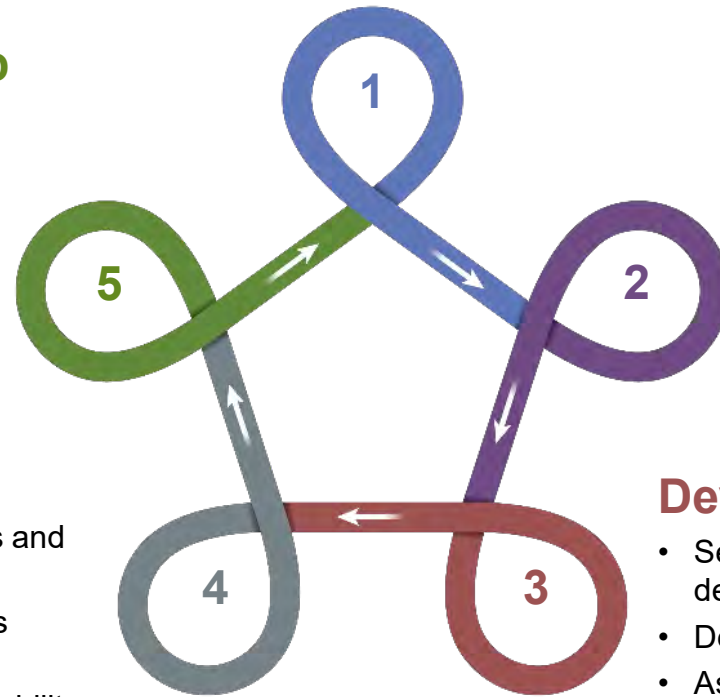
- Initiatives based on gaps discovered during Maturity Assessment
- Aligned with each group and element of the Institute of Asset Management Framework

Finalize Implementation Roadmap

- Finalize sequence of Initiatives, schedule, budget, and resources
- Develop Initiative Workplans for Immediate Priority Initiatives
- Begin communication efforts to inform and gain support

Validate

- Review with stakeholders and validate and refine
- Re-organize initiatives, as appropriate
- Confirm and update availability of resources



Prioritize Initiatives

- Define priority by desired start date
- Consider predecessors and dependencies

Develop Implementation Roadmap

- Sequence Initiatives according to priority and dependencies
- Define Start/Finish/Duration
- Assign resources and responsibilities
- Identify other key stakeholders
- Develop planning-level budget

Program Implementation Initiatives and Implementation Roadmap

Initiative	Description	Start	End	Duration	Color
Initiative 1	Yellow
Initiative 2	Green
Initiative 3	Blue
Initiative 4	Purple
Initiative 5	Red
Initiative 6	Orange
Initiative 7	Tan

Program Implementation Initiatives and Implementation Roadmap

No.	Institute of AM Standard	Initiative	Brief Description	Predecessors	Priority
Group 1 - Strategy and Planning					
S1	Asset Management Policy	Develop organization-wide Asset Management Policy statement	A statement of commitment to what COS must do to deliver and comply.		Immediate
S2	Asset Management Strategy & Objectives	Define the scope of the AM Program	Intention for the whole asset portfolio; verification of the business units and the asset classes for which they are responsible and the supporting functions (IT, GIS, HR, etc.)		Immediate
S3		Develop the AM strategy and objectives	Written description of what is intended to be done (the strategy) and what must be delivered (objectives). Reinforces the alignment between strategic directions and tactical delivery.	parallel w S2	Immediate
S4	Demand Analysis	Establish strategic Levels of Service	List of constituent-centric statements typically driven by regulatory requirements and customer expectations that communicate COS's commitment to deliver service at a specified level of quality and reliability.	S2	Immediate
S5	Strategic Planning	Develop a Strategic Asset Management Plan (SAMP) that encompasses IAM, DWP, W&S, and associated divisions	Document that aligns with City-level strategic planning documents and includes an AM Policy Statement, specific AM Strategic Objectives, definition of assets covered, definition of AM framework adopted, business units impacted, and associated procedures. Takes a long-term view and considers the combination of organization needs, stakeholder expectations, and the realities of existing assets and AM capabilities. Sets the stage for system-level Asset Management Plans.	S2	Immediate / Near-term
S6	Asset Management Planning	Develop system-specific AMPs for asset systems identified in the SAMP	Asset management plans (paper or digital) for each major asset class will include: - Performance against levels of service - Asset condition - Future demands - Risk assessment - Life-cycle management plan - Rehabilitation and replacement needs - Capital and operating and maintenance budget forecasts	S5	
		Asset System A (Collection and Conveyance System)			Immediate / Near-term
		Asset System B (TBD)			Near-term
		Asset System C (TBD)			Medium-term

Initiative Workplan Development

Consistently Apply Risk Assessment Framework Across All Asset Classes

Apply the framework developed in R1a to specific asset classes included in the scope of the Asset Management Program. The result of this initiative is a series of scoring matrices specific to each asset class, which will be used subsequently to compute initial asset risk scores.

Executive Sponsor	Division or Department Director	Key Stakeholders	Desk Foreman Relevant department staff (TBD)
Champion	Jonathan Smith, Project Manager		
Initiative Owner	Hazen (in existing scope)		

Institute of Asset Management Group	Risk and Review
Institute of Asset Management Element	Risk Assessment and Management

Priority: Immediate Near-Term Medium-term Long-Term

Funding Strategy: Conform with Hazen

Implementation	Low	High	People	Process	Technology	Date
Costs (\$55 Thousands)	20	40	100%	100%	100%	100%

Current State (Issues/Problems/Concerns)

Based on the 2021 Maturity Assessment and institutional knowledge, the following statements describe the current challenges within the City of Somerville:

- Departments use project-specific assessment of risk when prioritizing CIP projects, but a consistent application of the risk assessment methodology across the City's entire portfolio of assets or within an asset class does not yet exist. Understanding the current risk landscape positions the City to proactively manage it.
- With the exception of the water distribution system, the City has not yet conducted a risk-based analysis for its major asset classes. A formal risk-based assessment across the major asset classes will allow the City to prioritize assets for inspection and renewal and optimize funding to obtain the greatest overall benefits. Risk scoring will also help build the case for increased funding by demonstrating the increase in risk of failure without further investment.
- Prioritization of work activities vary by department and asset class. Risk scoring of assets can play a key role in making informed decisions about where to invest time and resources.

Workplan Elements

- Executive Sponsor / Champion / Owner / Key Stakeholders
- IAM Conceptual Model Group/Element
- Priority
- Funding Strategy
- Implementation Costs
- Current State (Issues/Problem/Concerns)
- Future State (Desired Specific/Measurable Outcomes)
- Investigation and Solution Planning Tasks (Key Activities)

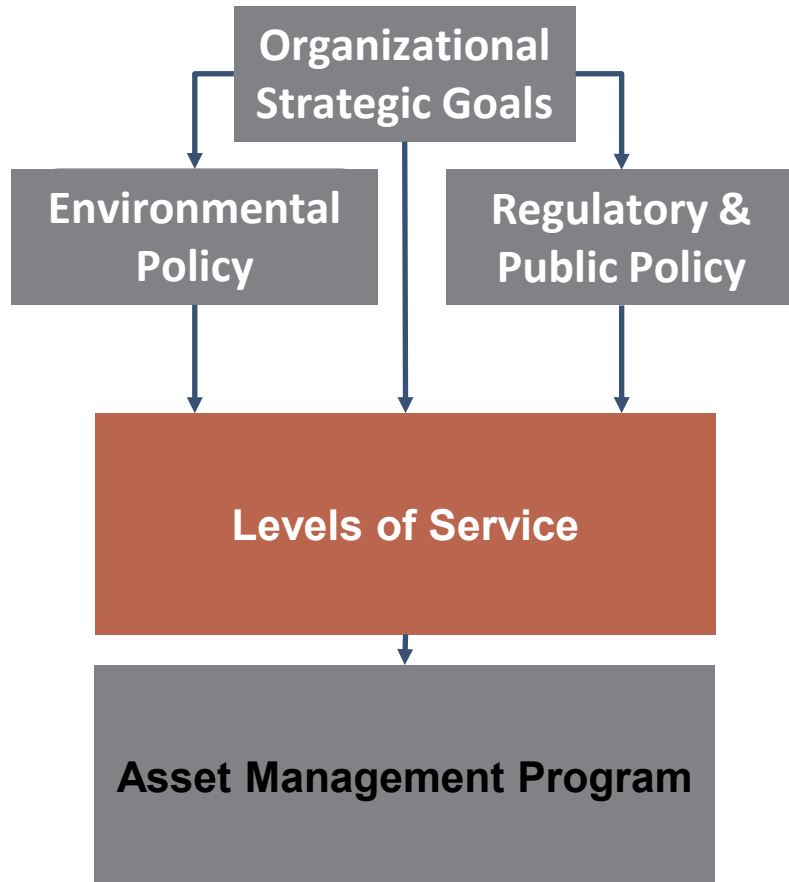
Future State (Desired Specific/Measurable Outcomes)

Desired Outcomes	Success Measures (KPIs)
Staying within the agreed upon risk level tolerance	Tracking of risk rating for each asset class
Reliable risk scores for all major asset classes throughout IAM, DPW and W&S	% of assets/asset classes with computed risk scores stored as an attribute in an enterprise data management system
Obtaining adequate funding to meet agreed upon risk threshold and desired levels of service	% of required funding needs that are approved

Investigation and Solution Planning Tasks (Key Activities)

- Work performed for this initiative will likely be conducted simultaneously with R1a.**
1. Using the standardized risk framework developed under Initiative R1a, adapt the framework to reflect asset class-specific criteria. In a workshop setting, develop quantifiable criteria for each scoring category for both (method of failure (LOF) and consequence of failure (COF). Relevant triple-bottom-line criteria (financial, social, and environmental) should be considered.
 2. Validate the availability and quality of asset data to quantify LOF and COF. Propose solutions to fill data gaps or adjust criteria, as needed, to accommodate them.
 3. Identify critical assets within the asset class.
 4. Develop draft and final scoring matrices for each asset class that includes criteria, scores, and weightings to compute LOF and COF. Externally applied factors to account for redundancy and/or criticality should also be considered and applied, as appropriate.

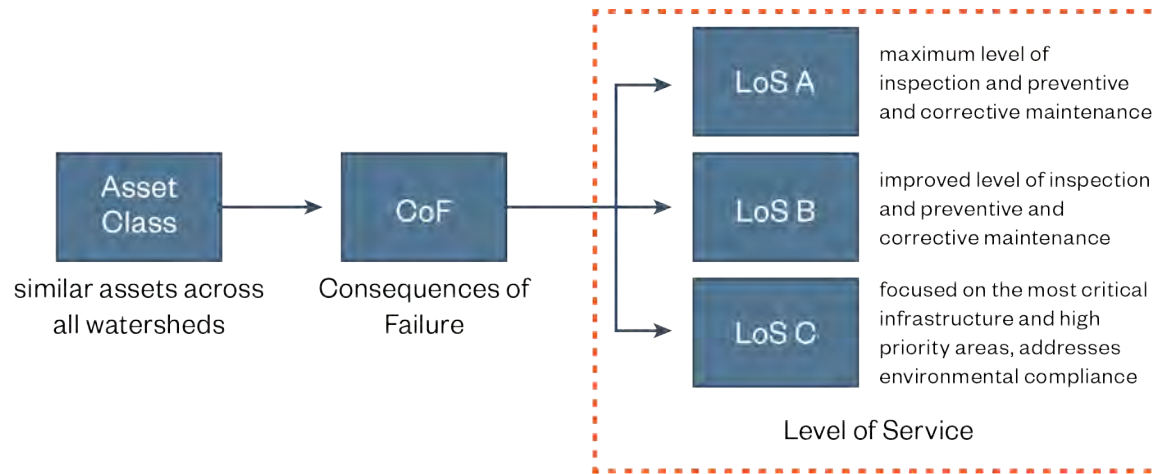
Levels of Service (LOS)



- A **commitment** to deliver a specified level of service, quality, and reliability
- Determined by the appropriate governing body in **collaboration** with utility staff and customers
- Relate to **funding** levels
- Describe **how much, of what nature, and how frequently** the service should be provided
- Help determine when to **maintain, replace, or rehabilitate** assets

Levels of Service - *Example*

City of Fort Lauderdale Department of Public Works



✓ Establishes the appropriate level and type of resources to satisfy LoS requirements

✓ Establishes most efficient utilization of resources through effective planning & scheduling



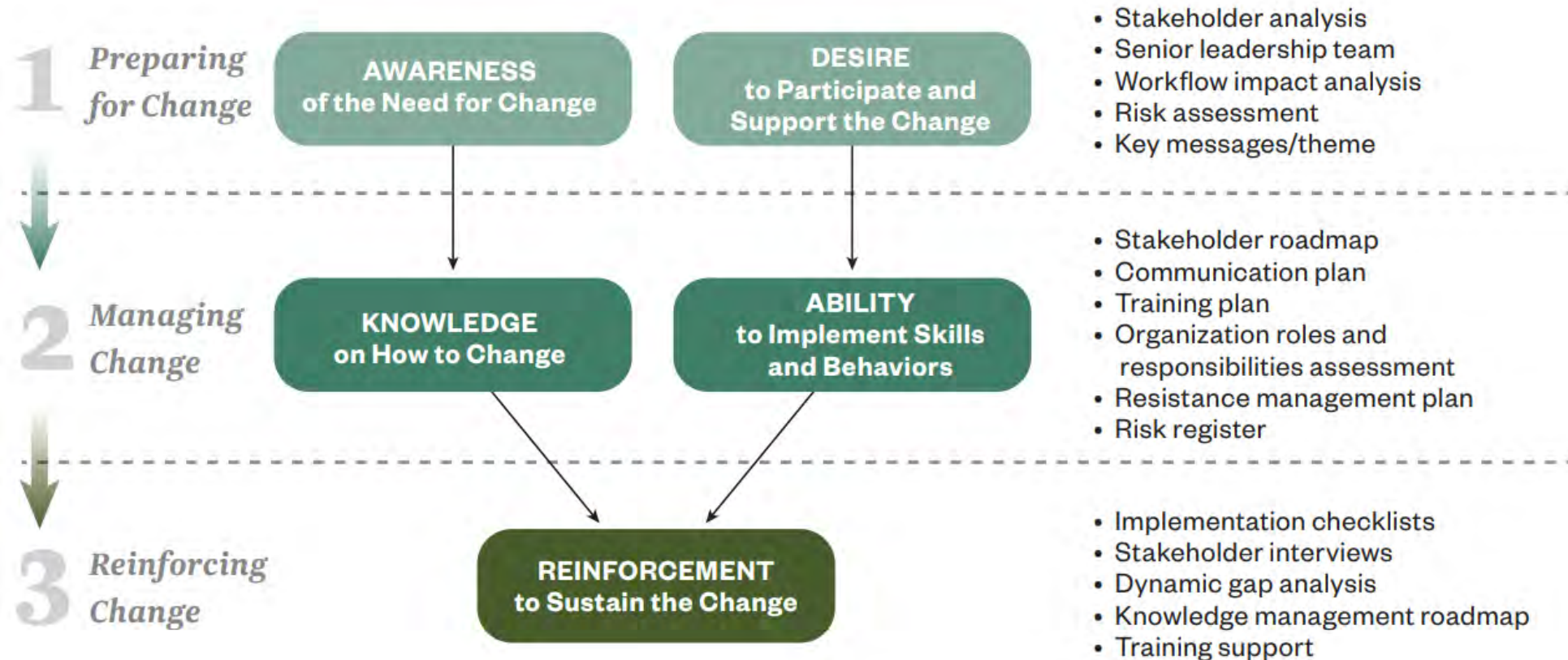
CITY OF FORT LAUDERDALE

Asset	LoS C	LoS B	LoS A
Control Valve	Inspect & test once annually	Inspect & test twice annually	Inspect & test quarterly
Inlet	Clean annually	Clean quarterly	Clean monthly
Manhole	Clean annually	Clean quarterly	Clean monthly
Gravity Main	WS 1,2,3,4,6,7,8, & 10 annual	WS 5 Semi-annual	WS 9 Quarterly
Pollution Control Structure	Inspect annually	Inspect quarterly	Inspect monthly
Pump Station	PS #3 quarterly	PS #4&5 monthly	PS #1&2 semi-weekly

Business Planning

Managing Organizational Change is Vital

Apply Throughout Development and Implementation



Asset Management Requires Key Organizational Roles / Responsibilities

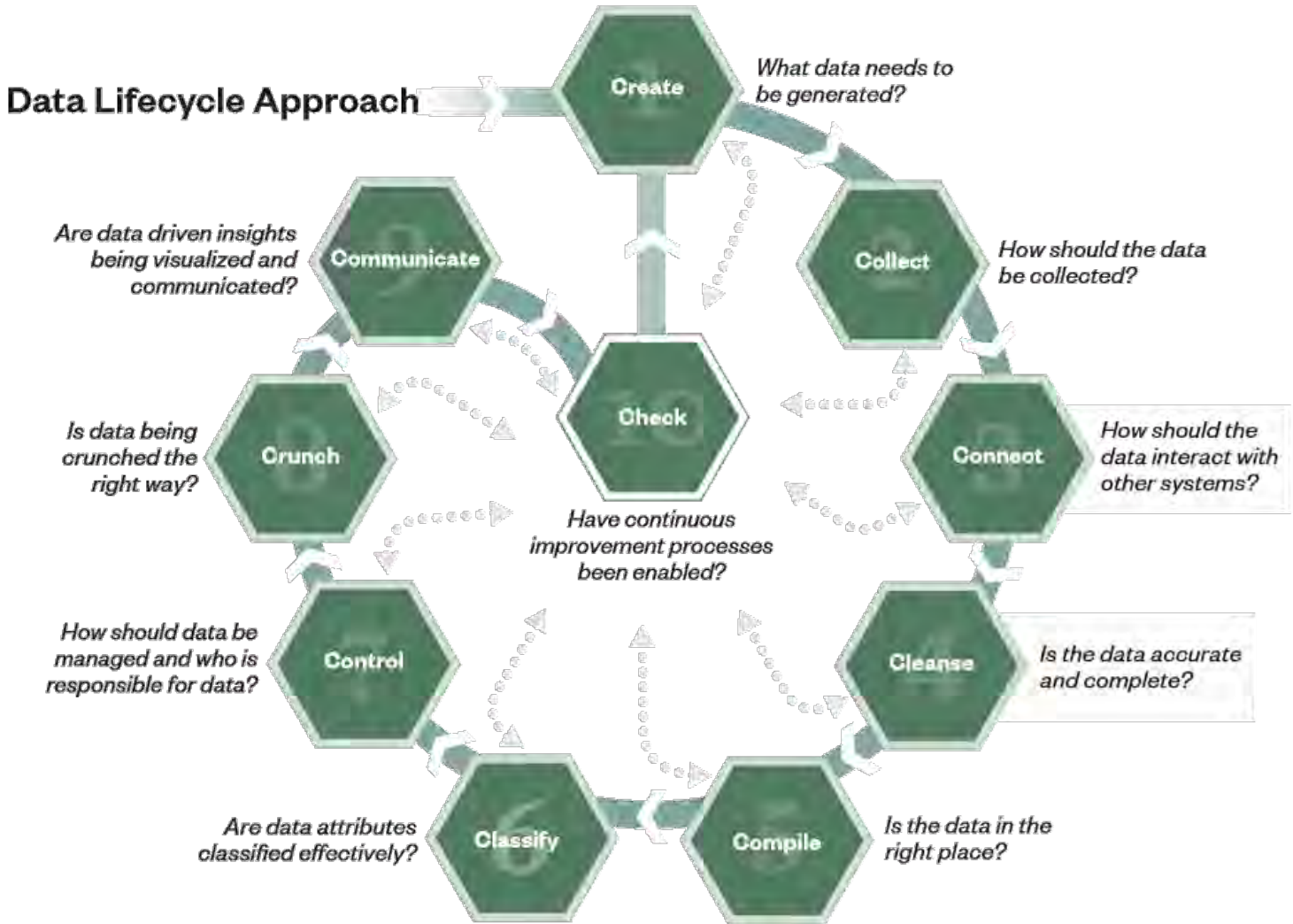


Balancing Diverse Business Drivers is the Key to Organizational Optimization for AM

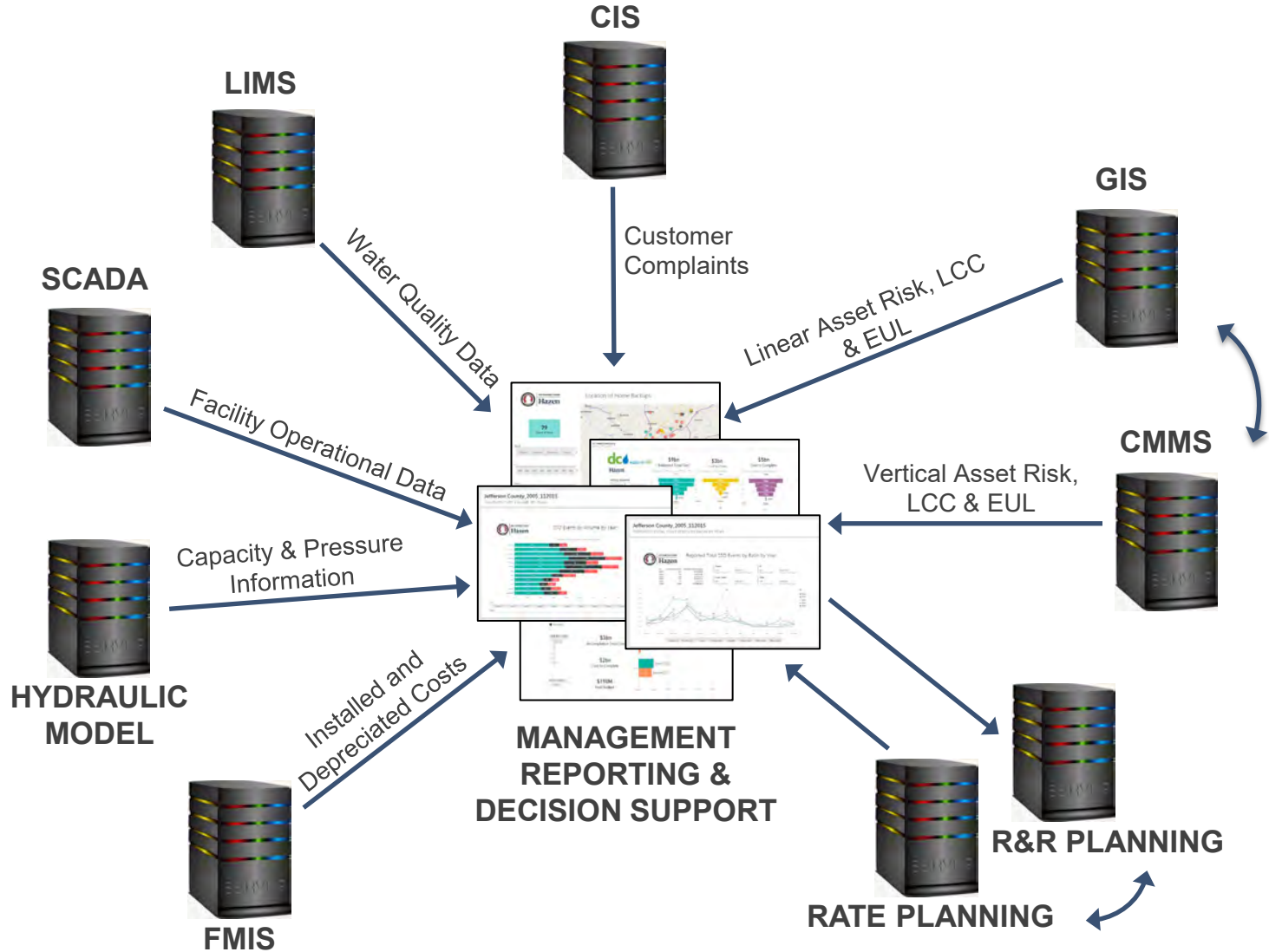
1. Business process workflow optimization
2. Staffing alignment with levels of service
3. Information management / system fitness
4. Knowledge capture & management
5. Performance measurement & tracking



Data / System Management



Streamlined Data Analysis and Integration

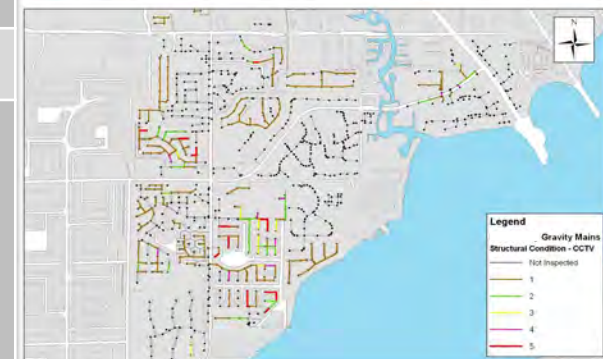
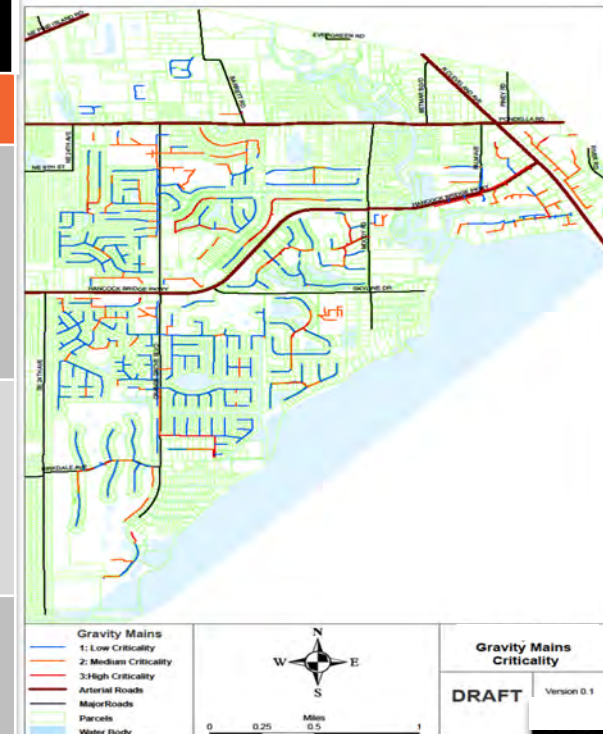


Infrastructure

Evaluation/Planning

Core Asset Management Tool – GIS (Linear Assets)

Pipeline Systems	
Attribute	Purpose
Length	<ul style="list-style-type: none"> Calculate asset value Indicate complexity of maintenance Calculate defects per foot of pipe Necessary for hydraulic modeling
Diameter	<ul style="list-style-type: none"> Calculate asset value Macro understanding of system performance Necessary for hydraulic modeling
Material	<ul style="list-style-type: none"> Calculate asset value Maintenance and repair methods Deterioration rates
Depth	<ul style="list-style-type: none"> Calculate repair costs
Installation Date	<ul style="list-style-type: none"> Calculate asset value Indicate quality of material and installation Future planning C-Factor determination for hydraulic modeling



Core Asset Management Tool – CMMS (Vertical Assets)

- **Focus on Core Functions 1st:**

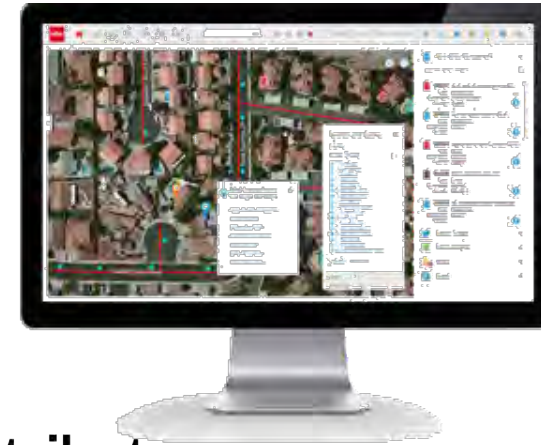
- Asset Inventory Completeness
- Work Order Management
- Risk Assessment
- Cost Accounting

- **Phase In Supporting Functions:**

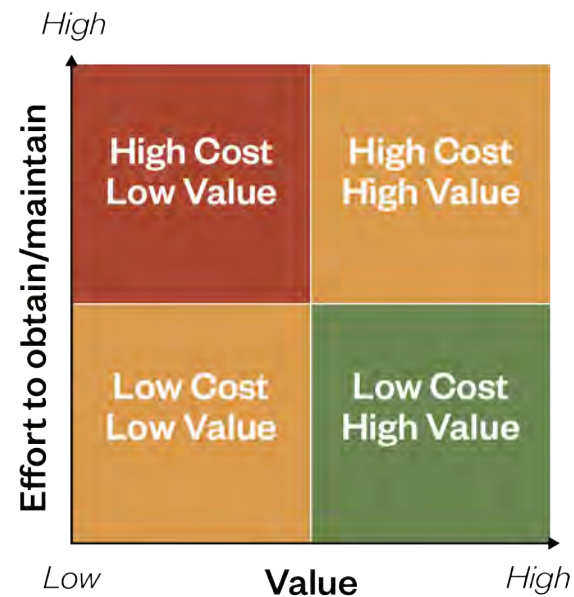
- Parts Management
- Purchasing
- Fleet Management

- **Key Technical Elements:**

- GIS Integration
- Reporting



Asset Attribute Prioritization



Typical Asset Hierarchy

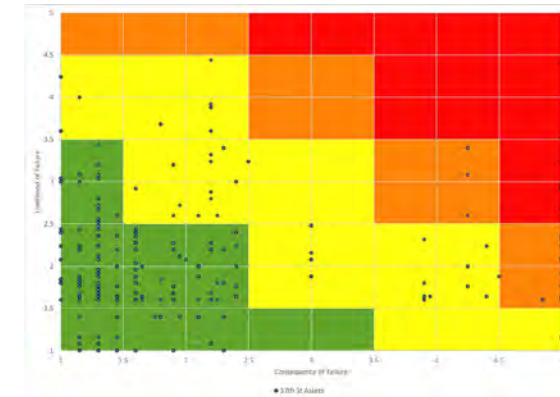


Asset Risk – How is it Defined?

Risk is defined as the quantification of the likelihood of failure (condition) times the quantification of the consequence of such failure (criticality), factoring in any required adjustments for redundancy or risk mitigation.



Criteria	Score				
	1	2	3	4	5
Regulatory Compliance	No impact	Eventual non-compliance if no response (typical response time would be adequate to avoid significant water quality violations). Non-compliance would have no repercussions.	Non-compliance if no response (typical response time would be adequate to avoid significant water quality violations). Non-compliance would result in fines from regulatory agencies.	Immediate localized impact before response (typical response time may or may not be adequate to avoid significant water quality violations). Non-compliance would result in fines from regulatory agencies.	Immediate widespread impact before response (typical response time would not be adequate to avoid significant water quality violations). Non-compliance would result in extensive fines from regulatory agencies and long term impact.
Level of Service	No impact	Eventual impact if no response (typical response time is expected to be adequate to avoid possible localized service interruption and reduced operational flexibility).	Impact if no response (typical response time is expected to be adequate to avoid possible significant capacity reduction, service interruption, reduced operational flexibility). Potential localized impact to surrounding downstream equipment.	Immediate localized impact before response (typical response time would not be adequate to avoid possible significant capacity reduction (can meet ADP but not peak or flow), service interruption, reduced operational flexibility). Localized impact to surrounding/downstream equipment.	Immediate widespread impact before response (typical response time would not be adequate to avoid possible significant capacity reduction (cannot meet peak and flow), service interruption, reduced operational flexibility). Impact to surrounding/downstream equipment.
Safety	No impact	N/A	Failure creates potential for damage to surrounding equipment.	N/A	Failure creates potential for injury to staff or the public (e.g. significant body injury and may damage environment such as chemical leak/explosion).
O&M Impacts	No impact	Short repair duration, low cost impact and can be repaired by in-house staff. No loss in redundancy.	Long repair duration, moderate cost, and can be repaired by in-house staff. No loss in redundancy.	Short repair duration, high cost, and requires outside expertise in addition to in-house staff. Limited redundancy (incidental for ADP, not peak or flow).	Long repair duration, high cost, and requires outside expertise in addition to in-house staff. No redundancy.



Likelihood of Failure

Failure Mode

- Mortality
- Level of Service
- Capacity
- Efficiency



Consequence of Failure

Consequences

- Economic
- Social/Safety
- Environmental

Redundancy Factor



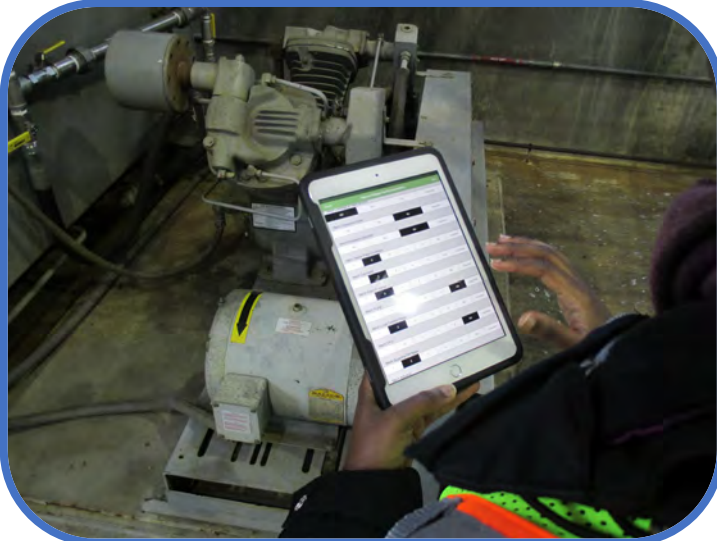
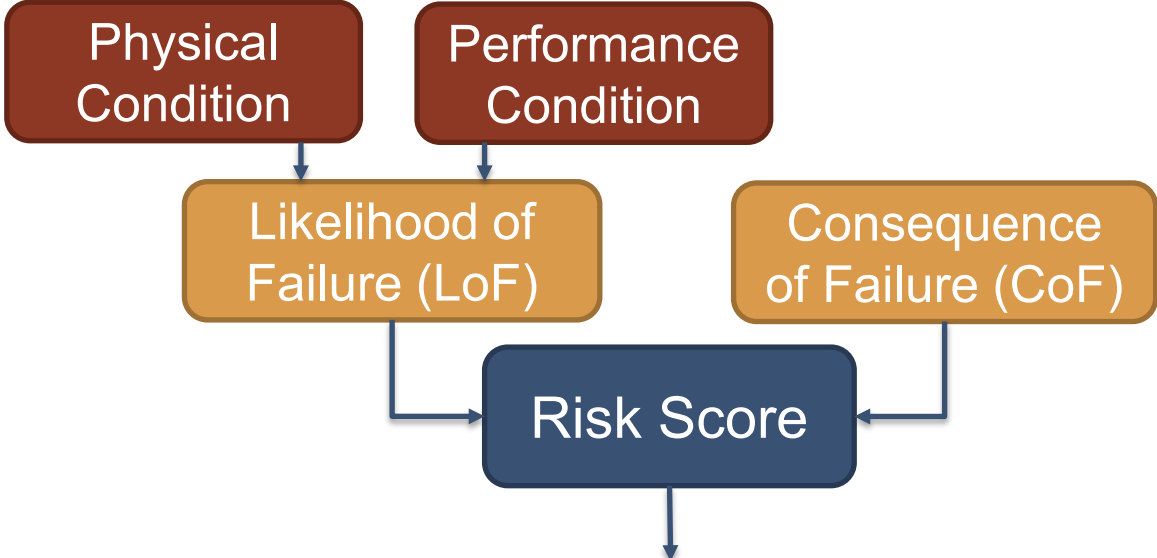
Risk Score

Likelihood

Consequence

Increasing Risk

Facility Risk Assessment



Risk Score = PoF * CoF		Probability of Failure (PoF)					Criticality Totals	Pump Station Risk Results	
		1 Very Good	2 Good	3 Fair	4 Poor	5 Very Poor			
Consequence of Failure (CoF)	1 Low Impact	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	Low	7 5%
	2	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%		Medium
	3 Medium Impact	7 5%	83 62%	27 20%	0 0%	0 0%	117 87%		
	4	2 1%	10 7%	4 3%	1 1%	0 0%	17 13%		
	5 High Impact	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	High	1 1%
Condition Totals		9 7%	93 69%	31 23%	1 1%	0 0%	134 100%		134 100%

Data Collection Strategies, Tools, and Technologies

- ESRI Survey-123
- Review, reconcile, and add asset inventory data
- Perform condition assessment
- Embed and link data, photos, as-builts
- Increase efficiency
 - Reduces time on site by 25%
 - Reduces time to transfer & QC data by 25%
 - Increases data quality

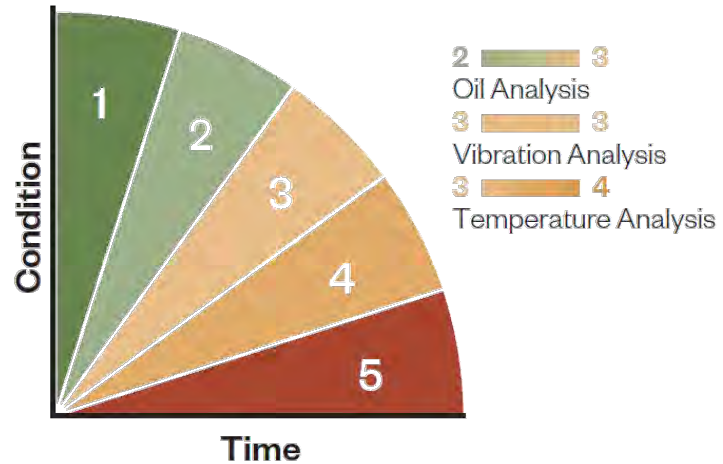


360° Photos Can Easily Link to Inspection Forms

Wet Well Inspection

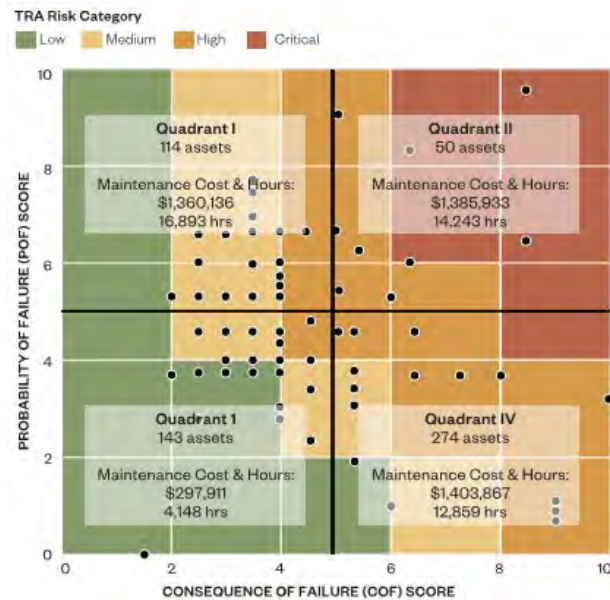


Risk-Based Inspection and Maintenance



Benefits:

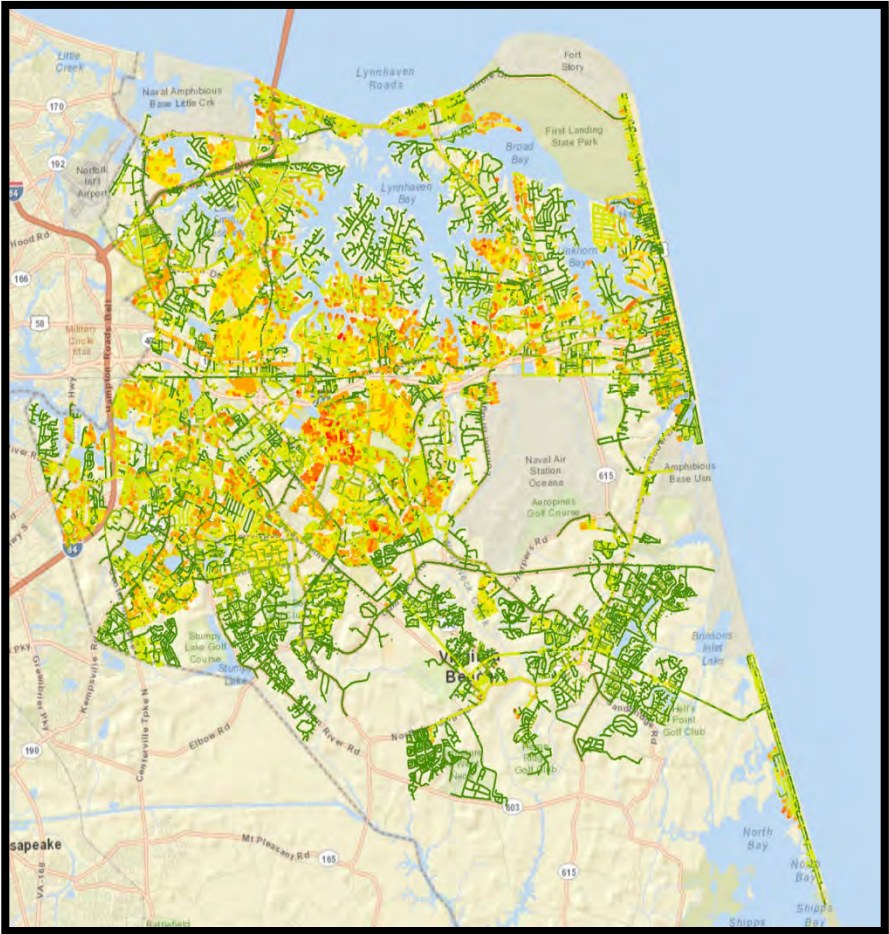
- Better estimate of EUL
- Avoid critical failures
- Optimize inventory and resources



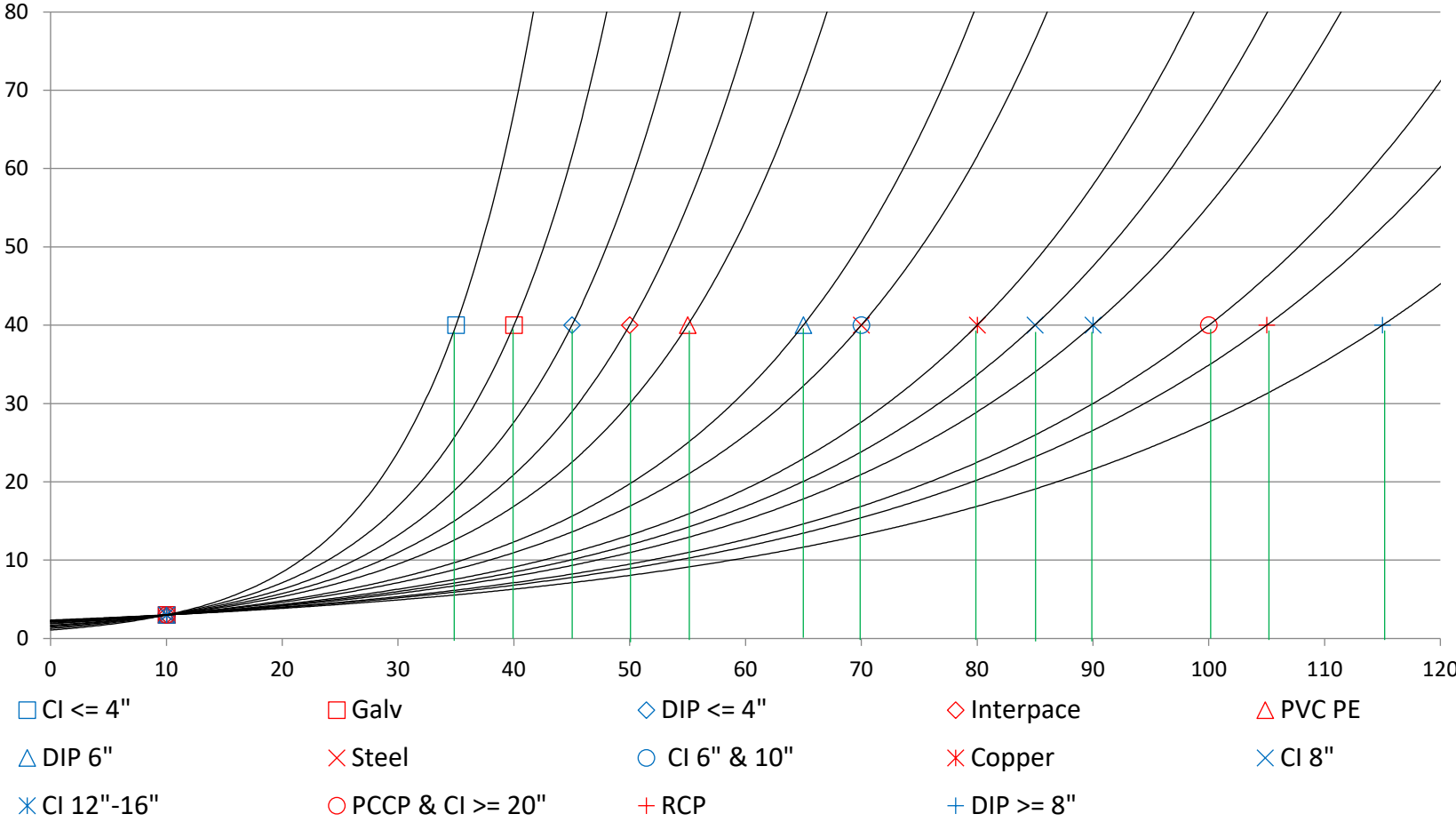
Inspection Program	Criticality	Maintenance
Visual + Performance + Testing	Highest	Time + Use + Condition
Visual + Performance	Moderate	Time + Use
Visual	Lowest	Time

Pipe Network Criticality (CoF)

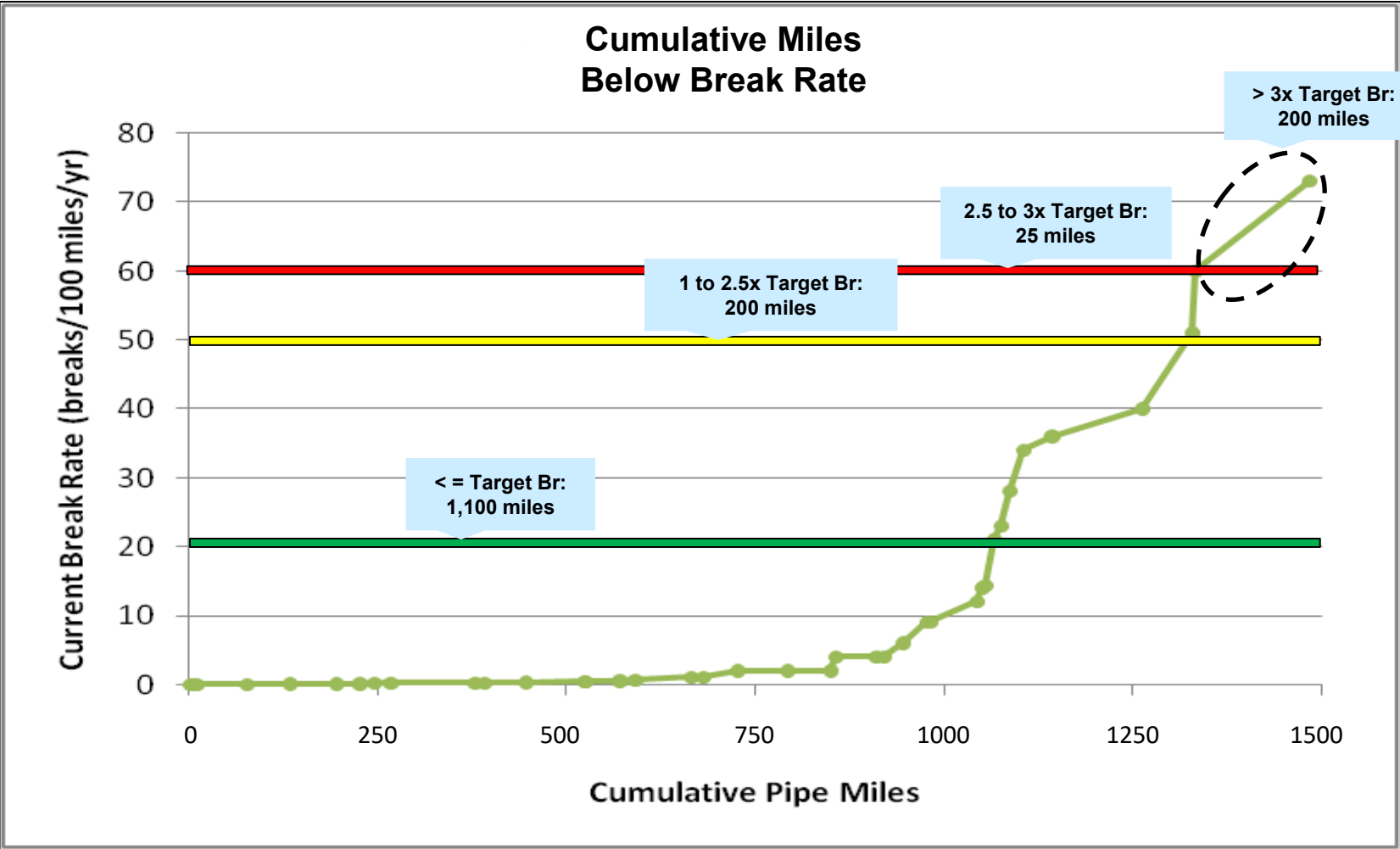
CRITERIA	CATEGORIES		
	Class 3 – High Criticality	Class 2 – Moderate Criticality	Class 1 – Minor Criticality
	Meets any Criteria Below	Meets no Class 3 Criteria and Meets any Criteria Below	Meets no Class 3 or Class 2 Criteria
Pipe Size	Diameter > = 16"	Diameter > = 10"	Meets no Class 3 or 2 Criteria
Traffic	Located on a road categorized as Interstate	Located on a road categorized as Primary	
Educational Services	Serving a college, university, or a high school	Serving a middle school, private school, elementary school, or technical school	
Health Services	Serving a medical facility, hospital, EMS, fire station, dialysis center, or authorized needs	Serving an assisted living center, nursing homes, or adult day care	
Military Services	Serving Military Facilities	-	
Municipality Services	Serving Critical Municipal Facilities (Courthouse, City Hall etc.)	-	
Entertainment Services	Serving Virginia Beach Amphitheater/Sportsplex/ Convention Center	Serving a community youth organization	



Pipe Cohort EUL Using Break Rate and LOS



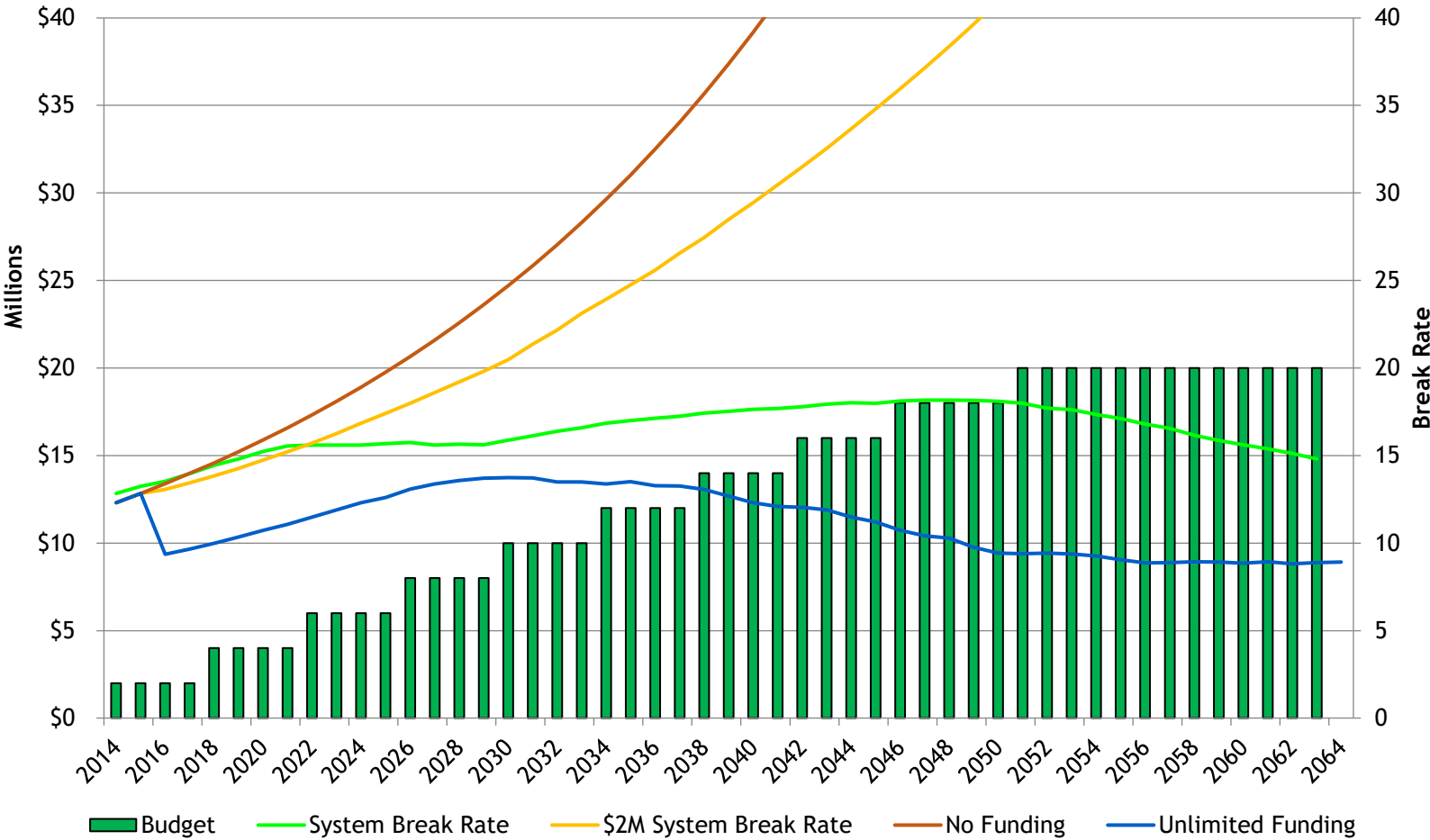
Risk and LOS Prioritization



LOS Assessment and Funding Analysis



Annual Funding Analysis



Financial Management/Planning

CIP Prioritization Leveraging Risk Assessment

1

Asset Prioritization through Risk Analysis



Project Scoping and Bundling

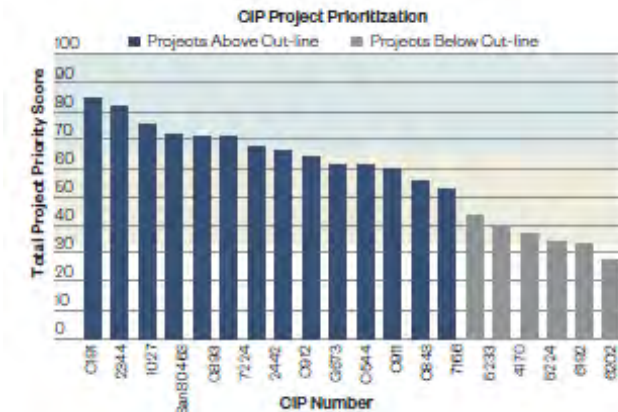
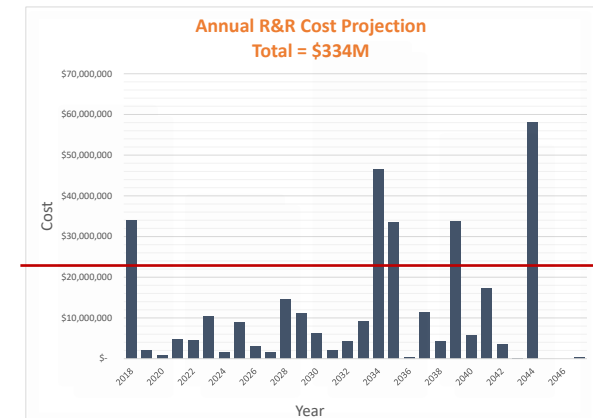


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Project Prioritization

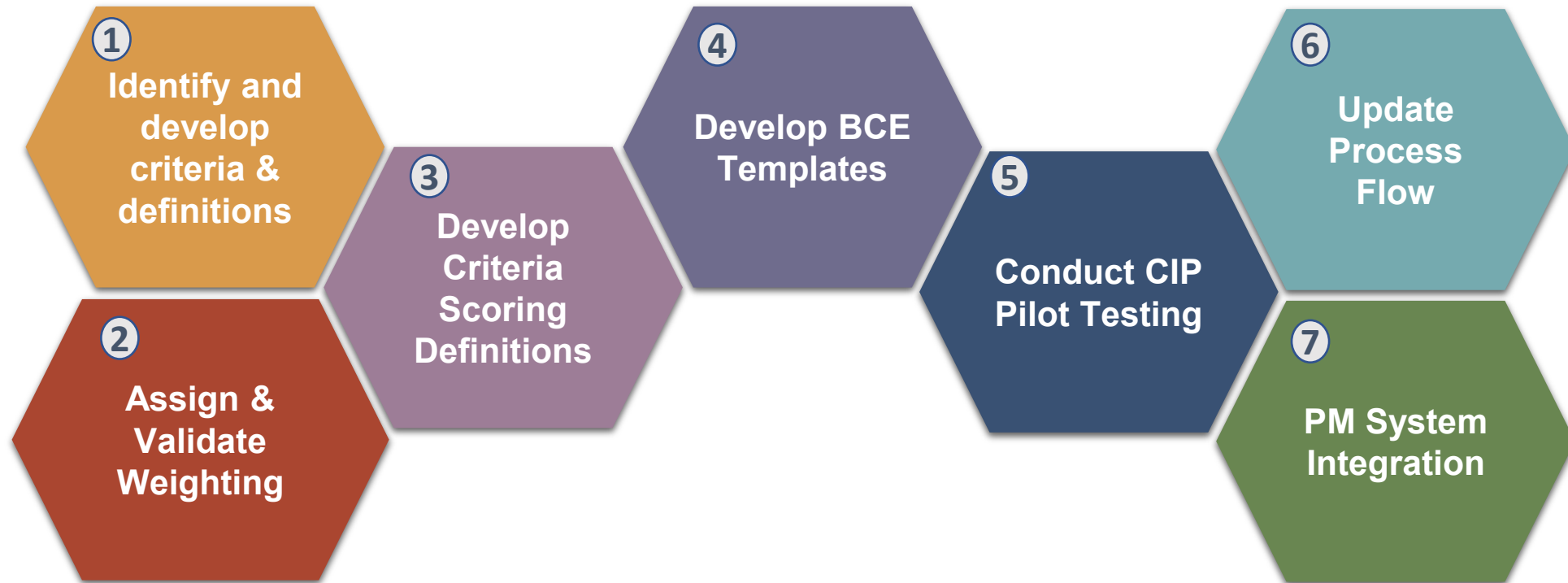
Risk Assessment

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		1 Very Good	2 Good	3 Fair	4 Poor	5 Very Poor			
Consequence of Failure (CoF)	1 Low Impact	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	Low	7 5%
	2	0 0%	0 0%	0 0%	0 0%	0 0%			
	3 Medium Impact	7 5%	83 62%	27 20%	0 0%	0 0%	117 87%	Medium	126 94%
	4	2 1%	10 7%	4 3%	1 1%	0 0%	17 13%		
	5 High Impact	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	High	1 1%
Condition Totals	9 7%	93 69%	31 23%	1 1%	0 0%	134 100%	134 100%		



CIP Planning and Prioritization Process

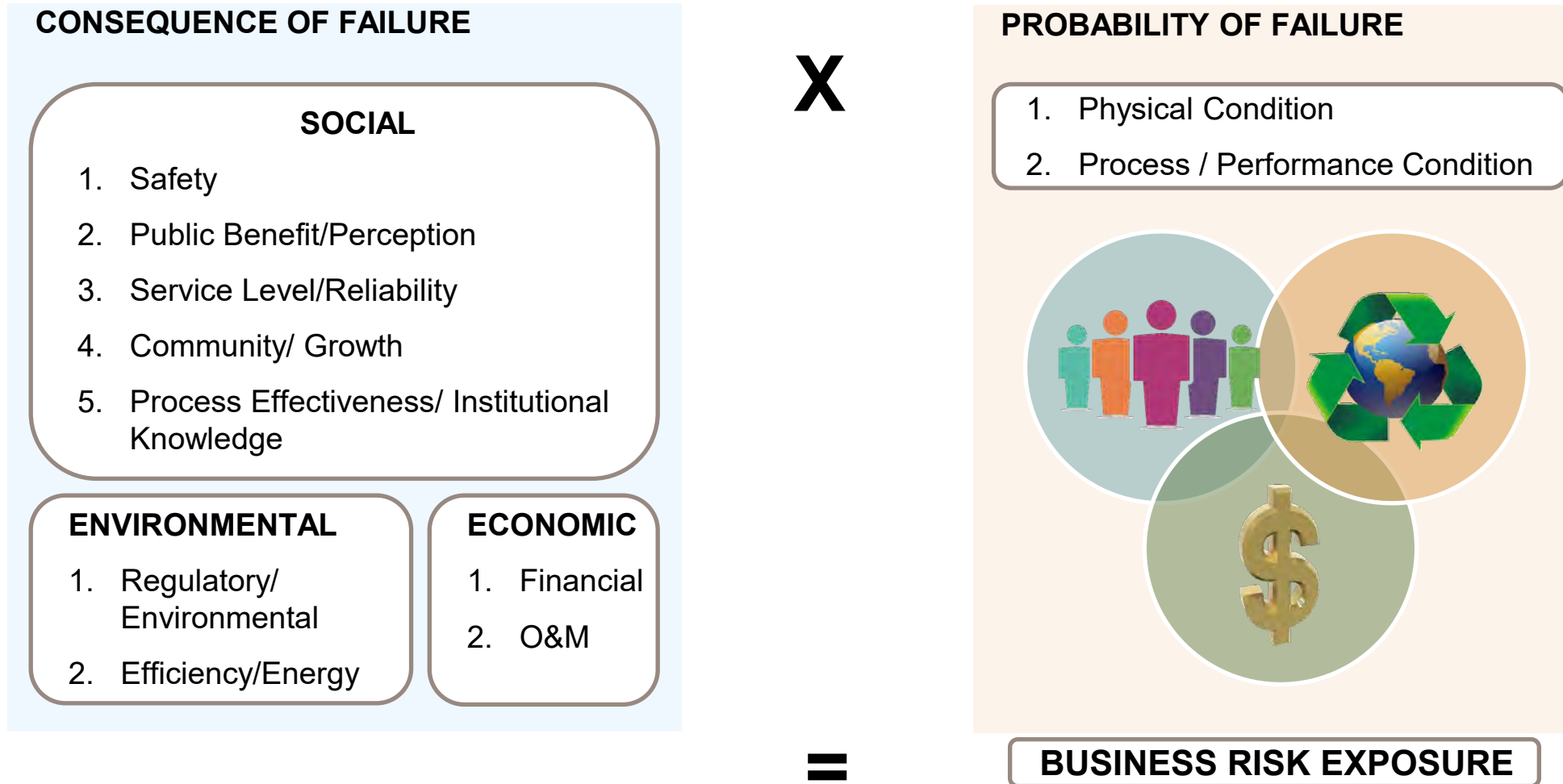
*Creating a level playing field for **apples-to-apples comparison** of projects across all **organizational Divisions, Branches, and ASSETS***



Aligned with **Strategic Objectives** and **Asset Management Program**


Prioritization Aligned with Triple-Bottom-Line

Newport News Water Works



Develop BCE Templates

- Summary Information
- Project Driver
- Project Description and Justification
- Project Financial Analysis
- Project Schedule Detail
- Alternatives Evaluation
- Project Constraints / Dependencies
- Supporting Narrative
- Prioritization Analysis



WATERWORKS CAPITAL IMPROVEMENT PROGRAM (CIP) PROJECT

PROJECT NAME:

DEPARTMENT:

PHONE:

CONTACT PERSON:

PROJECT LOCATION:

DISTRICT:	SOUTH	
	CENTRAL	
	NORTH	
	CITYWIDE	

PRIORITIES	Economic Dev & Redev	
	Environmental Sustainability	
	Community Renewal & Maint	
	Fiscal Mgt & Efficient Ops	
	Max Emphasis Public Safety	
	Mandated/Legal Requirement	

PROJECT CATEGORY:

TOTAL ESTIMATED COST:

NEW PROJECT:


PROJECT DESCRIPTION and/or JUSTIFICATION:

FUNDING SOURCE(S):	2019	2020	2021	2022	2023	5-Yr Project Total
Funding Source Total:						

PROJECT COST:	2019	2020	2021	2022	2023	5-Yr Project Total
Project Total:						

IMPACT ON OPERATING BUDGET:

ANTICIPATED PERFORMANCE / OUTCOME MEASURES:


Page 1

Identify and Develop Criteria / Definitions...

12. PRIORITIZATION ANALYSIS		
Criteria	Project Manager Evaluation Score (1-5)	Justification / Explanation To be completed by Project Manager/Business Case Owner
Physical Condition		
Process/ Performance Condition		
Strategic Plan Alignment		
Regulatory/Environmental		
O&M		
Service Level / Reliability		
Safety		
Public Benefit		
Financial		
Efficiency / Energy		
Process Effectiveness / Institutional Knowledge		

Physical Condition Criteria

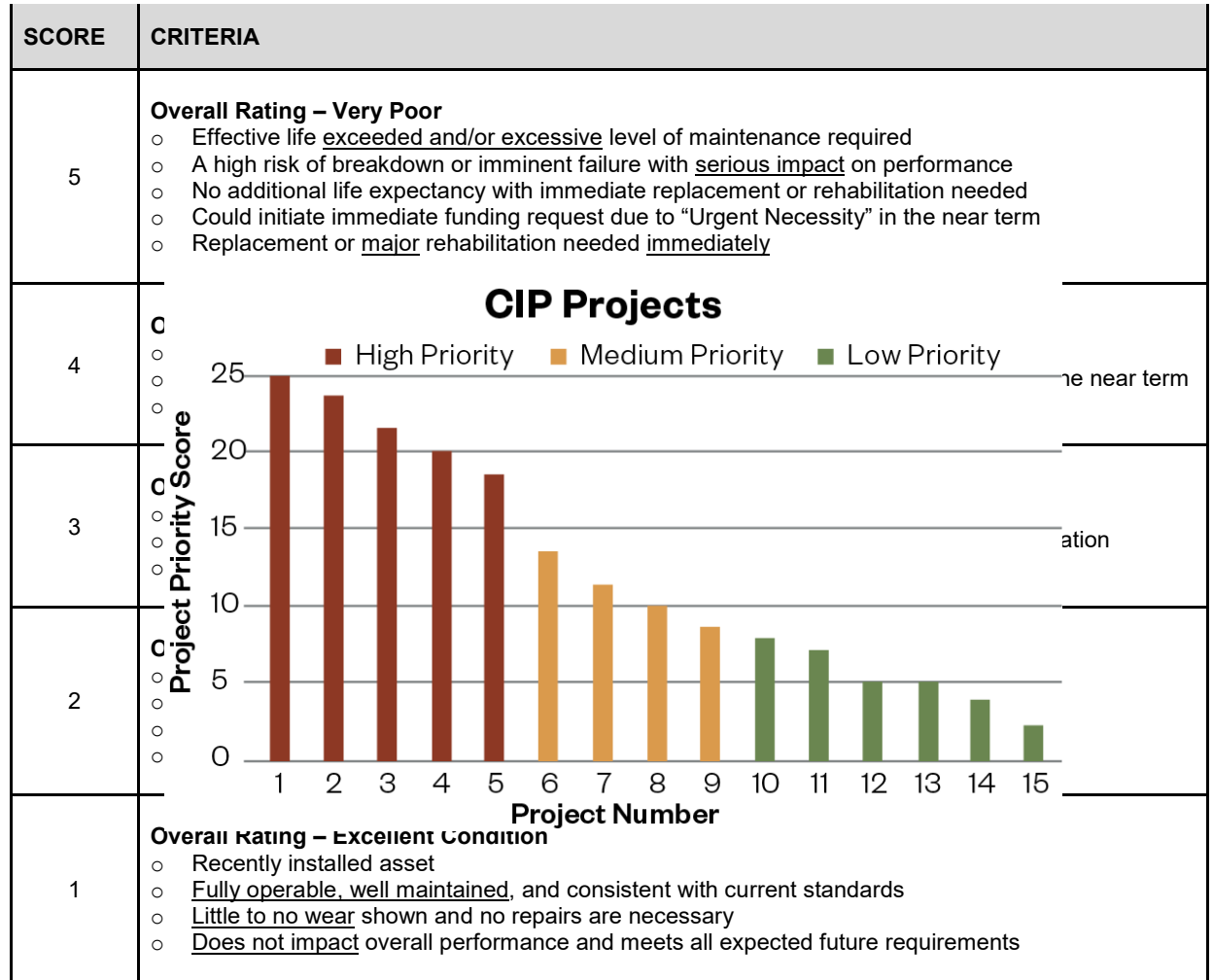
The current state of repair and operation for a collective group of assets included in a project. Condition scores should be based on documented observation of physical and operational condition as reflected by: service/operating conditions, historical maintenance, and overall age. The physical condition is a mechanism to assess the probability of failure for a collective group of assets in a project. When applying scores, consider probability of asset failure should the proposed project not be implemented, and the existing assets continue to deteriorate.

For infrastructure projects, this evaluation is typically based on results from a visual inspection, historic data and/or feedback from O&M staff and may include more advanced condition assessment if available (i.e. oil sampling, vibration analysis, thermography, etc.). For non-aging infrastructure projects, this would be determined based on internal or external consulting studies and/or information contained in business cases.

For projects where formal condition assessment information is available (typically aging infrastructure projects) initial scoring should be based on an average physical condition scores for all assets included in the project. Adjustments can then be made to reflect the aggregated project and supporting justification should be provided in the prioritization analysis section of the business case.

...and Project Scoring Framework

12. PRIORITIZATION ANALYSIS		
Criteria	Project Manager Evaluation Score (1-5)	Justification / Explanation To be completed by Project Manager/Business Case Owner
Physical Condition		
Process/ Performance Condition		
Strategic Plan Alignment		
Regulatory/Environmental		
O&M		
Service Level / Reliability		
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Financial		
Efficiency / Energy		
Process Effectiveness / Institutional Knowledge		

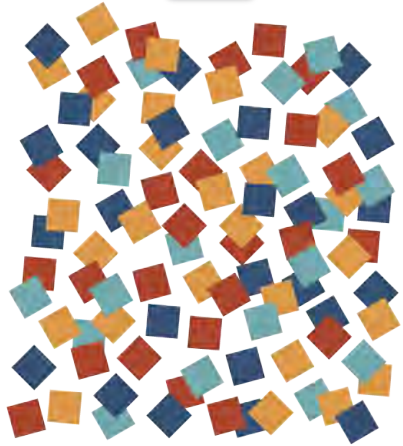


Business Intelligence and Performance Reporting

Performance Reporting and Business Intelligence

Data Analytics and Visualization using Business Intelligence Applications

1

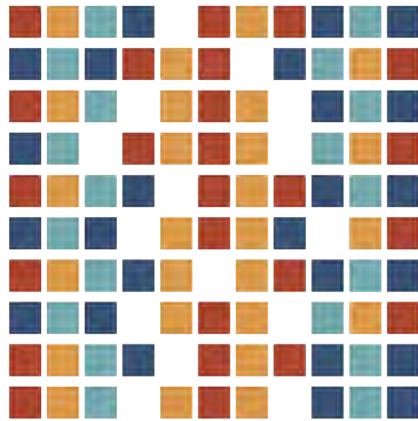


Realize

Data Capture & Validation

- Support connectivity and engagement
- Develop performance benchmarks and baselines
- Identify key performance indicators and metrics

2

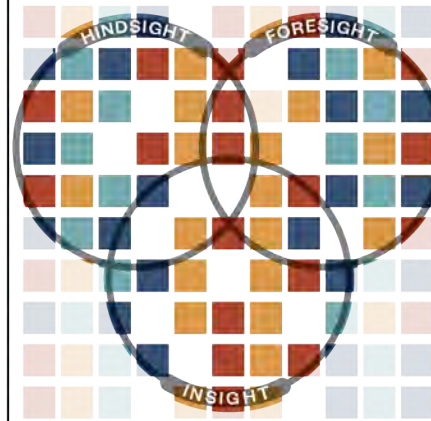


Organize

Curation & Integration

- Support connectivity and integration
- Develop performance benchmarks and baselines
- Identify key performance indicators and metrics
- Information accessibility

3

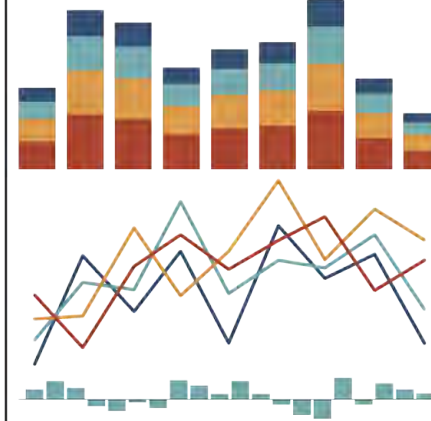


Analyze

Data Analytics

- Transform data into actionable intelligence
- Predictive process operations and O&M needs
- Root cause analysis
- Proactive action on process operations

4

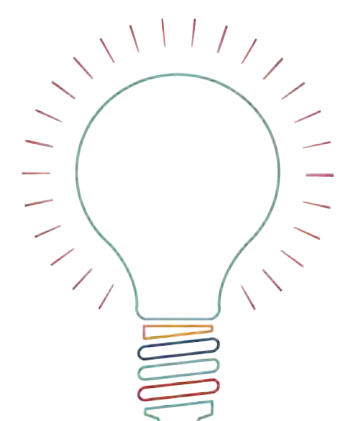


Visualize

Reporting & Visualization

- Optimize staff engagement and data transparency
- Track progress toward strategic goals

5

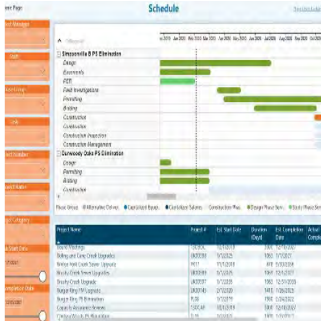


Optimize

BI & Knowledge Sharing

- Improve financial execution
- Enhance customer experience
- Optimize operations
- Manage risks and operations costs

Visualization Tools like Power BI Provide a Flexible Platform to Answer any Question with Available Data



Does my current CIP accurately reflect the actual project implementation schedule?

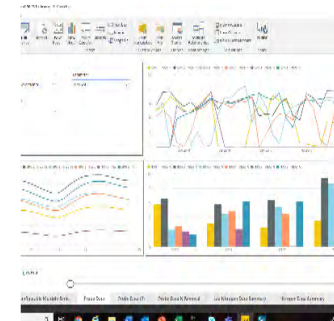


Do I have enough staff to execute my plan?

Based on my project schedules, will I be over or under budget?



How will my capital needs change if I experience lower than anticipated growth?



Enables Rapid Response to Changing Conditions

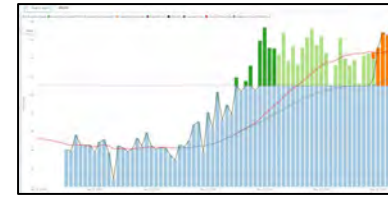
Digital Asset Management Plans

Business Intelligence Applications Allow for Dynamic Plan Development

- Identify long-term R&R needs based on risk assessment information
- Identify and updated capital and maintenance priorities
- Track CIP execution
- Monitor operational information at the asset level
- Track maintenance program effectiveness
- Conduct performance benchmarking
- Monitor process status and improvements

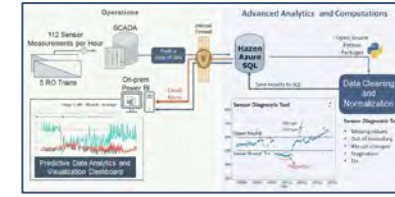


Machine Learning Enhances a Utility's Ability to Address Challenges Across its Operations



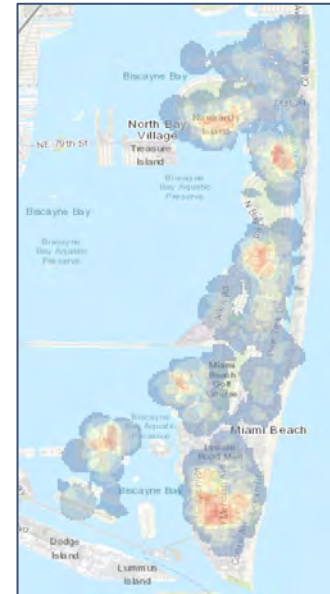
City of Raleigh, NC

Wet weather prediction and plant optimization



Chino Basin Desalter Authority, CA

RO Membrane Optimization in Chino II



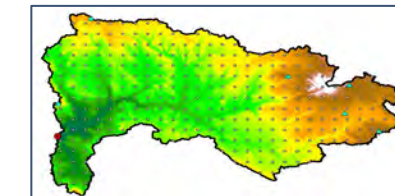
Miami Beach, FL

Lead Service Line Identification



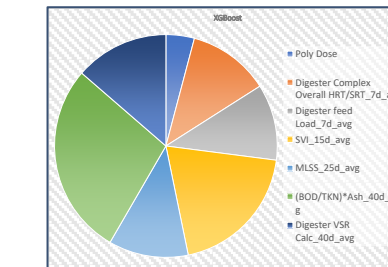
Jefferson County, AL

Predict Sewer Asset Deterioration Rate



Salt River, AZ

Water Supply Prediction



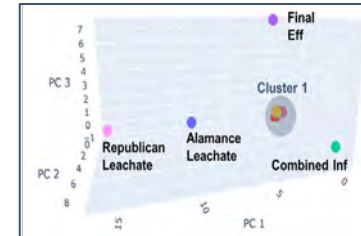
Metro Water Recovery, CO

Cake %TS prediction



Dayton, OH

H₂S Release Explanation



City of Burlington, NC

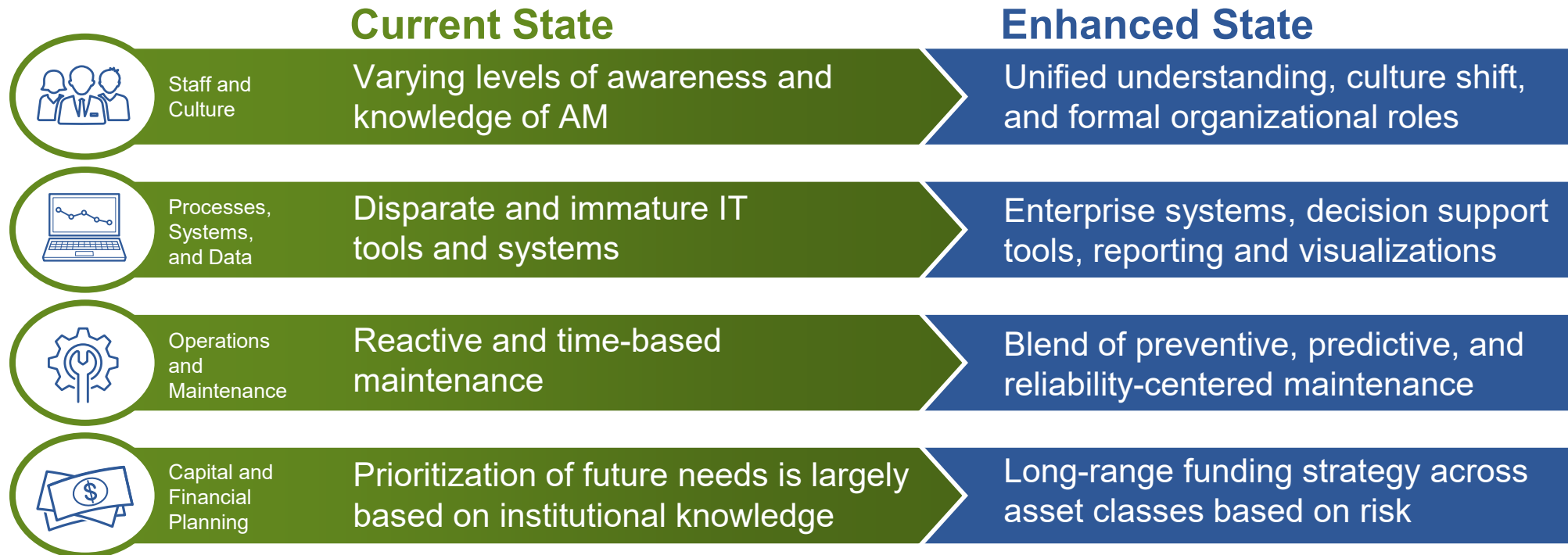
PFAS forensics

PVSC Phase 1: Decant Facility GeoBIM

Decant Facility BIM integrated with 3D GIS Scene in PVSC Enterprise GIS



Tangible Impacts





2021

AAEES - Resilient Utility Management - Plan, Respond, Recover and Adapt

Combatting Aging Infrastructure Risks

NJWEA Workshop

Ryan Nagel, PE, PMP

rnagel@hazenandsawyer.com

Hazen