

Conjunctive Use of Surface Water, Alluvial Groundwater and Basalt ASR City of Kennewick

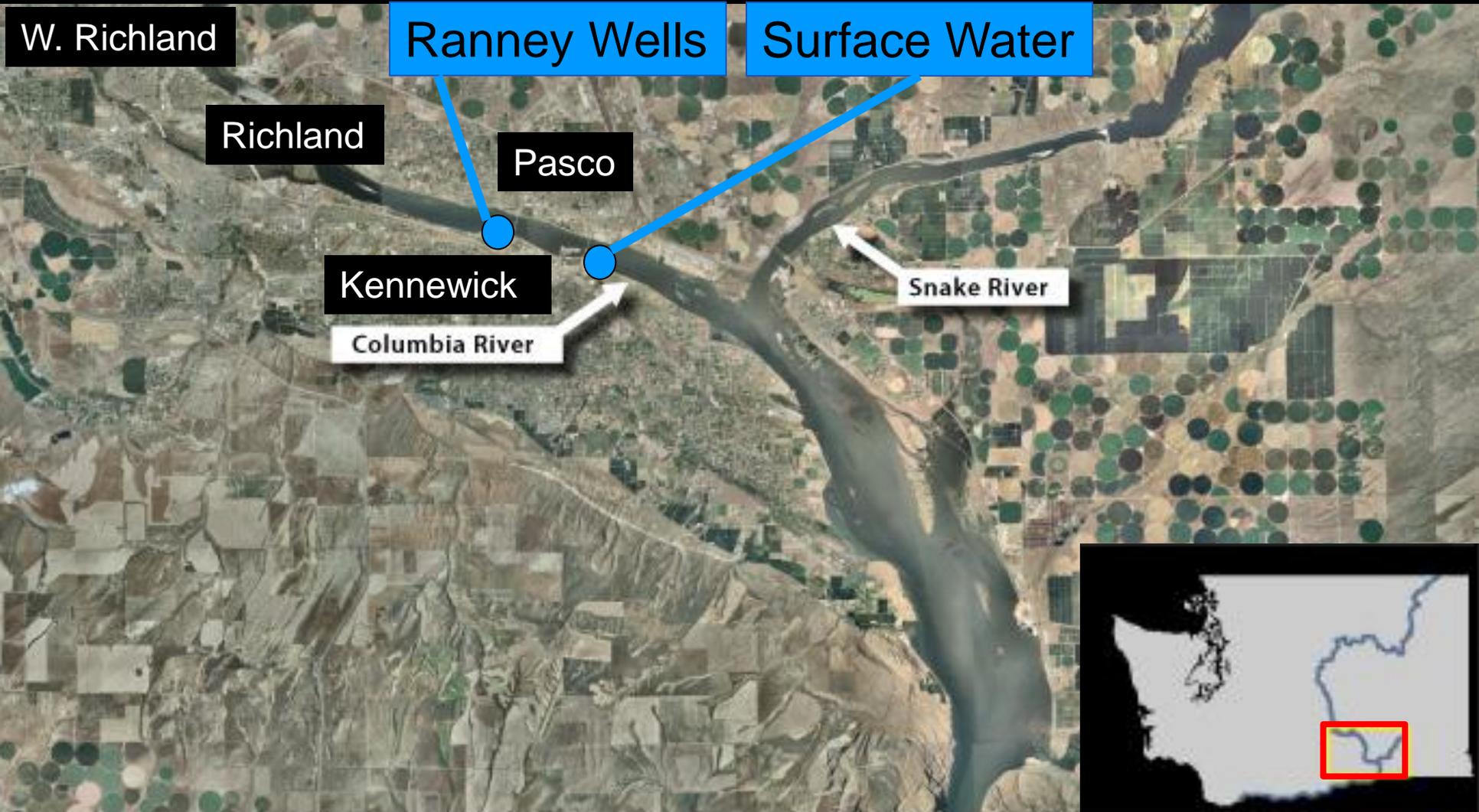


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Tri(Quad)Cities Area



Water Supply / Demand

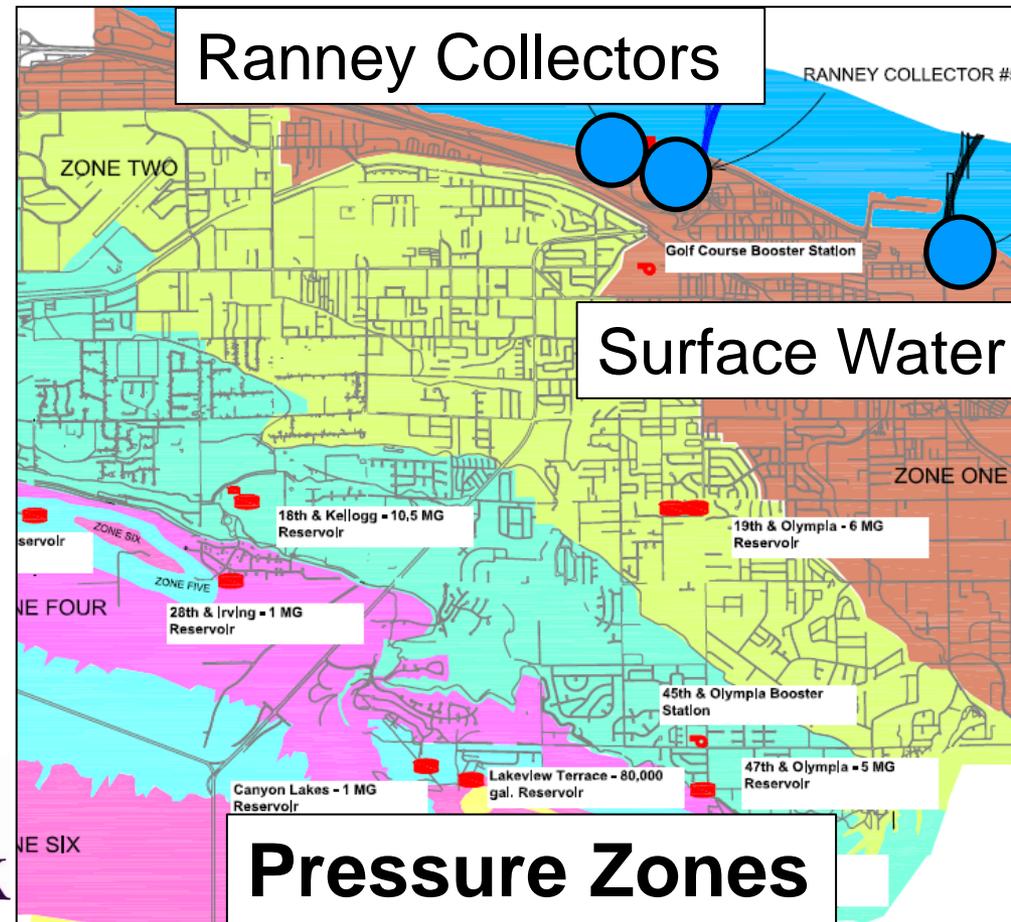
■ Source Capacity:

- Surface Water: 15 MGD
- Ranney Collectors: 15 MGD
- Total: 30 MGD

■ Demand:

- MDD = 24 MGD
 - Winter = 6-7 MGD
-
- Annual growth = 1.5%
 - Demand > Supply in 2023

5 miles



Needs/Solution – Presentation Outline

Needs:

- New supply in the right spot.
- Peak demand.
- System balance.
- Emergency sources.

Solution:

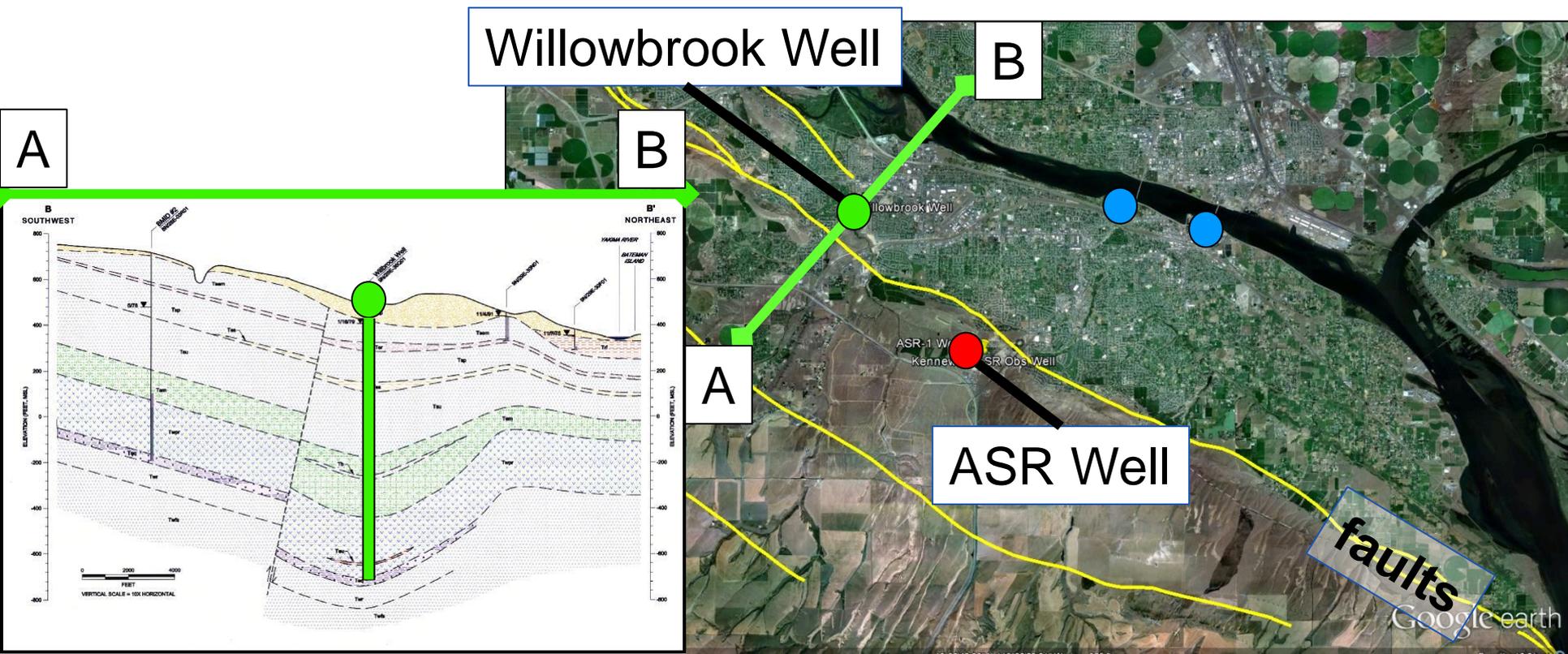
Aquifer Storage & Recovery

- Program evolution
- Regulations
- Water Quality
- Operations



Kennewick ASR – Initial Evaluation

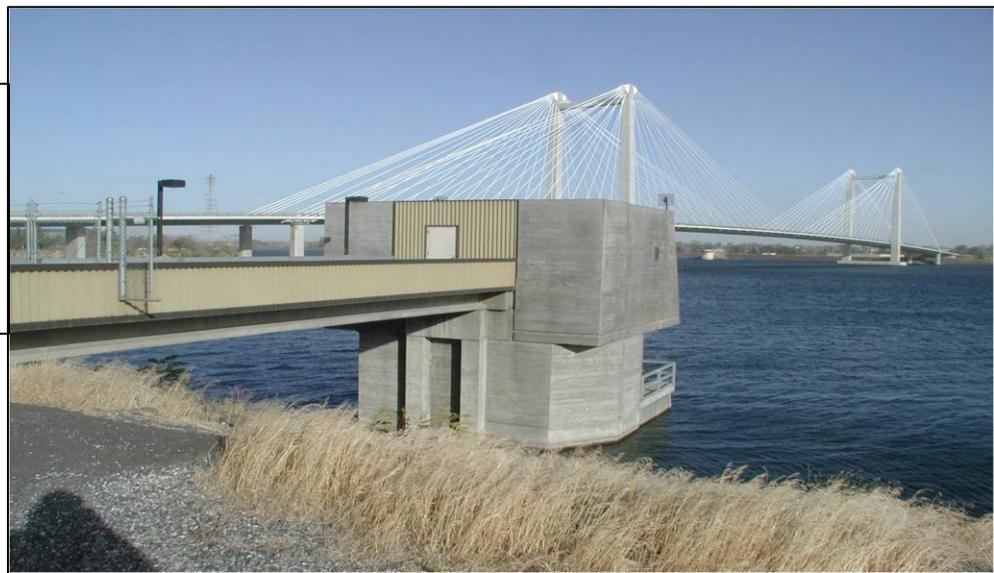
- 2000: First assessment conducted jointly by Kennewick & Richland
 - Promising geological structure recognized.
- 2001: Existing Willowbrook well tested – not the best water quality.
- 2002: Alternate location recommended.
 - Additional faults possible.



Quad City Water Right

- 2003 Ecology grants new Columbia River water supply (178 cfs).
- Quad Cities: Kennewick, Pasco, Richland, West Richland.
- Restricted to winter diversion (major), Interruptible by ESA BiOp (minor)
- ASR allows exercise of water right (interruptibility for ASR recharge is acceptable).

City of Kennewick
Columbia River
Surface Water Diversion



Kennewick ASR – Development

- 2005: Watershed planning endorsement (broad stakeholder group).
- 2008: Ecology provides shared funding.
- 2011: Test Well installed.
- 2013: ASR well being outfitted, Obs. well going in.
- 2014: ASR cycle testing scheduled.
- 2015: ASR to be operational.



Major Water Quality Considerations

- Regulatory
 - Anti-degradation of Groundwater (WAC 173-200) – DBPs, As, Sulfate...
 - Drinking Water – Potential release of Arsenic
- Operational (clogging):
 - Biofouling – prevented by residual chlorine.
 - Suspended sediment – prevented by system flushing O&M.
- No other regulatory water quality problems are anticipated.



Treatment

- Ranney Collectors:
 - Chlorination, UV, pH adjustment
- Surface Water:
 - Pre-treatment
 - Membrane filtration
 - Chlorination, pH adjustment
- Turbidity < 0.1 NTU
- THMs ~15-50 ppb



Ranney 5 Collector

Membrane Filtration



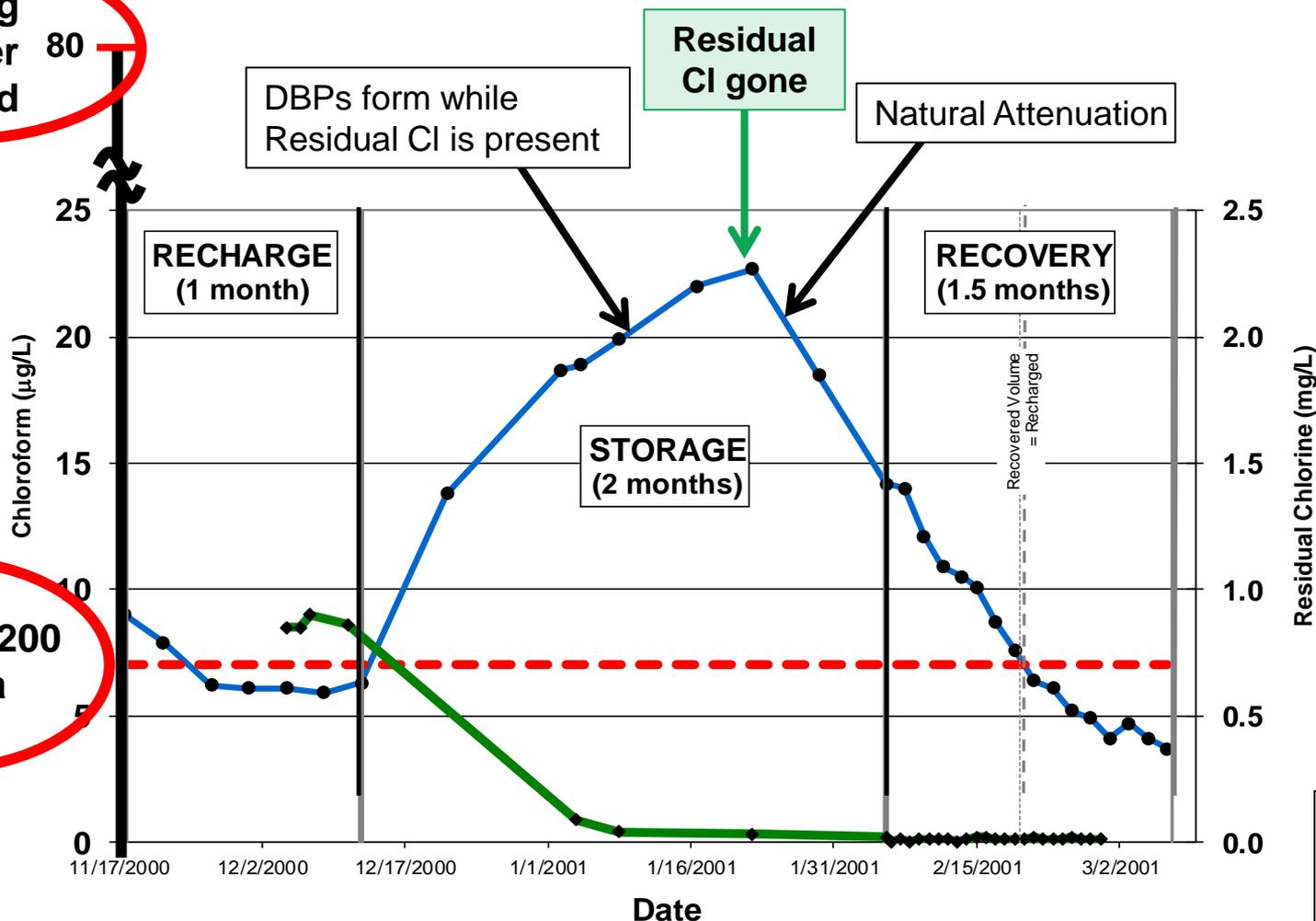
Anti-Degradation of Groundwater (DBPs)

- DBPs is a concern (TTHMs, HHA)
- Chloroform regulatory limits:
 - Federal SDWA: 80 ppb (TTHM)
 - Oregon ASR: 40 ppb (TTHM; 50% of SDWA)
 - WAC 173-200: 7 ppb (CHCl₃)
- Kennewick system has 15-50 ppb (seasonal high in late summer)
- **AKART** analysis – RO the only option to meet regs w/o variance:
Recommended acceptance of chlorination DBPs.
- Ecology supports **OCPI** to allow ASR testing with existing water quality for Kennewick.



Chlorination Disinfection Byproducts (DBPs)

Drinking water standard 80



Yakima ASR

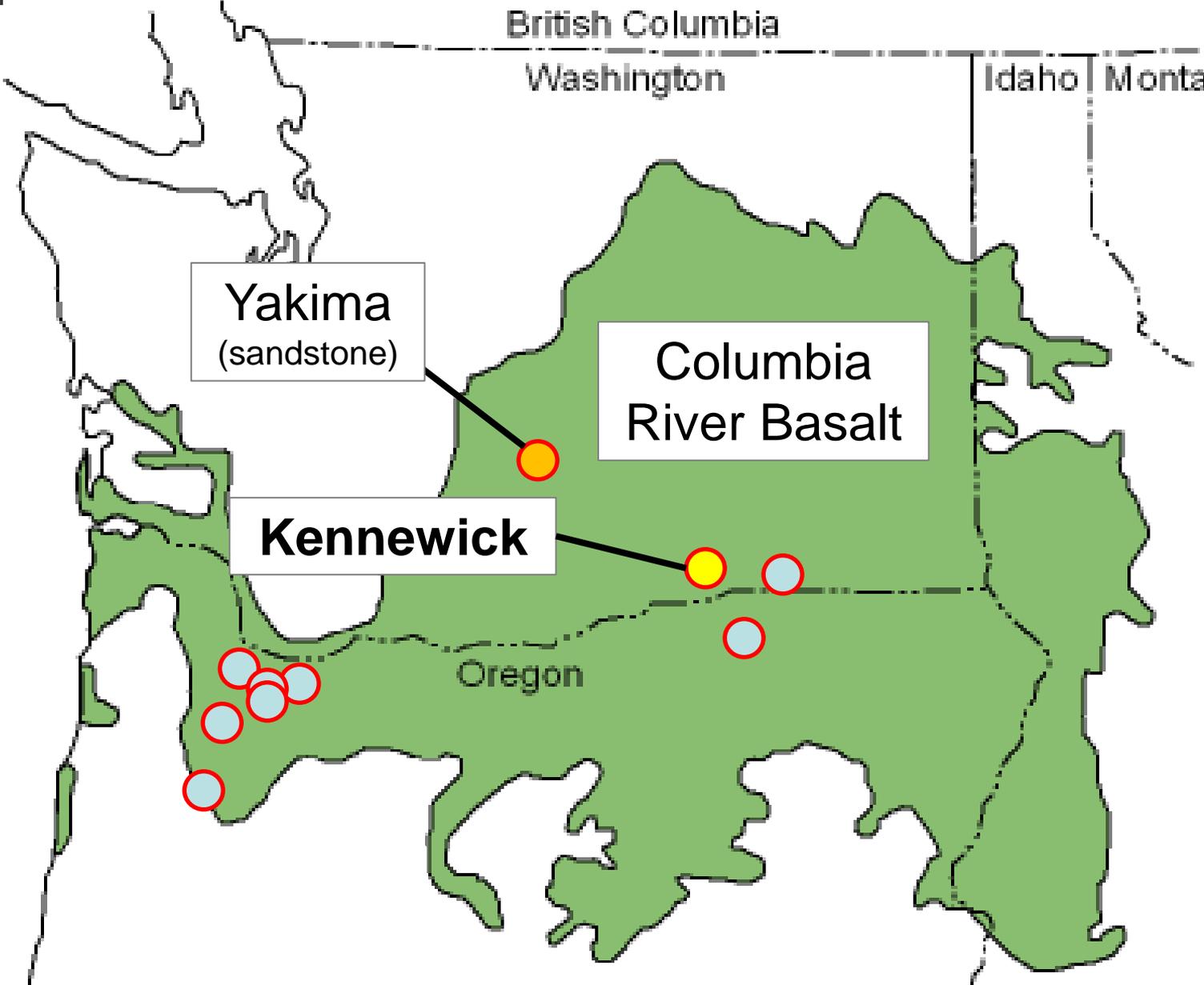
DBPs remain within safe drinking limits and naturally attenuate during storage

Drinking Water Compliance

- The only identified potential concern is potential release of arsenic from sulfide minerals (e.g., pyrite).
- Rigorous monitoring program scheduled to address:
 - SDWA (DOH)
 - DBPs (environmental – WAC 173-200)
 - Operational
 - Whole system diagnostics
- ASR regulatory water quality problems are well-known in the PNW.



ASR Projects within Columbia River Basalt Extents (Golder)



System Scale



- System scale is biggest concern for well clogging.



Sandstone



Fractured basalt

- System & well flushing key O&M program for ASR.



System Operations, Hydraulics

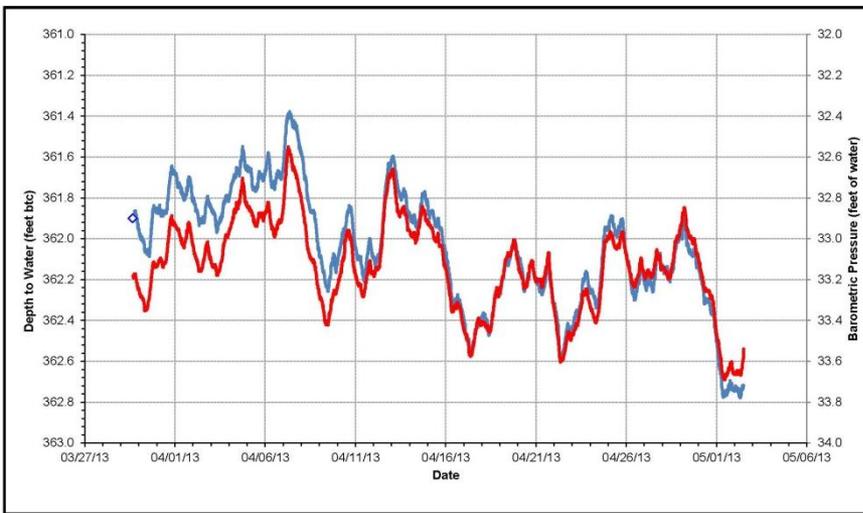
- Need to pump ~500 feet from Columbia River to drop into well.
- Need to pump ~400 feet out of well into system (i.e. pumping twice).
- Microhydropower may be considered in future wells.
- 5 Pressure zones – will better balance flow between zones (PRVs).
- ASR well will considerably ease peak booster loads.
- Improve distribution of sources, increase redundancy, reliability, emergency.
- 3 MGD per well expansion increments is good match for system demand growth (e.g., 1 well every 5 years).
- Can be used to meet storage requirements.

City Booster
Station



Recoverable Quantity - Do you get back what you put in?

- Recoverable quantity is a water right variable.
- Technical criteria based on water balance.
- Conceptual and computer simulation models are useful.
- Calibrated to pumping tests and long-term regional water level data.



LEGEND

- ASR-1 Depth to Water
- ◆ Manual Depth to Water
- Barometric Pressure



FIGURE 1
ASR-1 HYDROGRAPH



Recoverable Quantity - Sometimes

- Water that seeps out/leaks away is not recoverable.
- Recoverable quantity may decrease during storage.
- High recovery is expected in structurally-contained Columbia River Basalt systems (e.g., >90% estimated for Walla Walla; OR general default = 95%).

Recovery efficiency \neq Recoverable quantity
Water quality \neq water quantity

(poor water quality environments; e.g., Florida).

Summary

- **Kennewick needs new supply by 2023:**
 - System capacity, source distribution and water rights.
 - Instantaneous summer peaking and annual quantity.
- **New water available in winter (Quad city water right).**
- **ASR allows:**
 - Use of winter water right in summer.
 - Permitting sources in desirable balanced areas
 - Future expansion by 3 MGD / well.
 - Defer storage infrastructure.

- **Questions to be answered:**
 - Water quality.
 - Recoverable quantity.



Thanks and Appreciation Extended to Partners

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■ WA Dept. of Health



- Tom Justus, Regional Engineer
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■ HDR, Inc.



- Jay Decker, Project Manager
- Bruce Dudzik, Principal Engineer
- David Kuhns, Project Engineer

Thank You!



City of Kennewick ■

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- Gary Deardorff, Utility Program Mgr.
- Bob Hammond, City of Richland



Golder Associates

Golder Associates ■

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- Jennifer Renninger, Permitting
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