

How Small Water Providers Are Using ASR to Help Manage Supplies

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Ellen Svadlenak – GSI Water Solutions, Inc.

Larry Eaton – Summit Water Resources



Agenda

- Introduction
 - What is ASR and how does it work?
- Feasibility
 - Water availability, hydrogeologic conditions, project costs
- Case Studies
 - Orchard Heights, Lafayette, Cornelius, Liberty HS
- Summary and Conclusions

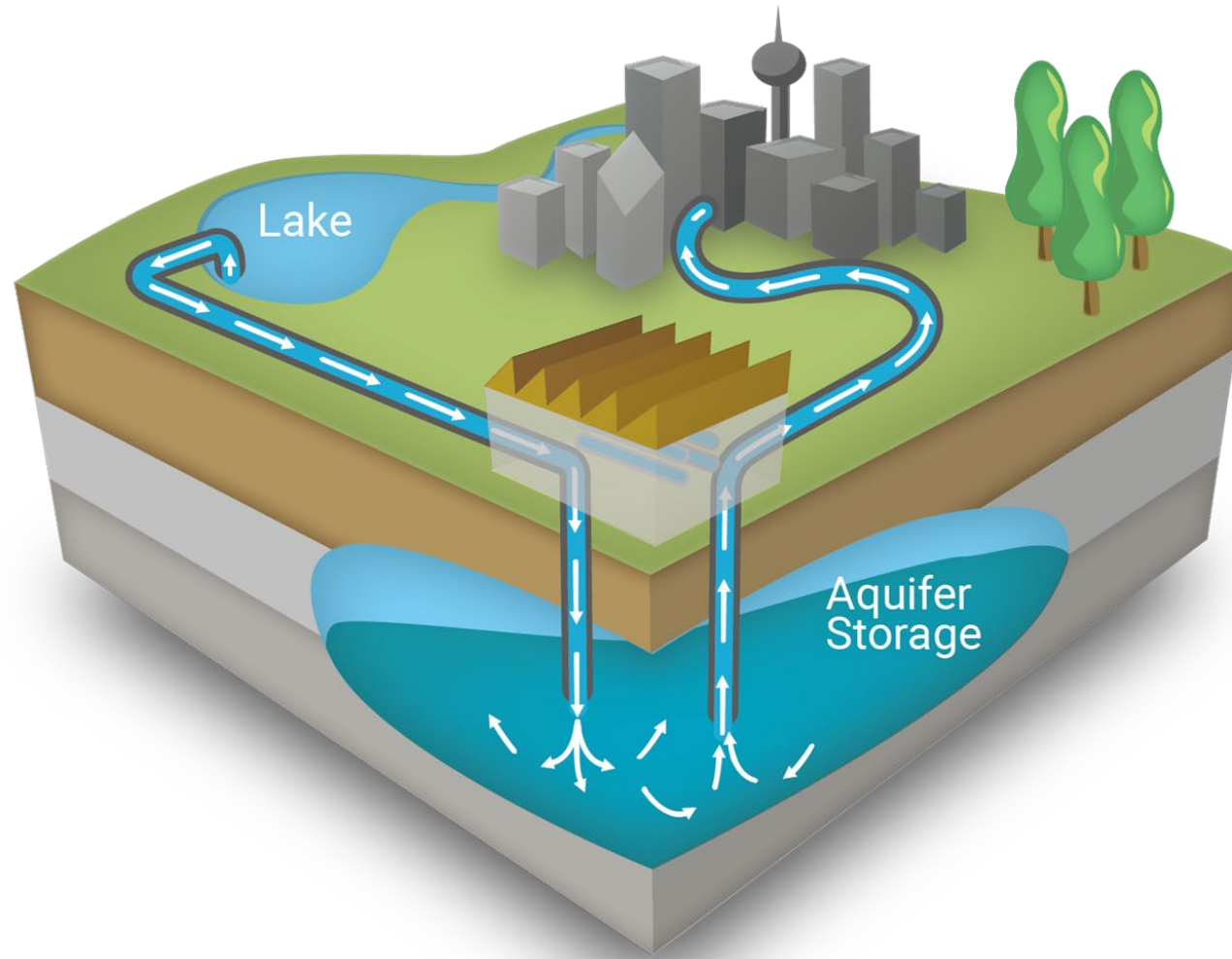
Aquifer Storage and Recovery

ASR is a water management tool which stores excess surface water underground, so it is available for later use as-needed.

What is
ASR?



Aquifer Storage and Recovery

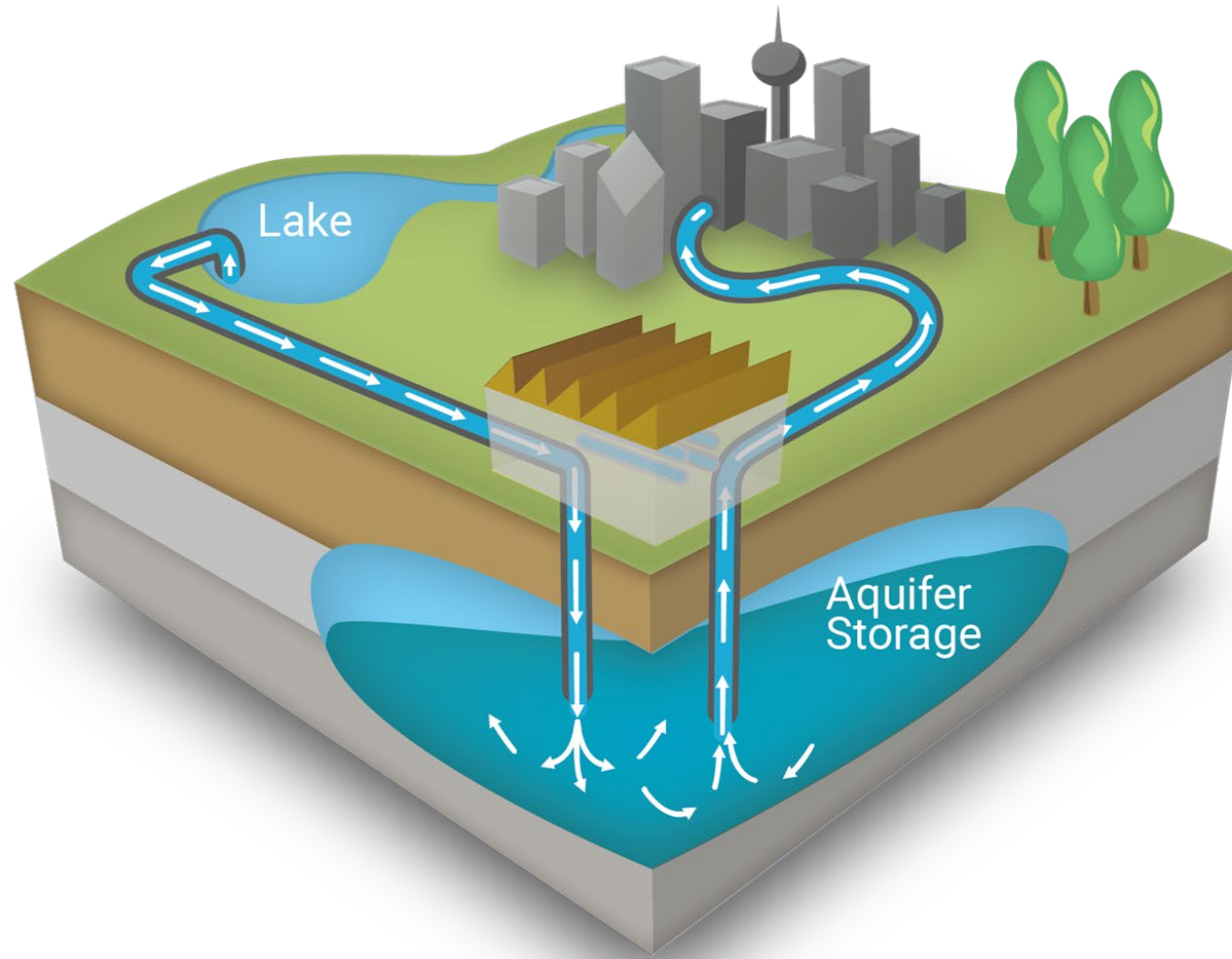


Winter (injection):

Water is collected and stored underground when precipitation is plentiful, and demands are low

How Does
ASR Work?

Aquifer Storage and Recovery

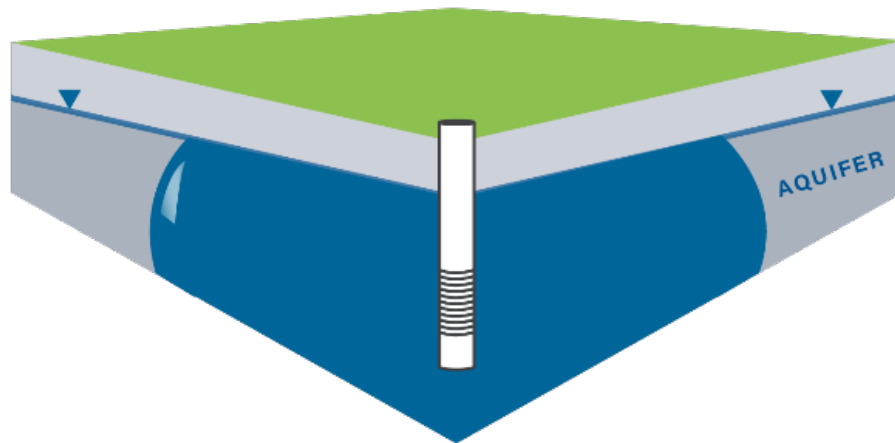


Summer (recovery):
Water is pumped out when demand is high and surface water sources are strained

How Does
ASR Work?

Water Storage Capacity

ASR Capacity =
50 to 250 MG



Storage Tank Capacity =
1 to 50 MG



Notes: ASR storage capacity depends on aquifer conditions and other factors.

ASR does not meet short-term flow needs like an aboveground tank, which is important to meet fire flow.

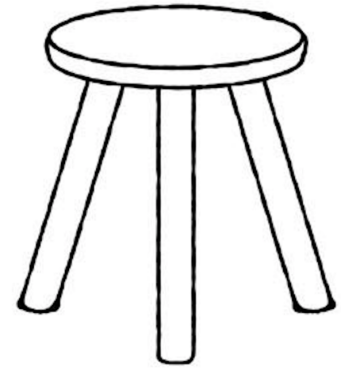
Large Scale vs Small Scale ASR

	Large Scale – (e.g. Beaverton)	Small Scale – (E.g. Cornelius, Lafayette)
System Design	Several Wells	Single Well
Well Diameter	> 10 inches	≤ 10 inches
Maximum Flow Rate	Injection: 675 – 1,050 gpm Recovery: 900 – 1,400 gpm	Injection: 40 - 200 gpm Recovery: 55 - 350 gpm
Storage Capacity	Up to 250 MG	Up to 80 MG (typically 10 – 30 MG)

ASR Feasibility

3 Components:

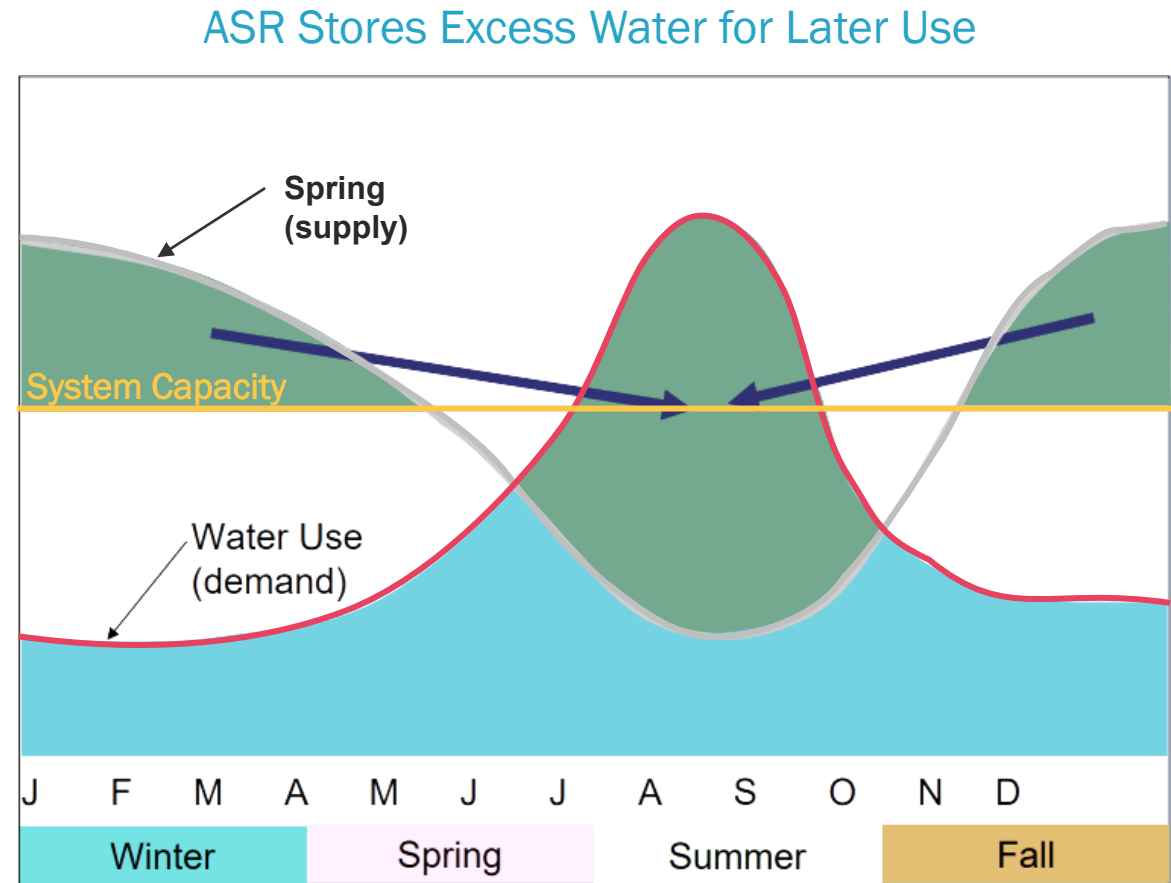
1. Source Water Availability
2. Hydrogeologic Feasibility
3. Economic Feasibility



Source Water Availability

Source Water Requirements:

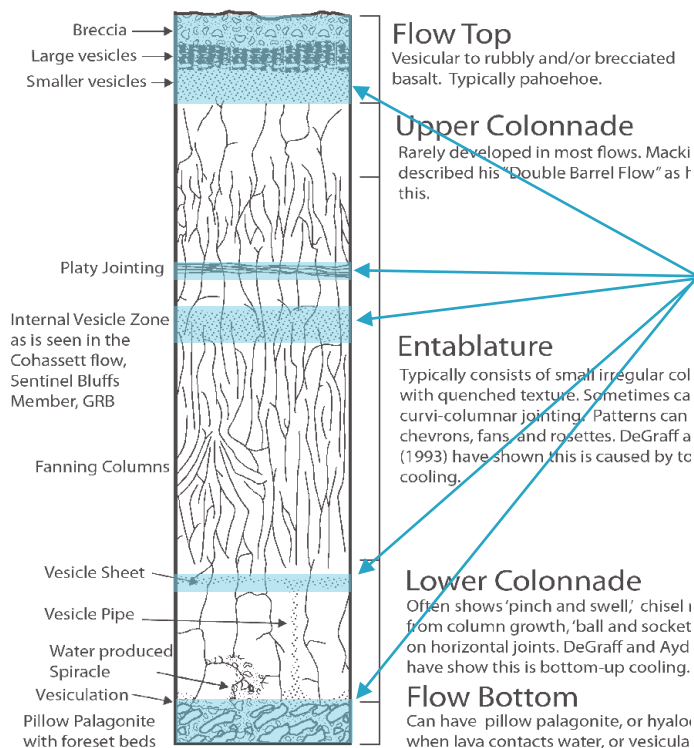
- Legal Availability
- Physical Availability



Hydrogeologic Feasibility

Hydrogeologic Requirements:

- Aquifer Suitable for Storage
- Compatible Water Chemistry



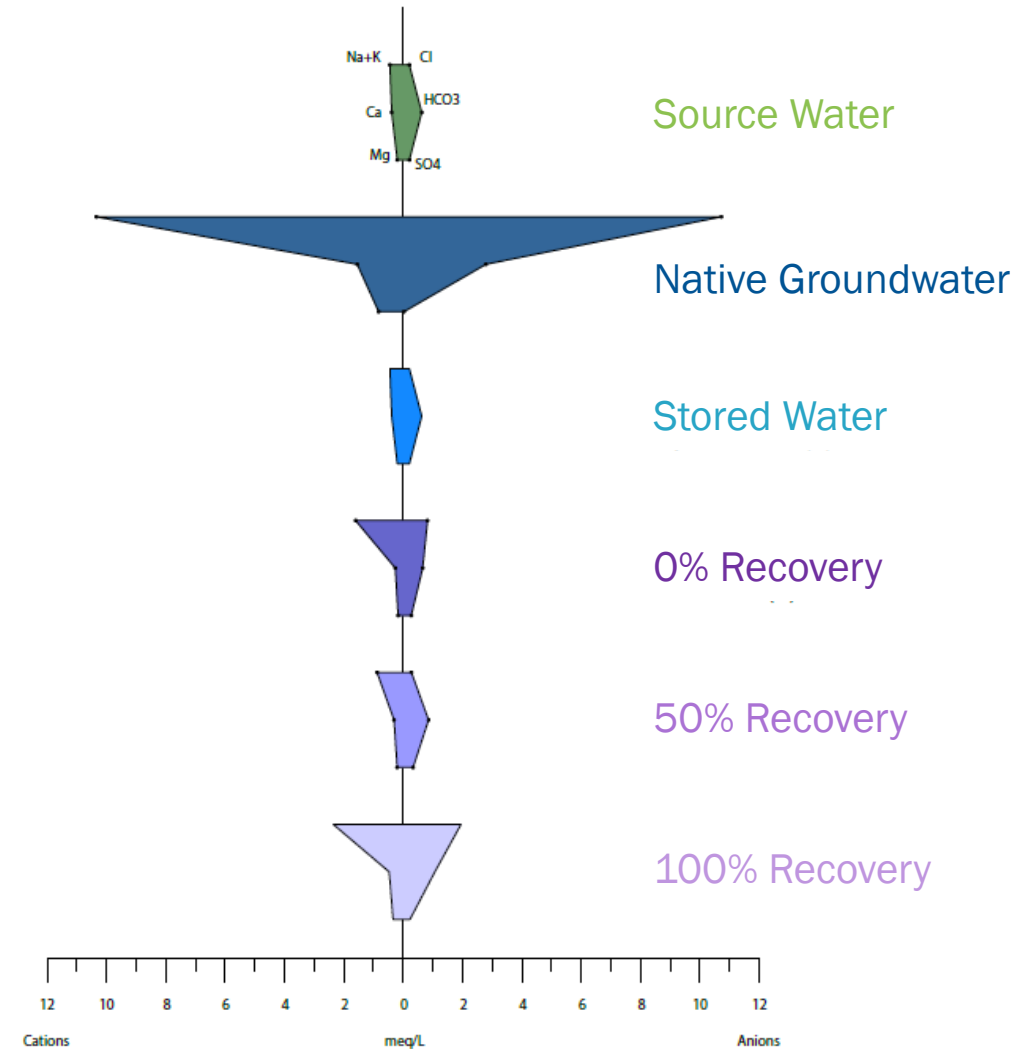
Water Bearing Zones



Hydrogeologic Feasibility

Hydrogeologic Requirements:

- Aquifer Suitable for Storage
- Compatible Water Chemistry



Economic Feasibility

Cost Considerations:

- Well Drilling and pump installation
- Permitting (ASR limited license)
- Monitoring requirements

However...

- Small-scale ASR may be less complex than a large-scale system
- Owner can perform own O&M
- Grant opportunities

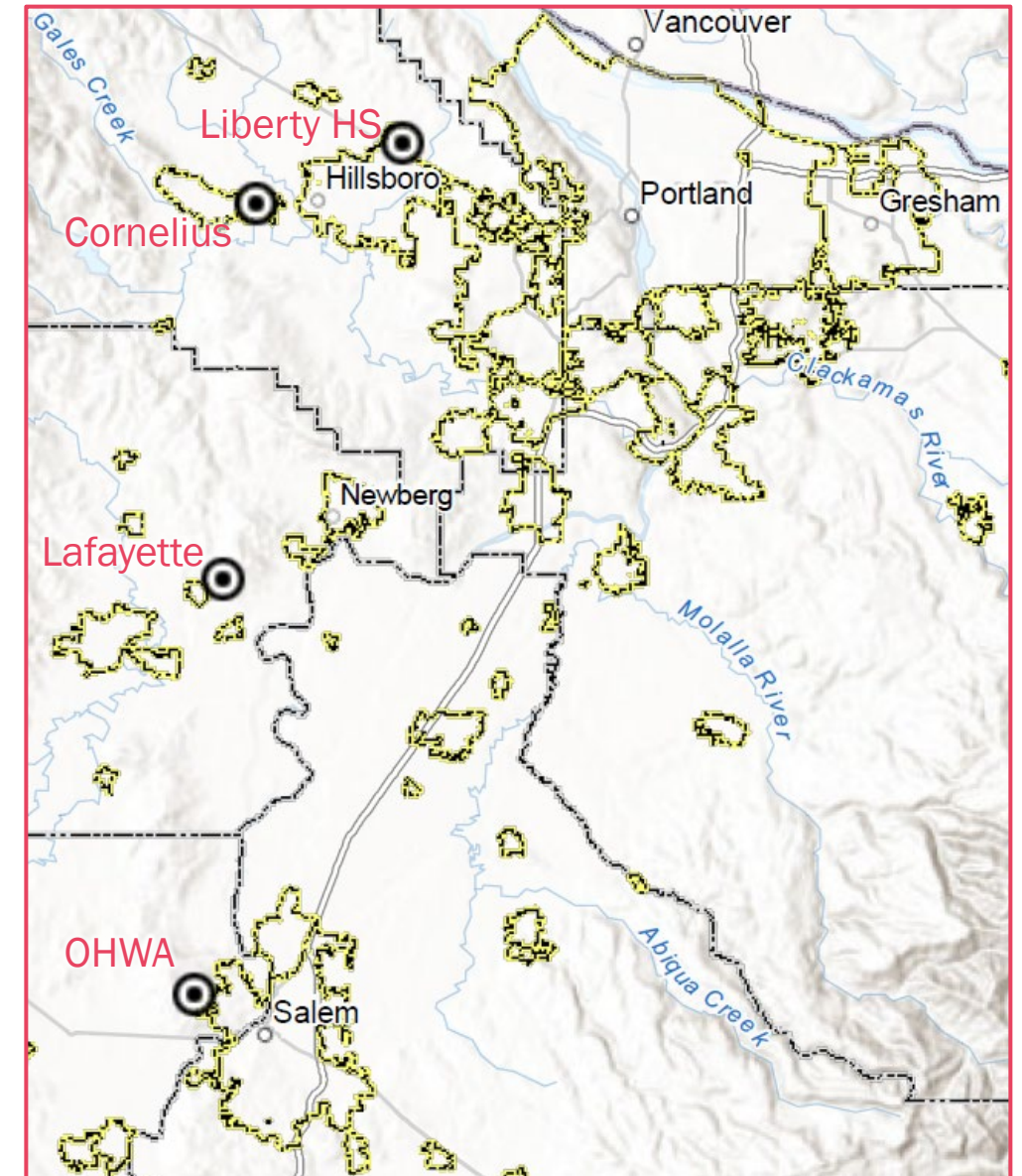
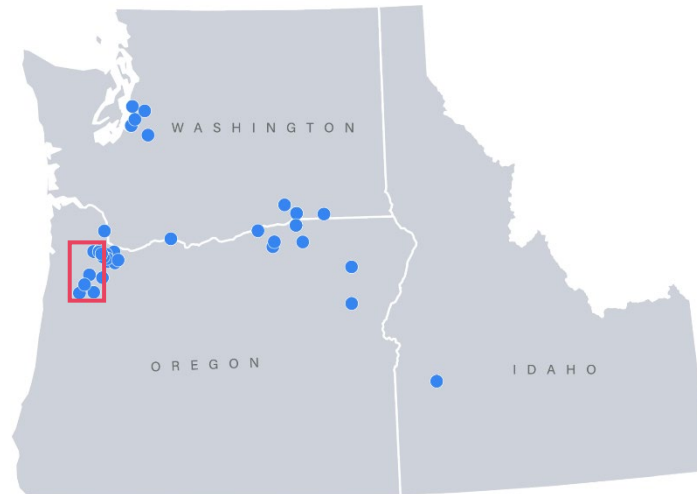
ASR Costs vs. Conventional Storage Capital Costs

Example	Total Storage Capacity	Total Cost	Cost per gallon
Tualatin Valley Water District Reservoir	8 MG	\$10 million	\$1.25
City of Cornelius ASR	80 MG	\$2.7 million	\$0.03

Small-Scale ASR Systems

Examples:

- Liberty High School
- Orchard Heights Water Association
- City of Lafayette
- City of Cornelius



Liberty High School

Drivers:

- Not able to secure a groundwater right for the school well
- Service development charge (SDC) for larger line for irrigating new athletic fields was cost prohibitive

Implementation:

- Retrofitted an existing low-yield well for ASR



Liberty High School

Operation:

- Injecting potable water at 40 gpm
- No water treatment
- Recovered water is used to irrigate sports fields
- Permitted system – lower cost

Maximum Volume Stored:
21 MG (2014)



Orchard Heights Water Association

Driver:

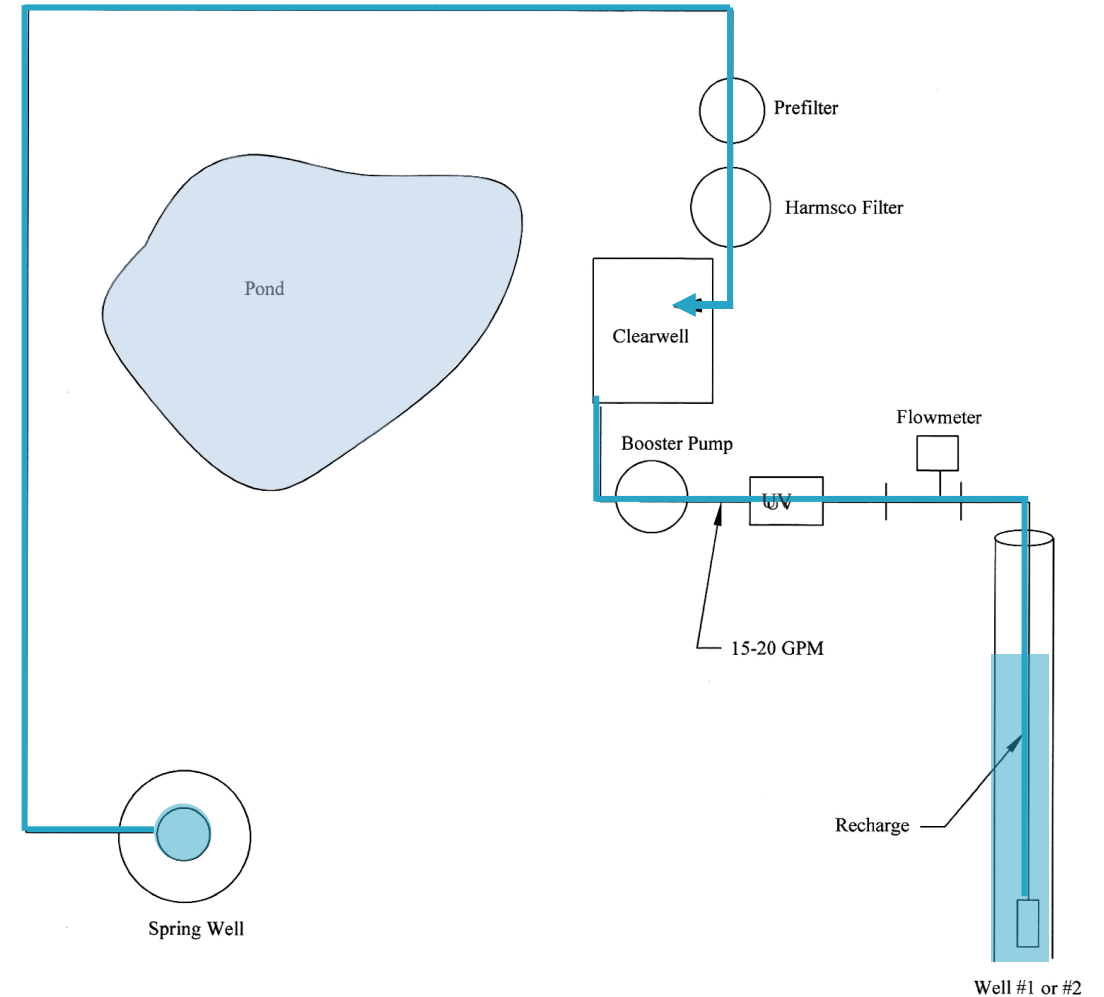
- Meet increasing summertime demands

Implementation:

- Would store treated water from a nearby spring at Well #1 or Well #2 for later recovery during the summer.

Outcome:

- Spring flow is variable and not well documented
- Permitting, infrastructure, and staffing costs are prohibitive



Orchard Heights Water Association

Driver:

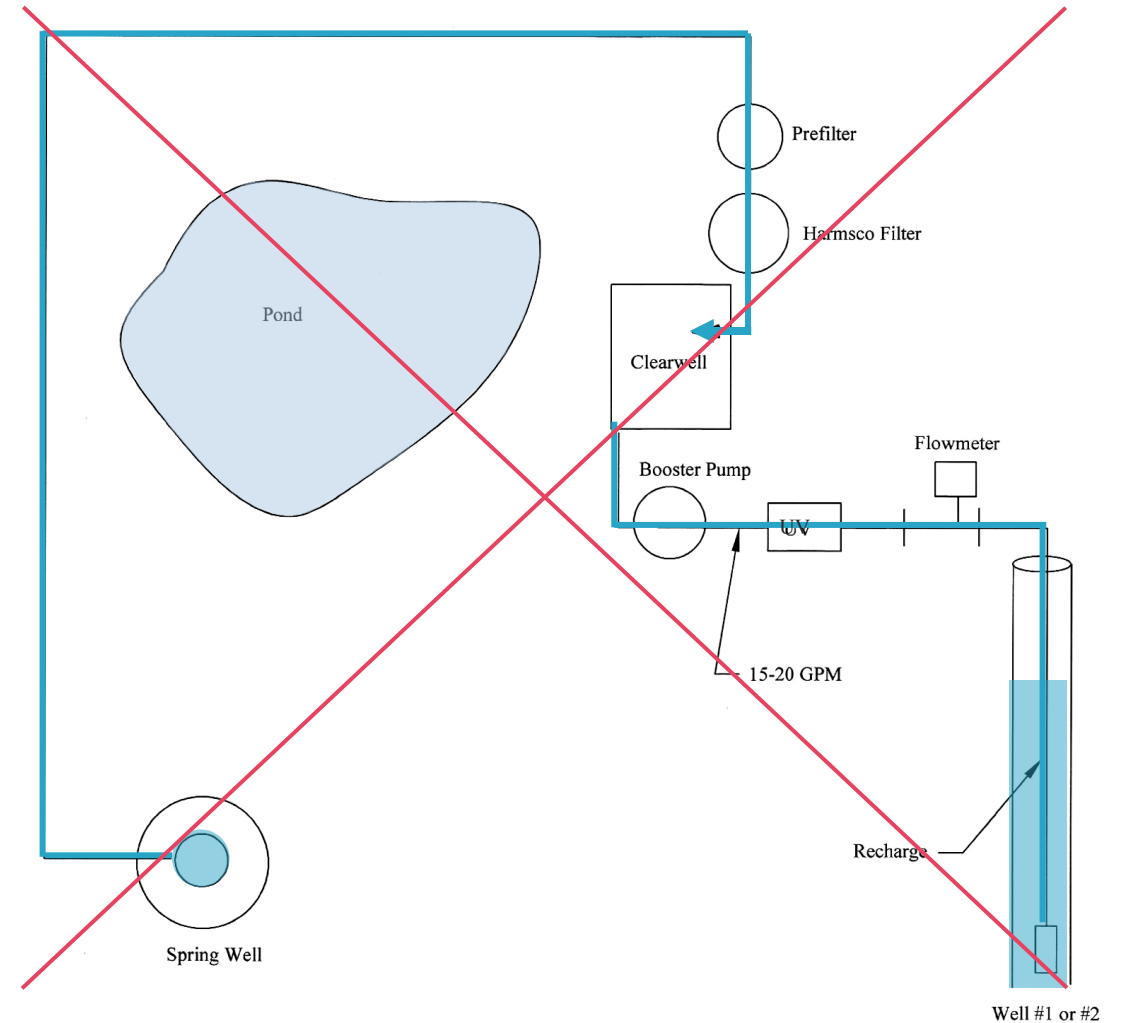
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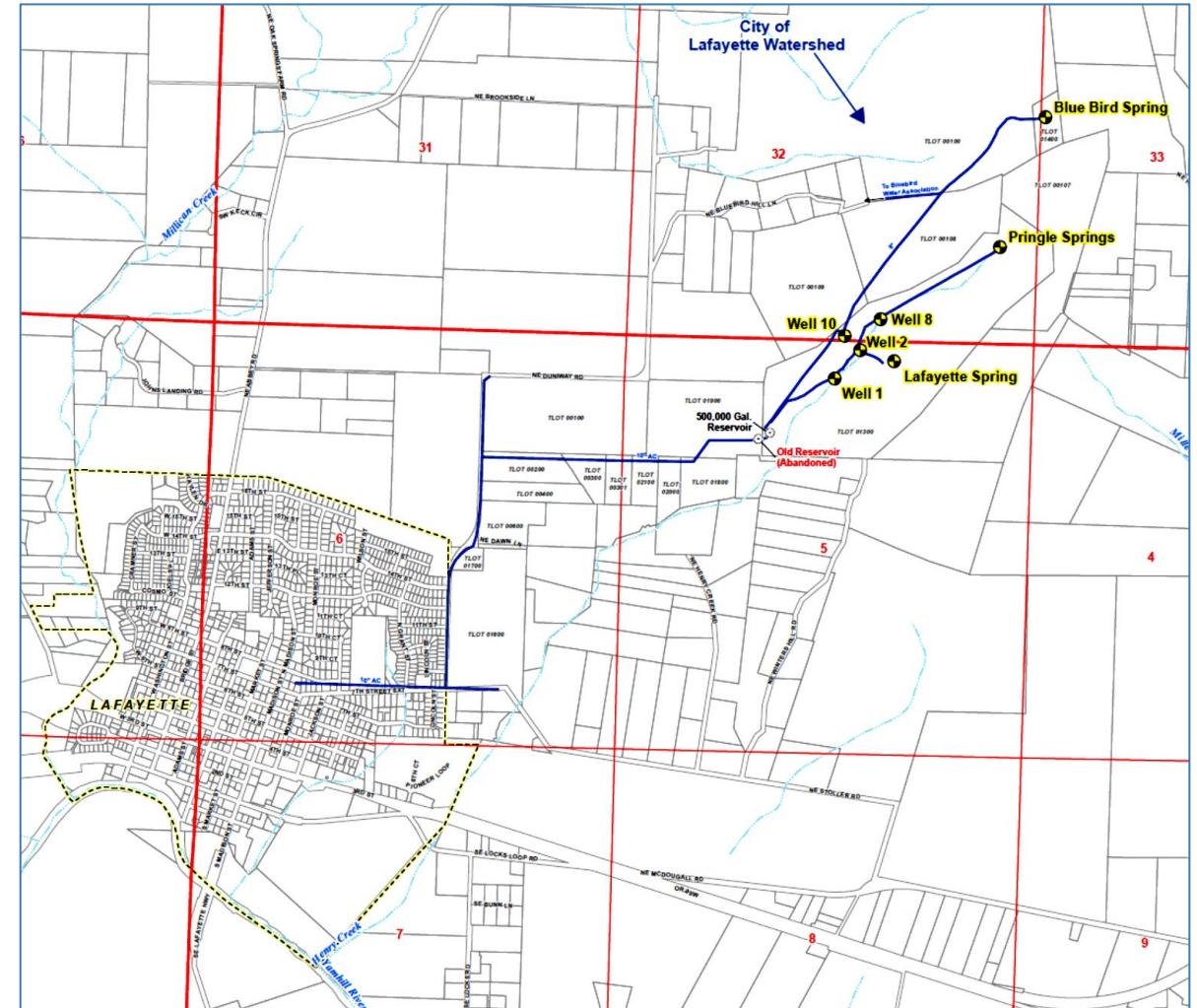
City of Lafayette

Driver:

- Capture excess spring flow in winter
- Offset declining GW levels

Implementation:

- City retrofitted existing Well 10
- Has been operating since 2011



City of Lafayette

Operation:

- Recharge volume depends on spring flow
- Source water is not chlorinated
- Option to recover additional water from Well 10 using a native groundwater right

Maximum Volume Stored: 22 MG (2019)

ASR Well (Well 10)

- 6-inch diameter
- 340 feet deep
- Sealed to depth of 50 feet
- Equipped with flow control valve



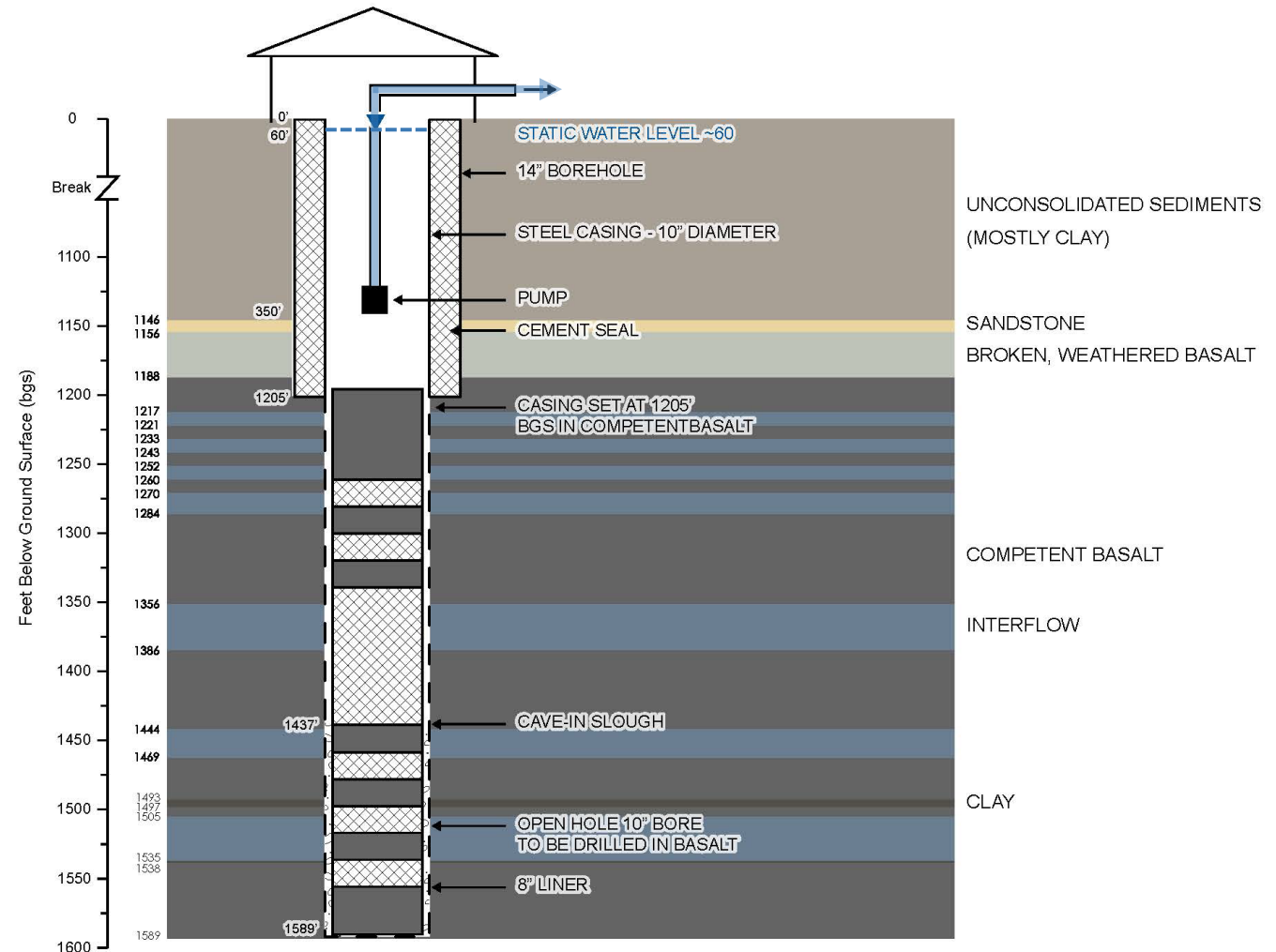
City of Cornelius

Driver:

- Need for additional in-town storage

Implementation:

- Grant funded test well
- Less expensive than a new above ground reservoir



City of Cornelius

Operation:

- Injecting chlorinated water under pressure
- Leaves some water in the well each cycle as a buffer between injected water and native groundwater

Maximum Volume Stored:
65 MG (2021)



Summary and Conclusions

Feasibility depends on a variety of factors:

- Water Availability
- Hydrogeology
- Project Cost

Small ASR Project Comparison

Feasibility	Liberty HS	OHWA	Lafayette	Cornelius
Source Water Availability	✓ Treated surface water (purchased)	✗ Spring source unreliable	✓ Untreated Spring Water (gravity fed)	✓ Treated surface water (purchased)
Hydrogeologic Conditions	✓ Existing well in CRBG	✓ Existing well in CRBG	✓ Existing well in CRBG	✓ New well in CRBG
Economic Feasibility	✓ Retrofit existing well	✗ Retrofit existing well ✗ Upgrade treatment system	✓ Retrofit existing well	✓ Grant funded new well
Results:	✓ Able to meet irrigation needs ✓ Recovering cooler, better-quality water	✗ N/A	✓ Improved groundwater levels ✓ Less lost/wasted water	✓ Increased in-town storage ✓ Recovering cooler, better-quality water

Summary and Conclusions

Benefits of Small-Scale ASR

Seasonal

Resiliency

Irrigation

In-Town Storage



Water Quality

Cost Savings

Groundwater Levels

Meet Demands

Summary and Conclusions

ASR is **Adaptable** and **Scalable**

Thank You

(Questions?)