

Water System Seismic Study

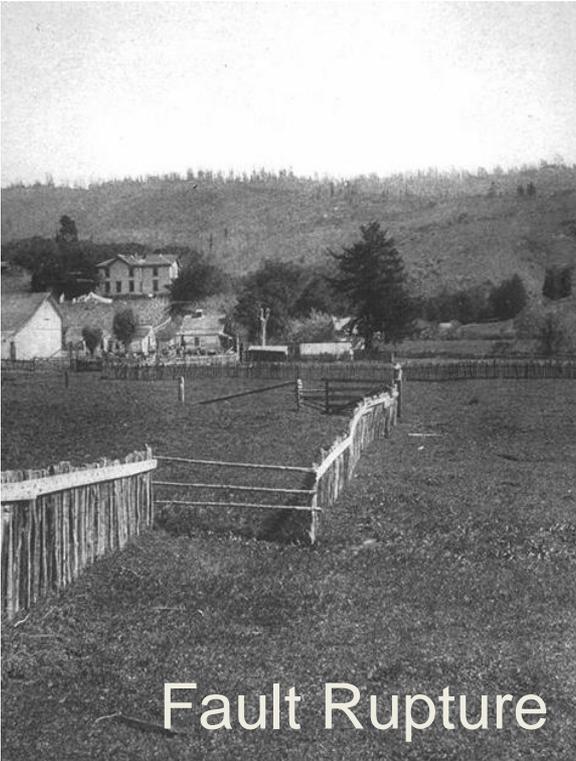
Presentation to the Customer Review Panel

11/30/2016

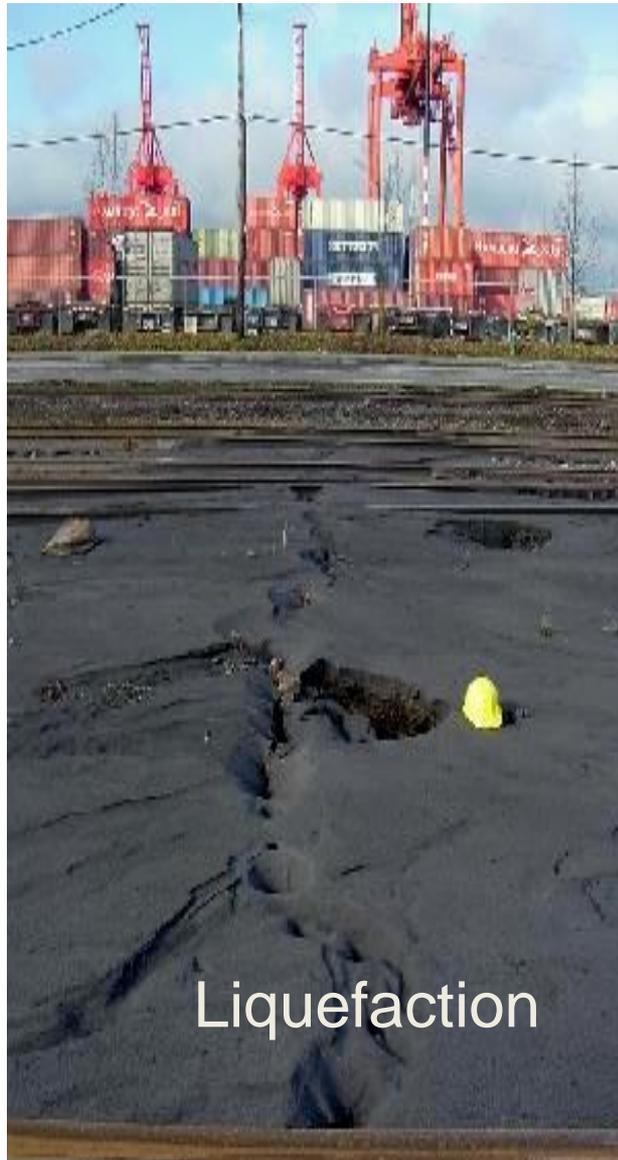
Agenda

- **Objectives**
 - Engage Customer Review Panel on seismic issues and potential future needs
- **Background**
 - Water systems and planning for seismic events
- **Current State**
 - Seismic study
 - Establish “service level goals” after a major earthquake
 - Balance goals vs. available funding
- **Looking Forward**
 - Plan short-term and long-term infrastructure seismic upgrades as part of Capital Improvements Program

Earthquake Hazards



Earthquake Hazards



Liquefaction

Earthquake Hazards



Importance of Water Post-EQ

- **Fire fighting**
- **Sanitation**
- **Consumption**

Water is an essential lifeline



Some Recent Earthquakes and Water System Impacts

	Year	Magnitude	Impacts
Loma Prieta, Bay Area	1989	6.9	Water outages mostly less than a few days; fire suppression water was an issue in Marina District
Northridge, So. Cal	1994	6.7	Over 100 fires; water system damage mostly in areas of poor soils; outage durations 8 to 13+ days
Kobe, Japan	1995	6.9	109 Kobe fires immediately after earthquake (another 88 in surrounding cities); 60+ days for restoration of service
Christchurch, NZ	2011	6.2	45+ days for restoration of service
Tohoku, Japan	2011	9.0	345 fires; 45+ days for substantial restoration of service

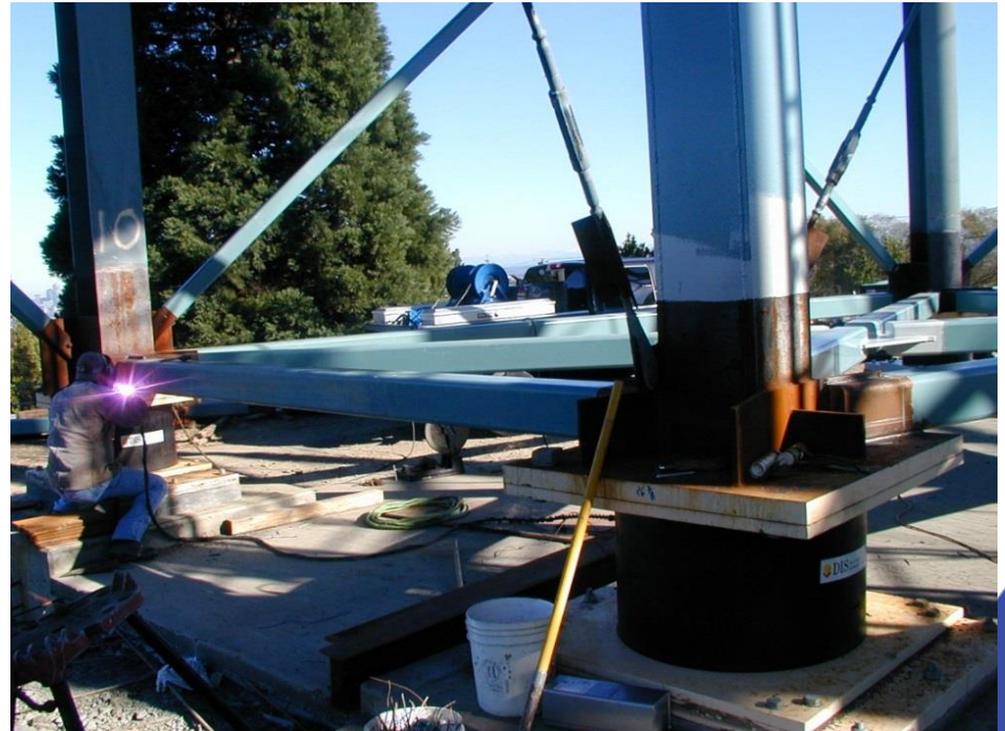
Nisqually 2001 (con't)



- Tolt East Side Supply Line Junction Valve Station damage
- SPU Admin Bldg (Dexter Horton) nonstructural damage
- Eastside Reservoir floor cracks and roof damage
- Operations and Control Center Damage

SPU History of Seismic Work

- **Working on seismic issues for several decades**
 - Various studies
 - Seismic retrofits
 - Incorporation of then-current seismic standards into new facilities



SPU History of Seismic Work

- **Regional collaboration with other water utilities**

Water Supply Forum

Regional Water Supply Resiliency Project

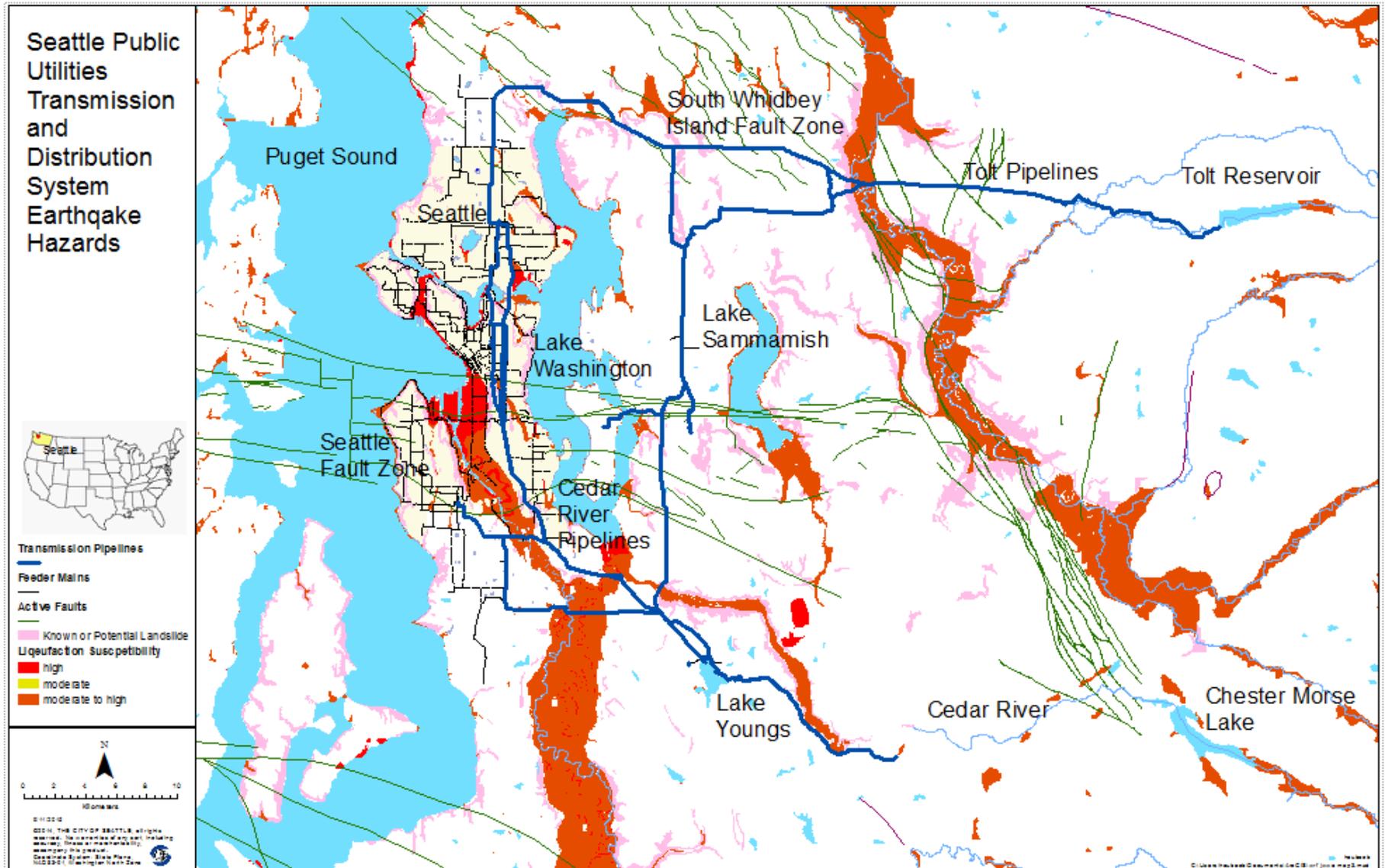
Earthquake Vulnerability Assessment Technical Memorandum

Snohomish, King, and Pierce Counties, Washington



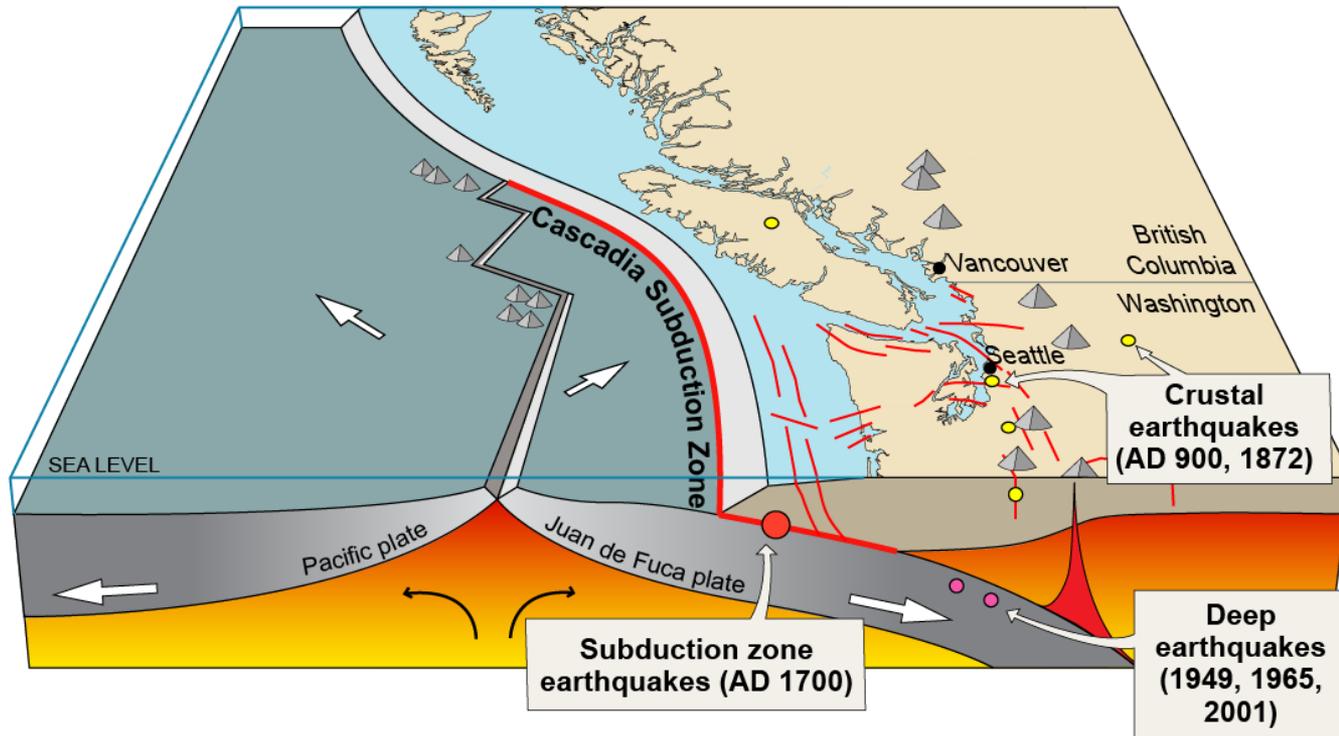
April 11, 2016

Better Understanding of Seismic Risks in Puget Sound – 1990 vs. 2015



Pacific Northwest Earthquake Sources

(Washington State Department of Natural Resources and USGS)



Source	Max. Size	Recurrence
● Subduction zone	M 9+	200–600 years
● Deep Juan de Fuca plate	M 7+	30–50 years
● Crustal faults	M 7+	Hundreds of years?

- ▲ Volcano
- Active crustal fault
- Active plate boundary fault

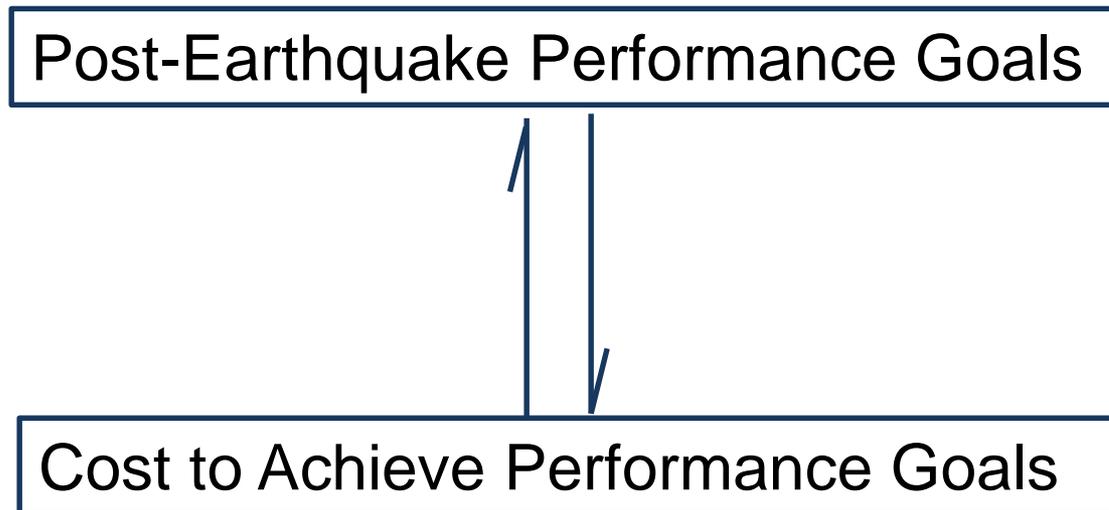
*figure modified from USGS Cascadia earthquake graphics at <http://geomaps.wr.usgs.gov/pacnw/pacnweq/index.html>

SPU Water System Seismic Study

- **Establish post-earthquake water system performance goals**
- **Seismic vulnerability assessments of facilities and pipes**
- **Balance performance goals against cost of upgrades**
- **Develop short-term (20 year) and long-term (50+ year) plans**
 - Integrate plans into Capital Improvement Program

Balancing Performance Goals and Seismic Improvement Needs

- **Consultant Recommendations**
- **Cost Considerations**



- ***This approach is typical of other water utilities***

Stakeholder Input is Critical to Developing Performance Goals

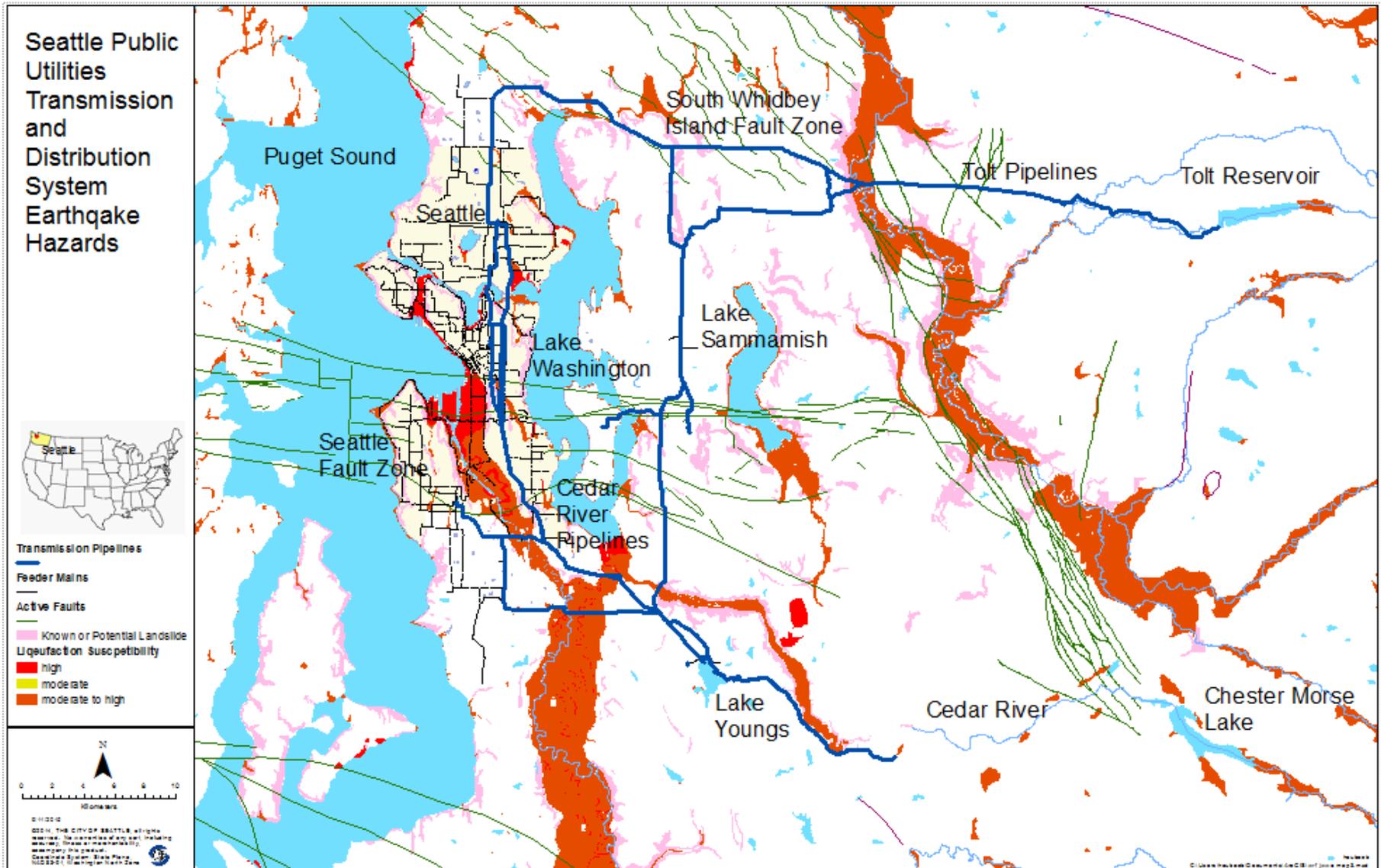
- **Public/Direct Service Customers**
 - Water System Advisory Committee
 - Customer Review Panel
 - Surveys
- **Wholesale Customers (Operating Board)**
- **City Leadership**
 - Mayor/Council
 - Fire Department
 - SPU
 - Emergency Executive Board
- **SPU Staff**

Draft Performance Goals

- **Water supply for fire fighting**
- **Water supply for critical facilities like hospitals**
- **Water supply for retail customers**
- **Water supply for wholesale customers**

How long should it take to achieve these goals for what % of the water system?

What Kinds of Upgrades Will Be Needed?



Next Steps

- **Proposed mitigation options**
- **Review cost of options and see if performance goals need to be changed**
- **Study complete in spring 2017**
 - Use results to develop short-term and long-term seismic recommendations
 - Fold into rest of Capital Improvement Program

Questions/Discussion