

Aspects of ASR Conversion & Related Regulatory Experience in Waukee, Iowa

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Resources



GWPC Tampa, FLA 9/13/2023

- GWPC ANNUAL FORUM
- **Aquifer Storage & Recovery /
Managed Aquifer Recharge 2nd
session**
- **Refurbishment of a deep well in
Waukee, Iowa to serve as an ASR**



What will we cover?

- Brief ASR Background for IA
- What is the regulatory background?
- Are there on-going problems?



What is an ASR Well?

- ASR stands for Aquifer Storage and Recovery (or “retrieval”)
- Typical usage is for temporary treated H₂O Storage, either seasonal or long-term
- This potable water is usually injected via a well as a “bubble” into a (relatively) brackish water aquifer



ASR: National vs Iowa

- In Iowa, ASR is only allowed for potable uses.
- In other States, also used for tertiary effluent disposal and to prevent rocket fuel migration.
- ASR wells have been operating in Florida since 1983. At least 100 ASR wells in 30 ASR systems.
- Less common in Midwest --- 8 in Iowa (we have favorable Cambrian Ordovician hydrogeology)



Why would a PWS want one?

- H_2O systems designed to provide source and treatment for Peak Day Use.
- Peak Day Use is Typically 2x Average Day Use.
- Large volume storage can be problematic due to land costs, development demands
- ASR costs “can” be quite favorable



What About Cost?

Current Project in Ankeny for 3 MGD ASR Well has total Construction Cost of About \$3 Million.

Project in North Liberty for 1.7 MGD ASR Well total Construction Cost of About \$2 Million

Grimes, IA similar

So In General about \$1 per Gallon.

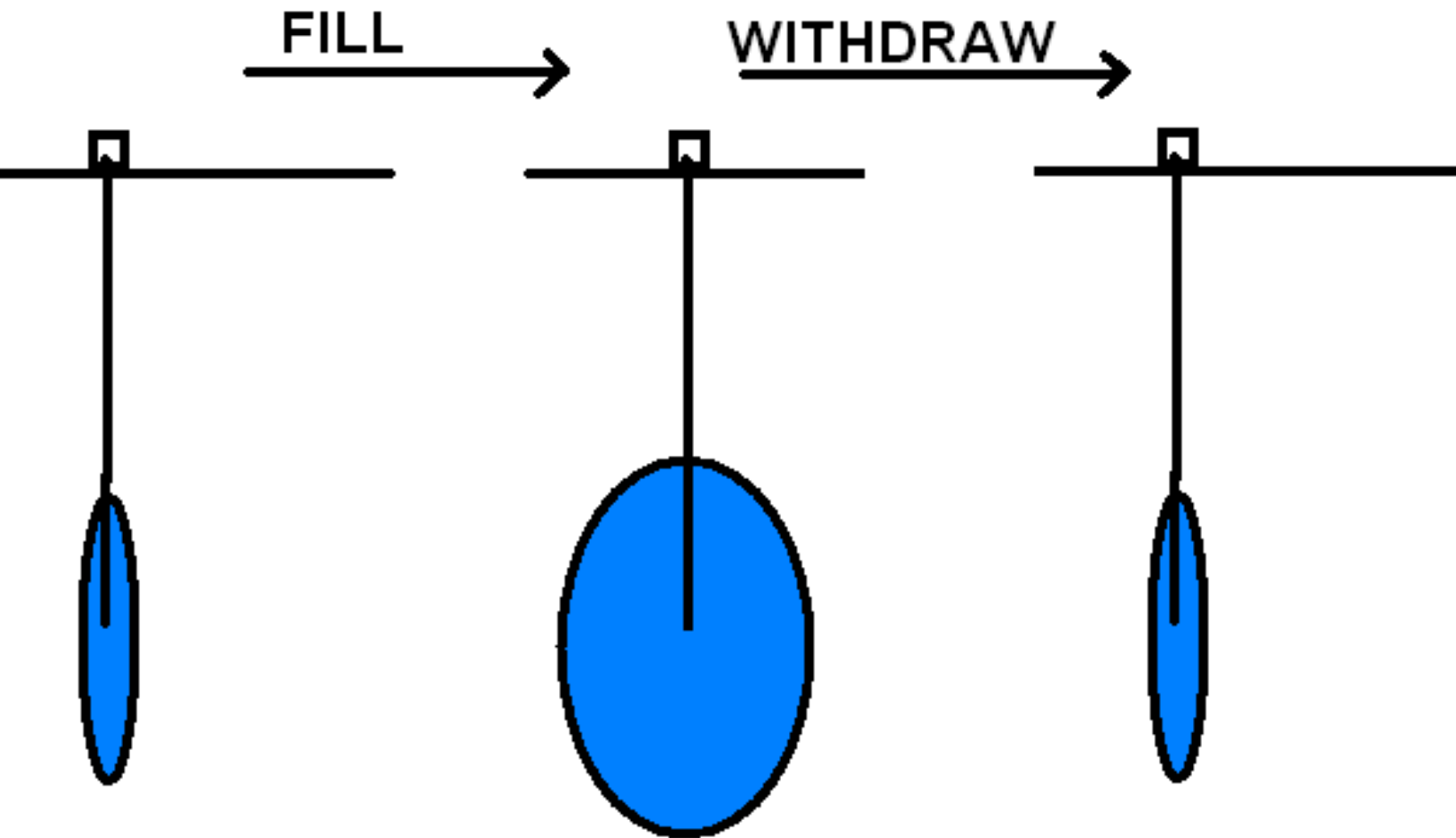
Using Jordan Aquifer, Cost for Well is ~ 1/2 of Total & remaining Cost is Pump, Controls, Chemical Feed and “Housing” Building.



An ASR system can provide large volumes of water over longer periods of time, increasing water supplies during seasonal and multi-year droughts.



ASR Well Use Cycle Graphic



ASR Concerns

- Need aquifer to store necessary quantity, & allow recovery at rate needed
- Treated H_2O & aquifer have to be chemically compatible (No Deposition, No Dissolution)
- Need to disinfect again on recovery, also possibly add other chemicals



Recovery Efficiency

- Improves with successive cycles.
Same volume of H_2O stored in each cycle.
- This is because the residual H_2O not recovered in one cycle tends to form a buffer zone of marginal quality surrounding the stored H_2O in the next cycle.



Rule Credit...

Oregon Water Resources Department,
OAR Chapter 690.

(They were adapted from Nevada).

Adapted to fit Existing Iowa H₂O Rights
Law (modified riparian).



Iowa DNR's Safeguards.....

- IDNR won't permit private wells within the storage volume area of an ASR.
- This is recorded with the county recorder.
- IDNR requires permittee to place observation wells if deemed necessary.



Upper casing

The upper casing is cement-grouted into place to prevent "washing" outside the casing due to water levels which can fluctuate by pumping and injection. The upper casing is preferably made of stainless steel, although mild (low carbon) steel has also been used to keep costs down.



Injection & downhole valves

The well head piping generally incorporates a magnetic flow-meter which is bi-directional, to measure the injection and pumping flows. When water levels are deeper than 20-40 feet, the downhole pump column piping requires a downhole flow control valve and a check valve.



Downhole Control Valves

- The SIGNIFICANT advantage of downhole control valves is the small diameter of the valve, and the specialized usage for ASR systems



City of Waukeee used

 Baski, Inc. (Denver) www.baski.com

The Baski Valve is a bladder-type design.



Now, let's talk about preliminary studies

- A hydrogeologic study SHOULD evaluate several subsurface storage zones
- Idea is to select a geologic interval for dispersion
- Won't necessarily be the highest capacity zone -> you're looking for hydraulic properties that emphasize separation of H₂O



Geochemical & Microbial

- Geochemical and microbial processes tend to occur close to the ASR well
- Usually w/in 10 feet
- In Iowa, biggest concern is Arsenic leaching.



also note this plugging requirement....

- There is liability associated with any wells other than the injection/recovery wells being finished in the ASR storage volume. Other wells could contaminate the aquifer, and the PWS would be responsible for the water withdrawn by the other user(s). As a result, IDNR requires plugging of any existing wells within the storage volume area.



City of Waukee Situation

- Far Western DSM suburb
- Population 24,000
- Extensive development pressure
- Inactive Cambrian_Ordovician well (~10 years)



Initial Proposal

- As of January, 2020, the City of Waukee approached Iowa DNR about the possibility of converting an existing Jordan aquifer well into an ASR well.
- Existing logs and information we had on the well were examined. The plan was for an obstruction to be removed and the well re-televised in early 2020.
- The consultant recommended the well be re-cased with a 14-inch upper and 7-inch lower casing before use as an ASR well. They recommended the Baski flow control valve that I/DNR recommends.



Waukee Well close-up



Regulatory “stuff”

- Federal Underground Injection Control (UIC) regulations apply, & a Class V permit from EPA related to the injection, including the mechanical integrity of the downhole components was required.
- An site survey of the location was required prior to utilizing it as an ASR well. The department was concerned about the presence of private residences within 100 feet of the well.
- An application compliant with xctr requirements and a public comment period were both required.
- Prior to issuance of an ASR permit, a “limited registration” for temporary operation and evaluation was required.
- A “LR” means the well must be tested for 2 or more years before the final ASR permit is issued. The well must go through at least 4 test cycles. The final permit runs 20 years. Following evaluation of the well’s feasibility, an engineering report had to be submitted.



Wellhouse



Let's talk about the three variances that were necessary

- Cemetery variance
- Transformer variance
- “Storm sewer” variance



Cemetery variance (separation distances)

- Not much chance of surface contamination to the Jordan aquifer at that site, as long as the ASR was constructed to code. Because of its proximity to the cemetery, I sent them some USGS material on possible contaminants (arsenic, etc.) from cemeteries that could be in the shallow groundwater. My thoughts were I suspected it would not be a problem if the ASR has adequate surface casing to prevent shallow groundwater from seeping into that annulus and merging with the treated groundwater.
- **Bottom line:** the location is fine and proper construction of the ASR is the key to preventing surface contamination.



Precautionary Measures

- Easements to prevent burials within 100', and allow only modern vaulted burials in the 100-200' range.
- Tile drainage around graves to direct groundwater flow away from the well.
- Monitoring well location (~10' deep, placed between well and cemetery). The well was to initially be sampled quarterly, with frequency to be reevaluated after a year, for: Total N, TKN, NH₃, Total P, As, Mn, E Coli & Formaldehyde.
- Recasing of the well by relining 719 feet of 12-inch diameter ASTM A53 Grade B steel pipe and 1,582 feet of 8-inch d. ASTM A53 Grade B steel pipe



the cemetery in question



Separation between well and cemetery



Transformer variance

- A waiver, which requires separation of potable water supply wells and above ground chemical storage. The well is a deep well; therefore, the required separation distance from above ground chemical storage is 100 feet. This involves construction and installation of a utility transformer containing oil within 100 feet of the existing ASR well.
- The Department determined that the criteria discussed above were met to grant this variance for the Waukee project.



And then a third issue arose..

- 3rd waiver was needed.
- The issue was nearby storm sewers, required to be constructed of sanitary sewer material if within 200' of a well. The sewers were RCP, which is considered sanitary grade, if constructed with gaskets.
- We initially approved their site survey, but forgot to confirm whether there were gaskets on the storm sewer. The storms did not have gaskets. Once we saw that, we needed to find a resolution.



Storm sewers (resolution)

- During a trouble-shooting call, Iowa DNR staff came up with a couple of waiver options that we ran by the city.
- Option 1: Line the storm sewers. This has been done for many other projects and is sufficient. They “bit the bullet” and did this.



Permit w/waivers, water allocation, limited registration

- Xctr permit w/ associated waivers issued in comprehensive package 12/2021.
- Final water allocation permit, and the concurrent 2022 limited registration, were officially issued on 11/07/2022. Comment period went through the 3rd and we had no public comments.....



CONCLUSION

- As you can see, in practice, we have a sit down “projects scoping” meeting, and from an Iowa DNR regulatory perspective, do a case-by-case analysis.
- Trouble-shooting usually follows.....
- The end result has been similar-looking ASR registrations and permits.
- Since they are all Cambrian_Ordovician based....



Questions?

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