Asset Management for Resiliency

Presented by
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Director, Southwest Environmental Finance Center
The Southwest EFC

Started in 1992

We promote self-reliance through innovative training and assistance focused on actionable results.
Work under contracts & agreements with federal, state, and local governments and private funders.
Asset Management:
At its core is a resiliency program
It’s most important that we do the basic functions well

AM Helps us do that

Google’s Secret Formula for Management? Doing the Basics Well

“Success at almost anything rests upon this single principle: Do the basics, do them well, and do them every day, even when you don’t feel like doing them.”

MATTHEW KELLY
The Culture Source

We realized how important it was for us to play well. We got back to basics. When we were struggling, we knew that was a wake-up call for us.

Clint Kriewaldt

Champions are brilliant at the basics.

- Author: John Wooden

Successful people master the basics. They become phenomenal by consistently doing the little things well.

Billy Alsbrooks
Resiliency

Doing the basics well helps maintain resiliency to all kinds of outside stressors.

When you bend with the wind but don’t break in the storm.
How does AM help with technical resiliency?
Outside Stressors - Managerial

- Water Contamination
  - Chemical leak into Elk River affects at least 8 counties

- Natural Disasters
  - Image of wildfire
  - Image of drought
  - Image of hurricane

- Coronavirus
  - Image of COVID-19 virus
How does AM help with managerial resilience?
Outside Stressors - Financial

- Financial crisis
- Coronavirus (COVID-19)
- Natural disasters
Financial Impacts from COVID

- Change in Usage Patterns
- Cancellation of Shut-Offs
- Unemployment Causing Customers Inability to Pay
- Lost Investment Income
- Business Closures
How does AM Help With Financial Resilience?
<table>
<thead>
<tr>
<th>Resources (money &amp; time) Available</th>
<th>Valve Exercising</th>
<th>Compliance Sampling</th>
<th>Hydrant Flushing</th>
<th>Preventative Maintenance</th>
<th>Repairs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Meter Reading</td>
<td>Routine Maintenance</td>
<td>Chlorine Residual Measurement</td>
<td>Daily/Weekly/Monthly Inspections of Equipment</td>
<td>Replacement of Assets</td>
</tr>
<tr>
<td></td>
<td>Rehabilitation of Assets</td>
<td>Operations</td>
<td>Capital Improvement Planning</td>
<td>Billing</td>
<td>Customer Relations</td>
</tr>
</tbody>
</table>

**Typical Situation**
Resources (money & time) Available

So what happens?
Financial Resiliency Comes From AM Helping You Make the Best Decisions About How To Spend Your Resources
We provide a safe, reliable, high-quality water supply with superior service and value.
Asset Management Switchboard

The Southwest Environmental Finance Center has partnered with EPA to create a repository of documentation and tools related to Asset Management.

Whether you are new to the Asset Management process or just need a refresher on a specific topic, the resource you are looking for is probably here. If you're unable to find what you're looking for, reach out and tell us about it.

If you would like to contribute by having a resource added to the repository, please email the Southwest Environmental Finance Center (by clicking on the link below) and tell us about it. We welcome your feedback and strive to serve your utility and water systems at large.

https://swefcamswitchboard.unm.edu/am/
Resources

https://swefc.unm.edu/home/

ASSET MANAGEMENT IQ

An Asset Management IQ Test is presented here in order to help you review the concepts of the various core components of Asset Management. Both the test and a scoring table are also available as a printable pdf, which may be copied for use by multiple personnel within your utility.

In the web version of the test, clicking on a choice will automatically enter the number of points for that option and keep track of the score for each section of the Asset Management IQ as well as the total cumulative score. If a new answer is selected, the new choice and the new points will appear and the old points will be removed.

If the user completes the entire Asset Management IQ tool (all 30 questions) before starting Asset Management, it will provide a baseline evaluation at the beginning of Asset Management. Comparing the scores of each of the six sections will show which areas have the biggest gaps in terms of Asset Management activities. Those scores may provide information about where efforts should be focused. You may wish to start with areas that are the weakest, offering a large improvement with a little effort, or with areas that are strong, which would offer a chance to get started in a familiar area.

As the utility progresses, the Asset Management IQ can be repeated and the scores compared to previous scores. At a minimum, you may wish to repeat the Asset Management IQ every year.

It should be noted that a total score of 150 would represent best practice in all areas of Asset Management. Not all utilities will be interested in achieving this goal. The utility should set its own target levels. The tool is meant to help utilities gauge their progress over time.
Resources

Building the Capacity of Drinking Water Systems

Implementation of Capacity Development Program – Related Safe Drinking Water Act Amendments in the America’s Water Infrastructure Act

This memorandum describes the approaches and methods for asset management promotion and training that are consistent with the 2018 America’s Water Infrastructure Act (AWIA), Section 2012 requirements.
Questions or Requests for Assistance can be entered into Chat or Question Box
Becoming Resilient Through Asset Management

EPA Capacity Development & Operator Certification Virtual Workshop

8/20/2020
Agenda

• Overview of SJW’s Water System
• Goal of Asset Management at SJW
• Enterprise Risk Identification & Prioritization / AWIA
• Work Activity Risk Evaluation During COVID-19 Pandemic
Overview of Water System

• Established in 1866
• Provide water service to over 1 million people in the Silicon Valley and greater San Jose metropolitan area
• 3 water treatment plants
• 2,400 miles of pipe
• 340 pumps and motors
• 100 wells
• 120 tanks and reservoirs
• 20,000 fire hydrants
• 34,000 valves
• 234,000 meters and service lines
Goal of Asset Management at SJW

Asset Management Program Goal:
To maximize value derived from assets by optimizing the balance between Risk, Cost, and Level of Service.
Asset Management Program Goal:
To maximize value derived from assets by optimizing the balance between Risk, Cost, and Level of Service.

Resilience, including financial resilience, falls in the category of risk.
### Risk

**Risk**

\[
\text{Risk} = \text{Probability of Failure} \times \text{Consequence of Failure}
\]

<table>
<thead>
<tr>
<th>Probability of Failure</th>
<th>Consequence of Failure</th>
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<td>120</td>
<td>1,410</td>
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<td>515</td>
<td>6,531</td>
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<tr>
<td>175</td>
<td>2,712</td>
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<table>
<thead>
<tr>
<th>Probability of Failure</th>
<th>Consequence of Failure</th>
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</thead>
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<tr>
<td>203</td>
<td>817</td>
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<tr>
<td>433</td>
<td>1,859</td>
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<td>1,186</td>
<td>5,586</td>
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<td>1,007</td>
<td>3,979</td>
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</table>

<table>
<thead>
<tr>
<th>Probability of Threat Occurrence</th>
<th>Consequence of Threat Impact</th>
<th>Vulnerability to Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>102</td>
<td>986</td>
<td></td>
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<tr>
<td>113</td>
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<td>82</td>
<td>986</td>
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</tr>
<tr>
<td>220</td>
<td>986</td>
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</tbody>
</table>

**Risk**

\[
\text{Risk} = \text{Probability of Threat Occurrence} \times \text{Consequence of Threat Impact} \times \text{Vulnerability to Threat}
\]
Types of Risk Evaluations

**Individual Asset Risk**

- In-Depth Risk Evaluation for Each Asset

**Station Level Risk**

- High-Level Risk Evaluation
- Considered Various Outside Threats
- Joint Effort Between Asset Management and Business Resiliency Depts

**Enterprise Level Risk**
Criteria for High-Level Risk Evaluation

Consequence of Threat to the Asset (CoT)

<table>
<thead>
<tr>
<th>Score</th>
<th>Impact Level</th>
<th>Social / Community</th>
<th>Financial</th>
<th>Environmental</th>
<th>Equivalent Dollar Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Low Impact</td>
<td>Can safely operate system and provide safe water service with minimal effort or coordination.</td>
<td>Minimal impact on business operations related to finance^{1}, on brand, and on shareholders.</td>
<td>Low environmental impact. Impact localized, not widespread.</td>
<td>&lt; $100,000</td>
</tr>
<tr>
<td>2</td>
<td>Med-Low Impact</td>
<td>Can safely operate system and provide safe water service, but requires concerted effort and coordination.</td>
<td>Noticeable but low impact on business operations related to finance, on brand, and on shareholders.</td>
<td>Localized but moderate environmental impact</td>
<td>&lt; $1 M</td>
</tr>
<tr>
<td>3</td>
<td>Moderate Impact</td>
<td>Generally able to safely operate system and provide safe water service, but requires difficult operations and puts notable strain on resources.</td>
<td>Moderate impact on business operations related to finance, on brand, and on shareholders.</td>
<td>Moderately widespread environmental impact (e.g. widespread in local creeks fishkill)</td>
<td>&lt; $10 M</td>
</tr>
<tr>
<td>4</td>
<td>High Impact</td>
<td>Difficult to safely operate system and provide safe water service, and high strain on resources.</td>
<td>Notable impact on business operations related to finance, on brand, and on shareholders.</td>
<td>Widespread environmental impact</td>
<td>&lt; $100 M</td>
</tr>
<tr>
<td>5</td>
<td>Severe Impact</td>
<td>Unable to safely operate system and provide safe water service. High chance of death or widespread illness.</td>
<td>Severe impact on business operations related to finance, on brand, and on shareholders.</td>
<td>Severe environmental impact (e.g. uncontained wildfire to the extent of national coverage, like PG&amp;E Camp Fire).</td>
<td>&gt;= $100 M</td>
</tr>
</tbody>
</table>

Likelihood of Threat Occurrence (LoT)

<table>
<thead>
<tr>
<th>Score</th>
<th>Likelihood</th>
<th>Description</th>
<th>Notes</th>
<th>Equivalent Likelihood</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Very Low Likelihood</td>
<td>Unlikely for threat to occur in the next 100 years</td>
<td>Events that have never occurred in the history of SJW, and have not come close to occurring.</td>
<td>&lt;= 0.01</td>
</tr>
<tr>
<td>2</td>
<td>Low Likelihood</td>
<td>Reasonable for threat to occur in the next 100 years (e.g. 1 in 100 year storm)</td>
<td>Events that have occurred (or have come close to occurring) once in the history of SJW.</td>
<td>&gt; 0.01</td>
</tr>
<tr>
<td>3</td>
<td>Moderate Likelihood</td>
<td>Reasonable for threat to occur in the next 50 years</td>
<td>Events that have occurred a few times in the history of SJW.</td>
<td>&gt; 0.02</td>
</tr>
<tr>
<td>4</td>
<td>High Likelihood</td>
<td>Most likely to occur in the next 10 years</td>
<td>Events that occasionally occur (typically once every 10 years).</td>
<td>&gt; 0.1</td>
</tr>
<tr>
<td>5</td>
<td>Very High Likelihood</td>
<td>Almost certain to occur in the next 5 years</td>
<td>Events that frequently occur (at least every few years).</td>
<td>&gt;= 0.2</td>
</tr>
</tbody>
</table>
Threat-Asset Pair Analysis (Station Level)

210 Station Level “Assets”
- 31 Exemplar / Singular
- 179 Non-Exemplar

840 TAPs Analyzed
(2,520 scores)
- 124 Exemplar / Singular
- 716 Non-Exemplar
## Threat-Asset Pair Analysis (Enterprise Level)

### 21 Enterprise Level TAPs Analyzed

<table>
<thead>
<tr>
<th>Threat</th>
<th>Asset</th>
<th>IT System If Applicable</th>
<th>CoT</th>
<th>LoT</th>
<th>Level of Concern</th>
<th>CoT Driver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundwater Aquifer Contamination</td>
<td>SJW</td>
<td>N/A</td>
<td>5</td>
<td>2</td>
<td>10</td>
<td>S</td>
</tr>
<tr>
<td>Fuel Shortage</td>
<td>SJW</td>
<td>N/A</td>
<td>4</td>
<td>3</td>
<td>12</td>
<td>S</td>
</tr>
<tr>
<td>Pandemic</td>
<td>SJW</td>
<td>N/A</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>S</td>
</tr>
<tr>
<td>Drought</td>
<td>SJW</td>
<td>N/A</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>S</td>
</tr>
<tr>
<td>Wildland Fire</td>
<td>SJW</td>
<td>N/A</td>
<td>5</td>
<td>4</td>
<td>20</td>
<td>S/F/E</td>
</tr>
<tr>
<td>Terrorism</td>
<td>Distribution System - Hydrants &amp; Services</td>
<td>N/A</td>
<td>5</td>
<td>1</td>
<td>5</td>
<td>S</td>
</tr>
<tr>
<td>Cyber Attack - IT System Intrusion 1</td>
<td>Accounting Data</td>
<td>E1</td>
<td>5</td>
<td>4</td>
<td>20</td>
<td>S/F</td>
</tr>
<tr>
<td>Cyber Attack - IT System Intrusion 1</td>
<td>Meter Reading / Billing Data and System</td>
<td>CC&amp;B / Itron</td>
<td>5</td>
<td>4</td>
<td>20</td>
<td>S/F</td>
</tr>
<tr>
<td>Cyber Attack - IT System Intrusion 1</td>
<td>Personnel Data and System</td>
<td>ADP</td>
<td>5</td>
<td>4</td>
<td>20</td>
<td>S/F</td>
</tr>
<tr>
<td>Cyber Attack - IT System Intrusion 1</td>
<td>Planning / Budgeting Data and System</td>
<td>PowerPlant / E1</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td>F</td>
</tr>
<tr>
<td>Cyber Attack - IT System Intrusion 1</td>
<td>Customer Profile Data and System</td>
<td>CC&amp;B</td>
<td>5</td>
<td>4</td>
<td>20</td>
<td>S/F</td>
</tr>
<tr>
<td>Cyber Attack - IT System Intrusion 1</td>
<td>SCADA Data and System</td>
<td>Wonderware</td>
<td>5</td>
<td>4</td>
<td>20</td>
<td>S/F</td>
</tr>
<tr>
<td>Cyber Attack - IT System Intrusion 1</td>
<td>Asset and Work Mgt Data and System</td>
<td>ArcGIS / intor EAM / WAM</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>S/F</td>
</tr>
<tr>
<td>Physical Damage to IT Systems</td>
<td>All IT System Servers</td>
<td>Multiple</td>
<td>5</td>
<td>4</td>
<td>20</td>
<td>S</td>
</tr>
<tr>
<td>Poor WQ from District</td>
<td>District Turnouts</td>
<td>N/A</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>S</td>
</tr>
<tr>
<td>Earthquake</td>
<td>Distribution System - Mains</td>
<td>N/A</td>
<td>5</td>
<td>3</td>
<td>15</td>
<td>S</td>
</tr>
<tr>
<td>Earthquake</td>
<td>Distribution System - Services</td>
<td>N/A</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>S</td>
</tr>
<tr>
<td>District Treatment Plant Outage</td>
<td>Penitencia WTP</td>
<td>N/A</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>S</td>
</tr>
<tr>
<td>District Treatment Plant Outage</td>
<td>Rinconada WTP</td>
<td>N/A</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>S</td>
</tr>
<tr>
<td>District Treatment Plant Outage</td>
<td>Santa Teresa WTP</td>
<td>N/A</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>S</td>
</tr>
<tr>
<td>District Treatment Plant Outage</td>
<td>All WTPs</td>
<td>N/A</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td>S</td>
</tr>
<tr>
<td>SBWR Plant Outage</td>
<td>SBWR Plant</td>
<td>N/A</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>S</td>
</tr>
</tbody>
</table>

**Notes:**
1. IT System Intrusion includes threats such as ransomware and malware
Threat-Asset Pairs of Highest Concern

Station Level TAPs
- Power Outage
- Contamination
- Earthquake
- Wildland Fire

Enterprise Level TAPs
- Groundwater Aquifer Contamination
- District Outage - Santa Teresa WTP
- District Outage - Rinconada WTP
- Cyber Attack - Asset Data
- Drought
- Pandemic
- Fuel Shortage
- Earthquake - Distribution Mains
- District Outage - All WTPs
- Cyber Attack - Budgeting Data
- Wildland Fire - Widespread
- IT Systems Physical Damage
- Cyber Attack - SCADA
- Cyber Attack - Customer Data
- Cyber Attack - Employee Data
- Cyber Attack - Billing/Meter Data
- Cyber Attack - Accounting Data

Legend:
- Contamination
- District Outage
- Drought
- Pandemic
- Fuel Shortage
- Wildland Fire
- IT Sys Damage
- Cyber Attacks
Work Activity During COVID-19 Pandemic

• Halted majority of field activity in March due to COVID-19; all office staff worked from home
• Only mission-essential field activity resumed with changes to procedures to ensure safety of employees and the public
• Needed a systematic and defensible way to resume work activities
• Health & Safety department led a collaborative, enterprise-wide work activity risk evaluation effort
• Risk evaluation framework was aligned with the asset management risk framework
**Brief Overview of Activity Risk Evaluation**

- Work activity risk assessments were conducted for all work functions
- Job Hazards Analyses conducted for work activities
- Triple bottom line considerations
- Risks evaluated:
  - Not To Do
  - To Do – Inherent
  - To Do - Residual

---

<table>
<thead>
<tr>
<th>Activity Risk Evaluation Breakdown</th>
<th>Environment</th>
<th>Environmental Health &amp; Safety (EH&amp;S)</th>
<th>Health &amp; Safety (EH&amp;S)</th>
<th>Critical Confidentiality</th>
<th>Financial Impact</th>
<th>Social &amp; Ethical Considerations</th>
<th>Level of Compliance</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Notes:**
- Not To Do
- To Do - Inherent
- To Do - Residual

**Scatter Chart:**
- Risk in the absence of any controls taken to alter either the consequence or likelihood
- Not To Do
- To Do - Inherent
- To Do - Residual

---
• Activities with high “Not To Do” Risk were considered first
• Activities with low enough Residual Risk were implemented after approved by Threat Leveling Management Team
• Activities re-evaluated on a weekly basis
Conclusion

• Asset management framework was used for identifying and prioritizing large scale risks; joint effort between Asset Management and Business Resiliency departments

• Framework for evaluating work activity risk during COVID-19 was developed by Health & Safety department in alignment with asset management framework and principles

• Cross-departmental collaboration was central to effort

• Asset management framework and principles play a critical role in ensuring operational and financial resilience
Andy Yang, PE, CRL, PMP
Manager of Asset Management
andy.yang@sjwater.com
Winooski Vermont Asset Management Program

Becoming Financially Resilient through Asset Management
Winooski has ~8500 residents w/in 1 Sq Mi of fun. The demographics have changed over the years from a tight—knit mill town to a now 80% rental population, home to many new Americans speaking~20 different languages.
Asset Management has allowed a small DPW staff of 12 to more efficiently prioritize and financially track projects. Most communities have always had some level of asset management whether they knew it or not; but now our AMP gives us a readily accessible central location for all information relating to city-wide assets. We spend less time looking for information and less need relying on paper and institutional knowledge (ie. Ask the old guy!)

In 2016 the City competitively bid for an AMP, short-listing to three companies to present their programs. We chose Nexgen located in Sacramento, CA for many reasons but mainly their ability to provide a utility-based program not a utility program adapted from a warehousing program.
A Service Request Module allows us to offer residents/business customers easy access to city services. This is the first line of contact to DPW and allows us a means of communication and professional resolution management.
The Work Order Module allows for SRs or stand-alone projects to be scheduled with particular staff or equipment. This is the program most used by DPW on a daily basis but is becoming an important predictive tool as asset information continues to build.
W/O’s can track any project predictive or corrective maintenance required. All staff, equipment, and any materials or contractual labor used is easily added right here once rates and costs are loaded into the program. Having a true sense of what projects really cost the department and how long they take has really added value to what DPW provides the City.
The GIS Module was the first thing we implemented; GPSing every structure associated with the three utilities. We are continually ground-truthing water valve configurations and manhole locations as well as piping connectivity. Having this pertinent and accurate asset info available to on-call staff is key for issues like quickly isolating a water leak by valve operation, for instance.
Any asset can be chosen or thumb-tacked in order to retrieve more information specific to that asset; for instance this hydrant. All pertinent data w/re to this hydrant is stored here and available to the operator on the mobile app as well. We are continually adding inspection forms for things like hydrants and valves, sewer and SW line video inspection, and manhole work.
All annual maintenance or specific work to this asset is stored here. We operate/flush each hydrant 2X/yr so that inspection info is easily updated each time.

As we populate the program with this information, prioritization of capital projects can be professionally presented to Council/Admin – not just our opinions as to what needs upgrading.
The State’s 2016 AMP grant program really sped up our RFB and implementation process – allowed us to use annual expense vs going thru capital planning. Focus on GPS/GIS work that initial year evolved into further asset inventory and assessment work in the 2017 grant cycle. Having grant deadlines forced staff to adhere to the implementation schedule too. Employees have really embraced use of this asset management tool and it’s now showing the benefits.