ARIZONA DEPARTMENT OF WATER RESOURCES

A.D.W.R. WATER LEVEL CHANGE MAP SERIES REPORT NO. 3
WATER LEVEL CHANGE MAP SHEET 3 OF 3

WATER-LEVEL ELEVATION

Water-level elevations in wells in the Upper San Pedro basin ranged from about 3300 to about 5600 feet above mean sea level (amsl) in November/December 2006. DTW below land surface ranged from less than zero near the San Pedro River (42 flowing wells) to about 730 feet near the Winchester Mountains.

A cone of depression has developed in the vicinity of Sierra Vista and Fort Huachuca at Township 21 south, Range 20 east, Section 33. This cone of depression has been previously reported (Roeske and Werrell, 1973: Konieczki, 1980; Barnes, 1997; Barnes and Putman, 2003). The deepest part of the cone of depression is bounded by the 4100 foot water-level contour.

SELECTED REFERENCES

Arizona Department of Water Resources, 2006, Arizona Water Atlas, volume 3, section 3.13, available at: http://www.azwater.gov/dwr/Content/Find_by_Program/Rural_Programs/content/water_atlas/v3/VIII_Sec3-13.pdf.

Barnes, R.L., and Putman, F., 2003, Maps showing groundwater conditions in the Upper San Pedro basin, Cochise, Graham and Santa Cruz Counties, Arizona–2001-2002: Arizona Department of Water Resources Hydrologic Map Series Report Number 34.

Barnes, R.L., 1997, Maps showing groundwater conditions in the Upper San Pedro basin, Cochise, Graham and Santa Cruz Counties, Arizona – 1990: Arizona Department of Water Resources Hydrologic Map Series Report Number 31.

Konieczki, A. D., 1980, Maps showing groundwater conditions in the Upper San Pedro basin area, Pima, Santa Cruz and Cochise Counties, Arizona, 1978: U.S. Geological Survey Open-File Report 80-1192, 2 sheets.

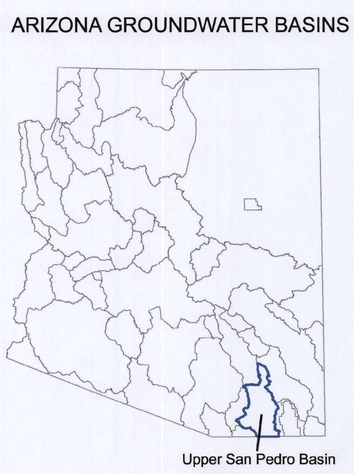
Roeske, R.H., and Werrell, W. L., 1973, Hydrologic conditions in the San Pedro River valley, Arizona, 1971: Arizona Water Commission Bulletin 4, 76 p., 1 sheet.

Explanation

- Well in which depth to water was measured in 2006. The number next to each point (3639) represents the groundwater elevation above mean sea level in feet rounded to the nearest foot.
- Well with water-level elevation (3632) and letter corresponding hydrograph (C) on sheet 2.
- Sierra Vista Environmental Operations Park
- USGS Streamflow Gage
- Highway
- Intermittent Stream
- Contour Line (Contour Interval = 50 feet from 3350 to 4200 and 100 feet from 4300 to 5200)
- San Pedro Riparian National Conservation Area
- City
- Fort Huachuca
- Upper San Pedro Water District
- Boundary of Groundwater Basin
- Township and Range
- Hardrock

Water-Level Elevation (feet amsl)

- < 3400
- 3400 to 3600
- 3600 to 3800
- 3800 to 4000
- 4000 to 4200
- 4200 to 4400
- 4400 to 4600
- 4600 to 4800
- 4800 to 5000
- 5000 to 5200
- > 5200



NORTH AMERICAN DATUM 1983 HARN

WATER-LEVEL ELEVATION, 2006

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ARIZONA DEPARTMENT OF WATER RESOURCES

HYDROLOGY DIVISION

WATER-LEVEL CONDITIONS IN THE UPPER SAN PEDRO BASIN, ARIZONA, 2006

By
David Schmerge, Frank Corkhill, and Stephen Flora

June 2009

For data go to:
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For more information or copies contact:
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3550 North Central Avenue
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(602) 771-8627
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CERTIFICATE NO.
29823
EDWIN FRANKLIN CORKHILL
Date Signed 7-13-09
ARIZONA U.S.A.

Expires 12-31-10

SRP2307

ARIZONA DEPARTMENT OF WATER RESOURCES

A.D.W.R. WATER LEVEL CHANGE MAP SERIES REPORT NO. 3
WATER LEVEL CHANGE MAP SHEET 1 OF 3

INTRODUCTION

Depth to water (DTW) measurements were taken in the Upper San Pedro basin by personnel of the Arizona Department of Water Resources at 636 wells from November 14, 2001 to December 14, 2001, and at 596 wells from November 27, 2006 to December 18, 2006. These data were reviewed, and measurements made with accompanying remarks (potentially indicating non-standard conditions of water-level measurements) were not included in this analysis. The most common remarks related to known pumping, but several measurements were remarked for having anomalous water levels that may have been caused by unobserved pumping. After records with remarks were removed, 613 wells remained from 2001 and 568 wells remained from 2006. These data were further reviewed to remove clusters of wells from the analysis in order to make the maps more readable – leaving 367 water-level changes from 2001 to 2006, and 457 water-level elevations in 2006.

WATER-LEVEL CHANGE

The average water-level change of the wells was a decline of about 2.1 ± 0.3 feet. DTW increased (water-level decline) in 241 of the wells, remained unchanged in 8 wells, and decreased (water-level rise) in 118 wells. The water-level changes ranged from an increase of 33.4 feet to a decrease of 30.2 feet. Most of these large changes – both increases and decreases – occurred near streambeds and mountain fronts and are susceptible to large short-term water-level fluctuations due to recharge events.

North of Little Dragoon Mountains
Water-level changes north of the Little Dragoon Mountains are generally small, ranging from a decline of -9 feet to a rise of 3 feet. The hydrograph of a well near the Tres Alamos Wash (hydrograph A) is shown on sheet 2.

San Pedro River North of Benson
Water levels of wells within several miles of the San Pedro River north of Benson generally declined, ranging from 0 to 19 feet. The hydrographs of these wells do not typically exhibit significant long-term trends (hydrograph B).

Benson
Water levels of wells in the vicinity of Benson ranged from an increase of 20 feet to a decrease of 16 feet. Many of these wells are completed in both a shallow aquifer and a deeper (artesian) regional aquifer (Barnes and Putman, 2003). Most of the water levels of the wells to the west of the San Pedro River decreased. Hydrographs of many of these wells exhibit a significant long-term decline; the water level of a well located at D-17-19 14ACA, for example, has declined about 0.63 ± 0.04 feet per year since 1982 (hydrograph C). However, not all hydrographs of wells in this area show a significant trend (hydrograph D). Water-levels to the east of the river generally increased, but hydrographs of the wells in this area do not typically exhibit any significant long-term trends.

St. David – Fairbank
Water levels from St. David to Fairbank ranged from a decrease of 8 feet to an increase of 5 feet. The water levels of 5 wells near St. David decreased as much at 8 feet. An area along the San Pedro River about 6 miles long and several miles wide at the northern boundary of the San Pedro Riparian National Conservation Area had increased water levels in most of the wells from about 0 to 5 feet. Water levels generally decreased from 0 to 5 feet in wells more than a few miles from the river. Hydrographs of the wells in this area generally do not exhibit significant long-term trends (hydrographs E, F, and G).

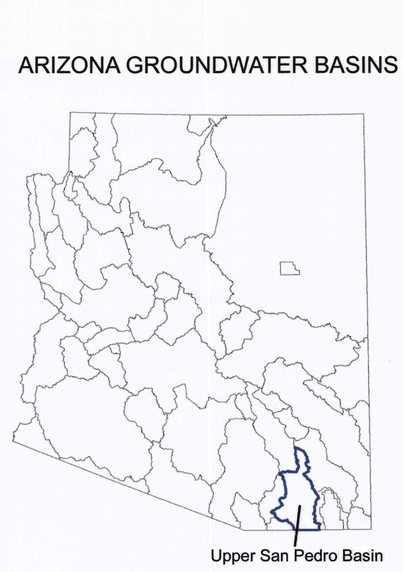
Tombstone
Water-level changes in wells in Tombstone ranged from an increase of 7 feet to a decrease of 11 feet. A well located at D-20-22 11ADB has significantly declined by about 0.75 ± 0.10 feet per year since 1991 (hydrograph H).

Huachuca City – Sierra Vista – Nicksville
Most of the water levels in wells in the area of Huachuca City, Sierra Vista, and Nicksville decreased between 2001 and 2006. Water levels ranged from a decline of 30 feet to a rise of 9 feet. However, one of the wells in which a water-level rise was observed is located at D-21-21 31DBC (hydrograph J), and it is apparent from the hydrograph that the water level at this well in 2001 was anomalously low and may have been due to unobserved recent pumping. Regardless, the water level in this well has been significantly declining at an average rate of 1.1 ± 0.1 feet per year since 1973. Also, the water level in a well located at D-21-20 16AAC (hydrograph I) has been significantly declining at a rate of 0.629 ± 0.002 feet per year since 1977 (the standard error of the slope of this trend is small due to the fact that this well is equipped with automated monitoring equipment taking 4 measurements daily, and there are thousands of measurements collected since February, 2001). Other hydrographs from wells in this area also exhibit long-term declines in water levels (hydrographs L and M).

Sierra Vista – Charleston
From northeastern Sierra Vista to Charleston, most of the water levels of wells have increased, ranging from a decrease of 2 feet to an increase of 19 feet. This is the location of the new Sierra Vista Environmental Operations Park which opened in 2002 and is using treated water to recharge the aquifer. The hydrograph of a well located at D-21-21 22DDC does not exhibit a significant long-term trend (hydrograph K), but the water-level rise since 2001 may reflect the influence of the recharge from the Sierra Vista Environmental Operations Park.

Hereford – Palominas
Water-levels of most wells in this area have increased slightly, ranging from a decline of 3 feet to an increase of 11 feet. The hydrographs of these wells do not typically exhibit significant long-term trends (hydrograph N).

Bisbee – Naco
Water-levels of most wells in the area of Bisbee and Naco have been significantly decreasing for years. Water levels of most wells in this area decreased about 7 feet in five years from 2001 to 2006. A general decrease of about 25 feet from 1990 to 2001 was observed for most wells in this area, and was previously reported (Barnes and Putman, 2003). The water-level in a well located at D-24-24 17AAA has decreased about 1.7 ± 0.3 feet per year since 1977 (hydrograph O).



Explanation

- Well in which depth to water was measured in 2001 and 2006. The number next to each point (-2) represents the difference in feet between measurements (water-level change). Water-level changes are rounded to the nearest foot. Unsigned values denote rises in water levels and negative values denote declines in water levels.
- Well with water-level change (-3) and letter of corresponding hydrograph (C) on sheet 2.
- Sierra Vista Environmental Operations Park
- USGS Streamflow Gage
- Highway
- Intermittent Stream
- San Pedro Riparian National Conservation Area
- City
- Fort Huachuca
- Upper San Pedro Water District
- Boundary of Groundwater Basin
- Township and Range
- Hardrock

Water-Level Change (feet)

- < -20
- -20 to -15
- -15 to -10
- -10 to -5
- -5 to 0
- 0 to 5
- 5 to 10
- 10 to 15
- 15 to 20
- > 20

0 2 4 8 Miles

NORTH AMERICAN DATUM 1983 HARN

CHANGE IN WATER LEVEL, 2001 TO 2006

WATER-LEVEL CONDITIONS IN THE UPPER SAN PEDRO BASIN, ARIZONA, 2006

By
David Schmerge, Frank Corkhill, and Stephen Flora
June 2009

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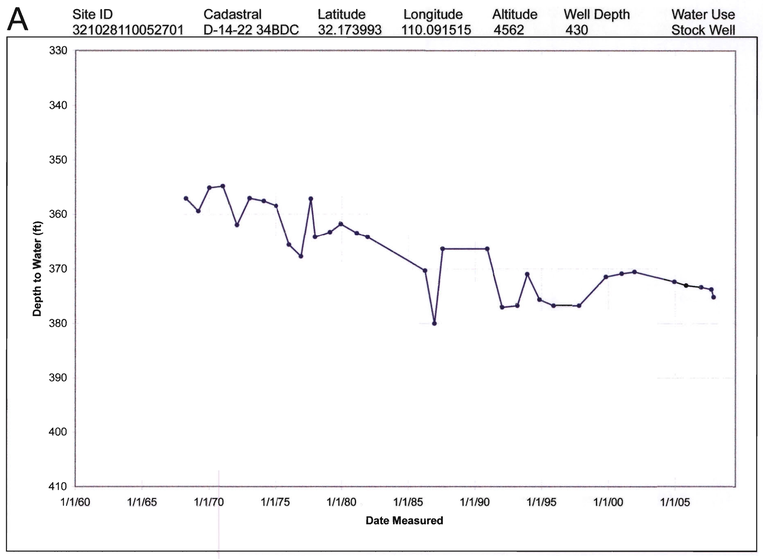
ARIZONA DEPARTMENT OF WATER RESOURCES

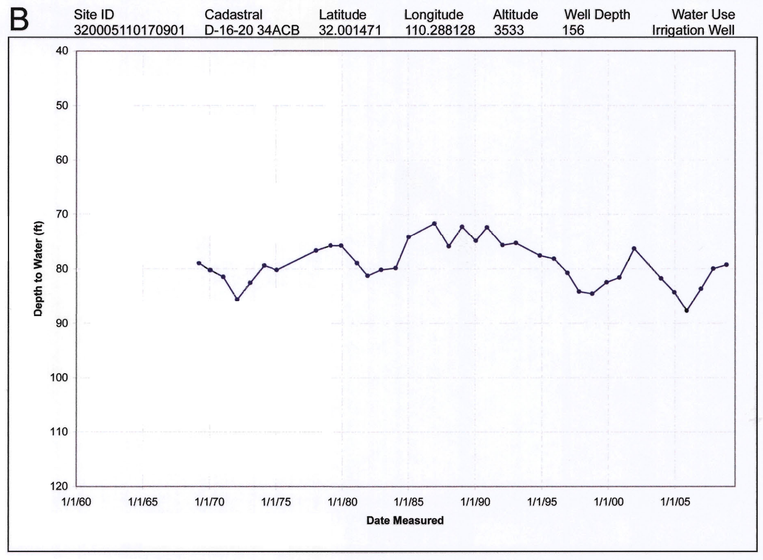
A

Site ID	Cadastral	Latitude	Longitude	Altitude	Well Depth	Water Use
321028110052701	D-14-22 34BDC	32.173993	110.091515	4562	430	Stock Well



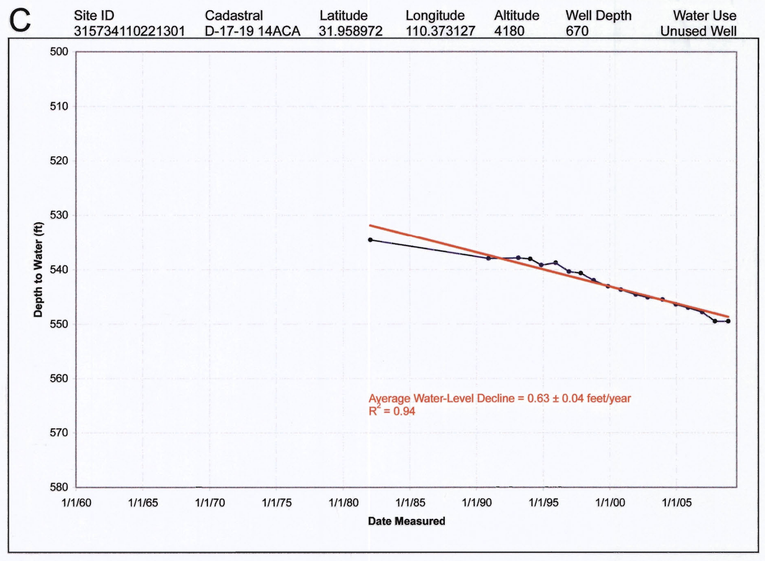
B

Site ID	Cadastral	Latitude	Longitude	Altitude	Well Depth	Water Use
320005110170901	D-16-20 34ACB	32.001471	110.288128	3533	156	Irrigation Well



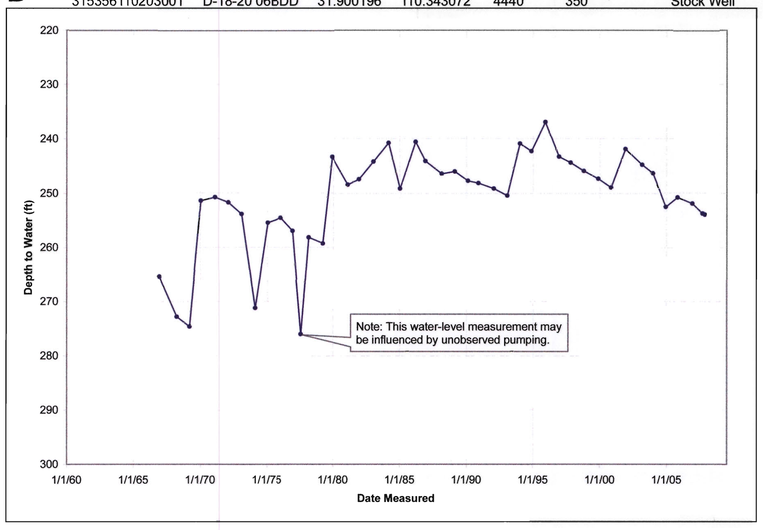
C

Site ID	Cadastral	Latitude	Longitude	Altitude	Well Depth	Water Use
315734110221301	D-17-19 14ACA	31.958972	110.373127	4180	670	Unused Well



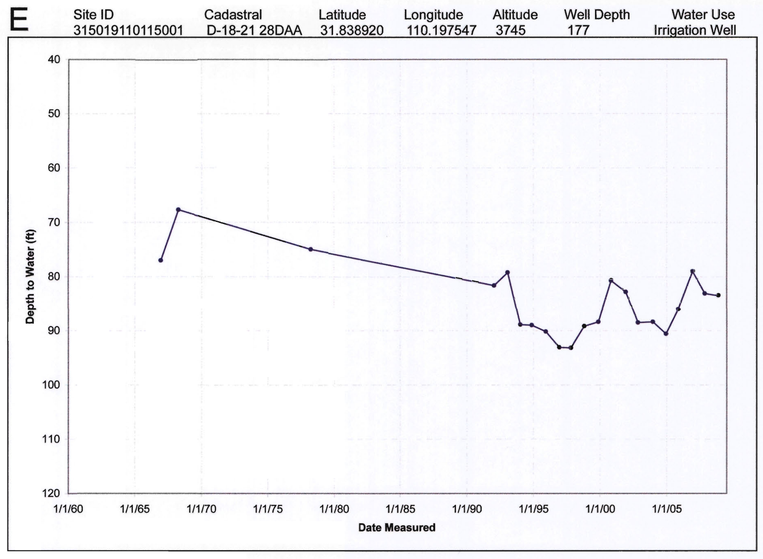
D

Site ID	Cadastral	Latitude	Longitude	Altitude	Well Depth	Water Use
315356110203001	D-18-20 06BDD	31.900196	110.343072	4440	350	Stock Well



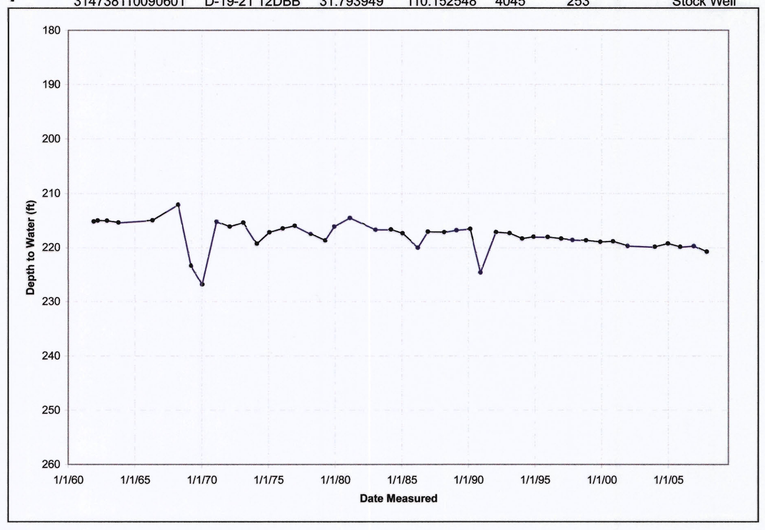
E

Site ID	Cadastral	Latitude	Longitude	Altitude	Well Depth	Water Use
315019110115001	D-18-21 28DAA	31.838920	110.197547	3745	177	Irrigation Well



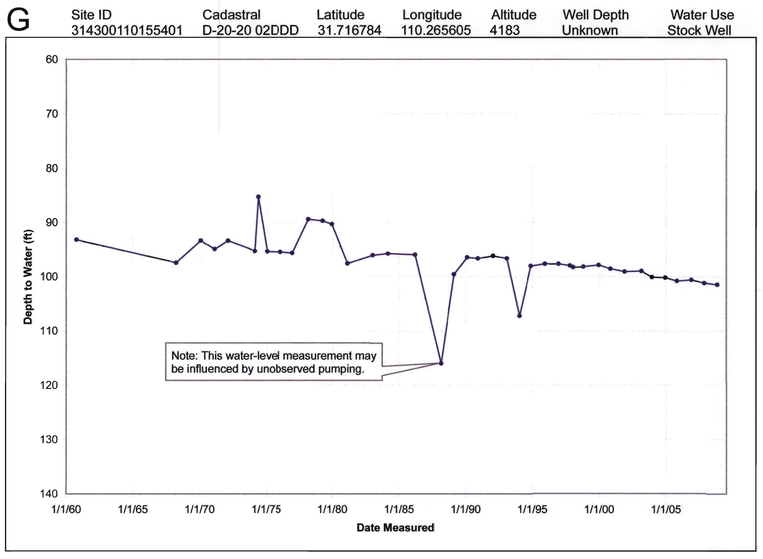
F

Site ID	Cadastral	Latitude	Longitude	Altitude	Well Depth	Water Use
314738110090601	D-19-21 12DBB	31.793949	110.152548	4045	253	Stock Well



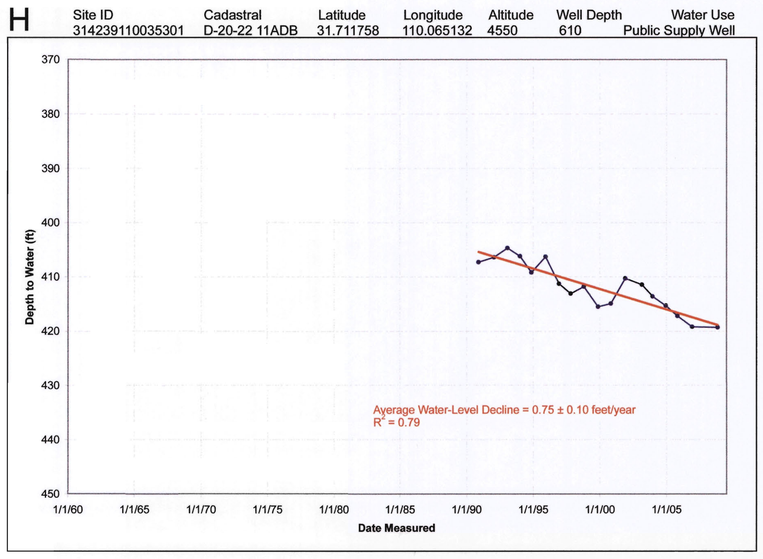
G

Site ID	Cadastral	Latitude	Longitude	Altitude	Well Depth	Water Use
314300110155401	D-20-20 02DDD	31.716784	110.265605	4183	Unknown	Stock Well



H

Site ID	Cadastral	Latitude	Longitude	Altitude	Well Depth	Water Use
314239110035301	D-20-22 11ADB	31.711758	110.065132	4550	610	Public Supply Well

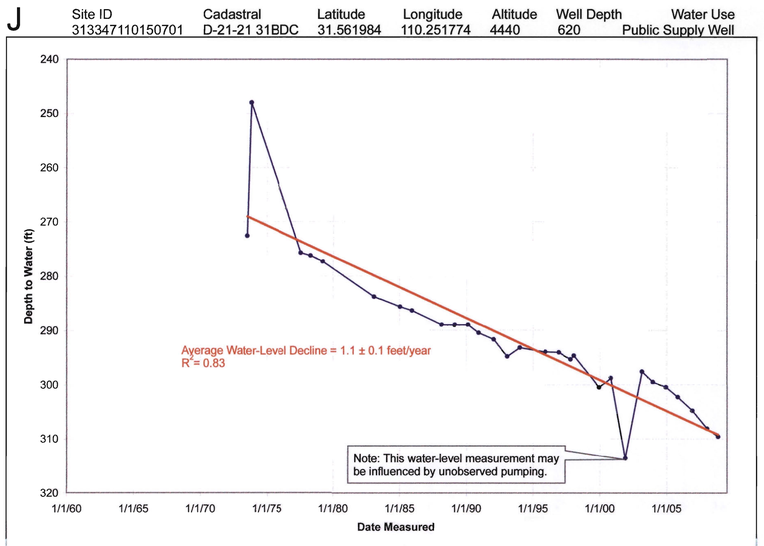


I

Site ID	Cadastral	Latitude	Longitude	Altitude	Well Depth	Water Use
313639110183501	D-21-20 16AAC	31.609954	110.311326	4415	807	Unused Well

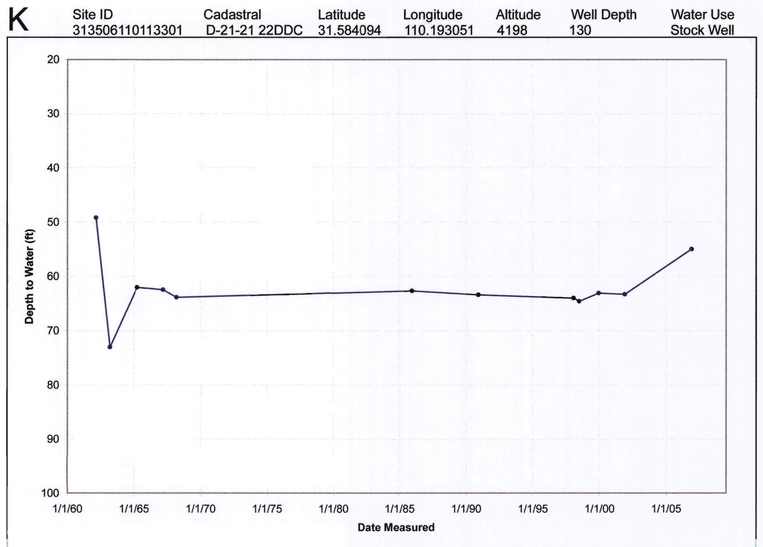
J

Site ID	Cadastral	Latitude	Longitude	Altitude	Well Depth	Water Use
313347110150701	D-21-21 31BDC	31.561984	110.251774	4440	620	Public Supply Well



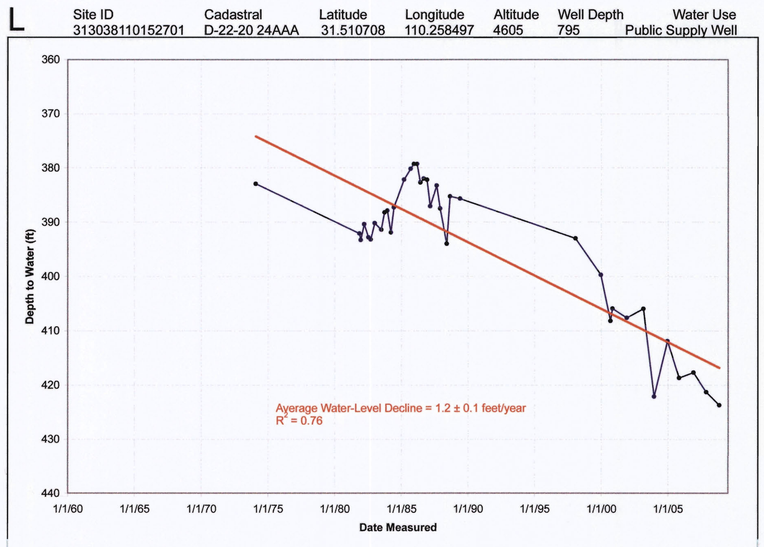
K

Site ID	Cadastral	Latitude	Longitude	Altitude	Well Depth	Water Use
313506110113301	D-21-21 22DDC	31.584094	110.193051	4198	130	Stock Well



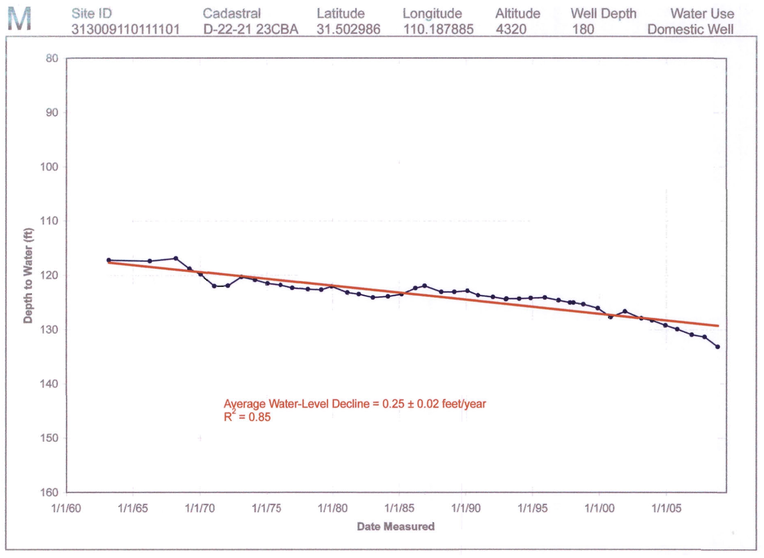
L

Site ID	Cadastral	Latitude	Longitude	Altitude	Well Depth	Water Use
313038110152701	D-22-20 24AAA	31.510708	110.258497	4605	795	Public Supply Well



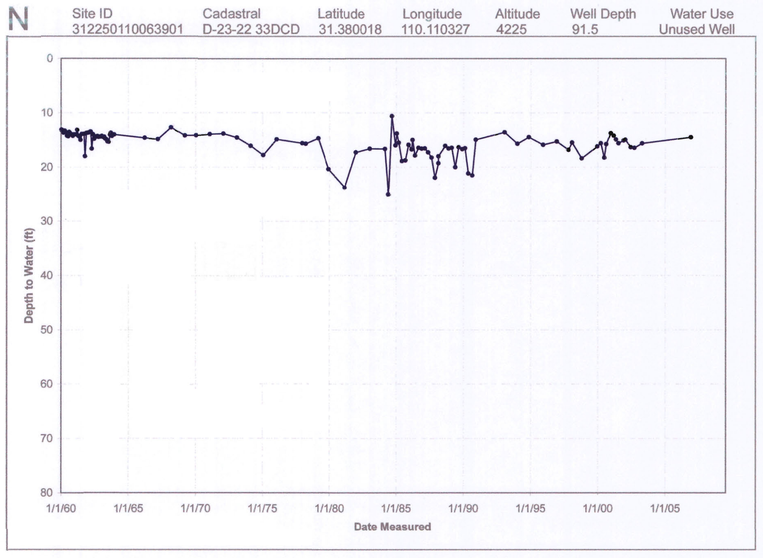
M

Site ID	Cadastral	Latitude	Longitude	Altitude	Well Depth	Water Use
313009110111101	D-22-21 23CBA	31.502986	110.187885	4320	180	Domestic Well



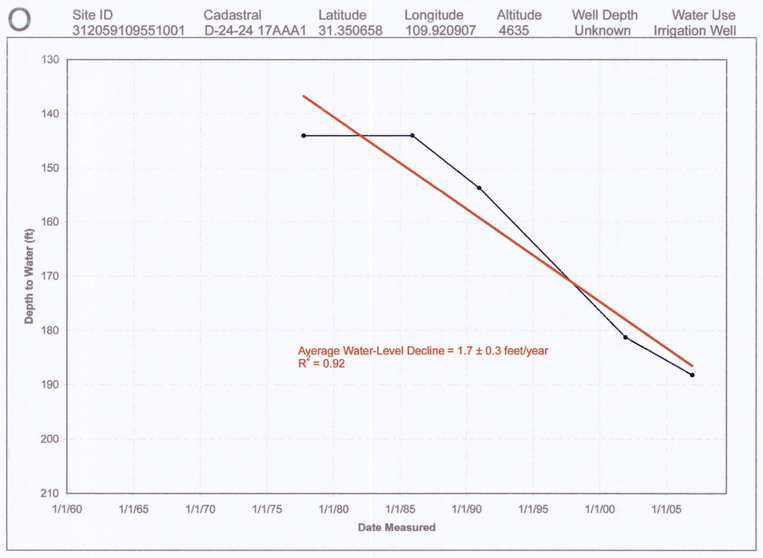
N

Site ID	Cadastral	Latitude	Longitude	Altitude	Well Depth	Water Use
312250110063901	D-23-22 33DCD	31.380018	110.110327	4225	91.5	Unused Well



O

Site ID	Cadastral	Latitude	Longitude	Altitude	Well Depth	Water Use
312059109551001	D-24-24 17AAA1	31.350658	109.920907	4635	Unknown	Irrigation Well



Note: R^2 is an indicator of the goodness of a linear fit ranging from 0 to 1. A value of 1 corresponds to a perfect fit and a value of 0 indicates no correlation in the data. The linear trend is shown in orange for all hydrographs with an R^2 greater than 0.7.

HYDROGRAPHS OF SELECTED WELLS

WATER-LEVEL CONDITIONS IN THE UPPER SAN PEDRO BASIN, ARIZONA, 2006

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