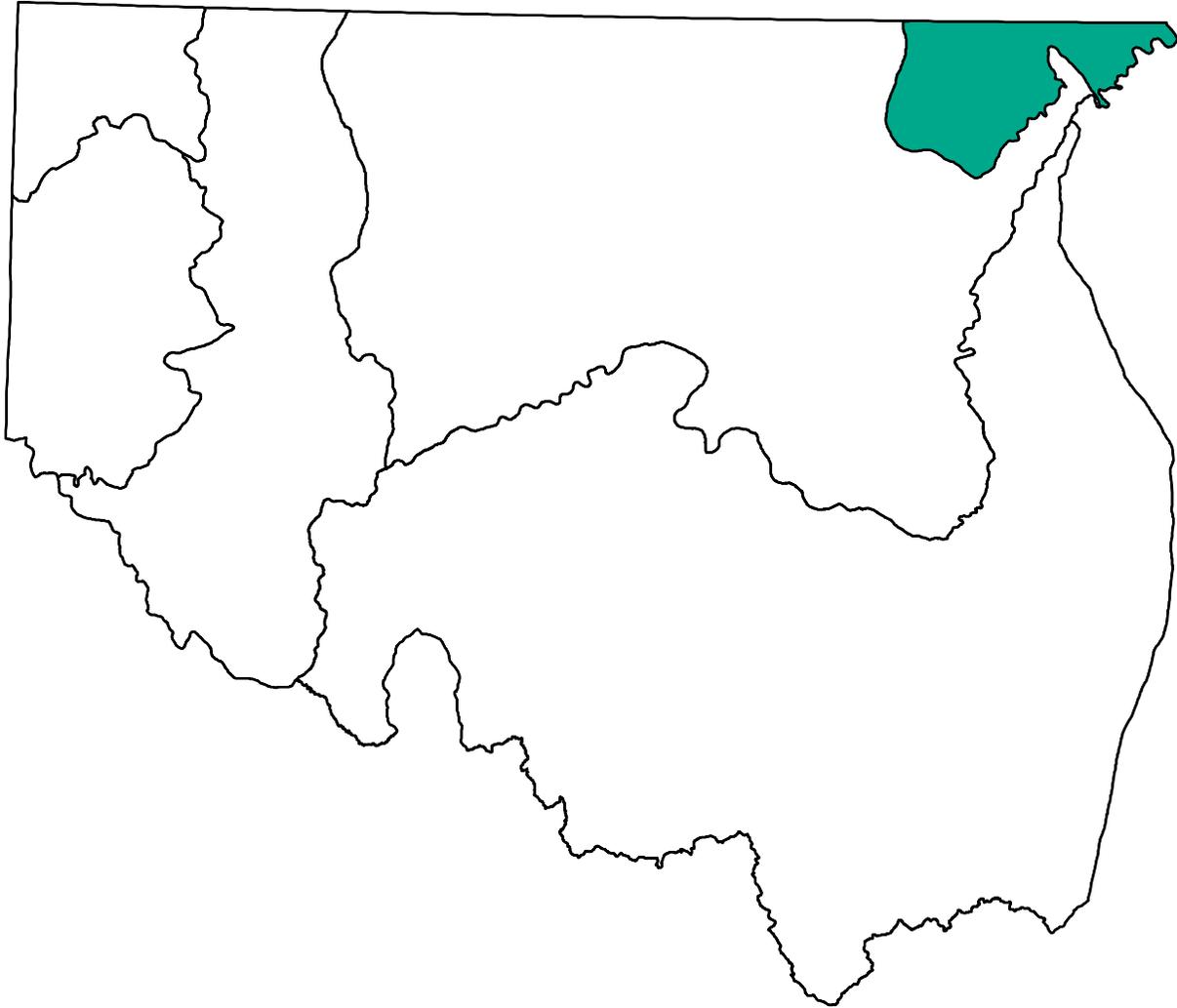


# Section 6.4

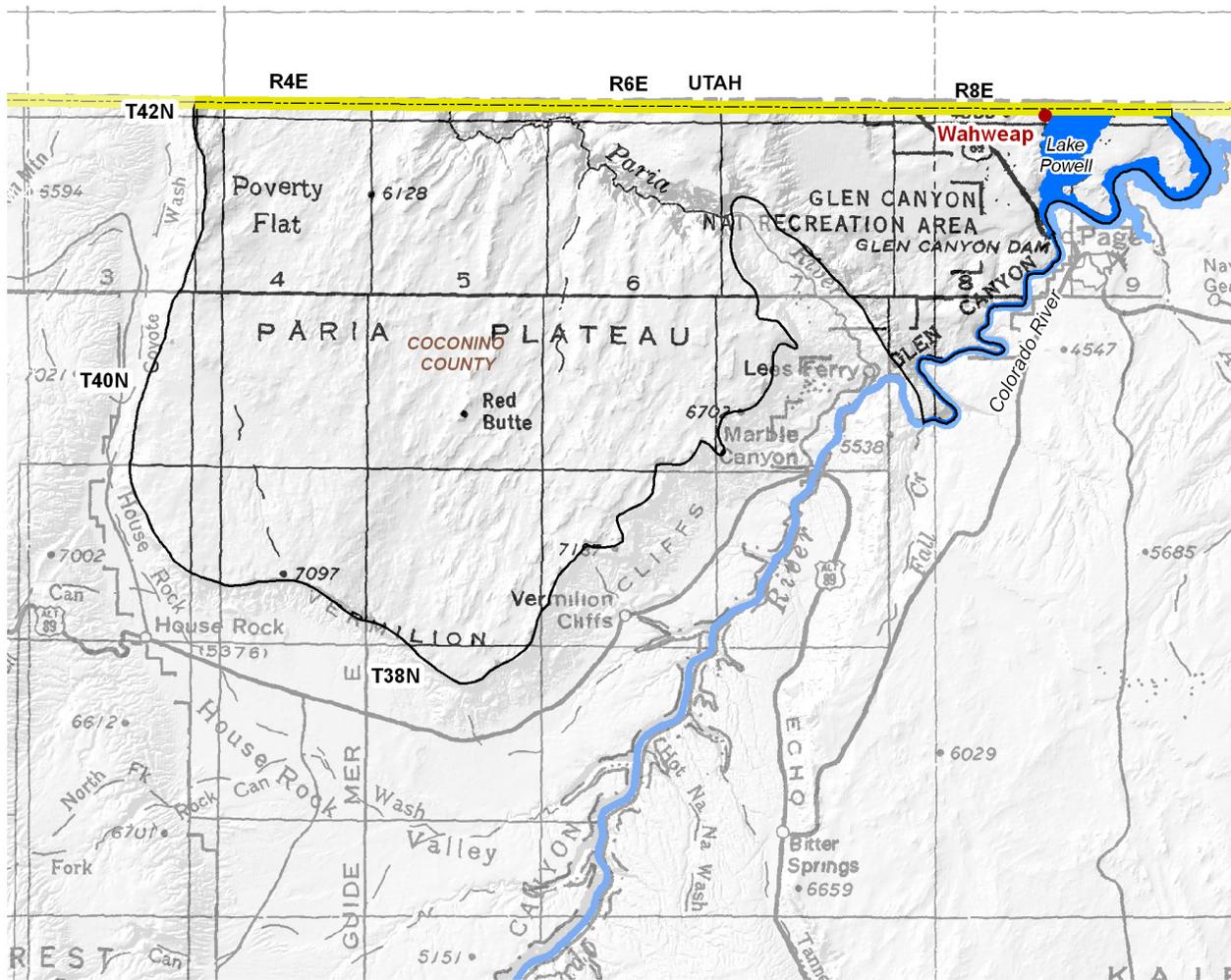
## Paria Basin



### 6.4.1 Geography of the Paria Basin

The Paria Basin, located in the northeastern part of the planning area is 408 square miles in area, the smallest basin in the planning area. Geographic features and principal communities are shown on Figure 6.4-1. The basin is characterized by a plateau and canyons. Vegetation types include Great Basin desertscrub and Great Basin conifer woodland. (See Figure 6.0-11)

- Principal geographic features shown on Figure 6.4-1 are:
  - The Paria Plateau
  - The Colorado River and Lake Powell on the eastern basin boundary and the lowest point at 3,100 feet where the River exits the basin.
  - Paria River in the north central portion of the basin
  - Vermilion Cliffs, which form the southern basin boundary with the highest point in the basin at 7,326 feet.



Base Map: USGS 1:500,000, 1981



**Figure 6.4-1**  
**Paria Basin**  
**Geographic Features**

Utah State Boundary  
City, Town or Place



## 6.4.2 Land Ownership in the Paria Basin

Land ownership, including the percentage of ownership by category, for the Paria Basin is shown in Figure 6.4-2. The principal feature of land ownership in this basin is the large portion of land, 86% of the total basin area, in the Vermilion Cliffs National Monument. 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 6.0.4. Land ownership categories are discussed below in the order from largest to smallest percentage in the basin.

### U.S. Bureau of Land Management (BLM)

- 83.7% of the land is federally owned and managed by the Arizona Strip Field Office of the Bureau of Land Management.
- Most of the BLM land in the basin is within the Vermilion Cliffs National Monument and includes a portion of the 79,000 acre Vermilion Cliffs Wilderness. (see Figure 6.0-14)
- Land uses include resource conservation, recreation and grazing.

### National Park Service (NPS)

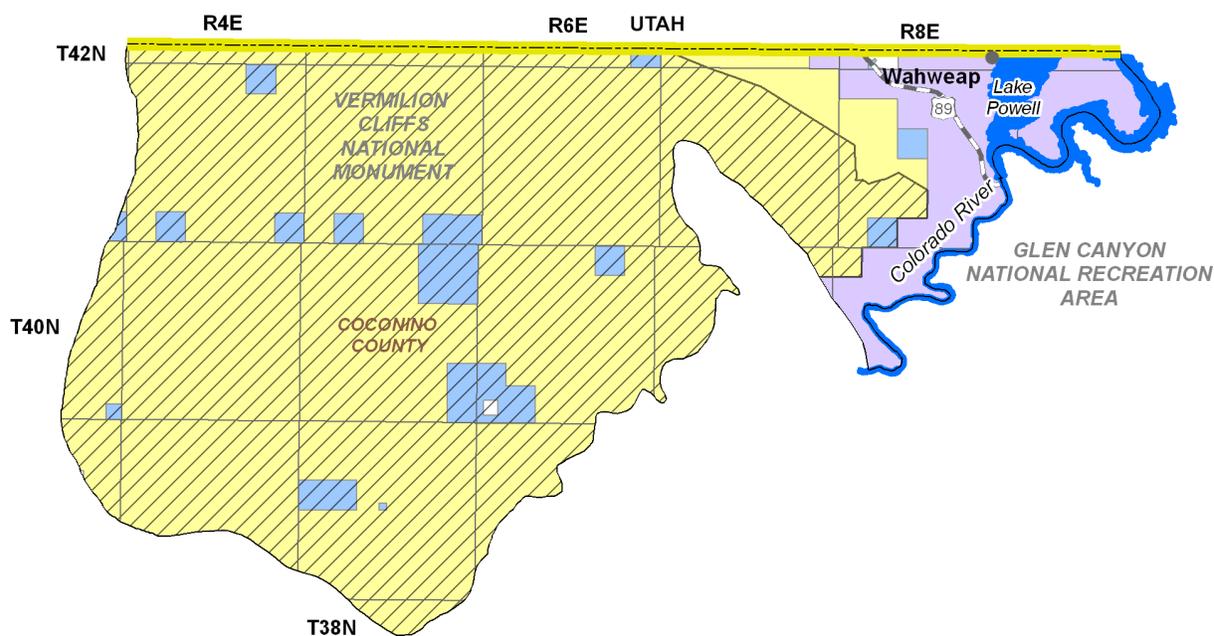
- 10.9% of the land is federally owned and managed by the National Park Service as the Glen Canyon National Recreation Area.
- Primary land use is recreation.

### State Trust Land

- 5.2% of the land is held in trust for the public schools under the State Trust Land system.
- State land is located throughout the basin interspersed with BLM land.
- Primary land use is grazing.

### Private

- 0.2% of the land is private, consisting of two small parcels.
- Private land is located in the vicinity of Wahweap and a small parcel is surrounded by state trust land in the central portion of the basin.
- Land uses include domestic, commercial and ranching.



**Land Ownership  
(Percentage in Basin)**

- U.S. Bureau of Land Management (83.7%) 
- National Park Service (10.9%) 
- State Trust (5.2%) 
- Private (0.2%) 
- National Monument 
- Utah State Boundary 
- Major Road 
- City, Town or Place 

0 3 6 Miles



**Figure 6.4-2  
Paria Basin  
Land Ownership**



Source: ALRIS, 2004  
Bureau of Land management, 1999

### 6.4.3 Climate of the Paria Basin

Climate data from NOAA/NWS Co-op Network and Evaporation Pan stations are compiled in Table 6.4-1 and the locations are shown on Figure 6.4-3. Figure 6.4-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Paria Basin does not contain AZMET or SNOTEL/ Snowcourse stations. More detailed information on climate in the planning area is found in Section 6.0.3. A description of the climate data sources and methods is found in Volume 1, Appendix A.

#### NOAA/NWS Co-op Network

- Refer to Table 6.4-1A
- Temperatures at the one NOAA/NWS Co-op Network station range from an average annual high of 84.5°F in July to an average annual low of 37.5°F in January.
- The highest average seasonal rainfall occurs in the summer season (July-September) when 30% of the annual rainfall occurs. Average annual rainfall is 6.78 inches.

#### Evaporation Pan

- Refer to Table 6.4-1B
- There is one evaporation pan station in the basin. This pan is at 3,720 feet and has an average annual evaporation rate of 100.18 inches.

#### SCAS Precipitation Data

- See Figure 6.4-3
- Additional precipitation data shows average annual rainfall as high as 16 inches in the southern portion of the basin and as low as four inches along the Colorado River.

**Table 6.4-1 Climate Data for the Paria 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
Wahweap	3,730	1971-2000	84.5/Jul	37.5/Jan	1.70	1.09	2.02	1.97	6.78

Source: WRCC, 2005

**Notes:**

<sup>1</sup>Average temperature for period of record shown; average precipitation from 1971-2000

**B. Evaporation Pan:**

Station Name	Elevation (in feet)	Period of Record Used for Averages	Avg. Annual Evap (in inches)
Wahweap	3,720	1961 - 2000	100.18

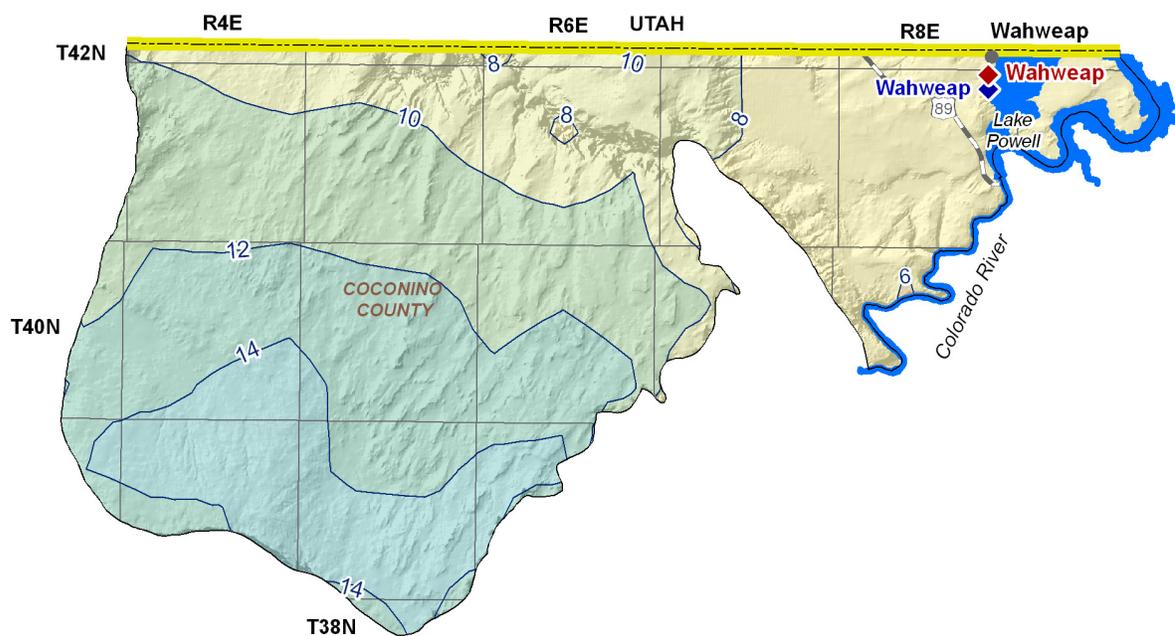
Source: WRCC, 2005

**C. AZMET:**

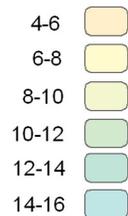
Station Name	Elevation (in feet)	Period of Record	Average Annual Reference Evapotranspiration, in inches (Number of years to calculate averages)
None			

**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**



**Meteorological Stations**



Precipitation Contour

Utah State Boundary

Major Road

City, Town or Place



**Figure 6.4-3  
Paria Basin  
Meteorological Stations  
and Annual Precipitation**



Precipitation Data Source: Oregon State University, 1998

#### 6.4.4 Surface Water Conditions in the Paria Basin

There are no streamflow data or flood ALERT equipment in this basin. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 6.4-2. The USGS runoff contours and large reservoirs are shown on Figure 6.4-4. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

##### Reservoirs and Stockponds

- Refer to Table 6.4-2.
- The only large reservoir in the basin is Lake Powell with a maximum storage capacity of 20.3 million acre-feet (maf). Most of the storage is in Utah.
- Lake Powell is used for hydroelectric, irrigation, recreation and other uses.
- There are 57 registered stockponds in this basin.

##### Runoff Contour

- Refer to Figure 6.4-4.
- Average annual runoff is highest, 0.5 inches per year or 26.65 acre-feet per square mile, in the southwestern portion and decreases to 0.1 inches, or 5.33 acre-feet per square mile, in the eastern portion of the basin.

**Table 6.4-2 Reservoirs and Stockponds in the Paria Basin**

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

MAP KEY	RESERVOIR/LAKE NAME <i>(Name of dam, if different)</i>	OWNER/OPERATOR	MAXIMUM STORAGE (AF)	USE <sup>1</sup>	JURISDICTION
1	Powell (Glen Canyon Dam)	Bureau of Reclamation	20,325,000	H,I,O,R	Federal

**B. Other Large Reservoirs (50 acre surface area or greater)**

MAP KEY	RESERVOIR/LAKE NAME <i>(Name of dam, if different)</i>	OWNER/OPERATOR	MAXIMUM SURFACE AREA (acres)	USE	JURISDICTION
None identified by ADWR at this time					

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)**

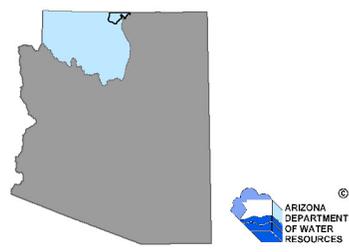
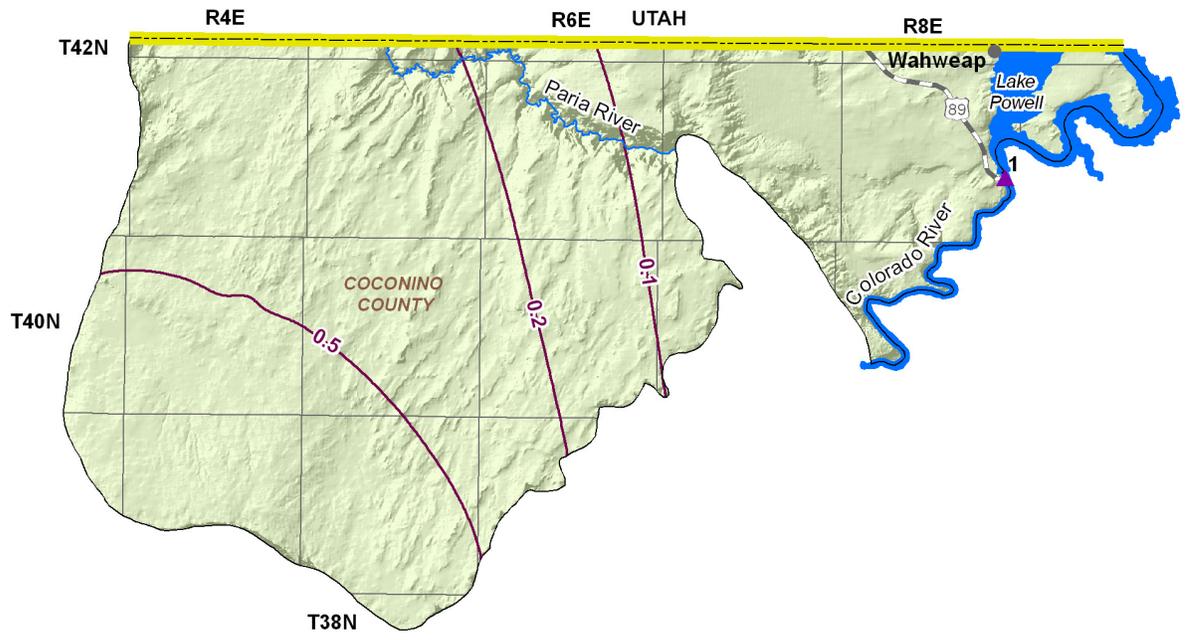
Total number: 0

Total surface area: 0 acres

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

Total number: 57

<sup>1</sup> H=hydroelectric; I=irrigation; O=other; R=recreation



Stream Data Source: ALRIS 2005



**Figure 6.4-4**  
**Paria Basin**  
**Surface Water Conditions**

- USGS Annual Runoff Contour for 1951-1980 (in inches)
- Stream Channel (width of line reflects stream order)
- Large Reservoir
- Utah State Boundary
- Major Road
- City, Town or Place

### 6.4.5 Perennial/Intermittent Streams and Major Springs in the Paria Basin

The total number of springs in the basin are shown in Table 6.4-3. The locations of perennial streams are shown on Figure 6.4-5. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There are no intermittent streams and the only perennial streams are the Colorado River and the Paria River.
- There are no major or minor springs.
- The total number of springs, regardless of discharge, identified by the USGS varies from two to three, depending on the database reference.

**Table 6.4-3 Springs in the Paria Basin**

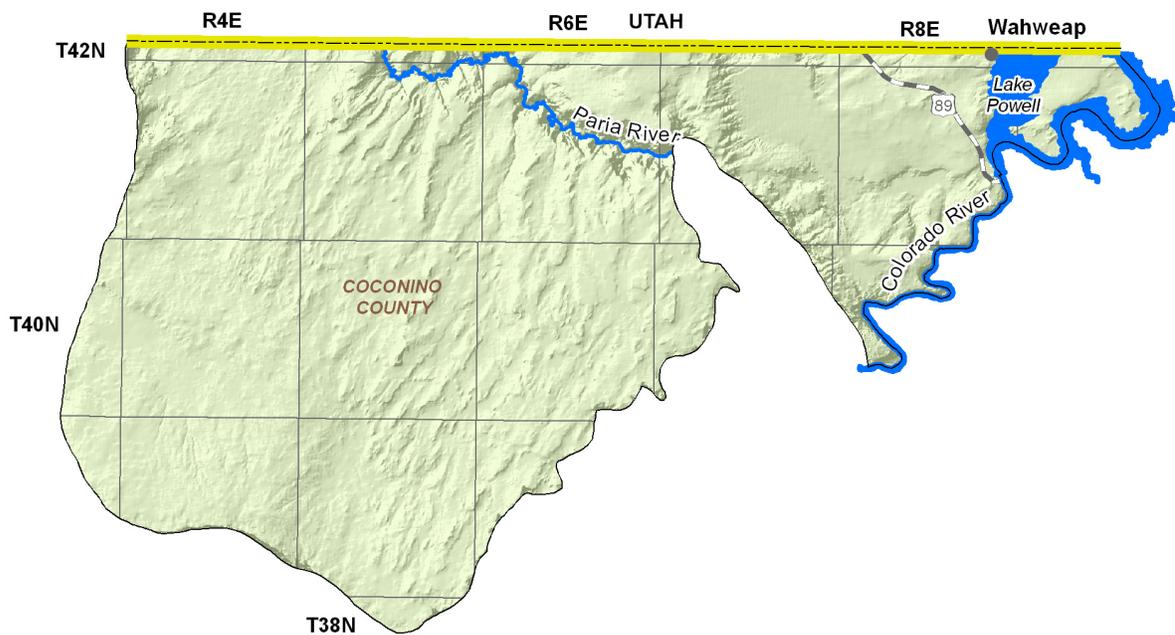
**A. Major Springs (10 gpm or greater):**

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, 2006b): 2 to 3**



Stream Data Source: AGFD, 1993 & 1997



**Figure 6.4-5**  
**Paria Basin**  
**Perennial/Intermittent Streams**  
**and Major (>10 gpm) Springs**

- Perennial Stream
- Utah State Boundary
- Major Road
- City, Town or Place



### 6.4.6 Groundwater Conditions of the Paria Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 6.4-4. Figure 6.4-6 shows water-level change between 1990-1991 and 2003-2004. Figure 6.4-7 contains the hydrograph for the selected well shown on Figure 6.4-6. Figure 6.4-8 shows well yields in two 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 6.4-4 and Figure 6.4-6.
- The major aquifer in the basin is sedimentary rock (N Aquifer).
- Almost all of the basin geology consists of consolidated crystalline and sedimentary rock.
- Data on natural recharge and groundwater flow direction is not available for this basin.

#### Well Yields

- Refer to Table 6.4-4 and Figure 6.4-8.
- As shown on Figure 6.4-8, well yields in this basin range from less than 100 gallons per minute (gpm) to 1,000 gpm. All well yield data is from the northeastern portion of the basin near Wahweap.
- One source of well yield information, based on three reported wells, indicates that the median well yield in this basin is 520 gpm in the vicinity of Wahweap.

#### Water in Storage

- Refer to Table 6.4-4.
- The storage estimate for this basin is 1.5 maf of water to a depth of 1,200 feet.

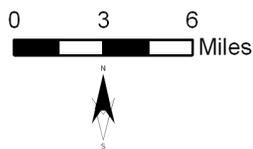
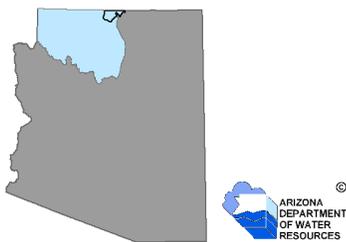
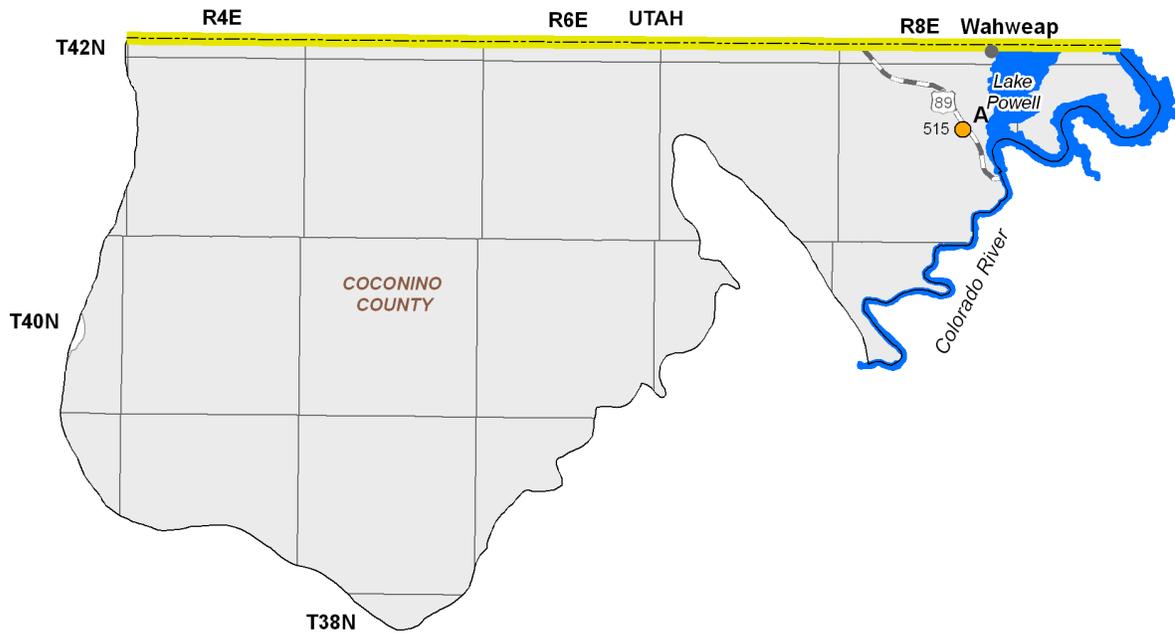
#### Water Level

- Refer to Figure 6.4-6. Water levels are shown for a well measured in 2003-2004.
- The Department annually measures one index well in this basin. A hydrograph for this well is shown in Figure 6.4-7.

**Table 6.4-4 Groundwater Data for the Paria Basin**

<b>Basin Area (in square miles):</b>	408	
<b>Major Aquifer(s):</b>	<b>Name and/or Geologic Units</b>	
	Sedimentary Rock (N Aquifer)	
<b>Well Yields, in gal/min:</b>	Range 30-600 Median 520 (3 wells reported)	Reported on registration forms for large (>10-inch) diameter wells (Wells55)
	Range 30-1,400	ADWR (1990 and 1994b)
	Range 0-500	Anning and Duet (1994)
<b>Estimated Natural Recharge, in acre-feet/year:</b>	N/A	
<b>Estimated Water Currently in Storage, in acre-feet:</b>	1,500,000 (to 1,200 ft)	ADWR (1994b)
<b>Current Number of Index Wells:</b>	1	
<b>Date of Last Water-level Sweep:</b>	1976 (34 wells measured)	

N/A = Not Available



**Figure 6.4-6**  
**Paria Basin**  
**Groundwater Conditions**

Water-level change in feet between 1990-1991 and 2003-2004

H      number is depth to water in feet  
375 ○ =      during 2003-2004;  
                 letter is hydrograph

Between -30 and -15      ●

Consolidated Crystalline & Sedimentary Rocks      ■

Unconsolidated Sediments      □

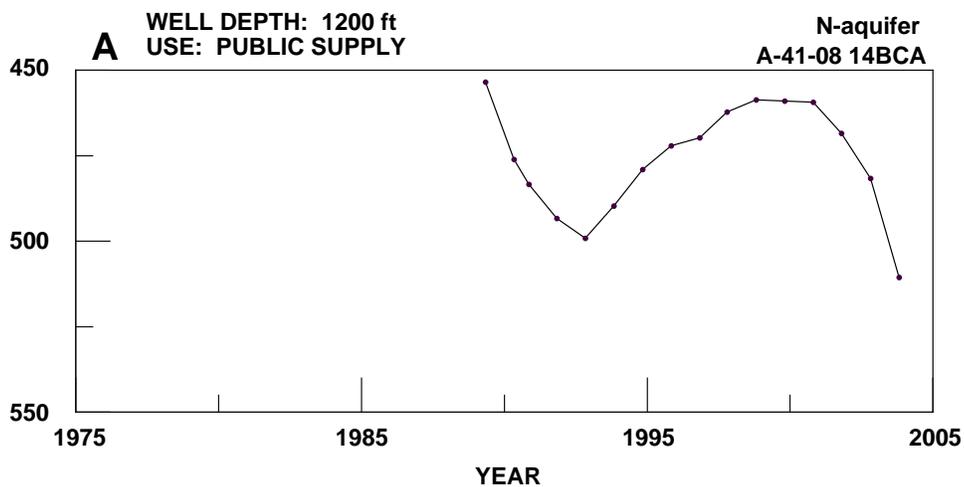
Utah State Boundary      ———

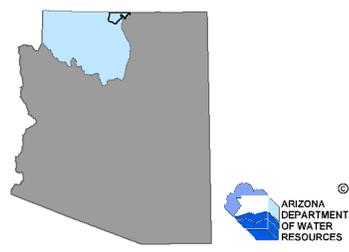
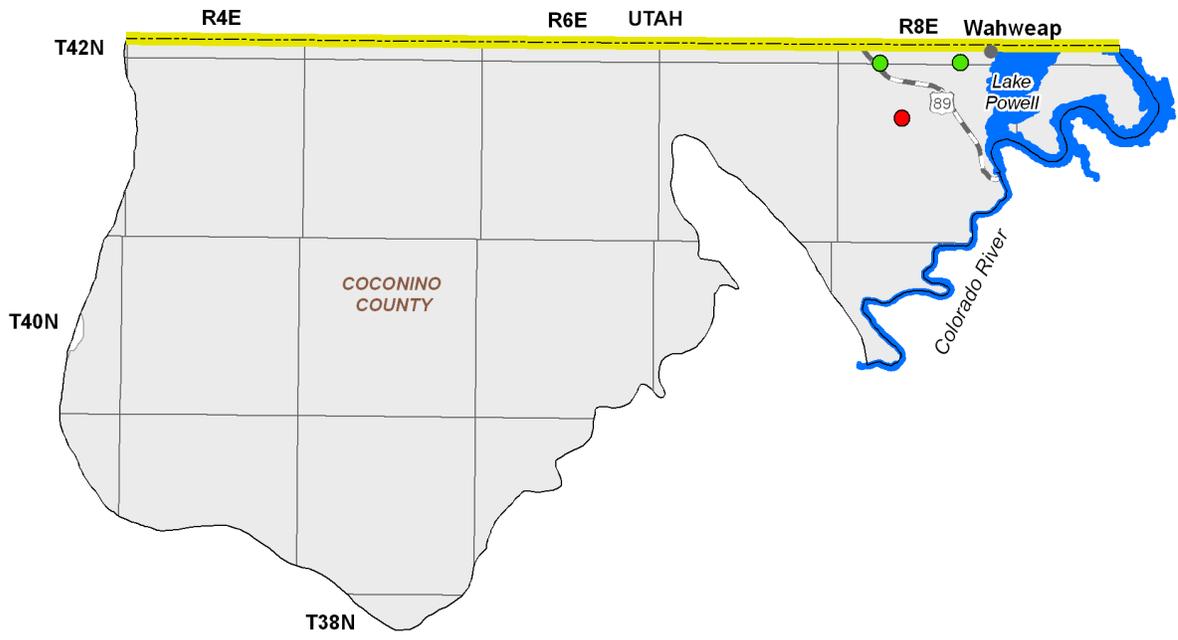
Major Road      ———

City, Town or Place      ●

**Figure 6.4-7**  
**Paria Basin**  
**Hydrographs Showing Depth to Water in Selected Wells**

Depth To Water In Feet Below Land Surface





**Figure 6.4-8  
Paria Basin  
Well Yields**

- Well Yields
  - Between 500 and 1000 gals/min ●
  - Less than 100 gals/min ●
- Consolidated Crystalline & Sedimentary Rocks
- Unconsolidated Sediments
- Utah State Boundary — — — — —
- Major Road — — — — —
- City, Town or Place ●

## 6.4.7 Water Quality of the Paria 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 6.4-5A. 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 6.4-5B. Figure 6.4-9 shows the location of water quality occurrences keyed to Table 6.4-5. 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 6.4-5A.
- Seven wells have parameter concentrations that have equaled or exceeded the drinking water standard for arsenic.

### **Lakes and Streams with impaired waters**

- Refer to Table 6.4-5B.
- The water quality standard for suspended sediment concentration was exceeded in one 29-mile stream reach, the Paria River from the Utah border to the Colorado River. A portion of this impaired reach is located in the Kanab Plateau Basin.
- This reach is not part of the ADEQ water quality improvement effort called the Total Maximum Daily Load (TMDL) Program at this time.

**Table 6.4-5 Water Quality Exceedences in the Paria Basin<sup>1</sup>**

**A. Wells, Springs and Mines**

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS) <sup>2</sup>
		Township	Range	Section	
1	Well	42 North	8 East	32	As
2	Well	42 North	8 East	35	As
3	Well	42 North	8 East	35	As
4	Well	42 North	8 East	36	As
5	Well	41 North	8 East	4	As
6	Well	41 North	8 East	14	As
7	Well	41 North	8 East	14	As

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 <sup>3</sup>	Parameter(s) Exceeding Use Standard
a	Stream	Paria River (Utah border to Colorado River)	29 <sup>4</sup>	NA	A&W	suspended sediment concentration

Source: ADEQ 2005

**Notes:**

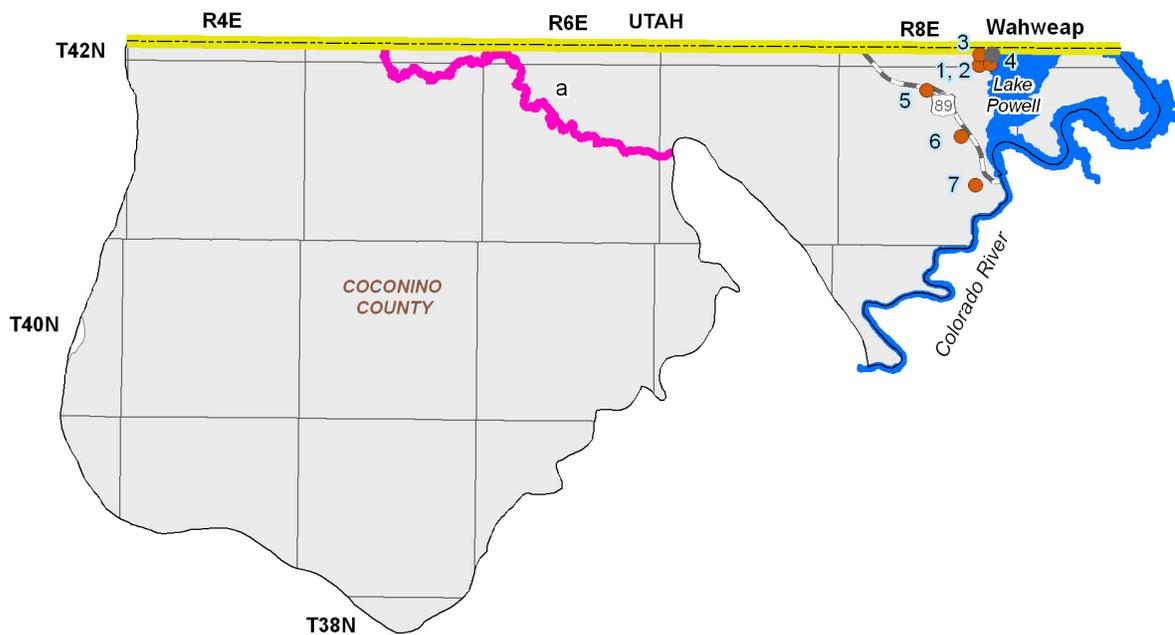
NA = Not Applicable

<sup>1</sup> Water quality samples collected between 1977 and 2001.

<sup>2</sup> As = Arsenic

<sup>3</sup> A&W = Aquatic and Wildlife

<sup>4</sup> Total length of the impaired reach. A portion of this reach is in the Kanab Plateau Basin.



0 3 6 Miles



**Figure 6.4-9**  
**Paria Basin**  
**Water Quality Conditions**

- Well, Spring or Mine Site that has Equaled or Exceeded DWS  1
- Impaired Stream or Lake  a
- Consolidated Crystalline & Sedimentary Rocks
- Unconsolidated Sediments
- Utah State Boundary
- Major Road
- City, Town or Place



### 6.4.8 Cultural Water Demand in the Paria 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 6.4-6. There is no recorded effluent generation in this basin. Figure 6.4-10 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 demand is found in Section 6.0.7.

#### **Cultural Water Demand**

- Refer to Table 6.4-6 and Figure 6.4-10.
- Population in this basin increased from 237 in 1980 to 528 in 2000 and is projected to increase to 695 in 2030.
- All water use is for municipal demand in the vicinity of Wahweap.
- There is no reported surface water use in this basin. Groundwater demand was reported as 1,000 acre-feet per year (AFA) on average from 1971-1990 and less than 300 AFA from 1991-2005.
- As of 2005 there were 12 registered wells with a pumping capacity of less than or equal to 35 gpm and four wells with a pumping capacity of more than 35 gpm.

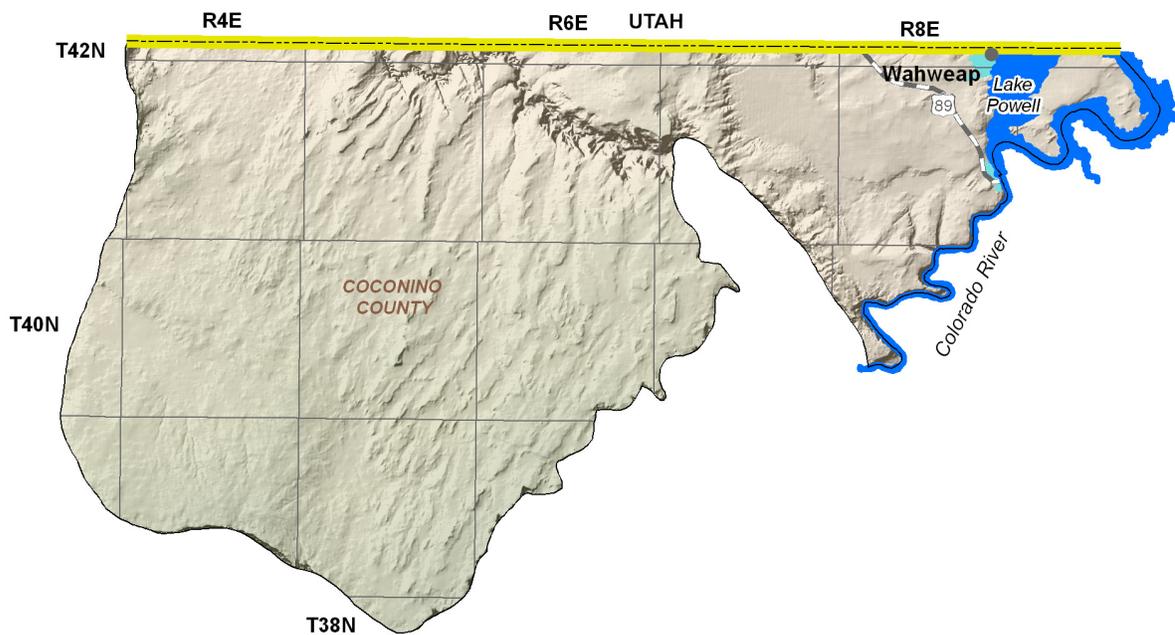
Table 6.4-6 Cultural Water Demand in the Paria Basin<sup>1</sup>

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		9 <sup>2</sup>	2 <sup>2</sup>	1,000			NR			ADWR (1994a)
1972				1,000			NR			
1973				1,000			NR			
1974				1,000			NR			
1975				1,000			NR			
1976				1,000			NR			
1977				1,000			NR			
1978				1,000			NR			
1979		1,000			NR					
1980	237	0	1	1,000			NR			
1981	262			1,000			NR			
1982	287			1,000			NR			
1983	312			1,000			NR			
1984	337			1,000			NR			
1985	362			1,000			NR			
1986	387			1,000			NR			
1987	412			1,000			NR			
1988	437	0	0	1,000			NR			
1989	462			1,000			NR			
1990	487			1,000			NR			
1991	494			1,000			NR			
1992	500			1,000			NR			
1993	507			1,000			NR			
1994	514			1,000			NR			
1995	521			1,000			NR			
1996	528	3	0	<300	NR	NR	NR			USGS (2007)
1997	535			<300	NR	NR	NR			
1998	541			<300	NR	NR	NR			
1999	548			<300	NR	NR	NR			
2000	528			<300	NR	NR	NR			
2001	532			<300	NR	NR	NR			
2002	536			<300	NR	NR	NR			
2003	539			<300	NR	NR	NR			
2004	543	<300	NR	NR	NR					
2005	547	<300	NR	NR	NR					
2010	566									
2020	637									
2030	695									
<b>WELLS TOTALS:</b>		<b>12</b>	<b>4</b>							

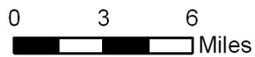
<sup>1</sup> Does not include effluent or evaporation losses from stockponds and reservoirs.

<sup>2</sup> Includes all wells through 1980.

NR - Not reported



Primary Data Source: USGS National Gap Analysis Program, 2004



**Figure 6.4-10**  
**Paria Basin**  
**Cultural Water Demand**

**Demand Centers**

- M&I - Low Intensity
- Utah State Boundary
- Major Road
- City, Town or Place



#### **6.4.9 Water Adequacy Determinations in the Paria Basin**

Water adequacy determination information including the subdivision name, location, number of lots, adequacy determination, reason for the inadequacy determination, date of determination and subdivision water provider are shown in Table 6.4-7. Figure 6.4-11 shows the locations of subdivisions 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.

- All subdivisions reviewed for an adequacy determination are in the vicinity of Wahweap. Nine water adequacy determinations for 1,356 lots total have been made in this basin through December 2008; all were determined to be adequate.

**Table 6.4-7 Adequacy Determinations in the Paria Basin**

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No. <sup>2</sup>	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination <sup>3</sup>	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
1	Greenehaven	Coconino	42 North	8 East	32	770	53-500757	Adequate		12/28/1977	Greenehaven Development Corp.
2	Greenehaven #4	Coconino	42 North	8 East	32	12	53-500758	Adequate		6/3/1988	Greenehaven Water Company
3	Greenehaven Unit #6	Coconino	42 North	8 East	32	83	53-400505	Adequate		3/16/2001	Greenehaven Water Company
4	Greenehaven # 5	Coconino	42 North	8 East	32	86	53-400507	Adequate		7/3/2001	Greenehaven Water Company
5	Greenehaven Mobile Home Estates	Coconino	42 North	8 East	32	151	53-500759	Adequate		7/8/1981	Greenehaven Water Company
6	Greenehaven Unit VII Phase 1	Coconino	42 North	8 East	32	58	53-402001	Adequate		6/22/2006	Greenehaven Water Company
7	Greenehaven Unit VII Phase 1	Coconino	42 North	8 East	32	81	53-402002	Adequate		6/22/2006	Greenehaven Water Company
8	Greenehaven Unit VIII	Coconino	42 North	8 East	32	75	53-402000	Adequate		6/22/2006	Greenehaven Water Company
9	Patio Homes @ Lake Powell View Properties-One	Coconino	42 North	8 East	32	40	53-400698	Adequate		4/2/2002	Greenehaven Water Company

Source: ADWR 2008

**Notes:**

<sup>1</sup>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.

<sup>2</sup> 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.

<sup>3</sup> A. Physical/Continuous

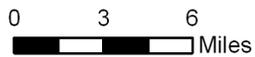
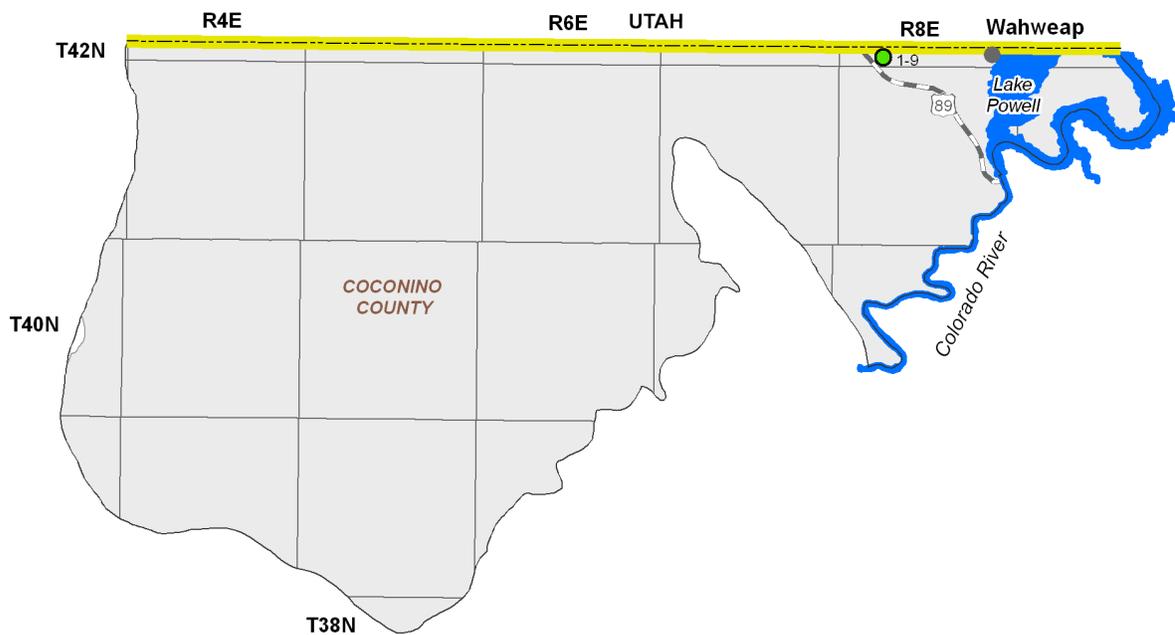
- 1) Insufficient Data (applicant chose not to submit necessary information, and/or available hydrologic data insufficient to make determination)
- 2) Insufficient Supply (existing water supply unreliable or physically unavailable; for groundwater, depth-to-water exceeds criteria)
- 3) Insufficient Infrastructure (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 6.4-11**  
**Paria Basin**  
**Adequacy Determinations**

<b>Adequacy Determinations</b>	
Adequate	
Consolidated Crystalline & Sedimentary Rocks	
Unconsolidated Sediments	
Utah State Boundary	
Major Road	
City, Town or Place	

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# Paria Basin

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