



# United States Department of the Interior

## U. S. GEOLOGICAL SURVEY

2730 N. Deer Run Rd.  
Carson City, NV 89701  
Phone: 775-887-7624

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### MEMORANDUM

To: Devin Galloway, WSFT-West Groundwater Specialist, Sacramento, CA  
From: Stephen R. Maples, Hydrologist, Nevada WSC, USGS  
Subject: AQUIFER TEST—Analyses of TRCC-2 multiple-well aquifer test of volcanic rocks, Tracy Segment, Storey County, Nevada.

#### Introduction

A proposed quasi-municipal supply well, TRCC-2 (NWIS Site ID: [393447119312302](#); 39°34'46.96" N, 119°31'22.97" W), for the Tahoe-Reno Commercial Center in the Tracy Segment Hydrographic Area was completed in a volcanic-rock aquifer. Well TRCC-2 was pumped at an average rate of 950 gallons per minute (gpm) from 10/24/06 through 11/3/06 as part of a 10-day constant-discharge test. Water-level data were collected both at pumping well TRCC-2 and at observation well TRCC-3 (NWIS Site ID: [393446119311701](#); 39°34'46" N, 119°31'17" W) for the duration of the test and during a 5-day recovery period so that transmissivity and storage coefficient of the volcanic rock aquifer could be estimated. The constant-rate aquifer test was conducted by Eco-Logic Inc. (D. Bugenig, personal communication, March 28, 2014; Bugenig, et al., 2007).

#### Site Description

Pumping well TRCC-2 is a 10-inch well that was completed in a 17.5-inch borehole (fig. 1). Drillers logs report that well TRCC-2 penetrates alternating clay, gravel and boulders to 180 feet below land surface (bls), and fractured volcanic rock to the total depth of 527 feet bls. The well was screened in volcanic-rock from 338–527 feet bls, and a gravel pack was installed from 50–527 feet bls. Depth to water is about 164 feet bls. The aquifer is assumed to be confined in the volcanic rock and unconfined in the overlying alluvial fill.

Observation well TRCC-3 is located 472 feet from TRCC-2 and was monitored during the aquifer test. Well TRCC-3 is a 12-inch production well completed in a 17.5-inch borehole. Drillers logs describe clay and rocks to 128 feet bls, underlain by andesite and basalt to 638 feet bls. Fracture zones were noted at 230, 430, 520, and 550 feet bls. Well TRCC-3 was gravel packed and screened in similar volcanic rock as the production well. An image well was used in this aquifer test evaluation at radial distance of 6,000 feet from pumping well to account for leaky boundary associated with transmissive unconfined unconsolidated sediments adjacent to Truckee River.

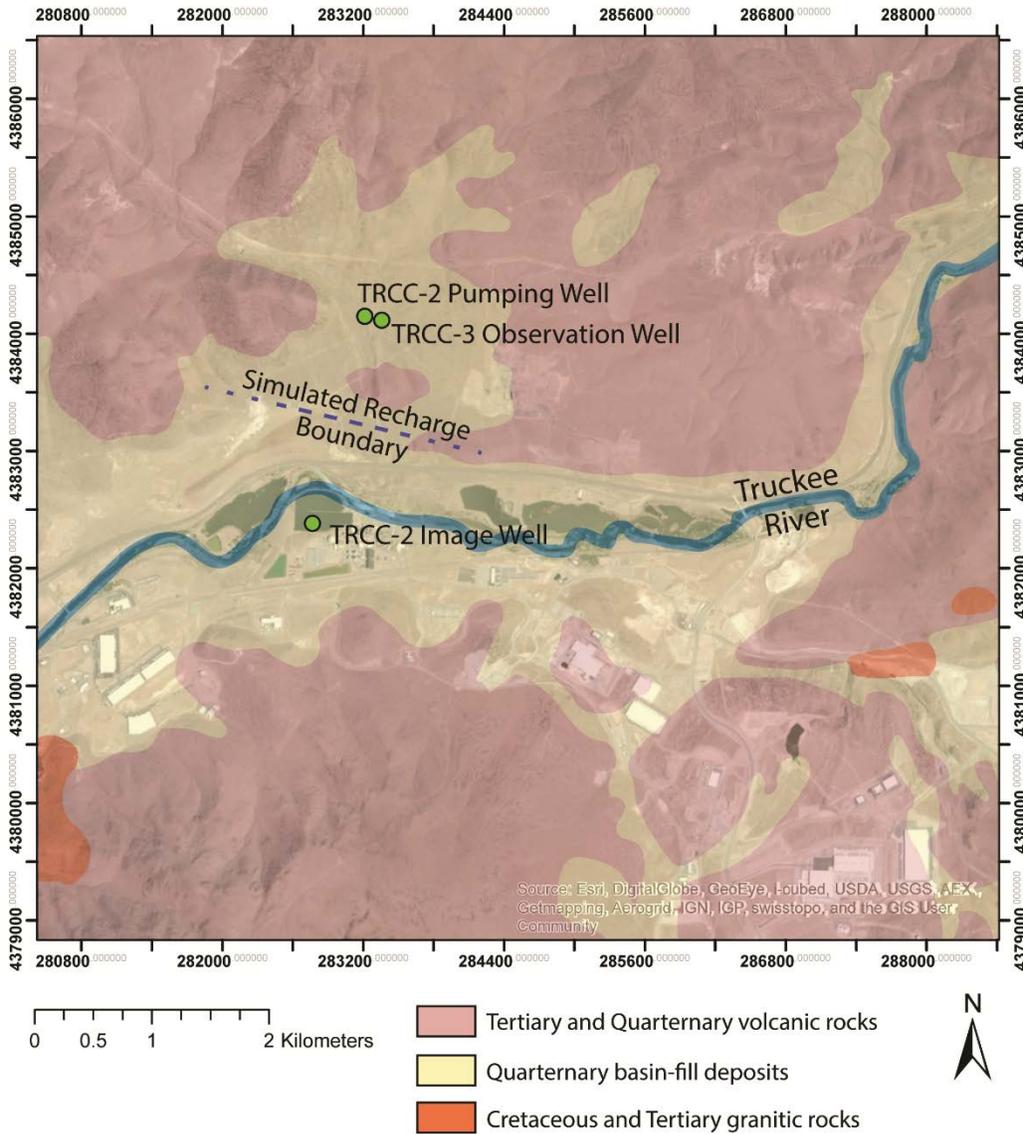


Fig. 1. Location TRCC-2 aquifer test site, wells, and location of simulated Truckee River recharge boundary.

Table 1. Wells, coordinates, radial distances, and completion intervals at the TRCC-2 site.

Well	Easting, m (UTM NAD83)	Northing, m (UTM NAD83)	Radial Distance, ft	Depth to Top of Screen, ft	Depth to Bottom of Screen, ft
TRCC-2 Pumping Well	283,218 E	4,384,145 N	N/A	338	527
TRCC-3 Observation Well	283,360 E	4,384,111 N	473	403	637
TRCC-2 Image Well	282,745 E	4,382,378 N	6,000	N/A	N/A

**Test Description**

The aquifer test commenced when well TRCC-2 began pumping at 09:30, 10/24/06 and continued for 10 days and 30 minutes until 10:00, 11/3/06. Discharge averaged  $953 \pm 3$  gpm through the duration of the test. Discharge water was routed to an ephemeral stream channel roughly 1500 feet from pumping well TRCC-2. Once pumping had ceased, water levels were allowed to recover for an additional 5 days. Water levels in pumping well TRCC-2 and observation well TRCC-3 were monitored at varying and 1-minute intervals, respectively, during the test and recovery period.

### **Aquifer Test Analysis**

Transmissivity and storage coefficient were estimated from the constant-discharge test by analyzing water-level drawdown and recovery in pumping well TRCC-2 and observation well TRCC-3 with a Theis solution and image well theory. An Excel spreadsheet program was used to analyze the data (Halford and Kuniandy, 2012). A decrease in the slope of drawdown vs. time in observation well TRCC-3 at approximately one day suggests that drawdown was affected by leakage of water through unconsolidated fluvial sediments adjacent to the Truckee River. Unconsolidated sediments along the Truckee River corridor were assumed to be more transmissive than the underlying volcanic-rock aquifer (fig. 1). Leakage of Truckee-River water from overlying unconsolidated sediments into the volcanic-rock aquifer was assumed to provide an effectively infinite source of water. Image well position and estimates of hydraulic properties were estimated by minimizing equally weighted residuals between simulated and measured drawdowns. Simulations of drawdown and recovery for pumping well TRCC-2 (fig. 2) and observation well TRCC-3 reasonably matched measured values (RMSE = 3.3 and 3.4 ft, respectively). The estimated position of the leaky boundary was generally consistent with the boundary of the unconsolidated sediments along the Truckee River (fig. 1). Transmissivity and storage coefficients estimated for the volcanic-rock aquifer from drawdown and recovery data were  $4,000 \text{ ft}^2/\text{d}$  and 0.002, respectively. Drawdown and recovery estimated with identical aquifer properties but without a leaky boundary matched late-time measured values for TRCC-2 and TRCC-3 poorly due to the departure in slope of measured drawdown beginning at approximately one day (fig. 2). Root mean square error for the simulated drawdowns and recoveries with the leaky boundary for both TRCC-2 and TRCC-3 were less than for the simulations without a leaky boundary.

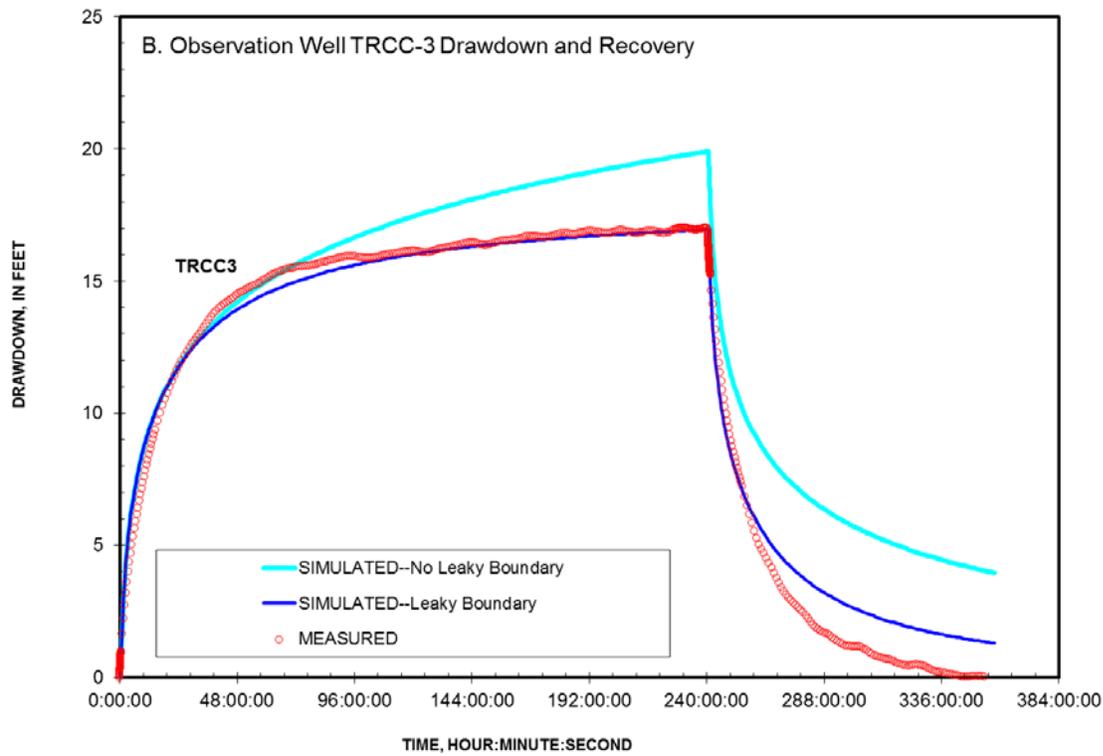
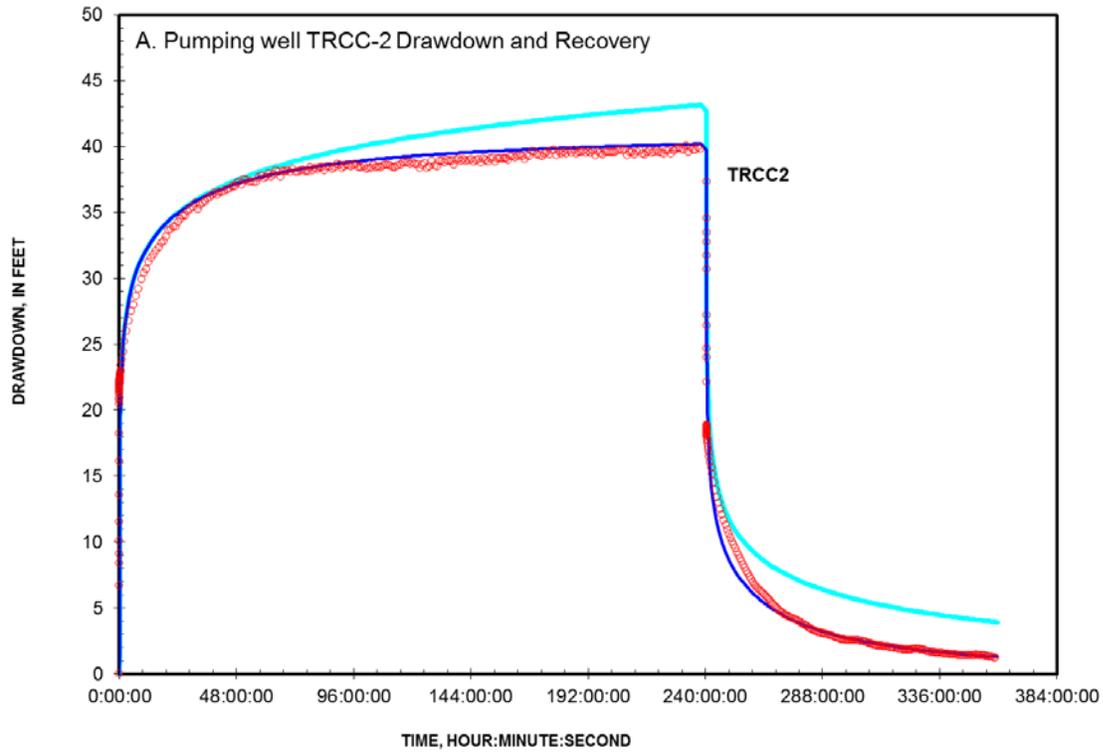


Figure 2. Simulated and measured drawdown and recovery in (A) pumping well TRCC-2 and (B) observation well TRCC-3.

References:

Bugenig, D.C., M. Hanneman, and T.H. Butler, 2007. *Evidence in Support of Water Rights Application 69594, 69595, and 69596, Washoe County, NV*. Unpublished report prepared by ECOLOGIC Engineering for the Nevada Division of Water Resources. Dated Feb. 2, 2007.

Halford, K.J. and E.L. Kuniatsky, 2002. *Documentation of spreadsheets for analysis of aquifer-test and slug-test data*. U.S. Geological Survey Open-File Report 02-197, 51 p.