Burned car is seen in a neighbourhood after wildfires destroyed an area of Phoenix, Oregon, U.S., September 10, 2020. REUTERS/Carlos Barria

Rogue Basin Wildfires and Drinking Water Supplies – Impacts and Opportunities

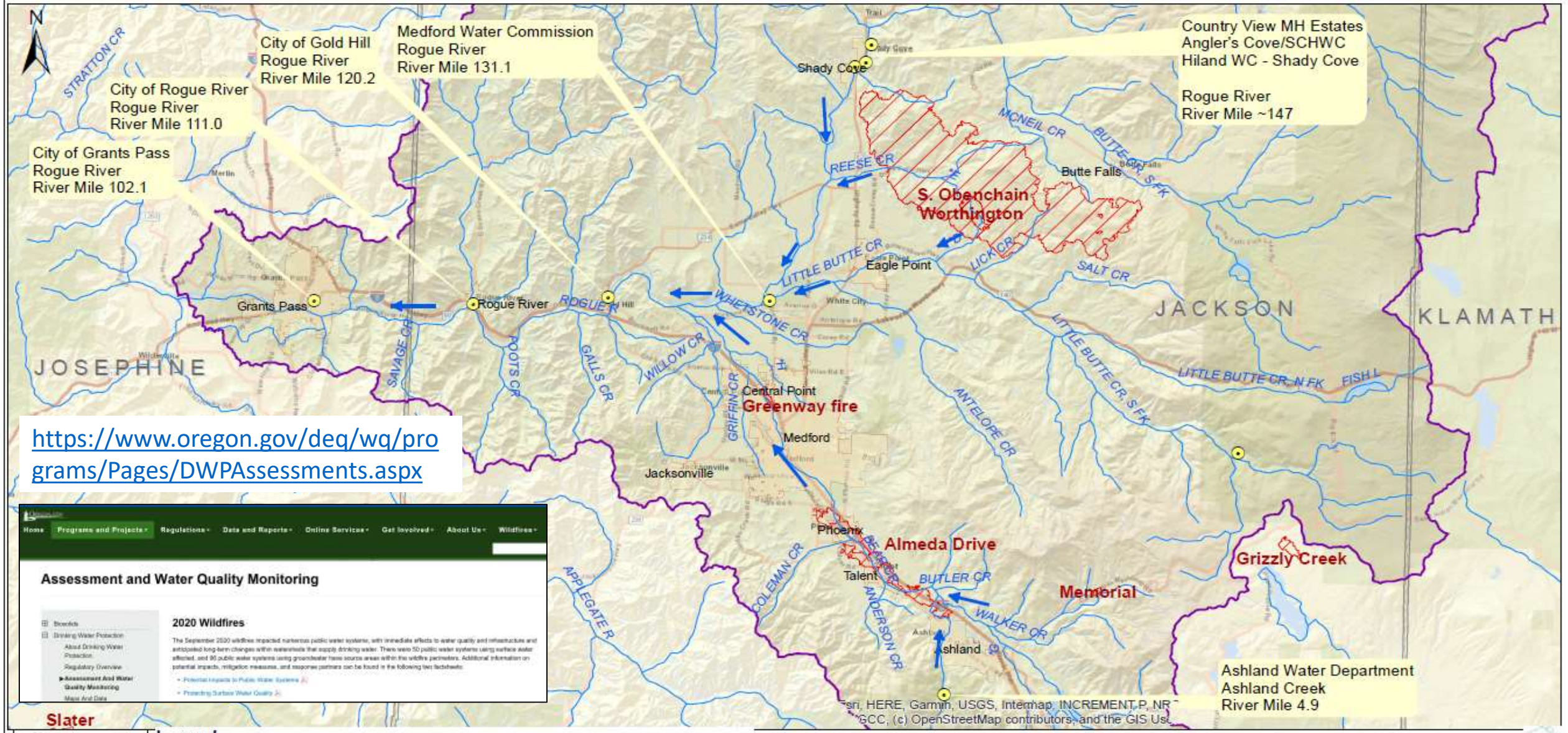
Addressing Short-Term Threats and Needs for Drinking Water Systems
January 13, 2021

Evan Hofeld
Oregon Health Authority – Drinking Water Services
503-504-8222
Evan.e.hofeld@dhsoha.state.or.us

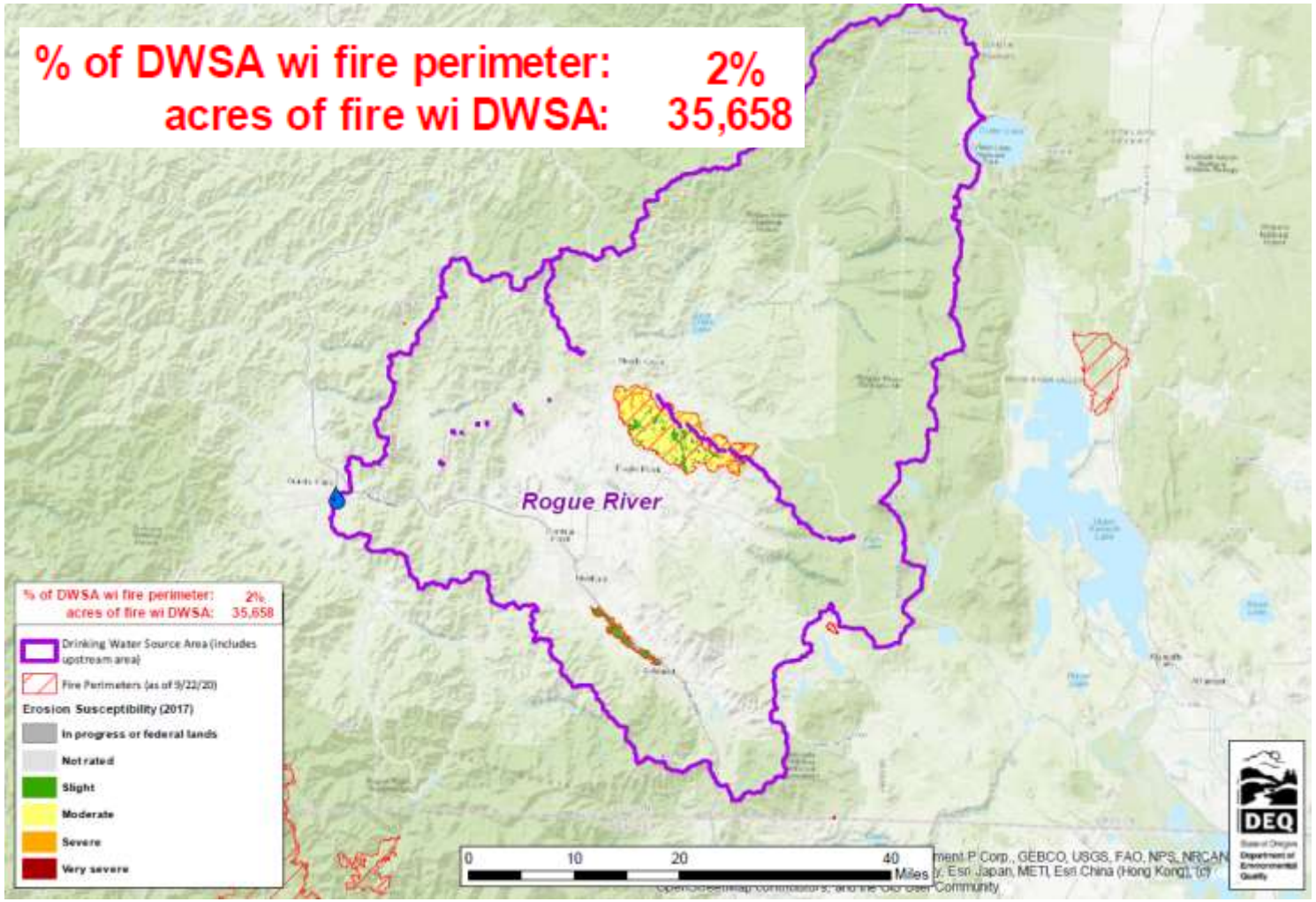
See new slides 31 and 32 on planning and outreach

Oregon Health Authority

Upper and Middle Rogue Public Water Systems and 2020 Wildfires



Surface water treatment impacts depend upon the proximity of fires to the intake, watershed characteristics, and burn extent/severity.



City of Grants Pass Watershed
Middle Rogue Subbasin

Drinking Water Source Area (includes upstream area)

Fire Perimeters (as of 9/22/20)

https://www.deq.state.or.us/wq/dwp/docs/swaadditionalinfo/AddInfo_00342GrantsPass.pdf

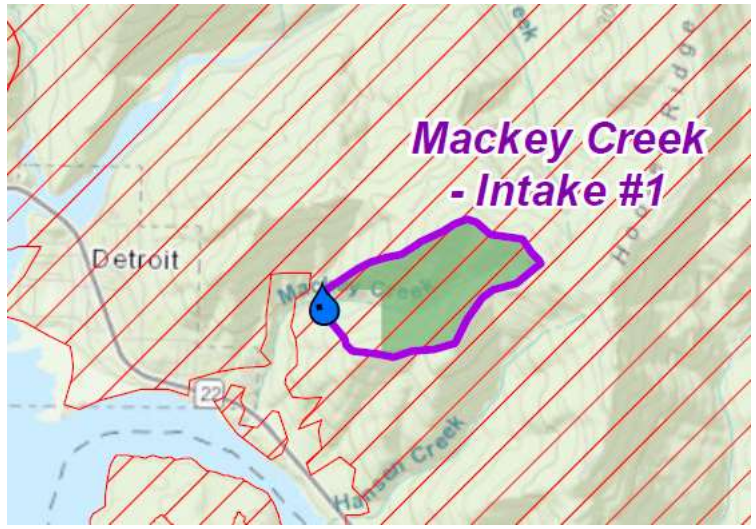
Oregon Health Authority

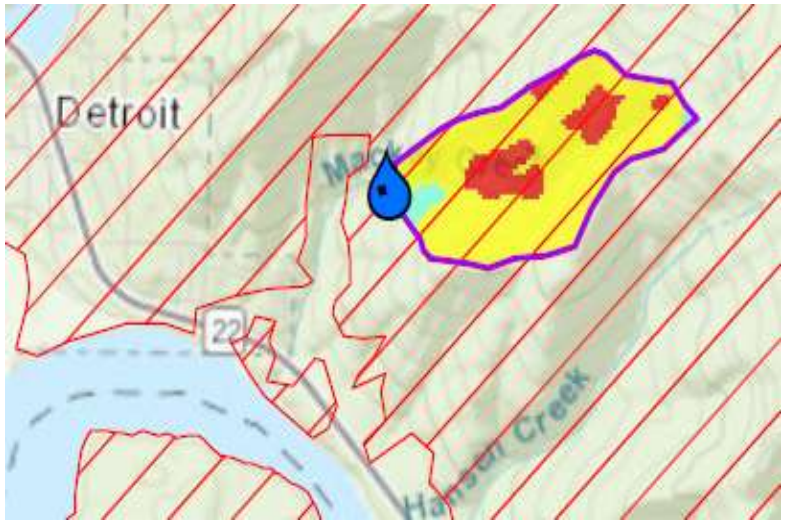
In some cases, 100% of the watershed was burned.

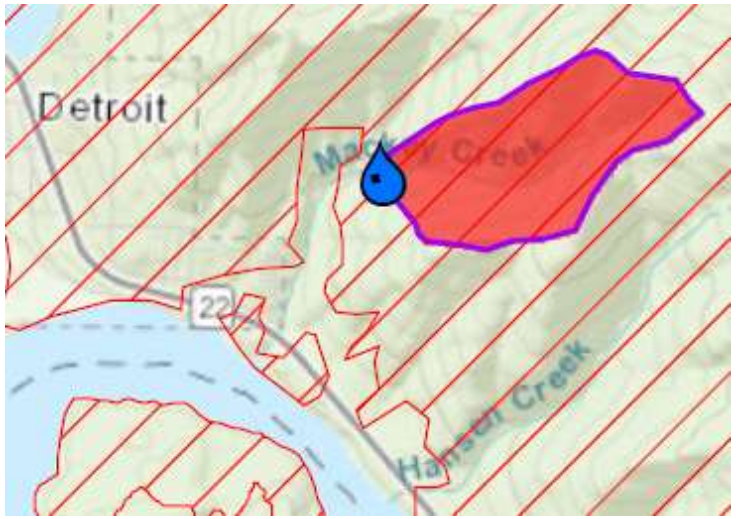
Detroit's Mackey Creek Watershed – N. Santiam Subbasin - Lionshead Fire

% of DWSA wi fire perimeter: 100%

acres of fire perimeter wi DWSA: 184







Land Ownership/Land Use

	Acres
Federal Lands	152
Private Industrial Forest	0
Private Non Industrial Forest	
Drinking Water Source Area (includes upstream area)	
Fire Perimeters (as of 9/22/20)	

Soil Burn Severity (BAER)

- High
- Moderate
- Low
- Unburned

Probability of Debris Flow

- 0-20%
- 20-40%
- 40-60%
- 60-80%
- 80-100%

https://www.deq.state.or.us/wq/dwp/swrpts.asp

https://www.deq.state.or.us/wq/dwp/docs/swaadditionalinfo/AddInfo_00257Detroit.pdf

Oregon Health Authority

Distribution system impacts depend upon number and type of water facilities damaged...

Detroit Water System (PWS ID #00257) - Marion County

Blue River Water District (PWS ID#00125) - Lane County

Oregon Health Authority

Also depends upon structures burned.

Devastation seen in Phoenix, Oregon, after the Almeda Fire that burned through the towns of Phoenix and Talent and destroyed approximately 600 homes.

AP

[City of Phoenix (PWS ID#00625) - Jackson County]

The numbered of damaged structures being assessed by the United States Army Corps of Engineers (USACE) and the Oregon State Fire Marshall (OSFM). The USACE summary of damaged structures is in the table below.

USACE Damaged Structures in Area Served by Drinking Water System

Drinking Water System	Not Assessed	Not Damaged	Unconfirmed	Damaged	Grand Total
Ashland Water Department		31			31
Blue River Water District	1	60		113	174
Canyonville, City of	2				2
Lincoln City Water District	16	38	3	2	59
Lyons Mehama Water District	3	18			21
Mapleton Water District	1				1
Mill City Water Department	2	133	1	36	172
Phoenix, City of	9	128	19	454	610
Roberts Creek Water District	81				81
Roseburg Forest Prod - Dillard	2				2
Roseburg, City of	1,042				1,042
Sutherlin, City of	238				238
Talent, City of	4	181	3	624	812
Tri-City JW&SA	1				1
Umpqua Basin Water Assoc	182				182
Winston-Dillard Water District	63				63
Grand Total	**4,917**	**3,552**	**120**	**4,683**	**13,272**

The OSFM appears to be narrowing their efforts on the following water systems in the table below.

OSFM Damaged Structures in Area Served by Drinking Water System

Drinking Water System	Commercial Structures Destroyed	Residential Structures Destroyed	Outbuilding Structures Destroyed
Blue River Water District	8	54	41
Colton Water District	0	0	0
Mill City Water Department	2	19	19
Grand Total	97	1,278	1,619

~75% of structures damaged in Talent and Phoenix

Erosion Threat Assessment/Reduction Team (ETART) Report

Water Quality/Drinking Water Supply Resource Report

Report Summary

Oregon Health Authority

Watersheds Impacts – Flooding and Erosion (turbidity)

The amount and timing of snowmelt and runoff from storms can lead to flash flooding, higher floodwaters, shorter times to peak flows, and erosion resulting in very high turbidity.

1996 Buffalo Creek Fire near Denver, CO

The Buffalo Creek Fire in May 1996 burned 4,690 hectares in the mountains southwest of Denver, Colorado. This wildfire lowered the erosion threshold of the watershed. As a consequence of this wildfire, a 100-year rainstorm in July 1996 caused erosion upstream and deposition of this alluvial fan at the mouth of a tributary to Buffalo Creek. Buffalo Creek is flowing to the right at the bottom of the photograph. (Credit: R. H. Meade, USGS.)

Rill erosion on a burned hillslope after the Buffalo Creek Fire. (Credit: John A. Moody, USGS.)

Oregon Health Authority

Watersheds Impacts – nutrients and organics (taste/odor, cyanotoxins, and disinfection byproducts)

- Build-up of ash, soil erosion, and fire debris can lead to problems with organics, taste, color and odor;
- Phosphate, nitrate, and nitrite runoff (firefighting agents may lead to short-lived run-off of phosphates and/or ammonia)
- Algal blooms may increase, some of which may results in harmful algal blooms and cyanotoxins;
- Adverse impacts to aquatic life

News Feature | September 23, 2020

Western Wildfires Likely To Cause Toxic Algal Blooms

By Peter Chawaga

Of the many adverse environmental effects caused by the major wildfires currently burning throughout the Western United States, at least one could be particularly devastating to source water management and, eventually, drinking water treatment operations.

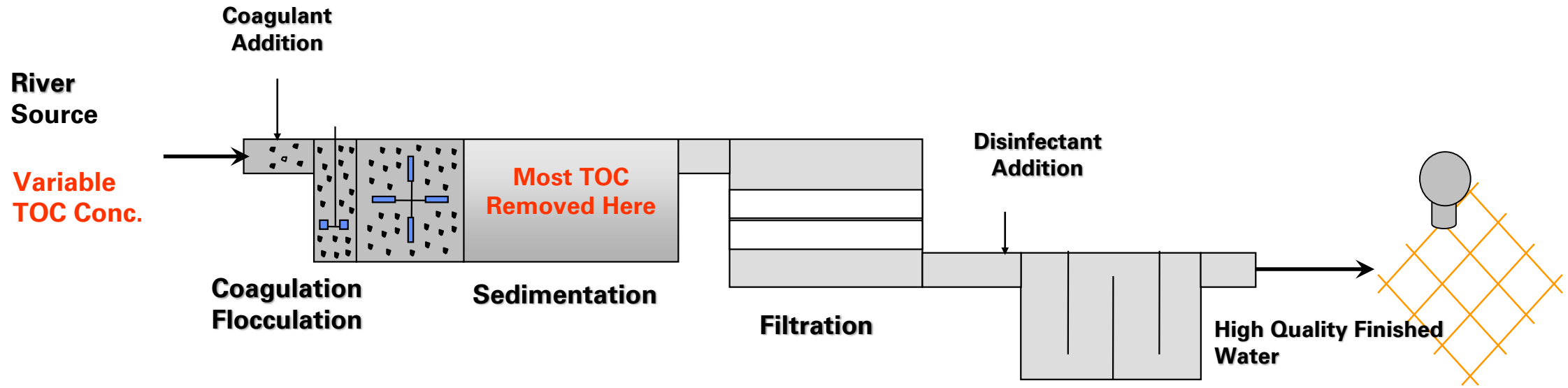
With nearly 1 million acres burned in Oregon and the fires far from contained, fundamental changes to watersheds are inevitable, state officials say. In particular, rising source water temperatures and the spread of ash are creating conditions that will foster more harmful algae blooms. In some parts of the state, this will exacerbate an already pervasive problem.

https://www.wateronline.com/doc/western-wildfires-likely-to-cause-toxic-algal-blooms-0001

Surface Water Treatment Impacts – TOC and DPB Precursors

- Coagulation and disinfection required to address higher turbidity and TOC, which also often requires more frequent backwashing and solids/waste handling capabilities and alkalinity if using alum;

- Organic carbon resulting from fire is more humic and aromatic than pre-fire organic carbon and, therefore, more likely to produce DBPs.



Watersheds Impacts – inorganics and unknown toxics

- Release of metals (iron, manganese, antimony, arsenic, asbestos, etc.)
- Ash after a fire can increase pH and alkalinity in soil and water affecting water treatment processes.

Sample of 760 NTU water taken from the Ship Creek supply Aug 9, 1971 – Fort Richardson, AK

Are you prepared for unusual events?

- What happens if your streaming current meter stops working?
- Can you operate in fully manual mode?
- Can you treat water during a flood?

Oregon Health Authority

Surface Water Treatment Impacts – increased pathogen loads (Giardia, Cryptosporidium, Viruses)

Increased run-off can inherently lead to increased pathogen loads in receiving water bodies.

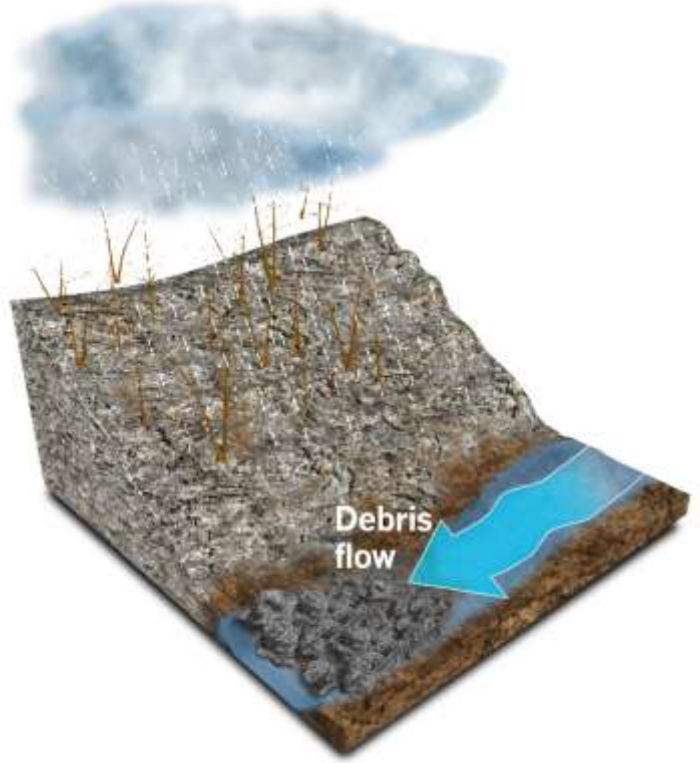
Image from CDC's site: http://www.cdc.gov/parasites/crypto/index.html

Watersheds Impacts – risks to drinking water infrastructure

- Sediment and debris buildup around intakes & impoundments.

- Risks to water bodies from landslides as well as risks to intakes, treatment plants, and other structures.

Organic debris and sediment were deposited in Strontia Springs Reservoir, which supplies drinking water to the cities of Denver and Aurora. This debris came from two watersheds (Buffalo Creek and Spring Creek) burned by the 1996 Buffalo Creek Fire. Associated with this debris was an increase in manganese, which increased the chlorine demand of water treated for municipal usage. (Credit: John A. Moody, USGS.)



<= Strontia Springs Reservoir - drinking water source for Denver and Aurora following 1996 Buffalo Cr. Fire

https://www.usgs.gov/media/images/burned-watersheds-debris-strontia-springs-reservoir

Watersheds Impacts – may last 4-8 years resulting in a "new normal"

Although the worst effects of fire occur in the first 1-2 years, watersheds may take from 4-8 years to recover and streams can take 4-5 years to recover from a wildfire (Clark, 2010). Recovery varies based on underlying soils & bedrock, vegetation, slopes, stream chemistry, and severity of fire.

Channels draining burned areas have zones of erosion and zones of deposition. This deposition was downstream from an erosion zone shown in the previous photo. The peeled bark indicates the highest level of water and debris during a flash flood. Sediment is coarse sand and gravel. The view is downstream and the blue backpack is about 1-meter tall. (Credit: John A. Moody , USGS.)

<= Channel erosion stripped bark off trees during flash flood due to abrasion of sand, gravel, and other debris.

https://www.usgs.gov/mission-areas/water-resources/science/hydrologic-and-erosion-responses-burned-watersheds?qt-science_center_objects=0#qt-science_center_objects

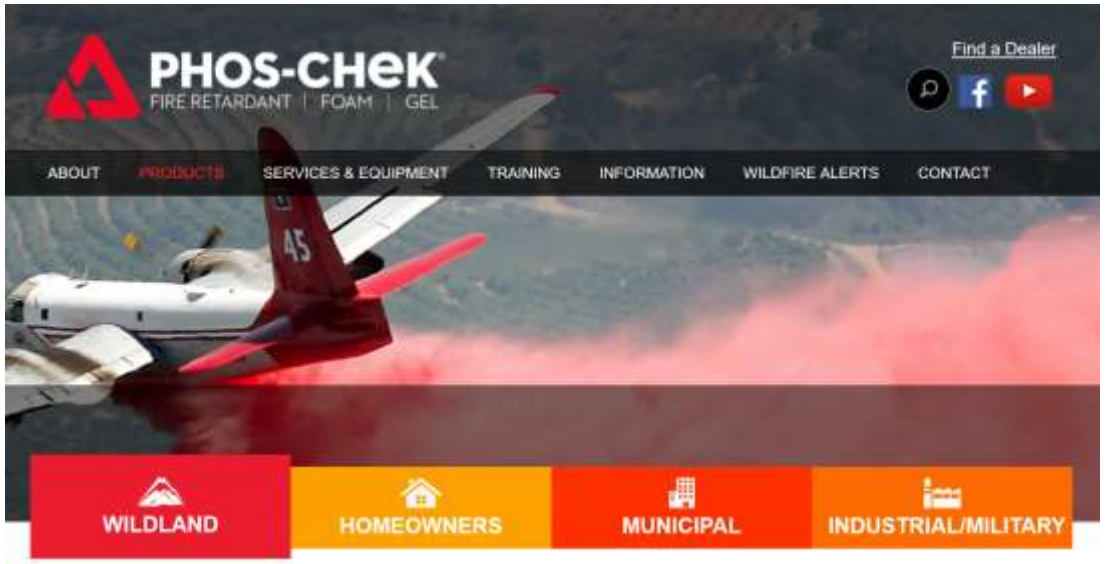
Fire Retardants

See DEQ's factsheet on Cleaning up Fire Retardant and Fire Suppressants online at:

https://www.oregon.gov/deq/wildfires/Documents/FireChemICUpWQ.pdf

PHOS-CHEK®

A common fire retardant is PHOS-CHEK® containing phosphorus and an iron oxide red colorant. Excess phosphorus can contribute to the formation of green algae blooms and harmful algae blooms, as well as negatively impact stream conditions for aquatic species.



https://phoschek.com/industry/wildland/

https://youtu.be/oU6HV9HnlEI

Oregon Health Authority

Firefighting Foams

PFAS/PFOA/PFOS

Per- and polyfluoroalkyl (PFAS) substances found in a wide range of consumer products such as nonstick products, polishes, waxes, paints and cleaning products. Two PFAS compounds, perfluorooctane acid (PFOA) and perfluorooctanesulfonic acid (PFOS), may be present in firefighting aqueous film forming foam (AFFF) solutions.

1. Could be a risk for firefighting activities in urban settings or at airports threatened by wildfires.
2. Risks may be incurred with short-term exposure.
3. Risk of contamination of groundwater sources is also possible, depending upon the susceptibility of the aquifer.
4. Contact your drinking water regulator if you are concerned.

If concerned, you may ask personnel at departments that use firefighting aqueous film forming foam (AFFF) if they:

- use newer fluorine-free foam AFFF solutions, free of PFAS/PFOA/PFOS;
- contain and manage AFFF and water runoff;
- recommend personal protective equipment (PPE) and a self-contained breathing apparatus (SCBA) for your protection if there is a risk of exposure;
- recommend specific cleaning wipes for your face, neck and hands immediately after exposure; and
- recommend showering within one hour or sooner when leaving from a site where you may have been exposed.

https://www.usfa.fema.gov/training/coffee_break/021120.html

Oregon Health Authority

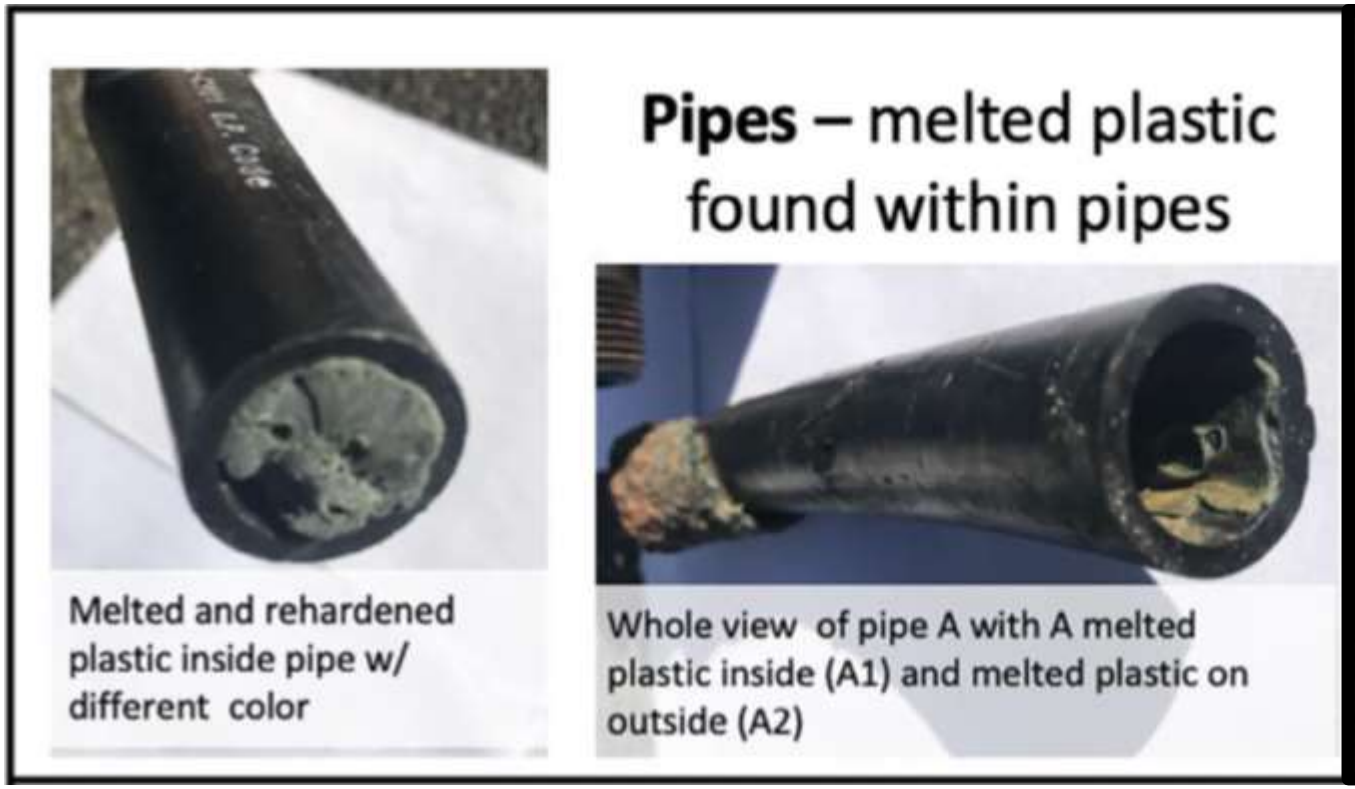
Firefighting Foams – not of concern in 2020 fires

- There is no indication that any class B firefighting foams (the class that contain PFAS) were used during the 2020 Oregon wildfires, therefore, testing for this is not required or being recommended.

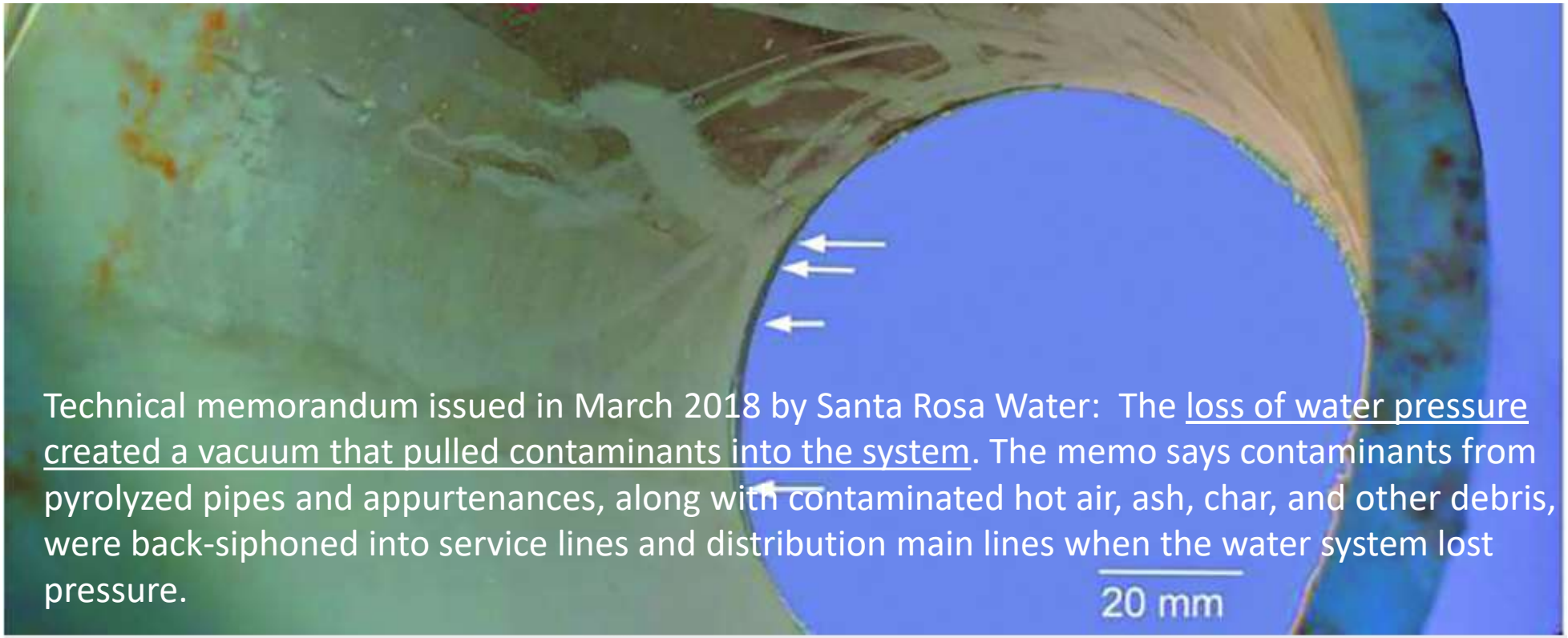
- Most, if not all, the PFAS contamination sites identified in Oregon are related to the use of aqueous film forming foams (AFFF).

- Efforts are currently underway to identify known and suspected AFFF use locations as well as other potential PFAS contamination sources so OHA can evaluate risk to any nearby water systems and determine if they should test their drinking water for PFAS.

Distribution System Impacts - physical damage, pipe obstructions, and inoperable isolation valves.



Distribution System Impacts – smoke, ash, and soot pulled into the system during loss of pressure events



Technical memorandum issued in March 2018 by Santa Rosa Water: The loss of water pressure created a vacuum that pulled contaminants into the system. The memo says contaminants from pyrolyzed pipes and appurtenances, along with contaminated hot air, ash, char, and other debris, were back-siphoned into service lines and distribution main lines when the water system lost pressure.

City of Santa Rosa

The inside of a section of a water main from the Fountaingrove neighborhood in Santa Rosa, Calif., shows a dark sooty material that indicates smoke, ash and soot from burned home sites made it into the water mains.

https://www.plasticsnews.com/news/towns-reeling-wildfires-now-face-contaminated-water

Oregon Health Authority

Distribution System Impacts – Toxics like benzene due to pyrolysis of pipe and intake during loss of pressure.

Plastic drinking water pipes exposed to high heat can leak hazardous chemicals

Lab tests may help explain high levels of benzene in water after recent California wildfires

This home northwest of Santa Cruz, Calif., burned during the 2020 CZU Lightning Complex Fire. Water testing in the region showed elevated benzene levels in drinking water after fires swept through.

AP PHOTO/MARCIO JOSE SANCHEZ

https://www.sciencenews.org/article/plastic-drinking-water-pipes-high-heat-wildfire-hazardous-chemicals

A lot of the research is still unfolding in Paradise, where results of the PID's initial round of water samples were described as "jaw-dropping" by a member of California's Water Resources Control Board. About 32 percent of the 500 water samples detected benzene at an average level of 27 parts per billion. California's drinking water standard is one ppb while the federal standard is five ppb.

Oregon Health Authority

What are the immediate steps we can take?

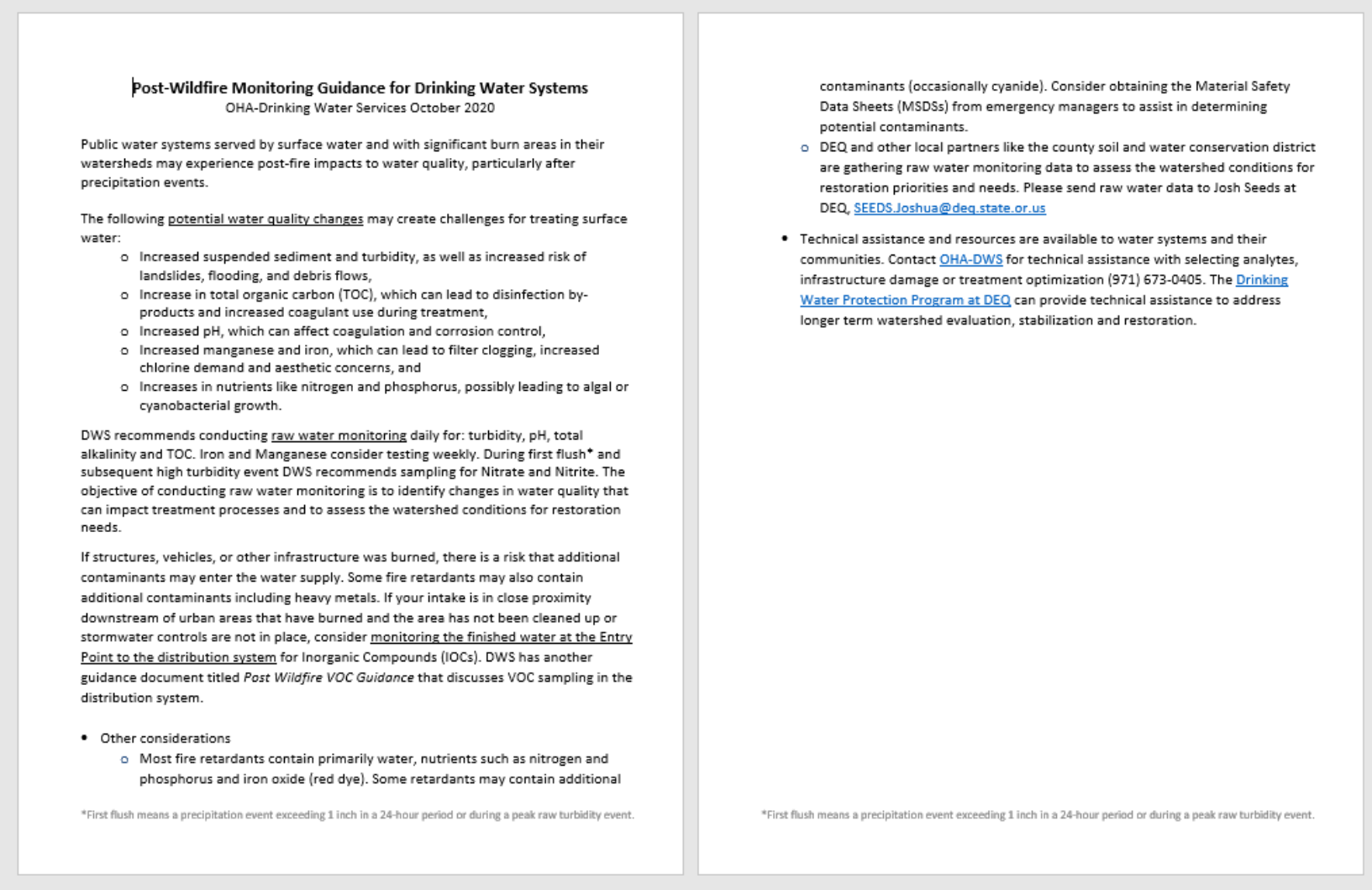
1. Communicate with local emergency mangers early and often to relay status and needs
2. Work with the local emergency managers to get debris and hazards removed
3. Enlist the help of others (OAWU, ORWARN, DEQ, OHA, neighbors)
4. Be on the lookout for hazards to life and infrastructure
   - ✓ Use the buddy system to ensure safety
   - ✓ Be on the lookout for hazardous trees (look at least 100-ft out from areas were people or critical infrastructure may be). 100-ft may not be enough for taller trees.
   - ✓ Landslides
   - ✓ Log jams
   - ✓ Hot spots that may reignite
5. Identify alternate travel routes in case of landslides or road closures.
6. Monitor road culverts and clear debris to prevent failure. Identify culverts that may need to be upsized as needed to handle additional runoff volumes.

For surface water systems:

- Monitor & clear intakes and impoundments for debris accumulation and plan to clean more often.
- Identify any burned structures upstream that may pose a chemical contaminant risk and mitigate ASAP.
- Evaluate/clean sedimentation and backwash basins – plan for more frequent cleaning in the future.
- Take stock of treatment chemicals, generator fuel/operability, consumables, and lab reagents and prepare to keep more on-hand.
- Evaluate adequacy of chemical dosing pumps, sludge handling, and backwash water to handle treating highly turbid water. Also evaluate the ability to meet demands with the plant off-line when storms bring turbidity too high to effectively treat.
- Calibrate turbidimeters and pH meters and service streaming current meters as applicable.
- Begin monitoring water quality for long-term impacts such as increases in baseline turbidity, TOC, and algal toxins and prepare for having to switch treatment practices and potentially coagulants to address competing priorities.
- Investigate raw water or in-stream monitoring for turbidity and verify alarm set-points to better alert you to sudden changes in raw water quality.
- Communicate with other landowners in the watershed about your concerns and provide them with a way to contact you at any time if there is a landslide or other incident that you should know about.
- As applicable, order more cartridge/bag filters, UV lamps (plan to clean quartz sleeve more often), and clean slow sand filters in a staggered cleaning schedule to avoid having to take all the filters off-line at the same time.

Post-fire source water monitoring guidance:

https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/PREPAREDNESS/Documents/post-fire-source-monitoring.pdf



Post-Wildfire Monitoring Guidance for Drinking Water Systems
OHA-Drinking Water Services October 2020

Public water systems served by surface water and with significant burn areas in their watersheds may experience post-fire impacts to water quality, particularly after precipitation events.

The following potential water quality changes may create challenges for treating surface water:

- Increased suspended sediment and turbidity, as well as increased risk of landslides, flooding, and debris flows,
- Increase in total organic carbon (TOC), which can lead to disinfection by-products and increased coagulant use during treatment,
- Increased pH, which can affect coagulation and corrosion control,
- Increased manganese and iron, which can lead to filter clogging, increased chlorine demand and aesthetic concerns, and
- Increases in nutrients like nitrogen and phosphorus, possibly leading to algal or cyanobacterial growth.

DWS recommends conducting raw water monitoring daily for: turbidity, pH, total alkalinity and TOC. Iron and Manganese consider testing weekly. During first flush* and subsequent high turbidity event DWS recommends sampling for Nitrate and Nitrite. The objective of conducting raw water monitoring is to identify changes in water quality that can impact treatment processes and to assess the watershed conditions for restoration needs.

If structures, vehicles, or other infrastructure was burned, there is a risk that additional contaminants may enter the water supply. Some fire retardants may also contain additional contaminants including heavy metals. If your intake is in close proximity downstream of urban areas that have burned and the area has not been cleaned up or stormwater controls are not in place, consider monitoring the finished water at the Entry Point to the distribution system for Inorganic Compounds (IOCs). DWS has another guidance document titled *Post Wildfire VOC Guidance* that discusses VOC sampling in the distribution system.

- Other considerations
  - Most fire retardants contain primarily water, nutrients such as nitrogen and phosphorus and iron oxide (red dye). Some retardants may contain additional contaminants (occasionally cyanide). Consider obtaining the Material Safety Data Sheets (MSDSs) from emergency managers to assist in determining potential contaminants.
  - DEQ and other local partners like the county soil and water conservation district are gathering raw water monitoring data to assess the watershed conditions for restoration priorities and needs. Please send raw water data to Josh Seeds at DEQ, SEEDS.Joshua@deq.state.or.us
- Technical assistance and resources are available to water systems and their communities. Contact OHA-DWS for technical assistance with selecting analytes, infrastructure damage or treatment optimization (971) 673-0405. The Drinking Water Protection Program at DEQ can provide technical assistance to address longer term watershed evaluation, stabilization and restoration.

*First flush means a precipitation event exceeding 1 inch in a 24-hour period or during a peak raw turbidity event.

*First flush means a precipitation event exceeding 1 inch in a 24-hour period or during a peak raw turbidity event.

For groundwater systems:

- Be aware of the potential for smoke, ash, and other contaminants to be drawn into the well casing through the air vent, flush the well, and consult your drinking water regulator for testing guidance.

- Monitor static water levels in wells as these can change if increased runoff impacts aquifer recharge rates.

For the water systems with wells that have burned structures and lost pressure, VOC samples have been collected and continue to be collected from the distribution systems to ensure the drinking water is safe. The VOC results so far in the Rogue basin have shown no detections above the maximum contaminant levels (MCL). If there was contamination in the groundwater it should show up in the distribution sampling.

If water systems are still concerned about potential impacts to ground water, they could apply for a source water protection Grant to conduct a contamination study. The grant application period should open soon, so continue to check on-line at: https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/SRF/Pages/spf.aspx.

The Domestic Well Safety Program is currently working on guidance for domestic well owners and provides assistance for limited monitoring at homes that were impacted by the fire. More information can be found on their website at: https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/SOURCEWATER/DOMESTICWELLSAFETY/Pages/Testing-Regulations.aspx

For distribution systems:

- Issue “Do Not Drink” notices when system loses pressure or if VOC contamination is likely due to burned structures.
- Isolate burned services or areas with broken lines until they can be repaired or replaced.
- Begin flushing lines to “chase bad water out with good water” and re-pressurize the system.
- Be aware of the potential for smoke, ash, and other contaminants to be drawn into tanks through air vents, drain tank or flush out system.
- Sample for VOCs as needed if services are burned or wildfire spreads over top of buried waterlines – contact your regulator for assistance and guidance.
- Restore and monitor chlorine residuals in the distribution system to ensure residual is at about 0.2 mg/l. Longer term increases in chlorine demand may indicate the presence of organics or other disinfection byproduct precursors in the system.
- Sample for coliform bacteria.
- Exercising critical valves so they will work when needed.
- Compare disinfection byproduct levels to historical data and look for upward trends.

VOC sampling guidance for customers:

https://www.oregon.gov/oha/ph/HealthyEnvironments/DrinkingWater/Preparedness/Pages/emergency.aspx

Oregon Health Authority

Customer Guidance Regarding Water Quality in Buildings Located in Areas Damaged by Wildfire

Oregon Drinking Water Services
Revised October 23, 2020

Disclaimer: This document was prepared by the California Water Resources Control Board, Division of Drinking Water, with input from other drinking water professionals. It has been adapted for Oregon. Information provided below is based on limited experience and understanding of how public drinking water systems are impacted by wildfires. This document summarizes what has been observed in wildfire-impacted areas and is intended to provide recommendations for building owners regarding how to perform a minimum baseline analysis of potential chemical contamination. Because of the many variables and unknowns regarding fire-damaged drinking water systems, it cannot be guaranteed that following the recommendations below will necessarily protect water system users from adverse health impacts associated with the water. Water customers are encouraged to work with their local water supplier and local health authorities.

Purpose
The purpose of this document is to assist water customers (individuals, businesses, schools and others) receiving drinking water from water systems impacted by wildfires with addressing possible contamination of their drinking water and building plumbing.

Background
When a wildfire occurs, it can damage not only buildings, but also the pipes that deliver water to those buildings. Some damage is visible, like charring or melting, but other damage is less obvious, like contamination of the water or the pipes. After recent fires in California, contaminants such as benzene were detected in the water above drinking water standards in some locations. This problem was first documented during the 2017 Tubbs Fire in Santa Rosa, CA and subsequent investigation concluded that thermal decomposition (combustion, melting and/or pyrolysis) of plastics contributed to the contamination. Benzene can soak into the walls of plastic pipes and be slowly released over time. While water mains get flushed to some extent as water is used, it is possible that some benzene may remain in the pipes and other materials connected to the standing buildings and in the water within those pipes. Without testing, it is unknown which pipes may be affected.

Health considerations
According to the United States Centers for Disease Control and Prevention, long-term exposure (years) to benzene in air or water can affect bone marrow production of red and white blood cells and may cause anemia and immune system damage. Benzene is also a known human carcinogen, and long-term exposure can lead to leukemia (a cancer of the blood-forming tissues). For most people, their exposure to benzene is from gasoline and auto exhaust in the air, or from tobacco smoke.

The US Environmental Protection Agency sets the maximum allowable level of a contaminant in water delivered to the users of a public water system. This level, the Maximum Contaminant Level (MCL), for benzene is 5 micrograms per liter, or parts per billion. For water customers,

your risk from your drinking water is related to the levels, frequency and duration of your exposure.

Recommendations – Flushing
Residents who are concerned about possible benzene or other contamination should thoroughly flush all their pipes and in-building components (water heater, ice maker, etc). Flushing is accomplished by undertaking the following:
1. Cold water: allow each water tap (sinks, showers, outside hose-bibs, etc.) to run for about 5 minutes (multiple taps can be run at the same time but maintain vigorous flow).
2. Hot water: allow each hot water tap to run until the water turns cold.
3. Refrigerators and other water dispensers (such as under-sink filtration systems): run the water for several minutes, and then replace the filter if present.
4. Ice makers: follow the manufacturer's instructions for cleaning ice maker water lines, dispose of any existing ice, and dispose the ice from three refills.

Note: Concentrations of benzene in air are expected to be negligible; however, as an added precaution you may wish to ventilate your house while conducting the flushing by opening windows and turning on exhaust fans.

Water testing
Contact an Oregon accredited laboratory and let them know that you would like to have your drinking water tested for benzene in accordance with US EPA Method 524.2. The lab may bundle analysis with other contaminants, such as BTEX (benzene, toluene, ethylbenzene, and xylene) or regulated volatile organic contaminants (VOCs). Experience of the California State Water Resources Control Board indicates that in most cases benzene is an appropriate indicator of the presence or absence of other contaminants that could pose adverse health risks. Researchers note there have been instances where other contaminants have been found in the absence of benzene.

The laboratory should provide you with the necessary sample collection bottles as part of the analysis cost. The laboratory should also provide you with specific instructions on how to prepare and fill the sample bottles, along with other useful guidance. These must be followed carefully and precisely, to avoid inadvertent contamination from other sources (such as tobacco smoke, gasoline, your hands, hair, clothing, etc). In some instances, laboratories may offer services to collect the sample.

Please make sure that any sampler follows these instructions:
1. Stagnation: After the building plumbing is flushed following the process set forth above, the water should remain untouched and stay in the pipes for a minimum of 8 hours before sampling. Some researchers recommend stagnation for 72 hours. Avoidance of water use is necessary to give time for any chemicals present in the water pipes to move back into the water. This reduces the risk of receiving an inaccurate test result. It may be convenient to take your sample in the morning after the water sat overnight.
2. Sample Location: Once water has been allowed to stand, a sample is ready to be taken. The recommendation is it to take a cold-water sample at the kitchen faucet, which is typically the primary location where water is obtained for consumption. *Note: Do not use a faucet with a filter.* The California guidance that this document is derived from states that testing at the kitchen faucet should generally provide representative data about the water pipes in the house. However, some researchers suggest a need for multiple samples from both hot and cold taps and from the service line. If consumers wish, they may take additional samples as

well, such as at a bathroom faucet, or other faucets where people use the water for drinking. Consumers can also sample the water coming into the building by taking a sample at the entrance of the building, if available (generally the outdoor hose bib by the shutoff valve).
Sample Collection: Follow the instructions provided by the laboratory
a. Set up the sample bottles and any other materials in a clean location near the faucet to be sampled.
b. Measure and discard the first two cups (16 ounces) of water from the tap before taking the sample for analysis (This is to help ensure that the sample represents water in contact with the building pipes, and not the faucet, nor the water main in the street).
c. Fill the sample bottles as directed.
d. Complete any additional steps in accordance with the exact directions provided by the laboratory where the sample will be analyzed and deliver the sample to the laboratory as instructed.

Interpreting results
If your results come back as "non-detect (ND)," "below quantification limit," or less than 5 ug/L, then the water meets the State and Federal standard. In the event of a sample result for benzene that is higher than 1 ug/L, DWS recommends following the flushing steps above to collect a second sample and submit it to your laboratory. If the second sample confirms the presence of benzene above 1 ug/L, it is recommended that you contact your water utility for additional advice, and possible testing of water being served through their system to your property. You may also wish to contact your local or county health department for health-related questions.

In-building treatment options
"Point-of-use" units using granular activated carbon (GAC) or reverse osmosis (RO) will remove low levels of benzene and other organic contaminants. They can be installed at faucets used for drinking water. Select a treatment unit certified by the National Sanitation Foundation, NSF standard 53 for VOC removal. These units must be maintained according to manufacturer's specifications.

Additional information
Health information: ATSDR Toxicological Profile for Benzene, Public Health Statement for Benzene, August 2007. www.atsdr.cdc.gov/ToxProfiles

Flushing: Gary Burlingame, Sheldon Master and Joan Przybylowicz,"'Rinse the Tap' Advisories are a Refreshing Measure" Opflow, Vol 45, No 5, pp 22-24, May 2019

Treatment units: US EPA: "Investigating point-of-use and point-of- entry devices to enhance water security."

https://cfpub.epa.gov/si/si_public_file_download.cfm?p_download_id=498211&Lab=NHSRC

"Wildfire caused widespread drinking water distribution network contamination." AWWA Water Science, 2020, Caitlin R. Proctor, Juneseok Lee, David Yu, Amisha D. Shah, Andrew J. Whelton. https://doi.org/10.1002/aws2.1183

Oregon Health Authority

VOC sampling guidance for water systems:

https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/PREPAREDNESS/Documents/post-wildfire-VOC-sampling-guidance.pdf

- Initial monitoring (3 samples for most systems) completed at 11 systems shortly after fire in September/October within distribution system were ND.

- Later evaluated 33 systems ranging from mobile home parks (customer/one connection) to community systems.

- 15 high risk systems with structures burned and loss in pressure were identified and sent a letter in December requiring them to identify, sample and track burned connections, take corrective actions for burned connections over MCL for benzene, and submit a monitoring plan due December 31, 2020.

- Monitoring results are being reviewed by Gregg Baird (OHA-DWS) for compliance with Maximum Contaminate Levels (MCLs) and Health Advisory Levels (HALs) – One burned connection over the MCL for benzene in Lincoln County.

- Contact Russ Kazmierczak for sampling assistance.

Russell A. Kazmierczak, R.G. OHA Drinking Water Services
Cell: 971-599-0121
Office: 541-726-2587 Ext. 26
email: Russell.A.Kazmierczak@state.or.us

Letter requiring benzene sampling at all service connections where structures had burned prior to restoring service.

PUBLIC HEALTH DIVISION
Center for Health Protection, Drinking Water Services
Kate Brown, Governor

Oregon Health Authority

800 NE Oregon Street, Suite #640
Portland, OR 97232-2162
(971) 673-0405
(971) 673-0694 – FAX
www.healthoregon.org/dws

December 1, 2020

RE: Post-wildfire Sampling Requirements for Volatile Organic Compounds (VOCs)

Dear Water Supplier:

In September 2020, OHA Drinking Water Services (DWS) distributed and posted on our website Post-wildfire VOC Sampling Guidance for Oregon public water systems potentially impacted by wildfires. Most of the impacted water systems voluntarily conducted initial screening-level sampling of their distribution systems under the guidance and follow-up samples are planned. Experience in California has shown that the highest concentrations of post-wildfire VOCs have been found in samples collected from service lines at properties where structures have burned. As property owners start to rebuild, it is important to sample service lines prior to restoring service to ensure water suppliers are providing safe water.

Therefore under authority provided in OAR 333-061-0036 (1) (g), we are requiring **all water suppliers whose water system lost positive pressure during the September 2020 wildfires to sample for benzene, at a minimum, prior to restoring service to properties where structures were destroyed by wildfire.** Sample results must demonstrate compliance with the maximum contaminant level of 5 ppb prior to restoring service. As an impacted water supplier, we are specifically requiring the following from you:

1) Submit an Action Plan within 30 days that provides for:
   a. Identification of service connections where structures have been destroyed by fire;
   b. Sampling of these service connections for benzene, at minimum, in accordance with DWS Post-wildfire VOC sampling guidance prior to restoring service;
   c. Corrective action measures where sample results are confirmed to exceed maximum contaminant levels; and
   d. Tracking the status and actions taken at each affected service connection.
2) Notify DWS upon completion of the Action Plan

The Action Plan can be very simple and submitted to Russ Kazmierczak, our post-wildfire VOC coordinator by email. Russ can also assist you with the action plan and can help coordinate sample collection at small systems. DWS has limited funding available to support lab analyses at the DEQ lab for small water systems.

If there are questions regarding this requirement, please contact Russ Kazmierczak at 971-599-0121 or Russell.A.Kazmierczak@state.or.us.

Sincerely,

Drinking Water Services

Therefore under authority provided in OAR 333-061-0036 (1) (g), we are requiring **all water suppliers whose water system lost positive pressure during the September 2020 wildfires to sample for benzene, at a minimum, prior to restoring service to properties where structures were destroyed by wildfire.** Sample results must demonstrate compliance with the maximum contaminant level of 5 ppb prior to restoring service. As an impacted water supplier, we are specifically requiring the following from you:

1) Submit an Action Plan within 30 days that provides for:
   a. Identification of service connections where structures have been destroyed by fire;
   b. Sampling of these service connections for benzene, at minimum, in accordance with DWS Post-wildfire VOC sampling guidance prior to restoring service;
   c. Corrective action measures where sample results are confirmed to exceed maximum contaminant levels; and
   d. Tracking the status and actions taken at each affected service connection.
2) Notify DWS upon completion of the Action Plan

OAR 333-061-0036
Sampling and Analytical Requirements

(1) General:

(g) The Authority may require additional sampling and analysis for the contaminants included in OAR 333-061-0030 when necessary to determine whether an unreasonable risk to health exists. The Authority may also require sampling and analysis for additional contaminants not included in OAR 333-061-0030 when necessary for public health protection.

Oregon Health Authority

What if I need to repair, replace, or bring in temporary water infrastructure (portable treatment plants, tanks, etc.)?

- Keep your drinking water regulator informed of any plans to install temporary tanks, pump stations, treatment facilities or modifications to the water system to see if plan review/approval is needed.

- Replacing waterlines with the same size and material of line in the same alignment, repairing damaged buildings, and replacing control systems & monitoring equipment does not need plan review from OHA-DWS (local permitting requirements may apply).

- Ensure all materials and treatment chemicals to be used for drinking water purposes are approved for potable use (NSF-61 certification for materials and NSF-60 certification for chemicals).

- Special requirements apply to cartridge, membrane, and UV systems, whether for temporary or permanent use.

Oregon Health Authority

Long-term strategies

Plan for a multiple barrier approach:

- Operators employ the multiple barrier approach when they consider each unit process as providing a distinct barrier to contaminants.
- Optimization is the process of improving the performance of each process to achieve its maximum performance, often performing well beyond that required by regulation. Use this process to demonstrate chemical feed capabilities and address any shortfalls or capital improvements needed.
- Update operation and maintenance manuals and emergency response plans as you find better ways to operate.

Practice:

- Use table-top drills and exercises to practice optimization strategies so they can be implemented when needed – don't wait until the storms come!
- Don't take things for granted; test as many assumptions as possible – ideally full scale.

- Gain experience and confidence with jar testing – it can be a powerful tool.
- Paying attention to details makes the difference between a good jar test and a bad one.

Long-term strategies

New Slide

Hold an after-action meeting to identify areas for improvement and update emergency response plans.

- Turn findings of the after-action meeting into action items to update emergency response procedures and improve future wildfire response.
- Communicate plans local emergency managers, fire departments, and state/federal emergency response partners before another event happens. Communicate emergency response expectations to customers.
- Consider communicating response plans with power utilities, local law enforcement, and fire departments to ensure water system concerns are considered in their plans.
- Emergency response planning resources are available on-line at the links below:

Oregon Health Authority - Drinking Water Services:

- https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/PREPAREDNESS/Pages/emergency.aspxhttps://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/PREPAREDNESS/Pages/emergency.aspx
- https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/PREPAREDNESS/Pages/index.aspx

Oregon Office of Emergency Management:

- https://www.oregon.gov/oem/Pages/default.aspx

Federal Emergency Management Administration and USEPA:

- https://www.fema.gov/
- https://www.epa.gov/waterutilityresponse

Long-term strategies

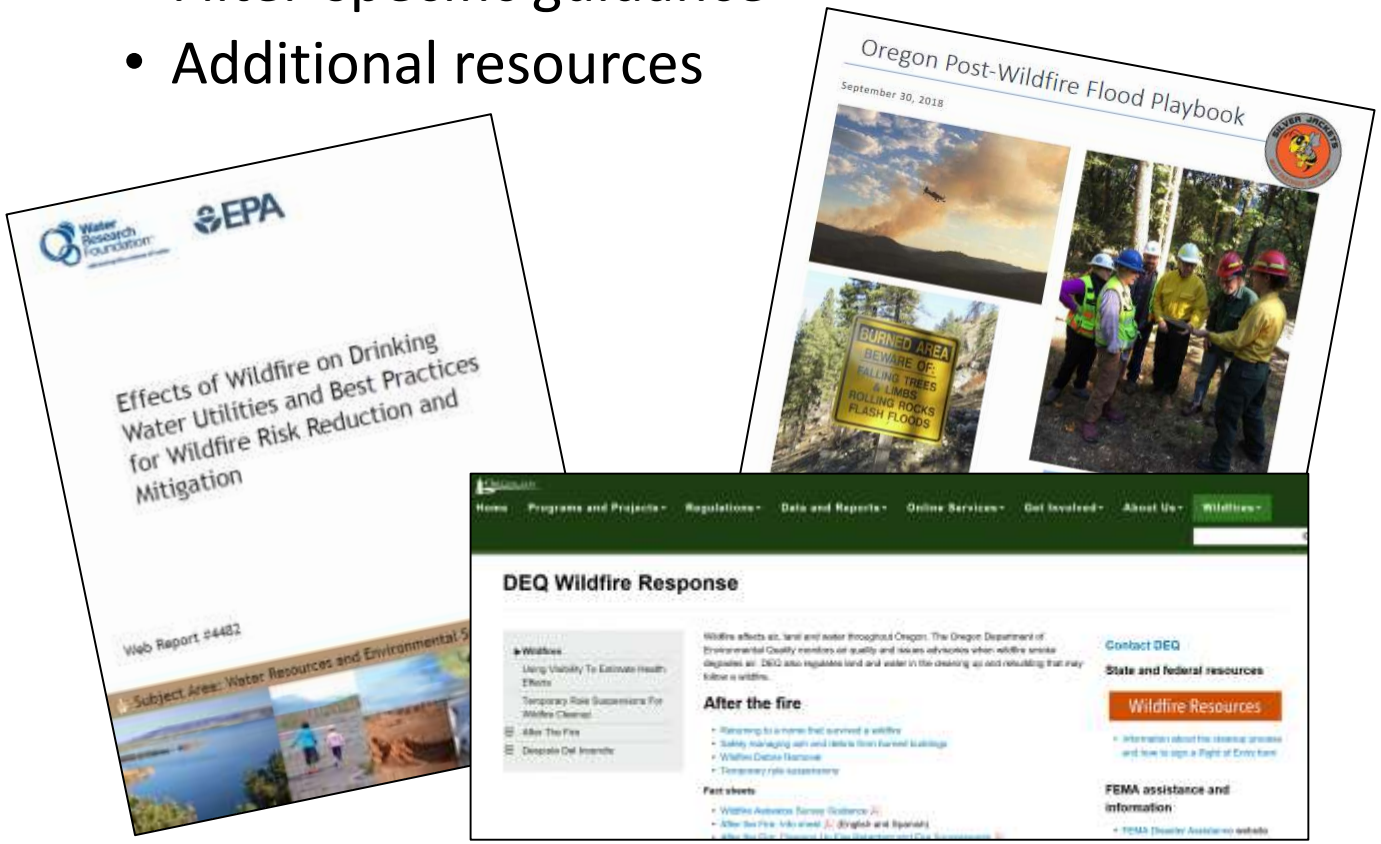
Translations for Public Notices: Four basic drinking water messages that have been translated into 27 different languages.

Plan for public outreach

- Develop press releases for "water curtailment", "do not drink", and "boil water" public notices ahead of time and make sure the process for issuing these notices is well understood and practiced and assign a public information officer to address questions from the media.
- Develop notices in multiple languages and identify ways to reach vulnerable populations.
- Identify how to distribute notices who to contact for posting in print publications, web or social media sites, direct mail, radio/news stations, community bulletin boards, etc. Consider e-mail lists, text alerts, phone trees, and reverse 911 capabilities.
- Identify someone to coordinate information sharing with facilities serving vulnerable populations like hospitals, schools, daycares, long-term care facilities, and emergency red cross shelters or other emergency response staging areas). Keep fire departments apprised of any anticipated water supply issues.
- Develop sets of "Frequently Asked Questions" (FAQ) for customer service representatives and develop a plan to provide additional customer service staffing during an emergency. Identify someone to monitor and address misinformation that may circulate on social media accounts or other media outlets.
- Public notice templates and FAQ are online at: https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/OPERATIONS/Pages/publicnotices.aspx

October 23, 2020 – Optimization Guidance

- What source water changes to expect
- What every surface water system can do
- Filter-specific guidance
- Additional resources



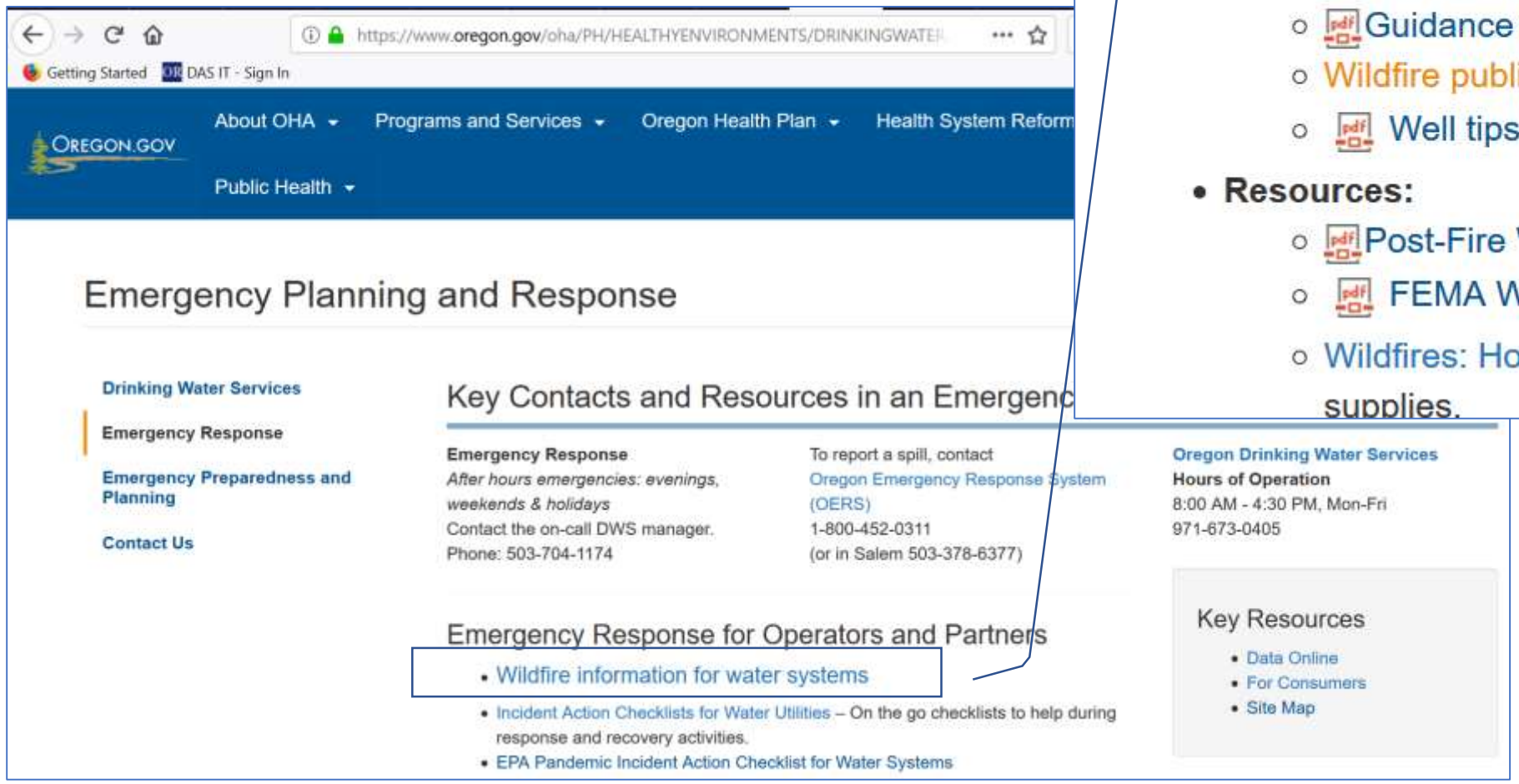
Optimizing Water Treatment Plants After a Wildfire
OHA Drinking Water Services
October 2020

The purpose of this document is to alert operators of things to consider following a wildfire and provide options to surface water treatment plants to optimize existing treatment to address potential impacts to water quality. Impacts to water quality can include changes in:

- The amount and timing of snowmelt and runoff from storms. Storm events can lead to flash flooding, higher floodwaters, and shorter times to peak flows,
- Raw water quality from build-up of ash, soil erosion, and fire debris, taste, color and smell of drinking water;
- Phosphate, nitrate, and nitrite runoff (firefighting agents may lead to short-lived run-off of phosphates, ammonia,)
- Naturally occurring metals (iron, manganese, arsenic, asbestos, etc.)
- Algal blooms, some of which may produce algal toxins;
- pH and alkalinity. Deposition of ash after a fire can increase pH and alkalinity in soil and water
- Sediment and debris buildup around intake impoundments;
- Coagulation and disinfection required to address higher turbidity and TOC, which also often requires more frequent backwashing and solids/waste handling capabilities and alkalinity if using alum; Organic carbon resulting from fire is more humic and aromatic than pre-fire organic carbon and, therefore, more likely to produce DBPs.
- Risks to water bodies from landslides as well as risks to intakes, treatment plants, and other structures;
- Although the worst effects of fire occur in the first 1-2 years, watersheds may take from 4-8 years and streams can take 4-5 years to recover from a wildfire (Clark, 2010). Recovery varies based on underlying soils & bedrock, vegetation, slopes, stream chemistry, and severity of fire
- Operability of valves and other control systems that may have been damaged or affected by debris and sediment.

Updated Website

https://www.oregon.gov/oha/ph/HealthyEnvironments/DrinkingWater/Preparedness/Pages/emergency.aspx



More Online Resources

Oregon Wildfire Recovery:
https://wildfire.oregon.gov/cleanup

Emergency Management Contacts (local and county OEMs)
https://www.oregon.gov/oem/Documents/locals_list.pdf

OHA-Drinking Water Services Wildfire Resource Page
https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/PREPAREDNESS/Pages/emergency.aspx#wildfires

DEQ – Wildfire Response Page
https://www.oregon.gov/deq/wildfires/Pages/default.aspx

DEQ – Source Water Protection Area & Fire Maps
(click on the "Additional Info" Map)
https://www.deq.state.or.us/wq/dwp/swrpts.asp

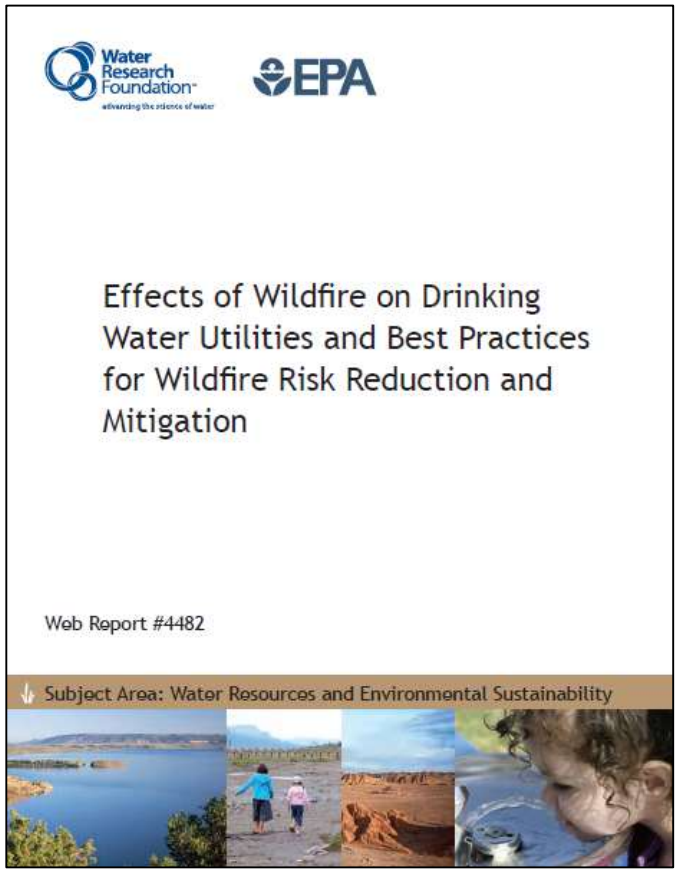
Business Oregon – Infrastructure Finance Authority – Regional Contacts
http://www.oregon4biz.com/About-Us/Contact-Us/map.php

https://www.readcube.com/articles/10.1002%2Fawwa.1113

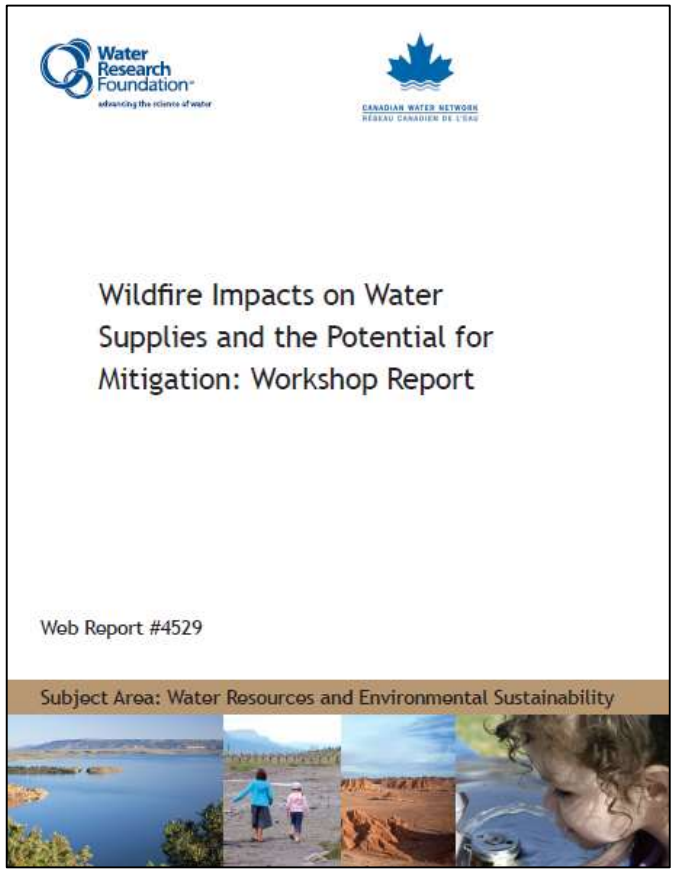
Other Resources – Water Research Foundation

https://www.waterrf.org/search?topic=Wildfires

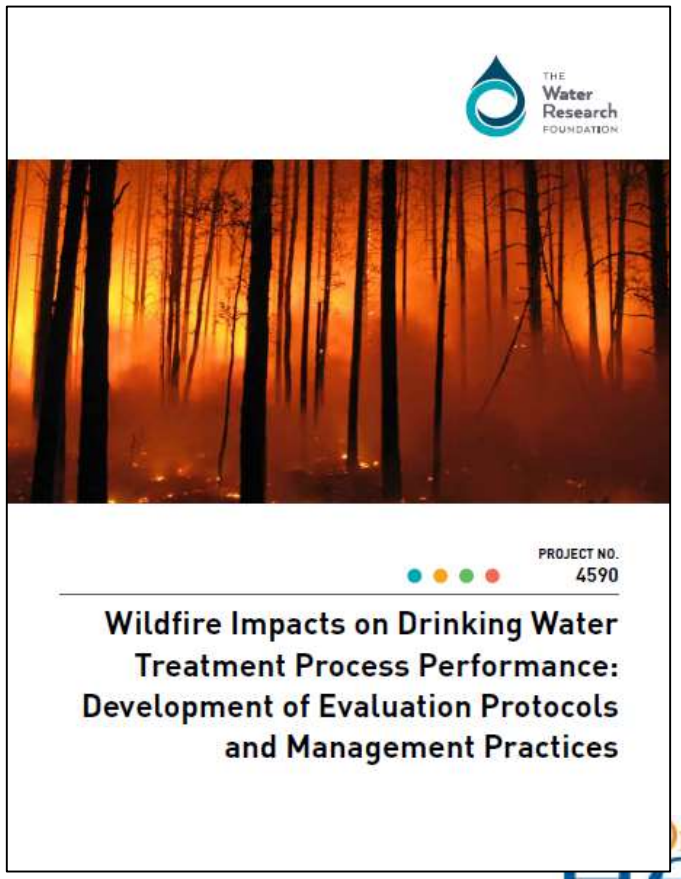
2013



2014

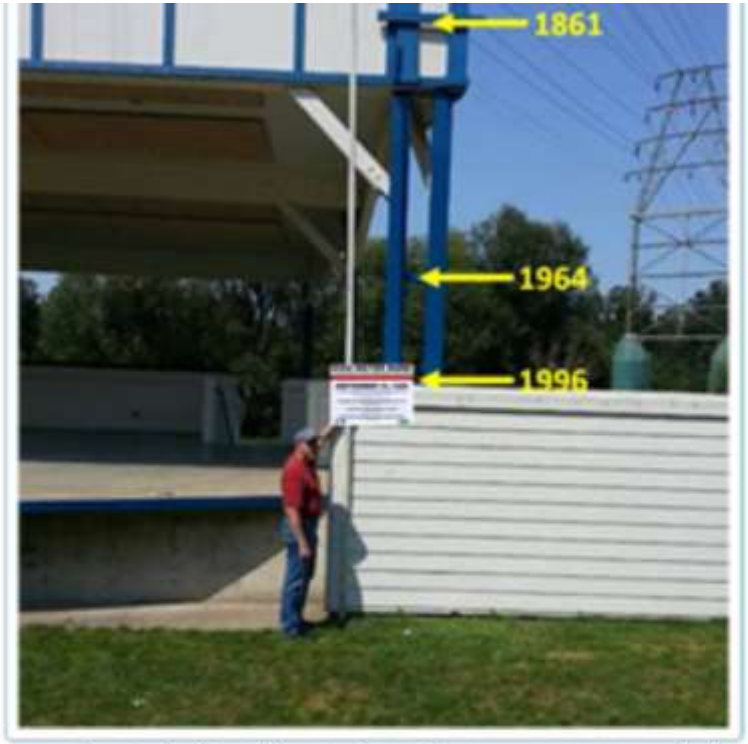


2018



Post-Wildfire Flood Playbook

https://silverjackets.nfrmp.us/State-Teams/Oregon



Several agencies, including Silver Jackets Team partners, worked together to locate and install high water mark signage to increase public awareness in Albany, Turner and Oregon City.

Oregon Health Authority

Questions?

Evan Hofeld
503-504-8222
Evan.e.hofeld@dhsoha.state.or.us

Optimizing Water Treatment Plants After a Wildfire
OHA Drinking Water Services
October 2020

The purpose of this document is to alert operators of things to consider following a wildfire and provide options to surface water treatment plants to optimize existing treatment to address potential impacts to water quality. Impacts to water quality can include changes in:

- The amount and timing of snowmelt and runoff from storms. Storm events can lead to flash flooding, higher floodwaters, and shorter times to peak flows,
- Raw water quality from build-up of ash, soil erosion, and fire debris, taste, color and smell of drinking water;
- Phosphate, nitrate, and nitrite runoff (firefighting agents may lead to short-lived run-off of phosphates, ammonia,)
- Naturally occurring metals (iron, manganese, arsenic, asbestos, etc.)
- Algal blooms, some of which may produce algal toxins;
- pH and alkalinity. Deposition of ash after a fire can increase pH and alkalinity in soil and water
- Sediment and debris buildup around intake impoundments;
- Coagulation and disinfection required to address higher turbidity and TOC, which also often requires more frequent backwashing and solids/waste handling capabilities and alkalinity if using alum; Organic carbon resulting from fire is more humic and aromatic than pre-fire organic carbon and, therefore, more likely to produce DBPs.
- Risks to water bodies from landslides as well as risks to intakes, treatment plants, and other structures;
- Although the worst effects of fire occur in the first 1-2 years, watersheds may take from 4-8 years and streams can take 4-5 years to recover from a wildfire (Clark, 2010). Recovery varies based on underlying soils & bedrock, vegetation, slopes, stream chemistry, and severity of fire
- Operability of valves and other control systems that may have been damaged or affected by debris and sediment.