Memo to File

December 10, 2008

David R Tuthill
Tim Luke

To: Cottonwood Critical Ground Water Area File

From: Lin Campbell

Subject: Analysis of Ground Water Conditions in the Cottonwood Critical Ground Water Area

This analysis is provided in response to continued concerns about declining ground water levels in the Cottonwood Critical Ground Water Area (CCGWA). The CCGWA was originally established in 1962 with several modification orders being issued since then.

Previous studies of the CCGWA include those by Crosthwaite (1969), Struhsacker and others (1983), Edwards and Young (1984), Young and Newton (1989), and Bendixson (1994).

Three lithologic units in the CCGWA have been identified as host-rock for aquifers. Two, the Quaternary alluvium and the Tertiary Idavada silicic volcanic rocks can be locally significant sources of ground water, but the pre-Tertiary sedimentary unit is the only aquifer considered in this memo. This unit consists of limestone, shaly limestone, and quartzite that have been intensely fractured during several periods of crustal deformation (Struhsacker and others, 1983). Ground water occurs in fractures and weathered zones in the limestone, and while accurate contouring of the potentiometric surface is not possible for a variety of reasons, the general direction of flow appears to be away from the recharge area in the Rock Creek Hills towards Foothills Road and then to the northwest and generally east. A fault roughly coincident with Foothills Road presents an effective barrier between the limestone aquifer to the southwest and the silicic volcanic aquifer that is a significant source of water in the adjacent West Oakley Fan Critical Ground Water Area. Very little hydraulic connection is apparent across the fault (Edwards and Young, 1984).

The aquifer is recharged by precipitation falling in the higher elevations of the Rock Creek Hills. Edwards and Young (1984) estimated that average annual precipitation was about 80,000 acre-feet and that after accounting for evapotranspiration and other local hydrogeologic characteristics, approximately 2-5 percent of that (1600 to 4000 acre-feet) was available for ground-water recharge. Because of the thin soil cover and extensive faulting in the Rock Creek Hills, the actual amount available is probably closer to the 5 percent estimate.

According to Idaho Department of Water Resources (IDWR) records, seven wells have been monitored for water levels since the establishment of the CCGWA. A general location map and hydrographs are presented in figure 1. Only one (13S21E-18BBC1) has a continuous record since 1961. The others have gaps between measurements or were added to or dropped from the network at later times. A summary of the wells is as follows:

13S21E-18BBC1: Well is part of the IDWR/U S Geological Survey (USGS) Cooperative Study. It was measured weekly from 1961 to 1996, monthly from 1996 to 2003, and bi-monthly from 2004 to present.

13S21E-08BDD1: Well was measured by the USGS weekly from 1982 to 1999.

13S21E-06DAD1: Well is part of the IDWR water level network and is measured bi-annually since 2004. Well was measured by the USGS weekly to monthly from 1984 to 1999. Well has also been measured during the irrigation season by Water District 45-O (Well 417) since 2005.

13S21E-05CCD1: Well is measured monthly during the irrigation season by Water District 45-O (Well 217) since 2004. This well was also measured by IDWR bi-annually from 1977 to 1985.

12S20E-25BCA1: Well was measured most recently by the USGS in the 2001-2002 and 2008 Eastern Snake Plain Aquifer Synoptic studies. The USGS measured it monthly from 1961 to 1969, then bi-annually from 1977 to 1978. A few sporadic measurements were collected between 1980 and 1984.

12S20E-25CBB1: Well has been measured monthly during the irrigation season by Water District 45-O (Well 209) since 2003.

12S20E-25CB1: This well was measured by IDWR weekly to quarterly from 1978 to 2003. Although this well is in the vicinity of 25CBB1, it is not the same well.

All of the measured wells have shown significant water level declines since the establishment of the CCGWA. Subsequent modifications to the original order have slowed the rate of decline, but have not been successful in stopping or, in ideal circumstances reversing the downward trend. This is illustrated by the hydrographs of the four wells that are currently measured (figure 2).

The most recent reduction in withdrawals was issued in 2004. The hydrographs for the period of 2004 to 2008 (figure 2) still show a general downward trend and most show significant responses to annual withdrawals, but the rate of decline is not as pronounced as it was in earlier years. Well 06DAD declined about 3.5 feet per year and wells 25CBB and 05CCD declined about 5 feet per year. Well 18BBC is located furthest from the pumped irrigation wells and is probably the best indicator of general aquifer conditions. While the annual fluctuations are still evident, the amplitude is much less and the average annual rate of decline is slightly less at about 2.5 feet per year.

Considering that the most optimistic estimate of natural recharge to the aquifer is around 4000 acre-feet per year, continued production by the ground-water users at that rate is probably not sustainable without further depletion of the resource. The hydrographs suggest that we may be nearing a sustainable production rate, but we are not there yet. My recommendation is in line with the recent agreement reached by the users – reduce production by 500 acre-feet per year and pursue all available opportunities for artificial recharge, especially in the northern end of the CCGWA.

Monitoring of the four wells currently in the network needs to continue. If funding is available, water-level transducers would be an ideal way of obtaining a continuous record of levels and may allow for fewer trips to the area to physically measure the wells. Care needs to be taken when specifying the type of transducer to ensure that the measurement range is sufficient to capture the fluctuations of the water levels. A method of correcting the measurements for changes in barometric pressure also needs to be considered. Finally, some type of locking cap would need to be installed to avoid theft/vandalism.

Selected Bibliography and References:

Bendixson, S. B., 1994. Summary of Ground Water Conditions in the Oakley Fan Area, Idaho Department of Water Resources Open-File Report. 15 p.

Crosthwaite, E. G., 1969. Water Resources of the Goose Creek-Rock Creek Area, Idaho, Utah and Nevada. Idaho Department of Reclamation, Water Information Bulletin 8. 73 p.

Edwards, T. K. and Young, H. W., 1984. Ground Water Conditions in the Cottonwood-West Oakley Fan Area, South Central Idaho. U.S. Geological Survey Water Resources Investigations Report 84-4140. 32 p.

Struhsacker, E. M., Smith, C. and Capuano, R. M., 1983. An Evaluation of Exploration Methods for Low-Temperature Geothermal Systems in the Artesian City Area, Idaho. Geological Society of America Bulletin, v. 94, p. 58-79.

Young, H. W. and Newton, G. D., 1989. Hydrology of the Oakley Fan Area, South Central Idaho. U.S. Geological Survey Water Resources Investigations Report 88-4065. 73 p.

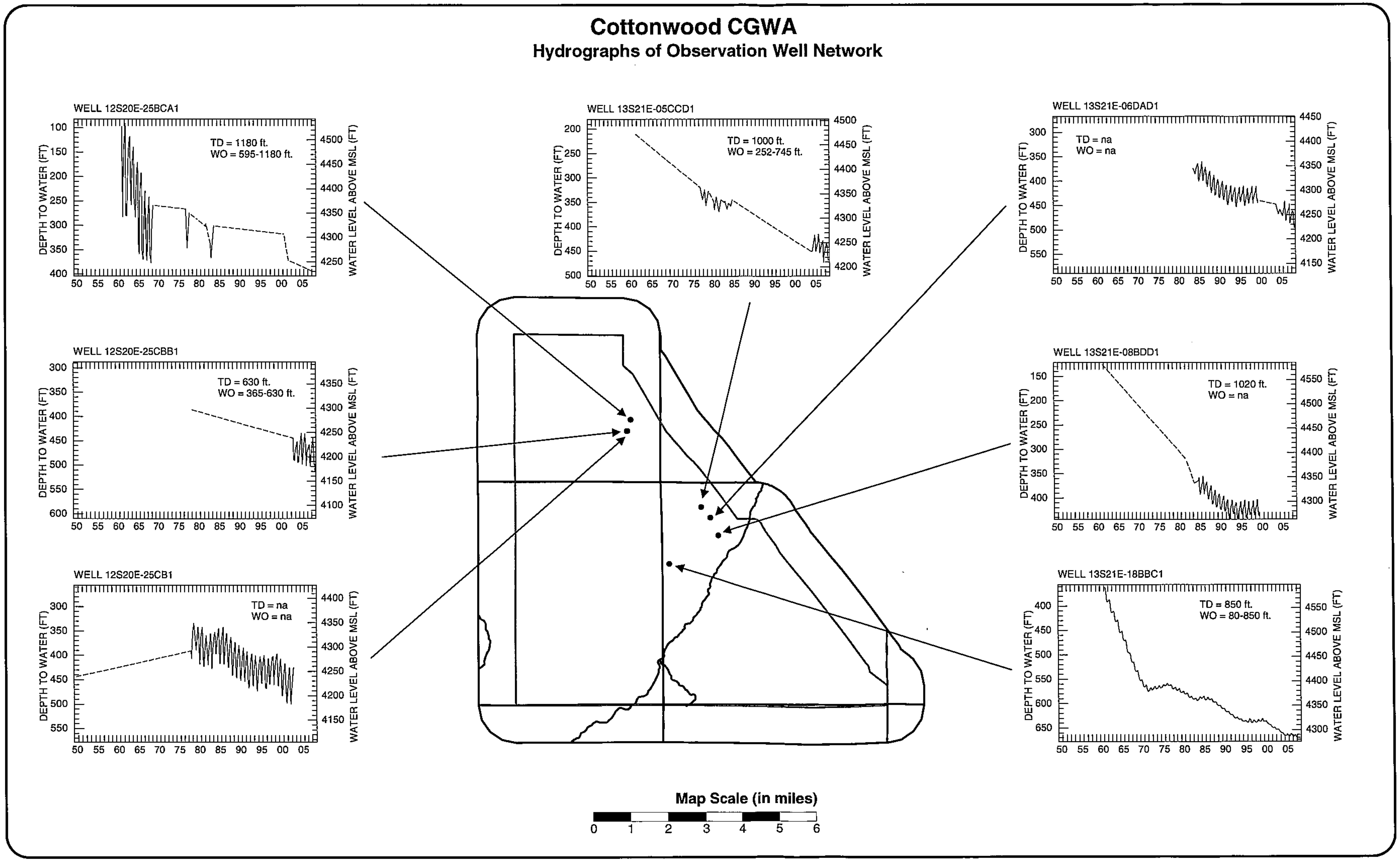

Figure 1: Hydrographs for observation wells in the Cottonwood Critical Ground Water Area.

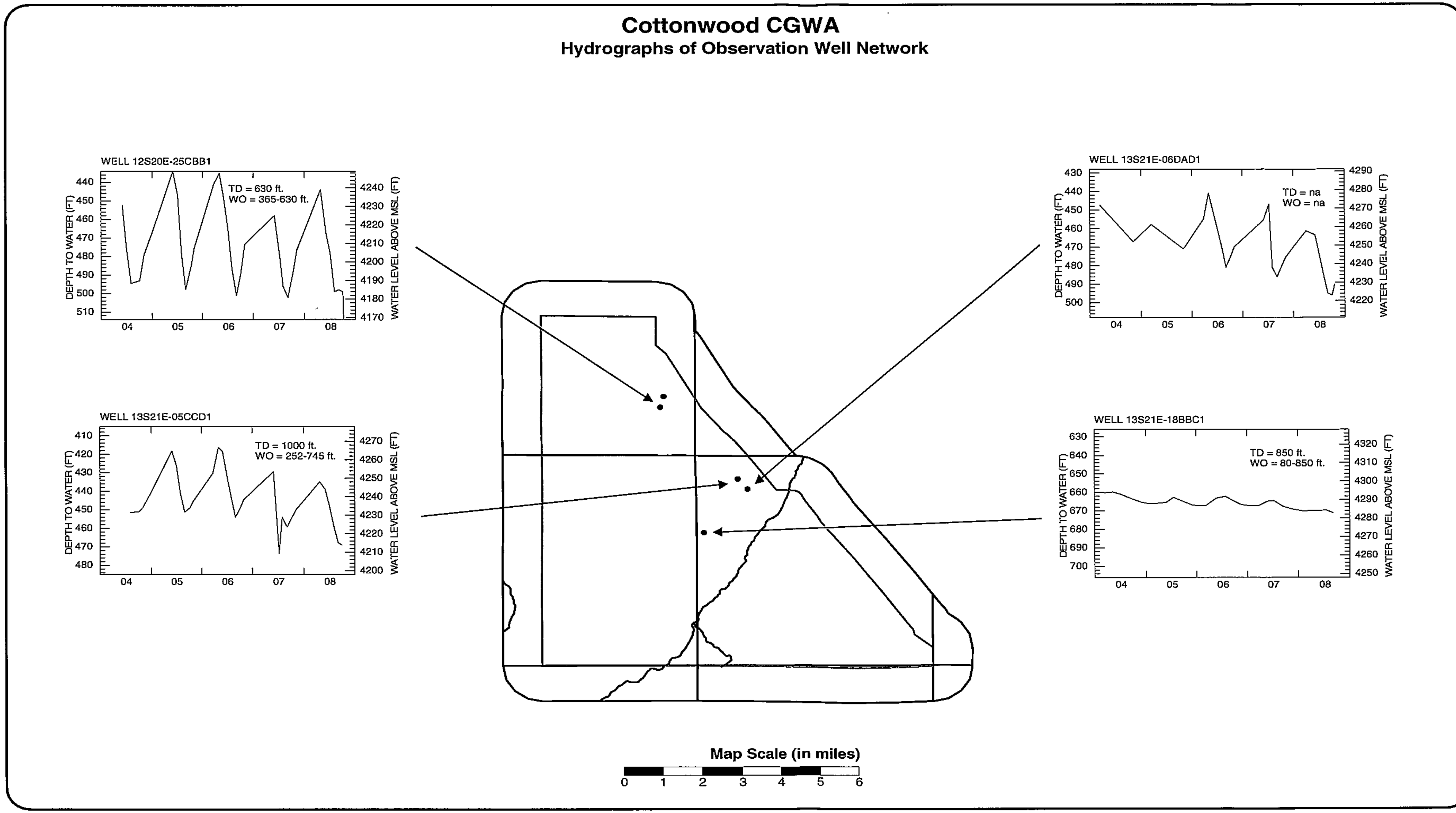

Figure 2: 2004 to 2008 hydrographs for selected observation wells in the Cottonwood Critical Ground Water Area.