Asset Management Program Executive Summary

Tools for Achieving Expected Levels of Service

LOTT Alliance

Cleaning and restoring water for our community

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Introduction

This Asset Management Program Executive Summary is a companion document to the LOTT Strategic Business Plan, published in 2008. The intent of this publication is to provide a broad overview of LOTT's Asset Management Program and describe how LOTT manages its wastewater and reclaimed water systems to meet the Levels of Service established in the Strategic Business Plan.

The Need For Asset Management

The LOTT Alliance owns and operates hundreds of millions of dollars worth of assets, including wastewater treatment facilities, reclaimed water plants, pump stations, groundwater recharge basins, and collection and distribution pipelines. In addition, LOTT's Capital Improvements Plan envisions investing $300 million through 2025 in new facilities, process improvements, and other system upgrades and replacements. These assets are critical to maintaining the established Levels of Service that are required to serve our communities. To ensure these Levels of Service are met at the lowest cost to the ratepayer, LOTT has been building a formal Asset Management Program to guide the acquisition, operation, maintenance, repair, and ultimate replacement of all its assets over time.

Asset Management can be defined as, "The systematic and coordinated activities and practices through which an organization optimally manages its physical assets, and their associated performance, risks, and expenditures over their life-cycle for the purpose of achieving its expected Levels of Service." The Asset Management Program provides an organization-wide framework to systematically evaluate, monitor, prioritize, coordinate, and execute the activities of the utility to ensure cost-effective and long-term sustainability. Asset Management also provides the use of fact-based methods, a focus on risk, concepts of Levels of Service, life-cycle cost analysis, and the use of integrated tools to improve the ways in which infrastructure assets are managed.

Levels of Service

The LOTT Alliance provides an essential public service, preserving and protecting public health and the environment by cleaning and restoring water resources for our communities. The LOTT service area includes the incorporated Cities and the urban growth areas (UGAs) of Lacey, Olympia, and Tumwater. The total area encompasses approximately 53,000 acres, with about 21,000 acres currently sewered. The system serves an estimated sewered residential population of 93,600, plus 86,300 sewered employees. In 2008, LOTT treated approximately four billion gallons of wastewater with an annual average flow of 11.0 mgd and peak hourly flow of 60.7 mgd.

The term "Levels of Service" refers to performance goals for meeting the organization's mission. Levels of Service describe the standard to which a service is delivered to the customer. It can be expressed both in qualitative and quantitative measures including responsiveness and consumer satisfaction. Knowing the required "sustainable" Levels of Service is critical to implementing a successful Asset Management Program and communicating to stakeholders LOTT's performance goals, both in the short- and long-term.

Asset Inventory and Condition Assessment

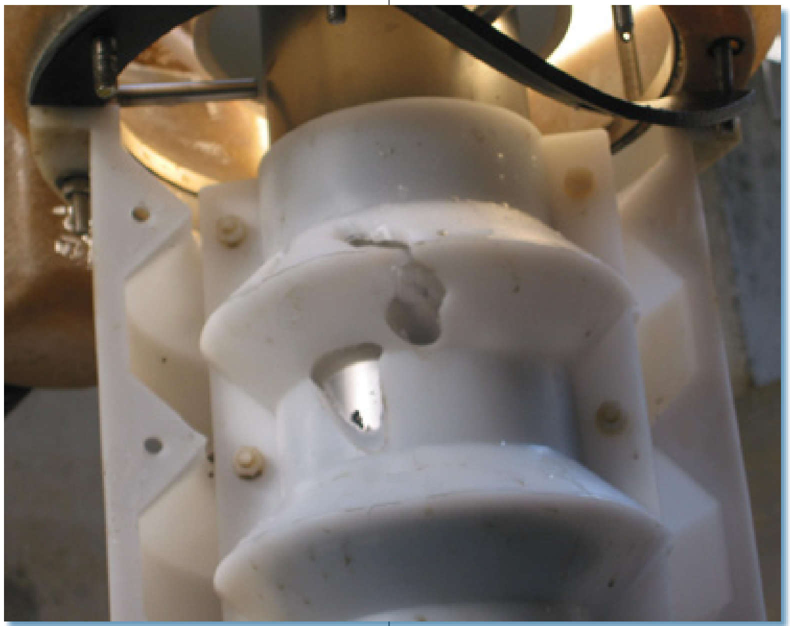
To properly manage LOTT's assets, the first step was to understand what the utility actually owns and what condition the assets are in. It is nearly impossible to manage something effectively if you do not know what that "something" consists of. Though this may seem like a rather straightforward question, it is not always easy to answer. Difficulties arise from several factors: some assets are underground and cannot be seen; assets generally are put in at different times; records regarding what assets have been installed may be old, incomplete, inaccurate, or missing; some assets are very complex with many parts; and staff turnover in operations and maintenance may limit the historical knowledge of system assets. LOTT's inventory of assets has developed over time and continues to expand as existing assets are identified and new ones are added. Asset Management will result in a standardized approach for identifying and tracking risk to LOTT's Levels of Service based on asset condition.

Risk Management

The ability to quantify and manage risk is one of the most important benefits of an Asset Management Program. By assessing the risk posed by the failure or inability of infrastructure assets to meet their intended functions, LOTT can identify operation and maintenance procedures, as well as capital rehabilitation and replacement projects, to mitigate these risks. Because all assets will eventually fail, how these risks are identified and managed is vital to LOTT's ability to meet its expected Levels of Service. As part of LOTT's initial asset inventory, each asset's condition (likelihood of failure) and criticality (consequence of failure) was determined.

Life-Cycle Management and Costing

Asset life-cycle management and costing is one of the most critical and complex components of the Asset Management Program. In basic terms, it is the process of determining the total cost of ownership for any alternative solution to a perceived problem. It includes the evaluation and quantification, in dollars, of all the activities required in owning a piece of equipment, system, or technology, from cradle to grave. In order to select the best alternative – the lowest total life-cycle cost alternative that meets the Levels of Service – a utility must evaluate all the activities required to plan for, acquire, operate, maintain, rehabilitate, and ultimately dispose of and replace its assets.



Initial capital costs can be substantial and, historically, have often dominated the decision-making process when acquiring new assets. However, the ongoing costs to operate and maintain an asset can represent a high proportion of the total life-cycle cost of many assets. These costs must be included in the financial analysis when evaluating asset investment options. Life-cycle costing is the process of evaluating all these steps and estimating the cost of each.

Long-Term Funding Strategy

Ensuring LOTT's long-term financial sustainability is paramount in meeting the Levels of Service. Revenues collected include monthly rates and new connection fees. These funds are required to operate the system, perform repairs, replace and upgrade system assets, and construct new facilities to meet increasing capacity demands. To ensure these charges are set appropriately, LOTT must have a good understanding of what its operating and capital requirements will be well into the future.

To ensure success in meeting the communities' values and expectations, LOTT has developed a variety of planning tools, one of which is the "intelligent" Capital Improvements Plan. Like many utilities, LOTT spends nearly two-thirds of its annual budget on capital projects and needed to find better methods to optimize capital expenditures. The intelligent Capital Improvements Plan is driven by a detailed and quantifiable planning model, which utilizes continuous planning to manage the utility's investments in the most cost-effective manner. The cornerstone of this model is the Asset Management Program.

Asset Management Implementation

Completion of this Executive Summary is one of the key steps in implementing LOTT's full Asset Management Program. It builds upon the Strategic Business Plan, and precedes development of a much more extensive Asset Management Operations Manual. Asset Management has become a core business principle that underlies everything LOTT does. It is a continuous responsibility and a way of doing business; it relies on policy guidance from the Board of Directors and directly involves staff in every one of LOTT's organizational divisions.

The successful implementation of the Asset Management Program does not rest solely on the Director, Capital Planning Manager, Maintenance Supervisor, or the Asset Management Team, but on every Board member and LOTT employee. Ensuring that all Board and staff members are aware of the program, the benefits it provides, the Levels of Service it maintains, and the activities they can do to support this effort will be a key focus in the continuous improvement of the program.

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The Need For Asset Management

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Introduction

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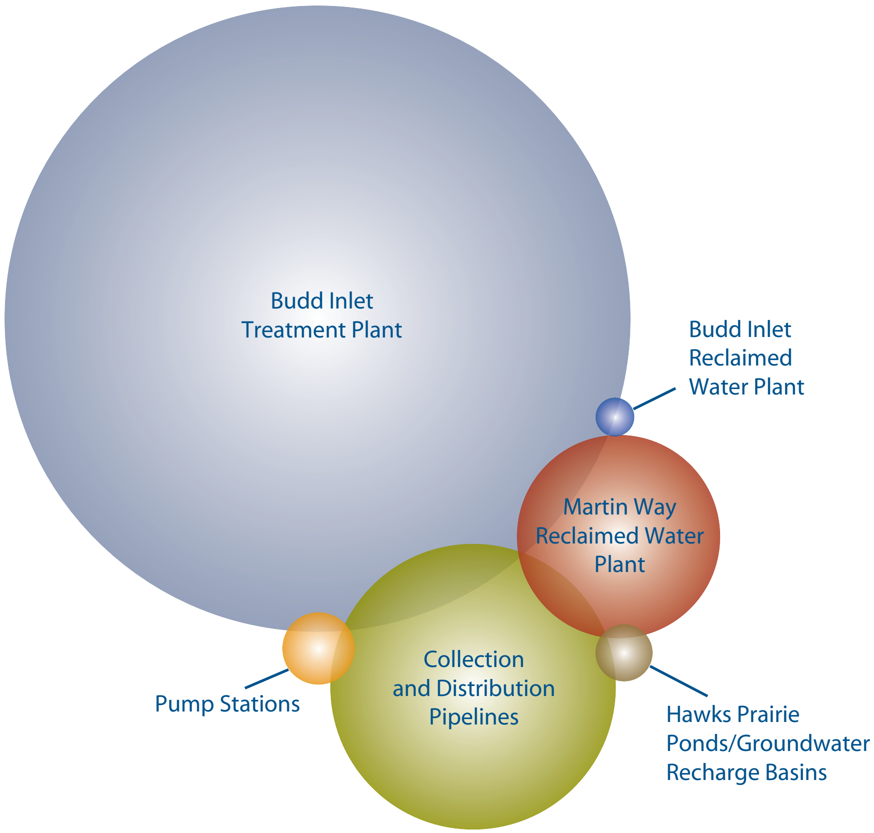
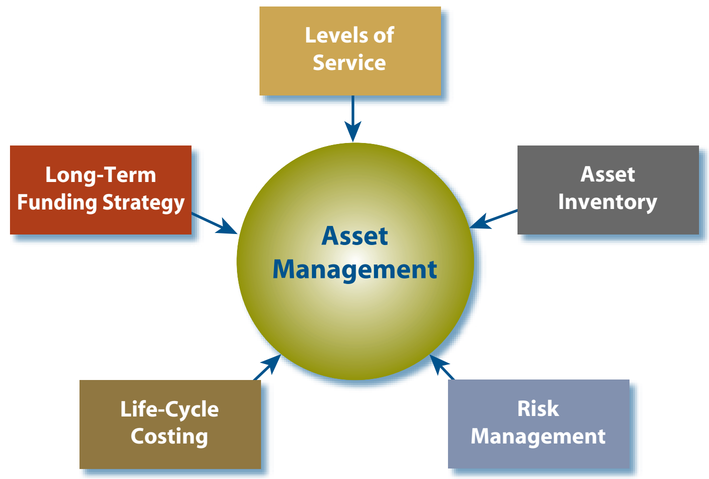
LOTT's Infrastructure Components



What is Asset Management?

Asset Management can be defined as, "The systematic and coordinated activities and practices through which an organization optimally manages its physical assets, and their associated performance, risks, and expenditures over their life-cycle for the purpose of achieving its expected Levels of Service."

Asset Management Program Core Components



Although the Asset Management concept is relatively new in the wastewater industry, the management of assets is not. Prior to the development of a formal Asset Management Program, decisions concerning infrastructure renewal have typically been based on the perception and intuition of utility staff members and pressures from regulatory agencies and other stakeholders. Most utilities perform portions of an Asset Management Program, but not in a fully coordinated fashion, as was the case for the LOTT Alliance. The Asset Management Program now provides an organization-wide framework to systematically evaluate, monitor, prioritize, coordinate, and execute the activities of the utility to ensure cost-effective and long-term sustainability. Asset Management also provides the use of fact-based methods, a focus on risk, Levels of Service concept, life-cycle cost analysis, and the use of integrated tools to improve the ways in which infrastructure assets are managed.

With aging infrastructure, increasing costs, population growth, and escalating demands from regulatory agencies, it is becoming increasingly important to manage resources efficiently and effectively. There are five core components of a successful Asset Management Program. For organizations without a formal program, these components may only be conducted in part or haphazardly. Establishment of a formal Asset Management Program focuses on the implementation of these components into a cohesive, comprehensive management system.

Implementing an Asset Management Program is not an event, but a way of doing business. LOTT strives for continuous improvement in the utility's ability to meet its Levels of Service, monitor its success in meeting these Levels of Service, and incorporating Asset Management into every activity, every action, and every decision that the utility undertakes.

Why Does LOTT Need Asset Management?

A formal Asset Management Program establishes the decision-making framework that is based on strategic considerations, allowing a utility to meet its Levels of Service in the most cost-effective and long-term sustainable manner. Prior to the development of the Asset Management Program, there were several weaknesses in LOTT's planning process for facility repair and replacement.

- Determination of cost effectiveness was difficult because: 1) asset-by-asset plans to replace, rehabilitate, or continue maintaining an asset were not fully in place or did not exist; and 2) a comprehensive register of the condition, current value, annual maintenance investment, and replacement value of assets was not available.
- Since the annual Capital Improvements Plan did not include the complete replacement or improvement cost of LOTT's facilities over one entire life-cycle, it presented further potential financial difficulties; existing fee and rate structures may not have covered the full cost of asset ownership and operation.
- A risk management program, to determine the consequences if an asset fails did not exist, thus there was an increased chance of being surprised with unexpected high-cost emergency repairs.

Development of the Asset Management Program will allow LOTT to manage assets to yield superior optimization and return on facility investment with long-range planning, life-cycle costing, proactive operations and maintenance, and capital replacement plans based on cost-benefit analyses that are the most efficient method of facility investment programming. The primary benefits of an Asset Management Program include:

Defensible Decision-Making – The Asset Management Program generates a more rigorous and organized decision-making process based upon quantifiable elements of risk, which ultimately results in more defensible and reproducible capital investment decisions and maintenance practices. The primary tool that LOTT uses to make these decisions is the Business Case Evaluation (BCE), which is based on identifying the lowest total cost of ownership alternative for meeting a need while meeting established Levels of Service. The BCE process is discussed further in Chapter 5.

Responsible Risk Management – Asset Management concepts are based on risk evaluation and mitigation. Historically, rehabilitation and infrastructure replacement projects were done out of necessity when unplanned failures occurred. These types of failures can be dangerous and costly. By evaluating the condition (likelihood of failure) and criticality (consequence of failure) of owned assets, the overall risk carried by each can be determined. The identified risk can then be mitigated to ensure the Levels of Service are met. Assessing risk and quantifying it in terms of dollars allows for the proper prioritization of limited resources. This also allows for the development and optimization of emergency response strategies for high-risk assets, minimizing collateral costs of failures. As a result, costs such as service loss, emergency restoration, damage to private property, lawsuits, fines, and damaged public image are minimized or eliminated.

Long-Range Capital Planning – Much of a wastewater utility's infrastructure consists of long-lived assets. Understanding the remaining useful life of assets and the risk they carry enables more efficient and cost-effective planning for their replacement. Data gathered through the Asset Management Program feeds the analyses needed to develop and prioritize the annual Capital Improvements Plan. This ensures that financial resources are focused on activities that are critical to sustained performance and that they are directed at meeting the Levels of Service.

Credible Communications – An organized Asset Management Program allows for credible and effective communication with ratepayers, elected officials, financial rating organizations, and regulatory agencies. Having factual data about infrastructure condition and performance builds the utility's public image and the confidence of its stakeholders. Asset Management tools provide a transparent mechanism to document, justify, and communicate near- and long-term budgetary requirements with stakeholders.

Integrated Information Systems – A utility generates and stores vast amounts of data to include project information, financial records, asset data, and operational and maintenance records. Most often, the systems that store this information do not communicate with one another. Integrating Asset Management practices within the utility can facilitate the sharing of information across departments for better coordination and informed decision-making. Having easily accessible, accurate, and current information reduces duplication of effort, and improves the allocation of staff time and other resources.

Reliable Financial Forecasting and Rate Setting – Understanding what is owned, what condition it is in, when it needs to be replaced, and how much it will cost is vital to ensuring the long-term sustainability of the utility. Asset Management practices help estimate the amount of revenue needed, above operating costs, to ensure recovery of the full costs of services in both the short- and long-term. Using this information, rates can be established based on sound operational information. Asset Management practices also reduce unexpected capital investments, which can disrupt utility budgets.

Optimized Operations and Maintenance – Asset Management practices can reduce operating and maintenance costs by preserving facility efficiency and prolonging an asset's life. These practices also help to identify the optimal point at which an asset should be replaced, thereby minimizing the overall life-cycle costs. It enables a proactive repair and replacement program rather than reactive maintenance and emergency repairs.

Developing an Asset Management Program

The process of building LOTT's formal Asset Management Program began with the development of the 1998 Wastewater Resource Management Plan, which outlined how LOTT intended to provide regional wastewater management services to our communities. As a follow-up to the 2002 Performance Evaluation of the Budd Inlet Treatment Plant, the 2004 Performance Standards Assessment was completed. It assessed the types of services offered by LOTT, the labor costs associated with each service, and the required skills necessary to meet the objectives outlined in the Wastewater Resource Management Plan. As a result, it was determined that a formal Asset Management Program was needed to achieve these objectives. The consultant team of Brown and Caldwell and Hunter Water Australia was selected in 2004 to facilitate the process.

The LOTT Alliance Strategic Asset Management Plan, prepared by the consultant team, was completed in March 2005. The plan defined the direction of the Asset Management Program and included an action plan for the program's implementation. To guide this process, LOTT created a new Asset Manager position and established an Asset Management Team, which included representatives from LOTT engineering, operations, maintenance, finance, and information technology. The development of the strategic plan started with an Asset Management Program evaluation based on multiple best practice categories:

- Asset Management Vision / Support
- Organization Structure
- Planning
- Asset Knowledge
- Asset Planning
- Asset Program Communication
- Asset Development
- Asset Operation and Maintenance
- Asset Condition Monitoring
- Asset Rehabilitation and Replacement
- Asset Financing
- Asset Financial Reporting
- Asset Information Systems

During this process, the Asset Management Team developed a consensus on the current state of LOTT's program relative to the best practice categories and prepared a three-year vision of where LOTT needed to be relative to these best practices. From this consensus, performance "gaps" were defined, and an action plan to close the prioritized gaps was developed.

In mid-2007, the Asset Manager and Utility Planner positions were combined to create a new Capital Planning Manager position. This combination assures integration of the Asset Management and overall capital planning functions.

Chapter 2:
Levels of Service

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Introduction

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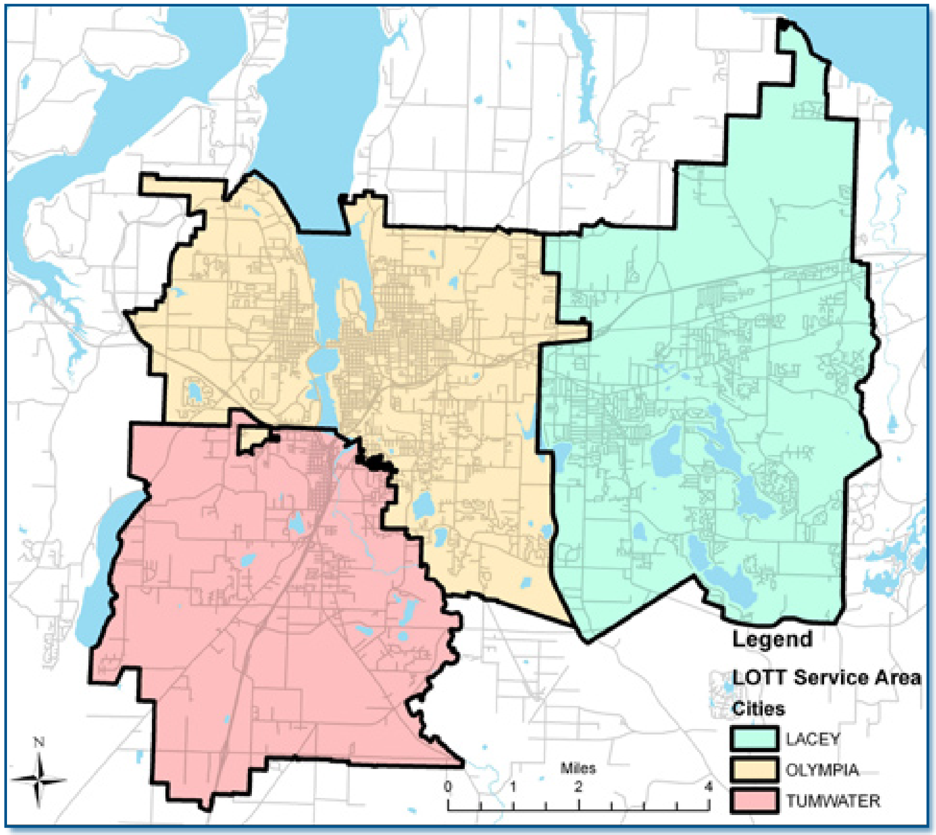
During 2007, the LOTT Board of Directors guided a year-long process to define Levels of Service for the utility. The Board reviewed existing public values, developed core values for the utility, defined Levels of Service, and identified Measures of Success for each Level of Service. That work was documented in the Strategic Business Plan, published in February 2008, and was updated in the Strategic Business Plan Mid-Year Report in August 2008. This chapter summarizes the values and Levels of Service identified through that process.

LOTT Service Area



Context Behind Levels of Service

As part of developing its long-range Wastewater Resource Management Plan, LOTT identified ten public values to serve as a guide to decision-makers and effectively act as a vision statement.

1. As a first priority, maximize utilization of LOTT's existing treatment capacity. Manage demand to avoid or delay the need for new treatment capacity.
2. Prepare a plan that meets current and future wastewater needs throughout the LOTT service area. Accommodate planned growth, consistent with LOTT's legal requirements.
3. Select wastewater facilities for the region's future that yield maximum benefits to the environment. Mitigate any potentially adverse impacts of new facilities.
4. Take all possible steps to control facilities costs. Carefully consider the lowest cost and most cost-effective alternatives, and evaluate the impact on LOTT ratepayers.
5. Treasure LOTT's treated wastewater as a valuable, long-term resource to be cleaned and restored, reused, then ultimately returned to the environment.
6. Clearly define, demonstrate, and document the value to the community of new facilities needed for the future. Design any new LOTT facilities to produce multiple benefits for the community.
7. Conduct a pro-active and open facilities planning process that informs and involves citizens in planning and decision making.

8. Assure an equitable distribution of costs for any new facilities between current ratepayers and new development.

9. Establish an organizational structure to build and operate the region's future facilities effectively and efficiently, and that assures equitable and accountable representation of the public.

10. Integrate LOTT's facilities plan with other related local issues, plans, and infrastructure programs to maximize regional cooperation and avoid duplication of effort and cost.

LOTT's core values were derived by review of these public values, key Board actions, and annual Board goals from 2001 - 2006. Seven core values were identified:

LOTT values its workforce as essential to the success of its mission.

LOTT values protection of health and safety for employees and the public.

LOTT values managing financial resources in a responsible, sound, and equitable manner.

LOTT values responsible environmental resource management and stewardship.

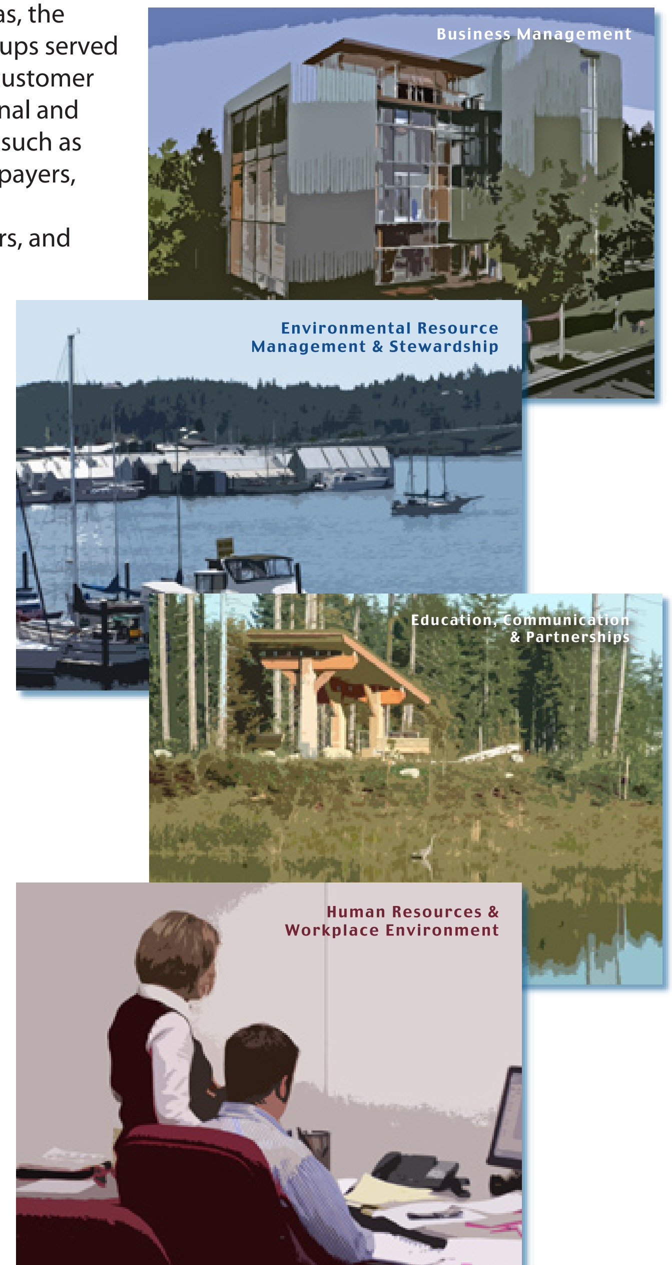
LOTT values community participation and support through open communication and outreach.

LOTT is committed to a "Good Neighbor Policy" in planning, development, construction, and operation of all of its facilities.

LOTT values community education regarding wastewater treatment, renewing water resources, and water conservation as essential to the success of LOTT's mission.

Defining Levels of Service

Four performance areas – Business Management; Environmental Resource Management and Stewardship; Education, Communication, and Partnerships; and Human Resources and Workplace Environment – were determined to encompass LOTT's activities and provide useful delineations for defining Levels of Service. Within each of the four performance areas, the primary customer groups served were identified. The customer groups included internal and external stakeholders such as LOTT employees, ratepayers, communities, partner jurisdictions, regulators, and tribal partners.



The primary considerations in developing the Levels of Service were that they needed to be meaningful to customer groups – staff and stakeholders. They needed to provide a clear picture of performance and relate to qualitative or quantitative Measures of Success. The Levels of Service needed to be consistent with industry practice and reproducible by others, yet unique in describing specific attributes of LOTT's services or activities. Most importantly, they needed to be useful in managing the utility and encouraging continuous improvement. The Levels of Service identified in the Strategic Business Plan 2008 - 2012 fall within four major performance areas.

Business Management

- Manage the utility within financial benchmarks
- Operate within accepted business and financial standards
- Embrace Asset Management and use of the triple bottom line as the operational standard for all system investments
- Ensure equitable distribution of costs between ratepayers and new development
- Preserve the design capacity at the Budd Inlet Treatment Plant
- Build capital facilities "just in time"

Environmental Resource Management and Stewardship

- Complete capital projects with minimal environmental impacts
- Protect water resources through high-quality wastewater treatment
- Produce and reuse renewable resources including Class A Reclaimed Water, Class B Biosolids, and methane
- Maximize use of existing treatment capacity through cost-effective water conservation, inflow and infiltration reduction, and flow diversion projects
- Minimize odor complaints from LOTT activities
- Support joint water quality and habitat improvement projects
- Collaborate with partner jurisdictions and other entities to ensure emergency preparedness

Education, Communication, and Partnerships

- Provide open and transparent access to information
- Respond quickly and openly to public inquiries
- Pursue recognition of excellence
- Collaborate with partner jurisdictions and other entities to participate in community programs and events that foster public awareness and support for LOTT activities
- Involve the public in planning and design processes
- Develop educational materials and programs that foster public awareness and support for LOTT activities

Human Resources and Workplace Environment

- Provide employee development and support programs that result in an adaptive, efficient, satisfied, and skilled workforce
- Build and maintain a culture of safety

For each Level of Service, Measures of Success (targets or metrics) were established to monitor and track LOTT's performance over time, and were documented in the LOTT Strategic Business Plan 2008 - 2012. The matrix summarizing that plan, and an updated matrix published in the Strategic Business Plan Mid-Year Report 2008, are included in Appendix A. The matrices include core values, customer groups, Levels of Service, and Measures of Success for each of the four performance areas. LOTT will continue to monitor and update these Levels of Service to account for changes due to growth, regulatory requirements, and technology improvements.

Establishment of these Levels of Service and completion of the Strategic Business Plan laid the groundwork for development of a formal Asset Management Program. The goals of the organization and standards to which LOTT's systems must perform are defined in the Levels of Service and as such, guide the Asset Management Program.

Chapter 3:
Asset Inventory and Condition Assessment

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Introduction

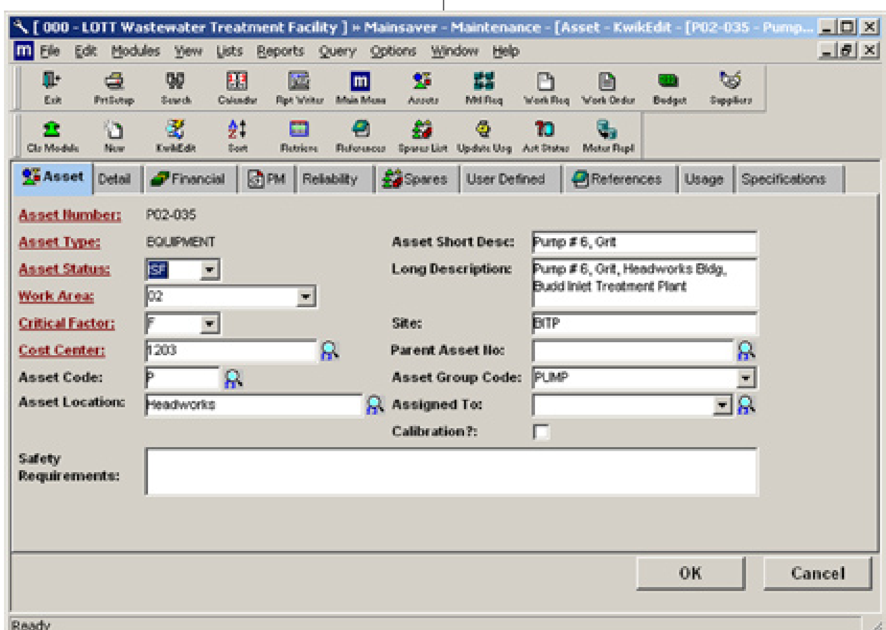
To properly manage LOTT's assets, the first step was to understand what the utility actually owns and what condition the assets are in. It is nearly impossible to manage something effectively if you do not know what that "something" consists of. Though this may seem like a rather straightforward question, it is not always easy to answer. Difficulties arise from several factors: some assets are underground and cannot be seen; assets generally are put in at different times; records regarding what assets have been installed may be old, incomplete, inaccurate, or missing; some assets are very complex with many parts; and staff turnover in operations and maintenance may limit the historical knowledge of system assets. LOTT's inventory of assets has developed over time and continues to expand as existing assets are identified and new ones are added. Asset Management will result in a standardized approach for identifying and tracking risk to LOTT's Levels of Service based on asset condition.

Information Management Systems

Information systems are an essential component of the Asset Management Program and are responsible for storing data about LOTT's owned assets. Information systems organize this data in a logical fashion that facilitates analysis, reporting, and sound business decisions.

Computerized Maintenance Management System

The Computerized Maintenance Management System, Mainsaver, is the primary tool for managing LOTT's asset inventory and the activities conducted to maintain them. It serves many functions, including storing information about LOTT's owned assets (i.e. location, type, size, installation date, etc.) and



providing tools to help manage the maintenance activities associated with each asset. This system serves as the core of work order process, scheduling jobs, assigning resources, and tracking performance and costs. It is used to manage the inventory of spare parts, tools, and other materials. Linking with other operational information systems, it identifies preventive maintenance tasks based on asset run times. The system can also produce status reports and documents giving details or summaries of maintenance activities. These reports are valuable in monitoring the effectiveness and efficiencies of maintenance activities, identifying trends in asset performance and failure, and providing information to management.

Asset Condition Assessment System

To expand the capabilities of the Mainsaver system, LOTT developed the Asset Condition Assessment System, a customized computer application that stores condition and criticality information for each asset. This tool is the key to identifying, quantifying, and managing the associated risk of each asset. This process will be discussed in detail in Chapter 4.

Pipeline Management Systems

LOTT owns and maintains approximately 28 miles of buried interceptors, forcemains, and reclaimed water distribution piping. The inventory of these assets is maintained in a geographical information system (GIS), which stores each pipe's location, date installed, size, material, and elevation. LOTT utilizes the software application GraniteXP to manage condition assessment data generated from the internal inspection of buried pipe using closed circuit television. The application utilizes the National Association of Sewer Service Contractor's standard method of defect coding and rating. The pipeline assessment and certification program rates and ranks common individual defects within a pipeline and categorizes the defects in four main areas, which can be used to identify and prioritize cleaning, maintenance, renewal, and replacement activities. This system is also used by the Cities of Olympia and Lacey, enabling sharing of standardized information.

Asset Inventory

A comprehensive asset inventory was conducted in 2006, which expanded upon the existing inventory included in the Mainsaver system. Operations and maintenance staff were interviewed, as-built drawings and GIS data sets were reviewed for underground assets, and visual observations were conducted for above-ground or visible assets. To ensure that the asset inventory is as accurate as possible, LOTT has developed procedures for adding/removing assets from the inventory as they are added, replaced, and decommissioned. Assets not added to the inventory included those that are part of another asset that is tracked, consumable assets (those that have an expected life-cycle of less than one year), and low-cost assets that do not require reoccurring maintenance (can be run to failure) and are not critical to meeting the expected Levels of Service. Currently, 1,852 assets have been identified, with key data collected for each asset, which are tracked in the Mainsaver system.

Key Asset Data

Standard Attributes
Size and/or capacity
Construction material
Installation date
Location
Original cost
Replacement cost
Condition assessment
Criticality assessment
Original service life
Estimated remaining life
Parent process (hierarchy level)

Replacement Cost

Knowing the original acquisition cost of an asset is important and can be used to assess depreciation costs over time. However, it does not always have a direct bearing on what it will cost to replace the service or function that the asset provides. The asset may be replaced by the same type of asset, or it may be replaced by a different technology entirely. Furthermore, costs of various assets may change over time.

To develop replacement cost estimates for planning level purposes, LOTT uses the following techniques depending on the situation.

- Escalating the original acquisition cost using standard price indexes (i.e. Engineering News Record)
- Analyzing replacement cost of similar projects completed recently
- Developing replacement cost estimates based on professional experience of LOTT staff and/or consultants
- Using asset hierarchies to estimate the replacement of systems (collection of assets), rather than estimating the replacement cost of each asset individually

Although the idea behind an asset value is relatively simple, obtaining costs for the asset's replacement is not as easy. A replacement cost has been developed for all LOTT assets and the method used was selected based on cost and level of accuracy needed. As assets approach the end of their useful lives and plans are made for their replacement, more accurate replacement cost estimates may be needed.

Condition and Criticality Assessment

As each asset was inventoried, an evaluation of its current condition (likelihood of failure) and criticality (consequence of failure) was completed and entered into the Asset Condition Assessment System. Together, these two assessments allow LOTT to quantify the risk associated with each asset. Risk management is a key function of LOTT's Asset Management Program and will be discussed in Chapter 4.

An Asset's Remaining Life

As all assets will eventually reach the end of their useful lives, it is important to estimate when this will occur in order to plan for their replacement. Depending on the type of asset, it will either reach this point through the amount of use or length of service. For example, a pump will wear out sooner if it is used more often, and will last longer if it is used less often. The actual age of the pump is not as important as the amount of work the pump has done. On the other hand, pipeline assets wear out based more on the length of time in the ground.

Methods for determining the remaining useful life vary depending on the type of asset and accuracy desired. Some assets, such as pumps, are run by computerized systems and run times are documented. Using the manufacturer's estimated life, the remaining life of these types of assets can be estimated based on hours of operation. However, other factors, such as the quality of installation and materials, maintenance activities, and the type of duty, can affect an asset's life.

The best assessment of an asset's life is based on physical inspections, past experience, system knowledge, existing and future conditions, and prior and future operations and maintenance activities. Utilizing the condition assessment system, periodic inspections are performed and the condition is updated in the system accordingly. The frequency of these inspections is based on the criticality of the asset.

Asset Hierarchies and Systems

In addition to the standard attributes of an asset, such as type, location, and installation date, developing a structure to organize this information is also important. An asset hierarchy was developed to enable the evaluation of performance and cost at different levels within the organization. An asset hierarchy is a framework that organizes assets into higher-level systems and processes. Each asset was assigned to a parent process. For example, a sub-process (grit pumping) can be assigned to a process (grit removal), the process can then be assigned to a system (headworks), which in turn is part of an overall facility (treatment plant).

Asset Hierarchy and Supported Business Process

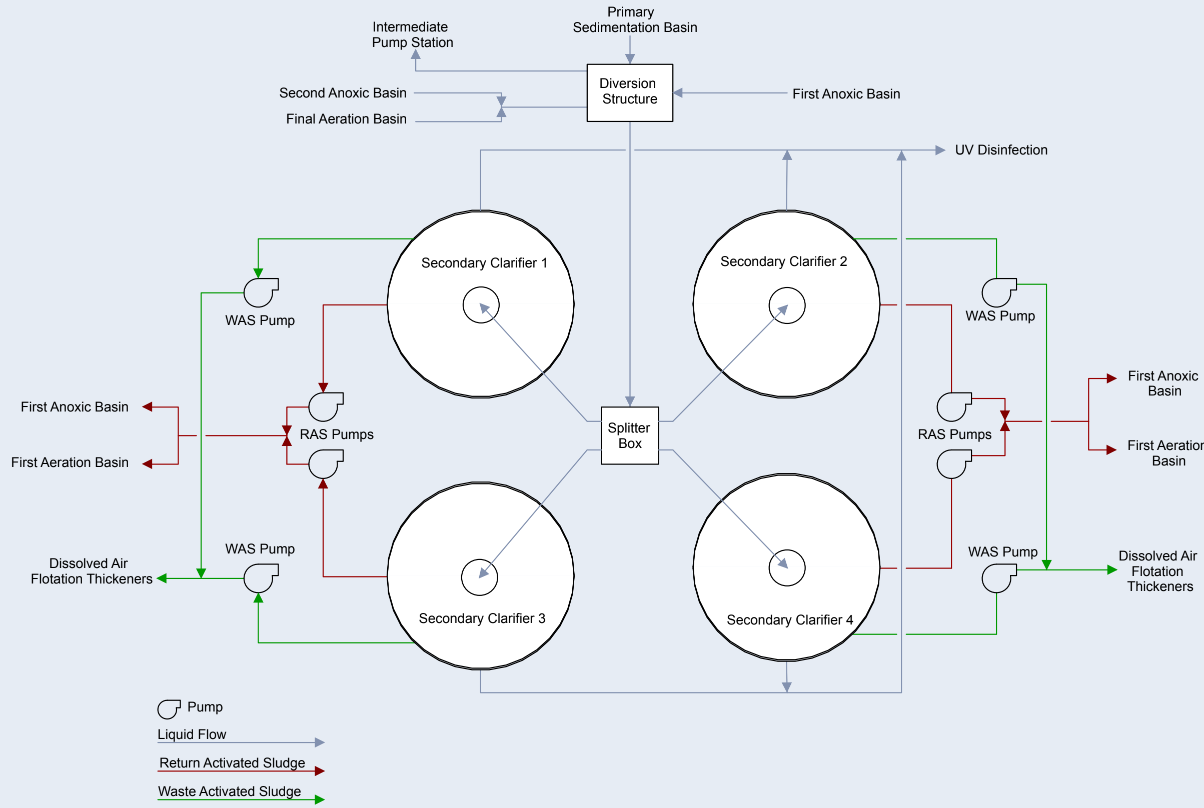
Hierarchy Level	Example	Supported Business Process
Facility	Budd Inlet Treatment Plant	Long-term financial planning
System	Headworks	Return on assets Budget rationalization Risk analysis
Process	Grit removal	Valuations Supporting Business Case Evaluations Recording maintenance costs
Sub-Process	Grit pumping	Recording failures Probability of failure Predictive maintenance Renewal / disposal / replacement

At a strategic management level, asset hierarchies provide a means to identify and plan for the replacement or renewal of major systems, organize assets in classes with similar use and risk, and enable long-term financial planning. At the operations and maintenance level, asset hierarchies provide a tool for process analysis, supporting better decision making, and improving the efficiency and effectiveness of both the assets and the staff that maintain and operate them.

Asset System Summary

Leveraging the established asset hierarchies, asset profiles were developed for each of the major systems. Each asset profile summarizes its major function, design features, capacity limitations, current performance assessments, failure modes, and key issues for further investigation. An asset profile of the secondary clarifiers at the Budd Inlet Treatment Plant is included here as an example. Additional asset profiles are located in Appendix B.

Budd Inlet Treatment Plant Secondary Clarifiers



1. System Profile

The purpose of the secondary clarifiers is to separate suspended solids from the biological treatment process mixed liquor prior to disinfection of the treated plant effluent. The clarifiers receive flow from the final aeration basin. Clarified effluent from the clarifiers flows to the UV disinfection system.

There are four clarifiers at the plant with a diameter of 120 feet and a 14.5-foot side water depth. A project to upgrade the secondary clarifiers was completed in 2008. The project included the replacement of the clarifier mechanisms and return activated sludge (RAS) pumps. The effluent launders were replaced in 2003.

Each clarifier is equipped with two RAS pumps and one waste activated sludge (WAS) pump. Settled sludge is withdrawn from each clarifier by dedicated RAS pumps that are connected to a manifold of pipes located on the clarifier's rotating sludge collector mechanisms.

A magnetic flow meter measures the flow from each pair of pumps. RAS is recycled by the pumps back to either the first anoxic or the first aeration basin. The pumping rate is adjusted to maintain a minimal blanket of thickened sludge in the clarifier.

The waste activated sludge is withdrawn from either the clarifier sump or the return activated sludge wet well and directed to the dissolved air flotation thickeners for solids processing. The WAS pumps are used to maintain the solids inventory in the system and the solids retention time in the secondary treatment process to allow the biological treatment process to operate correctly. The WAS pumps are operated continuously to even out the load to the dissolved air flotation thickeners.

2. Demand Profile and Performance

Peak, Average, and Standby Design Capacities

System Subsystem(s)	Design Capacity	Actual Performance
Secondary Clarifier Mechanisms	4@120 ft diameter, 14.5 ft deep	
Return Activated Sludge Pumps	8@20 hp and 2,000 gpm	
Waste Activated Sludge Pumps	4@10 hp and 300 gpm	

3. Failure Mode

Failure Summary

Process	Area	Rating				
		Condition	Capacity	Function	Reliability	Efficiency
Secondary Clarifiers		1	1	2	1	1
Return Activated Sludge Pumps		1	1	1	1	1
Waste Activated Sludge Pumps		1	1	1	1	1

4. Key Issues for Further Investigation

As part of the upcoming Process Improvements Project, it is anticipated that some of the process tank volume will be consolidated. This will require the aeration tanks to operate at relatively high mixed liquor solids concentrations, increasing the solids loading rates to existing clarifiers. Secondary clarifier capacity will need to be evaluated as part of this process.

5. Current Program

Study

Brown and Caldwell completed the Secondary Clarifier Capacity Analysis in 2008, reevaluating the existing secondary clarifiers' removal efficiency based on various solids loadings rates.

Planning

Information gathered as part of the Secondary Clarifier Capacity Analysis will be used to develop the Master Site Plan for the Budd Inlet Treatment Plant concerning future secondary treatment capacity requirements based on the selected alternative for the Process Improvements Project.

Design and Construction

The existing secondary clarifiers were rehabilitated in 2007 - 2008.

Management Strategies

N/A

6. Investment Strategy

5-Year Summary

Project	Investment ($1,000s)						
	Projected Budget	Cost to Date	2008	2009	2010	2011	2012
Secondary Clarifier Rehab	6,124	6,124					
Total	**6,124**	**6,124**					

O & M Cost Summary

	Cost ($1,000s)				
	2008	2009	2010	2011	2012
Operations	104	113	122	132	142
Maintenance	5	5	5	5	5

Together, these asset profiles make up the Asset System Summary. This summary provides a mechanism to evaluate comprehensive lists of assets in context with their overarching process system, and allows for a better assessment of their criticality in meeting the established Levels of Service. The complete Asset System Summary is located in Appendix B. It includes asset profiles for the Budd Inlet Treatment Plant, and other major LOTT facilities and assets. Data collection and evaluation is an ongoing process; data is included for each profile where available. Profiles are included for the systems listed below.

Budd Inlet Treatment Plant

Headworks – The headworks facility consists of preliminary treatment (screens and grit removal) and influent pumping.

Primary Sedimentation – The primary treatment process removes easily settleable material from the screened and degritted wastewater.

Aeration Basins – The aeration basins contain LOTT's biological nutrient removal system, which consists of a four-stage process to optimize total inorganic nitrogen and biochemical oxygen demand (BOD) removal from the primary effluent.

Secondary Clarifiers – The purpose of the secondary clarifiers is to separate suspended solids from the biological treatment process mixed liquor prior to disinfection of the treated plant effluent.

Ultraviolet Disinfection – The ultraviolet (UV) disinfection system disinfects the secondary clarifier effluent to satisfy NPDES permit requirements for marine discharge.

Budd Inlet Reclaimed Water Plant – This reclaimed water facility uses sand media and sodium hypochlorite to filter and disinfect secondary effluent to Class A Reclaimed Water standards.

Sludge Thickening (DAFTs) – The sludge thickening process removes excess water from the combined flows from the primary sedimentation and secondary clarifiers prior to anaerobic digestion.

Digesters (Sludge Stabilization) – The anaerobic digesters biologically stabilize thickened sludge from the DAFTs by converting portions of the sludge to carbon dioxide, methane, and water.

Sludge Dewatering – The solids dewatering process removes excess moisture from anaerobically digested sludge (2 to 3 percent solids) to create biosolids (20 to 24 percent solids).

Energy Recovery – Two separate heat loops at the plant recover heat and reuse energy that would otherwise be wasted.

Odor Control – There are four separate foul air treatment systems at the plant to treat air emissions; three are chemical wet scrubbers and the fourth is an activated carbon scrubber.

Additional LOTT Facilities and Assets

Martin Way Reclaimed Water Plant – This facility receives raw sewage flows from the collection system via the Martin Way Pump Station and treats to Class A Reclaimed Water standards.

Hawks Prairie Ponds and Recharge Basins – Reclaimed water from the Martin Way Reclaimed Water Plant that is not delivered for other beneficial uses is routed to the Hawks Prairie Ponds and Recharge Basins.

System Pump Stations – Pump stations lift the raw sewage into the conveyance system that ultimately delivers it to the Budd Inlet Treatment Plant and the Martin Way Reclaimed Water Plant.

Collection and Distribution Piping – The LOTT Alliance owns over 28.6 miles of pipelines; the system includes 18.9 miles of gravity sewer, 5.7 miles of pressurized forcemains, and 4 miles of reclaimed water pipelines.

Chapter 4: Risk Management

Chapter 4:
Risk Management

Introduction

The ability to quantify and manage risk is one of the most important benefits of an Asset Management Program. By assessing the risk posed by the failure or inability of infrastructure assets to meet their intended functions, LOTT can identify operation and maintenance procedures, as well as capital rehabilitation and replacement projects, to mitigate these risks. Because all assets will eventually fail, how these risks are identified and managed is vital to LOTT's ability to meet its expected Levels of Service. As part of LOTT's initial asset inventory, each asset's condition (likelihood of failure) and criticality (consequence of failure) was determined.

Asset Condition Assessment

In order to evaluate all assets consistently, a standard set of criteria was developed to quantify an asset's current condition. Staff knowledgeable of the LOTT systems scored each asset using criteria, such as performance, maintenance requirements, repair history, problem detectability, estimated remaining life, and use and duty.

For each asset, a score of 1 - 6 is given for each criteria (1 being the most positive and 6 being the most negative). All scores are added together to get a total condition assessment score.

Where appropriate, more sophisticated techniques were employed to assess asset condition and support the predictive maintenance program. These techniques include infrared thermography, ultrasonic measurement, and vibration analysis.

Asset Condition Assessment Criteria

Criteria	Description
Performance	Is the asset meeting its intended performance levels?
Maintenance Requirements	How intensive are the maintenance requirements?
Repair History	How many repairs have been needed to maintain the asset?
Problem Detectability	Can problems with the asset be easily detected?
Estimated Remaining Life	What percent of the asset's useful life has been consumed?
Use and Duty	How strenuous is the duty the asset performs?

Criticality Assessment

Assessing an asset's critically is often more difficult and qualitative in nature than assessing an asset's condition. In order to make the criticality assessment score meaningful, all possible costs of failure must be considered. Costs include not only the actual cost of repair but also the associated social, legal, environmental, safety, and collateral system repair costs. The consequence of failure can be high if any of these costs are significant, or if there are several consequences that occur with a failure that cause a loss in the Levels of Service. The followings costs were considered when developing the criteria to quantify each of the asset's consequence of failure:

Cost of Repair – When an asset fails, it will be necessary to fix the asset in some way. Depending on the type of asset and the extent of the failure, repair may be simple or extensive. If the asset can be repaired easily and without a tremendous cost, then there is a lower consequence. If the cost of repair is higher, then the consequence of the failure is also greater.

Permit Compliance and Environmental Costs – Some asset failures can result in environmental impacts and permit violations. These costs can be difficult to quantify in monetary terms, but they must be considered. The failure of a sewer pipe that leaked sewage into a waterway or onto land may result in fines, legal fees, cleanup costs, and actual damage to the environment.

Loss of Service – The assets must be in working order to deliver the Levels of Service desired by the utility and its customers. If an asset fails, the ability to deliver the desired Levels of Service may be compromised. An asset that has a major impact on the ability to meet the Levels of Service would be considered more critical to the system than an asset whose failure would not have a significant impact on the Levels of Service.

Collateral Damage – When an asset fails, in some cases damage may be caused to other LOTT assets unrelated to that particular system or to property owned by others. An example would be a loss of influent screens at the headworks; the cost of the screening material accumulating in other tanks increases operational costs and can damage downstream equipment, and needs to be considered in the assessment of costs of the consequence of failure.

Safety – For some assets, their failure may represent a safety hazard, resulting in injuries, or even death. These would have a high consequence of failure score.

Redundancy – When assessing the criticality of an asset, the level of redundancy is also considered. For highly critical assets, such as influent pumps, a level of redundancy has been established. If one pump fails, an emergency (redundant) pump can be activated while the other pump is repaired. Assets without the same level of redundancy would have a higher criticality (consequence of failure). The availability of spare parts and the time it would take to make the repairs must also be considered.

Organizational Image – The public's perception of a utility is critically important. Certain types of failures may negatively affect the public's confidence in the wastewater or reclaimed water system, resulting in a cost to the system. An example would be the failure of an odor scrubber, resulting in odor complaints. Though the failure results in no physical damage, there is still a cost that must be accounted for.

These considerations were used to develop the rating of Asset Criticality Assessment Criteria. Each of these scores was then assigned a dollar amount, which was then used to quantify the potential consequence of failure in terms of dollars, enabling economic analysis for risk management.

Quantifying Risk

Risk can be thought of as the product of the likelihood of an asset failing and the consequence of that failure. Mathematically it is expressed as:

$$\text{Risk} = [\text{Likelihood}] \times [\text{Consequence}]$$

As an example, an exhaust fan may have a high probability of failing due to its age, however the consequence of that failure may be minimal because it can be replaced quickly and is not critical to the treatment process. On the other hand, a generator at an off-site facility, such as the Martin Way Reclaimed Water Plant, is critical to the system's operation during power failures and poses a high consequence of failure. By lowering its likelihood of failure, the overall risk can be reduced.

Criticality Assessment Criteria

Criteria	Description
Spill or Flood	If a spill or flood occurred, what would be the severity?
Odor	Are there potential odor concerns?
Environmental Permit	Is there potential for a permit violation?
Economics	How much would unexpected repairs cost?
Loss of Service	Is there potential for not meeting expected Levels of Service?
Level of Redundancy	What is the level of redundancy?
Hierarchy Tier	What level in the hierarchy would be affected?
Safety	What are the safety concerns associated with a failure?
Public Image	What is the potential impact to LOTT's public image?

Risk Matrix

Negligible << Consequence >> Severe

10	20	30	40	50	60	70	80	90	100
9	18	27	36	45	54	63	72	81	90
8	16	24	32	40	48	56	64	72	80
7	14	21	28	35	42	49	56	63	70
6	12	18	24	30	36	42	48	54	60
5	10	15	20	25	30	35	40	45	50
4	8	12	16	20	24	28	32	36	40
3	6	9	12	15	18	21	24	27	30
2	4	6	8	10	12	14	16	18	20
1	2	3	4	5	6	7	8	9	10

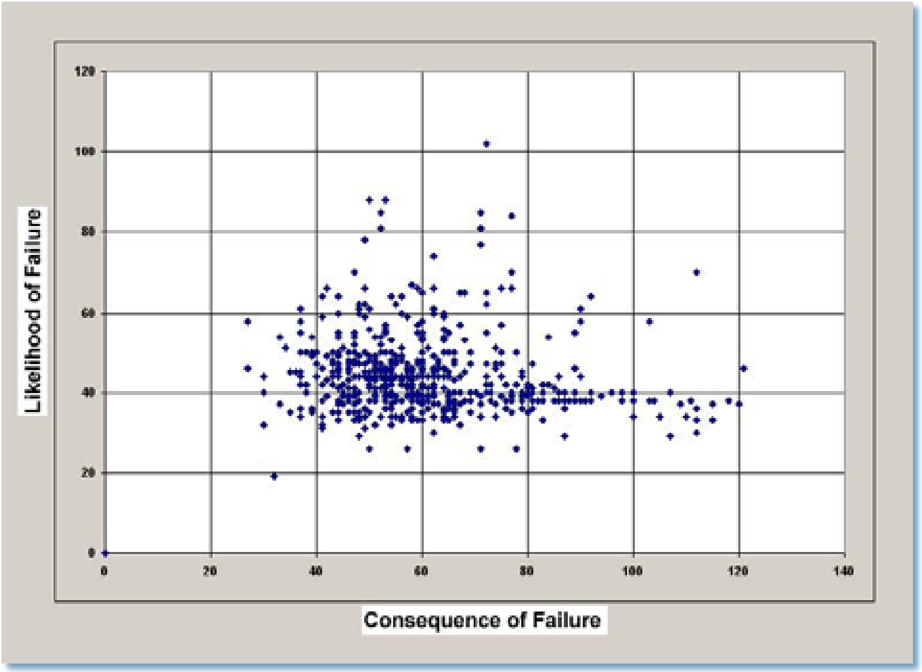
Not Likely << Likelihood >> Imminent

Managing Risk

Not every asset poses the same risk or is equally critical to the system's operations. At the heart of the Asset Management Program is LOTT's ability to identify, quantify, and mitigate risk. The primary objective of identifying critical assets is to enable LOTT to prioritize its resources to reduce the overall risk that each asset carries. Operational and maintenance strategies can be developed, and capital rehabilitation and replacement projects can be identified and prioritized based on the amount of risk reduced and the associated cost.

Based on the standardized likelihood and consequence of failure rating system, a risk score was developed for each of LOTT's 1,852 identified assets. Each dot represents an asset; assets towards the upper right have a high probability and consequence of failure, while assets toward the lower left have a low probability and consequence of failure. The initial evaluation of LOTT risk exposure demonstrates that LOTT is in a good position. Using this information, the high-risk assets have been identified and mitigation strategies are being developed to minimize their risk.

Asset Risk Profile



The condition of assets will change over time as well as their consequence of failure. Costs of repair may go up, the community demographics may change, or other factors may occur that cause the consequence of failure to change. Therefore, assets will be regularly reviewed, and both the condition and criticality assessments will be updated accordingly to account for these changes.

Chapter 5:
Life-Cycle Management and Costing

Chapter 5:
Life-Cycle Management and Costing

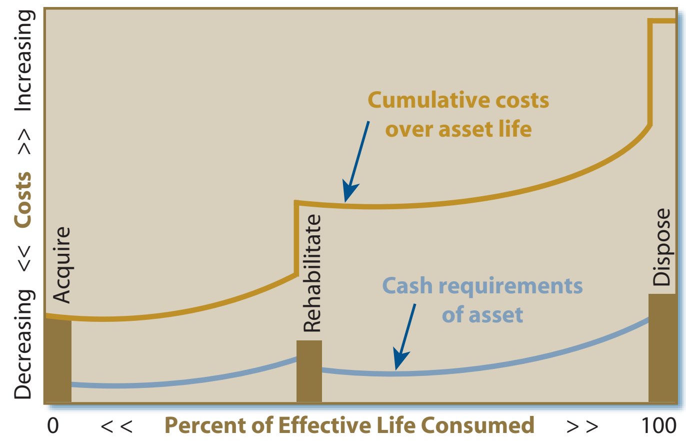
Introduction

Asset life-cycle management and costing is one of the most critical and complex components of the Asset Management Program. In basic terms, it is the process of determining the total cost of ownership for any alternative solution to a perceived problem. It includes the evaluation and quantification, in dollars, of all the activities required in owning a piece of equipment, system, or technology, from cradle to grave. In order to select the best alternative – the lowest total life-cycle cost alternative that meets the Levels of Service – a utility must evaluate all the activities required to plan for, acquire, operate, maintain, rehabilitate, and ultimately dispose of and replace its assets.

Initial capital costs can be substantial and, historically, have often dominated the decision-making process when acquiring new assets. However, the ongoing costs to operate and maintain an asset can represent a high proportion of the total life-cycle cost of many assets. These costs must be included in the financial analysis when evaluating asset investment options. Life-cycle costing is the process of evaluating all these steps and estimating the cost of each. The costs to be evaluated when selecting a strategy of owning an asset include the following:

- Planning, acquisition, and financing costs
- Operation and maintenance costs
- Risk exposure (the risk of not meeting Levels of Service)
- Rehabilitation costs
- Disposal and replacement costs

Life-Cycle Cost Profile

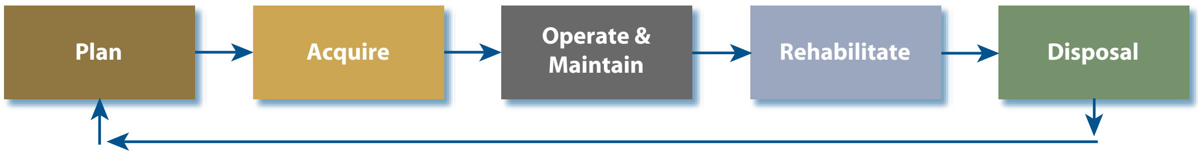


Business Case Evaluations

The primary tool for life-cycle planning is the Business Case Evaluation (BCE). The BCE is a process to evaluate a perceived need and determine how best to address this need considering financial, environmental, and social impacts (also known as the triple bottom line). Its a repeatable and defendable process whose ultimate purpose is to support a business judgment decision on a proposed project. All new substantial asset investments undergo a BCE.

The unique benefits of the BCE are that: 1) it forces the project proponent to clearly define the perceived need; and 2) it establishes a standard unit of measure (current year dollars) with which to evaluate each proposed alternative solution. The process determines the total life-cycle cost of each alternative to include upfront, ongoing, benefit and risk costs. The preferred alternative will be the lowest total cost of ownership alternative that meets the expected Levels of Service.

Asset Life-Cycle



Life-cycle management planning allows LOTT to consider all relevant economic and physical consequences, from initial planning through disposal, when selecting an alternative for managing an asset.

The BCE tool also provides the means to document the decision rationale, justify operational and capital expenditures, and communicate this to stakeholders. The Business Case Evaluation Steps were taken from The Business Case Evaluation: A Hands-On Manual, completed for LOTT by Brown and Caldwell in March 2008, and outlines the seven-step BCE process including the available tools for each.

Business Case Evaluation Steps			
Step	**Action**	**Guidelines**	**Tools to be Utilized**
1	Establish expert team	• Team members to be determined by Asset Management Team in conjunction with BCE Manager • Expert team should include at least one representative from the following areas: management, finance, engineering, operations, and maintenance	BCE charter
2	Define the problem	• Document the problem and the primary drivers, in writing • Define the Levels of Service that the solution to the problem must meet	Project prospectus
3	Collect data on the current situation	• Internal/external activities that could impact the problem (new CIP, permits, etc.) • History of failure/refurbishments • Consequences of failure • Annual maintenance costs (labor, materials) • Annual operations costs (labor, power, chemicals) • Design data • Number of units • Run time • Function in overall plant • Safety issues • Prior analysis • Other (any data that could be used to document social, environmental, or risk costs around the problem/asset in question)	Previous BCEs, standards, etc. Library materials and the Internet In-house experts Outside subject matter experts Computerized Maintenance Management System (Mainsaver) Supervisory Control and Data Acquisition Geographical Information System
4	Prepare alternatives	• Document the "do nothing" scenario first • Brainstorm new alternatives • Identify new data needs for new alternatives; include replacement costs • Convert consequences of failure in each alternative to dollars	Previous BCEs, standards, etc. Cost data table
5	Screen alternatives	• Screen alternatives based on Levels of Service, cost, and risk • Screen alternatives for fatal flaws (i.e. doesn't meet Levels of Service, unacceptable risk)	
6	Develop costs and analyze alternatives	• Define capital, operational, maintenance, and refurbishment costs for all scenarios that pass the initial screening • Develop environmental, social, and risk costs for each alternative (if possible) • Calculate Net Present Value for remaining alternatives using BCE spreadsheet • The alternative that maintains the established Levels of Service at the lowest Net Present Value is the preferred alternative	BCE spreadsheet
7	Recommend and report	• Summarize the process and make a recommendation	BCE report template

Asset Operation and Maintenance Optimization

Life-cycle management also includes the operation and maintenance (O & M) of owned assets. O & M functions relate to the day-to-day running and upkeep of assets, and are particularly relevant to short-lived dynamic assets (such as pumps) where deterioration through lack of regular maintenance may result in rapid failure. The use of proper O & M activities can substantially decrease the total cost of ownership of LOTT's assets by extending their cost-effective useful life, minimizing the likelihood of unexpected failures (reducing risk exposure), and maximizing the efficiency of operations and maintenance activities.

Operational Strategies

Standardizing operating procedures helps utility personnel to operate all assets within acceptable operational levels based on the manufacturers' recommendations and ensures that each staff member is following the same routines. Utilizing the Computerized Maintenance Management System (Mainsaver), asset performance, failures, and modes of operation can be tracked and analyzed to extend asset life and minimize unexpected failures.

Standard Operating Procedures (SOPs) are typically used during normal operations on a day-to-day basis. Alternate Operating Procedures are for situations where operations conditions change such as when an asset or process is to be modified or taken off-line. Emergency Operating Procedures are to be used in emergency conditions, and are normally incorporated into an overall emergency plan developed for a particular facility.

Developing and implementing effective and useful O & M procedures provides benefits that far outweigh the cost and time required to develop them. If SOPs are not implemented systemwide, inconsistent O & M activities may lead to fluctuations in process efficiencies, discord between operations and maintenance staff, increased asset downtime, premature failure, wasting of chemicals and energy, and other similar problems. SOPs also become effective training tools for new staff, and assures long-term operational consistency.

LOTT has developed SOPs for most of its day-to-day operations, though there are some that still need to be developed. LOTT has hired a consultant to facilitate completion of the remaining SOPs. In addition, for all new assets, systems, and facilities, LOTT has included standard language in its construction contracts requiring consultants and contractors to develop the needed SOPs and provide training to staff upon final project delivery.

Maintenance Strategies

Various strategies are used to maintain LOTT's assets. The selected strategy for each asset depends on its risk exposure and often includes a combination of the following:

Corrective Maintenance – Corrective maintenance is performed by staff when assets break down or are malfunctioning and need to be repaired or replaced. This strategy may include the "run to failure" mode of maintenance for low risk, inexpensive, or non-critical assets. As an example, an exhaust fan can be replaced quickly and preventive maintenance may not be cost-effective.

Preventive Maintenance – Preventive maintenance is time-based maintenance of equipment. Certain activities are performed on a reoccurring basis depending on elapsed time or the amount of work an asset has done, much like a car – when a certain number of miles are driven, the oil is replaced. Most assets come with manufacturer recommended preventive maintenance schedules.

Predictive Maintenance / Condition-Based Maintenance – This type of maintenance attempts to evaluate the condition of equipment by performing periodic or continuous (on-line) equipment condition monitoring. The ultimate goal of predictive maintenance is to perform maintenance at a scheduled point in time when the maintenance activity is most cost-effective and before the equipment loses optimum performance. This is in contrast to time-based and/or operation count-based maintenance, where a piece of equipment is maintained whether it needs it or not. Time-based maintenance can be labor intensive and does not identify problems that develop between scheduled inspections.

Reliability-Centered Maintenance – This engineering framework enables the development of a complete maintenance regime by identifying and establishing the operational, maintenance, and capital improvement policies that will manage the risks of asset failure most effectively. It regards maintenance as the means to maintain the functions required of an asset in a defined operating context and allows the utility to monitor, assess, predict, and generally understand the workings of its physical assets. This strategy is more intensive and costly in terms of labor, and is normally used for complex and highly critical assets. The reliability-centered maintenance process includes a Failure Mode and Effects Analysis, which involves answering the following questions:

What is the function of the asset?

In what ways can it fail to provide the required functions?

What are the events that can cause it to fail?

What is the consequence of failure?

Why does it matter?

What activities can be performed proactively to prevent, or reduce to a satisfactory level, the consequence of failure?

What must be done if a suitable preventive task cannot be found?

Once the critical assets have been identified and a Failure Mode and Effects Analysis has been completed for each, the most cost-effective maintenance strategy can be developed based on risk and Levels of Service.

Repair of Assets

Utilizing the life-cycle management framework and the Asset Condition Assessment System, different repair strategies can be identified, evaluated, and selected for each asset based on their overall risk score. Some assets with a low-risk score can be run to failure and then be replaced without the risk of not meeting the expected Levels of Service, whereas high-risk assets may be replaced before they ever fail. Utilizing risk data, combined with historical operations and maintenance data, helps to identify the most cost-effective strategy.

There is a balance between how much is spent in each category – maintenance, repair, and replacement – in order to achieve the most efficient system. For example, by spending more resources (personnel and money) on repair activities, there will be a decreased need for replacement. On the other hand, if greater resources are applied to replacing the assets, fewer resources will be needed for repair.

Consider the example of the car. If a new vehicle is purchased every year, there will be little to no repair costs, but there will be extremely high annual capital costs. However, if the car is kept for a long time and repairs are made on everything that breaks on the car in order to keep it running, capital cost will be very low, but repair costs will be very high. As the car gets older, the amount and cost of repairs will continue to increase. Neither of these extremes would be the most cost-effective approach to owning and operating a car. In the first case, the replacement cost is too high and in the second case, the repair costs are too high. The most efficient approach would lie in between these extremes, with repair taking place until costs are prohibitive, at which point the car would be replaced.

In developing LOTT's system repair schedule, the Asset Condition Assessment System is used to decide the proper balance, with the goal of minimizing risk and the total cost of ownership, while still meeting the expected Levels of Service. As these activities take place and more data is collected, LOTT will continue to become more efficient in identifying the optimum level of each.

Rehabilitation and Replacement of Assets

When assets reach the point where repairs are no longer cost-effective, there are two options. The asset can be replaced with a new asset or it can be rehabilitated to a useable condition without actual replacement. In many cases, it is less expensive to rehabilitate an asset, rather than replace it. Rehabilitation can extend the lifespan of an asset considerably, and may reduce other impacts related to its replacement. An example of a rehabilitation approach is sliplining a wastewater pipeline that is nearing the end of its useful life. The pipe can be lined without having to dig the original pipe out of the ground, thereby reducing the costs of installation and the resulting inconvenience to the community.

The Business Case Evaluation (BCE) tool is used to evaluate the options of rehabilitation or replacement based on total cost of ownership. The benefit of the BCE is that it looks at the total life-cycle cost and includes an evaluation of the system that the asset is a part of. Often it is more cost-effective to replace a group of assets (system) at the same time, even though not all of the assets are at the same level of deterioration. As an example, when replacing a failed bearing in a centrifuge, there is a high cost in labor to disassemble it. Even though the other bearing is still working, it may be more cost-effective to replace both bearings at the same time rather than reassembling the centrifuge and waiting for the other bearing to fail. The cost of the bearing is far less then the cost of the labor to replace it. Additionally, by using the BCE process, a new technology such as a screw press can be evaluated and potentially be determined to be a more cost-effective alternative. Though the upfront capital cost may be more expensive, by evaluating the total costs of ownership, the best alternative can be selected.

Scheduling, Prioritizing, and Funding Projects

Small recurring asset repair, rehabilitation, and replacement projects are completed through normal maintenance and operations activities and are funded through the annual maintenance budget. For larger projects, the Asset Condition Assessment System provides the basis for scheduling and planning rehabilitation and replacement projects. By constantly monitoring the condition and performance of LOTT's assets and updating their rating in the system, a prioritized list is developed based on overall risk. As priority projects are identified, a BCE is conducted to determine the best alternative (i.e. rehabilitation or replacement).

Depending on the cost, complexity, and relation to other assets and/or systems, these projects can be included as part of the LOTT equipment replacement schedule.

Chapter 6:
Long-Term Funding Strategy

Chapter 6:
Long-Term Funding Strategy

Introduction

Ensuring LOTT's long-term financial sustainability is paramount in meeting the Levels of Service. Revenues collected include monthly rates and new connection fees. These funds are required to operate the system, perform repairs, replace and upgrade system assets, and construct new facilities to meet increasing capacity demands. To ensure these charges are set appropriately, LOTT must have a good understanding of what its operating and capital requirements will be well into the future.

To ensure success in meeting the communities' values and expectations, LOTT has developed a variety of planning tools, one of which is the "intelligent" Capital Improvements Plan. Like many utilities, LOTT spends nearly two-thirds of its annual budget on capital projects and needed to find better methods to optimize capital expenditures. The intelligent Capital Improvements Plan is driven by a detailed and quantifiable planning model, which utilizes continuous planning to manage the utility's investments in the most cost-effective manner. The cornerstone of this model is the Asset Management Program.

Defining Total Cost of Service

Because LOTT derives almost all of its revenue from rates and fees, LOTT's financial planning utilizes a Cost of Service Model. The model involves estimating inclusive costs expected over a specified planning horizon for operations, asset upgrades and replacement, and new capacity facilities. The development of service rates and connection fees to meet operating and capital needs is entirely based on these projected costs.

The Asset Management framework enables sound management of operations costs through the BCE process of life-cycle costing. Through this process, the total cost of ownership can be determined to include not only the upfront capital costs, but also the ongoing operations costs. Past planning often placed too much emphasis on the lowest capital cost or short-term objectives, resulting in higher long-term operations costs.

On the capital side, comprehensive Asset Management benefits both the analysis of facility replacement and planning for new capacity investments. LOTT, like many utilities, is facing tremendous growth, which requires maximizing the lifespan of existing facilities, while at the same time ensuring optimized investment in new capacity.

Today's environment of increasing cost of service demands even more vigilance in managing ratepayer investment. Ensuring that policy makers are driving service levels, and receiving accurate and timely decision-making information, is more challenging than ever before. The LOTT Board of Directors has clearly identified Asset Management as the guiding force in the development of a facility investment strategy and hence the cost of service. Taking an investment strategy approach ensures the maximum value from dollars spent.

Developing Long-Term Capital Costs

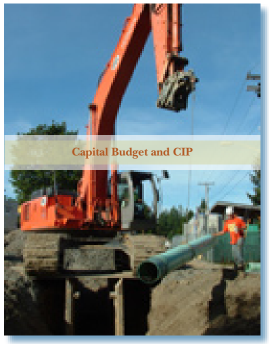
The integration of Asset Management into the development of the Capital Improvements Plan (CIP) is an on-going process and is critical in ensuring that LOTT systems are able to meet the defined Levels of Service. CIP projects are broken down into three primary categories: 1) system upgrades; 2) new capacity; and 3) equipment replacement projects. System upgrade projects include major improvements, modifications, or rehabilitation of existing facilities. Upgrades may be necessary to improve efficiency or meet higher water quality standards for treatment, discharge, or reuse.

A key to optimizing ratepayer investment in these facilities is Asset Management, and the use of the Business Case Evaluation. As a Measure of Success in LOTT's Strategic Business Plan, staff has committed to performing BCEs for all major projects on the annual CIP. LOTT's current planning horizon is 2009 - 2025, but will be replaced with a horizon reaching 2053, the currently anticipated "build-out" of the urban growth area.

Critical to long range planning is a reasonable and "predictable" asset replacement strategy. Sustaining LOTT's infrastructure over the long term depends on the proper funding plan, based on a defensible investment plan. Past strategies have typically employed standard "depreciation" models, but Asset Management replaces that method with a much more defined strategy based on understanding the system. Asset Management develops replacement cost estimates incorporating the following techniques:

- Escalating the original acquisition cost using standard price indexes (i.e. Engineering News Record)
- Analyzing replacement cost of similar projects completed recently
- Developing replacement cost estimates based on professional experience of LOTT staff and/or consultants
- Using asset hierarchies to estimate the replacement of systems (collections of assets), rather than estimating the replacement cost of each asset individually

Although the idea behind an asset value is relatively simple, obtaining costs for the asset replacement is not as easy. A replacement cost has been developed for all LOTT assets and the method used was selected based on level of accuracy needed. As assets approach the end of their useful lives and plans are made for their replacement, more accurate replacement cost estimates will be developed. Overall, this approach will reshape LOTT's CIP and ensure that planned replacement of all assets is included over time.



Additionally, performing BCEs on all major new CIP projects, ensures that the most cost-effective strategy is being selected. The BCE is a process to evaluate a perceived need and determine how best to address this need considering financial, environmental, and social impacts (also known as the triple bottom line). Its a repeatable and defendable process whose ultimate purpose is to support a business judgment decision on a proposed project. The unique benefits of the BCE are that: 1) it forces the project proponent to clearly define the perceived need; and 2) it establishes a standard unit of measure (current year dollars) with which to evaluate each proposed alternative solution. The process determines the total life-cycle cost of each alternative to include upfront, ongoing, benefit and risk costs. The preferred alternative will be the lowest total cost of ownership alternative that meets the expected Levels of Service.

The use of Asset Management, including BCEs, provides the tools and data necessary to complete these evaluations. The result is an understanding of the total cost of ownership. Once a new system or facility is installed or constructed, there will be continual costs to maintain and operate it.

Translating Costs into Rates and Connection Fees

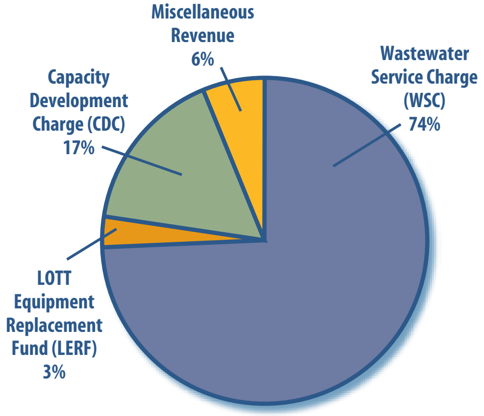
Rates and fees are set using sound Asset Management principles to help eliminate unexpected or unplanned increases. This detailed and logical approach is also very defensible to the public and brings transparency to the process, making it clear what the rates are based on. The more clearly the rates can be defended, the more likely they are to be accepted by elected officials, the LOTT partner jurisdictions, ratepayers, and the public.

As noted previously, LOTT's funding comes from two primary sources – monthly service rates and new connection fees. Revenues from these sources are dedicated to specific kinds of uses.

Wastewater Service Charge – LOTT's monthly rate, also known as the Wastewater Service Charge (WSC), is used to pay all operations costs, most of the cost for repairs or upgrades to the existing system, and loan payments for system-related repair and replacement capital costs. As part of LOTT's monthly rate structure, a specified portion of the monthly Wastewater Service Charge is set aside in the LOTT Equipment Replacement Fund (LERF). It is dedicated to the repair and replacement of existing equipment and small facilities that are reaching the end of their useful lives, assuring that such repairs will be adequately funded.

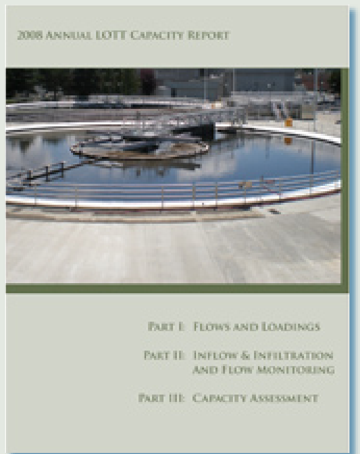
Capacity Development Charge – The one-time connection fee, called the Capacity Development Charge (CDC), is collected for new structures to be added to the sewer system. It is used to build projects that add new capacity, such as satellite reclaimed water plants, larger sewer or reclaimed water pipelines, and other projects that increase LOTT's ability to serve new customers.

Revenue by Source Estimated for 2009



Determining Future Demand

The Asset Management approach requires the highest level of planning to ensure appropriate investment of ratepayer dollars in existing facilities as well as longer-term modeling to ensure new capacity is on-line when it is needed. LOTT must maintain adequate capacity in the system to meet current and future needs. To identify these future demands, LOTT has established a systematic planning program, which includes modeling to monitor and evaluate capacity in the entire LOTT system. Capacity needs that are evaluated include wastewater treatment, Budd Inlet discharge, reclaimed water use/recharge, and conveyance capacity in the LOTT system. Findings and analyses are compiled in three annual report documents. These three reports are used to identify capital projects for BCE evaluation and inclusion in the annual Capital Improvements Plan:



Flows and Loadings Report – Analyzes residential and employment population projections within the Urban Growth Boundary and estimates the impact on wastewater flows and loadings within the LOTT wastewater system.

Inflow and Infiltration Report – Uses dry and wet weather sewer flow monitoring results to quantify the amount of unwanted surface (inflow) and subsurface (infiltration) water entering the sewer system and to prioritize sewer line rehabilitation projects.

Capacity Assessment Report – Uses flows and loadings data and inflow and infiltration evaluation results to analyze system components (i.e. conveyance, treatment, and discharge) to determine when limitations will occur and provide a timeline for new system components and upgrades.

Meeting Public and Organizational Values

During the development of LOTT's long-range planning process in 1996, one of the ten key public values that was identified stated:

> ***Take all possible steps to control facilities costs. Carefully consider the lowest cost and most cost-effective alternatives, and evaluate the impact on LOTT ratepayers.***

That value has become even more meaningful and achievable with the implementation of LOTT's Asset Management Program. During development of the Strategic Business Plan in 2007, the LOTT Board of Directors further recognized that public value by affirming the following organizational core value:

> ***LOTT values managing financial resources in a responsible, sound, and equitable manner.***

In addition, the LOTT Board of Directors identified a primary Level of Service as:

> ***Embrace Asset Management and use of the triple bottom line as the operational standard for all system investments.***

By implementing an Asset Management Program, LOTT is assuring it can fulfill the intent of these important public and organizational values. In LOTT's organization, Asset Management is not just a program; it has become a business philosophy. Asset Management provides the framework to estimate the repair and replacement costs required to maintain the existing infrastructure, develop total life-cycle costs of expected capacity development projects, and support the development of annual operating budgets.

Chapter 7:
Asset Management Implementation

Chapter 7:
Asset Management Implementation

Introduction

Completion of this Executive Summary is one of the key steps in implementing LOTT's full Asset Management Program. It builds upon the Strategic Business Plan, and precedes development of a much more extensive Asset Management Operations Manual. Asset Management has become a core business principle that underlies everything LOTT does. It is a continuous responsibility and a way of doing business; it relies on policy guidance from the Board of Directors and directly involves staff in every one of LOTT's organizational divisions.

The successful implementation of the Asset Management Program does not rest solely on the Director, Capital Planning Manager, Maintenance Supervisor, or the Asset Management Team, but on every Board member and LOTT employee. Ensuring that all Board and staff members are aware of the program, the benefits it provides, the Levels of Service it maintains, and the actions needed to support this effort will be a key focus in the continuous improvement of the program.

Planned Activities

The Asset Management Program is designed to be adaptable. Because system needs change over time, LOTT's Levels of Service defined in the Strategic Business Plan will be reevaluated periodically to ensure that they address the needs of LOTT's customer groups. The Strategic Business Plan, effective 2008 - 2012, is scheduled for review and revision on a six-year cycle.

Consistent with modified Levels of Service over time, LOTT's Asset Management processes and procedures will also be continuously improved and updated. This will be accomplished following the "Plan, Do, Check, Act" steps. Summaries of overall program progress will be incorporated into LOTT's annual State of the Utility Report, beginning with the 2009 edition.

Continuous Improvement Model

Plan	Establish the objectives and processes necessary to deliver the results in accordance with the expected output.
Do	Implement the new processes.
Check	Measure the new processes and compare the results against the expected results to ascertain any differences.
Act	Analyze the differences to determine their cause. Each will be part of either one or more of the Plan, Do, Check, Act steps. Determine where to apply changes that will insure improvement.

In other implementation steps, the Asset Management Program will focus on formalizing policies and procedures to best manage the Asset Management Program. These will be documented in an Asset Management Operations Manual, an internal document that will include all the operational business rules, data collection requirements, life-cycle analysis methods, maintenance optimization strategies, equipment evaluation and selection methods, and other standard operational procedures specific to the operation of the program. It will be a living document, continually reviewed, updated, and added to as necessary to ensure that all elements of the program are identified and documented.

Other activities will include further integration of information management systems, continual optimization of maintenance strategies by leveraging data included in the Mainsaver system, and providing training to staff on system tools used to support the Asset Management Program.

Updating the Executive Summary Over Time

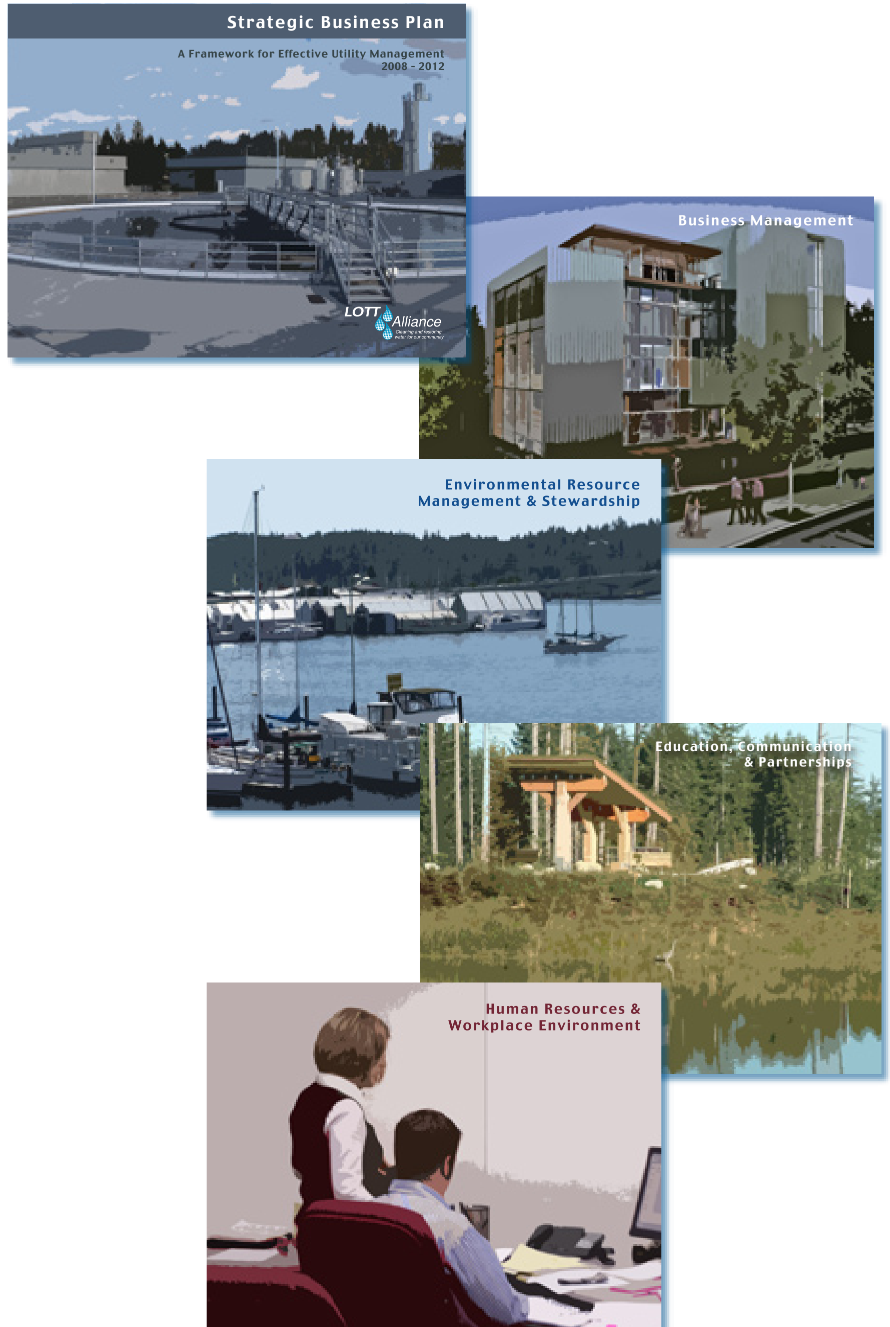
The information included in this Asset Management Program Executive Summary will be reviewed annually to determine if the overall methodology used for each component has changed. If changes warrant, the document will be revised and redistributed. If not, the document will be left in its current state until the next review. At a minimum, the plan will be updated and redistributed once every six years, in coordination with the updating of the Strategic Business Plan.

Appendix A: Levels of Service Matrices

Appendix A:
Levels of Service Matrices

The following two-page matrix provides the framework for LOTT's Strategic Business Plan. For each of the four major performance areas, it outlines LOTT's core values, customers, Levels of Service, and Measures of Success to be used to determine whether or not the Levels of Service are being achieved.

LOTT monitors and updates these Levels of Service and Measures of Success on a semi-annual basis. The second matrix in this section, the four-page Mid-Year Report for 2008, provides an example of progress and adjustments. The Year-End Report for each year will be included in LOTT's annual State of the Utility Report beginning with the 2009 edition.



LOTT Strategic Business Plan 2008 - 2012

Core Values	Customers	Levels of Service	Measure: Targets or Metrics
Business Management			
LOTT values managing financial resources in a responsible, sound, and equitable manner	Partner Jurisdictions Ratepayers Communities	Manage the utility within financial benchmarks	Revenue: 100% or greater of projected revenue Expenditures: Annually less than or equal to 85% of revenue Cash Balance: Positive annually Costs: Track budgeted versus actual total project costs Rate History: Track rates versus inflation
		Operate within accepted business and financial standards	State Audit: Free of findings Peer Review: Comprehensive peer reviews completed within every 6-year planning period Internal Audits: Conducted annually Independent Financial Operations Review: Conducted every 2 years Liability Risk Audit: Conducted annually
		Embrace asset management and use of the triple bottom line as the operational standard for all system investments	Validated Capital Improvements Plan: Business Case Evaluations for 100% of projects in the 6-year schedule
		Ensure equitable distribution of costs between ratepayers and new development	Cost Distribution: Meet Capacity Development Charge and Wastewater Service Charge allocation guidelines for all projects
		Preserve the design capacity at the Budd Inlet Treatment Plant	Budd Inlet Treatment Plant Treatment Capacity: Maintain at 18 mgd DWF / 28 mgd WWF Discharge Capacity to Budd Inlet: 14.5 mgd DWF / 28 mgd WWF
		Build capital facilities "just in time"	Reserve Capacity: Maintain at an annual average of 1.5 mgd
Environmental Resource Management and Stewardship			
LOTT values responsible environmental resource management and stewardship	Partner Jurisdictions Tribes Communities Regulators	Complete capital projects with minimal environmental impacts	Environmental Reviews: Proactively complete environmental reviews as required and/or deemed optimal for success Investment in Enhancement: Track capital project expenditures dedicated to enhancement and/or mitigation
		Protect water resources through high quality wastewater treatment	Compliance: 100% compliance with numerical permit requirements
		Produce and reuse renewable resources including Class A Reclaimed Water, Class B Biosolids, and methane	Production of Class A Reclaimed Water: Trend production per facility (mgd) Percentage of Class A Reclaimed Water: Trend percent of flow used to produce Class A Reclaimed Water Use of Class A Reclaimed Water: Trend reuse versus recharge/discharge
			Class B Biosolids: 100% of LOTT's biosolids beneficially used Methane: Track percentage methane captured and reused
		Maximize use of existing treatment capacity through cost-effective water conservation, inflow & infiltration reduction, and flow diversion projects	Water Conservation: 500,000 gpd additional flow reduction by 2012 Inflow & Infiltration (I&I): Trend annual I&I removal over time
		Minimize odor complaints from LOTT activities	Odor Compliance: 100% compliance with ORCAA numerical requirements Odor Complaints: 5 or fewer per year
		Support joint water quality and habitat improvement projects	Investment: Track investments in water quality and habitat improvement and preservation projects
		Collaborate with partner jurisdictions and other entities to ensure emergency preparedness	Emergency Operations Plan (EOP): Update EOP annually Joint Preparedness: Track participation in Joint Emergency Preparedness activities

LOTT Strategic Business Plan 2008 - 2012

Core Values	Customers	Levels of Service	Measure: Targets or Metrics
Education, Communication, and Partnerships			
LOTT values community participation and support through open communication and outreach	Partner Jurisdictions Tribes Communities Employees	Provide open and transparent access to information	Reporting: 100% reports up-to-date Access to Information: Track website visits over time Internal Communications: 100% scheduled internal communications completed
		Respond quickly and openly to all public inquiries	Number of Inquiries: Track number of public inquiries Response Time for Inquiries: 100% compliance with response time guidelines
		Pursue recognition of excellence	Peer-Reviewed Recognition: Track awards applied for and received Peer-Reviewed Presentations: At least one LOTT representative to present at peer-reviewed forum annually
		Collaborate with partner jurisdictions and other entities to participate in community programs/events that foster public awareness and support for LOTT activities	State-Wide Policy Development: Staff hours dedicated to advancement of reclaimed water and other policies Joint Events: At least two collaborative events/programs annually
LOTT is committed to a "Good Neighbor Policy" in planning, development, construction, and operation of all of its facilities		Involve the public in planning and design processes	Regulatory Compliance: Complete required public involvement for all SEPA regulated projects Public Involvement: Complete workshops, meetings, and interviews for additional projects as deemed appropriate Informed Public Consent: Achieve little or no opposition to proposed programs or facilities during final project stages
LOTT values community education regarding waste-water treatment, renewing water resources, and water conservation as essential to the success of LOTT's mission		Develop educational materials and programs that foster public awareness and support for LOTT activities	Community Presentations: At least 4 annually Plant/Facility Tours: At least 10 tours annually Tour Participants: At least 300 participants annually Education Center: Initially, at least 2500 visitors annually Written Materials: Fact sheets for each major project and facility; provide for tours, events, and on request
Human Resources and Workplace Environment			
LOTT values its workforce as essential to the success of its mission	Employees Communities Contractors	Provide employee development and support programs that result in an adaptive, efficient, satisfied, skilled workforce	Vacancy Rate: Monthly average less than or equal to 10%
			Succession Planning: 100% of critical functions have a succession plan by 2009
			Apprenticeships: 75% of apprentices become journey-level workers and fulfill service commitments
			Career Development Program: Track and trend number of employees participating in CDP
			Training: Track and trend average hours of training per employee per year
			Employee Turnover: Report, trend, and analyze information Movement Within the Organization: Track and report reassignments and reclassifications
			Retirement Eligibility: Track number of employees eligible to retire in 2, 5, and 10-year horizons
			Amount of Employee Experience: Track employee tenure
LOTT values protection of health and safety for employees and the public		Build and maintain a culture of safety	Reportable Safety Incidents: Track monthly rate
			Time Loss: Track and report worker hours lost due to injury
			Labor and Industries Experience Rating: Track against industry base rating
			Contractor Safety: 100% compliance with health and safety standards
			Safety Incentive Program: 100% staff participation

LOTT Strategic Business Plan Mid-Year Report 2008

Levels of Service	Measure: Targets or Metrics	Mid-Year Performance January to June	Measure Achieved
Business Management			
Manage the utility within financial benchmarks	Service Revenue: 100% or greater of projected revenue	WSC = 101%	Yes
	New Connections Revenue: Annually review projected revenue versus long-term Capital Improvements Plan needs	Results available end of year	On Track
	Expenditures: Annually less than or equal to 85% of revenue	Results available end of year	On Track
	Cash Balance: Positive annually	June 30 = $51,038,930 (includes reserves)	Yes
	Costs: Track budgeted versus actual total project costs	Secondary Clarifiers Total: $5,404,300 (budgeted) / $5,889,765 (actual) 2008: $0 (budgeted) / $172,360 (actual)	Monitoring
	Rate History: Track rates versus inflation	WSC = 5.9%, CPI = 4.5% (Jan-June 08) CDC = 6.2%, PPIs = 9.2% & 13.6%	Monitoring
Operate within accepted business and financial standards	State Audit: Free of findings	Completed May 2008 with no findings	Yes
	Peer Review: Comprehensive peer reviews completed within every 6-year planning period	Completed August 2002	Due Between 2008 - 2012
	Internal Audit: Conducted annually	Completed March 2008	Yes
	Independent Financial Operations Review: Conducted every 2 years	Currently underway	On Track
	Liability Risk Audit: Conducted annually	Completed May 2008 with no findings	Yes
Embrace asset management and use of the triple bottom line as the operational standard for all system investment	Validated Capital Improvements Plan: Business Case Evaluations for 100% of projects in the 6-year schedule	24 projects in the 6-year schedule 10 projects with completed BCEs Developing schedule for remaining projects	On Track
Ensure equitable distribution of costs between ratepayers and new development	Cost Distribution: Meet Capacity Development Charge and Wastewater Service Charge allocation guidelines for all projects	Results available end of year	On Track
Preserve the design capacity at the Budd Inlet Treatment Plant	Budd Inlet Treatment Plant Treatment Capacity: Maintain optimum capacity at 25 mgd during shoulder seasons	Maintaining capacity at or above 25 mgd Ongoing refinement of Master Plan	Yes
	Discharge Capacity to Budd Inlet: 14.5 mgd DWF / 28 mgd WWF	Maintaining capacity at or above 14.5 mgd DWF and 28 mgd WWF	Yes
Build capital facilities “just in time”	Reserve Capacity: Maintain at an annual average of 1.5 mgd	Capacity Assessment Report available in October	On Track

LOTT Strategic Business Plan Mid-Year Report 2008			
Levels of Service	**Measure: Targets or Metrics**	**Mid-Year Performance January to June**	**Measure Achieved**
Environmental Resource Management and Stewardship			
Complete capital projects with minimal environmental impacts	Environmental Reviews: Proactively complete environmental reviews as required and/or deemed optimal for success	Kaiser Road Forcemain Admin/Education Center & Lab	Yes
	Investment in Enhancement: Track capital project expenditures dedicated to enhancement and/or mitigation	Mitigation Wetland at Hawks Prairie Pond Site = $23,147	Monitoring
Protect water resources through high quality wastewater treatment	Compliance: 100% compliance with numerical permit requirements	100%	Yes
Produce and reuse renewable resources including Class A Reclaimed Water, Class B Biosolids, and methane	Production of Class A Reclaimed Water: Trend production per facility (mgd)	Budd Inlet Reclaimed Water Plant = 0.4 mgd Martin Way Reclaimed Water Plant = 0.54 mgd	Monitoring
	Percentage of Class A Reclaimed Water: Trend percent of flow used to produce Class A Reclaimed Water	9.9%	Monitoring
	Use of Class A Reclaimed Water: Trend reuse versus recharge / discharge	Reuse = 44.3% Recharge = 45.2%	Monitoring
	Class B Biosolids: 100% of LOTT's biosolids beneficially reused	100%	Yes
	Methane: Track percentage of methane captured and reused	41%	Monitoring
Maximize use of existing treatment capacity through cost-effective water conservation, inflow & infiltration reduction, and flow diversion projects	Water Conservation: 500,000 gpd additional flow reduction by 2012	2007 = 36,484 gpd 2008 = 15,198 gpd	Monitoring
	Inflow & infiltration (I&I): Trend annual I&I removal over time	I&I Report available in October	Monitoring
Minimize odor complaints from LOTT activities	Odor Compliance: 100% compliance with ORCAA numerical requirements	Results available in August	Monitoring
	Odor Complaints: 5 or fewer per year	1 complaint	Monitoring
Support joint water quality and habitat improvement projects	Investment: Track investments in water quality and habitat improvement and preservation projects	Ayer Creek Enhancement = $1,763 Budd Inlet Restoration = staff time	Monitoring
Collaborate with partner jurisdictions and other entities to ensure emergency preparedness	Emergency Operations Plan (EOP): Update EOP at least annually	On-going	Yes
	Joint Preparedness: Track participation in Joint Emergency Preparedness activities	10 joint planning meetings	Monitoring

LOTT Strategic Business Plan Mid-Year Report 2008			
Levels of Service	**Measure: Targets or Metrics**	**Mid-Year Performance January to June**	**Measure Achieved**
Education, Communication, and Partnerships			
Provide open and transparent access to information	Reporting: 100% reports up-to-date	5 of 9 completed	On Track
	Access to Information: Track website visits over time	4000 visits/month	Monitoring
	Internal Communications: 100% scheduled internal communications completed	100%	Yes
Respond quickly and openly to all public inquiries	Number of Inquiries: Track number of public inquiries	272 inquiries	Monitoring
	Response Time for Inquiries: 100% compliance with response time guidelines	Calls/Emails = within 1 day Public Records = within 4 days (4 requests) Other inquiries = 6.62 days	Yes
Pursue recognition of excellence	Peer-Reviewed Recognition: Track awards applied for and received	Applied for 7 Received 4	Monitoring
	Peer-Reviewed Presentations: At least one LOTT representative to present at peer-reviewed forum annually	2 papers accepted for WEF	Yes
Collaborate with partner jurisdictions and other entities to participate in community programs/ events that foster public awareness and support for LOTT activities	State-Wide Policy Development: Staff hours dedicated to advancement of reclaimed water and other policies	60 hours	Monitoring
	Joint Events: At least two collaborative events/programs annually	Earth Day Town Hall Tours, Budd Inlet Community Forum, and Sand in the City	Yes
Involve the public in planning and design processes	Regulatory Compliance: Complete required public involvement for all SEPA regulated projects	Kaiser Road Forcemain Admin/Education Center & Lab	Yes
	Public Involvement: Completed workshops, meetings, and interviews for additional projects as deemed appropriate	No non-SEPA activity	Yes
	Informed Public Consent: Achieve little or no opposition to proposed programs or facilities during final project stages	Kaiser Forcemain = no opposition Admin/Education Center = no opposition	Yes
Develop educational materials and programs that foster public awareness and support for LOTT activities	Community Presentations: At least 4 annually	16	Yes
	Plant/Facility Tours: At least 10 tours annually	Budd Inlet Treatment Plant = 20 Martin Way Reclaimed Water Plant = 15	Yes
	Tour Participants: At least 300 participants annually	Budd Inlet Treatment Plant = 424 Martin Way Reclaimed Water Plant = 137	Yes
	Education Center: Initially, at least 2500 visitors annually	N/A	N/A
	Written Materials: Reports, brochures, or fact sheets for each major project and facility; provide for tours, events, and on request	10 produced/updated	Yes

LOTT Strategic Business Plan Mid-Year Report 2008			
Levels of Service	**Measure: Targets or Metrics**	**Mid-Year Performance January to June**	**Measure Achieved**
Human Resources and Workplace Environment			
Provide employee development and support programs that result in an adaptive, efficient, satisfied, skilled workforce	Vacancy Rate: Monthly average less than or equal to 10%	2.4%	Yes
	Succession Planning: 100% of critical functions have a plan by 2009	Identifying critical functions	In Progress
	Apprenticeships: 75% of apprentices become journey-level workers and fulfill service commitments	4 of 4 apprentices progressing	On Track
	Career Development Program: Track and trend number of employees participating in CDP	5 employees	Monitoring
	Training: Track and trend average hours of training per employee per year	28.5 hours	Monitoring
	Employee Turnover: Report, trend, and analyze information	1 employee resigned	Monitoring
	Movement Within the Organization: Track and report reassignments and reclassifications	1 reclassification	Monitoring
	Retirement Eligibility: Track number of employees eligible to retire in 2, 5, and 10-year horizons	2 years = 3 2 to 5 years = 6 5 to 10 years = 7	Monitoring
	Amount of Employee Experience: Track employee tenure and relevant experience	9.2 years tenure 19.3 years relevant experience	Monitoring
Build and maintain a culture of safety	Reportable Safety Incidents: Track monthly rate	0.17 per month	Monitoring
	Time Loss: Track and report worker hours lost due to injury	0 hours	Monitoring
	Labor and Industries Experience Rating: At or below industry base rate of 1	0.7165	Yes
	Contractor Safety: 100% compliance with health and safety standards	100%	Yes
	Safety Incentive Program: 100% staff participation	93%	No

Appendix B:
Asset System Summary

Appendix B:
Asset System Summary

Purpose

The key objective in developing the Asset System Summary was to organize LOTT's assets into a logical fashion, facilitating the following:

- Establishment of a hierarchical structure in which assets could be organized
- Illustrate systems components in an easily understandable way for the Board, elected officials, and the public
- Enable the analysis of risk and cost at an inter- and intra-system level
- Create a communication tool to provide context for evaluating and explaining new capital improvements projects, and operation and maintenance strategies

Structure of Asset Profiles

Each Asset Profile has been built around a common structure. This structure provides a framework for ongoing use and development of the profiles. The key elements of the structure for each key process area of the plan are:

System Profile – A qualitative description of the asset, its primary functions, and recent relevant history.

Demand Profile and Performance – A description of the key capacity design values for assets in terms of peak, average, and standby design capacities, and, where available, the current performance.

Failure Mode Summary – For each of the primary failure modes, a summary score of a 1 - 5 scale (where 1 is good and 5 is poor) is provided, on how the asset is performing. Data is provided when it is known.

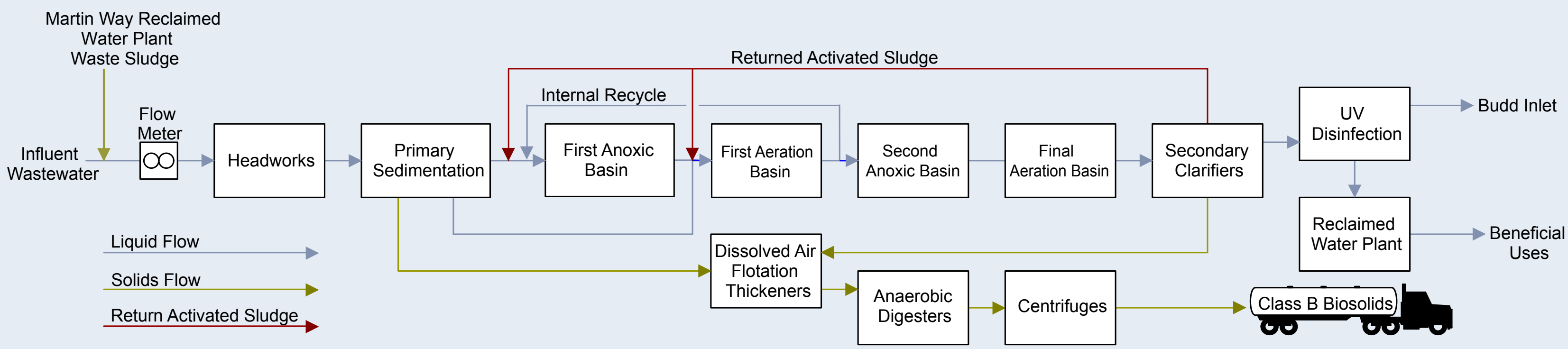
Key Issues for Further Investigation – Includes issues identified through the Demand Performance and Failure Mode analysis as well as issues provided by staff, and the overall consequence and criticality assessment for the grouped assets.

Current Program – Describes the current studies, planning, design, construction, and management strategy for the system.

Investment Strategy – Defines funding summaries of the system for the previous year and estimated near future expenditures.

Asset System Summary modeled after profiles in the Orange County Sanitation District Asset Management Plan 2006.

Budd Inlet Treatment Plant Process



Asset Profiles

The following asset profiles make up the Asset System Summary. This summary provides a mechanism to evaluate comprehensive lists of assets in context with their overarching process system. This allows for a better assessment of their criticality in meeting the established Levels of Service. Data collection and evaluation is an ongoing process; data is included for each profile where available. Profiles are included for all systems listed below.

Headworks – The headworks facility consists of preliminary treatment (screens and grit removal) and influent pumping.

Primary Sedimentation – The primary treatment process removes easily settleable material from the screened and degritted wastewater.

Aeration Basins – The aeration basins contain LOTT's biological nutrient removal system, which consists of a four-stage process to optimize total inorganic nitrogen and biochemical oxygen demand (BOD) removal from the pimary effluent.

Secondary Clarifiers – The purpose of the secondary clarifiers is to separate suspended solids from the biological treatment process mixed liquor prior to disinfection of the treated plant effluent.

Ultraviolet Disinfection – The ultraviolet (UV) disinfection system disinfects the secondary clarifier effluent to satisfy NPDES permit requirements for marine discharge.

Budd Inlet Reclaimed Water Plant – This reclaimed water facility uses sand media and sodium hypochlorite to filter and disinfect secondary effluent to Class A Reclaimed Water standards.

Sludge Thickening (DAFTs) – The sludge thickening process removes excess water from the combined flows from the primary sedimentation and secondary clarifiers prior to anaerobic digestion.

Digesters (Sludge Stabilization) – The anaerobic digesters biologically stabilize thickened sludge from the DAFTs by converting portions of the sludge to carbon dioxide, methane, and water.

Sludge Dewatering – The solids dewatering process removes excess moisture from anaerobically digested sludge (2 to 3 percent solids) to create biosolids (20 to 24 percent solids).

Energy Recovery – Two separate heat loops at the plant recover heat and reuse energy that would otherwise be wasted.

Odor Control – There are four separate foul air treatment systems at the plant to treat air emissions; three are chemical wet scrubbers and the fourth is an activated carbon scrubber.

Martin Way Reclaimed Water Plant – This facility receives raw sewage flows from the collection system via the Martin Way Pump Station and treats to Class A Reclaimed Water standards.

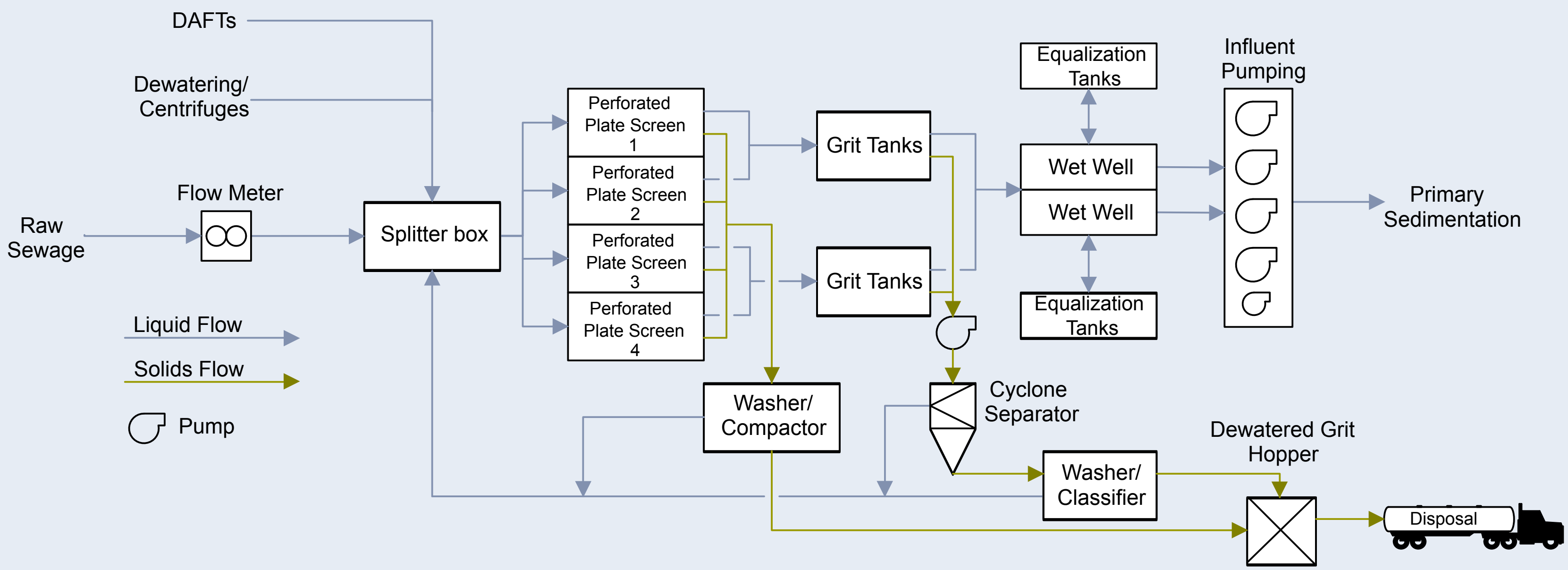
Hawks Prairie Ponds and Recharge Basins – Reclaimed water from the Martin Way Reclaimed Water Plant that is not delivered for other beneficial uses is routed to the Hawks Prairie Ponds and Recharge Basins.

System Pump Stations – Pump stations lift the raw sewage into the conveyance system that ultimately delivers it to the Budd Inlet Treatment Plant and the Martin Way Reclaimed Water Plant.

Collection and Distribution Piping – The LOTT Alliance owns over 28.6 miles of pipelines; the system includes 18.9 miles of gravity sewer, 5.7 miles of pressurized forcemains, and 4 miles of reclaimed water pipelines.

Flow of Information through the Asset Profiles

Headworks



1. System Profile

The headworks facility consists of preliminary treatment (screens and grit removal) and influent pumping.

The raw sewage influent flow rate entering the plant is measured by a flow meter in the 60-inch plant influent pipe. A splitter box directs flow through four influent channels, and motor-operated sluice gates at the head of each channel control the flow to four mechanically cleaned screens that remove large debris from the influent wastewater. Screenings are conveyed to two screenings pits where chopper pumps convey ground-up screenings to a washer/compactor unit. Dewatered screenings are collected and hauled to the Thurston County landfill for disposal.

After being screened, wastewater enters two aerated grit removal tanks that remove large inorganic and organic particles. Grit is collected in hoppers at the bottom of each tank and is removed by ten grit pumps. Grit is conveyed to the grit screening/handling room where the grit is processed through a cyclone separator, and a grit washer/classifier, to remove organic material. Washed grit is stored in hoppers and then hauled to the landfill for disposal. Liquid supernatant (liquified influent) from the separator and classifier are recycled to the plant influent splitter box.

Degritted sewage overflows from the grit chambers into two influent wet wells. Four variable speed, 200 hp pumps and one variable-speed, 50 hp pump provide the influent pumping capacity. The influent pumping system conveys degritted raw sewage to the primary sedimentation basins.

Five equalization (EQ) basins provide up to 2.25 million gallons of storage. As the water level rises in the wet wells during peak flows, the EQ basins fill, in series, with the flow controlled by internal weirs.

The scum handling system at the headworks provides a single means of concentrating, storing, and disposing of scum collected from the primary sedimentation tanks. Scum from other sources, such as the secondary clarifiers, aeration, and anoxic basins, is routed directly to the influent splitter box through the septage and sanitary drain piping systems.

2. Demand Profile and Performance

Peak, Average, and Standby Design Capacities

System Subsystem(s)	Design Capacity	Actual Performance
Screenings Pumps	2@200 gpm	
Screenings Compactors	2@45 cubic feet per hour	
Grit Tanks	2@43.9 mgd	
Grit Pumps	10@25 hp and 150 gpm	
Grit Separators	2@200 gpm	
Grit Washer	2@1.5 tons per hour	
Grit Chamber Blowers	3@20 hp	
Influent Pumps	4@200 hp and 18 mgd; 1@50 hp and 5 mgd	
Equalization Basins	5 each, total volume 2.25 million gallons	

3. Failure Mode

Failure Summary

Process	Rating				
	Condition	Capacity	Function	Reliability	Efficiency
Influent Flow Meter	1	2	2	3	2
Influent Gates	4	2	4	3	2
Influent Screens	1	1	1	1	1
Screenings Pumps	1	2	2	2	2
Washer/Compactors	2	2	2	2	2
Grit Tanks	2	1	1	1	2
Grit Pumps	2	1	1	2	2
Grit Separators	3	2	2	2	3
Grit Washer	3	2	2	2	3
Grit Chamber Blowers	2	2	2	2	2
Influent Pumps (200 hp)	2	1	1	1	2
Influent Pump (50 hp)	2	1	1	1	1

4. Key Issues for Further Investigation

Conceptual planning for the Budd Inlet Treatment Plant Process Improvements Project indicates that future peak-hour flows may reach 86 mgd. Further evaluation of the influent pumping and internal conveyance capacity will be included as part of this upcoming project.

5. Current Program

Study

Brown and Caldwell completed the Budd Inlet Wastewater Treatment Plant Air Handling Study in 2007 to evaluate the existing ventilation air handling systems. Based on this report, it was concluded that the headworks air handling system was not performing to design, and was in need of rehabilitation.

Planning

The current influent gates and controllers are reaching the end of their useful life and are scheduled for replacement in 2009 - 2010.

Design and Construction

Design for the air handling improvements is completed and scheduled for construction in 2009. The design for the influent gates and controllers will be completed in 2009, with construction starting in 2009, and anticipated completion in 2010.

Management Strategies

N/A

6. Investment Strategy

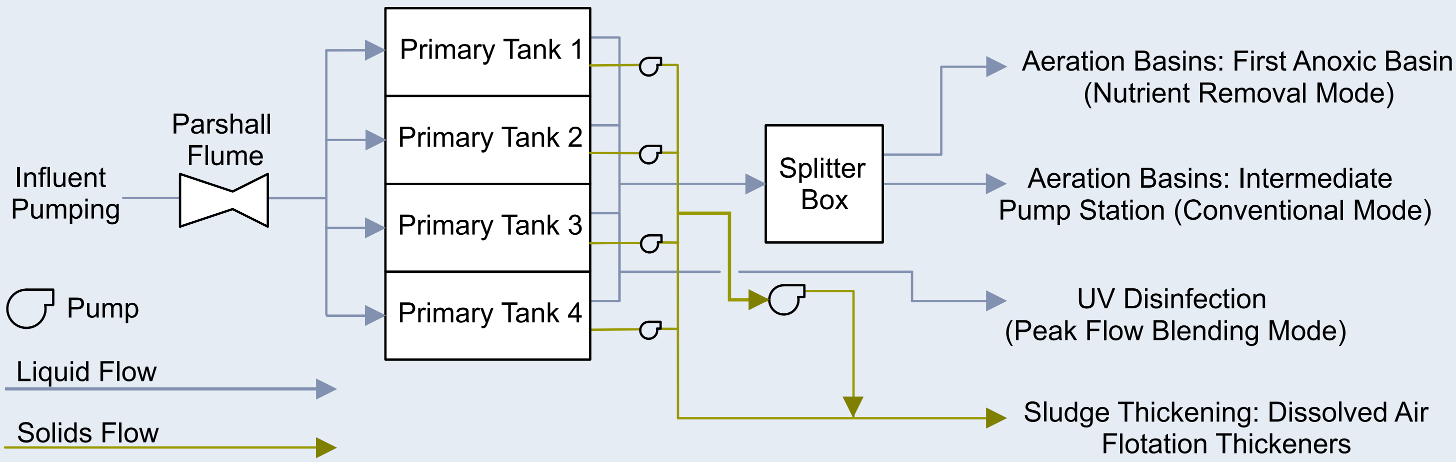
5-Year Summary

Project	Investment ($1,000s)						
	Projected Budget	Cost to Date	2009	2010	2011	2012	2013
Air Handling Improvements	625	22	625				
Influent Gates and Controllers	500	20	240	240			
Total	**1,125**	**42**	**865**	**240**			

O & M Cost Summary

	Cost ($1,000s)				
	2008	2009	2010	2011	2012
Operations	205	209	225	244	236
Maintenance	55	30	50	30	60

Primary Sedimentation



1. System Profile

The primary treatment process removes easily settleable material from the screened and degritted wastewater. Primary treatment at the Budd Inlet Treatment Plant includes flow measurement, seven rectangular primary sedimentation tanks with scum collectors, surface return flight sludge collectors, and primary sludge pumps.

The wastewater flow rate entering primary treatment is measured by a 60-inch throat-width Parshall flume and an ultrasonic level indicator located in the primary sedimentation tank influent channel. This flow measurement is used by the plant computer to control influent gates and the pump speed for influent pumping, return activated sludge, waste activated sludge and internal mixed liquor recycle pumping, and sample acquisition for laboratory analysis.

Seven identical rectangular primary sedimentation tanks remove floatable materials and easily settleable solids from the influent wastewater. The west tank is operated independently, whereas the remaining six tanks are hydraulically connected and operated in pairs. Effluent from the primary sedimentation tanks overflows into troughs at the end of each tank. Gates direct primary effluent to either the first anoxic basin or the intermediate pump station wet well, depending on the mode of operation. High wet well levels in the intermediate pump station can cause primary effluent to be directly routed to ultraviolet (UV) disinfection.

Primary sludge is removed from the primary sedimentation tanks and pumped to the dissolved air flotation thickeners. Plant staff has the option of using a set of four diaphragm pumps (one dedicated to each pair of tanks) or a single, positive displacement, progressing cavity pump to move sludge to the thickeners.

Scum collected from the primary sedimentation tanks is conveyed to the scum holding tank in the headworks building.

2. Demand Profile and Performance

Peak, Average, and Standby Design Capacities

System Subsystem(s)	Design Capacity	Actual Performance
Influent Flow Meter	55 mgd	
Primary Sedimentation Tanks	7 tanks, capacity approx. 72 mgd based on hydraulic modeling	
Progressive Cavity Sludge Pump	1@200 gpm	
ODS Diaphragm Sludge Pumps	4@100 gpm	

3. Failure Mode

Failure Summary

Process	Rating				
	Condition	Capacity	Function	Reliability	Efficiency
Primary Sedimentation Tanks	3	3	4	3	3
Progressing Cavity Sludge Pump	2	1	1	1	1
ODS Diaphragm Sludge Pumps	3	3	5	3	5

4. Key Issues for Further Investigation

N/A

5. Current Program

Study

After a thorough engineering evaluation of the system in 2007, it was determined that new primary sedimentation basins were needed in order to meet the Levels of Service. The existing primary sedimentation basins were constructed in 1952. The corrosive environment inside the primary sedimentation building has systematically degraded the integrity of the roof structure and some of the mechanical elements within the building. The risk of catastrophic failure of the mechanical elements has been evaluated and determined to be likely within five to ten years. In addition, much of the mechanical equipment is no longer manufactured and requires maintenance staff to manufacture replacement parts. The structure may no longer meet current seismic code; however, the concrete has been found to be sound.

Planning

HDR Engineering is under contract to design new primary sedimentation tanks and required upgrades to the existing primaries, which will also act as equalization basins for peak flow events until the space is needed for other processes.

Design and Construction

The design process, which began in 2008, will be completed in 2009. Construction will begin in 2010, with anticipated completion by 2012.

Management Strategies

A General Contractor/Construction Manager design process will be used for this project to improve efficiency and minimize constructability issues during the construction phase.

6. Investment Strategy

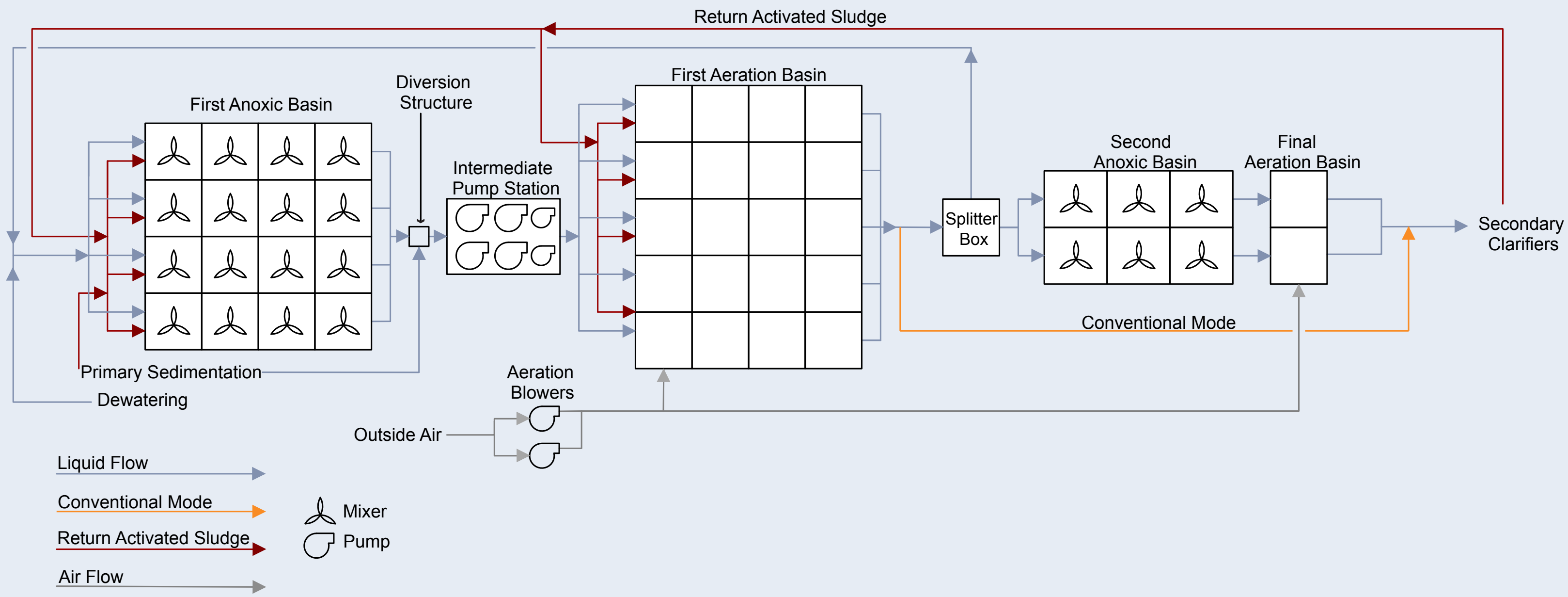
5-Year Summary

Project	Investment ($1,000s)					
	Projected Budget	Cost to Date	2009	2010	2011	2012
New Primary Sedimentation Tanks	42,104	1,616	810	5,400	17,139	17,139
Total	**42,104**	**1,616**	**810**	**5,400**	**17,139**	**17,139**

O & M Cost Summary

	Cost ($1,000s)				
	2008	2009	2010	2011	2012
Operations	104	112	122	132	142
Maintenance	15	12	12	12	12

Aeration Basins



1. System Profile

The aeration basins contain LOTT's biological nutrient removal system, which consists of a four-stage modified Bardenpho process to optimize total inorganic nitrogen and biochemical oxygen demand (BOD) removal from the primary effluent. Primary effluent is combined with other recycle flows through a series of anoxic (low dissolved oxygen) basins and aeration (higher dissolved oxygen concentration) basins. These basins are identified as the first anoxic, first aeration, second anoxic, and final aeration basins. In order to achieve the required nitrogen limits, flows are recycled inside the aeration basin system from the first aeration basin back to the first anoxic basin at a rate that is typically four times the plant's influent flow.

The first anoxic basin (stage 1) removes nitrate from the wastewater (denitrifies). Each basin is mixed by a mixer mounted on the roof of the basin. Denitrified mixed liquor flows by gravity to the intermediate pump station.

The intermediate pump station lifts denitrified mixed liquor up to the first aeration basin. This allows the mixed liquor and primary effluent to flow by gravity through the remaining elements of the secondary treatment process and UV disinfection.

In the first aeration basin (stage 2), the wastewater is aerated to provide for BOD removal and nitrification (conversion of ammonia to nitrate). The mixed liquor is aerated with fine bubble diffusers located on the basin's floor. Air is supplied to the diffusers by a system of four blowers. Mixed liquor flows from the first aeration basin to a splitter box that directs flow either back to the first anoxic basin or to the second anoxic and final aeration basins.

The second anoxic and final aeration basins (stages 3 and 4) provide the final biological denitrification and nitrification steps prior to settling and disinfection. Stages 3 and 4 consist of two trains, each with four cells. The first three cells of each train serve as the second anoxic zone and the fourth cell as the final aeration zone. In the anoxic cells, additional nitrate removal is achieved. In the final aeration cells the mixed liquor is aerated to further freshen the mixed liquor prior to flowing to the secondary clarifiers.

2. Demand Profile and Performance

Peak, Average, and Standby Design Capacities

System Subsystem(s)	Design Capacity	Actual Performance
First Anoxic Basin	4@13.75 mgd	
First Anoxic Basin Mixers	16@10 hp	
First Aeration Basin	5@14.5 mgd	14.1 mgd limiting capacity
First Aeration Basin Mixers	5@25 hp	
Second Anoxic Basin	2@27.5 mgd	
Second Anoxic Basin Mixers	6@15 hp	
Final Aeration Basin	2@27.5 mgd	
Intermediate Pumps	2@75 hp, 17 mgd 4@150 hp, 33 mgd	
Aeration Blowers	4@500 hp 7400 scfm each (21,310 scfm with one blower out of service)	16.3 mgd limiting capacity based upon existing number of diffusers in cell 2

3. Failure Mode

Failure Summary

Process	Rating				
	Condition	Capacity	Function	Reliability	Efficiency
Aeration Basins	2	1	3	1	3
Intermediate Pump Station	1	1	1	1	3
Aeration Blowers	1	1	3	1	4
Mixers	4	3	4	4	4
Diffusers	4	3	3	3	3

4. Key Issues for Further Investigation

The current biological nitrogen removal system is effective at meeting the current discharge requirement of 3 mg/L total inorganic nitrogen, but the system is cumbersome to operate and requires significant energy for air supply and mixed liquor recirculation.

5. Current Program

Study

A project to optimize nitrogen removal efficiency and capacity of the Biological Nutrient Removal (BNR) facilities of the Budd Inlet Treatment Plant was initiated in 2008. HDR Engineering was hired to evaluate the BNR process to identify the best improvements for both process control and increased capacity. The project will likely reconfigure the existing first anoxic, first aeration, second anoxic, and final aeration basins, as well as substantially reduce the energy consumption for recycle pumping to accomplish biological nutrient removal.

Planning

A series of workshops with HDR Engineering, Brown and Caldwell, and LOTT staff was held in 2008 to develop and evaluate potential process improvement alternatives. This involved a detailed engineering analysis including process computer modeling, pre-design, and an engineering report.

Replacement of the second anoxic basin mixers, some of which have broken off, is planned for 2009 - 2013.

Design and Construction

The Process Improvements Project design will begin in 2015, and construction will be completed in 2016 - 2017.

Management Strategies

N/A

6. Investment Strategy

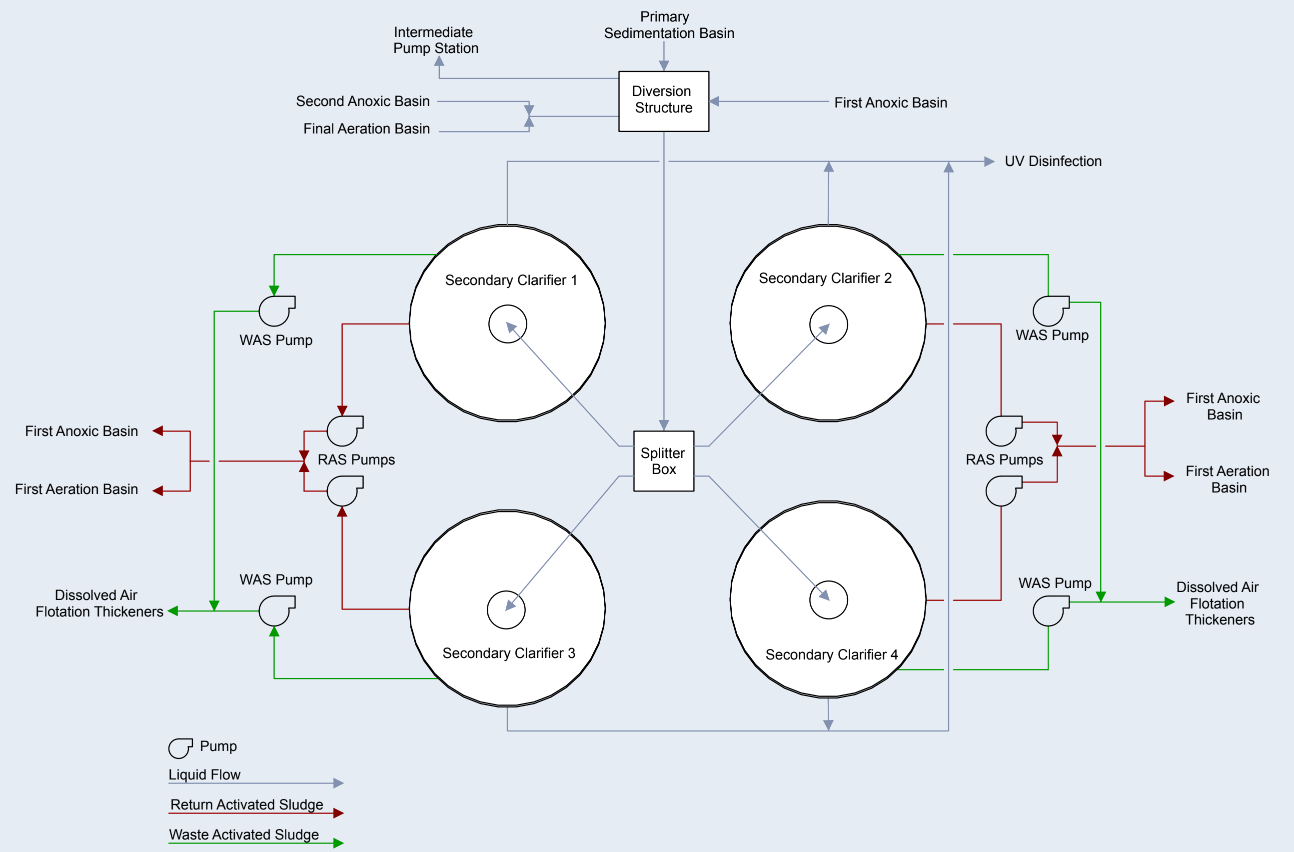
5-Year Summary

Project	Investment ($1,000s)						
	Projected Budget	Cost to Date	2009	2010	2011	2012	2013
Second Anoxic Basin Mixers	125		25	25	25	25	25
Budd Inlet Process Improvements	34,733	268					
Total	**34,858**	**268**	**25**	**25**	**25**	**25**	**25**

O & M Cost Summary

	Cost ($1,000s)				
	2008	2009	2010	2011	2012
Operations	95	125	135	146	158
Maintenance	18	18	18	18	18

Secondary Clarifiers



1. System Profile

The purpose of the secondary clarifiers is to separate suspended solids from the biological treatment process mixed liquor prior to disinfection of the treated plant effluent. The clarifiers receive flow from the final aeration basin. Clarified effluent from the clarifiers flows to the UV disinfection system.

There are four clarifiers at the plant with a diameter of 120 feet and a 14.5-foot side water depth. A project to upgrade the secondary clarifiers was completed in 2008. The project included the replacement of the clarifier mechanisms and return activated sludge (RAS) pumps. The effluent launders were replaced in 2003.

Each clarifier is equipped with two RAS pumps and one waste activated sludge (WAS) pump. Settled sludge is withdrawn from each clarifier by dedicated RAS pumps that are connected to a manifold of pipes located on the clarifier's rotating sludge collector mechanisms.

A magnetic flow meter measures the flow from each pair of pumps. RAS is recycled by the pumps back to either the first anoxic or the first aeration basin. The pumping rate is adjusted to maintain a minimal blanket of thickened sludge in the clarifier.

The waste activated sludge is withdrawn from either the clarifier sump or the return activated sludge wet well and directed to the dissolved air flotation thickeners for solids processing. The WAS pumps are used to maintain the solids inventory in the system and the solids retention time in the secondary treatment process to allow the biological treatment process to operate correctly. The WAS pumps are operated continuously to even out the load to the dissolved air flotation thickeners.

2. Demand Profile and Performance

Peak, Average, and Standby Design Capacities

System Subsystem(s)	Design Capacity	Actual Performance
Secondary Clarifier Mechanisms	4@120 ft diameter, 14.5 ft deep	
Return Activated Sludge Pumps	8@20 hp and 2,000 gpm	
Waste Activated Sludge Pumps	4@10 hp and 300 gpm	

3. Failure Mode

Failure Summary

Process	Area	Rating				
		Condition	Capacity	Function	Reliability	Efficiency
Secondary Clarifiers		1	1	2	1	1
Return Activated Sludge Pumps		1	1	1	1	1
Waste Activated Sludge Pumps		1	1	1	1	1

4. Key Issues for Further Investigation

As part of the upcoming Process Improvements Project, it is anticipated that some of the process tank volume will be consolidated. This will require the aeration tanks to operate at relatively high mixed liquor solids concentrations, increasing the solids loading rates to existing clarifiers. Secondary clarifier capacity will need to be evaluated as part of this process.

5. Current Program

Study

Brown and Caldwell completed the Secondary Clarifier Capacity Analysis in 2008, reevaluating the existing secondary clarifiers removal efficiency based on various solids loadings rates.

Planning

Information gathered as part of the Secondary Clarifier Capacity Analysis will be used to develop the Master Site Plan for the Budd Inlet Treatment Plant concerning future secondary treatment capacity requirements based on the selected alternative for the Process Improvements Project.

Design and Construction

The existing secondary clarifiers were rehabilitated in 2007 - 2008.

Management Strategies

N/A

6. Investment Strategy

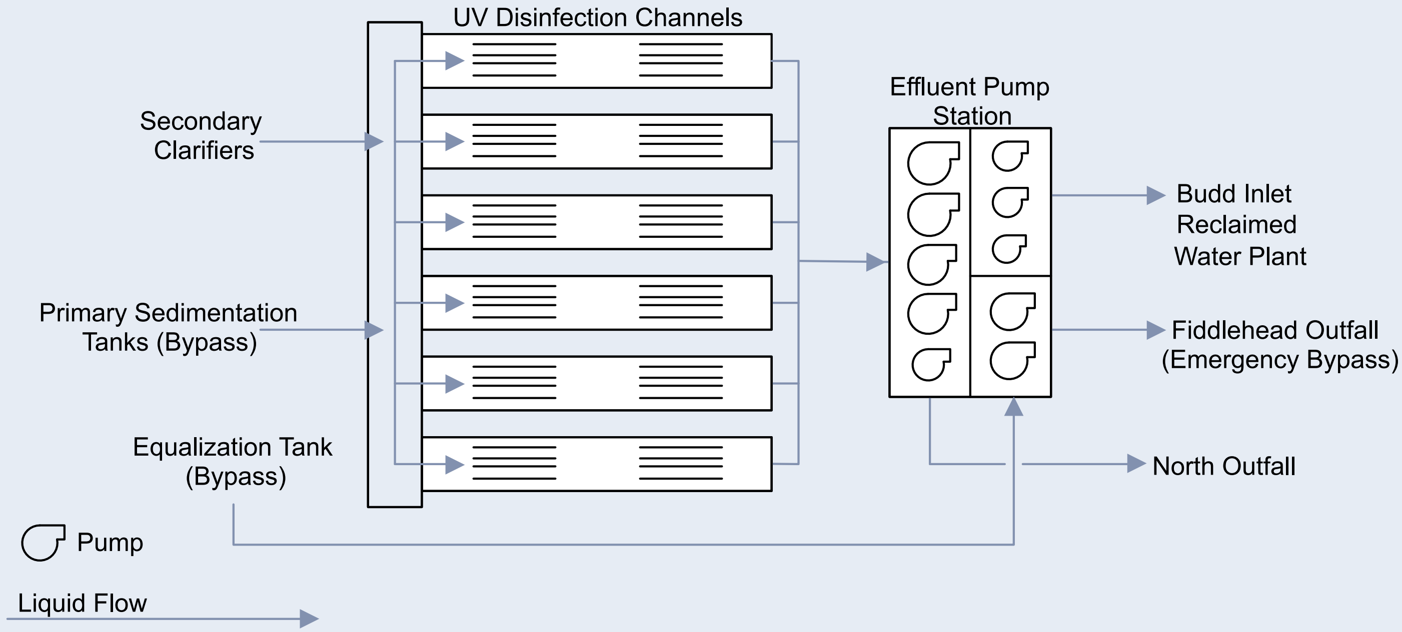
5-Year Summary

Project	Investment ($1,000s)						
	Projected Budget	Cost to Date	2009	2010	2011	2012	2013
Secondary Clarifier Rehab	6,124	6,124					
Total	**6,124**	**6,124**					

O & M Cost Summary

	Cost ($1,000s)				
	2008	2009	2010	2011	2012
Operations	104	113	122	132	142
Maintenance	5	5	5	5	5

Ultraviolet Disinfection



1. System Profile

The ultraviolet (UV) disinfection system is the final liquid stream processing step. Its purpose is to disinfect the effluent from the secondary clarifiers to satisfy National Pollutant Discharge Elimination System (NPDES) permit requirements for marine discharge.

A UV disinfection system relies upon the bacteria in the effluent being exposed to ultraviolet light by flowing past UV bulbs. The ultraviolet disinfection system consists of seven channels. Six channels are equipped with horizontal UV bulbs, while the seventh is vacant for future expansion. Each channel can disinfect between 3 mgd and 11 mgd of secondary effluent.

UV lamps are arranged in modules across the width of a channel. The spacing of the lamps in the channels provides sufficient UV radiation to ensure destruction of pathogenic microorganisms as effluent flows through the channel. The performance of the UV disinfection system is contingent on the successful performance of the secondary clarifiers, since high suspended solids will block the UV radiation and reduce the amount available for disinfection.

Disinfected secondary effluent flows to the effluent pump station for discharge to Budd Inlet or to the Budd Inlet Reclaimed Water Plant. The pump station is equipped with seven effluent pumps and three wet wells, which are connected by motor-operated sluice gates. Two of the pumps are dedicated to the Fiddlehead Outfall, which is used only for high flows and combined sewer overflows (CSOs). Three pumps for internal plant distribution include pumping to the Budd Inlet Reclaimed Water Plant.

The Budd Inlet Treatment Plant has two 48-inch outfalls. Treated effluent is typically discharged to Budd Inlet out of the North Outfall that extends 953 feet off the shoreline near the north end of Washington Street. The final 250 feet of the outfall contains a diffuser section approximately 19 feet below the mean lower low water level.

The North Outfall is used for all plant flows up to 64.0 mgd at high tide and approximately 85 mgd at low tide. In the case of an emergency, peak flows in excess of the North Outfall capacity may be discharged through the Fiddlehead Outfall. Emergency discharge through the Fiddlehead Outfall requires notification to the Department of Ecology.

The North Outfall was upgraded from 30- to 48-inch diameter in 1997. A portion of the pipeline could not be upgraded to 48-inch because it crosses through a State-regulated hazardous waste site. Approximately 1,200 feet of the North Outfall run remains at 30-inch diameter, creating a flow bottleneck.

2. Demand Profile and Performance

Peak, Average, and Standby Design Capacities

System Subsystem(s)	Design Capacity	Actual Performance
UV Disinfection Channels	6@11 mgd	
North Outfall	64 mgd at high tide	
Effluent Pump Station Pumps	4@18 mgd and 1@12 mgd (North Outfall); 2 CSO@18 mgd (Fiddlehead); 3@1 mgd internal plant distribution	55 mgd North Outfall at high tide; 36 mgd Fiddle Head at high tide

3. Failure Mode

Failure Summary

Process	Rating				
	Condition	Capacity	Function	Reliability	Efficiency
UV Disinfection System	2	3	2	2	
North Outfall	2	4	2	3	4
Effluent Pump Station	2	1	2	2	1

4. Key Issues for Further Investigation

Keys issues for further investigation include the level of contamination in the log yard, which the outfall runs through, and various alternatives to mitigate the costs of upsizing the pipe.

5. Current Program

Study

A mixing zone study was conducted in 2008 by Cosmopolitan Engineering Group. The analysis evaluated the diffusers' hydraulic performance under various effluent flows and tide levels, and assessed the mixing zone impacts.

Planning

A project to upgrade the North Outfall is planned to begin in 2015 to address the hydraulic limitation in the outfall pipeline.

Design and Construction

Control and power upgrades for the UV system are planned for 2011. Design is scheduled for 2012, with construction completed in 2012.

Management Strategies

N/A

6. Investment Strategy

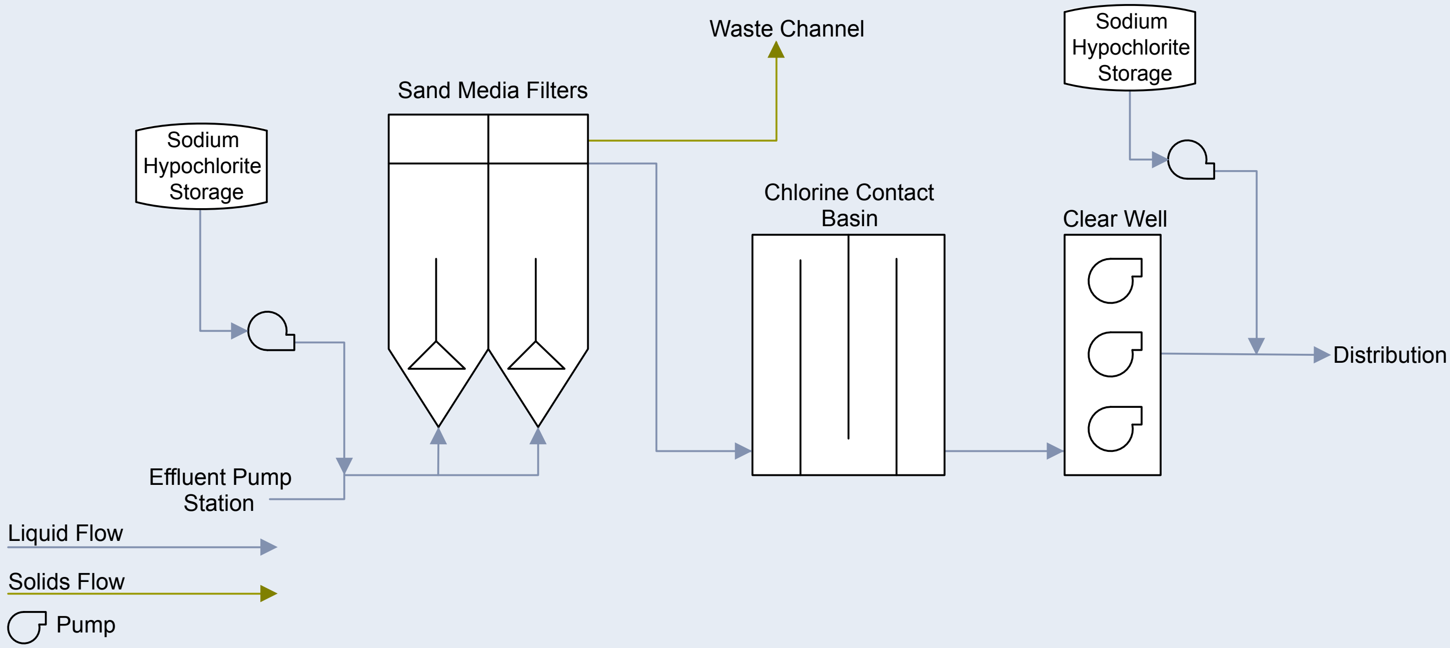
5-Year Summary

Project	Investment ($1,000s)						
	Projected Budget	Cost to Date	2009	2010	2011	2012	2013
UV Power and Control Upgrades	305				5	100	200
North Outfall Evaluation and Upgrade	4,351	109					
UV System 7th Channel	494						
Total	**5,150**	**109**			**5**	**100**	**200**

O & M Cost Summary

	Cost ($1,000s)				
	2008	2009	2010	2011	2012
Operations	104	113	122	132	142
Maintenance	29	10	10	10	10

Budd Inlet Reclaimed Water Plant



1. System Profile

The Budd Inlet Reclaimed Water Plant, completed in 2004, uses sand media and sodium hypochlorite to filter and disinfect secondary effluent to Class A Reclaimed Water standards. The facility is capable of treating up to 1.5 mgd on a continuous basis.

Three pumps can draw final effluent from the effluent pump station wet well and discharge it to the reclaimed water plant. Coagulants and sodium hypochlorite solution are injected into the effluent prior to entering the sand filters. Feed to the filters is adjusted by a flow regulator valve and by the number of the filter feed system pumps on-line. The sand media in each filter is circulated and backwashed via a pair of sand circulating/backwashing units.

Filtered effluent is discharged to the chlorine contact basins for a 30-minute period to achieve Ecology's total chlorine requirements of 0.5 mg/L residual in the reclaimed water transmission lines, and a 1 mg/L residual following the 30-minute contact time.

The reclaimed water from the plant has been filtered and disinfected to Class A standards and is now considered Class A Reclaimed Water. A portion of the reclaimed water is stored in a 140,000 gallon capacity clear well. Reclaimed water from the clear well is distributed through the plant for equalization basin wash down, scum and foam suppression spray systems, cooling water makeup, grit washer sprays, and pump seal water systems, as well as distribution to the City of Olympia, Port of Olympia, and State Department of General Administration for irrigation.

Reclaimed water distribution and pumping is accomplished via three variable speed vertical turbine pumps, each located in a sump adjacent to the clear well. The system is designed so that two pumps can provide a reclaimed water distribution pumping capacity of approximately 2,100 gpm at a minimum pressure of 45 psi. The third pump is a standby pumping unit. A hydropneumatic tank maintains system pressure and flow during pump starts, minimizes pump cycling, and dampens pressure surges in the distribution system.

2. Demand Profile and Performance

Peak, Average, and Standby Design Capacities

System Subsystem(s)	Design Capacity	Actual Performance
Reclaimed Water Plant	1.5 mgd	
Off-Site Reclaimed Water Distribution Pumps	3@1,050 gpm	
Plant Reclaimed Water System	120 gpm	
Secondary Effluent Pumps (to Reclaimed Water Plant)	3@1,100 gpm	

3. Failure Mode

Failure Summary

Process	Rating				
	Condition	Capacity	Function	Reliability	Efficiency
Reclaimed Water Plant	1	1	1	1	1
Off-Site Reclaimed Water Distribution Pumps	1	1	1	1	1

4. Key Issues for Further Investigation

N/A

5. Current Program

Study

A Business Case Evaluation was conducted in 2008 to determine if additional reclaimed water production capacity was needed in order to meet system demands. It was concluded that the existing production capacity was sufficient to meet demand until the Process Improvements Project was constructed, which may include additional reclaimed water production capacity.

Planning

A reclaimed water feature is being planned adjacent to the new LOTT Administrative and Education Center, and extending across to the future East Bay Public Plaza.

Design and Construction

Additional reclaimed water production capacity will be included as part of the Process Improvements Project, scheduled to begin in 2015.

Management Strategies

In order to maximize the existing treatment capacity during the critical irrigation season, a project is planned to build reclaimed water storage capacity somewhere in the system.

6. Investment Strategy

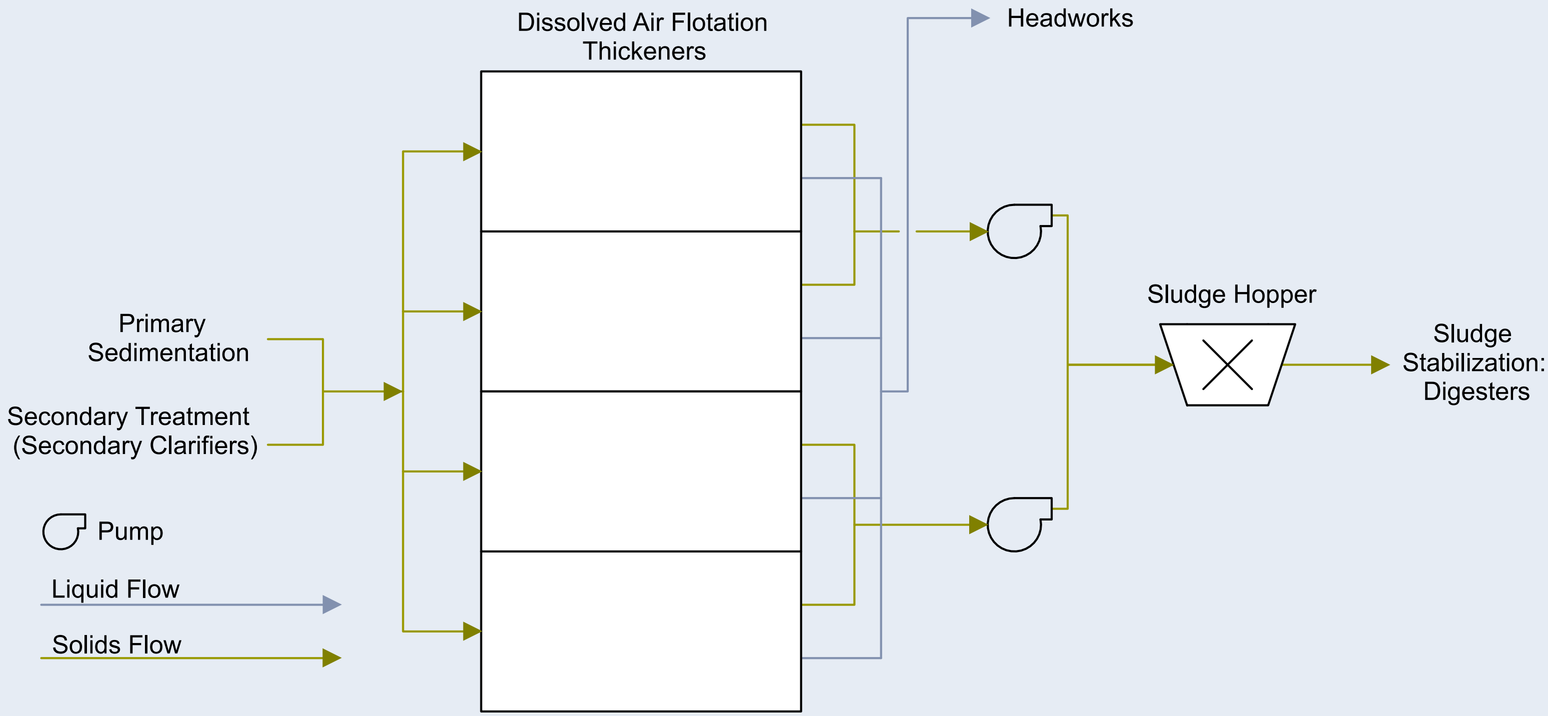
5-Year Summary

Project	Investment ($1,000s)						
	Projected Budget	Cost to Date	2009	2010	2011	2012	2013
Reclaimed Water Feature	376			80	294		
Total	**376**			**80**	**294**		

O & M Cost Summary

	Cost ($1,000s)				
	2008	2009	2010	2011	2012
Operations	78	85	91	99	106
Maintenance	2	2	2	2	2

Sludge Thickening (DAFTs)



1. System Profile

The sludge thickening process removes excess water from the combined flows from the primary sedimentation and secondary clarifiers prior to anaerobic digestion. The Budd Inlet Treatment Plant sludge thickening system consists of four rectangular dissolved air flotation thickener (DAFT) units. Polymer is used to enhance sludge thickening and performance of the DAFT thickeners.

Each thickener has a dedicated pressurization system to provide high-pressure air for solids flotation. A portion of the DAFT effluent is recycled to the pressurization tank, and the pressure is elevated to 40 psig using the plant's high-pressure service air. Pressurized flow from the tank is passed through a pressure release valve, where it combines with the polymerized sludge feed into the DAFT. The decompressed air bubbles attach to the flocculated sludge particles and the thickened sludge floats to the surface. Skimmers collect the thickened sludge and scrape it into hoppers for transfer to the anaerobic digesters via the thickened sludge pumps.

Sludge that falls to the bottom of the DAFT unit can also be directed to the digesters via the thickened sludge pumps. Clarified effluent (supernatant) from the DAFTs drains to the headworks for processing with the plant influent flow.

2. Demand Profile and Performance

Peak, Average, and Standby Design Capacities

System Subsystem(s)	Design Capacity	Actual Performance
Dissolved Air Flotation Tanks	4@600 lb/solids/hour	4@800 lb/solids/hour
Thickened Sludge Pumps	4@100 gpm	4@65 gpm

3. Failure Mode

Failure Summary

Process	Rating				
	Condition	Capacity	Function	Reliability	Efficiency
DAFTs	4	3	3	3	3
Collection Flights and Sprockets	4	4	3	3	4
Thickened Sludge Pumps	3	4	3	3	3

4. Key Issues for Further Investigation

The thickened sludge from each dissolved air flotation thickener (DAFT) combines in a common manifold and is carried to the sludge digestion system. Flow through this pipeline is pressure-limited.

5. Current Program

Study

A Business Case Evaluation was completed in 2007, to include the replacement of the existing thickening system with a new technology. The evaluation determined that refurbishment of the existing DAFT equipment was sufficient.

Planning

N/A

Design and Construction

Replacement of the DAFT collector flights and sprockets is scheduled for 2009 and will be completed by LOTT maintenance staff. Upgrades to thickened sludge transfer piping will also occur in 2009.

Management Strategies

N/A

6. Investment Strategy

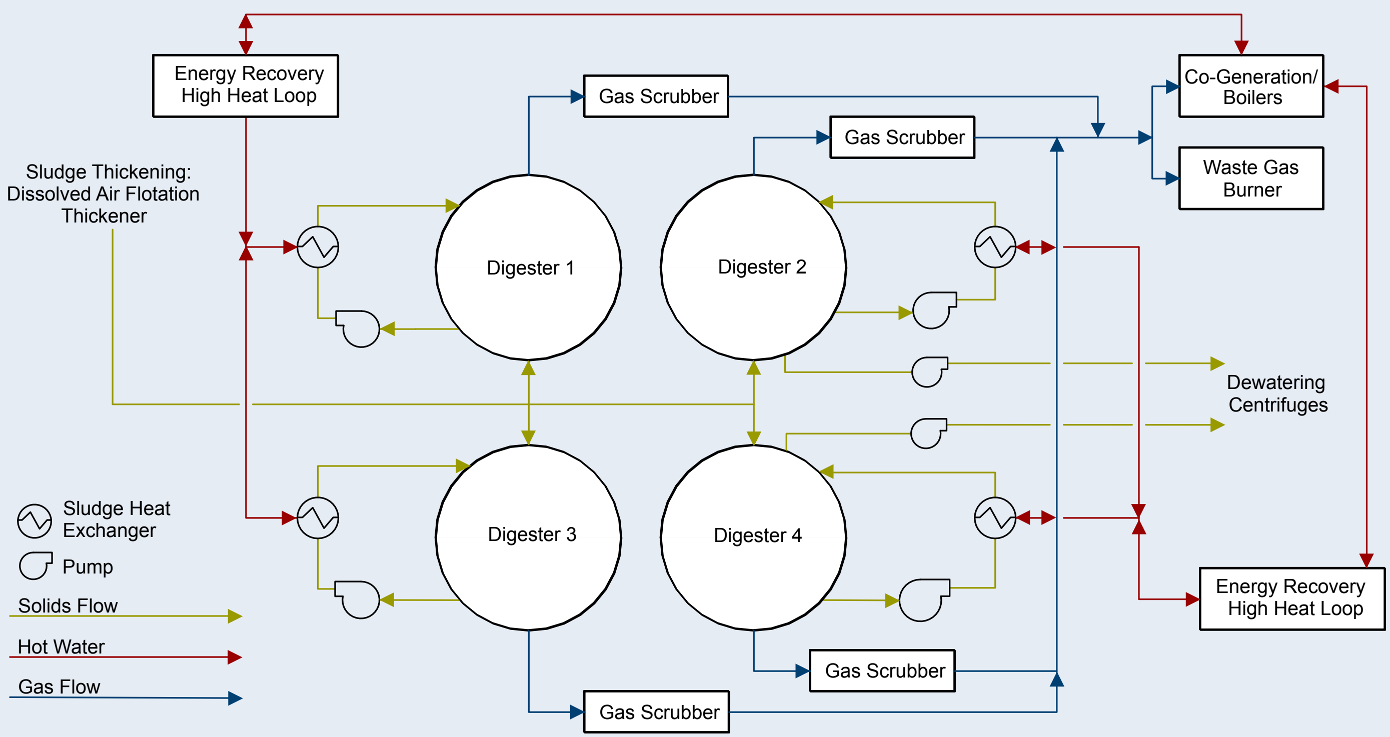
5-Year Summary

Project	Investment ($1,000s)						
	Projected Budget	Cost to Date	2009	2010	2011	2012	2013
Thickening System	479		479				
Equipment Replacement							
Total	**479**		**479**				

O & M Cost Summary

	Cost ($1,000s)				
	2008	2009	2010	2011	2012
Operations	132	165	178	192	208
Maintenance	2	2	3	3	3

Digesters (Sludge Stabilization)



1. System Profile

The anaerobic digesters biologically stabilize thickened sludge from the DAFTs by converting portions of the sludge to carbon dioxide, methane, and water. Following anaerobic digestion, the residual material (Class B Biosolids) is suitable for land application.

Anaerobic sludge digestion facilities include four 70-feet diameter 30-feet deep concrete tanks with floating covers. Normal practice is to operate three digesters at a time, with the fourth digester held in reserve.

The anaerobic digester equipment building contains all process mechanical equipment needed to operate the digestion process. Thickened sludge is fed to the bottom of the digesters through the sludge recirculation piping in the center of the tank. Circulating sludge is withdrawn from each digester and pumped to sludge heat exchangers before being returned to the digesters to assist in keeping them completely mixed and heated. The heat exchangers are used to maintain the temperature in the digesters at 95° F, which is a permit requirement in order to meet Class B Biosolids standards.

Methane gas from the digesters is the principal fuel for the high temperature heat loop system. Digested sludge is withdrawn from the bottom of the digester and pumped to solids dewatering centrifuges. Each digester is equipped with floating gasholder-type covers, which are supported by digester gas pressure. Each digester contains two separate gas piping systems. The gas utilization system withdraws gas for use as fuel for the high temperature heat loop system. The second system uses digester gas to continuously mix the contents of the digester. A dedicated gas compressor recirculates digester gas through each digester.

Foul air from the anaerobic digester equipment building is collected and treated in the odor control system prior to release into the atmosphere.

2. Demand Profile and Performance

Peak, Average, and Standby Design Capacities

System Subsystem(s)	Design Capacity	Actual Performance
Anaerobic Digesters	4@137,840 cubic feet	
Sludge Transfer Pumps	3@10 hp and 250 gpm	
Sludge Recirculation Pumps	5@10 hp and 310 gpm	
Gas Circulating Compressors	5@20 hp, 25 psig, and 180 scfm	
Sludge Heat Exchangers	5@1,500 mbtu/hr	

3. Failure Mode

Failure Summary

Process	Rating				
	Condition	Capacity	Function	Reliability	Efficiency
Digesters	2	2	2	2	3
Sludge Transfer Pumps	2	2	2	2	3
Sludge Recirculation Pumps	4	4	4	4	4
Gas Circulating Compressors	2	2	2	3	3
Sludge Heat Exchangers	2	2	2	2	3

4. Key Issues for Further Investigation

The digester heating and circulation/mixing pumping systems for the digesters have reached the end of their useful lives and need to be replaced. The current system is not fully reliable; it involves a high level of manual operation, and can negatively affect treatment plant performance levels required to meet NPDES permit limits.

5. Current Program

Study

A Business Case Evaluation was completed in 2007, which evaluated the digester sludge handling system. It determined that the most cost-effective long-term solution included replacing the spiral heat exchangers, pumping, and piping.

Planning

N/A

Design and Construction

The engineering design for this project began in 2008, and will be completed in 2009. Construction will be completed during 2009 and 2010. The digester cover refurbishments were completed in 2007 - 2008.

Management Strategies

The digester sludge improvements will take place in phases, insuring ongoing operability of the system.

6. Investment Strategy

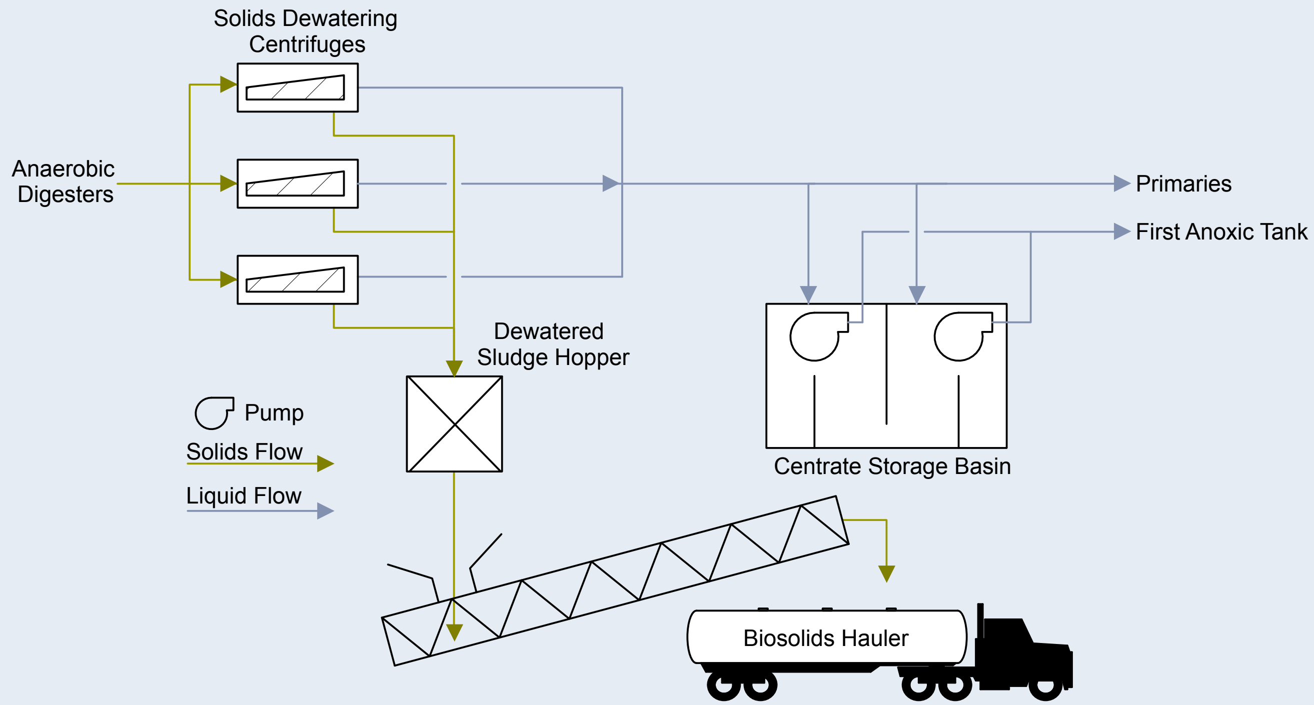
5-Year Summary

Project	Investment ($1,000s)						
	Projected Budget	Cost to Date	2009	2010	2011	2012	2013
Digester Roof Cover Repair	289	293					
Digester Sludge Improvements	2,486	47	439	2,000			
Total	**2,775**	**340**	**439**	**2,000**			

O & M Cost Summary

	Cost ($1,000s)				
	2008	2009	2010	2011	2012
Operations	104	112	121	131	142
Maintenance	15	15	15	15	15

Sludge Dewatering



1. System Profile

The solids dewatering process removes excess moisture from anaerobically digested sludge (2 to 3 percent solids) to create biosolids (20 to 24 percent solids) and thereby reduce land application hauling costs. Solids dewatering equipment consists of three centrifuges, dewatered sludge conveyance equipment, and loading facilities for biosolids hauling trucks. All solids dewatering equipment is contained in the solids handling building. Foul air from the centrifuges and solids handling building is exhausted to the odor control system.

The sludge transfer pumps in the digester equipment building convey anaerobically digested sludge to the centrifuges. Two low capacity centrifuges were installed in the 1979 plant expansion, and the high capacity unit was added in 1999. Current solids loads allow the plant to operate using only the high capacity unit.

Polymer is used to improve dewatering performance. Dewatered biosolids are discharged from the centrifuges into a screw auger conveyor and transferred to the biosolids hauling trucks for land application.

Effluent from the centrifuges (centrate) drains to the headworks, or it can be directed to a centrate storage basin. One of the spare primary sedimentation basins can be used as a centrate storage basin to equalize ammonia loads to the treatment process.

Two truck and trailer combination sets capable of hauling over 30 tons each are alternately used to transport biosolids to contracted land application sites. One 37-foot end-dump trailer with a capacity of 26 tons is used on a standby basis during times of increased production. The trucks and trailers are all equipped with heavy-duty tarping systems and watertight tailgates to reduce odors and eliminate spillage. Depending on dewatering efficiency, 250 to 350 truckloads of biosolids are delivered for land application every year.

2. Demand Profile and Performance

Peak, Average, and Standby Design Capacities

System Subsystem(s)	Design Capacity	Actual Performance
Low Speed Centrifuges	2@1,500 lb/hr	
High Speed Centrifuge	1@2,500 lb/hr	

3. Failure Mode

Failure Summary

Process	Rating				
	Condition	Capacity	Function	Reliability	Efficiency
Low Speed Centrifuges	2	3	3	2	3
High Speed Centrifuge	2	1	2	3	2

4. Key Issues for Further Investigation

The current biosolids treatment system produces Class B Biosolids that must be beneficially used on controlled access sites. A CIP project has been identified by 2025 to eventually produce a Class A Biosolids product, which will be beneficially used on unrestricted sites.

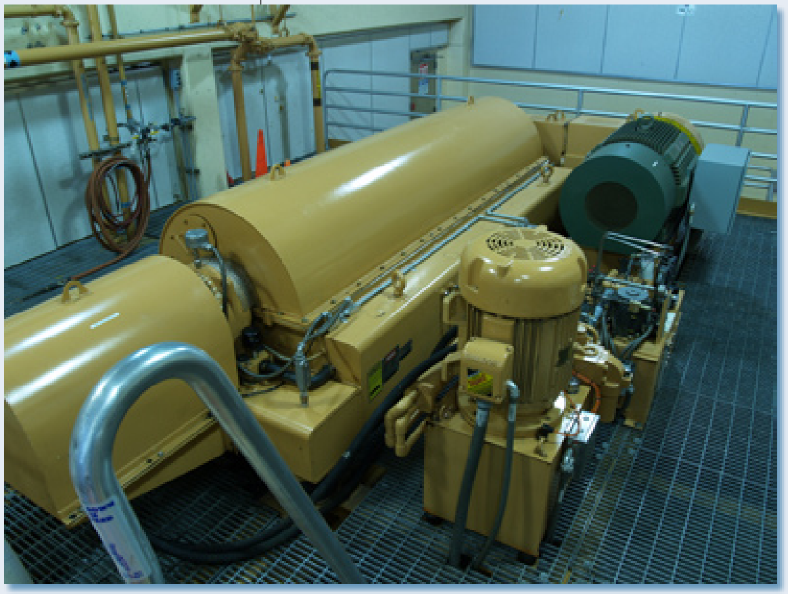
5. Current Program

Study

A Business Case Evaluation was conducted to determine if it was cost-effective to upgrade the centrifuge backdrives to increase efficiency of the low speed centrifuges, which would include an electrical upgrade. It was determined not to be cost-effective at this time.

Planning

The LOTT Biosolids Management Plan will be updated in 2009. As part of this, a Business Case Evaluation will be completed to assess the existing dewatering system and evaluate other alternatives.



Design and Construction

N/A

Management Strategies

N/A

6. Investment Strategy

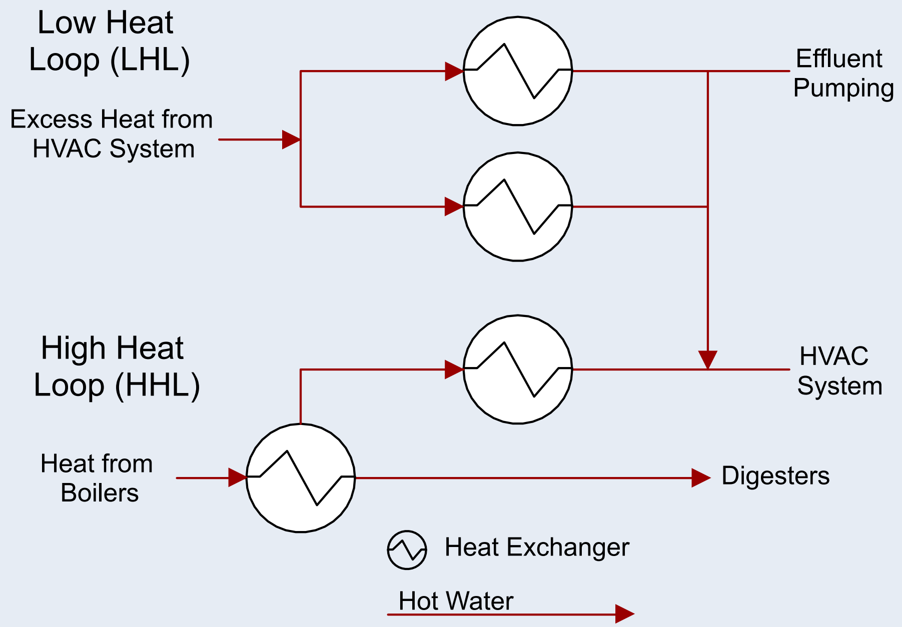
5-Year Summary

Project	Investment ($1,000s)						
	Projected Budget	Cost to Date	2009	2010	2011	2012	2013

O & M Cost Summary

	Cost ($1,000s)				
	2008	2009	2010	2011	2012
Operations	371	401	433	467	505
Maintenance	23	30	30	30	30

Energy Recovery



1. System Profile

Two separate heat loops at the plant recover heat and reuse energy that would otherwise be wasted.

The low temperature heat loop (LHL) recovers low-grade waste heat for heating and cooling uses at the plant. The main heat demand is the plant heating, ventilation, and cooling (HVAC) system. The LHL is the heat source and heat sink for all HVAC equipment. Cooling equipment transfers heat into the loop, whereas heating equipment extracts heat from the loop.

Three heat exchangers are used to thermally balance the system. Two heat exchangers transfer heat to the reclaimed water circuit when there is excess heat. The third exchanger draws heat from the high temperature heat loop. The LHL was originally designed to remove heat from ozone generators and oxygen compressors, neither of which are in service today. Consequently, much of the heat required in this loop must be transferred from the high heat loop.

Sludge heating is the primary purpose of the high temperature heat loop. Other purposes include delivery of heat to the LHL (as needed), and disposal of excess digester gas. The primary heat sources for the high temperature heat loop are the boilers. When the heat supply is greater than the demand, and there is no other use for this energy; the HHL water is directed to a heat exchanger and cooled with reclaimed water.

Purified digester gas, collected from the floating covers, is used to satisfy immediate demands for the boilers. Excess gas is flared off. When demand for digester gas is greater than the supply, natural gas is provided as an auxiliary fuel.

2. Demand Profile and Performance

Peak, Average, and Standby Design Capacities

System Subsystem(s)	Design Capacity	Actual Performance
Hot Water Boilers	2@150 hp	
Emergency Generators	3@400 kW	

3. Failure Mode

Failure Summary

Process	Rating				
	Condition	Capacity	Function	Reliability	Efficiency
Hot Water Boilers	3	2	2	2	3
Emergency Generators	2	2	2	2	2

4. Key Issues for Further Investigation

As part of the co-generation project, the sizing of the planned engine generator should take into account current and future gas production.

5. Current Program

Study

The plant has dual power feeds from Puget Sound Energy and has limited emergency power generation from the emergency generators. A study is planned for 2010 to evaluate installation of an additional 750 kW generator to provide additional power to effluent pumps and UV disinfection.

Planning

A project to utilize digester gas to generate electricity and heat (co-generation) is being planned. The project will be compatible with electrical and heat needs for the new Administrative/Education Center and will be eligible for LEED accreditation.

A project to upgrade the four major substations at the plant – to provide compliance with arc-flash requirements, new breakers, switches, and other components – is planned for 2011.

Design and Construction

TRANE has been hired to design the co-generation project, which will include gas conditioning, installation of a high-efficiency gas generator, and a heat loop system supplying hot water to the new Administrative/Educaton Center building and the planned adjacent Hands On Children's Museum.

Management Strategies

An energy savings performance contract was entered into with the State Department of General Administration to complete the co-generation project.

6. Investment Strategy

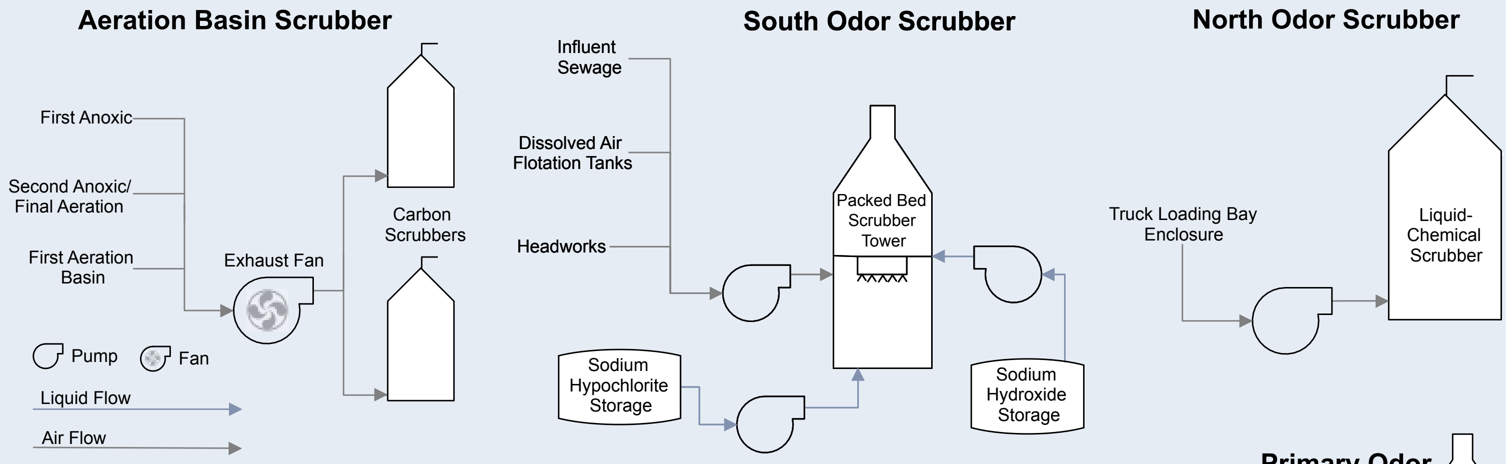
5-Year Summary

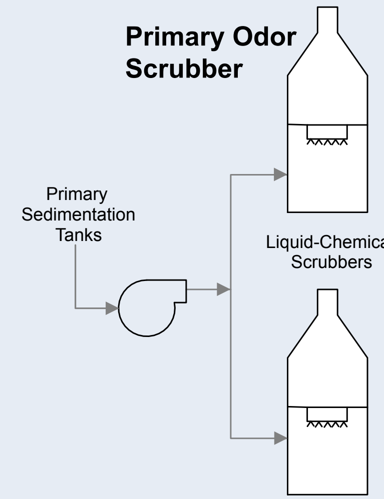
Project	Investment ($1,000s)						
	Projected Budget	Cost to Date	2009	2010	2011	2012	2013
Emergency Power Phase II	2,084						
Co-Generation	2,738	80	1,289	1,369			
Plant Electrical Substation Upgrades	630						
Total	**5,452**	**80**	**1,289**	**1,369**			

O & M Cost Summary

	Cost ($1,000s)				
	2008	2009	2010	2011	2012
Operations	2	2	2	2	2
Maintenance	3	2	2	2	2

Odor Control





1. System Profile

Odor control was incorporated in the first enlargement of the Budd Inlet Treatment Plant in 1979. During the last major expansion, completed in 1994, a majority of the wastewater treatment unit process areas were enclosed to provide foul air treatment. There are four separate foul air treatment systems at the plant; three are chemical wet scrubbers and the fourth is an activated carbon scrubber.

Aeration Basin Scrubber

The largest odor control system consists of two 10-foot diameter, activated carbon bed scrubbers located west of the second anoxic and final aeration basin. This system removes odors from the first aeration basin, first and second anoxic basins, final aeration basin, and the centrate storage tank.

South Odor Scrubber

The south odor scrubber includes a packed bed scrubber tower, exhaust fan, stack, associated ductwork, and chemical feed and storage facilities. Caustic soda is added to raise the pH of the scrubber liquid, which facilitates absorption of hydrogen sulfide, with sodium hypochlorite added to oxidize the absorbed hydrogen sulfide and other odor causing compounds. The south odor scrubber treats foul air collected primarily from the headworks building and the headspace of the south equalization basins. A portion of the foul air collected in the digester building is also routed to the south odor scrubber.

North Odor Scrubber

The north odor scrubber is a liquid-chemical scrubber that was installed in 1984. The north odor scrubber is designed to treat foul air from the solids handling building and the north equalization basins. A portion of the foul air collected in the digester building is also routed to the north odor scrubber.

Primary Odor Scrubber

A pair of liquid-chemical scrubbers operating in parallel provides odor control for the primary sedimentation building. A project to replace these scrubbers will be coordinated with the design and construction of a new primary sedimentation system.

2. Demand Profile and Performance

Peak, Average, and Standby Design Capacities

System Subsystem(s)	Design Capacity	Actual Performance
Activated Carbon Scrubber		
South Scrubber		
North Scrubber		
Primary Scrubber		

3. Failure Mode

Failure Summary

Process	Rating				
	Condition	Capacity	Function	Reliability	Efficiency
Activated Carbon Scrubber	1	1	1	1	1
South Scrubber	1	1	1	1	1
North Scrubber	4	4	4	4	4
Primary Scrubber	4	4	4	4	4

4. Key Issues for Further Investigation

N/A

5. Current Program

Study

Brown and Caldwell completed the Air Handling Study in 2007, which identified deficiencies and proposed improvements.

Planning

Replacement of the north scrubber with new state-of-the-art technology, which will remove odors more effectively and provide better balance of air flows, is planned. The project is coordinated with other work relative to the south scrubber, and air supply fans and ducts. The primary sedimentation scrubber project is scheduled after those projects are completed.

Design and Construction

N/A

Management Strategies

N/A

6. Investment Strategy

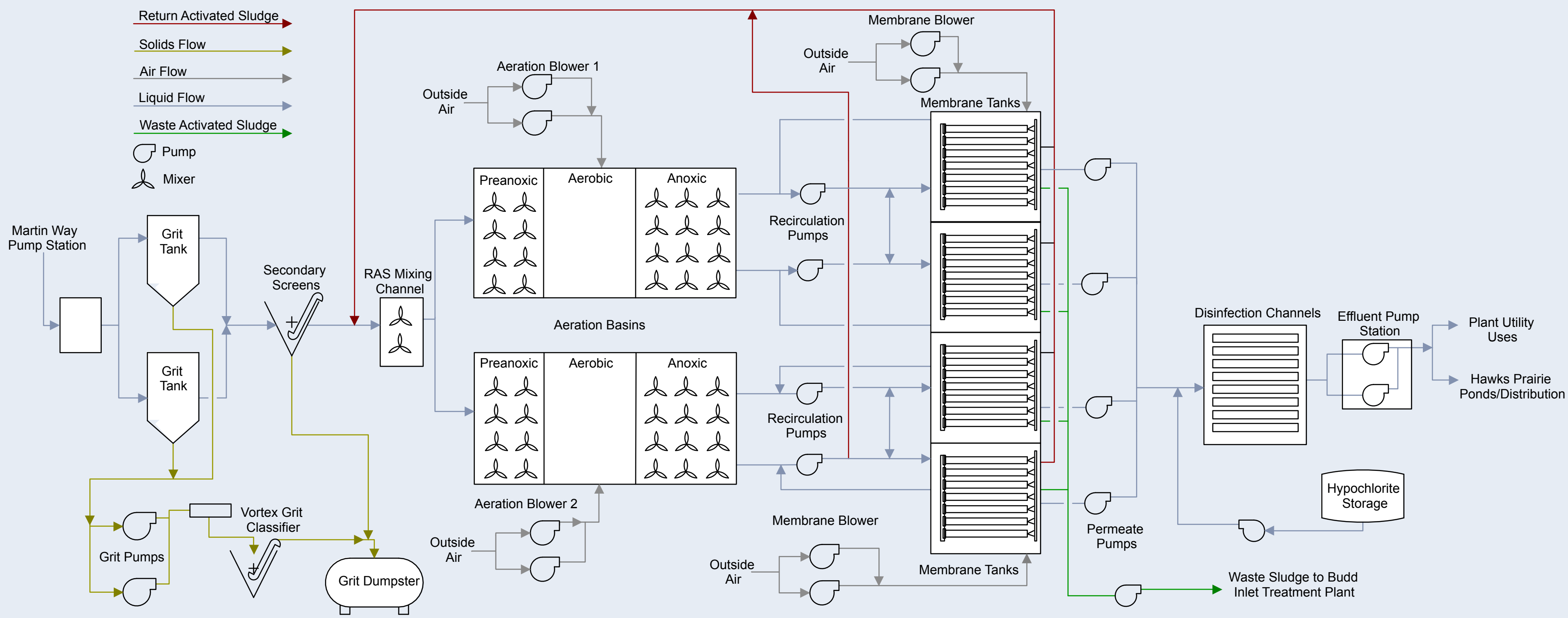
5-Year Summary

Project	Investment ($1,000s)						
	Projected Budget	Cost to Date	2009	2010	2011	2012	2013
North Scrubber	2,668						267
Total	**2,668**						**267**

O & M Cost Summary

	Cost ($1,000s)				
	2008	2009	2010	2011	2012
Operations	52	56	61	66	71
Maintenance	4	5	5	5	6

Martin Way Reclaimed Water Plant



1. System Profile

The Martin Way Reclaimed Water Plant is located at 6121 Martin Way East in Lacey. The facility receives raw sewage flows from the collection system via the Martin Way Pump Station and treats to Class A Reclaimed Water standards.

The Martin Way Pump Station, which includes two perforated escalator screens, acts as the headworks for the Martin Way Reclaimed Water Plant. Screened wastewater is pumped to the plant. The initial treatment processes at the Martin Way Plant are secondary screening and grit removal. Pumps transfer grit collected at the bottom of a grit tank to a classifier where the grit is dewatered.

The plant's biological treatment system is a single sludge aerobic process. Degritted raw sewage is introduced into the anoxic (low dissolved oxygen) zone where bacteria break down nitrate to release oxygen and nitrogen gas (denitrification). In the downstream aerobic zone, wastewater undergoes carbonaceous oxidation and nitrification (conversion of ammonia to nitrate). This process is accomplished by diffusing air into the mixed liquor to provide oxygen to the biological process and also to mix the tank's contents.

Mixed liquor is pumped from the aeration basins to the membrane operating system, located in separate membrane tanks. The mixed liquor is introduced, along with air, evenly across the bottom of the membrane tank. Mixed liquor flows upward through bundles of membrane fibers, creating a cross-flow across the membrane surface that scours the membranes. A low-pressure vacuum on the inside of the membrane fiber pulls clean water (permeate) through the membranes and discharges the filtered water to the disinfection channel. Solids do not pass through the membrane and are retained in the mixed liquor, which is then recycled to the anoxic zone. A portion of the mixed liquor is wasted from the system to maintain the desired solids retention time and the proper microbiology in the treatment process. Wasted sludge is pumped to the Budd Inlet Treatment Plant via the Martin Way Pump Station forcemain.

The disinfection system meters sodium hypochlorite solution (HOCl) into the permeate for disinfection of the reclaimed water. The permeate pumps discharge to the disinfection channel, which provides a detention volume to achieve the required disinfection contact time to meet Class A Reclaimed Water standards. The residence time in the disinfection channel insures that the germicidal reaction between the HOCl solution and organisms in the filtered effluent stream has continued for a sufficient duration to achieve adequate disinfection.

Class A Reclaimed Water flows from the contact channel to the distribution system wet well. Variable speed vertical turbine pumps withdraw water from the wet well and discharge to the reclaimed water distribution system. The Class A Reclaimed Water is routed to the wetland polishing ponds through a 14-inch diameter pressurized forcemain. There are two 4-inch diameter draw-off pipelines connected to the forcemain downstream of the pump station for uses at the Martin Way Plant and at the Martin Way Pump Station.

2. Demand Profile and Performance

Peak, Average, and Standby Design Capacities

System Subsystem(s)	Design Capacity	Actual Performance
Martin Way Reclaimed Water Plant Expansion	2 mgd initial capacity; to 5mgd in 1 mgd increments	1.75 mgd

3. Failure Mode

Failure Summary

Process	Rating				
	Condition	Capacity	Function	Reliability	Efficiency
Martin Way Reclaimed Water Plant	1	2	2	2	2

4. Key Issues for Further Investigation

The Martin Way Plant was originally designed with a maximum buildout capacity of 5 mgd. A hydraulic evaluation of the Hawks Prairie Recharge Basins is currently being conducted to assess whether 8 mgd of recharge is possible.

5. Current Program

Study

If it is determined that the Hawks Prairie Ponds and Recharge Basins are capable of 8 mgd, an evaluation of the Martin Way Plant will be conducted to assess the feasibility of expanding the plant to 8 mgd.

Planning

Plans for providing additional capacity at the plant currently call for the 3rd mgd of capacity to be installed in 2013, the 4th mgd in 2017, and the 5th mgd to be installed in 2020.

Design and Construction

Secondary screening at the Martin Way Plant was installed in July 2008 to improve the removal of fibrous material in the raw sewage that enters the plant.

Management Strategies

Replacement of the membrane filter cartridges is anticipated to be required once every five years, with the first replacement scheduled for 2011.

6. Investment Strategy

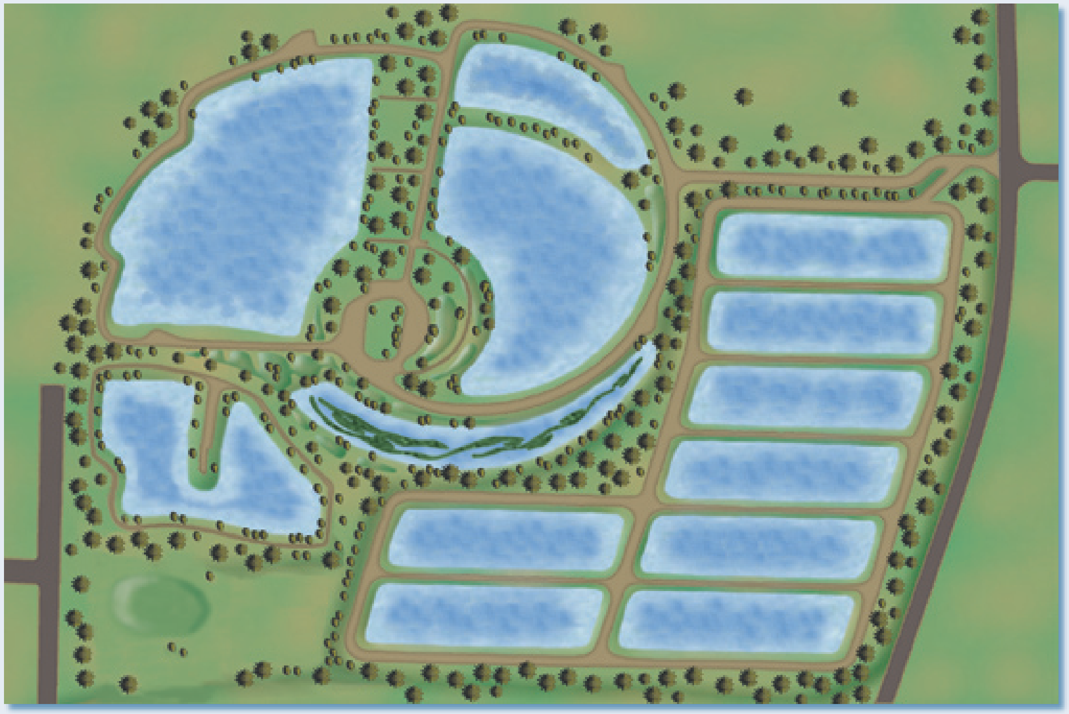
5-Year Summary

Project	Investment ($1,000s)						
	Projected Budget	Cost to Date	2009	2010	2011	2012	2013
Pre-Screening	700	700					
Membrane Replacement	2,400				600		
Total	**3,100**	**700**			**600**		

O & M Cost Summary

	Cost ($1,000s)				
	2008	2009	2010	2011	2012
Operations	78	85	91	99	107
Maintenance	12	13	14	15	16

Hawks Prairie Ponds and Recharge Basins



1. System Profile

Reclaimed water from the Martin Way Reclaimed Water Plant that is not delivered for other beneficial uses is routed to the Hawks Prairie Ponds and Recharge Basins.

The wetland ponds consist of a series of ponds constructed to achieve the necessary hydraulic retention time for the intended pond functions. Class A Reclaimed Water from the Martin Way Reclaimed Water Plant passes through each of the five ponds consecutively in a plug flow manner. Each individual pond has specific functions incorporated into the design. The wetland ponds are lined with bentonite clay to minimize permeability.

The wetland ponds are intended to accomplish four primary objectives:

- Provide public visibility and perceivable disassociation of Class A Reclaimed Water from the treated source wastewater
- Provide passive public recreation and interaction
- Provide isolation capability to prevent below-standard reclaimed water discharge from entering the groundwater
- Provide storage for peak reclaimed water demands

The purpose of the recharge basins is to provide final discharge of Class A Reclaimed Water that has not been utilized by reclaimed water customers. After passing through the wetland ponds, the reclaimed water is infiltrated through the vadose zone into the aquifer via the groundwater recharge basins. Reclaimed water from the last wetland pond flows through a sampling vault prior to entering the recharge basins. Flow to the basins is controlled by automated control valves located on the feed pipelines to each basin.

The recharge basins provide a path for the Class A Reclaimed Water to reach the shallow aquifer in a managed and efficient manner. By infiltrating the Class A Reclaimed Water into the shallow aquifer, the water becomes a renewable resource available to the entire community, and decreases dependence on marine discharge from the Budd Inlet Treatment Plant.

Infiltration into the groundwater helps reduce the decline in groundwater levels during the summer, provides storage for later use, and provides increased flows to surrounding streams during dry periods, protecting stream habitat.

Being a natural system, recharge basins also provide for a finishing treatment mechanism of the highly treated water as it passes through the soil strata (vadose zone) into the groundwater aquifer. The soils filter and condition the water as it moves through the different geologic layers into the aquifer.

2. Demand Profile and Performance

Peak, Average, and Standby Design Capacities

System Subsystem(s)	Design Capacity	Actual Performance
Hawks Prairie Recharge Basins	5 mgd	

3. Failure Mode

Failure Summary

Process	Rating: Condition	Capacity	Function	Reliability	Efficiency
Wetland Ponds	1	1	1	1	1
Recharge Basins	1	1	1	1	1

4. Key Issues for Further Investigation

N/A

5. Current Program

Study

The hydraulic model prepared during the initial construction of the basins is being updated to assess the potential of expanding the infiltration capacity from 5 mgd to 8 mgd.

Planning

N/A

Design and Construction

N/A

Management Strategies

N/A

6. Investment Strategy

5-Year Summary

Project	Investment ($1,000s): Projected Budget	Cost to Date	2009	2010	2011	2012	2013

O & M Cost Summary

	Cost ($1,000s): 2008	2009	2010	2011	2012
Operations	21	23	24	26	28
Maintenance	3	3	3	3	3

System Pump Stations

Martin Way Pump Station

Capitol Lake Pump Station

Kaiser Road Pump Station

1. System Profile

LOTT owns and operates three raw sewage pump stations. Pump stations lift the raw sewage into the conveyance system that ultimately delivers it to the Budd Inlet Treatment Plant and the Martin Way Reclaimed Water Plant.

Martin Way Pump Station

The Martin Way Pump Station is a combined use facility, which conveys wastewater collected from northeast Lacey to both the Budd Inlet Treatment Plant and the Martin Way Reclaimed Water Plant. It also provides odor control and screening of all pump station flows.

The Martin Way Pump Station was renovated in 2003. The station houses four 200 hp pumps, each of which has a design capacity of 6 mgd. Flow is conveyed to the pump station from the east via the 24-inch diameter interceptor (Martin Way Interceptor East), and from the south via a 21-inch interceptor.

Flows of up to 2 mgd are routed to the Martin Way Reclaimed Water Plant, and peak flows above 2 mgd are pumped to the Budd Inlet Treatment Plant.

Capitol Lake Pump Station

The Capitol Lake Pump Station was renovated in 2000. Flow is conveyed to the station by parallel 20- and 22-inch pressurized gravity sewers from Tumwater (Southern Connection) and the 30-inch outlet of the Percival Creek Interceptor.

Kaiser Road Pump Station

The Kaiser Road Pump Station is currently being upgraded and will include three 1 mgd capacity pumps. Flow is conveyed to the pump station from the north via Olympia's Cedrona Pump Station forcemain and from The Evergreen State College via 14-inch gravity pipes. The 10-inch Kaiser Road forcemain conveys flow from the pump station to 14th Avenue.

2. Demand Profile and Performance

Peak, Average, and Standby Design Capacities

System Subsystem(s)	Design Capacity	Actual Performance
Martin Way Pump Station	4.9 mgd annual average; 11.0 mgd peak hour	
Capitol Lake Pump Station Pumps	5@6 mgd	
Kaiser Road Pump Station Pumps	3@1 mgd	

3. Failure Mode

Failure Summary

Process	Rating				
	Condition	Capacity	Function	Reliability	Efficiency
Martin Way Pump Station	2	3	2	2	3
Capitol Lake Pump Station	2	2	2	2	2
Kaiser Road Pump Station	4	4	4	4	4

4. Key Issues for Further Investigation

Potential methods of reducing water usage by the screens at the Martin Way Pump Station were investigated in October 2007.

5. Current Program

Study

A detailed study was completed in 2006 to evaluate improvements to the pumps, surge tank, electrical equipment, and odor control equipment at the Kaiser Road Pump Station.

Planning

System piping upgrades at the Martin Way Reclaimed Water Plant are planned to route reclaimed water to the Martin Way Pump Station for wash down of the escalator screens.

Design and Construction

The Kaiser Road Pump Station upgrade will be completed in 2009.

Management Strategies

N/A

6. Investment Strategy

5-Year Summary

Project	Investment ($1,000s)							
	Projected Budget	Cost to Date	2009	2010	2011	2012	2013
Kaiser Road Pump Station Improvements	2,254	471	1,605	178			
Total	**2,254**	**471**	**1,605**	**178**			

O & M Cost Summary

	Cost ($1,000s)				
	2008	2009	2010	2011	2012
Operations	31	34	37	39	43
Maintenance	60	70	76	82	88

Collection and Distribution Piping

1. System Profile

The LOTT Alliance owns over 28.6 miles of pipelines. The system includes 18.9 miles of gravity sewer, 5.7 miles of pressurized forcemains, and 4 miles of reclaimed water pipelines. In total, the system comprises 563 inch-diameter-miles of pipe. Approximately 50% of LOTT pipes are concrete, 9% are ductile iron, 25% are PVC, and 16% are HDPE. The LOTT pipes range in size from 10 to 60 inches in diameter.

Collection System Piping

Martin Way Interceptor (East)
This gravity pipeline runs from Marvin Road to the Martin Way Pump Station, ranging in size from 18 to 24 inches.

Martin Way Interceptor (West)
This gravity pipeline runs from Sleater-Kinney Road to Devoe Street and ranges in diameter from 30 to 36 inches.

Indian Creek Interceptor
This interceptor collects flow from the Martin Way Interceptor, and runs to downtown Olympia at East Bay Drive and I-5. Size varies from 24 to 36 inches.

Plum Street Interceptor
This line collects flow from northeast Tumwater, and the east side of downtown Olympia. Size ranges from 24 to 42 inches.

Cherry Street Interceptor
The Cherry Street Interceptor collects flow from the Indian Creek Interceptor and much of downtown Olympia. Size ranges from 36 to 48 inches.

Chestnut Street Interceptor
This interceptor is an overflow pipeline, which relieves the Cherry Street Interceptor at Union Avenue. Size ranges from 36 to 48 inches.

State Avenue Interceptors
A series of large diameter pipes collect flow from the Plum, Cherry, and Chestnut Street Interceptors, plus the remaining portions of downtown Olympia. A 60-inch pipeline carries those flows to the Budd Inlet Treatment Plant.

Cooper Point Interceptor
This gravity pipeline runs from 14th Avenue NW to 21st Avenue SW, crossing Highway 101 near its outlet. Size ranges from 12 inches, north of Capital Mall Boulevard, to 21 inches in the portion to the south.

Percival Creek Interceptor
This 24- to 30-inch pipeline runs from RW Johnson Road to the Capitol Lake Pump Station on Deschutes Parkway.

Southern Connection
A 22-inch HDPE pipe runs from a diversion structure at the southern end of Tumwater Falls Park to the Capitol Lake Pump Station.

Kaiser Road Forcemain
This 10-inch forcemain conveys flows from the Kaiser Road Pump Station to the Cooper Point Interceptor.

Martin Way Forcemain
The 18-inch forcemain conveys flows from the Martin Way Pump Station to the Indian Creek Interceptor.

Capitol Lake Forcemains
These 20-inch (north) and 24-inch (south) forcemains connect the Capitol Lake Pump Station to downtown Olympia and the Budd Inlet Treatment Plant.

Reclaimed Water Distribution Piping

Reclaimed water pipelines are designed to convey a fixed flow, either to another LOTT facility, a purveyor, or to a recharge site. Class A Reclaimed Water produced at the Martin Way Reclaimed Water Plant is pumped through the Hawks Prairie Pipeline to the Hawks Prairie Ponds and Recharge Basins via a 14-inch ductile iron pipeline. A portion of the reclaimed water generated at the Budd Inlet Treatment Plant is pumped through the Downtown Olympia Pipeline to Heritage Park and Marathon Park for irrigation use via a 10-inch line.

2. Demand Profile and Performance

Peak, Average, and Standby Design Capacities

System Subsystem(s)	Design Capacity	Actual Performance
Martin Way Interceptor (East)	17 mgd	
Martin Way Interceptor (West)	28 mgd	
Indian Creek Interceptor	56 mgd	
Plum Street Interceptor	35 mgd	
Cherry Street Interceptor	52 mgd	
Chestnut Street Interceptor	28 mgd	
State Avenue Interceptors	52 mgd	
Grass Lake Interceptor	5 mgd	
Cooper Point Interceptor	37 mgd	
Percival Creek Interceptor	32 mgd	
Southern Connection	12 mgd	
Kaiser Road Forcemain	2.4 mgd	
Martin Way Forcemain	8 mgd	
Capitol Lake Forcemains	24 mgd	
Hawks Prairie Pipeline	5 mgd	
Downtown Olympia Pipeline	3 mgd	

4. Key Issues for Further Investigation

N/A

5. Current Program

Study

The sewer system capacity is evaluated annually through flow monitoring and sewer modeling in order to update flow projections.

Planning

Sewer modeling projects capacity limitations in the Martin Way Interceptor (East) in the period 2020 - 2030. Design project to install a 10,000 feet of parallel pipeline is planned (East Corridor Upgrade).

3. Failure Mode

Failure Summary

Process	Rating				
	Condition	Capacity	Function	Reliability	Efficiency
Martin Way Interceptor (East)	2	3			
Martin Way Interceptor (West)	1	1			
Indian Creek Interceptor	2	2			
Plum Street Interceptor	2	1			
Cherry Street Interceptor	2	2			
Chestnut Street Interceptor	2	1			
State Avenue Interceptors	2	2			
Grass Lake Interceptor	3	1			
Cooper Point Interceptor	1	2			
Percival Creek Interceptor	2	1			
Southern Connection	1	1			
Kaiser Road Forcemain	4	3			
Martin Way Forcemain	1	1			
Capitol Lake Forcemains	1	1			
Hawks Prairie Pipeline	1	1			
Downtown Olympia Pipeline	1	2			

Design and Construction

The Kaiser Road forcemain was replaced in 2008.

Management Strategies

The Capital Improvements Plan includes the ongoing Interceptor and Manhole Inspection and Rehabilitation Project for regular inspections using closed circuit TV, and completing minor repairs where needed.

6. Investment Strategy

5-Year Summary

Project	Investment ($1,000s)						
	Projected Budget	Cost to Date	2009	2010	2011	2012	2013
Southern Connection Line Abandonment	142						71
Percival Creek Interceptor	4,132	918					651
Kaiser Road Forcemain Replacement	1,550	1,535	15				
Indian Creek Interceptor	606	20	26	400	160		
Interceptors Inspection and Rehabilitation	2,250	54	110	119	128	139	150
East Corridor Upgrade	4,152						126
Flow Monitoring	3,000	84	166	179	193	209	225
Total	**15,832**	**2,611**	**317**	**698**	**481**	**348**	**1,223**

O & M Cost Summary

	Cost ($1,000s)				
	2008	2009	2010	2011	2012
Operations					
Maintenance					

LOTT Alliance

Cleaning and restoring water for our community

500 Adams Street NE, Olympia, WA 98501
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