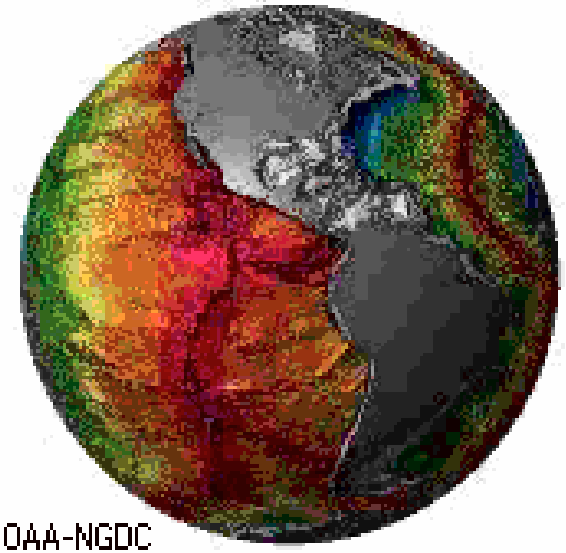
The Oregon Resilience Plan For Water & Wastewater Systems

House Committee on Veteran's Services and Emergency Preparedness

and

Senate Committee on Veterans and Emergency Preparedness



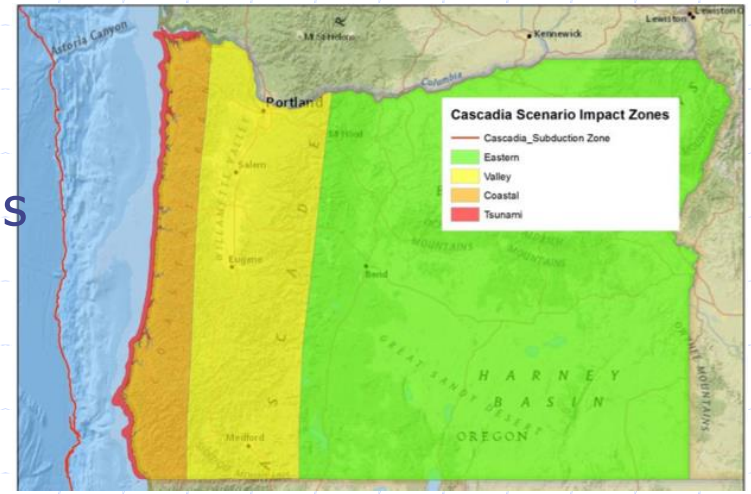
NOAA-NGDC

June 20, 2013

Michael Stuhr, PE
Chief Engineer
Portland Water Bureau

Water & Wastewater Resilience Plan

- Co-chairs: Mark Knudson (TVWD) and Mike Stuhr (PWB)
- Participants included representatives of ~ 45% of state
  - Portland, TVWD, Salem, Gresham, Eugene, Coos Bay, Bend, Pendleton
  - PSU, OSU, U of P, multiple consultants
- Four zones: Tsunami, Coast, Valley, East
- Approach
  - Identify event (maps)
  - Identify requirements & expectations
  - Identify performance of existing systems
  - Identify interdependencies
  - Identify "gaps" in systems performance
  - Generate recommendations



Cascadia Scenario Impact Zones

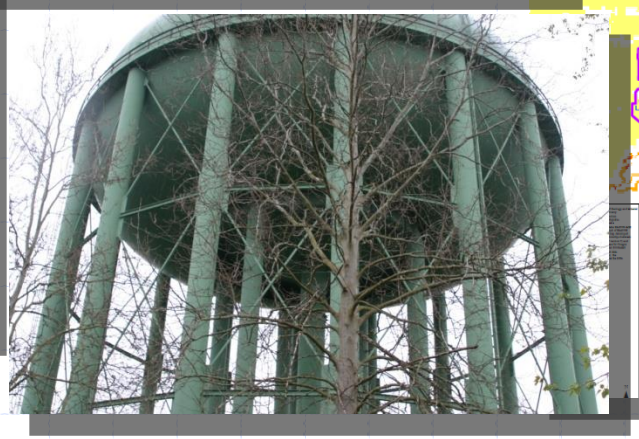
Why Are Water/WasteWater (W/WW) Systems Vulnerable?

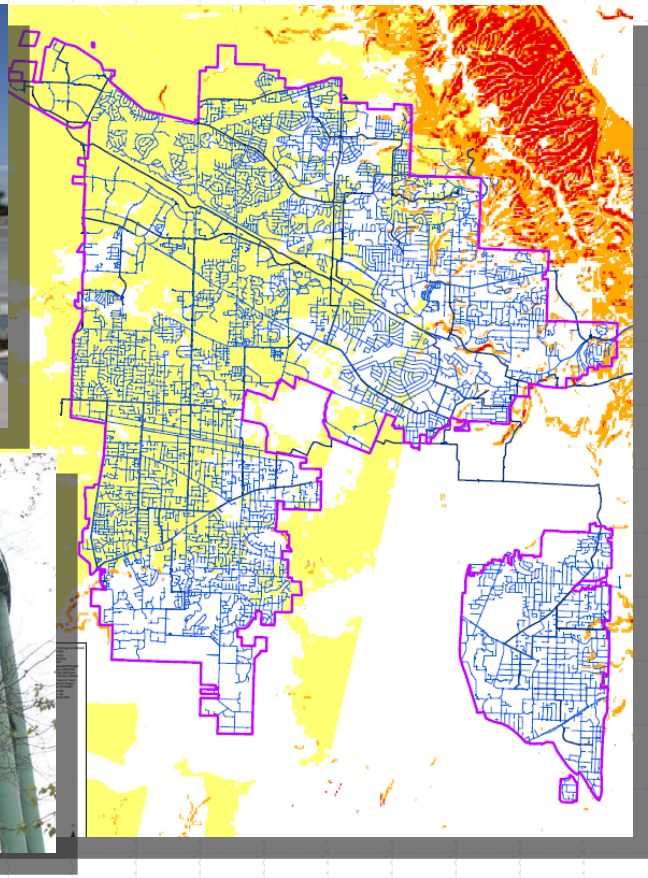
- Causes of damage
  - Tsunami (inundation)
  - Shaking (acceleration & velocity)
  - Permanent Ground Deformation (landslide, liquefaction, subsidence)
  - Cumulative effects
- System Vulnerability

The Great San Francisco EQ - 1906

Why Are W/WW Systems Vulnerable?

- Large, complex systems, multiple failures
  - Source, treatment, pumping, storage, distribution





Why Are W/WW Systems Vulnerable?

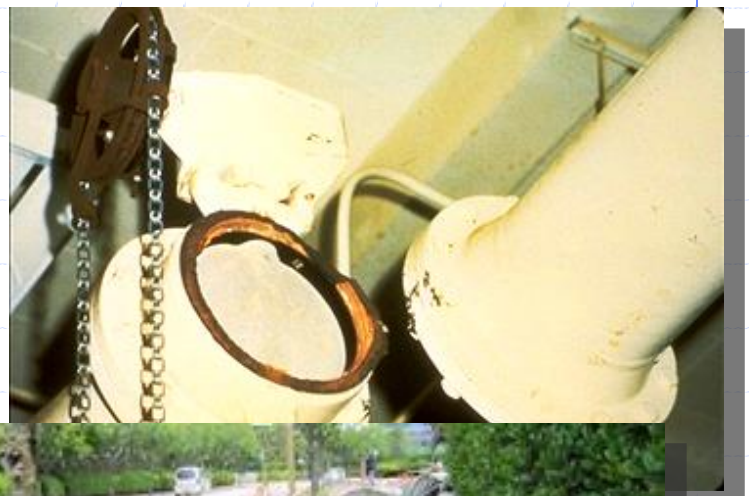
- Recovery highly dependent on other systems
  - Energy, transportation, people, equipment, financial

Why Are W/WW Systems Vulnerable?

- Age, age, age (and condition)

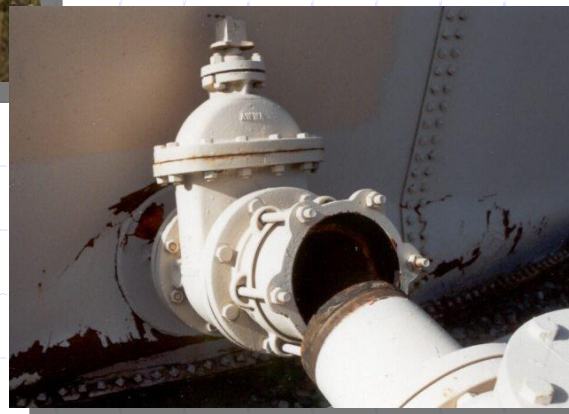
Why Are W/WW Systems Vulnerable?

- Pipelines vulnerable to structural damage



Why Are W/WW Systems Vulnerable?

- Connections to structures



Why Are W/WW Systems Vulnerable?

- Leaks, breaks & damage "after the meter"

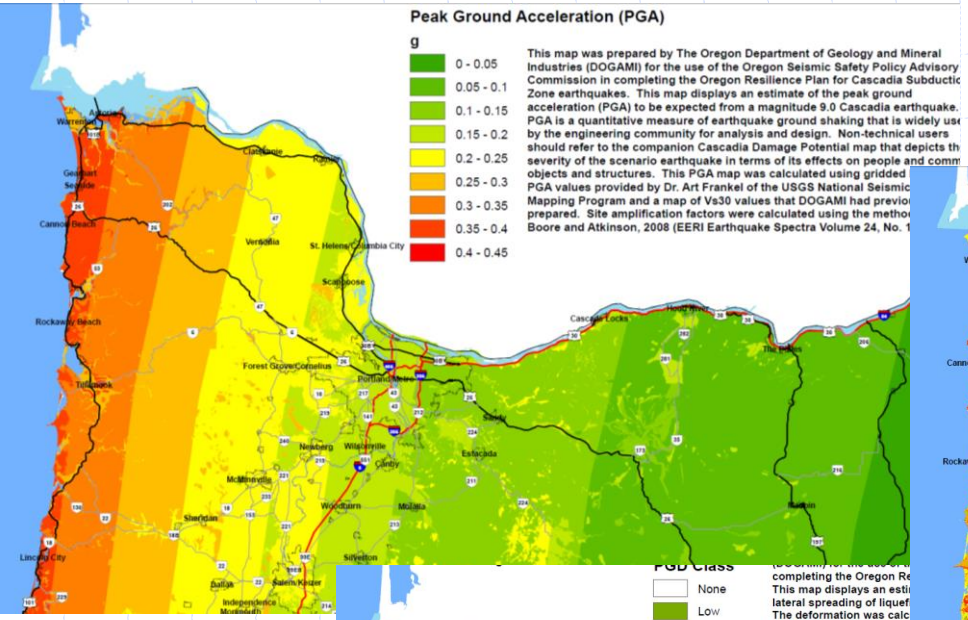
Resiliency Goals (Valley)

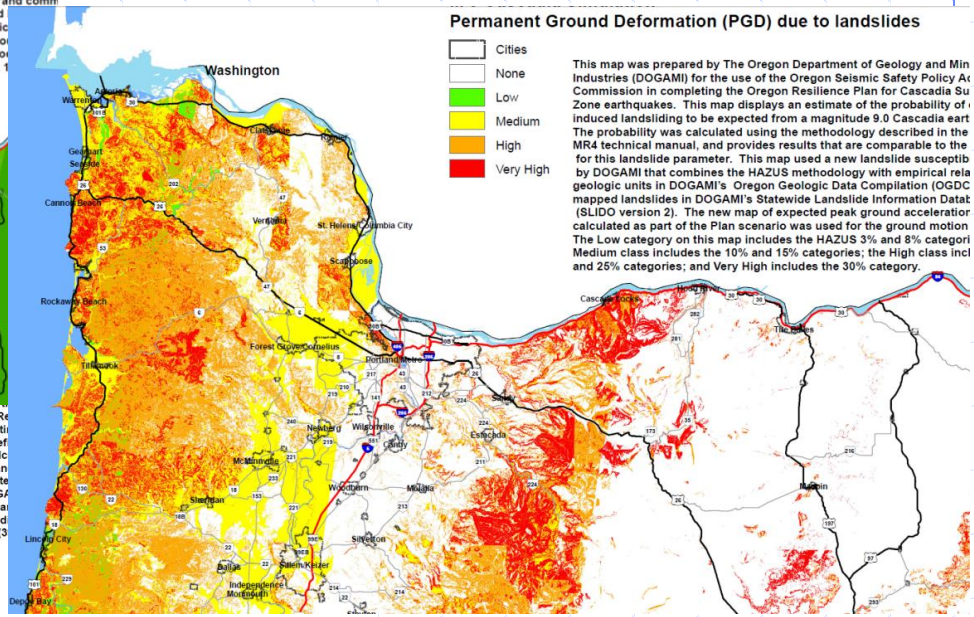
TARGET STATES OF RECOVERY: WATER & WASTE WATER SECTOR

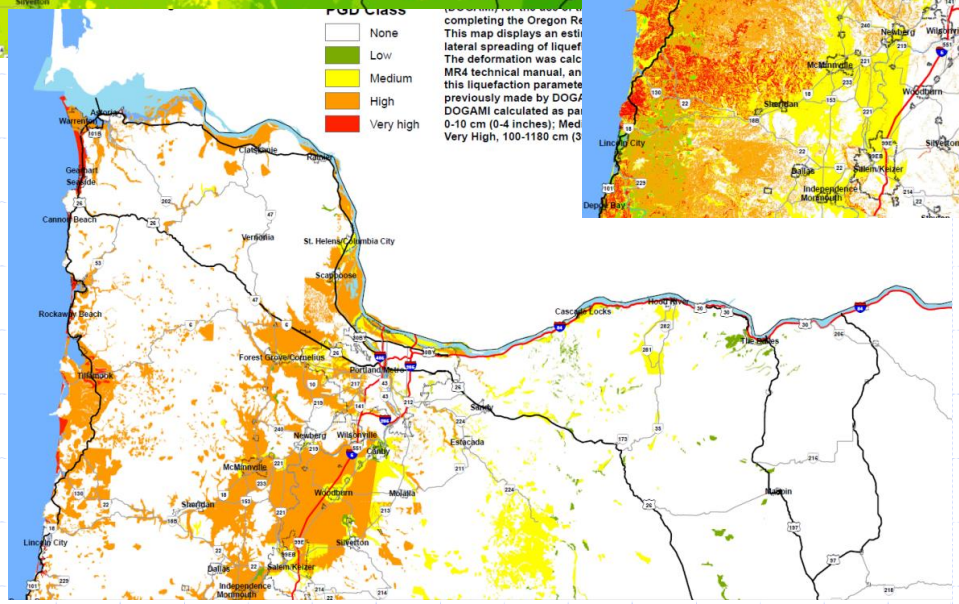
	Event occurs	0–24 hours	1–3 days	3–7 days	1 week–2 weeks	2 weeks–1 month	1 month – 3 month	3 month – 6 month	6 month -1 year	1 year–3 years	3 + years
Domestic water supply											
Potable water available at supply source. (WTP, wells, impoundment)		R	Y		G			X			
Main transmission facilities, pipes, 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				X		
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	
	Event occurs	0–24 hours	1–3 days	3–7 days	1 week–2 weeks	2 weeks–1 month	1 month – 3 month	3 month – 6 month	6 month -1 year	1 year–3 years	3 + years

Evaluating Pipeline System Performance

PGA, Landslides & Liquefaction







Evaluating Pipeline System Performance
System Specific Pipe Performance Estimates

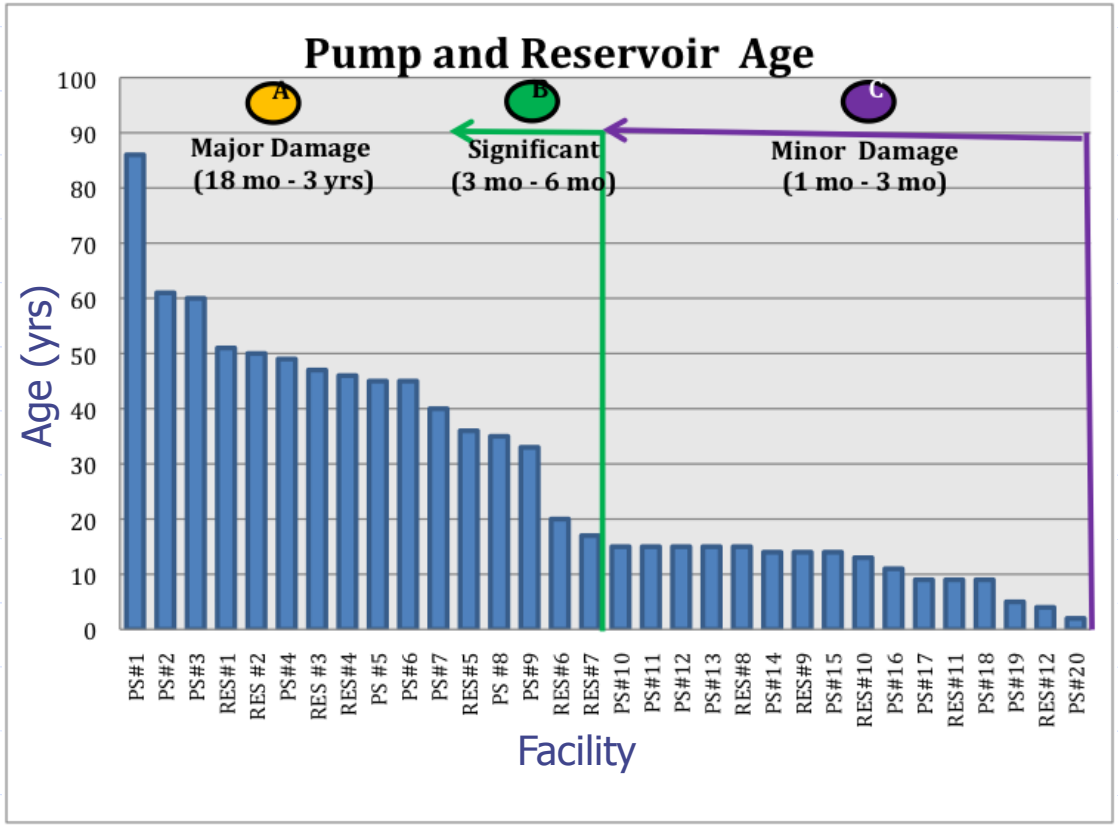
- Estimate of main line leaks & breaks
  - "Seismic Fragility Formulations for Water Systems" American Lifeline Alliance, 2011
  - Based on empirical data from prior events
  - Input: Peak Ground Velocity, Permanent Ground Deformation, length of pipe, pipe material
  - Output: number of main leaks & breaks by pipe type
- Estimate of service line leaks & breaks
  - Based on anecdotal data for similar events
  - About 7% of all service lines fail (2% on utility side & 5% on customer side)

Water Pipeline System Performance

Characteristic	Main Lines	Services
Length, Number	4,592 miles	385,600 connections
Number of Breaks	2,656	7,712 (utility side)
Number of Leaks	941	19,280 (customer side)
Total Leaks & Breaks	**3,597**	**26,992**

- Unprecedented number of pipeline failures
  - Equivalent of ~16 years of breaks
- Will required ~3 months to repair
  - Assumes 3 hrs/break, 12hrs/d, 7d/wk, unlimited materials, equipment & transportation
  - Does not include repairs to customer-side

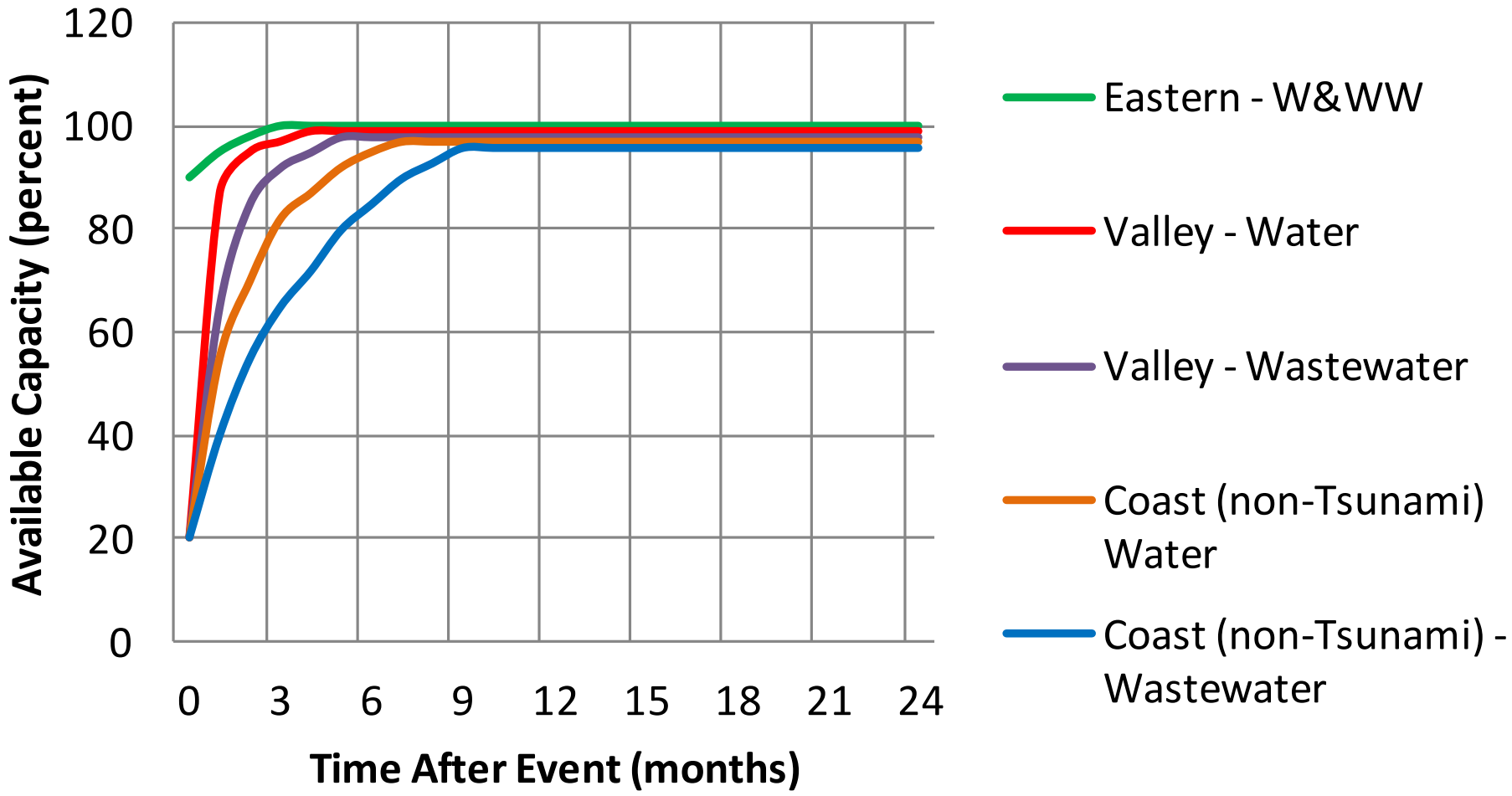
Evaluating Facility Performance
Performance of Reservoirs & Pump Stations



- Oregon Seismic Code
  - Before 1960 = none
  - 1960-70 = 0.06 g
  - 1970-90 = 0.12 g
  - 1990-2000 = ~ okay
  - 2000 → = stringent
- Pump Stations
  - 1/3 – major damage
  - 1/3 – some damage
  - 1/3 – minor affects
- Reservoirs
  - 2/3 – major damage
  - 1/6 – some damage
  - 1/6 – minor damage

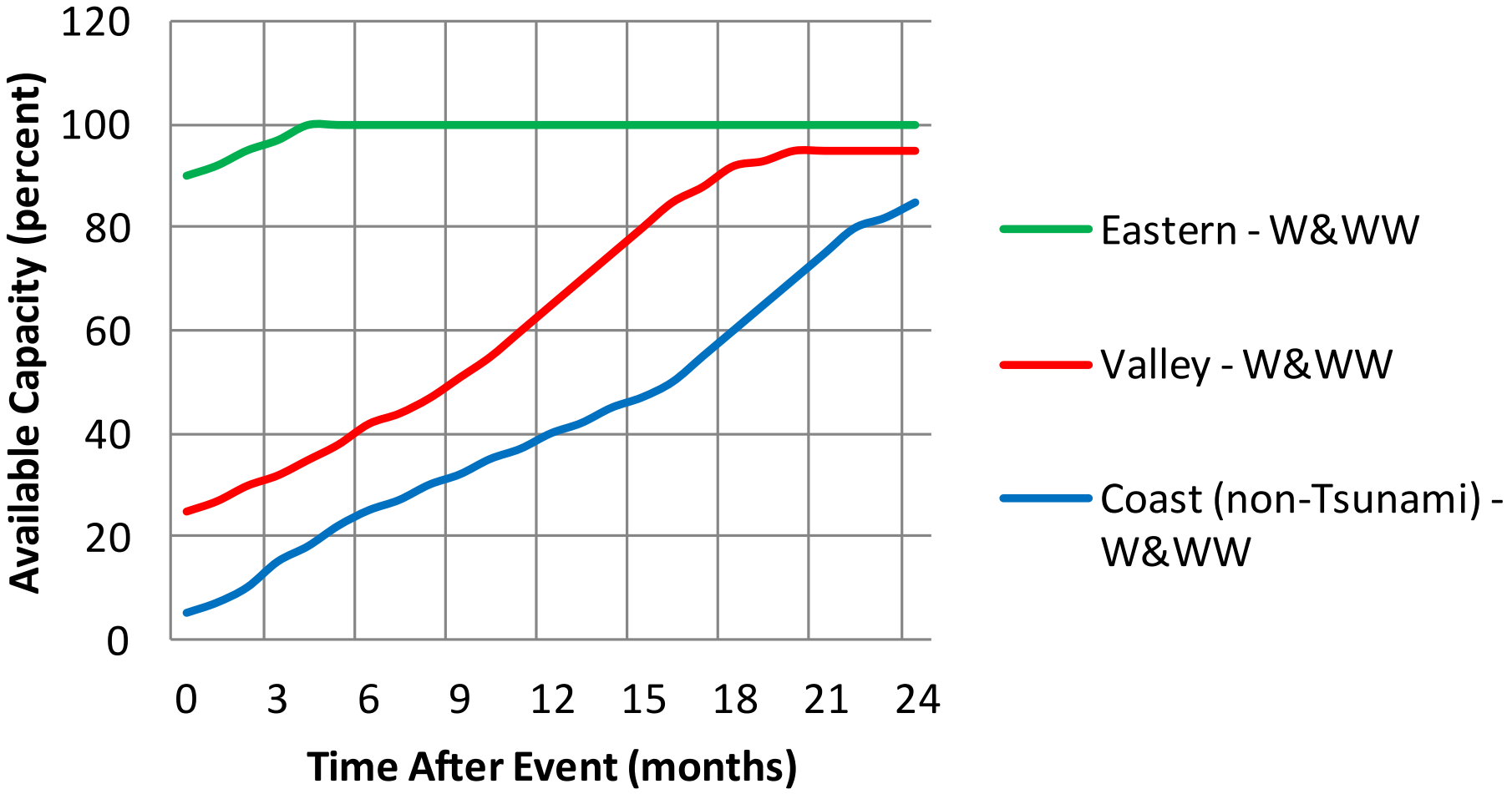
Resiliency Goals

Water & Wastewater System Performance



Existing Condition

Water & Wastewater System Performance



Findings & Conclusions

- Significant gap between goals and existing state
- If CSZ EQ occurs today, it will result in dramatic change in "life as we know it" for W & WW
- Water generally better prepared than wastewater
- Eastern Oregon limited impacts
- Tsunami Areas take years to recover if ever
- Coast critically impacted; up to 3 years
- Extensive impacts to Valley; 6 months – 1 year

Findings & Conclusions

- Resiliency upgrades will improve recovery times
- Focus on system “backbone” & water supply to critical facilities
- Costs will be significant but can be managed

Recommendations

- Reset public expectations for recovery times
- Recommend Water/Wastewater utilities join ORWARN
- Require seismic response plans by all sectors
  - Include business continuity, employee & family support
- Require seismic assessments for all systems
  - Part of periodic update of master plans

Recommendations

- OHA/DEQ require Water/Wastewater utilities to complete seismic risk assessment and mitigation plans as part of periodic updates to existing facility plans
- OHA/DEQ require Water/Wastewater utilities to include seismic design as part of system design
- OHA/DEQ work with Water/Wastewater utilites to define appropriate service levels, goals and expectations for post-EQ regulatory compliance

Recommendations

- Encourage public health agencies, water and wastewater utilties to plan for significant water quality impacts to the Willamette and Columbia Rivers.