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

Fault Rupture

Ground Shaking
Earthquake Hazards

Liquefaction
Earthquake Hazards

Landslide

Tsunami
Importance of Water Post-EQ

- Fire fighting
- Sanitation
- Consumption

*Water is an essential lifeline*
### Some Recent Earthquakes and Water System Impacts

<table>
<thead>
<tr>
<th>Year</th>
<th>Magnitude</th>
<th>Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loma Prieta, Bay Area</td>
<td>1989</td>
<td>6.9</td>
</tr>
<tr>
<td>Northridge, So. Cal</td>
<td>1994</td>
<td>6.7</td>
</tr>
<tr>
<td>Kobe, Japan</td>
<td>1995</td>
<td>6.9</td>
</tr>
<tr>
<td>Christchurch, NZ</td>
<td>2011</td>
<td>6.2</td>
</tr>
<tr>
<td>Tohoku, Japan</td>
<td>2011</td>
<td>9.0</td>
</tr>
</tbody>
</table>
Nisqually Earthquake - 2001

- Magnitude 6.8, centered near Olympia, 32 miles deep
- Minimal effect on SPU functionality
- Approximately $4 million in earthquake related costs
  - Masonry Pool Engineered Fill Failure
  - 12 Pipe breaks and 7 pipe leaks
  - 500 Ft. Long, ½-Inch wide crack in Cascades Dam
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
Better Understanding of Seismic Risks in Puget Sound – 1990 vs. 2015
Pacific Northwest Earthquake Sources
(Washington State Department of Natural Resources and USGS)

Subduction zone earthquakes (AD 1700)

<table>
<thead>
<tr>
<th>Source</th>
<th>Max. Size</th>
<th>Recurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subduction zone</td>
<td>M 9+</td>
<td>200–600 years</td>
</tr>
<tr>
<td>Deep Juan de Fuca plate</td>
<td>M 7+</td>
<td>30–50 years</td>
</tr>
<tr>
<td>Crustal faults</td>
<td>M 7+</td>
<td>Hundreds of years?</td>
</tr>
</tbody>
</table>

Volcano
Active crustal fault
Active plate boundary fault

*figure modified from USGS Cascadia earthquake graphics at http://geomaps.wr.usgs.gov/pachw/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