



# Portland City Council Work Session

## *Bull Run Treatment*

Portland Water Bureau  
June 23, 2009



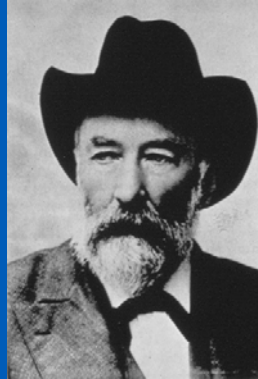
## Goal—Obtain Direction on Treatment Decision

- The treatment decision has been studied for the last 20 years.
- Bureau has multi-track LT2 response.
- The best value for the Bull Run system is direct filtration at Lusted Hill.
- Recommendation respects public values.
- EPA deadline is April 1, 2014.

# Introduction to the Bull Run Water Supply

## Isaac Smith's Legacy

- Isaac Smith and others designed an elegant system.
- Portland has provided water at an excellent value for more than 100 years.



## Bull Run Watershed

- Portland's primary water source
- Fed by gravity to the distribution system



## Bull Run Water

- High-quality unfiltered supply with minimal treatment
- Long history of watershed protection
- Watershed protection is the first barrier in a multiple-barrier approach to public health protection.

# Existing Treatment Systems

- Watershed protection
- Chloramination
- Corrosion control



## Why Additional Treatment for Bull Run Drinking Water?

- Regulatory Compliance
  - EPA – Long Term 2 Enhanced Surface Water Treatment Rule (LT2)
  - Regulates *Cryptosporidium* and *Giardia*
- Multiple benefits with some technologies



# History

## History of the LT2 Rule

- 1974 Congress passes Safe Drinking Water Act
- 1993 Milwaukee *Cryptosporidiosis* outbreak
- 1996 Safe Drinking Water Act updated—  
directed EPA to develop a rule to regulate  
*Cryptosporidium* and disinfection byproducts



## History of the LT2 Rule

- 2003 Draft Long Term 2 Enhanced Surface Water Treatment Rule (LT2) proposed.
- 2006 Final LT2 rule affecting both open finished water reservoirs and source water treatment published.

Today's discussion is only about source water treatment.

## History of Portland's Response

- Participation in 1999 Federal Advisory Committee
- 2001-2002 Bull Run Treatment Citizen Panel
- 2005 Portland City Council Resolution No. 36297 to "pursue regulatory or legislative alternatives to the pending rule"
- 2007 Court challenge to final LT2 rule
- 2008 Court challenge rejected
- 2009 Multi-track response

## History of Public Process

- 2001 Focus groups—42 customers (randomly selected)
- 2001 Public hearings—40 community members
- 2001 Telephone surveys—30 key stakeholders (community leaders and others active in community affairs)
- 2001–2002 Citizen Panel—14 voting members; citizens and representatives of business, public health, environmental, and water wholesale groups

# History of Public Process

- Monthly Citizen Panel meetings, 15 total
  - Technical presentations on treatment options
  - Community values identified
  - Recommendations for treatment options based on values
- Citizen Panel values incorporate input from focus groups and telephone surveys



## History of *Cryptosporidium* Sampling, 1986–2009

- Over 30,000 liters (nearly 8,000 gallons) in approximately 360 samples of varying volumes
- 46 samples detected at least one *Cryptosporidium* oocyst
- 100 *Cryptosporidium* oocysts have been detected
- No *Cryptosporidium* found in samples, 2003–2009

## Multi-Track Response to LT2 Treatment

- Pursue variance to rule with alternative compliance method
- Legislative alternative
- Traditional compliance (treatment)



## Deadline for Compliance

**April 1, 2014** (includes 2-year extension “for systems making capital improvements”)

# Treatment Technologies

## Evaluation of Treatment Options

Citizen Panel evaluated five treatment options that achieve inactivation or removal of *Cryptosporidium* as required by LT2.

### ▪Disinfection—inactivation

- Chlorine dioxide
- Ozone
- UV disinfection

### ▪Filtration—removal

- Direct filtration
- Membrane filtration

## Chlorine Dioxide

Chlorine dioxide, injected as a liquid into raw water, oxidizes *Cryptosporidium* and *Giardia* micro-organisms and penetrates their protective barriers.

Citizen Panel ruled out chlorine dioxide as treatment option due to concerns about regulated byproducts.

## Ozone

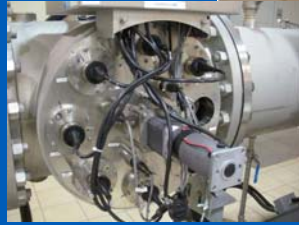
Ozone gas, injected into raw water, oxidizes *Cryptosporidium* and *Giardia* microorganisms and penetrates their protective barriers.

Citizen Panel ruled out ozone because it was not the least-cost disinfection option.

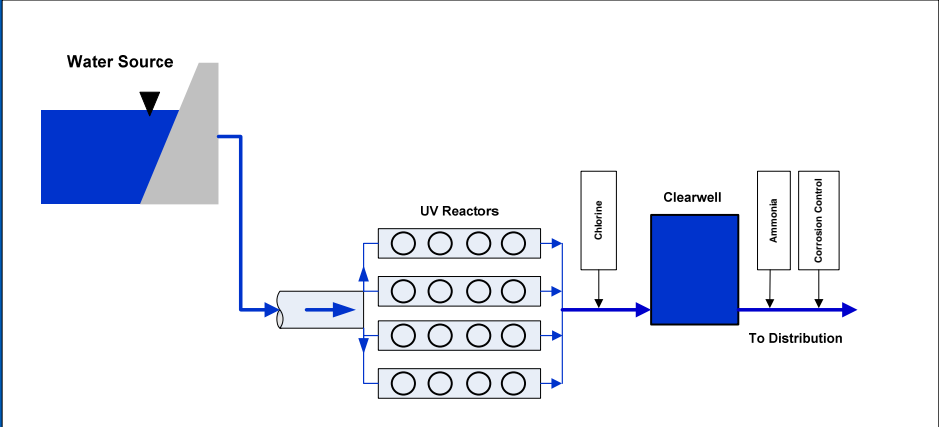
## Ultraviolet (UV) Light

UV light rays inactivate *Cryptosporidium* and *Giardia* and prevent microorganisms from replicating and causing illness.

# UV Disinfection



# UV Disinfection





# UV Disinfection



Victoria, British Columbia, Canada – 150 mgd UV treatment system

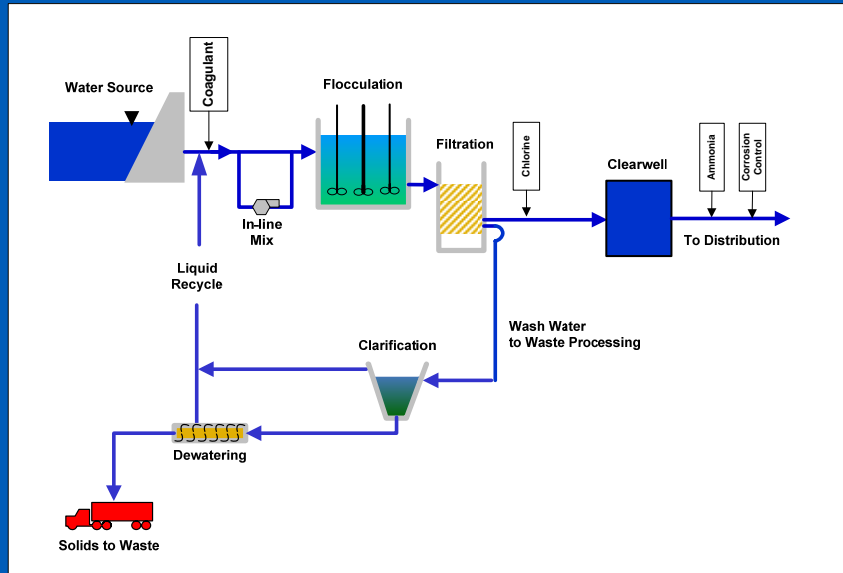
## Direct Filtration

Raw water mixes with a coagulant then settles through a bed of sand or charcoal. The filter bed removes the coagulant, *Cryptosporidium*, *Giardia*, turbidity, and some organic material.

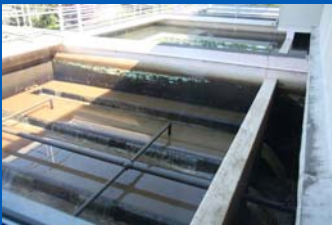


Seymour Capilano,  
Vancouver, British  
Columbia, Canada,  
470 mgd direct filtration

# Direct Filtration



# Direct Filtration



Clackamas River Water, Clackamas, Oregon; 30 mgd, direct filtration



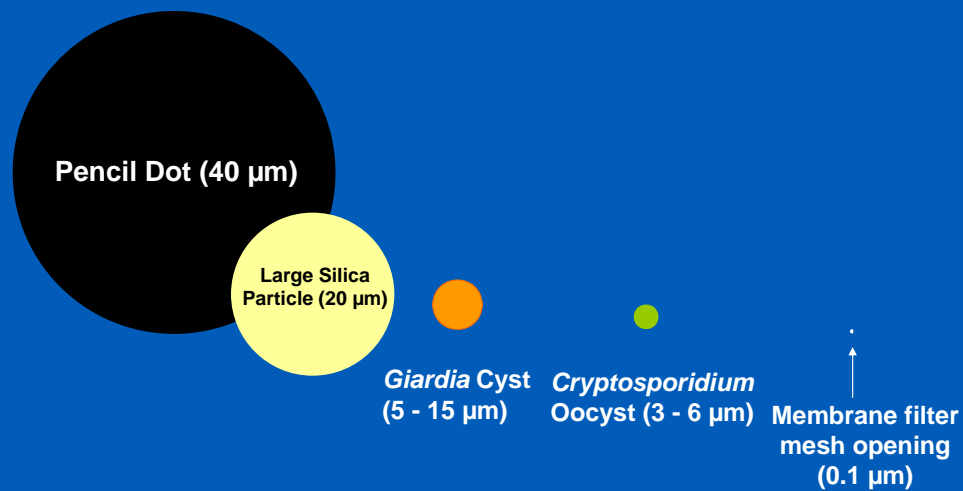
Seymour Capilano, Vancouver, British Columbia, Canada, 470 mgd direct filtration

# Membrane Filtration

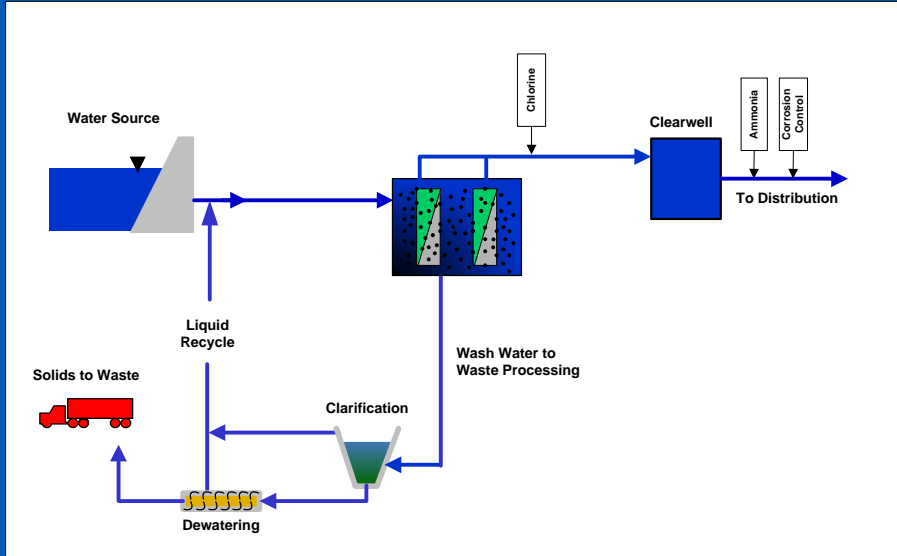
Raw water is forced through a fine membrane to remove very small particles.



# Particle Sizes Relative to Membrane Mesh Opening

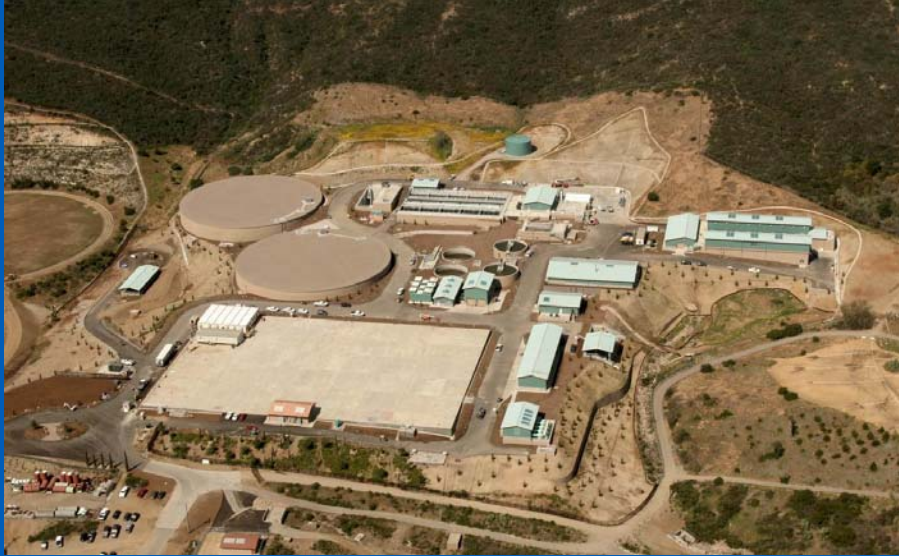


# Membrane Filtration





# Membrane Filtration



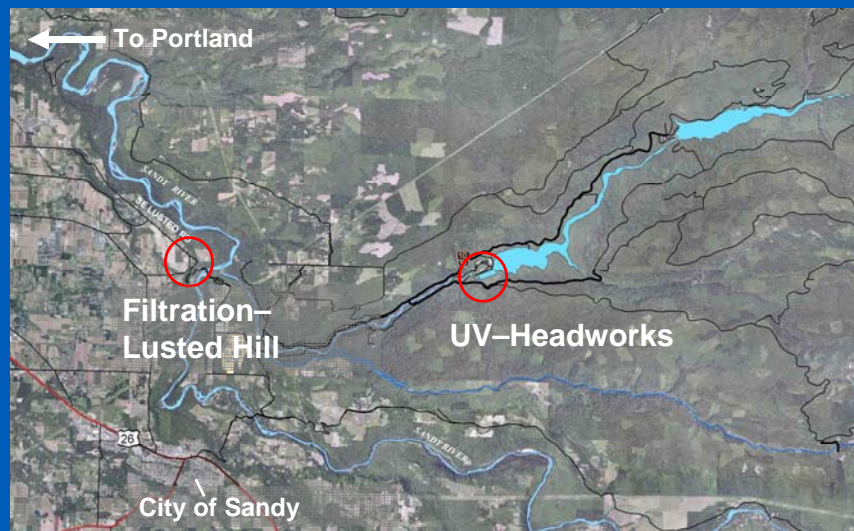
Twin Oaks WTP, San Diego, California, 100 mgd Membrane Filtration

## Treatment Methods Used by Large Water Utilities

- About 76 surface water suppliers in the U.S. provide more than 100 million gallons per day (mgd).
- Of the 76...
  - 70 use filtration
  - Only 1 of the 70 uses membrane filtration
  - 6 are unfiltered

# Location

## Where Would Treatment be Located?



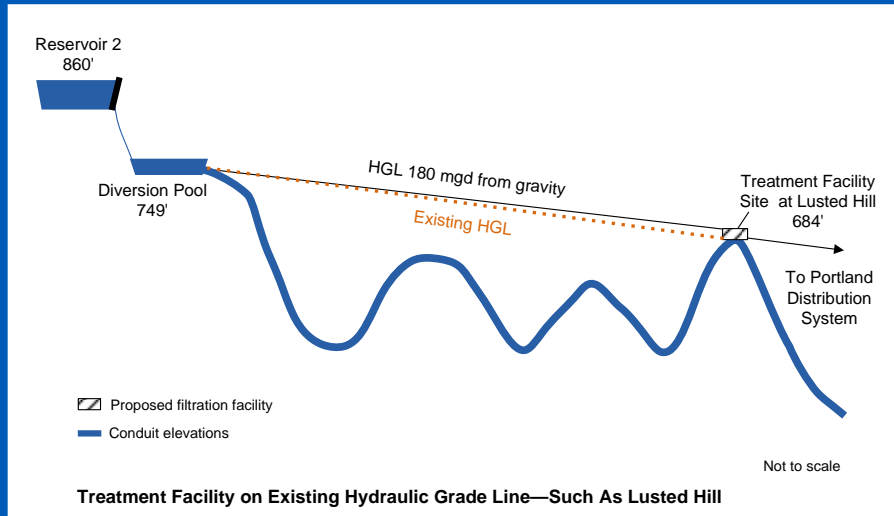
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## Importance of Location

- Hydraulic grade line (HGL)—the line that water follows from a higher to a lower elevation, also called gravity flow.
- Positioning facility on the HGL
  - Takes advantage of gravity flow
  - Minimizes cost of pumping
  - Continues the legacy of wise planning

# HGL Location Avoids Pumping



# Citizen Panel Recommendations

## Evaluation of Treatment Options

- Citizen Panel weighed treatment options against community values:
  - Water is **safe** to drink
  - Source is **reliable**
  - Water is consistent in **quality**
  - Option provides **good value**
  - Treatment supports **environmental protection** and **sustainability** goals



# Filtration Benefits Linked to Values

The Citizen Panel determined that the long-term benefits of filtration outweighed the initial capital costs.

## Filtration Benefits Linked to Values

- Provide more robust barrier to pathogens
- Improve water quality by reducing disinfection byproducts
- Enable Bull Run water to be delivered more reliably during times of high turbidity

## Filtration Benefits Linked to Values

- Increase the total water available from the Bull Run
- Keep watershed sediment out of the distribution system
- Reduce our reliance on groundwater

## Citizen Panel Recommendations

1. Consider **membrane filtration** if vendors address issues related to membrane supply and performance under conditions similar to Portland's.
2. Consider **direct filtration** if membrane filtration issues cannot be resolved.
3. Consider **UV treatment** if capital cost is the only criterion.

## Membrane Option — Remaining Issues

- Highest capital and O&M costs
- Portland facility would be 2x larger than largest plant in world
- Highest energy use
- Sole-source procurement for replacement membranes would make us vulnerable

## Technologies Under Consideration

- Eliminated
  - Chlorine Dioxide
  - Ozone
  - Membrane Filtration
  
- Considering
  - UV
  - Direct Filtration

## Analysis Since Citizen Panel

- Conducted more thorough evaluation of benefits
- Updated costs
- Identified impacts to ratepayers
- Set milestones for project schedule

# Evaluation of Benefits



## Evaluation of Benefits

- Staff evaluated 9 risk scenarios.
- UV and direct filtration provide different mitigation benefits for the risks.



## Risk Mitigation Benefits

- The greatest benefit is *Cryptosporidium* control.
- The next greatest benefit is addressing turbidity.



## Risk Example

- Turbidity events cause more frequent, large-volume uses of groundwater
- Groundwater use during turbidity events
  - 8 times since 1985
  - Average run 14 days

## Risk Example

- Summer dry seasons often require use of groundwater as supplemental supply
- Groundwater use as supplemental supply
  - 13 times since 1985
  - Average run 44 days

## Risk Example

- Filtration would reduce dependence on groundwater
  - Remove turbidity
  - Provide additional supply from Bull Run
- UV would not remove turbidity and would not reduce dependence on groundwater
- Annual savings from reducing our reliance on the groundwater system is about \$400,000.

# Global Climate Change

- Heavier, more intense, more frequent rains in winter and spring
- Longer, drier summers



# Mitigating Risks

- Plan for the unexpected
- Meet the needs of future generations



# Benefits of Treatment Options

Benefit Scenario	Treatment Option Mitigates Risk	
	Yes = ✓	No = blank
	UV	Direct Filtration
Meet LT2 rule	✓	✓
Provide Bull Run water, rather than groundwater, during turbidity events caused by fire, storms or other events		✓
Continue to provide water during a turbidity event when groundwater becomes unavailable due to power outage, flooding, or earthquake		✓
During a summer drought, provide more Bull Run water than we are able to use with the current system		✓
Ensure more consistent water supply than current system provides for industrial customers and sensitive water users		✓
Create a barrier to pathogens		✓
Remove organic materials that lead to disinfection byproducts		✓
Reduce sediment levels and color in the distribution system (a major source of customer complaints)		✓
Provide a more rigorous treatment system than we currently have to meet future regulations		✓



# Costs

## Treatment Options — Capital and Annual Operating Costs

### Estimated Costs in Millions of Dollars

	Ultraviolet (UV)	Direct Filtration
<b>Capital Costs</b>	<b>\$100</b>	<b>\$385</b>
<b>Net Annual Costs* (increase over current costs)</b>	<b>\$2.5</b>	<b>\$3.6</b>

\*Includes avoided groundwater pumping annual costs, averaged across all years.

## Projected Monthly Bill Impacts on Single-Family Residential Customers by Treatment Option\*

Filtration Facility Project	Fiscal Year				
	09-10	10-11	11-12	12-13	13-14
<b>Total Projected Increase Each Month</b>	2.76	3.44	4.10	4.90	5.80
<b>Projected Monthly Bill</b>	<b>\$18.16</b>	<b>\$21.60</b>	<b>\$25.70</b>	<b>\$30.60</b>	<b>\$36.40</b>

UV Facility Project					
UV Facility Project	Fiscal Year				
	09-10	10-11	11-12	12-13	13-14
<b>Total Projected Increase Each Month</b>	2.76	2.34	2.50	2.90	3.30
<b>Projected Monthly Bill</b>	<b>\$18.16</b>	<b>\$20.50</b>	<b>\$23.00</b>	<b>\$25.90</b>	<b>\$29.20</b>

\*Based on fiscal year 2009-2010 rate projections and typical single-family residential customer using 6 ccf (hundred cubic feet) of water per month.

## Projected Monthly Bill Impacts on Medium-Sized Commercial Customers by Treatment Option\*

Filtration Facility Project	Fiscal Year				
	09-10	10-11	11-12	12-13	13-14
Total Projected Increase Each Month	75.61	94.44	112.65	132.65	159.20
Projected Monthly Bill	\$498.56	\$593.00	\$705.65	\$838.30	\$997.50

UV Facility Project					
Total Projected Increase Each Month	75.61	63.44	69.70	77.70	90.10
Projected Monthly Bill	\$498.56	\$562.00	\$631.70	\$709.40	\$799.50

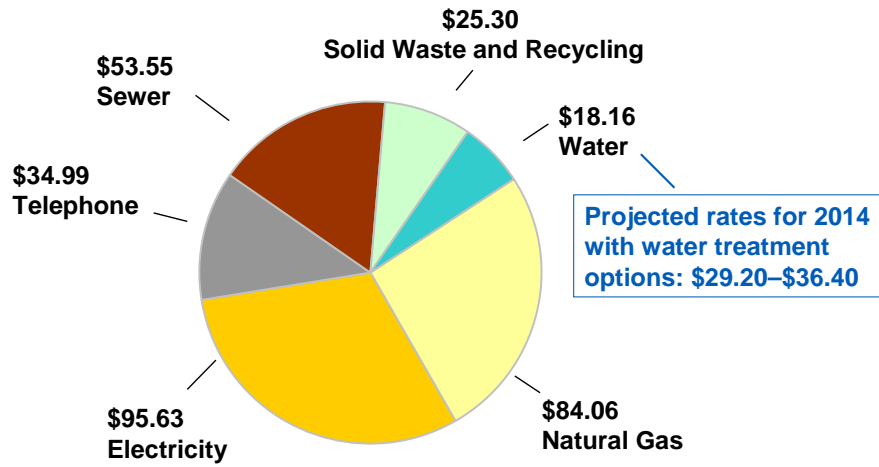
\*Based on fiscal year 2009-2010 rate projections and typical medium-sized commercial customer using 200 ccf per month.

### Current Projected Rate Increases with Treatment Facility Projects\*

	Percentage Increase per Fiscal Year				
	09-10	10-11	11-12	12-13	13-14
<b>Filtration Facility Project</b>	2.4	8.0	8.4	8.6	8.2
<b>Current Service Level</b>	15.5	10.9	10.6	10.2	10.8
<b>Total Projected Rate Increase</b>	17.9%	18.9%	19.0%	18.8%	19.0%
<b>UV Facility Project</b>	2.4	1.8	1.8	2.1	1.9
<b>Current Service Level</b>	15.5	10.9	10.6	10.2	10.8
<b>Total Projected Rate Increase</b>	17.9%	12.7%	12.4%	12.3%	12.7%

\*Based on fiscal year 2009-2010 projected rates.

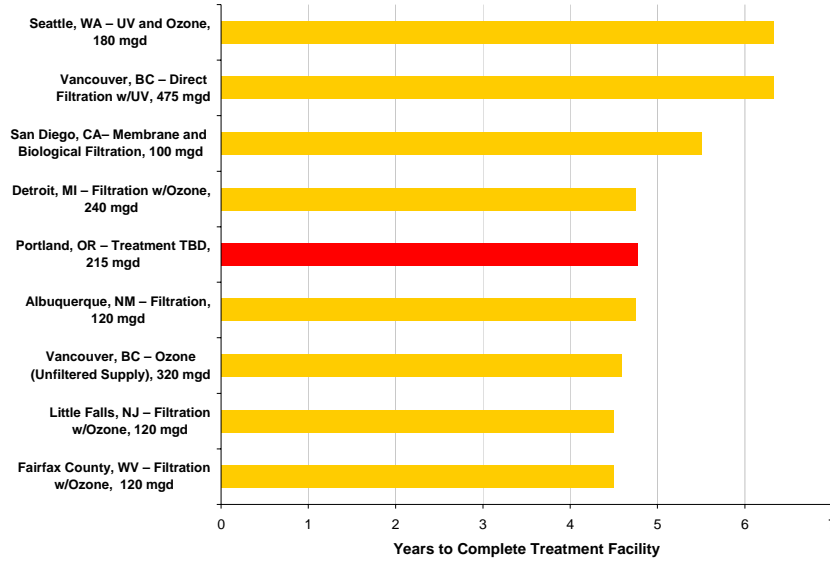
# The Lowest Utility Bill in Portland



Based on 2009 rates.

# Schedule

# Average Time to Complete Treatment Facility



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## Project Schedule

- 4 years, 283 days until the extended EPA compliance deadline
- Only possible to complete if we start in July 2009
- Budget approved for the first year

# Water Bureau Summary and Recommendation

## Project Recommendation

- City Council approval to design a direct filtration facility near Lusted Hill
- Council resolution within the next 30 days
- Design facility in parallel to pursuing variance and legislative approaches

## Building on Smith's Legacy — Filtration

- Consistent with community values
- Provide safe, reliable, consistent water
- Water will be a good value for future generations of Portlanders



# Providing for the Future

- The Water Bureau has always had the foresight to plan for the future—gravity flow, watershed protection, building penstocks for future hydroelectric power generation.

