McDowell Sonoran Preserve Ground Water Investigation

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Introduction

Population and development have increased in Maricopa County over the past several decades while the region has experienced prolonged drought. Historically, the region has relied primarily on groundwater. Increasing use due to development has led to declining water levels and some land subsidence.

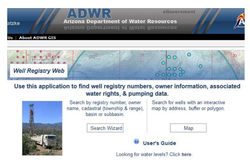
In 1963 Arizona was granted a right to Colorado River water. In 1968 Congress authorized the Central Arizona Project (CAP) to transfer that water to central and southern Arizona. The US Department of Interior demanded that Arizona enact tough groundwater laws prior to construction of the CAP. This was done in 1980 with a goal of safe yield (i.e. withdrawals equal to recharge) by 2025.

Prior to 1980, 100% of Scottsdale's municipal water was from groundwater wells. Since the late 1990s, Scottsdale has supplemented groundwater supplies to create reserves in the event of CAP shortages by treatment and injection of treated CAP and wastewater into the vadose zone. Today groundwater provides less than 10% of Scottsdale's water supply; Scottsdale achieved safe yield by 2006.

Based on past trends, there is a concern that groundwater withdrawals in surrounding areas could impact Preserve resources. The objective of our effort was to document groundwater use in and around the Preserve and to identify possible effects.

Materials and Methods

McDowell Sonoran Preserve is surrounded by many wells that are registered with the Arizona Department of Water Resources (ADWR). Relevant wells surrounding the Preserve were identified that may indicate trends of concern. In this manner, water supply trends were observed to assess potential impacts of withdrawals on the Preserve.

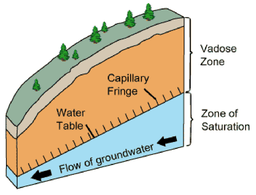


https://gisweb.azwater.gov/waterresourcedata/WellRegistry.aspx

The wells were located using an ADWR website (left) which allowed a search of records to identify wells in and around the Preserve to show trends in water level. Charts for these wells were downloaded and placed on the base map of the Preserve to allow for interpretation. The map in the center panel resulted from this effort.

Observations and Conclusions

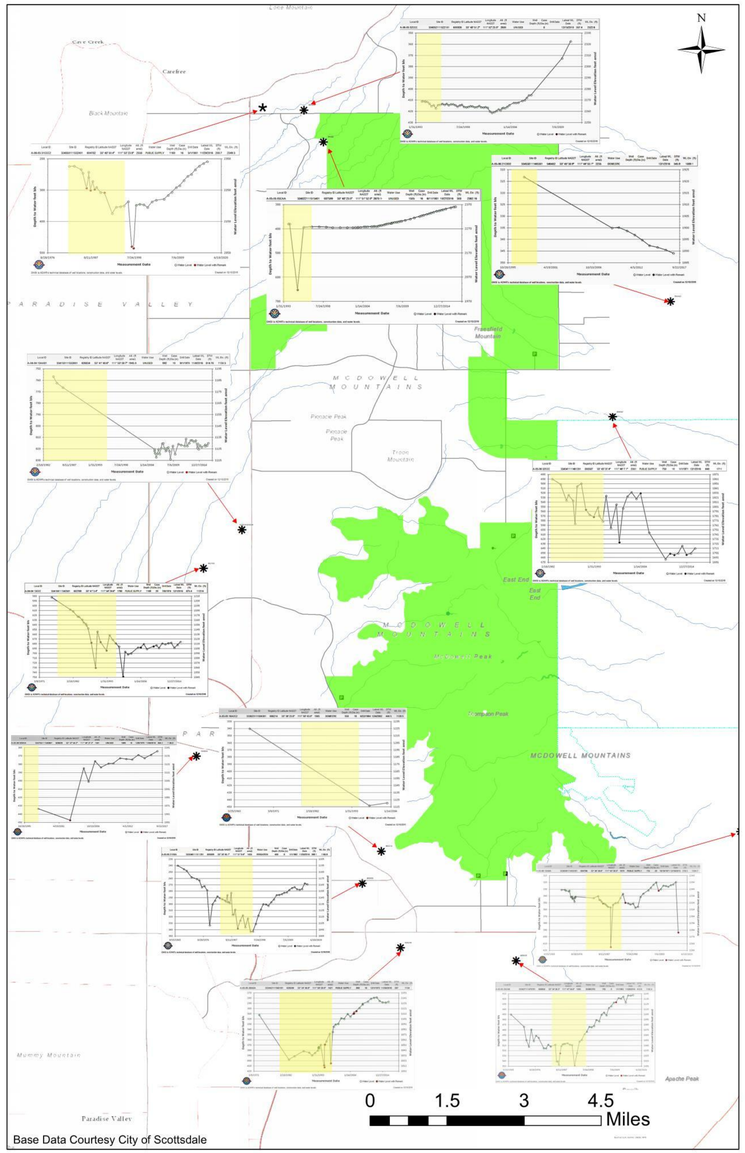
The period during which Scottsdale groundwater was replaced by CAP water is bracketed on the charts by the yellow highlights. The charts indicate that there is generally a period of water level decline in the early years, followed by stabilization as CAP water replaced pumping and as Scottsdale began injecting treated CAP water into wells. In some cases, particularly on the northeast side of the Preserve outside of the basin of influence where wells are primarily privately owned, there is continued decline. A basic review of some other principles enables a more complete understanding of conclusions drawn from this analysis. This is accomplished through the illustrations in the following discussion.



At left is a depiction of the typical relationship between the land surface and groundwater. Water falling on the land surface percolates through the soils; what is not used by plants then percolates through the vadose zone and capillary fringe and into the groundwater. The zone of saturation is supplemented through the same process in the upland areas, and the elevation drives the flow of these waters.

In the desert environment of the Preserve, you may also find perched water zones, particularly in washes, but are not likely to find surface water during most of the year.

Results



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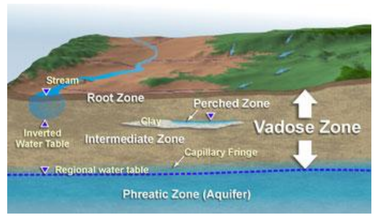
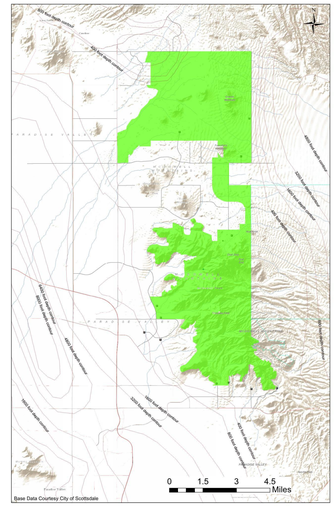
Observations and Conclusions (continued)



To the left is a diagram showing a more complex land surface with pools and pockets, a perched aquifer zone and a surface stream.

Most of the regional groundwater supplies in Maricopa County are derived from rainfall and snowmelt from the Colorado Plateau and transition zone to the north and east of the valley.



The diagram below shows the depth to bedrock surrounding the Preserve. This is a depiction of the depth of sediments that would contain water. It's clear that most groundwater is likely to occur in the deep pockets around the Preserve. Most Scottsdale groundwater comes from sources to the west of the Preserve.

One final important observation is the nature of the Preserve with respect to its geologic history. The Preserve is a mountain range that was formed by the uplift of a block of metamorphic and igneous rocks. This resulted in a southern portion dominated by rocks of volcanic origin and a northern portion that contains primarily granite and a smattering of volcanics such as basalt. The volcanics and un-weathered granite are relatively impervious compared with the sediments surrounding the Preserve and are limited in their ability to contain and transmit water and are therefore a limited potential water supply.

At the very edges of the Preserve, there is contact with the water-bearing sediments but very little potential for declining water levels to impact groundwater on the Preserve due to the poor communication between the units and their differences in transmissivities. If anything, it is more likely that activities on the Preserve could impact the waters in the deeper aquifers as runoff from the Preserve through the various washes can discharge into the aquifers to the west, north, south and east.

In conclusion, based on an analysis of current conditions, there appears to be no reason to be concerned with groundwater withdrawals in surrounding areas affecting groundwater on the preserve because of the following:

- Groundwater levels in wells surrounding the Preserve are generally showing an increase rather than a decline in water levels, due to actions of Scottsdale.
- Even if there were a decline and no recovery, the lack of groundwater on the Preserve and lack of communication between the regional supplies and the Preserve would make any significant impact unlikely.
- There is greater potential impact from activities on the Preserve on runoff into regional groundwaters, but this is not likely as long as activities on the Preserve are properly managed.

*Note: Groundwater and vadose zone diagrams were found in https://www.bing.com/images/search?q=Geology+Water+Table&FORM=RESTAB