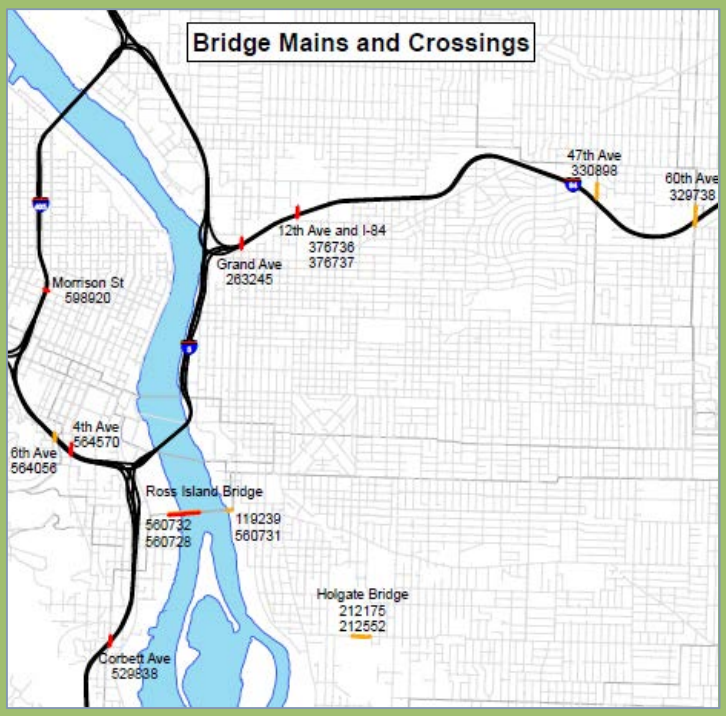
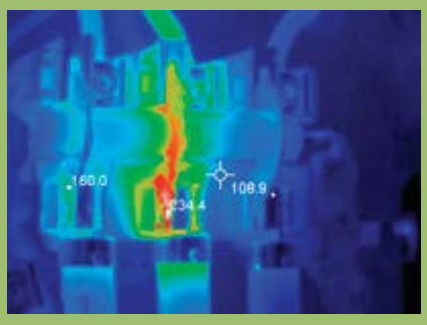
**Portland Water Bureau**

# Asset Management Tactical Plan

## FINAL

## August 2015 – July 2017

This 2015 Asset Management Tactical Plan has been approved by the following members of the Asset Management Steering Committee:

**Michael Stuhr,** Chief Engineer _____

**Chris Wanner,** Director of Operations _____

**Ty Kovatch,** Director of Maintenance and Construction _____

**Cecelia Huynh,** Director of Finance and Support Services _____

**Kathy Koch,** Director of Customer Service _____

**Edward Campbell,** Director of Resource Protection and Planning _____

**Jeff Leighton,** Asset Management Coordinator _____

**Danny Allison,** Water Operations and Support Manager _____

**Steve Schenk,** Water Supply Manager and Principal Engineer _____

**Stan VandeBergh,** Planning Principal Engineer _____

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# Contents

# INTRODUCTION

The Water Bureau has focused on specific actions to develop and implement asset management methods and best business practices throughout the bureau. Asset management enables PWB to set and maintain desired levels of service to its customers while supporting the lowest possible asset life-cycle cost. The goal of the Portland Water Bureau Asset Management Branch (AMB) is to create a framework from which to pursue and achieve sustainable infrastructure maintenance and replacement and to obtain and provide data in support of making decisions. The bureau has used these methods and practices as strategies to guide the implementation of the Asset Management Program since 2005. The AMB's August 2015–July 2017 work plan has been reviewed and approved by the Asset Management Steering Committee.

## Current PWB Asset Management Strategies

The Asset Management Steering Committee (AMSC) is the executive-level group that sets policy, makes decisions, and reviews policy for the Asset Management Program.[1] The AMSC has identified the following six strategies as key objectives for the Water Bureau:

- Manage risks of asset failure
- Implement whole-of-life asset planning and make decisions using triple-bottom-line measures
- Identify water-system assets and groups, assess conditions, and estimate remaining economic life and replacement costs
- Implement maintenance, repair and replacement strategies that optimize asset useful life-cycle cost while maintaining desired level of service.
- Forecast infrastructure replacement needs and funding requirements
- Understand and implement leading business practices for managing assets

These key asset management strategies have supported the organizational objectives articulated in the former Water Bureau Strategic Plan (2008-2011).

[1] See Table 2 on page 8 for a description of the responsibilities of this group.

# Alignment of Asset Management Strategies with Bureau Objectives

The bureau operates under eight strategic objectives. Table 1 shows the six Portland Water Bureau strategic objectives relevant to asset management and the related Asset Management Program actions.[2]

**Table 1. Portland Water Bureau Strategic Objectives and Related Asset Management Program Actions**

| Strategic Objective | Related AM Program Actions |
|---|---|
| Promote engagement of the community | Consult retail customers about service levels |
| Improve maintenance of aging water system infrastructure | Implement strategies from the asset management plans and the practices of reliability centered maintenance |
| Employ efficient and effective management practices | Implement risk evaluation and mitigation recommendations, continue business case evaluations, support decision-making based on remaining economic life |
| Increase flexibility and preparedness to meet future challenges | Improve performance using benchmarking and forecast replacement needs |
| Continue to incorporate sustainability into the bureau's everyday work | Use triple-bottom-line measures for decision-making |
| Continue to invest in recruiting, retaining, and developing a knowledgeable, multi-skilled, and culturally competent workforce | Provide training for improved asset management competency |

# Resources, Roles and Responsibilities

Implementation of the asset management strategies and tactics depends on staff resources and the commitments and strategies of the Water Bureau as an organization. Table 2 shows the groups with roles and responsibilities that affect implementation of this plan.

**Table 2. Group Roles and Responsibilities for Implementing AM Strategies and Tactics**

| Group | Role | AM Implementation Responsibility |
|---|---|---|
| The Asset Management Steering Committee (AMSC) | The AMSC is the executive level group that reviews progress in asset management, sets policy direction and makes decisions. | The AMSC is responsible for ensuring improvement activities in this plan are completed in a timely manner (or major changes in priority or schedule are approved). |

[2] The two strategic objectives not directly tied to Asset Management Program actions are: "Provide excellent water for our customers" and "Comply with federal regulations using practical, locally driven solutions."

**Table 2. Group Roles and Responsibilities for Implementing AM Strategies and Tactics**

| Group | Role | AM Implementation Responsibility |
|---|---|---|
| The Asset Management Coordinator (AMC) | The Senior Engineer in charge of the Asset Management Branch has the role of coordinating all asset management activities in the Water Bureau (Jeff Leighton). | The AMC is responsible for coordinating all improvement activities in this tactical plan as well as providing the AMSC with sufficient information to assist its role in the decision-making process. |
| The Asset Management Branch (AMB) | The role of the AMB is to take the lead on implementing many of the tactics in this plan. The AMB is a group of the Asset Management Coordinator plus 3 Engineers (Jeremiah Hess, Mia Sabanovic and Dave Demchak) and 1 Economist (Eric Brainich) dedicated to the goal of advancing asset management in the organization. The bureau's Technical Writer (Jessica Letteney) also assists the AMB. | Individuals in the AMB have been given responsibility in recent years to implement risk management, business case improvements, and condition assessments. AMB members also provide training and decision-support tools to other bureau groups and some incidental methods analysis, and data review. Additional task responsibilities are outlined in this document. |
| Recommended Strategies Team (REST) | REST compiles candidate AMP strategies and prioritizes actions to further the strategies or towards ensuring implementation of actions associated with these strategies. | Provides guidance and support for candidate AM strategies at the budget level. |
| Consequence of failure, Likelihood of failure, Evaluation Methodology (CLEM) Committee | The methodology for considering the risk of asset failure was originally developed with the help of the bureau-wide CLEM Committee. The CLEM Committee considers changes to the methodology. | A member of the AMB is responsible for maintaining a risk data base and evaluating assets. AMB staff assist others to understand and apply the methodology. The CLEM Committee recommends changes for the risk methodology to the AMSC. |
| Engineering Planning | Most asset investment alternative evaluations begin in Engineering Planning. The Project Validation Report is prepared by Engineering Planners. Planners use life-cycle best-value standards when weighing alternatives. | It is the responsibility of the Engineering Planner to evaluate options and incorporate concepts of total life-cycle cost and the triple bottom line with input from the AMB. |
| Finance | Budget preparation, management, and accounting | Track performance in service levels (Key, Programmatic, and Workload Measures)<br>Review the capitalization policy and its application to condition assessment and asset replacement |

**Table 2. Group Roles and Responsibilities for Implementing AM Strategies and Tactics**

| Group | Role | AM Implementation Responsibility |
|---|---|---|
| Engineering Design Managers | Design Managers are responsible for developing proposed CIP projects for repair, rehabilitation, replacement, or additions to assets. As part of project completion, they will coordinate with Operations and Maintenance to document the assets and their maintenance needs. | Coordinate the development of the project to reduce business risk exposure, optimize asset life-cycle cost, and meet criteria developed in the business-case evaluation. |
| Engineering Design Program Managers | Lead as subject-matter expert within assigned asset groups; provide current state-of-the-art engineering knowledge of assets to support development of the Asset Management Program | Effectively communicate the needs of the assigned asset group and monitor the planning, design, and construction activities for each asset group to achieve desired life-cycle and benefit-cost outcomes. |
| Engineering Construction Management | Manage construction activities to assure asset meets Asset Management Program goals | Assure that construction and rehabilitation activities achieve the desired life-cycle and benefit-cost outcomes. |
| Engineering Technical Services | Provide for the information-system and data needs for Information System Integration tasks, provide resources for mapping, and provide graphical presentations of data. | The Bureau IT Plan and various related information system activities are the responsibility of the Engineering Technical Services group. The Principal Engineer in ETS and the Senior Program Managers (in CADD and GIS/Records) are responsible for implementing this task. |
| Budget Program Leads | There are 22 budget programs in the Water Bureau. Each program has a designated lead. Each Budget Program Lead tracks performance on service levels, programmatic service levels, and workload measures. Program Leads also evaluate service-level revisions suggested in AMPs | Budget Program Leads report on Key Service Levels, Programmatic Service Levels, and workload measures that define the goals and objectives of the program. Reporting on service levels and workloads is an integral part of Tactical Area 1 in this plan. |
| Project Review Board | The PRB is responsible for oversight of capital projects schedules and budgets. | Ensure that the business case for projects applies when scope and budget changes. |
| Maintenance & Construction Field Crews | M&C field staff performs most of the work on the distribution piping network. | Field crews document failure codes while responding to pipe breaks, exercise critical valves, report on critical valve condition, and ensure that installation and rehabilitation of system assets meet identified goals. |

**Table 2. Group Roles and Responsibilities for Implementing AM Strategies and Tactics**

| Group | Role | AM Implementation Responsibility |
|---|---|---|
| Operations Field Staff | Operations field staff performs most of the assessment and maintenance work on the facility assets and some of the major pipe segments. | Operations staff work with the AMB to make rehabilitation, repair or replacement decisions to achieve efficient and focused operation and maintenance activities including exercising critical valves, performing reliability-centered maintenance, reporting data, implementing lowest life-cycle cost maintenance strategies, and identifying critical assets. |

# POLICY AND PLANNING

There are four areas of focus for asset management that fall within the Policy and Planning category:

- Establishing targets for levels of service and consulting with stakeholders
- Developing and implementing strategies from asset management plans
- Managing risks of asset failure
- Evaluating project investments through business cases

## Tactical Area 1. Level of Service Targets and Customer and Stakeholder Consultation

### 1.2 Key Staff

Jeff Leighton, AMC
Jessica Letteney, Resource Protection
Cecelia Huynh, Finance
Budget Program Leads

### 1.3 Accomplishments to 2015

Since 2008, the Water Bureau has tracked its performance according to 27 Key Service Levels.[3] The service levels provide targets for the bureau's goals and objectives. Programmatic Service Levels and Workload Measures measure performance in more detail. Table 3 provides the Key Service Level results from Fiscal Year (FY) 2008-09 to FY 2013-14. The bureau's internal semi-annual budget reports show performance on Key and Programmatic Service Levels.

#### New Bureau Key Performance Measures Starting in Fiscal Year 2015-16

Starting with the FY 2015-16 budget, all City of Portland bureaus are required to report on Key Performance Measures (KPMs).[4] In a collaborative process, the City Budget Office and bureau staff identified six targets for KPMs: complying with 100% of drinking water quality regulations, maintaining average call holding times of 2 minutes or less, addressing at least 80% of high-risk assets by an established deadline, having 2 or fewer unplanned events leading to outages that last more than 8 hours, maintaining an Aaa bond credit rating, and complying with 100% of environmental regulations. The KPMs have some overlap with the existing service

[3] The former Strategic Plan for 2008-2011 identified 24 Key Service Levels. Key Service Levels A.4, B.4, and E.1 were added in 2010.
[4] Key Performance Measures are similar to Key Service Levels—targets that measure an organization's progress towards goals and objectives at the highest level. For more on the distinctions among the various performance goals, see the memo Relationships Among PWB's Performance Targets.

levels (Table 3). The bureau may align KSLs more closely with KPMs after consulting with customers in the first half of 2016.

**Table 3. Relationship of Key Performance Measures to KSLs**

| Key Performance Measure | Change from 2014 KSL?[a] |
|---|---|
| Number of violations of state and federal drinking water quality regulations is 0 | no |
| Average time that customers are on hold before speaking to a customer service representative is 2 minutes or less | yes |
| Percent of identified high risk-assets addressed by the deadline is 80% | no |
| Number of unplanned events leading to customers out of water for more than 8 hours is 2 | yes |
| Maintain Water Revenue bond credit rating at Aaa | no |
| Number of violations of state and federal environmental regulations is 0 | yes |

[a]In 2015 the Water Bureau Management Team approved the changes to these measures.

The bureau will report on these KPMs each year in a dashboard as part of the bureau budget. The dashboard will indicate whether bureau performance remains the same, improves, or declines compared to the baseline period. At the same time, the bureau will retain its list of 27 Key Service Levels and will continue to report on them in a process parallel to the reporting on the KPMs. Table 4 shows the performance trends for the 27 Key Service Levels.

**Table 4. Portland Water Bureau Service Level Trends, Fiscal Years 2008-09 to 2013-14**

| | Fiscal Year | | | | | |
|---|---|---|---|---|---|---|
| **Key Service Level** | **2008-09** | **2009-10** | **2010-11** | **2011-12** | **2012-13** | **2013-14** |
| A.1 100% compliance with water quality regulations | Met | Not Met | Met | Met | Not Met | Not Met |
| A.2 Adequate pressure, more than 20 psi 99% of time | Unclear | Unclear | Unclear<br>44% of areas monitored | Unclear<br>57% of areas monitored | Met<br>93% of areas monitored | Met<br>93% of areas monitored |
| A.3 Fewer than 7 water quality complaints per 1000 customers | Met 6.2,<br>water line | Met 6,<br>water line | Met 6,<br>water line only | Met 5,<br>water line only | Met 5,<br>water line only[a] | Met 6.99[a] |
| A.4 Chlorine is 0.5–4.0 in 95% of samples | ---------- | -------- | Met 99% | Met 99.3% | Met 98.2% | Met 96.3% |
| B.1 High or Very High rating for quality of water service, at least 75% of customers | Met<br>82% | Met<br>85% | Met<br>77% | Not Met<br>72% | Not Met<br>73% | Not Met<br>70% |
| B.2 Respond to 95% of customer inquiries in less than 5 days | Met | Met | Met | Met | Met | Met |
| B.3 Answer 80% of calls within 60 seconds | Not Met<br>(Ave CHT = 3:14) | Not Met 49%<br>(Ave CHT= 2:02) | Not Met 54%<br>(Ave CHT= 1:39) | Not Met 49% (Ave CHT= 2:03) | Not Met 55% (Ave CHT= 1:50) | Not Met 43%<br>(Ave CHT= 1:52) |
| B.4 Use of preferred payment methods | ---------- | -------- | 39% | 45% | 50% | Met 54% |
| C.1 Less than 5% of customers out of water more than 8 hours a year | Met[b] | Met[b] | Met[b] | Met[b] | Met[b] | Met[b] |
| C.2 No one out of water more than 3 times in a year | Met | Not Met<br>1 customer | Not Met<br>6 customers | Unclear | Met | Met |
| C.3 90% of service installs completed in 15 days | Not Met 75% | Not Met 60% | Not Met 76% | Not Met 61% | Not Met 62% | Met 93% |
| C.4 Working hydrants within 500 feet of all services | Met | Met | Met | Met | Met | Met |
| C.5 90% of valves tested worked | Met 95% | Not Met 89% | Met >95% | Met >97% | Met >97% | Met |
| D.1 Aaa bond rating | Met | Met | Met | Met | Met | Met |
| D.2 Debt service coverage 1.9/1.75 | Unclear | Met 2.46/1.96 | Met 2.4/1.9 | Met 2.3/1.9 | Met 2.5/1.9 | Met |
| E.1 CIP projects on schedule | Met 84% | Met | Met 97% | Not Met 78% | Met 80% | Met 100% |
| E.2 Maintenance improvement | Met 21% | Met 41% | Met 55% | Met 60% | Met + 12.5% | Met |
| E.3 Manage risks, 80% of risk standards met | Not Met 64% | Met 83% | Met 91% | Met 92% | Met 95% | Met 96% |
| E.4 Benefit cost analysis for new projects | Met | Met | Met | Not Met | Not Met | Met |
| F.1 50% of employees engaged | Unclear | Unclear | Met | Met | Met | Met |
| F.2 OSHA SHARP certification | Met Renewed | Met Renewed | Met Renewed | Met Year 5[c] | Met Graduated | -------- |

**Table 4. Portland Water Bureau Service Level Trends, Fiscal Years 2008-09 to 2013-14**

| | Fiscal Year | | | | | |
|---|---|---|---|---|---|---|
| **Key Service Level** | **2008-09** | **2009-10** | **2010-11** | **2011-12** | **2012-13** | **2013-14** |
| F.3 Promotion of internal candidates 60–80% | Met 65% | Met 71% | Met 65% | Met 71% | Met 69% | Met 63% |
| F.4 Workforce diversity | Unclear | Not Met | Not Met | Not Met | Not Met | Not Met |
| G.1 Per capita water use steady or declining | Met | Met | Met | Met | Unknown | Unknown |
| G.2 25% water savings from technical assistance | Met 36% | Met 30% | Met 29% | Met 33% | Not Met 23.7% | Met 32% |
| G.3 Carbon emissions less than 2007 levels | Unclear | Met At 12,216 | Met At 9,788 | Met At 11,526 | Met At 10,885 | Met At 9,062 |
| G.4 % Renewable energy up from 2007 | Not Met | Met | Met | Met | Met | Met |

Abbreviations: psi= pounds per square inch, CHT=call hold time, CIP= Capital Improvement Program, OSHA SHARP=Occupational Safety and Health Administration Safety and Health Achievement Recognition Program

Abbreviations: psi= pounds per square inch, CHT=call hold time, CIP= Capital Improvement Program, OSHA SHARP=Occupational Safety and Health Administration Safety and Health Achievement Recognition Program

[a]Due to an error in data collection methodology, the results for KSL A.3 for Fiscal Years 2012-13 and 2013-14 were initially reported differently. The values in this table are accurate.

[b]Due to an error in data collection methodology, the quantified results for KSL C.1 for all years are not available.

[c]Reached the five-year maximum level in Fiscal Year 2011-12.

## 1.4 Next Steps

### 1.4.1 Budget Program Service Levels

Currently, each budget program is associated with certain service levels. The Asset Management Plans included recommendations for additional service levels to be considered by Budget Program Leads. These recommendations include key and programmatic service levels. As an example, both the Conduits and Transmission Mains budget programs currently each have one programmatic service level. The Asset Management Plans recommend eight key service levels and two additional programmatic service levels. A coordinated review of the AMP recommendations by Budget Program Leads should be conducted with the participation of Asset Management and Finance staff.

### 1.4.2 Stakeholder Consultation on Service Levels

For several years, the AMB has sought and used the feedback of stakeholder groups. The AMSC has ranked consulting customers on the Key Service Levels as a top priority of the Asset Management Program. In 2014, the bureau piloted surveys to obtain input from all employees and PSU students on service levels.

In Fiscal Year 2015-16 the AMB is planning a survey of residential and business customers. Customers will be asked for opinions about a blend of the existing service levels and the KPMs. Proposed topics include call hold times, unplanned and planned water outages, and willingness to pay for smart meter technology. The bureau may also conduct focus group discussions on the risk and project management service levels. Following the completion of the service level survey(s), bureau stakeholders (including the bureau Administrator, the Management Team, and the AMSC) will consider revising its current list of service levels.

## 1.5 Recommendations

- Standardize the name and purpose of the measures (Key Service Levels or Key Performance Measures), obtain organizational agreement, promulgate standardized terms
- Convene Budget Program Leads and key Finance and Asset Management staff to review Key Service Levels, Programmatic Service Levels, and Workload Measures.
- Revise Key Service Levels, Programmatic Service Levels, and Workload Measures for each budget program if appropriate
- Incorporate any changed Key Service Levels into the budget
- Conduct a customer survey on selected Key Service Levels
- Consider convening two focus groups to examine and discuss more complex KSLs such as the bureau's measure for addressing high-risk assets and possibly one additional topic

# Tactical Area 2. Asset Management Plans and Strategy Implementation

## 2.1 Key Staff

Jeremiah Hess— AMB
Mia Sabanovic – AMB
Recommended Strategies Team
AMP Leads (finish AMPs)

## 2.2 Accomplishments to 2015

The Water Bureau has a well-developed methodology for creating asset management plans (AMPs). The process of creating them is standardized and documented through guidelines, AMP authorship is usually a collaboration of members of the AMB, Engineering Project Planning staff, Operations staff, and other asset stakeholders. To date, the bureau's AMPs have focused on tactical and operational measures.

### 2.2.1 Asset Management Plans

To date, 17 AMPs had been completed. There are six more currently in development. Table 5 shows the AMP by topic and year completed.

**Table 5. AMPs by Topic and Year Completed**

| AMP Topic | Year Completed |
|---|---|
| Conduits | 2012 |
| Distribution Mains | 2012 |
| Electrical Systems, Instrumentation and Controls | 2015 |
| Facilities | 2012 |
| Fountains | 2012 |
| Groundwater | 2012 |
| Hydrants | 2012 |
| Pump Stations | 2012 |
| Regulators | 2013 |
| Roads | 2012 |
| Security | 2014 |
| Service Lines | 2012 |
| System Meters | 2013 |
| Tanks | 2012 |
| Transmission Mains | 2012 |
| Valves | 2012 |
| Wholesale Meters | 2013 |

### 2.2.2 Strategy Recommendations

Completed AMPs identify current assets and their condition as well as the expected remaining life and recommend maintenance, repair and replacement strategies. These AMPs have offered more than 300 strategy recommendations that have been summarized in a master list. During the first wave of decision-making, 15 (4%) were identified by the Recommended Strategies Team (REST) as having the highest priority. Other recommendations are being evaluated and considered by REST members in collaboration with AMP leads. REST recommends the high-priority strategies for implementation and budget funding. From the recommended strategies in Table 6, the bureau has begun implementing all but one. The status of each strategy is recorded in the Strategies Selected by the Recommended Strategies (REST) Subcommittee spreadsheet.

## 2.3 Next Steps

### 2.3.1 Asset Management Plans

AMPs for Large Meters, Bull Run Supply, Bull Run Treatment, Vaults, Terminal Reservoirs, and Data Management, are expected to be completed by the end of 2015. At least one completed version of all 23 asset-class Asset Management Plans will be available by the end of 2015. As information changes, or additional work is done, new versions of AMPs could be prepared. However, this is a time-consuming process. The AMB proposes that, in the future (i.e., the next two years), rather than update some of the AMPs (e.g., services, distribution mains, and conduits), authors focus on creating technical memos to capture recent work. The technical memos can be attached as addenda to the original (or latest) AMP. Staff efforts that would have gone towards AMP updates will be allocated to other projects (including those outlined in this tactical plan). The plan is to update AMPs on a five-year basis.

### 2.3.2 Strategy Implementation

The Recommended Strategies Team (REST) is responsible for evaluating the hundreds of recommended strategies and moving the organization forward in implementing the strategies considered most valuable. To date, the focus has been on 15 strategies (see Table 6).

The plan is to increase the level of effort of REST; to prioritize more strategies, and track and implement these additional asset strategies. With the assistance of AMP and budget program leads, the REST intends to review the feasibility of remaining strategies and implement one to three from each AMP during the next two years depending on ease of implementation and available resources. Through the REST committee, AMB staff will also provide the AMSC with the summary list of all asset strategies. The summary list will include information about the status of the strategy, the potential outcome of the strategy (for example, some strategies propose studies that would produce information for making decisions). AMSC will review, prioritize, and eliminate strategies.

**Table 6. Strategies Selected by the Recommended Strategies (REST) Subcommittee of the Asset Management Steering Committee**

| Asset | Strategy |
|---|---|
| 1. Conduits | 2.13 Establish official process and procedures for collecting data on pipe condition whenever a conduit is exposed as part of other work. Gather together and centralize conduit condition data<br><br>(This includes strategy 2.2, Develop better system for tracking leaks and repairs. Get old data out of SRS basement into electronic form.) |
| 1. Conduits | 1.1 High-Risk Conduits—Conduct an internal inspection to verify condition of main and lining. Consider relining. |
| 2. D. Mains | 4.10 Sustainable replacement rate for pipes that includes business cases. Establish budget around useful life expectations for the piping system rather than replacement rate in the past.<br><br>(This includes strategy 4.3, Business case framework for pipe replacement. Alter RANK to be more effective in prioritizing pipe replacements.) |
| 2. D. Mains | 3.1 Critical valves—locate, exercise, and add/replace when needed. Begin with highest-risk pipes, especially prior leaks and breaks. Enter as corrective maintenance task in CMMS. |
| 4. Fountains | 4.3 (new) Calculate likelihood and consequences of failure if a member of the public were to slip at Keller and Lovejoy fountains.[a] |
| 6. Hydrants | 4.2 Hydrant renewal. Renew obsolete (screw-type) models beginning by focusing on units that are also critical |
| 7. Pump Stations | 2.4, Reduce maintenance on redundant assets, including<br>-Base pump oil analysis on run time: Every 2 years for non-lead pumps and every year for lead pumps<br>-Reduce motor starter PM to once every two years for motors on non-lead pumps. Note: consider checking oil condition based on pump run time<br><br>(This works with strategy 2.6.) |
| 7. Pump Stations | 2.6 Perform PM on critical subcomponents such as generator fuel and batteries including-Replace batteries every 3 years [possibly more often]-Have technicians present for generator start test-Test fuel every quarter for contaminants-Add pressure vacuum vent on outside fuel tanks (This works with strategy 2.4.) |
| 7. Pump Stations | 5.5 Optimize RCM effort by continuing to evaluate metrics and areas of focus |
| 8. Roads/ Culverts | 1.3 Culvert condition assessment. Inspect high-risk culverts on annual cycle. Include large culverts 36" or larger. |

**Table 7. Strategies Selected by the Recommended Strategies (REST) Subcommittee of the Asset Management Steering Committee**

| Asset | Strategy |
|---|---|
| 8. Roads | 2.1 Paved road maintenance—sealing based on consequence of failure. Crack sealing, chip-sealing and thin overlays based on PCI rating with frequencies that vary by road category. Break points vary by CoF.<br><br>Actual maintenance determined by roads engineer and SRS manager. |
| 11. Tanks | 4.1 Seismic upgrades for tanks & standpipes—more in-depth analysis |
| 12. T. Mains (and D. Mains) | 1.6 Identify locations where valves are needed to isolate high-risk pipes and enter as Corrective Maintenance task in CMMS. |
| 12. T. Mains | 1.3 Leak detection for high-risk mains (at uncased crossings) |
| 12. T. Mains | (new) 1.8 Air/vacuum valves—Identify locations where air valves may need to be upsized to prevent pipe collapse if pipes rupture. |

[a]In 2013, the Water Bureau transferred responsibility for decorative water fountains back to the Portland Parks and Recreation Department.

## 2.4 Recommendations

- Create technical memos to capture recent work and update AMPs. The technical memos can be attached as addenda to the original (or latest) AMP.
- Review the feasibility of the recommended strategies and implement one to three (approximately 69 total) from each AMP during the next two years depending on ease of implementation and available resources.
- Follow up post strategies implementation to assess level of success and gained benefits to the bureau. Include this information into the technical memo attached to the front of the AMP. Present this information during the AMSC meetings and share with directly affected groups to gain program support.
- Prepare a report at the end of each calendar year that includes the status of implementation for each asset management strategy.

# Tactical Area 3. Manage Risk of Asset Failure

## 3.1 Key Staff

Mia Sabanovic, AMB
Dave Demchak, AMB

## 3.2 Accomplishments to 2015

The AMB has developed methodologies and tools for analyzing and quantifying the risks of asset failure. The approach includes a methodology for documenting the consequence and

likelihood of asset failure in the PWB system, an expert panel to review the matrix, and the development of a new tool that dynamically assesses pipe risk based on material, age, environment, and other factors. All identified risks of asset failure are maintained in a risk evaluation database.

### 3.2.1 Risk Methodology, Risk Service Level, Risk Evaluation, and Ranking

The AMB created the Consequence and Likelihood Evaluation Methodology (CLEM). In recent years, the AMB improved the likelihood of failure methodology that led to a refinement in the number of high or extreme risk pipes that identified as such. The AMB provides support to other bureau staff that need assistance in identifying risk.

The bureau has made managing the risk of asset failure a key focus. The Risk Service Level, which covers both ranking risks and taking action to mitigate those risks, is one of the six Key Performance Measures (KPMs) that appear in the budget dashboard (see Section 1.3 for a description). Results over the past four years on bureau performance are presented in Figure 1.

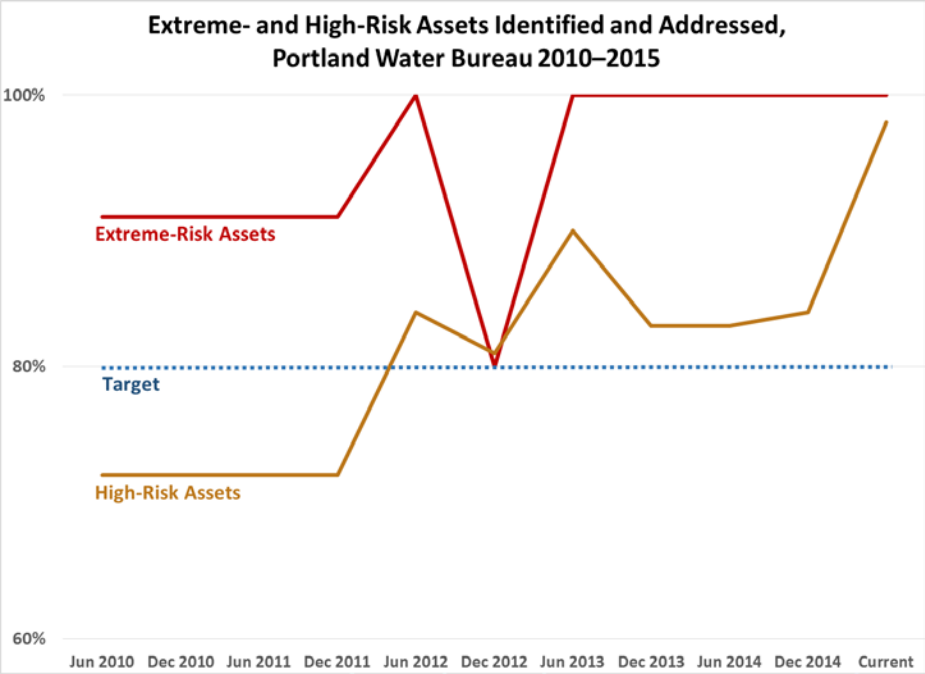


**Figure 1. Extreme- and High-Risk Assets Identified and Addressed, 2010-2015**

Most of the high-risk assets have been identified through discussions with staff. For example, 14 high-risk assets were identified as part of staff collaboration during AMP development. An additional 25 high-risk assets have come recently from a review of Project Maintenance (PJM) work order task requests from Operations.

Some of the presented risk cases have been mitigated after staff performed additional condition assessments that refined and reduced the estimated likelihood of asset failure. Most high-risk

cases are being mitigated through a capital improvement project that is somewhere in the planning-design-construction sequence (in other words, the risk has not been fully mitigated yet; rather the mitigation is being addressed).

### 3.2.2 Management of Consequential Pipes

High-consequence pipes include uncased pipes crossing under high-traffic roads and major railroad lines, pipes on bridges that cross major roads and railroad lines or water bodies, pipes that provide connections to critical customers, vulnerable or deteriorated conduit sections, pipes in areas with high potential for landslides, and pipes that are part of the in-town supply backbone.[5] A study of the seismic vulnerability of the water system is anticipated to be completed in 2016. The findings from this study will be integrated into the current list of high-consequence pipes.

Efforts in this area have focused on those pipes that are uncased and cross under high-traffic roads or major railroad lines and on bridge crossings.[6] The focus on uncased pipes comes from the quantification of historic failures. The most consequential failures were 1) a pipe on a bridge owned by a railroad that scoured away a significant portion of the adjacent slope (Willamette Boulevard, 1985) and 2) an uncased crossing of McLoughlin Boulevard that failed in 2010, causing major traffic disruptions. Both had societal costs exceeding $1 million.

There are between 100 and 150 uncased crossings. There are around 100 pipes on bridges. Considerable effort has gone into identifying the valves that are needed to shut down high-consequence pipes. Assessments have been completed for uncased pipe below high-traffic roads and are in progress for uncased pipe below major railroad lines.

### 3.2.3 Management of Consequential Valves

The AMB has been working closely with the GIS Branch to identify critical valves in a GIS layer (a critical valve is an isolation valve on a critical pipe). The AMB has also worked with Operations and Maintenance and Construction groups to develop condition rating cards for valves. These cards are filled in by the Mechanic/ Valve Operators and the Planners/Schedulers enter the information into CMMS and GIS during the work order closeout process.

In 2014, the first set of crossings (in the distribution system network) were identified for valve testing by the Maintenance and Construction Group. Meanwhile, a separate effort to assess consequential valves in facilities (pump stations and tanks) has been waiting for the initial step of creating facility maps first. Consequential facility valves are tested after facility maps are generated.

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[5] The supply backbone means the pipes and infrastructure that have been identified as essential for supplying water to certain parts of the system.

[6] The bureau focuses on uncased crossings because the lack of casing means there is not a pipe to direct water flow away from the immediate location of the break and therefore nothing to prevent major erosion at the break site.

## 3.3 Next Steps

### 3.3.1 Risk Methodology, Risk Service Level, Risk Evaluation and Ranking

Now that the risk service level has been elevated as a KPM for dashboard reporting in the budget (see Section 1.3 for details), it is important to continue to identify, rank and mitigate water system risks. The AMB will continue to take the lead on this task. Several risk methodology changes have been discussed; however, no change is currently proposed, so that the bureau maintains continuity in its risk service level approach. The methodology changes that have been proposed are listed below:

- **Consider medium risks.** The original service level included medium risks with a risk mitigation time frame. However, an analysis showed that hundreds of asset failure modes were rated as medium risk, whereas far fewer were considered to be high risk. As an organization, we decided to focus on the high risks. There is no current plan to measure the bureau's time response to mitigate medium risks.
- **Improve current consequence of failure table.** Work with the CLEM Committee to refine consequence of failure table to reflect recent asset failure consequence estimates. Standardize tiers across categories using impact cost estimates.
- **Consider consequence-rating methodology.** Currently, a risk is based on the single highest-category consequence that is assigned to the asset failure. There have been situations in which an asset failure was predicted to generate multiple impacts of similar magnitude. It might be appropriate to consider, for example, three category 3 consequences as equivalent to a single category 4 consequence, but that is not how we apply the methodology. Again, there is no current plan to aggregate consequences in this way.
- **Review business case assumptions.** There have been situations in which the CLEM risk matrix generates high risk ratings, but the subsequent business case can't justify risk mitigation. The best example of this is in health and safety. In the CLEM, a fatality is a category 5 consequence, as is a financial loss of $25 million. However, when the risk of fatality is being evaluated for risk mitigation, avoiding a loss of life is assigned a value of $9 million, from the U.S. Department of Transportation. In other words, the monetary value of a life that we use in the business case is not the same as the monetary value that we align the fatality with on the consequence table. Previous discussions with the CLEM Committee led to continued support for the existing placement of consequences in all categories, including the health and safety category. The AMB recommends reviewing the consequence value at each tier so that the gap between the CLEM risk rating and business case evaluations are reduced.

Other planned activities include refining the likelihood of failure based on failure data from CMMS and gathering information on consequential pipes.

- **Refine likelihood of failure.** Work with maintenance construction group to improve failure data quality being stored in CMMS. Analyze the available data within next 5 years and adjust water main deterioration curves. This will enable better estimate of the

likelihood of failure. Analyze failure and available diagnostics data for other types of assets and develop deterioration curves that enable refined likelihood of failure estimates.

- **Gather information on consequential pipes.** Tabulate the list of consequential pipes including locations, most likely failure modes, and applicable condition-assessment technologies. Also, assess high-consequence pipes where failure was avoided to directly assess and characterize the likelihood of failure for that pipe under those conditions (where and when possible).

### 3.3.2 Management of Consequential Pipes

As noted previously, efforts to-date have focused on uncased undercrossings of high-traffic roads and major railroad lines, and on bridges that cross major roads and railroad lines or water. Future work is planned to address critical customers, vulnerable conduit sections, and the "backbone" (essential elements) of the supply system:

- Connections to critical customers, as defined in Section 3 of the Services Asset Management Plan, and pipes in high landslide potential areas (including a planned inventory of these pipes and the valves necessary to shut off the critical pipes
- Vulnerable conduits sections (the inventory was created as part of the Conduits Asset Management Plan. See the Tactical Plan task for Risk Management Field Activities, Section 5.3.1, for more details on next steps.)
- The in-town supply backbone piping system. (These pipes will be identified in a seismic study by the Engineering Planning group, expected to be completed in the fall of 2016.)

### 3.3.3 Management of Consequential Valves

On-going testing of distribution valves serving high-consequence pipes will continue. The AMB will maintain a priority list of locations for Maintenance and Construction, and Operations, to exercise the valves. Next steps for facility valves are discussed under Risk Management Field Activities, Section 5.3.3. Other appurtenances (such as drains and blowoffs) may also be identified for maintenance.

## 3.4 Recommendations

- Review the consequence valuation at each tier and recommend changes to the AMSC.
- Review Likelihood of Failure estimates and improve using available data and information (such as condition-assessment results).
- Inventory connections to critical customers
- Assess conduit vulnerability, create CLEM records for each segment of the conduits. Capture in a summary report with possible maintenance and CIP improvements that will lower the assessed business risk exposure. Continue assessing distribution valves on high-consequence pipes. Provide information to M&C and prioritize the valve exercising schedule.
- Identify high-priority blow-offs and drains for assessment and testing.

# Tactical Area 4. Business Case Evaluations

## 4.1 Key Staff

Eric Brainich, AMB
Project Planning staff, on use of methodology in planning studies

## 4.2 Accomplishments to 2015

The Water Bureau's business case evaluations use benefit-cost analyses as part of the process for making good investment decisions. The process includes analyses of total life cycle costs, considerations of the triple bottom line and monetizing benefits in order to derive dollar valuations for both benefits and costs. The Project Planning Branch uses the methodology of business case evaluations in Project Validation Reports. As part of continued improvements in the process, new or updated impact valuation guidelines were produced for fire flows, boil water advisories, travel time on highways and freeways, and social impacts of construction equipment on neighborhoods during construction projects. Business case evaluations allow the bureau to evaluate project feasibility in a holistic way, considering all of the associated costs.

## 4.3 Next Steps

The bureau will continue to improve the way in which investment decisions are made, through the utilization of business case methodology and the triple bottom line (TBL). We propose to update TBL valuation guidelines as needed.

We are currently working on adding quantification of environmental consequences (such as chlorinated water spilled into the Columbia slough or other freshwater bodies) for low-probability but high-consequence events. Resources for this include Water Research Foundation Project 4451 to quantify environmental impacts of pipe breaks and a group of internal experts. In addition, we plan to test the Intangible Consequence Assessment Tool (ICAT) from Australia to quantify impacts through an approach called paired comparisons.

Improvements considered include guidelines on business cases to ensure that all projects over a minimum amount are required to conduct a business case (at one of three levels of effort, depending on estimated budget). If a project budget or scope changes significantly, the business case justification should be reviewed.

## 4.4 Recommendations

- Expand the number of consequences that have values to include more events that affect the environment
- Include business cases as part of the process used by the Project Review Board in its decision-making
- Track completion of business cases as part of AtTask reporting

# ASSET OPERATIONS AND MAINTENANCE

There are three areas of focus for asset management that fall within the Asset Operations and Maintenance category:

- Conducting risk-management field activities
- Implementing reliability-centered maintenance
- Evaluating water loss and outages

## Tactical Area 5. Risk Management Field Activities

Field activities for risk management include performing condition assessments for high-consequence pipes, sampling pipe breaks during high-consequence events, and a program for exercising critical valves.

### 5.1 Staff

Jeff Leighton, AMC
Jeremiah Hess, AMB
Dave Demchak, AMB
Mia Sabanovic, AMB
Engineering Planning
Engineering Design
Maintenance and Construction
Operations

### 5.2 Accomplishments to 2015

Several field activities relate to the Bureau's approach to managing the risk of asset failure. Some field activities are implemented by the AMB with outside consulting support. Most of the critical field work is led by Maintenance and Construction, and/or Operations, with support from the AMB. The Conduit Rehabilitation Plan was completed by Project Planning in 2015. Asset Management will support Engineering Design during condition assessment of the conduits.

#### 5.2.1 High-Consequence Pipe Condition Assessment

High-consequence pipes include pipes crossing major roads, rail, and water bodies; the large transmission and distribution-transmission mains, and the conduits.

#### High-Consequence Pipes at Crossings

The AMB has worked with contractors to perform leak detection on 30 miles of high-consequence pipe since 2009, when the large-diameter leak detection efforts began. The AMB has tested some of the different types of condition-assessment and leak-detection methods

currently available such as the broadband electromagnetic method (BEM), acoustic leak detection, and visual robotics. The AMB continues to evaluate new condition-assessment technologies for assessing consequential water mains. The AMB also performed condition assessments on 71 pipes on bridges using visual methods as well as ultrasonic thickness measurements of the pipe wall. One assessment resulted in immediate repair; five resulted in planning studies. Approximately 30 more pipes on bridges remain to be inspected, as of June 2015.

#### Transmission and Distribution-Transmission Mains

An internal visual inspection was performed on a portion of the Washington County Supply Line (WCSL) in 2014. Prior to pipe entry, the team developed a standard operating procedure (SOP) developed for accessing the interior of this large-diameter main. The SOP for inspection can be used in future pipeline internal inspection efforts.

#### Conduits

Engineering Project Planning completed a Conduit Rehabilitation Plan in 2015 with contributions from AMB staff. The plan outlines steps needed that lead to rehabilitation of the conduits, including assessment and enhancement of the cathodic protection system, internal and external inspection of the pipe, and rehabilitation/replacement of conduit sections. AMB staff have developed a database for water main condition assessment. This database is integrated into GIS. AMB staff can assist with the creation of a work plan for the conduit inspections, the inspection data collection efforts, including storing and analyzing the data, as well as preparing summary reports and business case analyses pertaining to the inspection findings. Creating a coordinated plan for collecting, storing, and disseminating data is a key part of Tactical Area 6, Information Systems and Business Workflows.

### 5.2.2 Pipe Break Inspections During Consequential Events

#### Reporting on Pipe Breaks

Accurately identifying the type of failure experienced on a pipe is important to understanding the stresses and environmental conditions the pipe is experiencing, and better defines the condition of the infrastructure. Continuing to gather this information will enable PWB to make more cost-effective decisions regarding which pipes are adequate to continue to serve and which pipes should be renewed.

The AMB created a failure data collection form and digital photo log to increase the value of observations associated with main breaks. This type of information enables the team to better predict the most likely failure mode, identify environmental factors that contribute to premature pipe failure, and identify the appropriate renewal or condition assessment technique that can be tied to given types of failures and deterioration mechanisms. The AM team also collects information on the consequence of the pipe failure using the triple-bottom-line approach. This approach includes gathering information on business impacts, supply disruptions, traffic delays and other social costs, and PWB expenditures.

This process has been used to document 20 failure events in detail. Of these, seven were horizontal breaks, six were vertical breaks, and seven were leaks. Two of these have been classified high-consequence breaks (NE Sandy at 138th and SW 4th at Burnside). Failure information from these events have led to improved estimations of the triple-bottom-line impacts in CLEM and business case analyses and to more detailed planning studies. Failure information is stored within CMMS and used to modify pipeline degradation curves; financial impact information is stored within Asset Management files. Forensic analyses of pipe breaks are not planned as a part of this effort.

#### Pipe Break Failure Data Collection and Interpretation

Failure mode information provided by Maintenance and Construction (M&C) on pipe breaks for the last four years has given the bureau a reliable data set from which to reach conclusions about the kind of pipe failures that are occurring for different pipe types. For example, most cast iron pipe failures are vertical breaks. Corrosion failures of cast iron pipe are quite rare in PWB's water system. This has implications for the consequence of failure and the technologies that can be applied to predict pending failures. Corrosion can be detected with several technologies. Pipe strain, which sometimes leads to vertical breaks, is not yet detectable by available technology. The M&C failure data provide PWB with more information regarding the condition of the piping network, and are being used in business case analyses.

All this information is processed and frequently used by the AMB to better understand pipe failure mechanisms and root causes, predict modes of pipe failures and the corresponding likelihood and consequence. For example when the team is faced with a question regarding the mode of failure for a pipe in a consequential area such as and undercrossing of a highway, the team refers to the processed data of past pipe failures of a similar cohort. This enables the AMB to make more consistent and data-driven decisions assumptions pipe repair, renewal or replacement.

### 5.2.3 Exercising Critical Valves

Three of nine high-consequence highway crossings identified by the AMB in FY 2013-14 have had their shutdown valves tested for operability by M&C thus far. Of the remaining six crossings, three are currently scheduled for testing by M&C for completion this fiscal year (2014-15); the last three crossings are Pump/ Transmission Mains and will be closely coordinated with Operations and scheduled for testing within the next fiscal year (2014-15).

## 5.3 Next Steps

### 5.3.1 High-Consequence Pipe Condition Assessment

The AMB will continue to lead efforts to assess the condition of high-consequence pipe segments. This includes the following:

- Non-intrusive leak detection on uncased crossings of major highways, railroads and water bodies.
- Intrusive leak detection—and camera inspection—on points of interests on uncased crossings identified by non-intrusive leak detection (or other means of detection)
- Visual inspection of pipes on bridges (Approximately 30 planned during next two years)
- Visual inspection of the conduits also including ultrasonic thickness measurements at the chosen locations. (described below)

The AMB will provide guidance on the method of data collection and storage for the high-consequence pipes.

### Conduits

The next steps are generally understood and outlined in the Conduit Rehabilitation Plan. For example, an over-the-line survey will be conducted as part of the cathodic protection assessment. This evaluation may include spot excavations to uncover and inspect the condition of the pipe on the outside.

With respect to the conduit condition, the Conduit Rehabilitation Plan proposes an internal visual inspection of the liner and exposed sections of pipe and joints, which is expected to require access improvements and take place over a three-year period through 2018. It may be appropriate to also use an internal technology insertion device for "hot spot" metal thickness measurement. The AMB recommends funding this step and including it in future work. If, for example, the results of the over-the-line survey identified 10 miles of "hot spots" (areas where the pipe is likely to have major metal loss), the insertion device (electromagnetic detection) could pinpoint the specific segments in that 10-mile length that were most deficient and could focus the rehabilitation work. This kind of focused assessment would be performed by a contractor and might be capitalized, as it has been in some other utilities. These efforts will be part of the Asset Management Program, as described under Conduits in Section 5.2.1 of this plan.

## 5.3.2 Pipe Break Inspections During Consequential Events

While the proper documentation within CMMS of the pipe failure data has been greatly beneficial in developing pipe deterioration curves used for assessing failure rates and likelihood of failure for similar pipe cohorts, there is still room for improvement and a need to collect more data. The AMB plans to continue to discuss the benefits of collecting good data with M&C crews. Current CMMS data do not always provide enough information from which to draw accurate conclusions. Further discussions will include the information already provided and categories of additional information that may be possible and highly beneficial in predicting future pipe failures. The AMB intends to continue to gather data during main breaks; however, AMB staff do not consistently receive notification of such events, limiting the opportunities for data collection. Improving the notification process will be an area the AMB will focus on in order to continue to build on the pipe break data register. Improving the overall quality and

consistency of the data collected is a key part of Tactical Area 6, Information Systems and Business Workflows.

### 5.3.3 Exercising Critical Valves

#### Distribution Pipe Network

Only three of the first nine high-consequence highway crossing locations have had shutdown valves exercised. Of the remaining six crossings, three are currently scheduled to have their shutdown valves exercised this fiscal year by M&C; the last three crossings are Pump/ Transmission Mains which require additional coordination and scheduling through Operations to ensure shutdowns have minimal impact on the surrounding supply. The AMB is working with Operations to exercise these shutdown valves within the next fiscal year.

The most recent analysis by the AMB has identified 59 additional high-consequence crossing locations for valve operability testing: 14 highway crossings and 45 railroad crossings. Nine of the 14 highway crossings are currently scheduled for testing by M&C this fiscal year; the remaining five crossings are Pump/ Transmission Mains and will be closely coordinated with Operations and scheduled for testing in the future. This fiscal year, 31 of the 45 railroad crossings are currently scheduled for testing by M&C.

The AMB keeps an updated priority list of distribution pipe network valves that require exercising (ideally to full closure). It is the responsibility of Maintenance and Construction (and Operations) to perform the field work and report back to the AMB and GIS on the results.

#### Facility Valves

Exercising facility valves is dependent on having updated drawings. As of May 12, 2015, one updated drawing (of approximately 100) is complete. Additional site plans are being completed. Questions that the AMB is helping resolve include the following: Do we have adequate resources to create these drawings? How many site plans can we create per year? How do we know when a drawing is completed and how does that get distributed? Where should these drawings be located for the future use of Operating Engineers?

Concurrent with the plan updates for critical valves is the development of a GIS process to revise pump station/tank sites in GIS. Questions that have been posed: What needs to be done? How does this get triggered? Do we have resources to make this happen as facility site plans are completed?

The CMMS will be used to generate the work order to exercise the valves. Questions that have been posed: Are the valves shown in a drawing all of the assets in CMMS? If not, how should we handle that? Do we need to identify critical valves on each of these site plans? If so, how do they get labeled in CMMS or GIS as critical? What is the best way to accomplish this effort?

How should AMB trigger OEs to exercise these valves, and track efforts? It may also be possible to schedule facility valve exercising along with other events, such as tank cleaning.

## 5.4 Recommendations

- Continue to assess the condition of assets at high-consequence crossings, including pipe crossing on bridges, railroad crossings, river crossings, and water mains that are designated as critical to the operation of the PWB backbone system.
- Populate the condition assessment data repository with high-consequence crossings condition information. Link the information to GIS layer through asset identification number. Enable all PWB users to access the information through the GIS.
- Improve notification to the AMB of main breaks. One way to improve the communication between the AMB group and Maintenance and Construction is to include the AMB on the work orders that are issued by Planners Schedulers. The AMB would be required to close out their portion of the work order and potentially enter beneficial information on the consequence of the pipe break during the work order closeout process.
- Inspect the conduits input information into pipeline condition access database to be available through GIS, and provide a written summary of the results.
- Educate crews about the value of improve data collection during consequential pipe breaks through opportunities such as the Short School and presentations.
- Continue to collect and update the opportunistic main break pipe register. Use the information to update the consequence of failure and likelihood of failure table and process.
- Identify high-consequence crossings and associated 1st and 2nd order shut-down valves; the AMB will work collaboratively with M&C and Operations to ensure valve exercise testing program is completed and create an exercise schedule (with condition-assessment information) for high-consequence crossings.
- Create site plans for facility valves; specifically, identify critical valves for regular exercise testing. Set programmatic measures to track progress and identify areas of potential improvement.
- Update pump station/ tank sites in GIS with critical valve layers.

# Tactical Area 6. Implementation of Reliability-Centered Maintenance

## 6.1 Key Staff

Mia Sabanovic, AMB
Dave Demchak, AMB
Operations

## 6.2 Accomplishments to 2015

Reliability centered maintenance (RCM) is defined as "the process used to determine the maintenance requirements of any physical asset in its operating context." It recognizes that all equipment is not of equal importance to either water delivery or safety and provides methods for apportioning maintenance activities according to the benefits the asset delivers, driven by data about the asset condition, performance, and past maintenance history. The anticipated advantages of RCM include efficiency improvements, lower total life-cycle cost of assets, minimization of unnecessary asset overhauls, and improvement of reliability of critical equipment.

At the Water Bureau, RCM process improvements started with internal data improvements to track how and why assets fail and how often. Until relatively recently, although PWB had an inventory of the operational assets in the computerized maintenance and management system (CMMS), the bureau did not track how assets failed and how frequently they failed. The AMB worked with Maintenance and Construction as well as Operations to identify asset failure codes for key assets such as pipes, valves, and pumps, and these were included as information options in work orders. Failure codes in recent completed work orders have allowed the bureau to better answer questions such as: how do the assets fail, what assets fail more frequently, do maintenance strategies appear to be effective in minimizing emergency asset failures?, and so on. As the bureau continues to use RCM, the quality and reliability of the CMMS failure data should improve.

The AMB has also collaborated with Engineering and Operations staff to launch the CMMS mobile application for Electricians, Instrument Technicians, Industrial Painters, Operating Engineers, and M&C crews. Field staff can now collect and enter data into the Water Bureau's work order system with this application. Data include information about asset condition, some field test results, and work performed on work orders. The data input from the application is uploaded to the CMMS database.

More progress has been made on distribution-system assets than on supply-side assets. The greatest progress in implementing RCM has been with pump stations.

## 6.3 Next Steps

RCM has been characterized in terms of 10 specific steps, given below. This is an ambitious set of goals that requires coordination across departments and changes to systems and subsystems to achieve. Implementation of RCM at bureau will continue after the two-year horizon of this plan.

1. Implement an RCM strategy

PWB has established the CMMS Data Management Steering Committee. The committee meets once a month to review actions that support the goals of better data management and integration of RCM strategies into the PWB maintenance and operation culture. A major part of RCM is using asset data to make informed decisions about maintenance, repair, rehabilitation, and replacement.

2. Develop predictive/preventive maintenance strategies

Since approximately 2012, most of the preventive and predictive maintenance strategies have been entered into CMMS. Staff are identifying data storage locations for diagnostic data. The AMB will take a lead in developing standards and processes for using these data to determine the overall condition of the asset. AMB and Operations will use information such as the mean time between asset failures to evaluate the effectiveness of the current predictive/preventive maintenance strategies. The AMB will engage stakeholders in evaluating the predictive/preventive maintenance strategies proposed in AMPs, designate an implementation lead, and report on implementation status.

3. Complete an asset register for all maintenance-managed items (MMI)

Bureau staff will complete an asset register for Lusted, Headworks and watershed assets and add new assets following construction (e.g., Powell Butte 2).

A procedure and guidelines for adding assets to the register upon project closeout is needed.

4. Refine workflow processes

The AMSC recommends that the bureau evaluate one workflow process each year, including analyses of repetitive work, opportunities for information-sharing, and the costs that could be avoided through refinements.

5. Set maintenance performance targets

The AMB is recommending an analysis of hours spent doing predictive/preventive maintenance and the ratio of corrective to predictive maintenance hours with the goal of balancing the investment in maintenance with benefits from the asset. Targets and programmatic service levels could be created or refined to address areas that need improvement. The AMB will research condition assessment methods with other asset-management utility leaders to find out how condition assessment is performed, whether they use condition rating cards, and how they store condition assessment data.

6. Complete work order scheduling structure in Computerized Maintenance Management System (CMMS)

The bureau could implement tools to share work order location to optimize mobilization. Progress in improving work order planning could be tracked as a Programmatic Service Level.

7. Record and track maintenance actions in CMMS

To improve asset failure data, AMB will provide additional training to the Operations staff. The training would focus on improving condition assessment and encouraging the Operations group to enter information during the work order closeout process.

8. Implement cost-effective predictive and preventive maintenance activities

If SAP cost information were integrated with CMMS data, it would be possible to produce benefit-cost estimates of different maintenance strategies.

9. Meet/exceed performance targets (e.g., for percentages of preventive compared to reactive maintenance)

The AMB will work with trade leads and Operations group supervisors to set Programmatic Service Levels based on the historical trends of preventive/reactive maintenance.

10. Develop RCM strategy for certain asset categories

The predictive maintenance program could be optimized with feedback from the root cause failure analysis (RCFA) of repairs and using quantitative preventive maintenance. The AMB recommends creating a feedback loop to proactively keep critical assets in their optimal operating condition with minimal maintenance cost.

## 6.4 Recommendations

- Develop and implement standards and processes for gathering and storing diagnostic data and condition assessment for assets. Prepare summary report.
- Evaluate asset failure data and refine current likelihood of failure methodology and estimates.
- Improve the standards and processes for gathering failure data. Use data to refine CLEM through modifications to the likelihood and consequence of failure calculations.
- Evaluate current predictive and preventive maintenance strategies. Identify improvements that minimize total expected asset life cycle cost. Present the information to the PWB work groups tasked with maintenance activities. Prepare technical memos on the benefits gained.
- Develop targets to improve predictive maintenance strategies. Incorporate targets into Programmatic Service Levels and report on them. Identify areas of improvement.
- Develop an asset register for water supply assets
- Document one to three workflow processes and identify potential efficiencies annually.
- Improve CMMS work system through creation of additional data fields.
- If possible, integrate SAP cost information with CMMS

# Tactical Area 7. Water Loss and Outages

## 7.1 Key Staff

Marie Del Toro, Project Planning
Jeremiah Hess, AMB
Mia Sabanovic, AMB

### Water Loss

In FYs 2012-13 and 2013-14 the bureau estimated a water loss for unaccounted-for water that exceeded 10% (Table 7). This is a considerably higher value than the 7.0–7.8% estimated for FYs 2009-10 through 2011-12. The causes for the increase in estimated water loss are being investigated. A better understanding of reasons for the increase in unaccounted for water will enable the bureau to focus on areas of improvement to reduce water loss.

**Table 7. System-Wide Production Data**

| | Fiscal Year | | | | |
|---|---|---|---|---|---|
| | **2009-10** | **2010-11** | **2011-12** | **2012-13** | **2013-14** |
| Total water produced (BG) | 36.9 | 35.7 | 35.6 | 36.8 | 35.9 |
| Total water consumed (BG) | 34.3 | 32.9 | 32.9 | 33 | 32 |
| Total non-revenue water (BG) | 2.6 | 2.8 | 2.7 | 3.8 | 3.9 |
| Percent of non-revenue water to total produced | 7.0% | 7.8% | 7.6% | 10.4% | 10.9% |

Data Source: PWB Finance Department, billed volume compared to supply volume
BG is billion gallons

The bureau has a workload measure for Leak Locates that is intended to track performance toward minimizing water loss. The workload measures used to report on this service level state the following: (1) Respond to 100% of leak assistance requests from crews and customers within 24 hours and (2) Survey 15% of service area annually.

The methodology for reporting on the survey workload measure has been discussed recently, and areas for improvement have been identified. The Leak Locates crew currently uses a paper recording and filing system, and the information would be beneficial for engineering planners to use to verify the condition of mains under analysis. This information is likely not being used to its full advantage with regard to documenting historical work performed, and may result in pipes being unnecessarily surveyed multiple times.

### Outages

Compared to other utilities, the Water Bureau has had low rates of reported water main breaks and outages (less than 10 main breaks per 100 miles per year). For water outages, previously we reported that fewer than 0.1% of customers were out of water for more than 8 hours a year, either planned or unplanned. An audit of the results was completed in early 2015. It was determined that many of the customer outages were not being reported and tracked, leading to

a misrepresentation of the actual results. There is a need to better understand the types of outages that occur.

Research questions for the upcoming customer survey[7] will include questions about planned and unplanned water outages. The AMB will use the results of the survey to evaluate Key Service Levels and possibly Programmatic Service Levels so that they may be tracked for reporting.

## 7.2 Accomplishments to 2015

### Water Loss

The AMB worked with the M&C Planners/Schedulers and Leak Locates crew to create an Access database to electronically record the feet of main surveyed by the Leak Locates crew. The process of entering the backlog of years of survey information is currently underway.

### Outages

The bureau has changed the Key Service Level related to outages from "less than 1% of customers out of water more than 8 hours a year" to "less than 2 unplanned outages of more than 8 hours a year." This is included in the six Key Performance Measures that are part of annual budget measurement and reporting.

The logic behind this change was: 1) customers are typically notified of planned outages and able to adjust their behavior, 2) outages limited to less than 8 hours are less burdensome than those that last longer, and 3) the bureau puts a great deal of effort into limiting the number of outages that exceed 8 hours. A review of the last two years indicated that the bureau had achieved the new service level goal.

## 7.3 Next Steps

### 7.3.1 Documenting Leak and Break Response Processes

The AMB will document the work of the Leak Locates crew to better understand how the crew is dispatched, how leaks are identified, how leaks are tracked, and how information on the work of the crew is recorded. The historical paper-based leak detection information will be transferred into electronic form at a common location accessible to staff outside the Leak Locates crew. Leak inspection information will be available through GIS. The AMB will work with the leak inspection crew to understand their current work practice and modify it so that the data produced is properly stored and displayed in GIS. This information will be considered for addition to the Engineering Planning tracking records for pipe replacement decision making.

[7] The customer survey is mentioned in Tactical Area 1, Level of Service Targets and Customer and Stakeholder Consultation.

The AMB will also document the work by M&C crews responding to pipe break events. The circumstances under which throttling, valve closure, and supply of supplemental water occurs will be documented. The work flow associated with these activities will also be mapped.

### 7.3.2 Outages Reporting and Water Loss Audit

The bureau will discuss the need for tracking of planned and unplanned events of various durations (0-4, 4-8, >8 hours). Since AWWA benchmarking reports on all six of these categories, the bureau will need to decide whether it intends to provide data to satisfy this reporting request. The question of how the bureau evaluates its performance with regard to water outages is part of the consultation with customers that is planned for later in 2015 (see Tactical Area 1, Level of Service Targets and Stakeholder Consultation).

Engineering Planning is moving forward with a water audit. The water auditing process allows PWB to quantify consumption and losses that occur in the distribution system and document the water management processes of PWB in a comprehensive written report. The report will include summarization of PWB's data, evaluation and recommendations for improvement of PWB's data collection processes in both quantity and quality, estimation of the quantity of water loss reduction available to PWB, prioritized list of actions to develop a Water Loss Reduction Program for PWB, and estimated cost to achieve the recommended water loss reduction including equipment purchases and staff resources. The recommendations from this plan will likely include an asset-management approach such as prioritizing system elements for maintenance and developing a strategy to optimize the repair, rehabilitation, and replacement of assets to achieve the greatest benefits.

## 7.4 Recommendations

- The AMB (with assistance from M&C) recommends adding "shutdown required (Y/N)" and "Number of services impacted" fields to CMMS work orders in order to more accurately capture and report on outages during main break events (Key Service Level).
- Transfer leak detection paper records into an electronic database and create a GIS layer showing all pipes surveyed, the associated dates, and condition.
- Implement the following in conjunction with the recommendations from the water audit, anticipated to be completed in the fall of 2015:
    - Work with CIS implementation team to understand confidentiality of the consumption data and data usage restrictions.
    - Import water consumption data from the Historical Meter Database into GIS and create GIS layer.
    - Import SCADA data into GIS to show data on water supplied.
    - Compare water consumption spatial data to the water-supplied data to determine pressure zones with the highest water loss. Use this information to modify work order prioritization for the water main leak crew. This analysis will not be up-to-date due to delay of the meter readings but it will provide bureau with a better understanding of the areas that might experience high water loss.

# ASSET RENEWAL

The Asset Renewal category includes work to forecast infrastructure replacement needs and identify funding requirements.

## Tactical Area 8. Forecast Infrastructure Replacement Needs and Funding Requirements

### 8.1 Key Staff

Jeff Leighton, AMC
Eric Brainich, AMG
Dave Demchak, AMG

### 8.2 Accomplishments to 2015

One of the primary goals of asset management is to forecast the infrastructure maintenance and replacement needs of the water system. The focus of the Water Bureau (and the industry) has been on pipe replacement forecasting, since this is a significant percent of the system cost, and because it is hardest to forecast when buried infrastructure needs to be replaced.

The current rate of distribution main replacement is about 5 miles out of a total system length of more than 2000 miles, equivalent to a 400-year replacement rate. A short-term replacement strategy based on that frequency has not resulted in the problem of an undesirable rate of asset failure because the majority of pipes in the distribution system have not yet reached the end of their expected useful lives. The point of replacement forecasting is to understand the expected useful life of the assets and to translate that into estimates of the miles of pipe (and the cost) that need to be replaced at certain points in the future.

#### 8.2.1 Forecasting Pipe Replacement

Asset Management has developed new pipe failure curves based on improved data received from Maintenance and Construction in recent years. Curves were developed for different pipe cohorts based on material, size and construction date using the Weibull formula, which is considered the industry standard for estimating failure. The AMB used the new failure curves and impact valuation guidelines to conduct business case evaluations on high-risk pipes, starting with the Fulton pump main crossing at I-5.

#### 8.2.2 Forecasting Replacement of Other Assets

Some of the Asset Management Plans have replacement forecasts and funding needs estimates and some do not. Any updating of an AMP to include this information would be treated as an appended technical memo, per the recommendation in Section 2.3.1 of this plan.

## 8.3 Next Steps

### 8.3.1 Forecasting of Pipe Replacement

The AMB will produce a long-range forecast of pipe replacements (miles and dollars each year) based on the Weibull failure probability distributions.

Close to 20% of cast iron pipe records have no install year. The AMB will continue to estimate the install year for cast iron pipe with unknown data. As more of the pipe receives an estimated install year, the replacement forecast will be refined. Estimating cast iron pipe install years occurs as resources are available and results are added to the GIS database. Replacement costs will be expanded to include demolition and disposal costs.

### 8.3.2 Forecasting Replacement of Other Assets

The AMB will also develop replacement forecasts for other assets. Some will come from the AMPs, some will be generated based on current condition of the assets, and others will be based on industry standard effective useful life and current asset ages. Replacement costs will be expanded to include demolition and disposal costs. The information will be summarized in a report.

## 8.4 Recommendations

- Use Weibull curves to generate pipe replacement cost forecasts.
- Continue to estimate installation year for cast iron pipes that have no installation date.
- Use AMPs and other resources to generate replacement costs for other assets.
- Prepare an Infrastructure Replacement Needs and Funding Requirements Report from the forecasts.

# BUSINESS SUPPORT SYSTEMS

Two areas of focus fall within the Business Support Systems category: implementing a capitalization policy and characterizing bureau technology systems and business work flows.

## Tactical Area 9. Capitalization Policy

### 9.1 Key Staff

Jeff Leighton, AMC
Remani Mathew, Accounting

### 9.2 Accomplishments to 2015

The Asset Management Coordinator (AMC) and the Accounting Business Operations Manager reviewed the capitalization policies of other utilities. Accounting found that the Bureau of Environmental Services does not capitalize assessments and the necessary analyses to determine appropriate engineering solutions. Jeff Leighton (AMC) found that Anchorage Water and Wastewater Utility, American Water, and WaterOne[8] capitalize condition assessments if the assessments lead to pipe rehabilitation.

Accounting has created a Capital Asset Policy to provide guidance on capitalization for specific asset groups. Accounting updated and drafted policies governing asset capitalization for valve replacement and pump stations. New large valves (24 inches or greater) that meet the $10,000 threshold will be capitalized and recorded as a separate component in the fixed asset system. A draft capital policy for pump stations is under review. Previously pump stations were recorded as one asset. The draft capital policy for pump stations defines how pump stations will be recorded going forward. Pump stations will be componentized into the following five categories: (1) pump station (building, roof, HVAC, piping, gates, valves, power supply, electrical components that do not fall under telemetry), (2) pump/motor, (3) telemetry and instrumentation, (4) magnetic flow meter; (5) motor control center.

### 9.3 Next Steps

As discussed under Section 5.3, the bureau may use an internal technology insertion device for "hot spot" metal thickness measurements on the conduits as part of its decision process for

[8] American Water Operates water utilities in 16 states (for more information, see http://www.amwater.com/about-us/our-states.html). WaterOne provides water for several communities in eastern Kansas (for more information, see http://www.waterone.org/about-us/our-story/waterone-service-area).

conduit rehabilitation. The costs include shutting down one conduit, the assessment labor and equipment costs, and the costs for ensuring safe operations. Is this a capital cost? That is a significant unresolved issue and further discussions will need to occur.

### 9.4 Recommendation

- Work with Finance and Accounting to develop a written capitalization policy for conduit condition assessment.

## Tactical Area 10. Technology Systems and Business Workflows

### 10.1 Key Staff

Mia Sabanovic, AMB
Bob Goldie, Engineering Technical Services
Mary Ellen Collentine, Engineering Technical Services

### 10.2 Accomplishments to 2015

The Data Management Steering Committee (DMSC) meets monthly to discuss issues related to asset data, technology systems, and business workflows. Asset data has been covered in Section 7 (reliability-centered maintenance). DMSC meetings in 2014 and early 2015 have reviewed the capabilities of various technology systems. An Asset Management Plan for Technology Systems is being developed.

### 10.3 Next Steps

Bob Goldie previously developed a list of work tasks for technology systems and business workflows. A summary of that plan is repeated here:

- Understand the data structure, and the various mechanisms by which we can communicate between databases and IT systems
- Understand bureau data needs. We need to better understand the demands for data and reporting in the bureau.
- Design a Data Management Implementation Plan
- Implement, and monitor, the Data Management Implementation Plan
- Create a list of the major business workflows at PWB, and prioritize them for mapping
- Complete mapping the 12 previously identified business workflows that impact Key Service Levels
- Complete mapping of the remaining business workflows

Progress has been limited, in the past, by available resources to perform this work. The bureau needs to assign more resources to make progress.

## 10.4 Recommendations

- Identify resources needed and propose a plan for expanding existing resources
- Complete the Asset Management Plan for Technology Systems
- Work with key staff and other stakeholders in other tactical areas to support improvements to data storage requirements
- Support key staff and other stakeholders in other tactical areas in mapping work flows. Identify business work flows, propose improvements and summarize and present findings.

# IMPROVEMENT AND INFORMATION

The AMB is focusing on three areas within the Improvement and Information category: (1) participating in benchmarking, (2) reporting on bureau assets, and (3) quantifying the benefits of asset management.

## Tactical Area 11. Benchmarking

### 11.1 Key Staff

Jeff Leighton, AMC
Mia Sabanovic, AMB

### 11.2 Accomplishments to 2015

The bureau has been involved in benchmarking, especially those related to asset management, since 2005. In recent years, PWB has completed the AWWA Annual Utility Benchmarking Survey and participated in the Water Services Association of Australia (WSAA) Asset Management Performance Improvement Project in 2008 and 2012. The bureau completed the Strategic Asset Management (SAM) GAP Analysis survey in 2005, 2008 and 2011 and the EPA AM "IQ Test" in 2014. The EPA AM survey was modified by the AWWA Asset Management Committee (Jeff Leighton is the Chair) and more than 500 utilities, including PWB, participated.

### 11.3 Next Steps

The bureau Management Team has discussed whether to continue to complete the AWWA Annual Utility Benchmarking Survey. A decision is needed before the next annual effort, beginning in September 2015.

The Asset Management Steering Committee has discussed whether to participate in the International Water Association and Water Services Association of Australia (WSAA) Asset Management Performance Improvement Project again in 2016. A North American version of the benchmarking project is planned for 2016.

Results from a separate national survey, fielded by AWWA on asset management, will be available in late 2015. The survey has had responses from hundreds of utilities. PWB will be able to compare its performance to others. PWB is likely to be nominated to be part of a proposed case study compendium.

The ISO 55000 series is a newly developed international standard for asset management. The bureau could compare its approach to asset management to this standard or even pursue certification from a third party. It is not recommended that the bureau get certified, but it is worth considering what the standards recommend. The bureau will have access to a report

prepared by the AWWA Asset Management Committee describing the standards. Once that report is complete, the bureau could review what efforts it wants to make to improve its "consistency" with the standard.

### 11.4 Recommendations

- Participate in the WSAA 2016 benchmarking effort
- Compare PWB performance to other utilities as part of the AWWA national survey on asset management to find areas for improvement and prepare recommendations
- Review the AWWA report on ISO 55000 to create a plan for PWB improvement

## Tactical Area 12. Asset Management Reports

### 12.1 Key Staff

Jeremiah Hess, AMB

### 12.2 Accomplishments to 2015

PWB completed an updated Inventory and Condition report, dated January 2014. Two previous reports covering similar material were dated February 2006 and July 2010. The information that goes into these reports (water system inventory, condition estimate and replacement value) is summarized in an annual City asset report. That annual City report also has an estimate of a funding gap for each bureau based on information supplied by the bureau.

The Statistical Report of the water system was prepared for the first time in decades by the AMB. It covers service levels, water supply and consumption, capital assets, water quality analysis, and personnel. The Statistical Report was issued in March 2015.

### 12.3 Next Steps

Following the historical trends of past issuance (the frequency has been every four years— 2006, 2010, 2014 are the last 3 dates of issuance), the next Inventory and Condition Report will be produced in 2018. The Statistical Report will be published annually at the end of the fiscal year following the previous report. For example, the report for FY 2014-15 will be produced by the end of the 2015-2016 fiscal year. As discussed under Tactical Area 8, Forecast Infrastructure Replacement Needs and Funding Requirements, a replacement forecast will be generated and published in a report.

### 12.4 Recommendations

- Prepare the next Inventory and Condition Report in 2018
- Prepare the FY 2014-15 Statistical Report in 2016
- Prepare an annual progress report on all tactical areas in this work plan

# Tactical Area 13. Quantified Benefits of Asset Management

## 13.1 Key Staff

Jeff Leighton, AMC

## 13.2 Accomplishments to 2015

Implementing asset management business process improvements has led to benefits to the bureau that can be quantified. The AMB's focus has been on avoiding costs through considering total life cycle costs, monetizing benefits in bureau investment decisions (compared to making a decision involving only initial capital cost or ignoring societal costs, for example), and identifying and mitigating risks, which have on-going risk costs (the cost of a failure that the risk is describing).

The AMB has maintained both a log of costs avoided through business cases and a risk-management log. The log of business cases lists alternatives to the engineering problem that led to reallocating funds to address other issues. As of February 2015, the estimated reallocated funds from business cases equals $75 million (this value excludes projects related to the LT2 regulatory compliance effort and the Willamette River crossing) and the annual savings due to risks avoided are estimated at $13 million.

## 13.3 Next Steps

We will continue to maintain a log for business cases and risk-cost savings.

## 13.4 Recommendations

- Continue to log business cases and the associated costs avoided.
- Periodically update the Benefits of Asset Management memo
- Outline briefing information on asset management for the Portland Utility Board

# Tactical Area 14. Developing Asset Management Competency

## 14.1 Key Staff

Jeff Leighton, AMC
AMB staff

## 14.2 Accomplishments to 2015

The AMB promotes increasing organizational competency in asset management. The AMB provides training and information for other groups and AMB members continue to develop expertise in many areas of asset management.

### Providing Training and Information for Others

The AMB led a major effort to develop asset management plans with staff from many areas of the organization. Many of the individuals who were designated AMP Leads were not familiar with the concepts of asset management. An AMP Leads group was formed, training sessions were held, an Asset Management Plan development guidance document was provided, and AMP Leads met regularly during development to present progress, share concepts, and collaborate on improvements. AMB staff still provide guidance on AMP development, including developing best practices in operations and maintenance.

The AMB assists and advises engineers in the development of business cases for capital projects. The AMB's Economist has developed a guidebook for business cases. The business case guidance resources include spreadsheets that assist in the development of benefit cost analyses and risk analyses. The Economist has trained professional staff in the Engineering Planning and Design groups and has provided a more general training for Operations and Maintenance and Construction staff. The internal asset management website includes spreadsheets, examples, and other resources to aid other staff in making business-case evaluations.

The AMB has also provided information and training to many other bureau and city groups:

- The AMB sponsored a workshop in November 2012 on Advanced Asset Management for interested PWB staff and managers. The class included material on assessing risks.
- The AMB disseminates information on asset management to interested City staff through a basic and advanced class on asset management.
- AMB staff train Maintenance and Construction field staff on pipe failure modes and the importance of documenting pipe condition as part of the work-order process.
- The AMC has made several presentations to all bureau branches on the basic principles of asset management.

- AMB staff present information every month to the AMSC on asset-management projects and programs. AMSC members participate in the Recommended Strategies subcommittee and the risk subcommittee.

AMB staff attend webinars and professional seminars throughout the year on topics such as pipe condition assessment, reliability-centered maintenance, pipe inspection and rehabilitation, performance measurement, and strategic planning.

### Assessing Organizational Competency

All members of the AMSC and AMB participated in organizational benchmarking in 2008 and 2012 that covered areas such as policy and planning; asset acquisition, operations, maintenance, replacement, and rehabilitation; and business support systems. The 2012 results showed improvements in all areas compared with 2008. A description of the benchmarking results is available in the report Asset Management Planning at the Portland Water Bureau, June 2013.

A national survey of utility business practices on asset management will be available in the fall of 2015. When the information is available, PWB will compare its practices to the survey results to identify areas for organizational improvement.

## 14.3 Next Steps

The AMB plans to continue to raise awareness at the organizational level about the role of asset management at the Water Bureau. AMB staff will prepare reports and presentations on using asset management to support decision-making and make investment decisions. The establishment of the Portland Utility Board (PUB) will provide an opportunity for the AMB to describe to these public stakeholders how asset management has shaped the bureau's investments in repairing, rehabilitating, and replacing assets.

AMB staff will review communication channels (such as the internal and external websites and the bureau's internal newsletter, Dispatch) for additional opportunities to describe AMB activities to staff and external stakeholders. The AMB plans to engage budget program leads and Finance staff in reviewing existing and proposed programmatic service levels, as recommended in Section 1.5. The AMB will continue to participate in the Citywide Asset Managers Group that provides City Council with formal updates on assets across the city.

## 14.4 Recommendations

- Create an improvement plan for PWB asset management based on national best practices
- Revise internal and external websites to provide the most recent materials
- Continue participation in Citywide Asset Managers Group
- Continue providing training opportunities to AM and other bureau staff

# Tactical Area 15. Alignment with International Standards

In 2014 the International Standards Organization (ISO) published new standards for asset management. The series, referred to as ISO 55000, includes goals for implementing asset management according to best practices for managing and optimizing benefits from assets throughout their life cycles. Key themes of the standards include alignment of asset management practices with organizational and business strategies including the following:

- Develop asset management policies and objectives
- Define leadership steps
- Describe organizational roles and responsibilities related to asset management
- Describe resources needed
- Identify competencies required
- Document all aspects of establishing and standardizing asset management (including work flows, standards and criteria, parameters for decision-making, benchmarks, and performance).

The Portland Water Bureau AMB proposes evaluating the bureau's current asset management framework, identifying areas for improvement, and making improvements where feasible and practical to create better alignment with the international standards.

## 15.1 Key Staff

Jeff Leighton, AMC
Asset Management Steering Committee
AMB staff

## 15.2 Accomplishments to 2015

As part of his responsibilities as chair of the AWWA Asset Management Committee, Jeff Leighton has reviewed the ISO 55000 standard. Jeff Leighton is also moderating a special session on the standards at the Water Infrastructure Conference in October 2015.

## 15.3 Next Steps

To excel at asset management and participate at the leading edge in the U.S., the bureau should review the ISO 55000 series and consider making progress on the steps prescribed by the guidance. Utilities in Canada, Australia, and the United Kingdom have been using an approach that is similar to ISO 55000 to guide their organizations. A small number of U.S. utilities have taken the first steps in this direction, or have expressed an interest in ISO 55000. Some North American utilities have indicated that they want to get certified; that is not what the AMB is recommending for the Water Bureau. Here are some key steps:

- More closely align asset management activities with bureau strategic objectives (similar to the information provided in Table 1 of this plan)

- Identify roles and responsibilities, including at the highest level of management (similar to Table 2), for facilitating and supporting the bureau's asset management program
- Provide support for the implementation of asset management, ensuring resources are available and competent. Some of the tactical areas in this plan address needed resources, such as bureau policies that support condition assessment, and staff from other departments to carry out the tasks and activities that provide information for the AMB.
- Create documentation, including the processes and procedures needed to achieve the asset management activities

Many of these ideas were highlighted in the Water Services Association of Australia (WSAA) Performance Improvement Project in 2012. For example, "Has the agency assigned accountabilities and responsibilities for each of the processes in this function, including procedure documentation, implementation and maintenance?" In its responses, PWB scored low in this area.

In a recent example, failure to fully assign accountabilities and responsibilities for all processes had negative consequences: problems with the collection, transference and analysis of outage information from the field has meant that the bureau could not provide an accurate report of how many customers had been out of water. Although the bureau did report values, we learned that the reported information was erroneous. If the bureau had clear responsibilities and accountabilities for this process, it would have been able to successfully document its performance in this Key Service Level.

## 15.4 Recommendations

- Brief AMSC on the ISO 55000 series standards relevant to PWB
- AMSC to propose organizational improvements that will better support managing assets according to the standards
- Capture progress on implementing asset management according to the standards in the annual progress report on all tactical areas.