Texas Water Development Board

Technical Note 13-02

Summary of Groundwater Conditions in Texas: Recent (2011-2012) and Historical Water-Level Changes in the TWDB Recorder Network

by

Blake Neffendorf and Janie Hopkins, P.G.

August 2013

Blake Neffendorf, as program specialist for the recorder program, installed, operated, and maintained the recorder network and created the maps, hydrographs, and tables for this report.

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The contents of this report document the work of the following Texas Licensed Geoscientist:

Janie Hopkins, P.G. No. 487
As program manager for groundwater monitoring, Janie Hopkins wrote the report.

The seal appearing on this document was authorized on August 15, 2013.

STATE OF TEXAS
JANIE HOPKINS
GEOLOGY
No. 487
LICENSED
PROFESSIONAL GEOSCIENTIST

Janie Hopkins

Janie Hopkins

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1.0 Executive Summary

The Texas Water Development Board (TWDB), in partnership with its cooperators, continues to install and monitor automatic water-level recorders in observation wells throughout the state. This report discusses the water-level changes observed from 2011 to 2012 in 145 recorder wells, including 125 recorder wells in the state's nine major aquifers, 17 recorder wells in eight minor aquifers, and three recorder wells in undesignated aquifers. The TWDB posts hydrographs and daily water-level measurements for these wells at http://www.twdb.texas.gov/groundwater/data/waterlevel.asp. The report does not include water-level data from those recorder wells that were added to the network during 2012. Since 2011 the recorder well network has expanded by over 12 percent. A relatively greater number of recorder wells exists in areas where water-level declines have been documented, such as in the High Plains, and more recently in areas where groundwater use is increasing, such as in Central Texas. In 2012, 25 recorders were operating in wells in the Ogallala Aquifer and 35 recorders in wells in the central Texas Trinity Aquifer; together, these wells represent just under half of the 125 recorders in major aquifers discussed in this report.

Groundwater levels throughout the state generally declined in 2012, but the decline is less than that observed in the previous year. Considering the 125 recorders in major aquifers, groundwater levels declined in 94 wells with a median water-level decline of 0.9 feet from 2011 to 2012. This was a smaller median water-level decline – measured in more recorder wells – than previously observed from 2010 to 2011. Water levels measured from 2010 to 2011 in major aquifers had a median water-level decline of 4.8 feet, nearly five times greater than the median water-level decline of 0.9 feet from 2011 to 2012. For wells that experienced rising water levels from 2011 to 2012, the water-level rise of 1.9 feet that occurred in 31 of the 125 wells was 24 percent greater than the median water-level rise of 1.5 feet that occurred in 9 of the 110 wells from 2010 to 2011.

Considering water-level change by region, the 25 Panhandle Ogallala wells experienced the greatest decline, or a total median change of -1.8 feet from 2011 to 2012, a rate of decline essentially unchanged from the previous year's median decline of 1.9 feet. The two Pecos Valley Aquifer wells in west Texas experienced the least decline of 0.7 feet, and the four Edwards (Balcones Fault Zone) Aquifer wells in the northern segment of the Balcones Fault Zone experienced the greatest median water-level rise of 0.9 feet. The water level in the one recorder well in the Hueco(-Mesilla) Bolson Aquifer in El Paso (that was not included in this comparison) dropped 3.6 feet from 2011 to 2012, in comparison to its previous year's rise of 1.5 feet. The LaSalle County recorder well, completed in the Carrizo-Wilcox Aquifer, again experienced the greatest decline (and change) of any of the recorders, or 72.2 feet, compared to 76.5 feet of decline from 2010 to 2011. Groundwater levels in the area of the Eagle Ford Shale Play, such as displayed by the LaSalle County recorder, may have been affected by increased irrigation pumping due to persistent drought conditions and, locally, to temporary pumping of groundwater to support oil and gas drilling activities.

This report only addresses water-level changes in 145 wells out of hundreds of thousands of wells throughout the state. To equate these changes, primarily declines, with specific amounts of total volume changes in aquifer groundwater storage is not feasible. Furthermore, the impacts of declining water levels on short- and long-term water supplies is dependent on a number of local factors.

2.0 Introduction

An automatic groundwater-level recorder well, or recorder well, refers to an unused water well installed with water-level recording equipment (a recorder) and a datalogger. The recorder is a sensor that obtains the actual water-level measurement. An optical sensor (or encoder—a measurement device that converts mechanical motion into electronic signals) uses a float and pulley system to obtain measurements, whereas a pressure sensor uses water pressure changes to obtain the data. Typically, older recorders use encoders, and newer ones are outfitted with pressure sensors or transducers. The TWDB operates both. The main electronic unit that receives the data from the sensor and stores the measurements is the logger or datalogger.

Additionally, the majority of TWDB (and cooperator) wells with recorders are also equipped with telemetry. This report summarizes water-level changes from these wells and does not include a discussion of water-level changes in a number of wells (mainly in Pecos County) that are only equipped with dataloggers. A transmitter receives data from the logger at scheduled intervals and transmits the information to a receiving site. TWDB (and cooperator) recorders use the Geostationary Operational Environmental Satellite (GOES satellite) system to relay data, although some groundwater conservation district (GCD) programs use a cell phone network.

As of January 2012, through the end of December 2012, the TWDB was operating 145 recorders: 125 in the state's nine major aquifers, 17 in eight minor aquifers, and three in three undesignated aquifers, all equipped with satellite telemetry that allows publication of near real-time (provisional) data on the TWDB web site. This annual summary report includes location maps, tables listing water-level changes, and hydrographs[1] for the period of record (up through the end of 2012) in all online recorders in these geographic areas (Figure 2-1):

- Northwest Texas: Ogallala and Seymour major aquifers; Edwards-Trinity (High Plains) minor aquifer; and one undesignated aquifer,
- West Texas: Hueco(-Mesilla) Bolson, Pecos Valley, and Edwards-Trinity (Plateau) major aquifers; Bone Spring-Victorio Peak, Igneous, West Texas Bolsons, and Lipan minor aquifers, and two undesignated aquifers,
- North-central Texas: Trinity and Edwards (BFZ) major aquifers and Woodbine minor aquifer,
- East and South Texas: Carrizo-Wilcox and Gulf Coast major aquifers, and
- Central Texas: Trinity major aquifer and Hickory and Ellenburger-San Saba minor aquifers.

[1] Please note that hydrographs published in last year's report presented the vertical or depth axis with different minimum and maximum depths to best illustrate water level changes within each well. This year, however, we are presenting the vertical axis for each hydrograph with the same minimum value, or land surface at '0' depth (except in two wells with historical records indicating flowing conditions), although total maximum values (depths) vary. Both approaches have their merits. This year's approach emphasizes the relative difference in water level depth from land surface for each well compared to others in the same aquifer or geographic area.

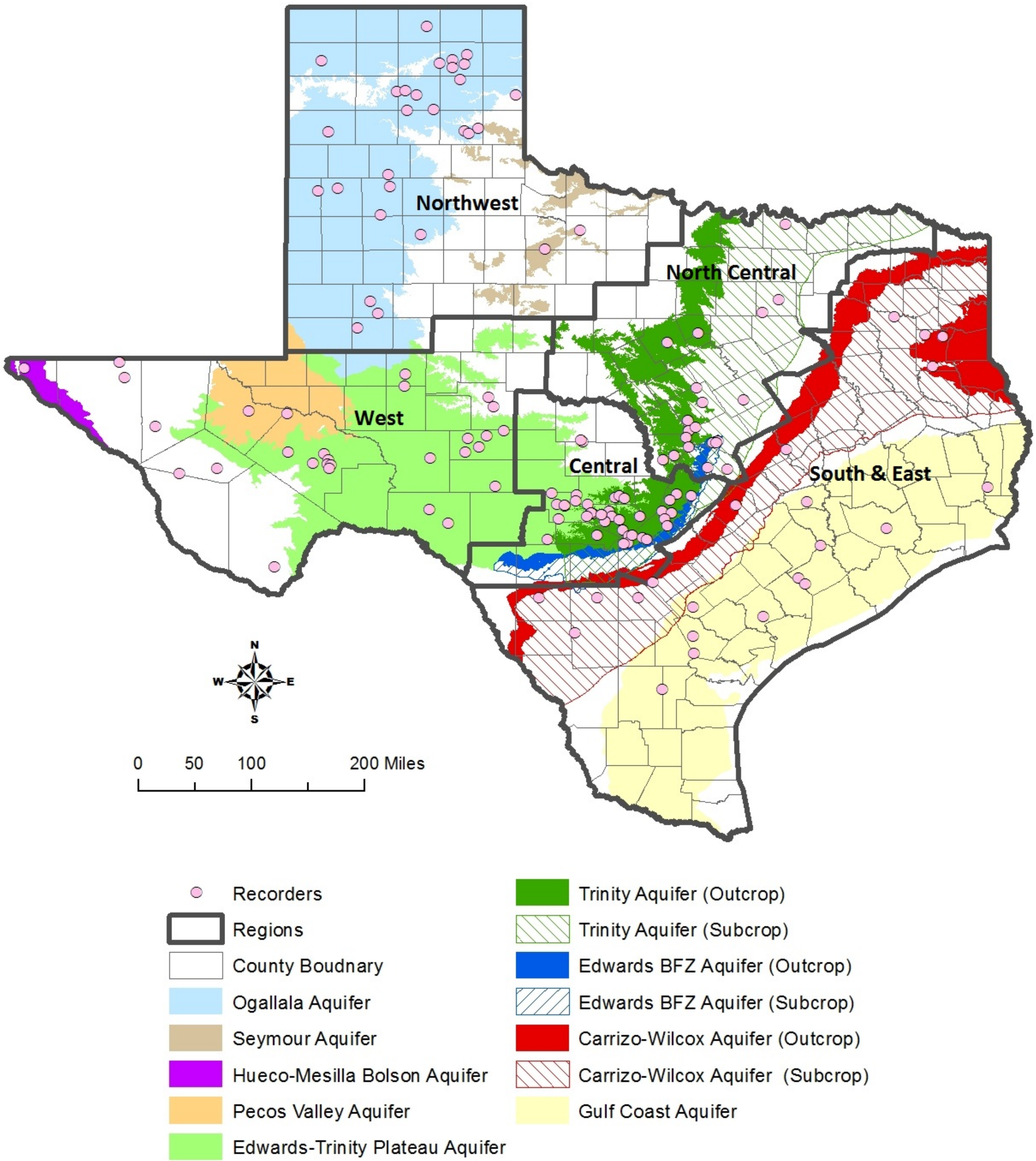


Figure 2-1. Location of 145 recorder wells operated by the TWDB and cooperators and areas discussed in this report.

3.0 Northwest Texas (including the High Plains and Rolling Plains)

The TWDB monitors 29 recorder wells in the northwest part of the state, in the High Plains (Panhandle) and Rolling Plains areas (Figure 3-1). The Wheeler County Ogallala Aquifer well 0529711 was dropped from the program in 2012 when the owner decided to put the well back in service. Twenty-seven wells are in the High Plains, including 25 wells completed in the Ogallala Aquifer, one in the Edwards-Trinity High Plains Aquifer (in Hale County), and one in the Whitehorse Aquifer (in Wheeler County). The two wells in the Rolling Plains are completed in the Seymour Aquifer.

3.1 Major aquifers

Water levels declined in all but two of the 25 Ogallala Aquifer wells from 2011 to 2012 (Table 3-1 and Figure 3-2), but at a slower rate than from 2010 to 2011. Changes in levels ranged from +1.2 to -10.1 feet with a median of -1.9 and an average of -1.8 feet. By contrast, water-level changes in these 25 Ogallala wells from 2010 to 2011 ranged from +1.2 feet to -36.9 feet, with median and average changes of -2.2 and -7.4 feet.

The Ogallala Aquifer is used primarily for crop irrigation and has experienced water-level declines throughout its extent as corroborated in the historical and yearly average changes. The Panhandle Groundwater Conservation District maintains its monitoring program in Roberts, Carson, Potter, and Armstrong counties where groundwater is also being pumped for municipal purposes. The largest 2010 to 2011 decline in the Ogallala Aquifer (nearly 37 feet) occurred in one of the district's monitoring wells –0510923—in Roberts County. From 2011 to 2012, this same well experienced the largest decline of the Ogallala recorder wells, or 10.1 feet.

Two recorder wells in the Ogallala Aquifer experienced water level rises from 2011 to 2012 where irrigation pumping decreased during the year. One Dawson County well experienced a rise of 0.9 feet after the previous year's decline of 5.3 feet. The water level in the Crosby County well rose 1.2 feet, in contrast to the previous year's decline of 3.4 feet.

The Seymour Aquifer wells experienced declines of 0.4 feet in Haskell County and 1.4 feet in Baylor County from 2011 to 2012, after declines in each of 2.3 and 4.0 feet, respectively, between 2010 and 2011. Shallow well depths in this aquifer account for greater sensitivity to rainfall and pumpage and subsequent slightly more pronounced groundwater level rises and declines.

3.2 Minor and undesignated aquifers

Water levels in the Hale County Edwards-Trinity High Plains and Wheeler County Whitehorse recorder wells declined 0.3 feet and 2.3 feet respectively from 2011 to 2012, compared to the larger declines the previous year, of 2.6 and 4.5 feet, respectively.

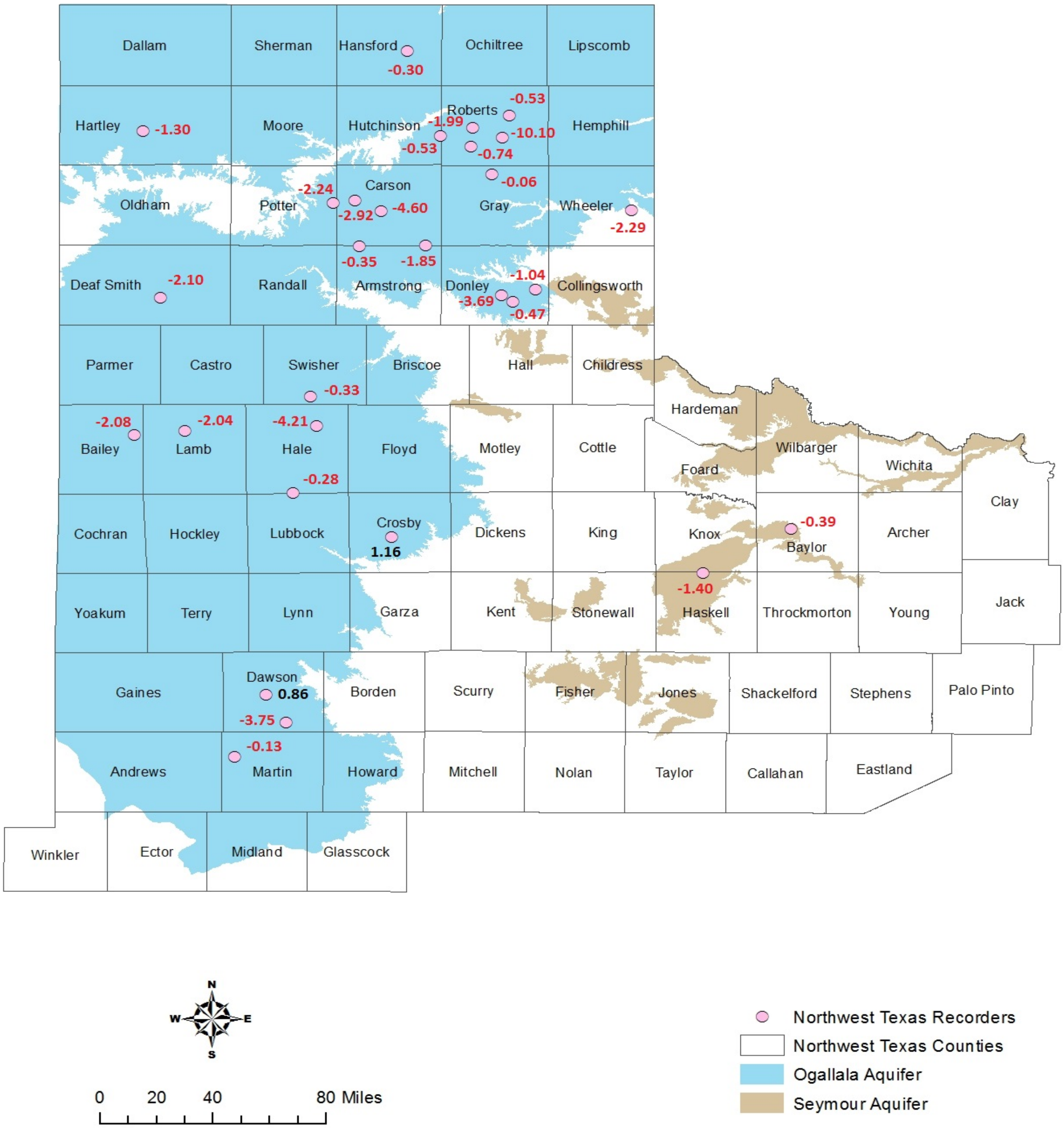


Figure 3-1. Location of wells with TWDB operated automatic water-level recorders in northwest Texas and water-level changes, in feet, from 2011 to 2012.

Table 3-1. Water-level changes, in feet, in TWDB recorder wells in northwest Texas counties for various time periods.

County & well #	Aquifer	2012 Change (ft)	2011 Change (ft)	2008-2012 Change (ft)	2003-2012 Change (ft)	Historical Change (ft)	Historical Yearly Avg. (ft)
Hansford 0354301	Ogallala	-0.30	-0.83	-3.41	-9.21	-83.48 (1951)	-1.35
Roberts 0503709	Ogallala	-0.53	-0.59	-0.42	N/A	-1.53 (2005)	-0.20
Roberts 0509553	Ogallala	-1.99	-2.56	-9.53	-18.34	-18.29 (2002)	-1.83
Roberts 0510953	Ogallala	-10.10	-36.93	-66.98	-67.08	-67.28 (2002)	-6.12
Roberts 0517203	Ogallala	-0.74	-0.62	-3.67	-6.99	-7.47 (2000)	-0.57
Gray 0526501	Ogallala	-0.06	-1.65	-3.99	-4.55	-25.11 (1958)	-0.46
Wheeler 0539904	Whitehorse	-2.29	-4.51	-5.59	N/A	-17.73 (1966)	-0.38
Hutchinson 0616702	Ogallala	-0.53	-0.76	-3.77	N/A	-4.70 (2003)	-0.52
Potter 0635912	Ogallala	-2.24	-1.69	-6.03	N/A	-7.57 (2006)	-1.16
Carson 0636602	Ogallala	-2.92	-4.79	-17.75	-30.58	-98.38 (1955)	-1.76
Carson 0645305	Ogallala	-4.60	-4.15	-11.68	-13.78	-13.78 (2003)	-1.38
Armstrong 0652603	Ogallala	-0.35	-0.46	-1.30	-2.62	-2.52 (2001)	-0.23
Armstrong 0655504	Ogallala	-1.85	-2.52	-6.53	N/A	-33.60 (1975)	-0.91
Hartley 0712401	Ogallala	-1.30	-2.52	-7.35	-20.31	-30.86 (1963)	-0.62
Deaf Smith 1004901	Ogallala	-2.10	-2.23	-7.84	-7.41	-29.77 (1975)	-0.78
Bailey 1051909	Ogallala	-2.08	-1.10	-6.56	-11.44	-19.45 (1981)	-0.63
Lamb 1053602	Ogallala	-2.04	-1.30	-7.67	-22.70	-114.37 (1951)	-1.84
Swisher 1142315	Ogallala	-0.33	-0.49	-2.36	-4.61	-16.00 (1988)	-0.65
Hale 1151403	Ogallala	-4.21	-1.88	-12.63	-21.94	-49.34 (1988)	-2.01
Donley 1202959	Ogallala	-3.69	-4.86	N/A	N/A	-7.77 (2010)	-3.89
Donley 1204452	Ogallala	-1.04	-5.52	N/A	N/A	-5.26 (2009)	-1.50
Donley 1211118	Ogallala	-0.47	-0.41	N/A	N/A	-2.88 (2008)	-0.61
Baylor 2122850	Seymour	-0.39	-3.96	N/A	N/A	-3.33 (2009)	-0.83
Haskell 2135748	Seymour	-1.40	-2.34	-7.76	-7.20	-6.15 (2002)	-0.60
Hale 2310401	Edwards-Trinity (High Plains)	-0.28	-2.62	-4.56	0.05	0.30 (2001)	0.03
Crosby 2330103	Ogallala	1.16	-3.40	-3.94	-5.40	-6.97 (1965)	-0.15
Martin 2739903	Ogallala	-0.13	-2.95	-8.26	-7.42	-35.50 (1964)	-0.73
Dawson 2817119	Ogallala	0.86	-5.34	-10.96	-9.33	-15.42 (2001)	-1.29
Dawson 2825604	Ogallala	-3.75	1.20	-1.17	0.89	0.81 (2000)	0.06

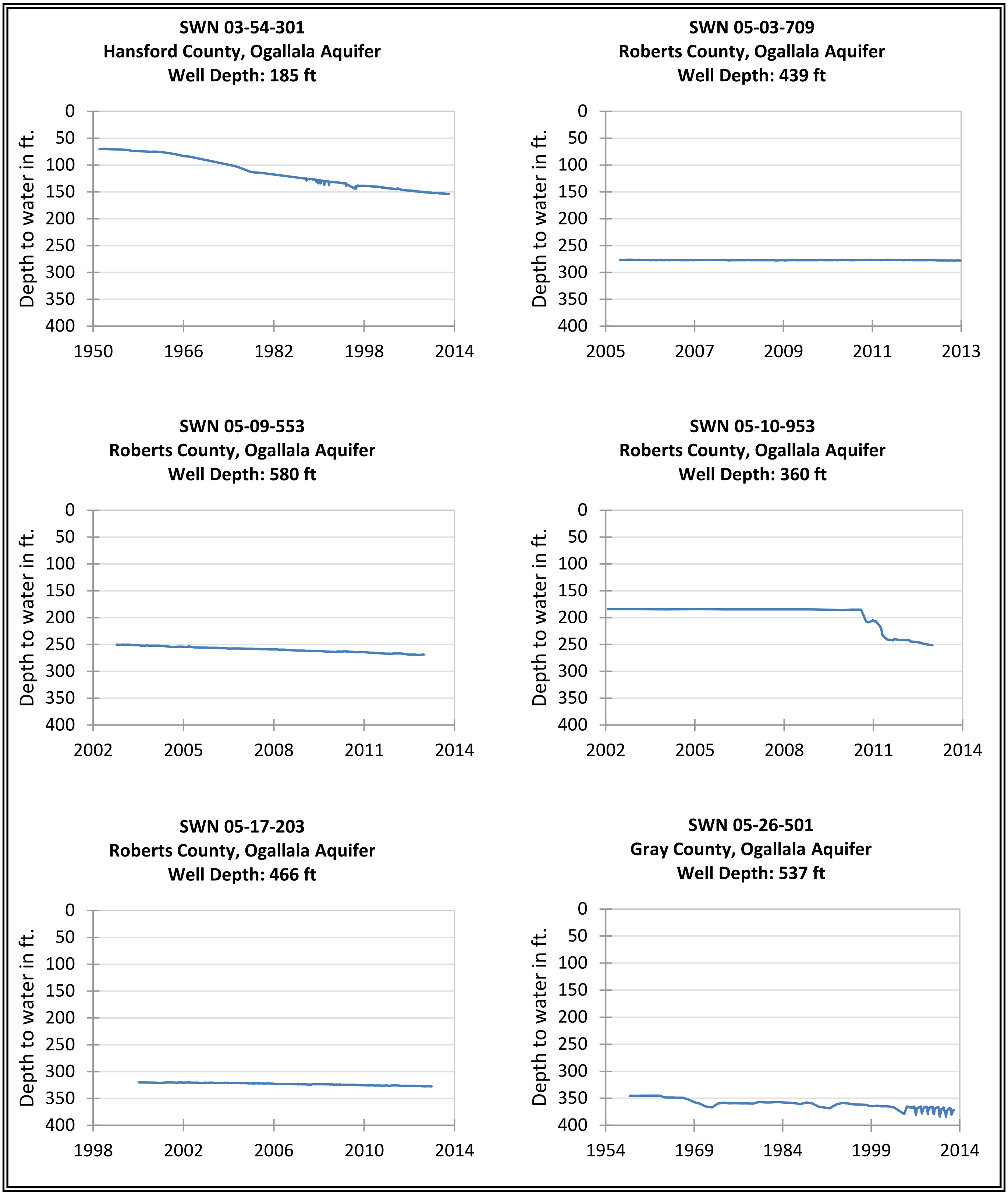


Figure 3-2. Hydrographs of TWDB recorder wells in the High Plains and Rolling Plains, Texas.

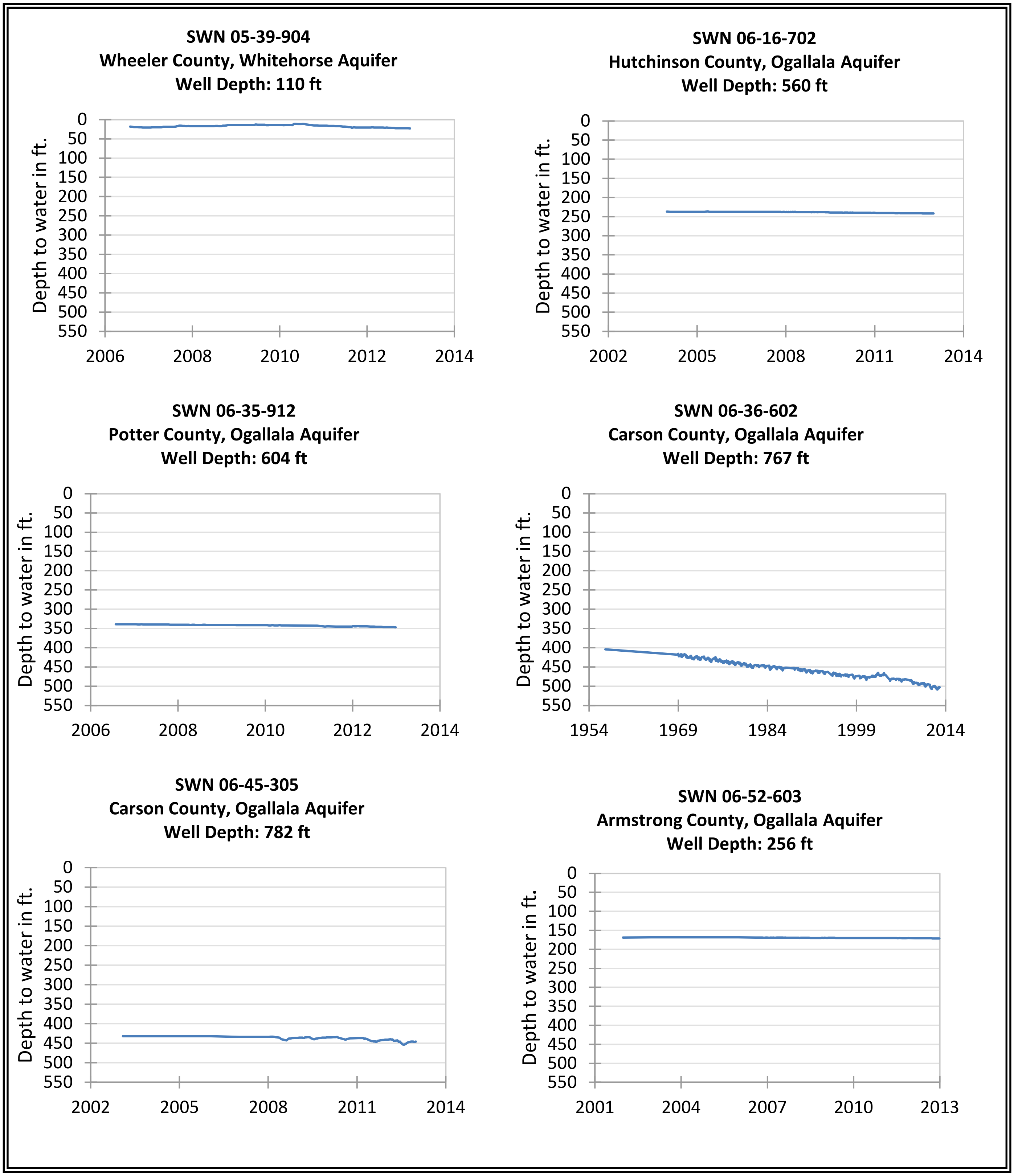


Figure 3-2 (continued). Hydrographs of TWDB recorder wells in the High Plains and Rolling Plains, Texas.

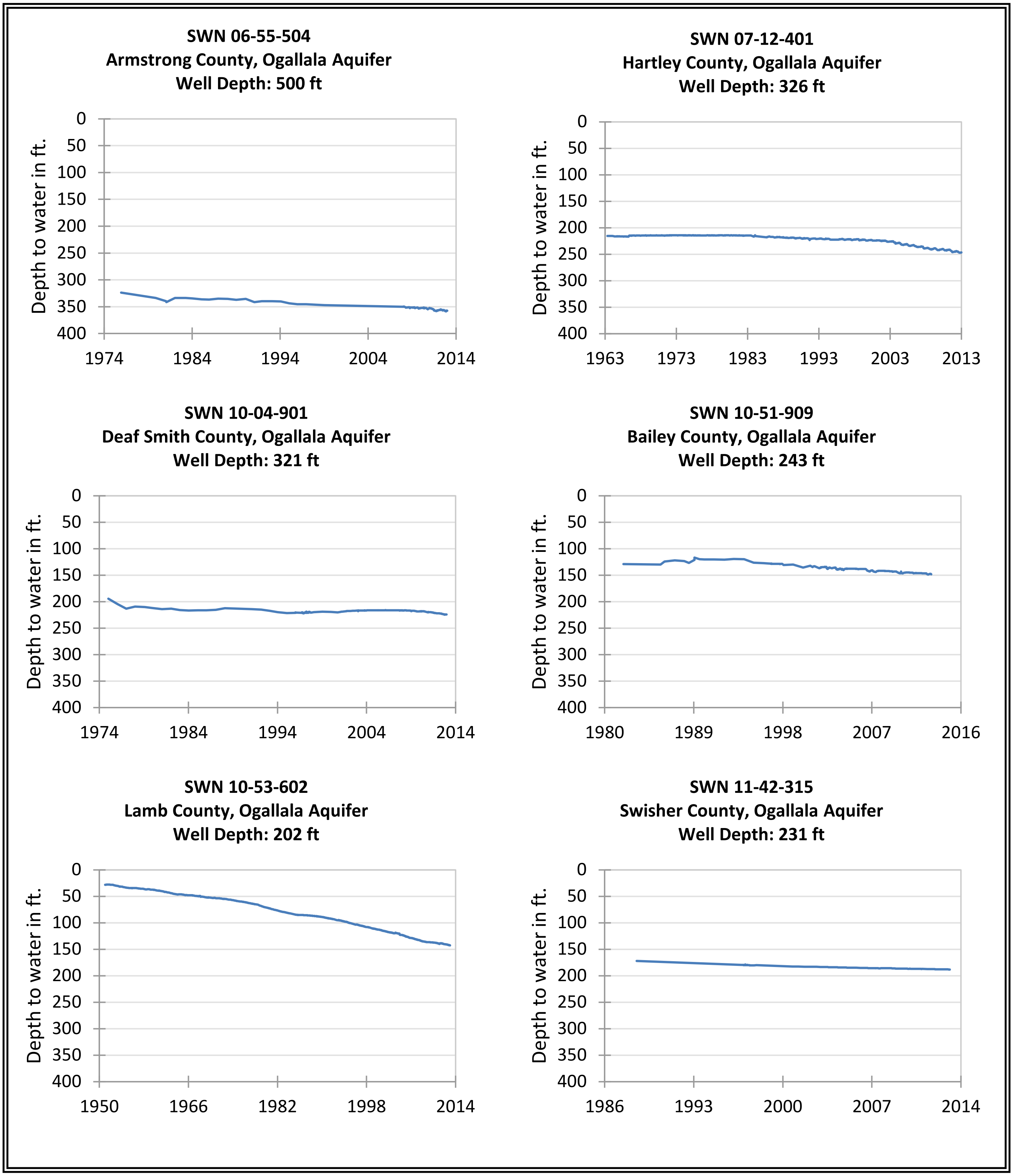


Figure 3-2 (continued). Hydrographs of TWDB recorder wells in the High Plains and Rolling Plains, Texas.

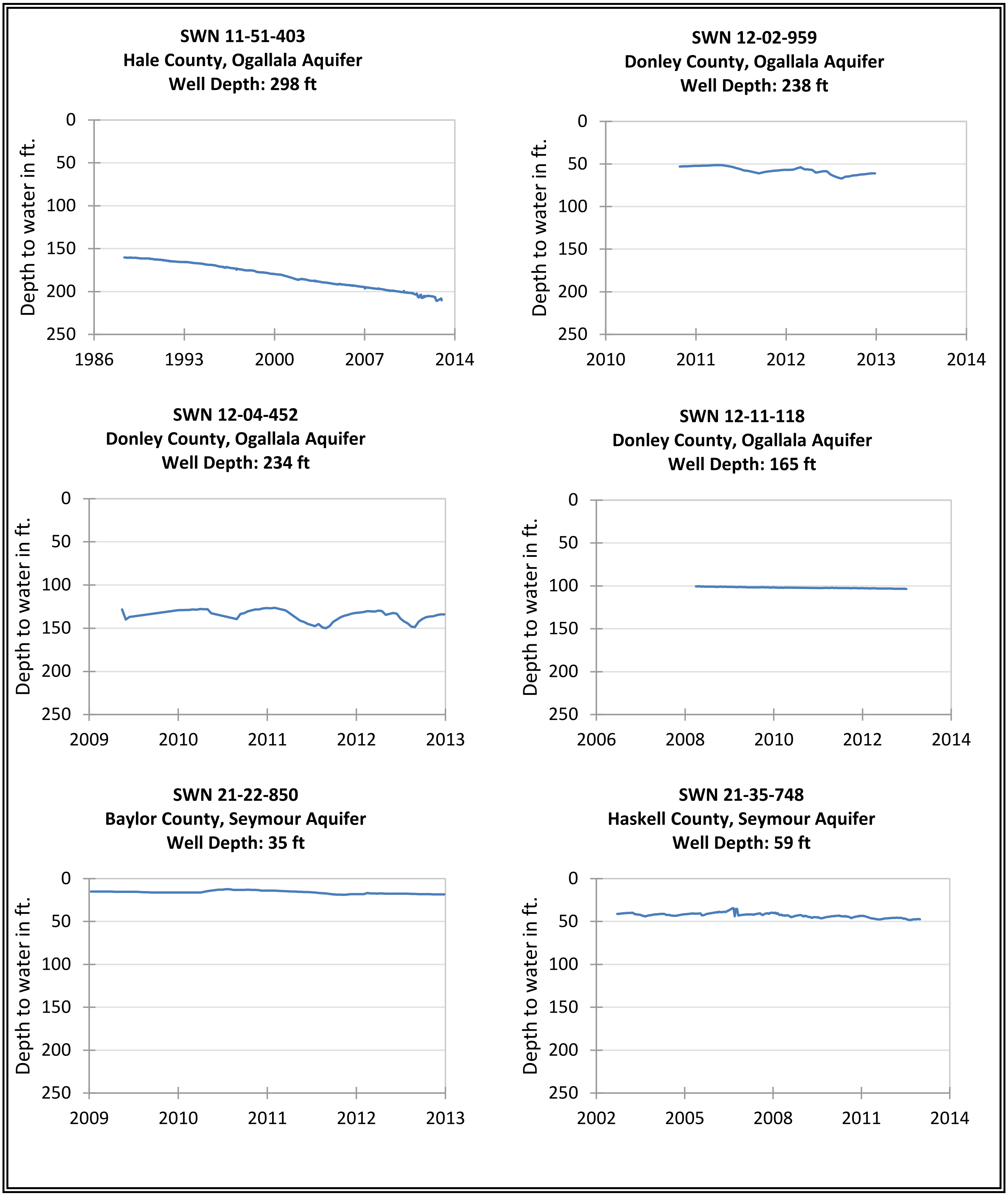


Figure 3-2 (continued). Hydrographs of TWDB recorder wells in the High Plains and Rolling Plains, Texas.

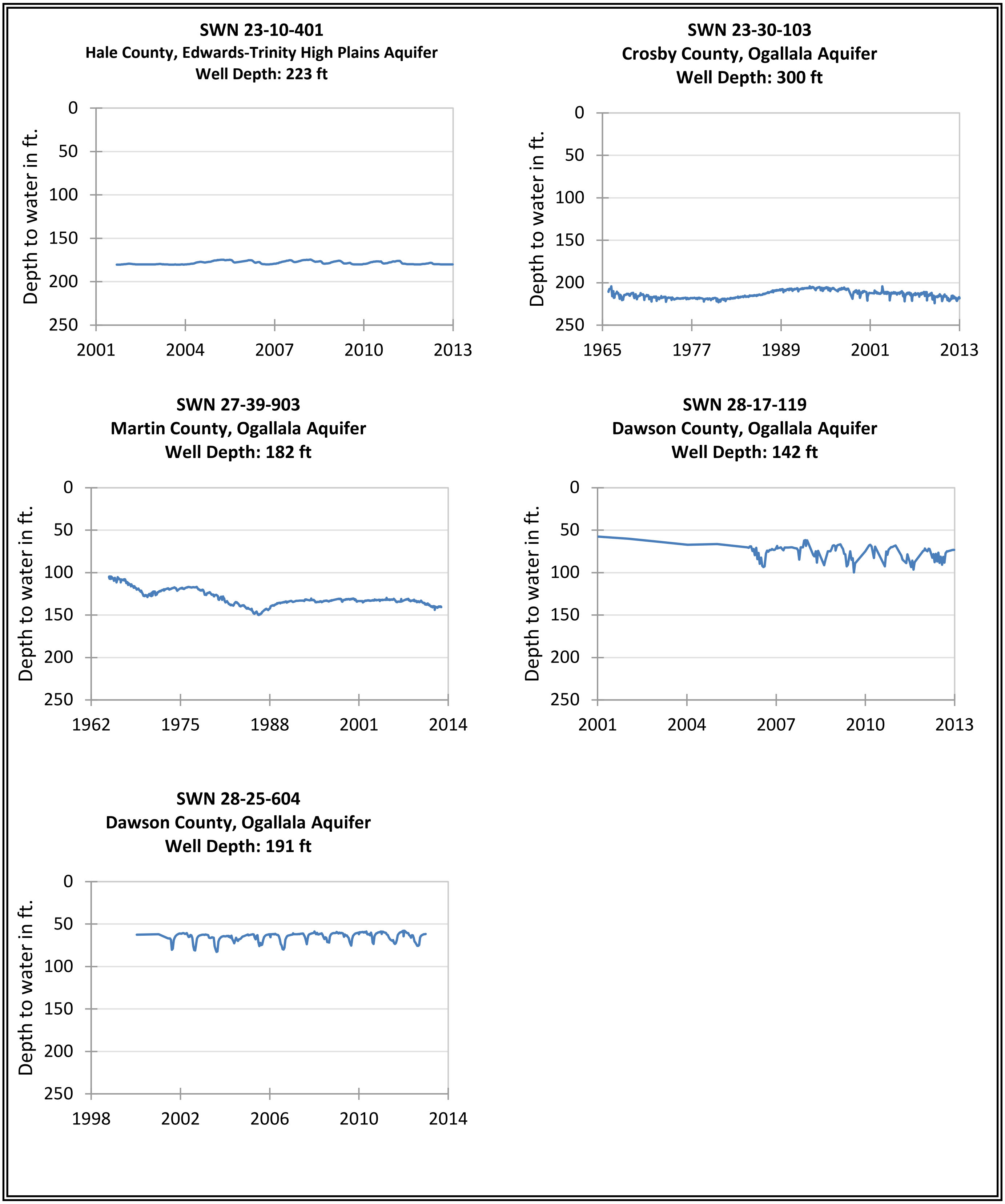


Figure 3-2 (continued). Hydrographs of TWDB recorder wells in in the High Plains and Rolling Plains, Texas.

4.0 West Texas

The TWDB monitors 30 wells in west Texas (Figure 4-1) of which 22 are wells completed in major aquifers and eight are wells completed in minor or undesignated aquifers. Wells completed in the major aquifers include 19 wells in the Edwards Trinity (Plateau) Aquifer—now including the Kerr County 5661102 well from the central Texas discussion in the 2010 to 2011 report and five more recorders in Schleicher and Pecos counties—two wells in the Pecos Valley Aquifer, and one well in the Hueco-Mesilla Bolson Aquifer. The eight recorder wells in minor aquifers include two in the Lipan Aquifer, two wells in the Bone Spring-Victorio Peak Aquifer, one well in the West Texas Bolsons, and one well in the Igneous Aquifer. One recorder well is completed in Quaternary volcanic rocks of an undesignated aquifer in Brewster County, and one recorder well is completed in the Cretaceous Aquifer in Culberson County.

4.1 Major Aquifers

Water-level changes in the wells completed in major aquifers were mainly declines (Table 4-1 and Figure 4-2). Water-level changes in the 19 Edwards-Trinity (Plateau) Aquifer wells between 2011 and 2012 ranged from +0.8 to -8.7 feet with a median of -0.9 feet and an average of -2.5 feet. The median water-level change in the wells with available measurements from the preceding year (2010 to 2011) was -0.7 feet with an average of -2.3 feet and a range of +1.9 to -11.9 feet.

Water levels in two Pecos Valley Aquifer recorder wells declined 1.0 and 0.1 feet from 2011 to 2012 in comparison to the previous year decline of 2.6 feet in the one well with available data.

Water levels in the Hueco-Mesilla Bolson well declined 3.6 feet from 2011 to 2012 after the preceding year's rise of 1.5 feet. The levels in this well have declined 61 feet over a nearly 60-year period. However, in the past several years the water levels, while continuing to fluctuate a negligible amount, have remained relatively flat.

4.2 Minor and Undesignated Aquifers

Water-level changes in wells completed in minor aquifers from 2011 to 2012 were the greatest in the two Lipan Aquifer wells in Tom Green County, as they were in the 2010 to 2011 year. However, the most recent changes were rises of 10.5 and 14.9 feet, in contrast to the 13.1 and 14.0 feet of decline, respectively, experienced by the wells in the 2010 to 2011 period. Swings of this magnitude are often characteristic of such highly transmissive shallow aquifers that are sensitive to recharge from rainfall and fluctuations in pumping demands.

The hydrograph of the Bone Spring-Victorio Peak wells in Hudspeth County with the longest period of record (47 years) reveals an overall water-level decline. The water level in this well dropped 1.2 feet from 2011 to 2012 compared to a decline of 2.2 feet from 2010 to 2011. Water levels in this aquifer experienced seasonal rebounds and remained relatively flat from the mid-1980s to mid-1990s. The hydrograph of the other Bone Spring-Victorio Peak recorder also reveals a decline of 2.2 feet from 2011 to 2012, compared to its decline of 2.9 feet from 2010 to 2011.

Water levels in the recorder wells of the Igneous Aquifer of Jeff Davis County (Fort Davis State Park) and the West Texas Bolsons Aquifer of Presidio County experienced little change of -0.4 and +0.11 feet for the 2011 to 2012 year compared to their previous year's changes of -0.5 and +0.3 feet, respectively.

The water-level change from 2011 to 2012 in the Cretaceous Aquifer recorder well in Culberson County was -1.1 feet following a 2010 to 2011 change of- 0.3 feet. For the 17-year period of record, the water level declined by 13.0 feet. The water-level change from 2011 to 2012 in the Volcanics Aquifer recorder in Brewster County was a rise of 10.1 feet following a 2010 to 2011 decline of 10.6 feet. For the five-year period of record, the water level declined by nearly 12 feet. This unused well in Big Bend National Park is within 100 to 200 feet of several active municipal supply park wells, and water-level changes in this type of highly transmissive, fractured aquifer are also sensitive to recharge (rainfall) and pumping.

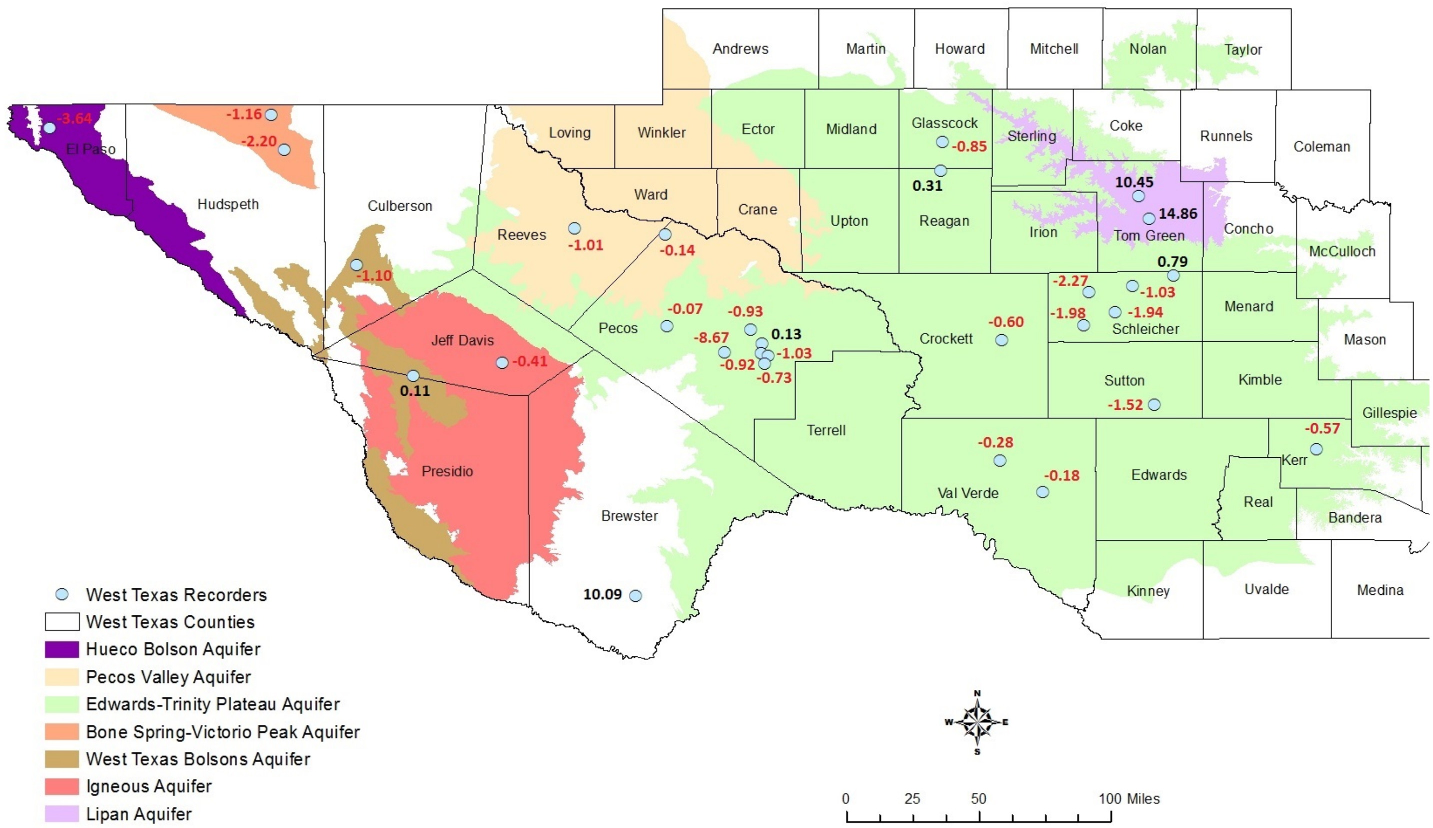


Figure 4-1. Location of wells with TWDB operated automatic water-level recorders in west Texas and water-level changes, in feet, from 2011 to 2012.

Table 4-1. Water-level changes, in feet, in TWDB recorder wells in west Texas counties for various time periods.

County & well #	Aquifer	2012 Change (ft)	2011 Change (ft)	2008-2012 Change (ft)	2003-2012 Change (ft)	Historical Change (ft)	Historical Yearly Avg. (ft)
4337101 Tom Green	Lipan	10.45	-13.11	3.92	N/A	-2.99 (2005)	-0.40
4345306 Tom Green	Lipan	14.86	-13.95	1.29	14.16	-9.28 (1991)	-0.44
***4361706 Schleicher**	ET (P)	-1.03	-0.97	N/A	N/A	-1.29 (1957)	-0.02
***4362607 Schleicher**	ET (P)	0.79	N/A	N/A	N/A	0.93 (2011)	0.93
4412611 Glasscock	ET (P)	-0.85	-3.02	-7.29	-15.58	-15.88 (2001)	-1.35
4420854 Reagan	ET (P)	0.31	-0.12	-2.31	-4.46	-15.61 (1990)	-0.68
4644501 Reeves	Pecos Valley	-1.01	-2.58	-8.61	-8.03	-55.40 (1952)	-0.91
***4648806 Pecos**	Pecos Valley	-0.14	N/A	N/A	N/A	1.76 (2011)	1.52
4759123 Culberson	Cretaceous	-1.10	-0.30	-2.98	-4.73	-12.98 (1995)	-0.76
4807516 Hudspeth	Bone Spring-Victorio Peak	-1.16	-2.19	-3.74	-10.70	-32.77 (1966)	-0.70
4815903 Hudspeth	Bone Spring-Victorio Peak	-2.20	-2.90	-5.80	N/A	-8.60 (2006)	-1.27
4913301 El Paso	Hueco Bolson	-3.64	1.51	-5.03	-7.52	-61.34 (1964)	-1.28
5129805 Presidio	West Texas Bolson	0.11	0.29	1.08	2.48	16.83 (1979)	0.50
5216802 Pecos	ET (P)	-0.07	-5.55	-22.43	-5.98	45.71 (1976)	1.24
5225209 Jeff Davis	Igneous	-0.41	-0.54	-2.03	-2.49	-4.09 (1999)	-0.30
5312803 Pecos	ET (P)	-0.93	N/A	N/A	N/A	-0.78 (2011)	-0.45
5319701 Pecos	ET (P)	-8.67	-11.93	N/A	N/A	-24.80 (2009)	-8.27
5320603 Pecos	ET (P)	0.13	-0.96	N/A	N/A	-2.67 (2009)	-0.76
5320903 Pecos	ET (P)	-0.92	-0.74	N/A	N/A	-2.25 (2010)	-0.90
5321704 Pecos	ET (P)	-1.03	0.07	N/A	N/A	-1.25 (2010)	-0.56
5328303 Pecos	ET (P)	-0.73	0.19	N/A	N/A	-0.04 (2008)	-0.01
5423106 Crockett	ET (P)	-0.60	-0.67	-4.50	N/A	1.20 (1963)	0.02
5463401 Val Verde	ET (P)	-0.28	-0.67	N/A	N/A	-0.71 (2005)	-0.09
***5503109 Schleicher**	ET (P)	-2.27	N/A	N/A	N/A	-5.11 (2011)	-3.64
***5510611 Schleicher**	ET (P)	-1.98	N/A	N/A	N/A	-5.46 (2011)	-3.64
5512134 Schleicher	ET (P)	-1.94	-7.74	-25.63	N/A	-11.02 (2003)	-1.16
5545308 Sutton	ET (P)	-1.52	1.87	N/A	N/A	-3.01 (2009)	-0.75
****5661102 Kerr**	ET (P)	-0.57	-0.42	-1.83	N/A	0.57 (2006)	0.09
7001707 Val Verde	ET (P)	-0.18	0.02	-0.73	N/A	-3.73 (2006)	-0.55
7347404 Brewster	Volcanics	10.09	-10.59	14.14	N/A	-11.62 (2007)	-2.11

*Indicates recorder added for the 2011–2012 report.
**Discussed in the Central Texas section in the 2010–2011 report.

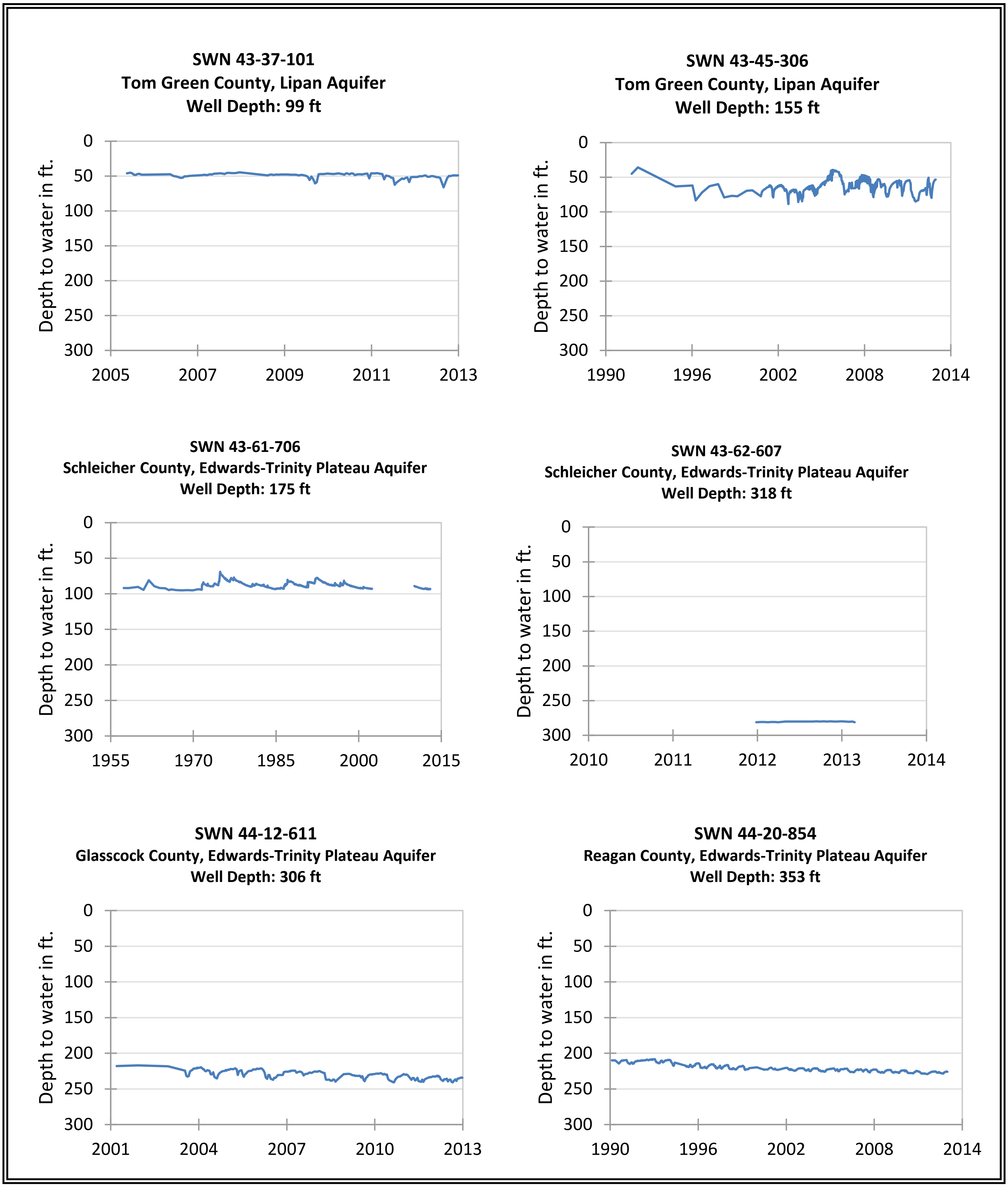
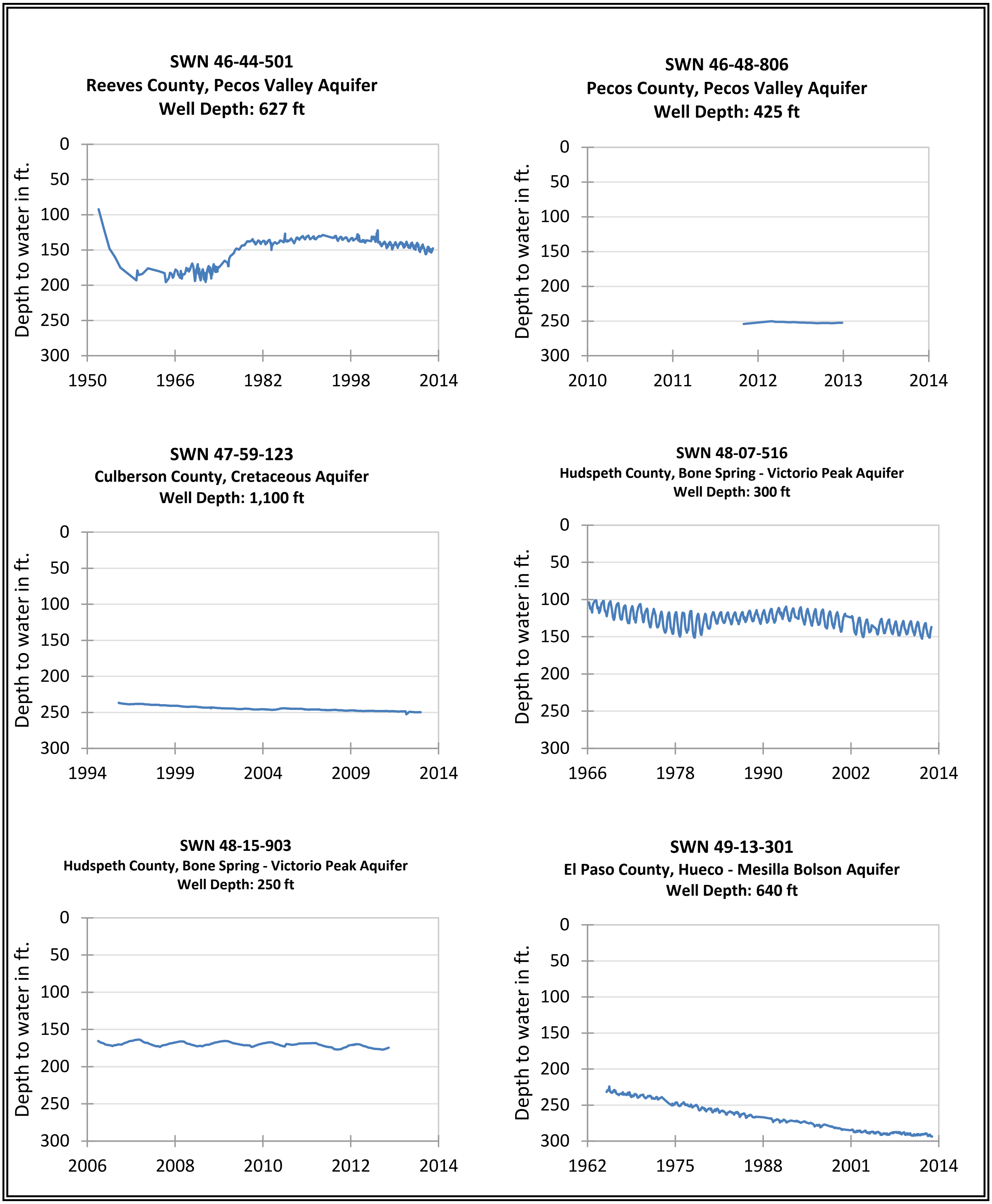


Figure 4-2. Selected hydrographs of TWDB recorder wells in West Texas.



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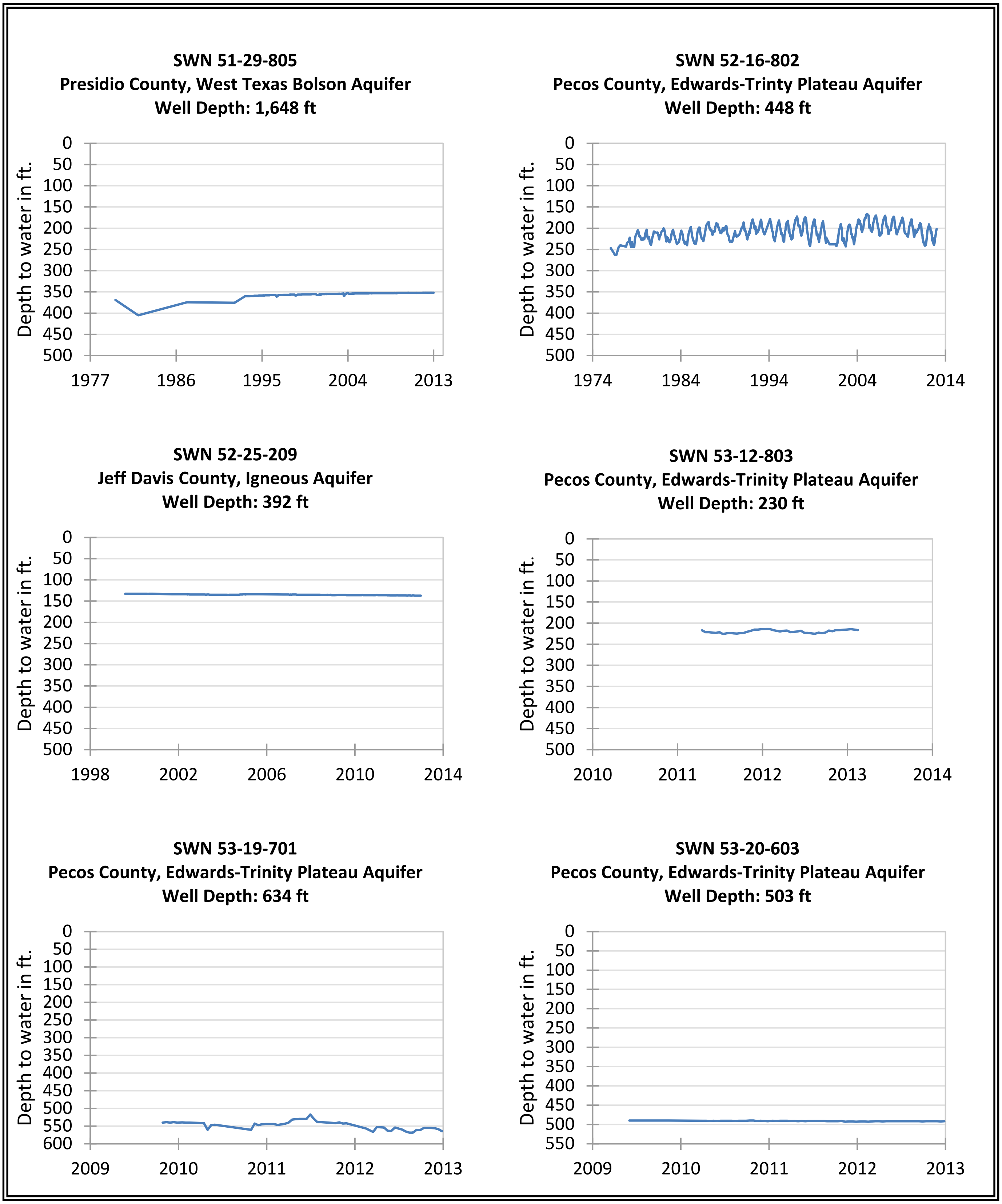

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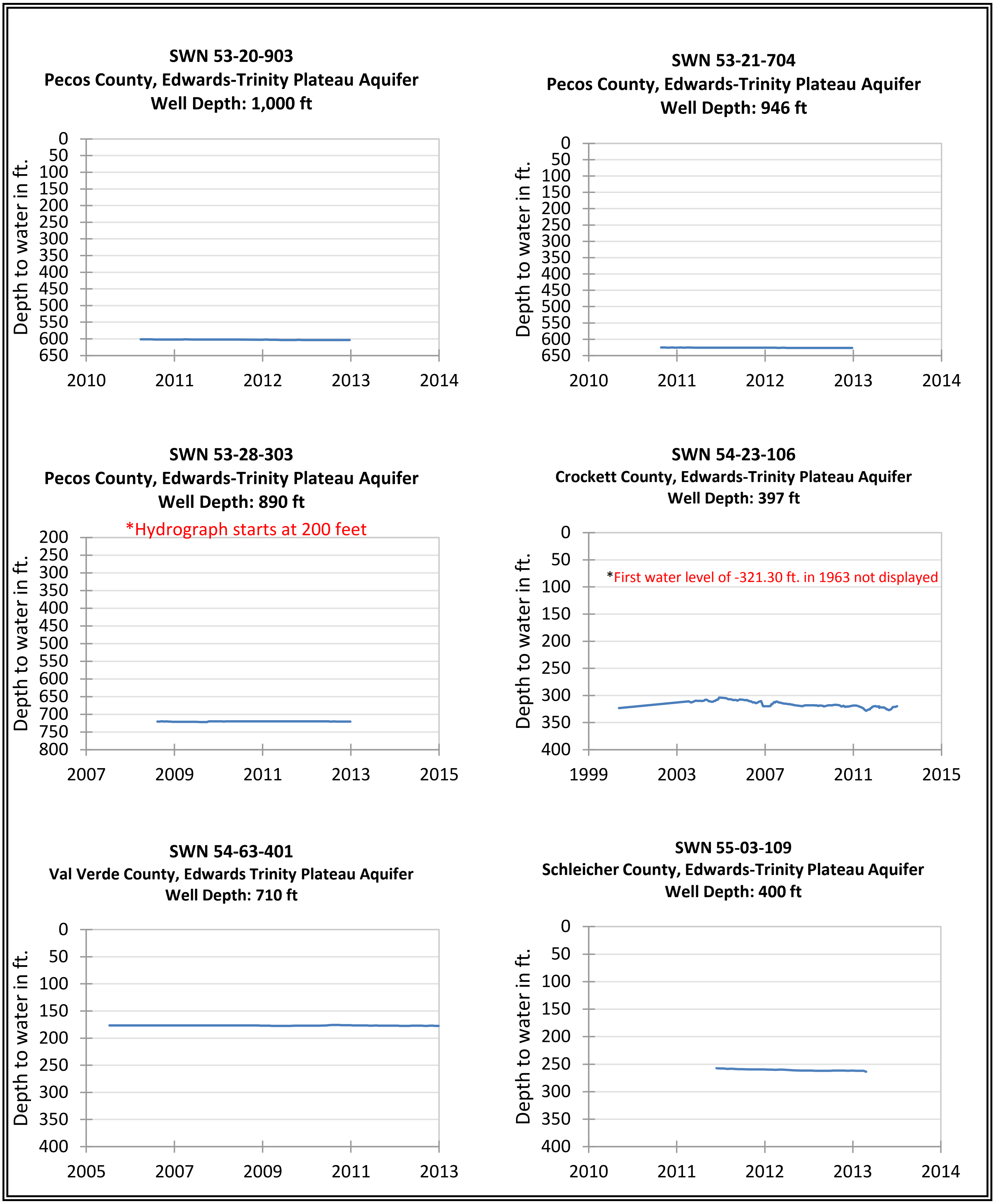

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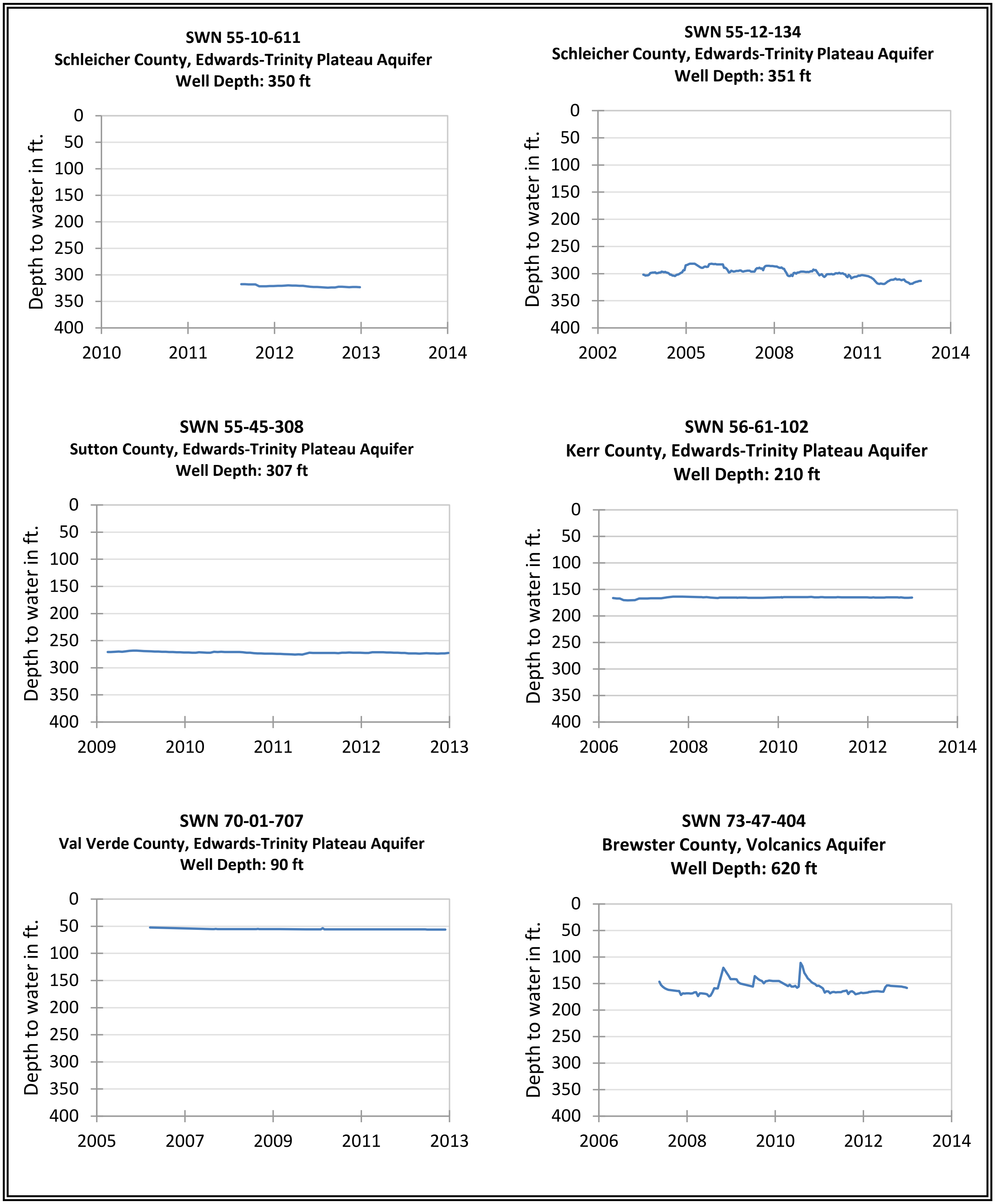


Figure 4-2 (continued). Selected hydrographs of TWDB recorder wells in West Texas.

5.0 North Central Texas

The TWDB monitors 20 recorders in northern Central Texas, all but one of which are in wells completed in major aquifers (Figure 5-1). Fifteen wells are completed in the Trinity Aquifer (three have been added since the 2010 – 2011 report, and the Tarrant County well was dropped because it was caved in), four wells are in the northern segment of the Edwards Trinity (Balcones Fault Zone) Aquifer in (south central) Bell and Williamson counties , and one well is in the minor Woodbine Aquifer in Grayson County.

5.1 Major Aquifers

The Trinity Aquifer covers a large area with diverse hydrologic conditions. Monitoring wells with recorders operated by the TWDB extend from Dallas County in the north to Williamson County in the south and are completed in both the outcrop and downdip (artesian) portions of the aquifer. Water levels in the recorder wells in the Trinity Aquifer between 2011 and 2012 experienced moderate changes compared to the wider fluctuations they experienced between 2010 and 2011: declines were not as great and water levels rose in five wells (Table 5-1 and Figure 5-2). Between 2011 and 2012, changes ranged from +7.4 feet in the Hood County well to -12.4 foot in the McLennan County recorder south of Waco, with a median change of -1.6 feet and an average change of -1.8 feet. By contrast, between 2010 and 2011, changes ranged from -0.6 to -43.1 feet in 13 of these wells with a median water-level change of -8.5 feet and an average change of -12.0 feet.

The McLennan County recorder well has been measured since 1964 and water levels have now declined just over 730 feet. The Williamson County 5829603 well was initially monitored as a flowing artesian well, with a water level estimated by pressure gauge at a height of 51 feet above land surface in 1958. With a water level at approximately 193 below land surface at the end of 2012, water levels have declined close to 245 feet since the original measurement.

In the four Edwards Trinity (Balcones Fault Zone) Aquifer recorder wells, changes between 2011 and 2012 ranged from +2.5 to -10.7 with a median change of +0.9 feet and an average change of -3.3 feet. Between 2010 and 2011, changes ranged from +10.4 to -21.4 feet with a median change of -3.5 feet and an average change of -4.5 feet. The water level in the Bell County 5804628 well declined 10.7 feet from 2011 to 2012 after the preceding year's rise of 10.4 feet, which is characteristic of Edwards Trinity (Balcones Fault Zone) wells where the aquifer water levels fluctuate rapidly. The water level in the Williamson County recorder well declined 4.4 feet from 2011 to 2012, in contrast to its larger decline of 21.4 feet from 2010 to 2011. The historical or period of record changes in the Edwards Trinity (Balcones Fault Zone) wells are similar to changes experienced in other Edwards Trinity (Balcones Fault Zone) wells farther to the south. Recorders in the Barton Springs and San Antonio segments of the aquifer, operated by other entities, are not discussed in this report.

5.2 Minor Aquifer

The TWDB monitors an unused public (City of Denison) supply well in the Woodbine Aquifer. The water level rose by 8.9 feet from 2011 to 2012, possibly attributable to the effect of more rainfall during the 2011 to 2012 year. During the two previous years the water level in this well had declined by nearly 33 feet. Overall, levels have dropped nearly 40 feet since the well was first measured in 1969.

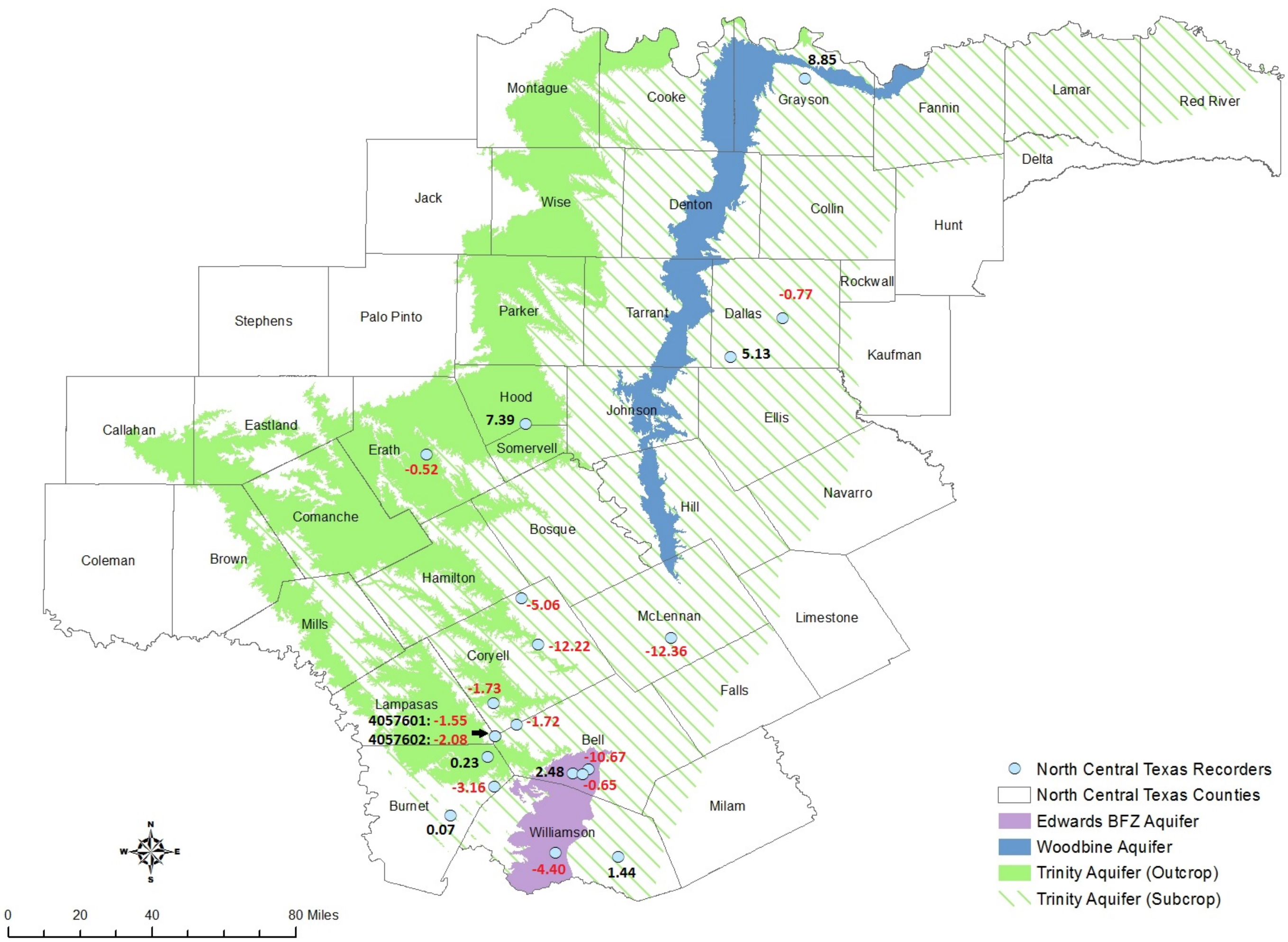


Figure 5-1. Location of wells with TWDB operated automatic water-level recorders in northern Central Texas.

Table 5-1. Water-level changes, in feet, in TWDB recorder wells in northern Central Texas counties for various time periods.

County & well #	Aquifer	2012 Change (ft)	2011 Change (ft)	2008-2012 Change (ft)	2003-2012 Change (ft)	Historical Change (ft)	Historical Yearly Avg. (ft)
Grayson 1819301	Woodbine	8.85	-18.86	-18.13	-15.39	-39.42 (1969)	-0.92
Erath 3155504	Trinity	-0.52	-9.20	-6.04	-3.16	-6.46 (2000)	-0.50
Hood 3242604	Trinity	7.39	-4.14	-1.05	-10.28	-18.69 (1997)	-1.21
Dallas 3319101	Trinity	-0.77	-15.79	-28.13	-24.13	-269.56 (1954)	-4.61
Dallas 3325202	Trinity	5.13	-30.39	N/A	-56.64	-30.92 (2000)	-2.52
Coryell 4026201	Trinity	-5.06	-5.38	-18.16	-33.22	-61.55 (1990)	-2.77
Coryell 4035404	Trinity	-12.22	-10.71	-37.55	-55.72	-212.45 (1955)	-3.69
McLennan 4039204	Trinity	-12.36	-43.15	-50.06	-144.19	-731.14 (1964)	-15.23
Coryell 4049601	Trinity	-1.73	-4.93	-10.97	-14.81	-19.54 (1993)	-0.98
Bell 4057601	Trinity	-1.55	-8.48	N/A	N/A	-7.43 (2009)	-2.48
Bell 4057602	Trinity	-2.08	-2.85	N/A	N/A	-6.04 (2009)	-1.86
Bell 4058201	Trinity	-1.72	-1.06	N/A	N/A	-3.65 (2010)	-1.33
***Burnet 5724101**	Trinity	0.07	-6.63	-17.47	-13.90	-33.97 (1961)	-0.65
***Burnet 5801202**	Trinity	0.23	-6.80	N/A	N/A	-6.38 (2009)	-1.74
Bell 5804628	Edwards (BFZ)	-10.67	10.35	N/A	N/A	-6.67 (2008)	-1.67
Bell 5804702	Edwards (BFZ)	2.48	-3.77	-1.26	4.93	-2.32 (1980)	-0.07
Bell 5804816	Edwards (BFZ)	-0.65	-3.25	N/A	N/A	-2.66 (2008)	-0.59
***Burnet 5809303**	Trinity	-3.16	-11.65	N/A	N/A	-10.47 (2009)	-2.99
Williamson 5827305	Edwards (BFZ)	-4.40	-21.43	-25.42	-22.21	-11.64 (1980)	-0.36
Williamson 5829603	Trinity	1.44	-19.52	-23.57	-19.67	-243.04 (1946)	-3.65

*Indicates recorder added for the 2011–2012 report (Tarrant County dropped).

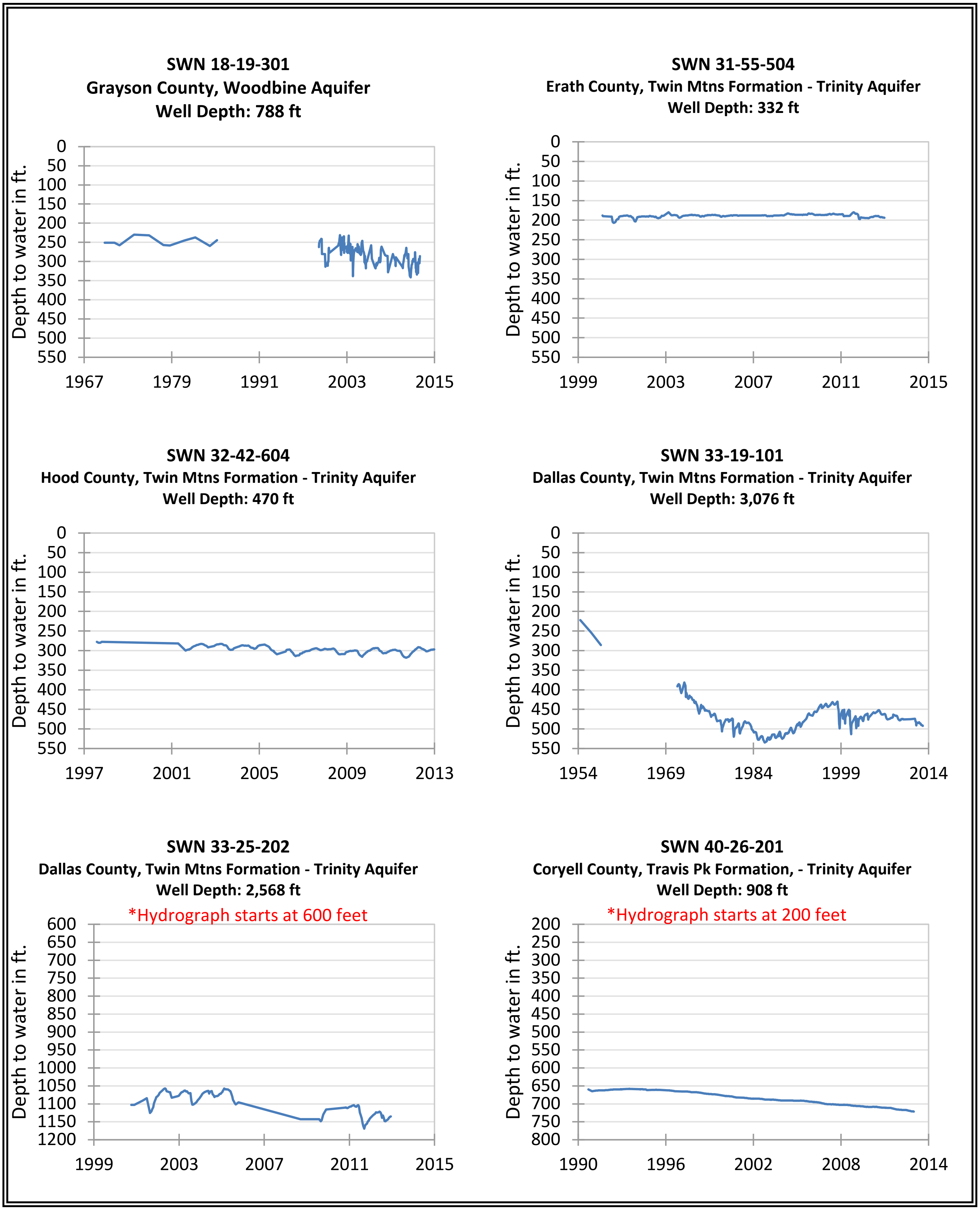


Figure 5-2. Selected hydrographs of TWDB recorder wells in northern Central Texas.

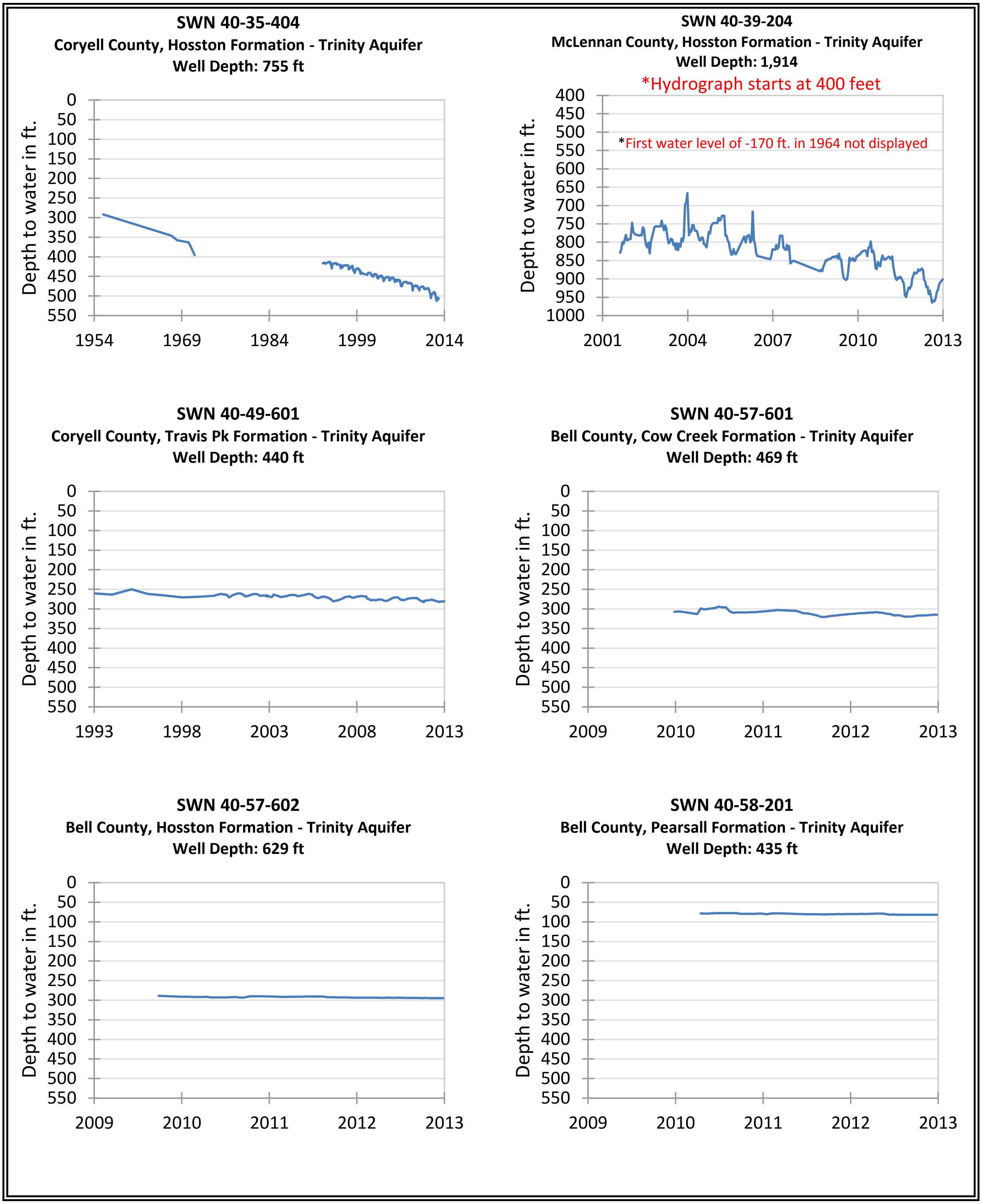


Figure 5-2 (continued). Selected hydrographs of TWDB recorder wells in northern Central Texas.

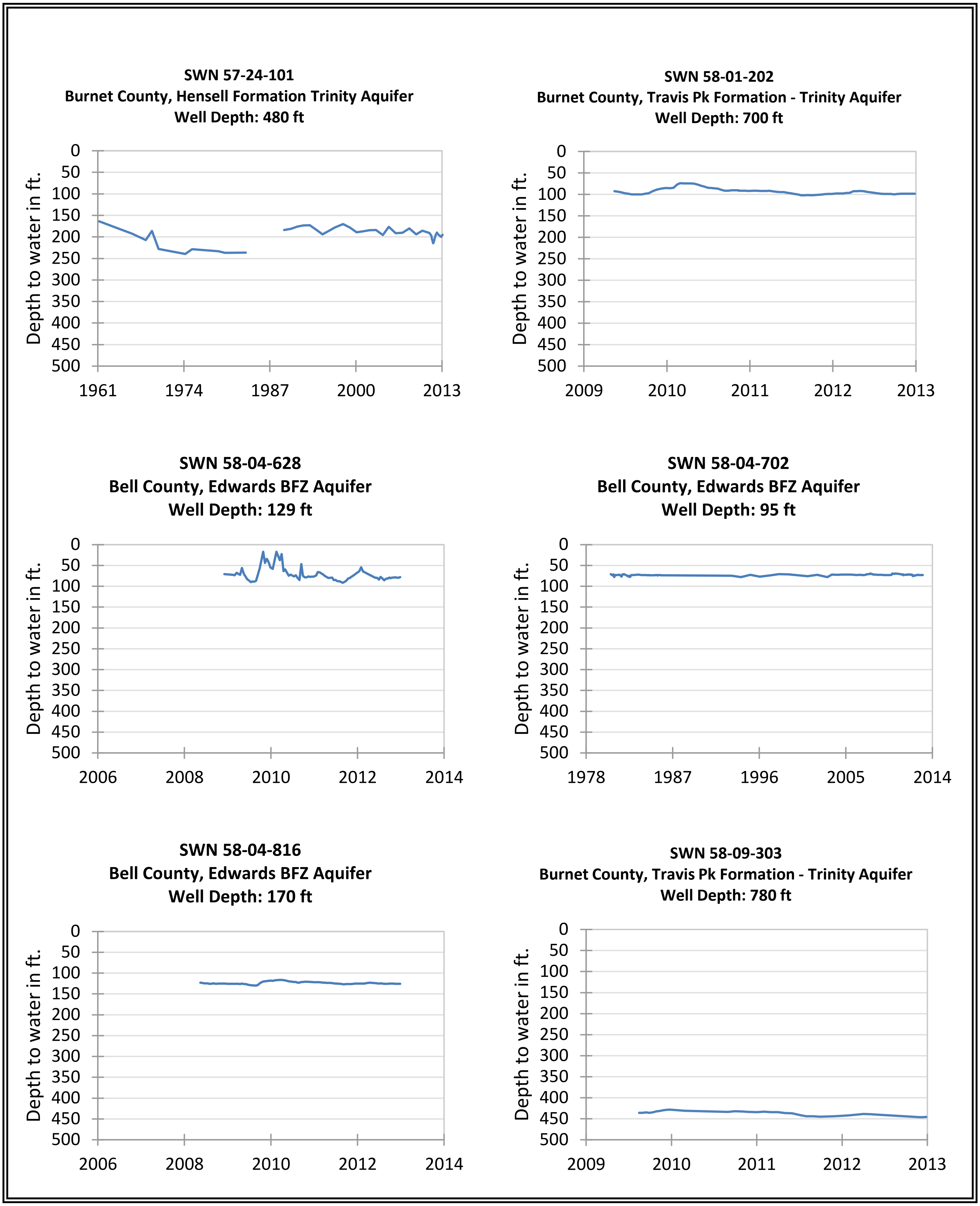


Figure 5-2 (continued). Selected hydrographs of TWDB recorder wells in northern Central Texas.

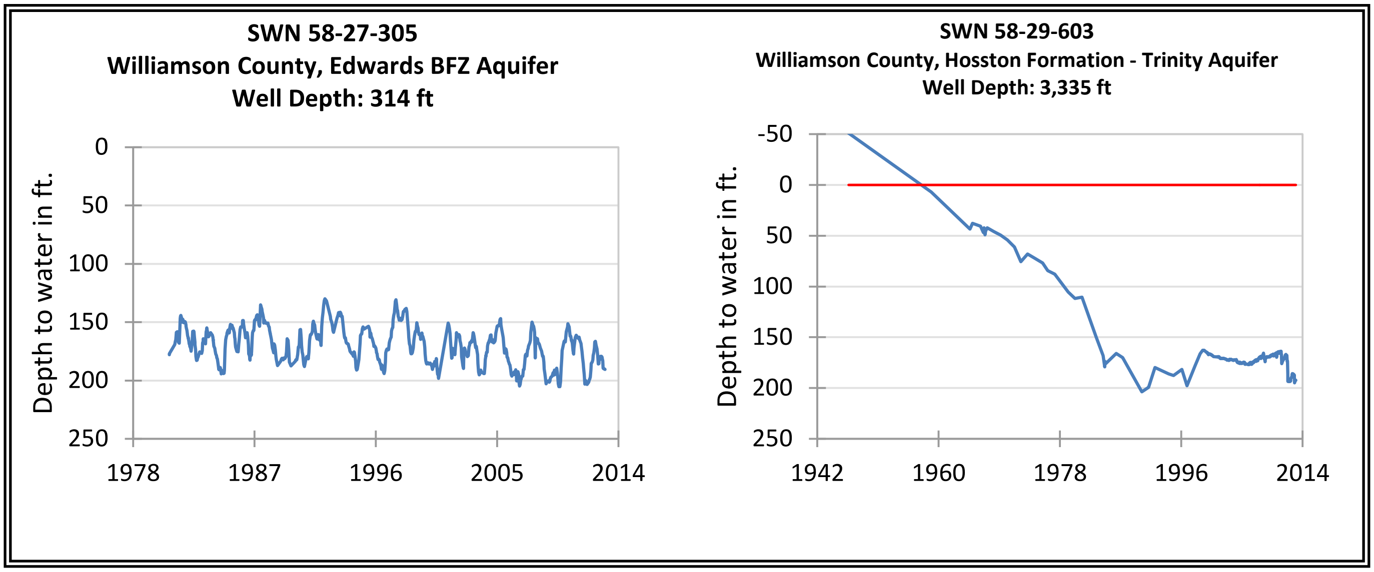


Figure 5-2 (continued). Selected hydrographs of TWDB recorder wells in northern Central Texas.

6.0 South and East Texas

The TWDB monitors 22 wells in South and East Texas (Figure 6-1)—having added six by the beginning of 2012—that are completed in either the Carrizo-Wilcox or Gulf Coast major aquifers. Most have short historical periods of record, with the exception of three recorders in Gulf Coast Aquifer wells in Harris, Victoria, and Duval counties, in which records began in the late 1940s, late 1950s, and early 1960s, and in two Carrizo-Wilcox wells in Milam and Smith counties, in which records began in the 1980s. Some entities have measured water levels for the past 60 years. Currently, the TWDB is operating 11 recorders in wells completed in the Gulf Coast Aquifer and 11 recorders in wells completed in the Carrizo-Wilcox Aquifer throughout the region.

6.1 Major Aquifers

Water-level changes in the 11 Carrizo-Wilcox Aquifer recorder wells ranged from +8.6 feet in the Bastrop County well to -72.2 feet in the LaSalle County well during the 2011-2012 period (Table 6-1 and Figure 6-2). The median water-level change was -0.9 feet and the average change was -9.0 feet. From 2010 to 2011, the change in water levels ranged from +0.6 feet to -76.5 feet, and the median change was -4.4 feet with an average change of -17.1 feet.

Irrigation pumpage during the drought has increased substantially in the Wintergarden area of southwest Texas, particularly in Zavala, Wilson, and Atascosa counties. Pumping of groundwater has also increased to support oil and gas exploration and production activities related to the Eagle Ford Shale. The greatest water-level decline documented has been in the LaSalle County well, in comparison to water levels in all of the recorder wells in the Carrizo-Wilcox Aquifer, which has shown the greatest historical change—208 feet of decline—since measurements began in 2003.

Between 2011 and 2012, water-level changes in the 11 Gulf Coast Aquifer recorder wells ranged from +19.7 feet in the Karnes County well to -16.7 feet in the northernmost Wharton County well with a median change of +0.5 feet and an average change of +0.9 feet. Between 2010 and 2011, the change in the eight wells with available measurements discussed in last year's report ranged from +8.7 feet to -13.6 feet with a median change of -5.7 feet and an average change of -6.3 feet.

The greatest decline in the Gulf Coast wells for the 2011 to 2012 period occurred in the Wharton 6631107 well, located in an area of seasonal irrigation, whereas in the preceding year this was the only Gulf Coast Aquifer well to experience a rise (+ 8.7 feet). Municipal groundwater pumping occurs in the vicinity of the Duval County well, experiencing the second largest decline (- 11.3 feet) in the 2011 to 2012 period, as well as in the Karnes County well. However, water levels in that well also exhibited relatively greater fluctuation in comparison to the previous year change, or a rise of nearly 20 feet after a decline in the 2010 to 2011 period of nearly 14 feet. The Karnes and Jasper county recorders, each first measured in 1956, have experienced the greatest declines historically of these wells at 124 and 117.4 feet, respectively.

The Harris County well hydrograph illustrates a decline and rebound pattern typical in several monitored wells in southern Harris County and northern Fort Bend, Brazoria, and Galveston counties. Municipal pumpage from the 1950s to the late 1970s/early 1980s was great enough to cause subsidence in much of these counties. With a switch from groundwater to surface water for municipal supply, groundwater levels began to rise, and in some areas to levels higher than originally recorded.

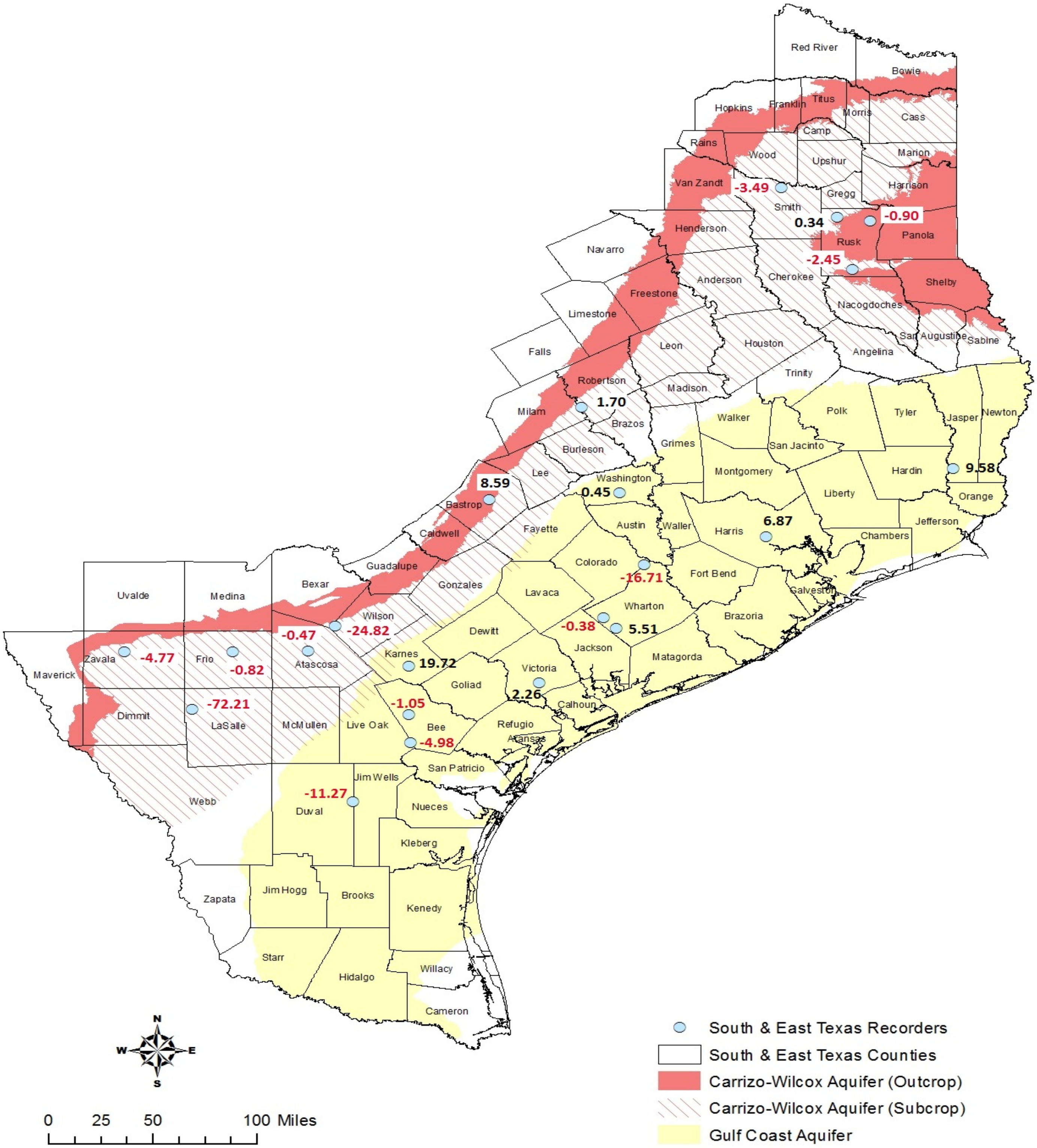


Figure 6-1. Location of wells with TWDB operated automatic water-level recorders South and East Texas

Table 6-1. Water-level changes, in feet, in TWDB recorder wells in South and East Texas counties for various time periods.

County & well #	Aquifer	2012 Change (ft)	2011 Change (ft)	2008-2012 Change (ft)	2003-2012 Change (ft)	Historical Change (ft)	Historical Yearly Avg. (ft)
3430907 Smith	Wilcox	-3.49	-2.94	-9.53	-23.09	-73.67 (1977)	-2.83
3541604 Rusk	Wilcox	0.31	-4.66	N/A	N/A	-1.65 (2010)	-0.73
***3543906 Rusk**	Wilcox	-0.90	N/A	N/A	N/A	-2.46 (2011)	-1.85
***3702905 Rusk**	Wilcox	-2.45	N/A	N/A	N/A	-1.54 (2011)	-0.92
5862208 Bastrop	Wilcox	8.59	-0.56	16.10	N/A	1.69 (2003)	0.18
5911621 Milam	Wilcox	1.70	-3.70	-4.36	N/A	-3.44 (1981)	-0.11
5953915 Washington	Gulf Coast	0.45	-4.28	-5.50	-4.55	-5.28 (2002)	-0.49
***6148209 Jasper**	Gulf Coast	9.58	-10.99	N/A	N/A	-117.37 (1956)	-2.07
6514409 Harris	Gulf Coast	6.87	-10.07	-2.80	30.06	-65.06 (1947)	-0.99
6631107 Wharton	Gulf Coast	-16.71	8.74	N/A	N/A	-5.79 (2010)	-2.57
6653406 Wharton	Gulf Coast	-0.38	-4.50	N/A	N/A	-30.65 (1947)	-0.47
6661302 Wharton	Gulf Coast	5.51	-9.41	-8.81	N/A	17.29 (2005)	2.31
6862104 Wilson	Carrizo	-24.82	-18.60	-45.49	-9.69	-26.94 (1994)	-1.42
7702509 Zavala	Carrizo	-4.77	-4.15	-37.84	-39.75	-27.74 (2002)	-2.69
***7708511 Frio**	Carrizo	-0.82	N/A	N/A	N/A	-9.65 (2011)	-6.43
7738103 LaSalle	Carrizo	-72.21	-76.51	-213.80	N/A	-208.17 (2003)	-23.13
7804508 Atascosa	Carrizo	-0.47	-25.57	N/A	N/A	-16.93 (2008)	-3.76
7910406 Karnes	Gulf Coast	19.72	-13.76	N/A	N/A	-124.01 (1956)	-2.18
***7934409 Bee**	Gulf Coast	-1.05	N/A	N/A	N/A	-2.91 (2011)	-1.94
***7950106 Live Oak**	Gulf Coast	-4.98	N/A	N/A	N/A	16.48 (2011)	10.99
8017502 Victoria	Gulf Coast	2.26	-5.83	-11.14	4.88	-2.69 (1958)	-0.05
8415702 Duval	Gulf Coast	-11.27	-6.72	N/A	-16.99	-32.98 (1964)	-0.68

*Indicates recorder added for the 2011–2012 report.

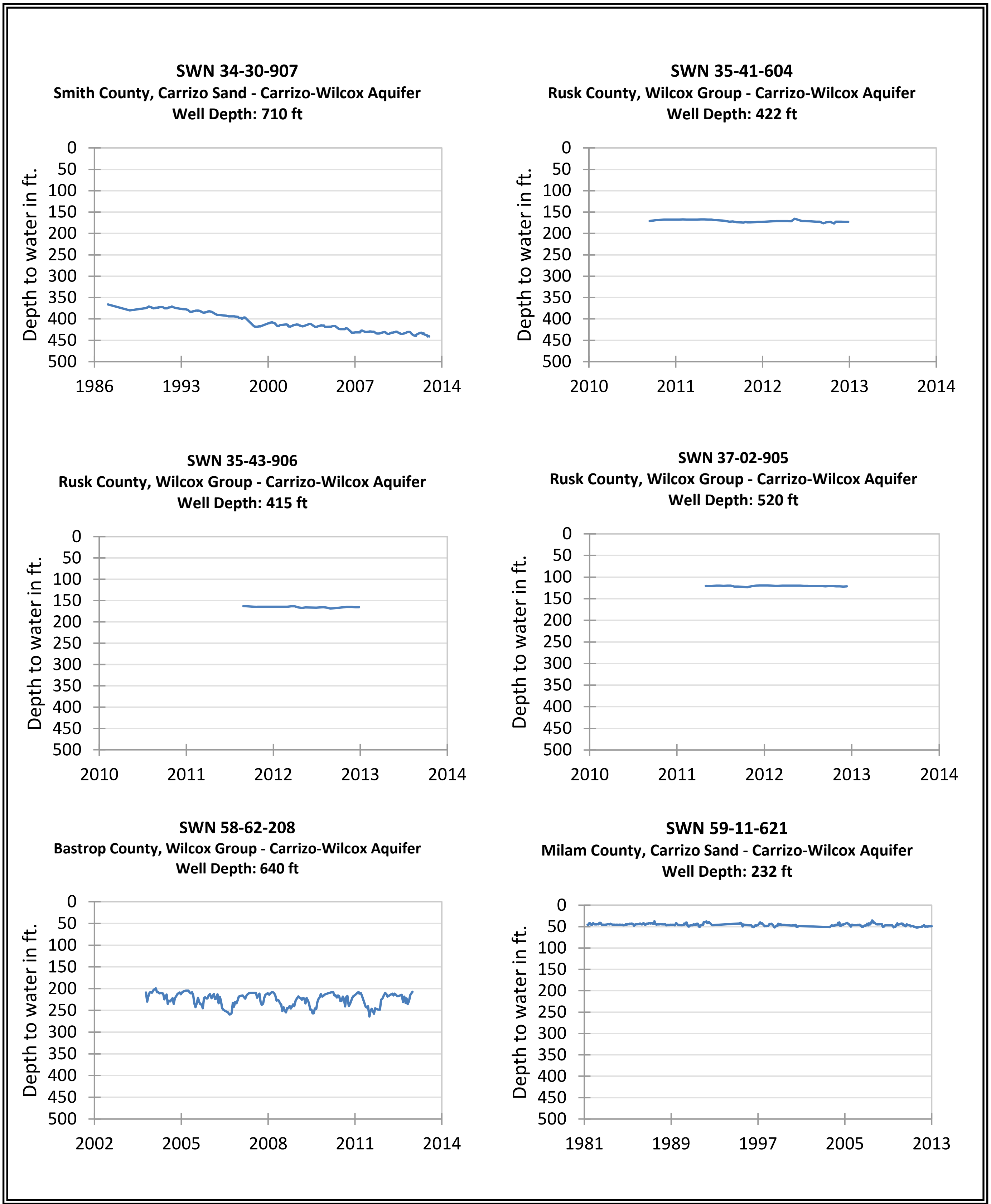


Figure 6-2. Selected hydrographs of TWDB recorder wells in South and East Texas.

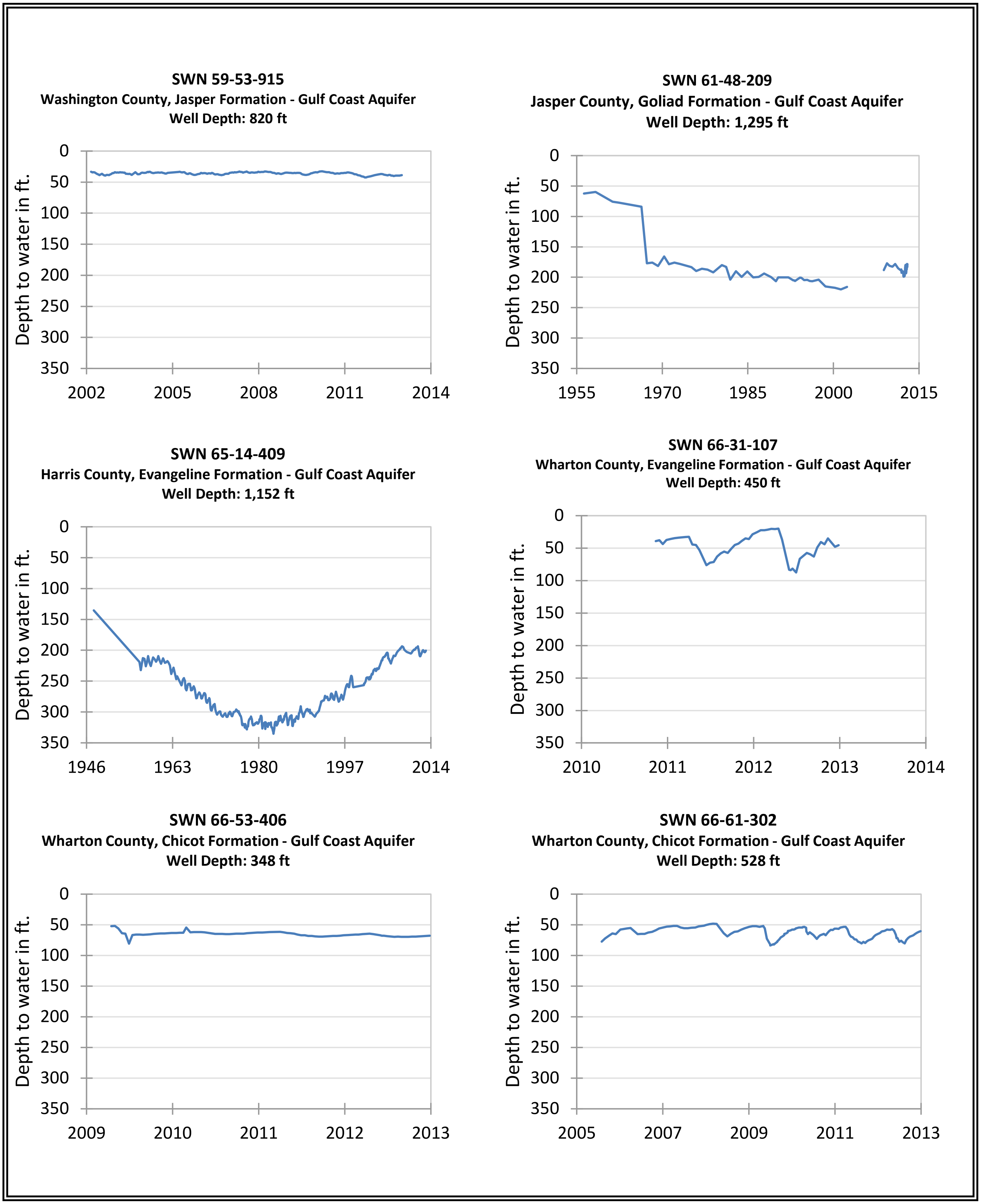


Figure 6-2 (continued). Selected hydrographs of TWDB recorder wells in South and East Texas.

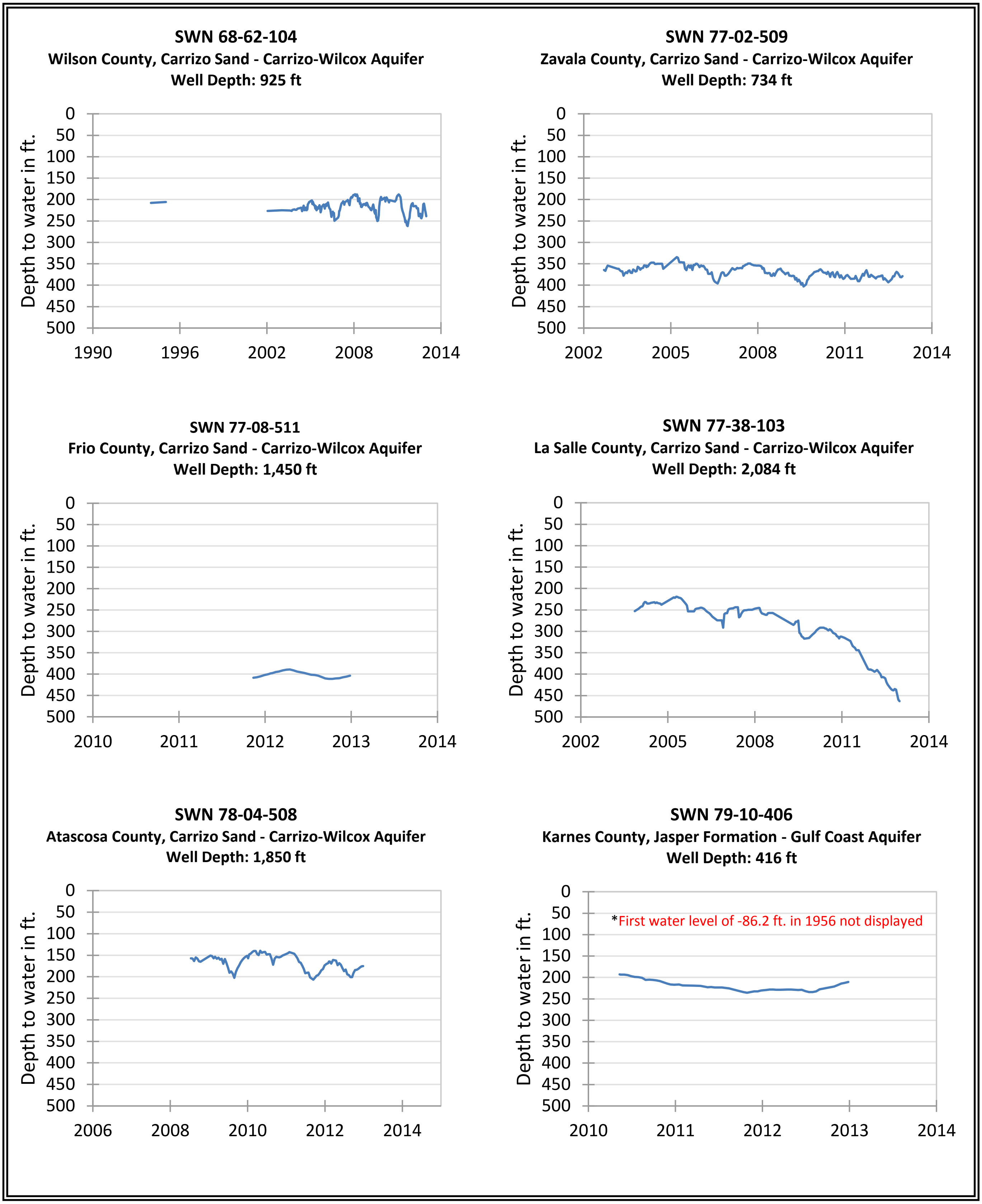


Figure 6-2 (continued). Selected hydrographs of TWDB recorder wells in South and East Texas.

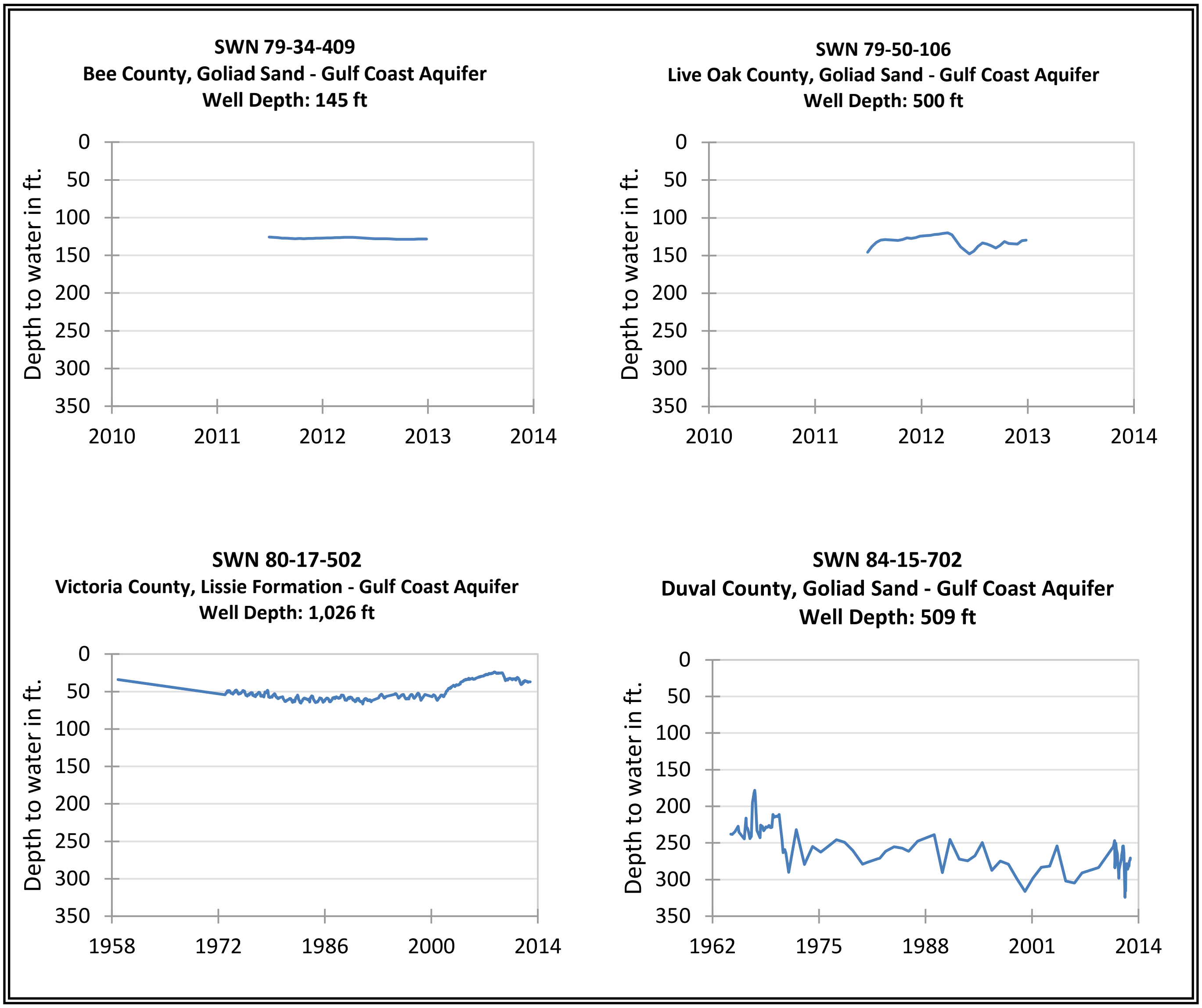


Figure 6-2 (continued). Selected hydrographs of TWDB recorder wells in South and East Texas.

7.0 Central Texas (including the Hill Country)

The majority of the 41 recorder wells in the Central Texas Hill Country are completed in the Trinity Aquifer (Figure 7-1). Five recorders were added during the 2011-2012 period: three Trinity Aquifer wells in Bexar County and one in Hays County, and one Ellenburger-San Saba Aquifer well in Burnet County. One Edwards-Trinity (Plateau) well in Kerr County is now discussed in the West Texas section, and one Trinity well in Travis County was discontinued. Groundwater conservation districts in four counties co-sponsor 29 of these recorders. Such local partnerships have led to the installation of a relatively larger number of recorders in these counties. Kerr County has facilitated the installation of 12 recorders, mostly since 2005. Thirty-five of the recorders in the Central Texas area are in the Trinity Aquifer, four are in the Ellenburger-San Saba Aquifer, and two are in the Hickory Aquifer.

7.1 Major Aquifers

Water levels from 2011 to 2012 in the 35 recorder wells in the Trinity Aquifer experienced a median change of -0.9 feet and an average of -3.0 feet, compared to the previous year's -16.7 feet median and -19.7 feet average changes (Table 7-1 and Figure 7-2). The water-level changes ranged from +7.3 feet in the Hays County well to -31.2 feet in the Bexar County 6827112 well, both of which are sites added to the recorder program since last year's report. Ten wells experienced water-level rises compared to the rise in only one Kerr well from 2010 to 2011. The water-level change experienced in the lower portion of the dual completed Kerr County recorder in the 2011-2012 period was -2.0 feet, compared to its change of -88.6 feet from 2010 to 2011 which was also the largest change experienced at any of the 110 recorder sites discussed in that year's period.

7.2 Minor Aquifers

Water levels in the four Ellenburger-San Saba Aquifer recorder wells from 2011 to 2012 experienced changes ranging from +0.3 to -6.9 feet with a median change of -0.8 feet and an average change of -2.0 feet. From 2010 to 2011, all water-level changes were declines and ranged from 3.5 to 14.6 feet with a median decline of 9.8 feet and an average decline of 9.4 feet.

The two recorder wells in the Hickory Aquifer from 2011 to 2012 each experienced water-level rises of 1.7 and 1.4 feet, compared to a decline in each of 2.1 and 5.4 feet, respectively, from 2010 to 2011. Records in both wells extend to 1974, since which time water levels have declined by 18.1 feet (McCulloch) and 3.9 feet (Mason).

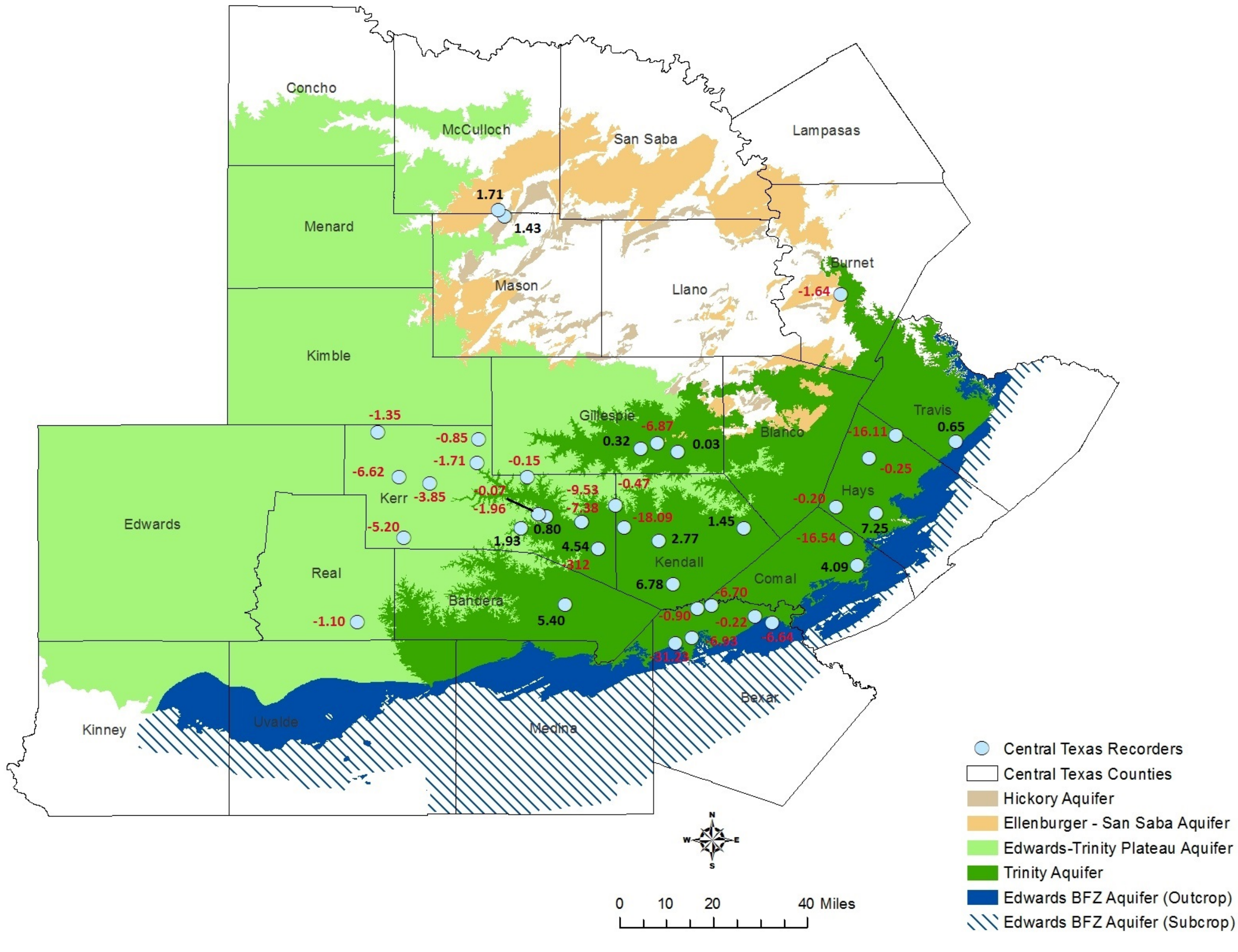


Figure 7.1. Location of wells with TWDB operated automatic water-level recorders in Central Texas**.**

Table 7-1. Water-level changes, in feet, in TWDB recorders in Central Texas counties for various time periods.

County & well #	Aquifer	2012 Change (ft)	2011 Change (ft)	2008-2012 Change (ft)	2003-2012 Change (ft)	Historical Change (ft)	Historical Yearly Avg. (ft)
5606613 Mason	Hickory	1.43	-5.36	-2.19	6.03	-3.87 (1974)	-0.10
5606614 McCulloch	Hickory	1.71	-2.08	0.46	5.53	-18.19 (1974)	-0.48
5643901 Kerr	Trinity	-1.35	-3.56	-9.51	N/A	-9.51 (2007)	-1.90
5652704 Kerr	Trinity	-6.62	-2.80	N/A	N/A	-19.64 (2008)	-4.62
5654106 Kerr	Trinity	-0.85	-1.88	N/A	N/A	-1.99 (2010)	-0.70
5654405 Kerr	Trinity	-1.71	-6.55	-11.51	N/A	-13.31 (2004)	-1.52
5655805 Kerr	Trinity	-0.15	-1.12	-1.14	N/A	-0.94 (2005)	-0.13
5661101 Kerr	Trinity	-3.85	-4.60	-20.94	N/A	-20.60 (2005)	-2.90
5663922 Kerr	Trinity	0.80	-57.20	-78.52	-79.94	-87.32 (1998)	-5.92
5663923 Kerr	Trinity	-0.07	-55.89	-84.26	N/A	-84.26 (2007)	-16.85
5663924 Kerr	Trinity	-1.96	-88.57	-102.33	N/A	-102.33 (2007)	-20.47
***5723406 Burnet**	Ellenburger – San Saba	-1.64	-14.55	N/A	N/A	-15.60 (2008)	-3.63
***5748811 Hays**	Trinity	-16.11	N/A	N/A	N/A	4.63 (2011)	3.86
5750108 Gillespie	Ellenburger – San Saba	0.32	-13.59	-26.41	-28.31	-22.59 (1987)	-0.89
5750324 Gillespie	Ellenburger – San Saba	-6.87	-3.54	-18.06	-15.49	-25.79 (1995)	-1.48
5751407 Gillespie	Ellenburger – San Saba	0.03	-5.95	-14.08	N/A	-14.08 (2008)	-2.82
5755607 Hays	Trinity	-0.25	-31.42	-53.80	N/A	-19.90 (2006)	-2.95
5757805 Kerr	Trinity	-0.47	1.69	-16.08	N/A	-31.98 (2003)	-3.37
5763705 Hays	Trinity	-0.20	-8.47	-21.92	-19.52	-9.15 (2002)	-0.85
5764705 Hays	Trinity	7.25	-12.51	-16.80	N/A	-17.39 (1997)	-0.83
5850120 Travis	Trinity	0.65	-28.40	-67.84	-83.14	-87.54 (1987)	-3.47
6801314 Kendall	Trinity	-18.09	-14.96	-68.70	-72.02	-66.25 (1984)	-2.28
6801703 Kerr	Trinity	4.54	-24.02	-35.68	-57.58	-47.08 (2001)	-4.21
6801704 Kerr	Trinity	-3.12	-19.70	-44.12	-54.22	-52.92 (2001)	-4.74
6802609 Kendall	Trinity	2.77	-18.16	-46.75	-41.97	-73.24 (1975)	-1.95
6804312 Kendall	Trinity	1.45	-16.67	-22.38	N/A	-19.43 (1999)	-1.39
6807407 Comal	Trinity	-16.54	-17.31	-41.50	-66.46	-37.78 (1997)	-2.36
6811417 Kendall	Trinity	6.78	-12.93	-21.61	N/A	-33.57 (1999)	-1.60
6815211 Comal	Trinity	4.09	-8.12	N/A	N/A	-3.86 (2010)	-1.54
6819208 Bexar	Trinity	-0.90	-3.24	N/A	3.80	-62.10 (1977)	-1.77
6819806 Bexar	Trinity	-6.93	-48.49	-95.39	-107.25	-59.55 (1990)	-2.68
6820110 Bexar	Trinity	-6.70	-18.41	-63.34	-127.26	-30.26 (1987)	-1.19
***6821410 Bexar**	Trinity	-0.22	N/A	N/A	N/A	-14.43 (1985)	-0.52
***6821519 Bexar**	Trinity	-6.64	N/A	N/A	N/A	-54.00 (2011)	-28.13
***6827112 Bexar**	Trinity	-31.23	N/A	N/A	N/A	-18.25 (2009)	-5.21
6904503 Kerr	Trinity	-5.20	-7.50	-23.10	N/A	-23.10 (2007)	-4.53
6907107 Kerr	Trinity	1.93	-31.51	-51.38	N/A	-54.28 (2003)	-5.52
6908304 Kerr	Trinity	-9.53	-22.58	-55.71	N/A	-49.41 (2006)	-7.97
6908305 Kerr	Trinity	-7.38	-27.67	-58.55	N/A	-44.95 (2006)	-7.25
6919401 Real	Trinity	-1.10	-23.12	-45.58	-55.06	-72.58 (1974)	-1.89
6924225 Bandera	Trinity	5.40	-0.61	N/A	N/A	8.00 (2008)	1.78

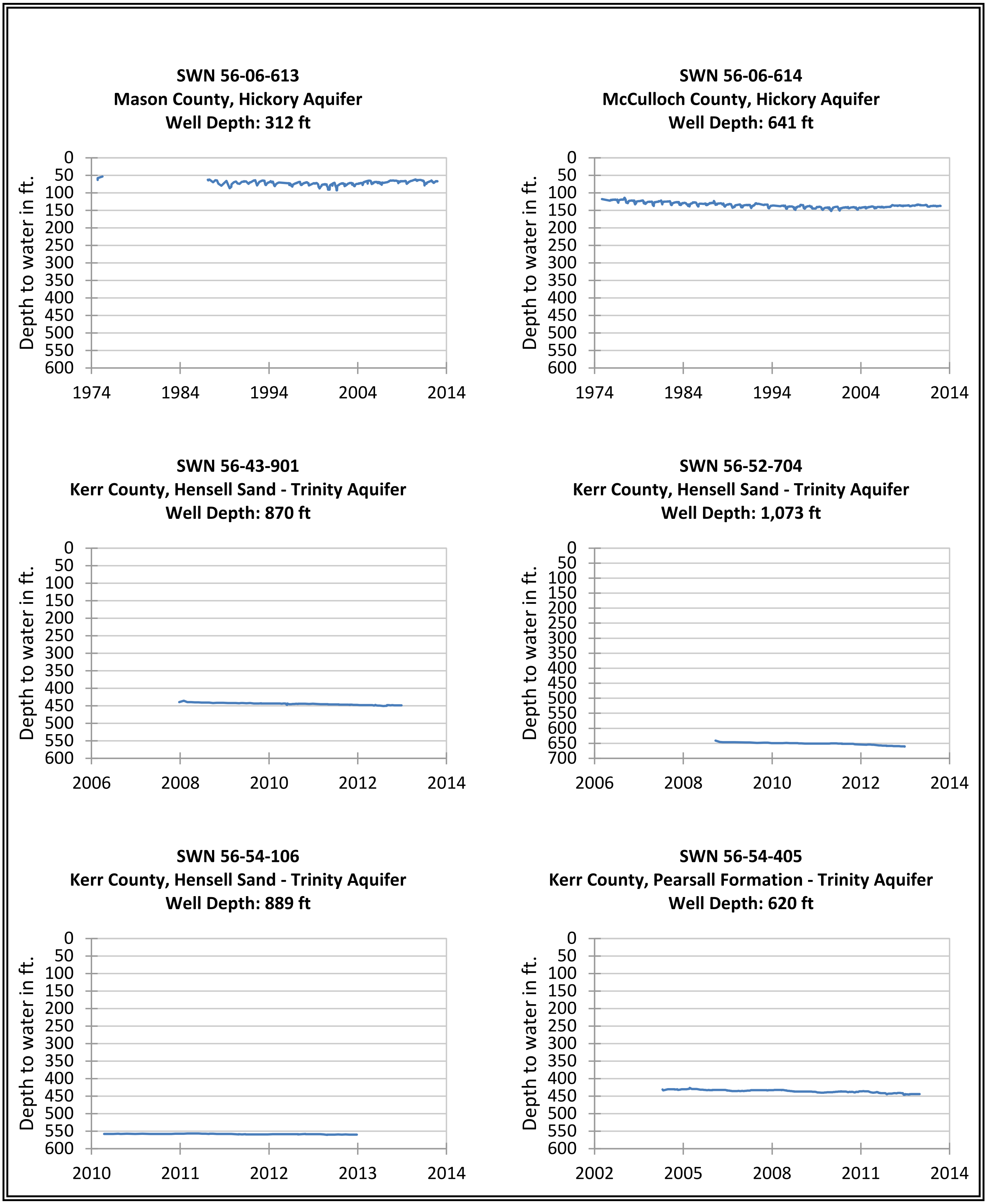


Figure 7-2. Selected hydrographs of TWDB recorder wells in Central Texas.

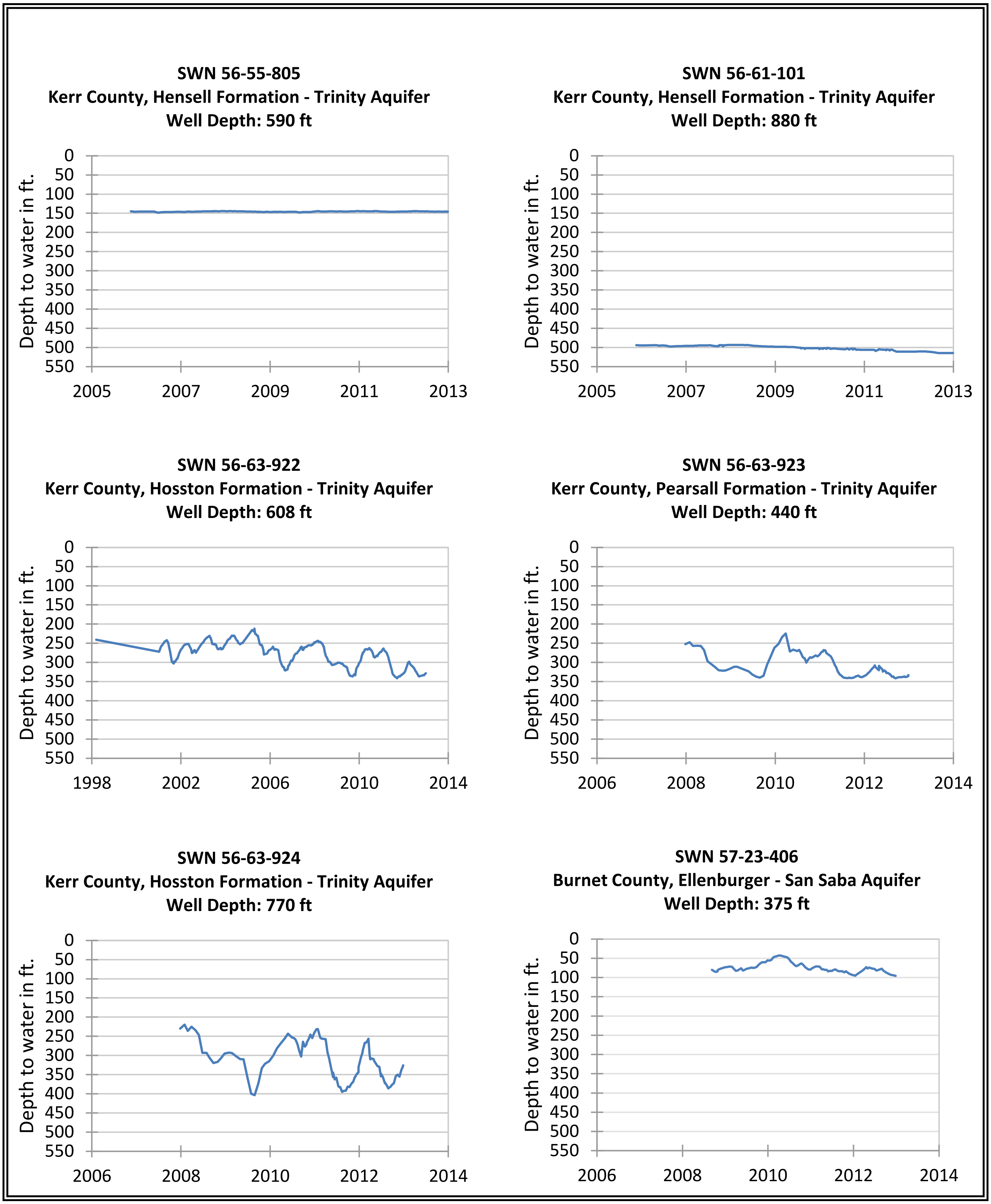


Figure 7-2 (continued). Selected hydrographs of TWDB recorder wells in Central Texas.

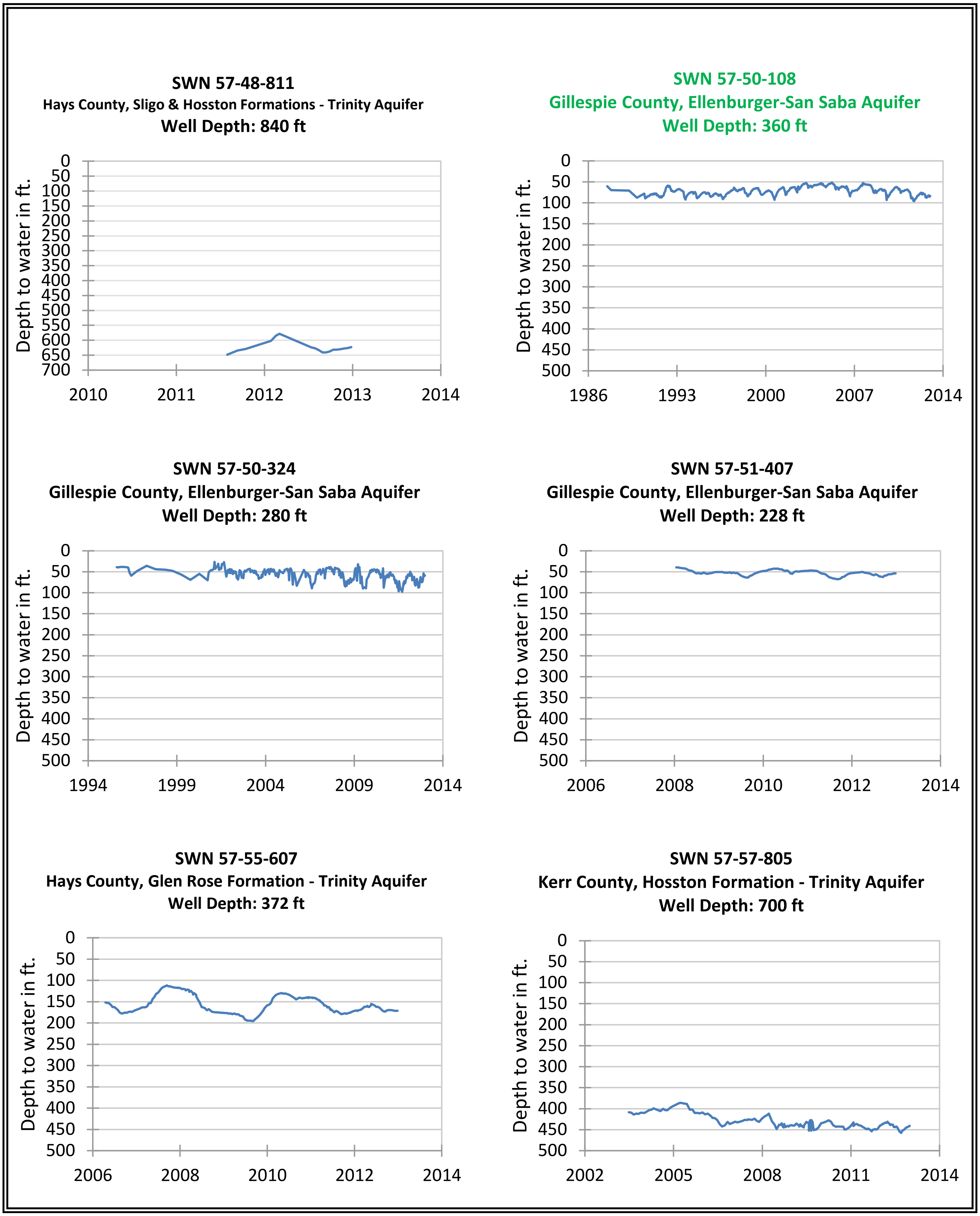


Figure 7-2 (continued). Selected hydrographs of TWDB recorder wells in Central Texas.

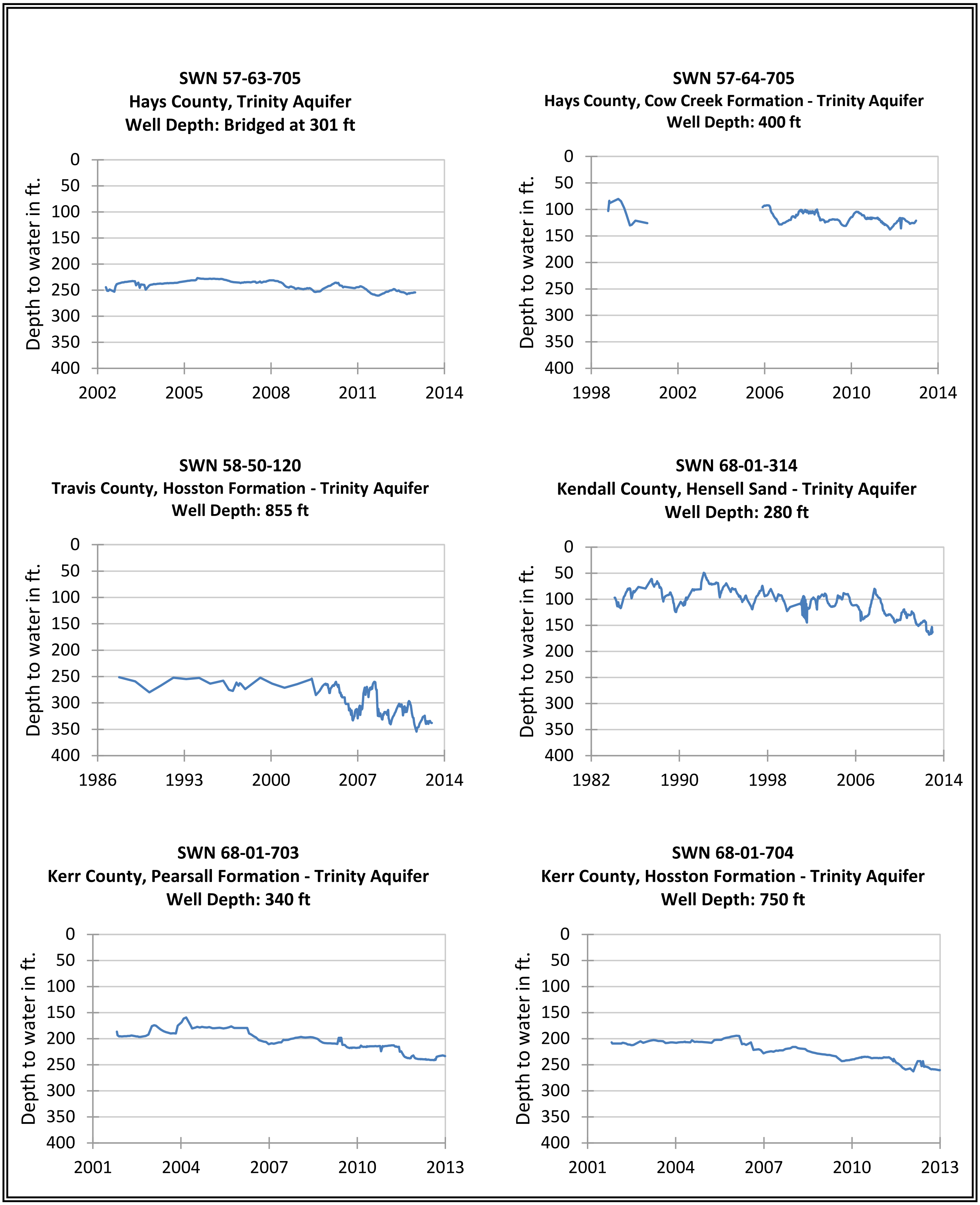


Figure 7-2 (continued). Selected hydrographs of TWDB recorder wells in Central Texas.

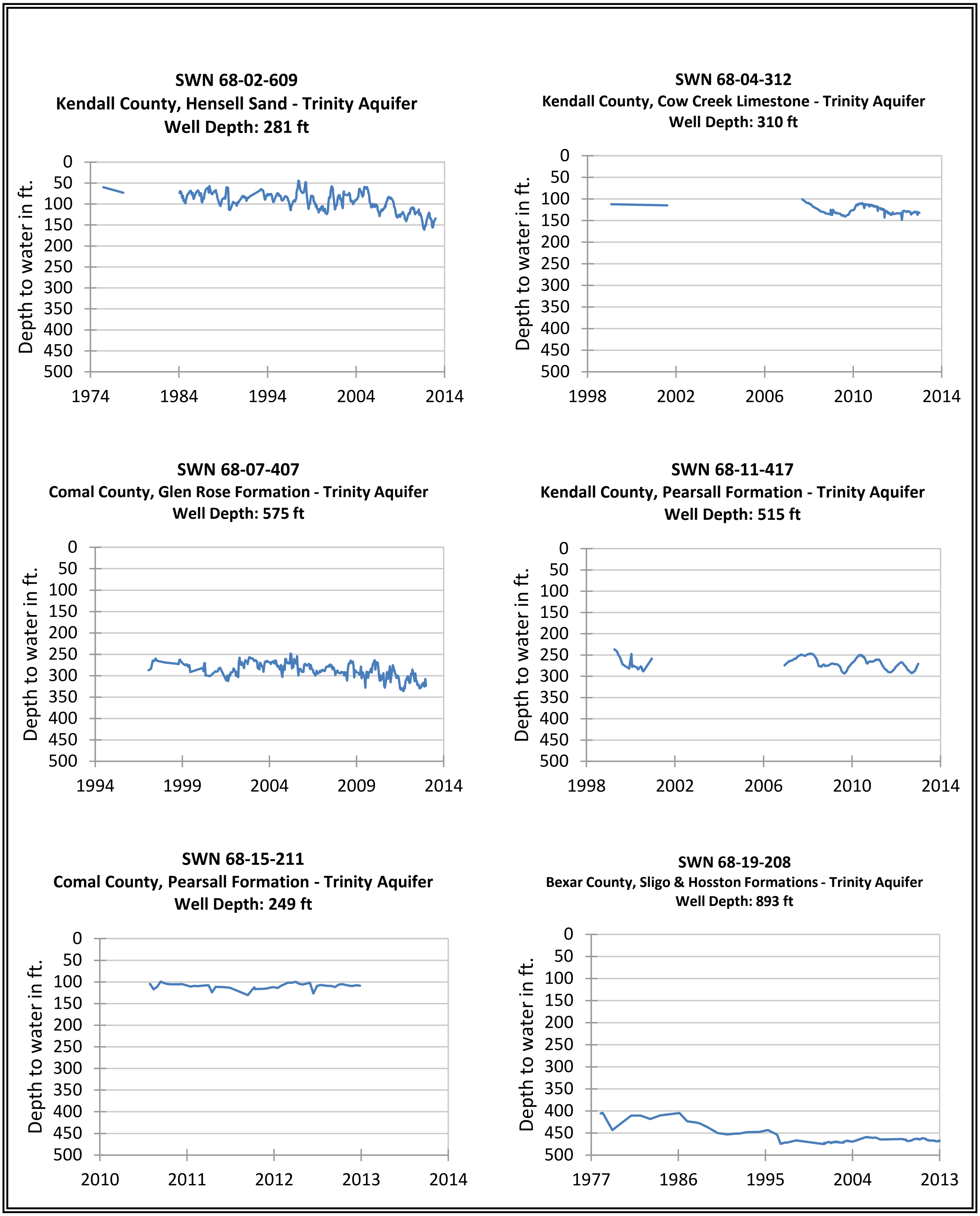


Figure 7-2 (continued). Selected hydrographs of TWDB recorder wells in Central Texas.

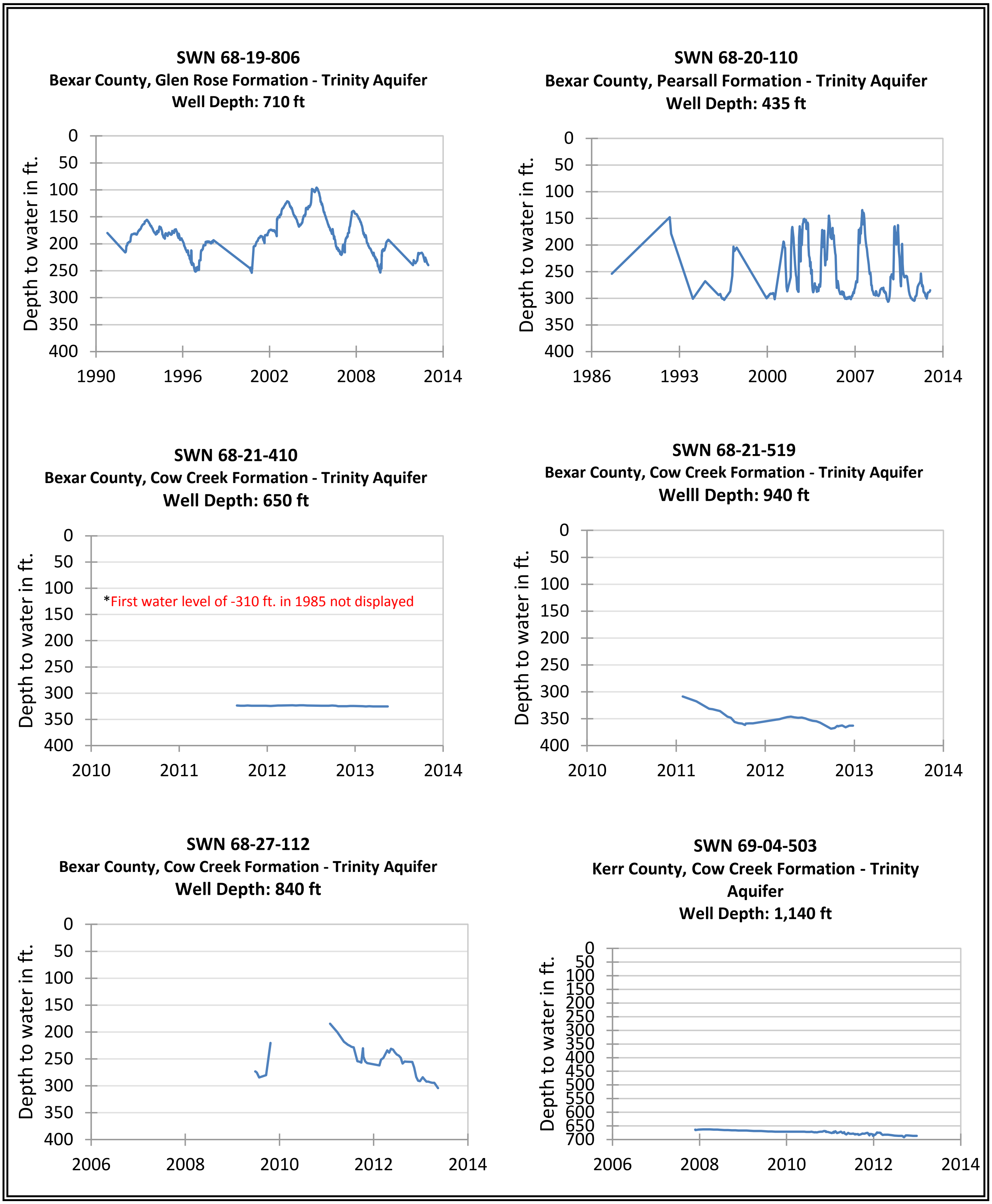
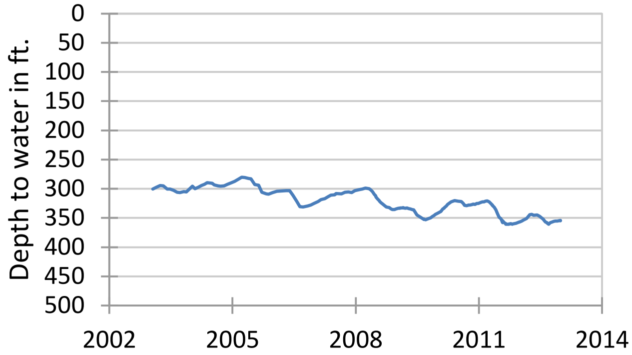
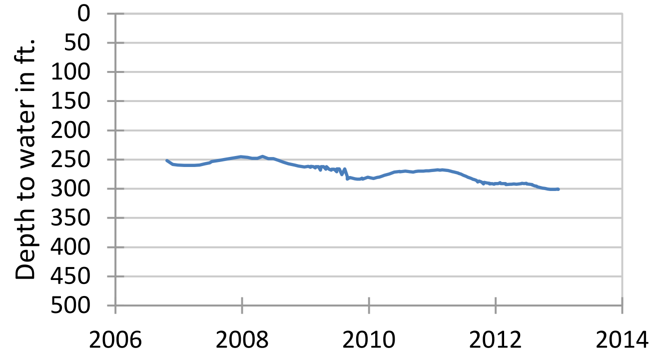


Figure 7-2 (continued). Selected hydrographs of TWDB recorder wells in Central Texas.

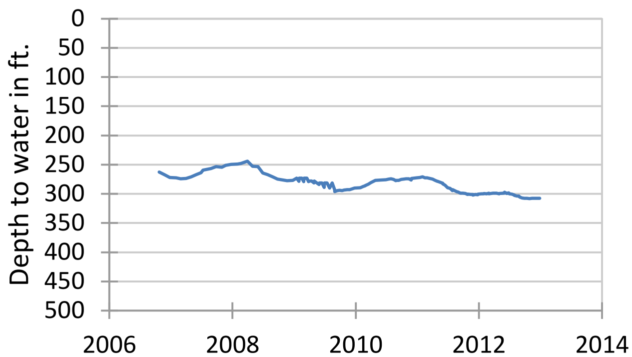
SWN 69-07-107
Kerr County, Hosston Formation - Trinity Aquifer
Well Depth: 610 ft



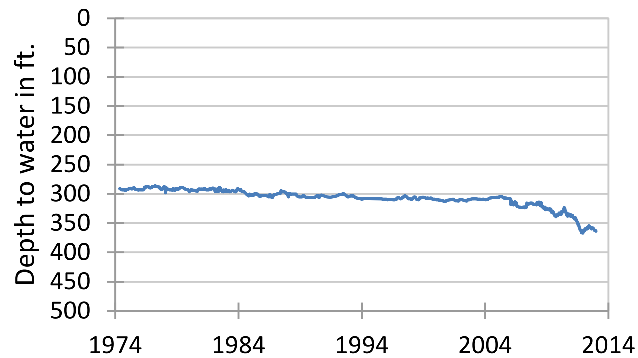
SWN 69-08-304
Kerr County, Hosston Formation - Trinity Aquifer
Well Depth: 760 ft



SWN 69-08-305
Kerr County, Hensell Sand - Trinity Aquifer
Well Depth: 520 ft



SWN 69-19-401
Real County, Hosston Formation - Trinity Aquifer
Well Depth: 820 ft



SWN 69-24-225
Bandera County, Hosston Formation - Trinity Aquifer
Well Depth: 800 ft

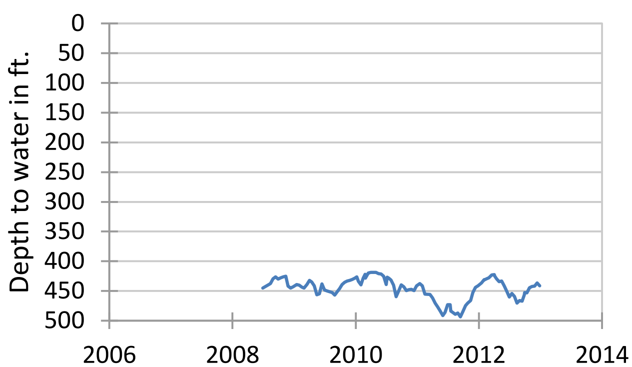


Figure 7-2 (continued). Selected hydrographs of TWDB recorder wells in Central Texas.

8.0 Conclusions

- In 2012 the TWDB maintained and monitored a statewide network of 145 wells equipped with automatic groundwater-level recording instruments and dataloggers. These wells monitor water-level conditions in major and minor aquifers defined by the TWDB, as well as undesignated aquifers. The number of wells monitored increased by 12 percent over the 2011 program.
- Groundwater levels throughout the state generally declined in 2012, but the decline is less than observed in the previous year. In the major aquifers, 31 recorders experienced water-level rises and 94 experienced water-level declines from 2011 to 2012, compared to the 9 recorders that experienced rises and 101 that experienced declines from 2010 to 2011. Total statewide median water-level change from 2011 to 2012 determined in the 125 recorders in major aquifers was 0.9 feet of decline, compared to the median water-level change from 2010 to 2011 in 110 wells in major aquifers of 4.8 feet of decline.
- Water levels in some wells have risen since 2011. Total statewide median water-level rise from 2011 to 2012 as determined from rises occurring in 31 of the 125 recorder wells completed in major aquifers was 1.9 feet, compared to the median water-level rise from 2010 to 2011 that occurred in 9 of 110 wells of 1.5 feet.
- Comparing water levels in major aquifer recorders by region (Table 8-1), the median water-level change from 2011 to 2012 was greatest in the Ogallala Aquifer wells, a decline of 1.8 feet, and least in the Gulf Coast Aquifer wells, a rise of 0.5 feet. The decline of 3.6 feet in the one Hueco-Mesilla Bolson Aquifer recorder well was not included in this comparison.
- By contrast, the greatest median water-level change for 2010 to 2011 by region was a decline of 16.7 feet in the central Texas (Hill Country) Trinity Aquifer wells with the least median change a decline of 0.7 feet in the west Texas Edwards-Trinity (Plateau) wells.
- Of all regions throughout the state, Central Texas currently has the largest number of recorder wells (35), indicative of interest in groundwater availability in an area with rapid population growth and variable patterns of rainfall.
- The median change (decline) in the 25 Ogallala Aquifer wells of 1.8 feet from 2011 to 2012 is relatively unchanged from the previous year's median change (decline) of 1.9 feet. Though smaller compared to the previous year's largest median change, a decline of 16.7 feet in Central Texas Trinity Aquifer wells, such smaller changes in water-table, or unconfined aquifers that are thinner in saturated thicknesses, are equivalent to much larger water-level changes in pressurized aquifers under artesian conditions of greater saturated thicknesses.

Table 8-1. Summary Table of median water-level changes, by major aquifer and region.

Median change (feet) 2011 – 2012	Median change (feet) 2010 – 2011	Median change (feet) 2009 – 2010	No. of Wells	Region	Major Aquifer
-1.8	-1.9	-1.0	25	High Plains	Ogallala
-1.6	-8.5	-0.2	15	North Central	Trinity
-0.9	-16.7	+2.8	35	Central	Trinity
-0.9	-3.2	+1.2	2	Rolling Plains	Seymour
-0.9	-4.4	-1.5	11	South and East	Carrizo-Wilcox
-0.9	-0.7	-1.3	19	West	Edwards-Trinity (Plateau)
-0.6	-7.6	-1.5	2	West	Pecos Valley
+0.5	-6.3	+0.9	11	South and East	Gulf Coast
+0.9	-3.5	-2.6	4	North Central	Northern Segment Edwards (Balcones Fault Zone)
-3.6	+1.5	+1.0	1	West	Hueco(-Mesilla) Bolson

*Indicates change in number of wells considered in this report from the previous (2010 to 2011) year's report.