20th Anniversary Celebration
Moving the Region Forward Together
March 25 | 2019
Water Supply Forum

VISION

Provide leadership, from the utility perspective, on current and future regional water supply and related water resources issues in King, Pierce and Snohomish counties.

MISSION

Provide a venue for policy discussions on critical water supply and stewardship issues while sharing utility perspectives and insights with regional stakeholders. The Forum provides members and the public with a portal for water supply and related water resource issues.
Natural Disasters by the Numbers
Hurricane Katrina
(New Orleans) 2005

- Nearly 2,000 fatalities
- Over 100,000 homes destroyed
- 80% of the city flooded
- $140 billion in economic losses
- Pre-Katrina population – 483,000
- Post-Katrina population - +/- 200,000
- Current population (2018) – 417,000
Hurricane Sandy (New Jersey / New York) 2012

- More than 150 fatalities
- 650,000 buildings damaged or destroyed
- More than $70 billion in economic losses
- 8 million homes lost power
Breezy Point, 80 homes
Hurricane Harvey (Houston) 2017

- More than 100 fatalities
- More than 8 million people experienced flooding impacts
- More than $125 billion in economic losses
- A year’s worth of rain in three days
Optimism Bias

This is the belief that each of us is more likely to experience good outcomes and less likely to experience bad outcomes. The key to optimism bias is that we disregard the reality of an overall situation because we think we are excluded from the potential negative effects.
Kobe Earthquake (Japan) 1995

- More than 6,000 deaths
- More than 30,000 injuries
- More than 150,000 buildings destroyed
- More than 300,000 people homeless
- About $200 billion in economic losses
- Over 60 days to restore water delivery to 90% of population
109 fires in Kobe
Chile 2010

• Almost 800 fatalities
• 500,000 buildings destroyed
• 93% of country experienced a blackout
• $30 billion in economic losses
The question is not whether infrastructure will fail.

It will fail!

The question is “How long will it take to recover once it does fail?”

That’s what the Forum tackled!
Forum Resiliency Overview

1. Resiliency project context and objective
2. Scope and Focus of Resiliency Project
3. Phase 1 Findings
4. Phase 2 Findings
5. What’s next?
Context and Objectives

1. Proactively evaluate and enhance region’s water supply system resiliency
2. Improve resiliency within and across utilities service areas
3. Develop short-term and medium to long-term action items
4. Communicate and educate stakeholders and funding agencies
Context and Objectives (cont.)

1. Engage emergency responders in local, County, State and Federal level.
2. Duty and responsibility to take action
3. Tackle elephant in small pieces
4. Cost of implementing action steps
Scope and Focus

Four Major Scope Areas and Risk Teams

1. Earthquake
2. Water Quality
3. Drought
4. Climate Change

Risk Teams assigned to tackle each – Forum partners will report back on Phase 1,2 and next steps
Resiliency Project Phase I Overview

Preparing for Water Supply Disruption

- EARTHQUAKE
- WATER QUALITY
- CLIMATE CHANGE
- DROUGHT
THE REALLY BIG ONE

An earthquake will destroy a sizable portion of the coastal Northwest. The question is when.

By Kathryn Schulz

W

When the 2011 earthquake and tsunami struck Tohoku, Japan, Chris Goldberg was two hundred miles away, in the city of Kashiwa, at an international meeting on seismology. As the shaking started, everyone in the room began to laugh. Earthquakes are common in Japan—that one was the third of the week—and the participants were, after all, at a seismology conference. Then everyone in the room checked the time.

Seismologists know that how long an earthquake lasts is a decent proxy for its magnitude. The 1989 earthquake in Loma Prieta lasted twenty seconds, but the 2011 Tohoku event lasted over four minutes. The longer it continued, the more damage it inflicted.

The next full-margin rupture of the Cascadia subduction zone will spell the worst natural disaster in the history of the continent.

Illustration by Christopher Helmstetter, Map

WATER SUPPLY FORUM
Serving St. Joseph, King & Pierce Counties
SURFACE FAULTS:

• South Whidbey Island Fault
• Seattle Fault
• Tacoma Fault
# EARTHQUAKE RESILIENCY

<table>
<thead>
<tr>
<th><strong>Physical Damage</strong></th>
<th><strong>Restoration Time</strong></th>
<th><strong>Economic Impact</strong></th>
<th><strong>Likelihood</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Extensive damage to water system facilities, over 100 transmission pipeline breaks/leaks, up to 6,000 distribution system breaks/leaks</td>
<td>60 days to restore water</td>
<td>Cost of water system damage could exceed $2 billion.</td>
<td>14 percent chance of Mw9.0 Cascadia Subduction event in next 50 years, 15 percent chance of Mw6.5 or larger surface fault event in next 50 years</td>
</tr>
</tbody>
</table>
WATER QUALITY RESILIENCY

1. Identified potential water quality risks
2. Prioritized risks based on likelihood and consequence
3. Evaluated priority risks and identified mitigation options
WATER QUALITY RESILIENCY

- Wildfire Impacts
- Volcanic Eruption Impacts
- Supply Chain Disruption
- Accidental Contamination
- Severe Adverse Weather
- Earthquakes
Groundwater Assessment
- Aquifer susceptibility
- Potential mitigation options

Surface Water Assessment
- Historical drought scenario
- Extreme drought scenario

Drought Survey
- Surveyed 45 water utilities in the central Puget Sound region
CLIMATE CHANGE RESILIENCY

- Surface Water Assessment
- Groundwater Assessment
- Climate Migration Study
- Water Quality Literature Review
- Wildfire Assessment
### CLIMATE CHANGE RESILIENCY

<table>
<thead>
<tr>
<th>Surface Water</th>
<th>Groundwater Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Water availability may be significantly reduced</td>
<td></td>
</tr>
<tr>
<td>• Impacts to surface water will be similar throughout the region</td>
<td></td>
</tr>
<tr>
<td>• Less risk to groundwater resources</td>
<td></td>
</tr>
<tr>
<td>• Sea level rise poses little or no risk</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Climate migration</th>
<th>Water quality</th>
<th>Likelihood</th>
</tr>
</thead>
<tbody>
<tr>
<td>is unlikely</td>
<td>will be degraded</td>
<td>frequency will increase</td>
</tr>
</tbody>
</table>
Resiliency Project Phase II Overview

- Earthquake
- Water Quality
- Climate Change
- Emergency Supply
- Lifeline Sectors
- Action Plan
## EARTHQUAKE RISK

<table>
<thead>
<tr>
<th>Post-Event LOS</th>
<th>Preparedness &amp; Response</th>
<th>Mitigation Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Time to restore services</td>
<td>• Transmission line repair materials</td>
<td>• Isolation of vulnerable areas</td>
</tr>
<tr>
<td>• Earthquake type (i.e., crustal vs. CSZ)</td>
<td>• Access to specialized personnel</td>
<td>• Seismic retrofit and replacement of vulnerable pipe</td>
</tr>
<tr>
<td>• Planning horizon (20 years vs. 50 years)</td>
<td>• Tanker truck availability for emergency supply</td>
<td></td>
</tr>
<tr>
<td>• Funding level (basic, moderate, aggressive)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Preparations & Response

- Transmission line repair materials
- Access to specialized personnel
- Tanker truck availability for emergency supply

### Mitigation Strategies

- Isolation of vulnerable areas
- Seismic retrofit and replacement of vulnerable pipe
Coordination with Other Lifeline Services

- Transportation
- Fuel Supply
- Electrical Power
## EMERGENCY SHORT-TERM WATER SUPPLIES

<table>
<thead>
<tr>
<th>Critical Needs</th>
<th>Alternative Supplies</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Fire Flows</td>
<td>▪ Bottled water deliveries</td>
</tr>
<tr>
<td>▪ Hospitals</td>
<td>▪ Public and private wells</td>
</tr>
<tr>
<td>▪ Vulnerable Populations</td>
<td>▪ Tanker trucks and bladders</td>
</tr>
<tr>
<td>▪ Domestic Needs</td>
<td>▪ Public utility reservoirs</td>
</tr>
<tr>
<td></td>
<td>▪ Rivers, lakes, and seawater</td>
</tr>
<tr>
<td></td>
<td>▪ Truck- or ship-mounted filtration plant</td>
</tr>
</tbody>
</table>

### Utility Roles and Coordination with Emergency Response Entities
(Held March 7 at Bellevue City Hall)

### Mapping of Emergency Wells
CLIMATE CHANGE RISK

Do’s and Don’ts for Using Climate Science

- When designing a study
- When selecting models
- When interpreting climate change data
RESILIENCY

A water utility's resiliency - the ability to provide an uninterrupted supply of safe, clean water - can be affected by natural occurrences such as earthquakes, drought, climate change and water quality conditions. The Water Supply Forum has embarked on a project to help water utilities in King, Pierce and Snohomish counties proactively evaluate the region's existing water supply systems resiliency and plan for potential water supply disruptions.

Phase 1 of this project was done in 2015-16, identifying key risks to water supply. These included risks related to earthquakes, climate change, drought, and threats to water quality that could have regional impact. Phase 2 was completed in 2018 and features more in-depth study of key topics, focusing largely on earthquake risks. Additional detailed information on appropriate approaches to climate change modeling, and response to water quality risks was also developed. The findings for both phases are listed to the right.

PHASE 2 FINDINGS

- Regional Water Supply Resiliency Project: Phase 2 Summary Report
- Appendix A - PE-LOS and Mitigation Measure Assessment
- Appendix B - Transmission Line Repair Materials for Earthquake Damage
- Appendix C - Specialized Personnel Database
- Appendix D - Tanker Truck Availability for Emergency Water Supply
- Appendix E - Mitigation Strategies for Earthquake Damage to Water Distribution Systems
- Appendix F - Break the System Analysis
- Appendix G - Guideline for Restoring Potable Water Service to Regional Infrastructure
- Appendix H - Emergency Communications Planning Template
- Appendix I - Climate Change Workshop
- Appendix J - Short-term Emergency Supply Options Following an Earthquake
- Appendix K - Mapping of Emergency Supply Wells
- Appendix L - Coordination with Emergency Response Agencies for Water Delivery
- Appendix M - Lifeline Sector Coordination
- Emergency Wells: Cascade | EPW | SPU | TPU