Applying Asset Management Principles to Stormwater Systems

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What is Asset Management?

A structured program to minimize the cost of asset ownership, improve service reliability, and sustain the infrastructure.
Each Organization has its Own Unique Drivers

Public Agencies

- Aging Infrastructure
- Population Growth
- Regulatory Requirements
- Stakeholder Initiatives
- Increasing Expectations
- Changing Processes & Systems
- Competing Demands
- Catastrophic Failures
Asset Management is Scalable

**Entry Level**
- Establish Fixed Asset Classes & Hierarchy
- Maintenance Strategy
- Condition Assessment
- Risk Policy
- CIP Prioritization Process
- Manage Private BMPs
- Strategic Plan with AM

**Advanced**
- Common Asset Database
- Triple Bottom Line
- Mobile Data Inspection
- GIS integrated business processes
- Forecast Future Rehab & Replacement
- Business Intelligence Solution
- Reliability Analysis
Set Desired Outcomes of the Asset Management Program

• Understand the conditions in the watersheds
• Identify high priority areas
• Target specific management strategies
• Prioritize the CIP
• Define short-term and long-term actions
• Improve partnering
• Optimize decision making
  – Improve Levels of Service
  – Reduce Costs
  – Improve Performance
Asset Management Framework

Asset Management Plan
- Mission/Vision
- Levels of Service
- Risk Management
- Strategic AM Plans

Asset Planning/Design
- New Asset Development
- Rehabilitation/Replacement
- Asset Financing
- Business Case Evaluations

Asset Management System
- System Reliability
- Asset Knowledge
- Maintenance Strategy
- Condition Monitoring
- IT Systems
Asset Management Plan

- Mission/Vision
- Levels of Service
- Risk Management
- Strategic AM Plans
A Gap Analysis Helps in Developing the Asset Management Plan

Where We Are Now

Where We Want to Be

GAP

Resources Needed

Asset Management Plan

- One Year
- Three Years
- Ultimate
Level of Service Considerations Define the Asset Management Program
Asset Management Balances Service Levels, Risks, and Costs

Customer Service

Social

Bearable

Equitable

Sustainable

Viable

Environmental

Economic

Life-Cycle Economy

Risk Management
Strategic Asset Management is a Continual Process
Asset Management is Made up of Many Strategies
Developing a Risk Management Framework Improves Levels of Service

- Establish the Context
- Identify Risks
- Analyze Risks
- Evaluate Risks
- Assess Risks
- Treat Risks
- Communicate and Consult
- Monitor and Review
Probabilistic Costs Incur As a Result of Asset Failure

$$\text{RISK COST} = \text{Frequency of Failure (in any year)} \times \text{Consequence of Failure (cost of failure, $)}$$

Risk Measure, $/year
Assets Fall into Different Risk Management Strategies

- History Based Economic
- Condition Monitoring Based
- Run to Fail

Frequency of Failure vs. Consequence of Failure
AM Framework Part 2

Asset Planning/Design

- New Asset Development
- Rehabilitation / Replacement
- Asset Financing
- Business Case Evaluations
Planning for the Entire Asset Life-Cycle Helps Optimize Ownership Costs
Funding Should Balance with Unmet Financial Needs

- **Asset Installation**
- **Asset Replacement**

<table>
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<tr>
<th>Year Installed</th>
<th>Miles of Pipe</th>
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<tbody>
<tr>
<td>1950</td>
<td>300</td>
</tr>
<tr>
<td>2000</td>
<td>500</td>
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<tr>
<td>2050</td>
<td>700</td>
</tr>
<tr>
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<td>900</td>
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**Key Points**:
- The chart illustrates the relationship between asset installation and asset replacement over different years.
- Funding should balance with unmet financial needs to ensure the sustainability of the infrastructure.
The Asset Financing Plan is Set to Meet the Overall Needs of the Program

- Asset Valuation
- Rate Planning
- Funding Plan
- Replacement Planning
- Financial Plans
Business Case Evaluation Process Helps to Make the Best Use of Available Capital

- Business Case Evaluation (BCE) is used in the asset creation process
- Repeatedly revisits the drivers for a project
- Validates the need for a solution in terms of customer value
- Seeks the lowest life-cycle cost solution consistent with risk
The Goal of the Business Case Evaluation is to Yield the Best Solution

- Identify Problem and Service Level Effect
- Brainstorm Alternatives
- Perform Cost Benefit Analysis
- Undertake Present Value Analysis
- Determine Best Solution
AM Framework Part 3

Asset Management System

System Reliability
Asset Knowledge
Maintenance Strategy
Condition Monitoring
IT Systems
Assets Fail Over Time and Fail Faster Under Stressful Conditions

- Detectable deterioration
- Potential failure
- Minimum Reaction Time
- PF-Curve
- Functional failure
- Total failure
- Gallons per Minute
- PB-Curve
Develop Asset Plans to Optimize Asset Reliability

Current Approach

Asset Management Approach (Lifecycle Rehab & Replacement)

- Use of Asset
- Rehab or Replacement
A Common Asset Hierarchy is Fundamental to Asset Planning

- ENTERPRISE
  - SECTION
    - FACILITY/PROCESS
    - FUNCTIONAL SYSTEM (ASSET MANAGEMENT UNIT)
    - COMPONENT
      - SUB-COMPONENT
The Value of Asset Knowledge

- Analyze and Monitor Asset Reliability
- Measure and Manage Performance
- Regulatory Reporting
- Budget Forecasting
GIS is Ideal for Stormwater Asset Management

- Water Quality Results
- BMP structural BMPs
- Location and cost
- Street Sweeping
- Catch Basin Maintenance
- Combined Sewer Overflows (CSOs)
- Stormtreat System
Asset Management Requires a Proactive Maintenance Strategy

- Financial Management
  - Forecast Costs

- Safety Management
  - Monitor Safety Plan

- Work Scheduling
  - Prioritize Work

- Work History
  - Track and Report Results
Condition Monitoring is Used to Manage the Remaining Useful Life of Assets
The Key is to Make the Most Effective Use of Community Dollars

- Asset Inventory
- GIS / CMMS
- Risk Assessment
- Low Risk Assets
- Condition and Performance Assessment
- High Risk Assets
- Failure Modes Analysis
- R&R Projects
- Prioritization Process
- CIP

Use of Risk Focuses Resources

O&M Strategies

Condition Assessment is a Learning Process

Cost Effective Mitigation Strategies Don’t Always Mean Replacement

Condition and Performance Assessment

Asset Inventory

Risk Assessment

Low Risk Assets

Failure Modes Analysis

R&R Projects

Prioritization Process

CIP
Data is Needed to Manage Processes and Control Performance

- System Performance
- Asset Performance
- Asset Condition
- Financial Results
- Funding Balance
- O&M Cost
- Maintenance History
- Asset Register
- Risk Rating
- Project Status
Business Intelligence Solutions Improve Data Access and Analysis
Asset Management is a Business Approach

- **Strategies** with objective of providing the required level of service in the most cost effective manner over the asset life cycle

- **Processes** that combine management, financial, economic, engineering, operation, & maintenance

- **Human Motivation** that results in performance control and sustainable service delivery