Texas Water Development Board

Technical Note 17-01

Summary of Groundwater Conditions in Texas: Recent (2014–2015) and Historical Water-Level Changes in the TWDB Recorder Network

by

Blake Neffendorf and Janie Hopkins, P.G.

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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 (recorder) wells throughout the state. The TWDB recorder well network complements non-automated groundwater level monitoring programs conducted by groundwater conservation districts and other cooperators such as the U.S. Geological Survey. In addition, the Edwards Aquifer Authority conducts both automated and manual monitoring of indicator wells in the Edwards (Balcones Fault Zone) Aquifer in South Texas, but wells in these programs are not included in this report.

This report discusses the water-level changes observed from 2014 to 2015 in 175 recorder wells operating in the network, which includes 155 recorder wells in the state's nine major aquifers, 17 recorder wells in eight minor aquifers, and 3 recorder wells in three undesignated aquifers. The TWDB posts hydrographs and daily water-level measurements from these wells at waterdatafortexas.org/groundwater/. This report does not include water-level data from those recorder wells that were added to the network during 2015.

Since 2011 the recorder well network has expanded by 34 percent. More recorder wells exist in areas where water-level declines have been documented, such as in the Ogallala Aquifer in the High Plains (25 wells) and in the Trinity Aquifer in northern Central Texas (19 wells), and recently in areas where groundwater use is increasing, such as the Trinity Aquifer in Central Texas (46 wells). Of the 155 recorders in major aquifers discussed in this report, 58 percent are completed in the Ogallala or Trinity aquifers. Some groundwater conservation districts have also been able to add more recorders in wells in their counties for a number of reasons. In an effort to install recorders in counties and aquifers where none currently exist and to supplement the agency's budget dedicated to recorder equipment maintenance, the TWDB's "Recorder Water-Level Data in Every Texas County" initiative was accepted as a Texas Commission on Environmental Quality (TCEQ) Supplemental Environmental Project in 2014 (see www.tceq.texas.gov/legal/sep/). This program allows certain monetary settlements of TCEQ enforcement actions to be directed to the TWDB specifically for maintenance and replacement of recorder equipment and installation of recorders at new sites to fill such gaps.

For the first time in five years, more recorder wells experienced water-level rises at the end of 2015 than declines. In recorder wells in the major aquifers, the median water-level change was a rise of 1.3 feet from 2014 to 2015 with 69 percent of wells experiencing water-level rises. The median change from 2013 to 2014 was a decline of 1.2 feet with 73 percent of wells experiencing decline; from 2012 to 2013, a decline of 0.5 feet with 68 percent of wells experiencing decline; from 2011 to 2012, a decline of 0.9 feet with 75 percent of wells experiencing decline; and from 2010 to 2011, a decline of 4.8 feet with 92 percent of wells experiencing decline. Considering only those recorder wells in major aquifers that experienced water-level declines in the last five years, the amount of yearly decline (expressed as a median value) was 0.7 feet at the end of 2015, 2.0 feet at the end of 2014, 1.7 feet at the end of 2013, 1.9 feet at the end of 2012, and 4.9 feet at the end of 2011. For only those wells that experienced water-level rises, the median value was 3.7 feet at the end of 2015, 1.9 feet at the end of 2014, 2.5 feet at the end of 2013, 1.9 feet at the end of 2012, and 1.5 feet at the end of 2011.

Considering water-level change in major aquifer wells by region, excluding El Paso with only one recorder well in the Hueco(-Mesilla) Bolson Aquifer that experienced a decline of 0.3 feet and the one Edwards (Balcones Fault Zone) well in Hays County in the Central Region that experienced a rise of 37.5 feet, Trinity Aquifer wells in Central Texas experienced the greatest annual median change of a rise of 8.2 feet. The five Edwards (Balcones Fault Zone) Aquifer recorder wells, three of which are completed in the confined (artesian) portion of the aquifer, experienced the next largest median

water-level rise of 6.3 feet. Median water-level rises also occurred in the Rolling Plains Seymour Aquifer wells; Northern Central Trinity Aquifer wells; and Gulf Coast, Carrizo-Wilcox, and Pecos Valley aquifer recorder wells. The median change for Edwards-Trinity (Plateau) Aquifer wells was essentially 0 (-0.1) feet. Water levels in the Ogallala Aquifer wells continued to decline, with a median decline of 0.5 feet, or the lowest level of decline in comparison to declines in the preceding four years: 1.2 feet from 2014 to 2015; 1.0 feet from 2012 to 2013, 1.8 feet from 2011 to 2012, and 1.9 feet from 2010 to 2011. The water levels in four Bexar County Trinity Aquifer recorder wells experienced the greatest annual changes, or rises ranging from 108.8 to 170.3 feet from 2014 to 2015. The recorder well in the confined portion of the Carrizo(-Wilcox) Aquifer in Atascosa County experienced the greatest decline (28.7 feet) from 2014 to 2015.

This report addresses water-level changes in 175 wells out of hundreds of thousands of wells throughout the state. To equate these changes—this year consisting of rises in 129 wells, no change in one well, and declines in 45 wells—with specific amounts of total volume changes in aquifer groundwater storage is not feasible. Furthermore, the impacts of changing water levels on short- and long-term water supplies is dependent on a number of local and regional factors.

2.0 Introduction

An automatic groundwater-level recorder well, or a 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 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. The TWDB (and cooperator) recorders use the Geostationary Operational Environmental Satellite (GOES) system to relay data, although some groundwater conservation district programs use a cell phone network.

In 2015, the TWDB operated 175 recorder wells: 155 in the state's nine major aquifers, 17 in eight minor aquifers, and 3 in three undesignated or local aquifers, all equipped with satellite telemetry that allows publication of near real-time (provisional) data on the TWDB website. Of the 155 recorder wells in major aquifers, 56 wells were completed in the confined or artesian portion of the aquifer; of the 17 recorder wells in minor aquifers, 9 were completed in the confined portion of the aquifer. 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 2015) 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
- Northern Central Texas: Trinity and Edwards (Balcones Fault Zone) major aquifers and Woodbine minor aquifer
- East and South Texas: Carrizo-Wilcox and Gulf Coast major aquifers
- Central Texas: Trinity and Edwards (Balcones Fault Zone) major aquifers and Hickory and Ellenburger-San Saba minor aquifers

[1] Please note that hydrographs published in the 2010–2011 report presented the vertical or depth axis with different minimum and maximum depths to best illustrate water-level changes within each well. Beginning with the 2011–2012 report, we presented 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. The current approach emphasizes the relative difference in water-level depth from land surface for each well compared to others in the same aquifer or geographic region.

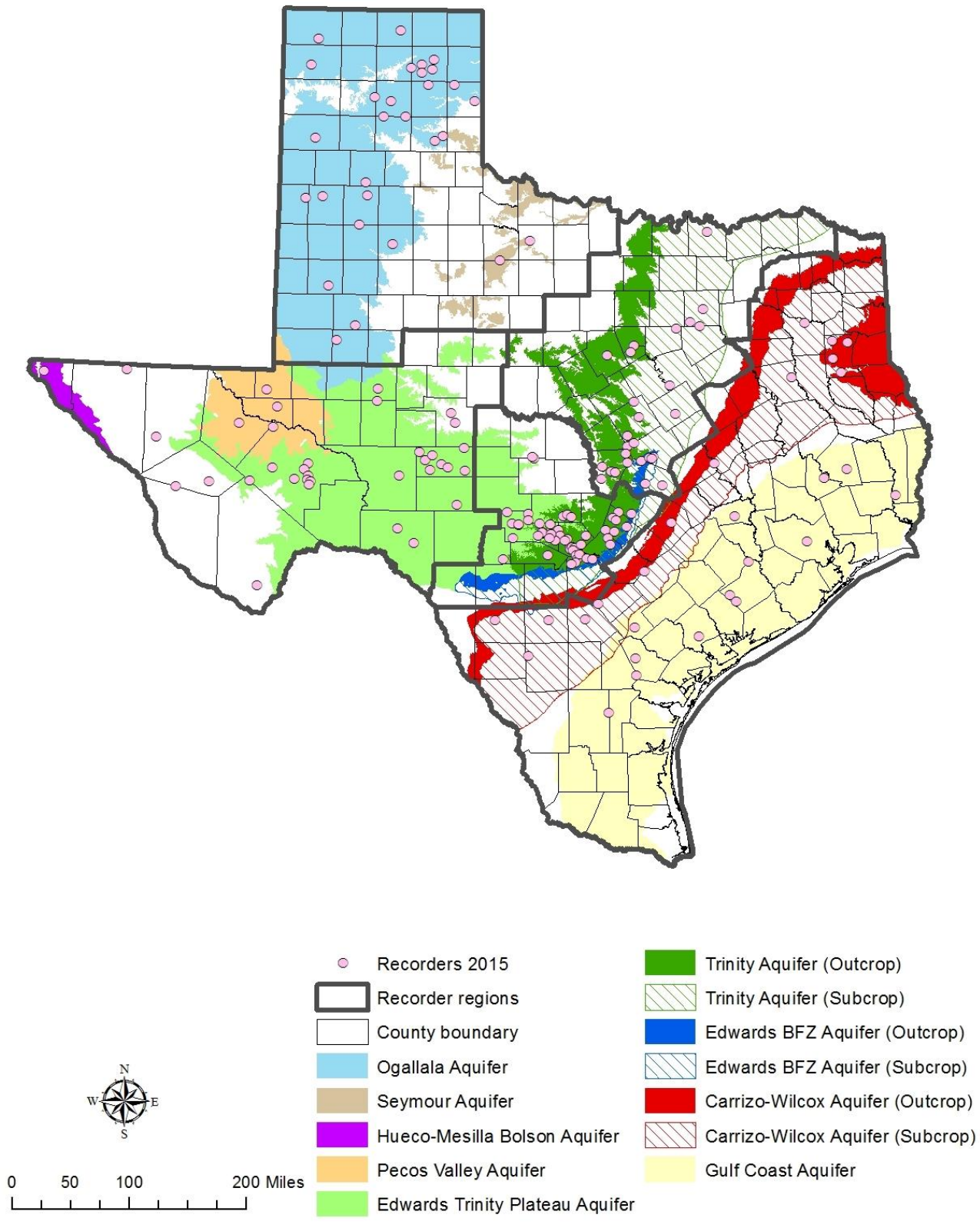

Figure 2-1. Location of 161 recorder wells operated by the TWDB and cooperators and recorder regions discussed in this report. BFZ = Balcones Fault Zone.

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 (Figure 3-1). Water levels in these recorder wells, all completed in unconfined aquifers or their unconfined portions, exist under water-table conditions. One Ogallala Aquifer well in Wheeler County—0539904—was dropped from the program after being taken out of service. The 27 wells in the High Plains include 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 16 of the 25 Ogallala Aquifer wells from 2014 to 2015 (Table 3-1 and Figure 3-2) while one well's water level ultimately showed no change for the period and eight wells experienced a water-level rise. Changes in levels ranged from +2.6 to -4.1 feet with a median of -0.5 feet and an average of -0.4 feet. The Roberts County (0510953) well experienced the largest decline of 4.1 feet, and theWheeler County (0539904) well experienced the largest rise of 7.7 feet. The greatest decline measured in any of the Ogallala recorders for the 2011 to 2015 period was nearly 60 feet in the Roberts County (0510953) well, and the greatest historical decline over 65 years was just over 118 feet in the Lamb County well.

The Ogallala Aquifer, used primarily for crop irrigation, has experienced water-level declines throughout most of 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. Slight water-level rises, however, continue to occur in periods of relatively less pumping as happened during the year in wells in the northern part of the Panhandle in Gray, Wheeler, and Donley counties; north of Lubbock in Hale County; and in the sourthernmost Ogallala recorders in Dawson and Martin counties.

The Seymour Aquifer wells both experienced rises of 3.0 and 1.7 feet in Baylor and Haskell counties from 2014 to 2015 following declines of 1.4 and 0.6 feet, respectively, in each between 2013 and 2014. Shallow well depths in this aquifer account for greater sensitivity to rainfall and pumpage and subsequently more pronounced groundwater level rises and declines.

3.2 Minor and undesignated aquifers

The water level in the Hale County Edwards-Trinity (High Plains) Aquifer well rose by 0.8 feet from 2014 to 2015 after it declined by 0.7 feet from 2013 to 2014, rose by 0.6 feet from 2012 to 2013, and declined by 0.3 feet from 2011 to 2012. After four years of decline in the Wheeler County Whitehorse Aquifer recorder well, the water level rose 7.7 feet.

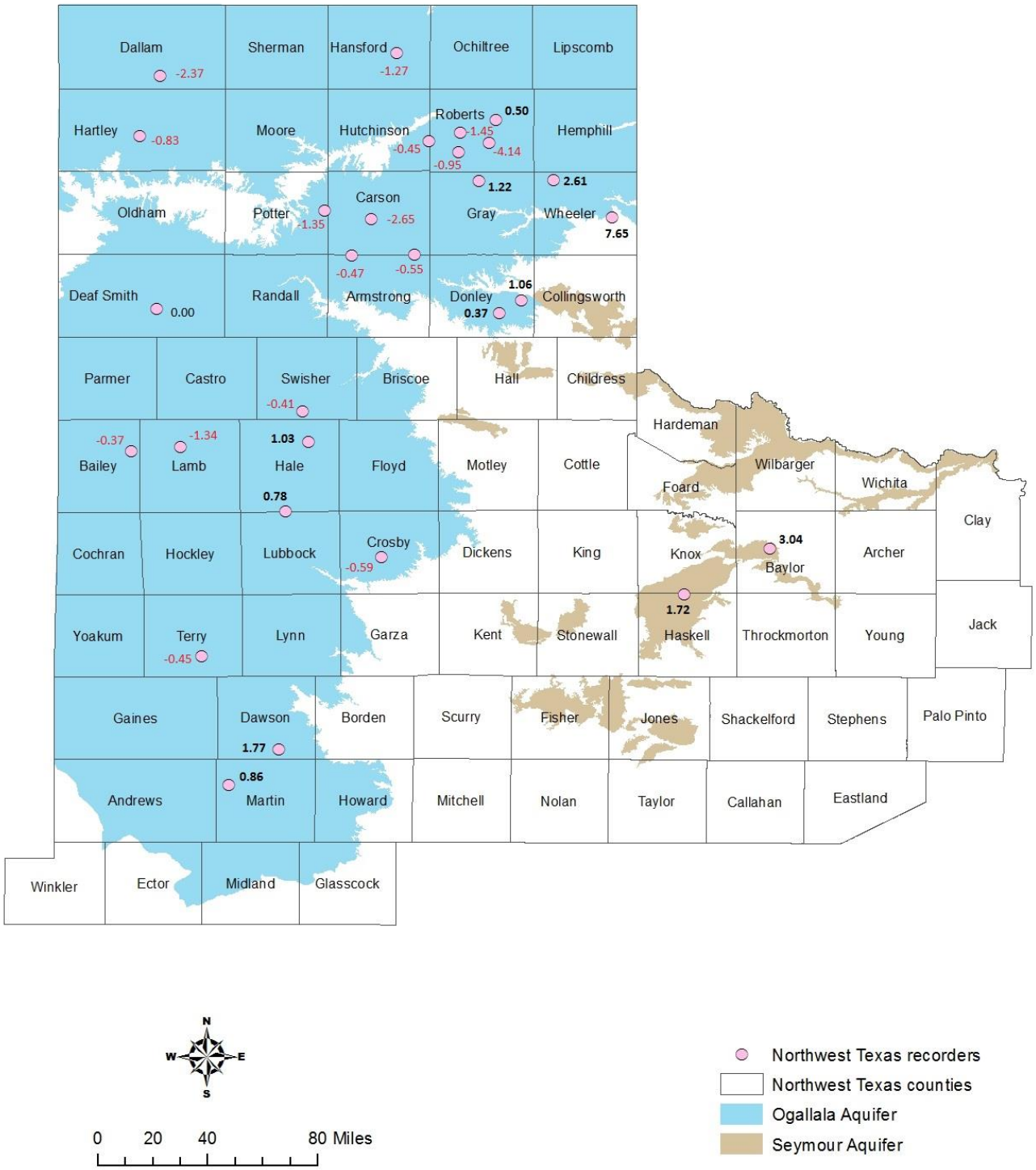

Figure 3-1. Location of wells with TWDB-operated automatic water-level recorders in Northwest Texas. Water-level changes from 2014 to 2015 are shown in feet. Black indicates a rise in water levels, and red indicates a decline.

Table 3-1. Water-level changes in TWDB recorder wells in Northwest Texas counties for various time periods. Blue indicates a rise in water level, and red indicates decline. Minor aquifer indicated in green text, and undesignated or local aquifer indicated in purple.

County and state well number	Aquifer	2015 change (ft)	2014 change (ft)	2011–2015 change (ft)	2006–2015 change (ft)	Historical change (ft, yr)	Historical yearly average (ft, yrs)
Dallam 0260303	Ogallala	-2.37	-3.54	-22.65	N/A	-22.65 (2010)	-4.53 (5)
Hansford 0354301	Ogallala	-1.27	-1.36	-4.56	-9.58	-86.91 (1951)	-1.34 (65)
Roberts 0503709	Ogallala	0.50	-0.74	-1.82	-1.06	-2.23 (2005)	-0.28 (10)
Roberts 0509553	Ogallala	-1.45	-2.20	-10.68	-18.83	-24.42 (2002)	-1.91 (13)
Roberts 0510953	Ogallala	-4.14	-3.47	-59.85	-79.60	-80.10 (2002)	-5.84 (14)
Roberts 0517203	Ogallala	-0.95	-1.48	-4.95	-8.00	-11.06 (2000)	-0.67 (16)
Gray 0526501	Ogallala	1.22	-1.15	-1.73	-5.11	-25.13 (1958)	-0.43 (58)
Wheeler 0529505	Ogallala	2.61	-2.64	N/A	N/A	6.57 (2012)	2.05 (3)
Wheeler 0539904	Whitehorse	7.65	-1.74	-2.83	N/A	-13.76 (1966)	-0.28 (50)
Hutchinson 0616702	Ogallala	-0.45	-0.96	-3.51	-6.56	-6.92 (2003)	-0.58 (12)
Potter 0635912	Ogallala	-1.35	-2.59	-9.66	N/A	-13.76 (2006)	-1.40 (9)
Carson 0645305	Ogallala	-2.65	-3.69	-18.74	-23.37	-23.77 (2003)	-1.83 (13)
Armstrong 0653401	Ogallala	-0.47	0.04	N/A	N/A	-0.43 (2014)	-0.22 (2)
Armstrong 0655504	Ogallala	-0.55	-1.23	-6.16	N/A	-35.39 (1975)	-0.88 (40)
Hartley 0712401	Ogallala	-0.83	-1.44	-7.81	-16.85	-34.85 (1963)	-0.66 (53)
Deaf Smith 1004901	Ogallala	0.00	-1.58	-7.48	-11.09	-32.92 (1975)	-0.80 (41)
Bailey 1051909	Ogallala	-0.37	0.93	-1.93	-8.86	-18.20 (1981)	-0.54 (34)
Lamb 1053602	Ogallala	-1.34	-0.91	-7.18	-17.67	-118.21 (1951)	-1.82 (65)
Swisher 1142315	Ogallala	-0.41	-0.38	-2.01	-4.14	-17.19 (1988)	-0.63 (27)
Hale 1151403	Ogallala	1.03	-1.03	-6.24	-17.06	-49.49 (1988)	-1.80 (27)
Donley 1204452	Ogallala	1.06	-6.96	-16.43	N/A	-15.13 (2009)	-2.33 (6)
Donley 1211118	Ogallala	0.37	-1.22	-2.46	N/A	-4.46 (2008)	-0.58 (8)
Baylor 2122850	Seymour	3.04	-1.41	-3.51	N/A	-2.49 (2009)	-0.36 (7)
Haskell 2135748	Seymour	1.72	-0.59	-3.39	-7.63	-5.80 (2002)	-0.44 (13)
Hale 2310401	Edwards-Trinity (High Plains)	0.78	-0.73	-2.23	-3.57	0.97 (2001)	0.07 (14)
Crosby 2330103	Ogallala	-0.59	-1.02	-4.03	-7.01	-8.76 (1965)	-0.17 (50)
Terry 2462601	Ogallala	-0.45	-0.65	-3.12	-6.89	-20.07 (1969)	-0.44 (46)
Martin 2739903	Ogallala	0.86	-1.15	-5.01	-10.79	-37.43 (1964)	-0.73 (51)
Dawson 2825604	Ogallala	1.77	-0.48	-1.61	1.41	1.75 (2000)	0.11 (16)

ft = feet, yr = earliest year measured, N/A = not available, yrs = years over which average determined

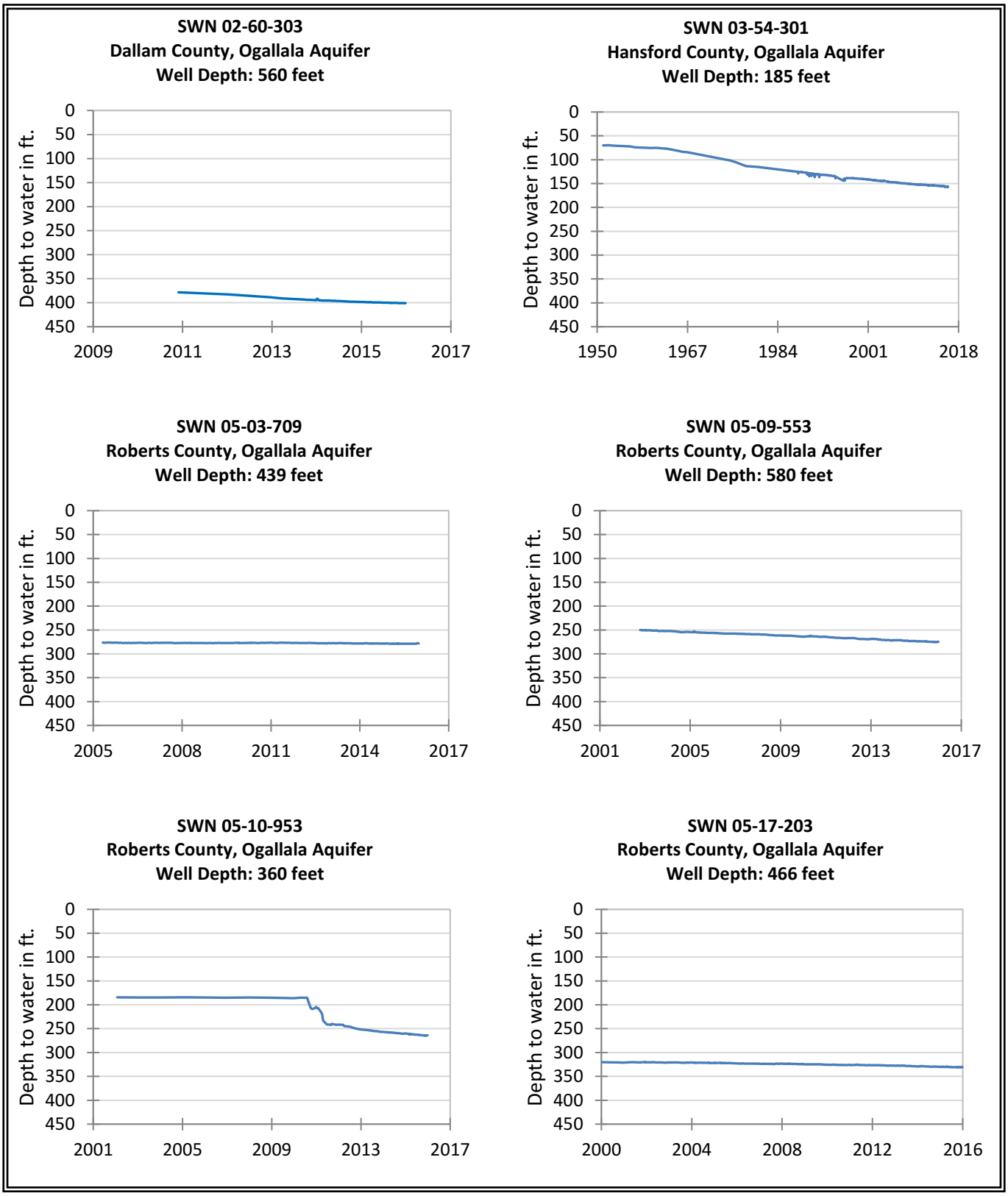

Figure 3-2. Hydrographs of TWDB recorder wells in the High Plains and Rolling Plains, Texas. SWN = state well number

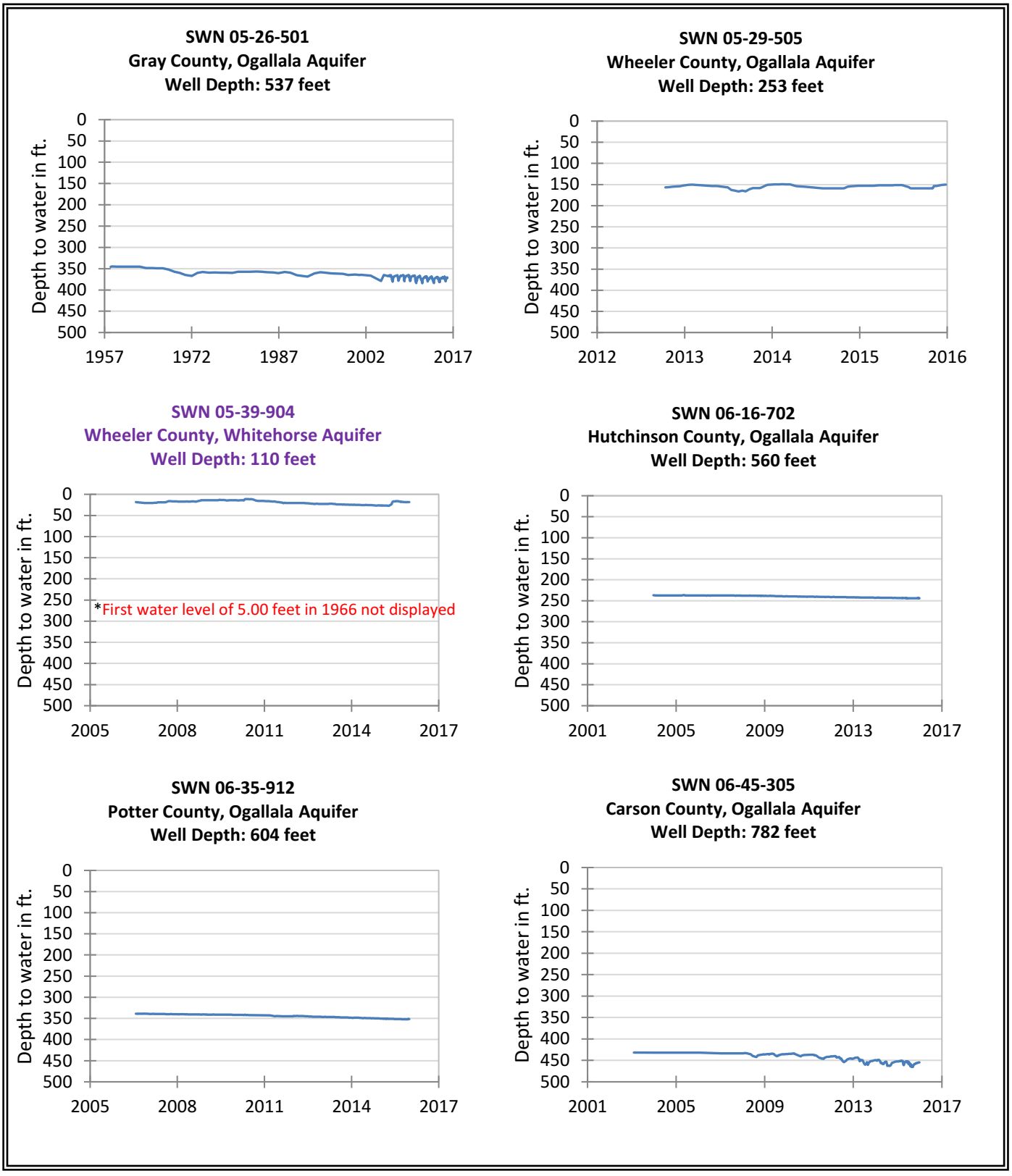

Figure 3-2 (continued) Hydrographs of TWDB recorder wells in the High Plains and Rolling Plains, Texas. Undesignated or local aquifer indicated in purple text. SWN = state well number

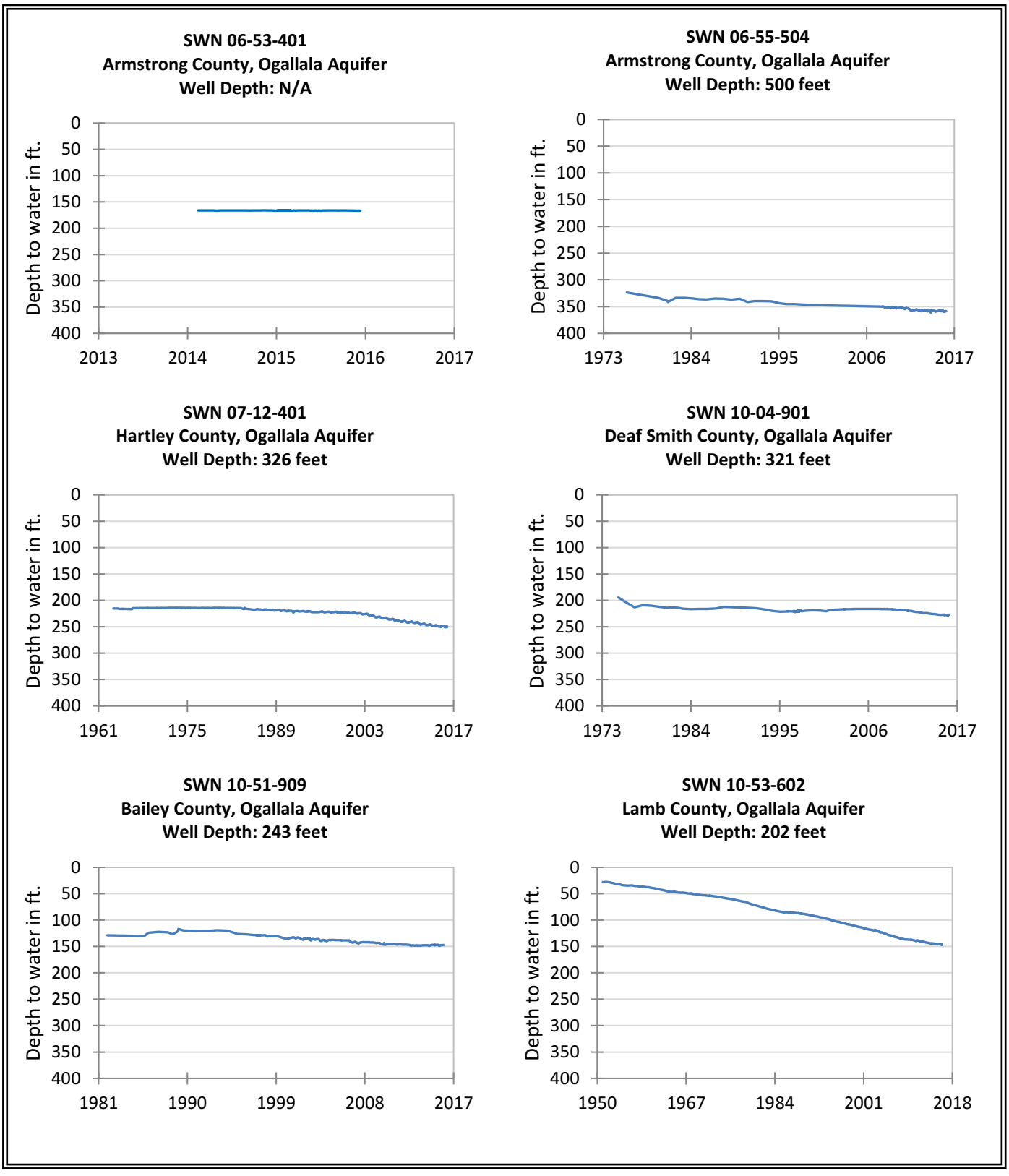

Figure 3-2 (continued) Hydrographs of TWDB recorder wells in the High Plains and Rolling Plains, Texas. SWN = state well number

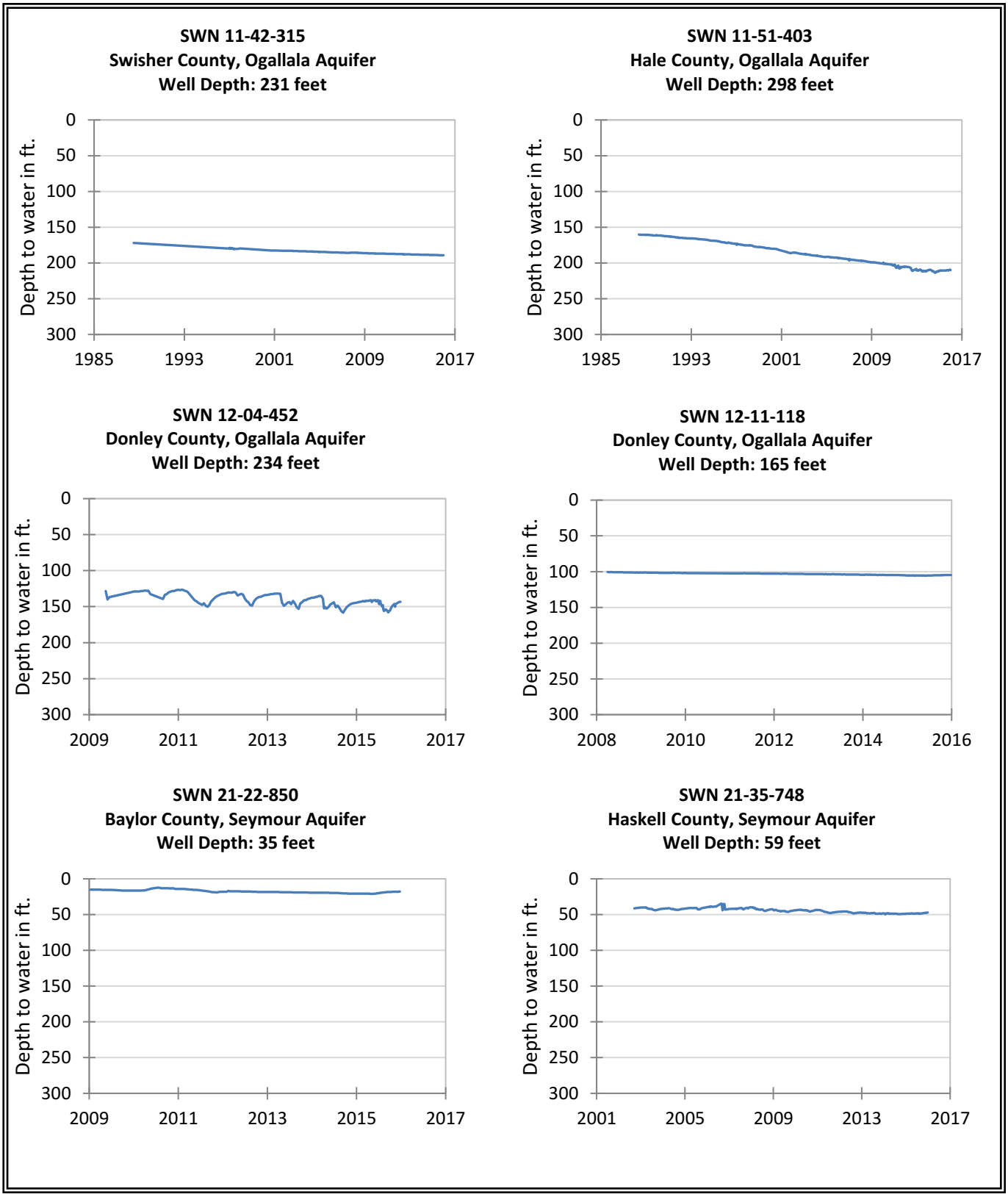

Figure 3-2 (continued) Hydrographs of TWDB recorder wells in the High Plains and Rolling Plains, Texas. SWN = state well number

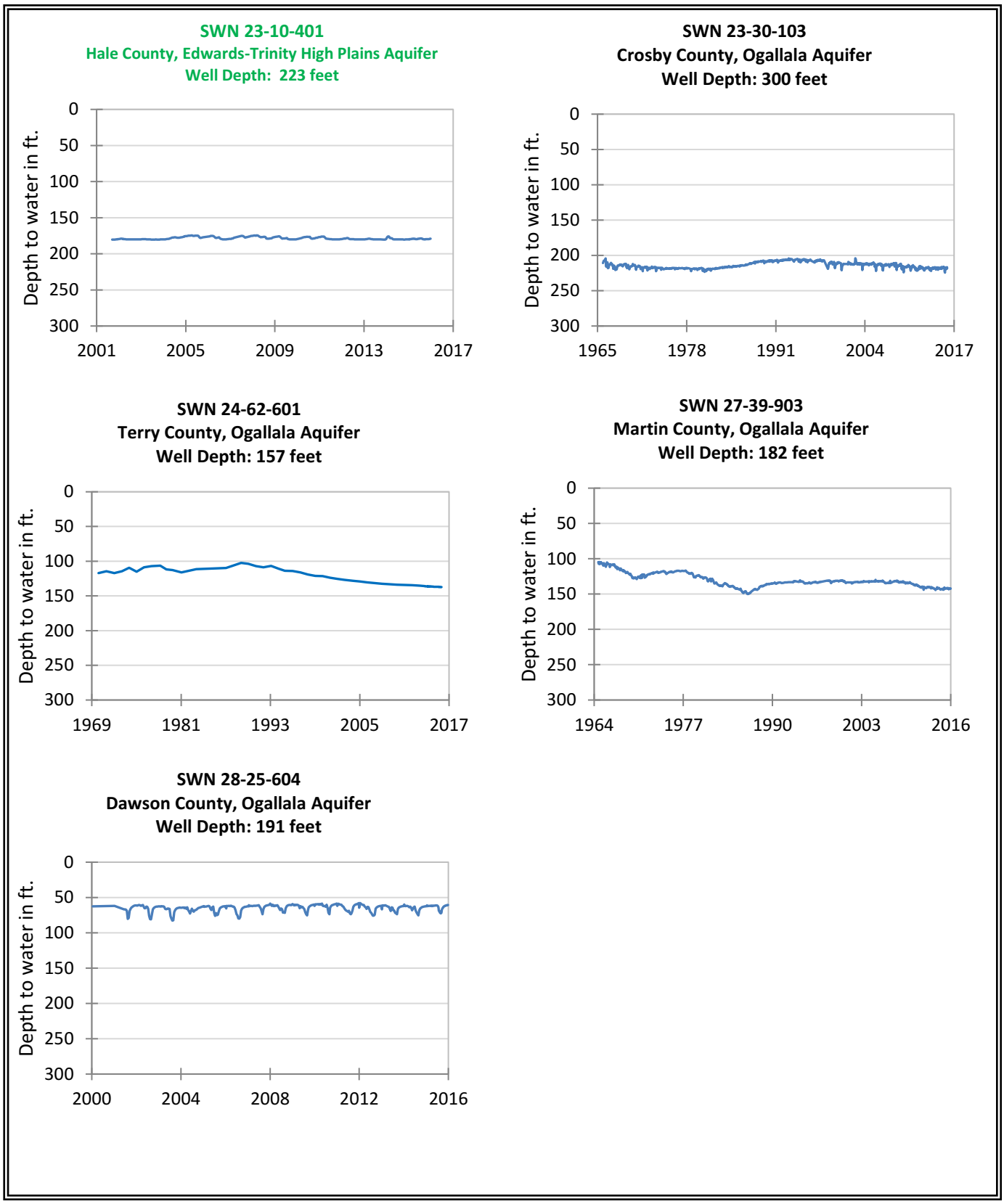

Figure 3-2 (continued) Hydrographs of TWDB recorder wells in Northwest Texas. Minor aquifer indicated in green text. SWN = state well number

4.0 West Texas

The TWDB monitors 37 wells in West Texas (Figure 4-1), 30 of which are completed in major aquifers and seven in minor or undesignated aquifers. Water levels in these recorder wells are all completed in unconfined aquifers or their unconfined portions. Wells completed in the major aquifers include 25 wells in the Edwards-Trinity (Plateau) Aquifer, four wells in the Pecos Valley Aquifer, and one well in the Hueco-Mesilla Bolson Aquifer. Two wells completed in the Edwards-Trinity (Plateau) Aquifer in Pecos County were added to the program at the end of 2014, and one Edwards-Trinity (Plateau) Aquifer well in Schleicher County was dropped from the program. The five recorder wells in minor aquifers include two in the Lipan, one in the Bone Spring-Victorio Peak, one in the West Texas Bolsons, and one in the Igneous aquifers. One recorder well is completed in Quaternary volcanic rocks of an undesignated aquifer in Brewster County, and another is completed in the Cretaceous Aquifer in Culberson County.

4.1 Major aquifers

Water-level changes in the 30 wells completed in major aquifers in this region between 2014 and 2015 continued to moderate, with 15 wells experiencing slight declines and 15 experiencing slight to moderate rises (Table 4-1 and Figure 4-2). Water levels in the 25 Edwards-Trinity (Plateau) Aquifer wells between 2014 and 2015 ranged from +7.8 to -1.8 feet with a median change of essentially 0 (-0.01) feet and an average change of +0.7 feet. Water-level changes in the 23 available wells from the preceding year (2013 to 2014) ranged from +2.3 to -5.3 feet with a median change of -0.5 feet and an average change of -0.6 feet. Water-level changes in the 21 available wells from 2012 to 2013 ranged from +0.9 to -4.4 feet with a median change of -0.8 feet and an average change of -1.2 feet. Thirteen Edwards-Trinity (Plateau) wells exhibited slight rises from 2014 to 2015, compared to seven with rises from 2013 to 2014, and two with rises from 2012 to 2013.

Water levels rose in three of the four Pecos Valley Aquifer recorder wells from 2014 to 2015. Changes in all four ranged from +1.8 to -0.6 feet with a median change of +0.9 feet and an average change of +1.3 feet. Changes in the preceding two years, 2013 to 2014 and 2012 to 2013, respectively, ranged from +0.2 to -4.3 feet with a median change of -1.5 feet and an average change -1.7 feet, and +0.8 to -2.2 feet with a median change of -0.9 feet and an average change -1.0 feet. Well 4644501 continues to experience the greatest change of the four Pecos Valley Aquifer wells, a decline for each of the last four years. The water level in this well has experienced 62.5 feet of decline since originally measured in 1952, with a yearly average decline of ~1.0 feet.

The water level in the Hueco-Mesilla Bolson well declined 0.3 feet from 2014 to 2015, compared to its declines of 2.2 feet from 2013 to 2014, 0.4 feet from 2012 to 2013, and 3.6 feet from 2011 to 2012. The water level in this well has experienced just over 64 feet of decline since originally measured in 1964, with a yearly average decline of 1.3 feet.

4.2 Minor and undesignated aquifers

The northernmost of the two Lipan aquifer wells (4337101) experienced a rise of 2.5 feet from 2014 to 2015. The 4345306 well, slightly more than nine miles south of 4337101, experienced a rise of 11.6 feet. This trend of larger changes in the southernmost Lipan Aquifer well has continued from previous years. From 2013 to 2014 the water level in 4337101 declined 0.4 feet but rose 13.1 feet in 4345306. From 2012 to 2013 the water level in each well declined by 3.5 and 11.7 feet, respectively; and from 2011 to 2012, water levels rose 10.5 and 14.9 feet, respectively. Swings of this magnitude are characteristic of highly transmissive shallow aquifers that are sensitive to recharge from rainfall and fluctuations in pumping demands.

Water-level changes in the three other minor aquifer wells were small. The water level in the Bone Spring-Victorio Peak well in Hudspeth County declined 1.0 feet from 2014 to 2015, following declines ranging from 0.2 to 2.9 feet in the previous four years. Water levels in the recorder well of the Igneous Aquifer of Jeff Davis County (Fort Davis State Park)

and in the West Texas Bolsons Aquifer of Presidio County continued to experience little change, or a decline of 0.4 feet in the Igneous Aquifer well and a rise of 0.2 feet in the West Texas Bolsons Aquifer well.

The water level from 2014 to 2015 in the Cretaceous Aquifer recorder well in Culberson County declined by 0.8 feet, following declines ranging from 1.9 to 7.9 feet in the previous three years. The decline of 22.2 feet from 2014 to 2015 in the Volcanics Aquifer recorder in Brewster County was the greatest water-level change experienced in any of all West Texas area recorder wells, following a rise of 28.3 feet from 2013 to 2014. This unused well in Big Bend National Park is within 150 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.

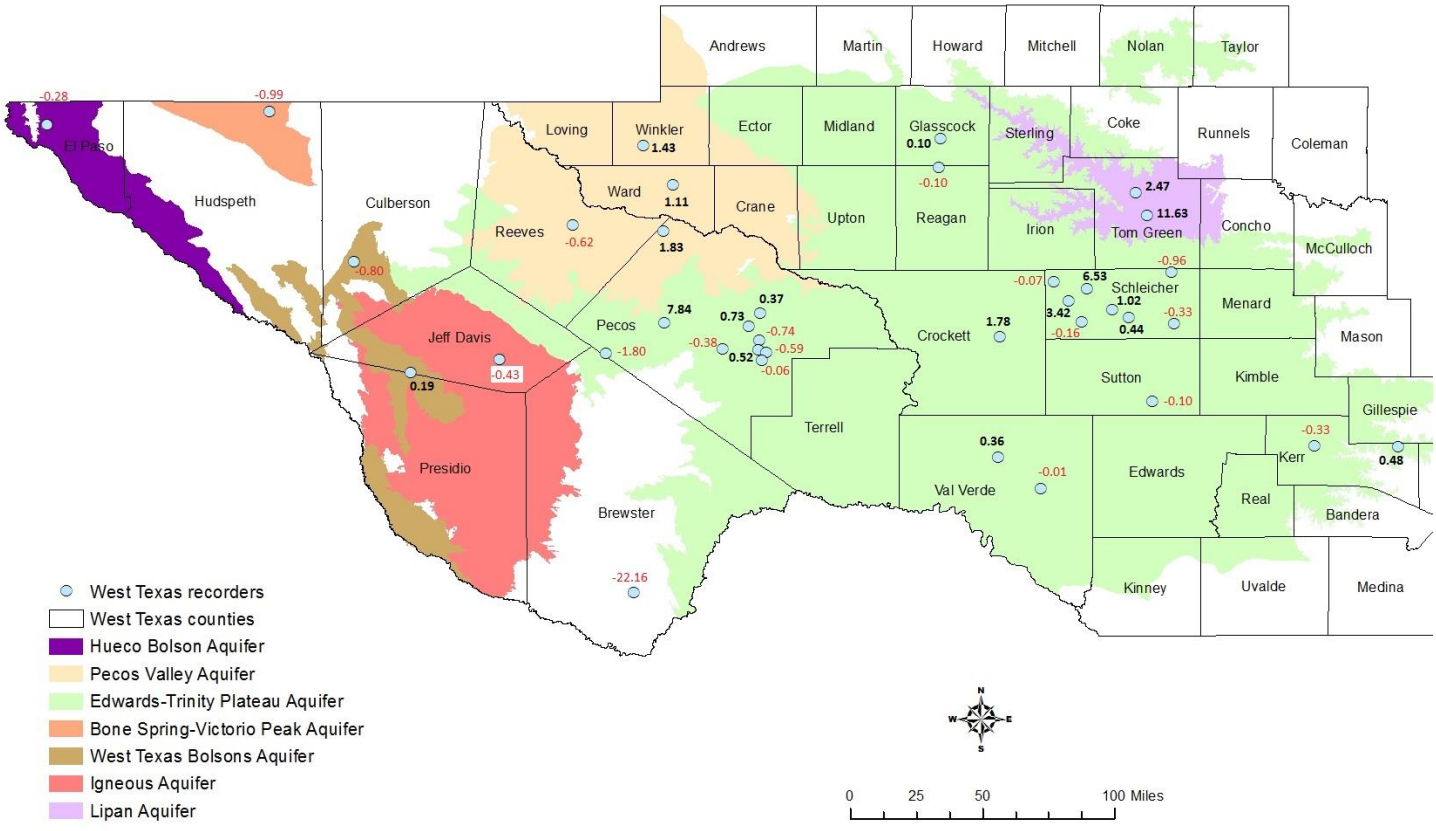

Figure 4-1. Location of wells with TWDB-operated automatic water-level recorders in West Texas. Water-level changes from 2014 to 2015 are shown in feet. Black indicates a rise in water levels, and red indicates decline.

Table 4-1. Water-level changes in TWDB recorder wells in West Texas counties for various time periods. Blue indicates a rise in water level, and red indicates decline. Minor aquifers indicated in green text and undesignated or local aquifers in purple.

County and state well number	Aquifer	2015 change (ft)	2014 change (ft)	2011–2015 change (ft)	2006–2015 change (ft)	Historical change (ft, yr)	Historical yearly average (ft, yrs)
Tom Green 4337101	Lipan	2.47	-0.37	-4.08	-2.74	-4.41 (2005)	-0.42 (10)
Tom Green 4345306	Lipan	11.63	13.11	13.92	-0.57	3.73 (1991)	0.16 (24)
Schleicher 4357905	ET (P)	-0.07	0.61	N/A	N/A	-1.22 (2012)	-0.36 (3)
Schleicher 4362607	ET (P)	-0.96	0.16	N/A	N/A	-0.02 (2011)	0.00 (4)
Glasscock 4412611	ET (P)	0.10	0.93	-7.24	-15.29	-19.25 (2001)	-1.31 (15)
Reagan 4420854	ET (P)	-0.10	-0.64	-1.35	-5.39	-17.15 (1990)	-0.66 (26)
Ward 4525715	Pecos Valley	1.11	0.24	N/A	N/A	-2.49 (2012)	-0.69 (4)
Winkler 4615924	Pecos Valley	1.43	-1.62	N/A	N/A	-1.37 (2012)	-0.46 (3)
Reeves 4644501	Pecos Valley	-0.62	-4.26	-10.71	-11.76	-62.52 (1952)	-0.98 (64)
Pecos 4648806	Pecos Valley	1.83	-1.27	N/A	N/A	1.63 (2011)	0.39 (4)
Culberson 4759123	Cretaceous	-0.80	-1.89	-4.51	-7.90	-16.09 (1995)	-0.80 (20)
Hudspeth 4807516	Bone Spring-Victorio Peak	-0.99	-0.54	-4.69	-8.47	-34.11 (1966)	-0.68 (50)
El Paso 4913301	Hueco Bolson	-0.28	-2.19	-4.99	-6.57	-64.20 (1964)	-1.26 (51)
Presidio 5129805	West Texas Bolson	0.19	0.22	0.80	1.74	17.23 (1979)	0.47 (36)
Pecos 5216802	ET (P)	7.84	2.33	2.49	-19.14	53.82 (1976)	1.35 (40)
Jeff Davis 5225209	Igneous	-0.43	0.27	-1.52	-3.59	-4.66 (1999)	-0.28 (16)
***Pecos 5230107**	ET (P)	-1.80	N/A	N/A	N/A	-8.95 (2010)	-1.63 (5)
***Pecos 5312301**	ET (P)	0.37	0.28	N/A	N/A	0.65 (2014)	0.34 (2)
Pecos 5312803	ET (P)	0.73	-0.05	N/A	N/A	-1.17 (2011)	-0.25 (4)
Pecos 5319701	ET (P)	-0.74	-1.55	-24.38	N/A	-28.58 (2009)	-4.76 (6)
Pecos 5320603	ET (P)	-0.59	-0.61	-1.43	N/A	-3.27 (2009)	-0.50 (6)
Pecos 5320903	ET (P)	0.52	-0.54	-1.80	N/A	-2.39 (2010)	-0.43 (5)
Pecos 5321704	ET (P)	-0.38	-0.24	-1.78	N/A	-2.07 (2010)	-0.39 (5)
Pecos 5328303	ET (P)	-0.06	-0.95	-1.54	N/A	-1.04 (2008)	-0.14 (7)
Crockett 5423106	ET (P)	1.78	0.98	0.70	-10.29	3.17 (1963)	0.06 (53)
Val Verde 5463401	ET (P)	0.36	-0.88	-1.55	N/A	-1.31 (2005)	-0.12 (10)
Schleicher 5502807	ET (P)	3.42	0.51	-13.34	N/A	8.06 (1958)	0.14 (57)
Schleicher 5503109	ET (P)	6.53	-5.32	N/A	N/A	-10.05 (2011)	-2.23 (4)
Schleicher 5510611	ET (P)	-0.16	-1.10	N/A	N/A	-9.44 (2011)	-2.10 (4)
Schleicher 5512134	ET (P)	1.02	-1.19	-10.76	-31.31	-12.10 (2003)	-0.97 (12)
Schleicher 5512606	ET (P)	0.44	-0.20	N/A	N/A	-1.15 (2012)	-0.36 (3)
Schleicher 5514909	ET (P)	-0.33	-2.34	N/A	N/A	-0.53 (2013)	-0.21 (2)
Sutton 5545308	ET (P)	-0.10	-2.31	-1.84	N/A	-5.20 (2009)	-0.74 (7)
Kerr 5661102	ET (P)	-0.33	-0.57	-3.26	N/A	-1.70 (2006)	-0.18 (9)
Kerr 5664302	ET (P)	0.48	-0.44	N/A	N/A	-1.02 (2012)	-0.26 (4)
Val Verde 7001707	ET (P)	-0.01	0.04	-0.17	N/A	-3.74 (2006)	-0.38 (9)
Brewster 7347404	Volcanics	-22.16	28.29	6.51	N/A	-4.61 (2007)	-0.54 (8)

* = recorder added for the 2014–2015 report, ft = feet, yr = earliest year measured, N/A = not available, yrs = years over which average determined, ET (P) = Edwards-Trinity (Plateau

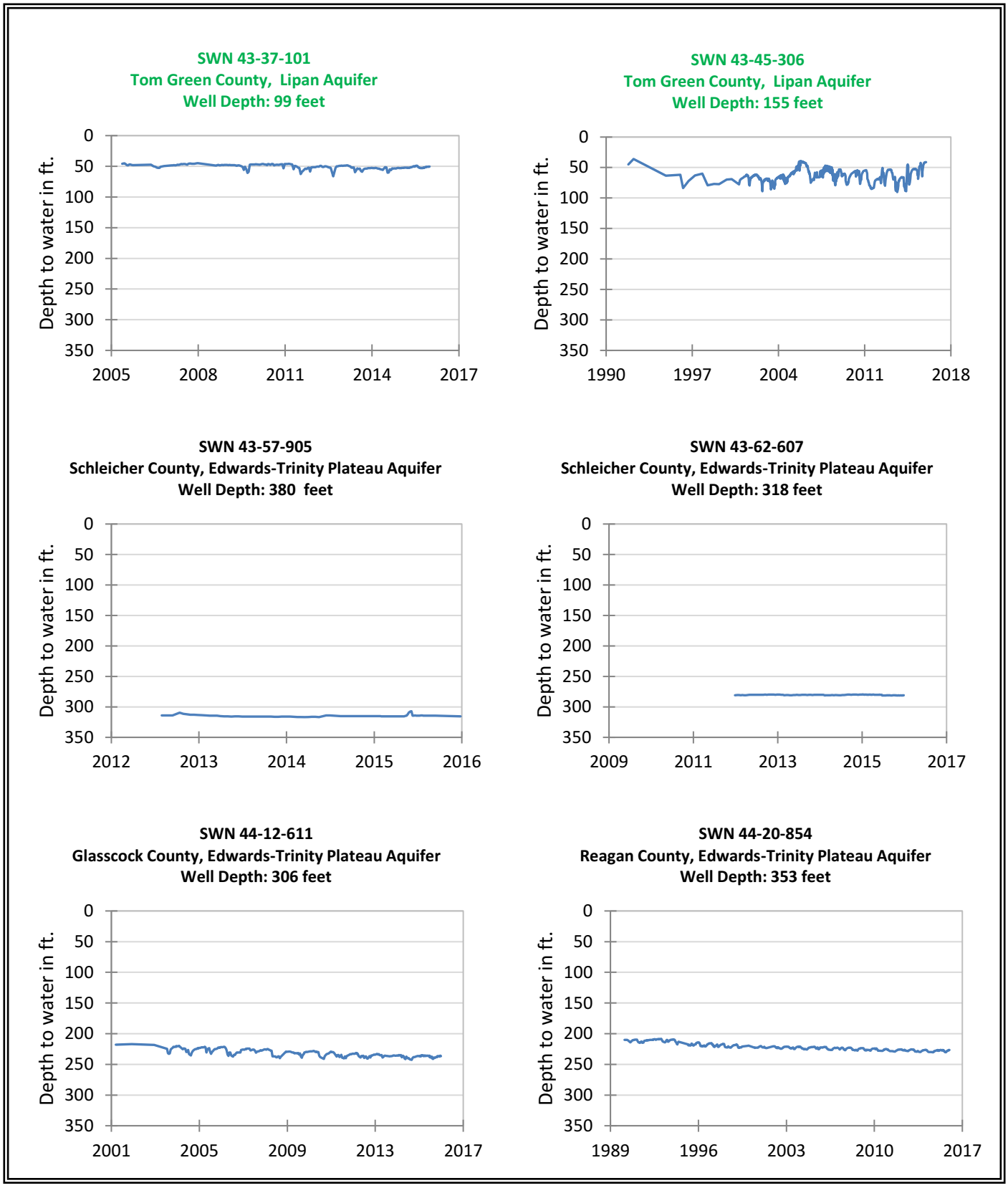

Figure 4-2. Hydrographs of TWDB recorder wells in West Texas. Minor aquifers indicated in green text. SWN = state well number

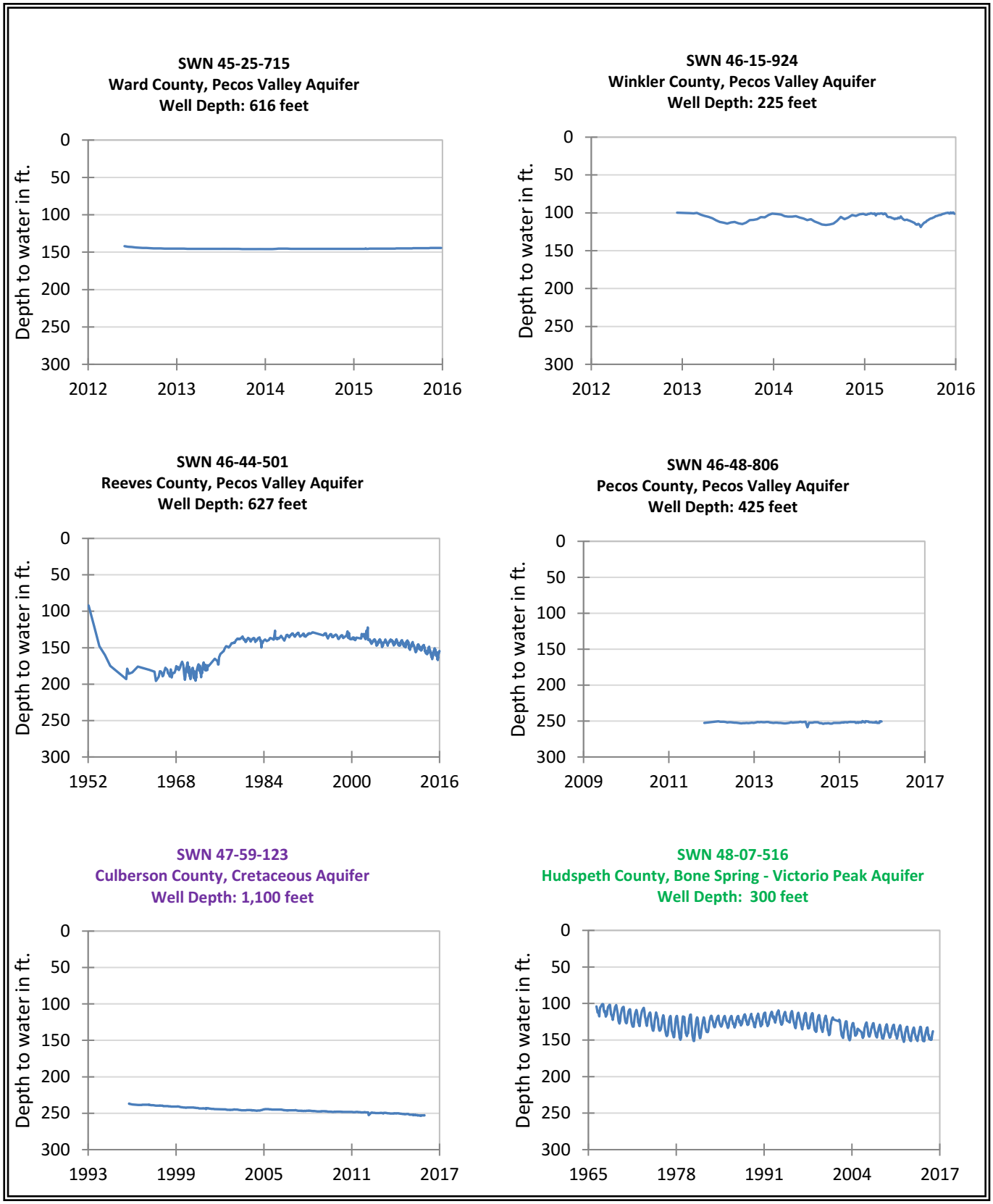

Figure 4-2 (continued) Hydrographs of TWDB recorder wells in West Texas. Undesignated or local aquifer indicated in purple text. Minor aquifers indicated in green text . SWN = state well number

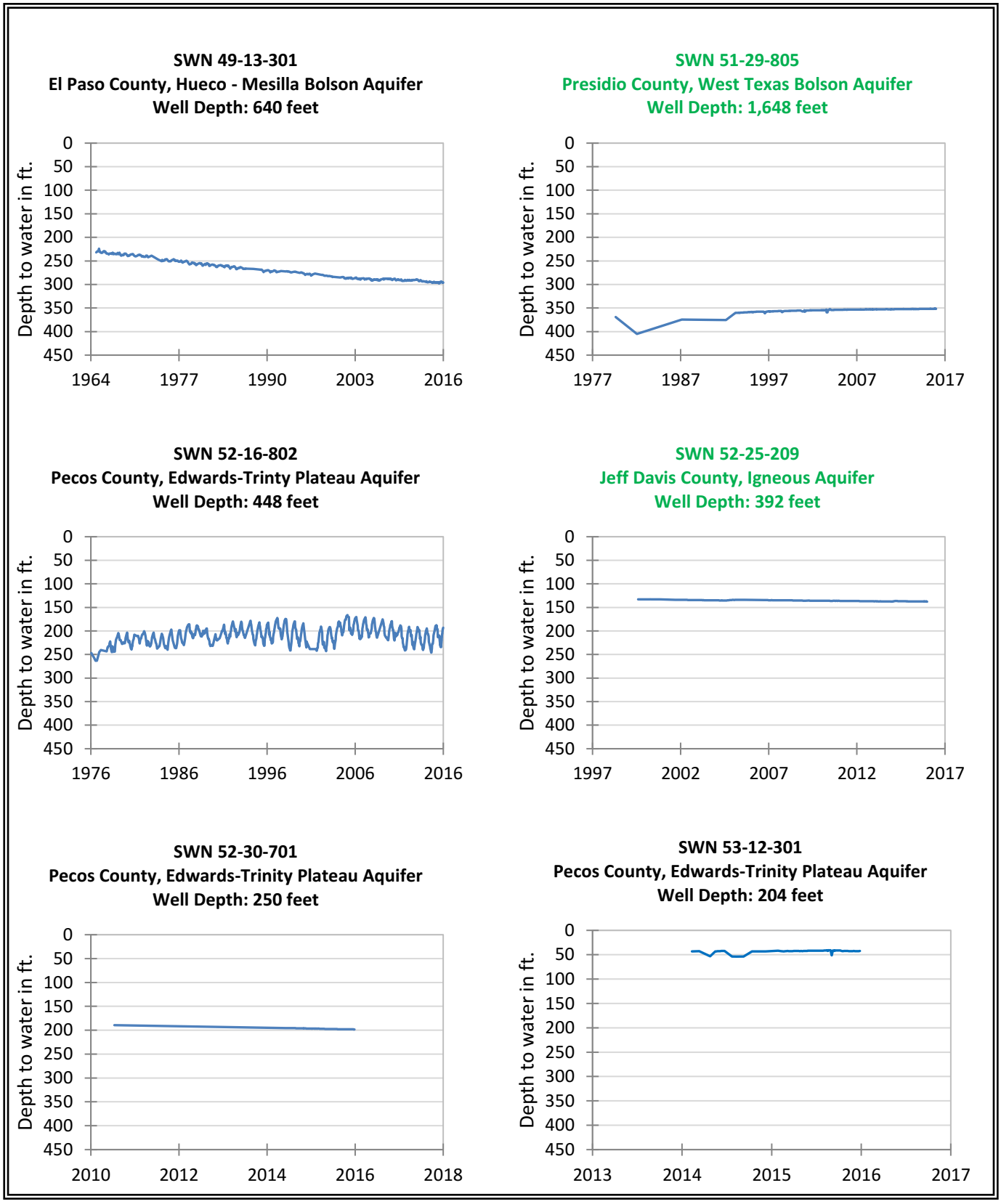

Figure 4-2 (continued) Hydrographs of TWDB recorder wells in West Texas. Minor aquifers indicated in green text. SWN = state well number

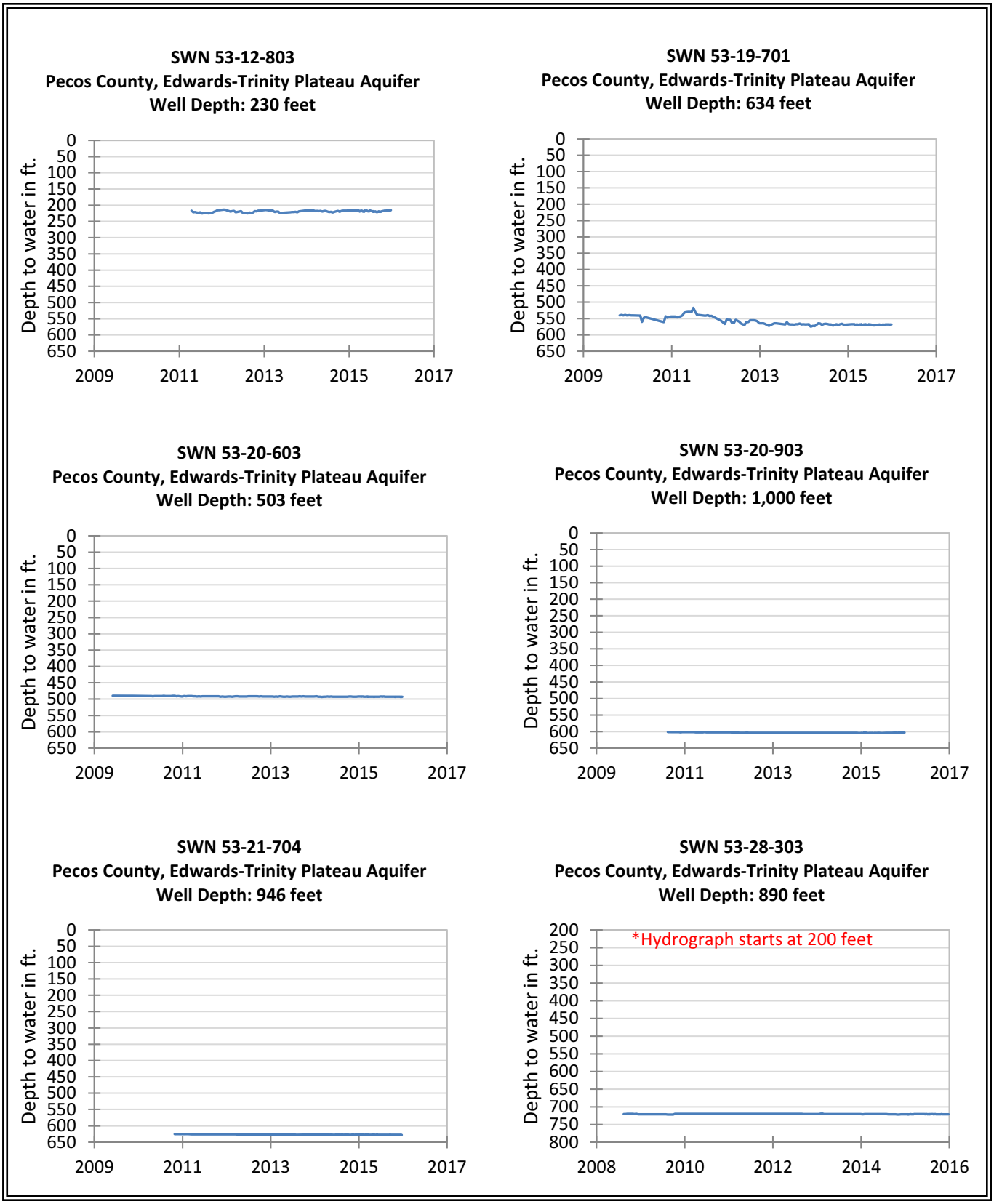

Figure 4-2 (continued) Hydrographs of TWDB recorder wells in West Texas. SWN = state well number

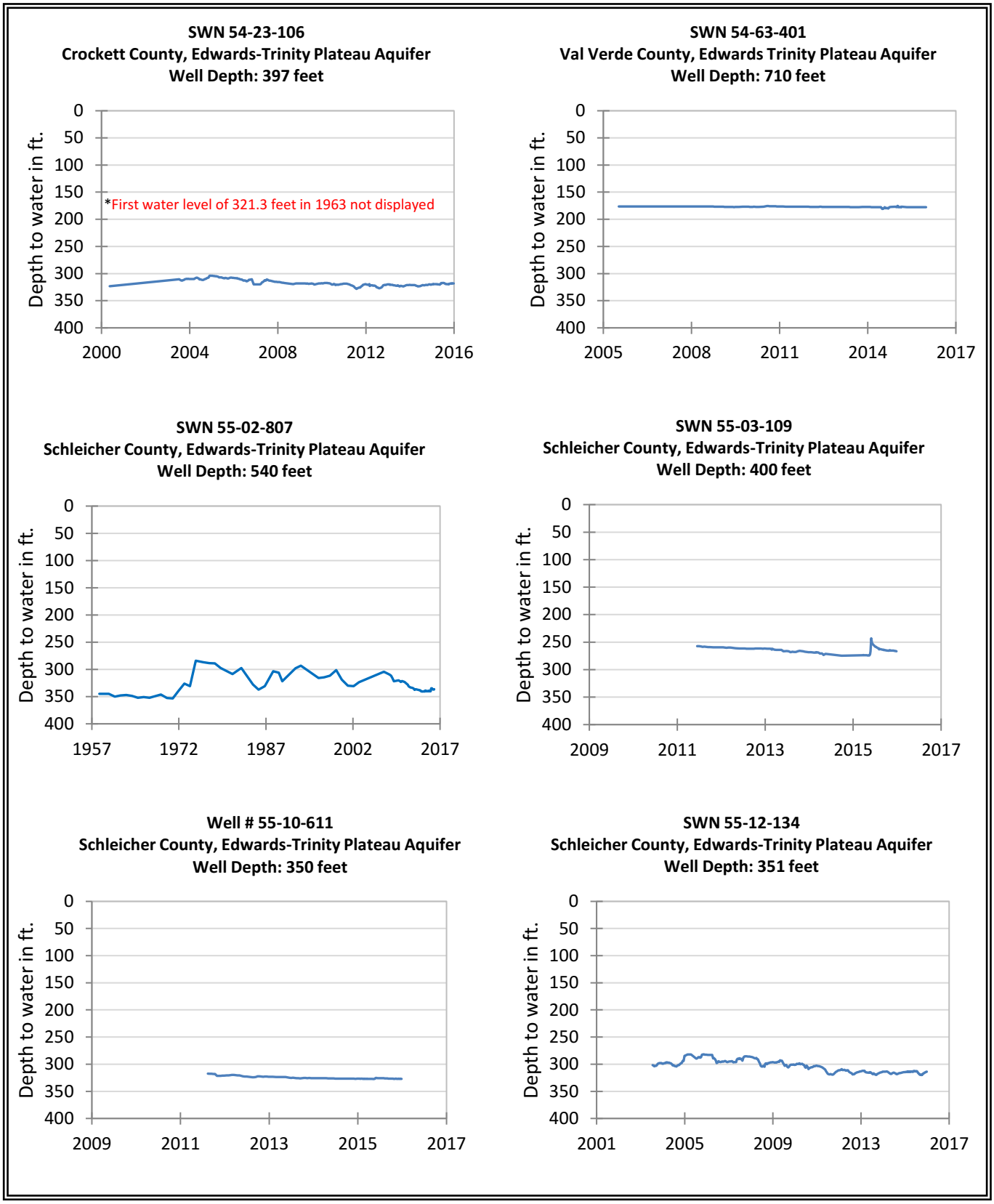

Figure 4-2 (continued) Hydrographs of TWDB recorder wells in West Texas. SWN = state well number

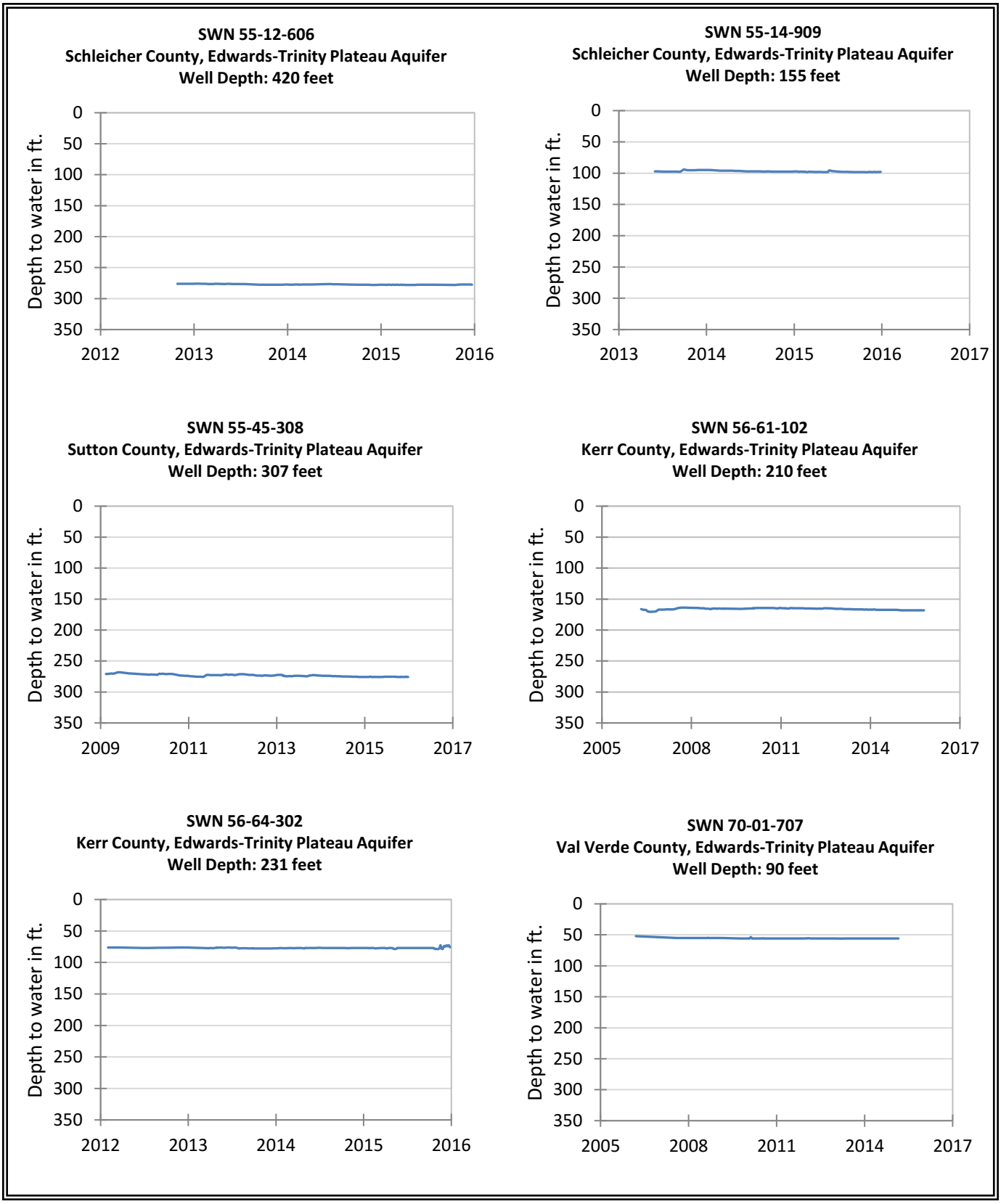

Figure 4-2 (continued) Hydrographs of TWDB recorder wells in West Texas. Undesignated or local aquifer indicated in purple text. SWN = state well number

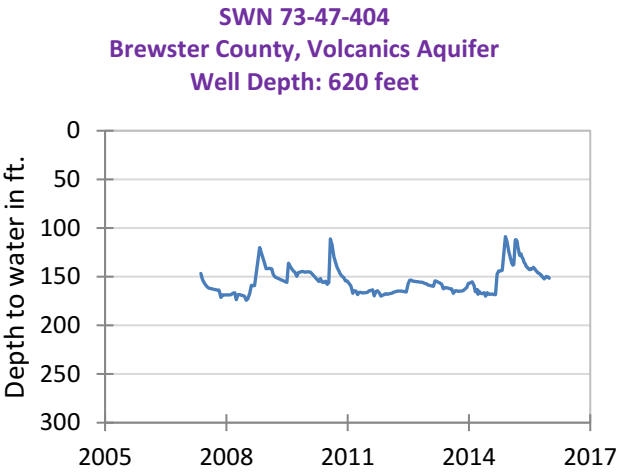

Figure 4-2 (continued) Hydrographs of TWDB recorder wells in West Texas. Undesignated or local aquifer indicated in purple text. SWN = state well number

5.0 Northern Central Texas

The TWDB monitors 27 recorders in northern Central Texas, and all but three are in wells completed in major aquifers (Figure 5-1). Nineteen wells are completed in the Trinity Aquifer, 14 of which are also in the confined or artesian portion of the aquifer. Five wells are in the northern segment of the Edwards (Balcones Fault Zone) Aquifer in south-central Bell and Williamson counties, three of which are in the confined zone. Three wells, all in the confined zone, are in the minor Woodbine Aquifer. This year, six wells were added to the network: wells 3231906 (Johnson County) and 3325202 (Ellis County) in the confined zone of the Woodbine Aquifer; wells 3250201 (Somervell County) and 4014602 (Hill County) in the unconfined zone of the Trinity Aquifer and 5803701 (Williamson County) in the confined zone of the Trinity Aquifer; and 5803702 (Williamson County) in the unconfined zone of the Edwards (Balcones Fault Zone) Aquifer. Water levels in recorder wells in the confined portions of aquifers exist under confined, also called artesian, conditions. The water levels in these wells will rise above the top of the aquifer formation due to the pressure in the aquifer. In some cases, the pressure is great enough to cause the water to flow above ground.

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. With the exception of water levels in two of the recorder wells, water levels in the recorder wells in the Trinity Aquifer between 2014 and 2015 experienced slight to moderate changes, as they did in the three previous one-year periods, compared to the wider fluctuations they experienced between 2010 and 2011. Between 2014 and 2015, water-level changes ranged from -22.9 feet in the McLennan County well to +37.1 in the newly added Somervell County well, with median and average changes each a rise of 1.8 feet. Between 2013 and 2014, water-level changes ranged from +9.7 feet in the Dallas County recorder (3325202) to -11.0 feet in the McLennan County well, with median and average changes each a decline of 0.9 feet. Between 2012 and 2013, the median and average changes, respectively, were 0.0 and +6.0 feet, with eight wells experiencing decline in contrast to 12 wells experiencing decline between 2013 and 2014. Between 2011 and 2012, the median and average changes, respectively, were declines of 1.6 feet and 1.8 feet in the 15 available Trinity wells; and between 2010 and 2011, the median and average changes, respectively, were declines of 8.5 feet and 12.0 feet in the 13 available Trinity recorder wells.

The water level in the Somervell County recorder well experienced the greatest water-level change of any Trinity recorder well from 2014 to 2015, or a rise of 37.1 feet. The water level in the McLennan County well declined 22.9 feet – the greatest water-level decline in this period of any of the Trinity Aquifer wells in this region. This McLennan County well has experienced large (greater than 100 feet) annual water-level fluctuations and the largest measured historical water-level decline (687.5 feet) of all the Trinity recorder wells in this region, a yearly average change of -13.5 feet over its 51 years of record.

In the five Edwards (Balcones Fault Zone) Aquifer recorder wells, changes between 2014 and 2015 ranged from +2.2 to +52.7 feet with a median change of +6.3 feet and an average change of +18.9 feet. In comparison, median changes in four wells with available levels were -1.4 feet from 2013 to 2014, +12.1 from 2012 to 2013, -1.9 feet from 2011 to 2012, and -3.5 feet from 2010 to 2011. The water level in the Bell County 5804628 well, in the confined part of the aquifer, continued to fluctuate the most, with this year's change a rise of 52.7 feet in contrast to a decline of 25.5 feet at the end of 2014 preceded by a rise of 33.9 feet at the end of 2013. The historical or period-of-record changes in the Edwards (Balcones Fault Zone) wells are similar to changes experienced in other Edwards (Balcones Fault Zone) wells farther to the south. This report does not include discussion of water-level changes in recorders operated by other entities in the Barton Springs and San Antonio segments of the aquifer.

5.2 Minor aquifer

The TWDB monitors three wells in the confined zone of the Woodbine Aquifer. Water-level changes between 2015 and 2015 ranged from +0.7 feet in the Johnson County well to +17.4 feet in the Ellis County well, with the water level in the Grayson County well experiencing the median change of +1.7 feet. The Grayson County well, measured since 1969, has experienced an overall rise of 2.9 feet in this period. The Ellis County well, with an original measurement recorded in 1985, has experienced an overall water-level rise of 45 feet in the last 30 years.

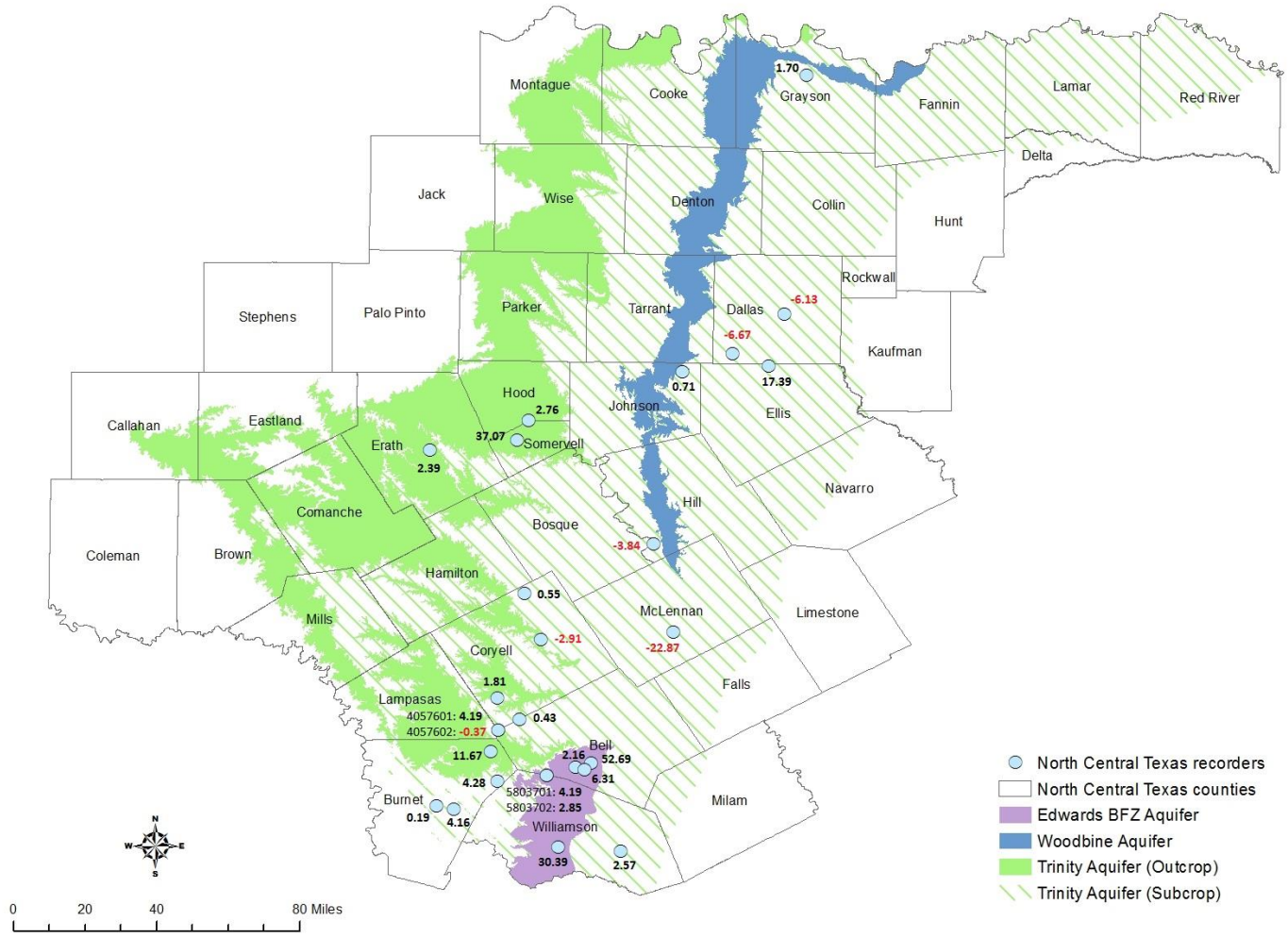

Figure 5-1. Location of wells with TWDB-operated automatic water-level recorders in northern Central Texas. Water-level changes from 2014 to 2015 are shown in feet. Black indicates a rise in water levels, and red indicates decline. BFZ = Balcones Fault Zone.

Table 5-1. Water-level changes in TWDB recorder wells in northern Central Texas counties for various time periods. Blue indicates a rise in water levels and red indicates decline. Minor aquifer indicated in green text.

County and state well number	Aquifer	2015 change (ft)	2014 change (ft)	2011–2015 Change (ft)	2006–2015 change (ft)	Historical change (ft, yr)	Historical yearly average (ft, yrs)
^Grayson 1819301	Woodbine	1.70	3.48	32.32	N/A	2.91 (1969)	0.06 (46)
Erath 3155504	Trinity	2.39	-0.27	-7.72	-4.85	-4.46 (2000)	-0.28 (16)
***^Johnson 3231906**	Woodbine	0.71	N/A	N/A	N/A	0.44 (2014)	0.44 (1)
Hood 3242604	Trinity	2.76	-1.71	3.04	5.58	-18.90 (1997)	-1.02 (18)
***Somervell 3250201**	Trinity	37.07	N/A	N/A	N/A	-16.94 (1950)	-0.26 (65)
^Dallas 3319101	Trinity	-6.13	0.47	-21.79	-33.80	-274.79 (1954)	-4.47 (61)
^Dallas 3325202	Trinity	-6.67	9.66	-7.44	N/A	-13.10 (2000)	-0.86 (15)
***^Ellis 3325202**	Woodbine	17.39	N/A	N/A	N/A	45.03 (1985)	1.47 (30)
***^Hill 4014602**	Trinity	-3.84	-1.04	N/A	N/A	-270.72 (1966)	5.44 (49)
^Coryell 4026201	Trinity	0.55	-2.49	-14.10	-30.62	-65.21 (1990)	-2.58 (25)
^Coryell 4035404	Trinity	-2.91	-3.23	-26.27	-48.98	-215.79 (1955)	-3.57 (60)
^McLennan 4039204	Trinity	-22.87	-11.02	-11.88	-70.00	-687.51 (1964)	-13.48 (51)
Coryell 4049601	Trinity	1.81	0.39	-2.40	-6.82	-15.28 (1993)	-0.66 (23)
^Bell 4057601	Trinity	4.19	-0.81	-5.72	N/A	-3.12 (2009)	-0.52 (6)
^Bell 4057602	Trinity	-0.37	-0.99	-7.39	N/A	-8.50 (2009)	-1.36 (6)
^Bell 4058201	Trinity	0.43	-1.28	-4.03	N/A	-4.90 (2010)	-0.85 (6)
^Burnet 5715901	Trinity	0.19	-0.34	4.59	N/A	6.71 (2009)	1.03 (6)
^Burnet 5724101	Trinity	4.16	-1.63	-2.50	-2.61	-29.91 (1961)	-0.54 (55)
Burnet 5801202	Trinity	11.67	-0.02	3.15	N/A	3.34 (2009)	0.50 (7)
***^Williamson 5803701**	Trinity	4.19	N/A	N/A	N/A	-9.34 (2014)	-4.92 (1)
***Williamson 5803702**	Edwards (BFZ)	2.85	N/A	N/A	N/A	2.94 (2014)	1.55 (1)
^Bell 5804628	Edwards (BFZ)	52.69	-25.49	60.75	N/A	54.40 (2008)	7.77 (7)
Bell 5804702	Edwards (BFZ)	2.16	-0.67	0.10	0.90	-0.93 (1980)	-0.03 (35)
^Bell 5804816	Edwards (BFZ)	6.31	-2.03	2.42	N/A	3.66 (2008)	0.49 (7)
^Burnet 5809303	Trinity	4.28	-3.26	-14.28	N/A	-9.94 (2009)	-1.53 (6)
^Williamson 5827305	Edwards (BFZ)	30.39	-10.66	20.17	47.48	34.36 (1980)	0.97 (35)
^Williamson 5829603	Trinity	2.57	2.27	-16.98	-13.90	-241.94 (1946)	-3.48 (69)

* = recorder added for the 2014–2015 report, ^ = well in the confined portion of the aquifer, ft = feet, yr = earliest year measured, N/A = not available, yrs = years over which average determined, BFZ = Balcones Fault Zone

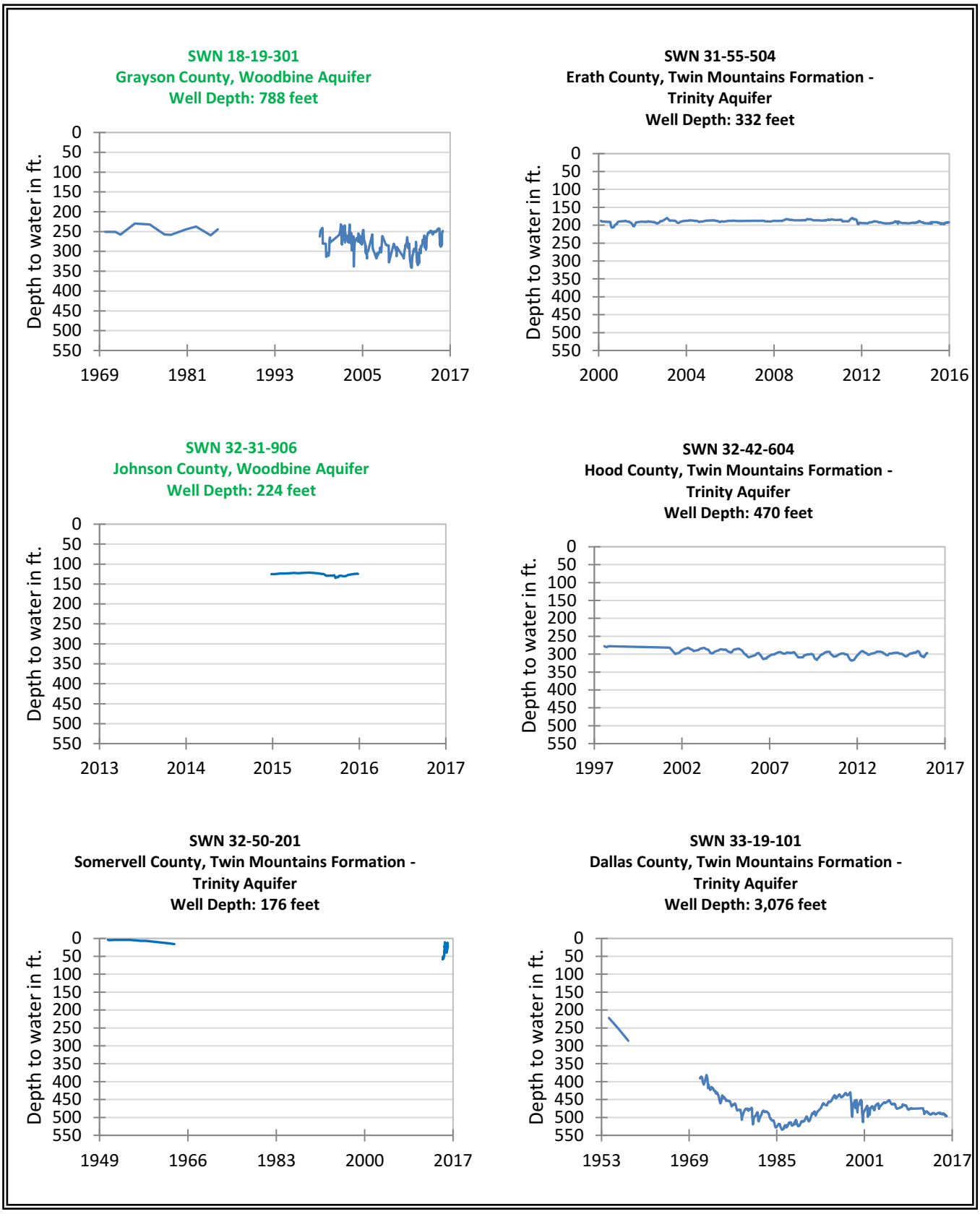

Figure 5-2 Hydrographs of TWDB recorder wells in northern Central Texas. Minor aquifer indicated in green text. SWN = state well number

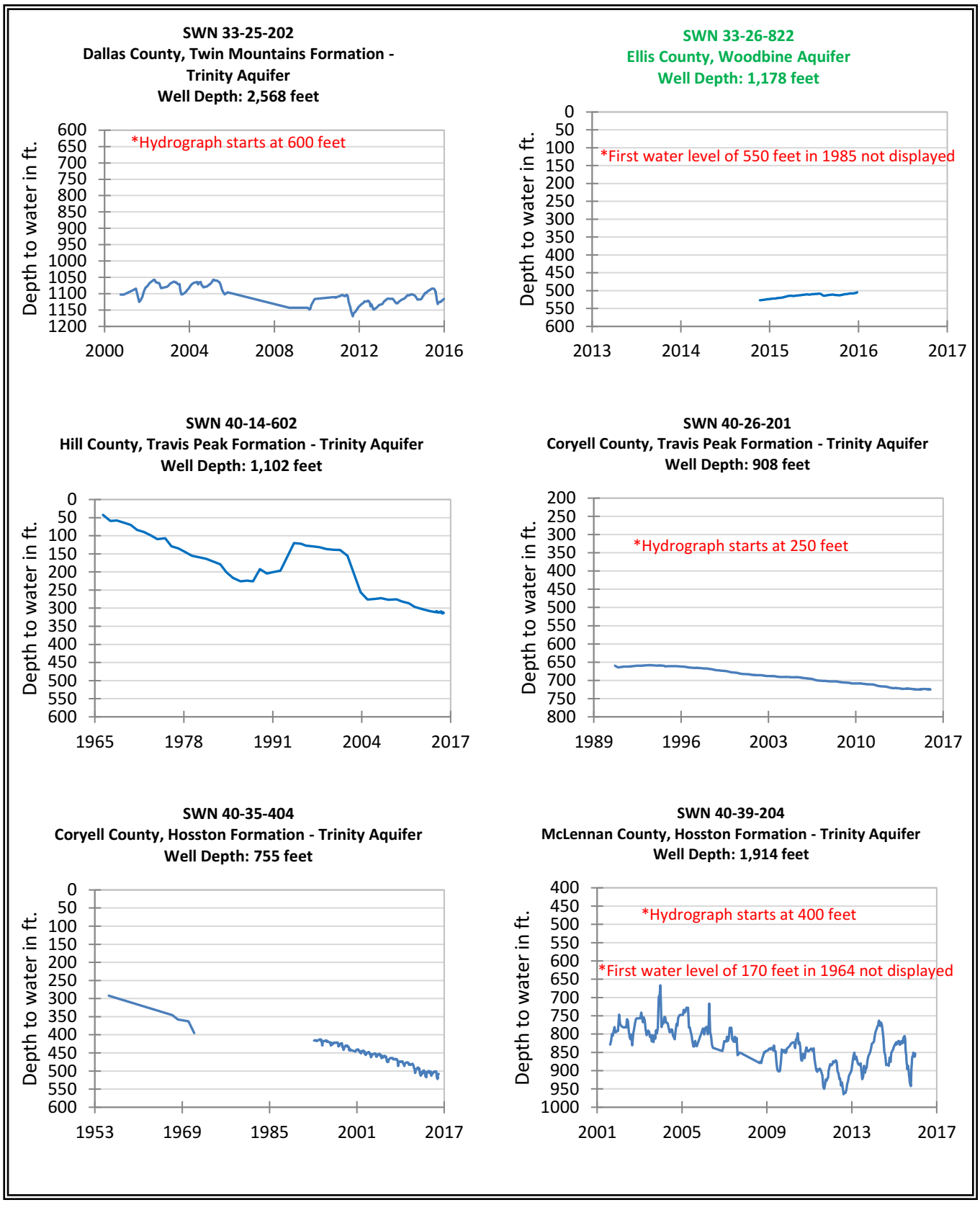

Figure 5-2 (continued) Hydrographs of TWDB recorder wells in northern Central Texas. Minor aquifer indicated in green text. SWN = state well number

Figure 5-2 (continued) Hydrographs of TWDB recorder wells in northern Central Texas. SWN = state well number

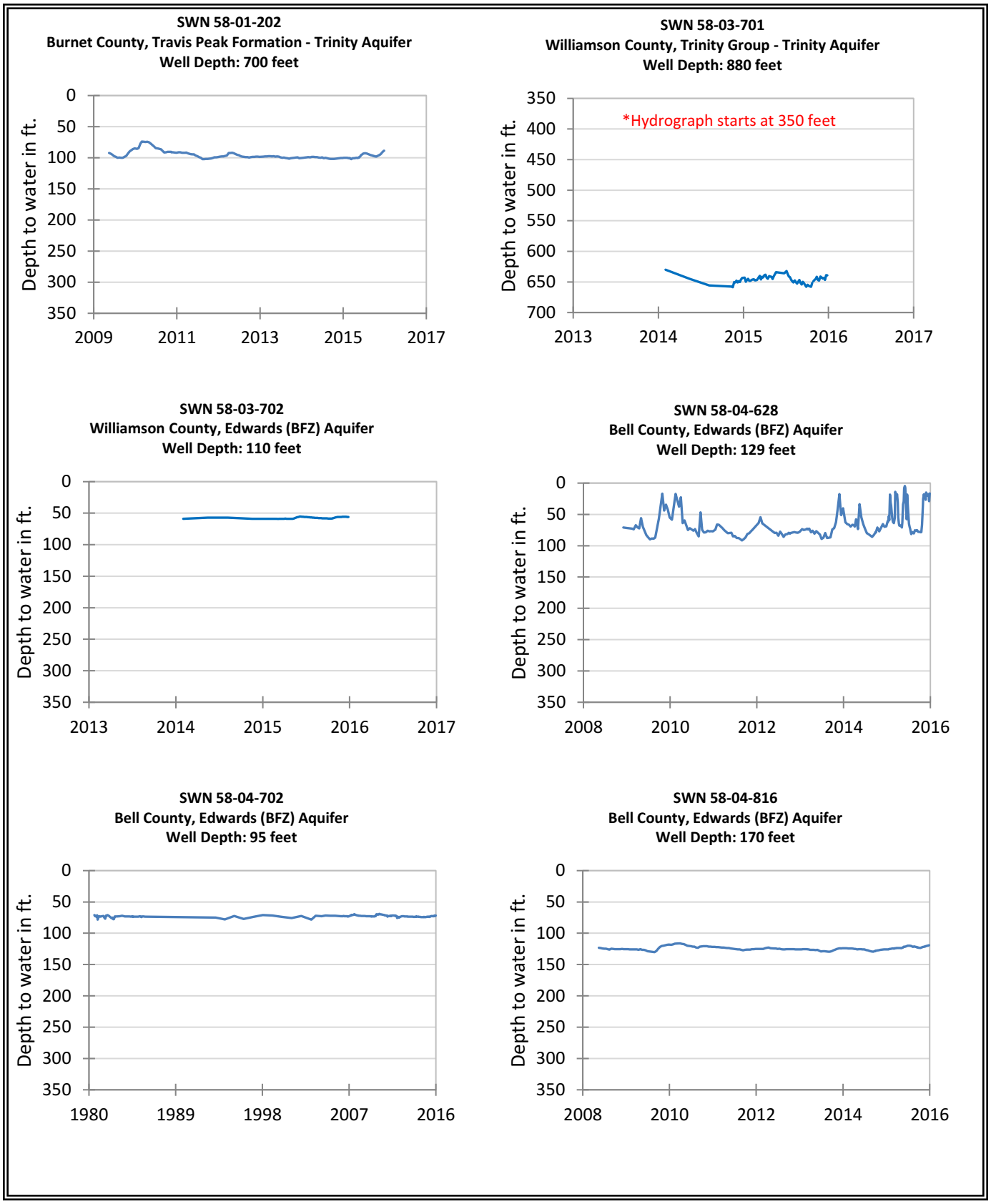

Figure 5-2 (continued) Hydrographs of TWDB recorder wells in northern Central Texas. SWN = state well number, BFZ = Balcones Fault Zone

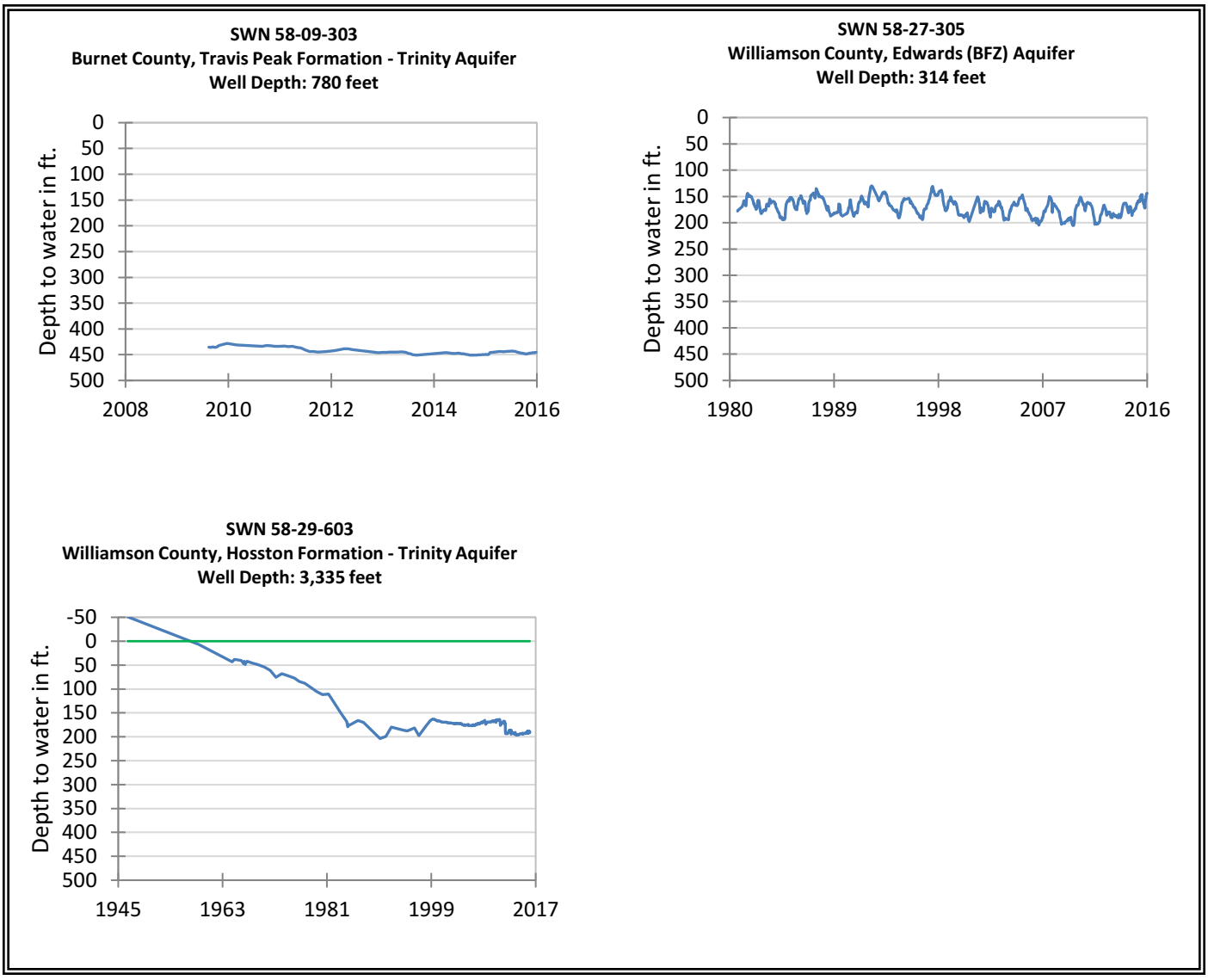

Figure 5-2 (continued) Hydrographs of TWDB recorder wells in northern Central Texas. SWN = state well number, BFZ = Balcones Fault Zone

6.0 South and East Texas

The TWDB monitors 27 wells in South and East Texas (Figure 6-1) that are completed in either the Gulf Coast or Carrizo-Wilcox aquifers. The 14 recorders in wells completed in the Carrizo-Wilcox Aquifer include two recorders added at the end of 2014 in the confined zone of the Wilcox Aquifer in Anderson and Gonzales counties. Five Wilcox Aquifer wells—in Smith, Rusk, Robertson, and Anderson counties—and six Carrizo Aquifer wells in Caldwell County and counties farther to the southwest are in the confined zone of the aquifer. Two recorders in the Wilcox Aquifer in Milam and Anderson counties have the longest historical records with initial measurements each in 1981.

Thirteen recorders are operating in wells in the Gulf Coast Aquifer. Some Gulf Coast Aquifer sites have long periods of record. Initial measurements were taken in 1947 in the Harris and Wharton county wells and in 1956 through 1964 in the Jasper, Karnes, Victoria, and Duval county wells.

6.1 Major aquifers

Water-level changes in the 14 Carrizo-Wilcox Aquifer recorder wells ranged from +39.6 feet in the LaSalle County well to -28.7 in the Atascosa County well from 2014 to 2015 (Table 6-1 and Figure 6-20). In comparison, changes ranged from +25.9 to -23.1 from 2013 to 2014, +19.1 to -26.3 feet from 2012 to 2013, and +8.6 to -72.2 from 2011 to 2012. From 2014 to 2015 the median water-level change was +1.7 feet and the average change was +4.4 feet. Median and average changes, respectively, were +1.5 and -0.3 feet from 2013 to 2014, -0.2 and -2.7 feet from 2012 to 2013, and -0.9 and -4.4 feet from 2011 to 2012.

The greatest water-level change in recorder wells completed in the Carrizo-Wilcox Aquifer from 2014 to 2015, a rise of 39.6 feet, occurred in the LaSalle County well, completed in the confined zone of the aquifer. This rising trend is in contrast to its three previous years of declines of 23.1, 26.3, and 72.2 feet. The water-level decline of 217.9 feet in the LaSalle County well since its initial measurement in 2003 is still the greatest change experienced in all Carrizo-Wilcox Aquifer recorder wells. Although irrigation pumping during the drought increased substantially in the Wintergarden area of Southwest Texas concurrent with increased use of groundwater to support oil and gas activities, pumping in this area has recently diminished. Of the 14 Carrizo-Wilcox recorder wells throughout the aquifer, 12 wells experienced water-level rises from 2014 to 2015 compared to the 7 (of 12) that experienced a rise from 2013 to 2014 and 2 (of 12) that experienced a rise from 2012 to 2013.

Between 2014 and 2015, water-level changes in the 13 Gulf Coast Aquifer recorder wells ranged from +6.8 in the Live Oak County well to -1.9 in the Jasper County well with a median change of +1.8 feet and an average change of +2.5 feet. Median and average changes in the Gulf Coast Aquifer wells, respectively, were +0.7 and +1.0 from 2013 to 2014, -0.9 to -1.4 from 2012 to 2013, and +0.5 and +0.9 from 2011 to 2012. The Karnes County well, with a total historical decline of 152.6 feet as of the end of December 2015, remains the Gulf Coast recorder well with the greatest water-level decline for the period of record. Historically, considering their total measurement records, the Jasper, Harris, and Wharton county wells have also experienced significant declines ranging from 29.8 to 124.8 feet. Although the Karnes and Jasper county wells experiencd declines of 1.9 and 0.4 feet, respectively, during the 2014 to 2015 year, water levels in the other 11 Gulf Coast wells experienced rises from 1.0 to 6.8 feet.

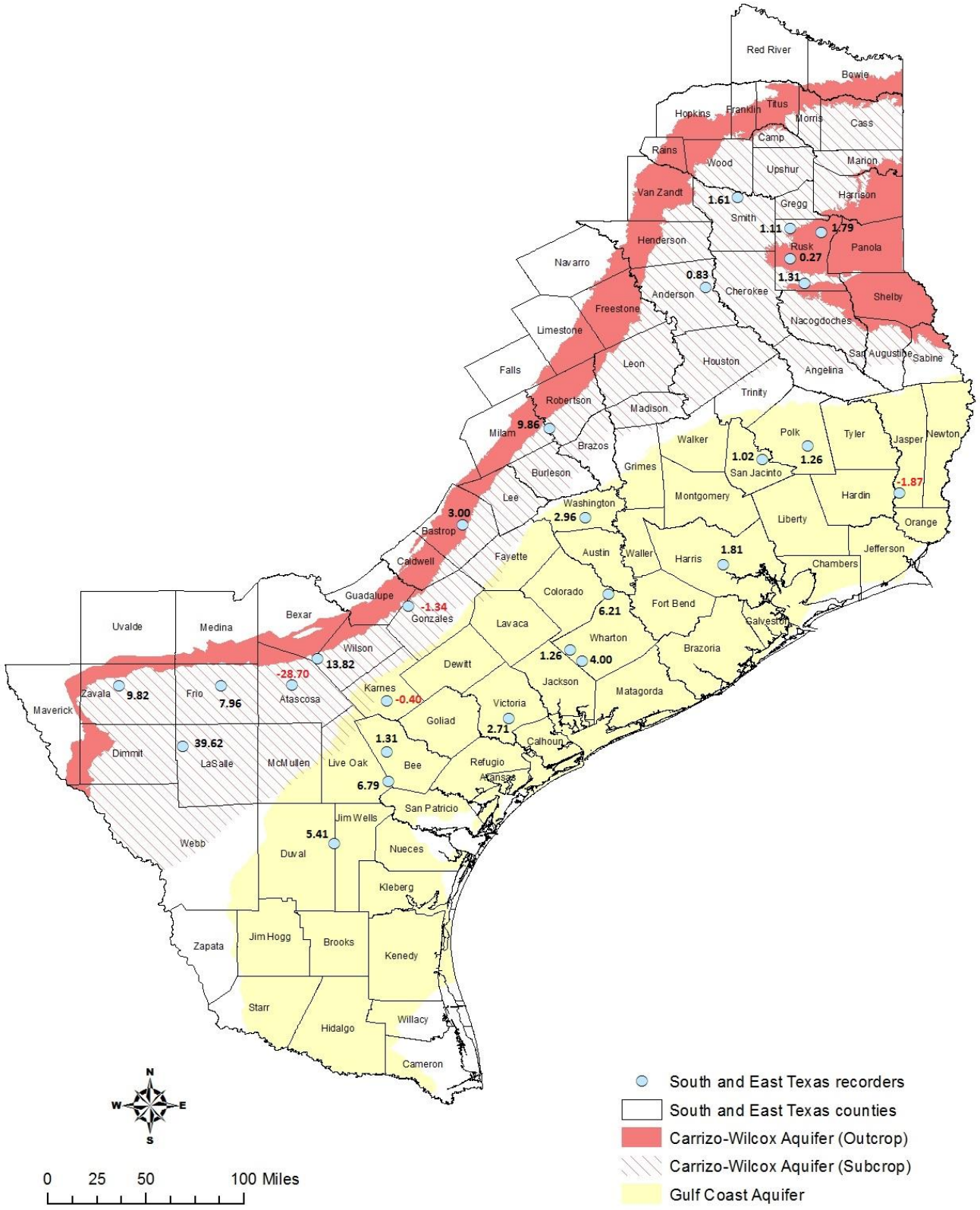

Figure 6-1. Location of wells with TWDB-operated automatic water-level recorders in South and East Texas. Water-level changes from 2012 to 2013 are shown in feet. Black indicates a rise in water levels, and red indicates decline.

Table 6-1. Water-level changes in TWDB recorder wells in South and East Texas counties for various time periods. Blue indicates a rise in water levels, and red indicates decline.

County and state well number	Aquifer	2015 change (ft)	2014 change (ft)	2011-2015 change (ft)	2006-2015 change (ft)	Historical change (ft, yr)	Historical yearly average (ft, yrs)
^Smith 3430907	Carrizo-Wilcox	1.61	4.12	-0.80	-10.36	-68.04 (1987)	-2.35 (28)
^Rusk 3541604	Carrizo-Wilcox	1.11	-1.79	-6.31	N/A	-3.61 (2010)	-0.69 (5)
Rusk 3543906	Carrizo-Wilcox	1.79	3.73	N/A	N/A	3.13 (2011)	0.72 (4)
Rusk 3558405	Carrizo-Wilcox	0.27	4.38	N/A	N/A	-6.76 (2012)	-1.93 (3)
^Rusk 3702905	Carrizo-Wilcox	1.31	0.45	N/A	N/A	0.13 (2011)	0.03 (4)
***^Anderson 3813106**	Carrizo-Wilcox	0.83	4.90	-3.87	-12.65	-78.27 (1965)	-1.54 (50)
Bastrop 5862208	Carrizo-Wilcox	3.00	2.50	10.00	12.60	3.66 (2003)	0.30 (12)
^Milam 5911621	Carrizo-Wilcox	9.86	-2.06	5.41	4.77	3.97 (1981)	0.11 (34)
Washington 5953915	Gulf Coast	2.96	0.14	0.68	0.81	-0.77 (2002)	-0.06 (13)
San Jacinto 6032219	Gulf Coast	1.02	0.70	N/A	N/A	0.96 (2013)	0.35 (2)
Polk 6119417	Gulf Coast	1.26	-1.15	N/A	N/A	0.73 (2013)	0.31 (2)
Jasper 6148209	Gulf Coast	-1.87	2.07	-8.85	N/A	-124.81 (1956)	-2.09 (59)
Harris 6514409	Gulf Coast	1.81	4.76	7.93	28.93	-53.93 (1947)	-0.79 (68)
Wharton 6631107	Gulf Coast	6.21	-7.48	-10.11	N/A	-7.93 (2010)	-1.51 (5)
Wharton 6653406	Gulf Coast	1.26	0.81	-4.03	N/A	-29.80 (1947)	-0.43 (68)
Wharton 6661302	Gulf Coast	4.00	1.00	-0.40	8.59	20.79 (2005)	1.98 (10)
^Wilson 6862104	Carrizo-Wilcox	13.82	-13.13	-23.59	6.49	-7.11 (1994)	-0.32 (21)
***^Gonzales 6727805**	Carrizo-Wilcox	-1.34	-6.89	-13.82	N/A	-23.56 (1981)	-0.68 (34)
^Zavala 7702509	Carrizo-Wilcox	9.82	-3.99	-3.88	-29.59	-22.70 (2002)	-1.70 (13)
^Frio 7708511	Carrizo-Wilcox	7.96	-11.03	N/A	N/A	-19.45 (2011)	-4.32 (4)
^LaSalle 7738103	Carrizo-Wilcox	39.62	-23.09	-158.44	-223.79	-217.89 (2003)	-18.16 (12)
^Atascosa 7804508	Carrizo-Wilcox	-28.70	25.85	-37.04	N/A	-27.93 (2008)	-3.72 (7)
Karnes 7910406	Gulf Coast	-0.40	-32.53	-22.67	N/A	-152.64 (1956)	-2.54 (60)
Bee 7934409	Gulf Coast	1.31	-1.90	N/A	N/A	-3.52 (2011)	-0.78 (4)
Live Oak 7950106	Gulf Coast	6.79	2.01	N/A	N/A	27.41 (2011)	6.09 (4)
Victoria 8017502	Gulf Coast	2.71	0.00	-2.11	-3.70	-1.23 (1958)	-0.02 (26)
Duval 8415702	Gulf Coast	5.41	44.76	15.48	N/A	0.49 (1964)	0.01 (51)

^ = well in the confined portion of the aquifer, * = recorder added for the 2014–2015 report, ft = feet, yr = earliest year measured, yrs = years over which average determined, N/A = not available

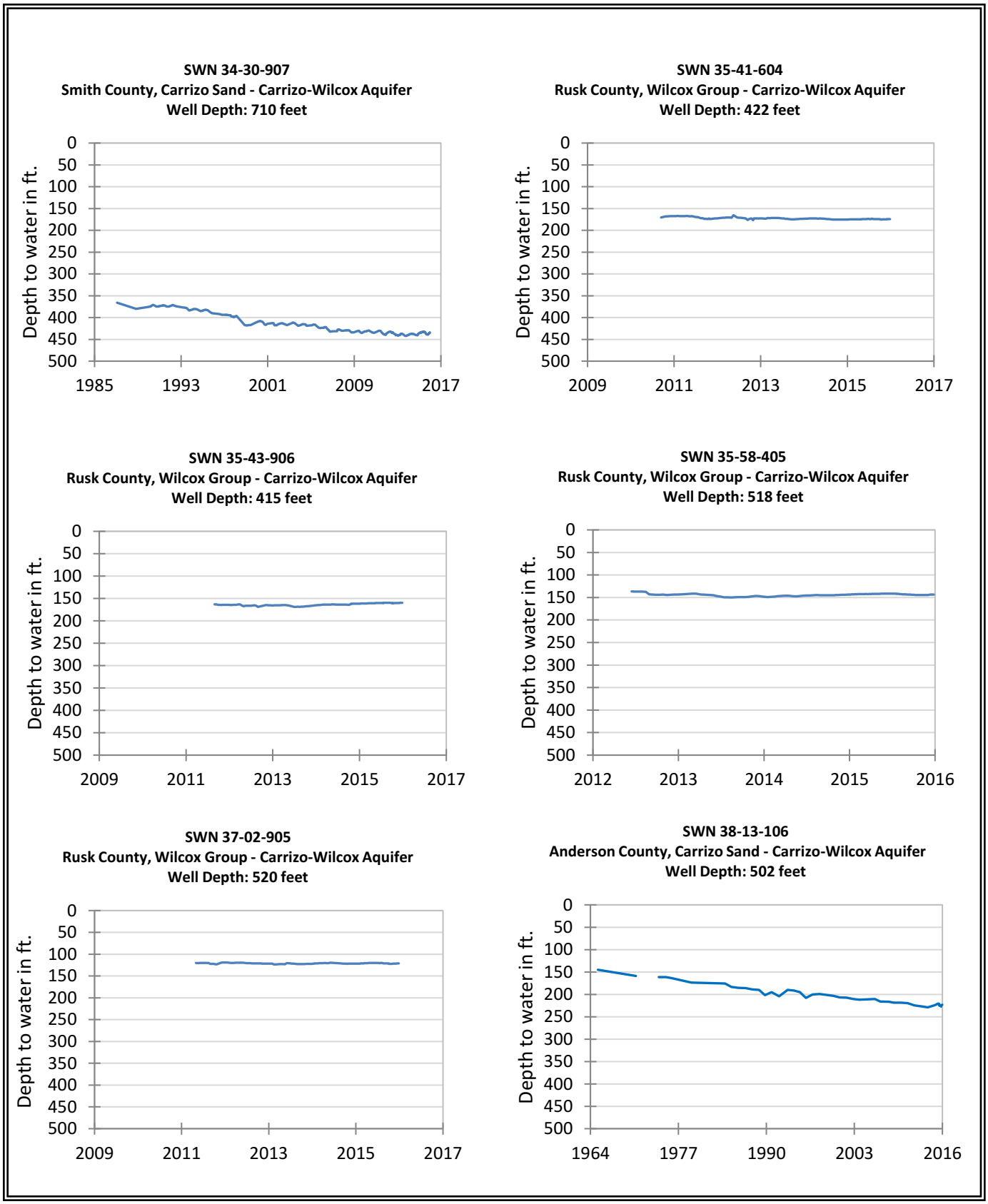

Figure 6-2. Hydrographs of TWDB recorder wells in South and East Texas. SWN=state well number

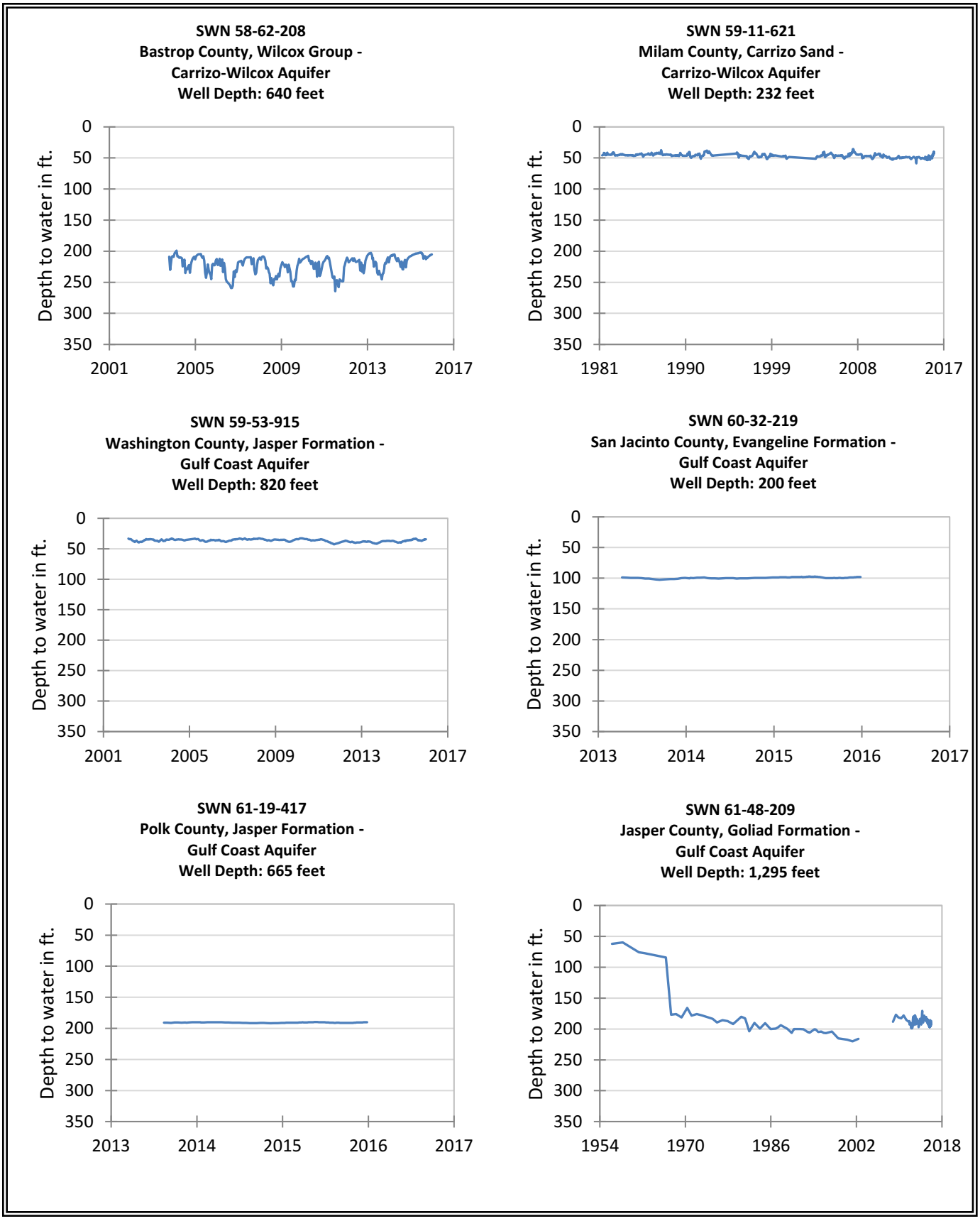

Figure 6-2 (continued) Hydrographs of TWDB recorder wells in South and East Texas. SWN=state well number

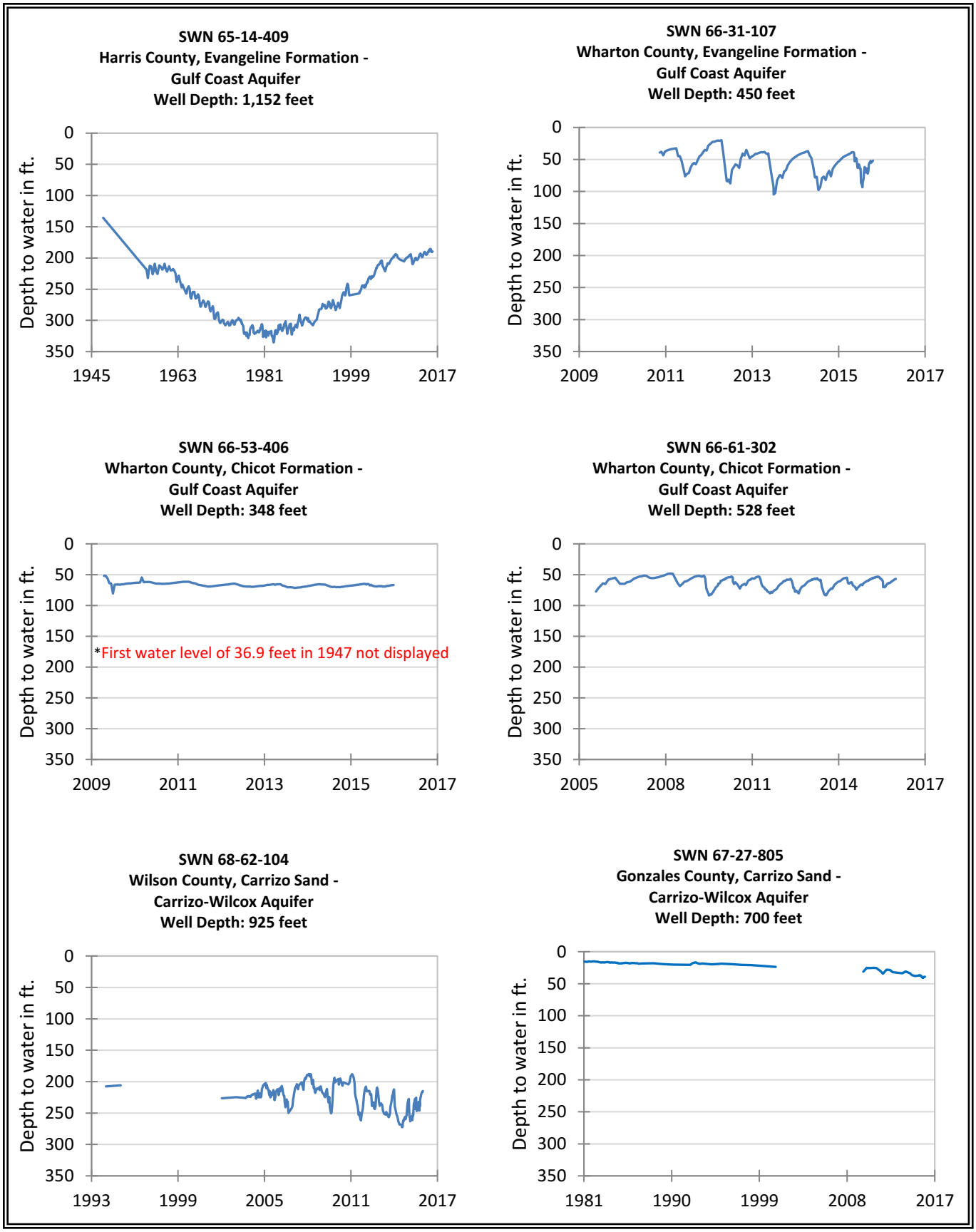

Figure 6-2 (continued) Hydrographs of TWDB recorder wells in South and East Texas. SWN=state well number

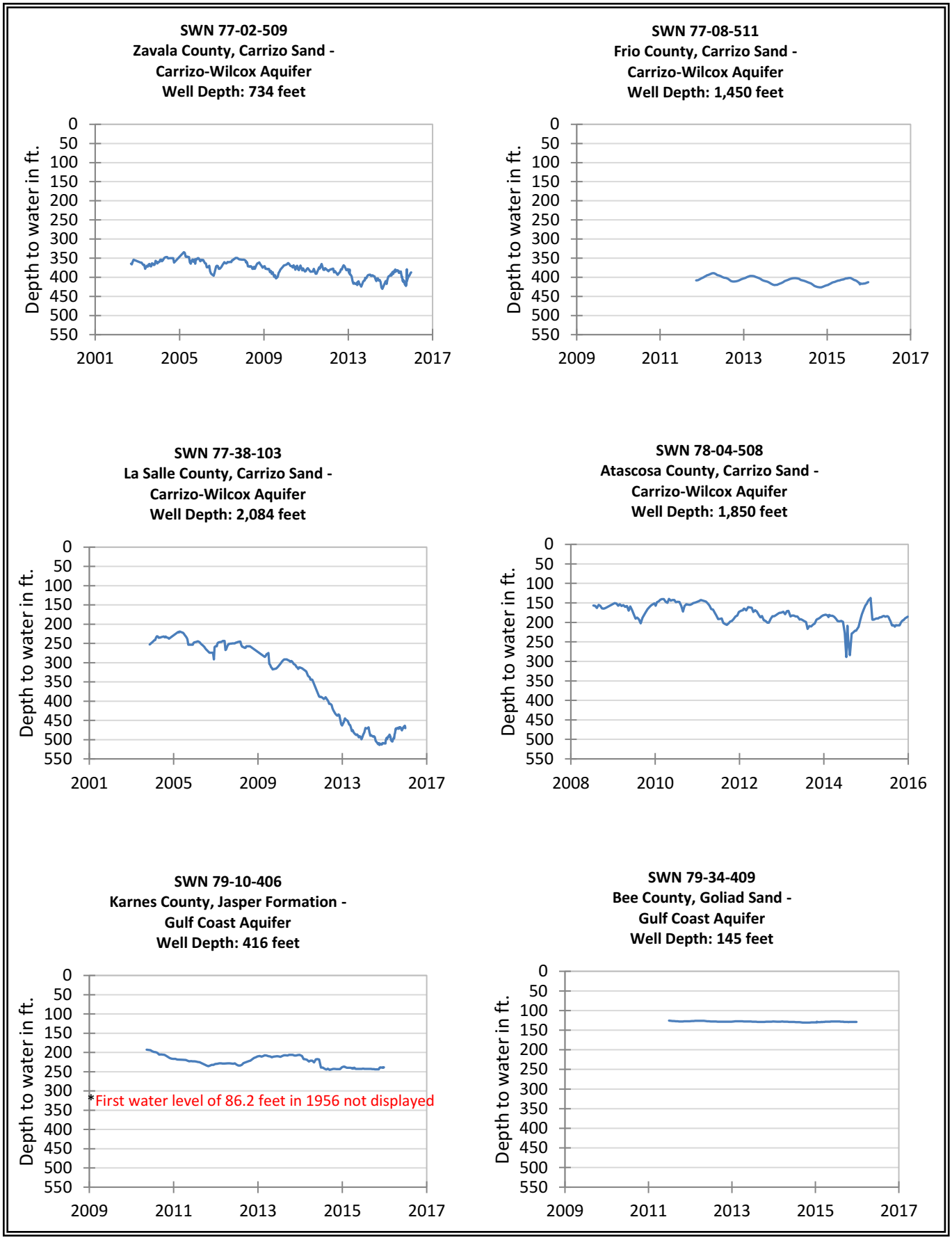

Figure 6-2 (continued) Hydrographs of TWDB recorder wells in South and East Texas. SWN=state well number

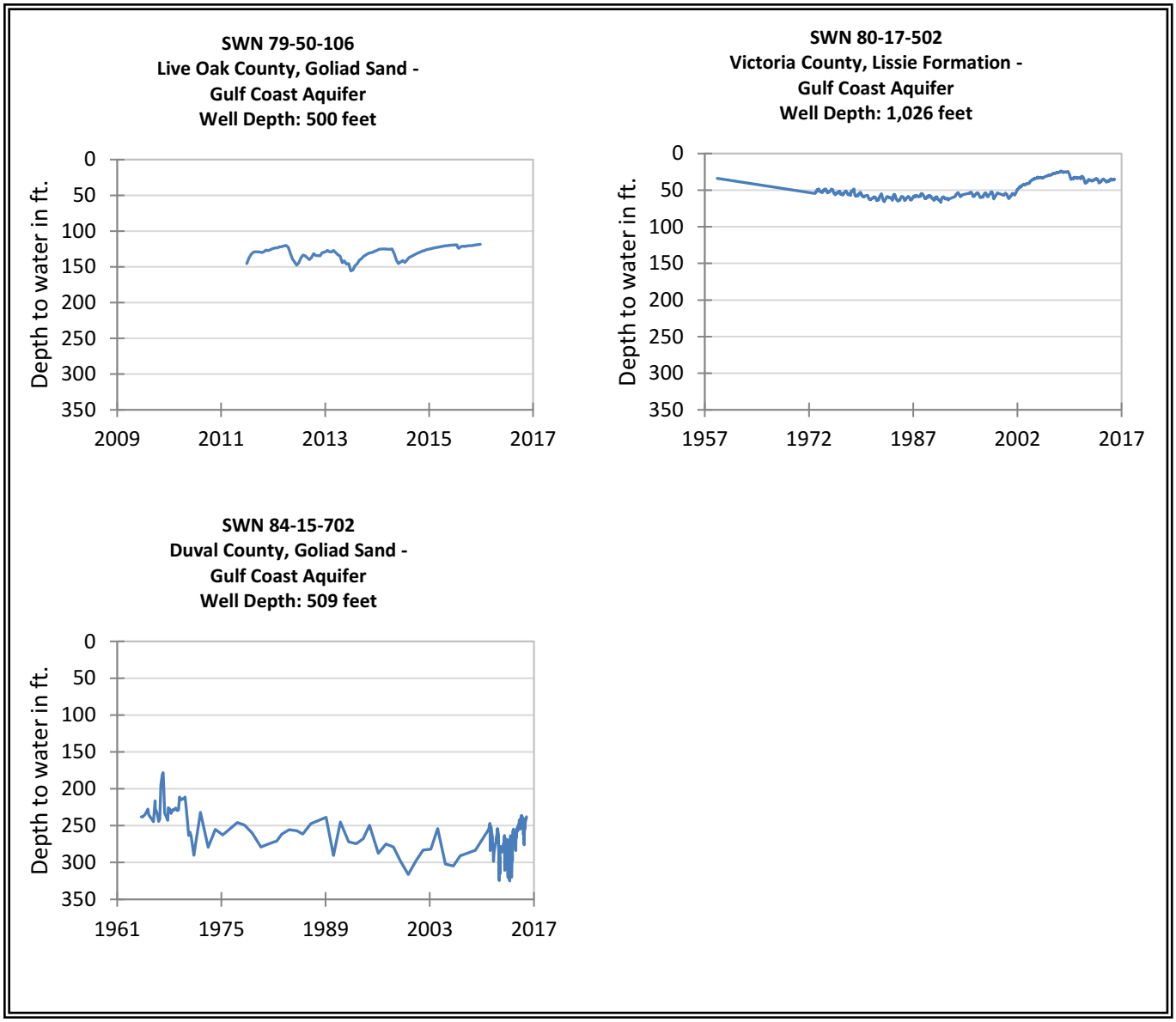

Figure 6-2 (continued) Hydrographs of TWDB recorder wells in South and East Texas. SWN=state well number

7.0 Central Texas (including the Hill Country)

The total number of recorders in this area has increased from 49 sites at the end of 2014 to 55 sites at the end of 2015 (Figure 7-1). One recorder was added in a Hays County well completed in the major Edwards (Balcones Fault Zone) Aquifer, and five recorders were added in wells completed in the Trinity: one in Hays County, three in Bexar County, and one in Kerr County. The four recorders each in the Ellenburger-San Saba and Hickory aquifers operating at the end of 2014 remained in the network at the end of 2015. Groundwater conservation districts in Kerr, Kendall, Bexar, Burnet, and Hays counties co-sponsor 40 of these recorders, which has resulted in the installation of a relatively larger number of recorders in these counties. Overall, the Headwaters Groundwater Conservation District in Kerr County has facilitated the installation of 19 recorders in the Trinity Aquifer with most installed since 2005.

7.1 Major aquifers

Water levels between 2014 to 2015 in the 46 Trinity Aquifer recorder wells experienced a median change of +8.2 feet and an average change of +22.8 feet (Table 7-1 and Figure 7-2), compared to smaller median changesin 41 Trinity Aquifer wells at the end of 2014 and 2013 of -2.4 feet and +0.3 feet, respectively, and average changes at the end of 2014 and 2013 of -4.9 and +0.7 feet, respectively. More rain in the area during 2015 contributed to the increase in water levels in this responsive aquifer. The water-level changes ranged from -5.9 in the 5661101 Kerr County well, completed in the confined zone of the aquifer, to +170.3 feet in the newly added 6819618 Bexar County well, completed in the unconfined zone. Nearly 85 percent of these 46 Trinity wells (39) experienced water-level rises from 2014 to 2015 compared to 20 percent (8 of 41) from 2013 to 2014 and 51 percent (21 of 41) from 2012 to 2013.

Relatively large fluctuations in water levels, whether on a daily, seasonal, or longer time scale, are characteristic of groundwater movement in the Trinity and Edwards (Balcones Fault Zone) aquifers. While water levels recover during periods of reduced pumpage, 30 of the 46 Trinity Aquifer recorders experienced historical water-level declines for their periods of record. As of December 31, 2015, the 6810616 Kendall County well, first measured in 1985, had experienced the greatest overall decline of 100.4 feet, while the 6819618 Bexar County well had experienced the greatest change for its period of record, a rise of 112.1 feet feet since its initial measurement in 1990.

The one recorder added to the program in the Edwards (Balcones Fault Zone) Aquifer in Hays County, in the unconfined zone of the aquifer, experienced a water-level rise of 37.6 feet between in 2014 and 2015 after a decline of 12.6 feet from 2013 to 2014.

7.2 Minor aquifers

Water levels from 2014 to 2015 in the four Ellenburger-San Saba Aquifer recorder wells, all in the confined zone of the aquifer, experienced changes ranging from -1.2 to +6.0 feet with a median change of +4.6 feet and an average change of +3.5 feet. Water level changes in these wells from 2013 to 2014 ranged from +2.2 to -0.9 feet with a median change of -0.1 feet and an average change of +0.3 feet.

The four recorder wells in the Hickory Aquifer experienced water-level changes ranging from -0.2 feet in the 5606614 McCulloch County well, completed in the confined zone, to +49.2 feet in the 5714604 Burnet County well, also completed in the confined zone. The median water-level change from 2014 to 2015 was +3.4 feet and the average change was 14.0 feet, compared to the median water-level change from 2013 to 2014 of -1.4 feet and an average change of -3.4 feet.

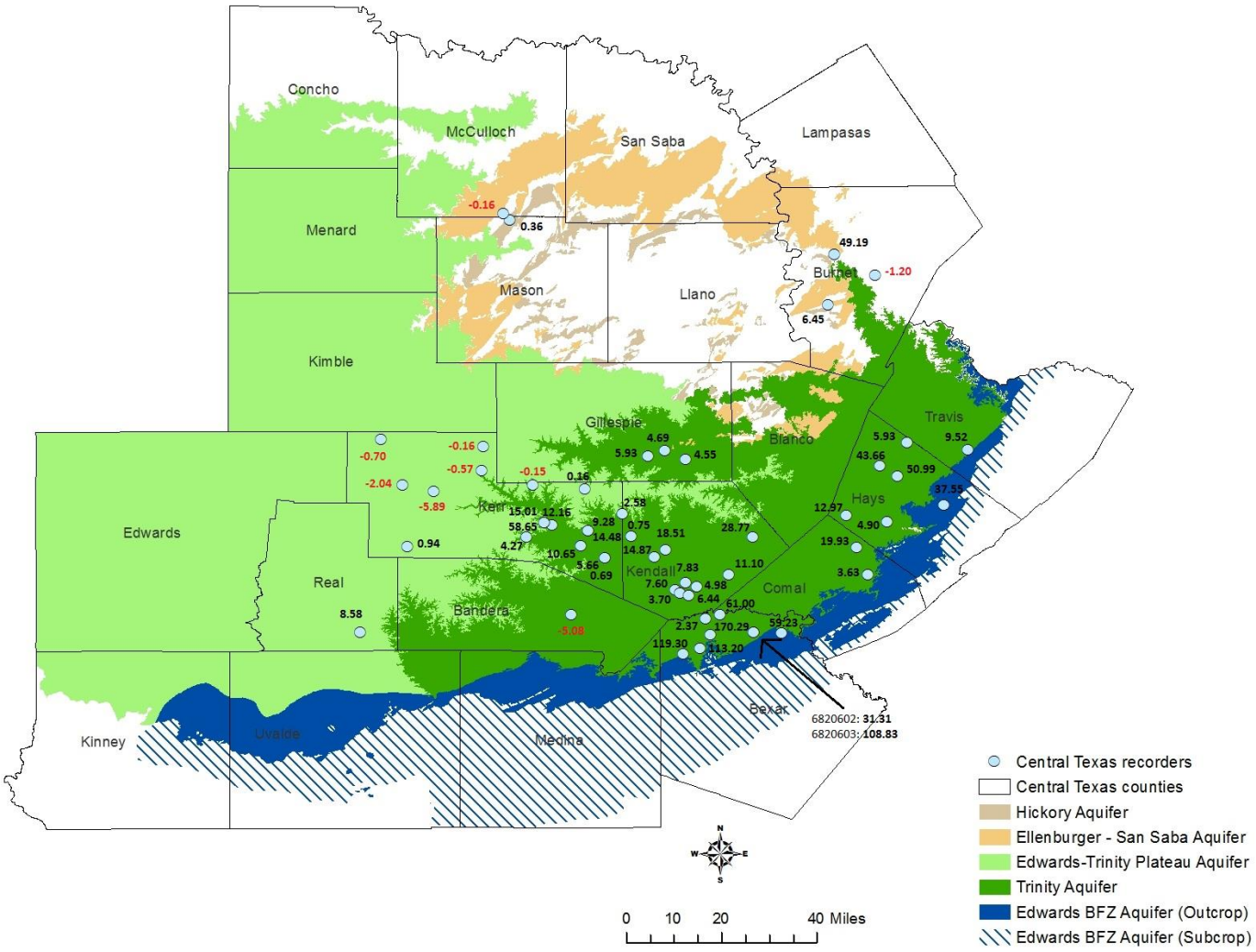

Figure 7-1. Location of wells with TWDB-operated automatic water-level recorders in Central Texas. Water-level changes from 2014 to 2015 are shown in feet. Black indicates a rise in water level and red indicates decline. BFZ = Balcones Fault Zone.

Table 7-1. Water-level changes in TWDB recorders in Central Texas counties for various time periods. Blue indicates a rise in water levels, and red indicates decline. Minor aquifers indicated in green text.

County and state well number	Aquifer	2015 change (ft)	2014 change (ft)	2011-2015 change (ft)	2006-2015 change (ft)	Historical change (ft, yr)	Historical yearly average (ft, yrs)
Mason 5606613	Hickory	0.36	-1.43	-5.02	1.10	-4.96 (1974)	-0.12 (41)
^McCulloch 5606614	Hickory	-0.16	-1.12	-3.73	1.20	-21.55 (1974)	-0.53 (41)
^Kerr 5643901	Trinity	-0.70	-2.14	-9.58	N/A	-14.18 (2007)	-1.77 (8)
^Kerr 5652704	Trinity	-2.04	-4.23	-18.66	N/A	-28.88 (2008)	-3.98 (7)
^Kerr 5654106	Trinity	-0.16	-0.96	-4.29	N/A	-3.55 (2010)	-0.61 (5)
^Kerr 5654405	Trinity	-0.57	-1.38	-10.91	-14.26	-15.96 (2004)	-1.36 (11)
^Kerr 5655805	Trinity	-0.15	-0.43	-2.11	-0.08	-1.78 (2005)	-0.18 (10)
^Kerr 5661101	Trinity	-5.89	-5.52	-21.38	-32.63	-33.53 (2005)	-3.32 (10)
^Kerr 5663922	Trinity	12.16	-8.50	-44.84	-48.86	-75.76 (1998)	-4.27 (17)
^Kerr 5663923	Trinity	15.01	-3.46	-39.47	N/A	-67.77 (2007)	-8.47 (8)
^Kerr 5663924	Trinity	58.65	-22.12	-33.66	N/A	-45.46 (2007)	-5.68 (8)
^Kerr 5664301	Trinity	0.16	-2.66	N/A	N/A	-1.91 (2012)	-0.49 (3)
^Burnet 5714604	Hickory	49.19	-9.88	N/A	N/A	43.98 (2013)	18.33 (2)
^Burnet 5715902	Ellenburger-San Saba	-1.20	-0.88	-4.15	N/A	-2.10 (2010)	-0.33 (6)
Burnet 5722505	Hickory	6.45	-1.29	-0.01	N/A	0.29 (2010)	0.06 (4)
^Hays 5748811	Trinity	5.93	-2.34	N/A	N/A	12.61 (2011)	3.00 (4)
^Gillespie 5750108	Ellenburger-San Saba	5.96	2.23	-4.16	-12.44	-13.48 (1987)	-0.47 (28)
^Gillespie 5750324	Ellenburger-San Saba	4.69	-0.45	-0.84	N/A	-16.22 (1995)	-0.80 (20)
^Gillespie 5751407	Ellenburger-San Saba	4.55	0.31	-2.23	N/A	-10.39 (2008)	-1.30 (8)
Hays 5755607	Trinity	43.66	-6.44	11.18	N/A	22.95 (2006)	2.35 (9)
***Hays 5756702**	Trinity	50.99	N/A	N/A	N/A	38.24 (1964)	0.74 (51)
^Kerr 5757805	Trinity	2.58	-2.38	0.42	-32.28	-32.78 (2003)	-2.62 (12)
^Hays 5763705	Trinity	12.97	-4.53	1.74	-14.97	1.26 (2002)	0.09 (13)
Hays 5764705	Trinity	4.90	4.75	6.85	-15.55	-5.28 (1997)	-0.31 (17)
^Travis 5850120	Trinity	9.52	1.57	-23.21	-32.18	-83.00 (1987)	-2.94 (28)
***Hays 5857502**	Edwards BFZ	37.55	-12.61	30.38	34.32	32.52 (1977)	0.85 (38)
Kendall 6801314	Trinity	0.75	3.94	-29.10	-46.85	-62.30 (1984)	-1.95 (32)
^Kerr 6801703	Trinity	5.66	-2.55	-14.34	-48.64	-41.94 (2001)	-2.96 (14)
^Kerr 6801704	Trinity	0.69	-3.24	-26.73	-68.73	-56.83 (2001)	-4.01 (14)
Kendall 6802609	Trinity	18.51	-7.22	-4.25	-19.12	-62.10 (1975)	-1.53 (40)
^Kendall 6802807	Trinity	14.87	-5.92	-4.86	-32.87	-65.77 (1978)	-1.74 (37)
Kendall 6804312	Trinity	28.77	-10.99	5.66	N/A	1.45 (1999)	0.09 (17)
Comal 6807407	Trinity	19.93	0.37	2.55	-10.05	-1.38 (1997)	-0.07 (19)
Kendall 6810616	Trinity	7.60	3.44	68.40	N/A	-100.44 (1985)	-3.29 (30)
Kendall 6811417	Trinity	3.70	-3.05	-1.03	N/A	-28.45 (1999)	-1.70 (16)

County and state well number	Aquifer	2015 change (ft)	2014 change (ft)	2011-2015 change (ft)	2006-2015 change (ft)	Historical change (ft, yr)	Historical yearly average (ft, yrs)
Kendall 6811418	Trinity	7.83	-1.78	10.25	1.80	37.80 (2005)	3.60 (10)
Kendall 6811509	Trinity	4.98	-1.25	-5.92	-10.42	2.50 (2005)	0.24 (10)
Kendall 6811708	Trinity	6.44	4.28	-14.99	10.95	-18.30 (1962)	-0.34 (53)
Kendall 6812106	Trinity	11.10	-0.09	7.74	7.89	9.14 (2005)	0.87 (10)
Comal 6815211	Trinity	3.63	-0.84	0.30	N/A	0.47 (2010)	0.09 (5)
Bexar 6819208	Trinity	2.37	2.08	2.52	-0.95	-55.44 (1977)	-1.46 (38)
***Bexar 6819618**	Trinity	170.29	-3.20	54.33	105.4	112.07 (1990)	4.44 (25)
Bexar 6819806	Trinity	113.20	-60.3	-45.85	-70.86	-49.98 (1990)	-1.98 (25)
Bexar 6820110	Trinity	61.00	1.88	41.55	74.80	36.40 (1987)	1.28 (28)
***Bexar 6820602**	Trinity	31.31	-3.14	6.00	8.50	7.68 (1991)	0.31 (24)
***Bexar 6820603**	Trinity	108.83	-9.47	11.55	13.86	66.51 (1996)	3.36 (19)
Bexar 6821519	Trinity	59.23	-12.4	-10.47	N/A	-10.47 (2011)	-2.13 (5)
Bexar 6827112	Trinity	119.30	-22.19	N/A	N/A	54.81 (2009)	9.97 (6)
^Kerr 6904503	Trinity	0.94	-11.31	-23.97	N/A	-34.37 (2007)	-4.24 (8)
^Kerr 6907107	Trinity	4.27	-2.43	-28.25	-46.75	-52.95 (2003)	-4.12 (12)
^Kerr 6908304	Trinity	9.28	-1.19	-25.36	N/A	-42.66 (2006)	-4.64 (9)
^Kerr 6908305	Trinity	14.48	-2.44	-23.09	N/A	-32.99 (2006)	-3.59 (9)
***^Kerr 6908513**	Trinity	10.65	N/A	N/A	N/A	10.65 (2014)	10.65 (1)
^Real 6919401	Trinity	8.58	-8.11	-27.89	-58.95	-76.25 (1974)	-1.84 (41)
^Bandera 6924225	Trinity	-5.08	-2.43	2.44	N/A	5.65 (2008)	0.75 (7)

* = recorder added for the 2014–2015 report, ^ = well in the confined portion of the aquifer, ft = feet, yr = earliest year measured, yrs = years over which average determined, N/A = not available

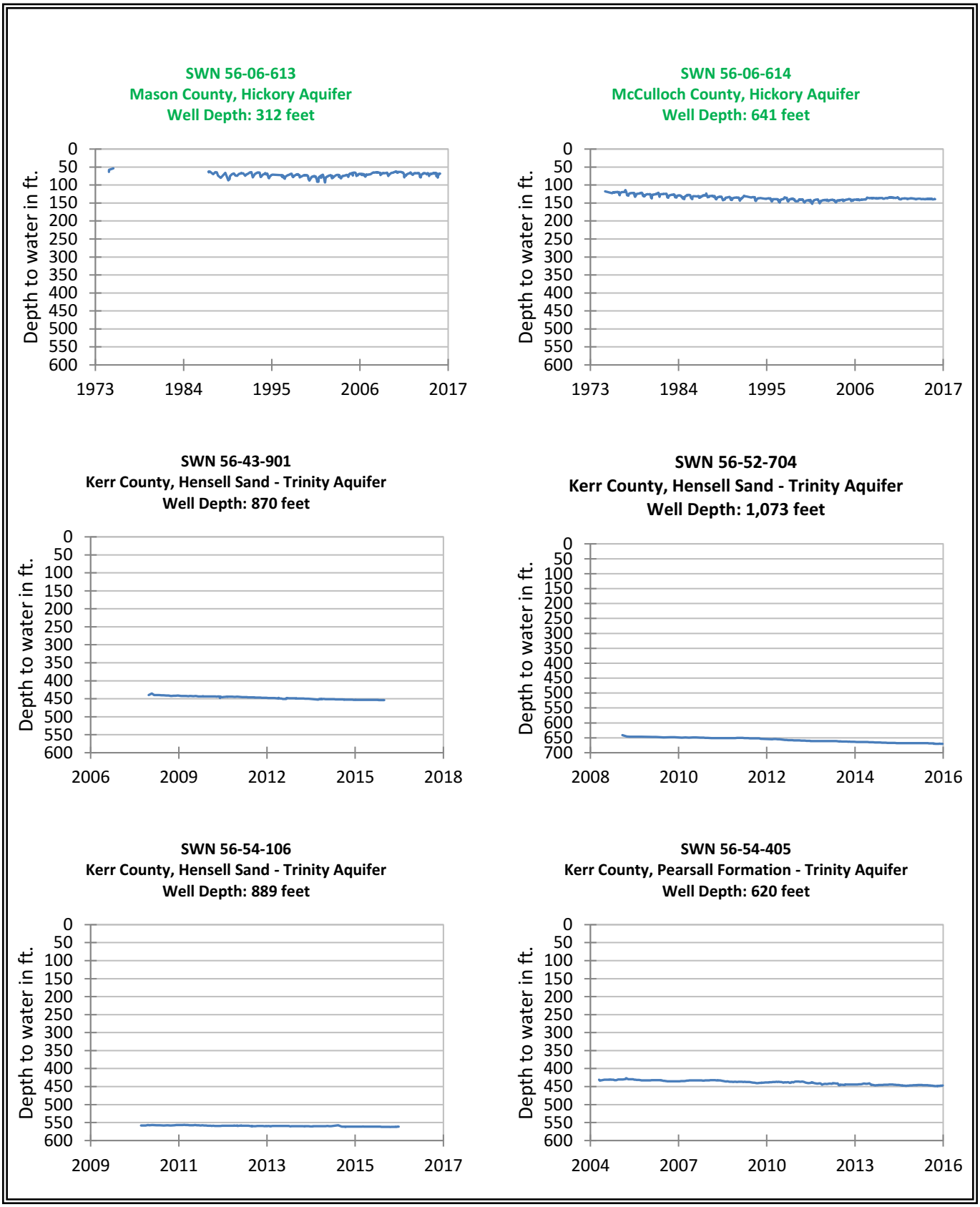

Figure 7-2. Hydrographs of TWDB recorder wells in Central Texas. Minor aquifers indicated in green text. SWN=state well number

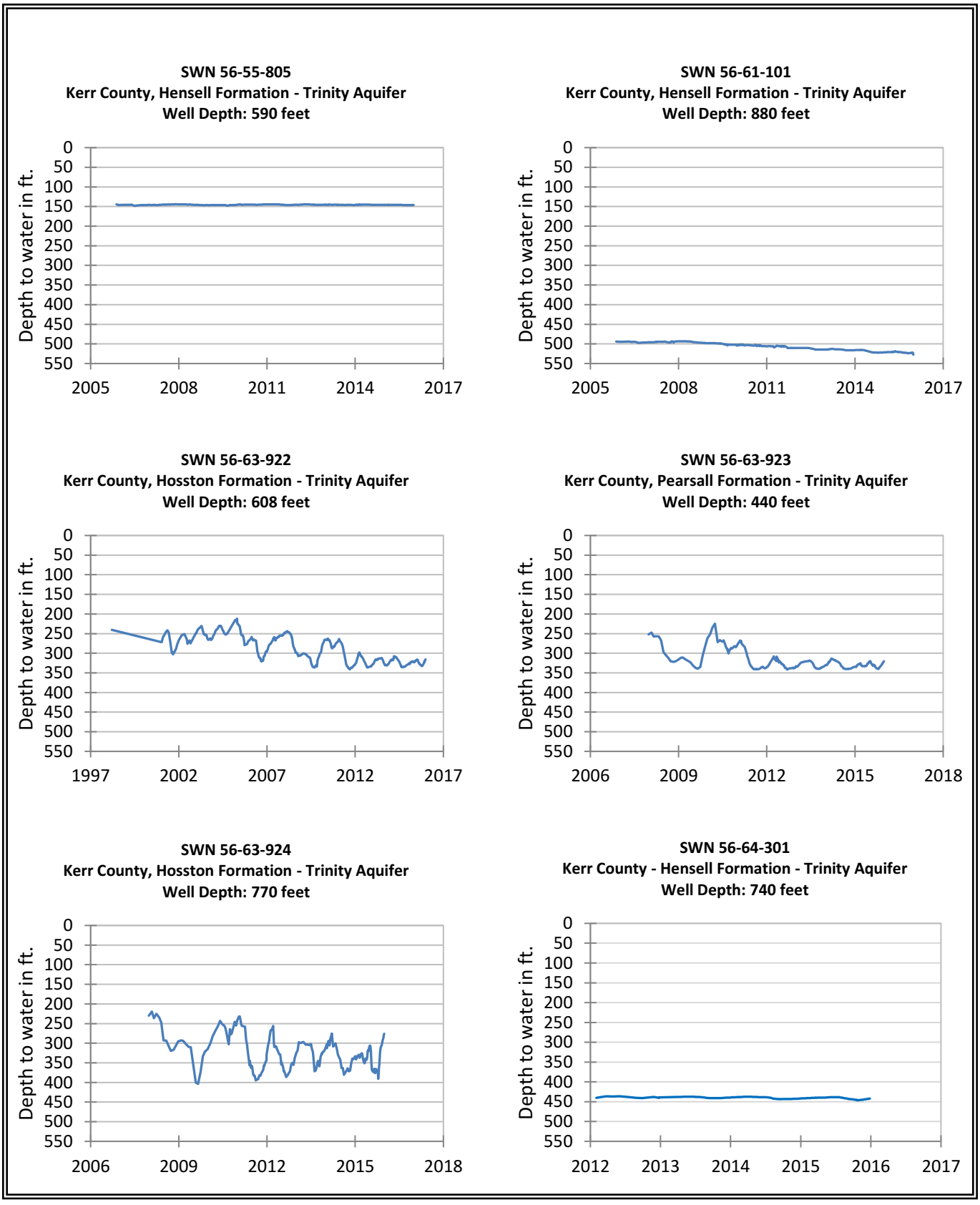

Figure 7-2 (continued) Hydrographs of TWDB recorder wells in Central Texas. SWN=state well number

Figure 7-2 (continued) Hydrographs of TWDB recorder wells in Central Texas. Minor aquifers indicated in green text. SWN=state well number

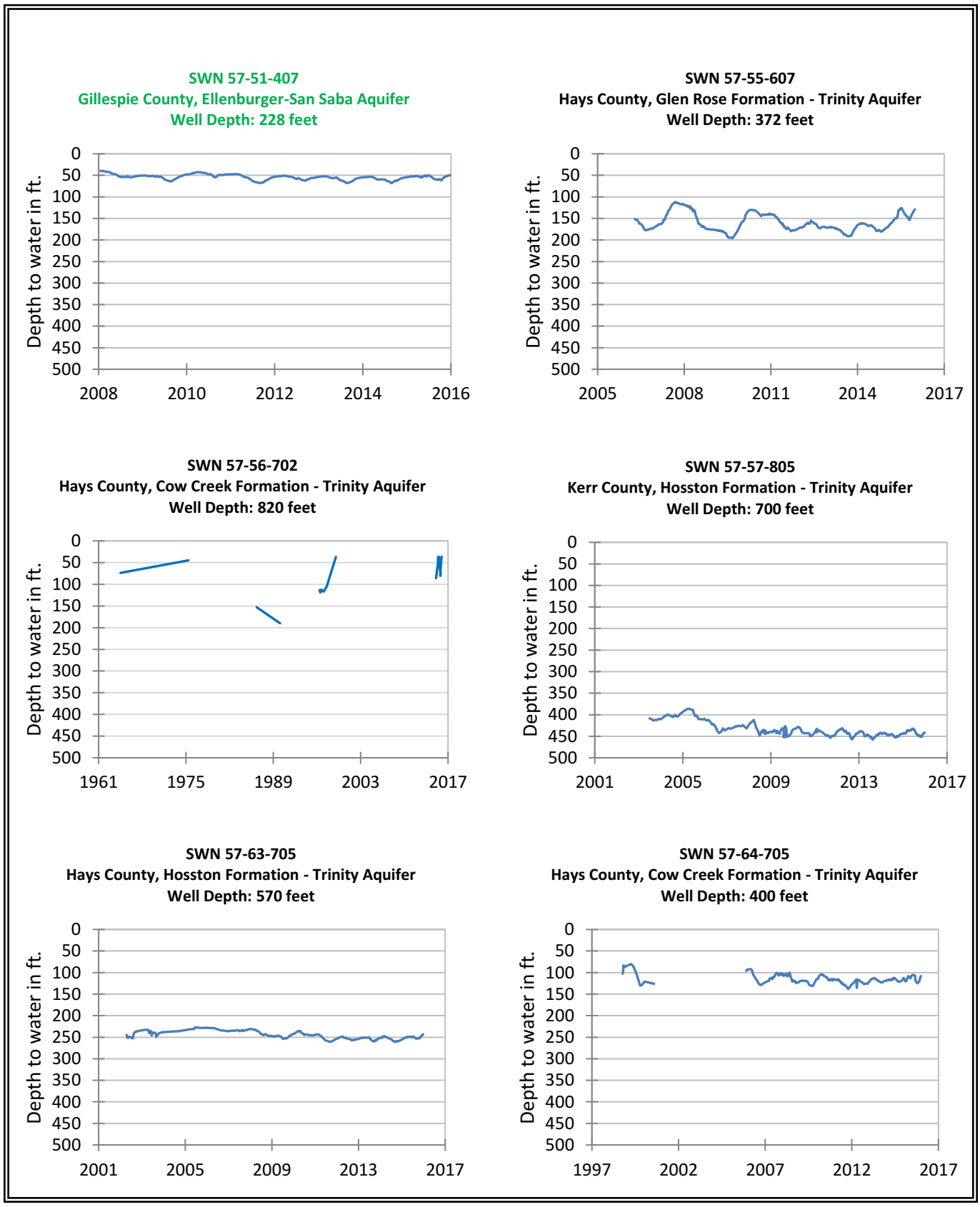

Figure 7-2 (continued) Hydrographs of TWDB recorder wells in Central Texas. Minor aquifer indicated in green text. SWN=state well number

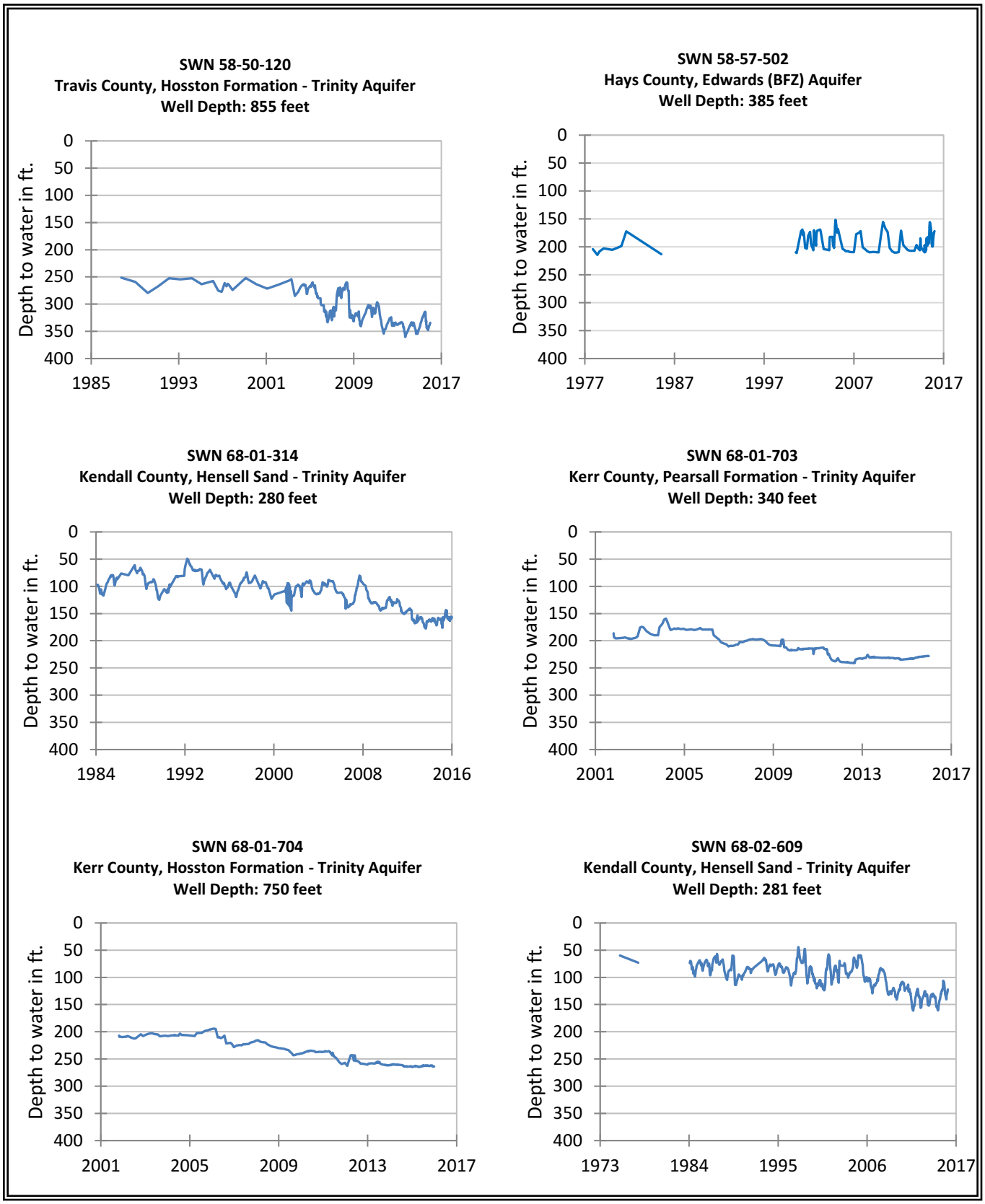

Figure 7-2 (continued) Hydrographs of TWDB recorder wells in Central Texas. SWN=state well number

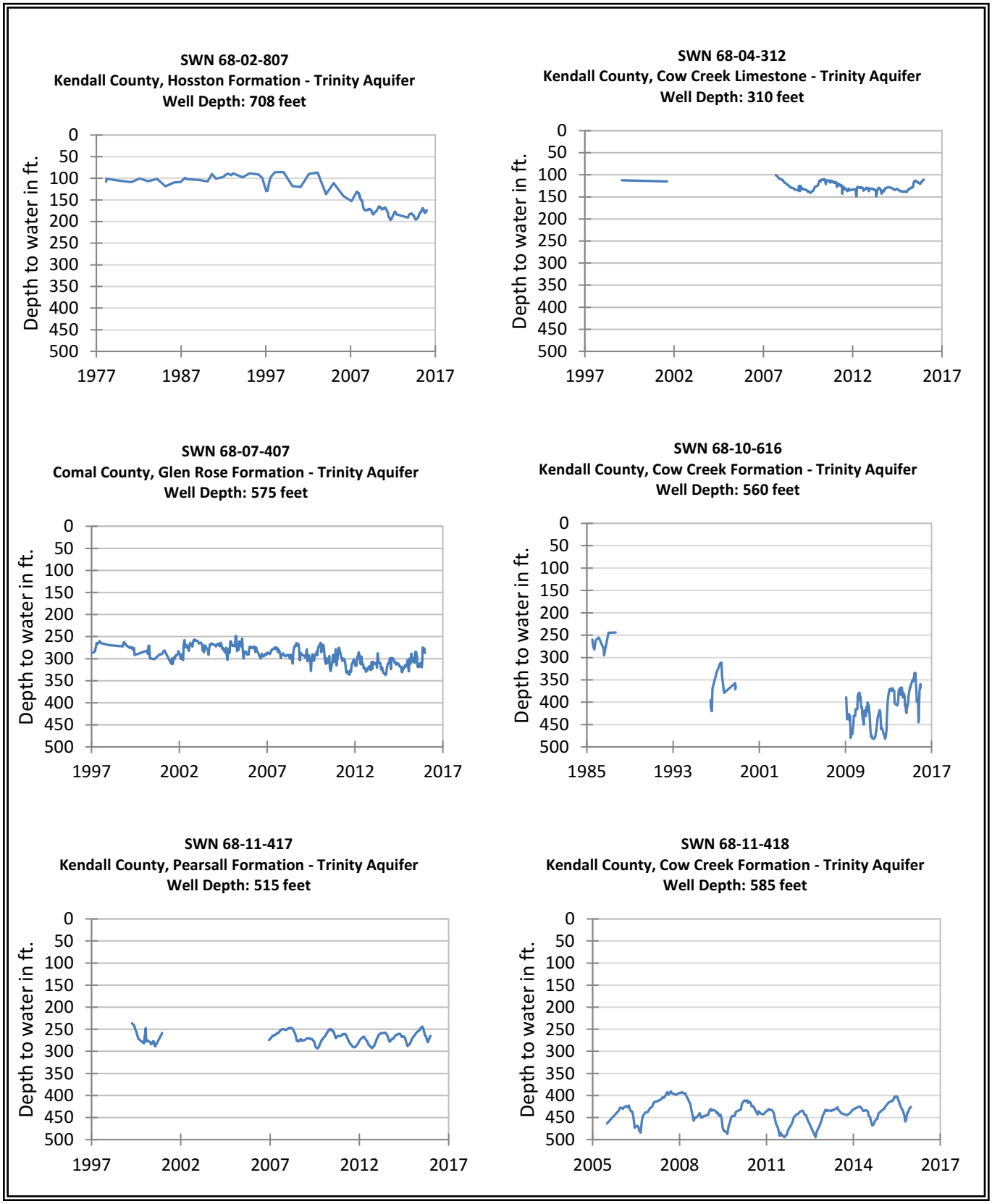

Figure 7-2 (continued) Hydrographs of TWDB recorder wells in Central Texas. SWN=state well number

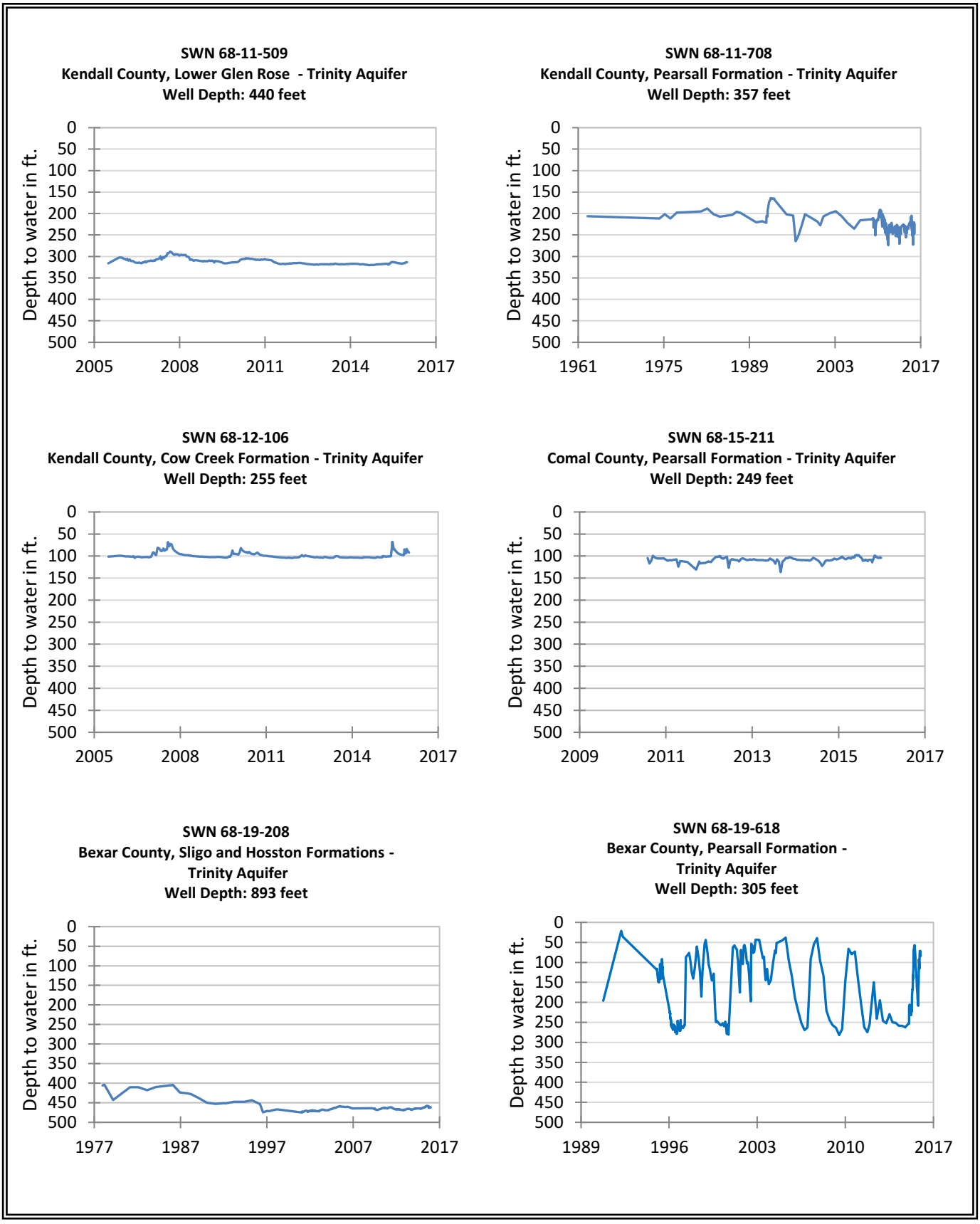

Figure 7-2 (continued) Hydrographs of TWDB recorder wells in Central Texas. SWN=state well number

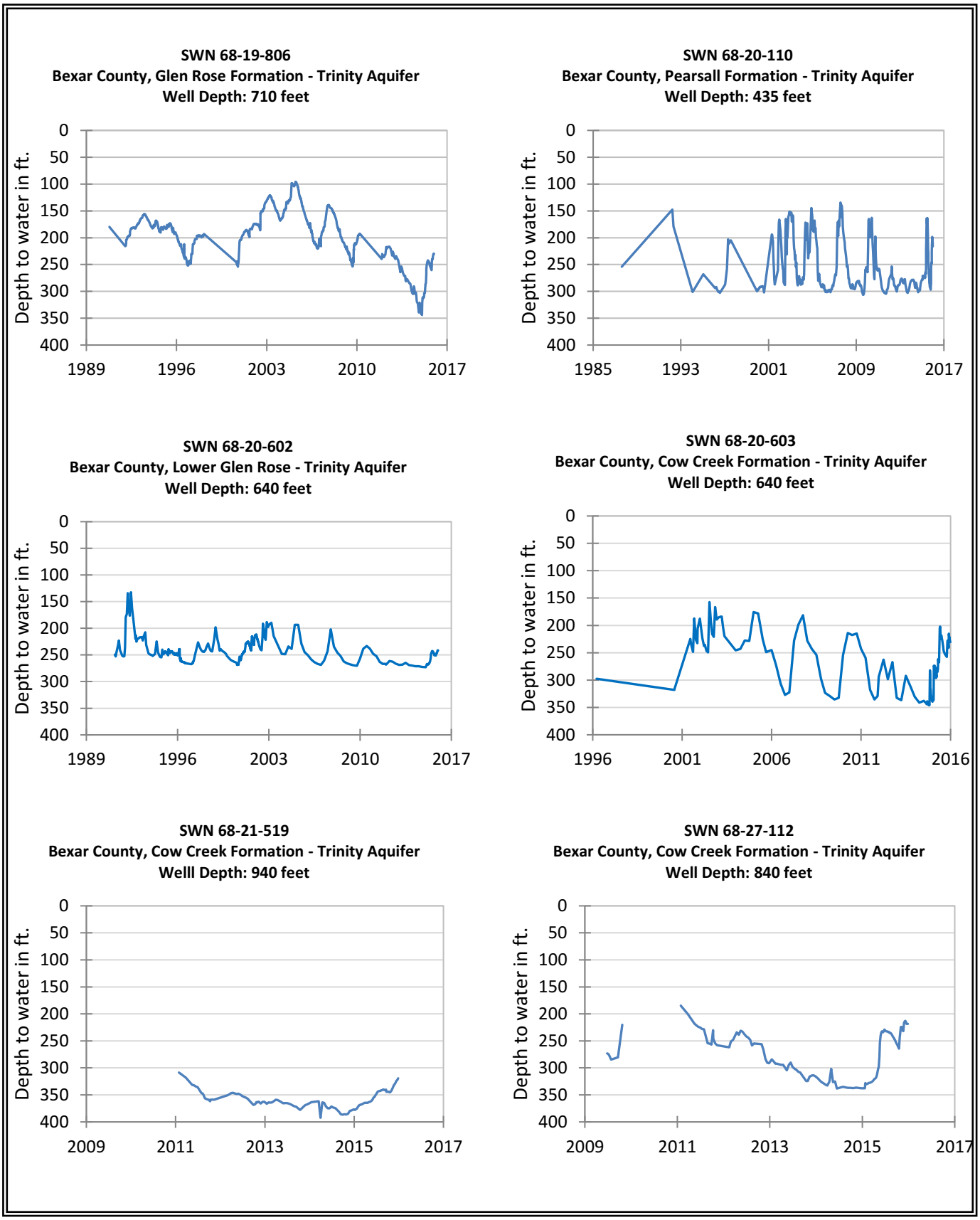

Figure 7-2 (continued) Hydrographs of TWDB recorder wells in Central Texas. SWN=state well number

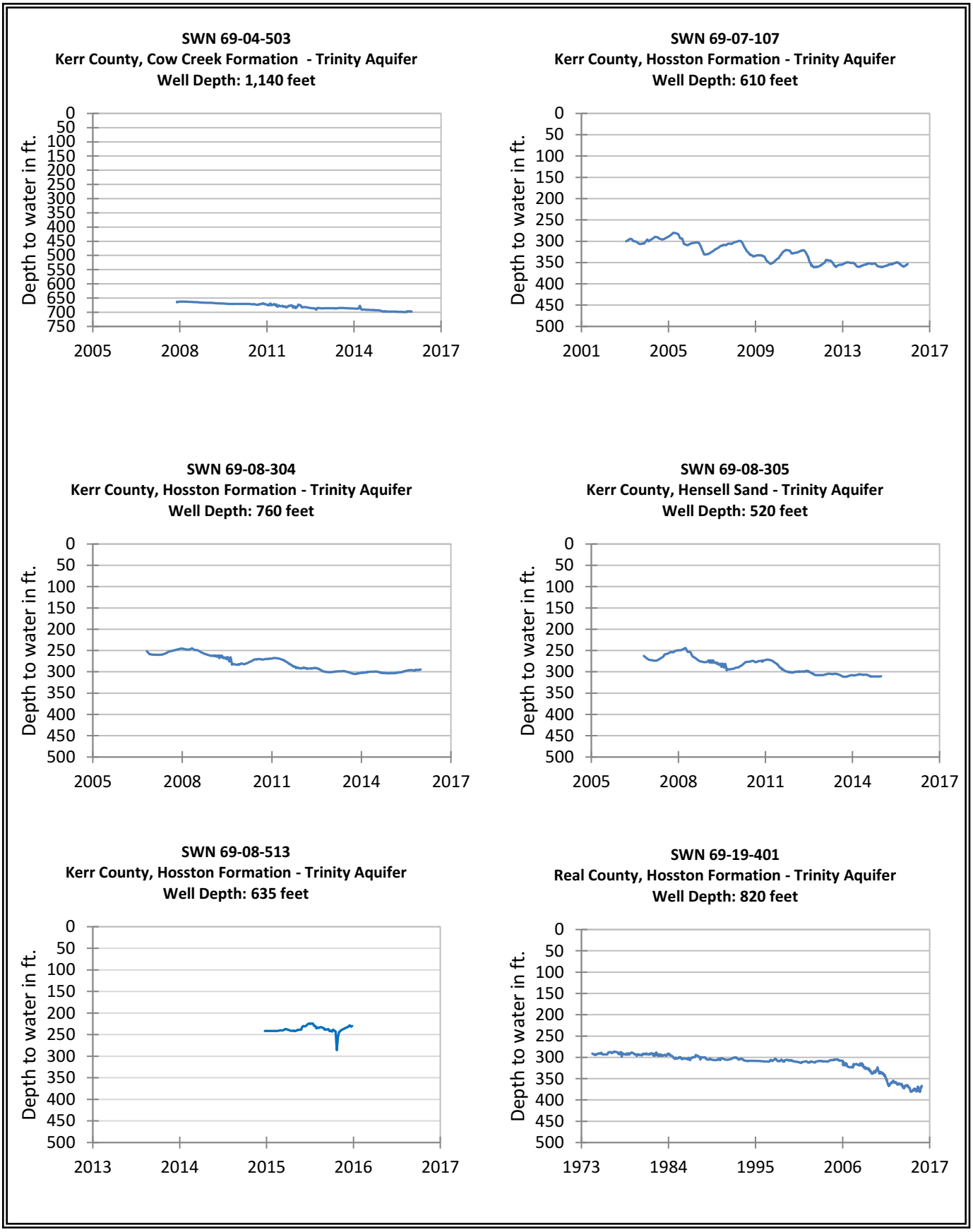

Figure 7-2 (continued) Hydrographs of TWDB recorder wells in Central Texas. SWN=state well number

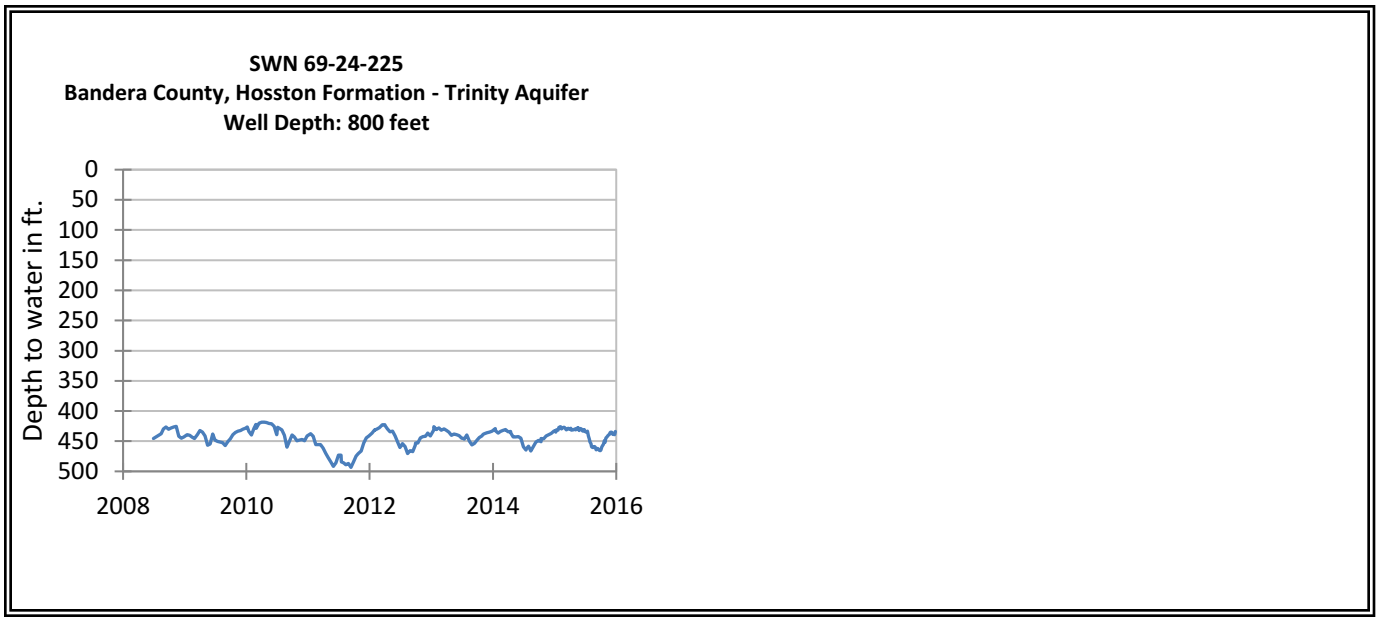

Figure 7-2 (continued) Hydrographs of TWDB recorder wells in Central Texas. SWN=state well number

8.0 Statewide changes in recorders in major aquifers by region

Every year additional recorders have been added to the program, mainly in wells completed in major aquifers. A few wells have also been deleted. Comparison of median changes in water levels in recorder wells of major aquifers by regions through time, a comparison of different sets, is less than ideal but still informative (Table 8-1). Comparison between regions is most helpful for the recent year.

Not including changes in the one Edwards (Balcones Fault Zone) Aquifer well in Central Texas or the Hueco-Mesilla Bolsons Aquifer well, the median water-level change from 2014 to 2015 was greatest in wells in the Trinity Aquifer in Central Texas, a rise of 8.2 feet, and least in the Edwards-Trinity (Plateau) wells at essentially 0 (-0.01 foot). Wells completed in five major aquifers in four regions also experienced median rises, ranging from 1.3 to 6.3 feet. Ogallala Aquifer wells in the High Plains experienced a median change of -0.5 feet, the smallest decline experienced by Ogallala recorder wells since the initial publication of this report covering the 2010 to 2011 period.

Table 8-1. Summary of median water-level changes by major aquifer and region. Blue denotes a rise in water level, and red denotes decline.

Major aquifer	Region	Number of wells	Median change (feet) 2014-2015	Median change (feet) 2013-2014	Median change (feet) 2012-2013	Median change (feet) 2011-2012	Median change (feet) 2010-2011
Ogallala	High Plains	25[a]	-0.5	-1.2	-1.0	-1.8	-1.9
Hueco (-Mesilla) Bolsons	West	1	-0.3	-2.2	-0.4	-3.5	1.5
Edwards-Trinity (Plateau)	West	24[b]	0	0.5	-0.8	-0.9	-0.7
Pecos Valley	West	4	1.3	-1.7	-0.9	-0.6	-7.6
Carrizo-Wilcox	South and East	14[c]	1.7	1.5	-0.2	-0.9	-4.4
Gulf Coast	South and East	13	1.8	0.7	-0.9	0.5	-6.3
Trinity	Northern Central	19[d]	1.8	-0.9	-0.8	-1.6	-8.5
Seymour	Rolling Plains	2	2.4	-1	-0.8	-0.9	-3.2
Edwards (Balcones Fault Zone)	Northern Central	5[e]	6.3	-1.4	12.1	0.9	-3.5
Trinity	Central	46[f]	8.2	-2.4	-0.1	-0.9	-16.7
Edwards (Balcones Fault Zone)	Central	1	37.5	-12.6	NA	NA	NA

Changes in the recorder well program:

a. One Donley County well taken out of service

b. Two wells were added in Pecos County, one well was dropped in Schleicher County
c. Two wells added in Anderson and Gonzales counties
d. Three wells added in Somervell, Hill, and Williamson counties
e. One well added in Williamson County
f. Three wells added in Bexar County, one well added in Hays County, one well added in Kerr County

9.0 Conclusions

In 2015, the TWDB maintained and monitored a statewide network of 175 wells equipped with automatic groundwater-level recording instruments and dataloggers. The number of recorder wells has increased by 34 percent since 2011. These wells primarily monitor water-level conditions in major and minor aquifers defined by the TWDB. Three wells monitor water-level conditions in undesignated or local aquifers.

The Central Texas region continues to have the largest number of recorder wells (55) and the largest number of recorder wells (47) completed in a major aquifer—the Trinity (and one in the Edwards (Balcones Fault Zone)—reflecting an interest in groundwater availability in an area with high population growth and variable patterns of rainfall. The Trinity Aquifer also contains the greatest number of recorders statewide (65), with 19 in northern Central Texas and 46 in Central Texas.

Considering major aquifers by region and excluding two regions each with only one major aquifer well and one region with no median water-level change, all but the Ogallala Aquifer recorder wells experienced a median water-level change of a rise from 2014 to 2015. The Central Texas Trinity Aquifer wells experienced the greatest median water-level change from 2014 to 2015, a rise of 8.2 feet. From 2013 to 2014, these Central Texas Trinity Aquifer wells also experienced the greatest water-level change, a decline of 2.4 feet. Median change in the Ogallala Aquifer recorder wells was a decline of 0.5 feet, the smallest decline in the last five years.

Generally, groundwater levels in the total number of TWDB recorder wells in major and minor aquifers aquifers rose in 2015. Total statewide median water-level change from 2014 to 2015 as determined in all 155 recorders in major aquifers was a rise of 1.3 feet, with one well in Deaf Smith County experiencing no change, 106 wells experiencing rises, and 48 wells experiencing declines. This compares to the median water-level change in major aquifer wells of-1.2 feet from 2013 to 2014 in 143 wells; -0.5 feet from 2012 to 2013 in 138 wells; -0.9 feet from 2011 to 2012 in 125 wells; and -4.8 feet from 2010 to 2011 in 110 wells. Total statewide median water-level change from 2014 to 2015 as determined in all 17 recorders in minor aquifers was a rise of 1.7 feet, with 13 wells experiencing rises and 4 wells experiencing declines.

Total statewide median water-level rise in recorder wells in major aquifers from 2014 to 2015 as determined from rises occurring in 69 percent (106 of 155) of the wells was 3.7 feet, compared to the median water-level rise of 1.9 feet occurring in 27 percent (39 of 143) of the wells from 2013 to 2014, 2.5 feet in 32 percent (44 of 138) from 2012 to 2013, 1.9 feet in 25 percent (31 of 125) from 2011 to 2012, and 1.5 feet in 8 percent (9 of 110) from 2010 to 2011.

Total statewide median water-level decline in recorder wells in major aquifers from 2014 to 2015 as determined from declines occurring in 31 percent (48 of 155) of the wells was 0.7 feet, compared to the median water-level decline of 2.0 feet occurring in 73 percent (104 of 143) of the wells from 2013 to 2014, 1.2 feet in 68 percent (94 of 138) from 2012 to 2013, 1.7 feet in 75 percent (94 of 125) from 2011 to 2012, and 4.9 feet in 92 percent (101 of 110) from 2010 to 2011.