

CHALLENGING ISSUES
ONE WATER UTILITY'S PERSPECTIVE

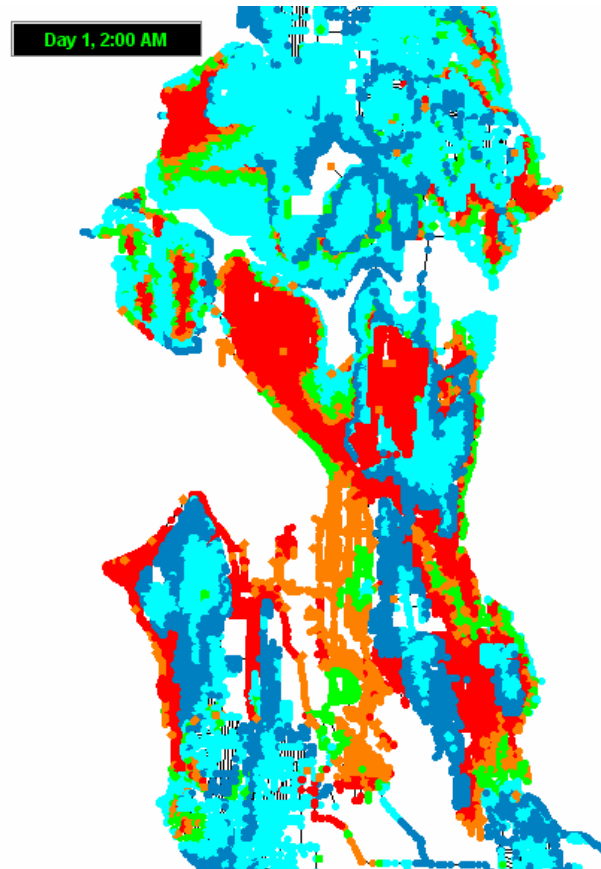
MCEER ANNUAL MEETING
SACRAMENTO, CALIFORNIA
FEBRUARY 25, 2005

BILL HEUBACH
SEATTLE PUBLIC UTILITIES

CHALLENGING ISSUES

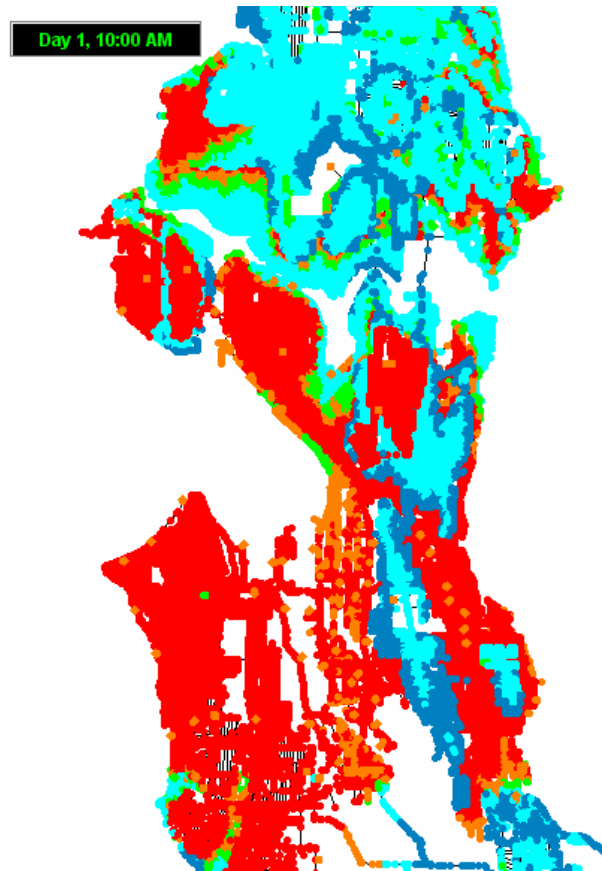
- Mitigating the effects of earthquake-caused pipeline damage
- Developing “realistic” economic loss estimates for earthquake-caused water outages (to be used in life-cycle cost analyses to evaluate seismic mitigation options)

MITIGATING THE EFFECTS OF EARTHQUAKE-CAUSED PIPELINE DAMAGE



SPU system two hours after 500-year earthquake

MITIGATING THE EFFECTS OF EARTHQUAKE-CAUSED PIPELINE DAMAGE



SPU system ten hours after 500-year earthquake

MITIGATING THE EFFECTS OF EARTHQUAKE-CAUSED PIPELINE DAMAGE

- Cost to replace SPU “vulnerable” pipe in poor soils is approximately \$500 million
- Alternate strategies?
 - Isolation/control
 - Emergency Planning
 - Prioritization of pipeline replacement (possibly with “seismic” pipe similar to Japanese S-joint ductile iron)

ESTIMATING ECONOMIC BENEFITS OF SEISMIC IMPROVEMENTS

- Repair cost
- Loss of revenue
- Fire
- Loss of business opportunity

ESTIMATING ECONOMIC BENEFITS OF SEISMIC IMPROVEMENTS - TYPICAL APPROACH

$$E = 0.5t * [\sum_a \sum_j (1 - r_j) * w_a * Q_{j,a}]$$

where

t = the outage duration/time to repair

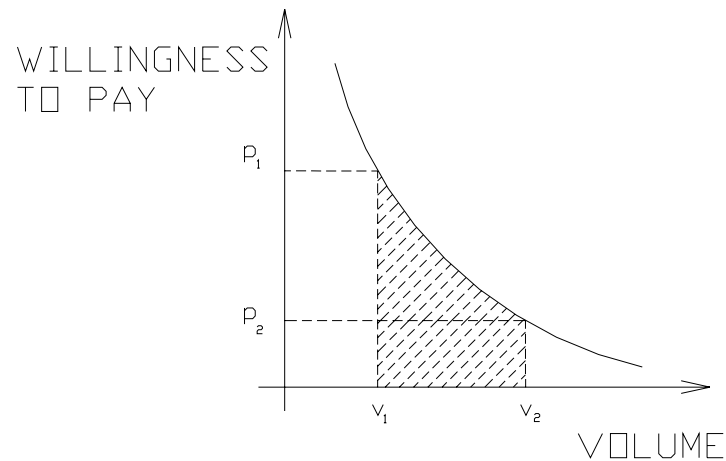
r_j = the resiliency factor (ability to continue production without water) for industry “j”

w_a = fraction of service area “a” without water

Q_{j,a} = economic product for industry “j” in area “a”

ESTIMATING ECONOMIC BENEFITS OF SEISMIC IMPROVEMENTS - ISSUES

- Relationship between water value and quantity is not linear



- Estimates need to be deaggregated so only losses from water outage is considered
- Should only consider portion of value-added economic product that is lost
- Geographic boundary of analysis
- Recovery