

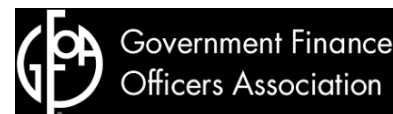


Smart Management for  
Small Water Systems

# EPA Tools for Small Public System Water Operators: Electronic Preventive Maintenance Logs

June 19, 2018 | Webinar

*[www.efcnetwork.org](http://www.efcnetwork.org)*



This program is made possible under a cooperative agreement with the U.S. EPA.



## **About the Environmental Finance Center Network (EFCN)**

The Environmental Finance Center Network (EFCN) is a university-based organization creating innovative solutions to the difficult how-to-pay issues of environmental protection and improvement. The EFCN works with the public and private sectors to promote sustainable environmental solutions while bolstering efforts to manage costs.

## **The Smart Management for Small Water Systems Program**

This program is offered free of charge to all who are interested. The Program Team will conduct activities in every state, territory, and the Navajo Nation. All small drinking water systems are eligible to receive free training and technical assistance.

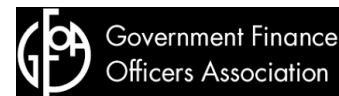
## **What We Offer**

Individualized technical assistance, workshops, small group support, webinars, eLearning, online tools & resources, blogs



# The Small Systems Program Team

- Environmental Finance Center at The University of North Carolina at Chapel Hill
- Southwest Environmental Finance Center at the University of New Mexico
- Syracuse University Environmental Finance Center
- Environmental Finance Center at Wichita State University
- EFC West
- Environmental Finance Center at the University of Maryland
- New England Environmental Finance Center at the University of Southern Maine
- Great Lakes Environmental Infrastructure Center
- Government Finance Officers Association (GFOA)
- National Association of Development Organizations (NADO)



# Areas of Expertise



Asset Management



Rate Setting and Fiscal Planning



Communication and Decision-Making Strategies



Water Loss Control



Controlling Energy Costs



Accessing Infrastructure Financing Programs



Workforce Development



Water Conservation Finance and Management



Collaborating with Other Water Systems



Resiliency Planning




Managing Drought

# Small Systems Blog

Learn more about water finance and management through our Small Systems Blog! Blog posts feature lessons learned from our training and technical assistance, descriptions of available tools, and small systems “success stories.”

[efcnetwork.org/small\\_systems\\_blog/](http://efcnetwork.org/small_systems_blog/)

Sign Me Up


**EFCN**  
environmental finance center network

Innovative Finance Solutions for Environmental Services

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> BLOG

Blog




**Magdalena, New Mexico: A Success Story from the Smart Management for Small Water Systems Project**

Written by: Allison Perch Allison Perch is a Program Coordinator with the Environmental Finance Center at the University of North Carolina. What can a small town do when the financial health of its water system is at risk? This is the question that Stephanie Finch, the town clerk and treasurer for the ...



**The Virtuous Cycle: Internal Energy Revolving Funds for Small Water Systems**

Written by: David Tucker David Tucker is a Project Director with the Environmental Finance Center at the University of North Carolina. How can small (and large) water systems pay for energy efficiency and renewable energy, helping cut utility costs? As energy is often the largest variable expense in a water system's operating ...



**Smart Management for Small Water Systems Program Newsletter | Fall 2015**

View Full Issue The Environmental Finance Center Network has published the third issue in a series of quarterly newsletters. The Fall 2015 Program Newsletter announces





# Poll Questions



# Who we are...



SOUTHWEST  
ENVIRONMENTAL  
FINANCE CENTER



Heather  
Himmelberger



Dawn Nall



Francine Stefan



Matt Ziegler



Diane Stevenson



Rose Afandi



Sandi Blanton



Mark Ogrentz



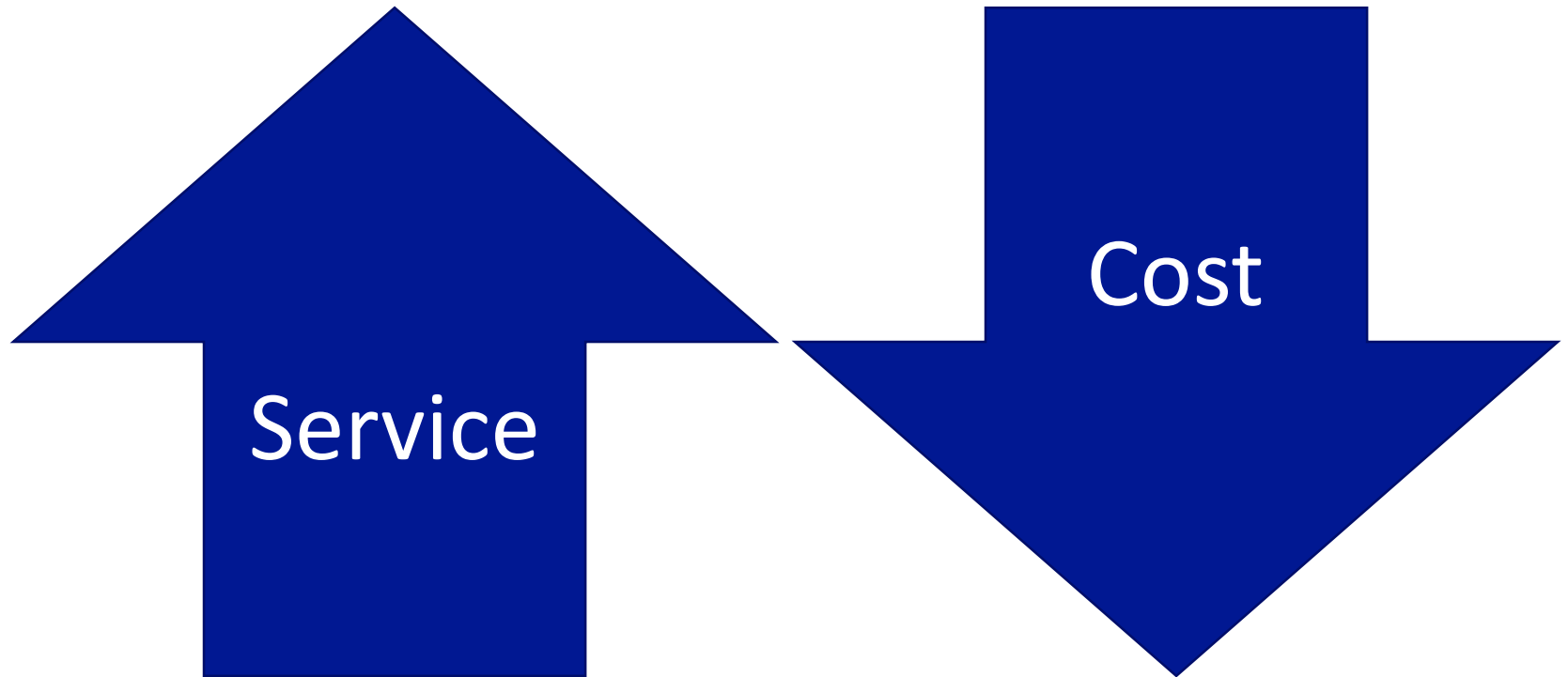
James Markham



Samrat Kunwar



Utilities are service organizations.



Competing Priorities





Maintenance will extend the life of the system





# **Why is O&M Valuable?**

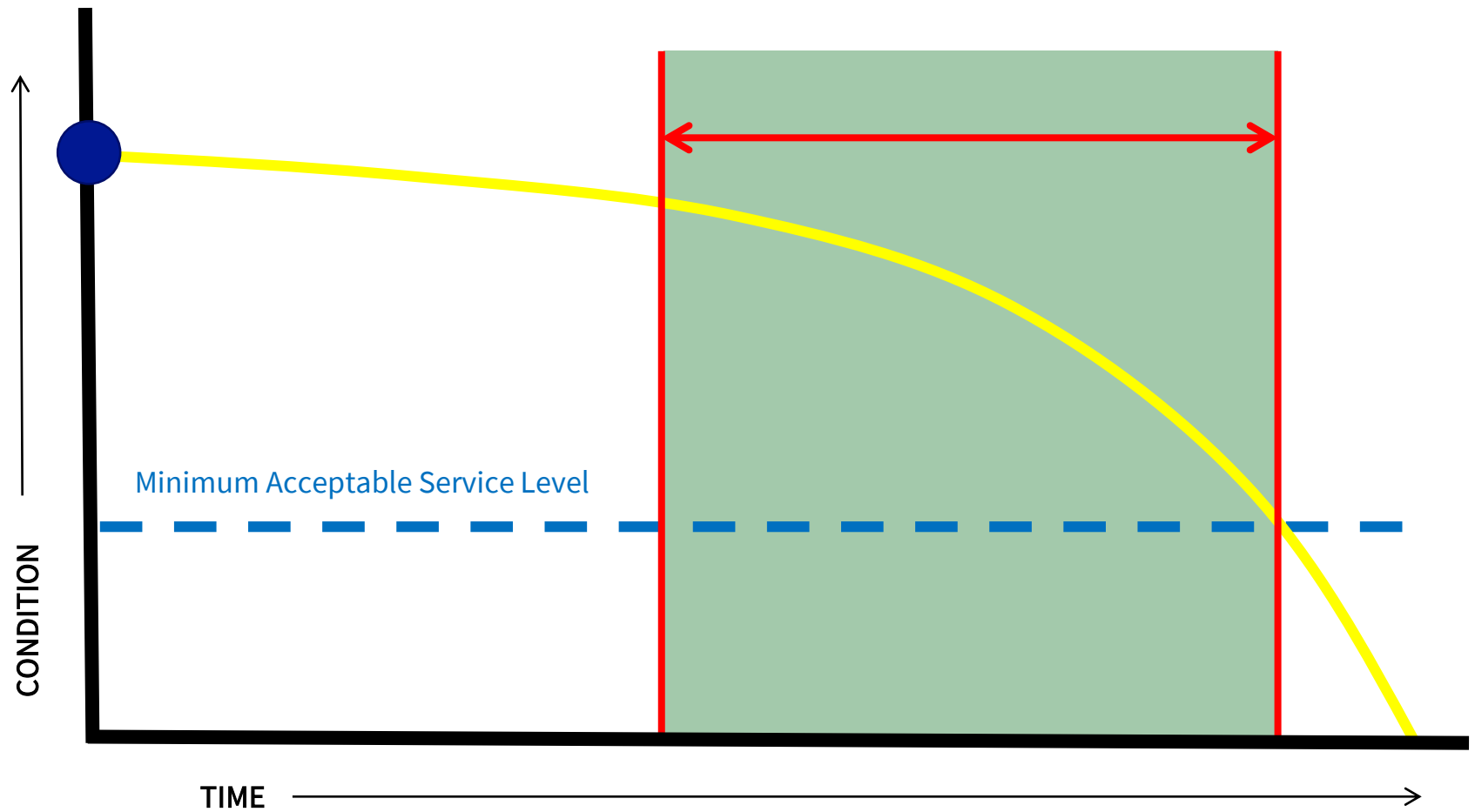
Or, to put it another way ...





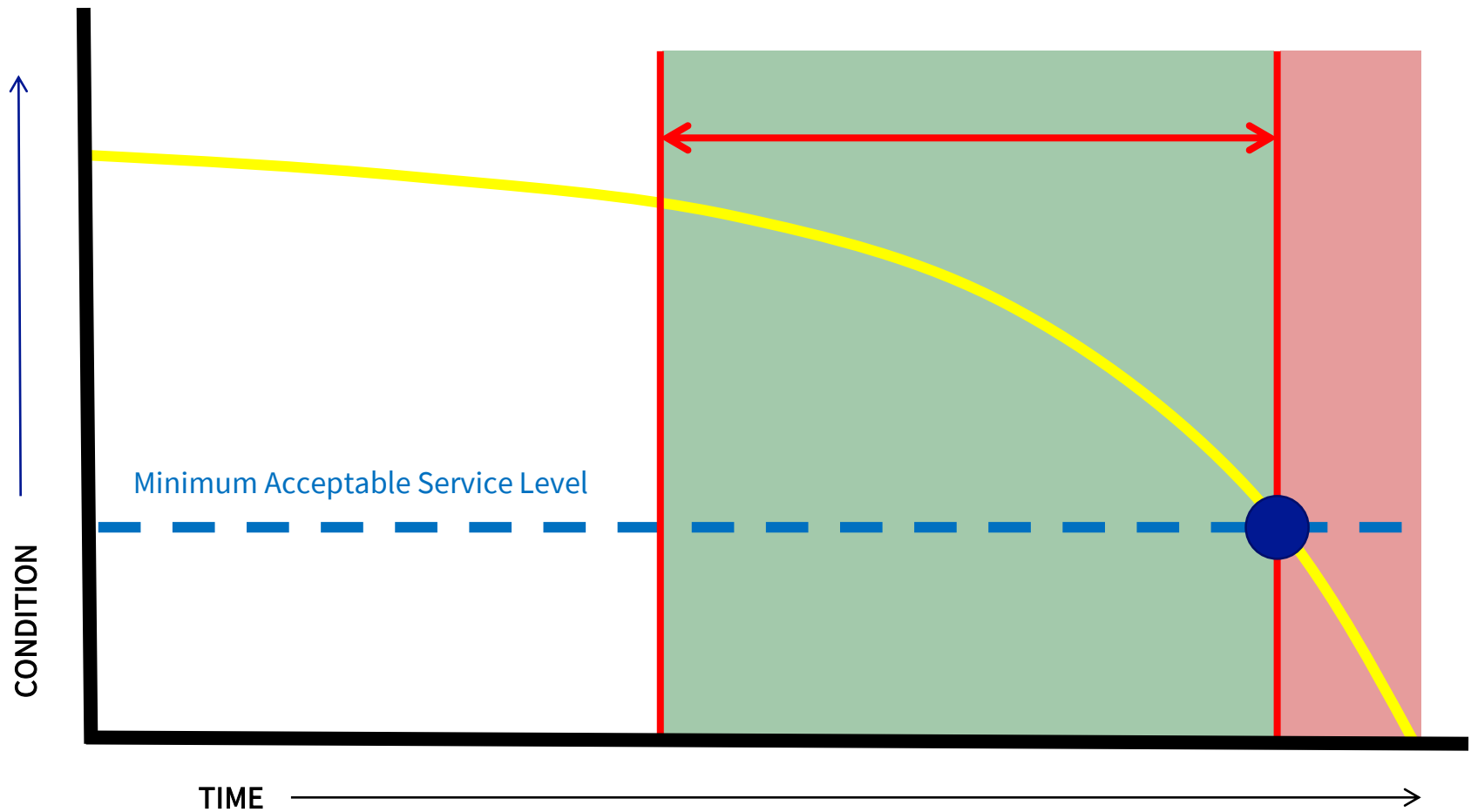


# Condition Curve





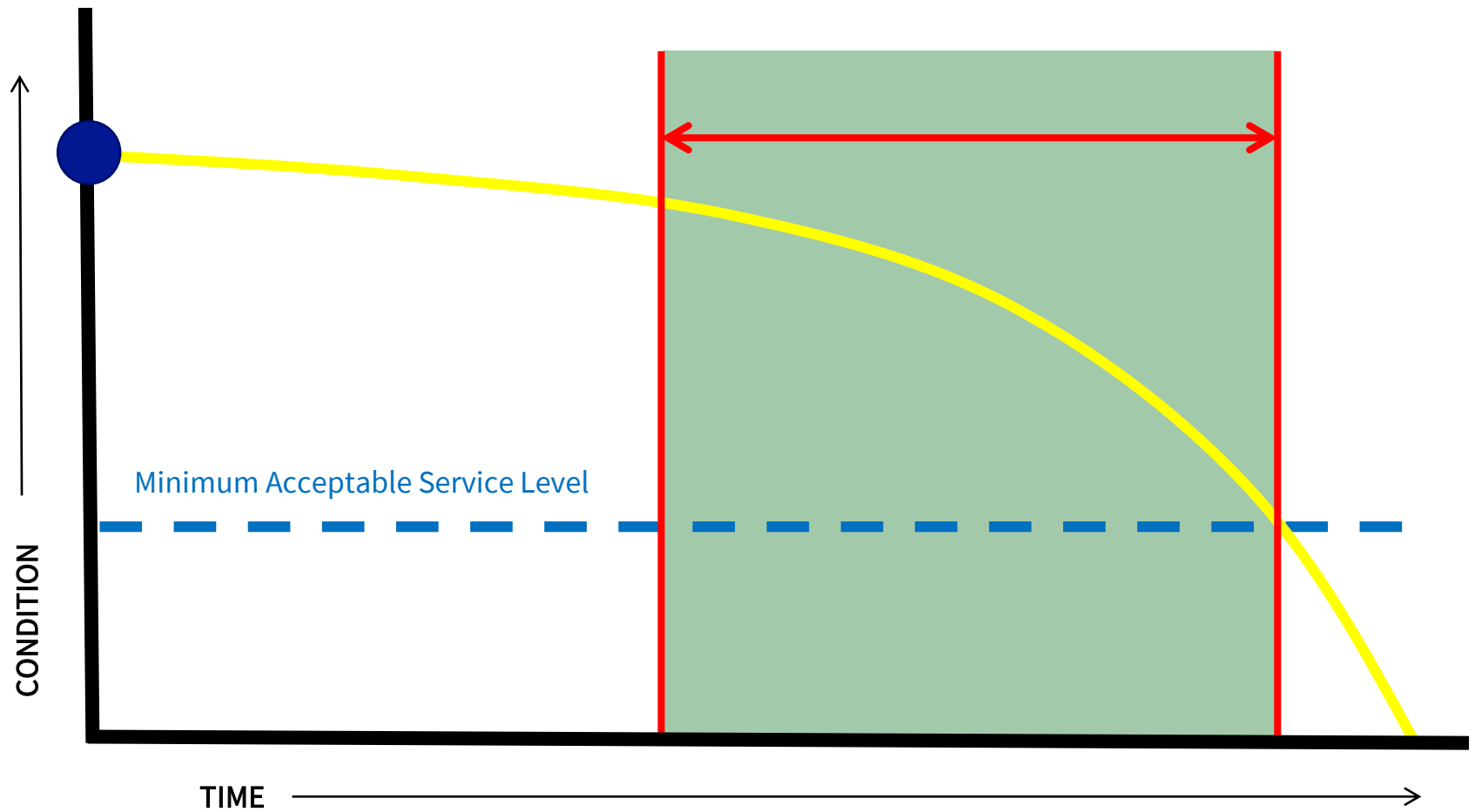
# Condition Curve





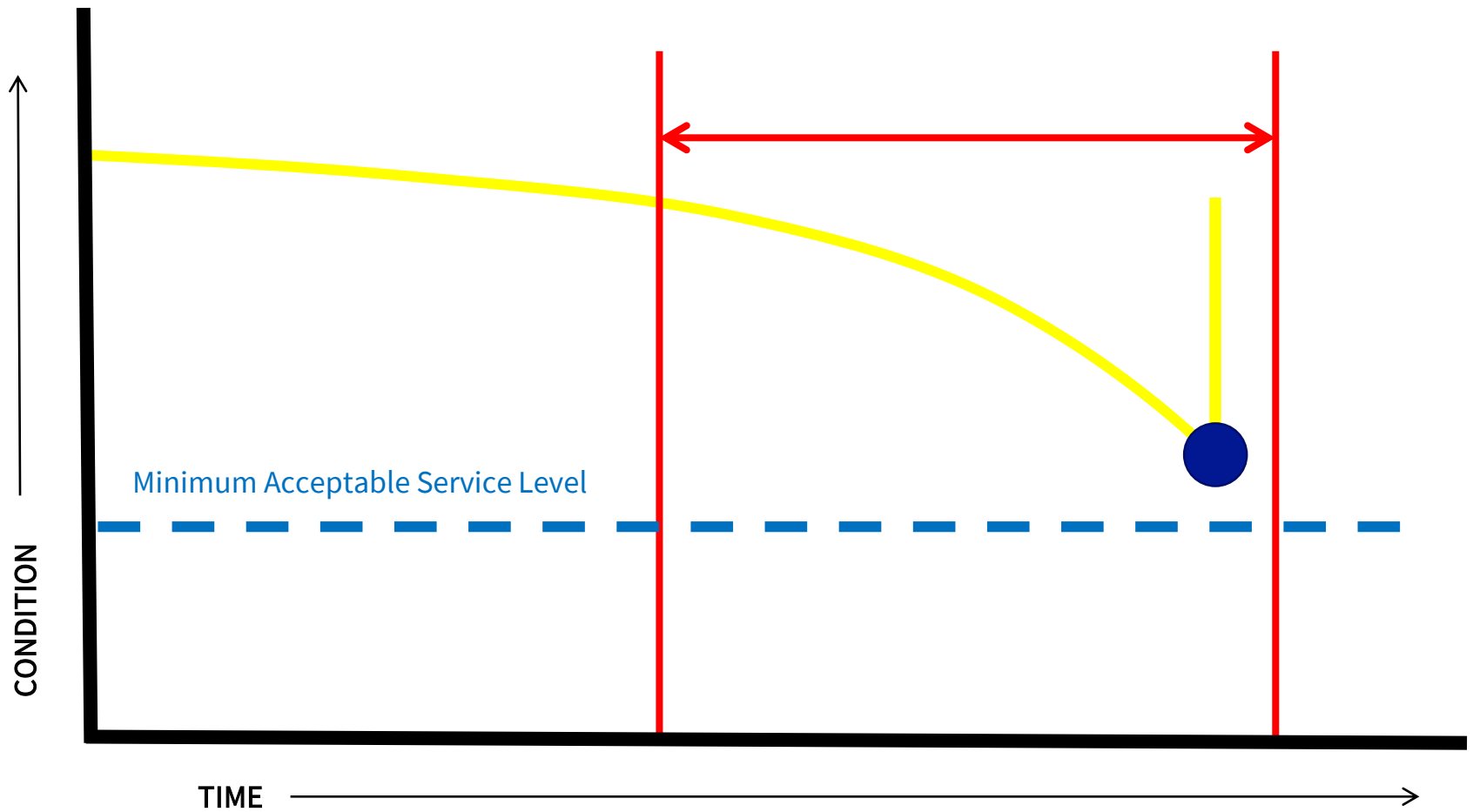


# Condition Curve



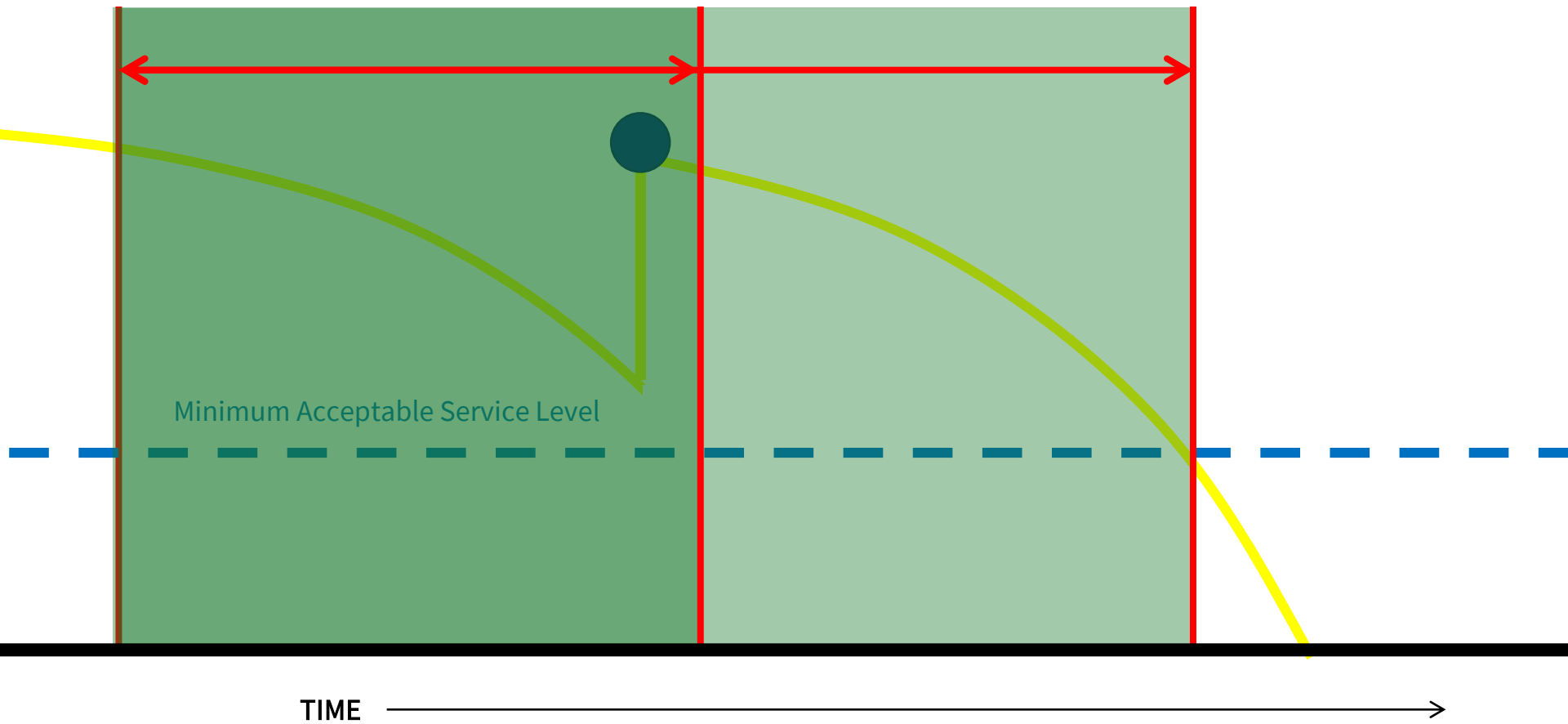


# Condition Curve





# Condition Curve





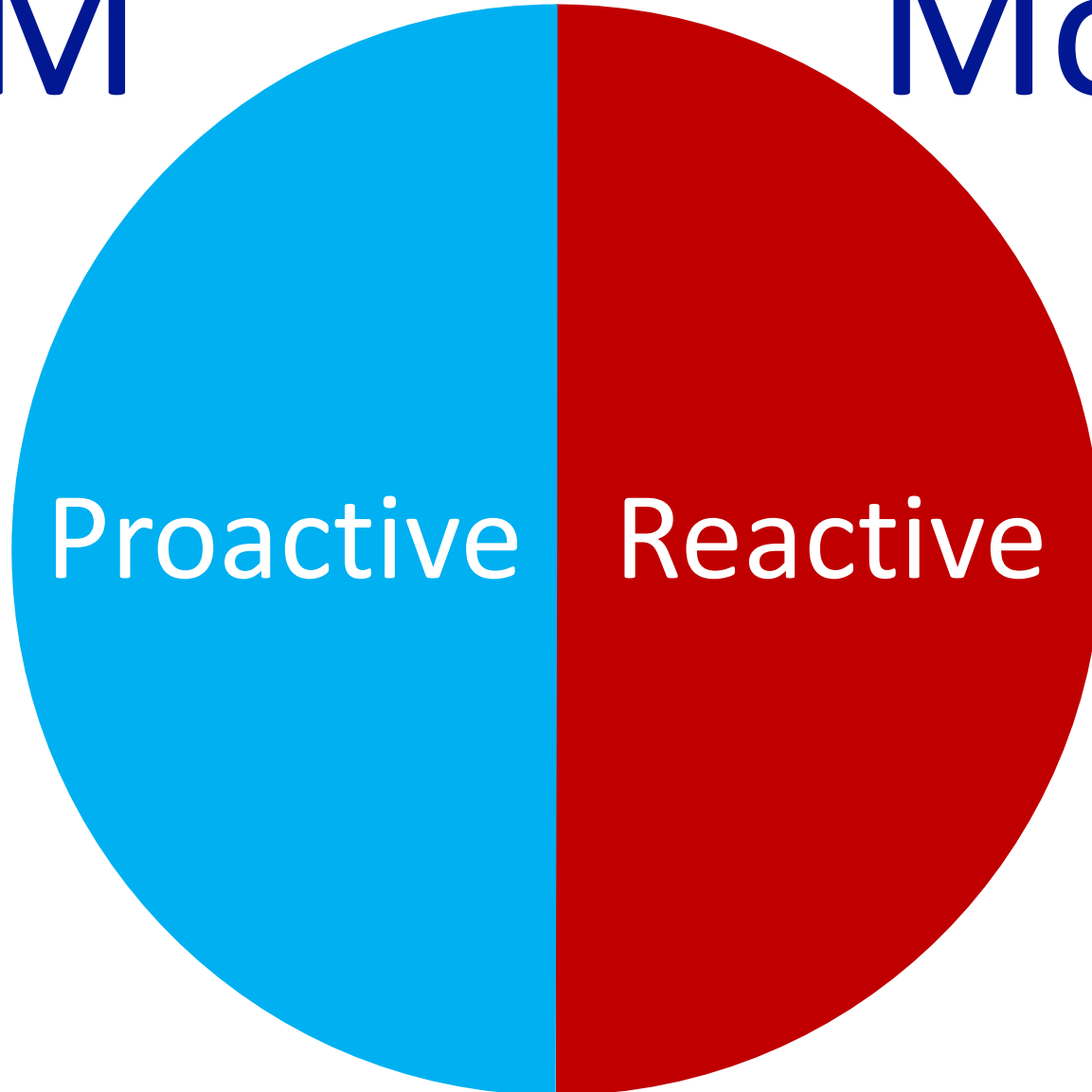
**Not all assets are maintained equally...**





O&M

Modes

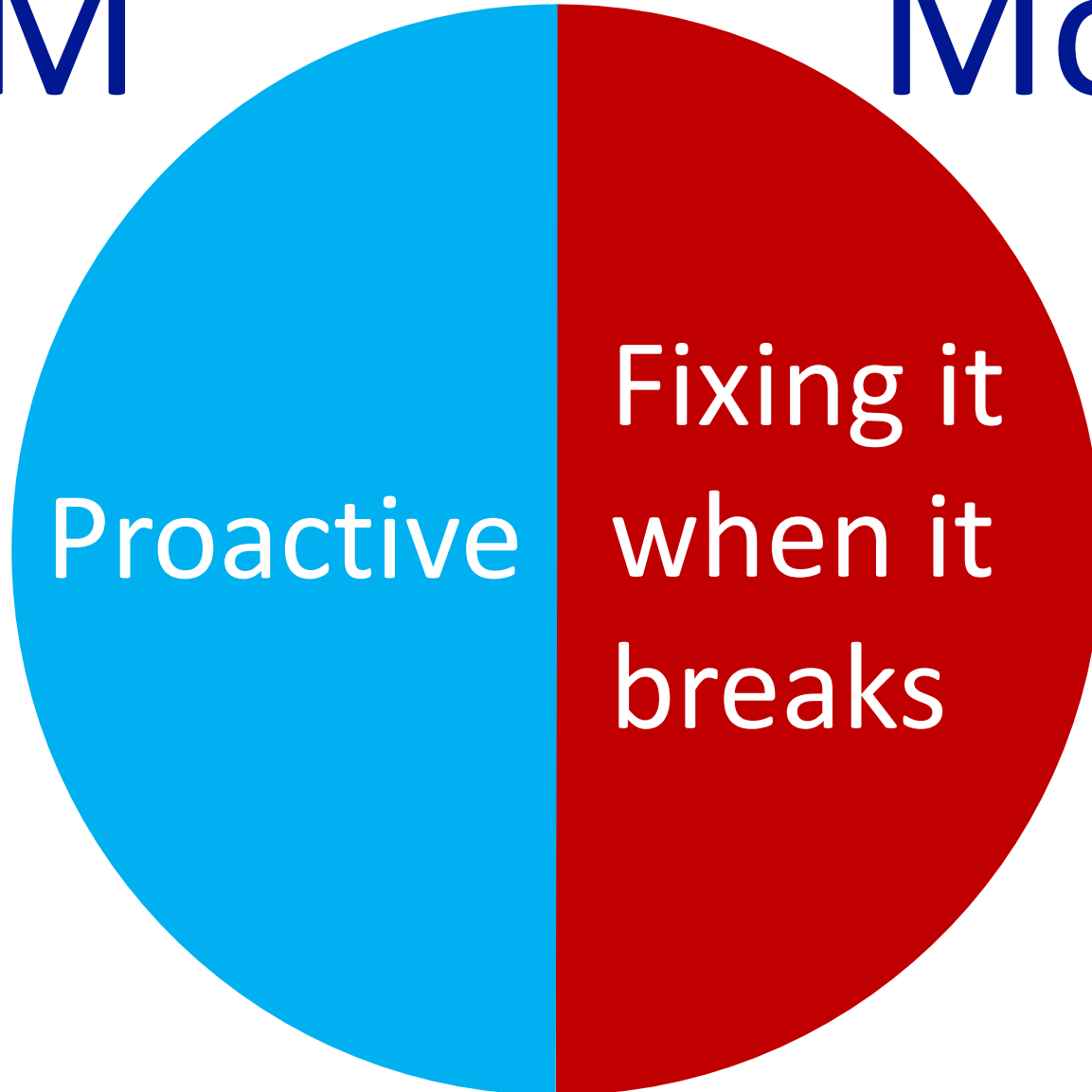






# O&M

# Modes





# O&M

# Modes

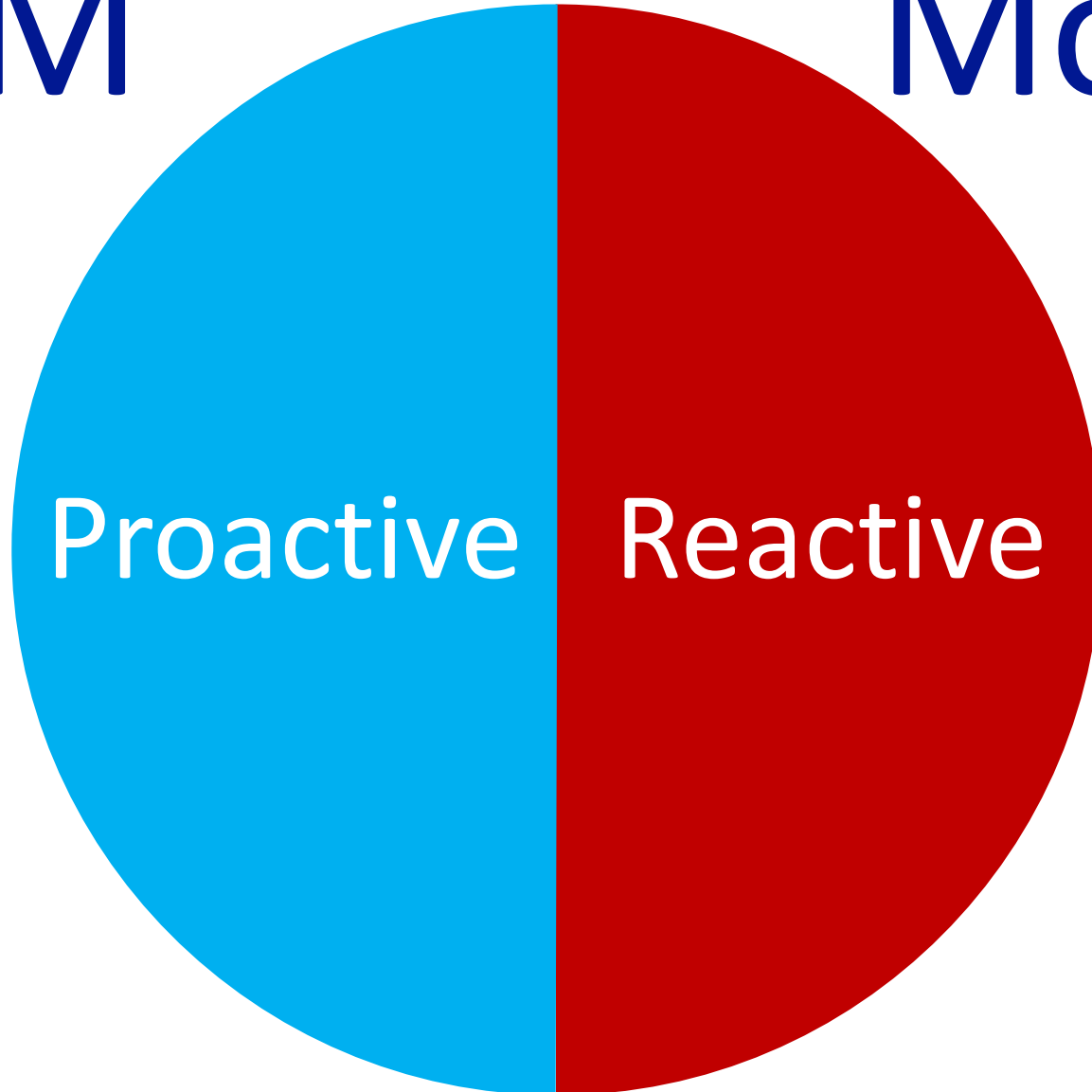
Keeping  
it from  
breaking

Fixing it  
when it  
breaks



O&M

Modes





# O&M

Proactive

# Modes

Routine

+ Preventive

+ Predictive

---

= Savings



# Preventive Maintenance:

*Periodic component replacement in the form of preventive maintenance saves an estimated 12 to 18 percent over reactive maintenance.*

(And yet, when there's a budget crunch, this is often the first thing that gets cut...)





## Active Management:

“The solution for exploiting acknowledged potential for efficiency is active management.”

91%



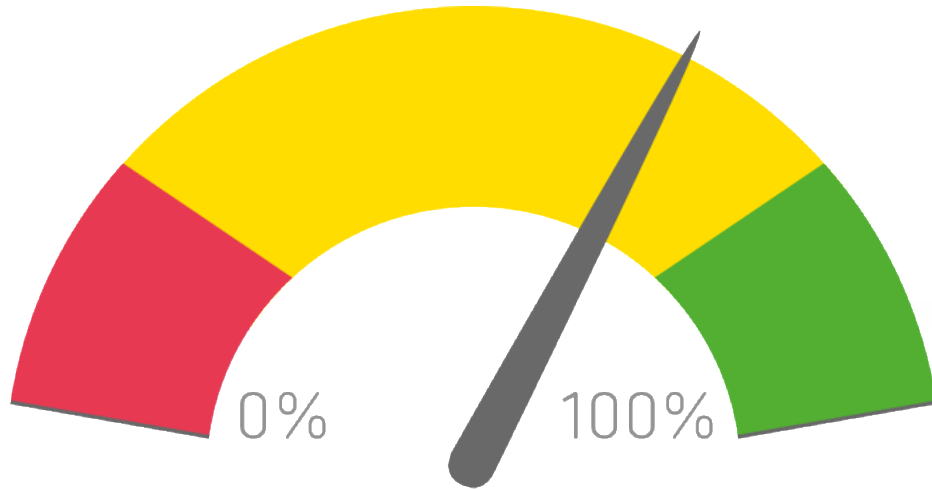
# Motor O&M Expense Reduction:



*"How does condition monitoring prevent motor failures?"* Nicole Dyess, Uptime



# Benchmarks and KPIs will help ...



Identify them

Monitor them

Analyze your data

**K**ey  
**P**erformance  
**I**ndicator







But you need...





*If you don't manage your  
assets, they will manage you.*





*Working overtime to repair broken equipment is (in a way) rewarding failure.*

# Benefits of PM are well established but...





**This begs the questions...**

?

What should I  
do?

When should I  
do it?





# “Black Box Card File”

Weekly

January February March Monthly May September October

Weekly Chemical Equipment Testing Log Card

Month of \_\_\_\_\_

Week (Date)	Is Equipment Calibrated Properly?	Are Reagents Clearly Marked and Safely Stored?	Are Reagents Expired?	Notes or Comments
1 <sup>st</sup>	Yes/No	Yes/No	Yes/No	
2 <sup>nd</sup>	Yes/No	Yes/No	Yes/No	
3 <sup>rd</sup>	Yes/No	Yes/No	Yes/No	
4 <sup>th</sup>	Yes/No	Yes/No	Yes/No	
5 <sup>th</sup>	Yes/No	Yes/No	Yes/No	

Daily

Guide Book

# New EPA Electronic PM tool:

United States  
Environmental Protection Agency

## Preventive Maintenance for Small Public Water Systems Using Ground Water

An Interactive PDF with Suggested Preventive Maintenance Tasks and Logs

Introduction, System Information, Reference, and Contacts





United States  
Environmental Protection Agency

# Preventive Maintenance for Small Public Water Systems Using Ground Water

An Interactive PDF with Suggested Preventive Maintenance Tasks and Logs

## January O&M Task Lists & Logs





# System characteristics

- Designed to help small systems
  - Plan and record O&M activities
  - Create a permanent print or digital record of those activities
- Intended for ground water systems with up to:
  - 6 wells & well pumps
  - 4 storage tanks and/or pressure tanks
  - 4 chemical feed pumps
  - 4 booster pumps
- Could be used by surface water systems as part of O&M program.



# Document characteristics

- A set of interactive PDFs:
  - Lists typical recommended daily, weekly, monthly, quarterly, biannual and annual preventive O&M tasks
  - Permits ongoing data entry to create a complete O&M record
    - check boxes,
    - value boxes,
    - room for notes and additions
  - Includes a conversion calculator and does many calculations
  - Has hyperlinked table of contents and makes use of the Adobe Acrobat Bookmark tool for easy navigation (demo to follow)



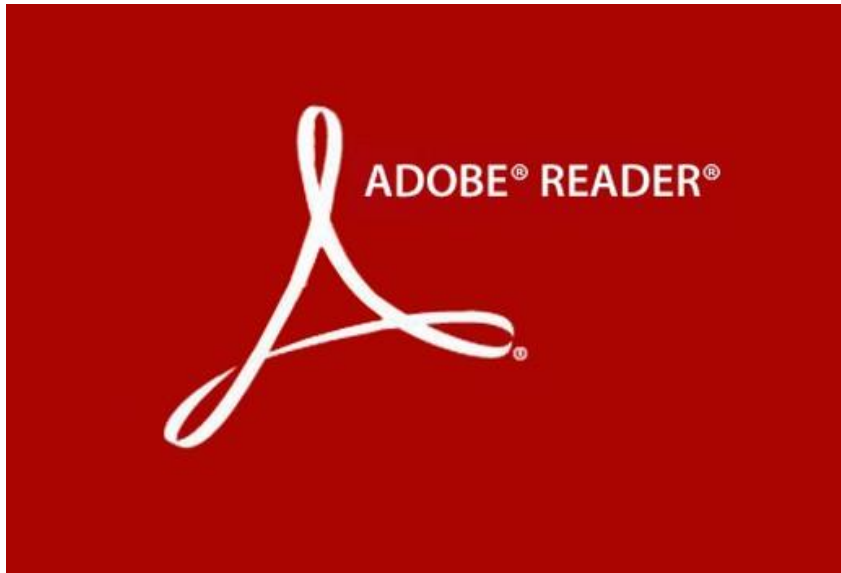
# Document characteristics

Data pages were capped at specific numbers of sources & equipment to limit file size, BUT ...

- If you have more sources or equipment pieces than this format is designed for we can help.
- Contact us and we can walk you through some options, or
- Potentially assist with a customized solution



# Software requirements:



Do not use Apple Preview



# Where to get it:

<https://www.epa.gov/dwcapacity/resources-small-public-water-system-operators>

Download entire package here:



Download individual files here:



The older Black Box files are here:



The screenshot shows the EPA website page for 'Building the Capacity of Drinking Water Systems'. The page features a sidebar with links: 'Building the Capacity of Drinking Water Systems Home', 'About Small Systems', 'Small System Resources', 'Information for States', 'Compliance Help', 'Capacity Development Partners', and 'EPA Capacity Development Contacts'. The main content area is titled 'Resources for Small Public Water System Operators' and includes sections for 'Knowledge Retention Tool', 'Electronic Preventive Maintenance Logs', and 'Preventive Maintenance Card File'. The footer contains a navigation bar with 'Discover.', 'Connect.', and 'Ask.' sections, each with sub-links. The 'Discover.' section includes 'Accessibility', 'EPA Administrator', 'Budget & Performance', and 'Contact Us'. The 'Connect.' section includes 'Data.gov', 'Inspector General', 'Jobs', and 'Museum'. The 'Ask.' section includes 'Contact Us', 'Hotlines', 'FOIA Requests', and 'Request Questions'. The page also features a search bar and social media links.



# Individual files:

<https://www.epa.gov/dwcapacity/electronic-preventive-maintenance-logs>

You can download individual files here:



Environmental Topics

Laws & Regulations

About EPA

Search EPA.gov



## Building the Capacity of Drinking Water Systems

Building the Capacity of  
Drinking Water Systems  
Home

About Small Systems

Small System Resources

Information for States

Compliance Help

Capacity Development  
Partners

EPA Capacity Development  
Contacts

CONTACT US

SHARE



## Electronic Preventive Maintenance Logs

It is highly recommended to download the entire file package in order to access the full schedule of recommended maintenance activities and to avoid accidental loss of data. Below are the individual files that comprise the file package.

You may need a PDF reader to view some of the files on this page. See EPA's [About PDF page](#) to learn more.

- [Introduction \(PDF\)](#) (16 pp, 250 K)
- [Guidebook \(PDF\)](#) (26 pp, 520 K)
- [Operation and Maintenance Customer Complaints \(PDF\)](#) (23 pp, 1 MB)
- [Operation and Maintenance Ongoing Logs \(PDF\)](#) (48 pp, 3 MB)
- [January Tasks and Logs \(PDF\)](#) (64 pp, 3 MB)
- [February Tasks and Logs \(PDF\)](#) (63 pp, 4 MB)
- [March Tasks and Logs \(PDF\)](#) (63 pp, 4 MB)
- [April Tasks and Logs \(PDF\)](#) (63 pp, 3 MB)
- [May Tasks and Logs \(PDF\)](#) (63 pp, 3 MB)
- [June Tasks and Logs \(PDF\)](#) (63 pp, 4 MB)
- [July Tasks and Logs \(PDF\)](#) (64 pp, 3 MB)
- [August Tasks and Logs \(PDF\)](#) (62 pp, 3 MB)
- [September Tasks and Logs \(PDF\)](#) (63 pp, 3 MB)
- [October Tasks and Logs \(PDF\)](#) (63 pp, 3 MB)
- [November Tasks and Logs \(PDF\)](#) (62 pp, 3 MB)
- [December Tasks and Logs \(PDF\)](#) (62 pp, 3 MB)

[Contact Us](#) to ask a question, provide feedback, or report a problem.



Discover.

Connect.

Ask.

# Where to get it:

<https://www.epa.gov/dwcapacity/resources-small-public-water-system-operators>

Start by downloading the entire package:



The screenshot shows the EPA website page for 'Building the Capacity of Drinking Water Systems'. The page has a blue header with the EPA logo and navigation links: 'Environmental Topics', 'Laws & Regulations', and 'About EPA'. A search bar is also present. The main content area is titled 'Resources for Small Public Water System Operators'. On the left, there is a sidebar with links: 'Building the Capacity of Drinking Water Systems Home', 'About Small Systems', 'Small System Resources', 'Information for States', 'Compliance Help', 'Capacity Development Partners', and 'EPA Capacity Development Contacts'. The main content area lists three resources: 'Knowledge Retention Tool', 'Electronic Preventive Maintenance Logs', and 'Preventive Maintenance Card File'. The 'Electronic Preventive Maintenance Logs' section includes a link to 'Download individual log files' and a description of the package. The 'Preventive Maintenance Card File' section includes a link to 'Preventive Maintenance Card File for Small Public Water Systems Using Ground Water'. At the bottom of the page, there is a footer with the EPA logo and four columns of links: 'Discover.' (Accessibility, EPA Administrator, Budget & Performance), 'Connect.' (Data.gov, Inspector General, Jobs), 'Ask.' (Contact Us, Hotlines, FOIA Requests), and 'Learn.' (EPA Museum, EPA Library, EPA Store).



## Building the Capacity of Drinking Water Systems

CONTACT US  
SHARE    

- Building the Capacity of Drinking Water Systems Home
- About Small Systems
- Small System Resources
- Information for States
- Compliance Help
- Capacity Development Partners
- EPA Capacity Development Contacts

## Resources for Small Public Water System Operators

### Knowledge Retention Tool

The [Knowledge Retention Tool Spreadsheet for Small Water Systems.xlsx](#) (18 pp, 153 K) is an Excel spreadsheet that helps operators consolidate system information into one location, enabling increased organization and coordination among operators. Designed to assist in personnel transition, the tool encompasses a wide variety of information that a new or contract operator would need to effectively manage and operate a small water system.

### Electronic Preventive Maintenance Logs

The [Electronic Preventive Maintenance Logs](#) (857 pp, 10 MB) include interactive pdf files to help operators of small ground water systems record and plan regular maintenance duties. This file set contains fillable pdf logs for each month, which includes common daily, weekly, and monthly tasks performed by water system operators, as well as a suggested schedule of annual tasks. Click on the link to download the complete file set.

[Download individual log files.](#) It is highly recommended to download the entire file package in order to access the full schedule of recommended maintenance activities and to avoid accidental loss of data. Below are the individual files that comprise the file package.

### Preventive Maintenance Card File

A related resource, the [Preventive Maintenance Card File for Small Public Water Systems Using Ground Water](#) (EPA 816-B-04-002) can be found here. This version also provides assistance to operators in recording and planning maintenance activities, though in a printed format.

[Contact Us](#) to ask a question, provide feedback, or report a problem.

Look in your downloads folder or open it from here



### Discover.

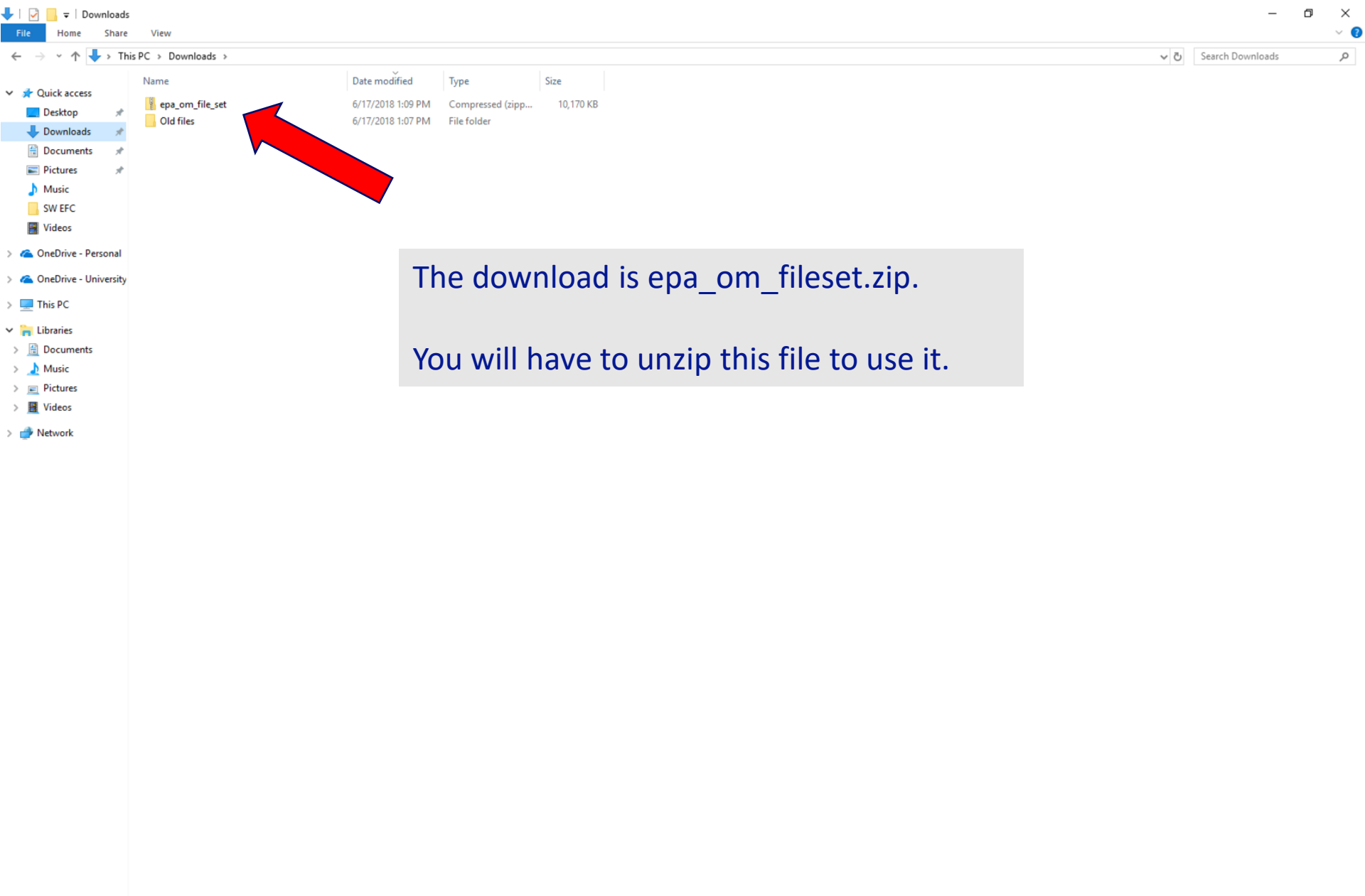
- Accessibility
- EPA Administrator
- Budget & Performance
- Contracting

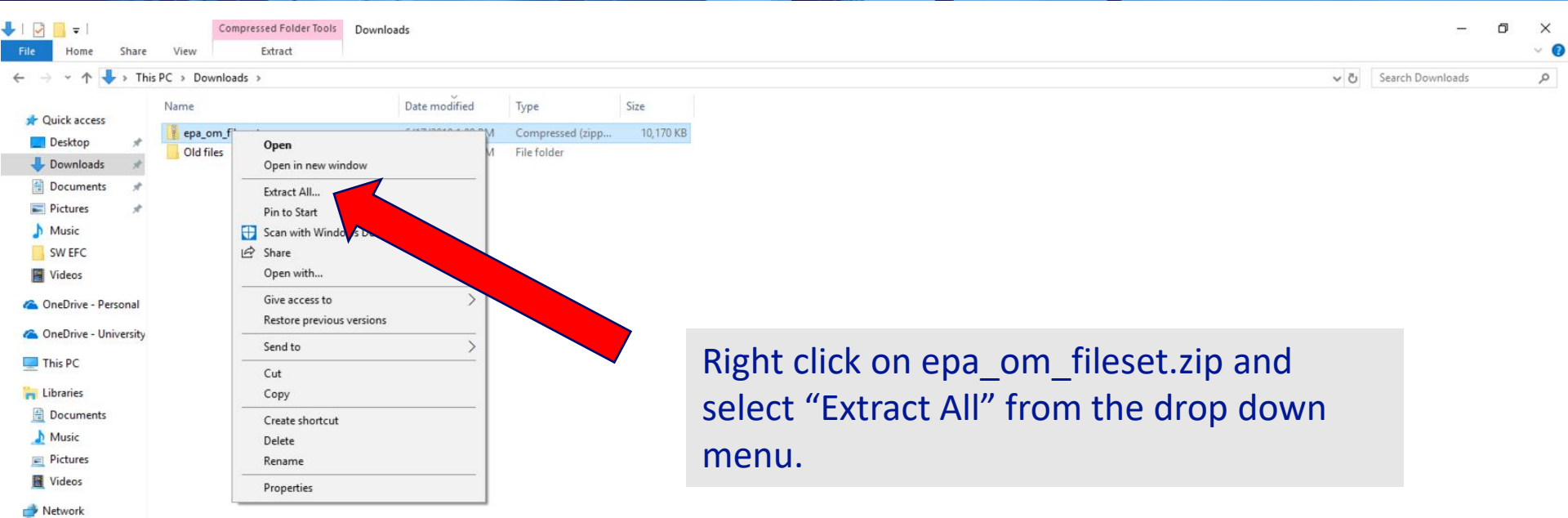
### Connect.

- Data.gov
- Inspector General
- Jobs
- Newsroom

### Ask.

- Contact Us
- Hotlines
- FOIA Requests
- Frequent Questions





Right click on epa\_om\_fileset.zip and select “Extract All” from the drop down menu.





File Home Share View

Compressed Folder Tools

Downloads

File Home Share View

Extract

← → ↶ ↷

This PC > Downloads

Search Downloads

Name	Date modified	Type	Size
epa_om_file_set	6/17/2018 1:09 PM	Compressed (zipp...	10,170 KB
Old files	6/17/2018 1:07 PM	File folder	

Quick access

Desktop

Downloads

Documents

Pictures

Music

SW EFC

Videos

OneDrive - Personal

OneDrive - University

This PC

Libraries

Documents

Music

Pictures

Videos

Network

←

Extract Compressed (Zipped) Folders

×

Select a Destination and Extract Files

Files will be extracted to this folder:

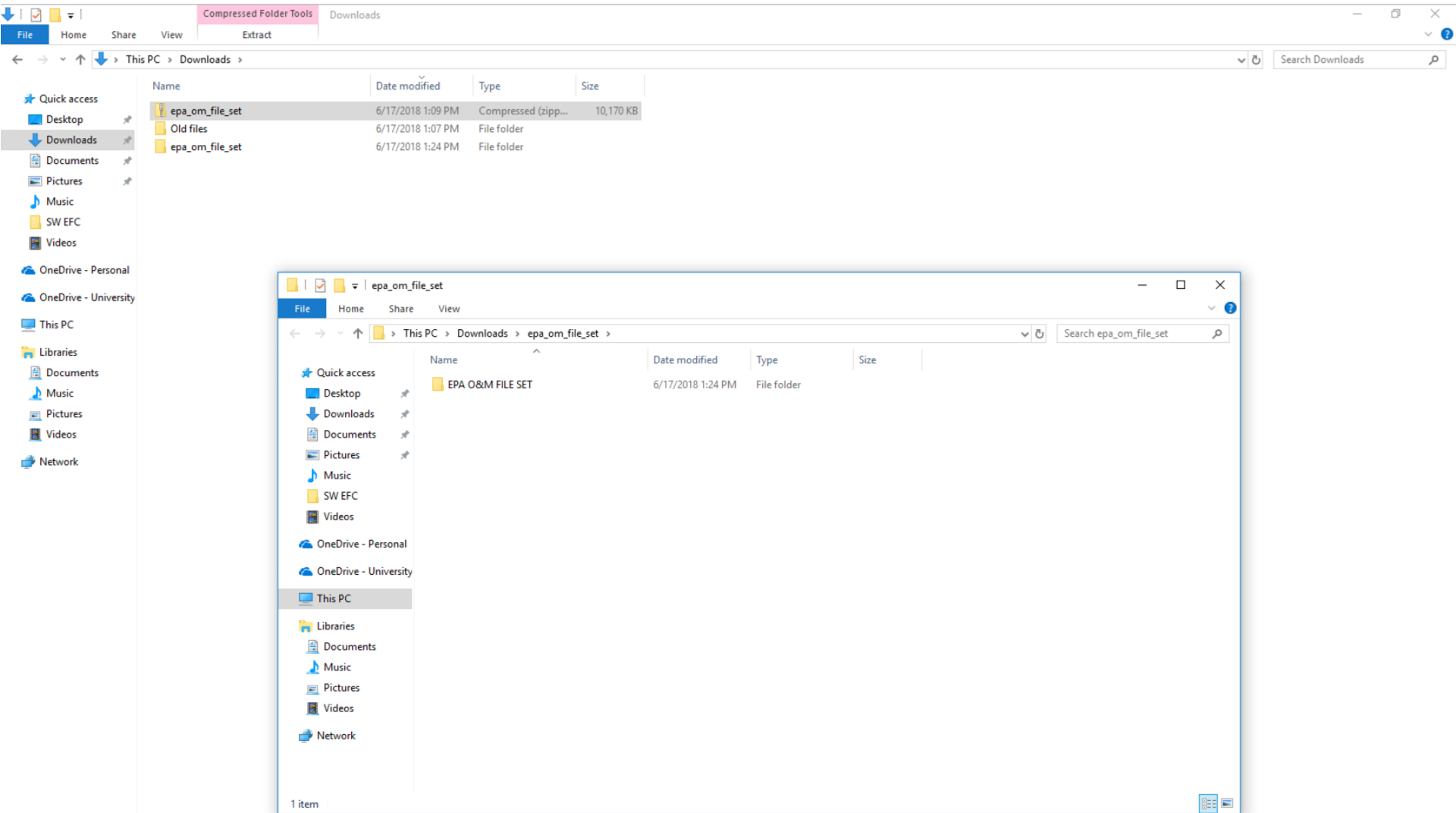
C:\Users\jmark\Downloads\epa\_om\_file\_set

Browse...

☒ Show extracted files when complete

Extract Cancel

Select a destination and then click  
“Extract.” (I’ve chosen to leave it in my  
downloads folder.)



The extraction will create a set of nested folders. “EPA O&M FILE SET” is the folder with the working files in it.



The screenshot shows a Windows File Explorer window with the address bar displaying the path: This PC > Downloads > epa\_om\_file\_set > EPA O&M FILE SET. The left sidebar shows the 'This PC' location selected. The main pane displays a list of files with columns for Name, Date modified, Type, and Size. The files are as follows:

Name	Date modified	Type	Size
01 - January Tasks and Logs	6/17/2018 1:24 PM	PDF File	3,133 KB
02 - February Tasks and Logs	6/17/2018 1:24 PM	PDF File	3,465 KB
03 - March Tasks and Logs	6/17/2018 1:24 PM	PDF File	3,722 KB
04 - April Tasks and Logs	6/17/2018 1:24 PM	PDF File	3,179 KB
05 - May Tasks and Logs	6/17/2018 1:24 PM	PDF File	3,382 KB
06 - June Tasks and Logs	6/17/2018 1:24 PM	PDF File	3,330 KB
07 - July Tasks and Logs	6/17/2018 1:24 PM	PDF File	3,300 KB
08 - August Tasks and Logs	6/17/2018 1:24 PM	PDF File	3,102 KB
09 - September Tasks and Logs	6/17/2018 1:24 PM	PDF File	3,110 KB
10 - October Tasks and Logs	6/17/2018 1:24 PM	PDF File	3,142 KB
11 - November Tasks and Logs	6/17/2018 1:24 PM	PDF File	3,081 KB
12 - December Tasks and Logs	6/17/2018 1:24 PM	PDF File	3,131 KB
O and M Customer Complaints	6/17/2018 1:24 PM	PDF File	1,257 KB
O and M Guidebook	6/17/2018 1:24 PM	PDF File	1,257 KB
O and M Introduction	6/17/2018 1:24 PM	PDF File	1,257 KB
O and M Ongoing Logs	6/17/2018 1:24 PM	PDF File	3,382 KB
READ THIS FIRST	6/17/2018 1:24 PM	Text Document	3 KB

Red arrows are overlaid on the image to highlight specific file groups: one arrow points to the monthly task and log files (01-12), another points to the O and M related files (Customer Complaints, Guidebook, Introduction, Ongoing Logs), and a third points to the 'READ THIS FIRST' text document.



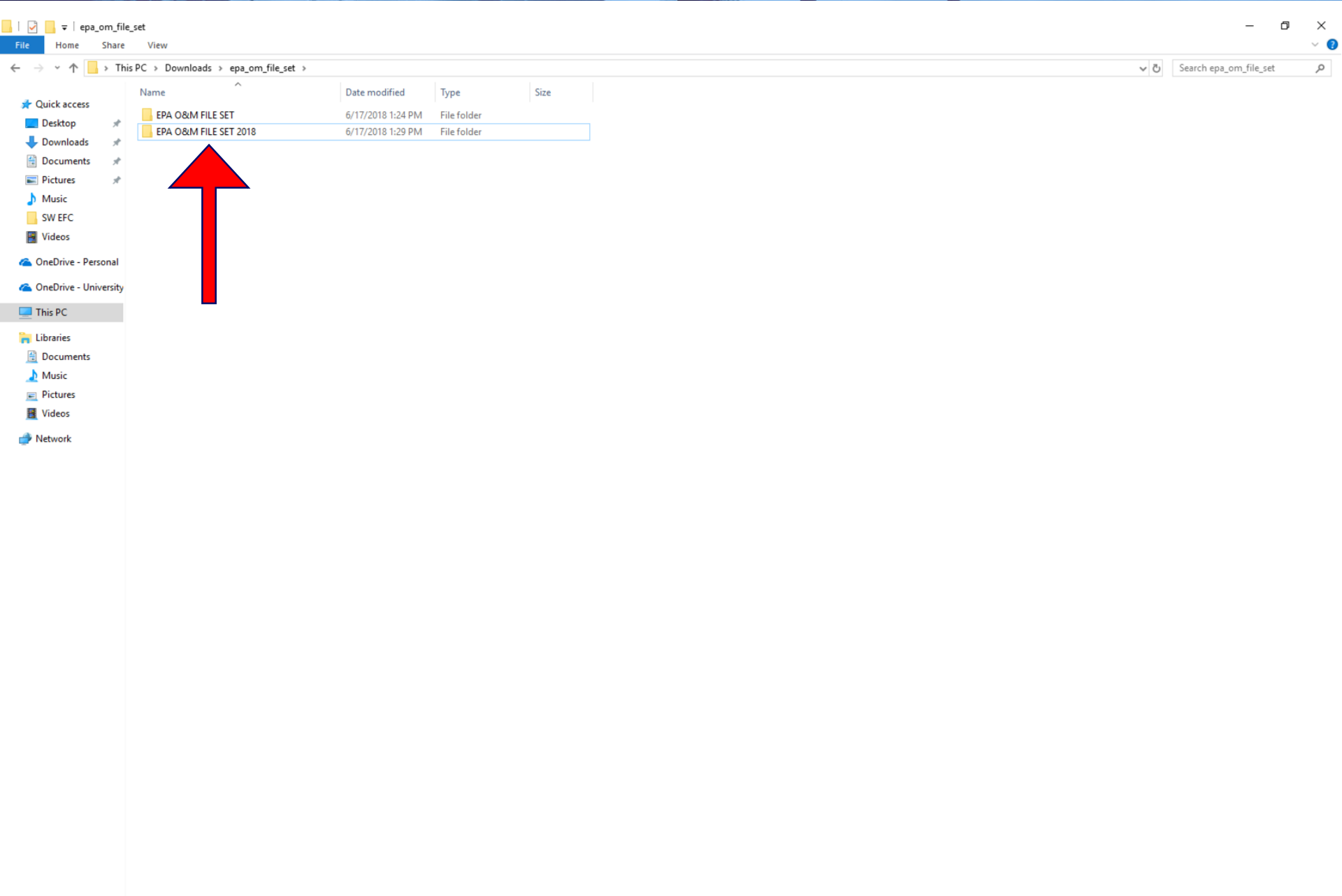
EPA O&M FILE SET

File Home Share View

This PC > Downloads > epa\_om\_file\_set > EPA O&M FILE SET

Search EPA O&M FILE SET

Name	Date modified	Type	Size
READ THIS FIRST - Notepad			
File Edit Format View Help			
READ THIS:			
<p>The enclosed file set consists of interactive PDFs created using Adobe software. They are formatted to fit in a standard 3-ring binder if printed out. Use Adobe Acrobat Reader or Adobe Acrobat to open, enter data into, and print these files.</p> <p>Note: Interactive functions in these PDFs will not work correctly in the file if you use Apple's "Preview" program to read them. Adobe Acrobat reader is available free to download from many sites on the internet. Each file in this set has an interactive table of contents that can be used to navigate to specific sections in the document.</p> <p>In addition, all major sections, headings and subheadings are bookmarked so that you can use Adobe Acrobat's bookmark feature to navigate back and forth in each document.</p> <p>Accessing the bookmark feature varies slightly between Acrobat versions. Typically, to access the bookmark menu, look for the vertical icon menu to the left of the main document. The ribbon icon opens the bookmark menu in a pane to the left of the main document. Clicking on a bookmark will move you to the corresponding section of the document. If in doubt use the Acrobat help menu to search for "bookmarks".</p> <p>Before you proceed make a copy of the entire root file folder (EPA O&amp;M FILE SET) for back up purposes. Then rename one of the folders with a name that includes the current year in the name (eg: "EPA O&amp;M FILE SET 2017"). Use this folder and the files contained therein for your current year O&amp;M activities.</p> <p>Begin by opening and reviewing the file named "O and M Guidebook.pdf". This file will give you an overview of the file set and how the pieces work together. Print a hard copy for future reference.</p> <p>Next open "O and M Introduction.pdf", complete the system information and emergency contact information fields, save the document and print a hard copy for your files. (If you prefer to use paper copies, simply print these documents, fill them out by hand, 3-hole punch them and store them in a 3-ring binder). Next open and begin to fill out "O and M Ongoing Logs.pdf", "O and M Customer Complaints.pdf" and the file for the month you are in. (Again, in if you prefer to use paper copies, print these documents out, 3-hole punch them and store them in a 3-ring binder).</p> <p>There are multiple log sheets for most tasks in the document set. If you need additional logs you can print extra copies of specific pages or make photocopies.</p>			







EPA O&M FILE SET 2018

File

Home

Share

View

←

→

↶

↷

This PC > Downloads > epa\_om\_file\_set > EPA O&M FILE SET 2018

Search EPA O&M FILE SET 2018

★ Quick access

Desktop

Downloads

Documents

Pictures

Music

SW EFC

Videos

OneDrive - Personal

OneDrive - University

This PC

Libraries

Documents

Music

Pictures

Videos

Network

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06 - June 2018 Tasks and Logs	6/17/2018 1:24 PM	PDF File	3,523 KB
07 - July 2018 Tasks and Logs	6/17/2018 1:24 PM	PDF File	3,331 KB
08 - August 2018 Tasks and Logs	6/17/2018 1:24 PM	PDF File	3,102 KB
09 - September 2018 Tasks and Logs	6/17/2018 1:24 PM	PDF File	3,110 KB
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12 - December 2018 Tasks and Logs	6/17/2018 1:24 PM	PDF File	3,131 KB
O and M Customer Complaints 2018	6/17/2018 1:24 PM	PDF File	1,257 KB
O and M Guidebook	6/17/2018 1:24 PM	PDF File	508 KB
O and M Introduction	6/17/2018 1:24 PM	PDF File	245 KB
O and M Ongoing Logs 2018	6/17/2018 1:24 PM	PDF File	3,382 KB
READ THIS FIRST	6/17/2018 1:24 PM	Text Document	3 KB



31<sup>st</sup>

DAILY DAILY DAILY  
Daily Water Production Log Well 2

WELL WATER PRODUCTION

Prior Month End Master Meter Reading:		Amount of Water Used	Notes or Comments
Date	Meter Reading		
1 <sup>st</sup>			
2 <sup>nd</sup>			
3 <sup>rd</sup>			
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29 <sup>th</sup>			
30 <sup>th</sup>			
31 <sup>st</sup>			
Total:		0	



# **Some Adobe Basics ...**

Navigation features built into Adobe Acrobat Reader





**United States  
Environmental Protection Agency**

# **Preventive Maintenance for Small Public Water Systems Using Ground Water**

An Interactive PDF with Suggested Preventive Maintenance Tasks and Logs

**January O&M Task Lists & Logs**





**United States  
Environmental Protection Agency**

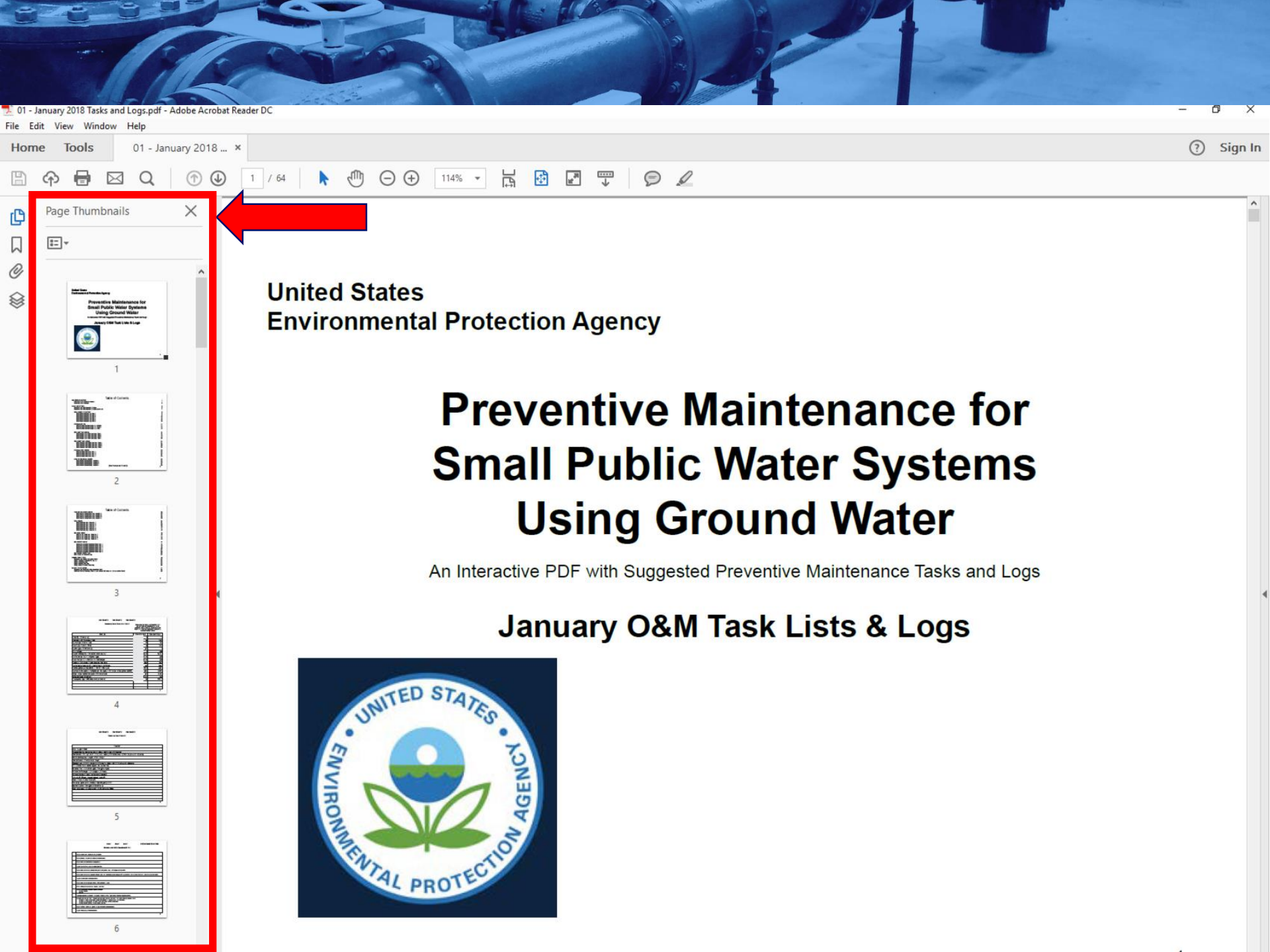
# Preventive Maintenance for Small Public Water Systems Using Ground Water

An Interactive PDF with Suggested Preventive Maintenance Tasks and Logs

## January O&M Task Lists & Logs







Page Thumbnails



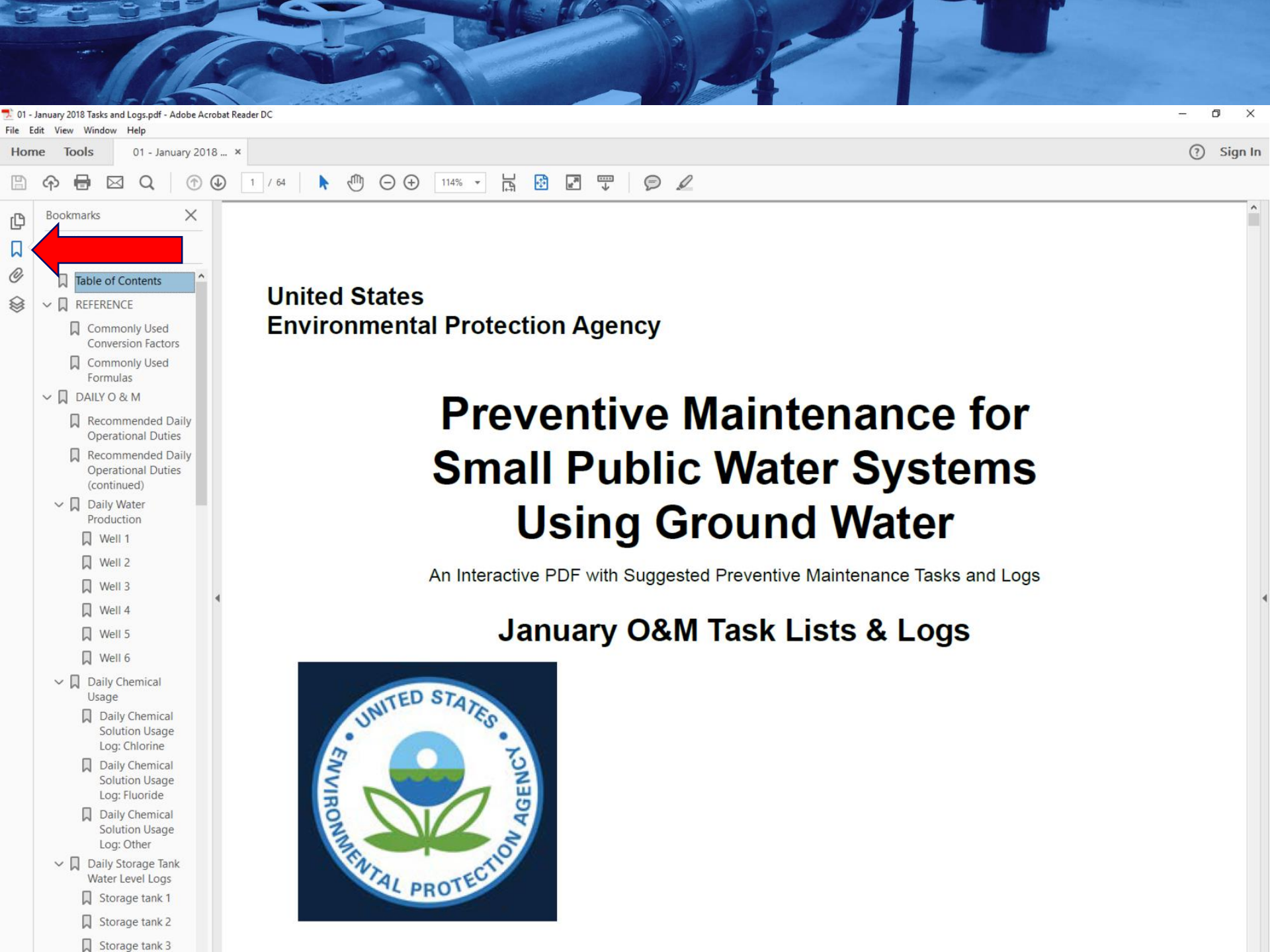
**United States  
Environmental Protection Agency**

# Preventive Maintenance for Small Public Water Systems Using Ground Water

An Interactive PDF with Suggested Preventive Maintenance Tasks and Logs

**January O&M Task Lists & Logs**





Bookmarks

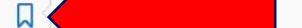
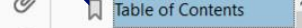


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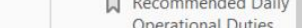
Commonly Used Conversion Factors



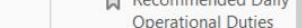
Commonly Used Formulas



DAILY O & M



Recommended Daily Operational Duties



Recommended Daily Operational Duties (continued)



Daily Water Production



Well 1



Well 2



Well 3



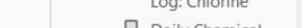
Well 4



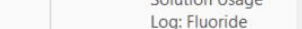
Well 5



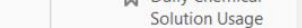
Well 6



Daily Chemical Usage



Daily Chemical Solution Usage Log: Chlorine



Daily Chemical Solution Usage Log: Fluoride



Daily Chemical Solution Usage Log: Other



Daily Storage Tank Water Level Logs



Storage tank 1

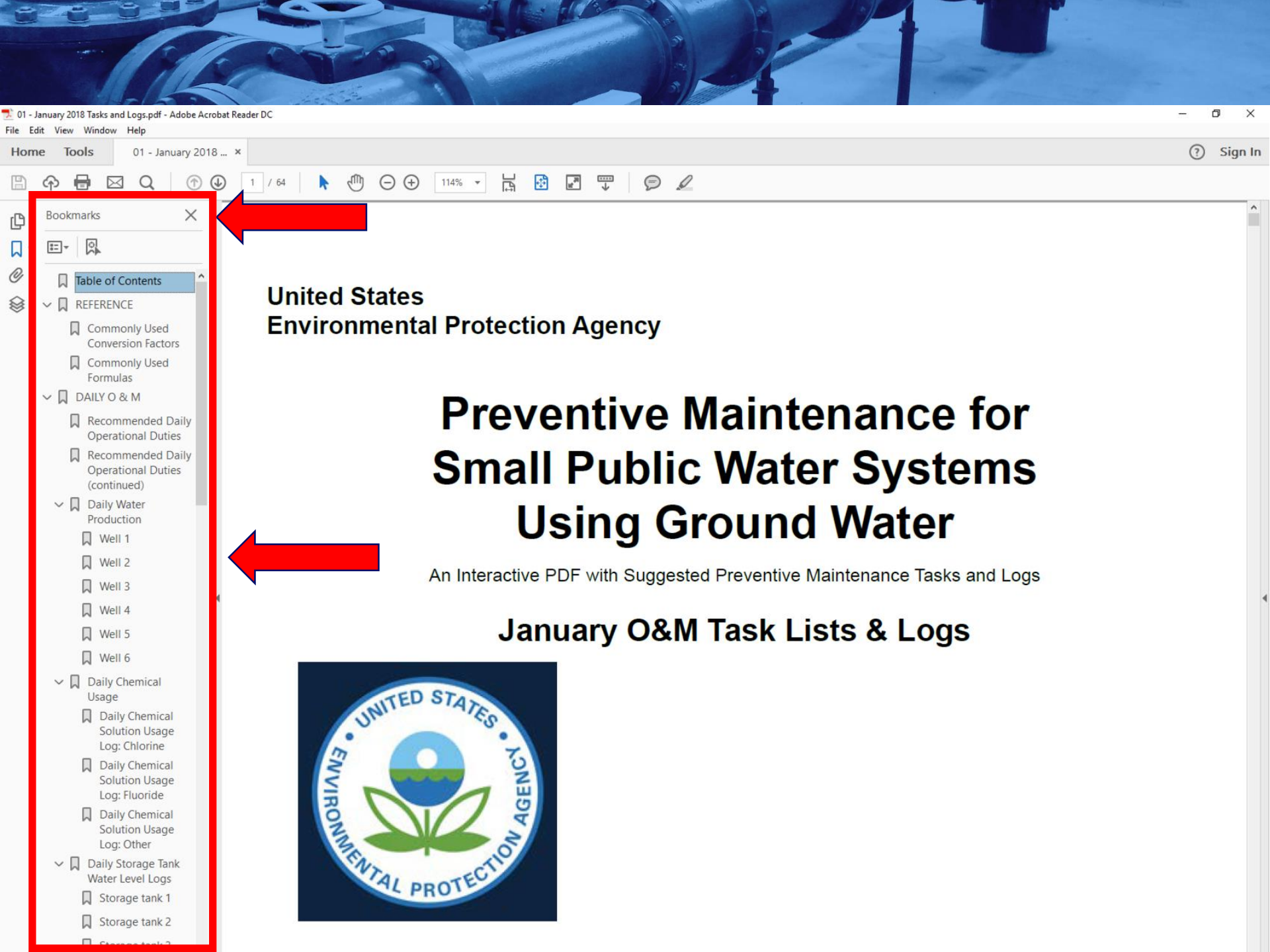
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Solution Usage  
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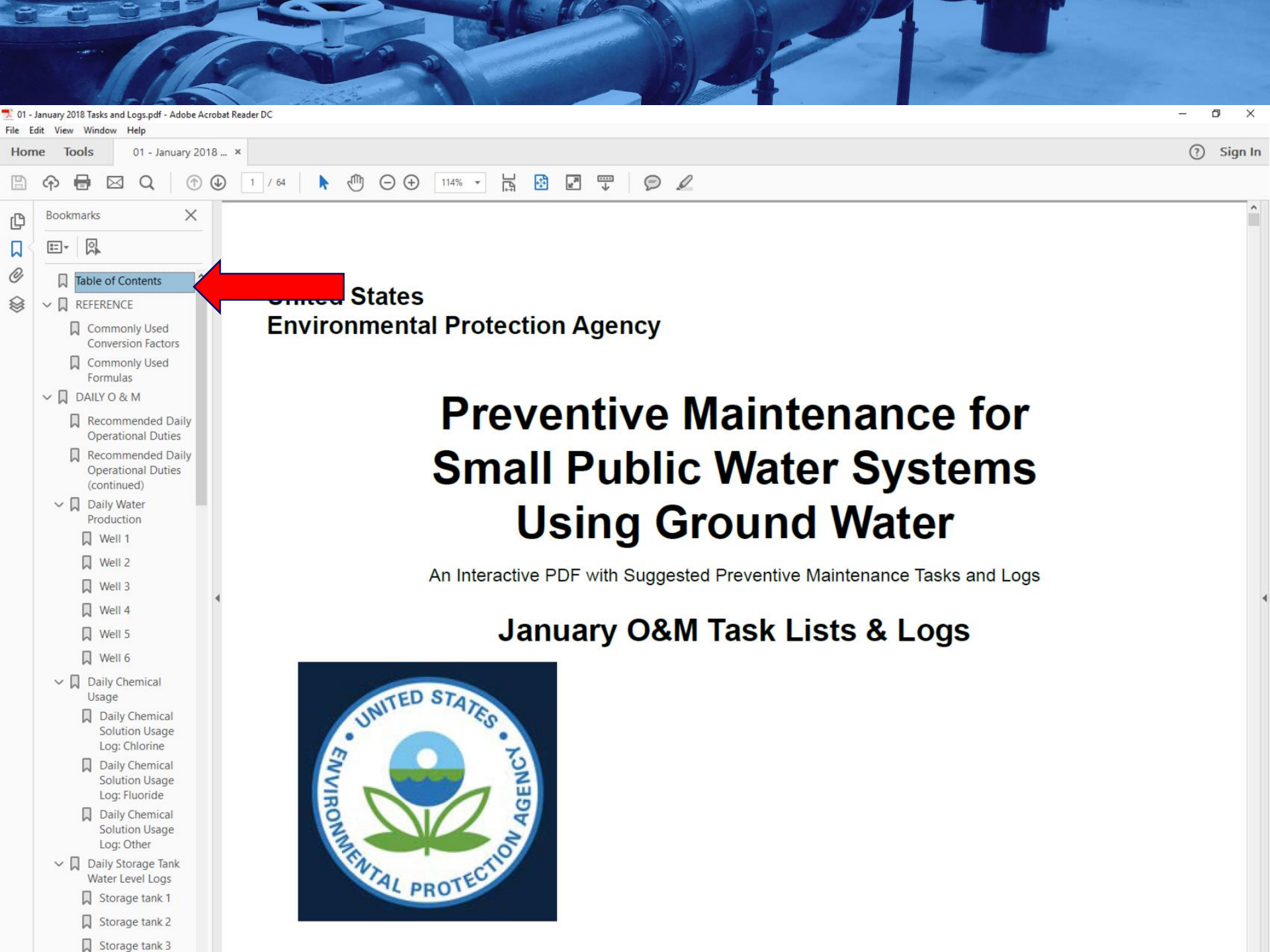
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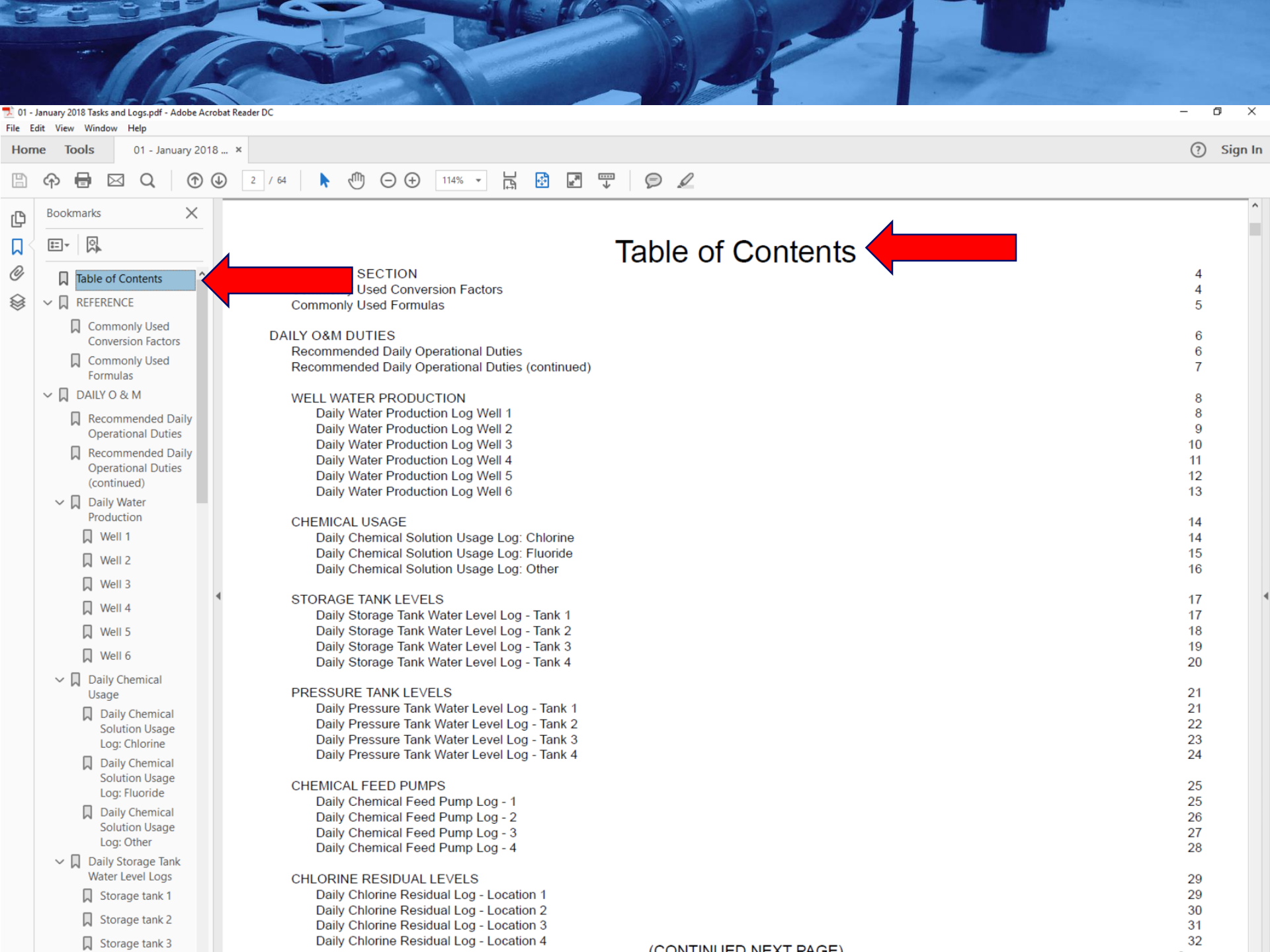
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# Document Demo



# Poll Questions





# Questions





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