PULLMAN AQUIFER STORAGE & RECOVERY PROJECT

2007 Palouse Basin Water Summit Presentation

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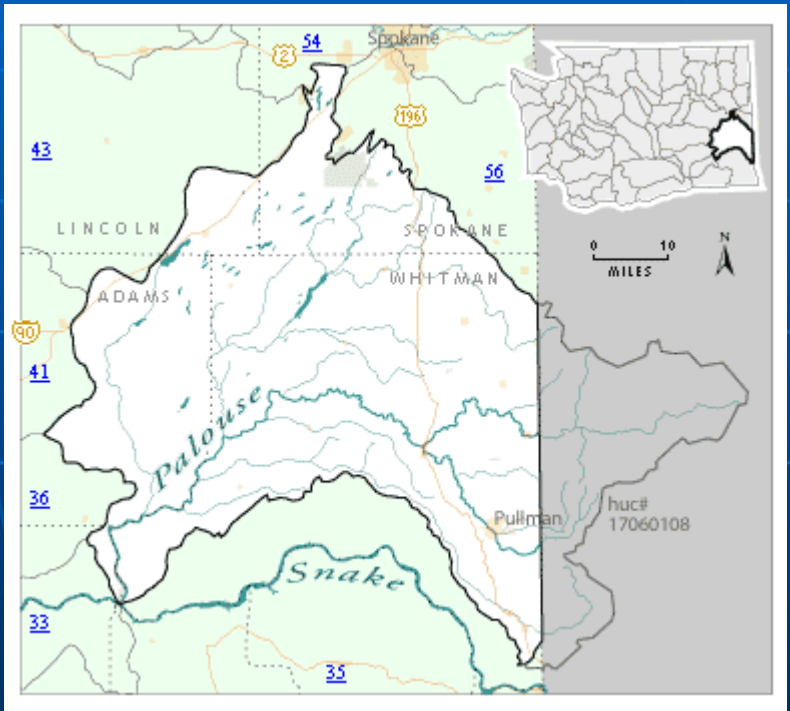
Aquifer Storage and Recovery (ASR) Definition

ASR involves injecting water into an aquifer through wells or by surface spreading and infiltration and then pumping it out when needed. The aquifer essentially functions as a water bank. Deposits are made in times of surplus, typically during the rainy season, and withdrawals occur when available water falls short of demand. (Ecology website)

Watershed Planning Act

- The 1998 legislature passed ESHB 2514, codified into Ch. 90.82 RCW, to set a framework for developing local solutions to watershed issues on a watershed basis.
- The legislature finds that the local development of watershed plans for managing water resources and for protecting existing water rights is vital to both state and local interests.

WRIA 34 Planning Unit Members & Boundary Map



- Washington and Idaho Municipalities
- Counties
- Conservation Districts
- Sprague Lake Users Group
- Landowners
- Ecology
- PBAC members
- PCEI
- WSU and UI

Final Report

Palouse Watershed (WRIA 34) Multi-Purpose Storage Assessment

Prepared for:
Palouse Watershed
(WRIA 34) Planning Unit

Funded through Grant # G0500093 from the Washington State Department of Ecology as authorized by the Watershed Planning Act (Chapter 90.82 RCW).

November 2006

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List of Promising Storage Concepts Investigated

- Enhance existing surface water storage in reservoirs and/or lakes.
- Enhance baseflows by the use of balancing basins, floodplain storage, wetland restoration and the use of small check dams.
- Enhance baseflows by infiltrating shallow groundwater withdrawn during winter months in locations that will result in return flows to streams during summer months and acceptable impact to groundwater resources.
- Enhance baseflows and aquifer recharge by infiltrating available reclaimed (i.e., treated municipal effluent).
- Enhance natural recharge for long term regional aquifer level recovery by using: (1) controlled connections between surface water and groundwater; (2) controlled connections between shallow and deeper aquifer systems; (3) diversion of surface water during high streamflows to infiltration facilities, and (4) capture and infiltration of precipitation via engineered catchment basins.
- Implement aquifer storage and recovery (ASR) to meet potable supply demand and to offset groundwater use.

Why Not New Surface Water Reservoirs?

- **ASR Benefits** (From Ecology Website)

  Some recognized benefits of Aquifer Storage and Recovery are:

  1. Substantial amounts of water can be stored deep underground. This may reduce the need to construct large and expensive surface reservoirs.
  2. ASR systems are considered to be more environmentally friendly than surface reservoirs. They also offer more protection from tampering.
  3. ASR may restore and expand the function of an aquifer that has experienced long-term declines in water levels due to heavy pumping necessary to meet growing urban and agricultural water needs.

- Other issues compared to ASR:

  1. Would still need to have a treatment plant and would have the additional cost of dam, land, etc.
  2. Likely farther from existing water system infrastructure with costs to extend conveyance pipelines.
  3. Environmental permitting.
  4. Would depend on location but sedimentation could be challenging.

Concepts Selected For Further Investigation By Planning Unit

- “Aquifer recharge to recover aquifer levels over the long term using enhanced surface infiltration at the contact between the basalt and crystalline basement rocks;” (Kamiak Butte project)
- “Aquifer storage and recovery (ASR) to meet water demand and to offset groundwater use.”

Multi-Purpose Storage Assessment Findings Related to ASR

- Analysis of available streamflow data, considering water rights and the need to keep a portion of winter flows in the stream for channel maintenance, indicate that surface water is available between November and May for storage…
- ASR could occur either as a regional aquifer recharge project or in proximity to one or more of the municipal well fields.
- The study indicates that both the Wanapum and Grand Ronde basalt aquifers appear favorable for ASR.
- Source water appears available from surface water sources… and, based on existing water quality data, appear generally compatible with groundwater…
- Collection and treatment for ASR is the same as for potable supply … with the additional considerations of the antidegradation standard for groundwater and geochemical rock-water interactions
- ..direct stream diversion paired with community or regional membrane filtration…
- The study recommends that further study on ASR feasibility be developed initially in Pullman …

How Much Surface Water is Available During the Wetter Months?

- Needs to be negotiated with the State of Washington
- Three options identified in Storage Assessment:
  - Option 1: provides the most flow, but it is fairly complicated to implement
  - Option 2: 10% of 50% Exceedance Flow – state agencies like this approach
  - Option 3: 20% of 50% Exceedance Flow (cfs)

20% of 50% - What does that Mean (Big Picture – Best Case Scenario)?

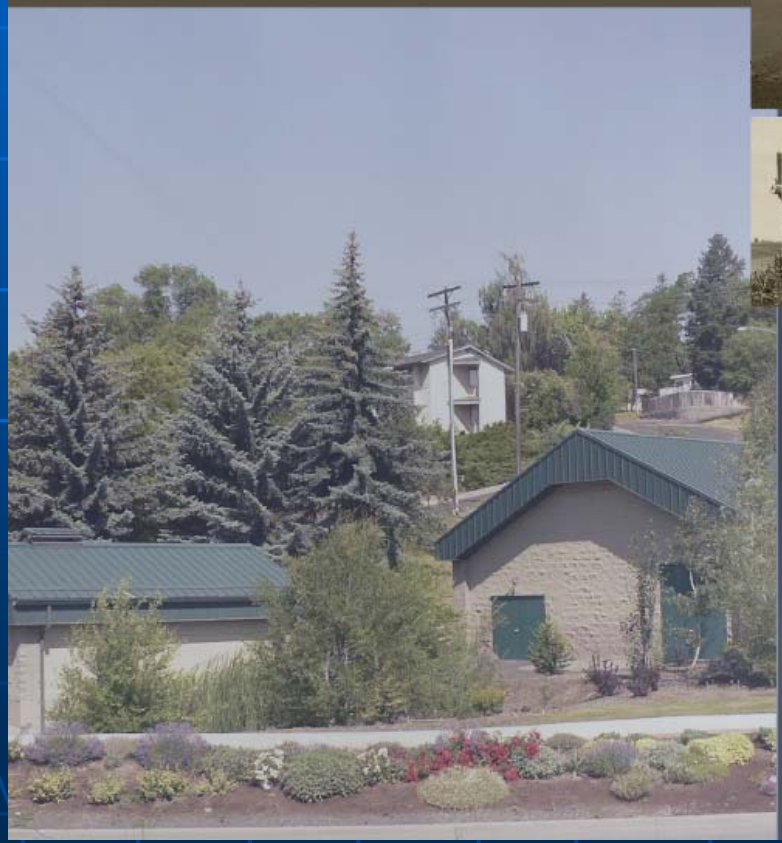
- Between Nov 1st and May 31st approximately 3907 AF would be available or 1.27 Billion Gallons (Pullman gage).
- In 2005, total combined pumpage from all PBAC entities was 2.77 Billion Gallons.

20% of the 50% - the details

- Available flow for ASR varies from month to month based on streamflow
- Between November and May a low of 1.5 cfs (673 gpm) would be available in November to a high of 19.7 cfs (8,841 gpm) in March. This presents engineering challenges and capital cost considerations. In other words, do you build a plant to treat 8,841 gpm for just one month a year?
- Between Nov and March the treatability of the surface water varies, and becomes especially difficult during high flow times with turbidity levels are high. So in reality there would probably be times (days, or perhaps weeks) of the year when the water was not diverted for treatment into an ASR system due to treatability problems.

City of Pullman Water System Plan

Volume 1, Plan Update
Draft
August 2007



HDR

Pullman Water Plan: Section 6 – Water Rights & Future Supply Options

- Conservation
- Wastewater Reuse
- ASR

Pullman ASR Scope of Work

- Task 1 – ASR Development Plan
- Task 2 – Intake Site Evaluation
- Task 3 – Planning Level ASR System Development Cost Estimate

Pullman received a grant from the Department of Ecology for $33,064 to fund the three tasks identified above.

ASR Development Plan

A number of elements were identified:

- Permitting
- Source Water Characterization
- Environmental Assessment
- Hydrogeologic Characterization Report
- Operations Plan
- Pilot Testing

Intake Site Evaluation

- Evaluation Criteria
  - Presence of Coarse Alluvium
  - Location relative to urban point source and non-point source discharges to the South Fork
  - Relative position in the watershed and the quantity of instream flow
  - Location relative to the city's existing water distribution system
  - Location relative to city owned property

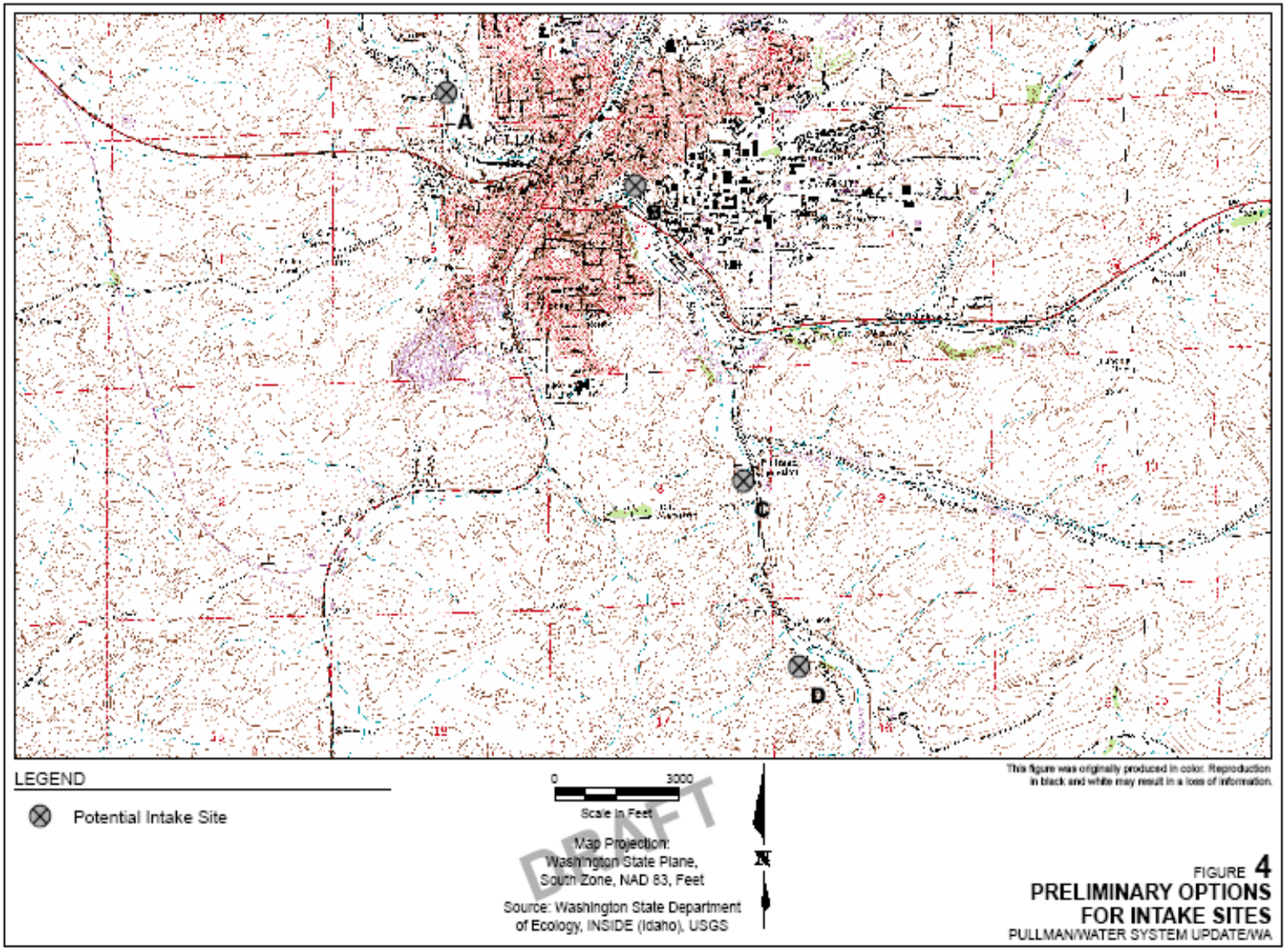


FIGURE 4
PRELIMINARY OPTIONS
FOR INTAKE SITES
PULLMAN/WATER SYSTEM UPDATE/WA

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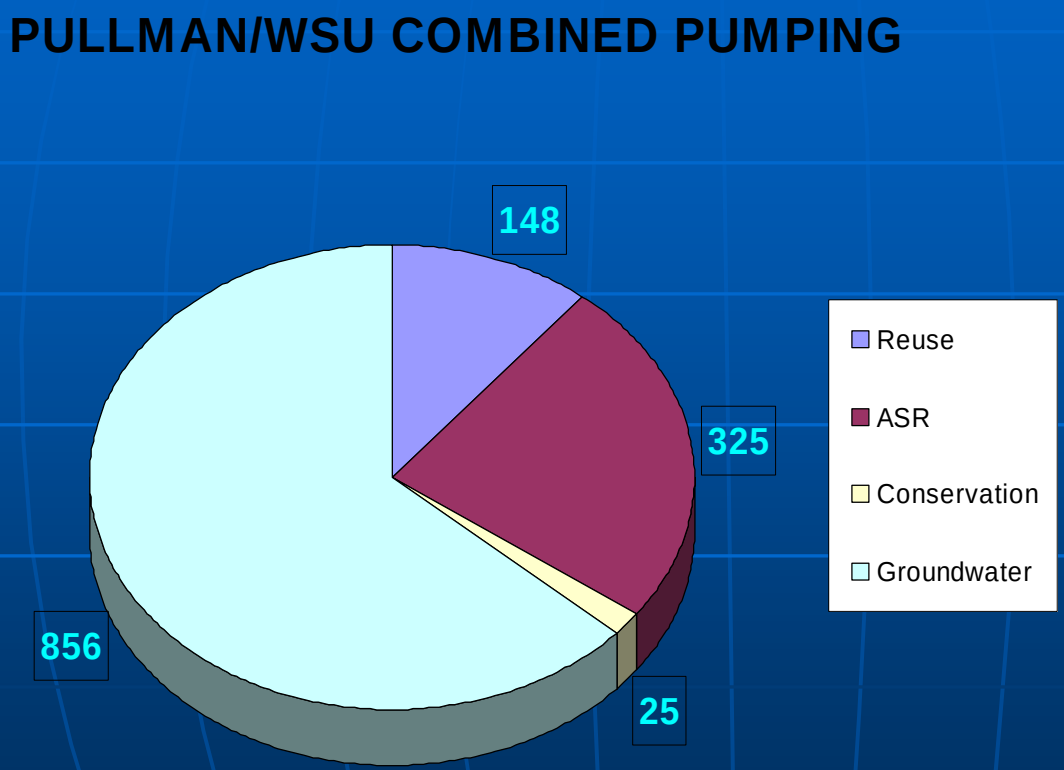
Cost Estimates

- In progress
- Further Study & Development Costs
- Treatment system, intake structure, land and conveyance costs
- Well Modification costs
- O&M costs

Comparison of Water Plan Supply Alternatives



- Pullman/WSU total pumping for 2005 = 1354 MG
- Reuse at 1.05 MGD – approx. 5 months
- ASR = 1,500 GPM Plant – approx. 7 months
- Conservation – Pullman/WSU combined targets (may be low)
- Note: All options could increase

WRIA 34 Water Quality Supplemental Assessment

- ASR Water Quality Evaluation
- Objective was to evaluate the potential for chemical reactions to occur upon mixing surface water and groundwater during ASR
- Considered available data
- "...the generalized assessment conducted here did not reveal significant water quality limitations to the feasibility of ASR using either Palouse River or Paradise Creek as the source water and using either the Grand Ronde or Wanapum aquifers as receiving aquifers."
- Further long term characterization and water chemistry analysis is needed

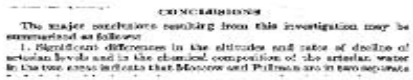
Pullman Surface Water Monitoring

- Grab samples taken on South Fork upstream of Paradise Creek in 2006 & 2007
- Parameters identified that would likely need to be addressed with treatment:
  - Iron and Manganese
  - Nitrate

Palouse Basin Ground Water Management: The Early Days

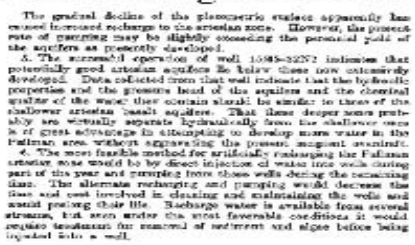
- 1953 - 1956

Foxworthy and Washburn - Conclusions



. . . the present rate of pumping may be slightly exceeding the perennial yield of the aquifers presently developed . .

The most feasible method for artificially recharging the Pullman artesian zone would be by direct injection of water into wells during part of the year and pumping from those wells during the remaining time. . .



Recharge water is available from several streams, but even under the most favorable conditions it would require treatment for removal of sediment and algae before being injected into a well. [USGS WSP 1655]

ASR Project Examples

- Washington:
  - Walla Walla
  - Yakima
  - Seattle PU
  - Lakehaven
  - Redmond
- Oregon (Municipal):
  - Salem
  - Beaverton/TVWD
  - Clackamas
  - Tigard
  - Pendleton
  - Baker City
  - Tualatin
  - Dallas
  - Sunrise Water Authority

Major Issues to Sort Out

- Determine how much flow is available & site identification
- Identify Treatment System Requirements
- Refine costs
- ASR vs. potable supply

Final Thoughts

- Excerpt from WRIA 34 Storage Assessment

  "Public outreach and education will be needed on a regular basis to improve understanding of ASR and to foster community support. Based on comments from Planning Unit members, there is concern that recharge of water into Palouse aquifers may contaminate an essential water resource. However, this should be balanced by an understanding that groundwater withdrawals from Palouse aquifers at current and increased rates are not sustainable in the long term"