Drinking Water Asset Management Grant 2016

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DEPARTMENT OF ENVIRONMENTAL CONSERVATION

DRINKING WATER CAPACITY DEVELOPMENT PROGRAM

Helping water systems improve their technical, managerial, and financial capabilities

Grant Overview

The Department of Environmental Conservation's Drinking Water Capacity Development and State Revolving Fund Programs are offering grants to help public community water systems develop Asset Management Programs. Vermont's public drinking water systems are vital to the health, safety, and economies of our communities. And the managers and operators of these systems face significant challenges as they try to provide their customers a sufficient amount of safe, affordable water. Challenges include managing, repairing, and replacing aging and inadequate infrastructure; achieving financial viability; recruiting and retaining qualified staff; responding to emergencies; documenting the knowledge of staff about to retire; overcoming resistance to rate increases; and complying with new and more stringent regulations. An Asset Management Program can help meet these challenges. An effective program uses asset inventories, life-cycle cost analyses, risk assessments, and financial planning to set priorities and help meet level of service goals in a cost-effective manner.

An Asset Management Program can help you:

- ***Increase knowledge about your assets***
- ***Operate more efficiently***
- ***Improve customer service***
- ***Prolong asset life***
- ***Plan and pay for future repairs and replacements***
- ***Set priorities and justify system needs***

To help systems develop an Asset Management Program, we will provide about $400,000 in grants. The maximum grant award will be $20,000 per system, with a required 20% in-kind match of total project costs. We expect systems that receive a grant to develop a plan, or portions of a plan, that will be the framework for an Asset Management Program. The plan should be designed to address the system's greatest need or challenge. Systems that already have a formal Asset Management Program may use this grant opportunity to further their efforts. Those without a formal program may use the grant to start one. Regardless, systems should use existing resources (e.g., maps, staff knowledge, as-built drawings, operation and maintenance manuals, hydraulic models, etc.) to help develop the plan.

All water systems can benefit from developing an Asset Management Plan. But the plan is not an endpoint. To get all of the benefits from Asset Management, everyone involved with the system - elected officials, managers, operators, engineers, and administrative staff - must use Asset Management tools and practices on a daily basis.

Grant Time Line

Important Dates

Release date: March 4th, 2016
Compliance consultation (see below): April 15th, 2016
Application deadline: April 29th, 2016 at 4PM
Award decisions: early May, 2016
Executed agreements: early June, 2016
Project progress report due date: August 26th, 2016
Final deliverables due date: December 30th, 2016

If you have questions regarding this grant opportunity, please contact Kimberley McKee by 4PM Friday, April 22nd, 2016 (kimberley.mckee@vermont.gov or 802-477-3349).

Eligibility Requirements and Award Information

- Public community drinking water system owners are eligible to receive a grant.
- The maximum grant award will be $20,000 per system (minimum of $10,000). We plan to award about $400,000.
- Grant recipients must provide at least a 20% in-kind match of the total project cost (e.g., a $20,000 grant requires an in-kind match of at least a $5,000, with total project costs of at least $25,000).
- Eligible Asset Management activities include:
  - Developing Level of Service Goals and Performance Measures
  - Creating an Asset Inventory and Assessing the Condition of Assets
  - Mapping Assets
  - Analyzing Asset Life Cycle Costs
  - Conducting a Risk Assessment to Identify Priority Assets
  - Developing Risk and Life Cycle Cost Reduction Measures; and
  - Creating Funding Strategies
- The use of outside services (e.g. consultants to help with condition assessment) are eligible for funding with this grant. However, software and equipment purchases are not eligible. Eligible services must be procured after the grant has been issued and completed by December 30th, 2016.
- ***Applicants must consult with the Drinking Water Capacity Program before submitting an application to ensure that the proposal addresses any compliance issues with state and federal drinking water requirements. Please contact Jim Siriano by Friday, April 15th, 2016, to schedule a telephone consultation (phone: 802-585-4889 or email: jim.siriano@vermont.gov) .***
- Grants will be awarded on a competitive basis (see ranking criteria on page 5).
- ***Applications must be emailed to Kimberley McKee (kimberley.mckee@vermont.gov) by 4 PM on Friday, April 29th, 2016.***
- ***Grantees must submit a project progress report by August 26th, 2016 and final deliverables December 30th, 2016.***

Eligibility Requirements and Award Information - Continued

- Grant monies are from the Environmental Protection Agency's Drinking Water State Revolving Fund's Local Assistance Set-Aside.

Federal Award Information:

CFDA Title - Safe Drinking Water State Revolving Fund
CFDA Number - 66-468
Award Name - DWSRF
Award Years - 2013 and 2014
Federal Granting Agency - EPA
Research and Development Grant - No

Grant Selection Process

A team of staff members from the Drinking Water Capacity Development and State Revolving Fund Programs will review and score applications using the criteria below. Grants will be awarded on a competitive basis using the scores, so systems with an application that receives a high score will be more likely to get a grant. ***Applicants are encouraged to include all components of an Asset Management Plan in their project scope, but are not required to do so.*** When ranking applications, points will be awarded for each component included in the project scope.

Proposal Scoring Criteria

Proposal Component	Maximum Points
Project Scope - Statement of Problem and Desired Outcome	10
Asset Management Program Team Qualifications and Implementation Plan	10
Level of Service Agreement with Goals and Performance Measures	10
Asset Inventory and Condition Assessment	15
Map of Assets	15
Life Cycle Cost Analyses	10
Risk Assessment to Identify Priority Assets	10
Risk and Life Cycle Cost Reduction Measures	10
Funding Strategies	5
Budget	5

Grant Application Submittal Instructions

Before submitting an application, systems must consult with the Drinking Water Capacity Program to ensure that the proposal addresses any compliance issues with state and federal drinking water requirements. Contact Jim Siriano by ***Friday, April 15th, 2016*** (phone: 802-585-4889 email: jim.siriano@vermont.gov) to schedule a telephone consultation.

The grant application (see page 7) must be ***submitted via email to Kimberley McKee (kimberley.mckee@vermont.gov) by 4 PM on Friday, April 29th, 2016.*** Please read the Asset Management Planning Grant Guidance (see page 16) before completing the application and be sure that your submittal:

- Clearly defines the need or challenge that you want to address with an Asset Management Program;
- Explains why it's your greatest need or challenge and the outcome you expect to achieve;
- Identifies which portions of the an Asset Management Plan will be developed under the grant;
- Has a realistic work plan and budget; and
- ***Includes a certificate of insurance indicating that the entity or entities have met the insurance requirements listed in Attachment C, and a completed Risk Assessment Questionnaire (see attachments)***.

If you have questions regarding the grant application, please contact Kimberley McKee by email or phone (802) 477-3349 by ***Friday, April 22nd, 2016.***

Confidentiality Notice:

After conclusion of the Request for Proposal process, responses are a matter of public record. If an application includes material considered by the applicant to be proprietary and confidential under 1 V.S.A., Chapter 5, the application shall clearly designate the material as such and explain why such material should be considered confidential. The Vendor must identify each page or section of the response that it believes is proprietary and confidential with sufficient grounds to justify each exemption from release, including the prospective harm to the competitive position of the applicant if the identified material were to be released.

Under no circumstances shall the entire response be designated as proprietary or confidential. If the Vendor marks portions of the response confidential, the Vendor shall provide a redacted version of the response for release to the public. Notwithstanding the above, the Secretary has an independent obligation under Vermont law to determine whether any proposal material is subject to public inspection and copying upon request, which may include material that has otherwise been designated as proprietary and confidential by the Vendor. The Vendor's designation of material as proprietary and confidential, and submission of a redacted response, are provided to the Secretary for informational purposes in the event the Agency receives a public records request and will not result in withholding of materials by the Secretary unless expressly supported by Vermont law.

Asset Management Grant Application

Complete the application by filling in the text boxes. You may submit the required information in a separate file (e.g., Word document), instead of using this form. Please read the Asset Management Grant Guidance (see page 17) before completing the application.

1) General Information

Water System Name:

WSID #: Owner:

Contact Person: Title:

Telephone Number: Email Address:

Other individuals involved in preparation of the proposal:

Grant Amount Requested:
(Minimum $10,000
Maximum $20,000)

Total Project Cost*:
(include 20% in-kind match of total project cost)

*** - Must match Total Project Costs for all tasks from page 16***

Organization's fiscal year (e.g., Jan 1 - Dec 31):

Water System Owner - please type your initials and the date in the spaces below indicating that you have read the following statement:

The applicant is aware that 1) they will need to agree to the State of Vermont Customary Contract Provisions (Attachment C) and Environmental Protection Agency Standard Terms and Conditions for Federal Sub-recipients (Attachment D) to execute an agreement for this project; and 2) in executing a grant agreement they will need to fulfill the Good Faith Efforts to ensure that disadvantaged business enterprises (Minority Business Enterprises/Womens' Business Enterprise) have the opportunity to compete for procurements funded by this grant (see page 16 and Attachment D).

Water System Owner Initials

Date

2) Project Scope

The project scope must include: 1) a brief overview of the water system; 2) a description of the need or challenge you want to address with an Asset Management Program; and 3) the anticipated outcome.

3) Asset Management Team Qualifications and Implementation Plan

Please list ***1)*** the system's Asset Management Team members (e.g., staff, board members, and consultants), their qualifications (e.g., occupation, education, experience, or training for assigned duties), and the tasks they will work on; ***2)*** a schedule outlining milestones for each tasks and when the milestones will be completed; ***3)*** a description of how the system will record time spent on grant activities, and the hourly rates that will be used to determine the required match (see page 17 for information about rates for volunteers); and ***4)*** how frequently the system will review and update the Asset Management Plan.

4) Activities to be Completed

Provide the required information for each proposed task to be completed under the grant. Applicants will only receive points for tasks that they propose to complete under the grant (see Proposal Scoring Criteria on page 5).

Developing a Level of Service Agreement with Goals and Performance Measures

- *Describe who and how (i.e., the process) the Level of Service Goals (external and internal), performance measures, and procedures for measuring success will be developed.*

Creating an Asset Inventory and Assessing the Condition of Assets

Describe:

- *The format that the inventory will be kept in (e.g., generic spreadsheet or database, Asset Management Software Program);*
- *The criteria to identify which assets will be included in the inventory (e.g., all assets, assets with a replacement cost of $1,000 or more, assets in the treatment building);*
- *How the condition of the assets will be assessed; and*
- *Who will maintain and update the inventory over time.*

Activities to be Completed Continued…

Mapping Assets

- *Identify which assets will be mapped (e.g., all distribution mains and appurtenances); and*
- *Describe the mapping protocol (e.g., who will create the maps, how data will be collected, map format, etc.), how staff will have access to the maps, and how the maps will be kept current.*

Analyzing Asset Life Cycle Costs

- *Describe the activities related to life cycle cost analyses that will be conducted (e.g., setting up a way to track expenditures on existing assets, estimating the future costs of owning assets, and/or comparing costs of different options for a capital improvements project).*

Activities to be Completed Continued…

Conducting a Risk Assessment to Identify Priority Assets

- *Describe how the system will assess and rate the consequences of failure, probability of failure, and overall risk for assets to identify priorities.*

Activities to be Completed Continued…

Developing Risk and Life Cycle Cost Reduction Measures

- *Describe what activities related to Risk and Life Cycle Cost Reduction Measures will be completed (e.g., reviewing and revising water system policies and ordinances; developing or updating schedules to operate, maintain, repair, rehabilitate, and replace assets; preparing a capital improvements plan).*

Creating Funding Strategies

- *Identify which funding strategies will be completed (i.e., developing a five year budget, reviewing existing rate and fee structures, and/or identifying and comparing financing options for capital improvement projects).*

5) Budget

In the table below, provide an itemized budget by task proposed to be completed under the grant. Any work to be contracted to a third party/project partner should be included in the "contractual" line item. For all amounts in the "contractual" line items, please provide additional budget detail in an attachment to this application. If a grant is awarded, all match information provided in the itemized budget will be required to be documented at the close of the project. The system will be required to submit a deliverable(s) to demonstrate completion of each task (e.g. copy of the asset inventory, including condition assessment).

Task	Requested Grant Funding	System In-kind Match	Total	Deliverable
Developing a Level of Service Agreement				**Copy of Goals and Performance Measures**
Personnel, including fringe benefits	$	$	$	
Supplies				
Contractual				
Other				
Total for Level of Service and Performance Measures (Requested Grant Funding + System In-Kind Match)				
Creating an Asset Inventory and Assessing the Condition of Assets				**Copy of Asset Inventory including Condition Assessment**
Personnel, including fringe benefits	$	$	$	
Supplies				
Contractual				
Other				
Total for Asset Inventory and Assessing the Condition of Assets (Requested Grant Funding + System In-Kind Match)				

Budget Continued…

Task	Requested Grant Funding	System In-kind Match	Total	Deliverable
Mapping Assets				**Copy of Map(s) Completed**
Personnel, including fringe benefits	$	$	$	
Supplies				
Contractual				
Other				
Total for Mapping Assets (Requested Grant Funding + System In-Kind Match)				
Analyzing Asset Life Cycle Costs				**Copy of Life Cycle Cost Analyses Performed and/or System Set up to Track Costs**
Personnel, including fringe benefits	$	$	$	
Supplies				
Contractual				
Other				
Total for Analyzing Asset Life Cycle Costs (Requested Grant Funding + System In-Kind Match)				
Conducting a Risk Assessment to Identify Priority Assets				**Copy of Risk Assessment Identifying Priority Assets**
Personnel, including fringe benefits	$	$	$	
Supplies				
Contractual				
Other				
Total for Risk Assessment to Identify Priority Assets (Requested Grant Funding + System In-Kind Match)				

Budget Continued…

Task	Requested Grant Funding	System In-kind Match	Total	Deliverable
Developing Risk and Life Cycle Cost Reduction Measures				**Copy of Risk and Life Cycle Cost Reduction Measures Developed**
Personnel, including fringe benefits	$	$	$	
Supplies				
Contractual				
Other				
Total for Risk and Life Cycle Cost Reduction Measures (Requested Grant Funding + System In-Kind Match)				
Creating Funding Strategies				**Copy of Funding Strategies Developed**
Personnel, including fringe benefits	$	$	$	
Supplies				
Contractual				
Other				
Total for Funding Strategies (Requested Grant Funding + System In-Kind Match)				
Total for all tasks:	**$**	**$**	$	

*Minority Business Enterprises/Womens' Business Enterprises
The Department of Environmental Conservation has the following "fair share" procurement objectives for Minority Business Enterprise (MBE)/Womens' Business Enterprise (WBE), and requires all grantees to try and meet these objectives for any subcontractor procurement under this award.

	MBE	WBE
Supplies	1.00%	3.50%
Services	1.00%	3.50%
Equipment	1.00%	3.50%

More information on Good Faith Efforts that any grantee will agree to in executing a grant agreement is in Section 12 of Attachment D. A list of MBE/WBE firms relevant to the work awarded under this grant are available in Attachment E.

Asset Management Grant Guidance

This guidance briefly describes the major components of an Asset Management Program and the tasks eligible for funding under the 2016 Drinking Water Asset Management Grant.

Asset Management Program Team Qualifications and Implementation Plan

The most successful Asset Management Programs have a team of elected officials, managers, engineers, operators, and administrative staff - each with clearly defined roles. For this grant, the application must include:

- A list of the system's Asset Management Team members, their qualifications (e.g. occupation, education, experience, or training for assigned duties), and the tasks they will work on;
- A schedule outlining milestones for each task to be funded by the grant, and when the milestones will be completed;
- A description of how time spent on activities under the grant will be recorded, and a list of rates that will be used for each person to calculate the system's required in-kind match[1]; and
- How frequently the team will review and update the Asset Management Plan. We recommend that the plan be reviewed each year and updated as needed. Situations that should trigger revisions to the plan include changes to the level of service goals, or methods used to determine consequences or probabilities of asset failure. Updates to the asset inventory, condition assessment, etc., should be done on an ongoing basis.

[1] - *Volunteers will be assigned an hourly rate by the Department of Environmental Conservation based on the expertise required for assigned duties under the grant. They will be matched with a State position description, and associated rate, that most closely aligns with the expertise required. When calculating match for the proposed budget, please use the following rates (which already include fringe benefits) or provide justification if proposing alternative rates:* ***volunteer board member*** *- $32.32/hour (rate of an Environmental Analyst V)* ***volunteer operator*** *- $25.82/hour (rate for an Environmental Technician III).*

Grant funding may be used for one or more of the activities discussed below. *Applicants are encouraged to include all activities in their project scope, but are not required to do so.*

Developing a Level of Service Agreement with Goals and Performance Measures

A Level of Service Agreement lists the benefits that the water system will provide its customers. It helps set clear expectations; justify user rates; identify which assets are most important; assess system performance; and guide the system's efforts. The Level of Service Agreement is not a substitute for local ordinances. But the system's ordinances should refer to the agreement. Ideally, systems will develop their Level of Service Agreement with input from their customers through meetings, surveys, etc. The governing body and water system staff may draft the agreement, however, and seek input from customers later.

A Level of Service Agreement helps...

- ***Justify user rates;***
- ***Identify which assets are most important;***
- ***Assess system performance;***
- ***Guide the system's efforts; and***
- ***Set clear expectations for the governing body, staff, and customers***

The agreement must include goals (external and internal) and performance measures to determine if goals are being met. The goals should be specific, measurable, achievable, relevant, and time bound (see page 19 for some examples). ***Meeting federal and state drinking water requirements must be a goal for all systems.*** The grant application must describe how the Level of Service Goals and Performance Measures will be developed.

External and Internal Goals

External Goals - Goals that the system's customers and governing body care about.

Internal Goals - Goals the system's staff use to help ensure that external goals are met.

When developing level of service goals, the system should answer the following questions:

- What do your customers and elected officials want from the system? (answers will help form the external goals)
- What internal measures would help ensure that external goals are met? (answers will help form the internal goals)
- What is a realistic target level for each goal (e.g., 95% of the time)?
- What data do you need to determine whether each goal is being met? Who will collect the data, how will they collect it, and where will it be stored?
- When will you start measuring the goals?
- How often will you measure whether the goals are being met?
- Whom will you share the goals with and how will you let them know whether the goals are being met?

The answers to these questions should be captured in the Level of Service Agreement section of the Asset Management Plan.

Examples of Level of Service Goals and Performance Measures

External Level of Service Goals	Performance Measures
Comply with all federal and state water drinking water regulations 100% of the time.	Review monthly compliance reports
Meet state and federal secondary standards related to aesthetics at least 95% of the time.	Review quarterly water quality test results
Provide minimum water pressures of 40 pounds per square inch throughout the system at least 95% of the time	Review monthly pressure readings
Respond to customer complaints within two business days at least 95% of the time	Review complaint logs monthly
Adequate fire flow will be available for all customers	Review flow testing every three years

Internal Level of Service Goals	Performance Measures
Rates will be reviewed annually and raised as needed to ensure full cost recovery.	Yearly by review committee
By-laws, ordinances, and policies will be reviewed at least every three years and amended as needed to ensure that level of service goals (including federal and state requirements) can be met.	Triennially by review committee
Conduct an annual water audit following American Water Works Association (AWWA) standards.	Annual water audit
Repair water line breaks within eight hours of initiation of repair 95% of the time	Review complaint logs and work orders annually

Creating an Asset Inventory and Assessing the Condition of Assets

An asset inventory and condition assessment serve as the backbone for an Asset Management Program. As assets age they tend to degrade, lose value, cost more to operate and maintain, and become more likely to fail. Using an inventory to track assets over time will help systems decide when it is best to maintain, repair, rehabilitate, or replace them.

Inventorying and assessing the condition of everything a system owns can be daunting task. So to start, a system might choose not to include all assets in the inventory. Instead, they might decide to include only those assets with a replacement cost more than a certain value (e.g. $1,000); or all assets related to the most immediate problem that they want to solve (e.g., inadequate pressures in part of the distribution system, insufficient treatment capacity, or limited documentation of system components). Then they can expand the inventory over time. If a system uses a dollar value as a threshold, they should also include 1) any critical assets that do not meet the threshold; and 2) assets such as meters and valves that individually may not meet the threshold, but because the system has so many that collectively they represent a significant financial investment.

Questions to ask when creating an asset inventory…

- ***What assets do you own?***
- ***Where are they?***
- ***What condition are they in?***
- ***What is their remaining useful life?***
- ***How much will it cost to replace them?***

The grant proposal must describe 1) the format that the inventory will be kept in (e.g., generic spreadsheet or database, Asset Management software program), 2) the criteria that will be used to identify assets to be included in the inventory, 3) how the condition of assets will be assessed (see page 20), and 4) who will maintain and update the inventory over time.

For each asset, the inventory must include the following:

- Identification number (i.e., unique number assigned to the asset)
- Asset category (e.g., “pump”)
- Asset type (e.g., “raw water pump”)
- Location (e.g., street name and/or address, name of building)
- Pertinent capacity information (e.g., size, length, horsepower, etc.)
- Condition (see below)
- Estimated remaining useful life
- Estimated replacement cost (purchase, installation costs, etc.)
- Probability of failure, consequence of failure, and overall risk ratings (see risk assessment discussion below).
- Notes related to basis for condition ranking; useful life and replacement cost estimates; probability of failure, consequence of failure, and overall risk ranking, etc.
- Photo (if possible)

Condition Assessment

The system must assess the condition of each asset in the inventory. A condition assessment can be completed in many different ways, depending on available resources. As a starting point, the people with the most knowledge of the system may get together and assign a numerical ranking to each asset (see example rating system below). The system should consider all available information for each asset, and may use assessment tools to collect new data (e.g., camera inspections). The condition assessment should be updated over time.

Some things to consider when assessing the condition of an asset…

- ***Age and estimated remaining useful life;***
- ***Repair and maintenance history;***
- ***Usage (e.g., pump run time, flow through meters);***
- ***Findings from visual inspections; and***
- ***Results from other condition monitoring approaches (e.g., leak detection surveys, remote camera inspections, ultrasonic tests, flow tests, and hydraulic analyses).***

Example of a Condition Rating System

Condition	Rating or Score	Description
Excellent	0	Asset is new or nearly new and has no known or suspected condition issues
Very Good	1	Asset has no known or suspected condition issues, but is no longer new
Good	2	Asset has a few known or suspected condition issues
Average	3	Asset has known or suspected condition issues, but issues are unlikely to impact its ability to perform
Fair	4	Asset has known or suspected issues that may impact the asset's ability to continue to perform in the next several years.
Poor	5	Asset has known or suspected condition issues that are likely to impact its ability to function in the near future (1 to 2 years)

Mapping Assets

A map provides a visual representation of the location of the assets. It is especially important because many water utility assets are buried. The grant proposal must describe 1) which assets will be mapped, 2) the form that the map(s) will be created in (e.g., hand-sketch, Google Earth, Geographic Information System, etc.), 3) who will create them, 4) how system staff will have access to use the map(s) (e.g. paper, computer tablet, etc.), and 5) how the map(s) will be kept current (i.e., who will update the maps, etc).

Systems should choose a mapping system that best meets their needs, capabilities, and resources. There is little benefit to having a sophisticated mapping system if it can not be readily used and updated by system staff.

Analyzing Asset Life Cycle Costs

The costs of owning an asset not only include initial planning and purchasing costs, but all other expenses that will occur after the asset is put into service (e.g., operation, maintenance, repair, and disposal costs). Grant funding may be used to develop and implement a system to track expenditures on existing assets (e.g., costs of repairing a pump), and to estimate the future costs of owning an asset (e.g., cleaning and repainting a storage tank). Ideally, costs will be analyzed for individual assets, but they may be grouped (e.g., all assets within a pump station).

Analyzing the life cycle costs of owning assets can help a system create budgets; evaluate alternatives when purchasing new assets; and decide when it is best to maintain, repair, rehabilitate, or replace an asset. An analysis might show, for example, that it would be less expensive to replace an asset than to keep it in service - the asset has failed economically. Indicators that an asset has failed economically, or might fail soon, include high energy use (e.g., inefficient or undersized pump), and frequent or expensive repairs (e.g., to fix an aging pump or leaks in a section of pipe).

Life Cycle Costs include...

- ***Initial capital costs (planning, purchasing, installing);***
- ***Operation and maintenance costs (labor, materials, fuel, electricity, etc.);***
- ***Repair and rehabilitation costs;***
- ***Legal, environmental, and social costs; and***
- ***Disposal costs or salvage value.***

Analyzing life cycle costs can help you...

- ***Create budgets;***
- ***Evaluate alternatives when purchasing new assets; and***
- ***Decide when it is best to maintain, repair, rehabilitate, or replace an asset.***

Conducting a Risk Assessment to Identify Priority Assets

Grant funding may be used to conduct a risk assessment to help set priorities. A system's highest priority assets should be those with the greatest consequences and probabilities of failure. So to identify its priorities, the utility should ask two questions for each asset in the inventory:

- What would be the consequences if the asset fails; and
- What is the probability that the asset will fail?

Once the system identifies its priority assets, it can develop ways to reduce the risks and life cycle costs. Five assets from a fictitious water system will be used to show how a risk assessment may be conducted (see next page).

The system's priority assets should be those that are most likely to fail and that will have the greatest consequences if they do fail.

Example - Water System Risk Assessment Background Information

The following provides a brief description of five assets from a water system that will be used to show a simple way to assign consequences of failure, probabilities of failure, and risk ratings.

Harvey's Spring

The spring is the system's only source. It was originally developed for a farm and has been serving the water system since the 1920s. Most of the time the spring yields enough water to meet customer demands, unless there is a large leak in the distribution system. But during dry periods the system has to ask customers to conserve water because the spring can not keep up with demands. Water shortages are becoming more frequent. The system had to haul water from a neighboring utility during shortages the past two years.

Storage Tank

The concrete storage tank was constructed in 1980 to replace an old, undersized steel tank. The concrete tank has been well maintained and a comprehensive inspection two years ago showed the tank to be in good shape.

Section of a 12" Distribution Line

This section of 12" cast iron distribution line was installed in the early 1920s. The line serves downtown, including a school and senior center and about 65% of the system's customers. In the past five years, the system has repaired three leaks in this section, the most recent caused by a break in April 2015, following an extremely cold winter.

Section of a 4" Distribution Line

This 4" PVC distribution line was installed in 2010 to serve a new 15 residential unit development. No leaks have been documented since installation.

Booster Pump #1

This pump was installed new in 2010 to provide adequate pressure (no fire flow) to the residential development completed in 2010 (15 residential units in a new upper pressure zone). The pump is currently operating within design specifications. The operator has performed all routine maintenance recommended by the manufacturer, and reports no problems with the pump. The manufacturer estimates a 25 year life. The system has another pump (same make and model) that serves as a back-up.

Consequences of Failure

When an asset fails (e.g., a distribution main ruptures) it has social, economic, and/or environmental consequences. As part of the risk assessment, the system must adopt a method to rate the consequences of failure, and use the method to rate each asset in the inventory relative to its other assets. A simple rating scale like the one below may be used. When rating assets, the system should consider all potential costs and impacts related to its failure, but does not have to determine exact costs.

Example of a Consequences of Failure Rating Scale

Consequences of Failure	Rating or Score
Very low	1
Low	2
Moderate	3
High	4
Very High	5

Consequences of Asset Failure

- ***Costs and difficulty to repair or replace the asset***
- ***Costs to fix any collateral damage caused by the failure (e.g., damage to other utility assets, roads, and private property)***
- ***Social impacts and costs (e.g., decrease in level of service, such as public health protection; loss of customer confidence and business revenues due to a water outage)***
- ***Legal costs associated with any collateral damage***
- ***Environmental costs***
- ***Other costs***

When assigning consequences of failure ratings, the system should also consider whether there is redundancy for each asset. If an asset can provide the same service (or partial service) that another asset provides, then the consequences of failure can be reduced. For example, the consequences of a well failing will be less severe if there is another well that can be used. A simple way to account for redundancy is to multiply the consequences of failure rating by a "redundancy factor" (see table below).

Example of a Redundancy Factor Table

Amount of Redundancy	Redundancy Factor
None	1
25%	0.9
50%	0.7
75%	0.5
100%	0.4
150%	0.3
200%	0.25

Example - Water System Risk Assessment Consequences of Failure

Asset	Consequence of Failure (COF)	Redundancy Factor	COF Adjusted for Redundancy	Notes
Harvey's Spring	5	1 (i.e., no redundancy)	5	This is the system's only source. If the spring fails, it would impact all users and be very expensive to replace - the town has been looking for a site to develop a well without success.
Storage Tank	5	1	5	Only storage tank on the system. If the tank fails, it would impact all users. Replacing the tank would be expensive.
12" Distribution Line	3	1	3	Serves downtown, the school, and a senior center. The valves on the line have not been mapped or maintained, and most do not work. If the line fails, it would impact 65% of the residential users and sensitive populations (children and elderly). The line would be difficult to repair, could shut down main street and several businesses.
4" Distribution Line	1	1	1	Serves 15 residential connections. If the line fails, it would only impact a small number of users. The line would be relatively easy to repair.
Booster Pump #1	1	0.4 (i.e., 100% redundancy)	0.4	Provides pressure to the 15 residential connections in the upper pressure zone. If the pump fails, it would only impact a small number of users. Booster Pump #2 provides full redundancy.

Probability of Failure

If kept in service, eventually all assets will "die" - stop working because they break, collapse, rupture, etc. But an asset can also fail if it becomes more costly to operate, maintain, and repair than to replace; or is not able to meet level of service goals or provide adequate capacity. As part of the risk assessment, the system must adopt a method to rate the likelihood that an asset will fail, and use the method to rate each asset in the inventory relative to its other assets. When considering the probability of failure, the system should consider the different ways an asset can fail - mortality, financial inefficiency, level of service, and capacity - and which mode of failure is most likely.

Modes of Asset Failure

- ***Mortality - the asset physically stops working (i.e., "dies").***
- ***Financial inefficiency - the asset becomes so costly to operate, maintain, and repair that it is no longer economical to keep in service.***
- ***Level of service - the asset still operates, but is unable to meet level of service needs (or goals).***
- ***Capacity - the asset still operates, but is unable to provide the capacity needed.***

For most systems, a simple rating scale like the one below can be used. When assessing the likelihood that an asset will fail, the system should consider the asset's age, estimated remaining useful life, condition (see page 21), vulnerability to hazards (e.g., floods, erosion, ice damage), history with similar assets, and staff's knowledge about the asset.

Example of a Probability of Failure Rating Scale

Probability of Failure	Rating or Score
Very low	1
Low	2
Moderate	3
High	4
Very High	5

Example - Water System Risk Assessment Probability of Failure

Asset	Probability of Failure (POF)	Notes
Harvey's Spring	5	Very high POF based on history of water shortages (i.e., capacity related failure).
Storage Tank	1	Very low POF based on expected useful life, maintenance history, and results from comprehensive inspection done two years ago.
12" Distribution Line	4	High POF based on age (nearing end of useful life) and repair history.
4" Distribution Line	1	Very low POF based on age (installed just five years ago), estimated remaining life, and maintenance and repair history (no documented leaks or repairs since installation).
Booster Pump #1	1	Very low POF based on pump age and run time, visual/ audio inspections, and maintenance and repair history (all routine maintenance recommended by the manufacturer has been conducted).

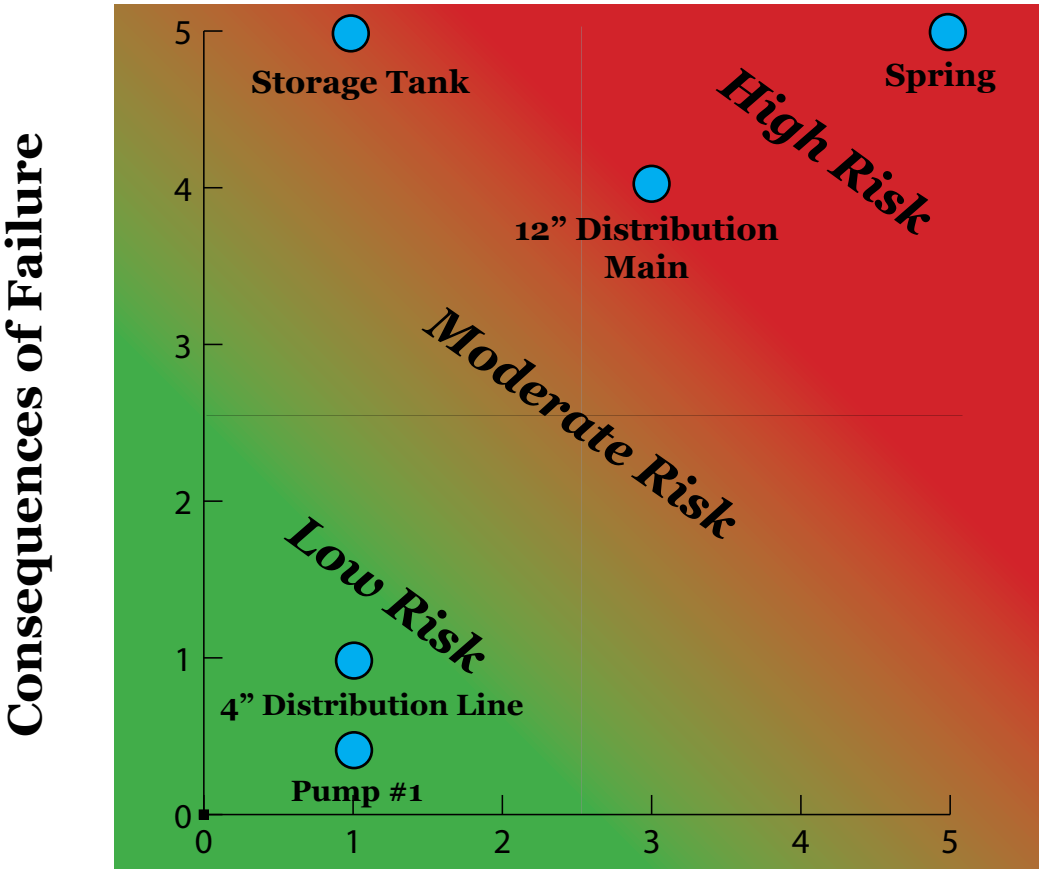
Priority Assets

Based on the consequences and probabilities of failure ratings, the system should assess each asset's risk to identify priority assets. So the system must decide on a methodology for assigning an overall risk rating to each asset. A simple way to do this is to multiply the consequence of failure rating (adjusted for redundancy) by the probability of failure rating. Assets with the highest risk scores would be considered the greatest priorities. Graphing assets based on their consequence of failure (COF) and probability of failure (POF) scores (see below) allows systems to easily see which factor (COF or POF) contributes more to the risk rating. These factors will be used to help decide how assets are treated (see the Developing Risk and Life Cycle Cost Reduction Measures Section, below).

Example - Water System Risk Assessment Asset Risk Rating

Asset	Consequence of Failure (Adjusted for Redundancy)	Probability of Failure	Risk Rating or Score
Spring	5	5	25
Storage Tank	5	1	5
12" Distribution Main	3	4	12
4" Distribution Line	1	1	1
Booster Pump #1	0.4	1	0.4

Risk Assessment Graph



Developing Risk and Life Cycle Cost Reduction Measures

When developing risk and life cycle cost reduction measures, the main focus should be on the highest risk assets. But other assets may also be considered. To help reduce risks and life cycle costs, systems may use grant funding to:

- Review and revise water system policies and ordinances; and
- Develop or update schedules to operate, maintain, repair, rehabilitate, and replace assets.

Water System Policies and Ordinances

Systems should review and update (if needed) their policies and ordinances every three years - more frequently if there is a major change that will impact the organization (e.g., changes to state or federal drinking water regulations). Effective policies and ordinances can help systems reduce risks and costs. A system that experiences water shortages because their source's yield declines during dry periods, for example, can conduct annual water audits, and adopt and enforce water conservation measures. Such measures may reduce the chance that they will run out of water, and provide the system more time to find other solutions if conservation is not enough. Water conservation measures may also reduce or eliminate the need to buy and haul water. Because water shortages can cause low water pressures, the system could also review its cross connection control policies and ordinances to make sure they are sufficient and being enforced.

Operation and Maintenance Schedules

Deferring maintenance reduces system performance and often leads to premature asset failures, emergencies, service disruptions, regulatory compliance issues, and increased costs - especially as a system ages. Over time it can cost three or four times more to run a system without proper maintenance. And yet, proactive maintenance activities are often the first things cut from a budget. Effective Asset Management Programs use proactive maintenance to save money, reduce risks, and limit the need for emergency repairs.

Types of Proactive Maintenance

- ***Routine Maintenance - activities done on a regular schedule (e.g., oil changes, lubrication, and line flushing).***
- ***Preventative Maintenance - activities triggered by a known condition that are done to help prevent a failure (e.g., repainting the outside of a storage tank to address corrosion identified during an inspection).***
- ***Predictive Maintenance - activities used to monitor and assess the condition or performance of an asset to predict when it might fail (e.g., pump run times, leak detection surveys, remote camera inspections, ultrasonic tests, flow tests, and hydraulic analyses). Systems can use information from predictive activities to plan and schedule maintenance, or help decide whether to rehabilitate or replace an asset.***

Although deferring maintenance can be costly, so can conducting maintenance activities that do not improve an asset's efficiency or extend its useful life. Systems should only conduct maintenance activities that:

- Are required for regulatory compliance or the terms of a warranty;
- Reduce risks (probability or consequences of failure); or
- Will improve the asset's efficiency or extend its useful life.

Systems may use grant funding to review and revise (if justified) their existing maintenance activities for each asset. When doing so, they should ask:

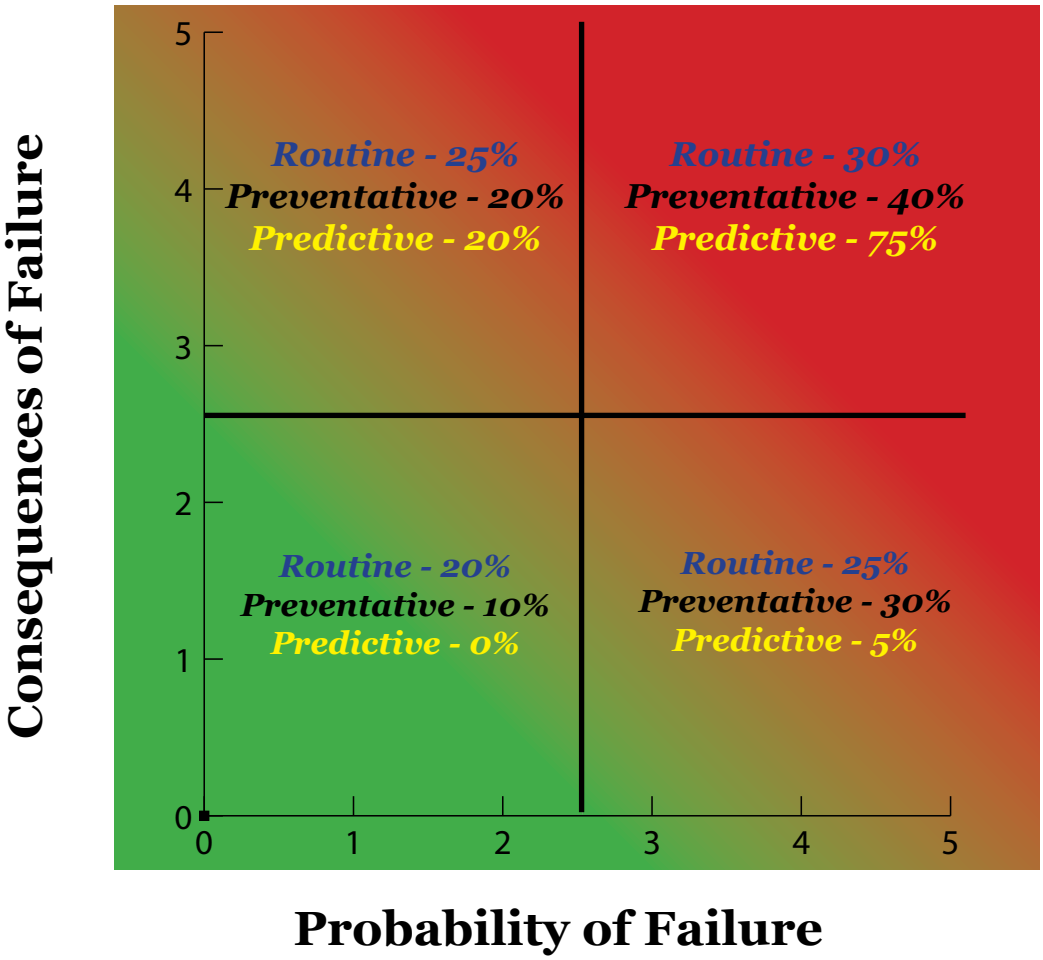
- Should we continue to do this activity? If so, should we conduct the activity more or less frequently?
- Are there activities that we should be doing that we are not doing?
- Are there activities that we are doing that we should not be doing?

Systems should consider risk when answering these questions. The probabilities and consequences of failure will help decide what types of proactive maintenance activities - routine, preventative, or predictive - are appropriate for each asset. For example, systems should spend little, if any, money on preventative or predictive maintenance for assets with very low consequences of failure. Instead, they may choose to run such assets until they fail and then repair, rehabilitate, or replace them. And almost all spending on predictive maintenance should be on the assets with the greatest consequences of failure. Risk should not influence decisions on routine maintenance (e.g., oil changes) as much as it does preventative and predictive maintenance. The graph on page 34 shows how systems with effective maintenance programs might spend money for routine, preventative, and predictive activities based on risk.

Questions to ask about your maintenance activities...

- ***Should we continue to do the activity (e.g., pump oil changes)? If so,should we do it more or less frequently?***
- ***Are there activities that we should be doing that we are not doing?***
- ***Are there activities that we are doing that we should not be doing?***

Proactive Maintenance Spending Based on Risk



Repair, Rehabilitation, and Replacement Schedule

Grant funding may be used to create a schedule for repairing, rehabilitating, and replacing assets. The schedule should include the following for each asset:

- When the system will likely need to repair (major repairs), rehabilitate, or replace the asset;
- The main reason it needs to be addressed (e.g., no longer provides adequate pressure); and
- The estimated cost to repair, rehabilitate, or replace the asset.

When developing the schedule, the system should consider the factors used to assess the assets condition and risk. The list should also include new assets that the system thinks it will need to address growth, new regulatory requirements, increases in services (e.g., adding fire protection), or to upgrade technology.

Capital Improvements Plan

Using the asset repair, rehabilitation, and replacement schedule, the system must develop a Capital Improvement Plan for the next 20 years. The plan should list dates for each project, assets that will be addressed in each project, and the estimated project cost.

Creating Funding Strategies

The Department of Environmental Conservation encourages public community drinking water systems to generate enough revenues from user rates and fees (e.g., allocation and connection fees) to cover the full costs of providing services. Funding from this Asset Management Grant may be used to:

- Develop a five year budget that accounts for the full costs of providing services, including risk and cost reduction measures (e.g., asset maintenance, repairs, and replacements) identified through the Asset Management Program;
- Review the system's existing rate and fee structure to determine whether it is adequate to cover the full costs of providing services for the foreseeable future, including reserves for emergencies and short-term (i.e., ten years) asset replacements; and
- Identify and compare financing options to determine the best sources of funding (e.g., system reserves, loan and grants, bonds) for projects in the Capital Improvement Plan.