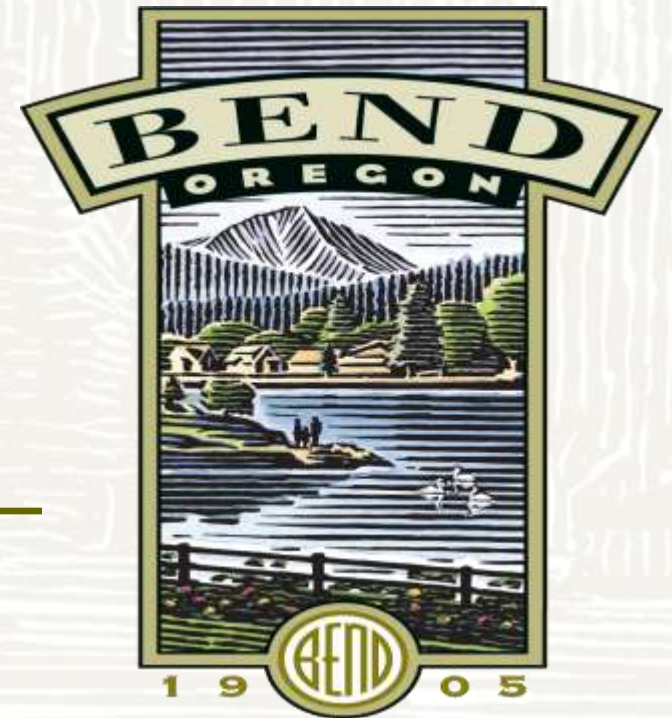
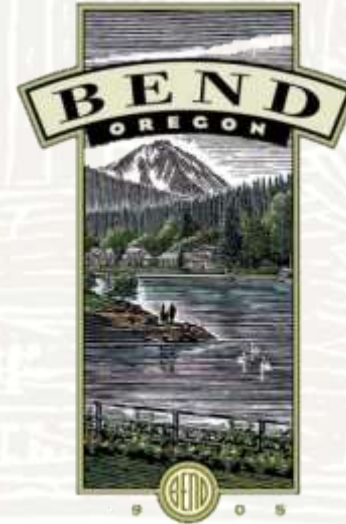


Water Shed Protection Against Wild Fire

Building a water system resilient to fire





Presenter:

Tom Hickmann P. E.

City of Bend, Director

Engineering & Infrastructure Planning Dept.



Bend's surface water supply is the "backbone" of the City's potable water system



Water Shed Protection



TUMALO CREEK WATERSHED ANALYSIS



Deschutes National Forest
Bend/Ft. Rock Ranger District

September 28, 2007



Watershed Control Program

12/2010

Bend Water Department
Public Water System

PWSID # 4100100

Date of Report Revision: 1/21/2011

Art Easton, Chris Brejje
Certified Operators

62975 Boyd Acres Rd.
Bend, OR 97701

Phone: 541-322-6330

- Characterize
- Identify
- Monitor



A Major Fire In The Watershed

is an unpredictable, but inevitable, event

Wildfire Risk Factors



- Fire frequency
- Fire behavior
- Weather conditions
- Alignment of drainages
- Specific location of fire
- Time of year
- Availability of firefighting resources



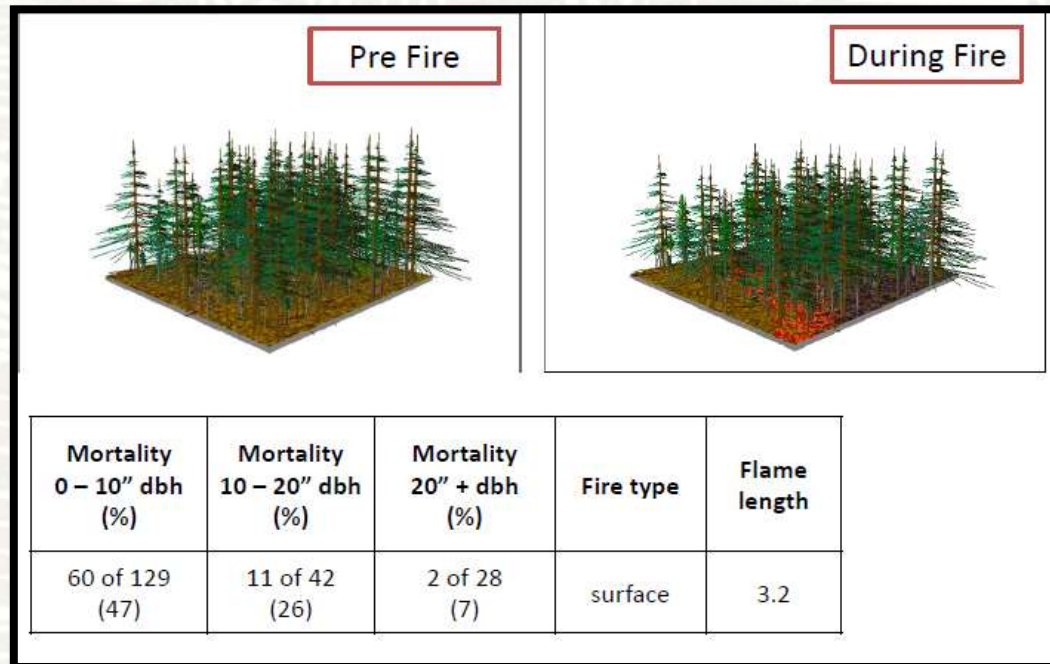
Crater Lake



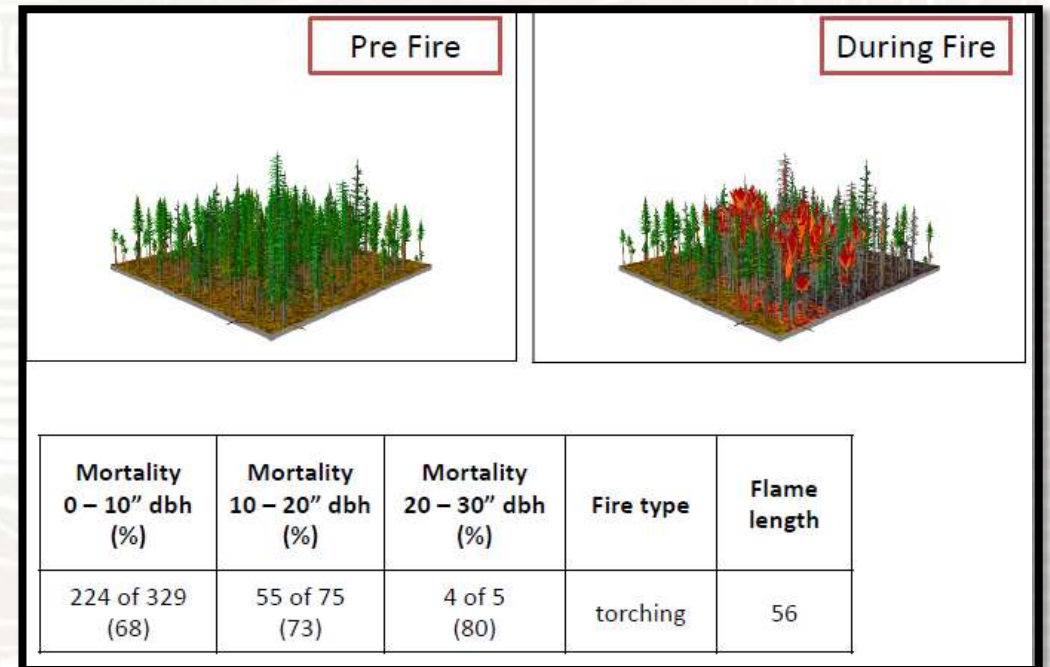
Forest Vegetation



Mountain Hemlock/ Fir Stand Type 2

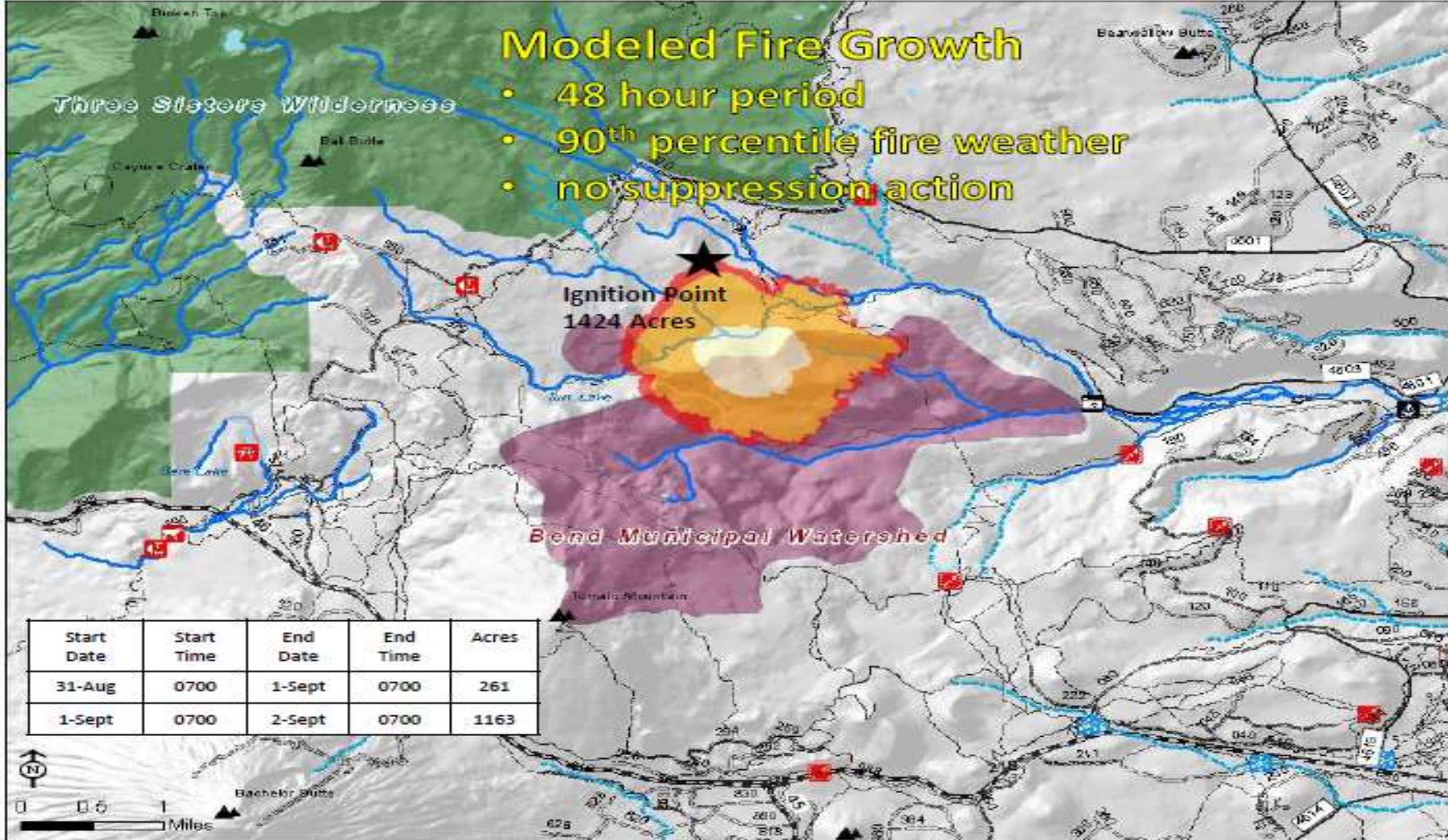


Lodgepole Pine/ Fir Stand Type



Modeled Fire Growth

- 48 hour period
- 90th percentile fire weather
- no suppression action



Effects of Wildfire on Water Quality

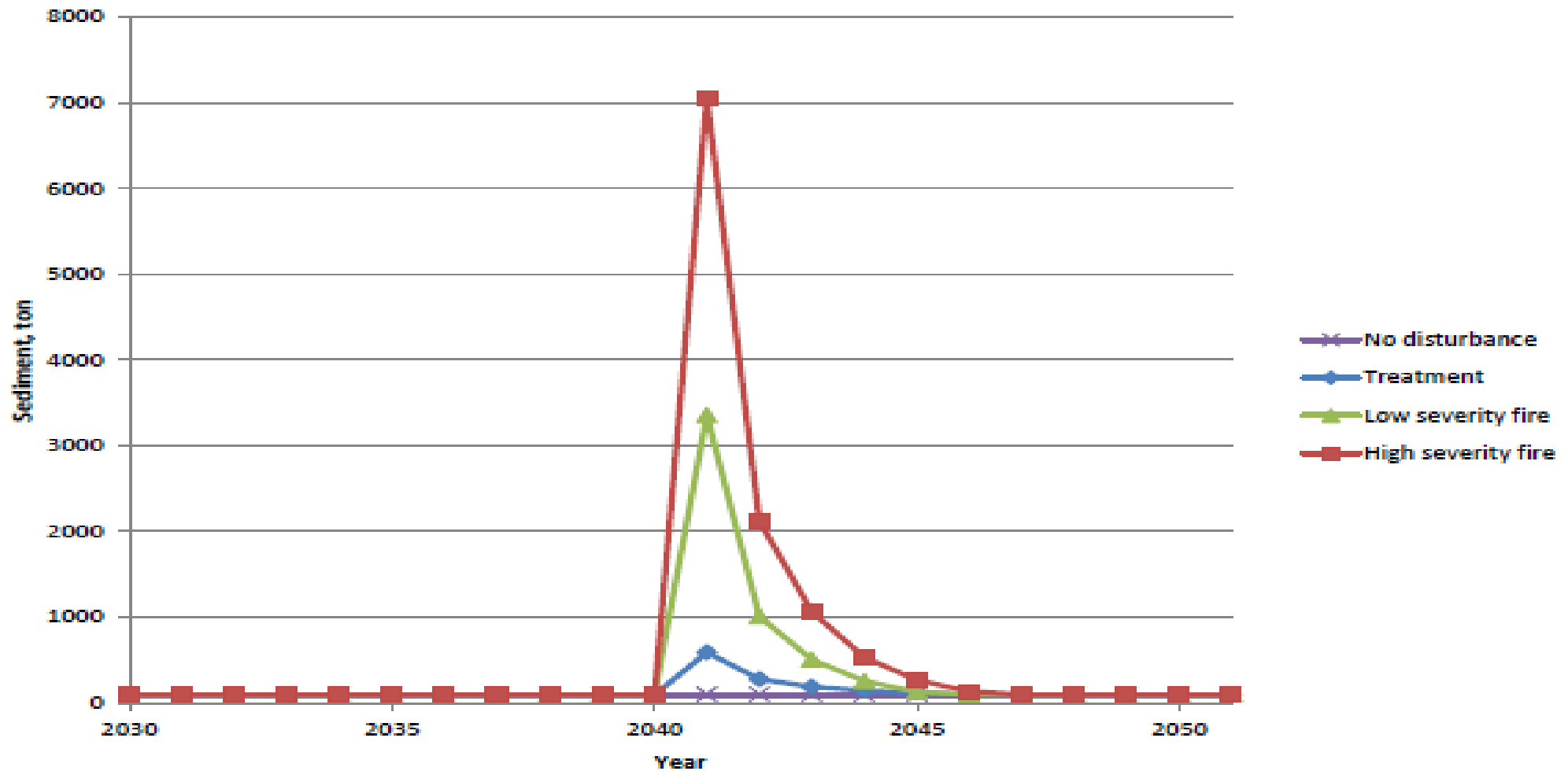


Contingent upon several factors, including:

- – Fire extent
- – Fire severity
- – Fire location
- – Pre-fire treatments
- – Post-fire weather events
- – Post-fire mitigations



Sediment delivery



Data and chart courtesy of Svetlana Kuhsch; data are for the entire Drink Planning Area, not just the Bridge Creek Watershed.

Mitigating Fire Risks



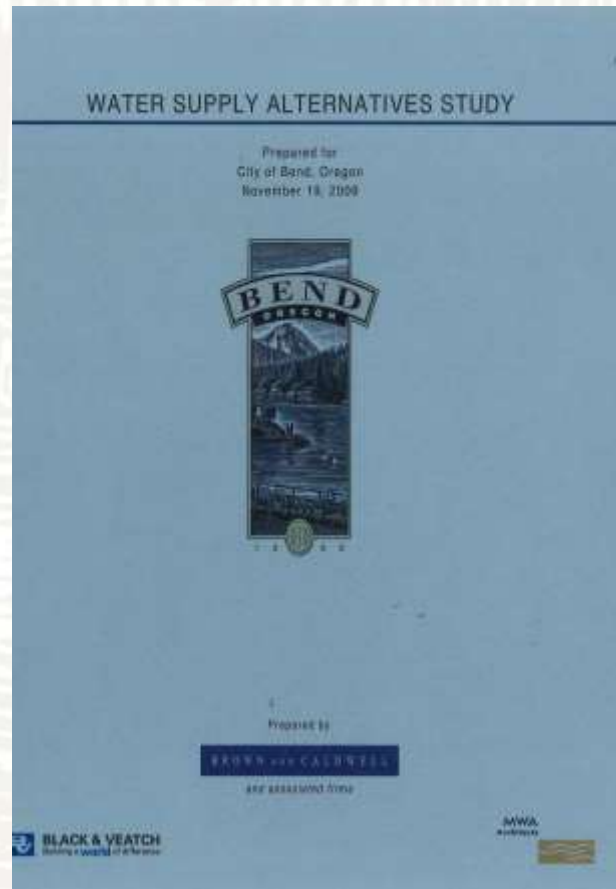
Potential mechanisms:

- Tree thinning
- Reduction of undergrowth
- Prescribed burning
- Riparian buffers

Proposed projects:

- Fuel breaks
- Drink
- Prescribed fire in wilderness

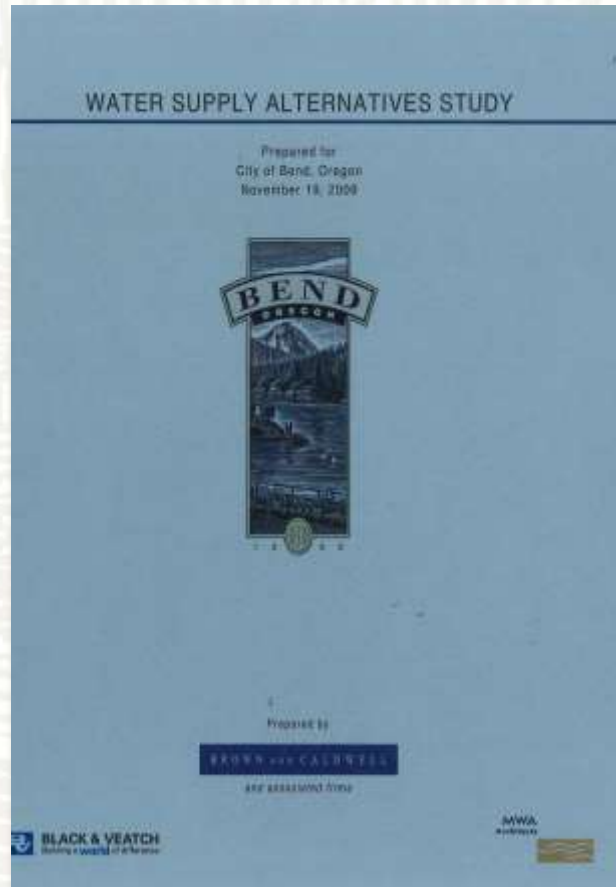
Assessment – Water Supply Alternatives Study



Finding:

The risk to the water quality of the Bridge Creek supply from fire in the Bridge Creek watershed is significant and poses both short and long term risk to the usefulness of that water source, if the system remains unfiltered.

Findings of the Study



- Recommended reinvestment in Bridge Creek rather than another source
- They found that Membrane filtration was the best option for dealing with the combination of factors (i.e. ash from fire, erosion from fire, very cold water)

Council Decision



11/17/2010

Council Resolution No. 2817



Findings:

I. The Council finds the following key benefits associated with membrane filtration:

- Provides a more reliable surface water supply that reduces water quality health risks, accommodates long-term regulatory compliance needs and supports economic development;
- Reduces time when surface water system needs to be shut down due to turbidity;
- Ensures that surface water source can be used after a fire in the watershed; and
- Provides opportunity to use the City portion of the \$10 million Collaborative Forest Landscape Restoration Grant, which will implement a more robust forest management program to reduce fire risk in the watershed.

Council Decision

11/17/2010

Council Resolution No. 2817



- Section 1. City staff shall proceed with the planning and design for a membrane filtration system as part of a new water treatment plant at the Outback Water Distribution site.
- Section 2. The structural elements that are needed for post and pre treatment shall be built with the initial construction, omitting the installation of the mechanical systems associated with pre and post treatments. However, the mechanical systems associated with pre and post treatment should be considered for inclusion in the initial construction if project costs savings are realized. If the mechanical systems associated with pre and post treatment are not installed during the initial construction, the City shall maintain adequate reserves in the Water Fund to allow the prompt purchase of the mechanical systems in the event of an emergency, and establish a reasonable timeline for the installation of the mechanical systems in the Water Capital Improvement Program, rather than waiting for a fire to occur.
- Section 3. This resolution commits the City to proceeding with membrane filtration treatment system, but does not commit the City to include hydropower as part of the project. Decisions on the hydropower option, and how to fund that option if it is pursued, will be made at a later date when more information is brought back to the City Council.
- Section 4. This resolution shall take effect immediately upon passage.

Council Decision



February 20, 2013

Scope of Water Treatment - Discussion

Section 6

“As part of its commitment to being responsive to community questions about the project, the City Council is willing to take an additional third party, independent look at the treatment methods, timing and hydro aspects of the project, with a neutral and knowledgeable third party facilitating the discussion.

The Water Treatment Advisory Committee



Charge

- Evaluate and select (maybe rate) treatment options of the surface water considering LT2 and other water quality aspects, as well as balance the cost with benefit and risk
- Advise the City Council
- Choose a treatment option that treats (regulatory requirements) the full water rights for the long term
- Strive for consensus (able to support the decision outside the committee)
- If consensus is not reached, will allow for minority report
- Provide information to the Public
- No hydro



The Water Treatment Advisory Committee

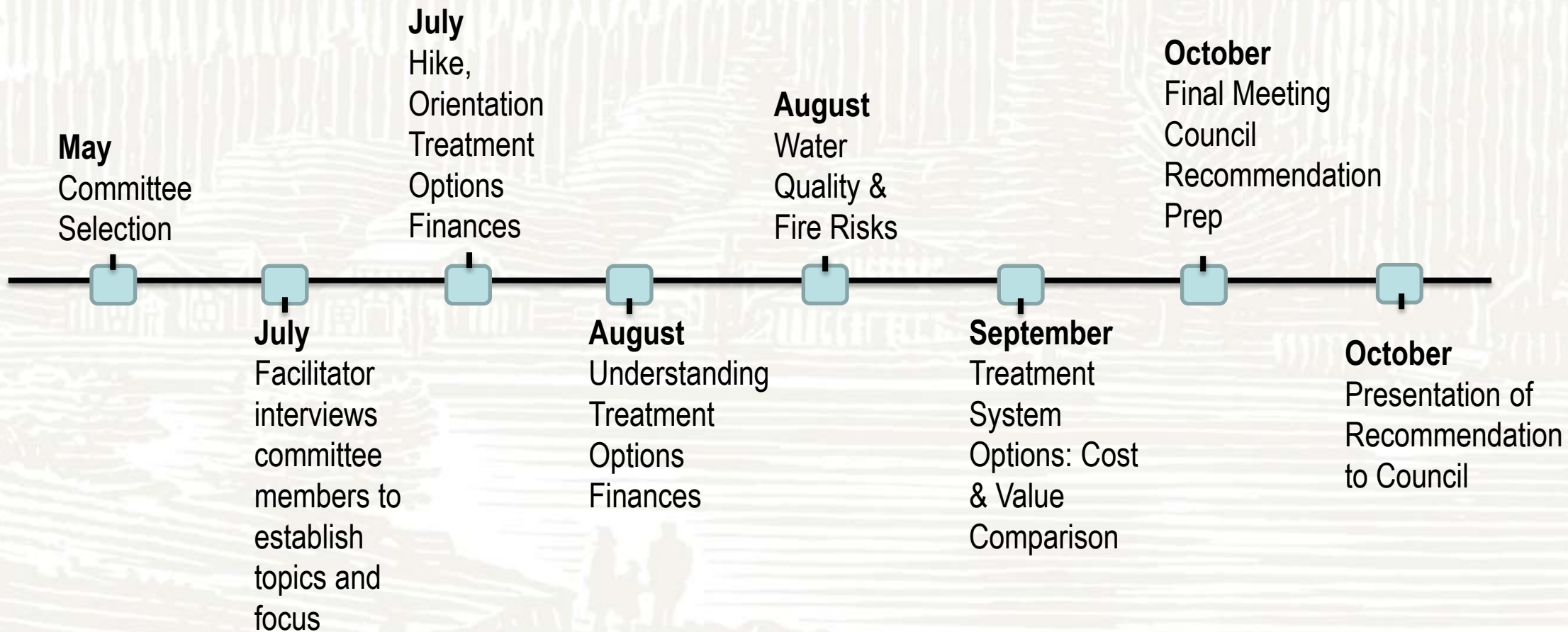


An eleven-member citizen committee, appointed by Bend City Council to generate information on additional treatment options to comply with the Long Term 2 Enhanced Surface Water Treatment Rule (LT2) for Council review and assessment.

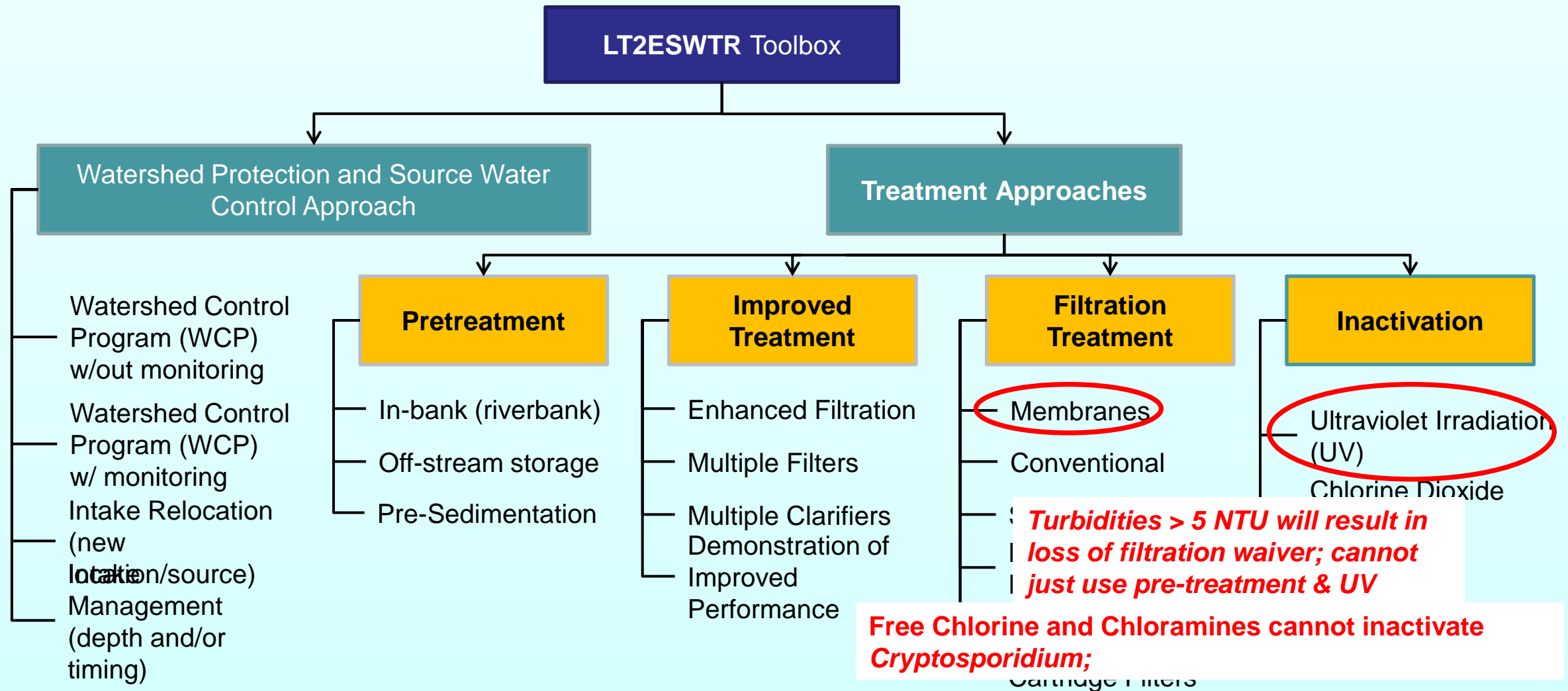


- Retired Irrigation District Mgr.
- Local Chemical Business Exec.
- Senior Economist
- Bend Chamber Representative
- Attorney
- Engineer
- Management Consultant
- Private Utilities Mgr.
- Private Water System Owner
- Paralegal
- District Ranger USFS (Ex-Officio)

The Water Treatment Advisory Committee



LT2ESWTR Microbial Toolbox Technologies, Programs, and Studies:



Membrane Filtration Overview



- Special engineered hollow-fiber membranes to exclude suspended particles greater than specified pore size; micro (0.1 – 10 micron), ultra (0.001-0.1 micron)
- Pressurized (40 psi +/-) or submerged (10 psi vacuum +/-)
- Does not require continuous coagulation depending on water quality
- Depending on Water Quality, may require pre-treatment (clarification prior to filtration)



Conventional Filtration Overview



- Granular media filters ; requires continuous coagulation
- Pressure filters or gravity filters; depends on capacity
- Depending on Water Quality, may require pre-treatment (clarification prior to filtration)



Membrane Filtration Advantages



- Compared to granular media filtration, selection of membrane filtration results in:
- Little to no coagulant addition (low turbidity source water)
- Potential to operate automatically
 - Less operator attention needed; i.e.
 - Lower labor costs
- Lower volumes of solids/backwash waste
- Smaller footprint required for process

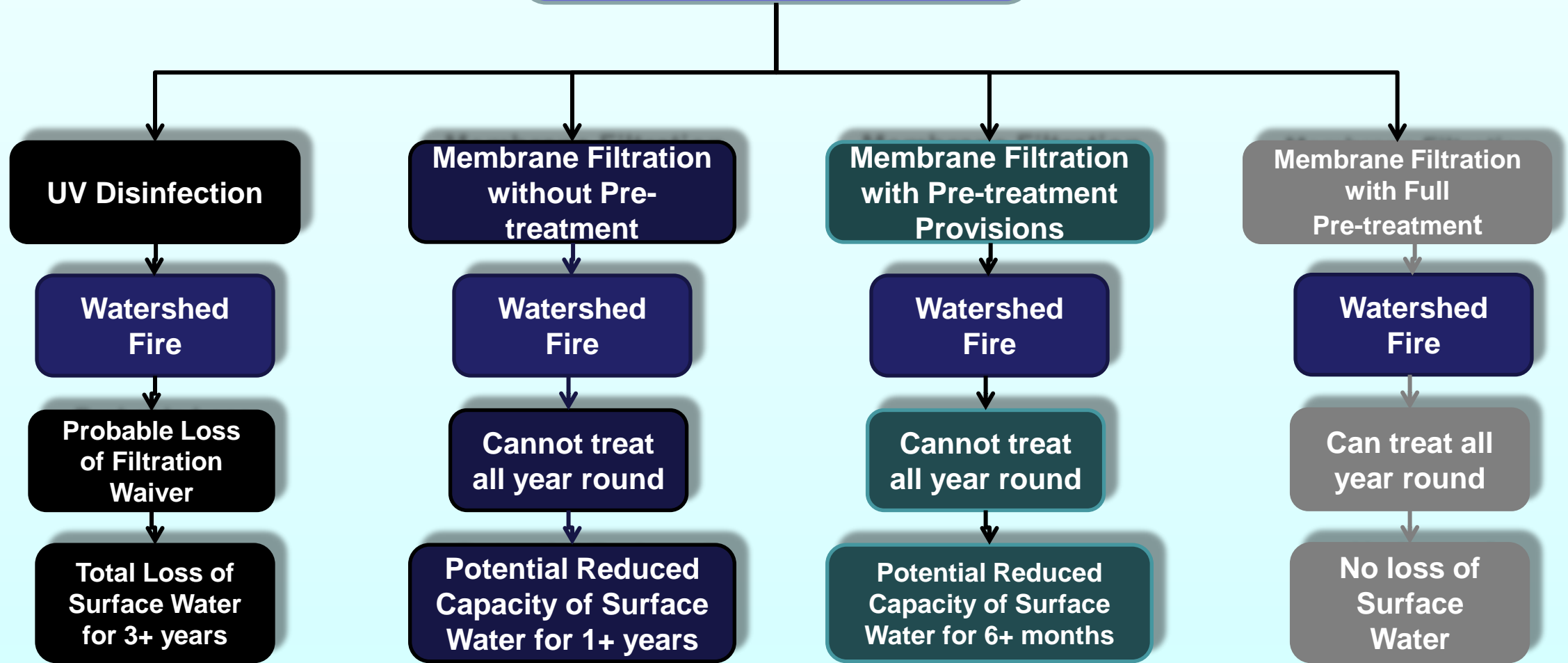
UV Disinfection Overview



- Only allowed for LT2 if filtration waiver exists (< 5 NTU)
- Pretreatment before UV will not be acceptable if filtration waiver lost
- Requires UV Transmittance of $>90\%$
- Need relationship between turbidity and UV Transmittance.
- Low-Pressure High Output
 - Bigger footprint
 - Lower O&M
 - Lower Capital Cost
- Medium Pressure
 - Fewer lamps



Schedule Impacts of Water Treatment Alternatives Following a Watershed Fire



Membranes are designed w/ 15% cross-flow, which will allow them to operate at higher turbidities; but not likely at maximum capacity

Water Treatment Advisory Committee



Recommendation :

The committee's deliberations focused on these two major aspects:

1. Design SWT* to maximize surface water asset vs. design SWT to minimize cost and meet LT2.
2. Design SWT to mitigate risk of wildfire vs. rely on ground water to eliminate risk of wildfire.

* SWT – Surface Water Treatment

Water Treatment Advisory Committee Recommendation

Statement	Level of Support
We value the dual source of surface water (SW) and ground water (GW).	10 of 10
We must treat surface water to meet LT2 requirements.	10 of 10
Membrane filtration (MF) can handle more variability in source water quality than can ultraviolet (UV) treatment.	10 of 10
Capital and O&M costs for UV treatment are less than MF.	10 of 10
If the risk of fire was zero, I would choose UV.	10 of 10
MF will allow SW to be used with high turbidity (historically the surface water has been turned off an average 54 days per year - 2008 to 2012 - due to turbidity above 1.49 NTU).	10 of 10
MF does not require a filter waiver for LT1 like UV does (eliminates the risk of losing the waiver).	10 of 10
In the event of a fire, MF will probably be operational sooner than UV treatment.	10 of 10
UV treatment will be suspended after a major fire until source water quality improves.	10 of 10
MF could be suspended after a major fire.	10 of 10
The extent of potential wildfire impacts to the watershed and water source is uncertain.	10 of 10

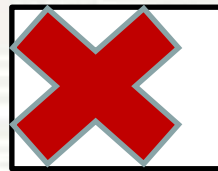
Water Treatment Advisory Committee Recommendation

Traits	Membrane Filtration		UV Treatment	
	Base	With Pretreatment	UV	UV + Wells
	High Cost, Will operate at turbidities greater than 5 NTU	Reduces Fire Risk	Low Cost, Will operate only at turbidities less than 5 NTU	Eliminates Fire Risk
Capital Cost Treatment	\$30.5M	\$35.6M	\$12.0M	\$12.0M
Capital Cost GW Expansion				\$16.2M
Total Capital Cost	\$30.5M	\$35.6M	\$12.0M	\$28.2 M
20 year Present Worth Cost Comparison	\$38.0M	\$43.0 M	\$14.1M	\$33.8M
Common Design Spent	\$0.5M	\$0.5M	\$0.5M	\$0.5M
Sunk Design Costs	\$4.5M	\$4.5M	0	0
Committee Members Selecting	5 ¹		5 ²	

1. All committee members choosing MF supported designing the system so that pre and post treatment could be added in the event of a catastrophic fire
2. All committee members choosing UV supported investing in additional ground water wells to provide a reliable source of water in the event that surface water is unusable. In one case, if aggressive expansion of ground water isn't feasible or is more expensive than the table displays, he would choose MF.



City Council proceeds with the Membrane Filtration Treatment



Yes

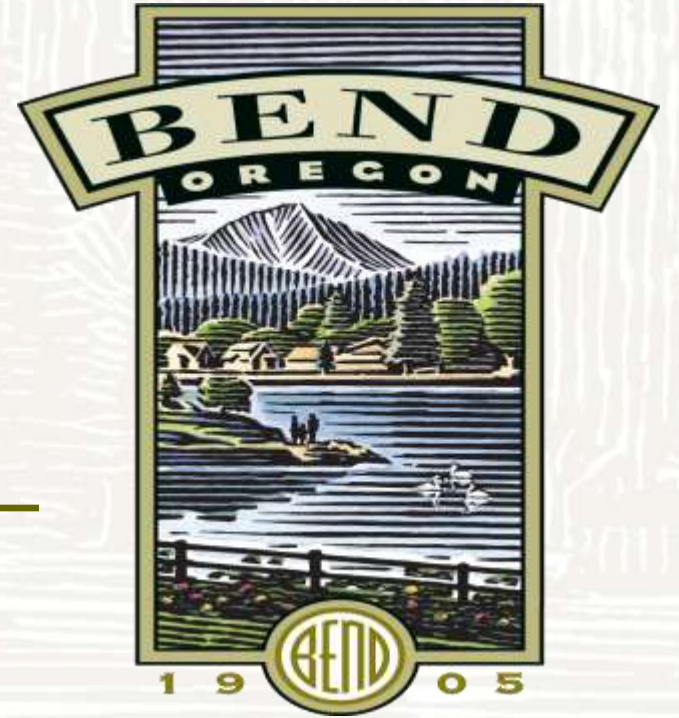


No



Water Treatment Plant

Fall 2015





Membrane Treatment Plant

04.03.2015



Membrane Treatment Plant

04.03.2015

Membrane Treatment Plant



04 03 2015

Membrane Treatment Plant





QUESTIONS