An Update on Highlands Ranch’s ASR Operations

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Highlands Ranch’s Location
Background on Highlands Ranch

• First home built in 1981
• Current population 105,000; 98% built out
• Conjunctive use system of surface water and non-tributary groundwater
• Use groundwater from Denver, Arapahoe and LFH aquifers
• Total wells drilled: 51; currently available wells: 35
• History of water use: 87% surface / 13% groundwater
• Annual water demand: 18,000 AF/yr
Deep Groundwater Resources

Area Extent of Denver Groundwater Basin Formations (after Robson, 1984)

CWSD is located on the Western edge of the aquifers
When is nontributary groundwater used?

• The goal is to maximize the use of surface water.
• Groundwater is used when:
  • Surface water is not available (ex: during droughts)
  • The surface water treatment plant (WTP) has insufficient capacity to meet demands.
  • When the WTP is under construction
  • For periodic maintenance of the wells
History of ASR use at Highlands Ranch

- Conducted a one year study of ASR in 1992
- From 1993 to 2023, have injected 15,357 AF using 25 different wells, as follows:
  - Arapahoe: 10,592 AF using 11 wells
  - Denver: 2,130 AF using 4 wells
  - LFH: 2,635 AF using 10 wells
- In 2023 injected 361 AF over 3 months using 5 Arapahoe wells, 7 LFH wells and one Denver well
Timing of ASR use at Highlands Ranch

Total ASR Injection 1990 - 2020

Injections in Acre/Ft vs. Year
ASR Equipped well locations

Denver Wells

- Existing Denver
- Proposed Denver
- Existing Tributary Denver
- Proposed Tributary Denver

Legend:
- ASR Equipped

Map of Denver Wells with locations marked as ASR Equipped.
Arapahoe aquifer:
Highest flow rates and good water quality
LFH aquifer: Good flow rates, poor water quality
**Costs to Use ASR**

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<tr>
<th>Ground Water</th>
<th>$/AF</th>
<th>Ratchet</th>
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<tr>
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<td>Treatment Chemicals</td>
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<tr>
<td>TOTAL</td>
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<td>$/1,000</td>
<td>$1.25</td>
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</table>

**Surface Water**

<table>
<thead>
<tr>
<th></th>
<th>$/AF</th>
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</thead>
<tbody>
<tr>
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<tr>
<td>TOTAL</td>
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<tr>
<td>$/1,000</td>
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</table>

Conclusion: ASR cost is 2.1 times cost of surface water only
Groundwater longevity challenge

- Water level sensors operating in all wells for 20 or more years
- Static water levels in Arapahoe average 30% into formation; some are 50% into the formation
- Decreed “paper” groundwater: 18,254 AF/yr; Actually available groundwater: 8,000 AF/yr
- Pumping rates on average have declined 50%
- 10 wells now unusable
- Trends show production declines sooner than expected
There is heavy GW use by our neighbors; CWSD use is 20% of total
Can ASR improve the groundwater longevity problem? (Answer: it’s unclear)

• ASR is proven to be physically feasible.
• The problem is having excess surface water to inject.
• When have surface water available:
  • First, provide only surface water to customers
  • Second, fill as soon as possible all surface reservoirs
  • Third, then can consider injecting water into aquifers
• Problem: current groundwater entities have limited surface water assets, and infrequently have excess surface water.
Thank you for your attention; Are there any questions?