Section 7.4
Lower Gila Basin

7.4.1 Geography of the Lower Gila Basin

The Lower Gila Basin, located in the center of the planning area is 7,309 square miles in area, the largest basin in the planning area. Geographic features and principal communities are shown on Figure 7.4-1. The basin is characterized by plains and valleys surrounded by low elevation mountain ranges. Vegetation types include Lower Colorado River Valley and Arizona uplands Sonoran desertscrub. (See Figure 7.0-9) Riparian vegetation includes tamarisk along the Colorado River and Gila River.

- Principal geographic features shown on Figure 7.4-1 are:
    - The Colorado River on the western basin boundary in the vicinity of Fishers Landing
    - The Gila River running east to west through the center of the basin
    - Numerous valleys and plains including Mohawk, San Cristobal, Growler and Childs Valleys in the southern portion of the basin and Castle Dome and Palomas Plains and King and Hyder Valleys in the northern portion of the basin
    - Mountain ranges including the Cabeza Prieta, Mohawk, Granite and Growler Mountains in the southern portion of the basin and the Castle Dome, Tank, Kofa and Gila Bend Mountains in the northern portion of the basin
    - The highest point in the basin, Castle Dome Peak, at 3,788 feet in the Castle Dome Mountains west of Fishers Landing
    - The lowest point in the basin at 160 feet west of Dome where the Gila River exits the basin.

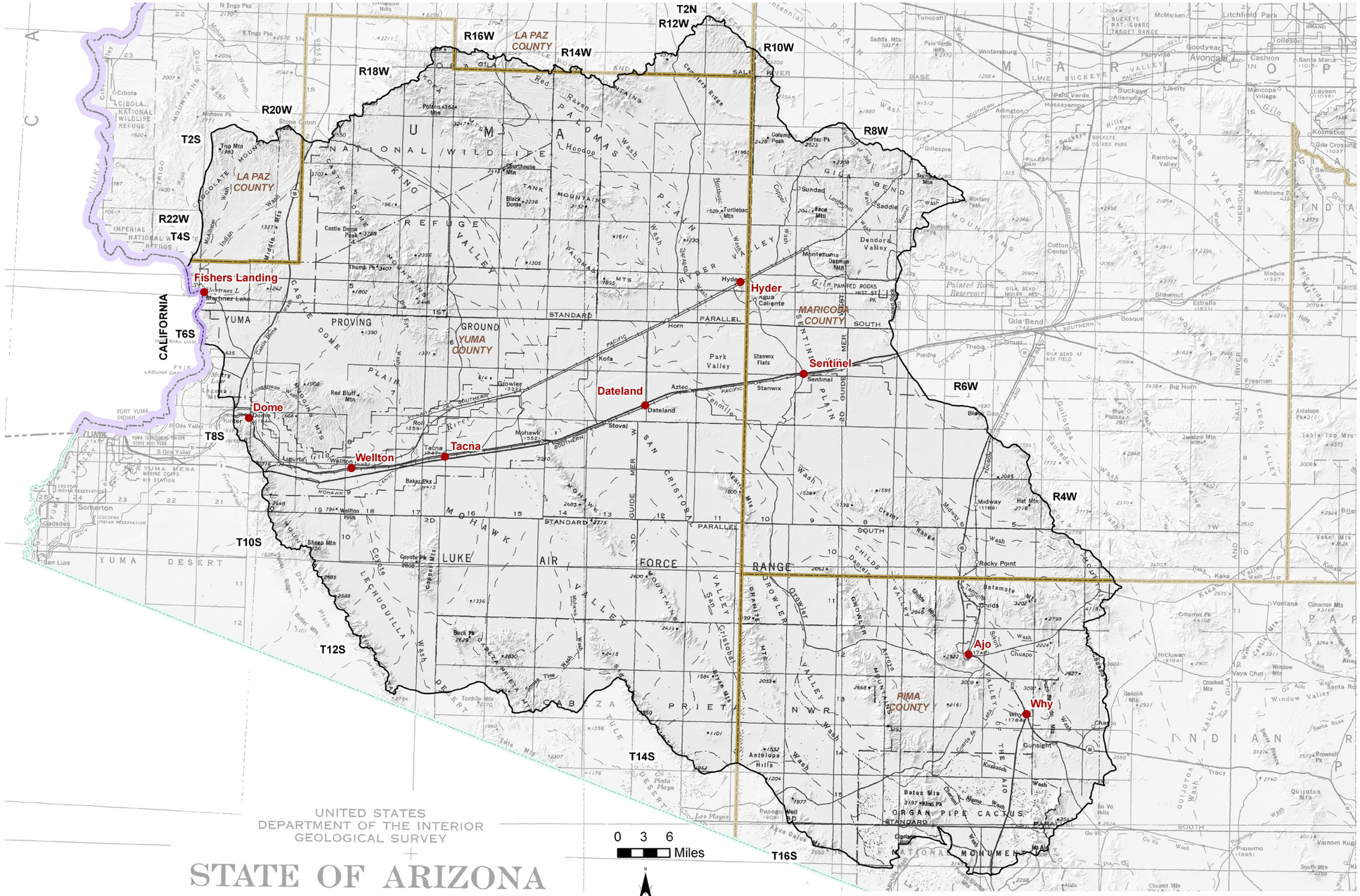


Figure 7.4-1
Lower Gila Basin
Geographic Features

7.4.2 Land Ownership in the Lower Gila Basin

Land ownership, including the percentage of ownership by category, for the Lower Gila Basin is shown in Figure 7.4-2. Principal features of land ownership in this basin are the large areas of military and national wildlife refuge lands. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 7.0.4. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

U.S. Military

- 38.8% of the land is federally owned and managed by the U.S. Military.
- U.S. Military lands in the basin include the Yuma Proving Ground and the Barry Goldwater Air Force Range.
- Primary land use is military activity.

Wildlife Refuge

- 23.4% of the land is federally owned and managed as National Wildlife Refuges (NWR).
- Most of two National Wildlife Refuges are located in this basin, the 665,000 acre Kofa NWR and the 857,000 acre Cabeza Prieta NWR. Part of the Imperial NWR is located along the California State boundary.
- Land uses include resource conservation, wildlife protection and recreation.

U.S. Bureau of Land Management (BLM)

- 20.9% of the land is federally owned and managed by the Lower Sonoran and Yuma Field Offices of the Bureau of Land Management.
- This basin contains 138,700 acres of wilderness, including 64,000 acres of the 100,000 acre Eagletail Mountains Wilderness, the 38,000 acre Muggins Mountains Wilderness, 15,000 acres of the 64,000 acre Woolsey Peak Wilderness and 12,000 acres of the 13,000 acre Signal Mountain Wilderness. (See Figure 7.0-12)
- Land uses include grazing, resource conservation and recreation.

Private

- 5.8% of the land is private.
- Land uses include agriculture, domestic and commercial.

State Trust Land

- 4.5% of the land is held in trust for the public schools and five other beneficiaries under the State Trust Land system.
- Land uses include agriculture and grazing.

National Park Service (NPS)

- 3.9% of the land is federally owned and managed by the National Park Service as the Organ Pipe Cactus National Monument.
- Land uses include resource conservation and recreation.

Indian Reservation

- 2.3% of the land is under tribal ownership as the Tohono O'odham Indian Reservation.
- Primary land use is grazing.

Other (Game and Fish, County and Bureau of Reclamation Lands)

- 0.4% of the land is federally owned and managed by the U.S. Bureau of Reclamation (USBOR).
- This land contains pump stations for the canals that are operated by the USBOR.

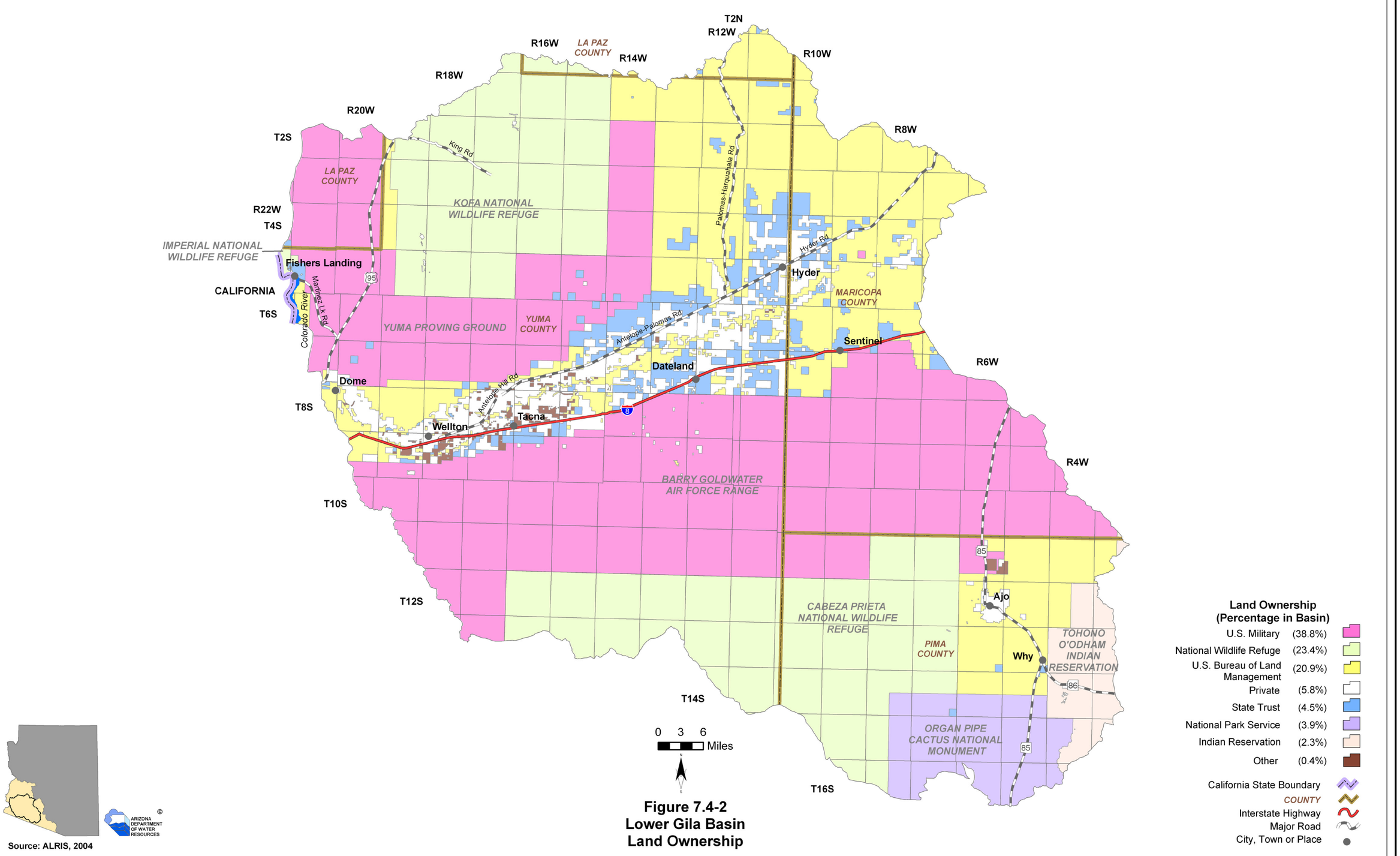


Figure 7.4-2
Lower Gila Basin
Land Ownership

7.4.3 Climate of the Lower Gila Basin

Climate data from NOAA/NWS Co-op Network and AZMET stations are complied in Table 7.4-1 and the locations are shown on Figure 7.4-3. Figure 7.4-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Lower Gila Basin does not contain Evaporation Pan or SNOTEL/ Snowcourse stations. More detailed information on climate in the planning area is found in Section 7.0.4. A description of climate data sources and methods is found in Volume 1, Appendix A.

NOAA/NWS Co-op Network

- Refer to Table 7.4-1A
- There are eight NOAA/NWS Co-op network climate stations in the basin. The average monthly maximum temperature occurs in July at all stations and ranges between 94.6°F at Mohawk and 89.5°F at Dateland Whitewing R. The average monthly minimum temperature occurs in January or December and ranges between 51.1°F at Wellton to 55.9°F at Kofa Mine.
- Highest average seasonal rainfall occurs at most stations in the summer (July-September). For the period of record used, the highest annual rainfall is 7.74 inches at the Ajo station and the lowest is 3.80 inches at Yuma Proving Ground.

AZMET

- Refer to Table 7.4-1C
- There are two AZMET stations in the basin. The stations are at 299 feet and 535 feet and have an average annual reference evapotranspiration of 77.8 inches and 88.06 inches respectively.

SCAS Precipitation Data

- See Figure 7.4-3
- Additional precipitation data show average annual rainfall as high as 16 inches in the Gunsight Hills south of Why and as low as four inches or less along the Colorado River in the western portion of the basin.

Table 7.4-1 Climate Data for the Lower Gila Basin

A. NOAA/NWS Co-op Network:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Temperature Range (in F)		Average Precipitation (in inches)				
			Max/Month	Min/Month	Winter	Spring	Summer	Fall	Annual
Ajo	1,800	1971 - 2000	89.9/Jul	54.5/Jan	2.10	0.43	3.20	2.01	7.74
Dateland Whitewing R	550	1971 - 2000	89.5/Jul	53.6/Dec	1.58	0.18	1.59	1.25	4.60
Kofa Mine	1,780	1971 - 2000	91.1/Jul	55.9/Dec, Jan	2.32	0.39	2.69	1.59	6.99
Mohawk	540	1900-1951	94.6/Jul	54.4/Jan	1.16	0.25	1.69	1.15	4.23
Sentinel	690	1899-1960	92.3/Jul	51.7/Dec	1.35	0.37	1.90	1.01	4.63
Tacna 3 NE	320	1971 - 2000	92.1/Jul	51.6/Dec	1.39	0.31	1.60	1.05	4.35
Wellton	260	1922-1980[1]	91.0/Jul	51.1/Jan	1.46	0.30	1.57	1.13	4.44
Yuma Proving Ground	320	1971 - 2000	93.1/Jul	55.3/Dec	1.23	0.26	1.33	0.98	3.80

Source: WRCC, 2005

Notes:
[1]Average temperature data from period of record shown; average precipitation data from 1971 - 2000

B. Evaporation Pan:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Avg. Annual Evap (in inches)
None			

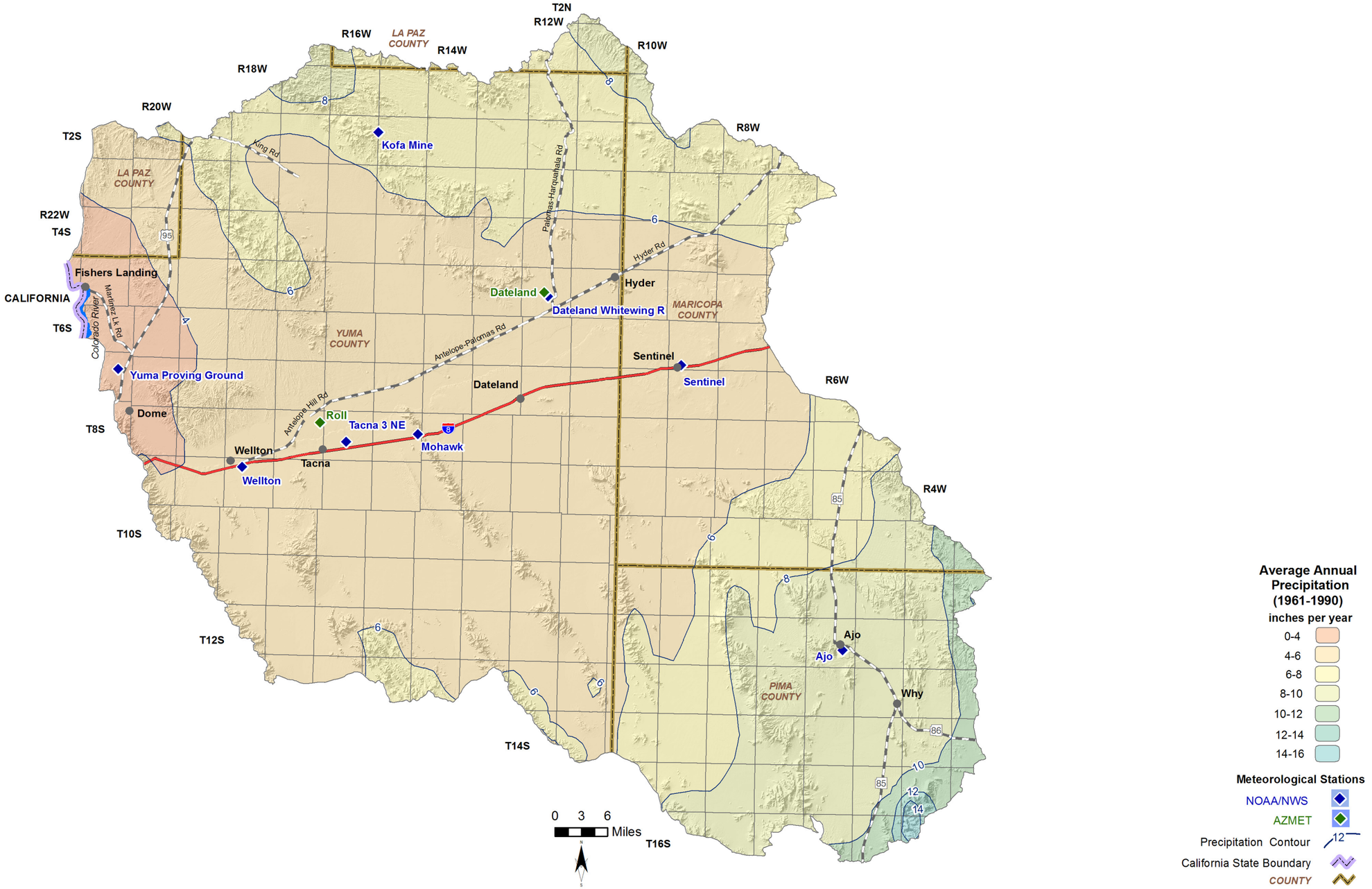
C. AZMET:

Station Name	Elevation (in feet)	Period of Record	Average Annual Reference Evaportranspiration, in inches *(Number of years to calculate averages)*
Dateland	535	1990 - 1996 (discontinued)	88.06 *(6)*
Roll	299	1997 - current	77.80 *(9)*

Source: Arizona Meteorological Network, 2007

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record	Average Snowpack, at Beginning of the Month, as Inches Snow Water Content *(Number of measurements to calculate average)*					
			Jan.	Feb.	March	April	May	June
None								



Average Annual Precipitation (1961-1990)
inches per year
- 0-4
- 4-6
- 6-8
- 8-10
- 10-12
- 12-14
- 14-16

Meteorological Stations
- NOAA/NWS
- AZMET
- Precipitation Contour
- California State Boundary
- COUNTY
- Interstate Highway
- Major Road
- City, Town or Place

ARIZONA DEPARTMENT OF WATER RESOURCES ©

Precipitation Data Source: Oregon State University, 1998

Figure 7.4-3
Lower Gila Basin
Meteorological Stations and Annual Precipitation

7.4.4 Surface Water Conditions in the Lower Gila Basin

Streamflow data, including average seasonal flow, average annual flow and other information are shown in Table 7.4-2. Flood ALERT equipment in the basin is shown in Table 7.4-3. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 7.4-4. The location of streamflow gages identified by USGS number, flood ALERT equipment, USGS runoff contours and large reservoirs are shown on Figure 7.4-4. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Streamflow Data

- Refer to Table 7.4-2.
- Data from four stations located at three watercourses are shown in the table and on Figure 7.4-4. Two stations have been discontinued and two are real-time stations.
- Average seasonal flow varies at the four stations. At one station, Colorado River below Imperial Dam, the average seasonal flow is similar in all seasons due to releases from Imperial Dam. The Rio Comez station near Ajo, with a small, local drainage area, receives 79% of its average seasonal flow in the summer season (July-September). The Gila River stations report highest average seasonal flow in the spring (April-June) season.
- The largest annual flow recorded in the basin is 10 million acre-feet (maf) in 1984 at the Colorado River below Imperial Dam station with a contributing drainage area of 188,500 square miles.

Flood ALERT Equipment

- Refer to Table 7.4-3.
- As of October 2005 there were nine stations in this basin.

Reservoirs and Stockponds

- Refer to Table 7.4-4.
- The basin contains five large reservoirs. The largest, Imperial, has a maximum surface area of 1,402 acres.
- Surface water is stored or could be stored in six small reservoirs in the basin.
- There are 65 registered stockponds in this basin.

Runoff Contour

- Refer to Figure 7.4-4.
- Average annual runoff is highest, 0.2 inches per year or 10.66 acre-feet per square mile, in the southeastern portion of the basin and decreases to 0.1 inches, or five acre-feet per square mile, in the remainder of the basin.

Table 7.4-2 Streamflow Data for the Lower Gila Basin

Station Number	USGS Station Name	Drainage Area (in mi^2)	Gage Elevation (in feet)	Period of Record	Average Seasonal Flow (% of annual flow)				Annual Flow/Year (in acre-feet)				Years of Annual Flow Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
9429500	Colorado River below Imperial Dam[1]	188,500	162	1961-current (real time)	24	21	31	24	233,128 (1971)	350,416	1,292,340	10,049,120 (1984)	31
9520170	Rio Cornez near Ajo	243	1,309	1/1967-9/1978 (discontinued)	8	1	79	11	615 (1969)	2,440	3,085	8,543 (1976)	11
9520280	Gila River near Dateland	55,000	363	10/1993-current (real time)	2	46	18	35	0 (2000, 2001, 2002)	4	69,331	610,467 (1995)	9
9520360	Gila River near Mohawk	55,430	300	2/1966-7/1994 (discontinued)	36	38	15	12	0 (1975-1976, 1987-1991)	413	317,233	2,029,309 (1980)	19

Source: USGS (NWIS) 2005 & 2008

Notes:
[1]Station in California
Statistics based on Calendar Year
Annual Flow statistics based on monthly values
Annual Flow/Year statistics were only completed for those gages that had at least 3 year of 12 month records
Summation of Average Annual Flows may not equal 100 due to rounding
Period of record may not equal Year of Record used for annual Flow/Year statistics due to only using years with a 12 month record
In Period of Record, current equals November 2008
Seasonal and annual flow data used for the statistics was retrieved in 2005

Table 7.4-3 Flood ALERT Equipment in the Lower Gila Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
5000	Mt. Oatman	Repeater/Precipitation	4/1/1981	Maricopa Country FCD
5010	Columbus Wash	Precipitation/Stage	9/21/1999	Maricopa County FCD
5030	Copper Wash	Precipitation/Stage	2/20/2001	Maricopa County FCD
5040	4th of July Wash	Precipitation/Stage	3/14/2002	Maricopa County FCD
5050	Gila Bend Mountains	Weather Station	6/1/1988	Maricopa County FCD
7202	Kofa	Precipitation	12/6/2001	ADWR
7204	Dateland	Precipitation	12/5/2001	ADWR
7210	Wellton Weather Station	Weather Station	4/29/2004	ADWR
7220	Cabeza Prieta aka Ajo	Weather Station	7/31/2004	ADWR

Source: ADWR 2005a

Notes:
ADWR = Arizona Department of Water Resources
FCD = Flood Control District
NA = Information is not available at this time

Table 7.4-4 Reservoirs and Stockponds in the Lower Gila Basin

A. Large Reservoirs (500 acre-feet capacity and greater)

MAP KEY	RESERVOIR/LAKE NAME *(Name of dam, if different)*	OWNER/OPERATOR	MAXIMUM STORAGE (AF)	USE[1]	JURISDICTION
1	Imperial	Bureau of Reclamation	160,000[2]	S,I	Federal

B. Other Large Reservoirs (50 acre surface area or greater)[3]

MAP KEY	RESERVOIR/LAKE NAME *(Name of dam, if different)*	OWNER/OPERATOR	MAXIMUM SURFACE AREA (acres)	USE[1]	JURISDICTION
2	Martinez	Bureau of Reclamation	640	R,F	Federal
3	Painted Rock Borrow Pit	Bureau of Reclamation	350	F	Federal
4	Unnamed[4]	USAF	100	NA	Federal
5	Unnamed[4]	USAF	69	NA	Federal

Source: Compilation of databases from ADWR & others

C. Small Reservoirs (greater than 15 acre-feet and less than 500 acre-feet capacity)

Total number: 0
Total maximum storage: 0 acre-feet

D. Other Small Reservoirs (between 5 and 50 acres surface area)[3]

Total number: 6
Total surface area: 70 acres

E. Stockponds (up to 15 acre-feet capacity)

Total number: 65

Notes:

[1] I = Irrigation, S = Water Supply, R = Recreation, F = fish & wildlife pond

[2] Much of the storage is in CA.

[3] Capacity data is not available to ADWR

[4] Dry lake

USAF = United States Air Force

Figure 7.4-4
Lower Gila Basin
Surface Water Conditions

7.4.5 Perennial/Intermittent Streams and Major Springs in the Lower Gila Basin

The total number of springs in the basin are shown in Table 7.4-5. The locations of perennial streams are shown on Figure 7.4-5. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There is one intermittent stream, the Gila River and one perennial stream, the Colorado River.
- There are no major or minor springs in the basin.
- The total number of springs, regardless of discharge, identified by the USGS varies from six to eight, depending on the database reference.

Table 7.4-5 Springs in the Lower Gila Basin

A. Major Springs (10 gpm or greater):

Map Key	Name	Location		Discharge (in gpm)	Date Discharge Measured
		Latitude	Longitude		
None identified by ADWR at this time					

B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)	Date Discharge Measured
	Latitude	Longitude		
None identified by ADWR at this time				

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 6 to 8

Stream Data Source: AZGF, 1993 & 1997

Figure 7.4-5
Lower Gila Basin
Perennial\Intermittent Streams
and Major (>10 gpm) Springs

7.4.6 Groundwater Conditions of the Lower Gila Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.4-6. Figure 7.4-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 7.4-7 contains hydrographs for selected wells shown on Figure 7.4-6. Figure 7.4-8 shows well yields in five yield categories. A description of aquifer data sources and methods as well as well data sources and methods, including water-level changes and well yields are found in Volume 1, Appendix A.

Major Aquifers

- Refer to Table 7.4-6 and Figure 7.4-6
- The major aquifers are recent stream alluvium and basin fill.
- The basin contains three sub-basins: Childs Valley, Dendora Valley and Wellton Mohawk.
- Predevelopment flow direction was from the north and southeast edges of the basin to the Gila River and downstream to the southwest. Extensive agricultural development has created a series of cones of depression including the Hyder Valley cone that pulls water from the Hyder area to the north and a cone east of Dateland.

Well Yields

- Refer to Table 7.4-6 and Figure 7.4-8
- As shown on Figure 7.4-8, well yields are generally greater than 1,000 gallons per minute (gpm).
- One source of well yield information, based on 597 reported wells, indicates that the median well yield is 1,600 gpm.

Natural Recharge

- Refer to Table 7.4-6
- Estimates of natural recharge range from greater than 9,000 acre-feet per year (AFA) to 88,000 AFA.
- The largest source of natural recharge is runoff in washes and the Gila River floodplain. In the western portion of the basin, "artificial" recharge from infiltration of irrigation water requires pumping of excess groundwater into drainage canals for removal from the basin. (ADWR 1994b)

Water in Storage

- Refer to Table 7.4-6
- Estimates of water in storage range from 100 million acre-feet (maf) to a depth of 1,200 feet to 246 maf to an unknown depth.

Water Level

- Refer to Figure 7.4-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 33 index wells in this basin. Hydrographs for 10 index wells and one other well (B) are shown on Figure 7.4-7.
- The deepest water level shown on the map is 809 feet in the vicinity of Why and the shallowest is five feet northeast of Wellton.

Table 7.4-6 Groundwater Data for the Lower Gila Basin

Basin Area, in square miles:	7,309	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Recent Stream Alluvium	
	Basin Fill	
Well Yields, in gal/min:	Range 184-5,095 Median 1,823.5 (56 wells measured)	Measured by ADWR (GWSI) and/or USGS
	Range 10-6,000 Median 1,600 (597 wells reported)	Reported on registration forms for large (>10-inch) diameter wells (Wells55)
	Range 100-2,500	ADWR (1990 and 1994b)
	Range 0-2,500	Anning and Duet (1994)
Estimated Natural Recharge, in acre-feet/year:	88,000	Freethey and Anderson (1986)
	>9,000	Arizona Water Commission (1975)
Estimated Water Currently in Storage, in acre-feet:	143,900,000 (to 1,200 ft)	ADWR (1990)
	100,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	246,000,000	Arizona Water Commission (1975)
Current Number of Index Wells:	33	
Date of Last Water-level Sweep:	1992 (589 wells measured)	

[1]Predevelopment Estimate

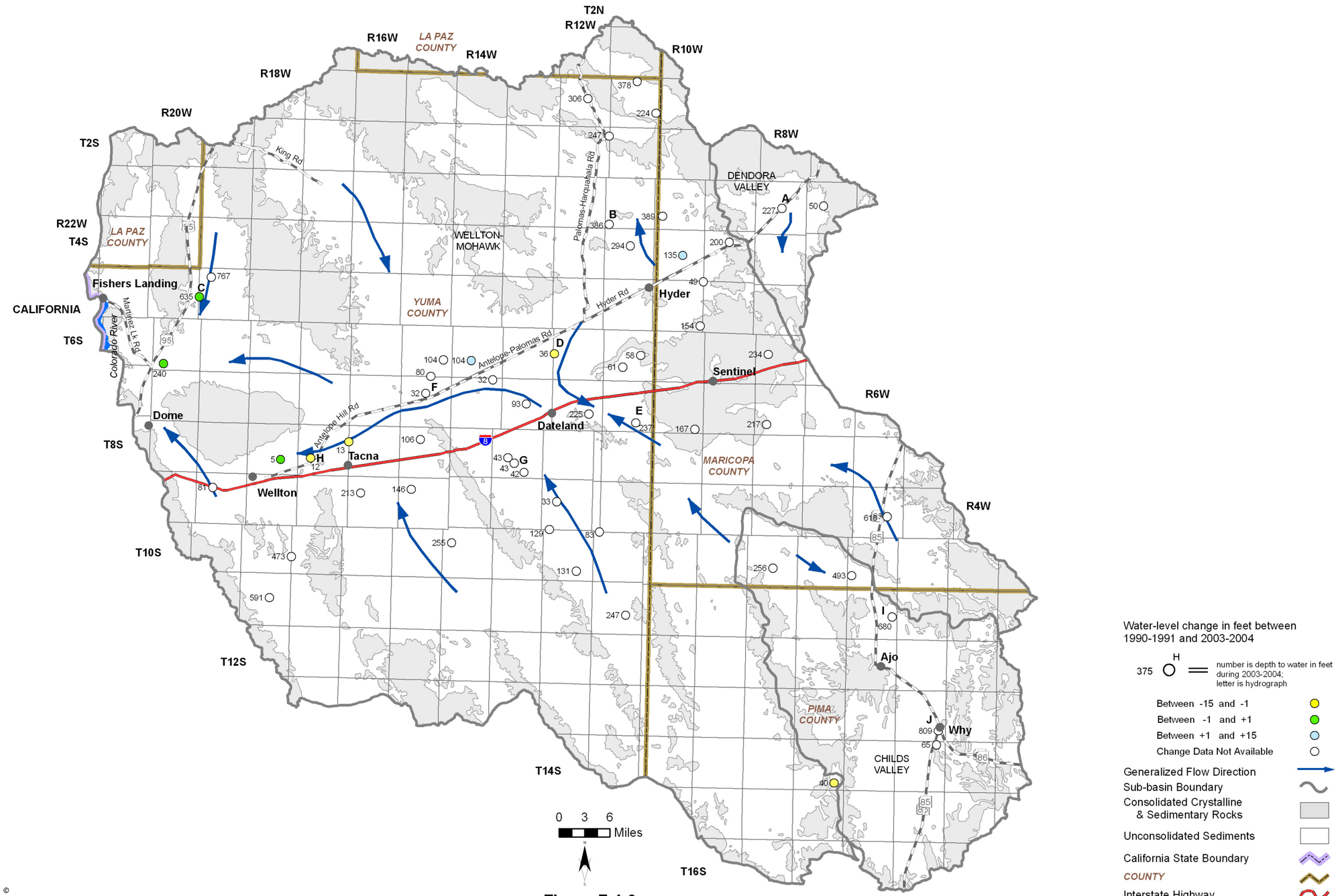


Figure 7.4-6
Lower Gila Basin
Groundwater Conditions

Figure 7.4-7
Lower Gila Basin
Hydrographs Showing Depth to Water in Selected Wells

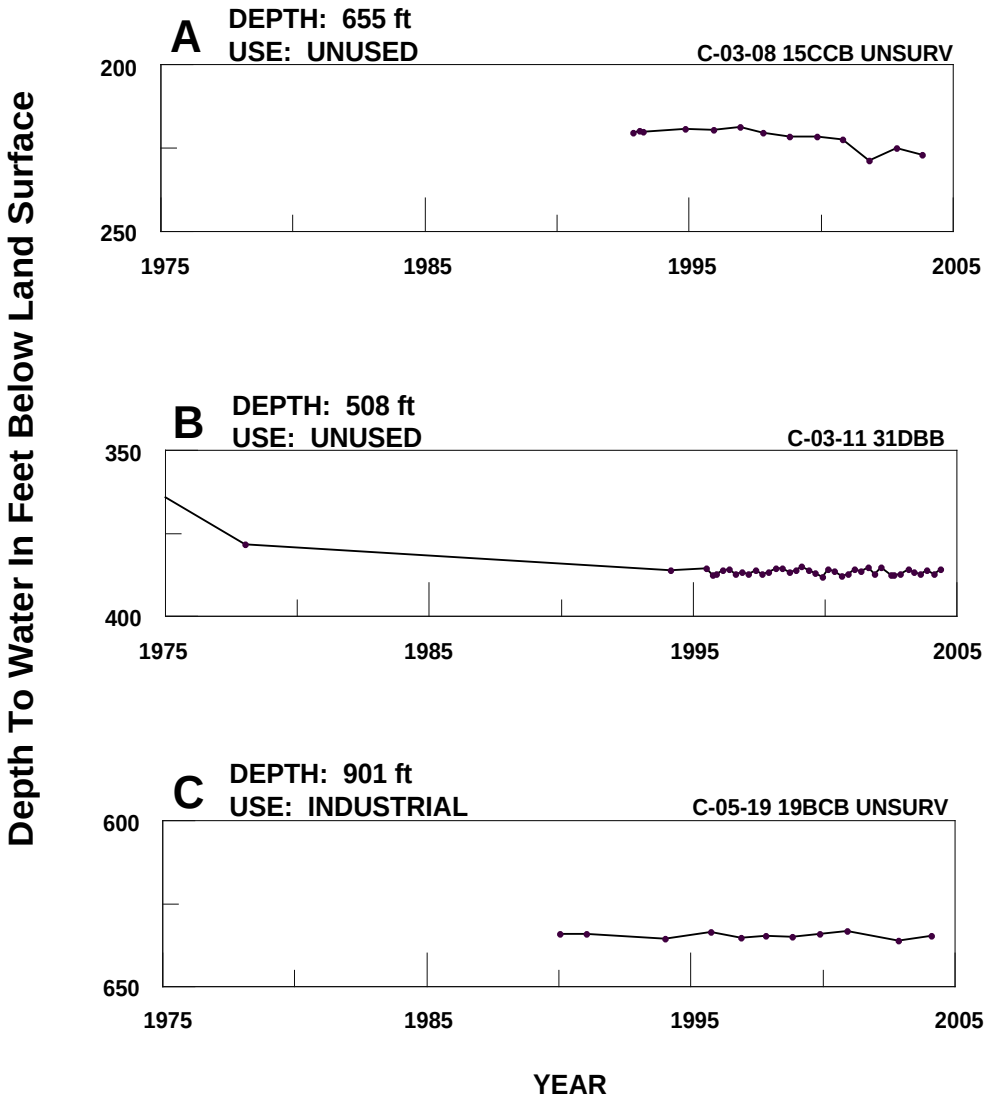


Figure 7.4-7 (cont'd)
Lower Gila Basin
Hydrographs Showing Depth to Water in Selected Wells

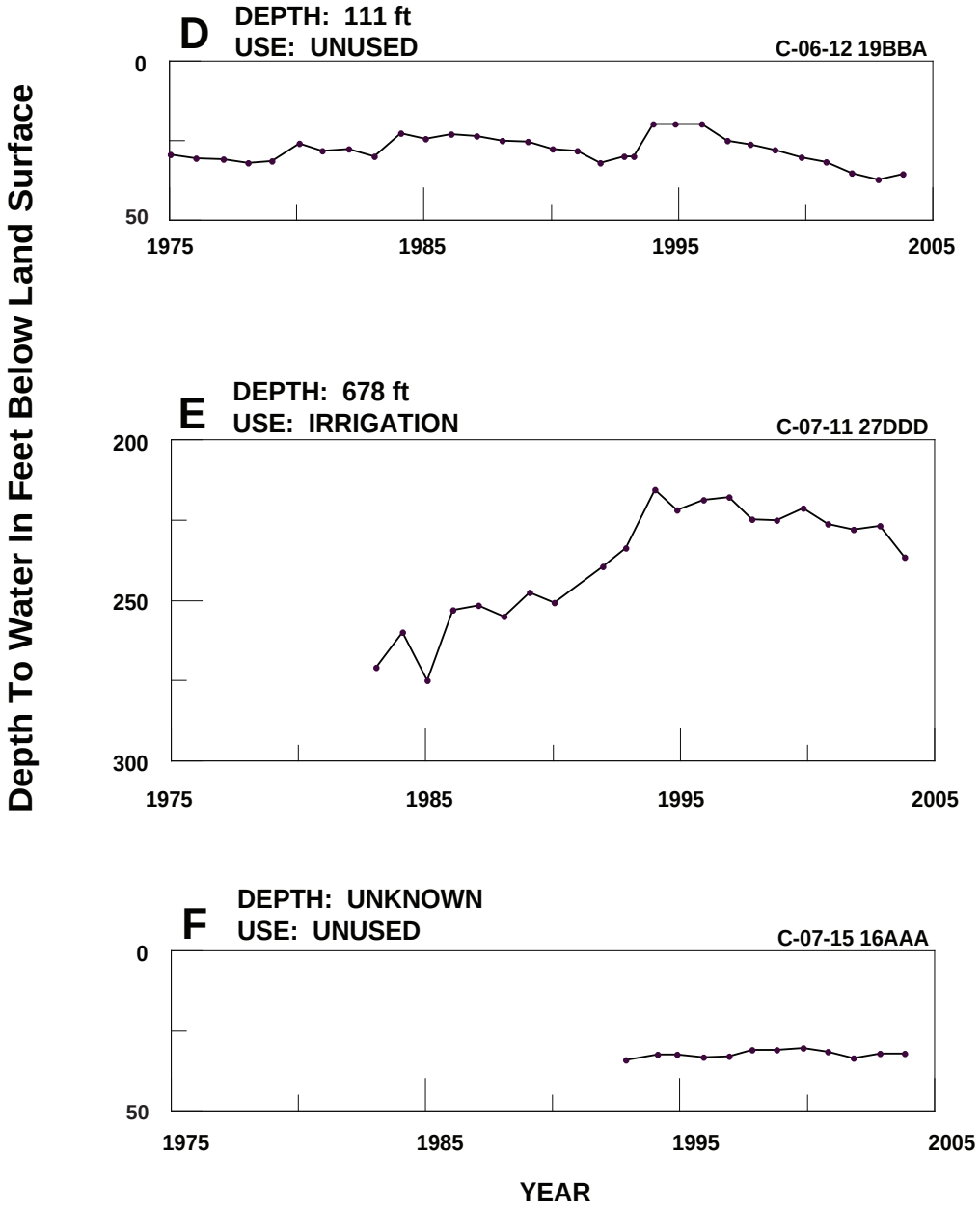
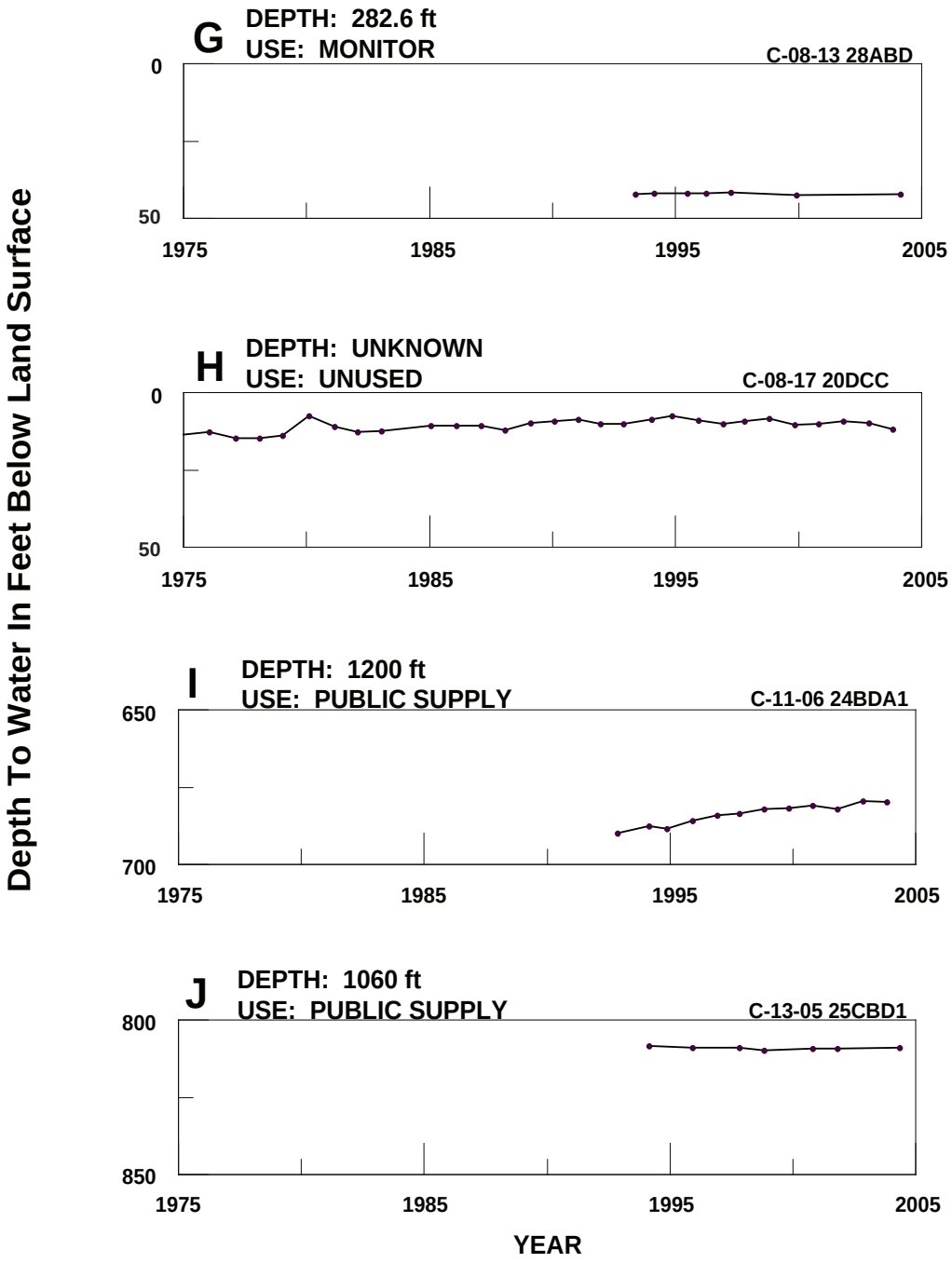


Figure 7.4-7 (cont'd)
Lower Gila Basin
Hydrographs Showing Depth to Water in Selected Wells



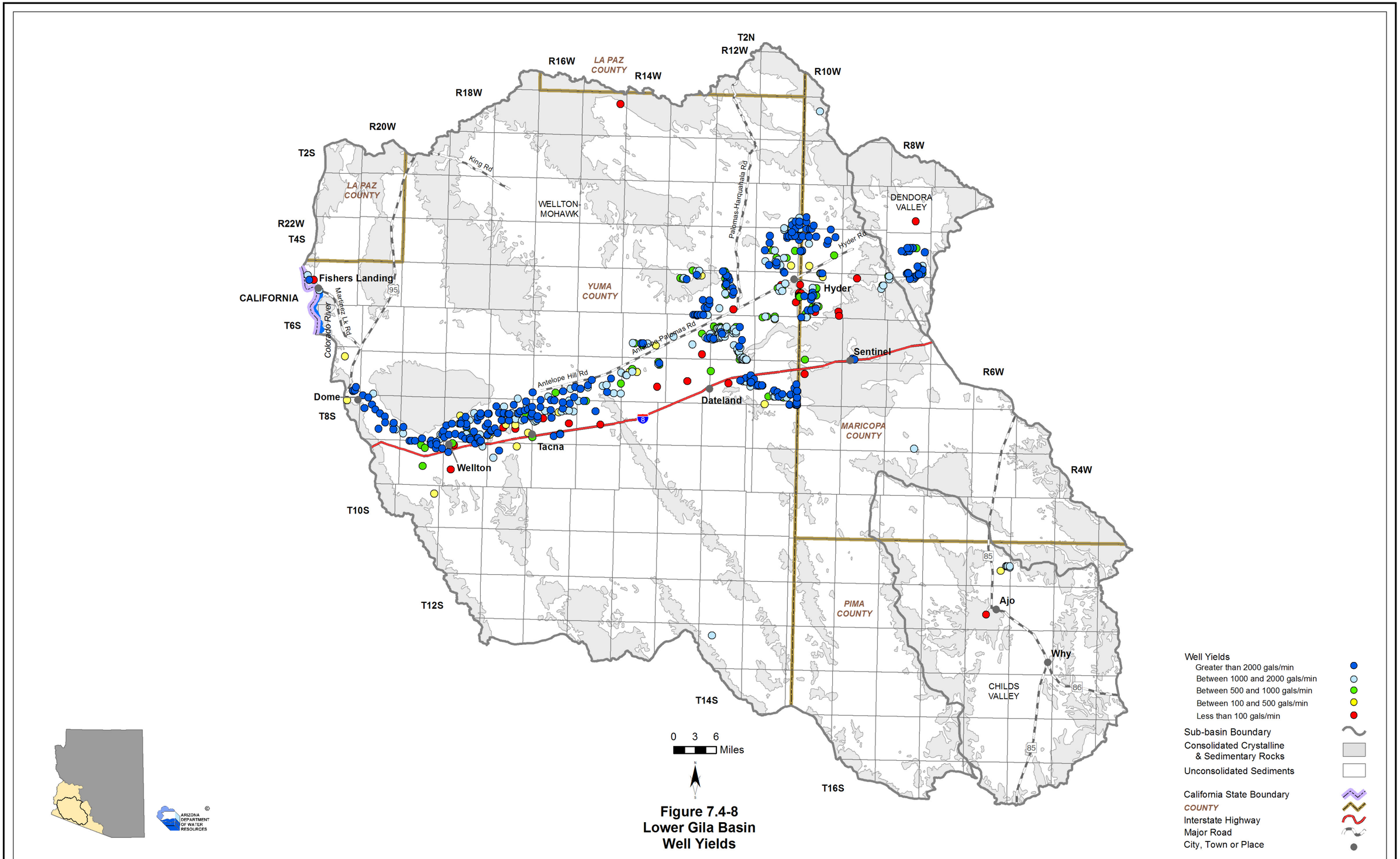


Figure 7.4-8
Lower Gila Basin
Well Yields

7.4.7 Water Quality of the Lower Gila Basin

Wells, springs and mine sites with parameter concentrations that have equaled or exceeded drinking water standard(s), including location and parameter(s) are shown in Table 7.4-7A. Impaired lakes and streams with site type, name, length of impaired reach, area of impaired lake, designated use standard and parameter(s) exceeded is shown in Table 7.4-7B. Figure 7.4-9 shows the location of water quality occurrences keyed to Table 7.4-7. All community water systems are regulated under the Safe Drinking Water Act and treat water supplies to meet drinking water standards. Not all parameters were measured at all sites; selective sampling for particular constituents is common. A description of water quality data sources and methods is found in Volume 1, Appendix A.

Well, Mine or Spring sites that have equaled or exceeded drinking water standards (DWS)

- Refer to Table 7.4-7A.
- Two hundred and forty-six wells have parameter concentrations that have equaled or exceeded drinking water standards.
- The most common parameter equaled or exceeded was fluoride.
- Other parameters equaled or exceeded include arsenic, cadmium, lead, nitrate, selenium and total dissolved solids.

Lakes and Streams with impaired waters

- Refer to Table 7.4-7B.
- The water quality standard for boron and selenium was equaled or exceeded in one 28 mile reach of the Gila River, a portion of this reach is also in the Yuma Basin. The standard for organics and dissolved oxygen was equaled or exceeded at Painted Rock Borrow Pit Lake.
- Neither the reach of the Gila River nor the lake are part of the ADEQ water quality improvement effort, the Total Maximum Daily Load (TMDL) Program, at this time.

Table 7.4-7 Water Quality Exceedences in the Lower Gila Basin[1]

A. Wells, Springs and Mines

Map Key	Map Location[2]	Site Type	Site Location			Number of Sampling Sites	Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[3]
			Township	Range	Section		
1	M	Well	1 South	15 West	18	1	F
2	M	Well	2 South	17 West	1	1	NO3
3	M	Well	4 South	8 West	16	1	NO3
4	M	Well	4 South	8 West	33	1	As, F
		Well	4 South	8 West	33	1	F
5	M	Well	4 South	8 West	34	2	F
6	M	Well	4 South	8 West	35	5	F
7	M	Well	4 South	9 West	9	1	As, F
8	M	Well	4 South	10 West	2	1	As, F
9	M	Well	4 South	10 West	5	2	F
10	M	Well	4 South	10 West	6	1	F
11	M	Well	4 South	10 West	7	1	F
12	M	Well	4 South	10 West	8	2	F
13	M	Well	4 South	10 West	17	1	F
14	M	Well	4 South	10 West	18	1	F
15	M	Well	4 South	10 West	19	1	F
16	M	Well	4 South	10 West	21	1	As, F
17	M	Well	4 South	11 West	1	3	F
18	M	Well	4 South	11 West	2	2	As, F
19	M	Well	4 South	11 West	8	1	As
20	M	Well	4 South	11 West	12	1	F
21	M	Well	4 South	11 West	21	1	NO3
		Well	4 South	11 West	21	1	As, F, NO3
		Well	4 South	11 West	21	1	F
22	M	Well	4 South	11 West	29	1	As, F
23	M	Well	4 South	11 West	33	1	F
24	M	Well	4 South	11 West	35	1	F
25	M	Well	4 South	19 West	21	1	NO3
26	M	Well	5 South	8 West	3	1	As
		Well	5 South	8 West	3	1	F
27	M	Well	5 South	8 West	6	2	F
28	M	Well	5 South	9 West	12	2	F
		Well	5 South	9 West	12	1	As, F
29	M	Well	5 South	9 West	13	1	F
30	M	Well	5 South	10 West	3	2	F
31	M	Well	5 South	10 West	16	1	F
		Well	5 South	10 West	16	1	As, NO3, TDS
32	M	Well	5 South	10 West	20	1	F
33	M	Well	5 South	10 West	28	1	As, F
34	M	Well	5 South	10 West	32	1	F
35	M	Well	5 South	10 West	36	1	F
36	M	Well	5 South	11 West	2	1	F
37	M	Well	5 South	11 West	15	1	F
		Well	5 South	11 West	15	1	As, NO3
38	M	Well	5 South	12 West	4	4	F
39	M	Well	5 South	12 West	5	1	F
40	M	Well	5 South	12 West	9	2	F
41	M	Well	5 South	12 West	16	1	F
		Well	5 South	12 West	16	1	As, NO3
42	M	Well	5 South	12 West	22	1	As
43	M	Well	5 South	13 West	36	3	F
44	M	Well	5 South	19 West	5	1	F
45	M	Well	5 South	21 West	19	1	As, F
46	M	Well	6 South	8 West	17	1	F
47	M	Well	6 South	9 West	5	1	F
48	M	Well	6 South	9 West	32	1	As, F

Table 7.4-7 Water Quality Exceedences in the Lower Gila Basin (Cont)[1]

A. Wells, Springs and Mines

Map Key	Map Location[2]	Site Type	Site Location			Number of Sampling Sites	Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[3]
			Township	Range	Section		
49	M	Well	6 South	10 West	35	1	Pb
		Well	6 South	10 West	35	1	F
50	M	Well	6 South	12 West	8	1	F
51	M	Well	6 South	12 West	10	1	F, TDS
52	M	Well	6 South	12 West	17	1	F
53	M	Well	6 South	12 West	18	2	F
54	M	Well	6 South	12 West	19	1	NO3, TDS
55	M	Well	6 South	12 West	27	1	F
56	M	Well	6 South	12 West	30	1	F
57	M	Well	6 South	12 West	35	5	F
58	M	Well	6 South	13 West	3	1	As
59	M	Well	6 South	14 West	22	1	As
60	M	Well	6 South	15 West	15	1	F
61	M	Well	6 South	18 West	32	1	F
62	M	Well	6 South	20 West	21	2	F
63	M	Well	6 South	20 West	32	1	F
64	M	Well	6 South	21 West	10	1	F
65	M	Well	6 South	21 West	23	1	F
66	M	Well	6 South	21 West	34	1	F
67	M	Well	7 South	10 West	7	1	F
68	M	Well	7 South	10 West	22	2	F
69	M	Well	7 South	10 West	36	1	F
70	M	Well	7 South	11 West	19	1	F
71	M	Well	7 South	11 West	24	1	F
72	M	Well	7 South	11 West	25	4	F
73	M	Well	7 South	11 West	26	2	F
74	M	Well	7 South	11 West	28	2	F
75	M	Well	7 South	11 West	32	1	F
76	M	Well	7 South	11 West	36	4	F
		Well	7 South	11 West	36	1	As, F
77	M	Well	7 South	12 West	7	1	As, F
78	M	Well	7 South	12 West	8	1	As, F
79	M	Well	7 South	12 West	13	2	F
		Well	7 South	12 West	13	1	As, F
80	M	Well	7 South	12 West	14	1	F
81	M	Well	7 South	12 West	17	1	F
82	M	Well	7 South	12 West	21	1	F
83	M	Well	7 South	12 West	23	1	F
84	M	Well	7 South	12 West	25	1	F
85	M	Well	7 South	13 West	13	1	F
86	M	Well	7 South	13 West	21	1	F
87	M	Well	7 South	13 West	24	1	TDS
		Well	7 South	13 West	24	2	As, F
		Well	7 South	13 West	24	3	F
88	M	Well	7 South	14 West	24	2	F
89	M	Well	7 South	15 West	13	1	TDS
90	M	Well	7 South	15 West	14	1	TDS
91	I	Well	7 South	15 West	20	2	TDS
92	M	Well	7 South	15 West	22	2	TDS
93	M	Well	7 South	15 West	26	1	As, F, TDS
94	I	Well	7 South	15 West	29	1	TDS
95	I	Well	7 South	15 West	30	3	TDS
96	I	Well	7 South	16 West	25	1	F, TDS
97	I	Well	7 South	16 West	26	1	TDS
98	I	Well	7 South	16 West	31	1	F
99	I	Well	7 South	16 West	33	1	TDS
100	I	Well	7 South	16 West	34	1	TDS
101	I	Well	7 South	17 West	35	1	As, NO3, TDS
102	M	Well	7 South	19 West	14	1	Pb

Table 7.4-7 Water Quality Exceedences in the Lower Gila Basin (Cont)[1]

A. Wells, Springs and Mines

Map Key	Map Location[2]	Site Type	Site Location			Number of Sampling Sites	Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[3]
			Township	Range	Section		
103	M	Well	7 South	21 West	10	1	F
		Well	7 South	21 West	10	1	As
104	M	Well	7 South	21 West	11	1	F
105	M	Well	8 South	13 West	6	1	Pb, TDS
106	M	Well	8 South	13 West	20	1	NO3, TDS
107	M	Well	8 South	13 West	28	1	NO3, TDS
108	M	Well	8 South	13 West	34	1	TDS
109	M	Well	8 South	14 West	16	2	F
110	I	Well	8 South	16 West	2	1	As
111	I	Well	8 South	16 West	4	1	TDS
112	I	Well	8 South	16 West	5	1	As, TDS
113	I	Well	8 South	16 West	7	1	NO3
114	I	Well	8 South	16 West	9	2	TDS
115	I	Well	8 South	16 West	11	1	F, NO3
		Well	8 South	16 West	11	1	TDS
116	I	Well	8 South	17 West	1	1	TDS
117	I	Well	8 South	17 West	3	1	TDS
		Well	8 South	17 West	3	1	As, NO3
		Well	8 South	17 West	3	1	As, F
118	I	Well	8 South	17 West	9	1	NO3, TDS
		Well	8 South	17 West	9	1	As, TDS
119	I	Well	8 South	17 West	10	2	TDS
120	I	Well	8 South	17 West	13	1	TDS
121	I	Well	8 South	17 West	14	1	As, F
122	I	Well	8 South	17 West	17	1	TDS
123	I	Well	8 South	17 West	18	3	TDS
124	I	Well	8 South	17 West	25	2	As
125	I	Well	8 South	18 West	14	2	F, TDS
126	I	Well	8 South	18 West	20	1	As, TDS
127	I	Well	8 South	18 West	21	1	F, TDS
		Well	8 South	18 West	21	1	TDS
128	I	Well	8 South	18 West	22	1	TDS
129	I	Well	8 South	18 West	25	1	As
130	I	Well	8 South	18 West	26	1	TDS
131	I	Well	8 South	18 West	27	1	TDS
132	I	Well	8 South	18 West	29	1	F
		Well	8 South	18 West	29	1	As, TDS
133	I	Well	8 South	18 West	31	1	TDS
134	I	Well	8 South	18 West	34	1	As
135	I	Well	8 South	18 West	36	1	NO3
136	I	Well	8 South	19 West	25	1	TDS
137	I	Well	8 South	19 West	31	1	TDS
138	I	Well	8 South	19 West	36	2	TDS
139	M	Well	8 South	20 West	9	1	As, TDS
		Well	8 South	20 West	9	1	NO3, TDS
		Well	8 South	20 West	9	1	TDS
140	M	Well	8 South	20 West	15	1	As, TDS
141	M	Well	8 South	20 West	25	1	As, TDS
142	M	Well	8 South	20.5 West	6	1	TDS
143	M	Well	8 South	21 West	1	1	TDS
		Well	8 South	21 West	1	1	As
144	M	Well	9 South	6 West	23	1	F
145	M	Well	9 South	7 West	29	1	As
146	M	Well	9 South	11.5 West	36	1	F
147	M	Well	9 South	12 West	16	1	NO3, TDS
148	M	Well	9 South	12 West	31	1	As, F
149	I	Well	9 South	17 West	4	1	TDS
150	I	Well	9 South	17 West	9	1	F

Table 7.4-7 Water Quality Exceedences in the Lower Gila Basin (Cont)[1]

A. Wells, Springs and Mines

Map Key	Map Location[2]	Site Type	Site Location			Number of Sampling Sites	Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[3]
			Township	Range	Section		
151	I	Well	9 South	18 West	6	1	F
152	I	Well	9 South	18 West	10	1	F, NO3, TDS
153	I	Well	9 South	18 West	11	1	F
154	I	Well	9 South	18 West	19	2	F, TDS
155	I	Well	9 South	18 West	20	1	F
156	I	Well	9 South	19 West	1	1	As, TDS
		Well	9 South	19 West	1	1	F
157	I	Well	9 South	19 West	2	1	As
158	I	Well	9 South	19 West	3	1	TDS
		Well	9 South	19 West	3	1	As, F
159	I	Well	9 South	19 West	4	1	As, TDS
		Well	9 South	19 West	4	1	TDS
160	I	Well	9 South	19 West	6	1	F, TDS
161	I	Well	9 South	19 West	13	1	As, F
162	I	Well	9 South	19 West	24	1	TDS
163	M	Well	10 South	6 West	30	1	F
164	M	Well	10 South	8 West	22	1	F
165	M	Well	11 South	6 West	24	2	As, F
166	M	Well	12 South	8 West	1	1	NO3
167	M	Well	12 South	8 West	17	1	NO3, TDS
168	M	Well	13 South	3 West	32	1	As
169	M	Well	13 South	5 West	25	2	As, Cd
						25	

Source: Compilation of databases from ADWR & others

B. Lakes and Streams

Map Key	Site Type	Site Name	Length of Impaired Stream Reach (in miles)	Area of Impaired Lake (in acres)	Designated Use Standard[4]	Parameter(s) Exceeding Use Standard[3]
a	Stream	Gila River (Coyote Wash to Fortuna Wash)	28	NA	A&W	Bo, Se
b	Lake	Painted Rock Borrow Pit Lake	NA	186	A&W, FC	DO, Organics

Source: ADEQ 2005d

Notes:

[1] Water quality samples collected between 1978 and 1991. Listed TDS exceedences indicate "mineralized water" that contains over 3000 milligrams per liter (mg/l) of TDS and would require special well construction procedures (A.A.C. R12-15-812(B)). The secondary drinking water

[2] M = main map, I = inset

[3] As = Arsenic
Bo = Boron
Cd = Cadmium
DO = Dissolved Oxygen
F = Fluoride
Pb = Lead
NO3 = Nitrate
Organics = One or more of several volatile and semi-volatile organic compounds and pesticides
TDS = Total Dissolved Solids
Se = Selenium

[4] A&W = Aquatic and Wildlife
FC = Fish Consumption

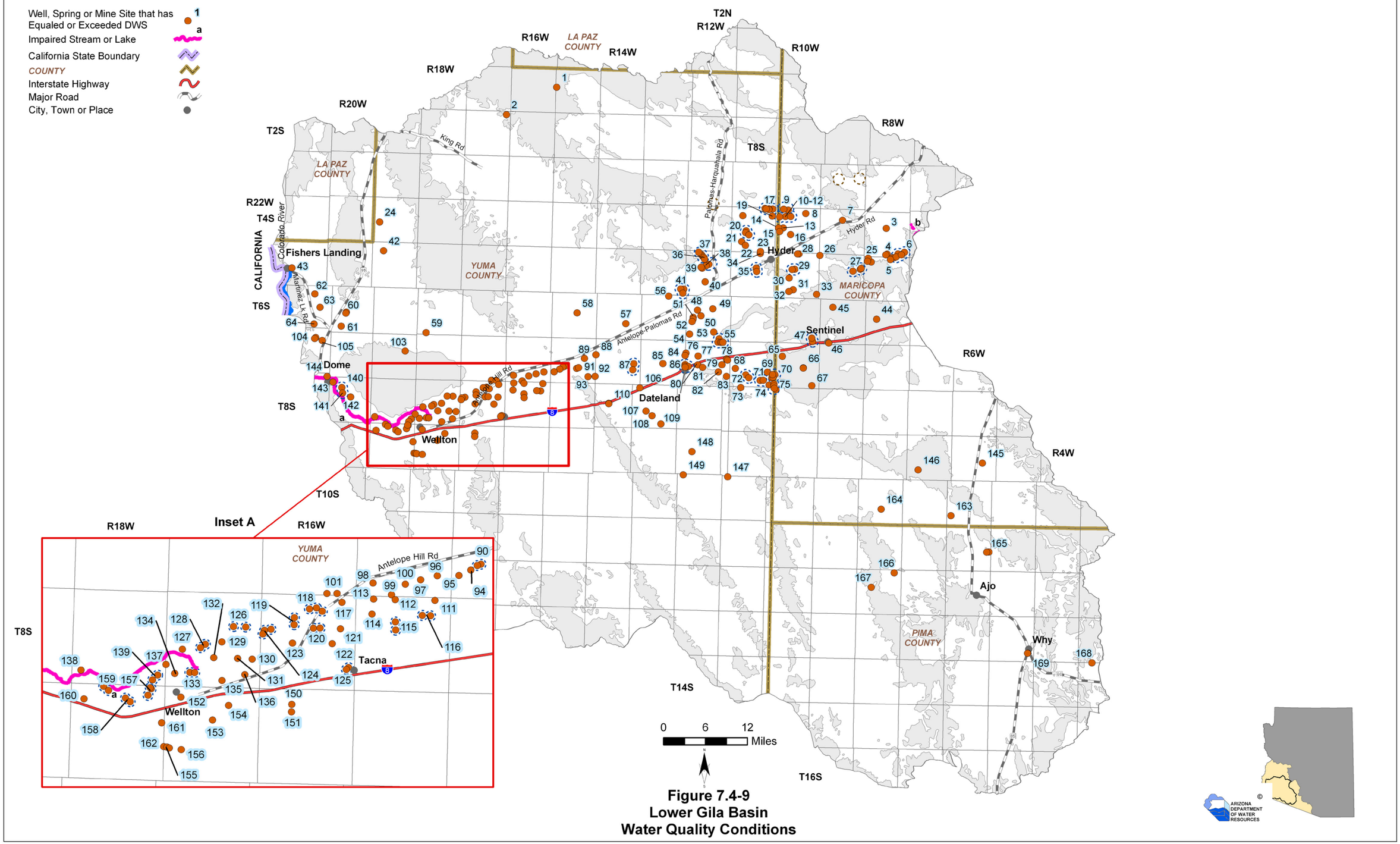


Figure 7.4-9
Lower Gila Basin
Water Quality Conditions

7.4.8 Cultural Water Demands in the Lower Gila Basin

Cultural water demand data including population, number of wells and the average well pumpage and surface water diversions by the municipal, industrial and agricultural sectors are shown in Table 7.4-8. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown in Table 7.4-9. Figure 7.4-10 shows the location of demand centers. A description of cultural water demand data sources and methods is found in Volume 1, Appendix A. More detailed information on cultural water demands is found in Section 7.0.7.

Cultural Water Demands

- Refer to Table 7.4-8 and Figure 7.4-10.
- Population in this basin increased from 9,873 in 1980 to 11,297 in 2000.
- Most cultural water use is for irrigation primarily near the Gila River.
- Agricultural groundwater demand decreased from 254,000 AFA in 1991-1995 to 246,000 AFA in 2001-2005. Total agricultural water demand increased from 619,000 AFA in 1991-1995 to 629,000 AFA in 2001-2005.
- Industrial groundwater demand is relatively small but increased from 3,400 AFA in 1991-1995 to 3,600 AFA in 2001-2005. Industrial uses in the basin include multiple dairies and a large feedlot.
- Municipal groundwater demand is relatively small and increased from 1,800 AFA in 1991-1995 to 2,000 AFA in 2001-2005. Municipal surface water use is also minimal but increased from 400 AFA in 1991-1995 to 500 AFA in 2001-2005.
- As of 2005 there were 718 registered wells with a pumping capacity of less than or equal to 35 gpm and 850 wells with a pumping capacity of more than 35 gpm.

Effluent Generation

- Refer to Table 7.4-9.
- There are eight known wastewater treatment facilities in this basin.
- Information on disposal method was available for seven facilities. Six facilities discharge to evaporation ponds and one facility discharges to golf course irrigation.

Table 7.4-8 Cultural Water Demand in the Lower Gila Basin[1]

Year	Estimated and Projected Population	Number of Registered Water Supply Wells Drilled		Average Annual Demand (in acre-feet)						Data Source
				Well Pumpage			Surface-Water Diversions			
		Q ≤ 35 gpm	Q > 35 gpm	Municipal	Industrial	Agricultural	Municipal	Industrial	Agricultural	
1971		389[2]	580[2]	360,000			1,251,000[5]			ADWR (1994a)
1972										
1973										
1974										
1975										
1976				404,000			1,102,000[5]			
1977										
1978										
1979										
1980	9,873									
1981	9,813	42	96	348,000			1,130,000[5]			
1982	9,752									
1983	9,692									
1984	9,632									
1985	9,571									
1986	9,511	73	79	402,000			1,229,000[5]			
1987	9,451									
1988	9,390									
1989	9,330									
1990	9,270									
1991	9,472	46	28	1,800	3,400	254,000	400	NR	365,000	USGS (2007) ADWR (2008b) ADWR (2008c)
1992	9,675									
1993	9,878									
1994	10,081									
1995	10,283									
1996	10,486	66	32	1,900	3,500	261,100	400	NR	391,000	
1997	10,689									
1998	10,892									
1999	11,094									
2000	11,297									
2001	11,556	102	35	2,000	3,600	246,000	500	NR	383,200	
2002	11,816									
2003	12,075									
2004	12,334									
2005	12,594									
2010	13,890									
2020	17,192									
2030	20,967									
	WELL TOTALS:	**718**	**850**							

[1] Does not include effluent or evaporation losses from stockponds and reservoirs.
[2] Includes all wells through 1980.
[3] Includes pumpage and diversion of Colorado River Contract Water.
[4] Well pumpage for irrigation includes drainage wells.
[5] Includes surface-water diversions in Parker and Yuma basins.
NR - Not reported

Table 7.4-9 Effluent Generation in the Lower Gila Basin

Facility Name	Ownership	City/Location Served	Population Served	Volume Treated/Generated (acre-feet/year)	Disposal Method								Current Treatment Level	Population Not Served	Year of Record
					Water - course	Evaportion Pond	Irrigation	Golf Course/Turf/ Landscape	Wildlife Area	Discharged to Another Facility	Infiltration Basins	Overland flow			
Ajo WWTF	Ajo ID	Ajo	1,089	144		X							Secondary	NA	2007
Fisher's Landing	Private	Fishers Landing	72	41		X							NA		2004
Links @ Coyote Wash WWTP	Private	Wellton	190	36				X					Secondary	NA	2007
Yuma Proving Ground-Laguna Airfield	US Army	Airfield	NA			X							NA		
Yuma Proving Ground-Kofa Firing Range	US Army	Army Base	NA	56		X							NA		
Yuma Proving Ground-Garrison Main WWTF	US Army	Army Base	NA			X							NA		
Yuma Proving Ground-Main Adminisitration Area WWTF	US Army	Army Base	1,000	NA		X							NA		
Yuma Proving Ground-Material Test Area WWTP	US Army	Army Base	NA												
Total			**2,351**	**277**											

Source: Compilation of databases from ADWR & others

Notes:
Year of Record is for the volume of effluent treated/generated
NA: Data not currently available to ADWR
WWTF: Waste Water Treatment Facility
WWTP: Waste Water Treatment Plant
ID: Improvement District

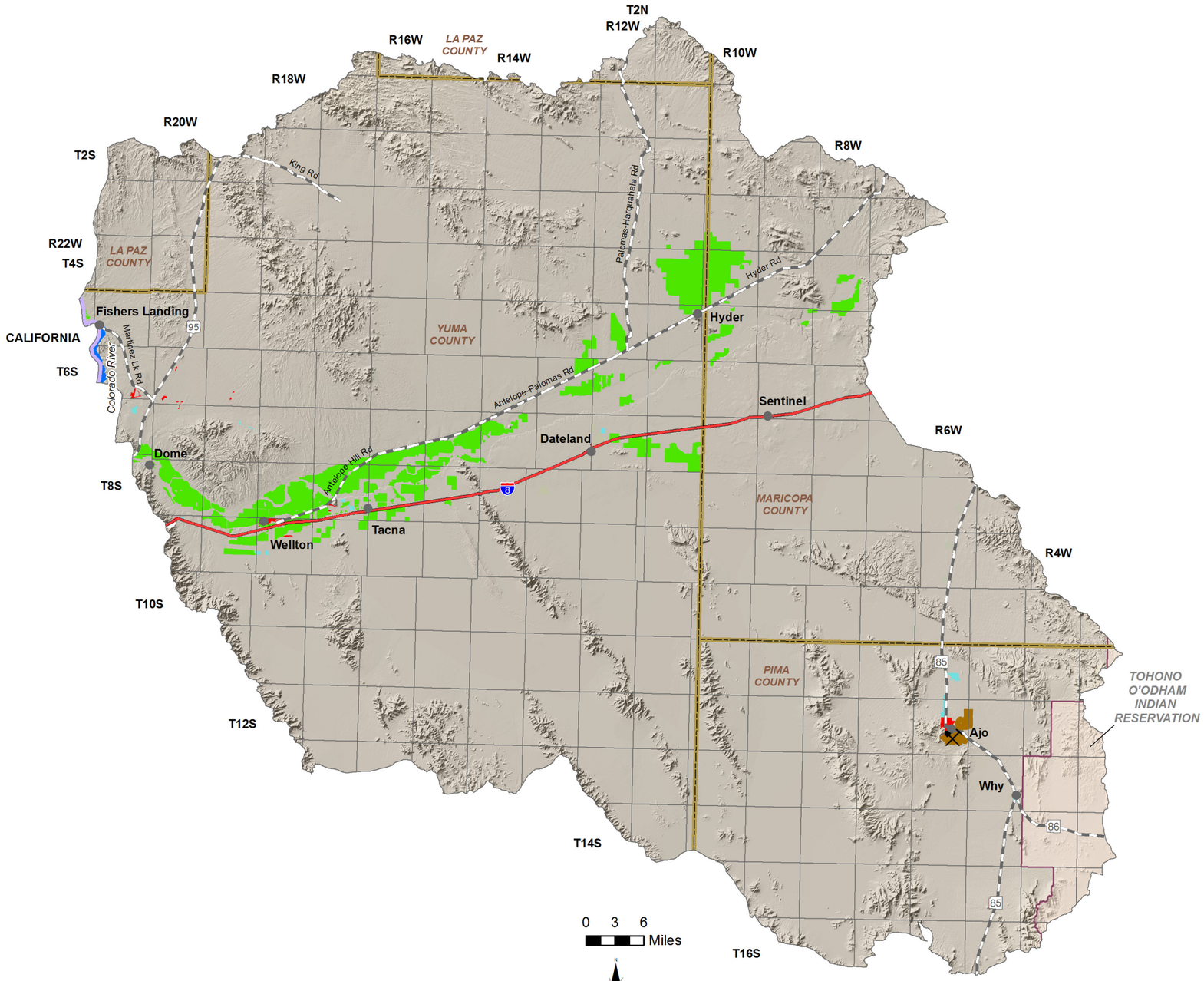


Figure 7.4-10
Lower Gila Basin
Cultural Water Demand

ARIZONA DEPARTMENT OF WATER RESOURCES ©

Primary Data Source: USGS National Gap Analysis Program, 2004

7.4.9 Water Adequacy Determinations in the Lower Gila Basin

Water adequacy determination information including the subdivision name, location, number of lots, adequacy determination, reason for an inadequacy determination, date of determination and subdivision water provider are shown in Table 7.4-10. Figure 7.4-11 shows the general locations of subdivisions (to the section level) keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

- Thirty water adequacy determinations for 3,087 lots have been made in this basin through December 2008.
- Six determinations of inadequacy have been made; the most common reason for an inadequacy determination was water quality.
- The number of lots receiving a water adequacy determination, by county, are:

County	Number of Subdivision Lots	Number of Lots Determined to be Adequate	Percent Adequate
Pima County	583	583	100%
Yuma County	2,504	2,173	87%

Table 7.4-10 Adequacy Determinations in the Lower Gila Basin[1]

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.2	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination3	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
1	Antelope Acres and Antelope Heights	Yuma	8 South	17 East	28	72	53-700428	Adequate		10/25/2007	Antelope Water Company
2	Arletta Estates	Yuma	9 South	19 East	14	8	53-500296	Inadequate	C	2/5/1975	Dry Lot Subdivision
3	Butterfield Bluff	Yuma	9 South	18 East	4, 5	201	53-500373	Adequate		10/29/1987	Town of Wellton
4	Butterfield bluff #4	Yuma	9 South	18 East	4	21	53-400385	Adequate		7/25/2000	Town of Wellton
5	Caballo Farms	Yuma	6 South	15 East	31	60	53-500375	Inadequate	C	5/19/1975	Dry Lot Subdivision
6	Cameron Place Addition	Pima	12 South	6 East	15	97	53-500384	Adequate		12/20/1985	Ajo Improvement Company
7	Camino Viejo	Yuma	9 South	18 East	6	18	53-400480	Adequate		4/25/2001	Town of Wellton
8	Citrus Park	Yuma	8 South	16 East	31	656	53-500461	Adequate		6/1/1973	Mohawk Water Co
9	Copper Ridge, Unit A	Yuma	9 South	18 East	5	8	53-400197	Adequate		12/13/1999	Town of Wellton
10	Coyote Wash Condominiums	Yuma	9 South	18 East	8	80	53-401632	Adequate		3/23/2005	Town of Wellton
11	Coyote Wash Condominiums Phase 2	Yuma	9 South	18 East	8	56	53-500092	Adequate		9/5/2007	Town of Wellton
12	Crystal Sands	Yuma	7 South	13 East	12, 13	15	53-500542	Inadequate	C	7/1/1974	Dry Lot Subdivision
13	Erickson	Yuma	9 South	16 East	4	8	53-400426	Adequate		5/12/2001	Town of Wellton
14	Grande Vista	Yuma	8 South	17 East	21, 22, 27, 28	20	53-400243	Adequate		2/2/2000	Dry Lot Subdivision
15	Hankins Subdivision	Yuma	9 South	18 East	5	17	53-500771	Adequate		7/18/1986	Town of Wellton
16	Jojoba Farms #1	Yuma	7 South	12 East	16	20	53-500821	Adequate		6/23/1983	Dry Lot Subdivision
17	Morisse	Yuma	3 South	19 East	29	30	53-501014	Adequate		5/5/1978	NA
18	New Cornelia Addition	Pima	12 South	6 East	14, 15, 22, 23	486	53-501046	Adequate		2/14/1986	Ajo Improvement Company
19	New Tacna Townsite	Yuma	8 South	17 East	25	10	53-501047	Inadequate	C	1/15/1987	Tacna Water Company
20	Orange Grove Ranch Estates	Yuma	9 South	18 East	3	122	53-501085	Inadequate	C	1/15/1975	Dry Lot Subdivision
21	Rio Lindo Shores	Yuma	11 South	18 East	31	36	53-501305	Adequate		2/29/1980	Graham Water Service
22	Rio Salado Ranches #1&2	Yuma	6 South	11 East	24, 25	116	53-501310	Inadequate	D	3/14/1974	Dry Lot Subdivision
23	Sandpiper, The #1	Yuma	10 South	19 East	15	73	53-501368	Adequate		1/14/1982	Graham Water Service
24	Sports Valley Condominiums	Yuma	10 South	19 East	22	24	53-501444	Adequate		9/1/1982	Graham Water Service
25	Tacna Manor	Yuma	8 South	17 East	25	16	53-501533	Adequate		8/12/1981	Tacna Water Company
26	The Links at Coyote Wash	Yuma	9 South	18 East	7	171	53-401007	Adequate		8/13/2003	Town of Wellton
27	The Links at Coyote Wash Unit #2	Yuma	9 South	18 East	7	333	53-401286	Adequate		5/18/2004	Town of Wellton
28	The Links at Coyote Wash, Unit 3	Yuma	9 South	19 East	11, 12, 13, 14	250	53-401820	Adequate		11/2/2005	Town of Wellton
29	Valley View Estates	Yuma	9 South	19 East	1	45	53-700201	Adequate		2/1/2007	Town of Wellton
30	VanGelder Subdivision	Yuma	9 South	18 East	6	18	53-501606	Adequate		1/24/1986	Town of Wellton

Source: ADWR 2008a

Notes:

[1]Each determination of the adequacy of water supplies available to a subdivision is based on the information available to ADWR and the standards of review and policies in effect at the time the determination was made. In some cases, ADWR might make a different determination if a similar application were submitted today, based on the hydrologic data and other information currently available, as well as current rules and policies.

[2] Prior to February 1995, ADWR did not assign file numbers to applications for adequacy. Between 1995-2006 all applications for adequacy were given a file number with a 22 prefix. In 2006 a 53 prefix was assigned to all water adequacy reports and applications regardless of their issue date.

[3] A. Physical/Continuous
1) Insufficient Data (applicant chose not to submit necessary information, and/or available hydrologic data insufficient to make determination)
2) Insufficient Supply (existing water supply unreliable or physically unavailable; for groundwater, depth-to-water exceeds criteria)
3) Insufficient Infrastructure (distribution system is insufficient to meet demands or applicant proposed water hauling)
B. Legal (applicant failed to demonstrate a legal right to use the water or failed to demonstrate the provider's legal authority to serve the subdivision)
C. Water Quality
D. Unable to locate records

NA = Not available to ADWR at this time

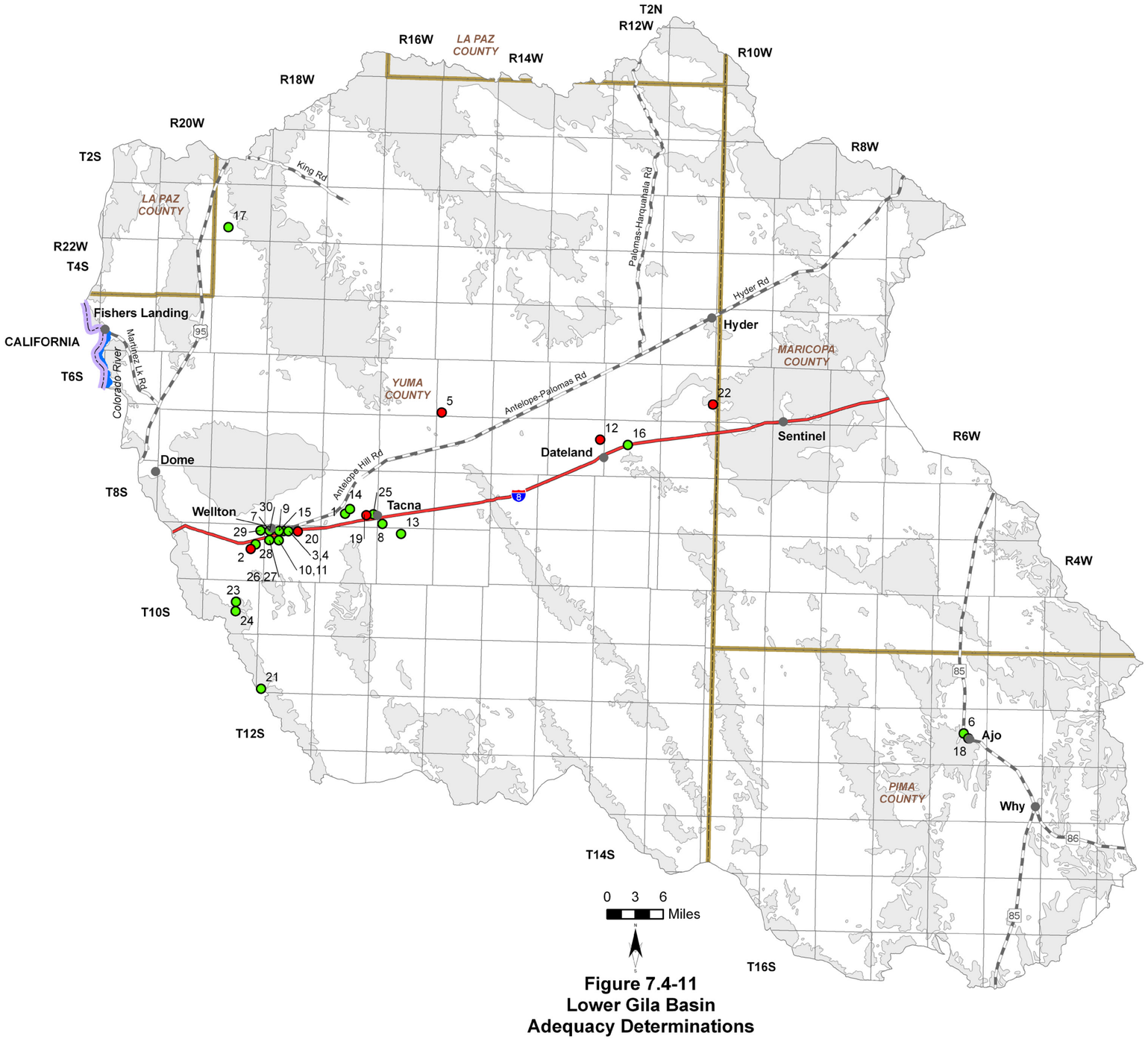


Figure 7.4-11
Lower Gila Basin
Adequacy Determinations

Lower Gila Basin
References and Supplemental Reading

References

A

Anning, D.W. and N.R. Duet, 1994, Summary of ground-water conditions in Arizona, 1987-90, USGS Open-file Report 94-476.

Arizona Corporation Commission (ACC), 2005, Annual reports, Private Sewer companies, 1990 to 2005: ACC Utilities Division. (Effluent Table)

Arizona Department of Economic Security (DES), 2005, Workforce Informer: Data file, accessed August 2005, http://www.workforce.az.gov. (Cultural Water Demand Table)

Arizona Department of Environmental Quality (ADEQ), 2005a, ADEQSWI: Data file, received September 2005.

_____, 2005b, ADEQWWTP: Data file, received August 2005.

_____, 2005c, Azurite: Data file, received September 2005.

_____, 2005d, Impaired lakes and reaches: GIS cover, received January 2006.

_____, 2005e, WWTP and permit files: Miscellaneous working files, received July 2005.

_____, 2004a, Water quality exceedences by watershed: Data file, received June 2004. (Water Quality Map and Table)

_____, 2004b, Water quality exceedences for drinking water providers in Arizona: Data file, received September 2004. (Water Quality Map and Table)

Arizona Department of Water Resources (ADWR), 2008a, Assured and adequate water supply applications: Project files, ADWR Hydrology Division.

_____, 2008b, Industrial demand outside of the Active Management Areas 1991-2007: Unpublished analysis by ADWR Office of Resource Assessment Planning.

_____, 2008c, Municipal surface water demand outside of the Active Management Areas 1991-2007: Unpublished analysis by ADWR Office of Resource Assessment Planning.

_____, 2005a, Flood warning gages: Database, ADWR Office of Water Engineering.

_____, 2005b, Groundwater Site Inventory (GWSI): Database, ADWR Hydrology Division.

_____, 2005c, Registry of surface water rights: ADWR Office of Water Management. (Reservoirs and Stockponds Table)

_____, 2005d, Wells55: Database.

_____, 2002, Groundwater quality exceedences in rural Arizona from 1975 to 2001: Data file, ADWR Office of Regional Strategic Planning. (Water Quality Map and Table)

_____, 1994a, Arizona Water Resources Assessment, Vol. I, Inventory and Analysis.

_____, 1994b, Arizona Water Resources Assessment, Vol. II, Hydrologic Summary.

_____, 1990, Draft outline of basin profiles for the state water assessment: ADWR Statewide Planning Division, Memorandum to L. Linser, D.W., January, 16, 1990.

Arizona Game and Fish Department (AZGF), 2005, Arizona Waterways: Data file, received April 2005. (Reservoirs and Stockponds Table)

_____, 1997, Remote Sensing Mapping of Arizona Intermittent Stream Riparian Areas: GIS cover.

_____, 1993, Arizona Riparian Inventory and Mapping Project: GIS cover.

Arizona Land Resource Information System (ALRIS), 2005a, Springs: GIS cover, accessed January 2006 at http://www.land.state.az.us/alris/index.html.

_____, 2005, Water features: GIS cover, accessed July 2005 at http://www.land.state.az.us/alris/index.html. (Reservoirs and Stockponds Table)

_____, 2004, Land ownership: GIS cover, accessed in 2004 at http://www.land.state.az.us/alris/index.html.

Arizona Meteorological Network (AZMET), 2007, Arizona climate stations: Pan evaporation data, accessed December 2005 at http://www.ag.arizona.edu/azmet/locate.html.

Arizona Water Commission, 1975, Summary, Phase I, Arizona State Water Plan, Inventory of resource and uses.

E

Environmental Protection Agency (EPA), 2005, Surf Your Watershed: Facility reports, accessed April 2005 at http://oaspub.epa.gov/enviro/ef_home2.water. (Effluent Generation Table)

_____, 2005, 2000 and 1996, Clean Watershed Needs Survey: datasets, accessed March 2005 at http://www.epa.gov/owm/mtb/cwns/index.htm. (Effluent Generation Table)

F

Freethey, G.W. and T.W. Anderson, 1986, Predevelopment hydrologic conditions in the alluvial basins of Arizona and adjacent parts of California and New Mexico: USGS Hydrologic Investigations Atlas-HA664.

G

Gebert, W.A., D.J. Graczyk and W.R. Krug, 1987, Average annual runoff in the United States, 1951-1980: GIS Cover, accessed March 2006 at http://aa179.cr.usgs.gov/metadata/wrdmeta/runoff.htm. (Surface Water Conditions Map)

O

Oregon State University, Spatial Climate Analysis Service (SCAS), 1998, Average annual precipitation in Arizona for 1961-1990: PRISM GIS cover, accessed in 2006 at www.ocs.orst.edu/prism.

U

United States Geological Survey (USGS), 2008 & 2005, National Water Information System (NWIS) data for Arizona: Accessed October 2008 at http://waterdata.usgs.gov/nwis.

_____, 2007, Water withdrawals for irrigation, municipal, mining, thermoelectric-power, and drainage uses in Arizona outside of the active management areas, 1991-2005: Data file, received November 2007.

_____, 2006a, National Hydrography Dataset: Arizona dataset, accessed at http://nhd.usgs.gov/.

_____, 2006b, Springs and spring discharges: Dataset, received November 2004 and January 2006 from USGS office in Tucson, AZ.

_____, 2004, National Gap Analysis Program - Southwest Regional Gap analysis study- land cover descriptions: Electronic file, accessed January 2005 at http://earth.gis.usu.edu / swgap.

_____, 1981, Geographic digital data for 1:500,000 scale maps: USGS National Mapping Program Data Users Guide.

Supplemental Reading

Andersen, Mark, 2005, Assessment of water availability in the Lower Colorado River basin: in Conservation and Innovation in Water Management: Proceedings of the 18th annual Arizona Hydrological Society Symposium, Flagstaff, Arizona, September, 2005.

Anning, D.W., 2002, Estimation and analysis of the uncertainty in stream flow and change in reservoir-content data at selected stream flow-gaging stations in the Lower Colorado River network, 1995-99: University of Arizona, M.S. thesis.

Biggs, T. H., Dempsey, K.A., and Pearthree, P.A., 2002, Surficial geology and geomorphology of the Tinajas Altas Area, Barry M. Goldwater Air Force Range, Yuma County, Southwestern Arizona: AZGS Open File Report 02-02, 21 p.

Bureau of Reclamation, 2000, Colorado River Interim Surplus Criteria: Final Environmental Impact Statement.

Clean Colorado River Alliance, 2006, Recommendations to Address Colorado River Water Quality.

Colorado River Basin Salinity Control Forum, 2005, Water Quality Standards for Salinity: Colorado River System.

Cordy, G., 2004, Pharmaceuticals and other organic wastewater compounds in Arizona's effluent, and its implications for water reuse: in The Value of Water: Proceedings from the 17th annual Arizona Hydrological Society symposium, September 2004, Tucson Arizona.

Davey-Cairo Engineering Inc., 2005, Hydrologic Study, Tacna Water Company, Water Service Area Expansion. Prepared for Arizona Department of Water Resources.

Harris, R.C. 1999, Bibliography and review of water quality studies in the upper Gila River watershed, Arizona: AZGS Open-File Report 99-25, 67 p.

Hart, R., 1999, Water quality of the Colorado River monitored by the USGS national stream accounting network: in Water Issues and Partnerships for Rural Arizona: Proceedings from the 12th annual Arizona Hydrological Society Symposium, September 1999, White Mountains Arizona.

Huckleberry, G., 1996, Historical geomorphology of the Gila River: AZGS Open –File Report 96-14, 31 p.

Kepner, W. G., 1987, Organochlorine contaminant investigation of the lower Gila River, Arizona: USWFS unnumbered report, 17 p.

King, K. A., and Baker, D. L., 1995, Contaminants in fish and wildlife of the middle Gila River, Arizona: USFWS unnumbered report, 17 p.

King, K. A., Andrews, B. J., Martinez, C. T., and Kepner, W. G., 1997, Environmental contaminants in fish and wildlife of the lower Gila River, Arizona: USFWS Project No. 22410-1130-2F30, 71 p.

Klawon, J.E., and Pearthree, P.A. 2001, Geomorphology of the western crater range, Barry Goldwater Air Force Range, Southeastern Arizona: AZGS Open File Report 01-03, 19 p.

R.B. Williams and Associates, Inc., 1974, Water Report for Orange Grove Ranch Estates, Yuma, Arizona. Prepared for Arizona Department of Water Resources.

_____, 1975, Water Report for Arletta Estates Subdivision, Wellton, Arizona. Prepared for Arizona Department of Water Resources.

Santec Consulting, 1999, Small and minor watercourses analysis for Yuma County, Arizona, Arizona State Land Department, Final Report.

W.S. Gookin & Associates, 1974, Adequacy of Water Supply for Crystal Sands and San Cristobal Subdivisions, Yuma County, Arizona. Prepared for Arizona Department of Water Resources.