SOUTHWEST ENVIRONMENTAL FINANCE CENTER

Script for Non-Community Asset Management Training

Note to trainer: Instructions regarding animations, advancing slides, and other session details are in red text.

Section 1: Introduction

Slide 1:

This is just a title slide. It can be modified to include the name and organization of the trainer.

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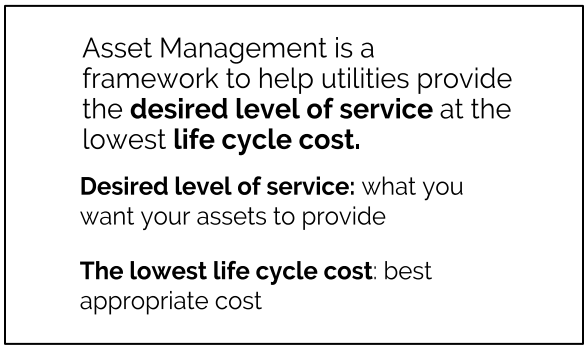
Slide 2:



Asset management is a strategic business process framework designed to help utilities provide their desired level of service at the lowest life cycle cost.

What do we mean by life cycle cost? The life cycle cost of the asset considers the entire life of the asset from the earliest phases of planning through design and construction, from operation to maintenance, repair, rehabilitation, and eventual replacement.

For example, if we are talking about a pump, the life cycle of the pump would include the initial planning and selection of the pump, the installation of the pump into the facility, the full cost of energy to run the pump, the cost of all the routine maintenance to keep the pump functioning properly, any corrective maintenance to fix problems that occur, the eventual replacement of the pump when it could no longer work properly, and ultimately, its disposal. There are expenses all along the way, and the life cycle would consider how much could be efficiently spent to keep the pump running properly.

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The desired level of service is what you want your assets to provide for your customers, or essentially, what you want them to do.

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The lowest life cycle cost is the best appropriate cost to operate your utility. It does not mean you are trying to drive the costs to zero but rather the costs when you manage your assets in the best way possible. It means that your utility is financially efficient.

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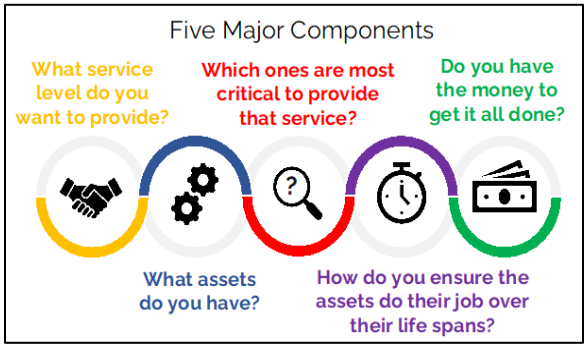
Slide 3:



Asset management consists of 5 core components. They can be thought of as questions to ask yourself, which include: what level of service do I want to provide; what assets do I have; which assets are the most critical to providing that service; how do I ensure that the assets can do their job over their life spans; and do I have enough money to do all the things I need to get done?

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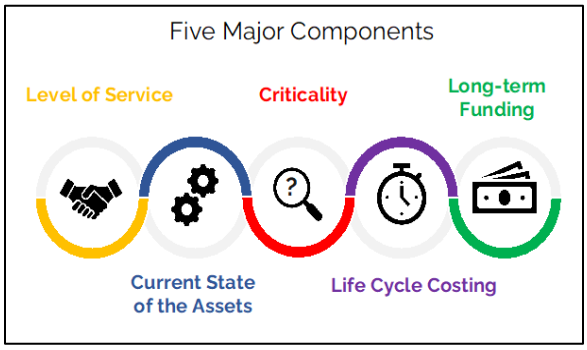
Slide 4:



This slide is animated, and you should click through each of the questions as you use this script.

The questions have labels that are the names of the 5 core components. The first is

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Level of Service. The second is

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called the Current State of the Assets. The third is

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called Criticality. The fourth is

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called Life Cycle Costing, and the fifth is

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called Long-Term Funding

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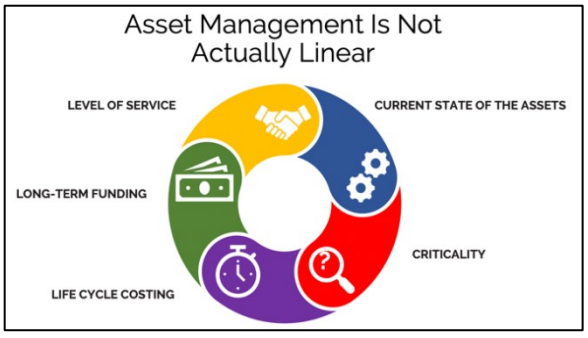
Slide 5:



For the last few slides, we've shown Asst Management as a linear process. In reality, Asst Management is not linear; it is a continuous

process with no beginning or end. The core components overlap and intersect with each other, and one portion depends on another. We show the linear version since it is sometimes easier to explain what Asst Management Is with the aid of that linear visual, but it is important to consider Asst Management as a continuous process.

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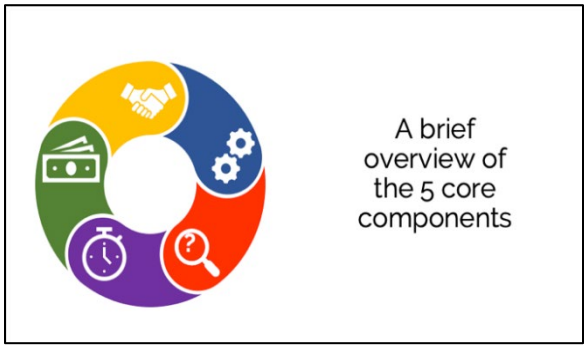
Slide 6:



Now that we have Introduced the overarching concept of Asst Management, we are going to go into a very brief overview of each of the core components and the key questions each of the components is designed to answer.

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Slide 7:

The first component we will discuss is the Level of Service. Level of Service answers the key questions of: what service levels do your

customers expect; what service levels can you actually provide; and how will you measure performance towards meeting these goals?

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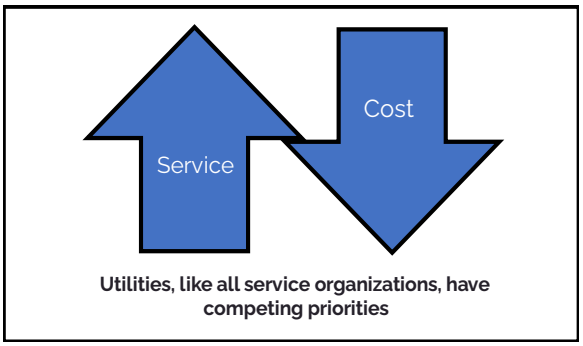
Slide 8:



For most Non-Community systems, water is not your primary business. The water utility – which we are calling the portion of the entity that provides the water to the rest of the entity – is generally a means to an end. For example, if you are a school, the purpose is to educate students. You need the water to keep the students safe and healthy while in the school environment. The water will be used for hand washing, drinking, flushing toilets, showering after exercise, or cooking, but providing water is not the primary function of the school. Similarly, a business might be engaged in making a product or selling a service but provides water to help make the product and take care of its workers.

However, even if water is not the primary function of your business, school, industry, or other entity, the delivery of water service within the organization is similar to that If any other service organization. Any service organization has the competing priorities of providing high quality service at a reasonable cost.

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Slide 9:

Understanding the service your customers want can be done by asking them. In the case of a Non-Community water system, the customers may be employees of the same organization, outside customers, or some combination of both. For example, the water "customers" of a restaurant are the employees of the restaurant as well as those who eat at the restaurant. The water customers of an industrial facility are the employees who work at the facility, while the water customers of a school water system are the teachers, administrators, and students who attend the school.

When we ask customers what they want, we typically find that there are a finite set of things that almost all customers want, whether they are community customers or Non-Community customers. That list can include reliability, quality, safety, professionalism, customer service, and perhaps a few others. Are there any other main wants that should be added to the list?

If live, ask the audience to name any others they can think of. If virtual, people can be asked to chat in an answer.

When we understand what the customers want, we can set goals around these needs to ensure that we give the customers their desired level of service. The goals we set can prioritize these needs. For example, if lack of water would shut down an assembly line, costing large amounts of money through down time, reliability may be the most important factor. In the case of a restaurant, having high quality water

may be most important to ensure that both the water and the food prepared with it is safe.

Optional: If needed, this Is where a poll question could be Inserted to get an understanding of LoS comprehension.

Now that we are on the same page about what we mean by Level of Service, let's go on to the next component of Asset Management.

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Slide 10:

To meet the Level of Service Goals, it is necessary to know the details about the assets that make up your system. It is these assets that will allow you to provide the service to your customers. If you don't understand what assets you have, where they are, what condition they're in, how long they will last, and what it costs to replace them, it becomes very difficult to reliably provide service and meet the level of service your customers want.

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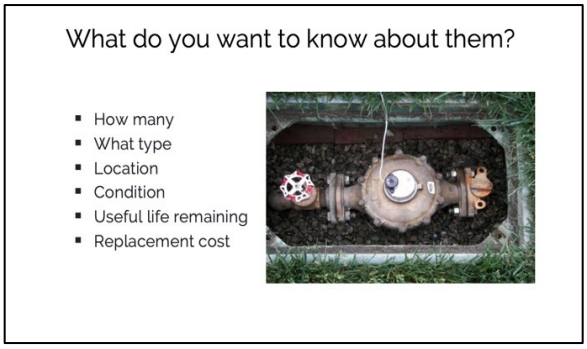
Slide 11:



To fully understand the information about our assets, we need to take an inventory. We want to know what assets we have as well as attributes about each type of asset. The attributes can be many different things including how many, what type, location, condition, useful life remaining, replacement cost, material, size, manufacturer, serial number, etc. The attributes can be based on specific classes of assets. A class is a collection of assets, such as pumps or valves or tanks. It is likely that the characteristics of one class of assets will be different than another class.

The most important thing is to create an inventory of the assets and include all the attribute information necessary for each asset.

Inventory, or the Current State of the Assets, is a building block for the other portions of Asst Management, including the next component, Criticality.

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Slide 12:

Once we know the level of service desired and the assets that make up the system, it is possible to determine the criticality of each asset. Understanding the criticality of assets will help a system assess its overall risk which will help the utility prioritize activities based on the risk.

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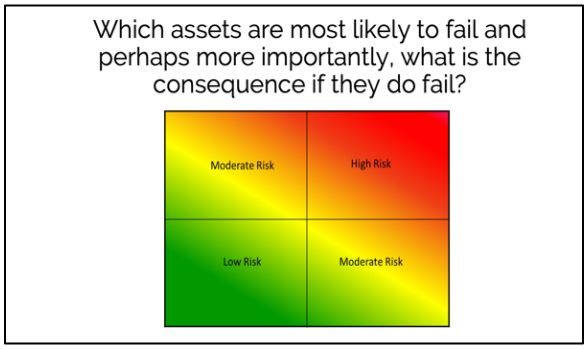
Slide 13:



Criticality is determined by establishing how likely each asset is to fail and what the consequence of that asset's failure might be. Both the probability of failure (POF) and consequence of failure (COF) can be ranked on a scale, generally a 1 to 5 or 1 to 10 scale, and then the two scores can be multiplied together to determine Criticality.

If the assets are plotted on a grid such as the one shown on the slide, those assets in the upper right-hand quadrant would be those most likely to fail and those for whom the consequences of failure would be greatest. These assets need to be considered the highest priority for action, to try to lower the risk by either lowering the potential for failure or the consequence of failure.

The assets in the lower left-hand quadrant are those that are the least likely to fail and even if they did the consequence would not be too high. These assets have a much lower level of risk and should be the lowest priority for action.

Criticality and Current State of the Assets lead into the next component in the Asset Management framework, Life Cycle Costing.

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Slide 14:

Once the necessary level of service is determined and the assets are inventoried and assessed for risk, it is necessary to consider the life cycle cost of the assets. The life cycle cost of an asset considers the entire life of the asset from the earliest phases of planning, through design and construction, operation and maintenance, repair or rehabilitation, and eventual replacement. At each stage of the asset's life, there are potential interventions that can be done.

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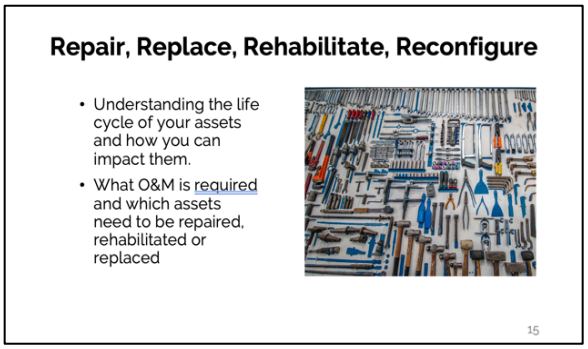
Slide 15:



It is important to identify and understand the various ways you can intervene in each stage of the asset's life. Once an asset is put into service following construction, it needs to be operated. There are different ways of operating assets that can impact efficiency, cost-effectiveness, and reliability. There are various options when an asset fails, including repair, rehabilitation, and replacement. Each of these options has implications, including cost, reliability, useful life remaining, and other important considerations. The goal is to undertake the most cost-effective interventions during each phase of the asset's life.

Now that we have talked about the first four components, we'll discuss the last remaining component: Long-Term Funding.

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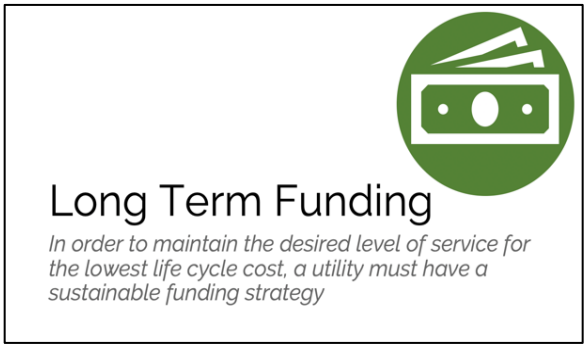
Slide 16:



It takes money to run any utility, including a Non-Community utility. Everything costs money and even the most cost-effective utility needs

to have a sustainable source of funding for the long term. There are financial needs for day-to-day operations as well as repair and replacement. It is also necessary to incrementally invest in the water infrastructure to ensure its reliability.

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Slide 17:

It is important to know how much money you need and where it will come from. In the case of a Non-Community system, the water system budget is most likely just a small part of the overall budget for the entity. Because water is not the main function of the entity, it can be harder to achieve an adequate budget. The water might be viewed as strictly a cost instead of both a cost and a benefit. In any case, it is necessary to determine an adequate budget and explain why it is necessary.

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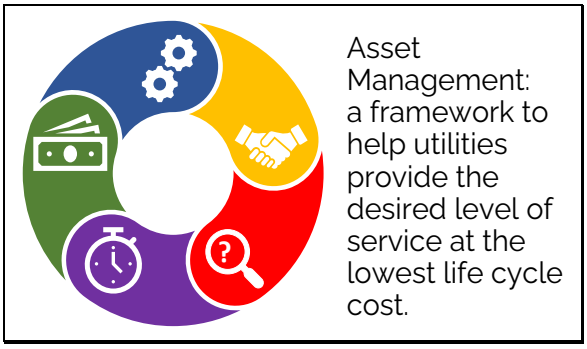
Slide 18:



As we talked about in the introduction, there are 5 core components of Asset Management. These components work together to create the overall purpose of Asst Management: to help utilities provide the desired level of service at the lowest life cycle cost. For the next few minutes, we're going to talk about the first part of the purpose – the "desired level of service"

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Slide 19:

As a Non-Community system, delivering water probably isn't your primary business. For example, you might be a school, or a hospital, with your own water system.

However, while water delivery may not be your primary business, your water system supports your primary business, and in many cases is critical to it. If the water system fails, the primary business may come to

a grinding halt. Neither of the two examples I gave can function without water.

Further, while we are discussing Asst Management today as it applies to water systems, Asst Management is not exclusive to water systems. These same principles can and should be applied to your primary business. Indeed, many businesses with no connection to the water utility world use Asst Management principles to determine how, where and when to spend their limited budgets to ensure they provide their desired level of service at the lowest lifecycle cost.

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Script for Non-Community Asset Management Training
Section 2 Level of Service

Slide 20:

In talking about Level of Service, you should be thinking about what service level your customers want, what service you can actually provide, and how you measure whether you were able to provide that service level. In the case of Non-Community systems, your customers may be part of the larger organization or business, or they may be outside individuals who access or use the facility. For example, the customers of a school may be students, teachers, and administrators. The students are outside individuals while the teachers and administrators represent a different part of the same organization. It is important to consider all of your potential customers when you think of Level of Service.

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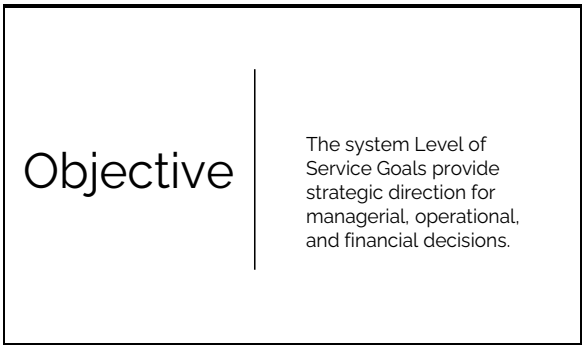
Slide 21:



The objective of the Level of Service portion of the training is to understand that "The system Level of Service Goals provide strategic direction for managerial, operational, and financial decisions." When you have goals, it helps drive your actions and focus them on what's truly important.

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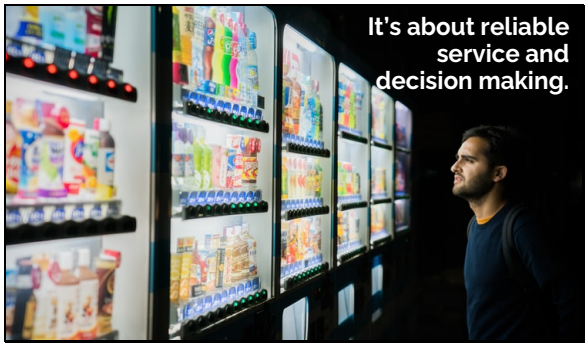
Slide 22:



Level of Service is fundamentally about 2 basic things: reliable service and decision making

1. No matter who the customers are, reliable service is something everybody wants. If water needed for a process within the business isn't available, the business line might have to shut down, which would cost money. Or if water is not available to a restaurant, the restaurant would have to close, at least temporarily. If this happened frequently, the restaurant could lose its customers.

Similarly, if the water wasn't available to a school, students would need to be sent home and parents would be upset. It is absolutely necessary to provide reliable water service to all customers.

2. Decision making is the other important element of Level of Service. Every decision has to be made based on something. Just like deciding what to drink is based on your thirst or sweet tooth or some other factors, the outcomes of that decision may or may not be as you'd hoped.

The decisions you make **WILL** impact how your system operates and ultimately, what Level of Service you provide and how reliable it is. When you have better information, you are able to make better decisions. It is also important to remember that when you are making decisions, you need to consider how they will affect the level of service you can provide.

Asset management allows a utility to make better decisions by harnessing the collective knowledge of the utility.

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Slide 23:

Level of Service sets the overall policies, goals and procedures for the water system and puts everyone on the same page. Everyone should understand their role in the system and how it helps the system meet these goals.

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Slide 24:

Desired Characteristics of Levels of Service Goals

Meaningful	Relevant to staff and stakeholders Provides a clear picture of performance
Measurable	Can be measured in a cost-effective manner Expressed as a qualitative or quantitative measure
Consistent	Consistent with industry practice Measurement is reproducible by others
Useful	Helps manage the utility Encourages improvement
Unique	Describes a specific attribute of utility services or activities Independent of other levels of service

Because Level of Service helps you set policies and procedures for the organization, the goals need to be well thought out. They should include specific characteristics to make sure they are useful to the utility rather than being vague statements that won't help much.

There are five characteristics that we think are useful when you are setting Level of Service goals. Let's go through them:

1. Level of service goals should be **Meaningful.** What we are saying is that the goals should be relevant to staff and stakeholders and provide a clear picture of the performance level that is expected. As an example, we talked about reliability before. A goal that addresses reliability would be meaningful to both staff and stakeholders since the business or facility is unlikely to be able to function if the water service is unreliable.

2. A goal won't help you if you can't tell if you met it. Therefore, all goals need to be **Measurable,** so we know if we actually did what we said we were going to do. It is also best if it will be cost-effective to measure it. We can also express our measurement in both quantitative and qualitative terms.

3. We want our goals to be **Consistent** with industry practice, and it is best if the measurement technique we use is reproducible by others. In other words, if another person looked at the same data, they would be able to come up with the same result.

4. The goals should be **Useful** to you and help you manage the system. They should also encourage you to improve.

5. Each goal should be **Unique** and describe a different, specific attribute of the utility, and each should be independent of the others.

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Slide 25:

Goals can be internal….

Meaning they are relevant primarily to internal staff (operators, managers)

Your goals can be internal or external. Internal goals are useful and important to the water system employees but probably not terribly useful or meaningful to individuals outside the water system personnel, such as other employees or customers who use the facility or frequent the business.

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Slide 26:

Types of goals: System Maintenance, Employee Safety, Energy Management

Internal goals could involve items such as how the system is maintained, how employee safety is ensured, and how energy is managed to improve energy efficiency.

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Slide 27:

Goals can be external….

Meaning they are also relevant to other employees, business leaders and, potentially, customers.

External goals are relevant to the water system employees as well as other employees outside of the water system itself, the business leaders, and potentially outside customers.

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Slide 28:

Types of goals: Public Health & Safety, Customer Service, Response Time

External goals could include things like public health and safety, reliability, customer service policies, and response times.

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Slide 29:

We want our goals to be measurable so we can track and report our progress and determine if we need to make changes or adjustments over time.

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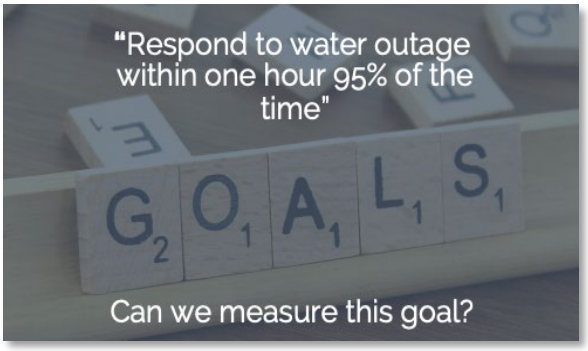
Slide 30:



Is the example goal presented here, "Respond to water outage within one hour 95% of the time" measurable?

Note: If this training is given live, allow attendees to discuss this. If it is not live, it could be a chat or poll question.

This goal could be measured. Let's discuss further how this could be done.

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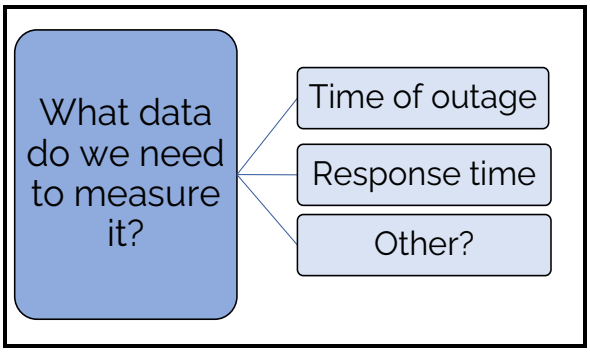
Slide 31:



If this was a goal for your utility, "Respond to water outage within 1 hour 95% of the time", we said you could measure it. But what would you need to measure it?

Note: In a live presentation discuss. In a virtual one use the chat feature.

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Here are some of the things we thought of: Time of Outage and Response Time

Are there others?

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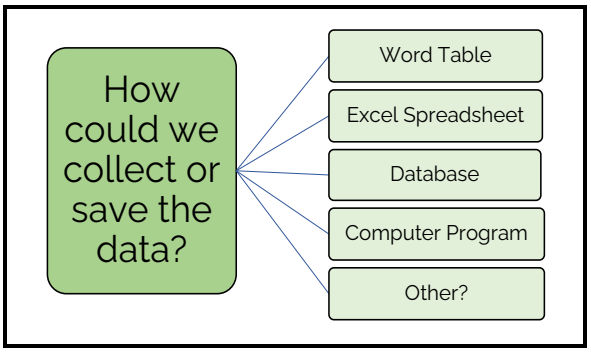

How would you collect the data?

Note: In a live presentation discuss. In a virtual one use the chat feature.

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Some of the things we thought of were Word®, Excel®, Database, Computer Program. Can you think of any others?

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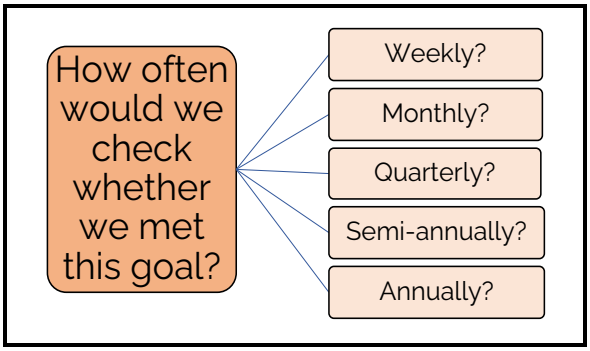

How often would we check whether this goal has been met?

What are the advantages and disadvantages of longer time frames versus shorter time frames?

This answer could vary based on the type of business and the impact of the outage. It is important to think about how much data you have and how often you collect it, as well as how often you are able to report to others. If you have an annual meeting with business leaders, you might only report to them once per year. If you have monthly meetings with upper management, you might do a monthly reporting. If we are talking about the goal of outages and only a few occur every year, annual reporting is often enough. If we have outages several times a week, monthly reporting is probably better.

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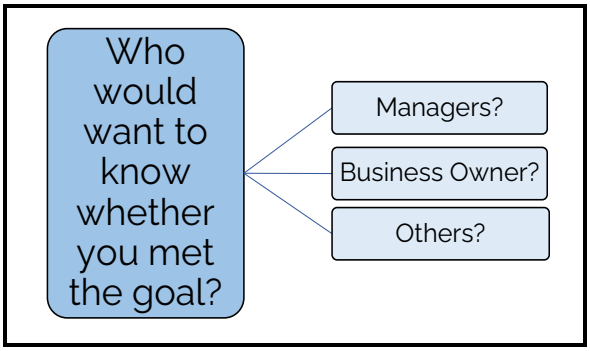
Slide 34:



Who would want to know if you met a goal?

Note: In a live presentation discuss. In a virtual one use the chat feature.

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We thought of Managers and Business Owners. Are there others? How would you share the information with each of these groups? Would it be written, verbal, or both?

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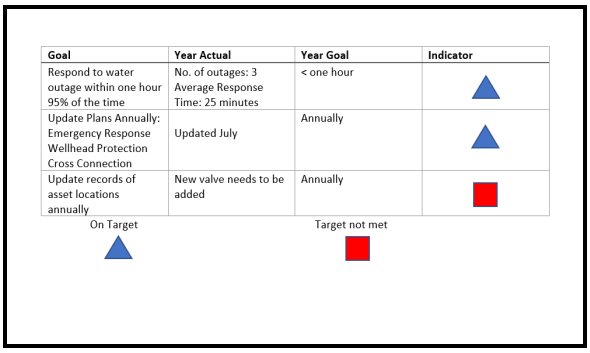

It is important to report the results of the goal tracking process. You need to consider your audience. Are you reporting to your managers, decision makers, and/or others? Consider what metrics you will share with what audiences, and how best to do that.

Here is an example of how a system reports the results of the goal tracking process. It includes targets, actual data, and an easy-to-read key for status:

- Blue Triangles for On Target
- Red Squares for Targets not met

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Slide 36:

The question is, do we really need to set goals? You may be thinking that you already operate with goals anyway so why do you need to set goals.

Note: Have an open discussion if the course is in person. If it is virtual either use poll questions or the chat function.

*In the discussion, it is worth pointing out that when systems operate, they are operating with **implied** goals but there is a big difference between implied goals and **written, explicit** goals. If the goals aren't written down and measured, the operation may change over time so that sometimes it provides what the customer wants and sometimes it doesn't.*

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Slide 37:

Sometimes you meet all your goals; sometimes you meet some but not others; and sometimes you are off the mark completely.

Goals allow for the conversation of what happens when you don't meet the goal.

It is this conversation that is most important. When goals are not met, it is critical to examine what you need to meet the goals. Is it more training? Better funding? Different equipment?

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Slide 38:

Goals aren't set in stone; they can be changed, adjusted, and added or removed. In fact, it is expected that the goals will change.

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Slide 39:

Let's review

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Slide 40:

Level of Service goals provide strategic direction for managerial, operational, and financial decisions.

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Slide 41:

Level of Service sets the overall policies, goals, and procedures for the organization and puts everyone on the same page.

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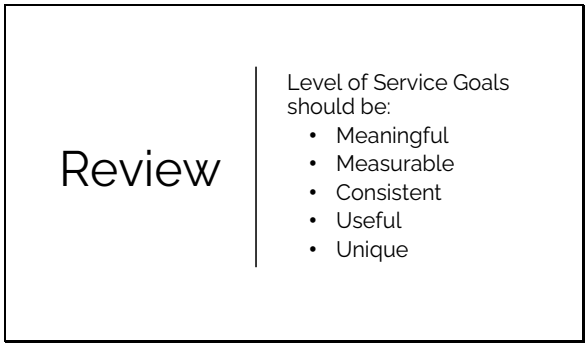
Slide 42:



Level of Service Goals should be: Meaningful, Measurable, Consistent, Useful, and Unique

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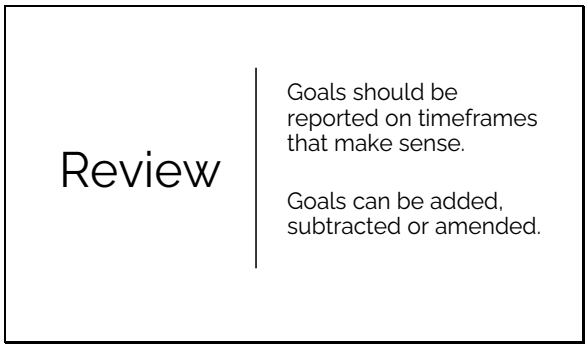
Slide 43:



Goals should be reported on timeframes that make sense.
Goals can be added, subtracted or amended.

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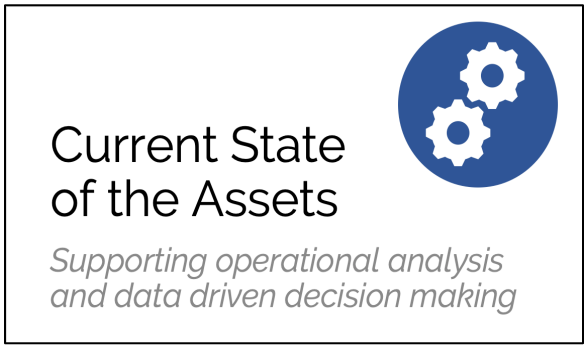
Script for Non-Community Asset Management Training
Section 3: Current State of the Assets

Slide 44:



The second core component of Asst Management is the Current State of the Assets, which is another way of saying "the asset inventory." This is where we examine system assets and the information you collect and maintain about them in order to ***support operational analysis and data driven decision making***.

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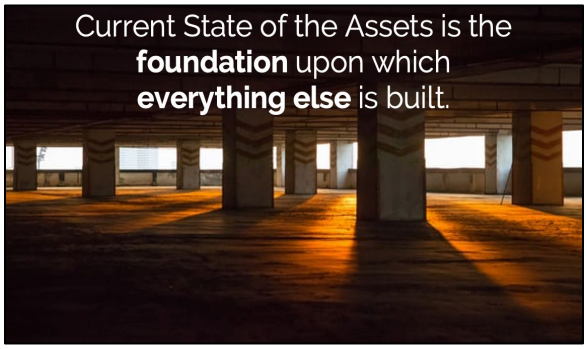
Slide 45:



Although we discuss the Current State of the Assets second in our review of Asst Management's core components, as you will see in this section, it is really the foundation upon which everything else in Asst Management is built.

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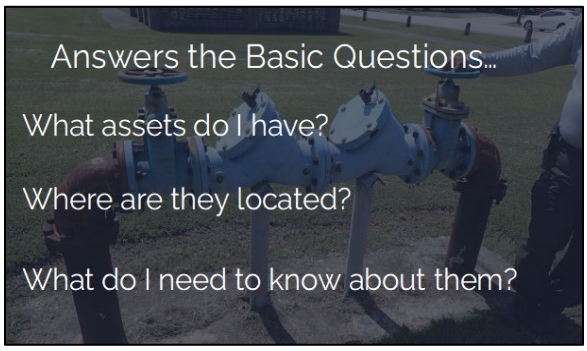
Slide 46:



What the Current State of the Assets, or asset inventory, tells you at a basic level is

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what you have,

(CLICK FOR ANIMATION)

where it all is

(CLICK FOR ANIMATION)

And what you know about it

And it is this last bit – the details - that are really the most important pieces of your inventory. An inventory is more than just a list of stuff you own or manage.

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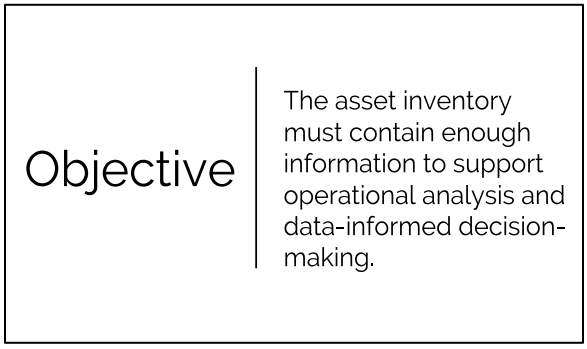
Slide 47:



This is the big take away from this section: Your asset inventory must have enough information in it to support operational analysis and data-informed decision-making. By the end of this section, you should understand the basic data points you will need to collect about your assets in order to accomplish this goal.

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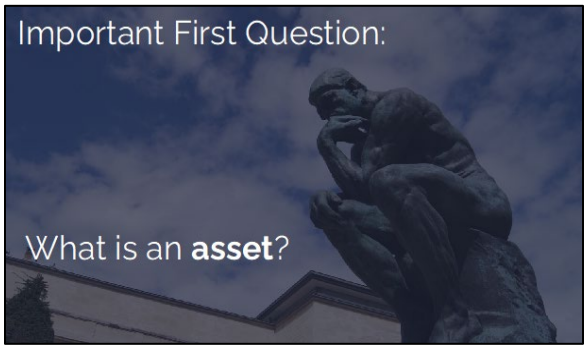
Slide 48:



Before we dive into the details, let's start with the basic questions:

First: *(Question to audience):* "What is an asset?"

The format of the presentation being given will determine how quickly the presenter proceeds past this slide. In the case of a live training the question "what is an asset?" should be posed to the audience to solicit responses.

In a live virtual setting this slide can be used to solicit responses using a virtual chat or white board feature or, if the size of the audience precludes individual interaction, can simply be stated as a rhetorical question. Acknowledge the responses and work them into the presentation if possible while viewing the next slide

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Slide 49:

This picture provides a lot of clues:

We've got a wellhead, treatment equipment, distribution pipe and valves

Presenter should incorporate responses from audience to prior slide into presentation on the fly if possible.

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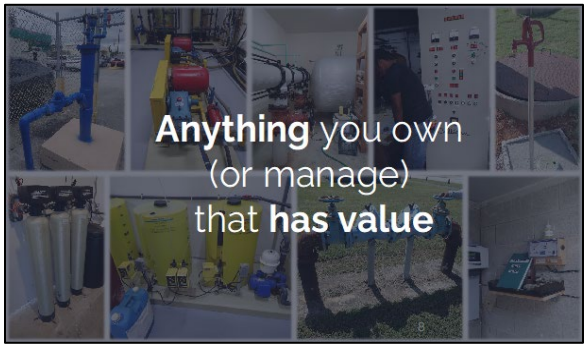
Slide 50:



An asset can be anything you own – or manage - that has value. In a community water system this typically this includes wells, treatment equipment, tanks, distribution pipe, hydrants, meters, valves, vehicles, etc. Non-Community systems may have these assets but may have other types of assets as well that need to be considered.

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Slide 51:

These could include water fountains and kitchen fixtures in a school, hospital scrub sinks, and restrooms or other specialized equipment, depending on the entity the water system serves.

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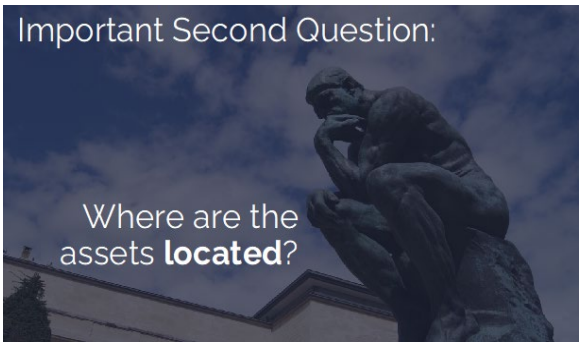
Slide 52:



The second important question is:

"Where are the assets located?

Location is critical, because once you know what assets you have, you need to be able to find them to perform maintenance, assess them periodically, and eventually rehabilitate or replace them.

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Slide 53:

There are many ways to collect and maintain asset location information but using GPS coordinates is best.

A map grid location, street address or area description may also work but be aware that in emergencies (such as a flood, fire, or other natural disaster) the reference points you used to describe a location may not be visible or may not even exist anymore.

Of course, if multiple assets are in a building, for example a well pump house or treatment facility, you only need the coordinates of the building or facility because once you find it, you've found everything in it. But for assets out in the field, individual GPS coordinates are a must.

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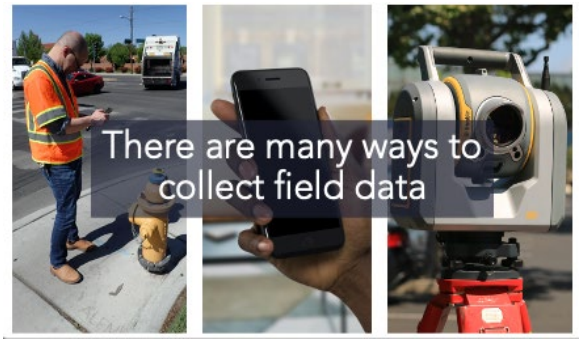
Slide 54:



There are many ways that you can collect field data. Collecting GPS coordinates has become very simple and affordable.

You can use a combination of a tablet such as an iPad, a tethered GPS or GNSS receiver like a Bad Elf®, (shown sitting on the hydrant in the left image), and a data collection app such as Fulcrum®, Esri's Collector® or Q-Field® to collect GPS coordinates and additional asset information quickly, uniformly and efficiently. This combination will produce highly accurate and uniform data and has a relatively flat learning curve.

Or you could use a data collection app with just a smart phone to take advantage of the standardized data collection that is possible using an app and the GPS that's already in the phone. A phone GPS is typically only accurate to about 3 to 5 meters but for most field assets that level of accuracy would probably be sufficient to locate them.

Or, if you want more complexity, you can hire a surveyor or use commercial grade survey equipment if you have it; but it is typically very expensive, may require specialized training to use, and isn't usually necessary.

Given the affordability and ease of use of modern GPS equipment, using GPS coordinates for asset location should be the standard. And if you use GPS equipment as part of your inventory process, you're generating a map at the same time as you generate your inventory.

(Note to Presenter: A GPS receiver only uses the US Global Positioning System ("GPS") satellites to triangulate location. A Global Navigation Satellite System (or "GNSS") receiver can typically use the US GPS satellites, as well as European, Russian, Indian, Japanese, and Chinese Geo-positioning satellite networks to triangulate location giving the user access to more satellites for geo-tagging.)

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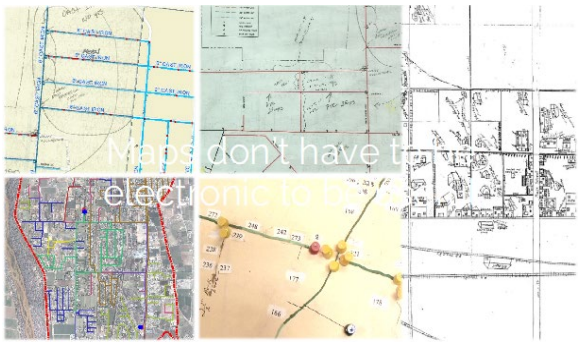
Slide 55:



And, of course, you can use that GPS (or other location) data to make maps or supplement maps that you already have (such as as-built drawings).

Electronic maps (such as maps created using a GIS system) are incredibly powerful tools, but your maps don't necessarily have to be electronic to be useful. Hand drawn maps and schematics showing relative positions of assets and event data can be great tools as well. The map in the bottom row center, for example, is a paper wall map for a small system and the push pins represent line breaks and other events. The image immediately above that is a map book that has been annotated by operators to provide a more detailed understanding of the material make up and water main age for another system. In fact, asset location data collection often starts with the maps you have.

But remember, manual options are prone to user error and don't allow the data to be manipulated electronically for analysis.

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Slide 56:

Non-Community water systems often have fewer maps because they tend to be smaller or only part of the business and not the main business. But water systems typically outlast their employees. Developing and updating maps is just one way to ensure that institutional knowledge isn't lost.

Aside from letting you know where things are today, developing maps create legacy by allowing the hard-won knowledge of your staff to be passed down, ensuring that when they leave the system the knowledge doesn't go with them.

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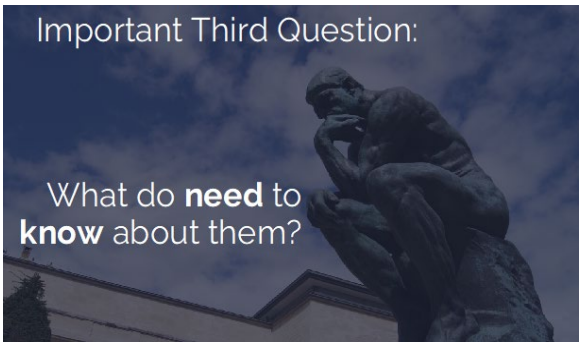
Slide 57:



The last of our basic questions is:

“What do we need to know about the assets?”

This is where the asset inventory or Current State of the Assets really starts to become useful because this is where the rest of the details are.

So, what details do we want to collect?

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Slide 58:

Every asset should have a unique name and identification or ID. All of your assets are, to a greater or lesser degree, critical to the water system operation and, in many if not most cases, you’ll have more than one of any given type of asset. Your assets have to be individually identifiable so that you can keep track of them individually.

Your ID system can be very simple – for example, a numerical list where each asset is given the next ID number in sequence as you tally them up.

Or it can be more defined and informative. You could, for example, prefix all of your pumps with P, and valves with V, so that you can more easily sort them and know from looking at the asset ID what type of asset you are reviewing.

A critical point is, however, that the Asset ID belongs to an individual asset. When the asset is replaced, the new asset gets a new ID number. That doesn't mean you throw away data you collected about its predecessor. That information is useful, and you don't want to lose it. But you must make sure that the various attributes and event data you collect about a specific asset is tied to that specific asset so your future analysis will be correct.

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Slide 59:

Condition data is particularly useful. The condition of an asset is essentially what shape it's in at a moment in time. It can range from excellent (brand new asset) to poor (an asset that is ready to fail.) You definitely want to collect data on your assets' condition to track how they deteriorate over time.

Condition is typically tracked on a numerical scale – for example 1 to 5 where 1 is excellent and 5 is failing or failed, or by using words such as

excellent, good, average, fair, and poor. But it is critical to define objective criteria for your condition scales so that they are applied uniformly. It is also important to understand that condition criteria will vary from asset class to asset class.

A motor may have condition factors addressing electricity consumption, bearing wear, or horsepower output, while a metallic pipe might have condition factors related to corrosion, internal scale build-up, or leakage and repair.

It's also worth noting that an asset can be functioning - maybe not in the manner desired - even if it is in fair or poor condition. Take the water valve in the picture here. It works but leaks constantly – so much so that the birds use it for a drinking fountain. However, these fair and poor assets require attention to restore them.

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Slide 60:

Closely related to condition is remaining useful life. Estimates of remaining useful life should be tracked because they will help you budget for capital improvement and maintenance.

There are a variety of sources available for determining the expected useful life of various assets. But you must supplement that information with your own knowledge and experience. Many factors will impact the useful life of an asset including its installation, its maintenance record, the load it is under, its location, etc.

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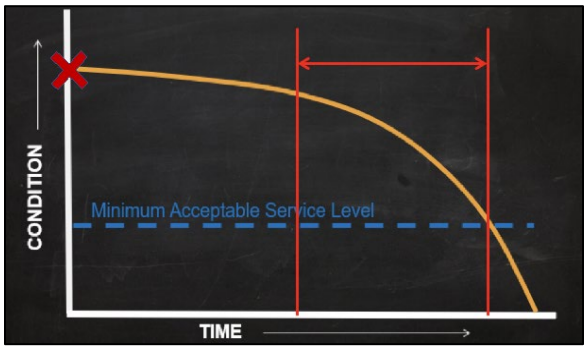
Slide 61:



This graph shows a typical asset lifespan curve in yellow. It plots the asset's condition over time starting on the left with installation and ending on the right with total failure.

When first installed (assuming the installation was done correctly) your asset is going to be in perfect condition and show up on the graph here

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Where the red X is.

Over time it will deteriorate along the yellow path and at some point, it will get here

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where the asset no longer meets the minimum service requirements you have set for it. It may still function, but it doesn't do what you need it to. Of course, if you don't intervene, eventually it will fail completely.

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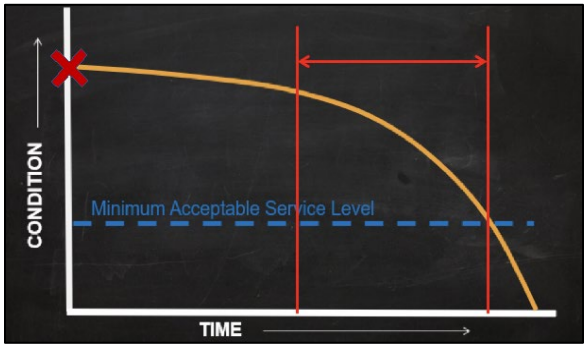
Slide 62:



By tracking condition over time, you aren't leaving replacements to chance.

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You'll be able to intervene and repair, rehabilitate, or replace your assets somewhere between those two vertical red lines, where condition is deteriorating more rapidly, but the asset hasn't completely failed. And you can do it at a time of your choosing. Planned intervention is almost always cheaper than reactive intervention.

Note that while the typical useful life of an asset might be X number of years under ideal conditions, your particular conditions may result in it having a much shorter or longer life span. Collecting and updating condition data will help you calibrate your expectations and make better predictions for intervention.

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Slide 63:

And, of course, replacement cost is important for future planning, and should be tracked in your asset inventory. Replacement cost isn't what you paid for a given asset when you installed it, but what it will cost to replace it with the current model in current dollars, or the future model in future dollars.

Generally, the farther out in time you go the less accurate your estimate will be, but it is important to try and track this information because it will help you with your capital improvement planning and the budgeting that goes with it.

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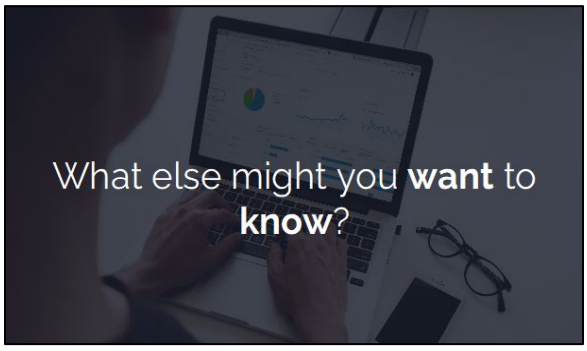
Slide 64:



So, what we have talked about so far is the bare minimum data you should be collecting and maintaining about your system assets.

Question to audience: "What else might you want to know about your assets?"

Other data that we highly recommend for your inventory include:

The format of the presentation being given will determine how quickly the presenter proceeds past this slide. In the case of a live training the question "What else might you want to know?" should be posed to the audience to solicit responses.

In a live virtual setting this slide can be used to solicit responses using a virtual chat or white board feature or, if the size of the audience precludes individual interaction, can simply be stated as a rhetorical question.

If answers are solicited from the audience, acknowledge the answers and either work them into your presentation on the fly, or (if the answer isn't covered in the following slides) incorporate them into the discussion for Slide 68.

(CLICK FOR NEXT SLIDE)

Slide 65:

Size. The asset's size is important. But recognize that "size" means different things in different contexts. For a meter size is diameter, but for a pipe section it could be both diameter and length. For a motor it might be horsepower, and for a tank size is volume.

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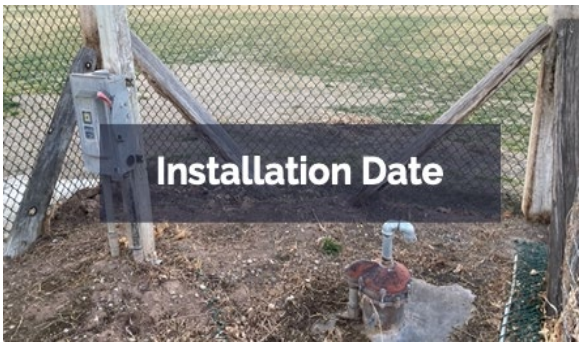
Slide 66:



Another important data point to capture is age. Although age often isn't the best predictor of lifespan it is good to know when an asset was installed so that when you are evaluating assets you can - for example - extrapolate condition from other similar aged and placed assets.

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Slide 67:

What materials the assets are made of should also be tracked where that attribute makes a difference. This is probably most important when you're tracking pipe as you are likely to have many different types in your system, and they all deteriorate at different rates.

This information is important for repairs as well by helping make sure you have the right kinds of repair supplies on hand for the different materials in your system.

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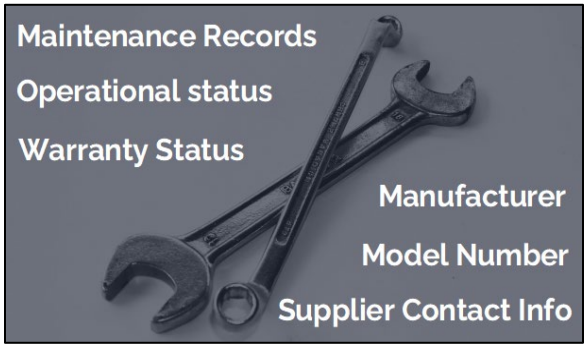
Slide 68:



Of course, the list of data points we've talked about isn't exhaustive. There is other information you can collect and add to your inventory (and your maps) that will help you track the Current State of your Assets, depending on how important you feel it is. Some of these are listed here, and there are many other data points you could collect. But only track data that is useful.

If answers were solicited from the audience at Slide 64 and haven't been covered by the preceding slides, incorporate them into the discussion here.

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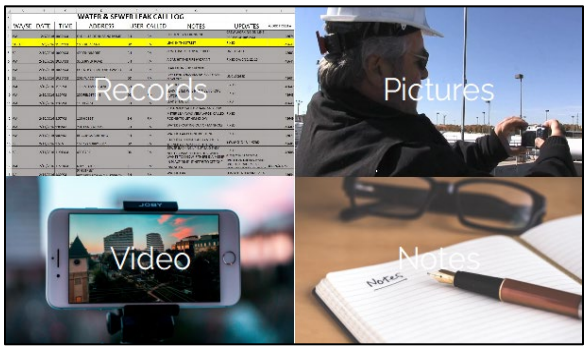
Slide 69:



There are a lot of ways to track inventory details and many sources of information when you are developing or improving your inventory.

Utility records, notes, pictures, videos, and logbooks are key sources.

The important thing is that useful asset data should be collected systematically. It helps you remember, assists in emergencies, is critical for planning, and allows the individuals in the system to leave a positive legacy.

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Slide 70:

All of the useful data we have been discussing can go into your inventory. By tracking this data, you transform the inventory from a simple list of things you own into a list with details on all the assets that you can use for analysis and decision making.

The preceding slides provided a good overview of the basic asset information you should include in your inventory to maintain an understanding about the current state of your assets, but the exact inventory details for your system are up to you and should be based on your needs.

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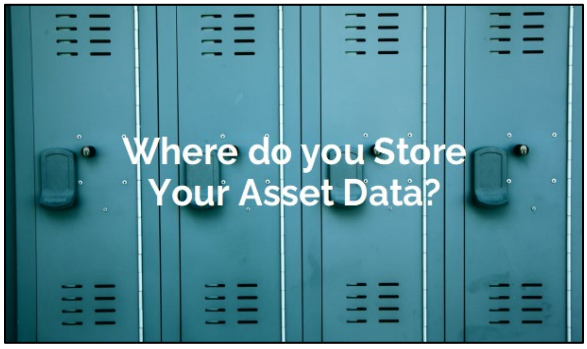
Slide 71:



Once you've determined what data you are going to collect, you need to determine how to store it.

Question to audience: "Where do you store your asset data?"

The format of the presentation being given will determine how quickly the presenter proceeds past this slide. In the case of a live training the question "Where do you store your asset data?" should be posed to the audience to solicit responses.

In a live virtual setting this slide can be used to solicit responses using a virtual chat or white board feature or, if the size of the audience precludes individual interaction, can simply be stated as a rhetorical question.

If answers are solicited from the audience, acknowledge the answers, and incorporate them into the discussion for the following slide.

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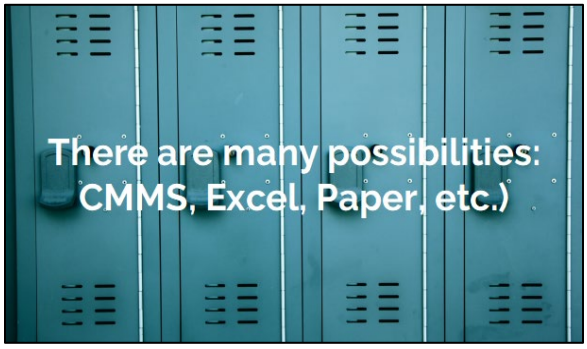
Slide 72:



There are many different ways to track your inventory. You could use a commercial computerized maintenance management system (often called a "CMMS"), or a geographical information system (GIS).

Or you could do something simpler like use a database program, or an Excel® spreadsheet.

If answers were solicited from the audience on the prior slide, acknowledge and incorporate them into the discussion here.)

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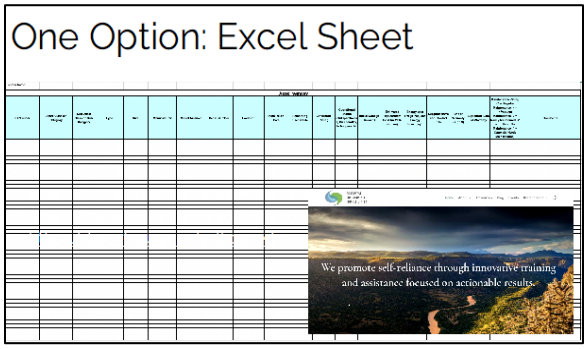
Slide 73:



If you are starting from scratch or want to transition from a paper-based inventory, a low-cost option is to start by using an Excel® spreadsheet. They're simple to use, can incorporate formulas, and the data in them can be sorted and filtered for analysis.

The Southwest EFC has developed a simple, free Excel®-based tool that you can use for your inventory. It has room for 10,000 assets, has fields for the data that we have talked about today and includes formulas to calculate details like remaining useful life. You can download it at www.swefc.unm.edu, along with many other Asst Management tools from the EFC Network and other entities.

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Slide 74:

Ultimately your goal should be developing an inventory:

- That is **complete** based on the thresholds you have set. It won't be perfect when you start, but you need to start somewhere. Your criteria can change over time and can always be updated later.

- That contains data **relevant** to your utility. Prioritize the data that's most important for your system.

- That is **current**. The inventory is a snapshot in time. The more out of date it is, the less useful it will be. It should be reviewed at least annually.

- That is as **accurate** as possible. When you find errors, update the inventory to reflect the **correct** information.

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Slide 75:

Review	The inventory should contain enough information to support operational analysis and data-informed decision making.

Remember, the inventory should contain enough information to support operational analysis and data-informed decision-making. Your goal is to make it into a useful tool.

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Slide 76:

Review	At a minimum collect and track: • Asset names and IDs • Location • Condition • Remaining useful life • Replacement cost

Focus on your most important assets to begin with and at a minimum collect and track:

- Asset names and IDs
- Location
- Condition
- Remaining useful life
- Replacement cost

(CLICK FOR NEXT SLIDE)

Slide 77:

Review	Supplement the minimum data with other useful information such as: • Size • Volume • Age • Material • Etc.

Supplement the minimum data with other information that is useful to you, such as Size, Volume, Age; Material, and anything else that is useful to you.

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Slide 78:

And finally, right size the inventory for your system. Don't overcomplicate things by collecting data you don't need or tracking assets that aren't consequential. Determine how much time you can invest in developing your inventory and take it step by step. The important thing is to start and keep at it.

Next, we will discuss the Criticality core component.

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Script for Non-Community Asset Management Training
Section 4: Criticality

Slide 79:

Once we know the level of service desired and the assets that make up the system, it is possible to determine the criticality of each asset.

Criticality is the Asst Management term for risk.

Understanding the Criticality of assets will help a system assess its overall risk which will help the utility prioritize activities based on the risk.

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Slide 80:

As many of you have experienced, there are several areas within a given water system that could use upgrading or rehabbing or replacement, but, unfortunately, there isn't funding for everything that you would like to do.

To determine where the limited funds should go first, you need to think about which assets are the most critical to your operation.
Of course, not all assets are created equal. There are some assets that are much more important to your sustained operations than others.

Criticality will help you prioritize those assets based on risk

It's important to note that the criticality of assets is completely system specific. What is critical for your system may not be critical to others and vice versa.

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Slide 81:

Objective	Understand how risk is determined so it can be used to prioritize activities.

The objective of this Asst Management component is to understand how risk is determined so you can use risk to prioritize your time and resources.

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Slide 82:

Criticality consists of two components:

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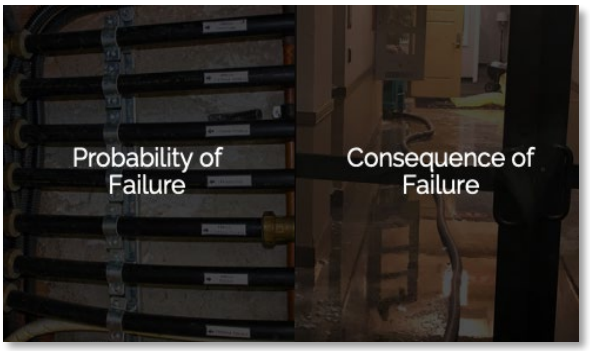
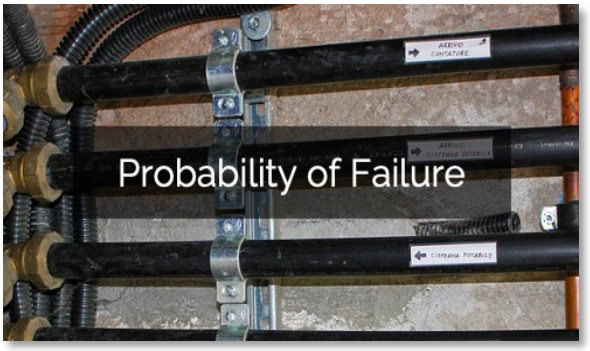
Slide 83:



Probability of Failure and Consequence of Failure

(CLICK FOR NEXT SLIDE)

Slide 84:



Let's start with Probability of Failure

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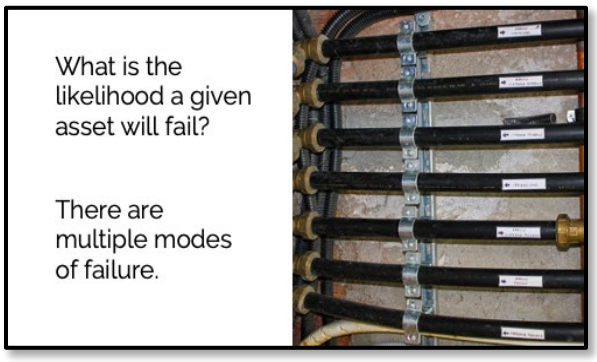
Slide 85:



Probability of Failure (PoF) refers to the likelihood a given asset will fail.

No single cause should be the sole predictor of PoF. You should think of all outside influences on an asset and how those influences could cause a specific asset to fail.

There are also multiple modes in which an asset can fail.

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Slide 86:

There are four failure modes to consider when thinking about Probability of Failure: **Mortality; Level of Service; Capacity: and Financial Inefficiency**. We usually only think of one way an asset can fail (mortality), but we need to consider all four.

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Slide 87:

Mortality is the most common type of failure for gray assets.

Asset mortality is when something physical happens to the asset and it fails due to a physical problem. **Some examples are** leaking pipes or stuck valves.

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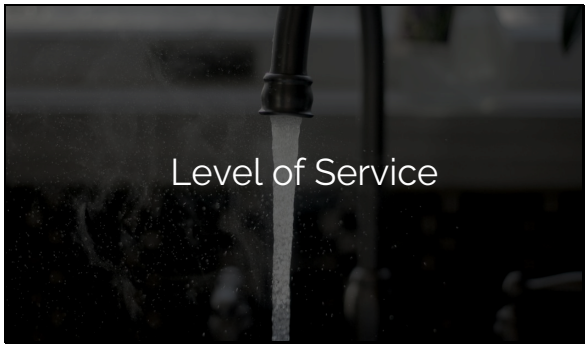
Slide 88:



Level of Service is customer service in Asst Management terms.

Level of service failures can occur because of changes in regulations or customer demands/desires. **For example:** Not providing the preferred water pressure - the pipes still deliver water, they just don't meet the level of service requirement

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Slide 89:

Capacity failure occurs when an asset is not able to deliver what you expect. An example would be the flow that you want.

The pipe could be in decent shape so there's no mortality failure but for some reasons it is not delivering the flow needed.

Examples: There is extensive mineral build up within the existing pipe that is causing flow to be limited. Or, You may have a 4" main in perfect condition, but you now want it to support fire flow and it can't because it is too small.

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Slide 90:

Financial failure occurs when you're spending too much money to continue operation & maintenance when ultimately it would be cheaper to replace an asset

Typically, it is cheaper to do maintenance than replacement but there comes a point when that is no longer true.

In cases where you are spending too much on operation, or maintenance is required too frequently for a specific asset, then it is time to replace the asset. You will have to decide how much is too much or how frequent is too frequent for your system.

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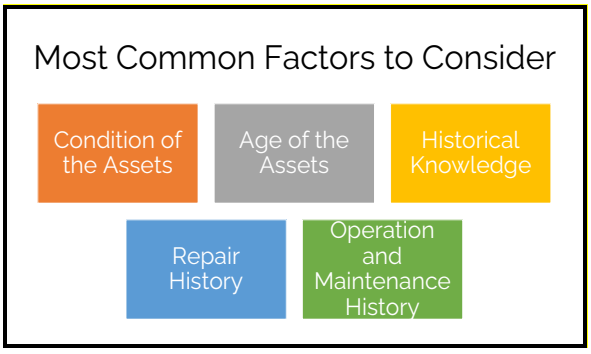
Slide 91:



There are common factors to consider when thinking about failure: asset condition, asset age, O&M, repair history and any historical knowledge. No single cause should be the sole predictor of PoF.

There is no "magic age" at which an asset can be expected to fail. So, while age is relevant, don't give It too much weight unless it is accompanied by something like an extensive repair history. For example, if a system has a cast iron pipe installed properly, made with good manufacturing techniques, that has never had a history of failure, it does not necessarily have a high probability of failure, even though it is 75 years old.

Of course, these factors will vary depending on the asset type (pipe, valve, meter etc.), and could even vary from location to location within your system

Condition and repair often go hand in hand. If the condition of the asset is good, it is less likely to fail soon. If the asset has not required repairs, then it is also less likely to fail soon. The less O&M you do on assets, the more likely they are to fail.

After considering all the factors, you need to determine how to rank assets. You do that using a numerical score.

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Slide 92:

PoF Rankings from 1 to 5

1	Extremely low probability of failure
2	Low probability of failure
3	Average probability of failure
4	High probability of failure
5	Extremely high probability of failure

Here is an example of a very general PoF ranking scale using a 1-5 scale. You do not have to use a 1-5 scale; you could create a 1-10 or a 1-7 scale; but try to make the ranking definitions as specific as possible.

Once you create a PoF scale, assign a PoF ranking to each asset.

The assets should be ranked relative to each other.

Once all assets are ranked, review them. Do they all make sense?

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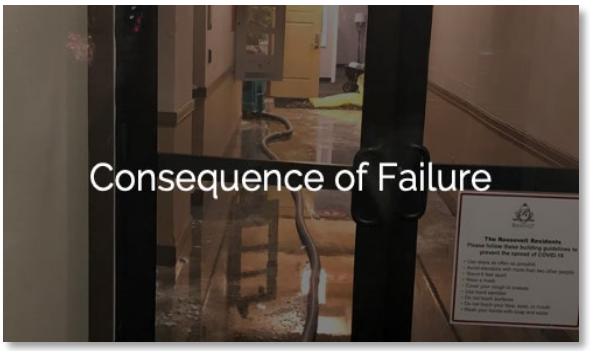
Slide 93:



We've talked about PoF; now let's focus on Consequence of Failure (CoF).

Consequence of Failure is the second part of Criticality. It focuses on the actual consequences if a specific asset were to fail.

You will need to consider the consequence of failure from a number of perspectives: safety; quality of service; property damage; environmental impact, etc.

If two assets fail at the same time and you have limited resources, an assessment of the consequences of those failures can help you determine which asset to fix first as well as where more resources should be allocated to prevent future failures.

Example: a small water pipe that serves one floor of a multistory building is not as important to a system as a single pump that supplies the entire water system. If the single pump fails, the whole building or several buildings would be out of water.

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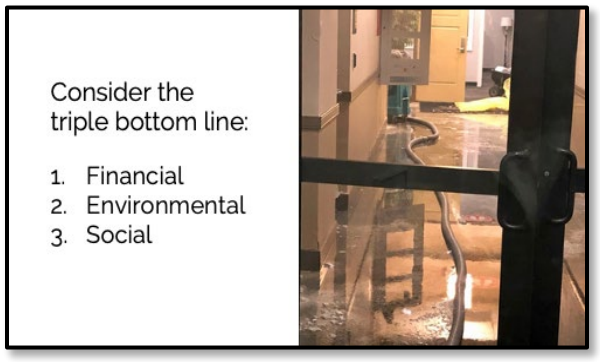

When considering the consequences of asset failure, use the Triple Bottom Line: Financial; Environmental; Social.

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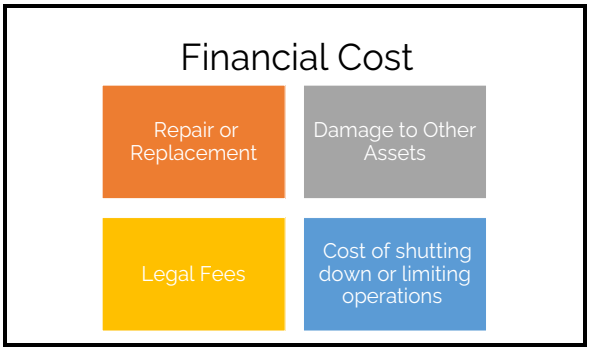
Slide 95:



Consider the financial costs associated with an asset failure. This is not an exhaustive list of financial costs but some of the most common costs to consider, including repair/replacements costs, repair or replacements costs for other damaged assets, legal fees, or the cost of shutting down or limiting operations.

Repair/Replace: The repair may be simple or extensive. Some failures may be so severe, or repairs may be so expensive that asset replacement is required. The financial cost of the repair or replacement of the failed asset must be considered in the analysis of the consequence of failure. 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.

> **Example:** A small leak in a pipe can be repaired with a clamp. A chlorine pump can be replaced with a spare pump or perhaps the parts can be replaced inside the pump. The failure of a well may be much more involved and may require much more extensive repair efforts.

Legal fees: Individuals or businesses may sue for damages or injuries caused by an asset failure. These costs would be in addition to the costs of repairing and replacing damaged property or other assets.

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Slide 96:

You also need to consider the cost of any environmental violation (fines) or contamination.

> **Example:** A sewer pipe that leaked sewage into a waterway or onto public or private land. A value, either monetary or qualitative, would need to be placed on this type of consequence. If the leakage could result in a regulatory fine, the cost of the fine should be included.

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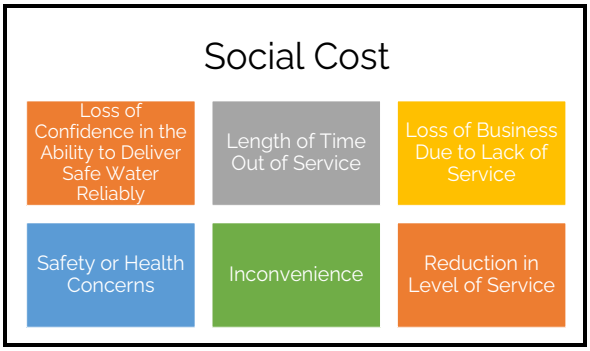

There are also social costs to consider, such as: reduction in business income due to lack of service or repair work blocking businesses; safety or health concerns for workers or general public; inconvenience due to blocked streets.

> **Example:** If a pipe must be repaired in a building, there may be a few people who are out of water for a short period of time. This would constitute an inconvenience but would not be a severe situation. On the other hand, if there were very few isolation valves in the building so that any repair requires the whole building to be shut down, the inconvenience to people is much greater.

When framed in terms of inconvenience, social costs appear insignificant, but to those who depend on the water service, the inconvenience may be extremely important and may impact how they feel about having their business in your building. There can also be a cross over between environmental and social costs.

> **Example:** Environmental damage leads to loss of reputation or a negative view of the system.

After considering the consequences of failure you will need to determine how to rank the assets based on the possible consequences of failure. This is done with a numerical score, similar to the process used for the probability of failure.

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Slide 98:

CoF Rankings from 1 to 5

1	Extremely low consequence of failure
2	Low consequence of failure
3	Average consequence of failure
4	High consequence of failure
5	Extremely high consequence of failure

Just like with PoF, you will create CoF rankings. You do not have to use a 1-5 scale, but you should use the same scale for PoF and CoF rankings. If you use a 1-5 scale for PoF rankings, use a 1-5 scale for CoF rankings.

Assign a CoF ranking to each asset. The assets should be ranked relative to each other, using not just similar asset types but against all assets in the system.

Once all assets are ranked, review them. Do they all make sense?

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Slide 99:

Calculating Criticality

Once you give each asset a PoF ranking and a CoF ranking, you can calculate a criticality score. The criticality score for an asset is its PoF ranking multiplied by its CoF ranking.

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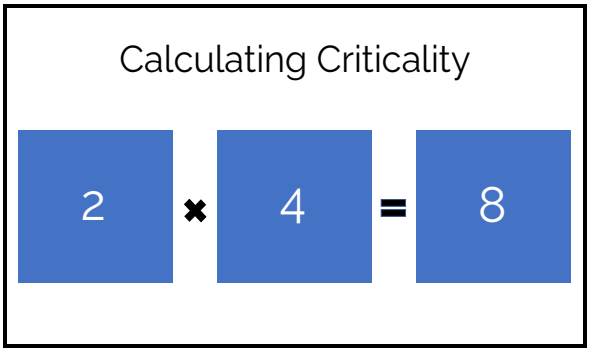

Example: If your PoF score for an asset is a 2

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and your CoF score for that asset is a 4,

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you multiply 2 x 4 to get a criticality score of 8.

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Once you calculate the criticality score of all your major assets, you will be able to determine which ones are the most critical because they will have the highest scores.

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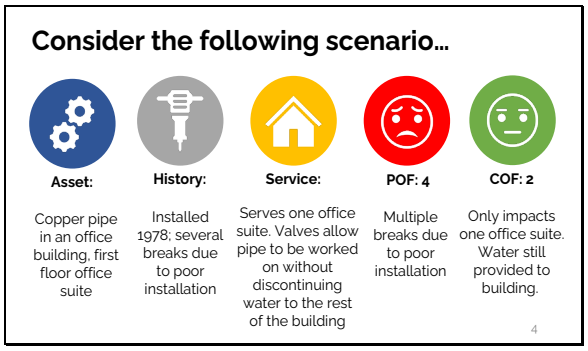

Consider the following scenario:

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Asset: The asset in this scenario is a copper pipe on the first floor of an office building.

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Asset History: The pipe was installed in 1978 and has had several breaks since then due to poor installation.

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Service: The pipe serves one office suite on the first floor of the office building. There are valves that allow the pipe to be worked on without discontinuing water to the rest of the building.

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Probability of Failure (POF) Ranking: I am going to give the pipe a POF of 4 because of the prior multiple breaks due to poor installation. The multiple breaks indicate that the pipe will likely break again.

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Consequence of Failure (COF) Ranking: I am going to give the pipe a COF of 2 because if the pipe does fail, it only impacts one office suite rather than the entire building. There are consequences like potential water damage or loss of office time that prevents the COF from being a 1.

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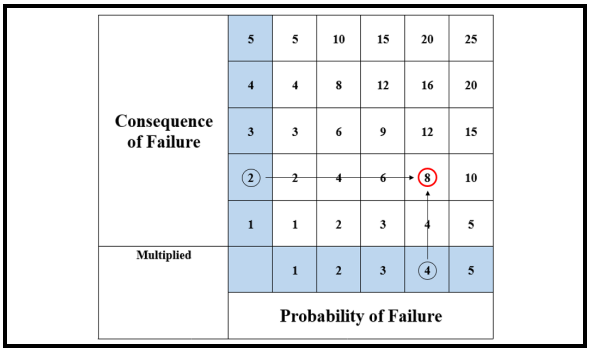

The y-axis (vertical) of the chart is the consequence of failure, and the x-axis (horizontal) is the probability of failure.

You can use this chart to multiple your CoF and PoF rankings to find the criticality score.

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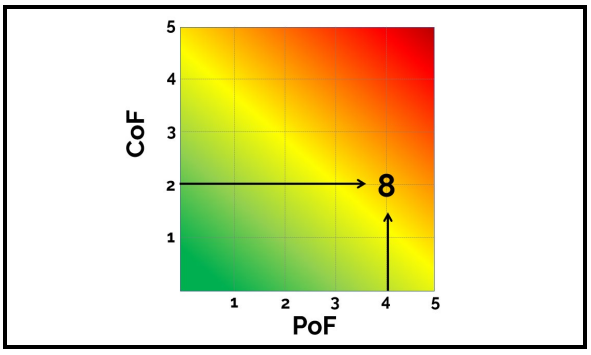

It can be helpful to plot the criticality scores on a colored grid like this one. If you plot scores for all the major assets on this grid, you will be able to visualize which assets are critical. This can be helpful for members of the public or board members who likely won't understand criticality scores if you just show them a number. If you pair criticality scores with visuals, like this color-coded chart, they can better understand which assets are the most critical.

In this example the criticality score is an 8. This score is in the orange zone which means it is more critical than any assets that would fall in the green or yellow zones.

The next example will show you a criticality score that ends up in the red zone.

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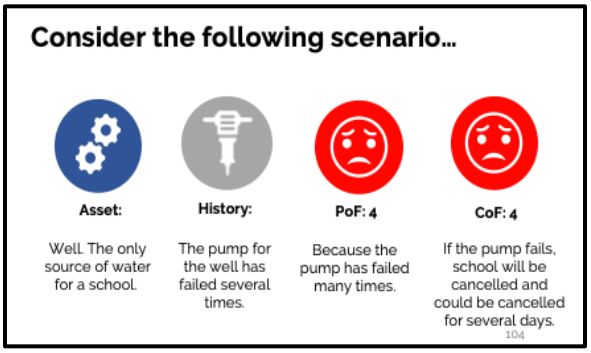

Now consider this scenario:

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Asset: The asset in this scenario is a well. The well is the only source of water for a nearby school**.**

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Asset History: The pump for the well has failed several times.

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Probability of Failure (POF) Ranking: I am going to give the well a POF of 4 because of the pump has failed several times and thus is likely to fail again.

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Consequence of Failure (COF) Ranking: I am going to give the well a COF of 4 because if the well pump fails, school will be cancelled and could be cancelled for several days.

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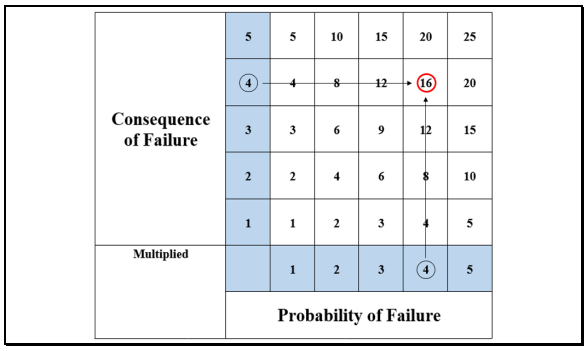

To calculate the criticality score in this example you multiply the CoF ranking (4) by the PoF ranking (4) and get a criticality score of 16.

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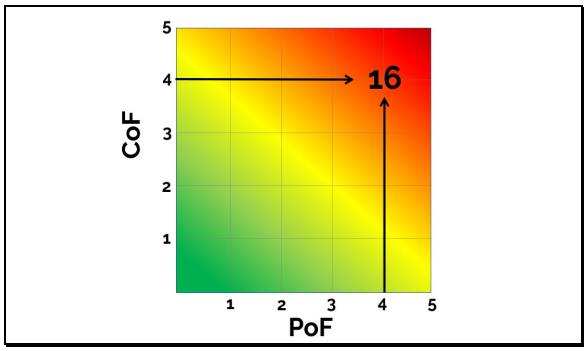

The example criticality score is a 16. This score is in the red zone which means it is one of the most critical assets for the system. You will want to monitor assets in the red zone closely and start preventative maintenance on them. You should also start to prepare for the potential need for an asset replacement.

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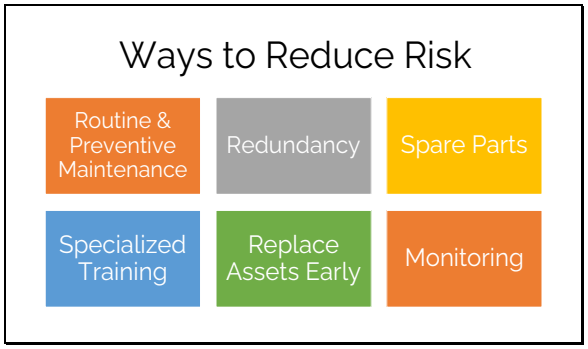

There are ways to reduce risk and thus reduce the criticality score of an asset.

You can perform routine maintenance on the low-risk assets and preventive and predictive maintenance on high-risk assets.

Risk can also be reduced by having redundant assets. Having redundant assets means that if an asset fails, there is another one that can fill in without much down time and without the delay of ordering a new asset, thus reducing risk.

> **Example:** there are three pumps available and only 2 are needed to meet the demand. If one pump fails, the standby pump will start so the demand will still be met.

Specialized training, like this one, and frequent monitoring will also reduce risk. Monitoring assets will allow you to perform the required O&M which will reduce the likelihood of an asset failing. Specialized training allows you to understand the risk factors and the importance of monitoring.

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Slide 108:

Criticality changes slightly each day as conditions change and assets are continuously used.

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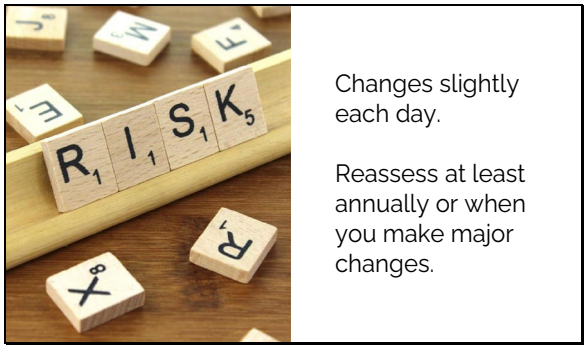
Slide 109:



You can't reassess your PoF and CoF scores daily, but you should reassess when there are upgrades, replacements, major construction, rehabilitation, or redundancy added.

If none of these occur, you should reassess PoF and CoF scores annually. Changing PoF or CoF scores will change the criticality score of an asset.

It is important to keep good records of criticality (condition assessments, field data, etc.,) to see how an asset's criticality components have changed over time. This data could be useful in the future when re-evaluating maintenance procedures or frequency or identifying assets that are considered high risk. Reassessment based on data might result

in some assets that were not previously considered high risk being re-classified as higher risk

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Slide 110:

So, let's review

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Slide 111:

Review

Criticality is made up of two components:

1. Probability of Failure

2. Consequence of Failure

Criticality is made up of two components:

1. Probability of Failure
2. Consequence of Failure

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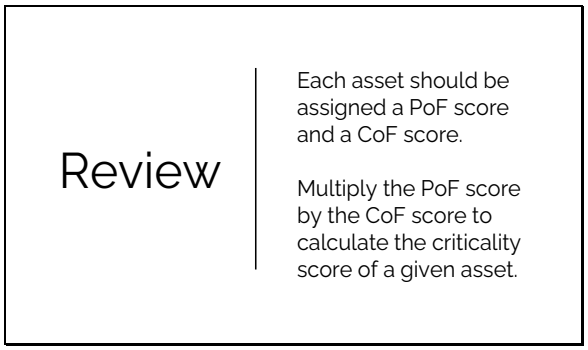
Slide 112:



Each asset should be assigned a PoF ranking and a CoF ranking. Multiply the PoF score by the CoF score to calculate the criticality score of a given asset.

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Slide 113:

The criticality of an asset can be reduced with monitoring, redundancy, training, and maintenance.

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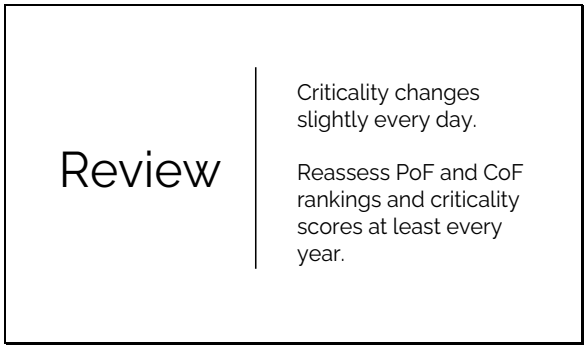
Slide 114:



Criticality changes slightly every day.
Reassess PoF and CoF rankings and criticality scores at least every year.

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Script for Non-Community Asset Management Training
Section 5: Life Cycle Costing

Slide 115:

The fourth core component of Asst Management is Life Cycle Costing. This is where we examine the overall life of the asset and the costs associated with that asset's life, as well as how best to manage the assets individually and collectively to ensure the most efficient operation.

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Slide 116:

Part of Life Cycle Costing is thinking about the collective – or all the assets together. We want to think about strategically managing the entire water system.

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Slide 117:

We also need to think of what is most effective and efficient for each individual asset as it proceeds through its life. For example, when should we conduct routine or basic maintenance? How should the asset be operated? When should we repair the asset? When should it be replaced? What kind of preventative maintenance should we do?

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Slide 118:

Life cycle costing is where strategic Asst Management (making decisions about the collective set of assets) meets managing assets (making individual decisions about each asset). Both of these aspects are important to a well-run, efficient, and effective water system.

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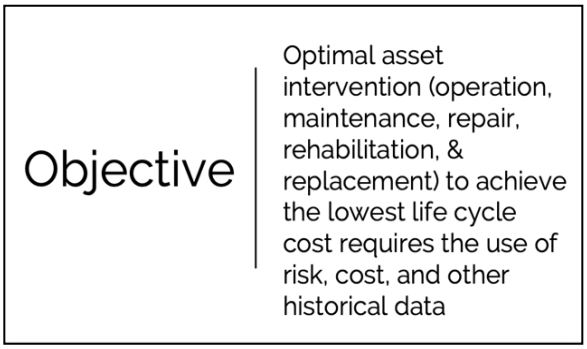

Within Life Cycle Costing, you will be making decisions about the optimal activities to do to the assets (which we call interventions). These interventions can be operational – such as deciding when to turn on a pump or how to run the lead/lag operation. Or they can be maintenance activities – when should inspections occur or when should routine maintenance be done. Or they can be interventions taken when an asset is starting to show signs of failure, which might include considerations of whether or not to replace the asset or do some type of preventative maintenance. In order to make these intervention decisions, it is necessary to have information about risk, cost, and other historical data about the assets.

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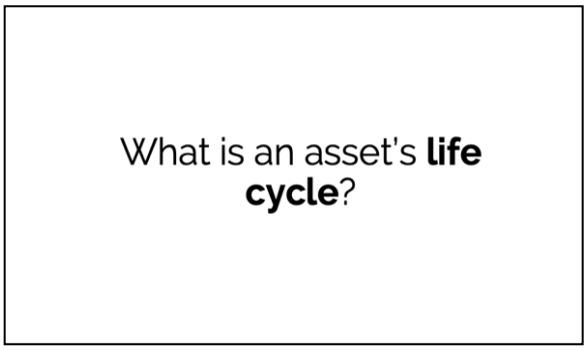

Because we are talking about Life Cycle Costing, it is necessary to consider what an asset's life cycle is.

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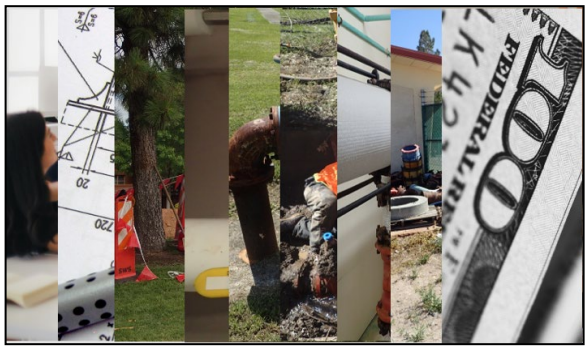

It is important to remember that an asset's life starts long before you put it into operation. The beginning of the asset's life is when it is first being contemplated as part of planning or conceptual design.

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The next part of an asset's life cycle is design.

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Followed by construction.

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Once the asset is installed, it is ready for operation.

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The next phase of the asset's life are the maintenance activities.

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If and when the asset fails, the next three stages of the asset's life come in.

Repair.

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Rehabilitation and Replacement. Which one of these activities occurs depends on the nature of the asset failure.

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At some point the asset will need to be replaced and the next phase of the asset's life comes in – decommissioning or disposal.

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Throughout the asset's life it is necessary to have funding to meet its life cycle needs, including operation, routine and preventative maintenance, and necessary repairs. Without sufficient funding to meet these needs the asset may fail prematurely and reduce the overall cost efficiency.

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Slide 122:

The part of the process where you have the most influence over the asset at the least cost is planning and design. At this stage, the asset is on paper only, and it is very easy to change things. It is much harder to change an asset once it is installed. It is really important to include operations personnel in the review at the planning, design, and construction phase because these individuals will be in charge of making the asset work once it's installed. They can point out problems with the design and construction that can be addressed *before* the asset is put into operation.

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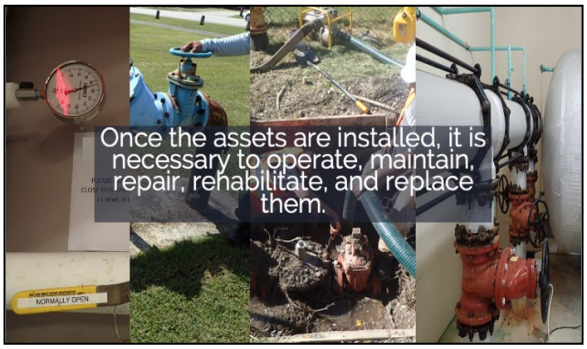
Slide 123:



Once the asset is installed, the next phases of the asset's life begin, from operation and maintenance through repair, rehabilitation, and replacement.

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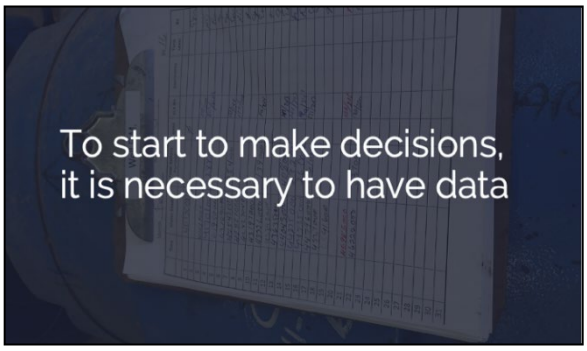

In order to know the best way to operate and maintain the asset, it is important to collect data on the asset. For example, how long did the pump run? What is the lead/lag operation? What did you observe on the last inspection? Are there visible signs of wear? When did alarm conditions occur and what was happening at the time the alarm occurred? Another key piece of information is information about costs, particularly what it costs to operate and what it costs for any maintenance activities conducted.

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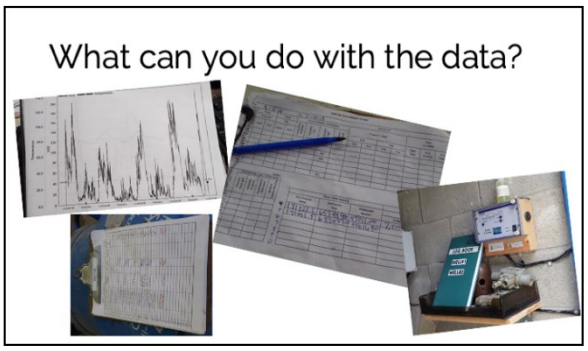

Once you have operational data, it can help you make informed decisions. For example, if you see that your time between preventative maintenance activities for your pump has been 4 months for the past year but you observe that problems were noted on inspections at 3 months, it might be time to increase the frequency of the preventative maintenance to once every 2 months to prevent the problems from occurring, rather than reacting a month after the problems occurred.

In another example, if alarm conditions occur with regularity or after very specific types of conditions (for example, when the weather changes), it may be possible to prevent the alarm condition from occurring by anticipating what might happen and adjusting operations.

Data can also be used to make better decisions going forward after a failure has occurred. The mantra, "don't just fix it, improve it", can be valuable here. If there are ways to improve the situation, that can help the entire facility.

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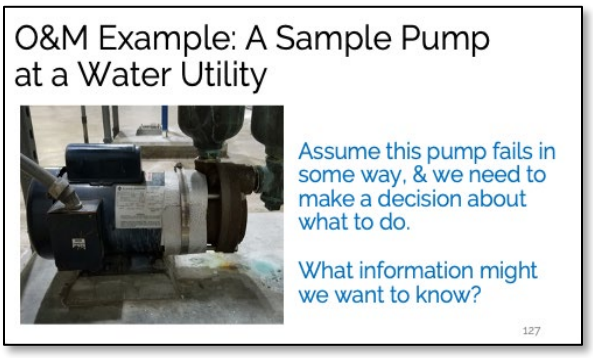

We will look at an example of a sample pump and how this facility actually used its data to make a better decision going forward. In this case, the sample pump has experienced a failure.

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If we were going to decide what action to take, what data would we want to know?

In the case of a live training, the audience should be asked what information they would want and be given a chance to state that. In a virtual training, they can be asked to chat in some answers. Give sufficient time for this to occur and read out any answers that are chatted in.

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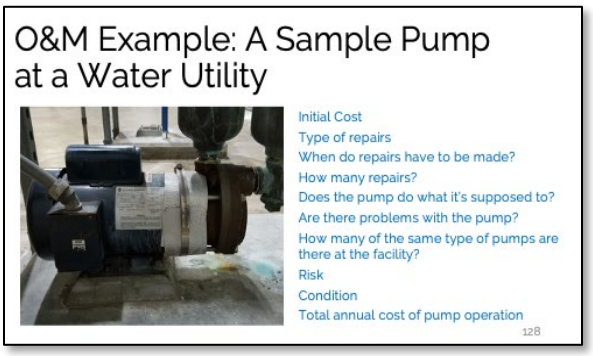
Slide 127:



There are lots of bits of information that could be helpful, including those listed on the slide, such as initial cost of the pump, type of repairs that have taken place, number of repairs, current condition, and so on.

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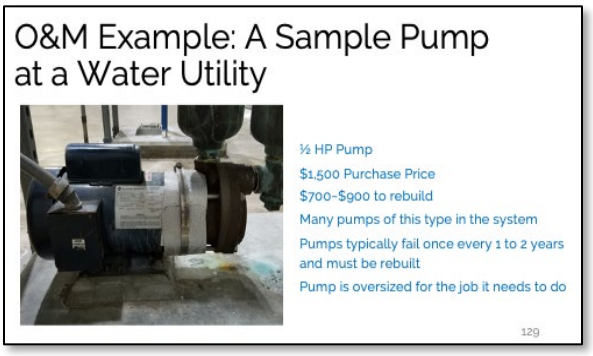
Slide 128:



This facility had more data than what is shown here, but for simplicity, we've provided some of the key pieces of information for this pump. It is a ½ horsepower pump that cost $1,500 to purchase and requires a rebuild every year or two at a cost of $700 to $900. The pump is oversized for the job it needs to do, which is to take water from a filter and pump it to a sample tap a few feet away. There are several pumps of this type in the facility, so whatever decision is made for this pump can apply to other pumps as well.

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Slide 129:

The facility determined that a cheaper alternative was to purchase a 1/16 horsepower pump that cost $250 new and didn't require any rebuild. This smaller pump is better suited for the application and will save the facility at least $2,000 every few years per pump. By using its data wisely, this facility was able to improve the situation instead of just fixing it.

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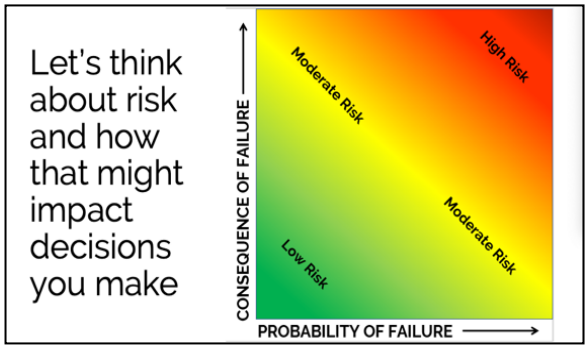
Slide 130:



In the previous section, we discussed risk. It is important to understand how the concept of risk can impact what decisions you make in terms of how you want to operate, maintain, repair, rehabilitate and replace your assets. Recall that the riskiest assets are those in the upper right in the red area and the least risky are in the lower left in the green area.

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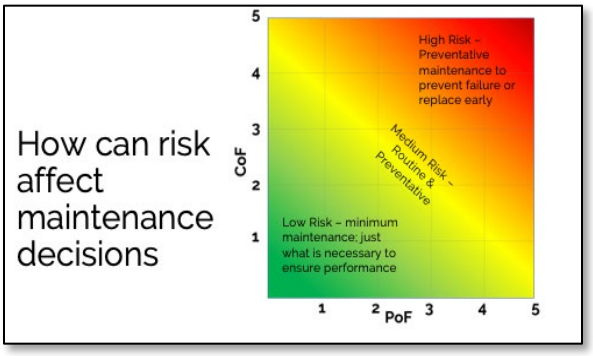
Slide 131:



Let's think about how risk can affect maintenance decisions. Assets in the high-risk category must not be allowed to fail. If they do, it will cause serious consequences for the facility. However, we also understand that these assets are indeed likely to fail. Therefore, we need to take action to prevent the failure. For each asset in this category, we need to think about what action can prevent the failure. For some assets, that might be some preventative maintenance; for others it might be rehabilitation; and for others it might be necessary to replace the asset to ensure it doesn't fail.

For those assets in the moderate risk category, we want to make sure to do our routine and preventative maintenance to ensure the asset stays in working order and does not move to high risk. Our goal is to move the asset to a lower risk category if at all possible, or at least have the asset remain in the moderate risk category.

Assets in the low-risk category are not likely to fail and even if they do, we aren't very concerned about it. These assets require only the minimum maintenance necessary to prevent the asset from increasing its probability of failure, but no extra work should be done.

Essentially when we talk about risk and how we should use it to make decisions, we want to expend more of our resources on the higher risk assets and less on the lower risk ones.

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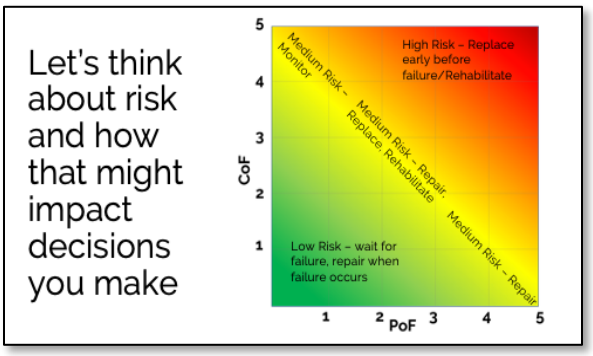
Slide 132:



In terms of repair, rehabilitation, and replacement decisions, the risk can again enter the decision-making process. High risk assets are likely to be replaced, while low risk assets are likely to be repaired. Those in the moderate category range from monitoring to replace to repair depending on whether the risk is moderate because it is likely to fail or because it will have a bad consequence or both.

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Slide 133:

Let's use what we've been talking about in a very simple example.

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Slide 134:

Instead of a water system, our operation is skydiving. The assets that matter for us are the jump-suit, the shoes, and the parachute.

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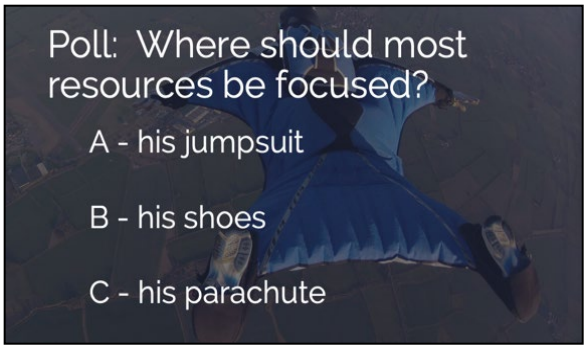
Slide 135:



Of these assets, where should most of the resources be focused?

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A – his jumpsuit

(CLICK FOR ANIMATION)

B - his shoes

(CLICK FOR ANIMATION)

C – his parachute

For this poll, it could be hand raising in the case of an in-person training or use of the chat feature or poll feature in the case of a virtual training.

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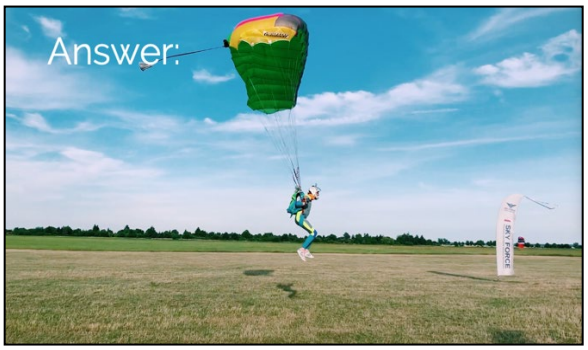
Slide 136:



The correct answer, of course, is the parachute. If we don't have the parachute in proper working order, the skydiver will die. If his suit or shoes don't work properly, he may be uncomfortable in the dive or in the landing but will likely survive.

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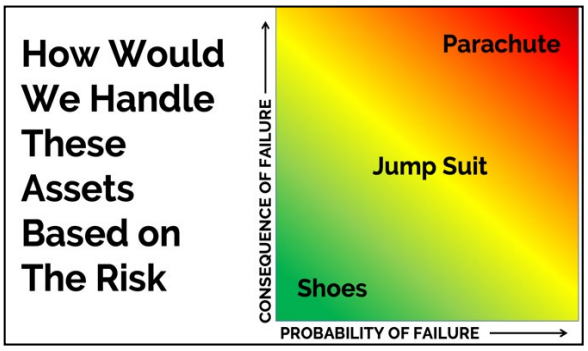
Slide 137:



Let's plot the assets on the risk chart we were using earlier. In this simple case, the parachute is the highest risk, the jump suit is moderate, and the shoes are low risk. If we haven't been taking care of our parachute, it is both likely to fail and would have serious consequences so it would show up on the graph on the top right. This is not a good

situation, and we would want to move the parachute out of the high-risk category. How could we do that? One option is to do repair or maintenance of the parachute to get it into better working order.

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If we do that, the parachute moves left to the moderate risk category where it is less likely to fail but the failure would still cause significant consequences. If we wanted to reduce the risk further, we could add a back-up parachute.

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In this case, the consequences are reduced because if the main parachute fails, the back-up parachute can engage to save the skydiver. You will note that the parachute does not move all the way to a low-risk asset because even with the backup, the consequence is still going to be a possibility. Both parachutes could fail.

(CLICK FOR NEXT SLIDE)

Slide 138:

> If we want to replace the assets in a planned manner over time, we need to think about when each asset should be replaced and how much that might cost.

If we consider the skydiving example a little further, we can think about when we would want to replace each of the assets and what it would cost us to do so. Let's suppose the parachute costs $4,000, the jumpsuit costs $1000 and the shoes cost $200. Let's say the parachute can last for 20 years, the suit for 10 years, and the shoes for 2. We would then

be able to design a simple capital replacement plan to cover 20 years. In that time, we would need to buy 1 parachute, 2 jumpsuits, and 10 pairs of shoes. The total cost would be $8,000. This would be the equivalent of spending $400 per year.

While the parachute example is simplistic, it still demonstrates the thinking that goes into replacing assets. We need to think about our water assets and how often they need to be replaced and what it will cost over a long term to replace them.

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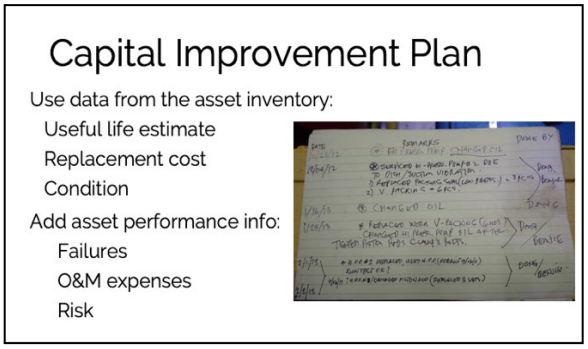
Slide 139:



To create your capital improvement plan, like we described for the parachute example, you can use data from the asset inventory including useful life estimates, replacement cost, and condition to help determine what year each asset will need to be replaced and the cost for the replacement. The replacement year can be adjusted with data from asset performance, including failures, O&M expenses, and risk to determine whether an asset needs to be replaced sooner or can be kept in service longer.

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Slide 140:

Capital Improvement Plan should cover at least 10 years, but 20 or more years is better measure of when assets should be replaced Provides a budget over time for replacing assets

The Capital Improvement Plan should cover at least 10 years, but 20 years is better. In fact, the longer the time frame the better. Looking long term avoids putting off investments in the short term because you are aware of the need for investments longer term. Once you know the total budget needed you can invest the equivalent amount of money per year to cover that total amount of money. That investment can be made a little at a time or it can be made in chunks with more money being invested in some years and less in others.

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Slide 141:

The capital improvement plan should be reviewed at least every few years to see if there are any changes needed.

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Slide 142:

What we've been talking about in the last few slides is the amount of money you need for capital replacements. This is called the "capital budget." It should include that incremental funding you need every year to replace assets. In some years you may not need to spend that amount while in other years you need to spend more, but the equivalent amount of the annual funding should be provided.

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Slide 143:

The other part of the budget is the annual operation and maintenance budget. That budget should include all the money you need for operating and maintaining all of the assets in the system.

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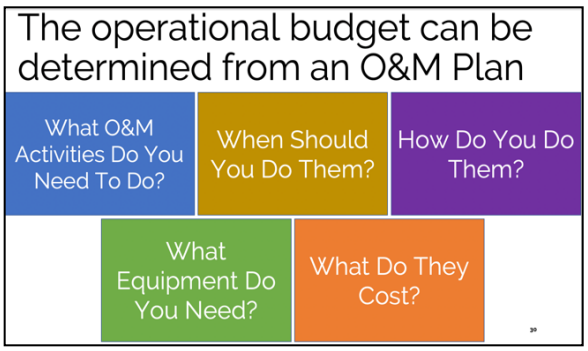
Slide 144:



Your O&M plan can help you determine your O&M Budget. If you don't have an O&M Plan you should develop one. It should help you determine the activities you need to do,

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the schedule to do them,

(CLICK FOR ANIMATION)

how you do them,

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the equipment you need to complete the tasks,

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and what the tasks cost.

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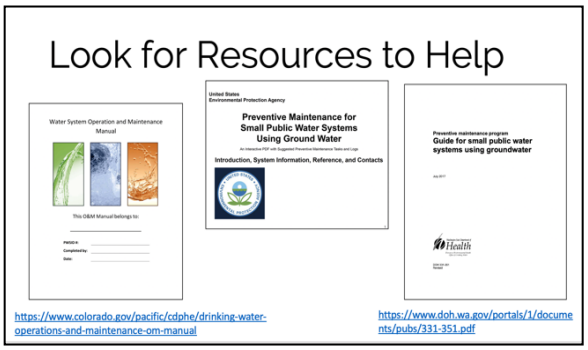
Slide 145:



There are lots of resources to help you develop a plan. Three good resources are shown on the screen. One of them is a tool that the SW EFC developed for EPA to help outline O&M tasks. It is available on EPA's website. The other two were developed by Colorado and Washington. Colorado's is very easy to use and has other components that you might find handy.

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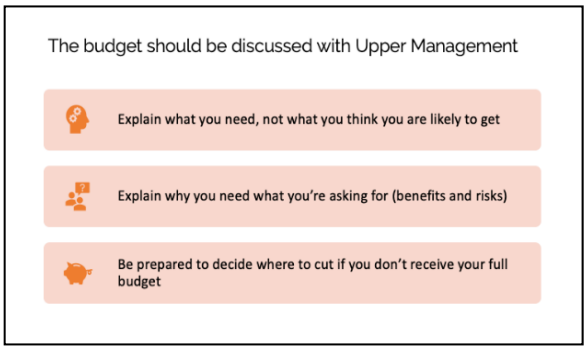
Slide 146:



It is very important that you request all the money you believe you will need even if you are unlikely to get that amount of money. It's important to convey the full cost of operations to the financial managers so that they understand that providing any less money means some tasks are not going to be completed. Any tasks that don't get done will increase the risk to the organization. The more money that is cut from the budget, the greater the increase in risk to the facility. It is important

to convey these risks and the benefits of providing the full budget. In the end, you will get whatever amount of money your upper management provides, but it is important to understand the true need. Once the budget amount is provided you can begin the task of deciding what you want to do and what you will put off.

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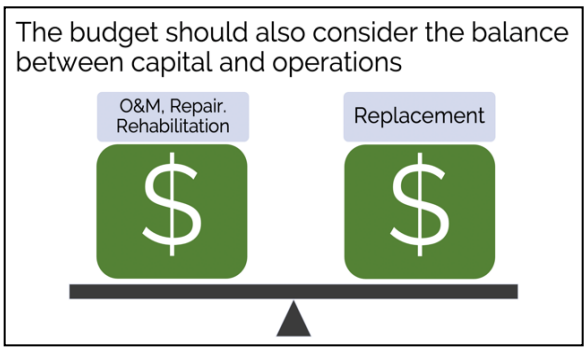
Slide 147:



Another component of not fully funding the operation and maintenance budget is that it can change the balance between O&M, repair, and rehabilitation versus replacement.

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The less that is put into the O&M side, the more that will have to be put into replacement because assets will fail sooner. When this balance favors replacement over maintenance and repair, costs will go up because replacement is generally more expensive that maintenance and repair.

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Slide 148:

In summary, it is important to think about what data you collect, how and where you keep it, whether or not it is accessible and how you can use it to make better decisions.

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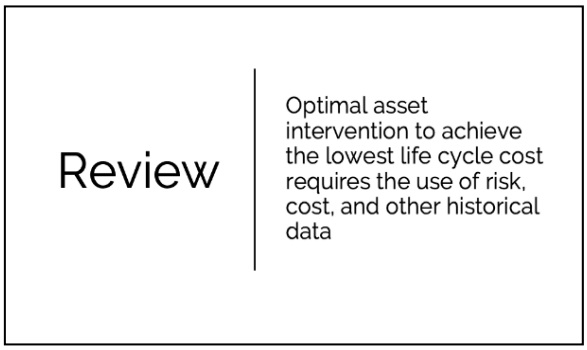
Slide 149:



Optimal asset intervention (operation, maintenance, repair, rehabilitation, & replacement) to achieve the lowest life cycle cost requires the use of risk, cost, and other historical data.

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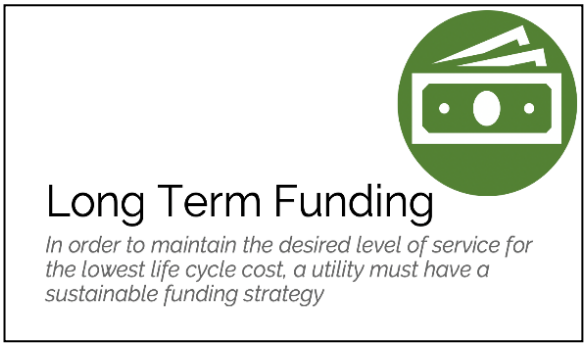
SOUTHWEST ENVIRONMENTAL FINANCE CENTER

Script for Non-Community Asset Management Training
Section 6: Funding

Slide 150:



The final core component of Asst Management is Long Term Funding. In order to implement any of your plans as a result of the first 4 components, you will need a way to pay for those actions. This core component helps you develop a sustainable, long term funding plan.

The two key words are "sustainable" and "long term." It is important that the funding be sustainable, or maintained at a specific level, so that the utility can meet its obligations and deliver the desired service to its customers. Additionally, the funding plan needs to be long-term. Since the assets are going to last for a very long time, the funding plan needs to consider at least 20 years, but even longer (50 years, for example) is better.

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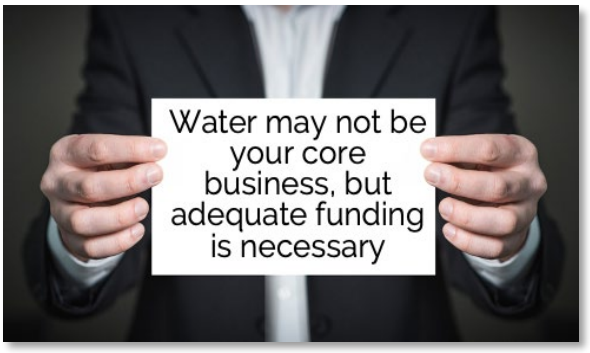
Slide 151:



For Non-Community systems, water is typically not the core business. So, the water system or water department is probably just a line item in the overall budget. Think about how your water system/department gets the money you need to deliver the service.

If the training is in person, have a discussion with the attendees regarding where their money comes from. Ask them if that funding is adequate. If the training is virtual, ask the attendees to chat in an answer. Rather than just the standard answer of "it's in the budget" we're looking for an answer related to how money comes to the actual facility/business, etc. For example, if it is a restaurant, the money is coming from food sales; if it is a factory, the money is coming from the sales of the product; if it is a school, the money is coming from property taxes or something of that sort.

It is important to understand the dynamic between the main source of business, how funds are obtained, and how that relates to the water system or water department. This information can help determine whether additional funds can be made available for water and how.

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Slide 152:

Objective	Understand that it is necessary to have a sustainable source of adequate funding to effectively manage your assets

It is impossible to run a utility without funding. Money is necessary to repair, maintain, rehabilitate, and replace assets. It is necessary to pay for supplies and equipment and pay operator salaries. If there is insufficient funding it will not be possible to run the utility effectively, and significant down-time or other negative impacts may result.

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Slide 153:

Daily/Weekly /Monthly Inspection of Equipment	Compliance Sampling	Conducting Safety Inspections or Checking Equipment	Preventive Maintenance	Repairs
General Housekeeping	Routine Maintenance	Chlorine Residual Measurement	Training of Operators	Replacement of Assets
Rehabilitation of Assets	Operations	Capital Improvement Planning	Record Keeping	Relations with Other Parts of the Organization

Thinking back to earlier discussions, it is necessary to have money in order to complete the tasks necessary to keep your water system running, such as those shown in the slide. Think about the tasks you have to do for your system, including which tasks take the most resources, both personnel time and money, for your organization.

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Slide 154:

Now think about the resources – both personnel and money – that you have available to complete your tasks. How many people are available to operate the system? How much time does each have available? What takes their attention the most? What's the annual operating budget?

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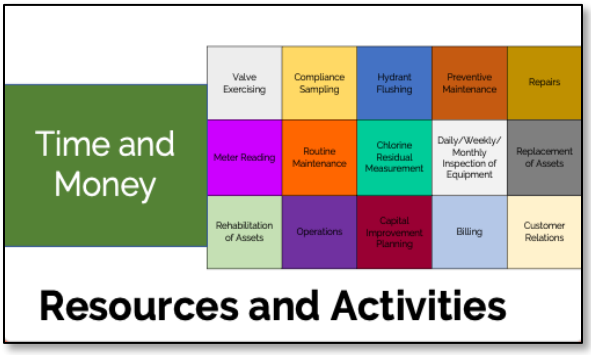
Slide 155:



Most likely, the resources available are less than the total resources required to complete the required tasks to keep the water system running properly.

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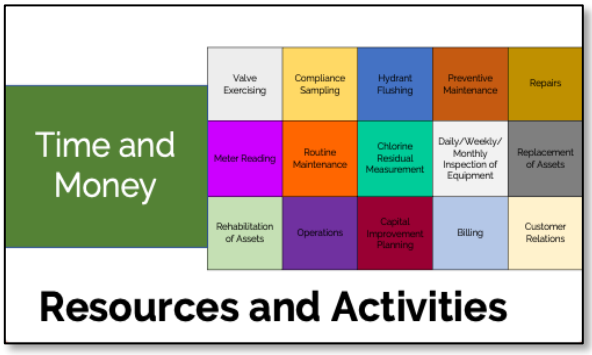
Slide 156:



So, what happens?

If you had enough resources, you could cover all your expenses with parts of the green box, which represents personnel time and money, with the resources available to you. But when you don't have enough resources, some tasks don't get done, while others are put off or done partially.

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Think about your system. What types of tasks are you likely to put off if funding is inadequate? What tasks are not done at all? Which ones do you put your time and dollars towards?

What happens when you can't complete these tasks? What if some of the tasks you aren't doing are higher priority than tasks you are doing? What would the impact be? How do you decide on the best way to spend your limited dollars and time?

You need a framework or an approach to help you decide the best place to dedicate your resources.

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Slide 157:

Let's talk about the financial resources available.

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Slide 158:

When you think about your utility's budget, think about whether the money is being spent efficiently; whether it is being wasted; or whether it is somewhere in between. Money is required to run the water system/department, and the goal of Asst Management is to ensure the money is spent as efficiently as possible. Which areas seem the least accurately funded? Which seem the most? If you had the ability to shift funds around, how would you do that? If someone gave you additional funds, where would you spend them?

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Slide 159:

How do you plan for your funds? Do you have a budget? Do you have a capital improvement plan? How recent and how relevant are these plans? How much effort goes into the plans? How accurately do they reflect your needs today?

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Slide 160:

O&M and minor repairs should be funded year to year as part of the budget planning. The budget process each year can start with a zero-based budget, meaning you wipe the slate clean each year and start fresh looking at needs. Or it can start with last year's budget and be adjusted up or down from there. There are pros and cons to each approach. The main thing is to take a serious look at the budgeting needs each year and to provide specific information related to your needs. Any actions or activities or circumstances that could cause a budget increase in the coming year should be considered.

Major repairs, rehab, and replacement require a capital improvement plan that plans out the money you will need over time. In general, the capital improvement plan will have more detailed and *specific* cost estimates for anything that needs to be addressed in the next year or two, and more *general*, less specific estimates for replacements that need to be done years into the future. The CIP should cover at least 20 years so budget projections can be made.

Think about your plans. Do they accurately reflect where your utility is? Or is your utility gambling that everything will go well with no idea of how to deal with it if it doesn't? There needs to be consideration of how to deal with unexpected events that could impact the utility.

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Slide 161:

To ensure sustainable funding, you must understand what funds are available to your utility. How are your funds provided? Where do they come from? Do you have any input into the amount of funding you get? In what way? If your budget is insufficient, could you address that during the year or only at the beginning of the next year?

What happens if you have insufficient funds? What activities do you intend to reduce or eliminate? What impact will that have on your operation of the overall facility?

Will a lack of water cause a shutdown in the main business of the facility or reduce activities in some other way ? What economic impact would a lack of water cause? How long could the facility go without water and how would that impact the ability of the facility to make money? For example, will it shut down a production line? Will the school have to close, or the restaurant shut down?

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Slide 162:

The other four parts of Asst Management provide you with sufficient information to determine your priorities. Use this information to develop a funding plan for how to spend your limited dollars based on those priorities. Understand which activities should not be cut at all (those that relate to regulatory requirements and those that ensure the overall organization keeps running); which could be reduced (those with medium priority); and which can be eliminated or significantly reduced (anything related to low-risk assets).

The funding plan can help you determine how to react to budget shortfalls or reductions without severely compromising the water system/water department or the overall operation. However, it is necessary to have a conversation in the next year to determine better ways to address the budget in the future. Long term reductions in necessary funds will lead to negative results. The funding plan will help in the short term, while an increased budget is needed for longer term sustainability.

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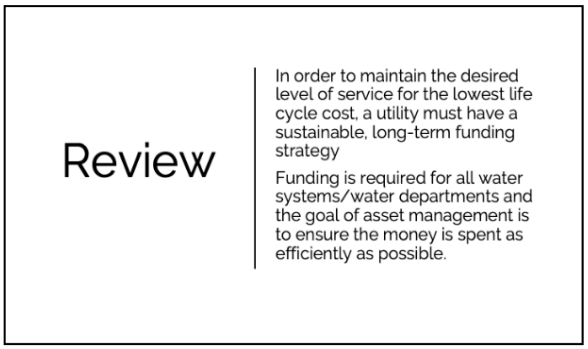
Slide 163:



In order to maintain the desired level of service for the lowest life cycle cost, a utility must have a sustainable, long-term funding strategy. Funding is required for all water systems/water departments. The goal of Asst Management is to ensure the money is spent as efficiently as possible.

Now that you have learned about the Asst Management framework, you can go through each step with your utility in mind to identify priorities and put together a plan that will keep your water system funded and operational for the long-term.

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Script for Non-Community Asset Management Training
Section 7: Wrap Up

Slide 164

Asset management is designed to help you decide **how**, **when**, and **where** to spend limited funds to achieve the best results for your assets and those consuming your drinking water.

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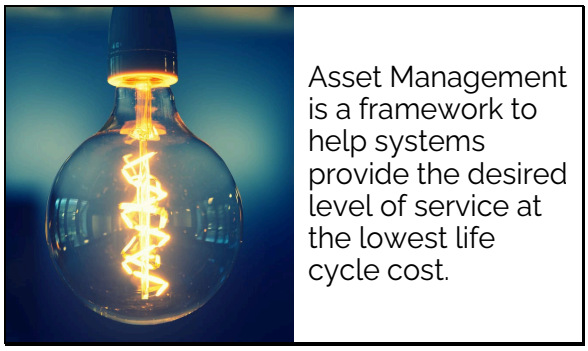
Slide 165:



Let's go back to our basic definition: Asst Management is a framework to help systems provide the desired level of service at the lowest life cycle cost.

The desired level of service is what you want your assets to provide or, essentially, what you want them to do.

The lowest life cycle cost is the best appropriate cost to operate your assets, so the system is financially efficient.

Asset management is not a linear process; as we have shown, it is a continuous process with no beginning or end. The core components overlap and intersect with each other; and one portion depends on another.

Before we end today, I want to briefly review each component of Asst Management for everyone.

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Slide 166:

Level of Service

The system Level of Service Goals provide strategic direction for managerial, operational, and financial decisions. .

For Non-Community systems, water is usually not your primary business, which might be a business, school, industry, or other entity However, the delivery of water service within the organization is similar to any other service organization. Any service organization has the competing priorities of providing high quality service at a low cost.

The Level of Service goals you create provide strategic direction for managerial, operational, and financial decisions. Creating Level of Service goals helps drive your actions and helps you maintain consistent service and high-quality water.

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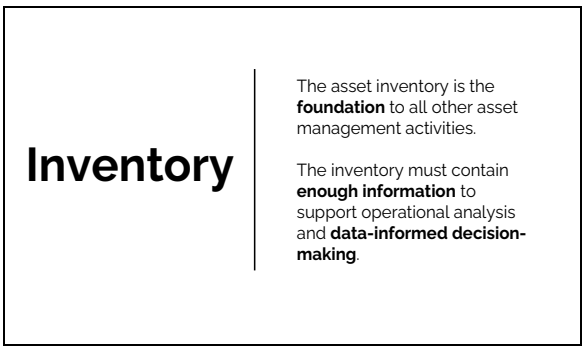
Slide 167:



In order to meet the Level of Service goals, you must know something about the assets that make up your system. It is these assets that will allow you to provide the service to your customers.

If you don't understand what assets you have, where they are, what condition they're in, how long they will last, and what it costs to replace them, it becomes very difficult to reliably provide service and meet the level of service those consuming your water want. Therefore, it is crucial to have an asset inventory with this information.

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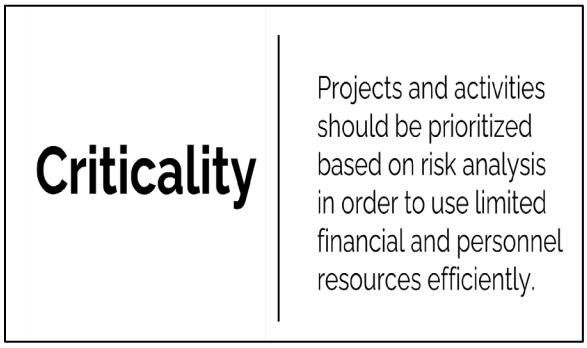

If you have set Level of Service goals and inventoried the assets that make up your system, you can determine which assets have the highest likelihood of failure and the highest consequence of failure. These variables determine an asset's criticality.

Understanding the criticality of assets will help you assess the overall risk associated with each asset which will help you prioritize activities based on the risk.

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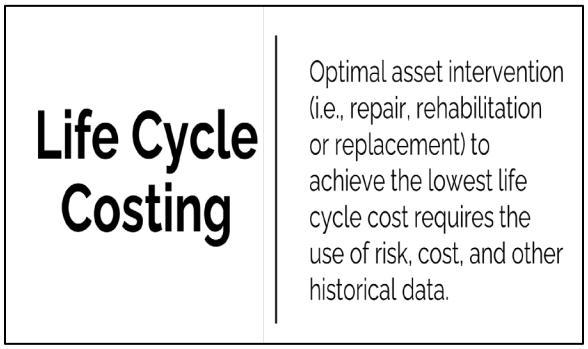

Staff usually focus on Life Cycle Costing once the level of Service goals are defined, and assets are inventoried and assessed for risk.

Remember, the life cycle cost of an asset considers the entire life of the asset from the earliest phases of planning, through design and construction, operation to maintenance, repair, rehabilitation, and eventual replacement.

At each stage of the asset's life, there are potential interventions that can be done.

The goal is to undertake the most cost-efficient interventions during each phase of the asset's life.

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Slide 170:

Everything costs money and even the most cost-efficient systems have to have a sustainable source of funding for the long term.

Know how much money you need and where it comes from. In the case of a Non-Community system, the water system budget is most likely a small part of the overall budget, but it is necessary to ask for an adequate budget and explain why it is necessary.

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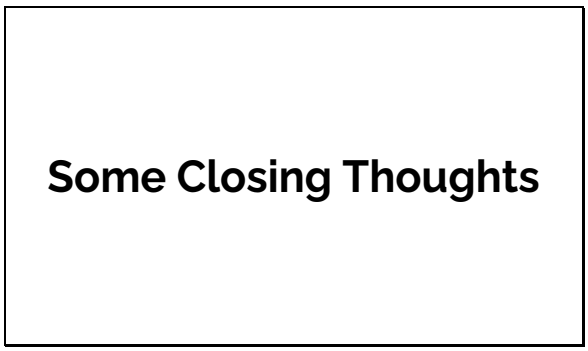
Slide 171:



Here are a few closing thoughts

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Slide 172:

> *"Asset Management is best done **by the people** who own, manage, and operate the assets"*

Asset management is best done by the people who own, manage, and operate the assets.

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Slide 173:

> *"Don't let what you can't do stop you from doing what you can do"*

Asset Management can seem like a daunting process but starting at any point, with any component can benefit your water system AND your primary business.

As you think about your business through the lens of Asset Management you may determine that some other part of the business requires immediate attention.

In the school cafeteria example I mentioned at the beginning of this presentation, the water system may be stable, and instead issues with

cooking or dishwashing equipment are impacting the school's ability to feed its students. Use these Asset Management principles to address those assets as well.

But remember, while water delivery may not be your primary business, your water system supports that primary business, and may be critical to it.

Applying Asset Management principles to your water system supports your primary business. Applying Asset Management principles to your primary business in general will help you develop an Asset Management framework and mindset across all aspects of your business and provide your primary business the desired level of service at the lowest lifecycle cost.

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Slide 174:

Insert relevant contact information on the slide.

Example:

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