

Memorandum

To: File

CC:

From: Chris Garrett, SWCA

Date: December 26, 2012

Re: Documentation of Background Groundwater Fluctuations along Cienega Creek and Empire Gulch

The purpose of this memo is to document hydrographs reviewed for several wells located along Cienega Creek and Empire Gulch. The groundwater level data reviewed were obtained from the Arizona Department of Water Resources Groundwater Site Inventory (<https://gisweb.azwater.gov/gwsi/Default.aspx>) accessed December 26, 2012.

The following wells with at least three measured water levels over time were reviewed:

Cadastral Location	Registration No.	Location	Number of Water Levels	Approximate Depth-to-Water Range (Excluding Outliers)*	Date Range	Total Range over Period of Measurement (feet)
D-18-17 26DCA	634324	Cienega Creek	3	34.6 – 36.8	1997 - 2005	2.2
D-18-17 33ADA	616221	Cienega Creek	9	92.5 – 95.8	1982 - 2012	3.3
D-19-17 03DDD		Cienega Creek	3	1.9 – 5.2	1982 - 2005	3.3
D-19-17 15BCA	608613	Cienega Creek	3	74.1 – 76.3	1982 - 2005	2.2
D-19-17 21CCD	634300	Cienega Creek	3	9.4 – 14.2	1982 - 2005	4.8
D-19-17 21DDD	608611	Cienega Creek	3	42.5 – 43.9	1982 - 2005	1.4
D-19-17 28ACB	634297	Cienega Creek	3	31.5 – 36.8	1982 - 2005	5.3
D-20-17 02CCC	608620	Cienega Creek	5	40.0 – 44.1	1970 - 2012	4.1
D-20-17 10DAB	634295	Cienega Creek	5	31.9 – 37.5	1972 - 2005	5.6
D-20-17 11BBB		Cienega Creek	3	39.6 – 41.0	1972 - 1987	1.4
D-20-17 15CCA		Cienega Creek	8	96.0 – 99.4	1952 - 1954	3.4
D-19-16 14BDD	634317	Empire Gulch	3	96.5 – 99.0	1982 - 2005	2.5
D-19-16 15ABA	646557	Empire Gulch	35	202.0 – 207.0	1952 - 2012	5.0
D-19-17 10BCD	608606	Empire Gulch	3	34.1 – 35.3	1982 - 2005	1.2
D-19-17 16ACA	634303	Empire Gulch	3	25.9 – 27.2	1982 - 2005	1.3
D-19-17 17BBD	608628	Empire Gulch	15	26.9 – 31.2	1982 - 2006	4.3
D-19-17 08BCB	634285	Oaktree Canyon	11	118.1 – 123.0	1972 - 2012	4.9
D-19-17 09ABB	608612	Oaktree Canyon	11	50.7 – 55.3	1982 - 2012	4.6

* Outliers typically include pumping water levels, which are usually but not always identified in the ADWR GWSI database.

It should be noted that the depth of the wells and source of water (i.e., shallow alluvial versus hardrock) has not been analyzed. Some wells are very likely associated with shallow alluvial aquifers, while others clearly exhibit deeper water levels that would have no connection to or association with shallow riparian zones. Rather, the purpose of this analysis is to determine the approximate range of background water fluctuations, excluding pumping, that occur due to natural seasonal and climatic variations.

Along Cienega Creek, the average range of background fluctuation is just over 3 feet, from as little as 1.4 feet to as high as 5.6 feet. The most useful wells have 5 or more water levels taken over the course of several decades and exhibit similar ranges: 3.3 feet (well #616221), 4.1 feet (well #608620), and 5.6 feet (well #634295).

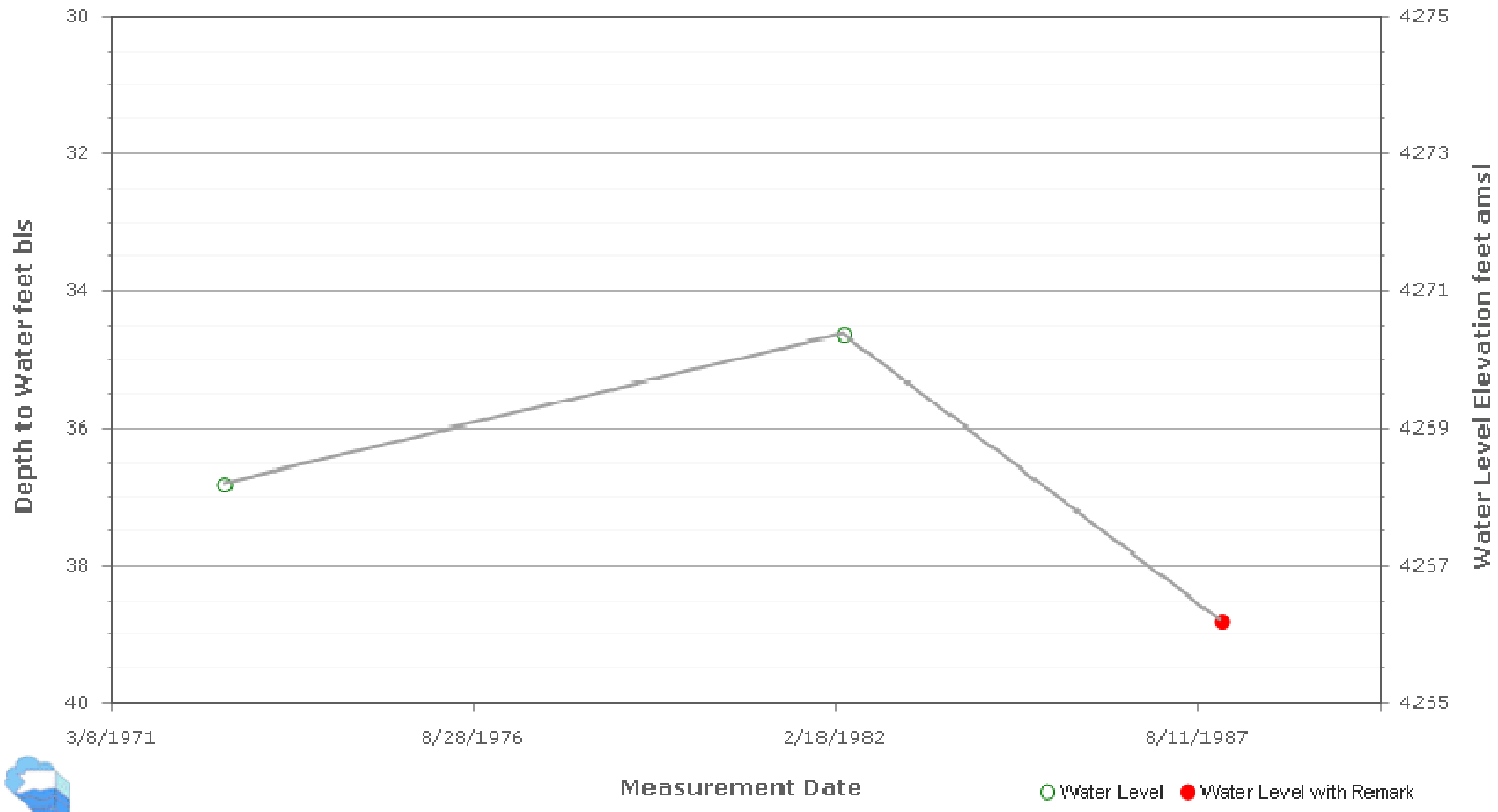
Along Empire Gulch, the average range of background fluctuation is just under 3 feet, from as little as 1.2 feet to 5 feet. The most useful wells exhibit ranges of 4.3 feet (well #608628), and 5 feet (well #646557).

Well Info Map Reset Graph Auto Site Hydrograph Email Help

Arizona GroundWater Monitoring Site Hydrograph

Local ID	Site ID	Registry ID	Latitude NAD27	Longitude NAD27	Alt. (ft amsl)	Water Use	Well Depth (ft)	Case Dia. (in)	Drill Date	Latest WL Date	DTW (ft)	WL Elev. (ft)
D-18-17 26DCA	314958110343901	634324	31° 50' 9.8"	110° 34' 29.8"	4305	STOCK	154	6		3/24/1982	34.62	4270.38

Set x-axis
Set y-axis
Measurement Remarks



GWSI is ADWR's technical database of well locations, construction data, and water levels.

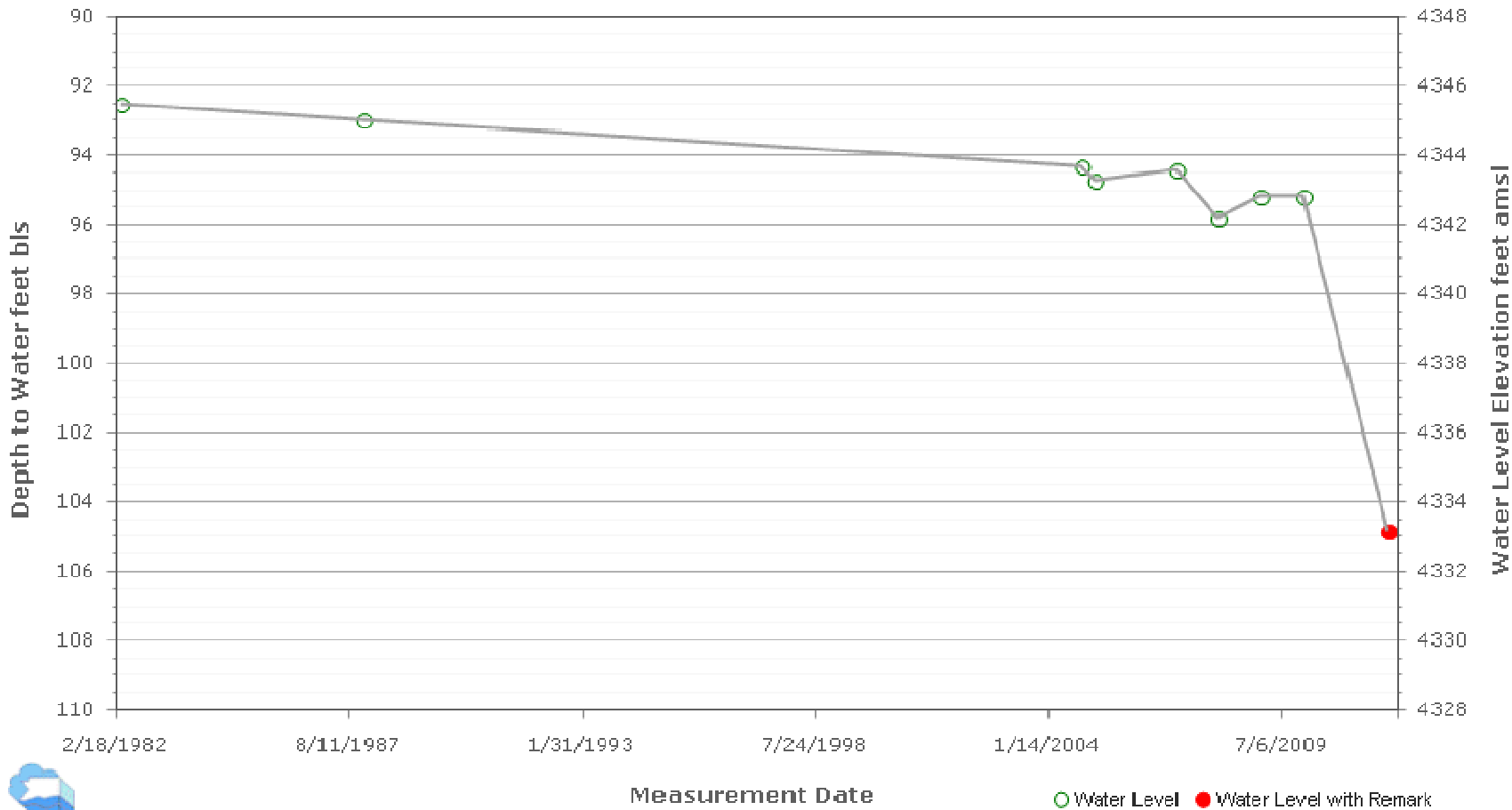
Created on 12/26/2012

Well Info Map Reset Graph Auto Site Hydrograph Email Help

Arizona GroundWater Monitoring Site Hydrograph

Local ID	Site ID	Registry ID	Latitude NAD27	Longitude NAD27	Alt. (ft amsl)	Water Use	Well Depth (ft)	Case Dia. (in)	Drill Date	Latest WL Date	DTW (ft)	WL Elev. (ft)
D-18-17 33ADA	314937110362301	616221	31°49' 37.6"	110°36' 22.5"	4438	STOCK	127	6		1/11/2010	95.2	4342.8

Set x-axis
Set y-axis
Measurement Remarks



GWSI is ADWR's technical database of well locations, construction data, and water levels.

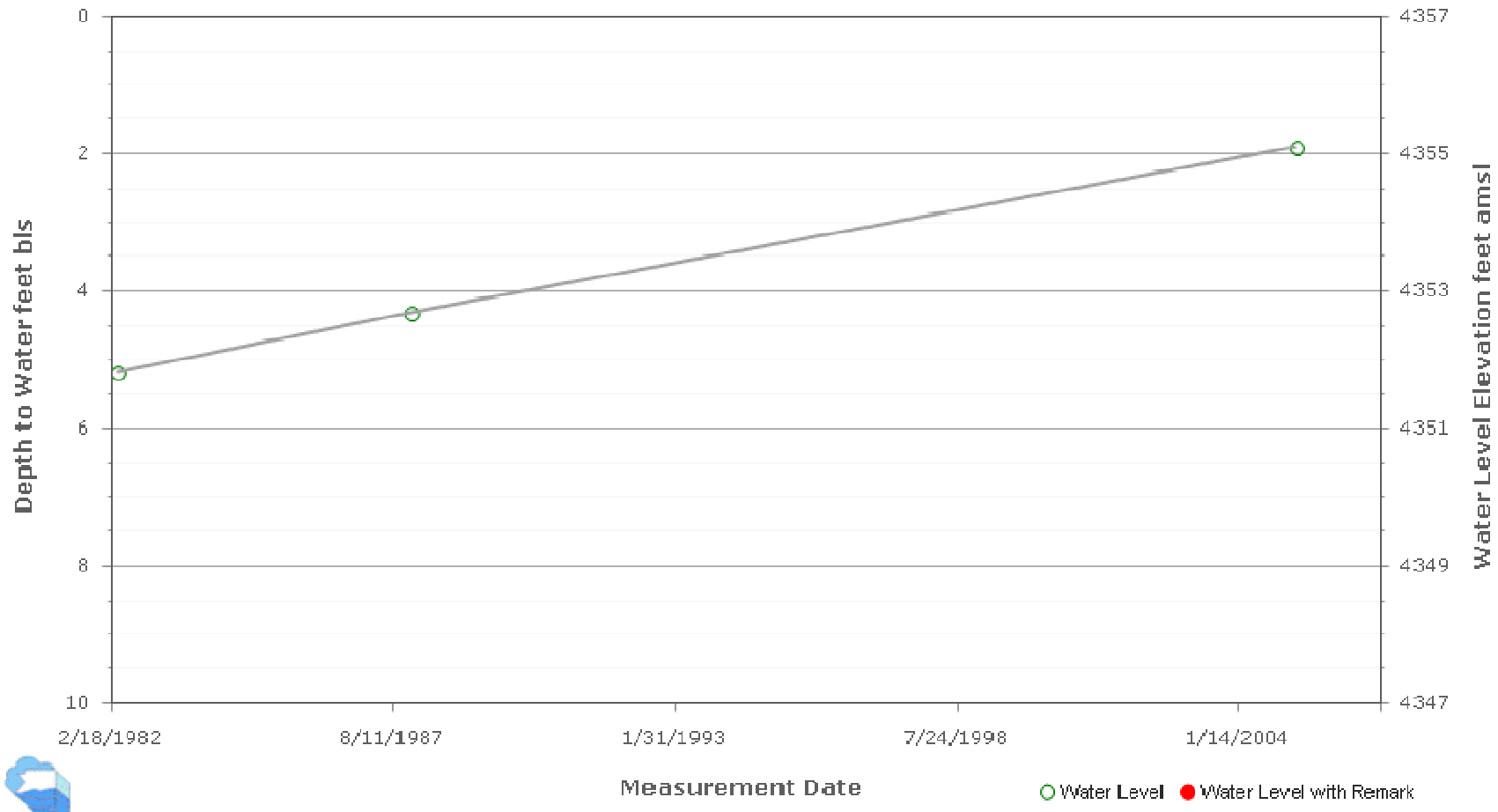
Created on 12/26/2012

Well Info Map Reset Graph Auto Site Hydrograph Email Help

Arizona GroundWater Monitoring Site Hydrograph

Local ID	Site ID	Registry ID	Latitude NAD27	Longitude NAD27	Alt. (ft amsl)	Water Use	Well Depth (ft)	Case Dia. (in)	Drill Date	Latest WL Date	DTW (ft)	WL Elev. (ft)
D-19-17 03DDD	314814110351701		31°48' 13.8"	110°35' 17.7"	4357	UNUSED		8		2/15/2005	1.9	4355.1

Set x-axis
Set y-axis
Measurement Remarks



GWSI is ADWR's technical database of well locations, construction data, and water levels.

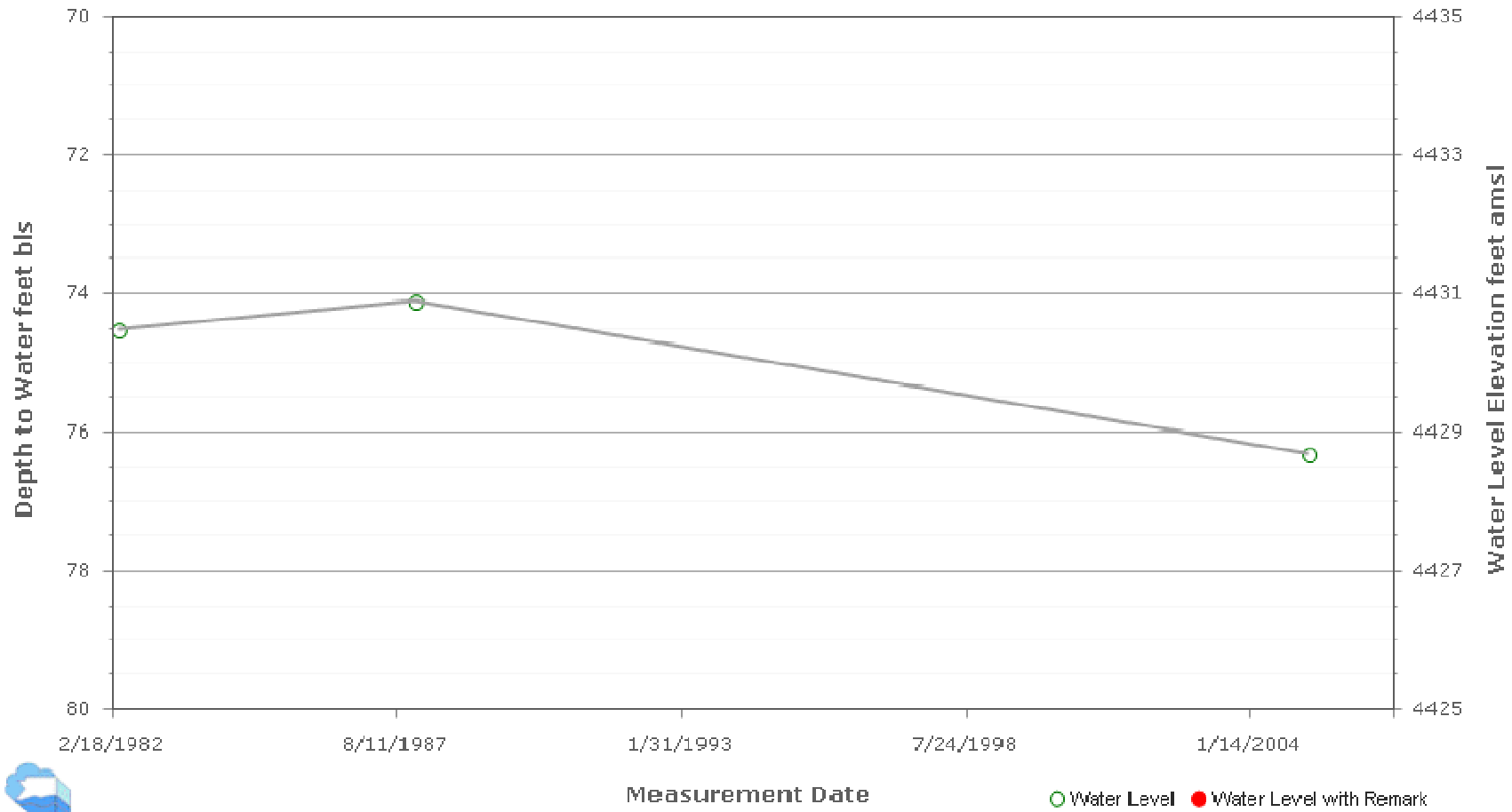
Created on 12/26/2012

Well Info Map Reset Graph Auto Site Hydrograph Email Help

Arizona GroundWater Monitoring Site Hydrograph

Local ID	Site ID	Registry ID	Latitude NAD27	Longitude NAD27	Alt. (ft amsl)	Water Use	Well Depth (ft)	Case Dia. (in)	Drill Date	Latest WL Date	DTW (ft)	WL Elev. (ft)
D-19-17 15BCA	314704110360301	608613	31° 47' 6.0"	110° 36' 4.5"	4505	UNUSED	1210	8		2/17/2005	76.3	4428.7

Set x-axis
Set y-axis
Measurement Remarks



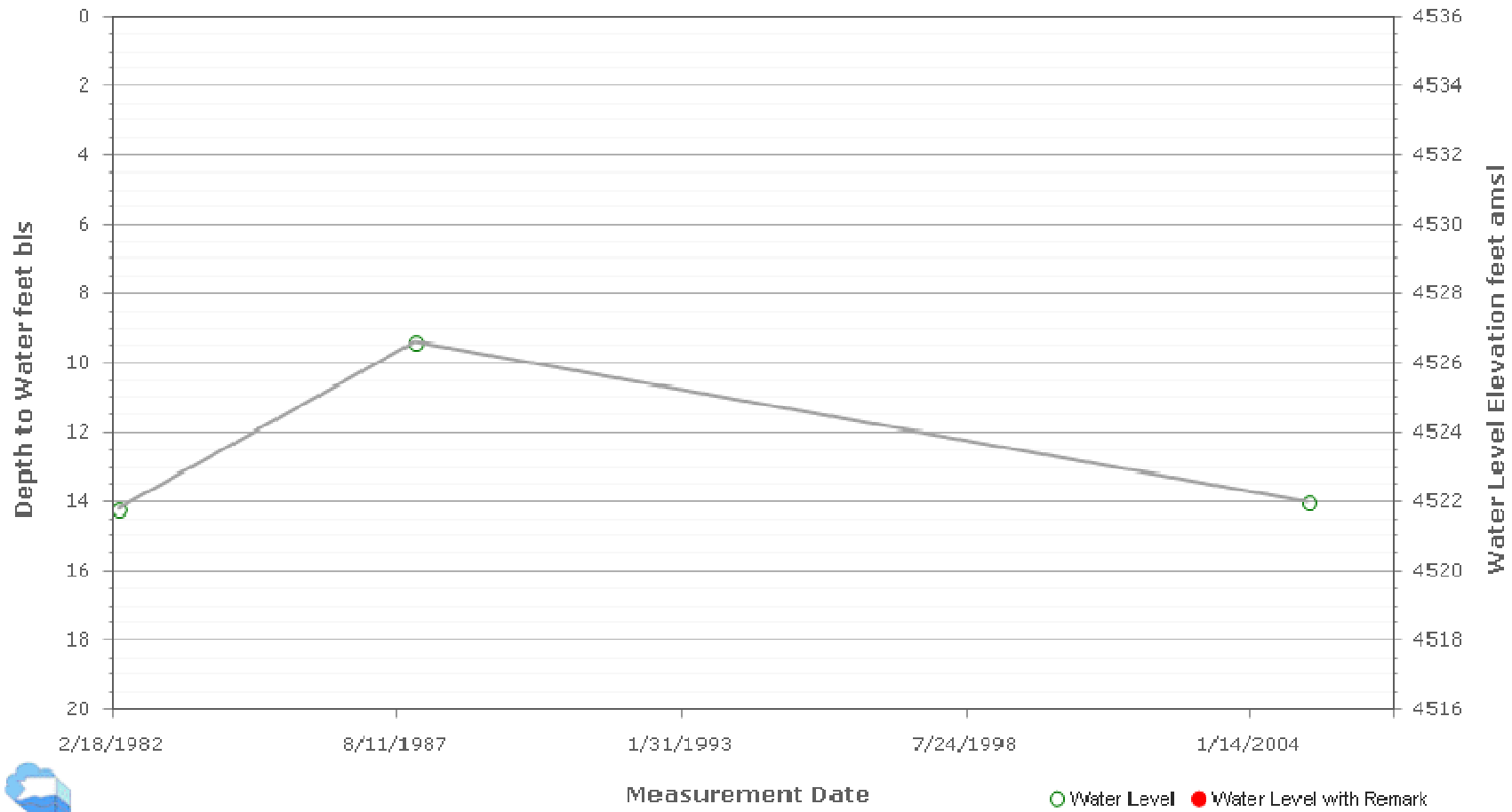
GWSI is ADWR's technical database of well locations, construction data, and water levels. Created on 12/26/2012

Well Info Map Reset Graph Auto Site Hydrograph Email Help

Arizona GroundWater Monitoring Site Hydrograph

Local ID	Site ID	Registry ID	Latitude NAD27	Longitude NAD27	Alt. (ft amsl)	Water Use	Well Depth (ft)	Case Dia. (in)	Drill Date	Latest WL Date	DTW (ft)	WL Elev. (ft)
D-19-17 21CCD	314540110370601	634300	31° 45' 40.8"	110° 37' 6.9"	4536	STOCK	117	6		2/15/2005	14	4522

Set x-axis
Set y-axis
Measurement Remarks



GWSI is ADWR's technical database of well locations, construction data, and water levels.

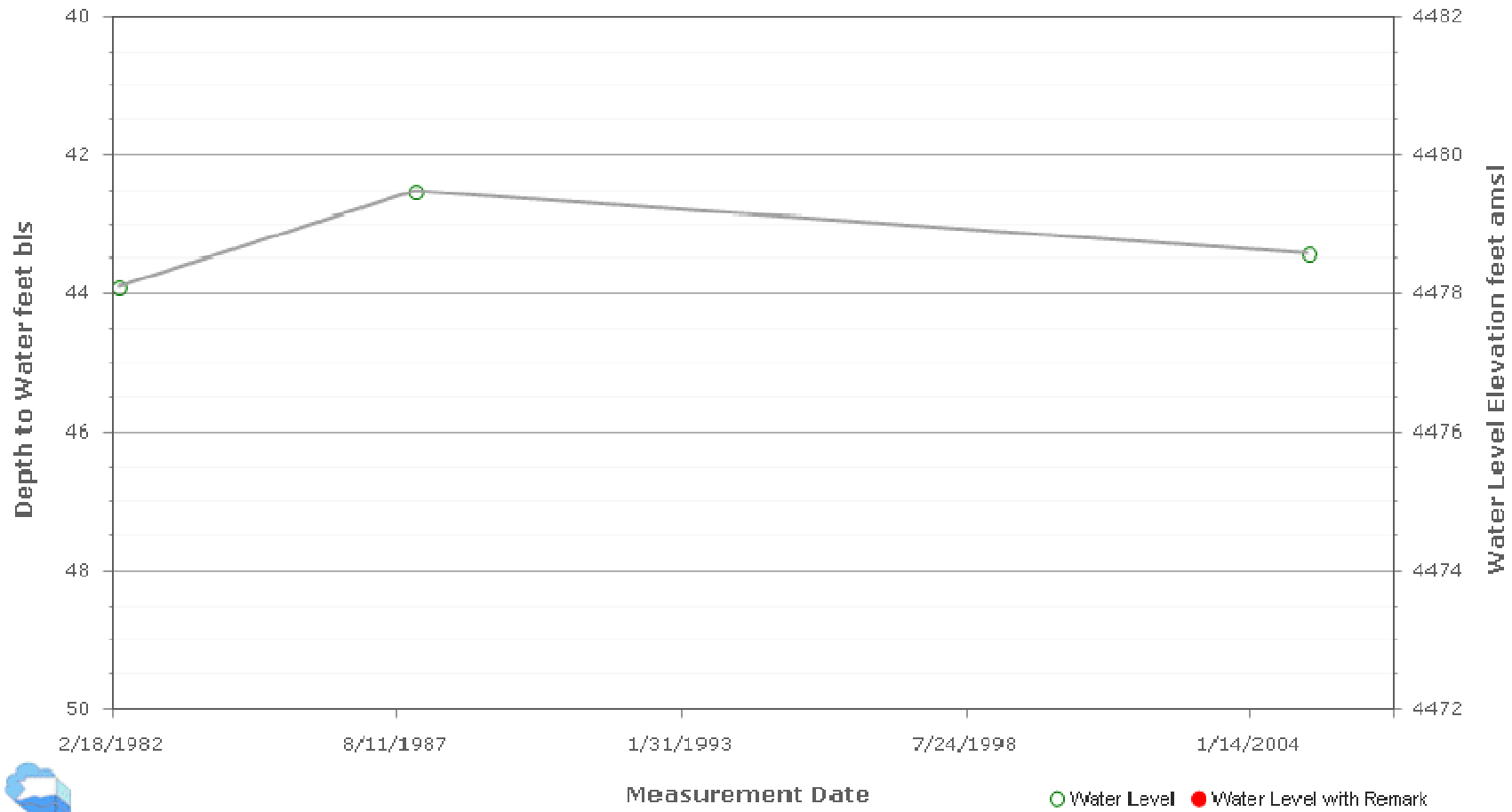
Created on 12/26/2012

Well Info Map Reset Graph Auto Site Hydrograph Email Help

Arizona GroundWater Monitoring Site Hydrograph

Local ID	Site ID	Registry ID	Latitude NAD27	Longitude NAD27	Alt. (ft amsl)	Water Use	Well Depth (ft)	Case Dia. (in)	Drill Date	Latest WL Date	DTW (ft)	WL Elev. (ft)
D-19-17 21DDD	314537110361901	608611	31°45' 37.0"	110°36' 18.9"	4522	UNUSED	1480	10.75	9/21/1974	2/15/2005	43.4	4478.6

Set x-axis
Set y-axis
Measurement Remarks



GWSI is ADWR's technical database of well locations, construction data, and water levels.

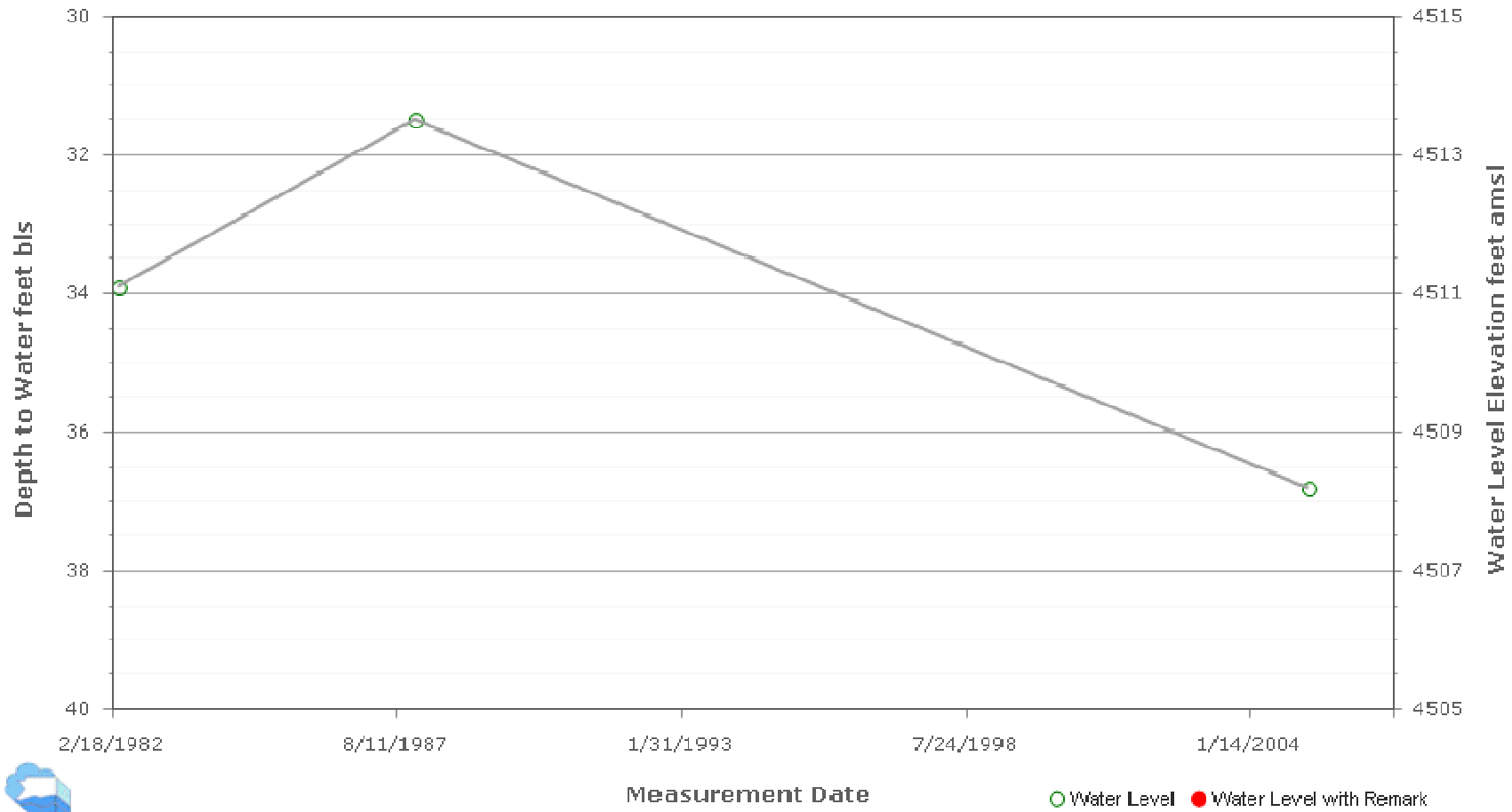
Created on 12/26/2012

Well Info Map Reset Graph Auto Site Hydrograph Email Help

Arizona GroundWater Monitoring Site Hydrograph

Local ID	Site ID	Registry ID	Latitude NAD27	Longitude NAD27	Alt. (ft amsl)	Water Use	Well Depth (ft)	Case Dia. (in)	Drill Date	Latest WL Date	DTW (ft)	WL Elev. (ft)
D-19-17 28ACB	314522110364201	634297	31°45' 20.8"	110°36' 41.6"	4545	DOMESTIC		6		2/15/2005	36.8	4508.2

Set x-axis
Set y-axis
Measurement Remarks



GWSI is ADWR's technical database of well locations, construction data, and water levels.

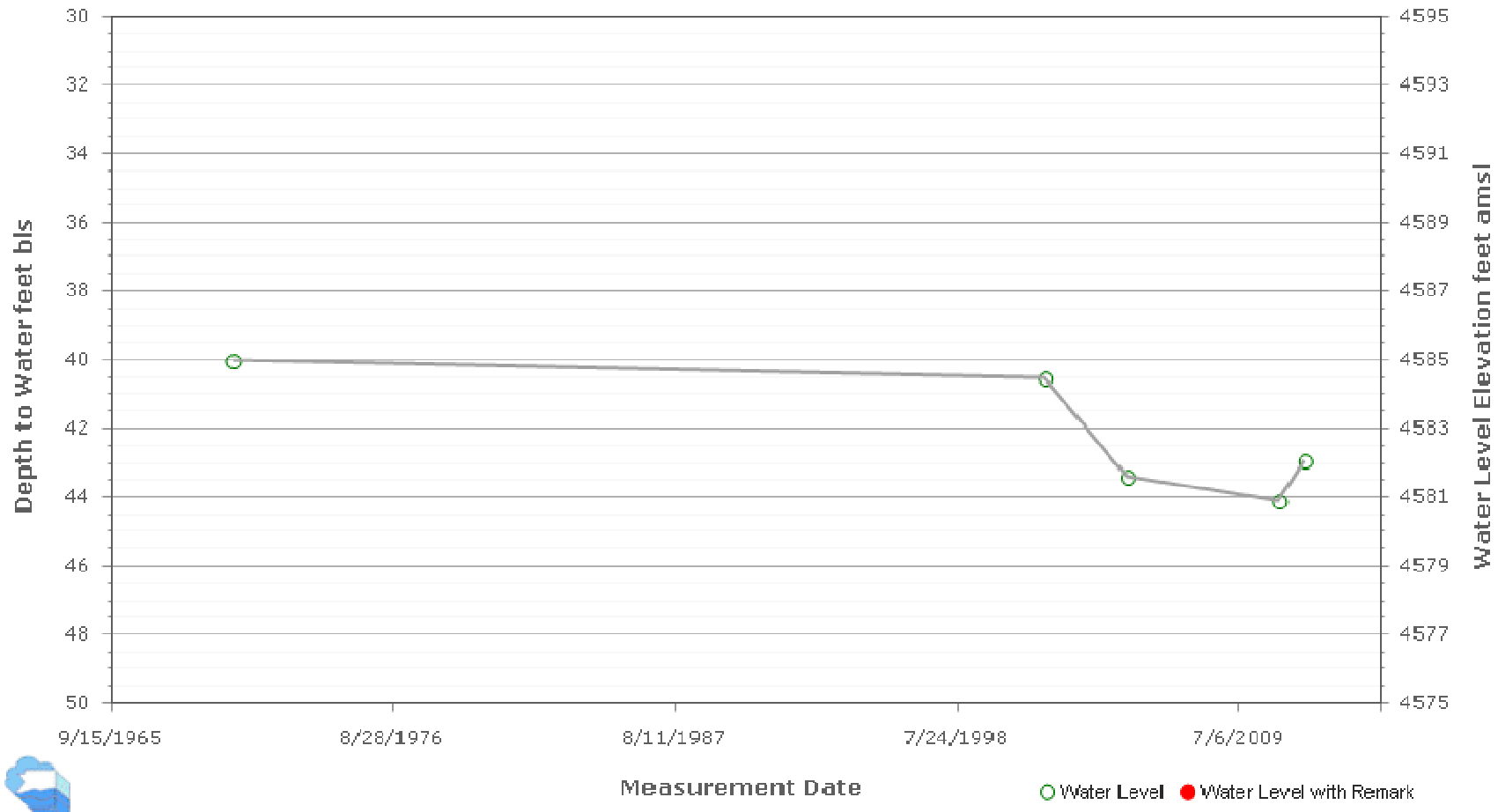
Created on 12/26/2012

Well Info Map Reset Graph Auto Site Hydrograph Email Help

Arizona GroundWater Monitoring Site Hydrograph

Local ID	Site ID	Registry ID	Latitude NAD27	Longitude NAD27	Alt. (ft amsl)	Water Use	Well Depth (ft)	Case Dia. (in)	Drill Date	Latest WL Date	DTW (ft)	WL Elev. (ft)
D-20-17 02CCC	314301110350901	608620	31° 43' .8"	110° 35' 13.1"	4625	STOCK	755	12	5/22/1970	1/10/2012	42.9	4582.1

Set x-axis
Set y-axis
Measurement Remarks



GWSI is ADWR's technical database of well locations, construction data, and water levels.

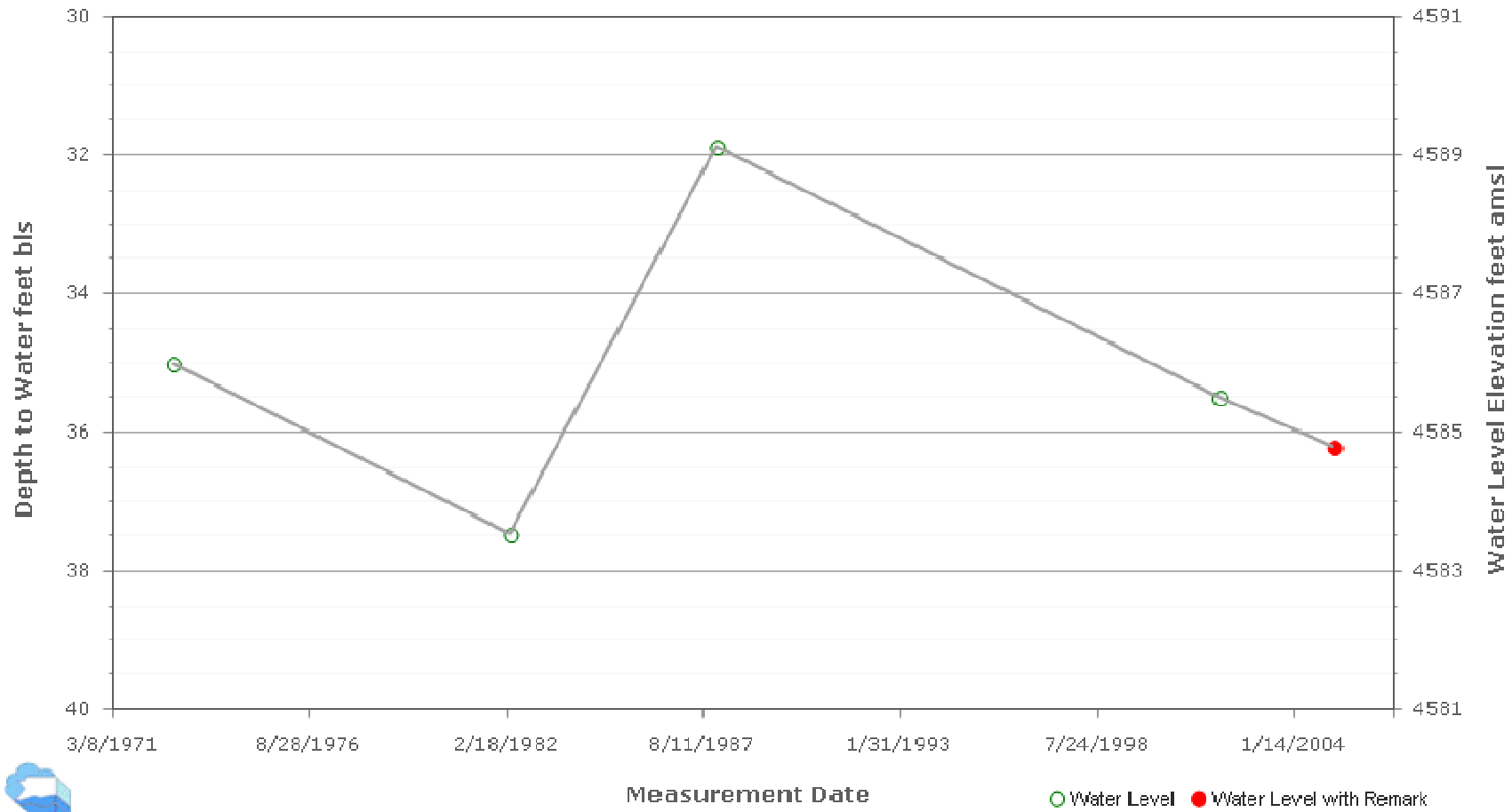
Created on 12/26/2012

Well Info Map Reset Graph Auto Site Hydrograph Email Help

Arizona GroundWater Monitoring Site Hydrograph

Local ID	Site ID	Registry ID	Latitude NAD27	Longitude NAD27	Alt. (ft amsl)	Water Use	Well Depth (ft)	Case Dia. (in)	Drill Date	Latest WL Date	DTW (ft)	WL Elev. (ft)
D-20-17 10DAB	314232110352401	634295	31°42' 34.0"	110°35' 21.7"	4621	STOCK	139	48		12/3/2001	35.5	4585.5

Set x-axis
Set y-axis
Measurement Remarks



GWSI is ADWR's technical database of well locations, construction data, and water levels.

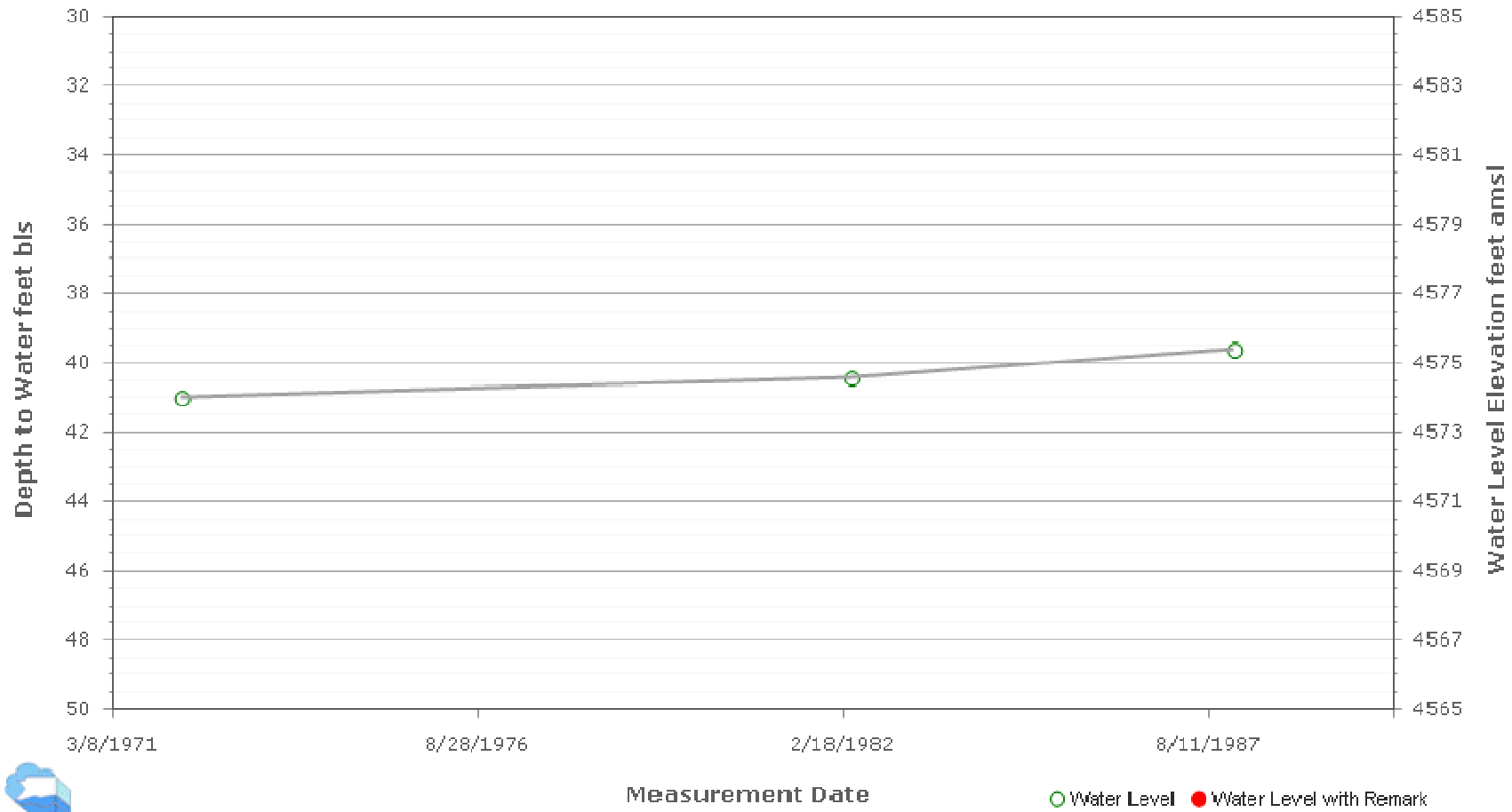
Created on 12/26/2012

Well Info Map Reset Graph Auto Site Hydrograph Email Help

Arizona GroundWater Monitoring Site Hydrograph

Local ID	Site ID	Registry ID	Latitude NAD27	Longitude NAD27	Alt. (ft amsl)	Water Use	Well Depth (ft)	Case Dia. (in)	Drill Date	Latest WL Date	DTW (ft)	WL Elev. (ft)
D-20-17 11BBB	314259110350901		31°42' 59.0"	110°35' 9.0"	4615	STOCK		10		12/16/1987	39.6	4575.4

Set x-axis
Set y-axis
Measurement Remarks



GWSI is ADWR's technical database of well locations, construction data, and water levels.

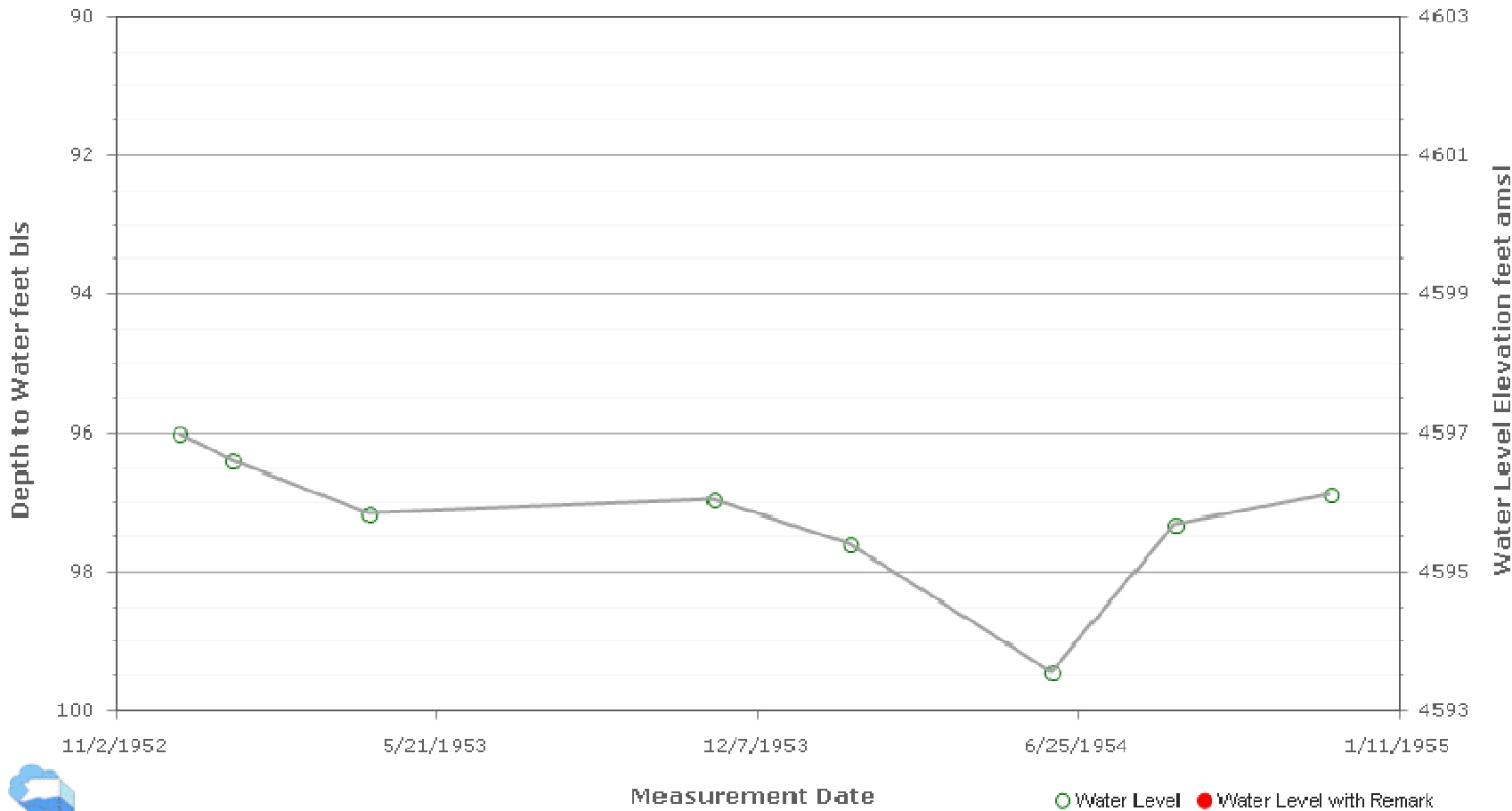
Created on 12/26/2012

Well Info Map Reset Graph Auto Site Hydrograph Email Help

Arizona GroundWater Monitoring Site Hydrograph

Local ID	Site ID	Registry ID	Latitude NAD27	Longitude NAD27	Alt. (ft amsl)	Water Use	Well Depth (ft)	Case Dia. (in)	Drill Date	Latest WL Date	DTW (ft)	WL Elev. (ft)
D-20-17 15CCA	314127110360801		31° 41' 27.0"	110° 36' 8.0"	4693	STOCK	140	6	1/1/1918	11/29/1954	96.86	4596.14

Set x-axis
Set y-axis
Measurement Remarks



GWSI is ADWR's technical database of well locations, construction data, and water levels.

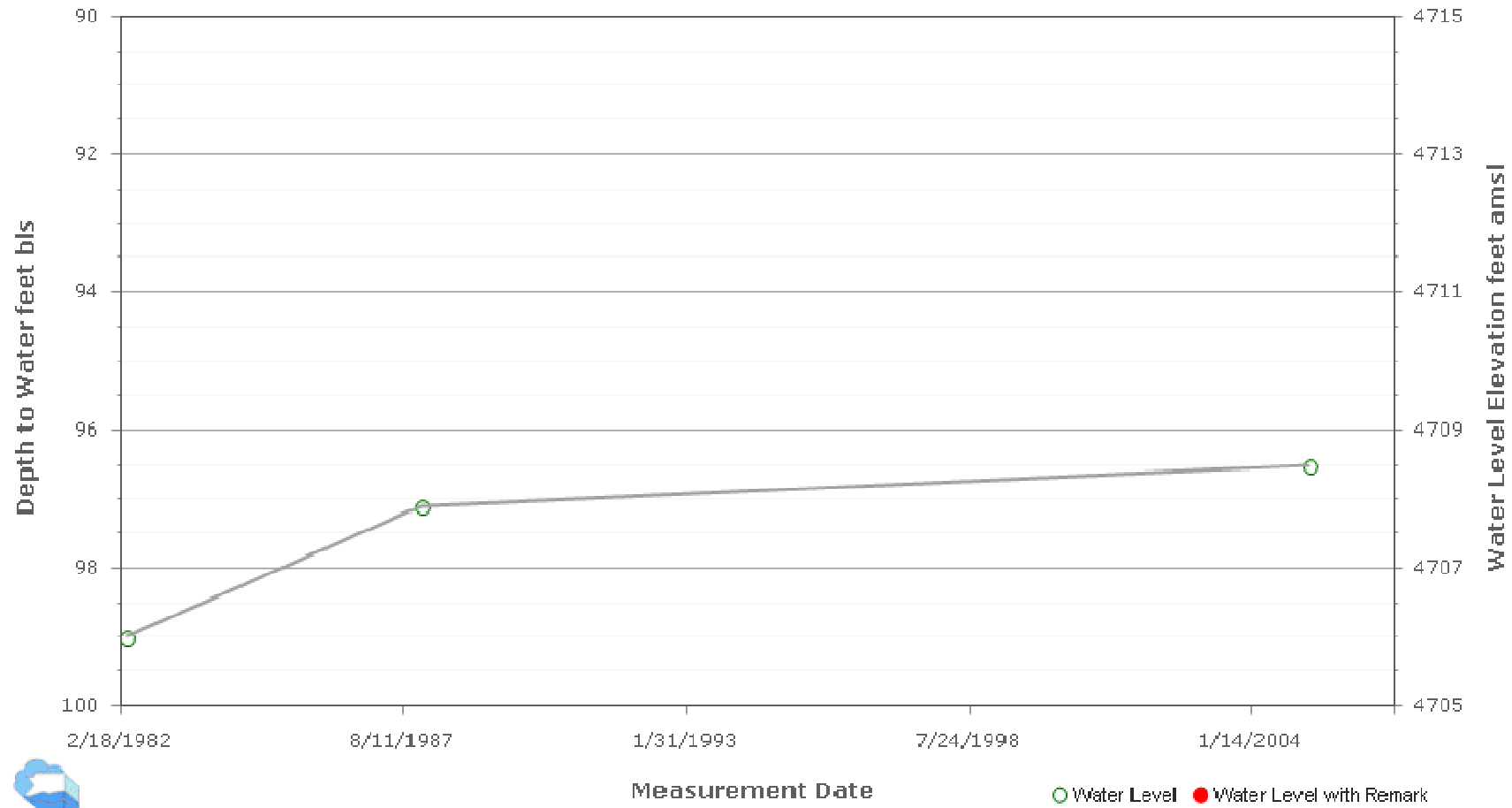
Created on 12/26/2012

Well Info Map Reset Graph Auto Site Hydrograph Email Help

Arizona GroundWater Monitoring Site Hydrograph

Local ID	Site ID	Registry ID	Latitude NAD27	Longitude NAD27	Alt. (ft amsl)	Water Use	Well Depth (ft)	Case Dia. (in)	Drill Date	Latest WL Date	DTW (ft)	WL Elev. (ft)
D-19-16 14BDD	314657110405401	634317	31°46' 58.0"	110°40' 53.7"	4805	STOCK	260	48		2/14/2005	96.5	4708.5

Set x-axis
Set y-axis
Measurement Remarks



GWSI is ADWR's technical database of well locations, construction data, and water levels.

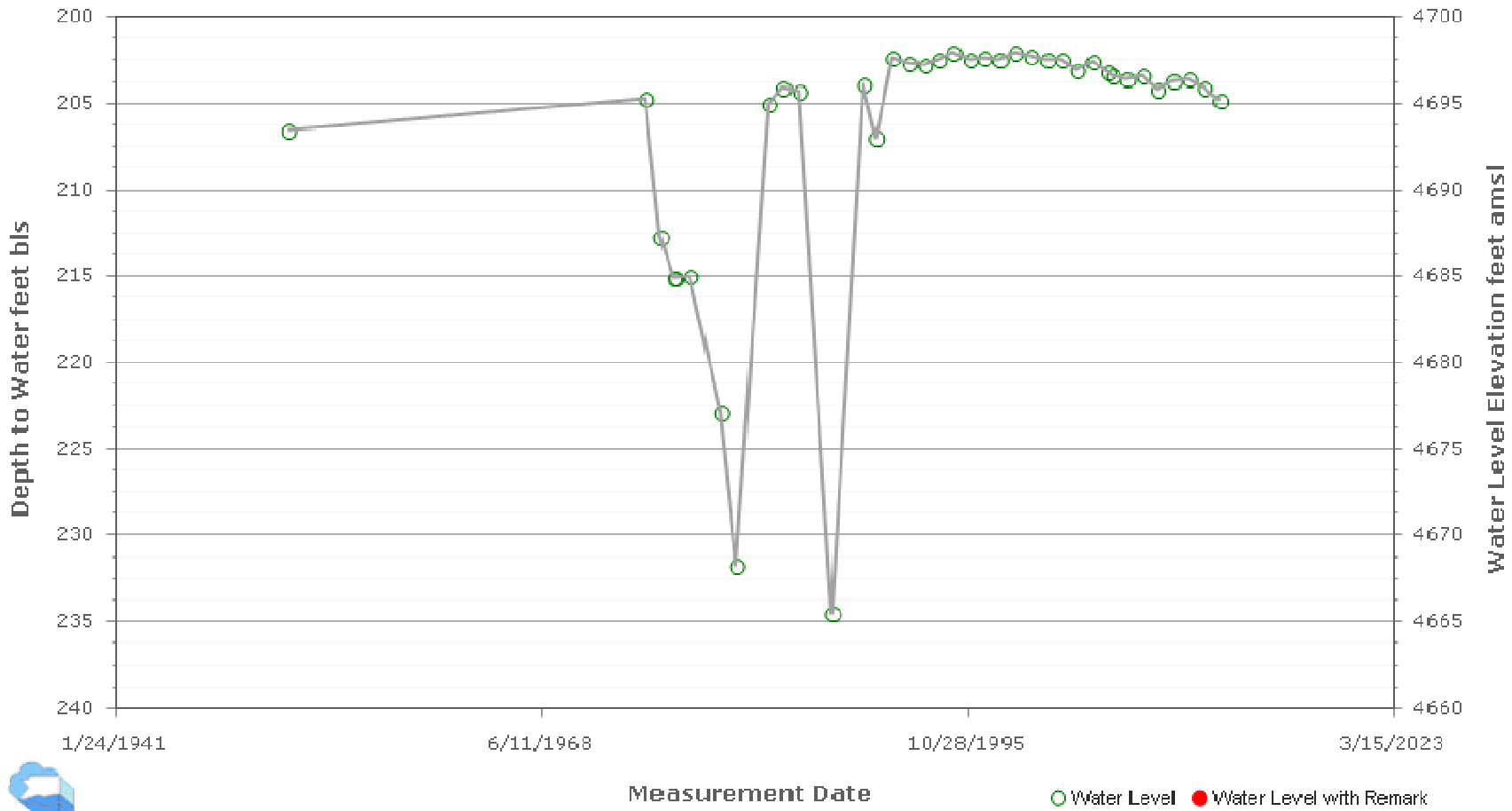
Created on 12/26/2012

Well Info Map Reset Graph Auto Site Hydrograph Email Help

Arizona GroundWater Monitoring Site Hydrograph

Local ID	Site ID	Registry ID	Latitude NAD27	Longitude NAD27	Alt. (ft amsl)	Water Use	Well Depth (ft)	Case Dia. (in)	Drill Date	Latest WL Date	DTW (ft)	WL Elev. (ft)
D-19-16 15ABA	314718110413801	646557	31°47' 15.6"	110°41' 40.1"	4900	UNUSED	300	6		1/9/2012	204.8	4695.2

Set x-axis
Set y-axis
Measurement Remarks



GWSI is ADWR's technical database of well locations, construction data, and water levels.

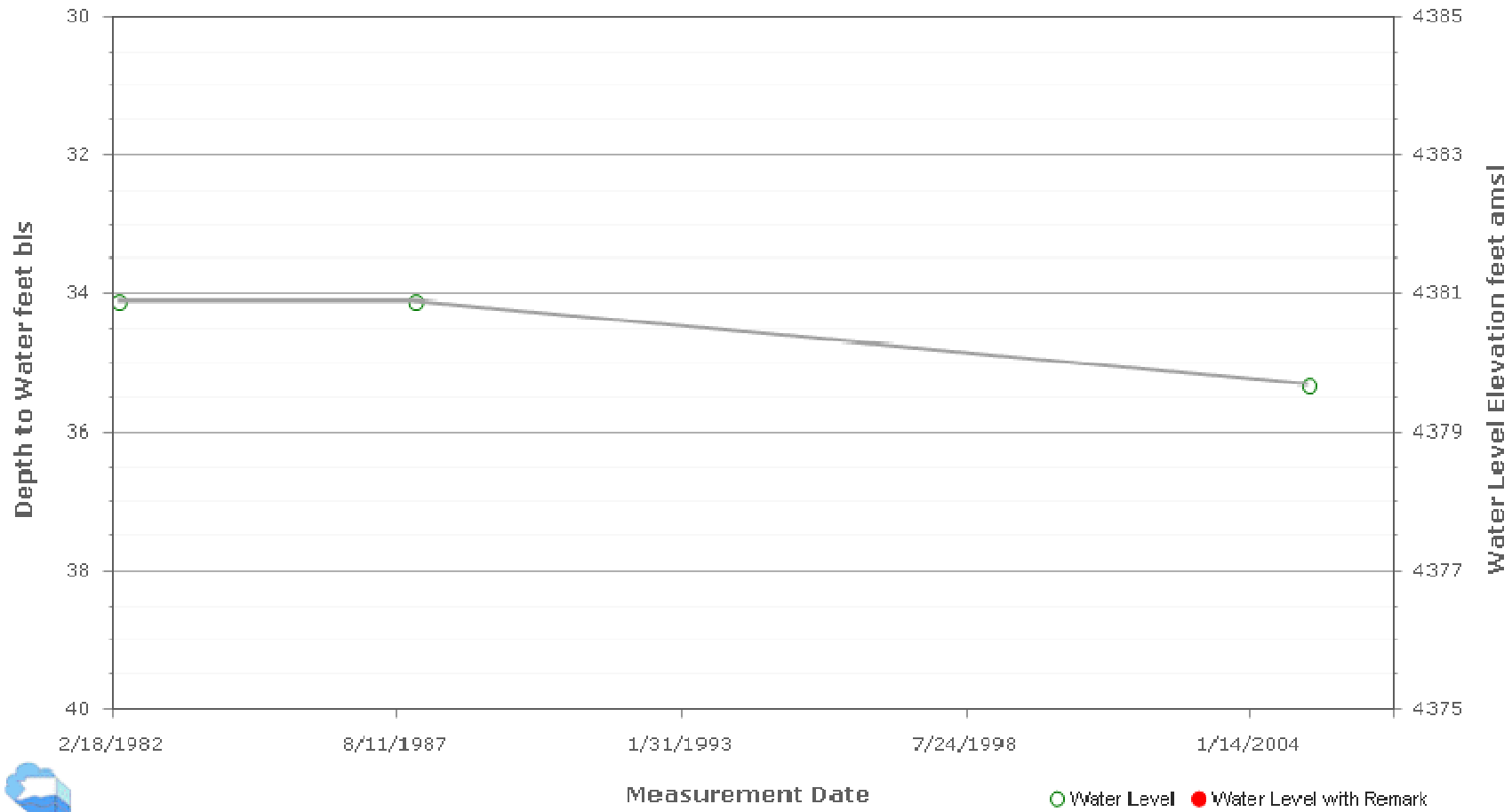
Created on 12/26/2012

Well Info Map Reset Graph Auto Site Hydrograph Email Help

Arizona GroundWater Monitoring Site Hydrograph

Local ID	Site ID	Registry ID	Latitude NAD27	Longitude NAD27	Alt. (ft amsl)	Water Use	Well Depth (ft)	Case Dia. (in)	Drill Date	Latest WL Date	DTW (ft)	WL Elev. (ft)
D-19-17 10BCD	314756110360601	608606	31°47' 52.5"	110°36' .2"	4415	UNUSED	1250	30	3/20/1975	2/15/2005	35.3	4379.7

Set x-axis
Set y-axis
Measurement Remarks



GWSI is ADWR's technical database of well locations, construction data, and water levels.

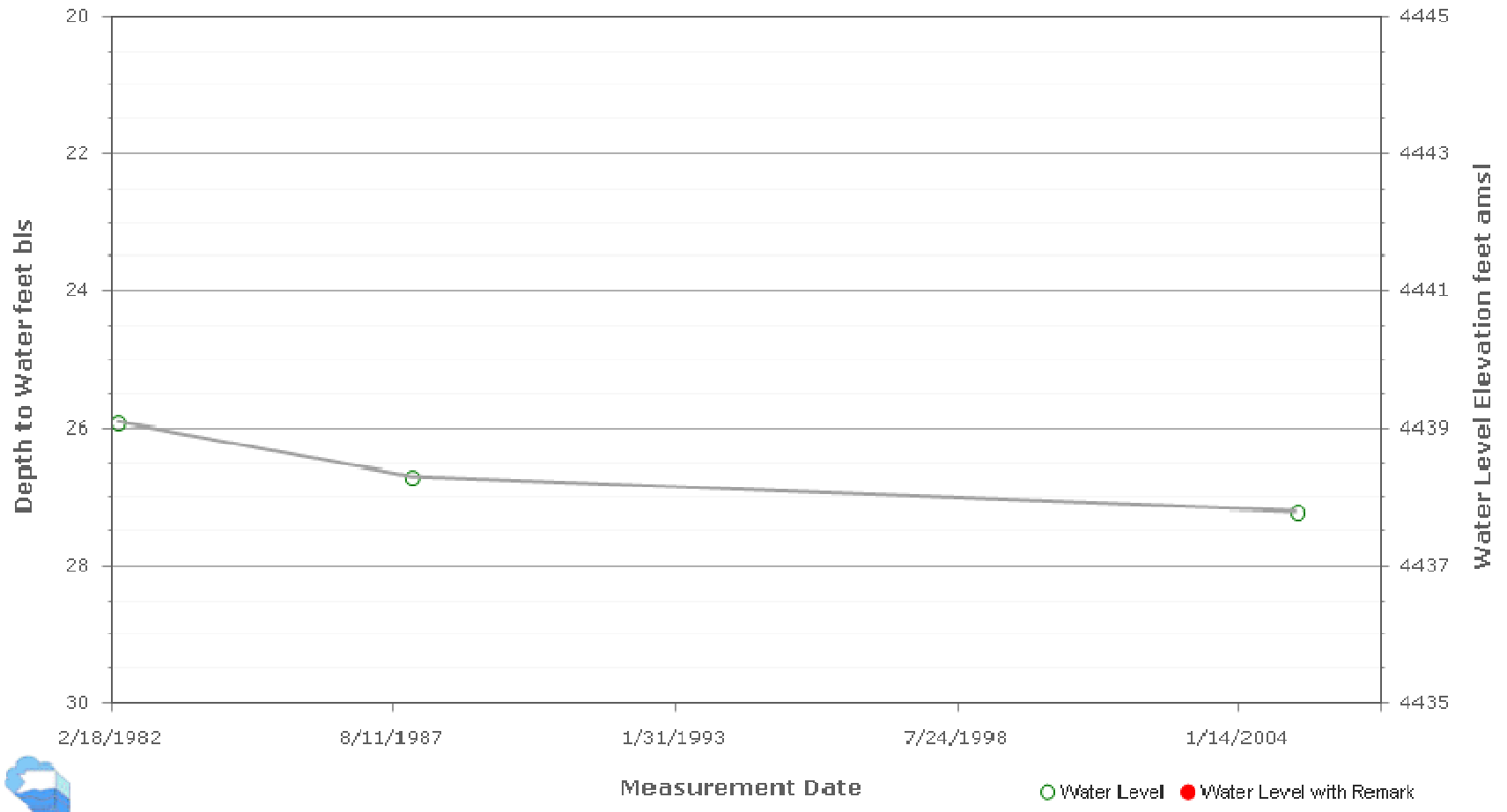
Created on 12/26/2012

Well Info Map Reset Graph Auto Site Hydrograph Email Help

Arizona GroundWater Monitoring Site Hydrograph

Local ID	Site ID	Registry ID	Latitude NAD27	Longitude NAD27	Alt. (ft amsl)	Water Use	Well Depth (ft)	Case Dia. (in)	Drill Date	Latest WL Date	DTW (ft)	WL Elev. (ft)
D-19-17 16ACA	314707110363401	634303	31° 47' 5.6"	110° 36' 34.5"	4465	STOCK	130	6		2/17/2005	27.2	4437.8

Set x-axis
Set y-axis
Measurement Remarks



GWSI is ADWR's technical database of well locations, construction data, and water levels.

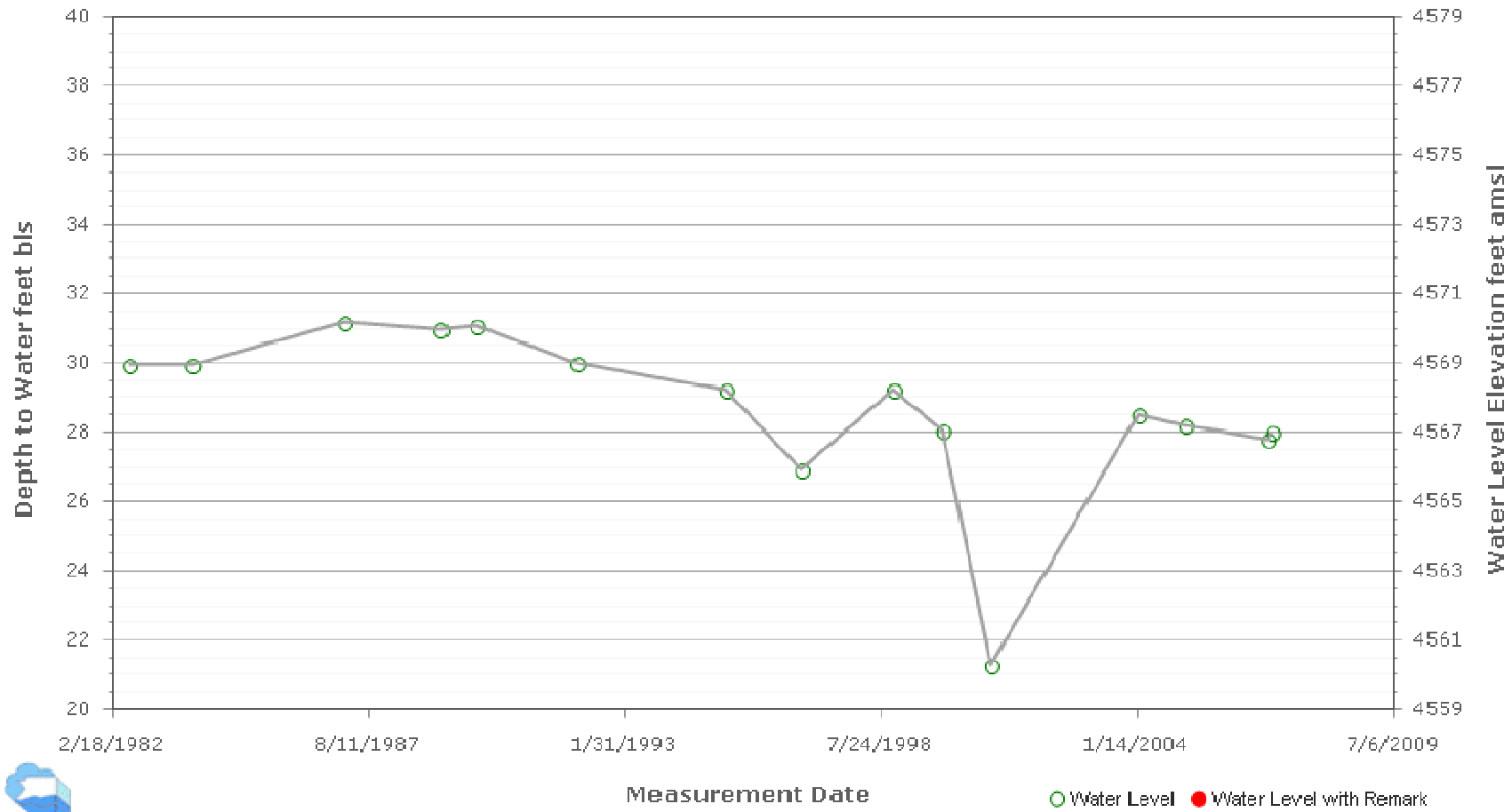
Created on 12/26/2012

Well Info Map Reset Graph Auto Site Hydrograph Email Help

Arizona GroundWater Monitoring Site Hydrograph

Local ID	Site ID	Registry ID	Latitude NAD27	Longitude NAD27	Alt. (ft amsl)	Water Use	Well Depth (ft)	Case Dia. (in)	Drill Date	Latest WL Date	DTW (ft)	WL Elev. (ft)
D-19-17 17BBD	314719110383001	608628	31°47' 16.5"	110°37' 58.9"	4539	STOCK	845	12	4/21/1970	11/29/2006	-28	4567

Set x-axis
Set y-axis
Measurement Remarks



GWSI is ADWR's technical database of well locations, construction data, and water levels.

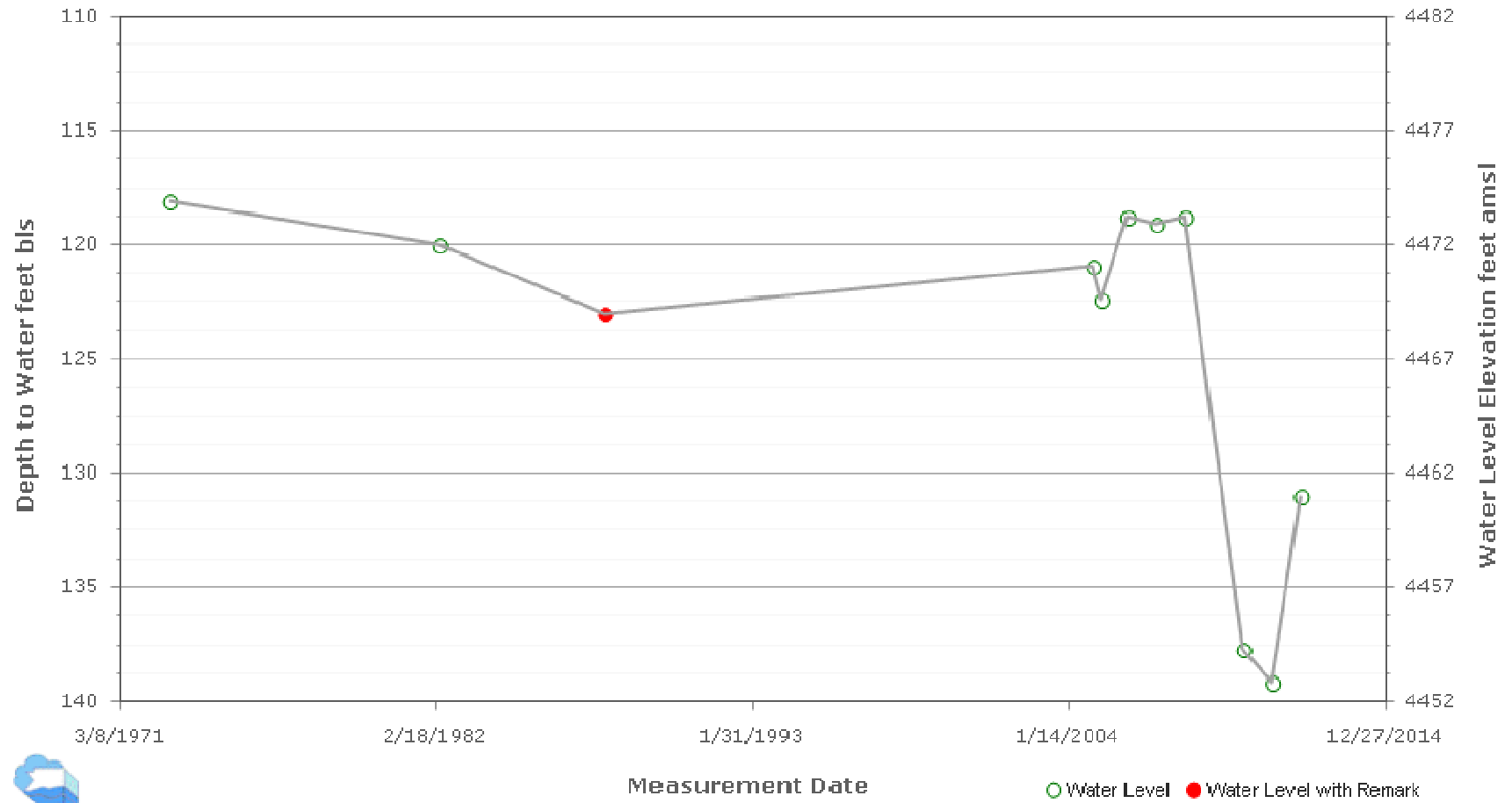
Created on 12/26/2012

Well Info Map Reset Graph Auto Site Hydrograph Email Help

Arizona GroundWater Monitoring Site Hydrograph

Local ID	Site ID	Registry ID	Latitude NAD27	Longitude NAD27	Alt. (ft amsl)	Water Use	Well Depth (ft)	Case Dia. (in)	Drill Date	Latest WL Date	DTW (ft)	WL Elev. (ft)
D-19-17 08BCB	314759110381001	634285	31°47' 58.4"	110°38' 10.1"	4592	STOCK	211	5		1/10/2012	131	4461

Set x-axis
Set y-axis
Measurement Remarks



GWSI is ADWR's technical database of well locations, construction data, and water levels.

Created on 12/26/2012

Well Info Map Reset Graph Auto Site Hydrograph Email Help

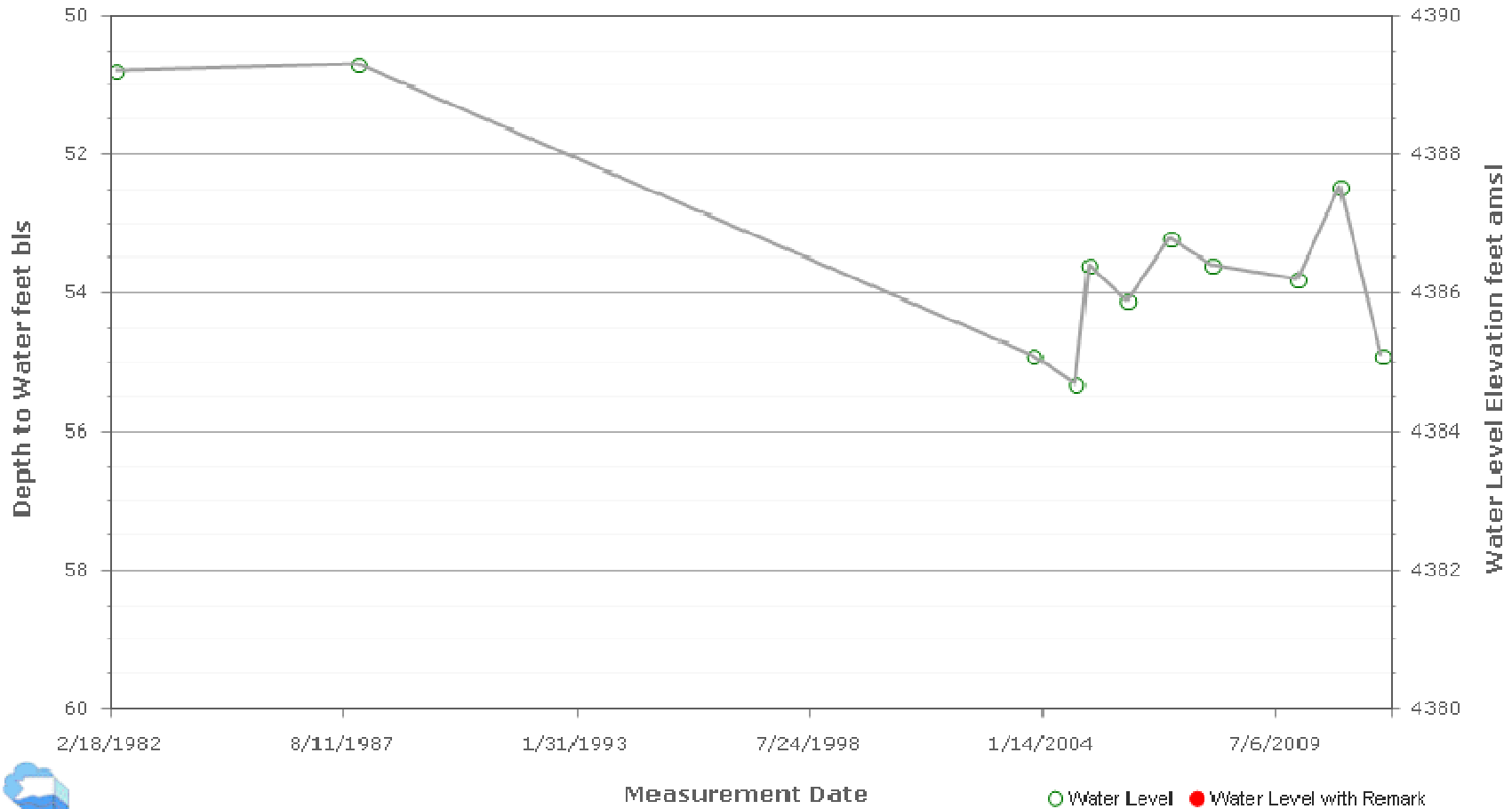
Arizona GroundWater Monitoring Site Hydrograph

Local ID	Site ID	Registry ID	Latitude NAD27	Longitude NAD27	Alt. (ft amsl)	Water Use	Well Depth (ft)	Case Dia. (in)	Drill Date	Latest WL Date	DTW (ft)	WL Elev. (ft)
D-19-17 09ABB	314808110363901	608612	31° 48' 7.1"	110° 36' 38.7"	4440	STOCK	1285	10.75	10/16/1974	1/10/2012	54.9	4385.1

Set x-axis

Set y-axis

Measurement Remarks



GWSI is ADWR's technical database of well locations, construction data, and water levels.

Created on 12/26/2012