Sustainability Policies Stakeholders Process

Location of Replenishment/Recharge and Hydrologic Impact of Pumping

Groundwater Modeling for Assured Water Supply Purposes
And Well Impact Analyses
"Final" Draft
June 30, 2008

~~The~~ Stakeholders have expressed concern about whether current laws, rules and practices of the Arizona Department of Water Resources (ADWR) adequately protect water that has been stored underground from the impacts of proposed groundwater pumping by applicants for designations, certificates and analyses of assured water supply (AWS applicants) and by those seeking permits for new wells. The Stakeholders invited ADWR to explain current law and practices at two Stakeholders meetings. ADWR has also elaborated on this discussion at a recent workshop on future applications for re-designation of assured water supply. This document explains the differences between the types of groundwater models and how they are used, and summarizes ADWR practices regarding groundwater modeling for assured water supply (AWS) purposes and the impact analysis required by ADWR's well-spacing rules.

Groundwater Models

Numerical and analytical are the two types of groundwater modeling used to assess how proposed pumping will affect groundwater levels.

1. Analytical model (TH Wells)

    a. A simplistic and conservative model that assumes the aquifer is a bathtub with the same hydrologic characteristics from top to bottom.

    b. Recharge is not considered in the analytical model.

    c. A spreadsheet can be used for TH Wells analysis. ~~This analysis can be completed in less than an hour.~~

2. Numerical model

    a. A computer program that uses complex mathematical equations to simulate flow in an aquifer.

    b. Groundwater levels are computed in "grids" or cells. Each cell represents a 3-dimension block of aquifer.

c. Model inputs include the geologic structure (depth to bedrock, the size of each cell, etc), hydrologic parameters that define how much and how fast the water moves through the aquifer, and the amount of water that flows into and out of the model such as pumping and recharge. Each parameter must be defined for each cell.

d. The USGS developed the industry standard computer model called Modflow. ADWR has developed a Modflow data set that simulates the Salt River Valley (SRV). The ADWR data set has been referred to as the SRV Model.

e. It can take months or years to develop a numerical model depending on the complexity of the area being modeled. Using the model to conduct a simple analysis can be set up in a week; more complex analyses, such as the re-designation process, can take months.

Groundwater Modeling for AWS Purposes

1. Purpose

ADWR requires AWS applicants to use a groundwater model to demonstrate that 100 years of groundwater is physically available for the proposed use. The modeling must demonstrate that the applicant's proposed groundwater pumping will not draw the aquifer below certain set limits (1000 feet below land surface for the Phoenix, Tucson and Prescott AMAs).

2. Groundwater Models Acceptable to ADWR

a. The groundwater model acceptable to ADWR for each AWS application is ~~usually~~ determined either at ~~the~~ a pre-application meeting with ADWR or pursuant to the hydrological guidelines on ADWR's website.

b. The type of model required depends on the complexity of the area and the relative volume of nearby pumping. For example, does the area have faults or hard rock, is the aquifer similar from top to bottom, how many additional pumpers are in the area, etc. The type of analysis required also depends upon ADWR's assessment of whether there are potential depth to water issues within the area.

c. In general, ADWR accepts the use of an analytical model (TH Wells) for only the most simple groundwater analyses.

d. ADWR is requiring more and more AWS applicants to use a Modflow model to demonstrate physical availability of groundwater for an AWS. Most applicants for a designation of assured water supply (DAWS) must use a Modflow model. Most master planned communities seeking an

analysis of AWS (Analysis) or a certificate of assured water supply (CAWS) must use a Modflow model.

e. Not every applicant that is required to use a numerical model must use an ADWR model.

3. Expiring DAWS

a. In the Phoenix AMA, many water providers' DAWS expire in the year 2010. ADWR expects a heavy workload to process the applications to renew these DAWS.

b. To more efficiently process the numerous applications for DAWS renewal, ADWR will use a regional groundwater model to account for all future pumping and recharge. In the Phoenix AMA, ADWR has updated the existing SRV Model to carry out this regional groundwater analysis.

(1) ADWR will consider incorporating new hydrologic information from DAWS applicants into the SRV model if it has been demonstrated to be better data.

(2) ADWR will update the pumping and recharge values using the multiple applicants' information.

(3) ADWR will update pumping and recharge for those areas with existing CAWS and Analyses.

(4) ADWR measures water levels in index wells located throughout the AMAs every year. There are 300 index wells in the Phoenix AMA alone. This data is used in reviewing AWS applications and to calibrate ADWR's SRV numerical model.

<u>"Protection" in Groundwater Modeling of Certain Water Supplies</u>[1]

1. <u>Groundwater relied upon to demonstrate and AWS.</u>

<u>Groundwater that has previously been demonstrated to be physically available for a DAWS, CAWS, Analysis or physical availability determination (PAD) may not be relied upon by subsequent AWS applicants to demonstrate an AWS. ADWR protects this groundwater in an AWS model by assuming that the groundwater has been "pumped out." By modeling this groundwater as being pumped out, this</u>

[1] <u>"Protection" refers to ADWR insuring that certain water supplies may not be relied upon by AWS applicants to demonstrate an AWS. However, non-AWS groundwater users (such as exempt well owners and persons withdrawing groundwater pursuant to industrial use permits) may still impact these water supplies.</u>

groundwater cannot be used by subsequent AWS applicants to demonstrate physical availability of groundwater.

2. Water replenished by CAGRD.

Water replenished by CAGRD ~~is assumed to be~~ becomes groundwater. Thus, such water ~~that~~ is available to any AWS applicant and is considered to be groundwater in all AWS models.

3. Water stored underground ("stored water")

a. Water stored underground may be relied upon to demonstrate an AWS only by the person who stored the water. ~~AWS applicants may not rely on water stored underground by others to demonstrate an AWS.~~

~~b.~~ ~~Except for water stored underground by the applicant, stored water will not be considered in the groundwater model.~~

b. In ~~the~~ an AWS model, ADWR "models" the water stored by someone other than the applicant as being "pumped out" during the model time period. By modeling stored water as being pumped out, this stored water cannot be used by the AWS applicant to demonstrate physical availability ~~for an AWS application~~.

c. While the model "protects" stored water ~~stored underground by persons other than the applicant~~ from being relied upon by an AWS applicant who is not the person who stored the water, it does not protect the water level of that stored water. In other words, the person who stored the water may have to pump that water from greater depths.

4. ~~Protection of~~ Groundwater Allowances

a. To the extent that a municipal provider has not relied on its groundwater allowance to demonstrate an AWS under its current ~~designation~~DAWS, the physical availability of the provider's groundwater allowance is not "protected" from other AWS applicants. In other words, while the municipal provider may have the legal ability to ~~rely on the~~ include its groundwater allowance in a future application to modify its DAWS, the groundwater may not be physically available because it has been relied upon by other AWS Applicants.

b. ADWR is considering extending the time for which a DAWS may be granted, which could increase the volume of a groundwater allowance~~s~~ that ~~will be "protected"~~ could be included in a DAWS and, therefore, would not be available to other AWS applicants to demonstrate and AWS.

c. ~~Non-assured water supply pumpers (e.g., exempt well pumping, agricultural pumping, industrial pumping and municipal pumping that pre-dates the 1995 AWS Rules for which a DAWS has not been demonstrated) still impact the physical availability of groundwater allowances.~~

Impacts of New Wells

1. Well-Spacing Rules

a. ADWR has adopted well-spacing rules[2] "to prevent unreasonably increasing damage to surrounding land or other water users from the concentration of wells" as required by A.R.S. § 45-598. The well-spacing rules apply to:

(1) The drilling of new wells in AMAs.

(2) The drilling of replacement wells in a new location in AMAs.

(3) The proposed use of a new well or an existing well as a recovery well (to withdraw water stored underground), unless the applicant for the recovery well is (a) a city, town, private water company or irrigation district in an AMA and the application is for an existing well within the applicant's service area; or (b) a conservation district and the application is for an existing well within the groundwater basin or sub-basin in which the district has stored water.[3]

b. The rules prohibit the Director of ADWR from approving an application for a new well or a replacement well in a new location if the probable impact of the withdrawals from the proposed well on any well of record with ADWR will exceed ten feet of additional drawdown after the first five years of operation (unless the owner of any well of record consents to the withdrawals).

c. Except for recovery wells, the standard in the well-spacing rules does not consider the existing regional drawdown. For example, if an existing well is in an area with groundwater levels declining 27 feet every five years, a new well would be allowed to increase the existing well's decline to 37 feet every five years.

[2] A.A.C. R12-15-1301, et seq
[3] A.R.S. § 45-834.01.B. 2 and 3

d. Except for recovery wells, the well impact analysis required by the rules does not take stored water into account because ADWR examines only the proposed well's impact on other wells.[4]

2. Additional Requirement for Recovery Wells

a. A person seeking to recover (pump) stored water from a new or existing well must apply for a recovery well permit from ADWR.[5] If the proposed recovery well is located outside of the area of impact of the stored water, the recovery well permit may not be issued unless the Director of ADWR determines that recovery at the proposed location is consistent with the management plan and the achievement of the management goal for the AMA.

b. The "area of impact" means "as projected on the land surface, the area where the stored water has migrated or is located."[6] ADWR assumes that the area of impact is a one-mile radius from where the water is stored unless the applicant can demonstrate a larger area.

c. In the Third Management Plans, ADWR has determined that recovery outside the area of impact is consistent with the management plan and the achievement of the management goal if the well is located in an area experiencing an average annual rate of decline that is less than four feet per year.[7] This determination is made ~~(~~at the time of the application for the permit~~;~~ and may be reviewed on an annual basis~~?)~~.

d. ADWR will review its interpretation of this limitation on recovery wells in the development of the Fourth Management Plans.

~~e. Water replenished by CAGRD is not stored water. Consequently, wells used to pump excess groundwater are not recovery wells and are not subject to this four-foot decline limitation.~~

[4] Note that A.R.S. § 45-856.01.A.4 appears to require ADWR to take stored water into account in issuing a permit for a new well within the area of impact of the stored water.
[5] A.R.S. § 45-834.01
[6] A.R.S. § 45-802.01
[7] See, for example, *Phoenix AMA Third Management Plan*, p. 8-36