An Overview of the Bear Canyon Recharge Demonstration Project

Stephanie J. Moore and John M. Stomp, II

Artificial recharge is a major part of the Albuquerque Water Resource Management Strategy, developed to provide a sustainable, long-term water supply for the Albuquerque-Bernalillo County Water Utility Authority.

Artificial recharge is a water resources management tool that allows for the efficient and conjunctive management of surface-water, groundwater, and reclaimed water sources. Despite their growing use in communities throughout the United States, no artificial recharge projects have yet been implemented in New Mexico. Two types of permits are required for enhanced recharge projects:

- Underground Storage and Recovery (USR) permit from the New Mexico Office of the State Engineer (NMOSE)
- Groundwater discharge permit from the New Mexico Environment Department (NMED)

To date, the NMOSE and NMED have not yet issued a permit for artificial recharge. This may be due, in part, to the rigorous requirements to demonstrate how much water is being recharged and to ensure that groundwater quality is being protected.

Artificial recharge is a major part of the Albuquerque Water Resource Management Strategy (AWRMS), which was developed to provide a sustainable, long-term water supply for the Albuquerque-Bernalillo County Water Utility Authority (the Authority). The Authority plans to use artificial recharge to address one of its most critical issues: providing adequate water supplies during times of drought.

The Authority funded several feasibility studies to evaluate artificial recharge alternatives. These efforts, combined with a review of the available literature on hydrogeology and geochemistry of the Middle Rio Grande Basin (MRGB) aquifer, indicated that in-channel infiltration systems appear to be an effective method for artificial recharge in the Albuquerque area. The reach of Bear Canyon Arroyo, between Wyoming and Louisiana Boulevards in Albuquerque, was identified as an ideal location for artificial recharge through in-channel infiltration systems. Existing infrastructure is available to deliver raw Rio Grande water to this unlined reach of the arroyo. The existing channel is wide and has reasonably high infiltration rates. Aquifer materials beneath this reach of Bear Canyon Arroyo are some of the most transmissive in the Albuquerque area. Groundwater levels in this area have declined between 80 and 120 feet

Figure 1

since 1960s pre-pumping conditions, and the direction of groundwater flow is generally from north to south, toward the major cones of depression, so all recharged water would easily be captured.

The Bear Canyon Recharge Demonstration Project (the Project) is designed to demonstrate the effectiveness of artificial recharge through an in-stream infiltration system. The goals of the Project are:

- Implement the existing aquifer storage and recovery policy of the Authority
- Use surface water supplies to recharge the MRGB aquifer
- Use the aquifer to store surface water and establish a drought reserve
- Establish the right to recover the recharged groundwater

As part of the Project, water will be delivered from the Rio Grande via the existing infrastructure of the North I-25 Reclamation and Reuse System, to the Arroyo del Oso non-potable reservoir tank (Figure 1). The source water is a combination of San Juan-Chama water diverted from the Rio Grande and a small amount (less than 0.2 MGD) of highly treated industrial wastewater. Water will be released from the reservoir into the arroyo and allowed to flow down the channel, where it will infiltrate into the streambed sediments, flow through the vadose zone and eventually reach the aquifer. The 2,800-foot long infiltration reach is located in the unlined segment of the arroyo between Wyoming Boulevard and Arroyo del Oso Dam; the channel is approximately 50 to 70 feet wide. The maximum discharge volume is 3,000 acre-feet, which will be released from the Arroyo del Oso reservoir into the infiltration reach over a maximum period of six months (October through March), with the majority of releases occurring during the months of November through February. The maximum discharge rate is limited to 5.6 MGD.

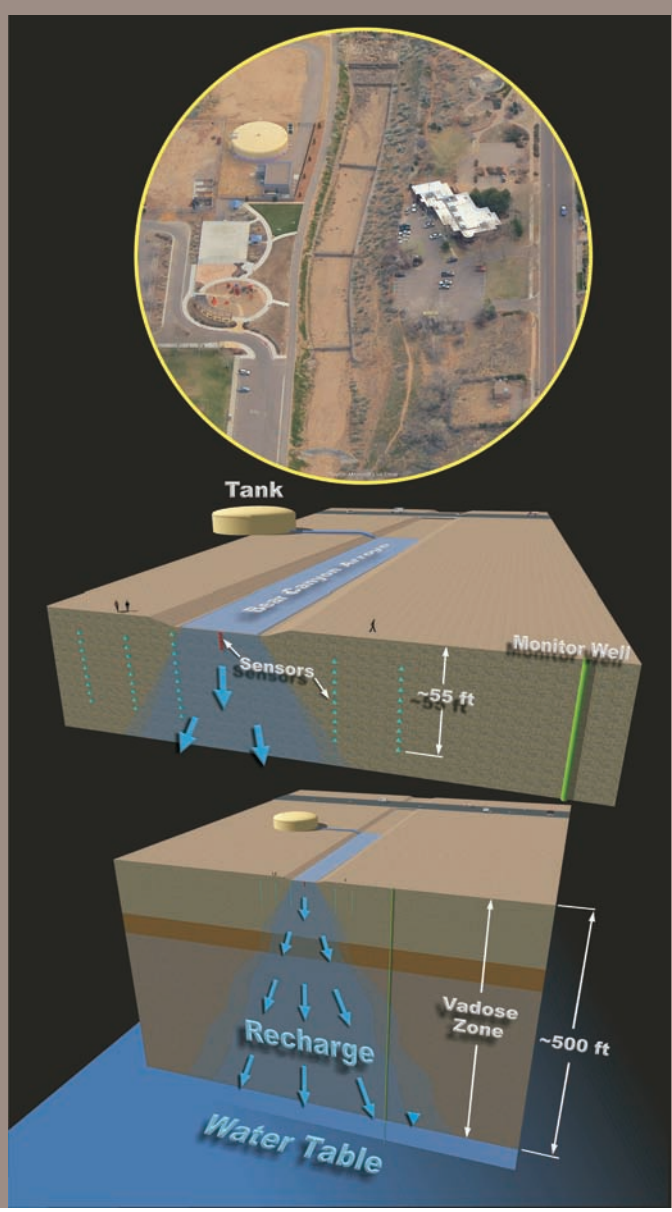
Vadose: Latin *vadosus* shallow, from *vadum*, noun, shallow, ford; akin to Latin *vadere* to go

The study area will be monitored extensively to track recharged water along its entire flow path from land surface, through approximately 500 feet of vadose zone, to the

regional aquifer. Data collected during the project will help determine the long-term feasibility of the recharge method and establish the means to calculate the recoverable groundwater right.

The plan includes monitoring of the source water discharged to the arroyo, the vadose zone, and the underlying aquifer. Because each artificial recharge project is site specific, we have employed an adaptive management program, which means that additional instrumentation may be installed based upon review of data collected during the first season of recharge. Continuous data collection has been automated for remote monitoring of streamflow, groundwater levels, streambed temperatures, and vadose zone moisture contents.

Figure 2



Surface water flow will be measured at several points to determine the amount of water transmitted downstream and the amount of water entering the study area. Streamflow measurements upstream from the area of hydrologic effect will allow for quantification of any ephemeral flow entering the study area. In general, ephemeral flows are not expected during the primary recharge periods (November through February), however, ephemeral flow is expected during the late summer to early fall monsoon season. The quality of source water introduced to the arroyo for recharge will be evaluated by analysis of samples collected at the above-ground storage tank outfall.

A combination of temperature sensors, heat dissipation sensors, lysimeters, and neutron logging will be used to monitor water as it moves through the vadose zone to the water table. Data collected will be used to determine the lateral extent of spreading and the rate of percolation. Transect location and sensor placement (Figure 2) were selected to define and track the wetting front, characterize the amount of lateral spreading, and evaluate temporal changes in moisture content in the vadose zone (including changes in storage in the vadose zone). Three water quality lysimeters were installed at various depths so that soil water samples can be collected for water quality analysis. This data will allow for evaluation of changes in water quality as recharge water moves through the vadose zone.

The aquifer will be monitored in and around the "estimated area of hydrologic effect," as defined in the NMOSE permit application. Three groundwater monitoring wells were installed around the study area to measure the water table response to increased recharge and pressure transducers will be used to ensure continuous water levels (at an hourly interval). The monitoring wells will also provide additional information about the vadose zone through the use of a neutron probe to measure soil moisture in the vadose zone. Water quality of both the recharge source water and groundwater from each monitoring well will be monitored throughout the demonstration project. Water quality samples will be analyzed for major ions, nutrients, trace elements, and selected isotopes.

The Bear Canyon Recharge Demonstration Project is the first artificial recharge project in the State of New Mexico. The Authority's primary interest in artificial recharge is to establish a drought reserve. The intent of this demonstration project is to collect necessary data to establish the right to recover recharged water. Monitoring began in late summer of 2007 and as soon as instrumentation was in place, and will continue throughout the demonstration project. The final demonstration permit applications have been accepted by NMED and NMOSE. The first recharge period is scheduled to begin in December 2007 and continue through March 2008. ❖

Stephanie Moore is a senior hydrologist with Daniel B. Stephens & Associates and project manager for the Bear Canyon Project. She spent eight years with the U.S. Geological Survey (USGS) before joining DBS&A in early 2005. Ms. Moore holds a B.S. degree in Environmental Science from TCU and an M.S. degree in Earth and Planetary Sciences from UNM. Her technical research interests include quantitative analysis of stream-aquifer interactions, vadose-zone processes, and spatial and temporal variations in water quality. She is currently serving as the President of the New Mexico Section of the American Water Resources Association and is active in Water For People.

John Stomp has a Bachelors and Masters of Science in Civil Engineering from UNM and is the Water Resources Manager for the Albuquerque-Bernalillo County Water Utility Authority. Mr. Stomp's responsibilities as Water Resources Manager include water conservation, water resources, ground water protection and arsenic investigations. One of his primary responsibilities is to implement the Authority's adopted Water Resources Management Strategy to provide a safe and sustainable water supply for the metropolitan area. The strategy includes transitioning from sole reliance on ground water to renewable surface water supplies, namely the Authority's San Juan-Chama water. The project includes the construction of more than $ 375 million in facilities consisting of a new surface diversion, water treatment plant and distribution pipelines