CHAPTER 8 ASSET MANAGEMENT

Much of the public drainage infrastructure in Bellevue has already been built; as a result, the current management emphasis is on maintaining, repairing, rehabilitating, and replacing the existing system. An asset management program has been established, which is developing a systematic approach to the management of Bellevue's drainage infrastructure. The objective of this program is to manage Bellevue's drainage infrastructure assets in a sustainable manner through their life cycles, from planning through decommissioning, in order to meet the Utilities Department's service level goals while optimizing costs and minimizing risk.

Asset Management Program Structure

The Utilities Department's asset management program is modeled after the asset management program framework developed by the U.S. Environmental Protection Agency (USEPA). USEPA's framework addresses five core questions:

1. What is the current condition of the assets?
2. What are the target levels of service these assets are intended to provide?
3. Which assets are critical to sustaining performance?
4. What capital investment plan and operations and maintenance strategies provide the target service levels at the lowest life cycle cost?
5. What is the best long-term funding strategy?

To address these questions, the USEPA identified the ten processes shown in Figure 8-1. These ongoing processes are not necessarily performed sequentially and involve iterating between processes. Each of these processes is described in more detail below.

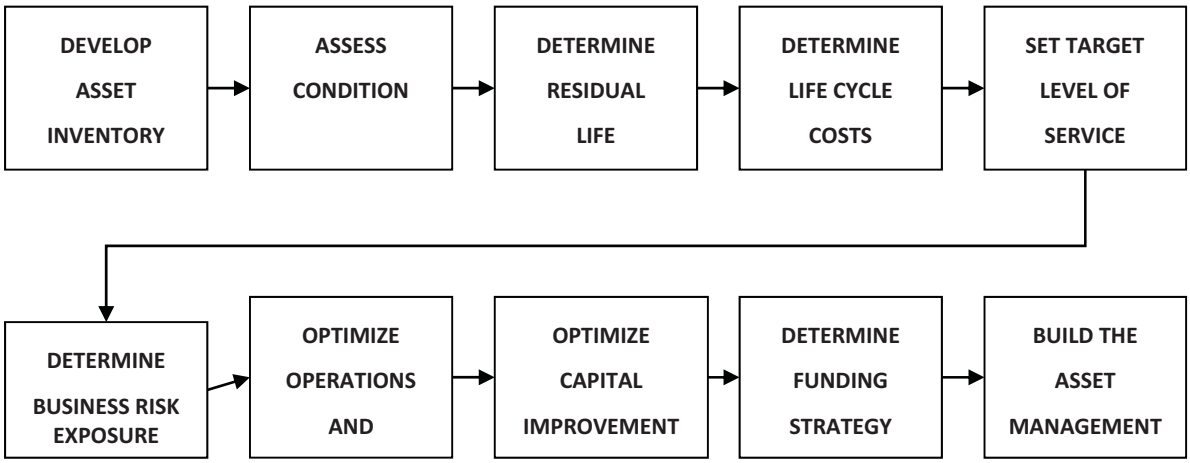

Figure 8-1. USEPA Asset Management Program framework processes.

Develop Asset Inventory

Asset management depends on having an accurate asset inventory and knowing the characteristics of those assets. Asset characteristics such as age, size, and material are needed to plan future asset management activities and schedules. Much of Bellevue's drainage infrastructure was installed prior to Bellevue's incorporation; as a result, a large portion of the infrastructure did not have as-built drawings, either because they were never created or were no longer available to be turned over to the City when

the Storm and Surface Water Utility was established in 1974. Consequently, some infrastructure asset characteristics are unknown. For example, the installation date is known for only approximately 25 percent of the drainage pipes. Because each property has an obligation to accept and convey surface water drainage to and from the property, the drainage system for the city is a mix of publicly and privately owned infrastructure. Drainage system assets outside the right-of-way are the responsibility of the property owner, unless there is legal documentation that they are the responsibility of the City.

The Utilities Department's drainage system asset databases are updated when new construction is completed, and when operations and maintenance staff notice discrepancies between asset records and their field observations. Redline drawings made by field staff are used to update the as-built record drawings. The data from the as-built record drawings are electronically pushed to Maximo, the Utilities Department asset data management system. The estimated number of known drainage utility assets owned by Bellevue Utilities is summarized in Table 8-1. Drainage pipelines are shown in Figure 8-2. As of 2010, the average public asset age is estimated to be 35 years old.

Table 8-1. Public Drainage Asset Summary.

Infrastructure Asset Type	Estimated Number of Assets[2]
Drainage Pipelines[1] (miles)	400 ±
Regional Detention Facilities	11
Detention Ponds	129
Detention Vaults	189
Detention Tanks	325
Oil/Water Separators (coalescing plates)	39
Water Quality Media Filters	15
Catch Basins/Inlet/Manhole Structures	21,000 ±
Rain Gauges	11

[1] Excludes ditches
[2] Number of assets is a raw count of individual assets determined with a Maximo database query.

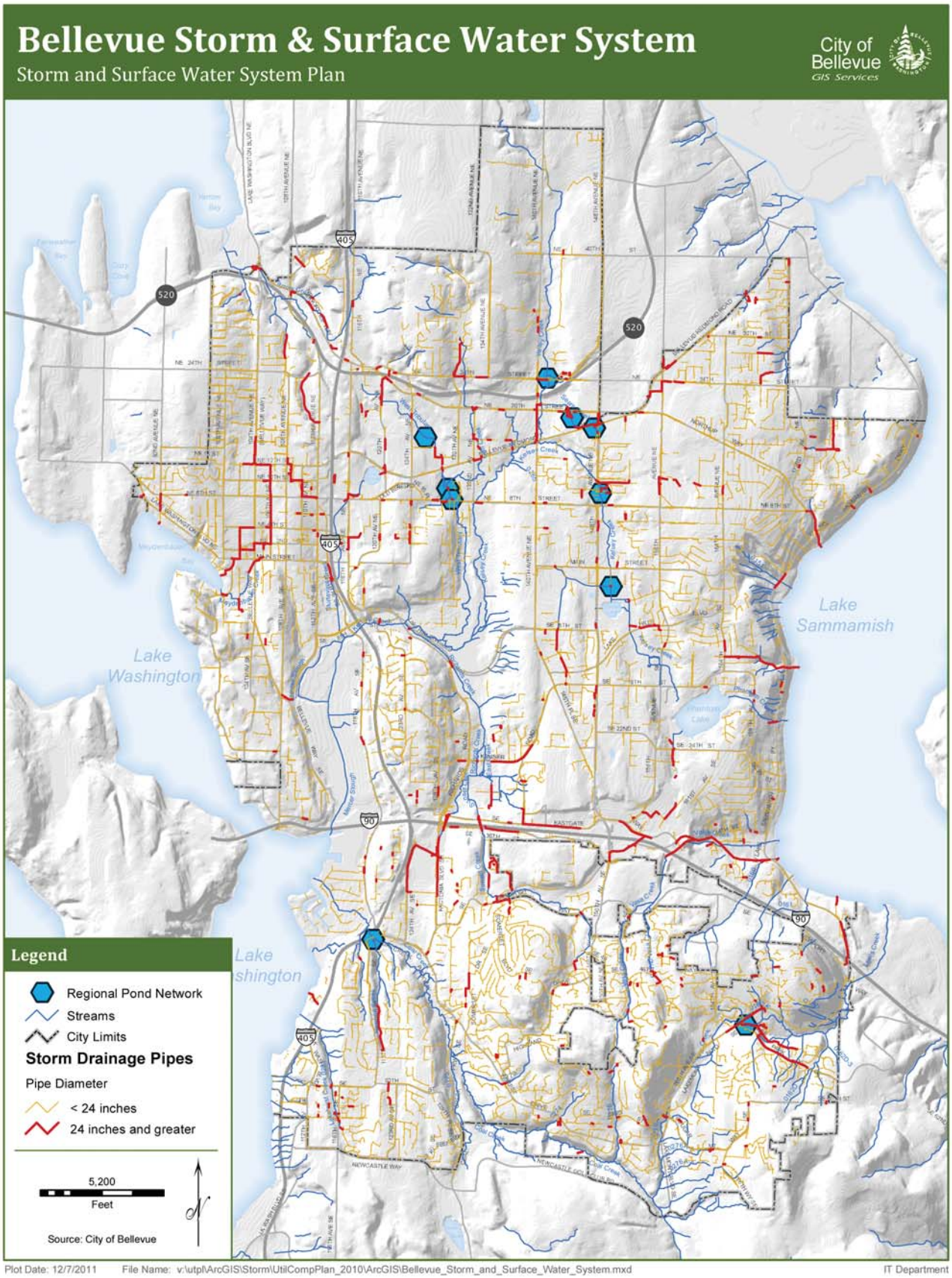

Figure 8-2. Bellevue's municipal storm and surface water conveyance system, including streams and most of the piped public drainage system.

Assess Condition

Asset condition is one of the necessary pieces of information needed to make asset management decisions. Condition information is used to determine how an asset should be operated and maintained, to estimate the probability of asset failure, and to predict future resource needs for rehabilitating or replacing an asset. Condition assessment data are currently being used to identify repairs and replacements that are needed.

Drainage asset condition assessment is performed by the Utilities Department's Operations and Maintenance Division staff as part of their normal responsibilities and completed through programs dedicated to conveyance facility inspection. Closed circuit television inspection is performed for approximately 2 percent of the Utilities Department's drainage pipes each year. In 2003, a consultant recommended that 10 percent of the system should be videotaped each year. However, the Utilities Department decided that 2 percent of the system was a more appropriate target given that resources are limited and because the relatively few drainage pipe failures detected by closed circuit television inspection do not have severe failure consequences similar to those associated with pressurized water and sewer main failures.

The highest priority for inspection is given to drainage pipes in arterial streets where planned capital projects such as street overlays are anticipated, drainage pipes that are critical to system performance, and drainage pipes that are suspected of being in very poor condition. In the future, drainage pipe videotape records will be better organized so that the length is identified for critical and non-critical pipes that have been videotaped.

Additionally, a culvert inspection program is being initiated so that culverts are inspected on a regular cycle. These inspections will assess both culvert condition and potential culvert failure consequences.

Determine Residual Life

An estimate of each asset's remaining useful life is needed so that future resources needed to rehabilitate or replace it can be estimated. The remaining useful life estimate may also be indicative of the asset's current reliability.

For long-range planning purposes, the remaining useful life of the Utilities Department's drainage pipes is primarily based on a 2003 consultant study recommendations. This study recommended using a survival curve with a median drainage pipe life expectancy of 75 years. Although this curve may be representative of the Utilities Department's drainage pipelines as a whole, significant variation between the different types of drainage pipe is expected. Factors affecting residual life can include the asset's material, bedload, water velocity, and age. For example, many of the Utilities Department's corrugated metal drainage pipes will likely need to be rehabilitated or replaced before they are 50 years old because many have already begun to fail, while concrete and PVC pipes may last well beyond 100 years. In order to better predict drainage pipe rehabilitation and repair needs, a more detailed analysis will need to be conducted.

In the short term, significant renewal and replacement expenditures are not expected for the other public drainage assets such as detention ponds. These assets will eventually require renewal and replacement. Preliminary estimates of these resource requirements are included in the long-range financial plan.

Determine Life Cycle Costs

Asset total life cycle costs, which include all costs from planning and design through decommissioning, are used to help evaluate alternative strategies for constructing, operating, maintaining, and replacing assets. The Utilities Department is currently formalizing its life cycle cost analysis procedures. Triple-bottom-line costs and benefits (economic, environmental, and social) are considered in the analysis. Life cycle cost analyses will be used to help evaluate drainage asset repair, rehabilitation, and replacement alternatives.

Set Target Level of Service

In order to know whether assets are performing satisfactorily, the service levels those assets are expected to provide must be defined. Asset management decisions and the resulting asset performance must be consistent with the service levels that are required by regulatory agencies and determined by the Utilities Department to be acceptable to its customers. When asset management decisions are made, only those options that would satisfy service level requirements should be further considered. Because resources are limited, it may sometimes be necessary to adjust service level goals to be compatible with resource availability.

Target service levels related to drainage assets are currently being developed based on adopted performance measures, but these have not yet been finalized. One performance measure being considered for developing target service levels is the number of claims paid each year due to drainage system failures.

Determine Business Risk Exposure

Risk is defined as the probability of failure multiplied by the failure consequences. Failure probability is estimated on a number of factors such as asset condition, age, type, characteristics, and failure history. Asset criticality is based on the potential adverse economic, environmental, and/or social impacts of drainage system failure.

Together with life cycle costs, the risk of asset non-performance is also needed to help evaluate asset design and construction, as well as operations, maintenance, and replacement strategies.

Risk is a function of asset condition, performance history, and asset criticality. An assessment of the risk for critical drainage pipe is underway. Critical drainage pipes will be identified by more completely incorporating all anticipated failure consequences. These consequences will be expressed in terms of expected monetary loss in order to calculate risk, prioritize asset rehabilitation and replacement needs, and quantify benefits used in life cycle cost analyses. Culvert criticality is currently being evaluated. In addition, a failures and claims analysis is completed annually to look for trends in the system that help prioritize where limited resources should be allocated. In the future, criticality will be defined for other drainage infrastructure.

Optimize Operations and Maintenance

Optimization of operations and maintenance programs is another activity that enables the Utilities Department to cost effectively reach service level targets. Under-expenditure of operations and maintenance resources can result in more failures and the inability to reach service level goals, while over-expenditure can result in wasteful resource allocation. In addition to developing the most appropriate levels of operations, maintenance, and repair of existing assets, operations and maintenance must be balanced against rehabilitation and replacement by considering the least overall life cycle cost.

Establishing appropriate capital projects and programs and appropriate operations and maintenance funding levels is dependent upon the following:

- Service level targets;
- Asset condition and remaining life;
- Asset criticality and failure consequences; and
- Life cycle cost comparison and available resources.

Work planning is used to estimate operations and maintenance resource investments each year. Operations and maintenance strategies are continually being evaluated and revised as appropriate. Stormwater maintenance standards were published in 2010.

Optimize Capital Improvement Program

Assets eventually wear out to the point where they need to be rehabilitated or replaced. Ideally, an asset should be rehabilitated or replaced when the life cycle costs for continuing to operate and maintain that asset in a condition that is consistent with the service level goals exceeds the rehabilitation or replacement life cycle costs. A capital improvement program that is consistent with these goals is necessary.

The Utilities Department's Capital Investment Program (CIP) Plan is updated every 2 years as part of the biennial budget process. The Utilities Department maintains a 75-year long-range budget forecast for the CIP Plan. Every 2 years, capital investment needs for the next 75 years are forecasted. These forecasts are based on the expected remaining useful life of the Utilities Department's assets.

The most recent emphasis has been on maintaining existing facilities and doing point repairs (repairs done at a single location as opposed to rehabilitating or replacing a continuous length of pipe) as needed. Because some drainage assets such as corrugated metal pipe and culverts can fail in as little as 25 or 30 years after they are built and the average drainage asset age in Bellevue is 35 years, rehabilitation and replacement needs are expected to start increasing in the near future.

Determine Funding Strategy

Financial resources are needed to design, construct, operate, maintain, and rehabilitate or replace assets. The Utilities Department operates primarily on a "pay-as-you-go" basis. Because much of the drainage system was constructed in a relatively short period of time within the past 25 or 30 years, eventual rehabilitation and replacement of the drainage system will cause resource needs to rapidly rise, peak, and then decline. The 75-year capital improvement needs forecast enables the Utilities Department to determine long-term funding needs and develop strategies for meeting those needs. A renewal and replacement fund has been established so that sudden rate spikes can be avoided when resource requirements begin to increase.

Build the Asset Management Program

More efficient asset management strategies and technologies are constantly being refined and developed. In order to optimize asset management, the most cost-effective strategies and technologies should be employed. Every 5 years the asset management program plan is revisited and revised, as necessary.

New technologies are evolving for drainage pipeline and structure rehabilitation and repair. These technologies and methodologies will be evaluated and incorporated, when appropriate.

Asset Management Program Relationship to the NPDES Program

The asset management program complements Bellevue's National Pollutant Discharge Elimination System (NPDES) Municipal Stormwater Permit. NPDES permit requirements include provisions for inventorying and monitoring the operations, maintenance, and performance of stormwater assets. Consequently, the asset management program and NPDES program share many of the same goals and objectives. Additionally, the NPDES requirements stipulate stormwater collection and discharge requirements such as minimum acceptable water quality. These NPDES requirements become part of the asset management program service level requirements.

Recommendations

To ensure resources are available for cost-effective, risk-managed asset replacement, it is recommended to:

1. Continue to visually inspect critical stormwater pipes (via closed-circuit television) at an appropriate rate, currently about 2 percent of the Utilities Department's drainage pipes each year.
2. Identify and inventory each drainage asset and estimate its remaining useful life so that future resources needed to rehabilitate or replace it can be determined.
3. Determine life cycle cost of each asset.
4. Develop short- and long-range resource needs projections based on the condition assessment program. Ensure resources are available for cost-effective, risked-based asset management and replacement by continuing to fund the renewal and replacement program at a level that is adequate to meet the Utilities Department's long-range financial goals.
5. Continue with the proactive maintenance program.
6. Continue to improve the stormwater asset management program by collecting inventory information and supporting an ongoing condition assessment program.
7. Develop the resource demand forecast to ensure that existing customer service levels are maintained as the system ages.
8. Continue to invest in capital programs and projects so critical facilities such as large diameter pipes and culverts conveying streams are repaired or replaced prior to failure (e.g., investments in the Stormwater System Conveyance Infrastructure Rehabilitation [D-64] project, and the replacement of the Coal Creek Culvert at Coal Creek Parkway [D-103] project).