ISSUE BRIEF

HYDROLOGIC DISCONNECT

ISSUE STATEMENT

The storage and recovery of water supplies in hydrologically disconnected areas within AMAs creates localized vulnerabilities in groundwater availability and quality with potential for greater impacts in the future when recovery of stored water becomes necessary.

BACKGROUND

Recharge and Recovery

The storage of renewable water supplies underground is one of Arizona's key long-term water management tools. Across the five Active Management Areas (AMA), Arizona water users have stored (or saved through in-lieu storage) over 11 million acre-feet of water through 2016.[1] The storage of water underground, *recharge*, and the eventual withdrawal of that water, *recovery,* are administered through the Arizona Department of Water Resources' Recharge Program.[2]

Recharge is accomplished through storage at either an underground storage facility or through the delivery of *in-lieu water* to a groundwater savings facility.[3] When qualified water supplies are stored underground within an AMA those supplies can be recovered within the same calendar year via annual storage and recovery (AS&R) or they can generate a long-term storage credit (LTSC) for recovery in future years. Stored water retains its initial legal classification and is accounted as such when it is recovered. For instance, recharged Central Arizona Project (CAP) water that earns a LTSC will still be classified as CAP water when it is recovered at a later date. Recharged water is subject to physical losses as well as a *cut to the aquifer* depending on the type of water and method of storage. Typically, with some exceptions, there is a 5% cut to the aquifer for water stored at a recharge facility, intended to provide a general benefit to the aquifer from the recharge activity.[4]

Arizona's Recharge Program requires that the recovery of stored water, whether through AS&R or LTSC recovery, take place within the same AMA where the water was originally stored. This means that water can be stored in one groundwater sub-basin and recovered in a different sub-basin that is spatially and hydrologically separate. The Phoenix AMA alone covers 5,646 square miles and contains seven distinct groundwater sub-basins.

Pumping and Replenishment

Arizona's Assured Water Supply (AWS) Program requires that new subdivision developments within AMAs have access to a water supply that is consistent with that AMA's statutory Management Goal. This requirement is satisfied by securing access to a renewable supply of water or, if groundwater will be utilized, through

[1] ADWR, LTSC Summary Dashboard https://new.azwater.gov/recharge/accounting
[2] Broadly governed by regulations in statute (Title 45, Chapter 3.1), administrative rules, and ADWR policy.
[3] See definitions at A.R.S. § 45-811.01 and § 45-812.01
[4] https://new.azwater.gov/sites/default/files/media/Cut%20to%20the%20Aquifer%20Table_Revised_May_07_2019.pdf

membership in the Central Arizona Groundwater Replenishment District (CAGRD). Membership in the CAGRD allows those water users, including water providers or individual subdivisions, to utilize groundwater today, while the CAGRD must find renewable water supplies to *replenish* that volume of groundwater through future underground storage in the same AMA within a statutorily-defined timeframe.

Whereas recharging available renewable water supplies "up front" allows a water user to later recover that water under the legal classification in which it was stored, replenishment by the CAGRD serves to replace groundwater that has already been pumped by its members, so it is not intended for later recovery. However, much like recovery of a LTSC, replenishment may take place in a location hydrologically distinct from the area where groundwater was pumped, so long as it's within the same AMA.

THE HYDROLOGIC DISCONNECT

The ability to legally recover or replenish water that was respectively stored or pumped in a different location is referred to as the *hydrologic disconnect.* While the recharge of aquifers has led to a significant increase in water levels in certain areas, the hydrologic disconnect permits water users to pump water in areas that may not be benefiting from the recharge or replenishment tied to that pumping. For example, CAP water stored at a recharge facility in the Hassayampa subbasin (located on the west end of the Phoenix AMA) can legally be recovered in the East Salt River Valley subbasin, nearly 100 miles away. Similarly, CAGRD member lands that are served groundwater in the northern portion of the Tucson AMA legally have their pumping replenished at facilities located in hydrologically distinct regions to the west and southwest.[5] These examples highlight the challenge that Arizona's accounting framework for recovery and replenishment faces in balancing operational and economic considerations with hydrologic reality.

Pumping groundwater that has been legally stored or replenished elsewhere in an AMA may lead to localized groundwater declines in certain sub-basins. Subsidence, fissuring, aquifer compaction and storage loss, and water quality impacts are all potential consequences of overdraft. Localized overdraft also threatens economic growth, reducing the physical availability of groundwater in certain areas and reducing the likelihood that new development can secure an AWS Determination. Stakeholders in the Arizona water community have also expressed concerns about the ability for water that was stored by one user to physically be pumped from an area by another user, despite the storer retaining that LTSC.

In addition to groundwater depletion, certain aquifers must be managed to account for rising groundwater levels, especially if recovery takes place outside the area of recharge. Shallow groundwater tables can contribute to problematic waterlogging, and operational constraints which limit the amount of water that can be stored at a recharge facility.[6]

The relationship between the hydrologic disconnect and localized groundwater declines has been well documented. In the Phoenix AMA, groundwater modeling scenarios conducted by ADWR demonstrated groundwater conditions drastically improved when both the recovery of LTSC and CAGRD's replenishment of excess groundwater use was tied to the area where water was originally stored or pumped.[7] Those recovery and replenishment assumptions that improved model outcomes, however, are not mandated by policy. In the

[5] See map of CAGRD member lands – Figure 2.3, 2015 CAGRD Plan of Operation; Overview of CAGRD replenishment location and capacity – http://www.cap-az.com/documents/meetings/2019-03-21/1741-032119-WEB-Final-Packet-CAGRD.pdf

[6] For example, recharge at the Granite Reef Underground Storage Project is often curtailed as rising groundwater levels trigger regulatory alert levels designed to prevent encroachment on a nearby landfill.

[7] ADWR Modeling Report No. 22, § 9.0, pg 75. https://new.azwater.gov/sites/default/files/Modeling_Report_22_2.pdf

Tucson AMA historical groundwater withdrawals led to water level declines due to an imbalance between the majority of recharge which takes place in the Avra Valley sub-basin, and recovery which occurs in the Upper Santa Cruz sub-basin.[8] Efforts over the past two decades to shift pumping to the Avra Valley have yielded measurable improvements in water levels and decreased rates of land subsidence.

POLICIES & EFFORTS TO ADDRESS THE HYDROLOGIC DISCONNECT

There are several policy and regulatory requirements that govern the location of recovery and replenishment which also so serve to mitigate some of the impacts stemming from the hydrologic disconnect:

1. ADWR's well spacing requirements prohibit recovery of stored water if, among other things, the recovery would lead to ≥ 10 feet of drawdown of local groundwater levels after the first five years of recovery or would exacerbate existing subsidence issues.[9]

2. The AMA Management Plans prohibit recovery of water in an area experiencing 4.0' of annual decline in groundwater levels.[10]

3. Recovery within the area of impact is considered physically available for assured water supply purposes[11]

4. Though not mandatory, statute requires the CAGRD replenish groundwater in the East and West portions of the Phoenix AMA in proportion to the replenishment obligation generated in each portion of the AMA, to the extent reasonably feasible.[12]

While these policies do have bearing on the location of recovery and replenishment, they do not provide a framework for water management tailored for sub-AMA application. Crafting policy to specifically address the hydrologic disconnect at such a scale has been a long-running discussion in the Arizona water community. The need for sub-regional groundwater management strategies was identified as a priority for ADWR as early as 1999 in the Third Management plans.[13] The hydrologic disconnect relating to CAGRD's replenishment has also been repeatedly recognized as an issue, including by the Central Arizona Water Conservation District (CAWCD) Board which has directed the CAGRD to "replenish in areas of hydrologic impact of groundwater withdrawals by CAGRD members" in its last two Strategic Plans. More recent attempts to address the hydrologic disconnect took place through stakeholder engagement led by ADWR in 2012 as part of initial efforts to develop the Fourth Management Plans. While concepts for adjusting the cut to the aquifer and designating certain sub-basins for targeted management were proposed, no policies were ultimately adopted.

[8] Tucson 4MP, Chapter 8 http://infoshare.azwater.gov/docushare/dsweb/Get/Document-10038/TAMA_4MP_Complete.pdf
[9] A.A.C. R12-15-1302.
[10] Phoenix AMA: 3MP § 8.7.2.3 / 4MP § 8-801
[11] A.A.C. R12-15-716
[12] A.R.S. § 48-3772(I)
[13] Phoenix 3MP - § 8.2; Tucson 3MP - § 8.7.2.3; Pinal 3MP - § 8.6; Prescott 3MP - §8.2