PORTLAND WATER BUREAU:
Further advances in asset management would benefit ratepayers

June 2012

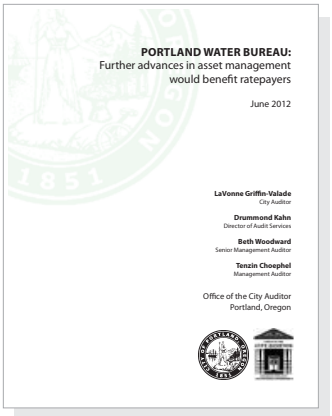
LaVonne Griffin-Valade
City Auditor

Drummond Kahn
Director of Audit Services

Beth Woodward
Senior Management Auditor

Tenzin Choephel
Management Auditor

Office of the City Auditor
Portland, Oregon



Production / Design
Robert Cowan
Public Information Coordinator

CITY OF PORTLAND

Office of City Auditor LaVonne Griffin-Valade

Audit Services Division
Drummond Kahn, Director
1221 S.W. 4th Avenue, Room 310, Portland, Oregon 97204
phone: (503) 823-4005
web: www.portlandoregon.gov/auditor/auditservices

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TO: Mayor Sam Adams
Commissioner Nick Fish
Commissioner Amanda Fritz
Commissioner Randy Leonard
Commissioner Dan Saltzman
David Shaff, Administrator, Portland Water Bureau

SUBJECT: Portland Water Bureau: Further advances in asset management would benefit ratepayers (Report #405)

The attached audit reviewed the Water Bureau's management of the extensive physical assets it uses to deliver water to customers. The Bureau set a high standard for managing its assets when it adopted asset management principles about five years ago. These principles focus on service delivery at the optimum long term cost. The Bureau has made progress in improving its asset management, particularly in evaluating capital project costs and benefits, and considering risk in plans for asset maintenance, repair and replacement.

We agree that asset management best practices benefit ratepayers, and we found the Bureau is viewed as a leader in asset management within the City and among U.S. water utilities as a result of its progress. However, we found several ways that the Bureau can improve its asset management practices to benefit ratepayers, including implemention of data management changes, confirmation and clarification of required service levels, and incorporation of clear management decisions and priorities in its Asset Management Plans.

We believe the improvements we recommend in this report will enable the Bureau to make further advances in providing cost-effective service to benefit Portland ratepayers.

As a follow-up to our report, we ask the Water Bureau to provide us with a status report in one year detailing steps taken to address the recommendations in this report.

We appreciate the cooperation and assistance we received from Portland Water Bureau staff as we conducted this audit.

L. Griffin-Valade

LaVonne Griffin-Valade
City Auditor

Audit Team: Drummond Kahn
Beth Woodward
Tenzin Choephel
Kari Guy
Daphne Lundi

Attachment

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Summary

Water users depend on Portland Water Bureau assets valued at $7 billion -- the pipelines, pump stations, tanks, and other equipment that get clean water to homes and businesses. The Bureau supplies an average of 100 million gallons of water per day.

Asset failures, such as pipe breaks, could result in problems – from customer inconvenience to health consequences and the costs to repair or replace assets. With good management, however, the Portland Water Bureau can minimize its overall costs while maintaining water service quality. We undertook this audit to review the Bureau's current practices to manage the City's water assets.

In 2007, The Bureau committed to adopting and carrying out internationally-accepted principles of asset management. The Bureau's commitment can be seen in its work drafting management plans for some assets, evaluating some capital projects to plan for maximum long term benefit, and prioritizing many maintenance and construction tasks based on risk. The Bureau published its goals for using asset management principles, in planning and revenue bond documents.

> "The 'Total Cost of Ownership' Principle – there exists a minimum optimal investment over the life cycle of an asset that best balances performance and cost given a target level of service and a designated level of risk."
>
> U.S. Environmental Protection Agency (EPA)

The Bureau also defined 27 service level indicators it uses to track and report progress, such as, "Respond to 95 percent of customer inquiries or requests within five business days," and "More than 90 percent of flow control valves will operate when needed."

These steps are positive and the Bureau has been recognized as a leader in asset management. In fact, many other U.S. utilities have yet to adopt a similarly comprehensive approach to asset management. However, we found the Bureau can do more to fulfill its goals for managing assets to benefit customers. The Bureau falls short in key areas, and these need attention to enable more cost-effective service delivery to ratepayers.

We found that the Bureau's data management efforts do not support its asset management objectives. Our 2004 audit reported the Bureau's difficulty in managing data to make evidence-based, cost-effective decisions about assets; the Bureau continues to experience that problem.

We found that the Bureau is not systematically using required service levels in budgeting. We further concluded that some service levels are internal workload targets that do not express the impact on customers, that the sheer number of identified service levels may dilute focus, and finally, that the Bureau has not sought input from representative customers about whether they agree with the required service levels the Bureau identified.

In addition, the Bureau has no overall plan for managing its assets, and planning efforts are splintered. It has drafted only a third of about 20 plans it identified as necessary for assets such as pipelines, fire hydrants, and meters. Meanwhile, the Bureau continues to rely on systems and practices that lead to reactive maintenance. Bureau managers indicated they agree that more proactive maintenance is needed to reduce long term costs.

To improve upon the foundation of asset management principles put in place, we recommend that the Bureau:

- Deploy resources, formalize leadership and develop accountability structures to implement a data management approach that meets its asset management needs.
- Identify and clarify the essential required service levels, obtain confirmation from representative customers so that required service levels can be more useful in decisions about resource allocation, and apply clarified service levels as budget criteria.

- Document management decisions and directions for prioritized actions in Asset Management Plans to increase accountability and likelihood of implementing the plans to benefit customers.
- Incorporate an accountability framework throughout the Bureau to increase the likelihood of successfully meeting its objectives.

Conduits at Bull Run

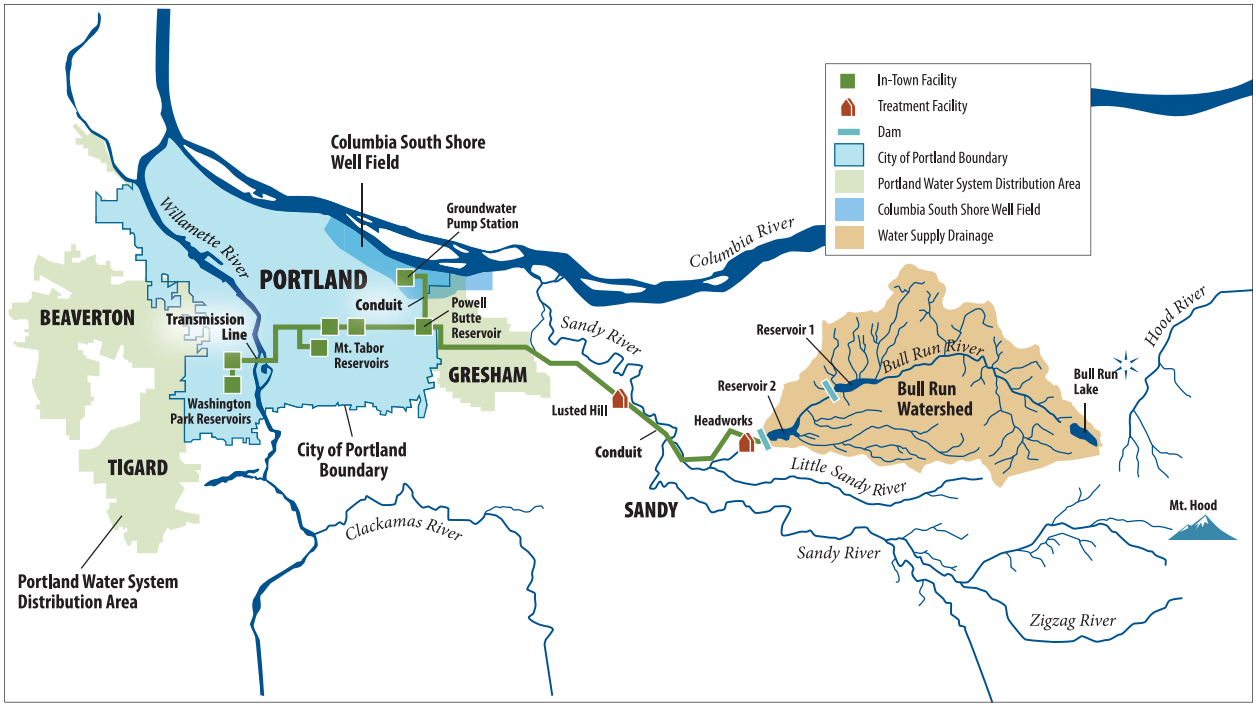
Source: Audit Services Division photo

Chapter 1 **Background**

Essential water delivery depends on high value assets

The Portland Water Bureau (Bureau) serves about one quarter of Oregon's population, both in Portland and other communities. It depends on its physical assets (assets) to continuously supply, store, pump, and deliver clean water to homes and businesses. The Bureau estimates that it would cost about $7 billion to replace its assets, such as treatment facilities, pipes, tanks, and meters. Figure 1 shows the extent of the water system and wholesale distribution areas, and some of the major assets needed to supply the average customer demand of 100 million gallons of water per day.

Figure 1 Portland water system



Source: Portland Water Bureau, 2011

Asset failures, such as pipe breaks or equipment breakdowns, could result in severe health consequences, transportation disruptions, and costs to repair or replace assets. Managing assets to provide water service at cost-effective rates while avoiding consequences to health and other unacceptable risks is a significant part of the Bureau's mission, "to be responsible stewards of the public's water infrastructure, fiscal and natural resources."

City policy requires bureaus to maintain assets in good working order to protect capital investments and to minimize future costs of maintaining and replacing them, especially to avoid costly deferred maintenance. In fiscal year 2011, the Bureau spent over $94 million in net operating expenditures (net of depreciation) and debt service (for purchasing new assets and major repairs on existing assets). Ultimately, Bureau and Council decisions about maintaining, repairing, and replacing assets directly affect current and future Bureau expenditures, water rates and water quality.

In 2004, we audited Bureau maintenance of the water distribution system (Report #299) and recommended that the Bureau prepare a maintenance plan, improve reliability of asset information, integrate information systems, and develop performance measures to track maintenance activities. At about the same time, the Bureau initiated elements of its asset management process. Our objectives in this audit were to review how the Bureau currently manages water system assets on behalf of its ratepayers, and whether it is following its commitment to asset management principles.

Broad agreement about the value of asset management

The Bureau, City Council, and the utility industry agree that the internationally accepted process for asset management provides the best way to deliver the service levels customers want at the minimum overall cost. Based on our review, we also agree that asset management would benefit customers and the City. Key principles and best practices of asset management are documented in the International Infrastructure Management Manual and by the U.S. Environmental Protection Agency (EPA). Our use of the term best practice, with respect to asset management, generally refers to those identified by these two organizations. The EPA's role in promoting asset manage-

ment in U.S. water utilities resulted from Congressional interest in the benefits of comprehensive asset management. At the City level, the Water Bureau and other City bureaus responsible for physical assets collaborate on an annual Citywide Assets Report, presented to City Council. The report includes their workplan for, and progress on applying seven specific asset management best practices.

Broad agreement about the value of asset management best practices does not mean they are widely implemented in the U.S. Although American Water Works Association (AWWA) policy also recommends comprehensive asset management planning for water uitilities, an AWWA representative told us that the organization is just starting to look at asset management and that the U.S. is lagging behind other parts of the world in utility use of asset management.

Advances in asset management benefit ratepayers

The cost of providing water is impacted by many factors including a consideration of what risks are acceptable. Asset management makes delivering required services over the long term the central focus of management's decisions. Benefits to ratepayers include:

- **Reducing overall costs through efficient operations and maintenance that prolongs asset life** - Asset management seeks to minimize total costs of acquiring, operating, maintaining, and renewing assets while keeping risk at an acceptable level. The American Water Works Association (AWWA) reported that utilities may save 20 to 30 percent of life cycle costs by adopting asset management practices.
- **Focusing on services delivered** - Delivering the service levels that customers confirm and regulators require, such as water quality, drives output-oriented management. Focusing on services helps prevent unnecessary spending.
- **Using a sound basis for setting rates** - Rates should be tied to, and limited to providing agreed-upon services through cost-effective asset management actions to maintain required services at acceptable risk levels. Asset management includes planning funding strategies for optimum capital, maintenance, and operations investments.

Overall, these benefits also improve accountability over the use of resources. Generally, service level measures and evidence-based asset decisions promote accountability and transparency.

Asset management best practices involve systematic, evidence-based, cost-effective decisions

Managing assets in a cost-effective way involves systematically making choices based on an understanding of asset performance, risks and costs in the long term. Asset management ties those asset maintenance and replacement choices to maintaining the services that assets are in place to provide. We summarize the following interrelated characteristics of a good asset management program, based on our review of these principles.

Having knowledge about assets and costs

Data and knowledge about assets form the basis of every decision and are the backbone of asset management practices. Needed data includes assets owned, asset condition, expected remaining life, cost to replace each type of asset, and how each asset would be likely to deteriorate. The key to good data and data systems is to tailor them to the utility's decision-making needs. Data quality, asset register, and data system architecture should support decision-making.

Maintaining desired levels of service, agreed by customers

The services a utility delivers are the reason for all the assets in its system. The utility must know the specific minimum levels of the services it delivers, in order to plan, budget, manage and evaluate the work and assets it needs to cost-effectively maintain those levels of service. An example of a service level is to deliver water reliably, limiting outages to no more than three events per year per customer. The steps for using service levels are: define the required levels of services that assets deliver; engage representative customers in confirming or modifying levels; and budget and manage as required to maintain the agreed-upon levels of service.

Lifecycle approach to asset management planning

An asset management plan (AMP) identifies the tactics and resources that are optimum (lowest cost) for meeting service requirements.

AMPs provide the basis for decisions about assets, including service levels and asset information such as condition, performance, and risks of failure. They include management strategies to maintain, repair and replace assets to achieve the lowest lifecycle (long term) cost, and the plan to fund those actions through rates and charges.

Implementing planned solutions to provide reliable cost-effective service

Planning optimal asset actions is not enough. Total cost over time is optimal only if the maintenance and other planned strategies are actually performed. It is through implementing evidence-based decisions, documented in Asset Management Plans, that service levels can be maintained at optimal long term cost.

Chapter 2 Progress made in asset management

Bureau committed to asset management best practices

The Bureau meets the City's voluntary timeline for implementation of asset management best practices described in the 2011 Citywide Assets Report, and is recognized as a leader in asset management among U.S. water utilities. The Bureau set a higher standard for its asset management approach in 2007, when it documented its commitment to becoming an "advanced asset management organization," in an Asset Management Charter, signed and prominently displayed by top management (Appendix). The Charter cites international best practices.

The Bureau's efforts to document asset information, evaluate asset failure risks and capital project alternatives, identify service levels, and begin drafting asset plans to guide cost-effective maintenance, repair and replacement are evidence of its commitment to asset management concepts. Figure 2 shows many of the actions the Bureau has taken since 2004. Moreover, the City has promoted the Bureau's commitment to asset management and the Bureau helps guide the Citywide efforts. The City publishes details about the Bureau's asset management program in its official statements to revenue bondholders.

Bureau leadership engaged in asset management

Bureau management formed an Asset Management Group within its Engineering Services Group to provide technical guidance, coordination and support to the Bureau as a whole. It also established the Asset Management Steering Committee ("Steering Committee") to make decisions and policy based on information presented to it by the Asset Management Group. With the exception of the Bureau Administrator, Steering Committee members include Bureau executive leadership and other selected managers with responsibilities tied to asset management.

Figure 2 Major milestones in Portland Water Bureau asset management program

2004	Formed Asset Management Group work unit in Engineering Services Received Audit Services Division's *Portland's Water Distribution System: Maintenance program needs improvement* audit report
2005	Formed Asset Management Steering Committee Conducted the first "business case" impacting management of an asset (hydrant overhaul) Utilized self-assessment tool to identify program gaps for benchmarking (first in a series of gap analyses)
2006	Improved asset information in the *Water System Status and Condition Report* Participated in the Water Services Association of Australia's international benchmarking study (first year of a three year program) Drafted the first Asset Management Plan for an asset group (distribution mains)
2007	Adopted Bureau *Asset Management Charter* Began reviews of work order data in the maintenance information system Developed a business risk methodology and applied to assets for the first time
2008	Adopted the *Bureau Strategic Plan (2008-2011)* with key service level indicators
2009	Published the *Business Case Development Guidebook*
2010	Published *Guidelines for How to Develop an Asset Management Plan* Developed a Bureau *Asset Management Work Plan* for 2010-2015 Prioritized completion of Asset Management Plans for about 15 asset categories

Source: Portland Water Bureau

Bureau information system improvements

The Bureau began using its Computerized Maintenance Management System (CMMS) in 2004, to manage in-house maintenance and construction task orders. It also uses a proprietary forecasting tool, Total Enterprise Asset Management Planner (TEAM Plan) to track the condition of water system assets and estimate time and cost of appropriate asset repair or replacement based on condition. The Bureau made progress developing its asset hierarchy and improving on the collection and organization of its asset information across CMMS, TEAM Plan and the Geographic Information System (GIS).

Bureau data management improvements

The Bureau reported that a significant accomplishment was to provide a better structure for finding information. A Bureau official stated that a multi-year project consolidated multiple file servers, removing a significant number of duplicates in the process. As part of this work, the Bureau stated it also reorganized the file server hierarchy, in part to better match the Bureau's asset hierarchy.

Bureau identified levels of service

The Bureau began identifying service levels in its first Asset Management Plan for water mains and continues to apply them to specific groups of assets. In its 2008 Strategic Plan, the Bureau identified 24 bureau-wide service levels. Since then it increased the number it considers key to 27. An important service level is to comply with all State and Federal water quality regulations.

Bureau case-by-case evaluation of risk and optimum cost

In 2007, the Bureau prioritized many assets according to estimated business risk. Since then, Bureau staff evaluated the risk for pipeline material types and many of the major assets it prioritized. The Bureau also performed business case analyses of projects and policy changes on a case-by-case basis, as directed by the Steering Committee or by capital project planners. Most of the Bureau's reported asset management cost savings have resulted from business case and risk evaluations.

Bureau guidance prepared

In order to assist other Bureau staff to participate in evaluations and planning, Bureau technical staff in the Asset Management Group prepared the Business Case Development Guidebook and Guidelines for How to Develop an Asset Management Plan. These documents provide Bureau methodologies for applying asset management practices to the water system. To support business case analysis, the Asset Management Group also prepared guidelines for estimating dollar values of changes in some service levels, including water outages and water pressure.

Draft Asset Management Plans in progress

The Bureau drafted AMPs for six groups of its similar assets and is working on many others to fulfill action items it described in its Asset Management Charter. It drafted plans for distribution pipes, tanks, commercial meters, pump stations, large valves, and fire hydrants. These efforts resulted in Bureau asset management experts presenting a peer-reviewed paper on the distribution pipes AMP to the American Society of Civil Engineers' Pipelines 2011 Conference.

Improvements in Bureau culture, coordination and communication

Throughout this audit, Bureau staff repeatedly described to us how asset management has become an important mechanism to make needed changes, although some also told us about resistance to it. The Bureau's asset management efforts brought teams together from distinct organizational divisions that may not have interacted before, to work on common goals. For example, engineers with asset design responsibilities and others with operations responsibilities are now more likely to discuss particular assets and projects from a broader perspective. Similarly, field crews responsible for collecting information about assets are improving their records to share the information with staff responsible for recording data in information systems.

Chapter 3 Data management progress has not kept pace with asset management needs

Managing information to make good decisions is one of the greatest challenges in today's operating environment. At its core, asset management is about making data-driven, evidence-based decisions. However, the Bureau is like other organizations that have pieced together a data management approach based on legacy systems and solutions to address emerging needs. Bureau staff, as well as expert sources outside of the Bureau, assessed the Bureau's current approach to data management as an impediment to its ability to meet its asset management objectives. We found that the Bureau has developed an overarching data management strategy but has yet to implement key tasks that meet the general needs of the Bureau as well as the specialized needs of asset management. Improving data management depends on leadership, dedicated technical resources and assigning responsibility for making data management improvements.

Long-standing data management challenges known

Over the years, the Bureau has relied on many data systems and processes to address its data needs. Our 2004 audit, at about the time the Bureau initiated an asset management program, dedicated a chapter to the Bureau's need for stronger data management. Since the 2004 audit focused on the maintenance of distribution assets, we reported that existing asset data systems were inefficient and unreliable, and that a number of duplicative databases existed at the Bureau due to the lack of good integration across existing systems. In addition, the Bureau was using unreliable information on the condition of key assets and the level of effort needed to address its requirements.

Figure 3 Select information systems significant to asset management

Name	System Type	Description
SAP	Enterprise Resource Planning System (ERP)	Financial system for the City, with personnel, timesheet, purchasing (e.g. capital project contracts) and aggregated cost data
Oracle WAM	Computerized Maintenance Management System (CMMS)	Work order and inventory management system with some asset attributes and cost-data for in-house projects
ArcGIS	Geographic Information System (GIS)	Visual presentation of mapped asset data with specific asset attributes, used primarily but not exclusively on distribution system and right-of-way assets
Cayenta	Customer Information System (CIS)	Customer billing system operated by the Revenue Bureau, which includes data from customer water meters
LabWorks	Laboratory Information Management System (LIMS)	Water quality information system with test data from water sampling stations, required for laboratory certification and data validation
OASys	Supervisory Control and Data Acquisition System (SCADA)	System remotely monitors and controls water treatment and distribution assets, and collects data for analytical purposes (e.g. water flow, pressure, etc.)
TEAM Plan	Forecasting model	Financial needs forecasting model, that includes asset-related data compiled from other Bureau sources
Various	Access databases	Individuals and units within the Bureau maintain various database files on specific asset groups, including data about infrastructure sites, roads, etc.
Microstation	Computer Aided Design & Drafting (CADD)	System includes three-dimensional models of key sites within the water system that augments existing asset information in GIS.
FileNet/P8 Job Tracks, General Plans	Content management	A software package and Access databases used collectively by the Bureau to store or provide location references for a variety of Bureau information
SQLserver	Database program	Primary and central repository for information about Bureau assets

Source: Portland Water Bureau

Now, about eight years later, the Bureau faces similar challenges, yet with even more data systems and its new objective of locating, collecting or analyzing data to use in asset management decisions. Figure 3 provides a list of the Bureau's current asset management-related data systems. Some of these systems are not directly within the Bureau's control (e.g. SAP, Cayenta), and the Bureau reports other systems (e.g. SCADA, LIMS) must stand alone due to security issues.

While the Bureau is aware of its data management issues, we found its recent asset management efforts have brought these concerns into the foreground. Because asset management activities have increased the coordination and communication between work units, the Bureau appears to have improved in its knowledge sharing and, likewise, its ability to identify areas for improvement.

During our review of Bureau documents, we studied detailed analyses that Bureau staff members prepared as part of their work developing business cases, status and condition reports, and especially Asset Management Plans. Staff members repeatedly reported a variety of limitations with data completeness, reliability and usefulness for asset management needs. They also cited inefficiencies due to numerous data sources and lack of system integration. The extent and type of problems vary depending on the asset category, information system, and work unit. These variations and inefficiencies led to inconsistencies when performing similar business processes. Our interviews with Bureau staff confirmed the limitations reported in these Bureau documents. Moreover, the Asset Management Group developed a document in 2008 to emphasize and prioritize the key data needs to support the Bureau's asset management efforts.

We found that numerous sources outside of the Bureau confirmed the importance of the data management issues identified in Bureau internal reviews. To help identify and prioritize needed improvements, the Bureau consulted with asset management experts and participated in various assessments with its international and domestic peers, beginning in 2005. In June 2011, it hired consultants to provide options for implementing improvements to its business processes and systems.

Figure 4 Past recommendations related to Bureau data management

	Select Recommendation(s)	Report	Author(s)
2004	Better plan and coordinate efforts to improve the reliability and accessibility of asset information.	*Portland's Water Distribution System: Maintenance Program Needs Improvement*	Audit Services Division
2005	Create data standard; improve data warehouse for storage, management and reporting of data; develop an information technology system strategy; and improve cost data.	*Asset Management Gap Analysis and Benchmarking*	GHD
2006	Define corporate data needs, data model, and implementation plan that reflects the needs of all stakeholders; integrate key systems.	*QualServe Peer Review Report*	AWWA, Water Environment Federation
2007	Initiate information management improvements to support asset management objectives, including data management, system integration and asset classification system.	*Distribution System Master Plan*	Camp Dresser & McKee Inc. (CDM)
2008	Establish common asset register, develop data mining capability, enhance cost accounting; establish procedures for data verification and import for data capture at asset handover	*2008 Asset Management Process Benchmarking Project*	Int'l Water Assoc., Water Services Assoc. of Australia, GHD, Marchment Hill, CH2M HILL
2009	Improve the asset hierarchy, asset register and asset attributes to enhance future modeling and improve the overall confidence level for decision-making activities.	*Report for Future Investment Needs Modeling for Asset Management*	GHD
2011	Improve business processes and integration of existing systems to support workflows; prioritize and implement gap closure action plans (19) based on available resources.	*Business Workflow Analysis Project*	Brown and Caldwell

Source: Audit Services Division, and documents provided by Portland Water Bureau

In all reports we reviewed, we found consistent recommendations for the Bureau to improve its data management, as listed in Figure 4. Since 2005, the Bureau has participated in self-assessment processes with other utilities, to identify any gaps in its asset management implementation. The Bureau acknowledged that in the "Data and Knowledge" category of the self assessments, it had a low overall score and also low scores relative to other top water and wastewater organizations.

Overarching data management strategy developed but needs to be implemented

We found the Bureau has developed an Information Technology Strategic Plan, but is still in the process of implementing our 2004 recommendation to better plan and coordinate efforts to improve the reliability and accessibility of water system asset information. The Bureau reported that it began developing an information technology strategy in 2006, culminating in the Information Technology Strategic Plan ("Strategic Plan") in 2009. The Strategic Plan includes a stated goal, objectives and strategies that encompass data and system enhancements. It also requires the development of annual Action Plans that list specific tasks to meet areas identified within the overall strategic framework. The Bureau reports that management and a separate Information Technology Strategic Plan Committee, comprised of representation from across the Bureau, annually reviewed the Strategic Plan and wrote the Action Plans.

Two tasks that are of particular importance to asset management are development of a common data model, and data standards for asset information. Both were included in each of the last three annual Action Plans. The fiscal year 2011-12 Action Plan states these tasks are planned for completion by the end of this fiscal year.

A Bureau official reported that these Action Plans serve as the backbone of its information technology efforts and, over the years, has successfully completed many of the tasks identified but not areas of focus in this audit. The official told us the Bureau's ability to implement the various tasks as planned was and is based on available resources. The Bureau reported that its Data Management Program resides within the Engineering Services Group but serves

Bureau-wide needs. Two staff members and their supervisor have data management as part of their portfolio of responsibilities. They coordinate and request time from other Bureau staff with information system-related responsibilities on a task- or project-basis. The Bureau reports, when funding is available, it has budgeted for the use of consultants to assist in projects if additional expertise or time is needed.

The Bureau tracks performance for the Data Management Program as part of its quarterly program budget reports. The reports include effectiveness measures as well as system-specific workload measures. However, despite agreed-upon goals and regular data quality reviews, performance in the areas tracked by these measures revealed mixed results. The most recent quarterly report we reviewed showed unmet or unclear targets for 11 of the 13 measures.

Given the 2011 consultant's report addressing data management challenges, this is a good time for the Bureau to implement its data management strategy. The consultant's report provided a foundation for the Bureau to build upon. For example, the report described whether or not the Bureau's data systems (listed in Figure 3) relate to each other. It also mapped 12 business process workflows, as well as the current and desired state of the Bureau's enterprise architectures (business, systems and technology) related to those workflows. The consultant's report states that Bureau teams agreed on the following objectives for the Bureau's future data management work:

- Integrate systems
- Provide for more effective reporting
- Provide end-to-end support for business processes
- Create a single version of the truth
- Reduce dependence on paper
- Define and enhance supporting business processes

The consultant's report identified 19 recommended action plans and the Bureau reported it began addressing key components from the report, which will require several years to implement.

Slow pace of data management improvements impede asset management progress

While the Bureau has begun to focus some attention on data management concerns, the slow pace of its improvements has delayed the Bureau's ability to meet its asset management objectives. We identify three interrelated areas where data management limitations have affected the Bureau's progress in fully implementing asset management.

Impact on asset register development

Data management challenges have affected the Bureau's ability to complete an asset register, the first step of any asset management program. The asset register is at the heart of asset management because it is the systematic recording of all assets an organization owns or for which it is responsible. The register should form the link between all asset-related applications. It must also support the structure and use of the information system to describe and appraise the assets as individual components, as composite assets – like a pump station - or as groups of similar assets. The register includes asset attributes and the asset hierarchy, on which additional data collection is based. Therefore, the Bureau has to determine what it knows about its assets, and also what unknown information it needs and how best to collect it.

The Bureau has invested staff resources and made progress in developing its register – for example, the Bureau reports that its Asset Hierarchy Subcommittee regularly meets to load and organize the asset register. However, challenges in accessing the Bureau's existing knowledge about its assets have made these efforts that much more difficult. Inefficiencies and limited data reliability, as described by the Bureau in its asset management-related documents, are examples of these challenges.

Impact on data quality used for decision-making

The 2011 consultant's report explained that current systems do not support the data collection and reporting needs of all processes and, as a result, data users have developed compensating processes and activities to fill any gaps. These compensating processes have created information islands that can result in multiple versions of the truth with users making decisions on inaccurate or expired information.

Elements of data quality include reliability, completeness, accuracy, consistency, timeliness and usefulness to decision-makers. Since asset data and data systems are central to asset management practices, the caliber of the organization's decision-making depends directly on the extent and quality of the organization's data.

There have been some improvements in data quality but not a systematic approach. For example, the Asset Management Group identified key data needs in 2008, focusing mostly on asset data attributes in GIS. The Bureau reported that it made progress in this area and, during our desk reviews, staff informed us of modifications made to data collection for GIS and CMMS. However, some data sets have yet to be addressed – for example, we reviewed multiple documents that stated the Bureau lacks some of the necessary cost data (e.g. tracking external costs against individual assets) it needs to make the cost-benefit decisions that are essential for effective asset management. While it may not be necessary to have the highest quality for all data, systematic standards and procedures are necessary to provide management with confidence in its data.

Impact on integrating asset management within existing business processes

The success of asset management in the Bureau depends on its ability to integrate asset management principles and practices within its overall business processes. For example, business processes at the Bureau involve information systems for accounting, maintenance, customer billing and spatial mapping. However, the Bureau has not yet defined its overall organization, or structure, for aligning systems and processes. An integration shortcoming reported by the Bureau is that some systems are outside of its control and that has caused significant inefficiencies and inabilities to share across its information systems. Without adequate system and process integration, those responsible for asset management tasks are put in the difficult position of developing asset management processes without the ability to relate them to, or integrate them in, the Bureau's business processes, systems and supporting technology.

Leadership, resources and accountability needed to effectively manage implementation

Even with the best strategies, data management changes at a large organization are risky because of the technical requirements and the changes employees need to adjust to. Organizations can easily become complacent, resistant to change or have difficulties implementing a good idea. In addition, the thought of trying to implement such changes can be daunting to management. Fortunately, the Bureau already has experience in this area, because much of its asset management success is due to its ability to facilitate changes within the organization.

Although the Bureau has made some recent efforts in the data management area, we found that these efforts could be more effective with stronger leadership, dedicated resources and a clearer accountability framework. The Bureau needs to apply to data management what it learned about organizational change from its asset management efforts. For example, asset management has the Asset Management Steering Committee to serve as executive leadership champions and the Bureau has dedicated resources for the Asset Management Group to manage implementation and coordinate across work units. If the Bureau can systematically identify leaders, dedicate technical resources, and establish clear accountability for implementing its data management strategy, it will increase its likelihood of success in asset management and its benefits to ratepayers.

The Bureau is in the process of addressing some of these areas. A Bureau official stated that one direct outcome from the consultant's work was the establishment of a Data Management Committee that will be in charge of implementing its data management strategy. As we were writing this report, the Bureau shared its charter for the newly formed Data Management Committee. Bureau staff informed us that the Asset Management Steering Committee adopted the charter and will be overseeing the work of the Data Management Committee moving forward.

In order for the Bureau to fully realize its asset management goals, it must incorporate its asset management needs in its Bureau-wide data management strategy. The Bureau reported it has included asset management experts who are familiar with data needs and

current data limitations to help lead the three subcommittees: Asset Management, Information Technology Infrastructure, and Business Workflows. The Bureau can gain from the investment it has made developing asset management experts, by involving them as leaders in planning its data management changes. Their input is crucial in prioritizing changes needed for general Bureau operations and reconciling differences between the Bureau's global, general needs and its specialized asset management needs.

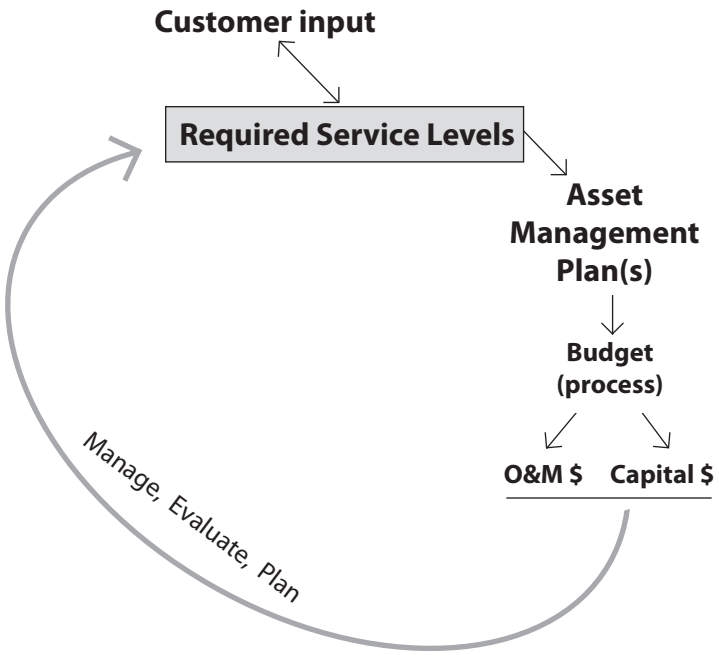
Chapter 4 **Use of service levels limited**

Although service levels are an essential part of the Bureau's asset planning – and the basis for decision-making according to its Asset Management Charter and best practices – we found that the Bureau has not begun using its identified service level indicators to budget its operating and maintenance expenditures, except in some project funding decisions. By not systematically using service levels as the basis for rates and spending, the Bureau has lost an opportunity to focus its operations on service delivery and effectively communicate the reason for any rate changes.

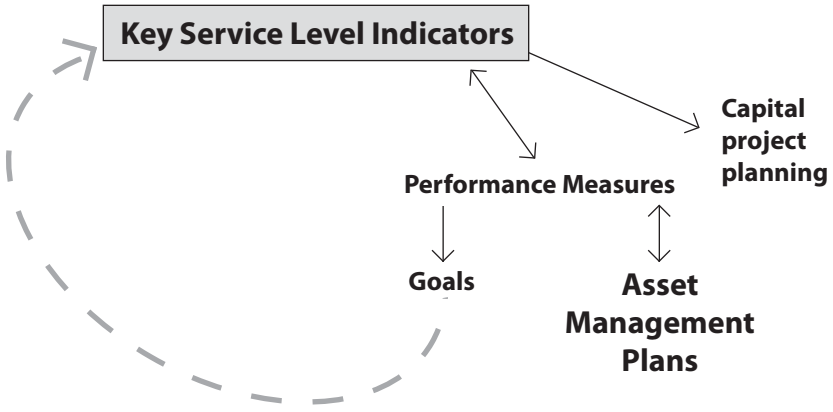
We found that managers' perceptions about the purpose of service levels are inconsistent, and some service levels are stated as internal workload targets instead of expressing required customer outcomes to guide resource decisions. In addition, the Bureau has not yet consulted with representative customers about whether services are delivered at the right level relative to cost. The difference between the Bureau's use of service levels as performance measures and goals, and their use according to best practice is shown in Figure 5.

Figure 5 Service levels in asset management

A. Best practice use of service levels



B. Portland Water Bureau current use of service levels



Source: Audit Services Division

Budget not based on defined service levels

Because assets exist to provide services, the service levels required by regulators and elected officials, and desired by customers, should be the criteria for making informed resource allocation decisions to manage assets. By City Code, ratepayers are responsible for payment of "water or water related service," and the City Charter constrains spending on other purposes. It follows that the Bureau should link rates and budgets to services, as asset management best practices indicate. However, based on Bureau managers' statements, we found that rates proposed to City Council during the budget process are not based on meeting the Bureau's defined service levels.

> "Knowing your required 'sustainable' level of service will help you implement an asset management program and communicate to stakeholders what you are doing. The required level of service is the basis for justifying your user rates."
>
> U.S. EPA

Capital project planners consider service levels. However, except when justifying the creation of new programs, the Bureau has not tied operating and maintenance costs to service levels. According to Bureau managers, rate increases are limited to the total amount that management thinks elected officials and customers would tolerate in the short term, rather than basing rates on the long term lowest overall cost of meeting specific service levels. Bureau managers told us the optimum cost would be higher to include more planned maintenance and other unmet needs, but practical considerations limit the Bureau's available resources. The amount budgeted for operations and maintenance (called the base budget) is effectively what remains of expected revenue after the Bureau subtracts debt service due on funds borrowed for capital projects, and all other obligations. The base budget is distributed to programs in proportion similar to prior years.

As annual debt service increases, less revenue is available for maintenance unless rates are allowed to increase to cover additional debt service. Debt service increased 52 percent from fiscal years 2007 through 2011, while in the same period, operating expenditures, net of depreciation, increased only 8 percent. As a fraction of available operating revenue, debt service increased from 18 to 25 percent in

those years. Bureau management told us that when revenue does not cover all needed operating, maintenance, and capital expenditures, the Bureau makes budget cuts to "minor maintenance," such as that in the backlog of task orders. These cuts result in deferring some maintenance to later years. Some deferred minor maintenance becomes more expensive 'major' capital maintenance.

The Bureau has not been able to limit its expenditures to those needed to meet service levels, although managers told us the base budget is insufficient to do the optimum amount of planned maintenance. Providing matching funds for transportation project grants is an example of Bureau expenditures not needed to achieve service levels. In our 2011 audit, *Spending Utility Ratepayer Money* (Report #398), we reported other examples of Bureau spending not directly related to utility services, such as spending over $1.5 million to remodel a building for Rose Festival Foundation use.

Bureau officials explained that service levels are a work in progress, evolving based on Bureau experience using them. The Bureau's insufficient cost data is one barrier to basing funding decisions on service levels, according to Bureau experts. We found that managers' perceptions about the purpose of service levels may be another reason the Bureau is not yet using service levels as criteria for budgeting. The need for more clarity in the way service levels are defined and the large number of Bureau service levels are two other possible reasons.

Bureau use of service level indicators unclear

Although the Bureau does not yet systematically use its service levels for budgeting operations and maintenance, it does use them as performance measures. It reports its key measures annually as a group, and quarterly in program budget reports with program-specific service levels. Once reported, however, it is not clear how the Bureau uses the information. Given this limited systematic use of service levels, management perceptions about them, lack of clarity in the way they are written, and the high number the Bureau identified as key, we found that generally the Bureau is not using them as the basis for cost-effective management, with customer input.

Management perceptions about required service levels inconsistent

Bureau managers expressed a variety of perceptions about the use of service levels. They said service levels are a mix of regulatory requirements, aspirations, and benchmarks – long term guides for what the Bureau would like to be doing as well as what it is providing. Bureau managers told auditors that they do not distinguish between commitments and aspirational goals, and that service levels are periodic performance reports, for which too much reporting of measures is required.

The Bureau's documented uses also differ. Only two Asset Management Plans that the Bureau drafted describe external service levels as "commitments and requirements that must be met under all circumstances," and internal service levels as establishing "what customers can expect from the Bureau with respect to response time, water quality, pressures, and system reliability." This is consistent with best practice, but one of the two AMPs was since revised, and other AMPs refer to service levels as goals, targets, or proposed levels. The Strategic Plan says they are pledged to customers, while the Bureau's asset management guidance documents refer to them as goals, or as service conditions that may need improvement.

Having the same understanding and use of the concept is more important than the specific terminology selected. According to best practice, it is essential to use required or actual service levels as a basis for customer consideration of higher service level targets.

Identified service levels unclear about specific service to customers

Many of the Bureau's 27 service level indicators do not clearly express which service is delivered to customers, and some are not clear about what is actually measured. The Bureau has not specified some services it uses the indicators to measure. Examples of Bureau service level indicators without clear outcomes for customers expressed include:

- "More than 90% of flow control valves will operate when needed" (Bureau category: Customer Service – Construction)

- "Meet at least 80% of standards established for inspection, testing, repair and replacement of assets that are identified as high or extreme risk. Risk scenarios rated extreme require immediate action" (Bureau category: Infrastructure Management)
- "50% of employees report they are fully engaged in and enthusiastic about their work" (Bureau category: Workforce and Workplace Excellence)

Three indicators in the Infrastructure Management category, including the one listed above, are technical measures of workload rather than measures of Bureau output or outcome. While these indicators may be useful as technical performance measures, neither the service delivered to customers nor its required level is clear. Since the purpose of identifying service levels is to focus on service rather than assets in decision-making, such indicators do not appear to be useful as service levels. Assets are the means of providing service. Service levels expressed and measured as outcomes would be more useful for relating service to cost and for decisions about changing service levels.

Bureau officials told us that service levels are too technical to be modified in a way that customers could understand – they are for Bureau use. However, utilities have many options for expressing service levels in a way that would be useful both to Bureau employees and for communicating with customers. The City of Seattle's water utility, another industry leader in asset management, reported clear "service level objectives" separate from its service level targets. The Bureau could use clearer service outcome descriptions for groups of service levels. For example, Seattle uses, "Provide adequate pressure for drinking water supplies," as the service level objective for maintaining minimum pressure. "Protect public health" could be a service objective for water quality. Seattle defines service levels as , "…desired performance outcome …high priority to customers…."

Large number of service levels

Although best practices recommend establishing a small, manageable set of service criteria that can be measured with available data

and are meaningful from a customer point of view, the Bureau identified 27 service level indicators that it considers key. The Bureau's use of its service level indicators as performance measures could be the reason it has included such a large number of service levels it considers key.

Even if each Bureau indicator was clear about the service, the large number of indicators the Bureau uses might be a barrier to clear communication within and beyond the Bureau. Fewer indicators would require less work to estimate costs for varying levels of service. In comparison, the City of Seattle's water utility uses less than half the number of water service levels at its highest level.

During completion of this report, a Bureau representative confirmed that it considers all of its 27 key service level indicators to be essential and pointed out that it has many more internal budget program service levels. The Bureau agrees that clarity of the service levels can be improved.

Bureau has not sought customer input on service levels

Although asset management best practices consistently refer to service levels as agreed-upon by customers, we found that the Bureau has not yet confirmed that representative customers would agree with the levels of services it has identified. Engaging representative customers in communication to confirm Bureau service levels and evaluate whether any are too high or too low would enable the Bureau to focus on the factors most important to customers and adjust spending to meet customer requirements. Bureau peer reviewers recommended in 2006 that the Bureau provide opportunities for customer input to understand "broadly-held community values." In 2010, the Bureau presented its service level indicators to the Bureau Employee/Community Budget Advisory Committee (BAC) as part of the introductory meeting. However, the Bureau told us that the nine community members were impressed but did not offer input, and that it has no plans to seek customer agreement.

Bureau officials explained that in addition to their difficulty expressing service levels in clear, non-technical terms, some service levels

are regulatory requirements that cannot be changed by customers, such as minimum water pressure. They also said that along with their significant responsibility to manage water supply and delivery, they have the authority to make decisions on behalf of ratepayers.

Seattle Public Utilities conducted a survey of randomly selected customers to help define its service levels. It reports that it plans to do more customer surveys as well as focus groups and studies of how much customers are willing to pay for services, to help set future service levels and ensure that customers understand the rate impacts of achieving specific levels. Surveying representative customers and hosting focus groups are methods of assessing customer perceptions consistent with best practice.

During completion of this report, Bureau management told us that it has sought input on service levels from its BAC every year since 2006. It also said its criteria for customer input is the 2010 Citywide Asset Management Workplan that called for bureaus to consult with BACs by 2014.

Need for effective service levels hampers accountable, efficient management

Without systematically using defined service levels as the basis for water rates and allocating resources, the Bureau can not assure ratepayers that resources are used cost-effectively, or that it is limiting spending on non-essential items. Not providing that assurance perpetuates the Bureau's difficulty defending rates it says are essential. Without clear service levels that can be understood by most customers, and customer confirmation of the levels to use as the basis for asset management decisions, the Bureau may not understand customer preferences.

Chapter 5 Without useful plans to implement, decisions may not be the most cost-effective

Despite its Asset Management Charter, and although asset management depends on substantial planning, the Bureau has no overall plan for managing assets. Instead, it is developing Asset Management Plans (AMPs) for each of about 20 of its major groups of similar assets like valves and fire hydrants. It completed drafts of less than a third of those plans, however, due in part to its data and resource limitations. Without plans, decisions are typically made on a case-by-case basis by individual managers, and the Bureau may not perform asset maintenance, repair and replacement at the best times to save costs. We found that even when the Bureau had plans for asset groups, the extent of plan implementation was unclear. We also found that the plans lacked elements needed for accountability.

No overall asset management plan and limited progress on specific plans

Portland residents have told government that maintaining existing utility assets is more important than spending on new projects, according to Davis, Hibbitts & Midghall, Inc., a Portland research firm, and others. Our 2004 audit of the distribution system recommended that the Bureau prepare a comprehensive maintenance plan. The Bureau affirmed its responsibility to maintain water system assets in its strategic plan and Asset Management Charter, and it addresses maintenance within AMPs. However, we found the Bureau has no overall plan for managing assets. Bureau management told us that one overall plan is not needed because it is developing comprehensive AMPs, a focus that was expanded in 2010.

Instead of an overall AMP, the Bureau is developing separate AMPs for its different groups of similar assets, including pipes, pump stations, and fire hydrants. Its primary objectives for the AMPs are to deter-

mine management strategies for each asset group and to identify which specific assets are most important to uninterrupted operation of the whole system. Asset groups differ in the ways they fail, and in maintenance, repair and replacement strategies and costs. This is the Bureau's rationale for creating many specific plans rather than one overall plan. Bureau assets may not all be included within the defined asset groups. In addition, creating so many different AMPs may not be the most efficient approach from the perspective of managers responsible for managing more than one asset group. Figure 6 lists the status of Bureau AMPs.

Figure 6 Status of Asset Management Plans (AMP) as of December 2011

Asset group	Started	Completed	In use
distribution mains	yes	yes *(2008, in revision)*	partly
large valves	yes	yes *(2008)*	partly
fire hydrants	yes	yes *(2010)*	partly
large meters (commercial)	yes	yes *(2007, in revision)*	partly
pump stations	yes	yes *(2008, in revision)*	partly
tanks	yes	yes *(2007, in revision)*	partly
Bull Run road system	yes	no *(revision sched for 2011)*	-
services (from main to meter)	yes	no *(revision sched for 2011)*	-
wholesale meters & vaults	yes	no *(revision sched for 2011)*	-
distribution - transport mains	yes	no *(revision sched for 2012)*	-
conduits (pipes from supply)	yes	no *(revision sched for 2012)*	-
fountains	yes	no *(revision sched for 2012)*	-
groundwater supply system	yes	no *(revision sched for 2012)*	-
line valves	yes	no *(revision sched for 2012)*	-
system meters	yes	no *(revision sched for 2012)*	-
transmission mains	yes	no *(revision sched for 2012)*	-
facilities, buildings	no	-	-
Bull Run supply	no	-	-
Sandy River Station	no	-	-
terminal storage (reservoirs)	no	-	-
regulator stations	no	-	-

Source: Portland Water Bureau planning documents

The Bureau's completed AMPs describe technical analyses and results, and they show that development included industry standards review, collection and analysis of available data, and knowledge of historical and current business processes. Typically, several sections of the AMPs identify and include proposals or recommendations for service levels, policies, management strategies, maintenance strategies, data collection, and other aspects of asset management. Most work on completed AMPs was done before the Bureau's guidance was ready.

Without completed and implemented plans, it is less likely the Bureau will discover and correct inefficiencies in a timely way. In addition, management can not determine whether its goals for managing Bureau assets are being met, and spending may be ineffective. According to Bureau management, implementing its Asset Management Charter depends on completing the AMPs and the Bureau is working to complete the majority on schedule. During completion of this report, the Bureau emphasized that prior to the current effort to update and complete most AMPs, it had devoted resources to other important asset management products, listed in Figure 2.

Challenges to plan completion

We found that the Bureau's data inadequacies were one reason it had not yet completed more AMPs. The reliable data needed for AMPs is often not available. Another reason was that team members may be accountable to different managers, and have other full-time responsibilities. Although the cooperative AMP development process has some benefits, it appears to depend primarily on individual motivation and perception of priorities. Other than the Steering Committee's generally reactive process, the Bureau lacks a framework for prioritizing asset management activities that involve more than one major Bureau division.

Data limitations

As discussed in Chapter 3 of this report, management has not yet implemented the comprehensive data management approach it needs for supporting asset management analyses. In our review of AMPs, we found confirmation of the Bureau's data limitations. For example,

a fire hydrant shown as active may not actually exist, and could cause potential delay to firefighters expecting to use it. Valve make and model was not routinely tracked and information about large valves was stored in 12 separate systems. Although identifying asset failure mode is essential for AMP analysis steps, maintenance staff only recently began to collect it and for only a few asset types. In addition, the Bureau does not measure all expenditures for planned and reactive maintenance sufficiently for its own use in determining optimum maintenance over time, and lacks reliable data on the extent of its deferred maintenance.

Early AMPs completed without guidance document

Staff in the Bureau's Asset Management group performed most work on the six AMPs completed, without the benefit of the Bureau's guidance document for preparing AMPs. In addition, the Steering Committee had prioritized the group's work on business cases, risk analysis, and defining service levels over its work on AMPS. The group prepared the 2010 guidance for AMPs based on experience gained during its work on AMPs and other asset management products.

Current team process for revising and completing plans

In 2010, the Steering Committee prioritized AMP completion and participated in developing current work plans for revising and completing priority AMPs, but it may not be directing the process as an essential Bureau activity. According to work plans, each team drafting an AMP includes expertise in different aspects of the specific asset group and in asset management, to incorporate collective organizational knowledge into the AMP and to spread understanding about asset management to the whole team Each team works cooperatively to complete its assigned AMP, and team leads meet monthly to share information as they progress. However, because assigned leads and members of AMP teams have other full-time responsibilities, work on AMPs is not their highest priority. Each member may be accountable to a different Bureau manager, and not necessarily to each other for completing tasks. For this reason it is unclear who is ultimately accountable for completing each AMP. Many different types of delays may occur when the higher priority work of any team

member takes precedence. During completion of this report, the Bureau reported that the leads are accountable for AMP completion, and it "has assigned a tremendous amount of resources to preparation of the AMPs."

Without plans, decisions are reactive and more costly

Without management plans for cost-effective maintenance, repair and replacement, individual asset managers typically make decisions on an informal basis, and more maintenance is performed in a reactive manner. The perception of managers and staff is that the Bureau needs to do more planned maintenance to reduce the amount of reactive work. Without enough planned maintenance performed at the best time, the risk of service interruption is higher and repair and replacement is likely more costly overall. During interviews, Bureau officials identified a concern that the Bureau has fewer resources than it needs for ongoing maintenance because of its funding structure. The Bureau knows that when assets are not maintained as they should be, more time is spent reacting to problems than it would take to prevent the problems through adequate maintenance. Although reactive unplanned maintenance can be the most expensive maintenance and should not take up more than a 20 to 25 percent of total maintenance effort, according to the EPA, the Bureau performs at least 40 percent reactive maintenance on the distribution system, according to a Bureau manager.

Bureau relies on individual subjective decisions

Bureau managers and staff typically make asset maintenance decisions, case-by-case, based on their professional judgment including historical practice and historical best practice, manufacturers' recommendations, and "rules of thumb." While they may use sound judgment given available information, an individual's judgment about maintenance cannot substitute for analysis of long term risk and cost combined with planning. Informal individual decisions also are unlikely to result in the improved distribution of resources under management authority that implementing a complete AMP could achieve. Accepted historical practices may not be the most cost-effective, and not all managers have extensive experience to draw from.

In addition, program managers may not have sufficient budget available to do preventive maintenance or timely planned repair. Managers told us they need higher operating and maintenance budgets to increase planned maintenance to an effective level. This reflects the lack of Bureau planning for adequate resources to accomplish needed maintenance. The Bureau does not create maintenance plans except those prepared for AMPs.

Comparison to peers showed high rate of breakdowns

By 2006 the Bureau had learned from benchmarking that it had a high ratio of breakdown to scheduled maintenance. Comparison with peers also showed that planning and scheduling maintenance could provide the highest potential cost savings for the Bureau. With exceptions in the Operations Group, the Bureau has changed little in maintenance practice for most asset groups, although officials express confidence that it will improve through asset management planning.

Neglected minor maintenance can turn into major maintenance

According to Bureau managers, because the base budget is inadequate to increase the proportion of planned maintenance, a major consideration for them is whether a needed maintenance expenditure meets accounting criteria for spending from the capital budget, and if not, whether their allotted base budget can cover the cost. Since bond proceeds can fund only capital projects, the Bureau must rely on ratepayer collections for the current year to fund its operating and maintenance (base) budget. For example, the expense of lubricating and exercising valves to keep them operating must be funded by the base budget, but replacing a valve in a water main would be an allowable capital expense. Planned maintenance needs compete with many other base budget needs including operational activities and reactive maintenance such as repairing leaks and breakdowns that may quickly use up available funds.

One Bureau official told us that preventive maintenance is expensive from a ratepayer perspective because it must be paid for in the year work is done. However, Bureau managers and staff know that when minor maintenance is not done it may become major – capitalized – maintenance.

Defined capital improvement work given priority

In revenue bonds, the City promises that it will maintain and preserve the water system, "in good repair, working order and condition," and City policy also requires bureaus to maintain assets to protect capital investments and minimize future costs of maintaining and replacing them. However, some Bureau managers told us that in practice, the Bureau gives higher priority to capital work than to planned maintenance. Unlike the Bureau's dedicated funding source and formalized process for capital projects, it has no comparable controlling and monitoring process for other maintenance work. When the Bureau's base budget is inadequate, although maintenance may not be targeted, ultimately it is cut. Without plans that specify maintenance requirements, there is a greater risk that maintenance could be cut to undesirable levels, increasing the need for more costly reactive maintenance and perhaps threatening compliance with bond covenants and City policy.

Drafted plans not systematically implemented

We found that the AMPs drafted were not systematically implemented. Because the role of the Steering Committee is unclear, it is also unclear what authority AMPs represent. Drafts of AMPs are presented to the Committee, but it has no formal approval process. Following Steering Committee consideration of an AMP, the budget program managers responsible for its specific asset group should facilitate implementation. However, according to the Bureau, even maintenance strategies and plans in drafted AMPs are not necessarily implemented, and the budget does not extend to implementing all of the recommendations made in AMPs. In addition, the Bureau does not track implementation of AMP recommendations. The effect is that the Bureau may not be achieving the extent of benefits in cost-effectiveness that it could be.

Bureau officials acknowledged that AMP implementation has been limited and said implementation should improve with the increased involvement of program staff on teams currently working on AMPs, and increased Bureau understanding of the benefits of implementing asset management.

Drafted plans missing accountability and implementation elements

We found that the Bureau's completed AMPs are missing elements that could make them more effective as management tools and easier to implement. It is not clear that the drafted AMPs are intended to be plans for action.

Bureau management considers the AMPs to be "compilation documents" that will be revised as Bureau understanding increases and more information is available. Despite all the information included, we found that AMPs do not clearly show which, if any, of the recommendations and strategies are intended actions to manage the assets more cost-effectively. Without more clarity about management's decisions and who is responsible for implementing its decisions, the AMPs could be viewed merely as reference documents. For example, the AMP for hydrants lists 21 recommendations, and additional recommendations can be found in other chapters. The AMP was presented to the Steering Committee in 2010, so it is not apparent to whom or by whom the recommendations are made, or which ones management adopted for action. Bureau officials explained that Steering Committee decisions about AMP implementation are discussed but not formally documented, consistent with the Bureau's collaborative approach to management.

Chapter 6 **Recommendations**

The Bureau has made progress in developing and using some asset management tools such as business case analyses and Asset Management Plans, and it has documented its commitment to achieving the benefits of using an asset management approach. However, five years after signing its Asset Management Charter, many of management's objectives have not yet been achieved. Improving the Bureau's overall structures for performance accountability and the decision process would address many of the conditions that are impeding asset management. For example, management could clarify to field crews that collecting data is an essential part of field work performance, and hold them accountable for collecting it, so that it can be used to determine lowest cost maintenance. Management's reliance on persuasion and voluntary cooperation to achieve essential work products and results is not effective by itself.

The Bureau can build on the work it has accomplished, overcome barriers described in this report and achieve its stated asset management objectives to manage assets cost-effectively in the long term. To do this, the Bureau needs to make decisions based on evidence to provide service levels agreed upon by representative customers. With its aging assets, potential costly legal mandates, and questions from members of the public about the justification for rate increases, the Bureau must strengthen its asset management capability and use those tools to inform decisions and its customers. Over the long term, this asset management approach will benefit ratepayers.

We recommend that the Commissioner in Charge direct the Portland Water Bureau to implement these recommendations:

To improve the availability and reliability of data necessary to carry out asset management objectives:

1. **Deploy resources, formalize leadership and develop accountability structures to implement a data management approach that meets the Bureau's asset management and other business process needs.**

   Develop and communicate to the whole organization the resulting data management implementation work, including data model, standards for asset-related data, and individual positions responsible for data sets and business workflows. Management should acknowledge the importance of this work by dedicating adequate resources for it, identifying milestones and timeframes for completion and by explicitly directing compliance with the implementation requirements developed.

To gain the benefits of using defined levels of service delivered to customers in determining rates and budgets and as criteria for asset management decisions:

2. **Agree on a consistent definition and use of "service level" in the Bureau, distinguishing between current service levels and higher goals.**

3. **Identify the essential service levels required to describe current results (outcomes) for customers, and make each one meaningful from the perspective of representative customers. Avoid using more service levels than necessary to define essential required and desired services to customers. Link the Bureau's more technical internal service levels and indicators to the service levels that are essential to customers.**

   Review the adequacy and clarity of each service level as a description of service outcome or output. The clarity of essential service levels and indicators used to measure them, together with any additional internal service levels, should be

adequate for use in decision making about water rates and budgets required to provide services.

4. **Obtain confirmation from representative customers that the Bureau's defined essential required service levels are appropriate for use in decision making, including financial decisions.**

5. **Apply service levels as budget criteria, allocating resources to meet service levels while excluding budget items that do not contribute to meeting service levels.**

To improve the planning process and Asset Management Plans:

6. **Document management decisions and direction in Asset Management Plans, using format and language to make the plans action plans supported by resources. Clarify the priority for implementing each planned action described.**

   Include assigned roles and responsibilities for taking action, by position title.

7. **Clarify accountability for preparing Asset Management Plans and provide resources for completing plans.**

   Include position titles.

8. **Consider preparing an overall asset management plan or other means of clarifying management policy and providing guidance for decision making that may not be explicit in the asset-specific AMPs.**

   An overall plan could be a resource for managers in the process of planning or making decisions, with links to asset-specific AMPs.

In support of achieving asset management objectives we also recommend that the Bureau:

9. Explicitly incorporate an accountability framework throughout the Bureau to increase the likelihood of successfully meeting its objectives as intended.

Document the authority and responsibilities of the Asset Management Steering Committee and other positions in the Bureau with responsibility for implementing AMPs.

Chapter 7 Objectives, scope and methodology

We conducted this performance audit to review the Bureau's approach to asset management. Our primary objective was to determine the status of the Bureau's implementation of its 2007 Asset Management Charter in which it listed goals for becoming an advanced asset management organization (Appendix). Secondary objectives were to determine whether the Bureau implemented recommendations made by contracted reviewers and others, to understand the Bureau's decision making process, and to determine the Bureau's results of applying its asset management criteria.

Our scope focused on the Bureau's actions and products related to asset management from 2005, when it began using asset management concepts in business cases, through about June 2011. Our 2004 audit, *Portland's Water Distribution System: Maintenance Program Needs Improvement* (Report # 299) recommended a comprehensive plan for maintenance and data management improvements. This audit expands upon the work of that prior audit in two ways. We included the whole water system in our review, and like the Bureau we enlarged our view of maintenance management to one of asset management.

As part of our analysis we reviewed various industry-specific reports and guidance documents about asset management. These included the *International Infrastructure Management Manual*, published by the Association of Local Government Engineering New Zealand and the Institute of Public Works Engineering of Australia, 2006; *Effective Utility Management* by American Water Works Association (AWWA) and other organizations, 2008; additional AWWA policy; U.S. Environmental Protection Agency (EPA) guidance documents; EPA slides for

Advanced Asset Management Training Workshops; and Government Finance Officers Association *Accounting for Capital Assets*, 2008. We reviewed *Seattle Public Utilities Asset Management Framework*, 2011, and other documents provided by SPU.

We also reviewed literature on performance management including *A Performance Management Framework for State and Local Government: From Measurement and Reporting to Management and Improving* published by the National Performance Management Advisory Commission, 2010; and "Better performance management," published by Public Performance & Management Review, 2011.

Given the context in which the Bureau operates, we reviewed various City and Bureau-specific documents. These included relevant portions of the City Charter and Code; City Financial Planning Policies (FIN-2.03, 2.11, and 2.12); *Citywide Assets Report 2010;* revenue bond documents; collective bargaining agreements, and financial plans and reports. We reviewed the Bureau's employee manual, results of its 2010 employee engagement survey results, verification of Bureau compliance with State and Federal regulations, and its capital project process guidance. We also reviewed the Bureau's work plans and guidance documents specific to its efforts to apply asset management principles, and gained familiarity with the Bureau's various information systems, conducting desk reviews of those systems that were significant to asset management.

Moreover, to better understand Bureau operations, concerns of Bureau managers and staff, and the implementation of asset management and decision-making at the Bureau, we conducted numerous interviews with management and staff across five of the Bureau's six operational groups, concentrating our interviews with Management Team members, those in the Asset Management Group, and others responsible for financial management and data management. Given the importance of field-based activities, we toured facilities and gained an understanding of assets significant to the Portland water system – from Bull Run Dams to treatment and storage facilities and residential customer meters. We spent time with maintenance crews to understand work order processing, completion and data capture into multiple Bureau information systems.

In order to achieve our audit objectives, we reviewed products describing or evaluating the Bureau's asset management efforts, and many Bureau products that resulted from those efforts. This work included analyzing specific consultant reviews, gap analyses and peer reviews referenced in this report. In addition, we reviewed numerous business cases, asset status and condition reports, Asset Management Plans (both in process and drafted), and records of Asset Management Steering Committee meetings. We conducted additional follow-up interviews based on results of our document reviews.

We relied upon management's representations about overall value of the water system and their conclusions from technical or cost-benefit analyses. We reviewed these documents for reasonableness, but our reviews are not intended to provide assurance about the reliability of Bureau documents nor that information provided by management is free from error, or fraud, waste and abuse.

The Office of the City Auditor developed this report independently for the public as well as for City officials. The report is the result of a performance audit, and was not part of the City's annual financial audit on the City's financial statements. Expressions of opinion in the report are not intended to guide prospective investors in securities offered by the City and no decision to invest in such securities should be made without referencing the City's audited CAFRs and official disclosure documents relating to a specific security.

We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

APPENDIX

Our Asset Management Charter

Our organization is embarking on a journey to better manage our assets. Asset Management is a way to evaluate and discuss choices we make in taking care of the bureau's aging infrastructure. The term may be unfamiliar to us, but the principles of Asset Management really are not, having been practiced to some degree throughout our organization since the water delivery system was first created in the late 1800's. We have always done asset management; now we want to become better at it, as an advanced asset management organization.

The current focus on advanced asset management (AAM) is simply an effort to consistently apply accepted principles of science and economics to better determine when certain groups of assets will be maintained or monitored for condition changes; as well as whether to repair or replace those assets that have failed or will likely fail soon.

According to the International Standard, an advanced asset management organization should do the following:

- **Service Level**: Measure the level of service our assets currently deliver, the level of service our customers expect, and our customers' willingness to pay for that level of service.
- **Physical Condition & Criticality of Assets**: Understand and monitor the condition of assets so we can predict what future action will be necessary, and when. Understand the relative criticality of each asset so our focus is on maintaining or replacing those assets most critical to our business of delivering service.
- **Failure Modes of Assets**: Assess and understand the various ways in which an asset may fail and take steps to reduce the risk of failure by preventing or overcoming those failures.
- **Performance of Assets**: Measure and understand the performance of our assets in order to assess the effectiveness of operations, maintenance and capital improvement programs.
- **Prioritization of Projects Based on Value**: Schedule projects to suit available budgets so those with the greatest ratio of benefit to cost are undertaken first. The prioritization should consider lifecycle cost analysis, the triple bottom line (economic, social and environmental factors), and the impact of the project on risk of asset failure and on level of service.
- **Optimization of Operations and Maintenance Activities**: Minimize costs through an optimal blend of planned and unplanned maintenance activities, and by operating the system cost-effectively.

These are our goals. We need your participation and contributions to make this a success.

Portland Water Bureau Management Team

David Shaff, Administrator

Edward Campbell, Director, Resource Protection and Planning

David Hasson, Director, Finance and Support

Kelly Mulholland, Director, Maintenance and Construction

Mike Stuhr, Director, Engineering

Chris Wanner, Director, Operations

PORTLAND WATER BUREAU
FROM FOREST TO FAUCET

January, 2007

RESPONSE TO THE AUDIT

PORTLAND WATER BUREAU
FROM FOREST TO FAUCET

Randy Leonard, Commissioner
David G. Shaff, Administrator

1120 SW 5th Avenue, Room 600
Portland, Oregon 97204-1926
Information: 503-823-7404
www.portlandonline.com/water

May 30, 2012

TO: Auditor LaVonne Griffin-Valade

FR: Commissioner Randy Leonard

Water Bureau Administrator David Shaff

RE: Audit #405, Further Advances in Asset Management Would Benefit Ratepayers

Thank you for the opportunity to comment on Audit #405, Further Advances in Asset Management Would Benefit Ratepayers. We acknowledge receipt and generally concur with the analysis and recommendations of the audit.

As you note in the audit Summary, **"...the Bureau has been recognized as a leader in asset management."** We are very proud of our asset management program and embrace the principal idea of the report that encourages further advances. We believe that we are on the path of advancement and that we will continue to be recognized as a national leader in asset management practices.

Although we agree generally with the recommendations, we would like to provide the following comments and observations to each of the 9 recommendations:

1. **Deploy resources, formalize leadership and develop accountability structures to implement a data management approach that meets the Bureau's asset management and other business process needs.**

   The bureau has formed a Data Management Committee (DMC) and charged it with coordinating the implementation of Information Technology activities within the bureau. The DMC officially reports to the Asset Management Steering Committee, and the chair of the DMC (Mary Ellen Collentine) is now officially a member of the Asset Management Steering Committee. Mary Ellen Collentine is also the owner of the bureau's Data Management Budget Program. Staff representing the bureau's groups and all data system managers are members of the DMC.The committee has begun meeting.

   There are subcommittees to specifically address asset-related issues, IT system issues, and business workflow issues. The committee has a series of tasks identified, all of which come from our IT Action Plan. Some of the tasks specifically assigned to this committee include developing a data model, conducting a business intelligence needs assessment, and developing and implementing an asset management plan for data. Staff is being assigned to these tasks, and work plans will be developed shortly. The

work plans will include identified project milestones and anticipated time frames. The recommendations contained in the Data Asset Management Plan will be reviewed by the Asset Management Steering Committee and incorporated into the overall Asset Management Implementation Plan.

2. **Agree on a definition and use of "service level" in the Bureau, distinguishing between current service levels and higher goals.**

   The bureau originally used the term "Effectiveness Measure" in 2006 to define budget program goals and objectives. The bureau began its use of the term "Service Level" in its Strategic Plan in 2009, to be consistent with national and international terminology. It took some time for the bureau to transition from the use of "Effectiveness Measure" to "Service Level" in budget programs. As Bureau Administrator, I provided clear direction in October 2010 when I issued the following e-mail:

   > "I would like to get all of our various documents aligned and consistent in terms. Service Level would be used in the Budget Program description where we currently use the term Effectiveness Measure. Service Levels continue to be the goals and objectives we are trying to accomplish in our Strategic Plan and through our various budget programs."

3. **Identify the essential service levels required to describe current results (outcomes) for customers, and make each one meaningful from the perspective of representative customers. Avoid using more service levels than necessary to define essential required and desired services to customers. Link the Bureau's more technical internal service levels and indicators to the service levels that are essential to customers.**

   In regard to this recommendation, we respectfully agree in part and disagree in part.

   The Water Bureau believes it has a good number of "key" service levels (currently 27) that we report to the public. We have more service levels that we call programmatic service levels (there are 39 under consideration in the budget programs). Table 1 shows that leading utilities practicing asset management provide considerable information about performance relative to goals and objectives and related to customers, the community, the water system, and the water utility.

Table 1. Water Utility Reporting on Performance Against Goals and Objectives

Utility	Number of measures reported	Reference Document
Portland Water Bureau	27	FY 10-11 Progress Toward Meeting Key Service Level Indicators
Seattle Public Utilities	54	Tracking Sheet for Strategic Business Plan Service Levels and Performance Measures, May 2011
Tacoma Water	59	2012 Tacoma Water Master Level of Service Definitions
San Francisco Water	84	Strategic Sustainability Performance on Goals and Objectives, Fiscal Year 2010-2011
Watercare (New Zealand)	53	2010 Annual Report
Sydney Water (Australia)	40	2011 Annual Report

The development of programmatic service levels is part of the ongoing improvement efforts to tie workload measures to service levels. Those programmatic service levels are almost all "technical internal service levels."

The Audit report, however, has helped us identify a better way to organize our key service levels and, in response to the recommendation, the bureau has reworded the following 27 service levels in three areas to improve clarity.

- **Essential to customers (10)**: A.1, Achieve 100% compliance with state and federal water quality regulations; A.2, Maintain a minimum service pressure of 20 pounds per square inch; A.3, Maintain a low level of customer complaints on water quality and pressure; B.2, Respond to 95% of customer inquiries or request within 5 business days; B.3, Answer 80% of calls within 60 seconds; B.4, Provide a broad range of convenient payment options; C.1, Maintain no more than 5% of customers out of water for more than 8 hours a year; C.2, Meet a goal of no customer out of water more than 3 times per year; C.3, Complete 90% of service installs within 15 days; E.3, Manage the risk of assets failing

- **Important to our community (6)**: B.1, Achieve a high rating on the Auditor's city-wide survey; F.2, Maintain safety certification; F.4, Ensure that workforce diversity mirrors diversity in the community; G.1, Maintain per capita residential water use at a steady or declining rate; G.3, Reduce the bureau's carbon emissions; G.4, Increase the use of renewable energy sources

- **Key to water system operation (11)**: A.4, Maintain a chlorine residual between 0.5 and 4.0 mg/L total chlorine in 95% of samples; C.4, Ensure that there is a working hydrant within 500 feet of all service connections; C.5, Ensure that more than 90% of flow control valves will operate when needed; D.1, Maintain Aaa

bond rating; D.2, Meet or exceed planned debt service coverage; E.1, Complete projects on schedule; E.2, Achieve continuous improvement in maintenance; E.4, Develop an economic business case for all new Capital Improvement Program (CIP) projects; F.1, Ensure that 50% of employees report they are fully engaged in and enthusiastic about their work; F.3, Fill most promotional vacancies with internal candidates; G.2, Achieve water savings through technical assistance

Note: the codes (e.g., A.1), refer to the service level numbering used in our reports on service level performance, available for viewing in Portland Online.

4. **Obtain confirmation from representative customers that the Bureau's defined essential required service levels are appropriate for use in decision making, including financial decisions.**

The bureau is following the Asset Management Work Plan in the Citywide Asset Report that is issued to City Council annually. In the latest report, Task #7, Community Information & Consultation states "The four participating CAM group bureaus will have had informed community conversations regarding the costs of providing desired levels of service. Primarily, this will take place in bureau budget advisory committees." And "All four bureaus [Water, BES, Parks and Transportation] will continue to consult with public members on their budget advisory committees..." The Water Bureau intends to continue to use its public Budget Advisory Committee members for this purpose.

We will look into the costs and benefits of a variety of means for consulting with our customers about their desired level of service.

5. **Apply service levels as budget criteria, allocating resources to meet service levels while excluding budget items that do not contribute to meeting service levels.**

The bureau has been working on strengthening the relationship between workload measures (the activities we do) and service levels (the goals and objectives that the activities help us accomplish). This can be seen in budget program quarterly reports. We intend to continue to refine this process.

Table 2 taken from last calendar year, is a specific example. There are two parts to this Budget Program Report. In the upper section, service levels are listed that correspond to the budget program – in this case, Customer Service. There are three key service levels and one programmatic service level shown. Our results are given in the Measure of Effectiveness/Results column. In the Subprogram Detail, the workload measures are given and related to the corresponding service level. The Billing subprogram activities support Programmatic Service Level PSL 1 and Key

Service Level B.4 within Customer Service. The Budget Program Report shows how the Water Bureau is allocating resources to meet service levels.

Table 2. Budget Program Report

2nd Quarter, Program Results Report, July - December 2011/2012
Customer Service Program Summary

Service Level	Measure of Effectiveness/Results
Key Service Level (KSL) B.2 Respond to 95% of customer inquiries or requests within 5 days.	**Current Status: Service Level Met** We estimate that more than 99% of customer contacts are addressed within 5 business days based on the following: Customers reach the Bureau through phone calls, e mails and regular mail. If the customer needs can not be addressed in the first day of contact, a service order is issued. Fewer than 2% of the customer contacts require a service order.
KSL B.3 Answer 80% of calls within 60 seconds.	**Current Status: Service Level Not Met** 50% of calls were answered within 60 seconds from 7/11-12/11. 64% within 120 seconds and 84% within 240 seconds. The average hold time was 2 minutes, 45 seconds during the 2nd quarter.
KSL B.4 Transition customers to payment options that cost less.	**Current Status: Service Level Met** Preferred payment options include: AR upload, IVR (not yet installed), Web-Customer and Auto-Pay. The percent of payment transactions for the fiscal year by these methods is 43.6% of all payments.
Customer Service Programmatic Service Level (PSL) 1 Customer bills are processed accurately and on schedule (reading, billing) 99 percent of the time.	**Current Status: Service Level Met** "On schedule" means the bills are processed no later than 2 weeks following the bill date for the account's cycle. The weekly Unbilled report shows less than 70 accounts waiting to bill beyond the 2 week goal, which is approximately .47% of the 15,000 bills produced each week. Outstanding service orders beyond 2 weeks are less than 75 each week, accounting for .5% of accounts billed per week.

Subprogram Detail

Billing	**2nd Quarter FY 2011-12**		
	Revised Budget $ 5,517,284	**YTD Expenditures** $ 2,047,857	
Workload	**Year To Date Results**		**Associated Service Level**
Greater than 99% of bills processed accurately and on schedule.	**Current Status: Workload Target Met** # of accounts on 1/30/12 = 188,096		**PSL 1**
99% of bills and letters are printed on schedule. 99.5% of payments are processed when received.	**Current Status: Workload Target Met** # bills printed: 593,140 # letters printed: 58,746 # payments processed: 219,832;		**PSL 1**
Process Payments (Note: Total monies include amounts processed in Cayenta Utilities, our utility billing system)	**Current Status: Workload Target Met** Payments processed = 493,333 Manual payments: Amt = $121,898,943.20 Electronic payments: Amt = $61,422,274.01 Total value of payments processed = $183,321,217.21 Percent of payment transactions by preferred methods: 43.6% Est. percent of payment dollars by preferred methods: 33.5%		**B.4**

6. **Document management decisions and direction in Asset Management Plans, using format and language to make the plans action plans supported by resources. Clarify the priority for implementing each planned action described.**

The 2010 Asset Management Work Plan made the following recommendation to the Asset Management Steering Committee, which was adopted:

- Completion of all high- or medium-priority Asset Management Plans is to occur by the end of 2012, with completion of all AMPs by 2014.

The 15 AMPs that are nearing completion are those identified in 2010 as high and medium priority. They are on schedule. In each, there are maintenance, repair, and replacement strategies proposed (in Section 7). At the time of the audit, the bureau had not yet documented the next steps in using the results of the Asset Management Plans.

To address the relative priority of the strategy proposals in each AMP, the Asset Management Steering Committee, in mid-May, authorized the creation of a subcommittee to review and assess the strategy recommendations. The subcommittee has the assignment to develop an approach to define criteria, prioritize, and compare and recommend strategies to the full AM Steering Committee. The subcommittee is led by Mike Saling, from Engineering Planning, with representatives from Asset Management (Jeff Leighton), Operations (Crystal Yezman), Maintenance & Construction (Kevin Suell), and Engineering (Stan VandeBergh). In addition, the AMPs have identified high-risk assets and new consequence of failure categories (Section 6), to be evaluated by an existing Risk Committee, led by Jeff Leighton in Asset Management.

7. **Clarify accountability for preparing Asset Management Plans and provide resources for completing plans.**

Since 2010, all AMPs have had two co-leads with responsibility for preparing the AMPs. These co-leads have engaged stakeholder groups to review essential information and strategies. The composition of the resource teams is given in Attachment A.

8. **Consider preparing an overall asset management plan or other means of clarifying management policy and guidance for decision making that may not be explicit in the asset-specific AMPs.**

We will consider developing an overall plan. The key outputs of the AMPs are the strategies and the risk identification. The strategy subcommittee will create a prioritized list of strategies to be used in the bureau's budget process. Implementation outcomes will be reported in quarterly program reports and in the annual Key Service Level report.

There are 10 Sections in the Asset Management Plan. Key information from the sections will inform the bureau's budget process, operations strategies, information

management, and ongoing improvement efforts. Table 3 describes how results from each of the sections will be used by the bureau as part of next steps.

Table 3. Next steps for AMP section content

Section Topic	What will be used	Where it will be used
1. Introduction		
2. Levels of Service	Service Levels and workload measure proposals	In Budget Programs and in the Budget Program reports
3. Asset Inventory and Valuation	Estimates of what we have and the replacement value	In the Water System Status and Condition report
4. Asset Condition and Utilization	Estimates of asset condition	In CMMS or GIS (if not already there); in Water System Status and Condition report
5. Failure Modes and Asset Life	Identification of key failure modes and estimates of asset life	In CMMS (failure mode drop down menus – if not already there); in forecasting model – if not already there
6. Risk	Potential high risk assets; consequence of failure categories	Risk Committee will be meeting and updating risk database with new information
7. Strategies	Strategy recommendations	Strategy sub-committee of AMSC will be prioritizing strategies for budget process
8. Budget Forecasting	Budget estimates	Strategy sub-committee of AMSC will be using budget estimates for prioritized strategies
9. Performance Tracking	Implementation outcomes	Quarterly program reports and in the annual Key Service Level report
10. Improvement Plan and Data Requirements	Next steps to improve AMP and to improve data	Data improvements will be used in Data Management AMP; AMP co-leads will be following up on improvement tasks

9. Explicitly incorporate an accountability framework throughout the Bureau to increase the likelihood of successfully meeting its objectives as intended.

As recommended by the Auditor, the bureau will document the authority and responsibilities of the Asset Management Steering Committee and other AMP team members for implementing AMPs.

Attachment A. Resources Currently Committed to Asset Management Plan Development

Asset Type	Co-Leads and Primary Analysts	Stakeholder Group
Conduits	Jodie Inman (CL), Engineering Planning; Tim Collins (CL), Water Supply Program Manager in Engineering Design; Teri Liberator, Asset Management	Chris Wanner, Director of Operations; Tim Grandle, Watershed and Conduit Supervisor; Bill Vass, Conduits Operating Engineer; Rich Seright, Engineering Design; Steve Schenk, Water Supply Manager
Transmission	Jodie Inman (CL), Eng Planning; Marvin Weber (CL), Supervising Engineer over Tranmission/Mains Program in Eng Design; Vu Mai (CL), Eng Design; Teri Liberator, Asset Management; Martha Taylor, Asset Management	Chris Wanner, Director of Operations; Crystal Yezman, Water Operations and Support Manager; Tim Kading, Supervising Operating Engineer; Charles Smith, Senior Water Maintenance Supervisor; Stu Greenberger, Corrosion Engineer; Peter Nierengarten, Asset Management; Holly Walla, Transmission/Mains Program Manager in Engineering Design
Pump Stations	Peter Nierengarten (CL), Asset Management; Mia Sabanovic (CL), Engineer in Storage and Pump Station Program in Engineering Design; Keith Walker, Storage and Pump Station Program Manager in Engineering Design	Crystal Yezman, Water Operations and Support Manager; Eric Rathbun, Operating Engineer responsible for pump maintenance; Rod Allen, Operational Analysis Supervisor; Marc Crowder, Electrical/Instrumentation Tech Supervisor; Kirk Nibler, Instrumentation and Security System Supervisor; Tim Kading, Supervising Operating Engineer; Devin Sanders, CMMS Planner/Scheduler for Operations
Tanks	Keith Walker (CL), Storage and Pump Station Program Manager in Engineering Design; Eric Brainich (CL), Asset Management; Mike Ross, Engineer in Storage and Pump Station Program in Engineering Design	Chris Wanner, Director of Operations; Crystal Yezman, Water Operations and Support Manager; Tim Kading, Supervising Operating Engineer; Marvin Weber (CL), Supervising Engineer over Storage and Pump Station Program in Engineering Design; Mike Saling, Supervisor of Engineering Planning; Dave Evonuk, Engineering Planning; Jeff Leighton, Asset Management
Bull Run Road System	Scott Bryan (CL), Engineer in Water Supply Program in Eng Design; Eric Brainich (CL), Asset Management; Tim Grandle, Watershed and Conduit Supervisor; Dick Robbins, Watershed Protection Program Manager; Celia Cornett, Watershed Protection GIS Tech; Steve Kucas, Environmental Compliance Program Manager	Steve Schenk, Water Supply Manager; Tim Collins, Water Supply Program Manager in Engineering Design; Mike Saling, Supervisor of Engineering Planning; Jeff Leighton, Asset Management
Groundwater	Pat Easley, Lead, Groundwater Program Manager, and Randy Albright, Environmental Specialist, Engineering Design	Crystal Yezman, Water Operations and Support Manager; Tim Kading, Supervising Operating Engineer; James Garner, Groundwater Operating Engineer; Marc Crowder, Electrical/Instrumentation Tech Supervisor; Jeff Leighton, Asset Management
Wholesale Meter and	Bryan Robinson (CL), Engineer in Design; Vill Villanueva (CL),	Crystal Yezman, Water Operations and Support Manager; Tim Kading, Supervising Operating

Attachment A. Resources Currently Committed to Asset Management Plan Development

Asset Type	Co-Leads and Primary Analysts	Stakeholder Group
Vaults	Distribution System Maintenance Program Manager in Engineering Design	Engineer; Jan Warner, Finance and Support Services, Ron Drath, Small/Large Meters Supervisor; Andrew Heinsch, Water Meter Technician; Deborah Roach, Meter Shop Support Specialist
System Meters	Joe Howe (CL), Engineering Planning; Rod Allen (CL), Operational Analysis Supervisor; Eric Brainich, Asset Management	Crystal Yezman, Water Operations and Support Manager; Tim Kading, Supervising Operating Engineer; Russ Halverson, Senior Water Maintenance Supervisor; Vill Villanueva, Distribution System Maintenance Program Manager in Engineering Design; Kirk Nibler, Instrumentation and Security System Supervisor; Ron Drath, Small/Large Meters Supervisor; Dave Evonuk, Engineering Planning
Fountains	Marie Del Toro (CL), Engineering Planning; Luanne Zoller (CL), Maintenance and Security Program Manager in Engineering Design; John Robson and John Bee, Operating Engineers with current or past responsibility for Fountains	Crystal Yezman, Water Operations and Support Manager; Tim Kading, Supervising Operating Engineer; David Gray, Maintenance and Security Program in Engineering Design; Sarah Santner, Conservation Program Coordinator
Distribution and Distribution-Transport Mains	Dave Evonuk (CL), Engineering Planning; Teri Liberator (CL), Asset Management; Jeff Leighton, Asset Management	Crystal Yezman, Water Operations and Support Manager; Tim Kading, Supervising Operating Engineer; Charles Smith, Senior Water Maintenance Supervisor; Stu Greenberger, Corrosion Engineer; Peter Nierengarten, Asset Management; Holly Walla, Transmission/Mains Program Manager in Engineering Design; Vill Villanueva, Distribution System Maintenance Program Manager in Engineering Design; Jennifer Gardner, Mapping & GIS Supervisor; Rob Paterson, Public Works Supervisor, CMMS
Services	Teri Liberator (CL), Asset Management; Rob Paterson (CL), Public Works Supervisor	Kevin Suell, Senior Water Maintenance Supervisor; Remani Mathew, Financial Analyst, Accounting; Jan Warner, Financial Analyst, Finance; Chris Chambers, Engineer in Transmission/Mains Program in Engineering Design; Marci Rees, Customer Service Supervisor in Billing; Pamela Torres, Revenue Bureau; Mari Moore, Development Services Supervisor; Dave McDonnell and Jim Baker, Water Quality Inspectors; Jim Griner, Maintenance Planner/Scheduler; Jennie Gardner, Mapping & GIS Supervisor
Line Valves	Martha Taylor (CL), Asset Management; Russ Halverson (CL), Senior Water Maintenance Supervisor	Dean Nelson, Public Works Supervisor (Large Valves); Nate Burton, Public Works Supervisor (Small Valves); Holly Walla, Transmission/Mains Program Manager in Engineering Design; Vill Villanueva, Distribution System Maintenance Program Manager in Engineering Design; Jennifer Gardner, Mapping & GIS Supervisor; Rob Paterson, Public Works Supervisor, CMMS
Meters	Eric Brainich (CL), Asset	Kathy Koch, Customer Service Director; Jeff

Attachment A. Resources Currently Committed to Asset Management Plan Development

Asset Type	Co-Leads and Primary Analysts	Stakeholder Group
	Management; Ron Drath (CL), Small/Large Meters Supervisor; Andrew Heinsch and Mark DeVore, Water Meter Technicians; Deborah Roach, Meter Shop Support Specialist; Garrett Moffit, Applications Analyst (BTS)	Leighton, Asset Management; Cecilia Huynh, Finance
Facilities / Buildings	Anna Lyman (CL) Engineering Planning; Ross Turkus (CL), Engineering Design; Luanne Zoller, Maintenance and Security Program Manager in Engineering Design;	Crystal Yezman, Water Operations and Support Manager; Steve Schenk, Water Supply Manager; Tim Kading, Supervising Operating Engineer; Tim Grandle, Watershed and Conduit Supervisor; Tom Carter, Permitting, Engineering Planning; Tom Klutz, Property Acquisition and Service Manager; Rich Rice, Grounds Maintenance Supervisor; David Gray, Maintenance and Security Program in Engineering Design; Craig Sautter, Stores Supervisor; Dick Robbins, Watershed Protection Program Manager; Mike Saling, Supervisor of Engineering Planning; Bill Sinnott and Roger Hediger, Water Bureau Security; Paul Wallman (BIBS); Jeff Leighton, Martha Taylor, Teri Liberator and Eric Brainich, Asset Management
Bull Run Supply (starting in Fall 2012)	Chad Talbot (CL), Engineering Planning; Steve Schenk (CL), Water Supply Manager, Operations	To be determined in the fall
Terminal Storage (starting in Fall 2012)	Jodie Inman (CL), Engineering Planning; Crystal Yezman (CL), Water Operations and Support Manager	To be determined in the fall
Regulator Stations (starting in Fall 2012)	Dave Evonuk (CL), Engineering Planning; Co-lead from Asset Management (TBD)	To be determined in the fall
Data Management (starting in Fall 2012)	Teri Liberator (CL), Asset Management; Bob Goldie (CL), Program and CADD Manager and responsible for IT Strategic Plan	To be determined in the fall

CL = co-lead

Audit Services Division
Office of the City Auditor
1221 SW 4th Avenue, Room 310
Portland, Oregon 97204
503-823-4005
www.portlandoregon.gov/auditor/auditservices

Portland Water Bureau: Further advances in asset management would benefit ratepayers

Report #405, June 2012

Audit Team Members: Beth Woodward, Tenzin Choephel, Kari Guy, Daphne Lundi

LaVonne Griffin-Valade, City Auditor
Drummond Kahn, Director of Audit Services

Other recent audit reports:

Portland Police Bureau Learning: Improvements needed to strengthen existing processes (#416, May 2012)

Downtown Office Space: City uses most of its owned space, but lease practices need attention (#417, April 2012)

PDC Economic Development Loans: Loan programs improved, but tracking major borrowers limited (#419, March 2012)