



Aquifer Storage & Recovery and Artificial Recharge in the State of Oregon

Oregon Dept. of Human Services
Oregon Dept. of Environmental Quality
Oregon Dept. of Water Resources



State of Oregon
Department of
Environmental
Quality



Outline

1. Intro to underground storage
2. Administrative processes
3. Feasibility: Key factors
4. Oregon Case Studies



What are the Benefits of Underground Storage?

- Allows capture and storage of water in winter when surface water is abundant.
- More water will be available for summer use and population growth.
- Improves use of declining aquifers.
- May increase base flow to streams.

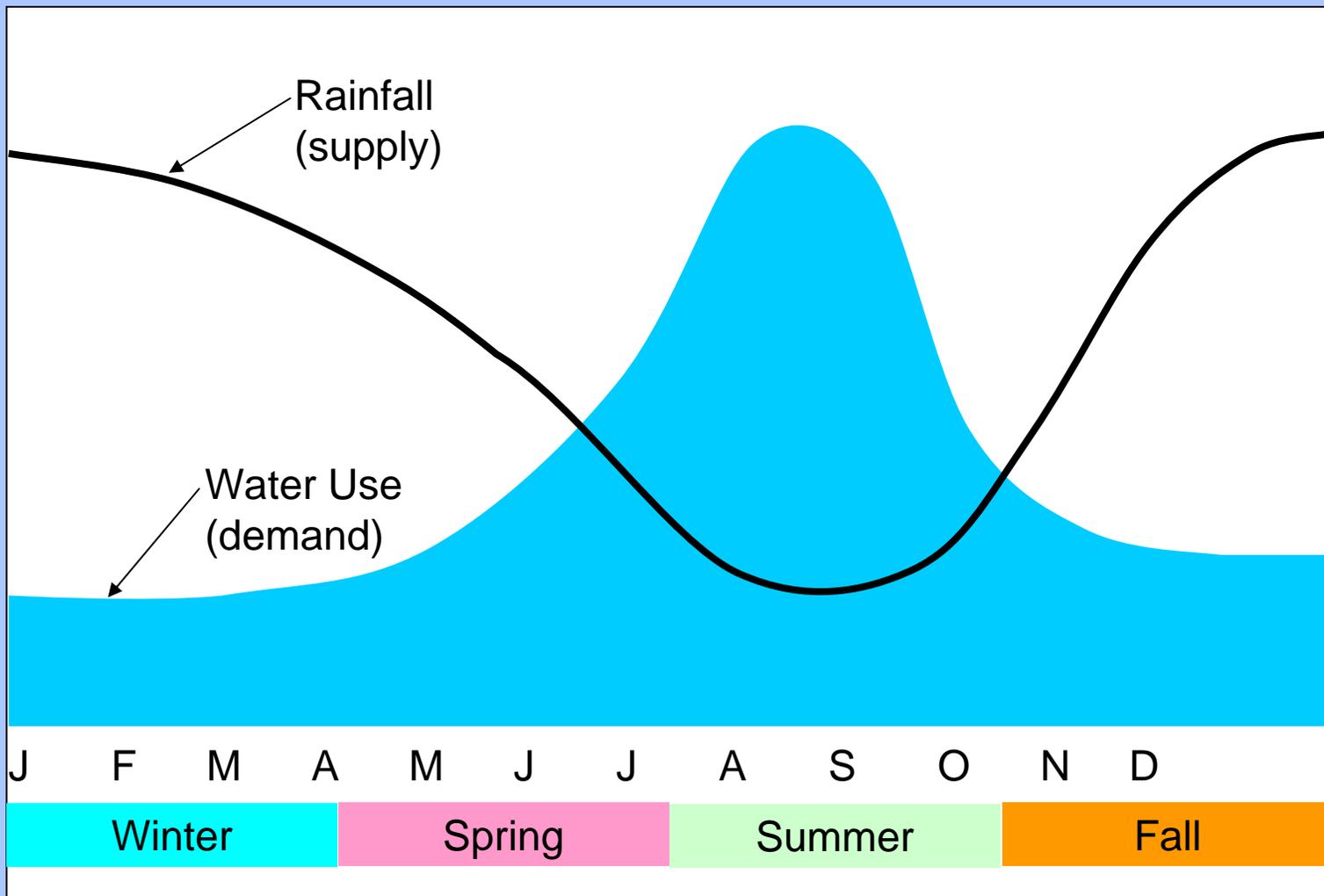


What are the Benefits of Underground Storage?

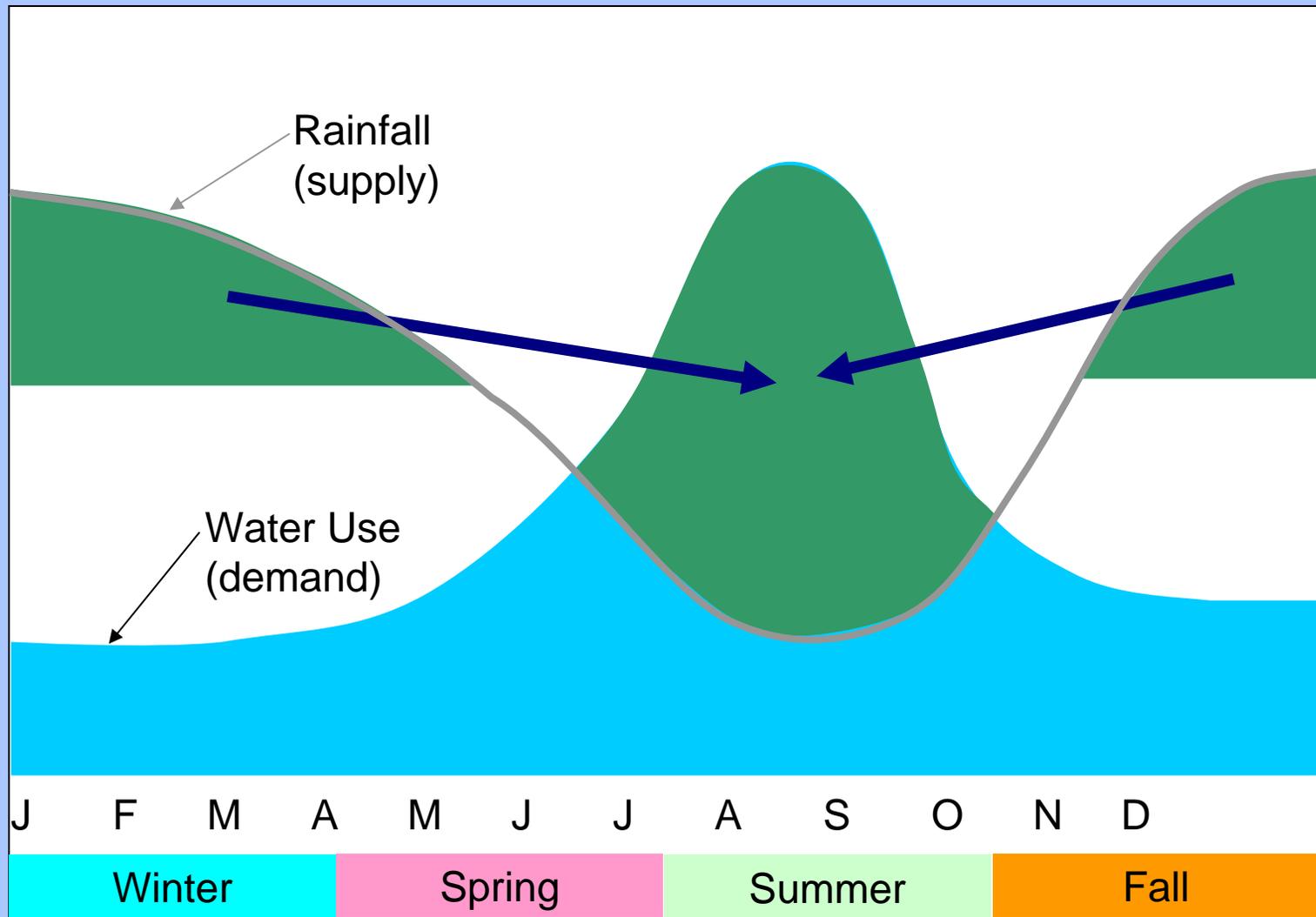
- May cause less environmental impact or use less surface area than reservoirs.
- Lower cost than surface storage.
- Helps plan for expected population growth and climate change projections that put a premium on the need for water storage
- Provides supplemental supply



What are the Benefits of Underground Storage?

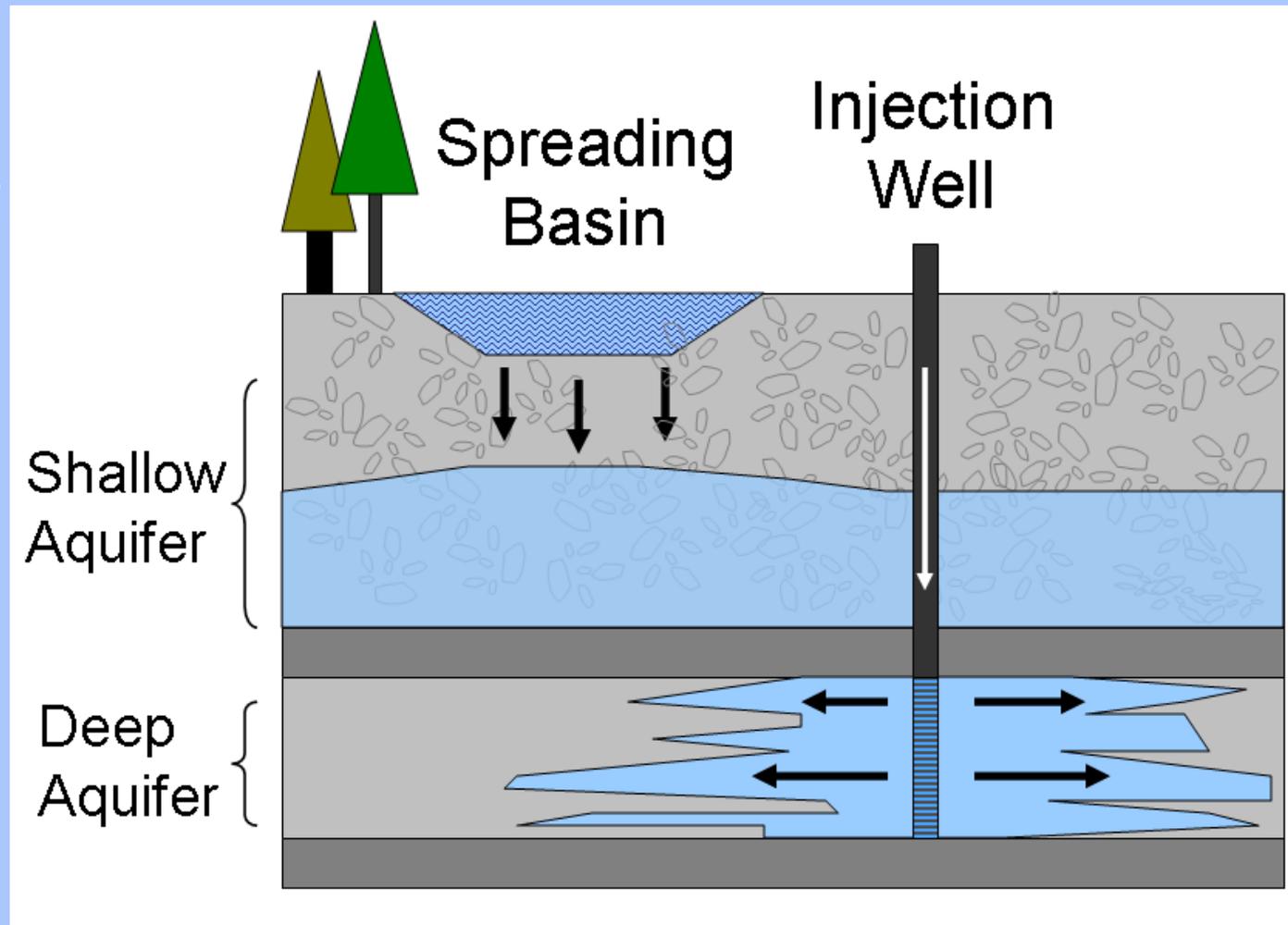


What are the Benefits of Underground Storage?



Methods of Underground Storage

- Infiltration
- Injection



Questions?





Underground Storage Administrative Process: an exercise in collaboration

Two Administrative Processes

- Aquifer Storage and Recovery (ASR)
- Artificial Recharge (AR)

Choose the one that best meets your needs.



Key Differences between AR & ASR

| Category | Artificial Recharge (1961) | Aquifer Storage and Recovery (1995) |
|----------------------------|--|--|
| Water Use | Primarily irrigation, industrial | Primarily drinking water |
| Recharge Method | Seepage systems, Injection wells | Injection wells only |
| Water Quality | Recharge water cannot impair or degrade ground- water quality | Recharge water must meet drinking- water standards |

Key Differences between AR & ASR

| Category | Artificial Recharge (1961) | Aquifer Storage and Recovery (1995) |
|--|---|--|
| Water- Rights | Permits required to appropriate source water and to pump recharged ground water | Can use existing rights to store and recover the water |
| Governing Statutes /Rules | ORS 537.135 OAR 690-350-0120 | ORS 537.531 to 537.534 OAR 690-350-0010 to 690-350-0030 |

Role of State Agencies

Authorizations are issued by Oregon Water Resources Department in collaboration with:

- Oregon Department of Environmental Quality
- Oregon Department of Human Services
- Oregon Department of Fish and Wildlife

Role of State Agencies



Oregon Water Resources Department:

- Regulates water rights for projects
- Coordinates review, comments, conditions from sister agencies
- Issues Limited Licenses and Permits
- Reviews annual reports

Role of State Agencies



Oregon Department of Environmental Quality

- Ensures projects meet Underground Injection Control Standards (UIC)
- Ensures that projects meet groundwater quality protection rules, including anti-degradation policy
- Issues permits for AR projects if DEQ deems necessary
- Reviews annual reports

Role of State Agencies

Oregon Department of Human Services

- Sets drinking water quality requirements for injected and recovered water
- Evaluates well construction/infrastructure and application materials
- Reviews annual reports



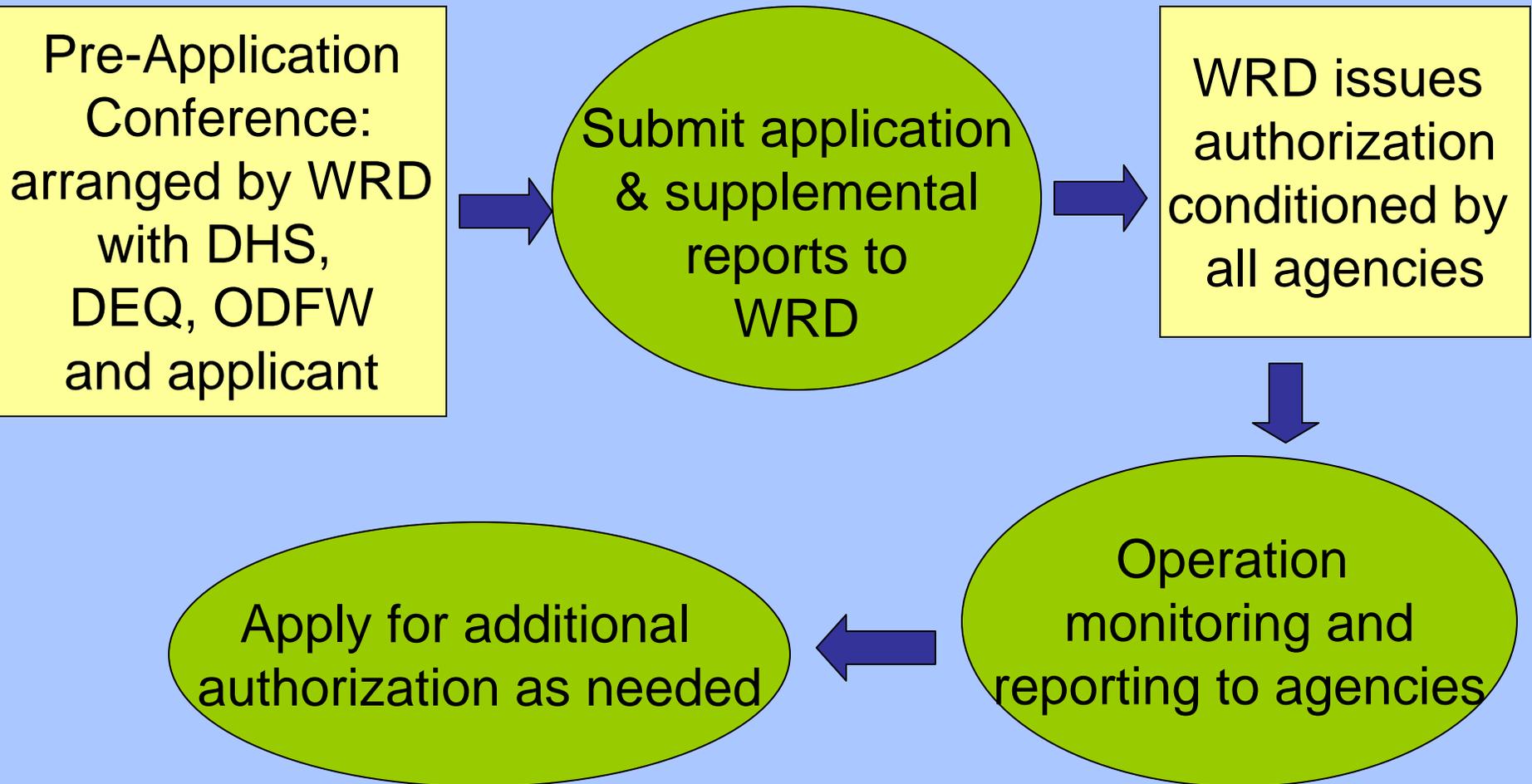
Role of State Agencies

Oregon Department of Fish and Wildlife

- Consults with OWRD on stream flow requirements that protect aquatic and fish life



Generalized Application Process for ASR and AR





Questions?



Feasibility: Will underground storage work for us?

What Kinds of Questions Should Interested Communities Ask?

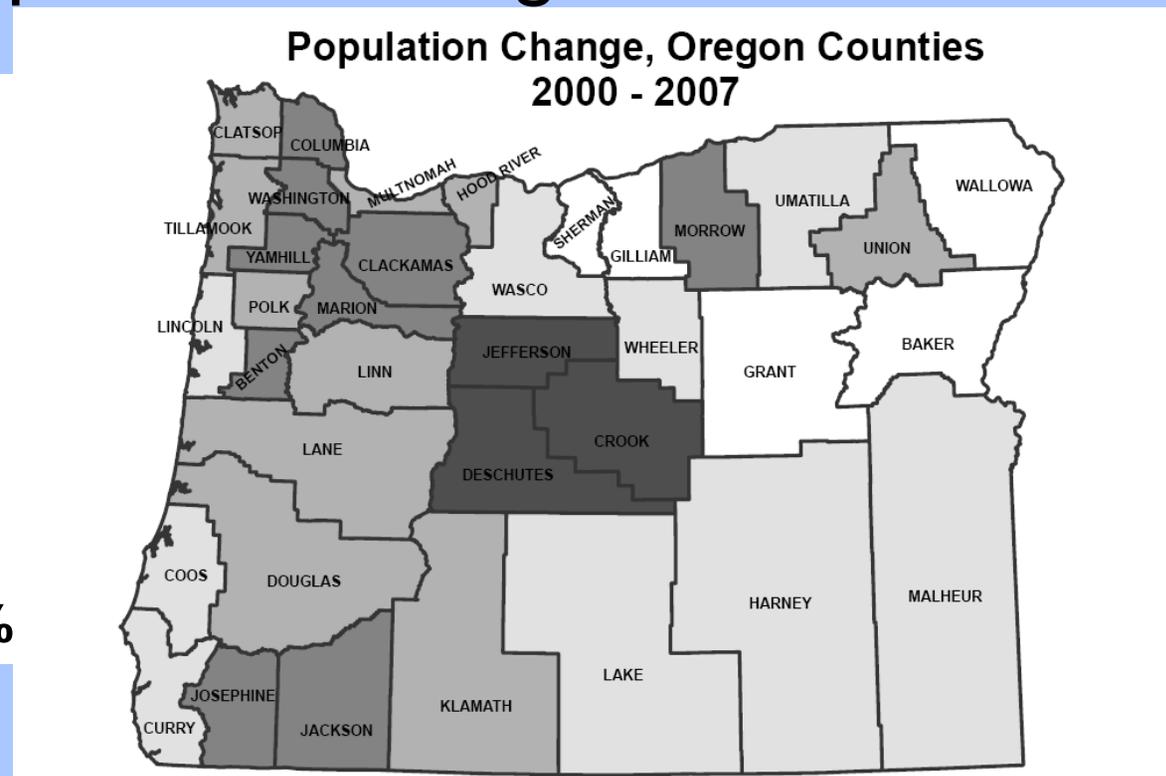
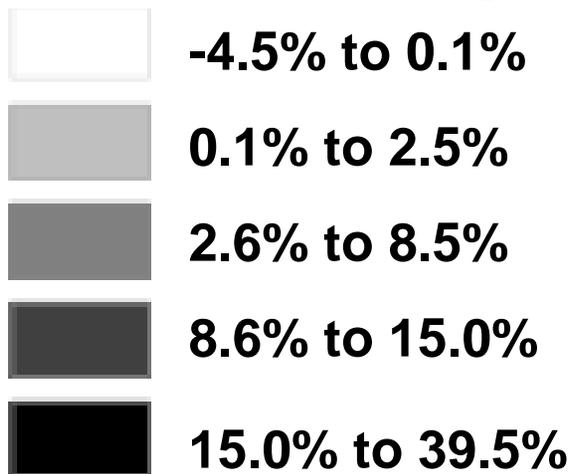
- What are our future water needs?
- Is water available for underground storage?
- Do we have a suitable hydrogeologic setting for underground storage?
- Are the appropriate water rights in place?
- What are the analysis and implementation costs?



Feasibility: What are our future water needs?

- How will population change affect need?

Percent Change



The U.S. Census Bureau projects a population increase of one million people in Oregon by 2030.

Feasibility: What are our future water needs?

- How will climate change effect water supply?
- Planning: community water system master plan

Feasibility: Water Availability in Oregon

- In general, there is more water available during the winter months than in summer months, when demand is highest.



Feasibility: Water Availability in Oregon

- Access surface water availability on OWRD web site, search by basin and stream name to find month by month report:

Water Availability Analysis

CLATSKANIE R> CLATSKANIE SL- AT MOUTH
NORTH COAST BASIN

Water Availability as of 8/20/2008

Watershed ID #: 70945
Date: 8/20/2008

Exceedance Level: 80%
Time: 10:52 AM

Water Availability Limiting Watersheds Complete Water Availability Analysis

Water Availability
Select any Watershed for Details

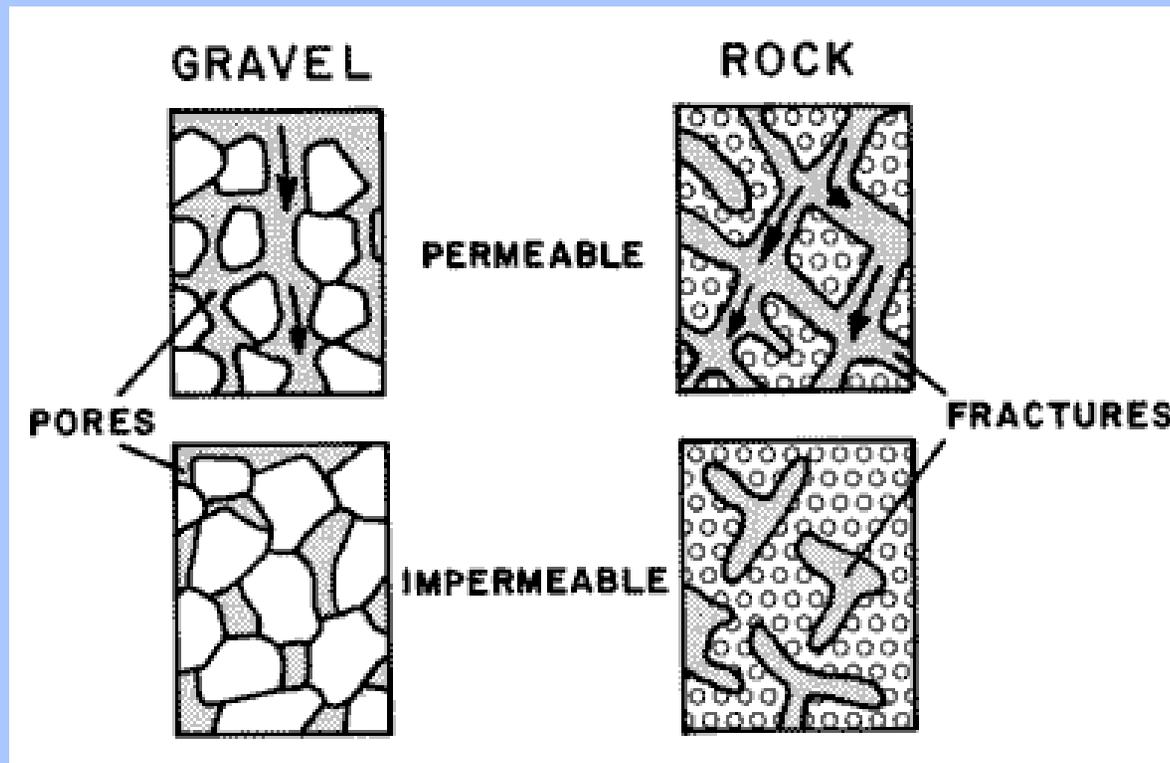
| | Nesting Order | Watershed ID # | Stream Name | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Sto |
|--------|---------------|----------------|---------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Select | 1 | 70945 | CLATSKANIE R> CLATSKANIE SL- AT MOUTH | Yes | Yes | Yes | No | Yes | No | Yes |

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Feasibility: What Hydrogeologic Features Influence Suitability?

- Ability of the aquifer to accept water
- Ability to retain water
- Sufficient storage to reach economy of scale
- Favorable aquifer boundary conditions

Feasibility: What Hydrogeologic Features Influence Suitability?

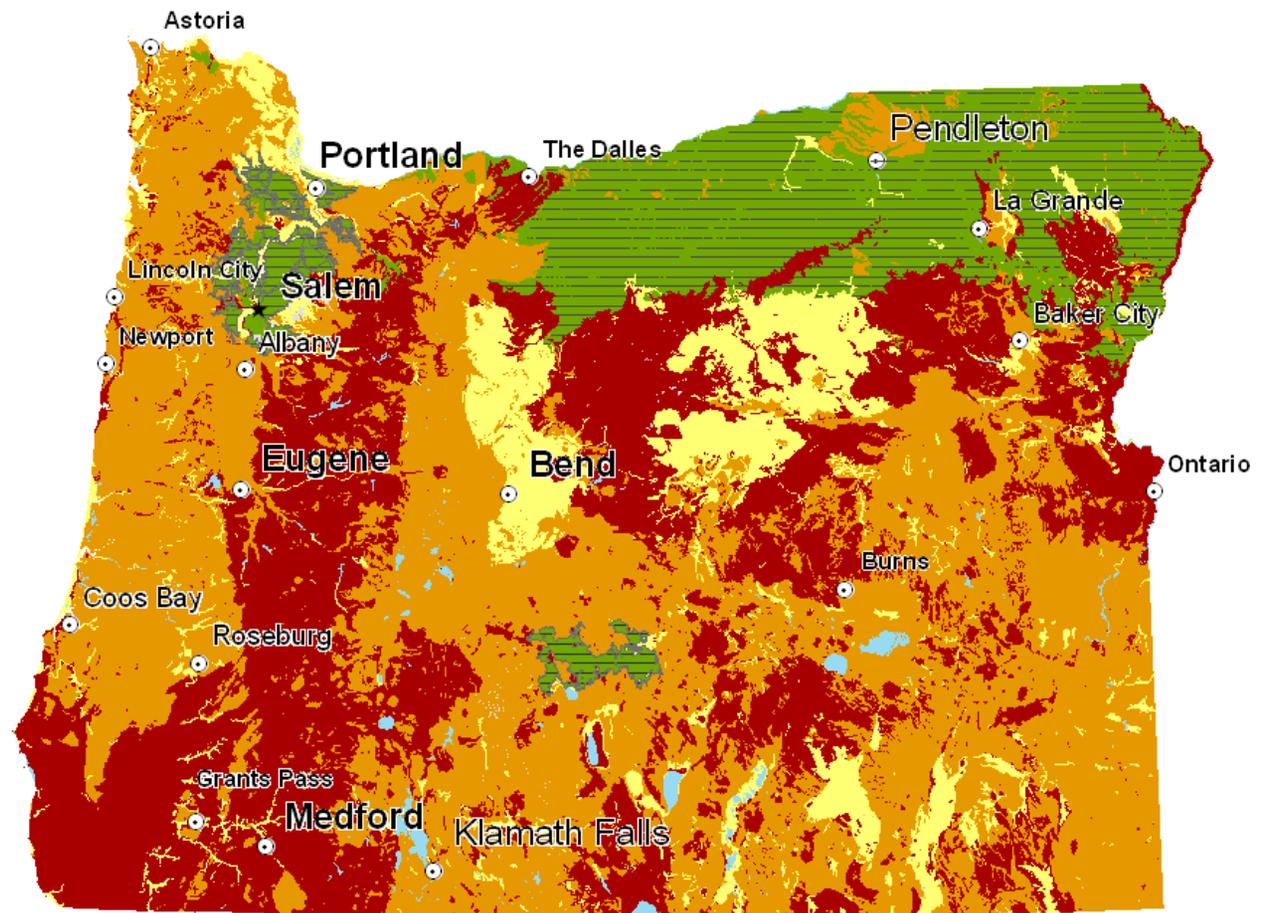


unconsolidated vs. fractured vs. layered volcanics

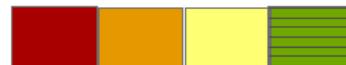
Feasibility: Hydrogeologic Suitability

- WRD staff are evaluating geology across the state for the physical ability to store water: results on the web in July 2009

Geologic Suitability for Underground Storage



Less Storage



More Storage

Feasibility: Cost vs. Benefit

- Costs are lower than for surface reservoirs
- Few environmental impacts
- Minimal land requirements
- Lower construction costs



Feasibility: Cost vs. Benefit

But nothing is free... Must factor in costs of

- Feasibility Study: site characterization and monitoring
- Water treatment: filtration and disinfection
- Infrastructure improvements: pumping systems, pipes, wells
- Ongoing maintenance and monitoring

Feasibility: Infrastructure

- Water treatment (esp. for ASR) and/or water quality monitoring equipment
- Canals and pipelines to move water from source to recharge site
- Monitoring wells upgradient and downgradient of recharge site



Feasibility: Water Quality Concerns

- Must meet water quality standards before recharge, during storage and at time of recovery
- Source water and ambient groundwater must be compatible



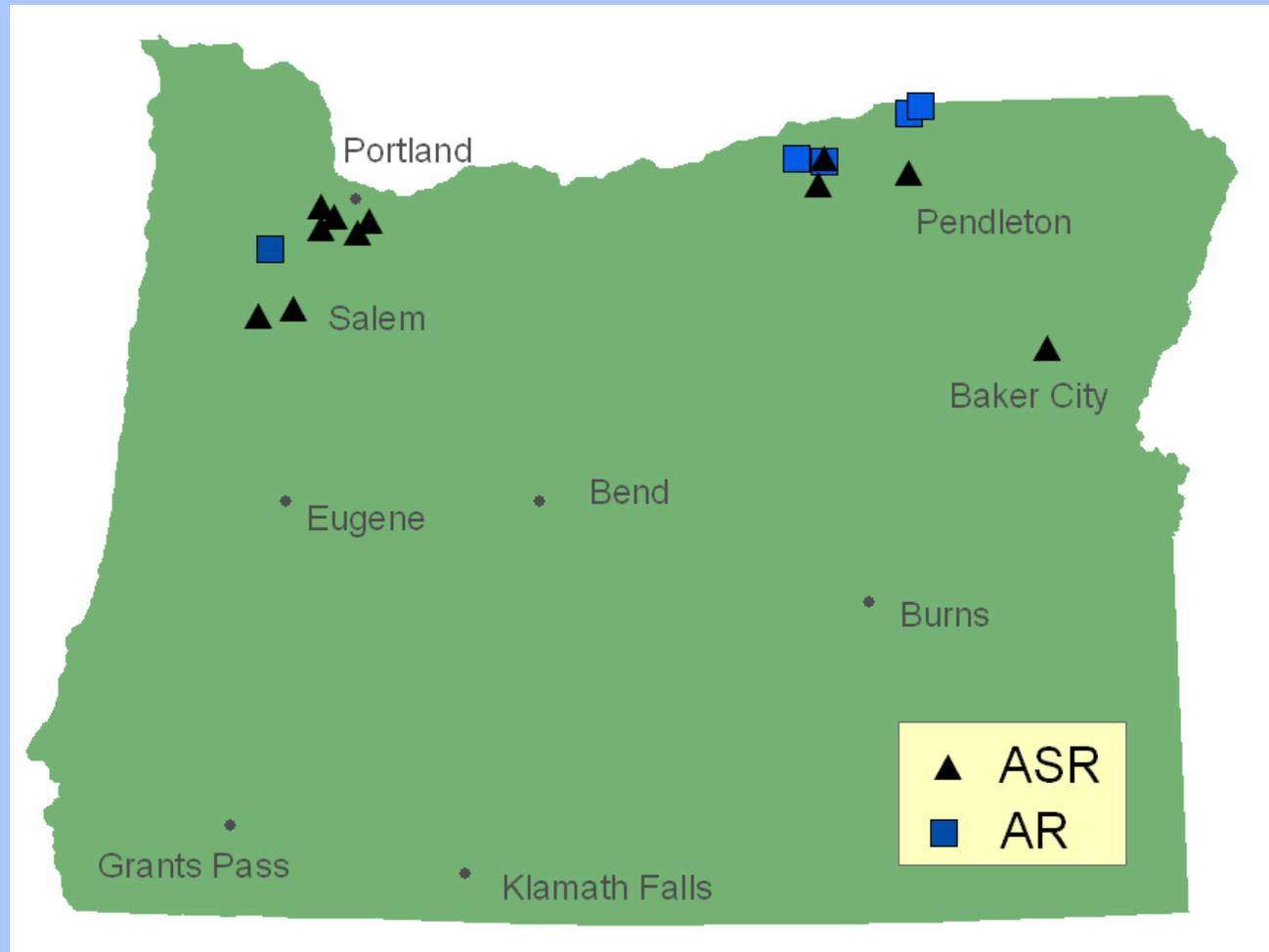
Questions?



Oregon Experience with underground storage: Case Studies

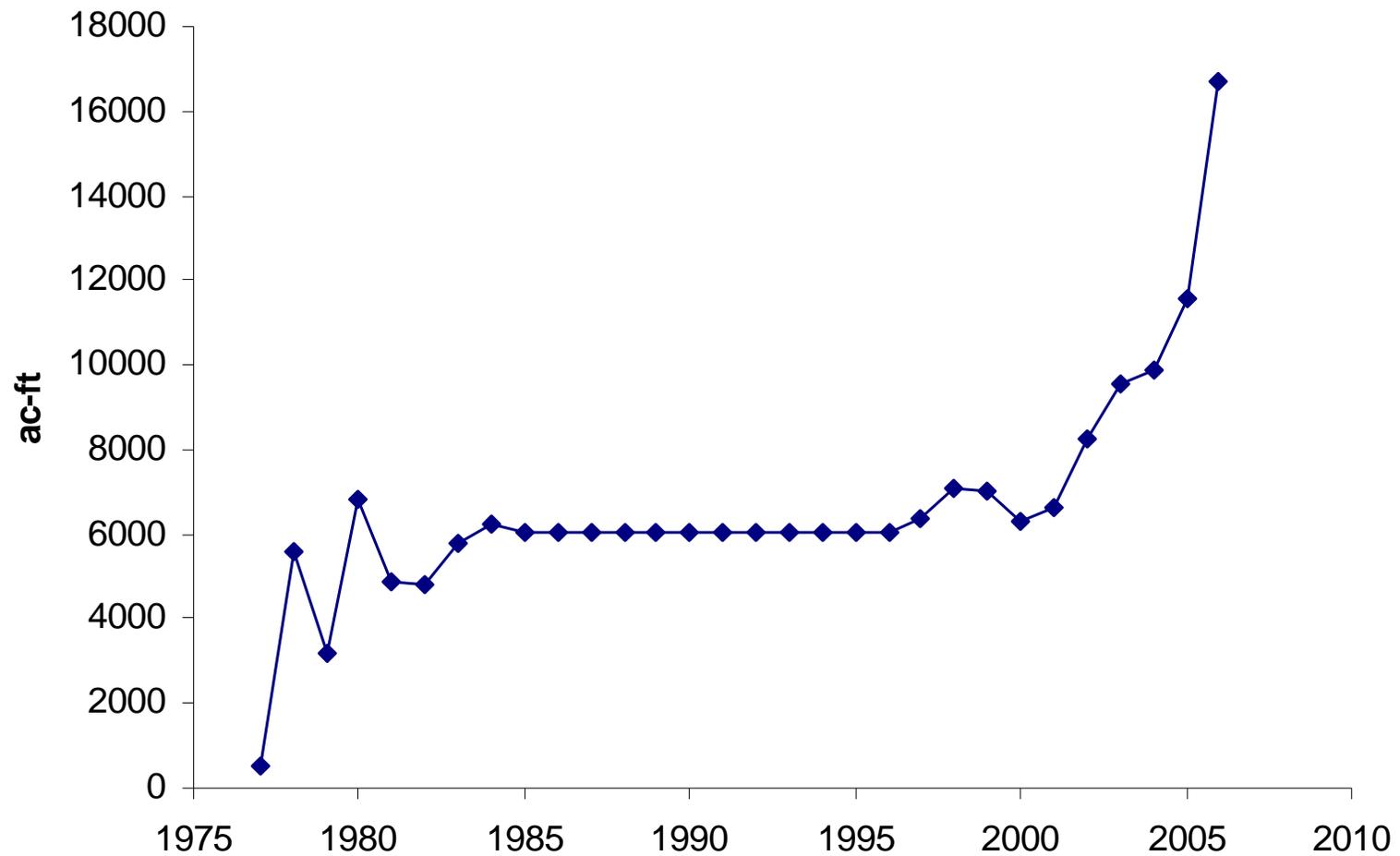
Status of ASR/AR in Oregon

- Active ASR sites = 11
- Active AR sites = 5

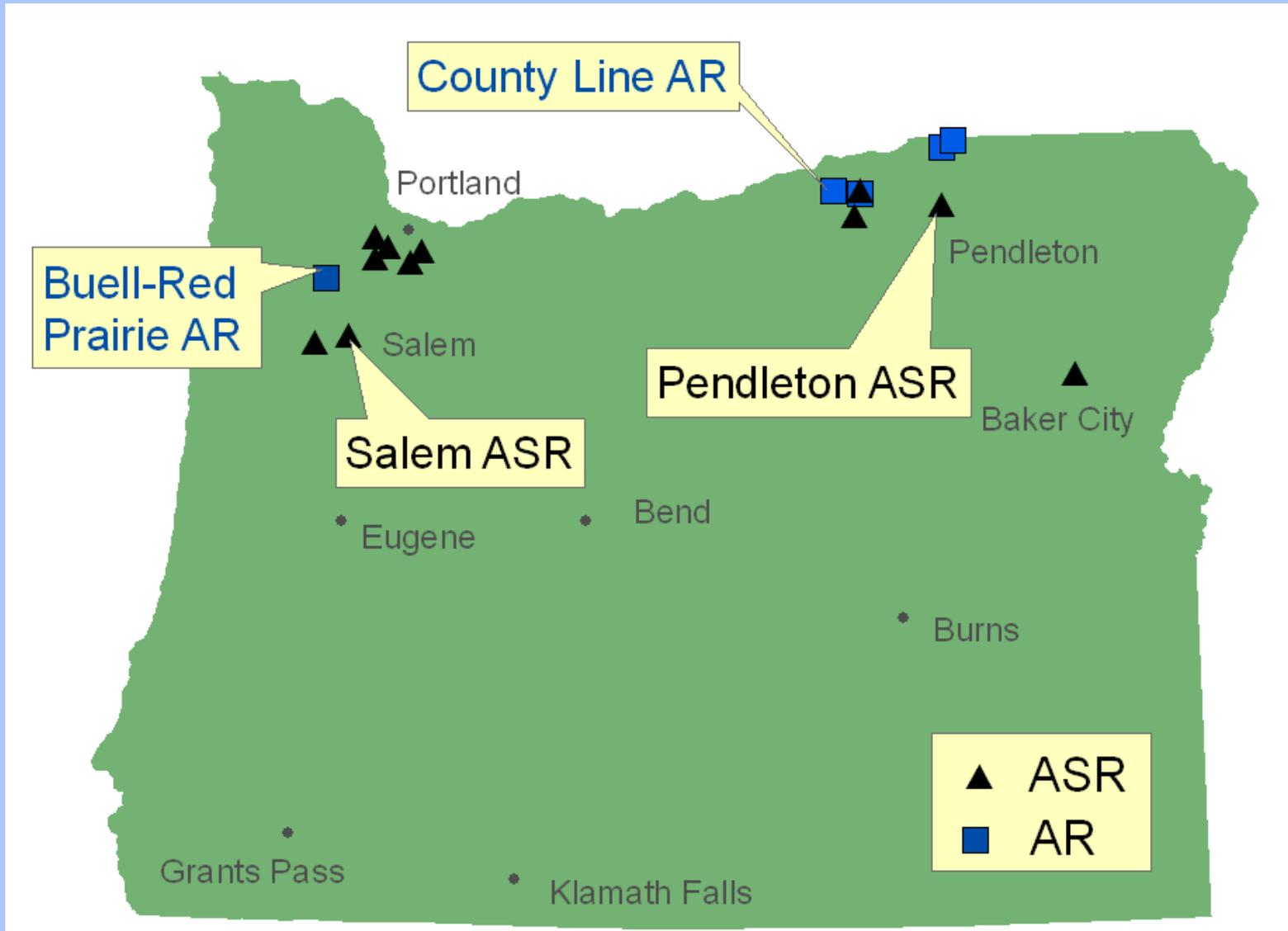


Status of ASR/AR in Oregon

Underground Storage (ac-ft) in Oregon

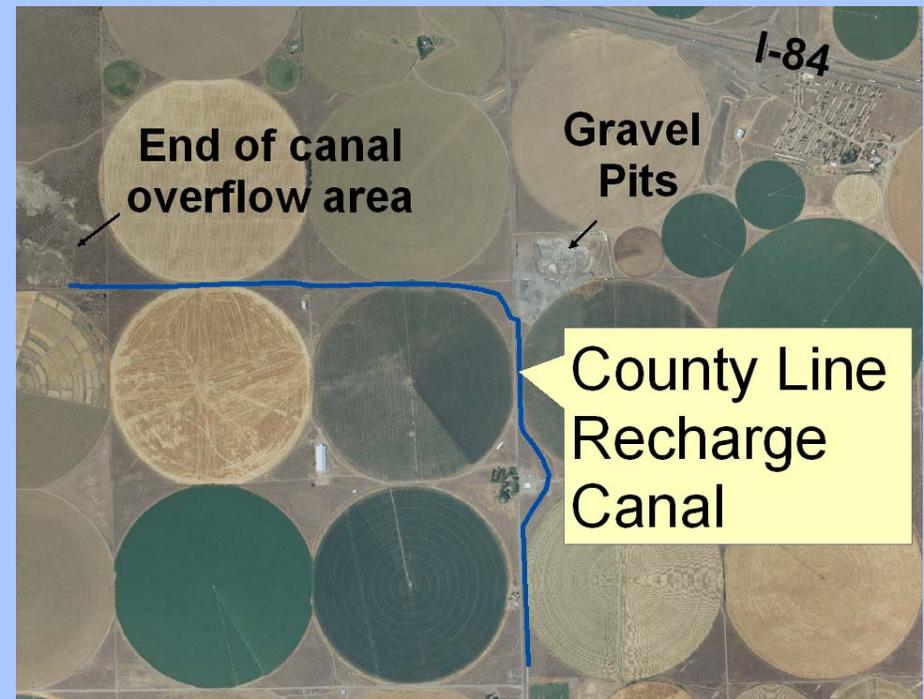


Oregon Experience: Case Studies



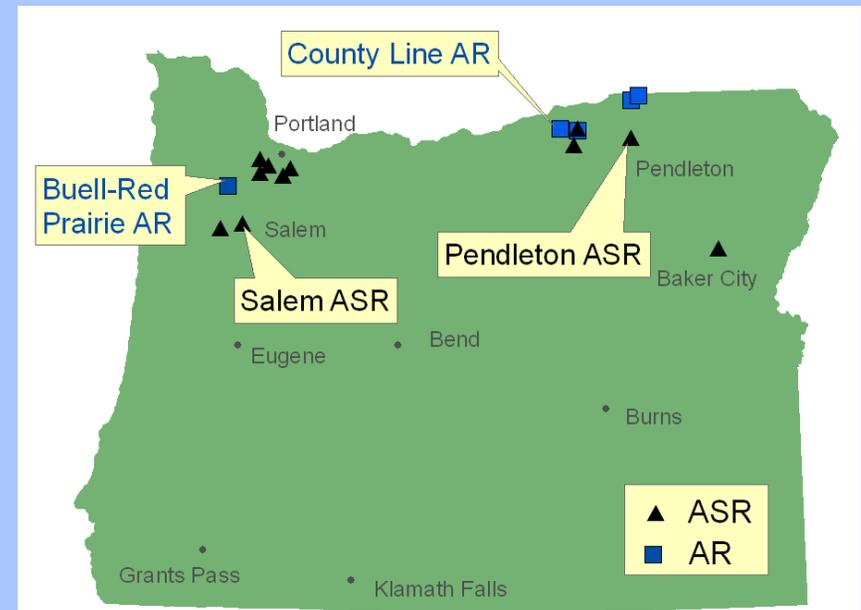
County Line AR: Umatilla/Morrow Counties

- Canal recharge began in 1978
- Recharges an average of 6,000 ac-ft/year
- Augments Ordinance Critical Area gravel aquifer for irrigation
- Source water: Umatilla River



Buell-Red Prairie AR: Polk County

- Obtained permit in 1991 for recharge through 2 wells (before current ASR rules were created)
- Annual maximum recharge to the Siletz River Volcanic aquifer is 61 ac-ft
- Source Water: Gooseneck Creek



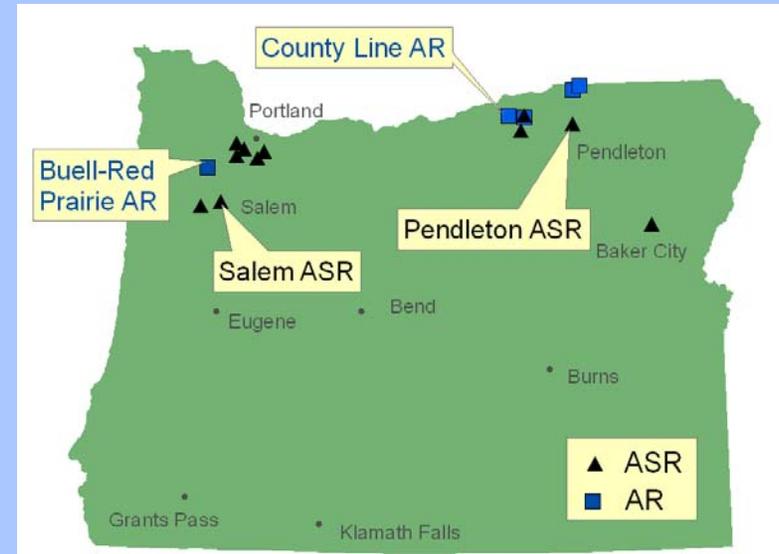
Pendleton ASR: Umatilla County

- Obtained an ASR limited license in 2003
- Injects up to 500 million gallons/year through 2-3 wells
- Stores water in Columbia River Basalt
- Source Water: Umatilla River



Salem ASR: Marion County

- The City began ASR in 1997
- Stores up to 500 Million Gallons/year
- Source Water: North Santiam River
- Columbia River Basalt aquifer



Status of ASR/AR in 2009-11 Agency Budgets

- Oregon Water Resources Dept.
 - ASR is in WRD's #1 priority package
 - 1 FTE to serve as ombudsman
- Oregon Dept. of Environmental Quality
 - 1 FTE in Eastern Region to evaluate water quality aspects of projects

Conclusions

- Underground storage is a useful tool to add to traditional storage methods
- Underground storage in Oregon is authorized through close collaboration between state agencies

Contacts for Further Information

- WRD – Jen Woody –
www.wrd.state.or.us
- DEQ – Barbara Sellars –
www.deq.state.or.us
- DHS – Tom Pattee –
www.oregon.gov/DHS/
- ODFW – Rick Kepler
www.dfw.state.or.us

