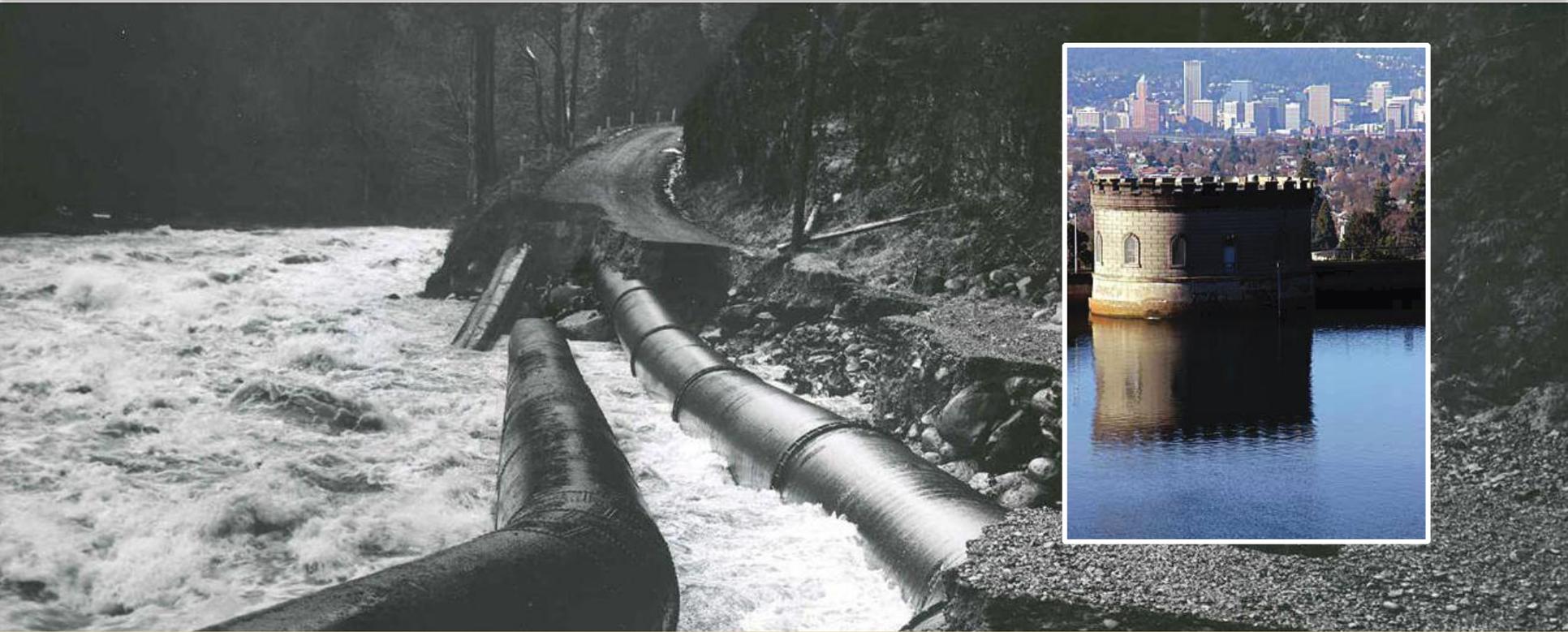


City of Portland Water Bureau

Water System Resilience



Water Finance Forum
March 31, 2016



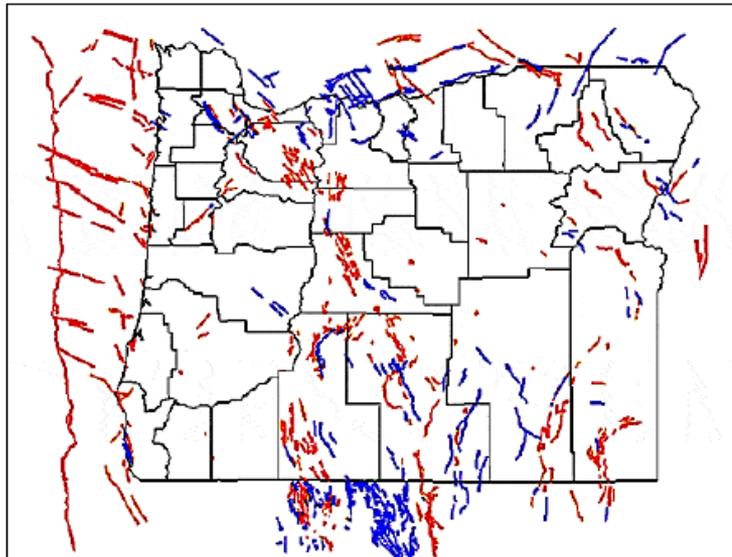


Are there really
earthquakes in
Oregon?

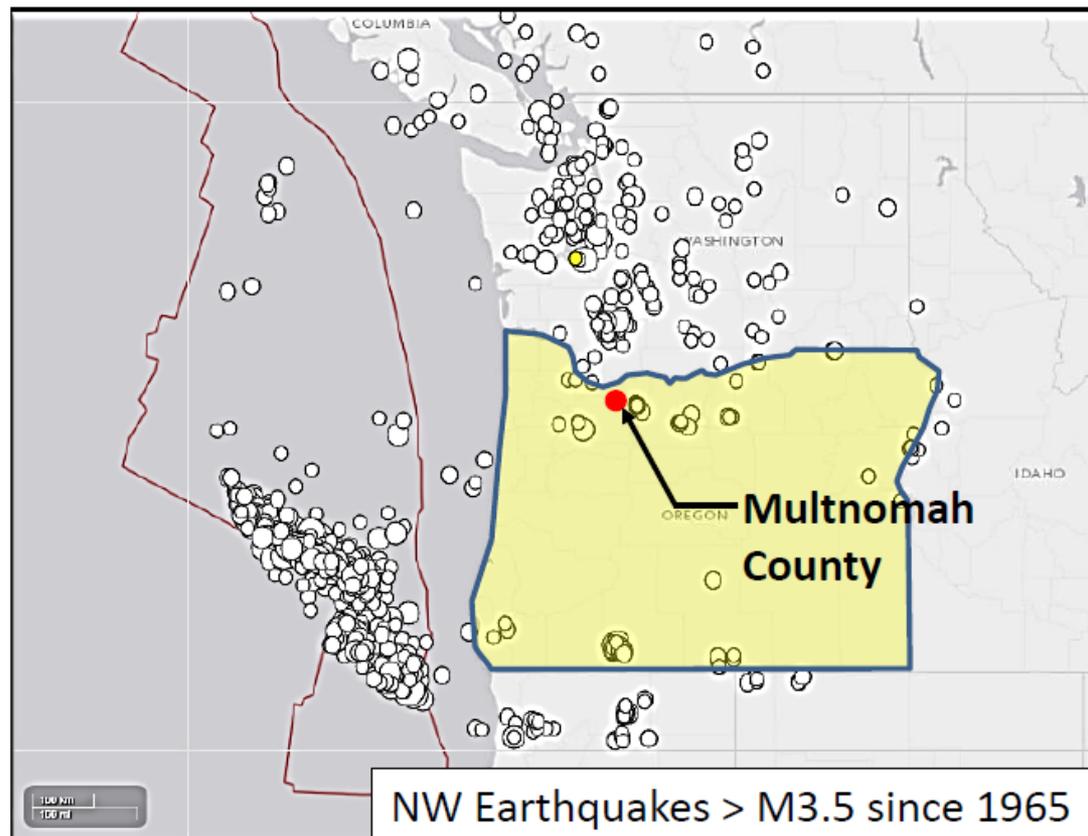
NW Earthquake Activity

Source	Magnitude	Frequency	Latest Occurrence
Crustal	M < 5.5	Every 15–20 years	Annually
	M ≥ 5.5	???	1993: Scotts Mills & Klamath-Falls
CSZ*	M ≥ 8.0	Every 350–500 years	January, 1700
Intraplate	M = 4–7	Every 30–50 years	Feb., 2009 M4.1, Grants Pass, OR

Note: M9.0 = 1000 x 2014 Napa EQ



Known Oregon EQ Faults



NW Earthquakes > M3.5 since 1965

Earthquakes are not the only Vulnerability

System Vulnerability Assessment, 2000

- Identify the risk of system damages and failure relative to all likely hazards
- Risks considered included 38 natural and human caused hazards
- Reduced water supply due to drought not included
- Intended to evaluate facilities based on existing data and studies
- Provide a comprehensive risk reduction list of ranked or prioritized risks/measures

Earthquakes are not the only Vulnerability

System Vulnerability Assessment, 2000

- System has been subjected to significant hazard events in its 100-year history
- 1964 Watershed Floods
- November 1995 Headworks Landslide
- February 1996 Watershed turbidity



1964 Headworks Floods

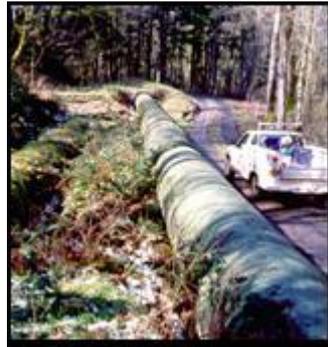
Headworks Landslide



Portland Water Bureau Statistical Information



2 Dams



100+ miles of
large pipe



2,300+ miles of
Smaller dia. pipe



66 Tanks and
Reservoirs



14,000+ hydrants



50,000+ valves



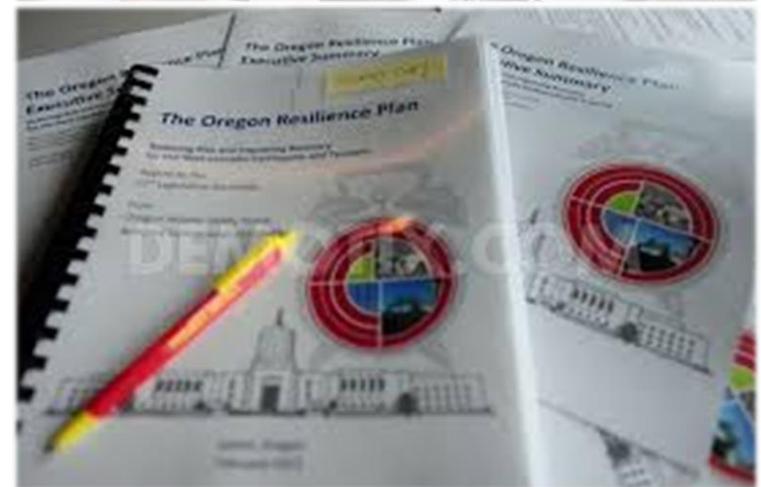
180,000 meters



41 pump stations

Oregon Resilience Plan (ORP)

- Specifies likely impacts of a magnitude 9.0 Cascadia earthquake.
- Defines target states of recovery goals to be met within 50 years.
- Recommends changes in practice and policy.
- [http://www.oregon.gov/OMD/OEM/ossac/docs/Oregon Resilience Plan Final.pdf](http://www.oregon.gov/OMD/OEM/ossac/docs/Oregon%20Resilience%20Plan_Final.pdf)



Target States of Recovery (ORP)

KEY TO THE TABLE

TARGET TIMEFRAME FOR RECOVERY:

- Desired time to restore component to 80–90% operational*
- Desired time to restore component to 50–60% operational*
- Desired time to restore component to 20–30% operational*
- Current state (90% operational)*

G
Y
R
X

TARGET STATES OF RECOVERY: WATER & WASTEWATER SECTOR (VALLEY)											
	Event occurs	0-24 hours	1-3 days	3-7 days	1-2 weeks	2 weeks-1 month	1-3 months	3-6 months	6 months-1 year	1-3 years	3+ years
Domestic Water Supply											
Potable water available at supply source (WTP, wells, impoundment)		R	Y		G			X			
Main transmission facilities, pipes, pump stations, and reservoirs (backbone) operational		G					X				
Water supply to critical facilities available		Y	G				X				
Water for fire suppression—at key supply points		G		X							
Water for fire suppression—at fire hydrants				R	Y	G		X			
Water available at community distribution centers/points			Y	G	X						
Distribution system operational			R	Y	G						

(To be continued on next page)

KEY TO THE TABLE

TARGET TIMEFRAME FOR RECOVERY:

- Desired time to restore component to 80–90% operational*
- Desired time to restore component to 50–60% operational*
- Desired time to restore component to 20–30% operational*
- Current state (90% operational)*

G
Y
R
X

	Event occurs	0-24 hours	1-3 days	3-7 days	1-2 weeks	2 weeks-1 month	1-3 months	3-6 months	6 months-1 year	1-3 years	3+ years
Wastewater Systems											
Threats to public health & safety controlled			R	Y		G			X		
Raw sewage contained & routed away from population		R		Y			G		X		
Treatment plants operational to meet regulatory requirements					R			Y	G		X
Major trunk lines and pump stations operational					R		Y	G			X
Collection system operational							R	Y	G	X	

KEY TO THE TABLE

TARGET TIMEFRAME FOR RECOVERY:

- Desired time to restore component to 80–90% operational*
- Desired time to restore component to 50–60% operational*
- Desired time to restore component to 20–30% operational*
- Current state (90% operational)*

G
Y
R
X

Water System Seismic Study

Tasks

- Task 1 – Assess liquefaction and lateral spreading
 - Produce hazard maps to assist in PWB’s emergency response
 - Produce high-resolution data of Permanent Ground Deformation (PGD) that can be utilized in determining risk (damage)
- Task 2 – Assess & Model backbone system performance
- Task 3 – Assess distribution system performance
- Task 4 – Evaluate emergency preparedness for response and recovery
- Task 5 – Develop & prioritize mitigation measures

Improvements

- Long Term Approach
 - \$600 M over the last 20 years
 - 50 year plan to reach Oregon Resilience Plan Goals
- Funding
 - Rates
 - Revenue Bonds
 - Grants

Larson Intertie



Sandy River Crossing



Sandy River Crossing



Diack's Conduit Trestles



Diack's Conduit Trestles



Powell Butte Reservoir



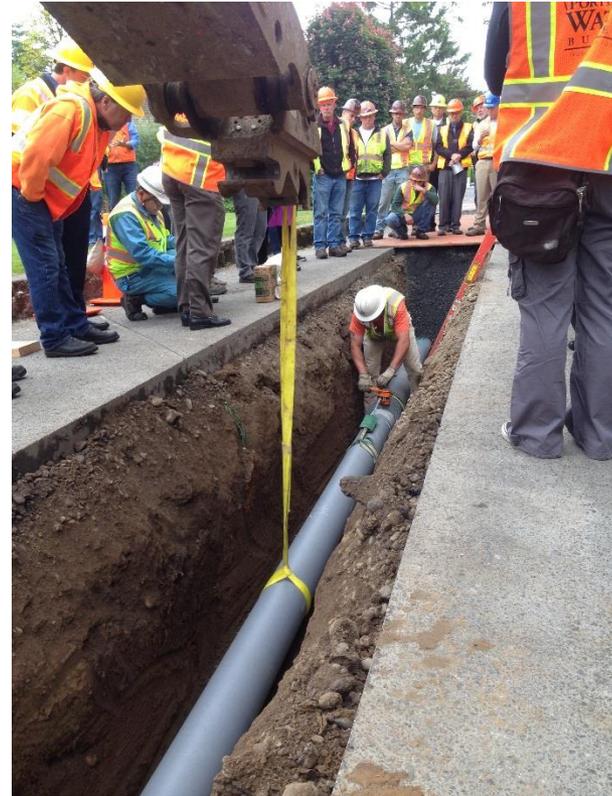
Groundwater Earthquake Reliability



Groundwater Earthquake Reliability



Earthquake Resistant Pipe

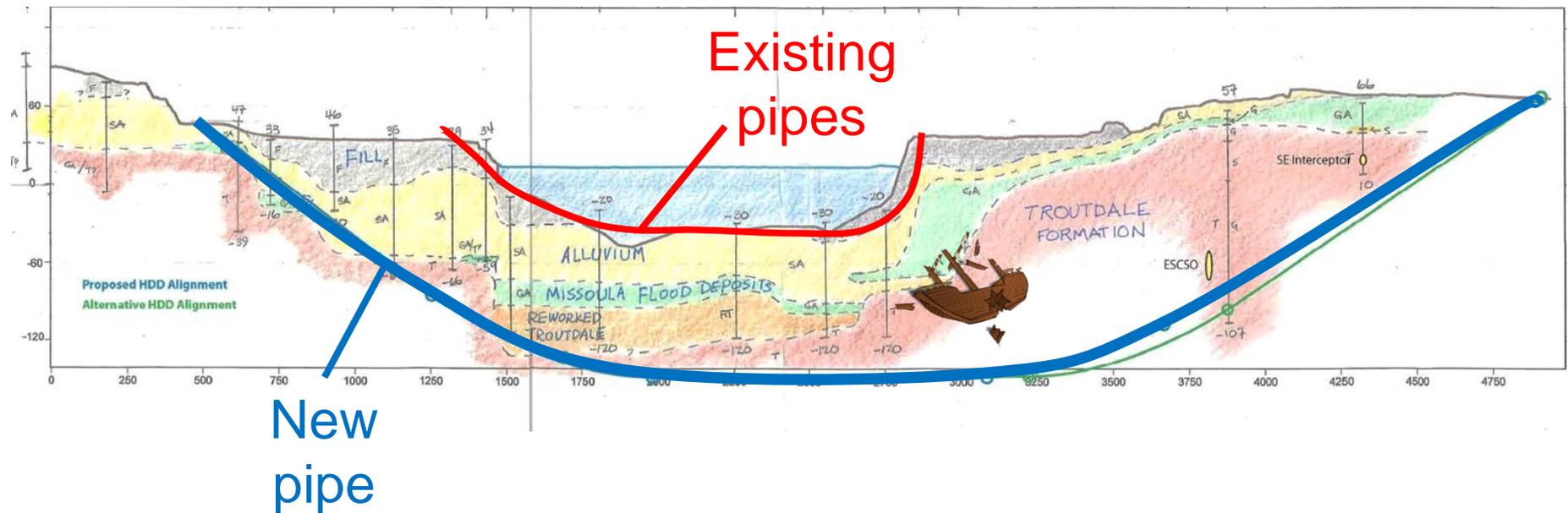


Willamette Crossing - Potential Alignment



Geologic Cross Section

- Proposed alignment beneath liquefiable soils.
- Deep enough to eliminate impact on Willamette River.



Interstate Operations Facility



Interstate Operations Facility



Emergency Coordination Center



Lessons Learned

- Take a long term approach.
- Start where you are.
- Take advantage of opportunities.

Questions ?

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