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LOWER COLORADO RIVER PLANNING AREA

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VOLUME 7 –LOWER COLORADO RIVER PLANNING AREA

PREFACE

Volume 7, the Lower Colorado River Planning Area, is the seventh in a series of nine volumes that comprise the Arizona Water Atlas. The primary objectives in assembling the Atlas are to present an overview of water supply and demand conditions in Arizona, to provide water resource information for planning and resource development purposes and help to identify the needs of communities.

The Atlas divides Arizona into seven planning areas (Figure 7.0-1). There is a separate Atlas volume for each planning area, an introductory volume composed of background information, and an executive summary volume. "Planning areas" are an organizational concept that provide for a regional perspective on supply, demand and water resource issues. A complete discussion of Atlas organization, purpose and scope is found in Volume 1. Also included in Volume 1 is general background information for the state, a description of data sources and methods of analysis for the tables and maps presented in the Atlas, and appendices that provide information on water law, management and programs, and Indian water rights claims and settlements.

There are additional, more detailed data available to those presented in this volume. These data may be obtained by contacting the Arizona Department of Water Resources (Department).

7.0 Overview of the Lower Colorado River Planning Area

The Lower Colorado River Planning Area is composed of eleven groundwater basins in southwestern Arizona. The planning area contains the driest and hottest portions of Arizona. Large areas of federal lands consisting of military reservations, wildlife refuges and national monuments are located in the planning area. Elevations range from over 7,700 feet in the Baboquivari Mountains along the southeastern boundary of the planning area to about 70 feet at the Colorado River where it enters Mexico. All of Yuma County and most of La Paz County (91% of the county) are contained within the planning area as well as portions of Maricopa (38%), Pima (43%) and Yavapai (1%) counties. Five Indian reservations including the Cocopah, Colorado River Indian Tribes, Gila Bend, Fort Yuma-Quechan and Tohono O'odham are located within the planning area. One of the planning area basins, Harquahala, has been designated as an Irrigation Non-expansion area (INA) due to insufficient groundwater to provide a reasonably safe supply for irrigation.

Although much of the planning area is relatively sparsely populated, there are several major population centers, particularly in the Yuma area. The 2000 Census planning area population was approximately 194,100 with basin populations ranging from less than 10 in the Tiger Wash Basin to almost 153,000 in the Yuma Basin. Yuma is the largest community with over 77,000 residents in 2000. Other population centers include Fortuna Foothills and San Luis located near Yuma, Parker/ Parker Strip, Ajo, Gila Bend and Quartzsite.

An average of over 3,038,400 acre-feet of water is used annually in the planning area for agricultural,

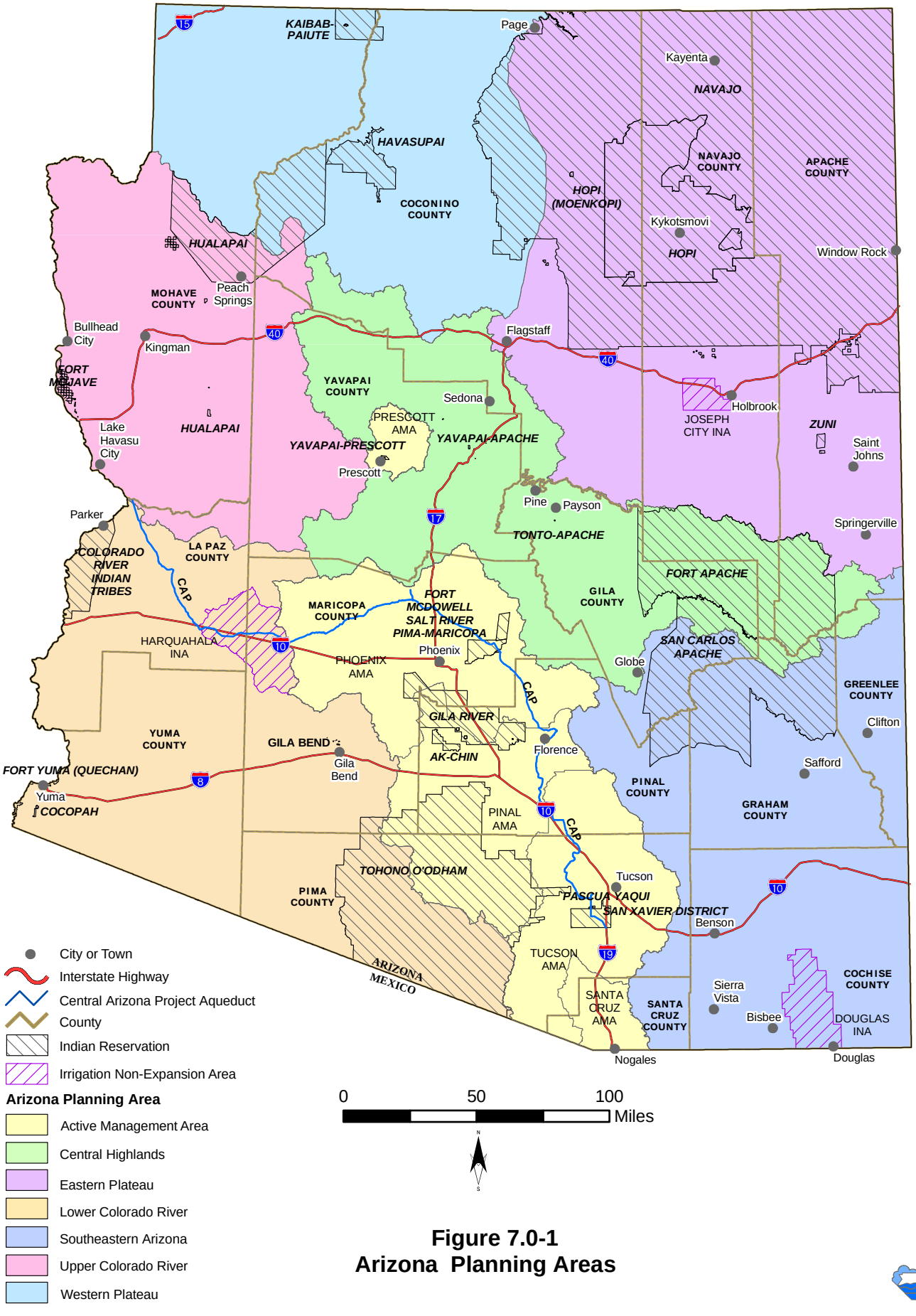


Figure 7.0-1
Arizona Planning Areas

municipal and industrial uses (cultural water demand) - almost as much water demand as the state's five active management areas combined. Of this total demand, approximately 1,027,250 acre-feet is well pumpage, 2,010,500 acre-feet are surface water diversions from the Colorado River, Gila River and the Central Arizona Project and about 680 acre-feet is effluent reuse. The agricultural demand sector is by far the largest with approximately 2,974,200 acre-feet of demand a year – 98% of the total demand. Average annual municipal sector demand is about 49,400 acre-feet and industrial demand is about 14,850 acre-feet.

7.0.1 Geography

The Lower Colorado River Planning Area encompasses about 17,200 square miles (sq. mi.) and includes the Butler Valley, Gila Bend, Harquahala, Lower Gila, McMullen Valley, Parker, Ranegras Plain, San Simon Wash, Tiger Wash, Western Mexican Drainage and Yuma basins. Basin boundaries, counties and prominent cities, towns and places are shown in Figure 7.0-2. The planning area is bounded on the north by the Bill Williams Basin in the Upper Colorado River Planning Area, on the east by the Phoenix, Pinal and Tucson Active Management Areas (AMA), on the south by the international boundary with Mexico and on the west by the State of California and the international boundary. The planning area includes all or part of four watersheds, which are discussed in Section 7.0.2. The Cocopah Indian Reservation (10 sq. mi.) and the Gila Bend Indian Reservation (16.3 sq. mi.) are entirely within the planning area. Approximately 86% (391 sq. mi.) of the Colorado River Indian Tribes Reservation, 57% (2,471 sq. mi.) of the Tohono O'odham Indian Reservation, and 4% (3 sq. mi.) of the Fort Yuma-Quechan Indian Reservation are also located within the planning area (Figure 7.0-1). The Gila Bend and Tohono O'odham reservations are two of the four land bases that make up the Tohono O'odham Nation. Comparable in size to the state of Connecticut, the Nation is the second largest Indian reservation in the United States.

The entire planning area is within the Basin and Range physiographic province characterized by northwest-southeast trending mountain ranges separated by broad alluvial valleys (See Volume 1, Figure 1-2). The planning area is relatively low elevation – generally less than 3,500 feet. Higher elevation mountain ranges occur along part of the northern boundary and in the Baboquivari Mountains that form the southeastern boundary where elevations rise to over 7,700 feet. The lowest elevation is about 70 feet where the Colorado River enters Mexico at the Southerly International Boundary (SIB) in the Yuma Basin. The basin with the largest elevational range is the San Simon Wash Basin with a range of 1,650 to 7,730 feet.

A unique geographic feature of the planning area is the arid climate, which has shaped its topography and surface water characteristics. In the more arid western part of the planning area, the geography consists of widely-scattered, small mountain ranges of mostly barren rock and broad, flat valleys (or plains). A number of groundwater basins in the planning area take their name from this geographic feature, e.g. Butler Valley, McMullen Valley and Ranegras Plain. Other examples of major valleys and plains are the Mohawk Valley in the Lower Gila Basin and the La Posa Plain in the Parker Basin. Relatively large areas of sand dunes occur south of Yuma and west of the Gila and Tinajas Altas Mountains in an ancient river terrace. To the southeast, the terrain contains more numerous mountain ranges and narrower valleys with higher rainfall and more plant diversity and density

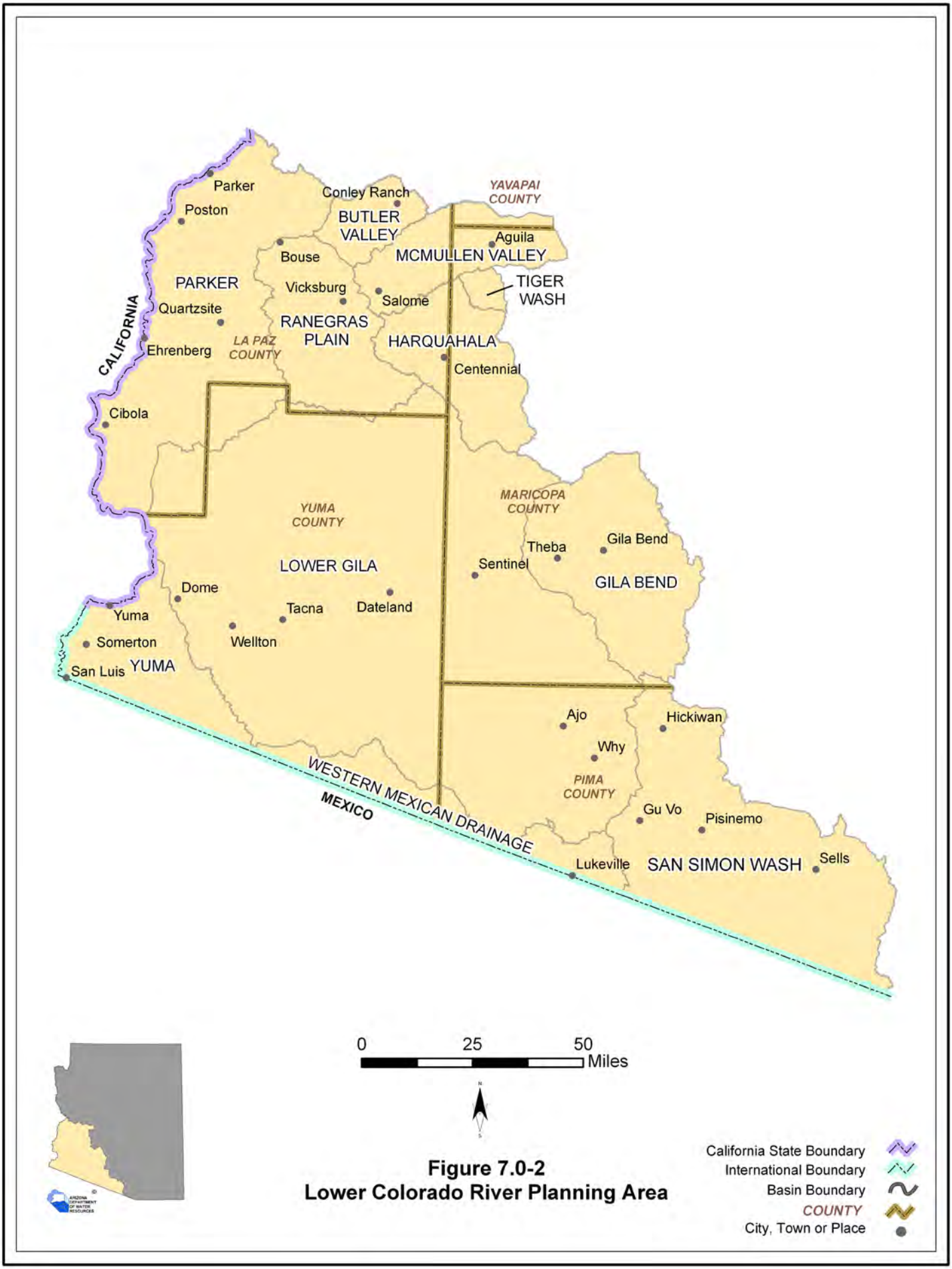


Figure 7.0-2
Lower Colorado River Planning Area

(ASDM, 2007a). With the exception of the Colorado River, there are no perennial streams in the planning area. The Gila River was historically perennial for most of its length but by the beginning of the 20th century the effects of farming and construction of dams both upstream and within the planning area caused cessation of perennial flows (Tellman, et al., 1997). Broad sandy washes are the main surface water feature in the planning area, flowing only in response to significant precipitation events

7.0.2 Hydrology[1]

Groundwater Hydrology

The groundwater basins of the Lower Colorado River Planning Area are composed of alluvial valleys with significant volumes of groundwater in storage. Basins adjacent to the Colorado River were categorized by Anderson, et al., (1992) as Colorado River basins. Colorado River infiltration was historically the main source of inflow to aquifers in these basins. Other basins in the planning area receive minimal groundwater inflow due to the aridity of the area. These other basins were categorized by Anderson, et al., (1992) as "west" basins. The geology of the Colorado River Basins and west basins are also somewhat different and are described below. More detailed information on groundwater level changes, water quality, well yields, depth to water, groundwater in storage, groundwater recharge and other groundwater conditions are found in the individual basin sections.

<u>Colorado River Basins</u>
Colorado River Basins include the Parker and Yuma basins. In these basins the direction and occurrence of groundwater are influenced by the amount of streamflow in the Colorado River, which supplies the largest portion of groundwater recharge. Stream alluvium occurs along the Colorado River and its tributary washes and groundwater in the alluvium is hydraulically connected to the river.

In general, the aquifer consists of recent stream alluvium overlying older, more cemented basin fill deposits, which in turn overlie the Bouse Formation. The Bouse Formation consists of two zones. The upper zone is composed of medium to coarse-grained sand which can yield moderate amounts of groundwater under unconfined conditions. The lower zone contains fine-grained sediments which produce limited amounts of groundwater. Groundwater is found under confined (artesian) conditions in this lower zone. A fanglomerate unit (composed primarily of cemented gravel and thin basalt flows) underlies the Bouse Formation and can yield moderate amounts of groundwater. (Anderson, et al., 1992)

Parker Basin
In the Parker Basin along the Colorado River, groundwater occurs under confined conditions in the Bouse Formation and fanglomerate unit and under unconfined conditions in alluvial deposits. The recent stream alluvium consists of silt, sand and gravel deposits and groundwater in these deposits is hydraulically connected to the river. In the eastern portion of the Parker Basin, groundwater is found in smaller amounts under unconfined conditions. In this area, groundwater flows toward

[1] Except as noted, information in this section is taken from the Arizona Water Resources, Asessment , Volume II, ADWR (August, 1994).

the Colorado River along stream courses. Elsewhere, groundwater flows away from the River or parallel to it.

Groundwater quality is generally good in the Parker Basin although arsenic, fluoride, nitrate and organic compounds at concentrations exceeding the Drinking Water Standard have been measured in wells. Most water quality measurements have been made in the Quartzsite area where septic tanks have caused nitrate contamination of groundwater.

Yuma Basin

Cenozoic basin fill is the primary aquifer in the Yuma Basin. Thickness of the basin fill may exceed 16,000 feet in some areas but only the upper 2,000 to 2,500 feet is considered hydrologically important because of its excellent transmissive properties. This aquifer is subdivided into three zones. In descending order these are the upper fine-grained zone, the coarse-gravel zone and the wedge zone. The upper zone includes younger alluvium and the uppermost deposits of older alluvium. Little water is pumped from this zone although beneath irrigated areas, the water table lies within this zone. The middle, coarse-gravel zone is the principal water producing unit in the Yuma basin. Depths to the coarse-gravel zone begin at about 100 feet in the Colorado and Gila River valleys and at about 180 feet below land surface beneath Yuma Mesa. Throughout most of the Yuma basin the wedge zone underlies the coarse-gravel zone and overlies the Bouse formation. The wedge zone is a major water-bearing deposit and consists of interbedded sands, gravel and cobbles. Depth to the top of this zone is about 160 feet near Laguna Dam and 300 feet in the southern Yuma Valley (Overby, 1997). The underlying Bouse Formation is a potential source of groundwater but units that underlie this formation (marine sedimentary rocks and volcanic rocks) are highly mineralized and deep and are not utilized.

Prior to development, nearly all groundwater recharge was from the Colorado and Gila Rivers through direct channel infiltration and annual flooding. The general groundwater flow pattern was from the Colorado and Gila Rivers southward under Yuma Mesa. A significant source of groundwater recharge now comes from percolation of excess water applied to crops. Irrigation water in excess of crop requirements is applied to reduce salt accumulation in the root-zone. A groundwater mound has developed under Yuma Mesa, as a result of agricultural irrigation and because groundwater flow away from the area is insufficient to drain rising water levels. This mound and rising groundwater levels in the Yuma area have affected groundwater flow patterns. In the western part of the basin, groundwater flow is now generally toward the Colorado River from Imperial Dam to the Northerly International Boundary (NIB). South of the mound, groundwater flow is generally south toward the natural drainage, but there also is a component of flow now toward the Colorado River and under the river toward the Mexicali Valley in Mexico (Dickinson, et al., 2006). In the eastern part of the Yuma Basin, groundwater moves from northwest to southeast across the Yuma Desert and exits the basin into Mexico east of the Algodones Fault (Overby, 1997). The Algodones Fault trends northwest to southeast across the basin south of Yuma and is a barrier to groundwater movement as reflected in water levels on either side of the fault.

Groundwater levels in the basin are also influenced by water management activities. The “242 Well Field and Lateral” is located east of San Luis in a 5-mile wide strip of land and consists of 21 wells that intercept part of the groundwater flow moving south into Mexico from Yuma Mesa.

Irrigation drainage water is a component of this groundwater flow. Water pumped from the well field is delivered to Mexico through the 242 Lateral and other laterals to meet international treaty obligations for Colorado River water deliveries. This activity, as well as groundwater pumping in Mexico, lowers groundwater levels in private wells in the vicinity of the wellfield (USBOR, 2007a).

Ground water quality varies across the Yuma Basin with elevated concentrations of total dissolved solids (TDS), arsenic, lead, agricultural pesticides, nitrate and volatile organic compounds in some areas (see Table 7.11-10). Groundwater was originally more similar in chemical composition to its source waters (Colorado and Gila rivers), but the quality has been altered by more than one hundred years of irrigation (Overby, 1997).

West Basins

West basins include Butler Valley, Gila Bend, Harquahala, Lower Gila, McMullen Valley, Ranegras Plain, San Simon Wash, Tiger Wash and Western Mexican Drainage basins. Groundwater inflows and outflows are small in these basins and there are no perennial streams. Groundwater inflows consist of minor amounts of mountain front recharge and stream infiltration. Basins are composed of a relatively thin, heterogeneous layer of upper basin fill underlain by lower basin fill. The lower basin fill consists of a unit of primarily fine-grained material underlain by a medium to coarse grained unit. Pre-Basin and Range sediments underlie the basin fill. Stream alluvium deposits occur along the lower Gila River and may be locally productive water-bearing sediments (Anderson, et al., 1992).

Butler Valley Basin

Butler Valley Basin contains basin fill deposits that make up the principal aquifer. These deposits range from about 500 feet in the southwest area to nearly 1,500 feet thick in the central portion of the basin. The valley is surrounded by mountains and some groundwater may be found along the basin margins in thin alluvium and in volcanic, granitic, metamorphic and sedimentary rocks. A 1½-mile wide area bordered by mountains where Cunningham Wash exits the basin is known as the Narrows. Groundwater is found under confined conditions northeast of the Narrows in T7N, R15W and confined conditions may occur in other areas due to the presence of clay layers. Groundwater flow is generally from northeast to southwest (Oram, 1987). Groundwater quality is generally good with locally high fluoride and arsenic concentrations in some areas.

Gila Bend Basin

Basin fill material is the principal aquifer in the Gila Bend Basin. Groundwater occurs primarily under unconfined conditions, but there are several areas where fine-grained layers in the alluvium create either underlying confined conditions or overlying perched water-table conditions as a result of percolation of irrigation water. Water levels in wells measured in 2003-2004 ranged from 34 feet in a well along the mountain front to almost 640 feet east of Gila Bend. Groundwater flow direction is generally from the Gila Bend Mountains east to the Gila River in the area north of Gila Bend. In the center of the basin, groundwater movement is toward the southwest (see Figure 7.2-6). Groundwater pumpage historically caused several cones of depression to form, with the largest cone north of Gila Bend and parallel to the Gila River. As shown in Figure 7.2-6 water level decline are still significant (>30 feet) in wells in this area.

Groundwater is recharged primarily from Gila River flow events and when river water is impounded behind Painted Rock Dam. Some recharge also occurs from infiltration of irrigation water, underflow from the Gila River and tributaries into the basin and precipitation.

Groundwater quality is generally poor across the basin with many measurements of arsenic and fluoride concentrations meeting or exceeding drinking water standards. High concentrations of TDS and nitrate have also been detected (see Table 7.2-7).

Harquahala Basin

Groundwater in the Harquahala Basin is found primarily in basin fill material composed of heterogeneous deposits of clay, silt, sand and gravel. The basin fill may be as much as 5,000 feet thick near Centennial. Groundwater is generally unconfined, although clay layers can cause semi-confined to confined conditions. Clay layers also cause perched water-table conditions in the east-central and southeastern parts of the basin from percolation of irrigation water. In the southeastern part of the basin the basin fill consists of coarse deposits of sand and gravel. North of T1S, fine-grained beds primarily composed of clay overly the coarse deposits. Wells in this area penetrate the fine-grained sequence and withdraw water from the underlying coarse-grained sequence. The fine-grained beds become thicker towards the northwest and grade into an alternating sequence of fine-grained and coarse-grained layers that overlie a conglomerate that begins at a depth of 800 to 850 feet below land surface (Hedley, 1990). Reportedly, the best well yields occur from this alternating sequence in the west-central part of the basin.

Groundwater recharge is negligible, coming primarily from infiltration of runoff in Centennial Wash. There may also be underflow from McMullen Valley Basin to the north. Seepage and infiltration of water from the Central Arizona Project (CAP) canal, which runs west to east across the southern part of the basin, may be another source of recharge.

Well pumpage caused the Harquahala Basin to be severely overdrafted from the 1950s through the mid 1980s, resulting in large water level declines and formation of a cone of depression in the south central portion of the basin. Prior to the 1950s groundwater moved from northwest to the southeast and exited where Centennial Wash leaves the basin. Introduction of CAP water in place of groundwater pumping has allowed groundwater levels to rise by more than 30 feet in a number of wells (see Figure 7.3-6). The Harquahala Basin was designated as an INA in 1984 pursuant to A.R.S. § 45-432 to prevent new lands from being brought into agricultural production. However, under A.R.S. § 45-555 groundwater may be withdrawn and transported from the basin to an initial active management area (such as the adjacent Phoenix AMA) under specific circumstances including a provision that groundwater levels not decline by an average of more than ten feet per year.

Groundwater quality is generally suitable for irrigation purposes, but elevated TDS, fluoride, arsenic and other constituent concentrations in some wells require treatment to meet drinking water standards.

Lower Gila Basin

Groundwater in the Lower Gila Basin occurs in both recent stream alluvium and basin fill. The stream alluvium consists of sand, gravel and boulders in the larger washes and the floodplain of the Gila River. The thickness of the stream alluvium ranges from 10 feet in smaller washes to 110 feet in the Gila River floodplain. The basin fill consists of three units. The upper sandy unit is composed of sand and gravel with some silt and clay layers. This unit is typically 200 to 380 feet thick. The middle fine-grained unit contains primarily silts and clays with occasional thin sand and gravel beds. The middle unit ranges from 250 to 750 feet thick. The lower coarse-grained unit is composed of coarse sand and gravel and contains some well-cemented zones. The thickness of this unit is variable. Well yields exceeding 2,000 gallons per minute (gpm) are commonly found in the vicinity of the Gila River, southeast of Dateland and north of Hyder.

Groundwater development in the eastern part of the Lower Gila Basin is in the broad alluvial plains that border the Gila River, where the main aquifer is the upper sandy unit in the basin fill. Groundwater is primarily unconfined. Historically, cones of depression occurred in irrigated areas north of Hyder, east of Dateland and in the Palomas Plain west of Hyder. Some historic groundwater level declines were as much as 15 feet per year. Recent data show more stable water level conditions in measured wells in the eastern part of the basin (see Figure 7.4-6).

In the western part of the basin, groundwater levels in the Gila River floodplain historically ranged from 10 to 20 feet below land surface and the streambed alluvium was the primary source of groundwater. As irrigation activity increased in the 1930s, groundwater levels declined and salinity increased. To provide a dependable water supply for irrigation, Colorado River water was brought to the area in 1952 and groundwater pumping for irrigation ceased. Infiltration of excess irrigation water to the stream alluvium aquifer raised water levels, necessitating the need for a system of drainage wells to maintain groundwater levels below crop root zones and canals to transport the drainage water out of the basin.

Groundwater recharge is primarily from infiltration of runoff in washes and the Gila River floodplain. Underflow from the Painted Rock Dam on the eastern basin boundary and releases from the dam during floods also contributes to groundwater recharge. Water releases from Painted Rock Dam in 1975 resulted in an estimated 59,500 acre-feet of recharge. In the far western part of the basin, infiltration of excess irrigation water is the largest source of recharge.

Groundwater flow directions have been impacted by irrigation pumpage at some locations in the basin, for example east of Dateland where a cone of depression exists (see Figure 7.4-6). Prior to development, groundwater flow was from north and southeast toward the Gila River and then downstream to the southwest. Infiltration of irrigation water in the western part of the basin has created groundwater mounds in the floodplain aquifer which affect groundwater flow.

Groundwater quality varies in the eastern part of the basin with elevated fluoride concentrations reported at a number of wells. In the western part of the basin, the quality of groundwater in the Gila River floodplain is unsuitable for most uses, with elevated TDS concentrations common as well as fluoride and arsenic.

McMullen Valley Basin

The principal aquifer in the McMullen Valley basin is alluvial-fan deposits in the basin fill. These deposits underlie most of the valley floor, varying in thickness from 230 feet in the Wenden-Salome area to 3,100 feet north of Aguila. Most large irrigation wells tap into this unit. Fine grained lake-bed deposits of low permeability overlie the alluvial fan deposits in the central and lower parts of the valley. These deposits range in thickness from 150 feet southwest of Wenden to about 1,100 feet northeast of Wenden. Because of their relatively low permeability, the lake-bed deposits may impede downward percolation of water, creating a perched aquifer. Stream alluvium has been deposited by Centennial Wash and its tributaries and is composed of silt, sand and clay. This unit is 50 feet thick in the lower end of the basin, 100 feet thick in the Wenden-Salome area, and over 450 feet thick north of Aguila. There has been some groundwater development in the stream alluvium for domestic and stock use, but irrigation pumpage has dewatered the unit in the Aguila area (Remick, 1981). The basal unit of the basin fill is a conglomerate present at a depth of about 850 to 1,600 feet below land surface and is largely unexplored.

Fluoride, arsenic and nitrate concentrations exceeding drinking water standards are found at wells throughout the basin. Elevated concentrations of nitrate have been measured in a number of wells near Salome (see Table 7.5-7).

Ranegras Plain Basin

Groundwater in the Ranegras Plain Basin occurs primarily in older (Tertiary) basin fill deposits composed of clay, volcanics, conglomerate and smaller amounts of sand and gravel. Although yields in some wells are relatively low due to the presence of clays, yields from large diameter wells reach 4,000 gpm with a median yield of 1,100 gpm (Table 7.7-6). The thickness of the basin fill deposit is not well known but is at least about 1,500 feet northwest of Vicksburg. The younger (Quaternary) alluvium, which includes stream alluvium, overlies the basin fill and is composed primarily of sand and gravel with a thickness of less than a few hundred feet. Perched groundwater occurs in the central part of T6N, R16W and in Sections 9 and 10 of T5N, R16W where water levels are 10 to 60 feet higher than the surrounding area. (Johnson, 1990)

Groundwater flow is generally to the northwest toward the community of Bouse but agricultural groundwater withdrawals have created a cone of depression southwest of Vicksburg (see Figure 7.7-6).

Natural groundwater recharge is from infiltration of runoff in Bouse Wash, Cunningham Wash and along mountain fronts. About 32 miles of the CAP canal runs through the northeastern portion of the basin and may contribute 2,000 to 3,000 acre-feet of recharge a year. (Johnson, 1990)

Groundwater quality is generally poor with elevated TDS concentrations measured in a number of wells. Of 48 wells measured between 1984 and 1989, only five wells had TDS levels below the secondary maximum contaminant level of 500 milligrams per liter recommended by the Environmental Protection Agency (EPA). The highest TDS concentrations were measured in the north-central part of the basin (Johnson, 1990). Water quality measurements taken between 1979 and 2000 also show a number of wells with elevated fluoride and arsenic concentrations (Table 7.7-7).

San Simon Wash Basin
Basin fill comprises the principal aquifer in the San Simon Wash Basin. The thickness of the basin fill ranges from near zero at the mountain fronts to over 8,000 feet near the international boundary. Four sedimentary units have been identified in the basin. Alluvial-fan deposits occur on the basin perimeter and vary in depth and well yield. Streambed alluvium consisting of sand, gravel and boulders occurs along stream channels and may yield significant volumes to wells. Deltaic deposits consisting of a sequence of clay, silt, sand and gravel are found near Papago Farms (T19S, R1E) where deposits may be 800 feet thick and well yields are high (Figure 7.8-6). Lakebed deposits consisting of thick sequences of fine-bedded silts and clays extend to depths of more than 1,000 feet. Wells drilled into these lakebed deposits in the center of the basin generally yield less than 50 gpm. Groundwater occurs under unconfined conditions in the basin. Depth to water averages about 300 feet below land surface and well yields appear to be highest at depths of 400 to 700 feet. Groundwater flow is generally toward the southwest, then south into Mexico. (Hollett, 1985)

Elevated arsenic concentrations are found in groundwater south of Pisinimo and near the international boundary and may occur in the lake-bed deposits in the center of the basin. Fluoride concentrations that equal or exceed drinking water standards occur in the area around Papago Farms and the international boundary (Table 7.8-7).

Tiger Wash Basin
Tiger Wash Basin is a shallow, alluvial basin composed of heterogeneous deposits of clay, silt, sand and gravel that are likely less than 1,000 feet thick. There are few wells in the basin with recent water level depths ranging from 29 feet to 219 feet below land surface (Figure 7.9-6). There appears to be a groundwater divide near the center of the basin from which groundwater flows to the southwest and to the northeast (Hedley, 1990).

Two water quality exceedences have been reported in basin wells, with concentrations of arsenic and nitrate that equal or exceed the drinking water standard (Table 7.9-7).

Western Mexican Drainage Basin
The Western Mexican Drainage Basin contains broad alluvial-filled valleys consisting of unconsolidated gravel, sand, silt and clay deposits that make up the main water-bearing unit. Groundwater flow is toward Mexico. Water levels varied from 27 to 237 feet below land surface at wells measured in 2003-2004 and levels appear to be declining near Lukeville, likely due to development in the Sonoyta area of Sonora, Mexico. Well yields are generally less than 100 gpm. Water quality data collected between 1976 and 1988 along the international boundary west of Lukeville show concentrations of fluoride, arsenic and lead that equal or exceed the drinking water standard (Table 7.10-7).

Surface Water Hydrology

The U.S. Geological Survey (USGS) divides and subdivides the United States into successively smaller hydrologic units based on hydrologic features. These units are classified into four levels. From largest to smallest these are: regions, subregions, accounting units and cataloging units. A hydrologic unit code (HUC) consisting of two digits for each level in the system is used to identify

any hydrologic area (Seaber et al., 1987). A 6-digit code corresponds to accounting units, which are used by the USGS for designing and managing the National Water Data Network. There are all or portions of four watersheds in the planning area at the accounting unit level: Lower Colorado River below Lake Mead; Lower Gila River below Painted Rock Dam (all); Agua Fria River-Lower Gila River; and the Rio Sonoyta (Figure 7.0-3). More detailed information on stream flow, springs, reservoirs and general surface water characteristics are found in the individual basin sections.

Lower Colorado Below Lake Mead

This watershed extends north to Hoover Dam and includes all or parts of three basins in the Upper Colorado River Planning Area (see Volume 4, Figure 4.0-3). Within the Lower Colorado River Planning Area, all or parts of Butler Valley, Ranegras Plain, Parker, Harquahala, Lower Gila and Yuma basins are included in the watershed. The Colorado River is the only perennial surface water in the entire watershed. Within the planning area, the river flows for about 200 miles south of Parker Dam to Mexico at the Southerly International Boundary. There are many diversions and several dams along the Colorado River. Dams include Imperial, Laguna and Morelos. There are major diversions from Imperial Dam to the All-American Canal, which delivers agricultural water to California and to the Gila Gravity Canal for use in Arizona. Drainages to the Colorado River in the planning area are ephemeral and contribute little to river flow with the exception of the Gila River during flood events.

Dam construction and diversions have fundamentally altered flow in the Colorado River, including the portion in the planning area. Historically, the Colorado was a broad, meandering, unpredictable, sediment-laden watercourse, with annual flooding and frequent changes in the configuration of the channel. It sometimes overtopped its banks and flowed west to the Salton Sink, forming intermittent lakes. In the early 1900s water began to be diverted from the Colorado River via the Imperial Canal to irrigate California's Imperial Valley. When the canal filled with silt, a cut was made in the west bank of the river to temporarily allow water to flow into the valley. In 1905, massive flooding on the Colorado overtopped this diversion canal and diverted the river toward the Salton Sink (Salton Sea Authority, 2000). This flow flooded the valley, destroying farms and towns and began filling the Salton Sink, creating the modern Salton Sea. Flow continued for 18 months and for a time the Colorado ceased flowing into Mexico (Tellman et al., 1997). There were concerns that if the cutback erosion in the flow channel reached the Colorado River, it would be permanently diverted to the Salton Sink. In 1907 the Southern Pacific Railroad, which had substantial business interests in the region, repaired the gap in the diversion canal and the river resumed its natural course toward the Gulf of California.

Prior to dam construction on the Colorado River, the river flowed to the Gulf of California, forming a delta with a maze of lagoons and dense riparian habitat. Today only about 420,000 acres of the original two million acre delta survives and the river reached the sea only about half of the years between 1981 and 2002. Since 1979, an average of about 100,000 acre-feet of salty drainage water from the Wellton-Mohawk Irrigation District is delivered annually to the eastern side of the delta, creating the Cienega de Santa Clara (Glenn, et al., 2004).

There are no major (>10gpm) or minor (1-10 gpm) springs in the entire watershed, and only 15 to 16 smaller springs, primarily in the Parker Basin.

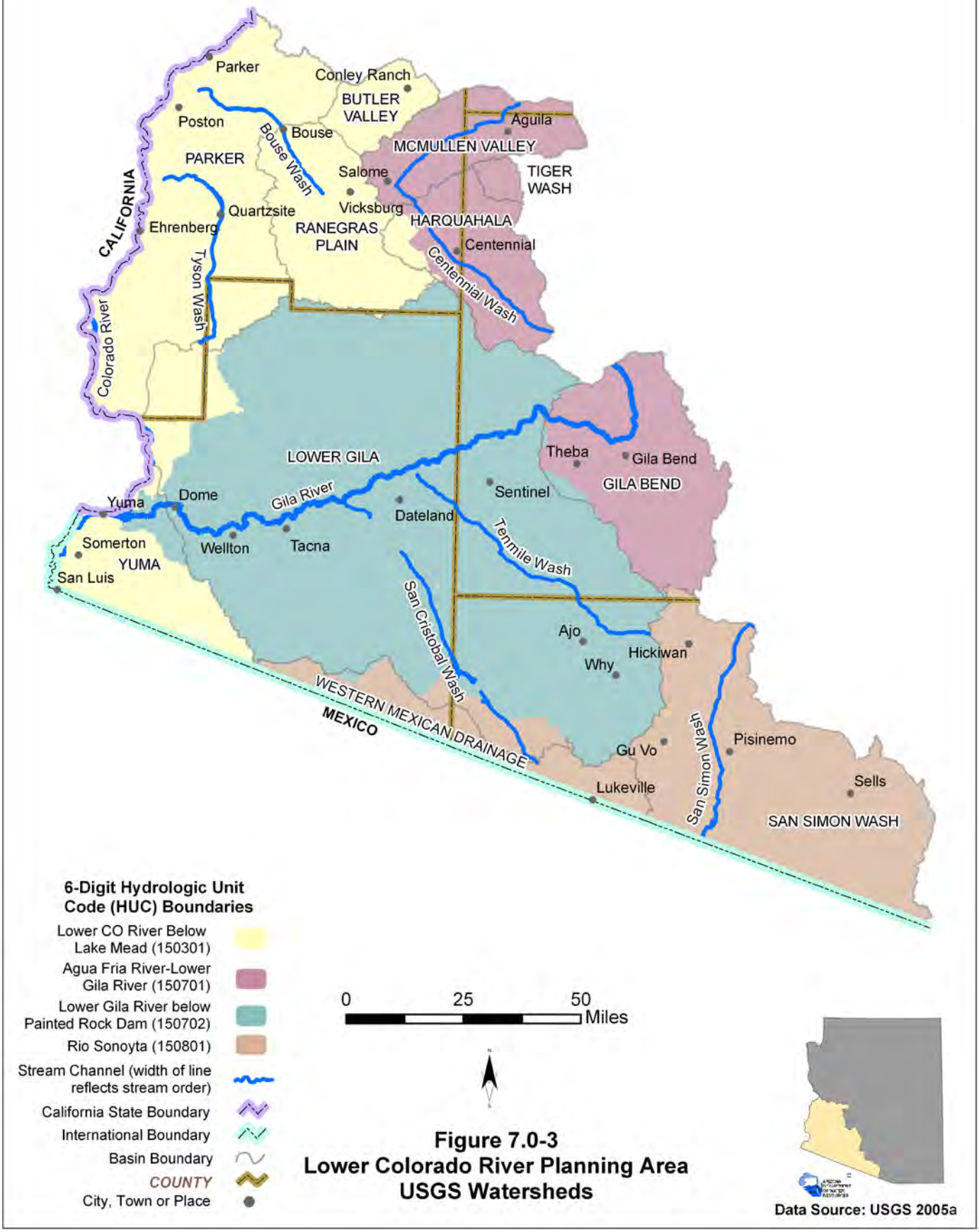


Figure 7.0-3
Lower Colorado River Planning Area
USGS Watersheds

Lower Gila River Below Painted Rock Dam

This watershed includes almost all of the Lower Gila Basin and part of the Yuma Basin. Major surface water drainages are the Gila River, Tenmile Wash and San Cristobal Wash (see Figure 7.0-3).

The Gila River drains the eastern and central parts of the planning area and extends 150 miles from Gillespie Dam (located where the Gila River enters the planning area in the Gila Bend Basin) to the confluence with the Colorado River in the Yuma Basin. The river originates in New Mexico and flows 600 miles from east to west across Arizona. The entire Gila River Watershed drains about 57,900 square miles and is the largest watershed in Arizona, covering over half of the state's total land area (Tellman, et al., 1997).

Historically, the Gila flowed in the planning area in the spring due to winter rain and snowmelt and in the summer following monsoon storms. Construction of upstream dams, beginning with Coolidge Dam near Florence in 1929, resulted in loss of flows and water supplies downstream. In the planning area, the Gila River flows only in response to precipitation events, irrigation return flow or releases from upstream dams. Recent sources list the river as either intermittent (AZGF, 1997) or ephemeral (ADWR, 1994a). The Gila River is a flashy stream, showing wide variations in annual flow in the planning area. There are four operating streamflow gages on the Gila River. Two gages are above Painted Rock Dam in the Agua Fria River-Lower Gila River Watershed in the Gila Bend Basin, one is in the Lower Gila Basin and one is in the Yuma Basin. All four gages have years with no flow (see Tables 7.2-2, 7.4-2 and 7.11-2). By contrast, total annual flow at the gages below Gillespie Dam and below Painted Rock Dam were over 5 million acre-feet (maf) in 1993. Further downstream near the confluence with the Colorado, the gage at the Gila River near Dome recorded a maximum annual flow of over 4.7 maf in 1993, but an annual median flow of less than 4,800 acre-feet.

Construction of Gillespie Dam in 1921, and Painted Rock Dam in 1959, impounded Gila River flow in the planning area for diversion to agricultural areas and to prevent flooding downstream. Gillespie Dam was breached during January, 1993 when a 135 foot section of the dam collapsed during flooding. The same flood event filled Painted Rock Dam to full capacity of 2.5 maf, making it the largest lake in Arizona, and high volumes of spillwater caused extensive downstream damage. The reservoir is normally dry.

There are no major (>10gpm) or minor (1-10 gpm) springs in the Lower Gila River Watershed below Painted Rock Dam, and only six to eight smaller springs.

Agua Fria River-Lower Gila River Watershed

The Agua Fria River - Lower Gila River Watershed includes the drainage areas of the Agua Fria River and the Gila River from below its confluence with the Salt River to Painted Rock Dam. Within the Lower Colorado River Planning Area, Gila Bend, Harquahala, McMullen Valley and Tiger Wash basins are included in the watershed. The Gila River is the only major watercourse (discussed above). Centennial Wash is the major tributary in the planning area and is an ephemeral stream with no streamgage data within the planning area. The only streamgage data for the watershed, other than those on the Gila River, is a discontinued gage at Sauceda Wash near Gila

Bend with a maximum annual flow of about 1,100 acre-feet (see Table 7.2-2).

There are no major (>10gpm) or minor (1-10 gpm) springs in the Agua Fria River-Lower Gila River Watershed, and only five to seven smaller springs, three of which are located in the Tiger Wash Basin.

Rio Sonoyta Watershed

The Rio Sonoyta Watershed in Arizona includes the San Simon Wash and Western Mexican Drainage basins and the south central portion of the Lower Gila Basin. Major drainages in the San Simon Wash Basin, all ephemeral, are San Cristobal Wash, San Simon Wash and Vamori Wash. Vamori Wash flows northwest to San Simon Wash, which in turn flows south to the Rio Sonoyta in Mexico. There are two active streamgages in the watershed in the San Simon Wash Basin, one at Vamori Wash at Kom Vo and one on San Simon Wash near Pisinimo. These ephemeral streams flow primarily in the summer as a result of monsoon precipitation. Annual mean flow at the Vamori Wash gage is over 6,600 acre-feet and almost 2,400 acre-feet at the San Simon gage (see Table 7.8-2). The largest ephemeral tributary to the Rio Sonoyta in the Western Mexican Drainage Basin is Aguajita Wash, located near the mountain fronts east of Quitobaquito and Cipriano Hills.

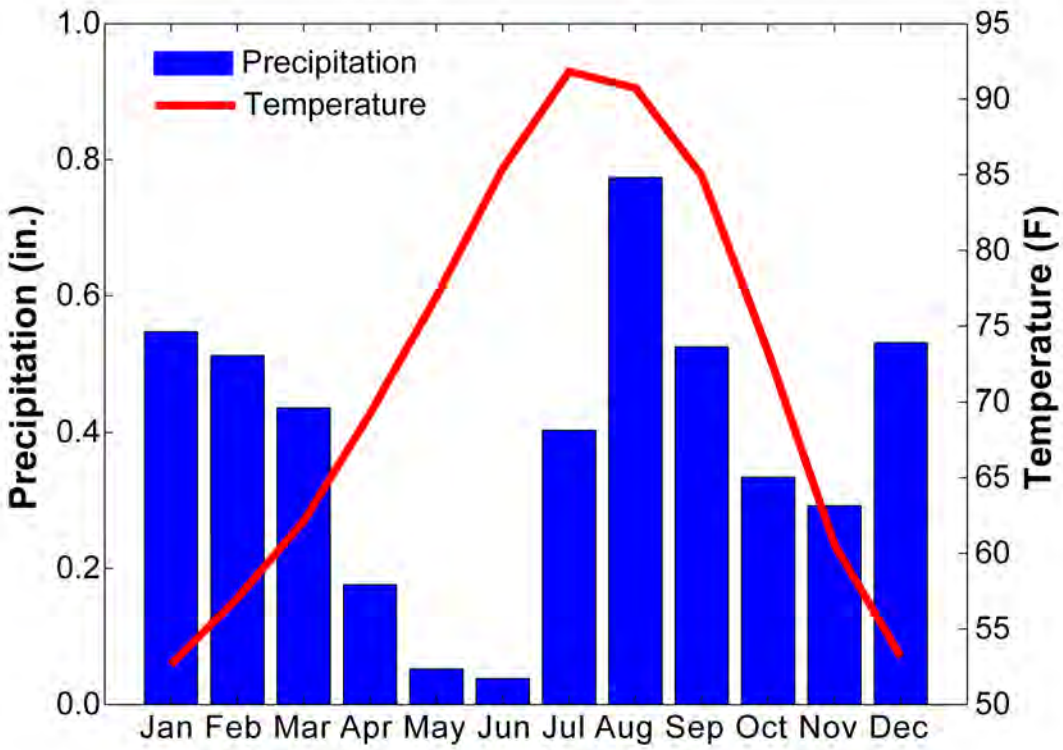
The only major (>10gpm) and minor (1-10 gpm) springs in the entire planning area are found in this watershed in the Western Mexican Drainage Basin. Quitobaquito Springs are the only major springs with a combined discharge of 28 gpm. Located adjacent to the international boundary in Organ Pipe Cactus National Monument, the springs flow from fractured granite that forms the Quitobaquito Hills. Groundwater moves through the fractured granite and discharges in a line of springs on the southwest side of Quitobaquito Hills (Carruth, 1996). Two of the largest springs have been capped and diverted into a manmade stream channel that flows to a half-acre pond that provides habitat for the endangered Quitobaquito pupfish (Knowles, 2003). The springs are relatively warm, (a near constant 74°F), and slightly brackish. The two minor springs in the planning area are located nearby. In total there are 15 to 23 total springs in the watershed, with most located in the San Simon Wash Basin.

7.0.3 Climate[2]

The Lower Colorado River Planning Area is characterized by the highest average annual temperature in the state, 71.5°F, which is much warmer than the statewide average of 59.5°F. Average annual precipitation in the planning area is 4.6 inches, though totals are probably considerably higher at high elevation ranges where precipitation is not recorded. Annual precipitation totals vary widely across the planning area, from 6-9 inches at Organ Pipe Cactus National Monument, Aguila, and Kofa Mine stations to less than 3 inches at Yuma Airport. On average, the Lower Colorado River exhibits the bi-modal precipitation seasonality characteristic of Arizona (Figure 7.0-4); however, the northwestern part of the planning area, near Parker, exhibits a stronger late winter peak, more typical of the Mohave Desert.

[2] Information in this section was provided by Institute for the Study of Planet Earth, Climate Assessment for the Southwest (CLIMAS), University of Arizona, December 2007.

Figure 7.0-4 Average monthly precipitation and temperature from 1930-2002

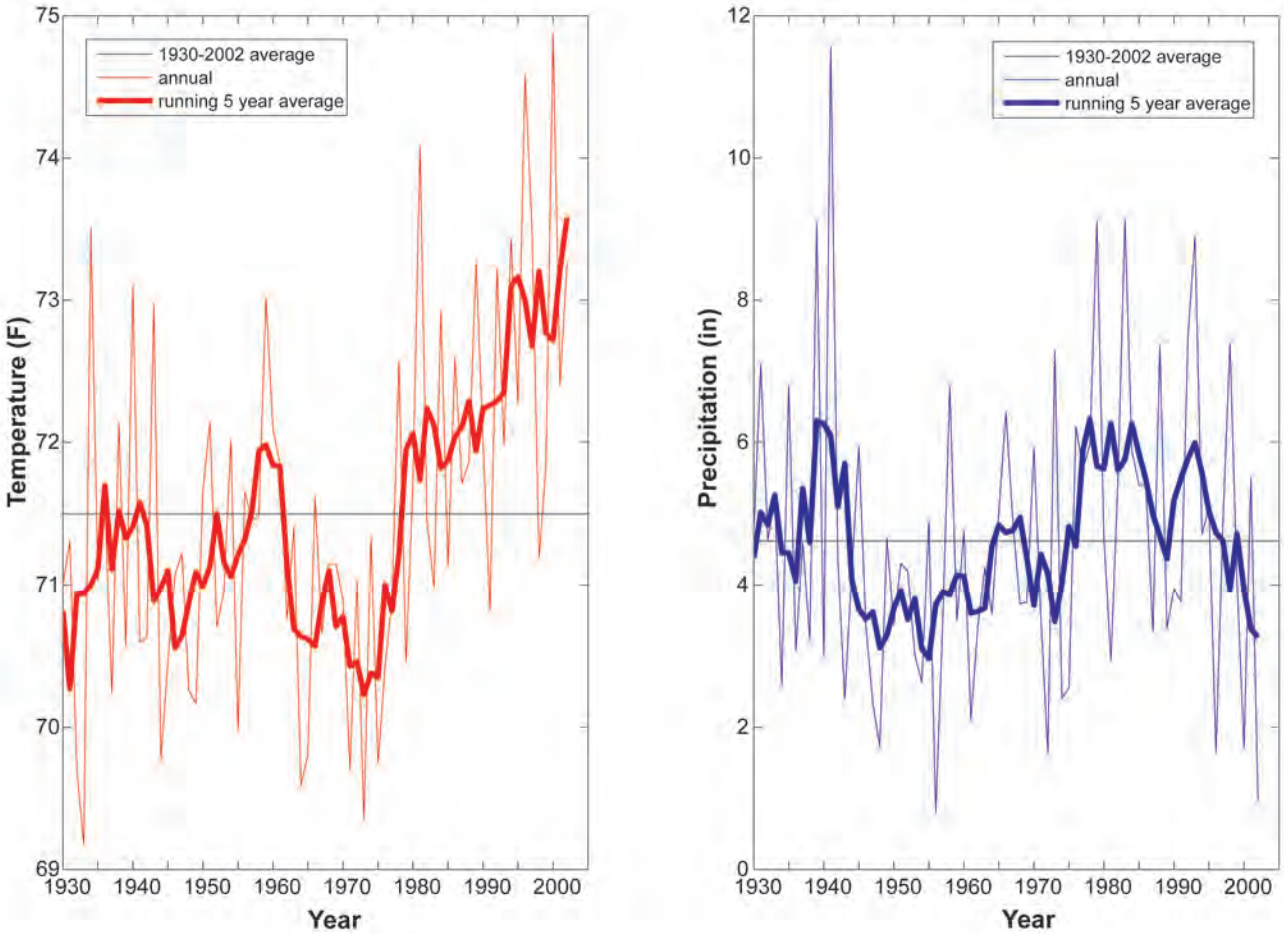


Data are from the Western Regional Climate Center. Figure author: Gregg Garfin, CLIMAS.

Frontal storm systems moving west-to-east, guided by the jet stream, deliver the area's winter and spring precipitation. Summer monsoon thunderstorms deliver abundant moisture to the eastern part of the Lower Colorado River Planning Area. The planning area shows a very strong response to El Niño conditions, with winters registering wet conditions 59% of the time and dry conditions only 24% of the time. Strong El Niño years, such as 1941, 1982, 1983, 1992 and 1993, show high precipitation (Figure 7.0-5). The precipitation response to La Niña conditions is not as pronounced with dry winters occurring only 50% of the time. Neutral El Niño-Southern Oscillation conditions yield dry Lower Colorado River Planning Area winters 57% of the time – a strong indication of the extreme aridity in this region.

Average annual temperatures in the Lower Colorado River Planning Area have been increasing since the 1930s, and especially rapidly since the mid-1970s (Figure 7.0-5). The long-term trend is superimposed on decadal variability generated primarily by Pacific Ocean and atmosphere variations. Decadal variations are particularly obvious in the instrumental record of precipitation. Drought conditions were present for the decades of the 1940s-1960s and since the mid-1990s; the 1980s and early 1990s were relatively wet. This part of the state exhibits Arizona's highest year to-year precipitation variability, with especially high variability during the dry 1940s-1960s.

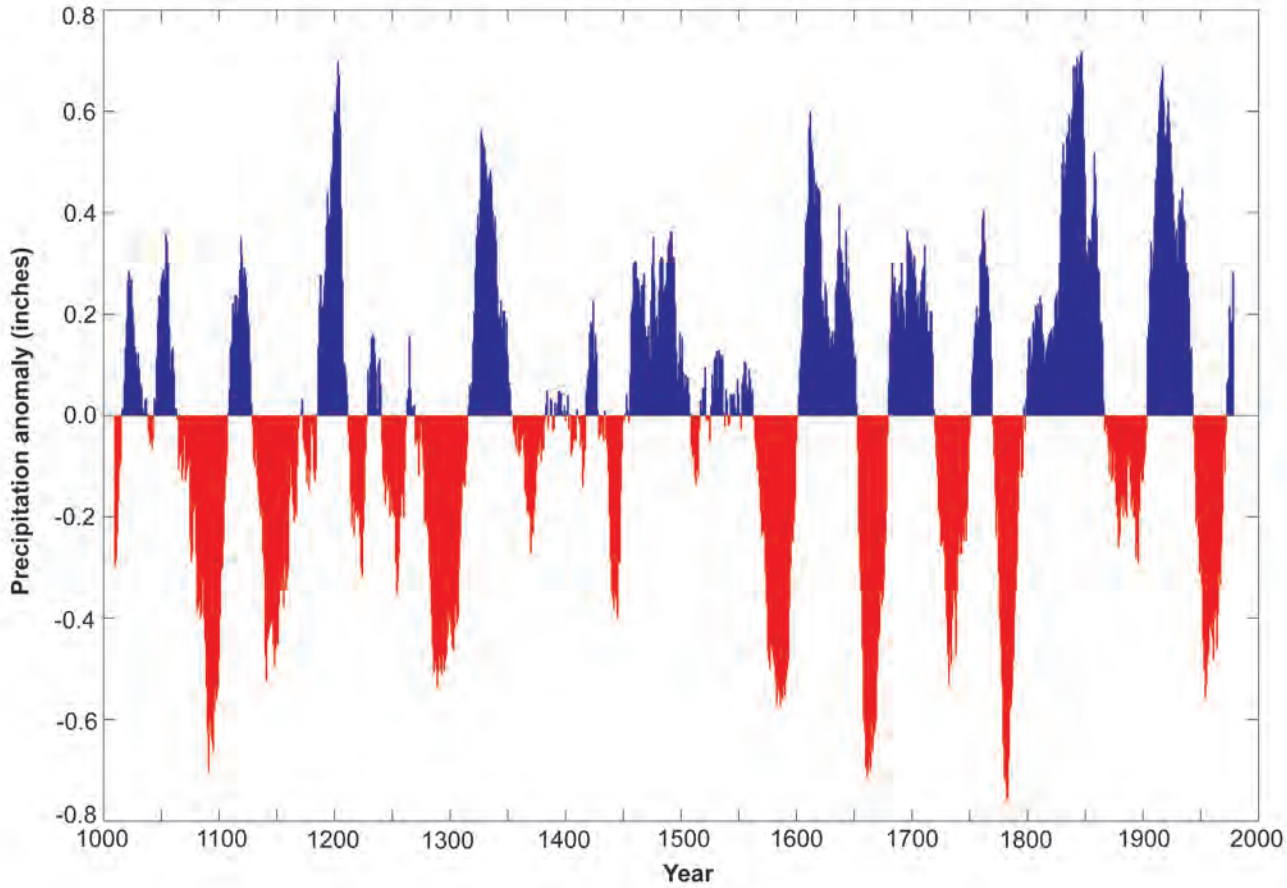
Figure 7.0-5 Average annual temperature and total annual precipitation for the Lower Colorado River Planning Area from 1930-2002



Horizontal lines are average temperature (71.5 °F) and precipitation (4.6 inches), respectively. Light lines are yearly values and highlighted lines are 5-year moving average values. Data are from the Western Regional Climate Center. Figure author: Gregg Garfin, CLIMAS.

Winter precipitation records dating to 1000 A.D. estimated from tree-ring reconstructions for Arizona climate divisions show extended periods of above and below average precipitation in every century (Figure 7.0-6). A climate division is a region within a state that is generally climatically homogeneous. Arizona has been divided into seven climate divisions and most of the Lower Colorado River Planning Area is within Climate Division 5, which includes La Paz and Yuma counties. Markedly dry periods in Climate Division 5 include the late 1000s, mid-1100s, the late 1200s, late 1500s, and several shorter, but very intense, periods during the last 300 years. Winters were relatively wet during the late 1400s, early 1600s, much of the 1800s, and the early 1900s.

Figure 7.0-6 Winter (November - April) precipitation departures from average 1000-1988 - Climate Division 5



Data are presented as a 20-year moving average to show variability on decadal time scales. Data: Fenbiao Ni, University of Arizona Laboratory of Tree-Ring Research and CLIMAS. Figure author: Gregg Garfin, CLIMAS.

7.0.4 Environmental Conditions

Environmental conditions reflect the geography, climate and cultural activities in an area and may be a critical consideration in water resource management and development. Discussed in this section is vegetation, protection of riparian areas through the Arizona Water Protection Fund Program, threatened and endangered species, public lands protected from development as national monuments, wildlife refuges and wilderness areas, and managed waters. No instream flow claims (a non-diversionary appropriation of surface water for recreation and wildlife use) have been filed in this planning area

Vegetation

Information on ecoregions and biotic (vegetative) communities in the planning area are shown on Figure 7.0-7. With the exception of a very small area of Chihuhuan desert and Sierra Madre Occidental pine-oak forest along the southeastern boundary, the entire planning area is within the Sonoran Desert ecoregion. Biotic communities range from Lower Colorado River Valley Sonoran

desertscrub to Madrean evergreen woodland. Most of the planning area is covered by Lower Colorado River Valley and Arizona Uplands Sonoran desertscrub.

Madrean evergreen woodland occurs at the highest elevations of the San Simon Wash Basin in the Baboquivari Mountains where mean annual precipitation exceeds 16 inches. The woodland consists of evergreen oaks, Alligator Bark and One-seed junipers, and Mexican pinyon and transitions to semidesert grassland at lower elevation. Cacti of the semidesert grassland may extend well into the woodland. (Brown, 1982)

Interior chaparral occupies mid-elevation foothill, mountain slopes and canyons in small areas along the boundary of McMullen Valley and Butler Valley Basin and along the McMullen Valley/ Harquahala/Tiger Wash basin boundaries. Interior chaparral is found in areas between about 3,500 and 6,000 feet in elevation that receive 15 to 25 inches of annual precipitation (Brown, 1982). Chaparral consists of dense shrubs that grow around the same height with occasional taller shrubs or small trees. Typical shrubby species are mountain mahogany, shrub live oak, and manzanita. Chaparral plants are well adapted to drought conditions. (AZGF, 2004)

The western limit of the semidesert grassland community occurs in the eastern part of the planning area. A small area adjoins the Madrean evergreen woodland community in the Baboquivari Mountains and smaller areas exist in the central part of the San Simon Wash Basin and in eastern McMullen Valley Basin. Semidesert grasslands receive between about 10 to 17 inches of annual rainfall. Grasses were originally perennial bunch grasses with intervening areas of bare ground. Where heavily grazed, grasses have shifted to annual species where summer rainfall is low, or to low growing sod grasses where rainfall is moderate to heavy. Shrubs, cacti and herbaceous plants are commonly found in the semidesert grassland community. (Brown, 1982)

Two subdivisions of the Sonoran desertscrub region exist in the planning area-the Lower Colorado River Valley subdivision and the Arizona Upland subdivision. The Lower Colorado River Valley subdivision is the hottest and driest of the Sonoran desertscrub subdivisions. There is intense competition for water, with plants widely spaced and more concentrated along drainage channels. In some areas the soil is covered by a single layer of tightly packed pebbles known as “desert pavement” that restricts plant types to ephemeral species. High concentrations of sodium in the soil below the pavement may also restrict plant growth. Sand dunes occur near Yuma and Parker. Characteristic plants include creosote bush, bursage, saltbush, and mixed, more diverse vegetation along washes and other areas with more water. These areas may include blue palo verde, ironwood and jojoba. Also commonly found in the subdivision are several types of cholla and other cacti. (Turner and Brown, 1982)

The Arizona Upland subdivision borders the Lower Colorado River Valley subdivision and occurs primarily on slopes and sloping plains at elevations of 980 to over 3,000 feet where it merges with interior chaparral or semidesert grassland. This subdivision receives more precipitation than the other Sonoran desertscrub subdivisions with average annual precipitation between 8 to 16 inches. Vegetation is scrubland or low woodland in appearance with blue and foothill palo verde, ironwood, mesquite and cat-claw acacia as common tree species. Cacti are extremely important in this subdivision including saguaro, organ pipe, cholla and barrel cacti. (Turner and Brown, 1982)

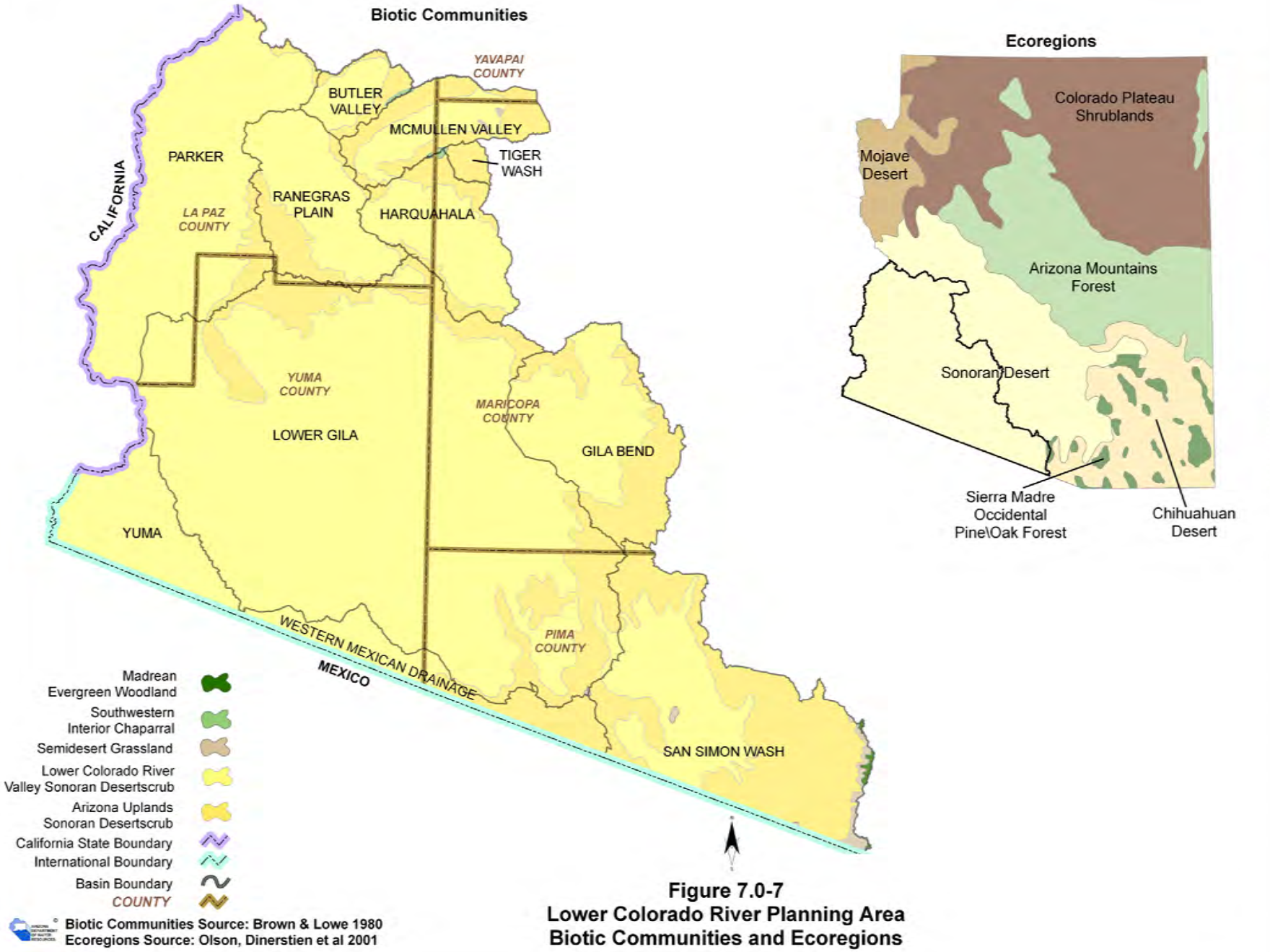


Figure 7.0-7
Lower Colorado River Planning Area
Biotic Communities and Ecoregions

Bufflegrass (Pennisetum ciliare), was introduced to the United States in the 1930s as livestock forage, and since the 1980s it has spread rapidly and can now be found on the edges of roads in most of southern Arizona. It is problematic in the Sonoran Desert because it grows densely, crowding out and competing for water with native plants and it is a fire-prone perennial that alters the natural fire regime. (ASDM, 2007b) When wildfires occur, the densely growing grass spreads fire rapidly and it thrives after fires while native species do not (Brooks and Pyke, 2002).

Some efforts to control the spread of bufflegrass have been successful. Organ Pipe Cactus National Monument undertook a large eradication effort through yearly weeding efforts and has managed to control and largely prevent its proliferation in the area (Burns, 2007).

The riparian corridor of the lower Colorado River was historically a mixture of cottonwood and willow trees with backwater wetlands. These habitats were maintained by the natural flow regime consisting of spring floods that washed salts from the banks, supported germination of tree seeds, and created seasonal wetlands (University of Arizona, 2003). In Mexico, the Colorado River Delta was historically two million acres in size and was a maze of lagoons and thickly forested. Today, only about 420,000 acres of riparian, wetland and intertidal habitat remain. This habitat is largely maintained by the delivery of irrigation drainage water from the Wellton-Mohawk Irrigation District in Arizona. This water has flowed to the eastern side of the delta since 1979, creating the largest wetland in the Sonoran Desert, the Cienega de Santa Clara (Glenn, et al., 2004).

There are reaches of riparian vegetation along the Colorado River that now consist primarily of tamarisk, mesquite and smaller areas of marsh and strand (riparian obligate plants adapted to periodic flooding, scouring, or soil deposition). There are scattered patches of cottonwood-willow along the river below Headgate Rock Dam. East of Yuma, tamarisk and strand vegetation are found along the Gila River west of highway 95. (AZGF, 1994)

Arizona Water Protection Fund Programs

The objective of the Arizona Water Protection Fund (AWPF) program is to provide grants for the protection and restoration of Arizona's rivers and streams and associated riparian habitats. Six restoration projects in the Lower Colorado River Planning Area had been funded by the AWPF through 2005. Four projects were funded in the Yuma Basin for wetland and watershed restoration, exotic species control and revegetation. Two projects in the Parker Basin projects funded habitat restoration and revegetation and exotic species control. A list of projects and project types funded in the Lower Colorado River Planning Area through 2005 is found in Appendix A of this volume. A description of the program, a complete listing of all projects funded, and a reference map is found in Appendix C of Volume 1.

Threatened and Endangered Species

A number of listed threatened and endangered species may be present in the Lower Colorado River Planning Area. Those listed by the U.S. Fish and Wildlife Service (USFWS) as of May 2006 are shown in Table 7.0-1.[3] Presence of a listed species may be a critical consideration in water resource

[3] An "endangered species" is defined by the USFWS as "an animal or plant species in danger of extinction throughout all or a significant portion of its range," while a "threatened species" is "an animal or place species likely to become endangered within the foreseeable future throughout all or a significant portion of its range."

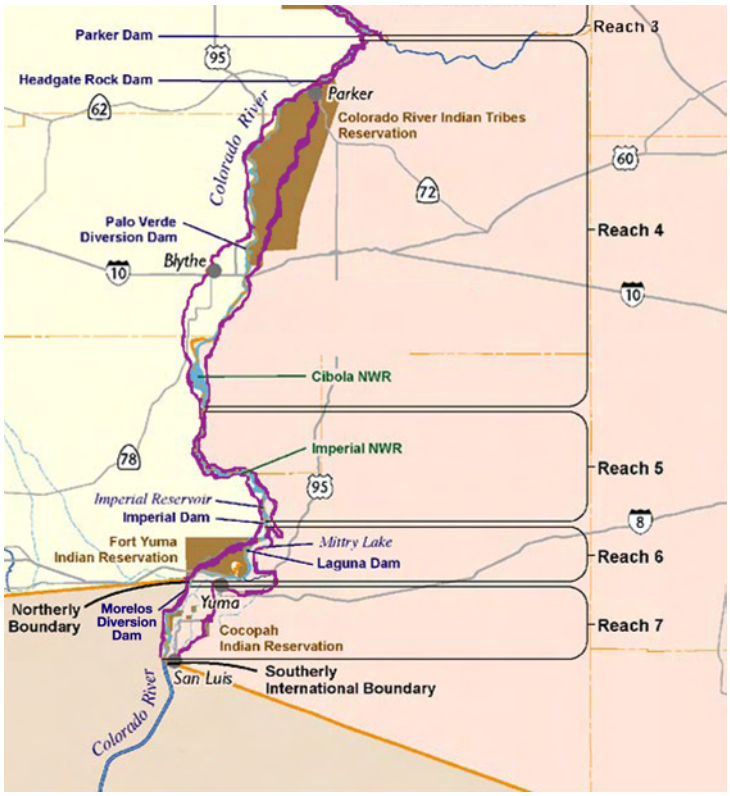
Table 7.0-1 Listed threatened and endangered species in the Lower Colorado River Planning Area

Common Name	Threatened	Endangered	Elevation/Habitat
Bald Eagle	X		Varies/Large trees or cliffs near water.
Bonytail Chub		X	235 - 1,960 ft/Main stream portions of mid-sized to large rivers (both strong current and pools), usually over mud or rocks.
Cactus Ferruginous Pygmy-Owl		X	1,300 - 4,000 ft/Cottonwoods, willows, mesquite bosques and dry washes.
California Brown Pelican		X	Varies/Lakes and rivers.
Kearny's Blue Star		X	3,685 - 4,500 ft/Canyon bottoms and sides in oak woodlands.
Lesser Long-Nosed Bat		X	1,190 - 7,320 ft./Desert grassland and shrubland up to oak transition.
Nichol's Turk's Head Cactus		X	2,400-4,100 ft./Sonoran desertscrub.
Quitobaquito Pupfish		X	0-4,950 ft/Small ponds and springs.
Razorback Sucker		X	<6,000 ft./Riverine and lacustrine areas, not in fast moving water.
Sonoran Pronghorn		X	400 - 1,600 ft/Broad alluvial valleys separated by block-faulted mountains.
Southwestern Willow Flycatcher		X	<8,500 ft./Cottonwood-willow and tamarisk along rivers and streams.
Yuma Clapper Rail		X	<4,500 ft./Fresh water and brackish marshes

Source: USFWS 2006

management and development in a particular area. The USFWS should be contacted for details regarding the Endangered Species Act (ESA), designated critical habitat and current listings.

Figure 7.0-8 LCR MSCP Reaches in the Lower Colorado River Planning Area



Source: Lower Colorado River Multi-Species Conservation Program, 2004

Actions related to operation of the Lower Colorado River water delivery and electrical power generation systems by both federal and non-federal entities may affect listed species and habitat or contribute to the listing of additional species in the future. The ESA directs Federal agencies to support the conservation of listed threatened and endangered species and to make sure that their actions do not jeopardize the continued existence of listed species or result in adverse modification of critical habitat. To comply with the requirements of the ESA, state and federal water and power interests created the Lower Colorado River Multi-Species Conservation Program (LCR MSCP). The LCR MSCP is a cooperative, Habitat Conservation Program that identifies specific measures to address the needs of 26 threatened, endangered and other species that rely on habitat associated with the lower Colorado River (USDOI, 2004). Its purposes include: 1) protection of habitat while ensuring current river water and power operations; 2) addressing the needs of listed species under the ESA; and 3) reduction of the likelihood of listing additional species along the river (USBOR, 2007b). LCR MSCP reaches 4-7 are within the planning area and their general location is shown in Figure 7.0-8.

The LCR MSCP also addresses compliance with the "take" provisions of the ESA. Incidental take of a listed species, as the result of carrying out an otherwise lawful activity, is not allowed without acquiring a permit from the U.S. Fish and Wildlife Service. The LCR MSCP documents the extent of the incidental take related to river operations and maintenance activities by both Federal and non-Federal entities and includes measures to avoid, minimize and mitigate the effect of the take (USDOI, 2004).[4]

Implementation of the LCR MSCP began in 2005. The program area extends from the full pool elevation of Lake Mead to the SIB with Mexico, a distance of 400 river miles and includes the historical floodplain of the Colorado River (USBOR, 2007b). The LCR MSCP is intended to serve as a coordinated and comprehensive conservation approach for a 50-year period and

[4] As defined by the ESA, take means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in other conduct." (16 U.S.C. section 1531[18])

therefore includes measures for species not currently listed that may become listed in the future. Implementation of the program is funded by a partnership of state, Federal and other public and private stakeholders in Arizona, California and Nevada. The plan will create riparian, marsh and backwater habitat for six federally listed species and 20 other native species including conservation programs for razorback sucker and bonytail chub, both federally listed endangered species.

Historically the "Great Valley", what is now known as the Palo Verde Valley in California and Cibola Valley from the Parker area downstream to Cibola Lake, supported an extensive riparian woodland ecosystem and this area is a focal area for conservation measures under the LCR MSCP. Significant conservation measures intended to restore native riparian woodland habitats, once common along the lower Colorado River, have been implemented in Arizona at Cibola Valley Conservation Area (CVCA) in the Cibola Valley Irrigation and Drainage District, Cibola National Wildlife Refuge (CNWR), and Imperial National Wildlife Refuge (INWR). Measures include planting cottonwood, willow, mesquite, and other seedlings to create habitat for riparian woodland obligate species at CVCA, CNWR, and INWR, creation of marsh habitat for Yuma clapper rail and California black rail at INWR, and creation of isolated refugia for razorback sucker and bonytail at INWR. Investigations continue on the suitability of existing backwaters for conversion into habitat suitable for razorback sucker and bonytail. In addition, experimental habitat restoration measures have been implemented at the 'Ahakhav Tribal Preserve on the Colorado River Indian Tribes Reservation.

National Monuments, Wildlife Refuges and Wilderness Areas

The Lower Colorado River Planning Area contains 15 wilderness areas administered by the Bureau of Land Management (BLM), four National Wildlife Refuges (NWR) and two National Monuments (Figure 7.0-9). Both monuments and three wildlife refuges also contain wilderness areas. In total there are 2.3 million acres of protected federal lands in the planning area, accounting for 21% of the land area.

Eight BLM wilderness areas are entirely within the planning area as well as parts of seven others. Wilderness Areas are designated under the 1964 Wilderness Act to preserve and protect the designated area in its natural condition. Designated wilderness areas managed by the BLM, their size, basin location and a brief description of the area are listed in Table 7.0-2.

The largest protected area in the planning area is the Cabeza Prieta NWR, the third largest refuge in the contiguous United States with an area of over 860,000 acres. Designated in 1939, it lies within the Lower Gila and Western Mexican Drainage basins and shares a 56-mile border with the Mexican state of Sonora. Most of the refuge is designated as wilderness. The refuge provides habitat for desert bighorn sheep, the endangered Sonoran pronghorn and lesser long-nosed bat, as well as 420 plant species and more than 300 kinds of wildlife. (USFWS, 2007a) The U.S. pronghorn population is estimated at around 50 animals.

Cibola NWR straddles the Colorado River, with almost 13,000 acres located in the Parker Basin and the remainder in California. The refuge was established in 1964 to restore and protect historic habitat and wintering grounds for migratory birds and other wildlife. About 85% of Arizona's

Table 7.0-2 BLM Wilderness areas in the Lower Colorado River Planning Area

Wilderness Area	Acres in the Planning Area	Basin	Description
Big Horn Mountains	18,000 (partial)	Harquahala	Desert plain escarpments, hills, fissures, chimneys and narrow canyons.
Eagletail Mountains	100,000	Harquahala, Ranegras & Lower Gila	Large desert plain with natural arches, high spires, monoliths, jagged sawtooth ridges and numerous washes six to eight miles long.
East Cactus Plain	15,000	Parker	Intricate crescent dune topography and dense dunescrub vegetation known only in this area.
Gibraltar Mountain	19,000	Parker	Volcanic rock dissected by deep, sandy washes and rocky canyons, includes may alcoves and caves.
Harcuvar Mountains	22,000 (partial)	McMullen Valley & Butler Valley	Bajadas and mountains with an isolated 3,500-acre "island" of interior chaparral habitat.
Harquahala Mountains	23,000	Tiger Wash, McMullen & Harquahala	Contains 5,691-foot- high Harquahala Peak, the highest point in southwest Arizona.
Hummingbird Springs	5,500 (partial)	Harquahala	Includes Sugarloaf Mountain which rises steeply from the Tonopah Desert plains.
Muggins Mountains	7,700	Lower Gila	Rugged peaks dissected by deeply cut drainages.
New Water Mountains	25,000	Ranegras	Craggy spires, sheer rock outcrops, natural arches, slick rock canyons and deep sandy washes.
North Maricopa Mountains*	40,000	Gila Bend	Low-elevation Sonoran Desert mountain range and extensive surrounding desert plains.
Rawhide Mountains	4,900 (partial)	Butler Valley	Low hills punctuated by numerous rugged outcrops.
Signal Mountain	12,000 (partial)	Lower Gila	Sharp volcanic peaks, steep-walled canyons, arroyos, craggy ridges and outwash plains.
South Maricopa Mountains*	40,000 (partial)	Gila Bend	Low-elevation Sonoran Desert mountain range and extensive surrounding desert plains.
Trigo Mountains	30,000	Parker	Sawtooth ridges and steep-sided canyons heavily dissected by washes.
Woolsey Peak	60,000 (partial)	Gila Bend & Lower Gila	Sloping lava flows, basalt mesas, rugged peaks and ridges.
Total Acres	400,100		

Source: BLM 2006
* Wilderness areas are within the boundaries of a National Monument.

wintering Canadian Goose population is found on the refuge. (USFWS, 2007b)

Kofa NWR, at 665,400 acres, is located in the Lower Gila, Parker and Ranegras Plain basins. Established in 1939, it provides habitat for desert bighorn sheep, currently numbering 800-1,000 individuals, and protection for the California fan palm, the only native palm in Arizona (USFWS, 2007c). Most of the refuge is designated as wilderness.

Imperial NWR protects wildlife habitat along 30 miles of the Colorado River in Arizona and California, including the last unchannelized section of the river before it enters Mexico. The entire refuge encompasses almost 25,800 acres, of which 15,000 acres is designated wilderness. In Arizona, refuge lands are located in the Lower Gila and Parker basins. Efforts are underway to restore wetlands, control tamarisk, plant cottonwood and willow trees, protect lakes and manage

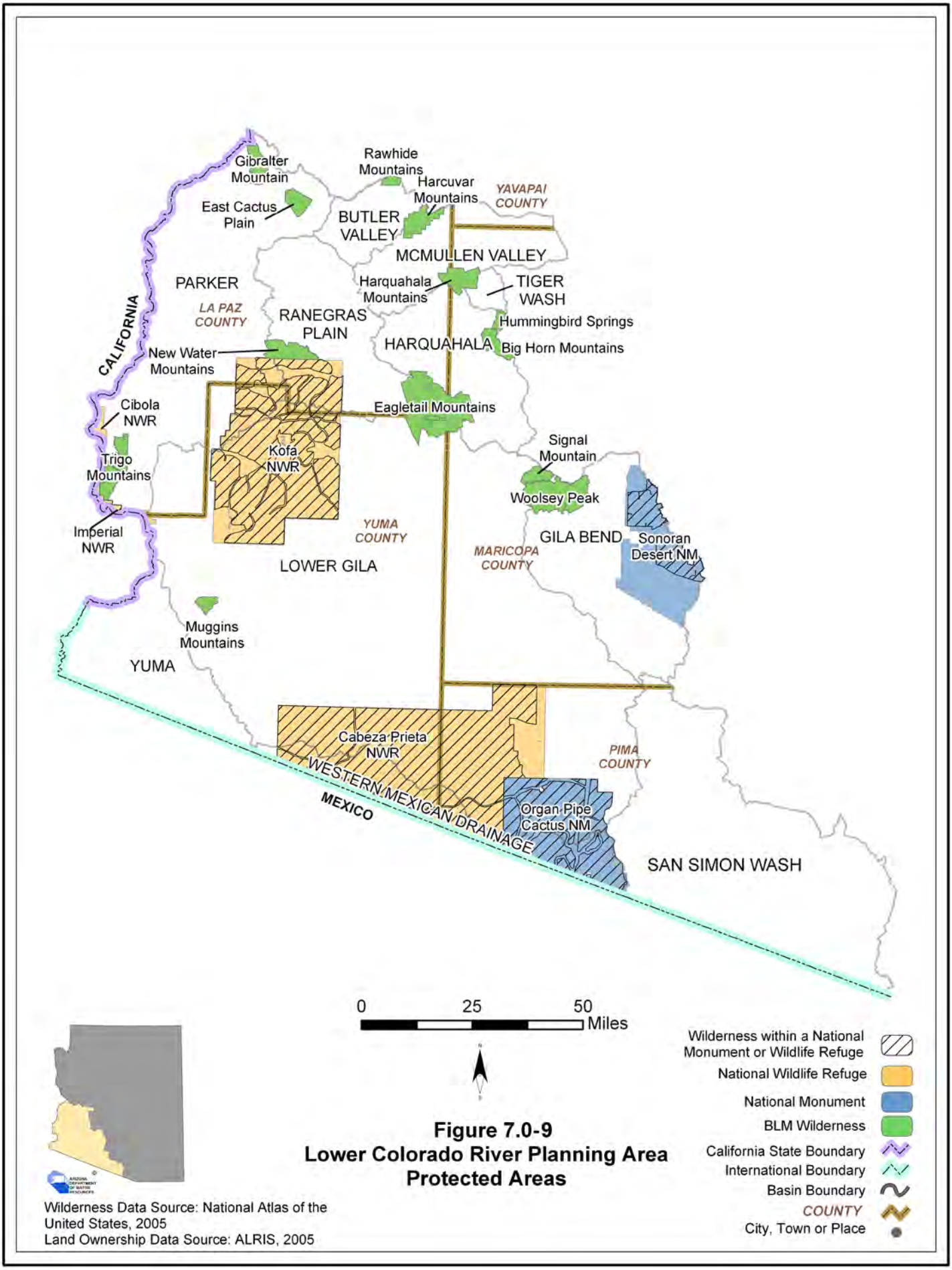


Figure 7.0-9
Lower Colorado River Planning Area
Protected Areas

Wilderness Data Source: National Atlas of the United States, 2005
Land Ownership Data Source: ALRIS, 2005

marshlands and croplands to provide food and habitat for wintering migratory birds. (USFWS, 2007d)

Organ Pipe Cactus National Monument preserves approximately 106,800 acres of relatively unspoiled Sonoran Desert ecosystem in the Lower Gila and Western Mexican Drainage basins. The Monument contains twenty-six species of cactus and provides habitat for the endangered Quitobaquito Pupfish and Sonoran Pronghorn. About 95% of the Monument is designated as wilderness. The United Nations designated the monument as an International Biosphere Reserve in 1976. Due to the remoteness of the area, each year thousands of people illegally enter the U.S. through the monument using unofficial roads and trails. This traffic has adversely impacted habitat including deposition of trash, damage to plants, pollution of water sources, and soil erosion. (NPS, 2007)

A portion of the 496,000-acre Sonoran Desert National Monument, established by executive proclamation in 2001, is located in the Gila Bend Basin. The monument contains extensive areas of saguaro cactus forest, and archeological and historic sites. Three wilderness areas are contained within the monument boundaries. (BLM, 2007)

Managed Waters

Water management decisions and operations outside of the planning area affect the character of the Colorado River within the planning area. Use of Colorado River water is primarily under the jurisdiction of the federal government and was developed through a number of Congressional acts, Supreme Court Decisions, multi-state compacts and an international treaty collectively known as the "Law of the River." More detail on management issues affecting the river are found in Section 7.0-8.

Historically, the Colorado River was highly unpredictable with annual variation of 5 maf to 24 maf at its point of discharge to the Gulf of California. Sediments were carried downstream with spring floods, forming beaches and a large delta where the river met the sea. These floods often changed the course of the river. Today the river flow does not always reach the Gulf due to diversions, sediment is trapped behind dams and the river is channelized through parts of its length.

Prior to development, the Colorado River delta area was one of the richest estuaries in the world. Upstream diversions have severely impacted the delta with a small remnant remaining in the Cienega de Santa Clara. This remnant has been maintained as a result of bypassed saline return flows generated by the Wellton-Mohawk Irrigation and Drainage District. Salinity standards established by the 1944 Treaty with Mexico require that these return flows can no longer be returned to the river in Arizona. The Cienega was designated as a Biosphere Reserve in 1994 (Tellman, et al., 1997). Discussions are ongoing on how to manage and utilize return flows in the Yuma area while still sustaining the Cienega.

7.0.5 Population

The Lower Colorado River Planning Area is growing rapidly with a 44% population increase between 1990 and 2000. Census data for 2000 show about 194,100 residents and Arizona Department of Economic Security (DES) population projections suggest that the planning area population will more than triple by 2050, to about 586,400 residents. Historic, current and projected basin populations are shown in the cultural water demand tables for each basin in Sections 7.1-7.11.

The most populous basin is the Yuma Basin with 79% of the total planning area population in 2000. Several basins have population totals less than 100 residents. The 2000 Census populations for each basin and Indian reservation, listed from highest to lowest, are shown in Table 7.0-3.

Table 7.0-3 2000 Census population of basins and Indian reservations in the Lower Colorado River Planning Area

Basin/Reservation	2000 Census Population
Butler Valley	18
Gila Bend	2,791
Gila Bend	*NA*
Harquahala	609
Lower Gila	11,303
McMullen Valley	2,291
Parker	16,166
Colorado River Tribes	*3,389*
Ranegras Plain	904
San Simon Wash	5,833
Tohono O'odham	*5,833*
Tiger Wash	<10
Western Mexican Drainage	34
Yuma	152,883
Cocopah	*1,025*
Fort Yuma (Quechan)	*45*

Shown in Table 7.0-4 are incorporated and unincorporated communities in the planning area with 2000 Census populations greater than 1,000 and growth rates for two time periods. Communities are listed from highest to lowest population in 2000. As shown, there are a number of rapidly growing communities in the planning area. San Luis, along the international border, had the most rapid growth rate during both time periods. Fortuna Foothills, an unincorporated community east of Yuma is also growing rapidly with a 165% growth rate between 1990 and 2000. Yuma, Fortuna Foothills and Quartzsite experience a large seasonal population increase in the winter when seasonal residents arrive to enjoy the relatively warm climate. This seasonal population is not accounted for in the population estimates and projections unless these communities are listed as the primary residence.

Table 7.0-4 Communities in the Lower Colorado River Planning Area with a 2000 Census population greater than 1,000

Communities	Basin	1990 Census Pop.	2000 Census Pop.	Percent Change 1990-2000	2005 Pop. Estimate	Percent Change 2000-2005	Projected 2050 Pop.
City of Yuma*	Yuma	54,923	77,515	41%	88,775	13%	255,612
Fortuna Foothills	Yuma	7,737	20,478	165%	27,437	25%	71,684
City of San Luis*	Yuma	4,212	15,322	264%	22,930	33%	71,521
City of Somerton*	Yuma	5,282	7,266	38%	9,750	25%	25,615
Town of Ajo	Lower Gila	2,919	3,705	27%	NA	NA	NA
Town of Quartzsite*	Parker	1,876	3,354	79%	3,600	7%	5,221
Parker Strip	Parker	1,646	3,302	101%	3,721	11%	6,460
Town of Parker*	Parker	2,897	3,140	8%	3,280	4%	4,202
Town of Gila Bend*	Gila Bend	1,747	1,980	13%	1,805	-10%	NA
Town of Wellton*	Lower Gila	1,066	1,829	72%	1,970	7%	2,854
Town of Ehrenberg*	Parker	1,226	1,357	11%	1,390	2%	1,607
Total >1,000		85,531	139,248	63%	164,658	63%	>444,775
Other		49,097	54,814	12%	NA	NA	141,630
Total		**134,628**	**194,062**	44%	NA	NA	**586,406**

Source: DES 2005: www.workforce.az.gov, U.S. Census Bureau 2006
Notes: 2005 population estimates not available for unincorporated communities
NA = not available
* = incorporated communities

Population Growth and Water Use

Arizona has limited mechanisms to address the connections between land use, population growth and water supply. A legislative attempt to link growth and water management planning is the Growing Smarter Plus Act of 2000 (Act) which requires that counties with a population greater than 125,000 (2000 Census) include planning for water resources in their comprehensive plans. Of the five counties in the planning area, four fit the size criteria in 2000; Maricopa, Pima, Yavapai and Yuma. Yuma County is entirely within the planning area. The Yuma County 2010 Comprehensive Plan provides a general overview on the quality and quantity of water in the county, including information on drinking water and distribution and wastewater management (Yuma County, 2000)

The Act also requires that twenty-three communities outside AMAs include a water resources element in their general plans. In the Lower Colorado River Planning Area this requirement applies to Yuma, Quartzsite, San Luis and Somerton and all communities have complied. Plans must consider water demand and water resource availability in conjunction with growth, land use and infrastructure.

Beginning in 2007, all community water systems in the state were required to submit Annual Water Use Reports and System Water Plans to the Department. The reports and plans are intended to reduce community water systems' vulnerability to drought, and to promote water resource planning to ensure that water providers are prepared to respond to water shortage conditions. In addition, the information will allow the State to provide regional planning assistance to help communities prepare for, mitigate and respond to drought. An Annual Water Use Report will be submitted each year by the systems, beginning June 1, 2007, and include information on water pumped or diverted, water received, water delivered to customers, and effluent used or received. The System Water Plan will be updated and submitted every five years and consist of three components- a Water Supply Plan, a Drought Preparedness Plan and a Water Conservation Plan. Systems serving populations greater than 1,850 were required to submit plans by January 1, 2007. Systems that serve populations less than 1,850 are required to submit plans by January 1, 2008. Plans have been submitted by the large systems of City of Yuma, Town of Parker, Ajo Improvement Company/ Phelps Dodge Corporation, City of Somerton, and Arizona Water Company-Ajo System (a small system). Water system, water supply and water demand information from these plans is presented in this document.

The Department's Water Adequacy Program also relates water supply and demand to growth to some extent, but does not control growth. Developers of subdivisions outside of AMAs are required to obtain a determination of whether there is sufficient water of adequate quality available for 100 years. If the supply is inadequate, lots may still be sold, but the condition of the water supply must be disclosed in promotional materials and in sales documents. Legislation adopted in June 2007 (SB 1575) authorizes a county board of supervisors to adopt a provision, by unanimous vote, which requires a new subdivision to have an adequate water supply in order for the subdivision to be approved by the platting authority. If adopted, cities and towns within the county may not approve a subdivision unless it has an adequate water supply. If the county does not adopt the provision, the legislation allows a city or town to adopt a local adequacy ordinance that requires a demonstration of adequacy before the final plat can be approved.

Subdivision adequacy determinations (Water Adequacy Reports), including the reason(s) for inadequate determinations, are provided in the basin sections of this volume and are summarized for each basin in Table 7.0-5. As shown on the table, a high percentage of lots have been determined to have an adequate water supply and only basins with relatively few subdivided lots have a high percentage of inadequacy determinations.

Two water providers in the planning area, Parker and the City of Yuma, are designated as having an adequate water supply for their entire service area. A service area designation exempts subdivisions from demonstrating water adequacy if served by the provider.

Table 7.0-5 Water adequacy determinations in the Lower Colorado River Planning Area

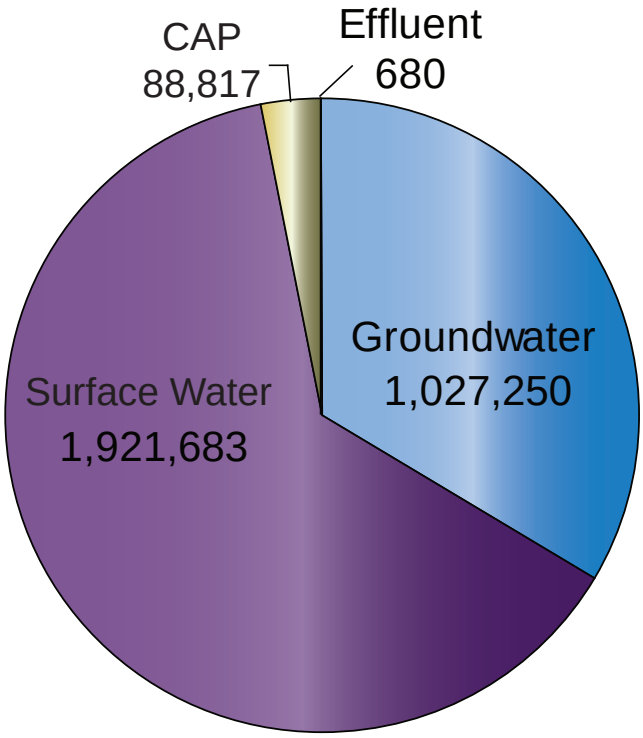
Basin	Number of Subdivisions	Number of Lots[1]	Lots w/ Adequate Detrm.	Lots w/ Inadequate Determ.	Approx. Percent of Lots w/ Inadequate Determ.
Gila Bend	4	≥89	≥24	65	73%
Harquahala	3	≥65	≥35	30	46%
Lower Gila	26	2,664	2,313	351	13%
McMullen Valley	9	2,030	1,904	126	6%
Parker	22	≥1,539	≥1,279	≥260	17%
Ranegras Plain	4	135	26	109	81%
Yuma	227	≥24,579	≥24,358	221	<1%

Source: ADWR 2005a
Notes:
[1] Data on number of lots are missing for some subdivisions; actual number maybe larger (≥)

7.0.6 Water Supply

Water supplies in the Lower Colorado River Planning Area include groundwater, surface water, Central Arizona Project water and effluent. As shown on Figure 7.0-10, most water used is surface water diverted from the Colorado River, and to a lesser extent, the Gila River. Colorado River water is the major supply in the Lower Gila, Parker and Yuma basins and CAP water is the largest supply in the Harquahala Basin. Gila River water combined with effluent discharge from the Phoenix AMA is an agricultural supply in the Gila River Basin. Elsewhere, groundwater is the primary water supply. Colorado River water is also used to meet environmental needs at the Imperial Wildlife Refuge in the Parker and Lower Gila basins. A discussion of

Figure 7.0-10 Water supply utilized in the Lower Colorado River Planning Area in acre-feet (average annual use 2001-2003)



Colorado River water entitlements and accounting is presented below. For purposes of the Atlas, water diverted from a watercourse or spring is considered surface water and if it is pumped from wells it is accounted for as groundwater. This is reflected in the cultural water demand tables in each basin section.

Colorado River Water

Decree Accounting

The right or authorization to beneficially use Colorado River water is defined as an entitlement. Entitlements held by Colorado River water users are created by decree of the United States Supreme Court in Arizona v. California et al. (Decree), through a contract with the Secretary of the Interior (Secretary) under Section 5 of the Boulder Canyon Project Act (BCPA) of December 21, 1928, or by Secretarial Reservation.

Table 7.0-6 shows the annual total amount of Colorado River water that was consumptively used for each category of water use within each basin in the planning area based on an accounting system established by Decree. Article V of the Decree directs the U.S. Bureau of Reclamation (Reclamation) to prepare an annual report of diversions from the mainstream, return flow of water to the mainstream that makes water available for downstream consumptive use in the U.S. or in satisfaction of the Mexican Treaty obligation, and the consumptive use of such water. The Article V report lists diversions and return flow separately by diverter, point of diversion and state, for each of the lower basin states.

According to the Article V report, consumptive use of Colorado River water in the planning area for agricultural, municipal, industrial and environmental purposes averaged 1,197,486 acre-feet annually for the 2001-2003 time period out of a total annual entitlement of 1,676,209 acre-feet. The table shows the quantities of water diverted by surface water diversions, in-river pumps, or pumped from wells assumed to be located within the hydraulically connected aquifer of the Colorado River. When determining consumptive water use, the Article V accounting system considers measured return flow and estimates of unmeasured return flows to the mainstream.

Reclamation has made a preliminary delineation of the lateral and vertical extent of the Colorado River aquifer to provide a basis for accounting of withdrawals against river water allocations. On August 18, 2006, Reclamation initiated a rulemaking process for Regulating Non-Contract Use of Colorado River Water in the Lower Basin (71 FR 47763) to prevent non-contract Colorado River water use from depleting the river and taking water from holders of Colorado River water entitlements. Reclamation's most current assessment indicates that most existing non-contract water use results from water withdrawn from wells located within the hydraulically connected aquifer of the Colorado River or from river pumps.

Because of the complexity of the accounting system and its unique methodology, the cultural water demand tables in Sections 7.4, 7.5 and 7.11 of this volume (those basins that utilize this supply), reflect the amount of water pumped from wells and diverted from streams. The tables do not attempt to distinguish whether the water is used pursuant to the entitlement system.

Table 7.0-6 Arizona v. California Decree accounting of the consumptive use of Colorado River water in the Lower Colorado River Planning Area (in acre-feet/year)

Basin/Year[1]	1971-75	1976-80	1981-85	1986-90	1991-95	1996-00	2001-03[2]	Entitlement[3]
Parker								
Agricultural	334,058	354,197	338,033	407,512	425,204	429,193	392,450	693,486
Industrial	0	0	0	0	0	0	0	0
Municipal	829	1,070	1,770	1,815	1,891	2,339	2,011	8,004
Environmental[4]	148	13,128	8,768	11,822	19,719	18,368	14,338	56,238
Lower Gila								
Agricultural [5]	309,367	209,015	258,612	312,237	241,267	278,826	273,365	272,980
Industrial	0	0	0	0	0	0	0	0
Municipal	2	5	6	7	19	62	76	265
Environmental [4]	40	59	22	743	1,800	1,773	920	6,262
Yuma								
Agricultural [5]	676,165	631,711	564,313	571,245	543,251	560,581	492,110	582,257
Industrial	1,046	1,021	839	610	469	2,250	892	1,772
Municipal	13,272	10,146	12,174	13,137	15,255	21,625	21,325	54,945
Environmental	0	0	0	0	0	0	0	0
TOTAL	1,334,927	1,220,352	1,184,538	1,319,126	1,248,876	1,315,019	1,197,486	1,676,209

Footnotes

[1] Reported consumptive use for individual users may not cover an entire 5 year period; the average is based on the years of record.

[2] In 2003, the United States Bureau of Reclamation (Reclamation) began deducting unmeasured return flows from the diversions by individual divertors. Prior to this time, Reclamation only deducted the total amount of unmeasured return flow from the total Lower Basin diversions.

[3] The entitlement amounts do not include 72,000 acre-feet for the Ak-Chin (50,000 acre-feet) and Salt River-Pima Maricopa Indian (22,000 acre-feet) water rights settlements. This water is delivered by the Central Arizona Project to the Ak-Chin and Salt River- Pima Maricopa Indian Communities.

[4] The Imperial National Wildlife Refuge spans an area in the Parker and Lower Gila basins. The consumptive use has been prorated based on the percentage of land in each basin.

[5] The Wellton-Mohawk Irrigation and Drainage District (IDD) spans an area in the Lower Gila and Yuma basins. The consumptive use has been prorated based on the percentage of land in each basin.

Entitlement Priority Levels

Rights to Colorado River water include the following several priority levels:

a. 1st Priority: Satisfaction of Present Perfected Rights as defined in the Arizona v. California decree
b. 2nd Priority: Satisfaction of Secretarial Reservations and Perfected Rights established prior to September 30, 1968
c. 3rd Priority: Satisfaction of entitlements pursuant to contracts between the United States and water users in Arizona executed on or before September 30, 1968 (2nd and 3rd priority are coequal)
d. 4th Priority: i) Contracts, Secretarial Reservations and other arrangements between the U.S. and water users in Arizona entered into after September 30, 1968, for a total quantity not to exceed 164,652 acre-feet of diversions annually and ii) contract No. 14-06-W-245, dated December 15, 1972, as amended, between the United States and the Central Arizona Project (CAP). Entitlements having a 4th priority as described in (i) and (ii) are coequal.
e. 5th Priority: Unused entitlement
f. 6th Priority: Surplus water

In general, the lower priority entitlements will be the first to be impacted when the Secretary declares a shortage on the Colorado River system. Within the planning area, entitlement holders with a first priority or present perfected rights include the Cocopah Indian Reservation, Colorado River Indian Tribes Reservation, Fort Yuma Indian Reservation, Yuma County Water Users' Association, North Gila Valley Irrigation District, Unit "B" Irrigation and Drainage District, the City of Yuma and the Town of Parker. Second and third priority entitlement holders (which are coequal), include the Ak-Chin Indian Community, Imperial and Cibola National Wildlife Refuges, Yuma Proving Grounds, the Marine Corps Air Station–Yuma, Wellton-Mohawk Irrigation and Drainage District and others. Information on Colorado River entitlements in the Lower Colorado River Planning Area is provided in Appendix B. Entitlements may be transferred under certain conditions. Within the planning area, the Cibola Valley Irrigation and Drainage District has assigned a portion of its entitlement to the Mohave County Water Authority (MCWA, Priority 5 and/or 6), to the Hopi Tribe (Priority 4, 5 and 6) and to Cibola Resources for municipal use at Ehrenberg. More information on entitlement transfers is in Appendix C.

Coordinated Operations and Shortage Criteria

In December 2007, Reclamation issued a Record of Decision (ROD) on interim operating criteria (2008-2026) including the coordinated operation of Lake Powell and Lake Mead and criteria for implementing shortage reductions in the Lower Basin. Historically, the reservoirs were operated independently; annual Lake Powell water releases were determined based on applicable law and relevant factors contained in the Long-Range Operating Criteria. The ROD adopted four key elements: 1) establishes rules for shortages; 2) allows coordinated operation of Lake Powell and Lake Mead to avoid Lower Basin shortages and avoid curtailment of Upper Basin water use; 3) establishes rules for surpluses; and 4) address ongoing drought by encouraging new initiatives for water conservation. If regional drought conditions continue, shortage operations could begin as early as 2011. The ROD could have implications for water supply availability in the planning area.

Colorado River Water Supply Distribution System

In the Lower Colorado River Planning Area, dams on the Colorado River were constructed primarily for the purpose of regulating river flow and creating storage to facilitate water diversions to Arizona, California and Mexico via canals pursuant to decrees, international treaties and other legal agreements. Figure 7.0-11 shows the location of major dams, water delivery and diversion structures, and other features along the Colorado and Gila Rivers in the planning area. The agricultural and municipal water delivery systems are discussed in the cultural water demand section (7.0.6). The Colorado River system is described briefly below, from north to south.

Parker Dam

Parker Dam, at the northern edge of the planning area in the Parker Basin, is a concrete arch structure 320 feet high and 856 feet long at its crest. It is the deepest dam in the world with 73 percent of its structural height below the original riverbed. Completed in 1938, it impounds Lake Havasu and provides a desilting basin and forebay for diversion of Colorado River water. The Metropolitan Water District of Southern California pumps water into its Colorado River Aqueduct from the forebay, conveying it 242 miles west to Lake Mathews near Riverside, California. On the Arizona side, water is pumped from the forebay into the CAP canal for use in central Arizona. (USBOR, 2007c) The dam includes a powerplant that is integrated with the Davis and Hoover powerplants, providing power to Arizona and southern California. The powerplant is remotely operated from the Hoover Control Center. (USBOR, 2006)

Headgate Rock Dam

Downstream of Parker Dam, irrigation water for the Colorado River Indian Tribes Reservation near Parker is diverted at Headgate Rock Dam. This dam was constructed in 1942 to stabilize the river channel and provide reliable irrigation supplies. (USBOR, 2007d) A levee system protects areas downstream from flooding.

Palo Verde Diversion Dam

Palo Verde Diversion Dam is located about 44 miles downstream of Headgate Rock Dam. It maintains a sufficiently high, constant water surface elevation at the Palo Verde Irrigation District canal headwork for delivery of irrigation water to the west side of the Colorado River near Blythe, California. The dam is a semipervious barrier of sand, gravel and rockfill, 46 feet high and 1,850 feet long. (USBOR, 2007e)

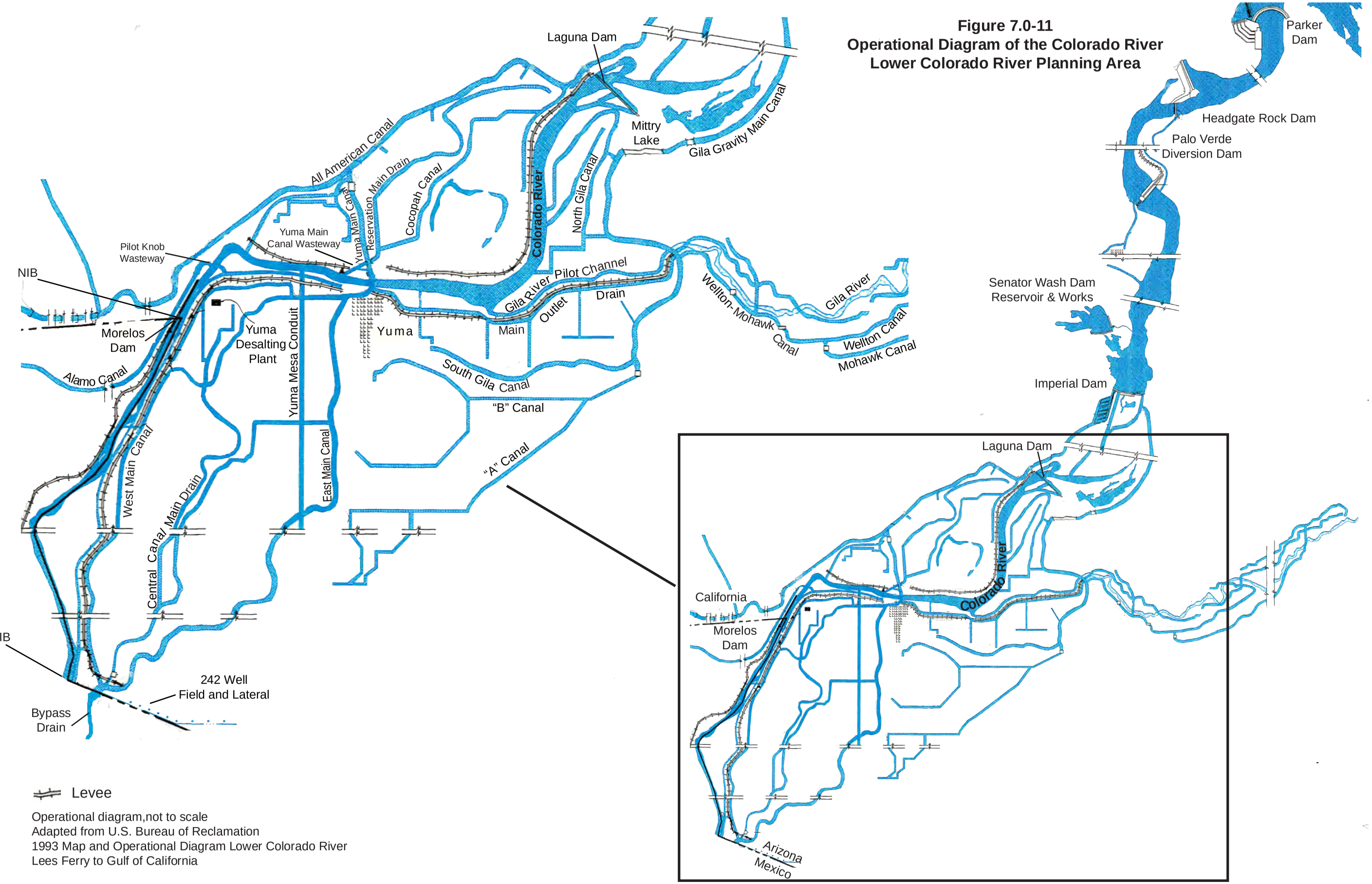
Senator Wash Dam

Senator Wash Dam and Reservoir is an offstream pumping facility located on the California side of the river about two miles upstream from Imperial Dam. This structure improves water scheduling by downstream users by storing part of the riverflow upstream of Imperial Dam when it is not needed, releasing it to the river for downstream use when needed. Without the dam it would take three days for water released at Parker Dam to reach Imperial Dam. The dam is an earth embankment structure 2,342 feet long with a height of about 94 feet. Other works include three dikes, a spillway and a pumping plant. (USBOR, 2007d)

Imperial Dam

Imperial Dam is a major diversion point for both Arizona and California. The dam raises the water

Figure 7.0-11
Operational Diagram of the Colorado River
Lower Colorado River Planning Area



surface about 25 feet, allowing controlled gravity flow into the All American Canal and the Gila Gravity Main Canal. The All American Canal system diverts water from the California side of the dam and serves Imperial Irrigation District, Coachella Valley Water District, the Yuma Project in Arizona and California, and the City of Yuma. The Gila Gravity Main Canal system diverts water from the Arizona side of the dam and serves the north and south Gila Valley, Yuma Mesa, and the Wellton-Mohawk Irrigation District area. Imperial Dam is also used to regulate water deliveries to Mexico required by international treaty. (USBOR, 2007b)

Laguna Dam

From Imperial Dam to the Northerly International Boundary between the U.S. and Mexico, the entire channel of the Colorado River is bounded by a system of levees. Laguna Dam, located five miles downstream of Imperial Dam serves as a regulating structure for Colorado River water. (USBOR, 2007b) Because of upstream diversions and dams, from Laguna Dam to Morelos Dam the river consists of a small active channel located within a broad, older riverbed entrenched below the historic level of the unregulated river (USBOR, 2007d).

Yuma Desalting Plant, Main Outlet Extension and Bypass Extension

Utilizing Colorado River water for domestic and agricultural purposes has steadily increased the salinity of its waters. In the 1960s crops in the Mexicali Valley were damaged by the high salinity of the Colorado River water used for irrigation. An amendment to the 1944 treaty with Mexico (Minute 242) guaranteed that the treaty water delivery would be no more than 115 ppm (+/- 30 ppm) more saline than the water diverted at Imperial Dam.

Nine miles downstream from Laguna Dam the Gila River enters the Colorado. Along the Gila River, extensive agricultural irrigation with Colorado River water in the Wellton-Mohawk Irrigation and Drainage District (WMIDD) has made it necessary to install drainage wells to pump excess irrigation water to keep salts from accumulating in the root zone. About 120,000 acre-feet of brackish groundwater is pumped annually. If this water was directly returned to the river it would increase salinity levels above the international treaty standard and could not be counted towards Mexico's Colorado River apportionment of 1.5 million acre-feet per year. To desalinate the drainage water so that it could be returned to the mainstem and counted toward the apportionment, Reclamation constructed the Yuma Desalting Plant (YDP). Completed in 1992, the YDP is designed to treat up to 96,000 acre-feet of water per year. It operated briefly in 1993 and was then put on standby status until a recent "demonstration run" in 2007. WMIDD drainage water is discharged to the Main Outlet Drain Extension (MODE) and its bypass extension in Mexico and delivered to the Santa Clara Slough (Cienega de Santa Clara). (WMIDD, 2004)

California and Pilot Knob Wasteways

Four miles downstream from the mouth of the Gila River, the Yuma Main Canal wasteway returns water to the river to comply with the treaty obligation to Mexico. In addition, a portion of the water scheduled to be delivered to Mexico is diverted at Imperial Dam, conveyed by the All American Canal, and returned to the river through the Pilot Knob Wasteway west of Yuma. (USBOR, 2007b)

Northerly International Boundary (NIB) to Southerly International Boundary (SIB)/Morelos Dam

The 23.7 mile long reach of the Colorado River between the NIB and the SIB is referred to as the limitrophe section. Levees have been constructed on both sides of the river. About 1.1 miles downstream of the NIB, Morelos Diversion Dam acts as a diversion control structure for the Alamo Canal, which conveys water to Mexico. Other infrastructure includes wasteways, bypass channel, levees, etc. (USBOR, 2007b) Below Morelos Dam, operation of a dredge in Mexico at the head of the Alamo Canal, deposits a considerable amount of sediment into the river. In addition, river flow is reduced in this section due to diversions by Mexico into the Alamo Canal, and the channel is overgrown with vegetation. As a result, the flood capacity of the channel has been reduced, posing a threat to the safety of the Valley Division of the Yuma Project. (USBOR, 2007d)

242 Well Field and Lateral

The 242 well field and lateral is located east of San Luis in a 5-mile wide strip of land consisting of 21 wells. The well field intercepts part of the groundwater flow, including irrigation drainage water that moves south into Mexico from the Yuma Mesa. Water pumped from the well field is delivered at the SIB to Mexico through the 242 Lateral and other laterals to meet international treaty obligations for Colorado River water deliveries. (USBOR, 2007a)

Central Arizona Project Water

Colorado River water is withdrawn at Lake Havasu at the Mark Wilmer Pumping Plant to the Central Arizona Project Aqueduct system. It crosses the Parker, Ranegras Plain and Harquahala basins via the Hayden-Rhodes Aqueduct to the CAP service area in central Arizona (Maricopa, Pima and Pinal counties).

CAP water is used both directly and stored underground in the planning area pursuant to the Department's Recharge Program. Storage facilities in the planning area are shown in Table 7.0-7. The Vidler Water Company Underground Storage Facility (USF) is located near Centennial in the Harquahala Basin where it is permitted to recharge up to 100,000 acre-feet of CAP water annually. Harquahala Valley Irrigation District (HVID), located in the southern part of the Harquahala Basin holds a groundwater savings facility permit (GSF). It receives excess (uncontracted) CAP water which it uses "in-lieu" of groundwater. The Arizona Water Banking Authority (AWBA) holds water storage permits to store excess CAP water at both facilities. HVID has been using CAP water since 1986 and it has replaced groundwater as the major water supply in the basin. As a result of this storage and direct use, groundwater levels have risen in the vicinity of Vidler and HVID. A long-term storage account was established for the McMullen Valley Water Conservation & Drainage District (Vicksburg Farms) in 2000 in anticipation of the accrual of long term storage credits from storage of CAP water via two injection wells. However, a water storage permit was never issued and no water has been stored.

Table 7.0-7 Storage facilities in the Harquahala Basin

Permit Type/No. (Duration)	Permit Holder	Project Description	Associated Water Storage Permit No's and Permit Holder
USF 71-576699.0004 (09/03/04 to 09/30/20)	Vidler Water Storage Company	Vidler Water Company Recharge Project: Annual recharge up to 100,000 acre-feet of CAP via basins and vadose zone wells.	73-576699.01: Vidler 73-576699.02: AWBA
GSF 72-593304.0000 (03/06/06 to 03/06/11)	Harquahala Valley Irrigation Dist.	Indirect recharge up to 50,000 acre-feet per annually of in lieu water.	73-593304; AWBA

Surface Water

The Gila River in the Gila Bend Basin is the only major surface water supply in the planning area in addition to the Colorado River. The river is intermittent or ephemeral in the planning area and the volume available for use is a mixture of upstream releases of water from dams, storm runoff from precipitation events, irrigation return flows and effluent flows from the 23rd Avenue and 91st Avenue Wastewater Treatment Plants (WWTPs) located in the Phoenix AMA. The 91st Avenue WWTP, located near the confluence of the Salt, Gila and Agua Fria Rivers, has a current treatment capacity of 179 mgd (over 200,000 acre-feet/year). In typical years, most if not all water in this reach of the river is wastewater effluent (ADWR, 1994a). Flow is extremely variable in the river with annual flows varying from 0 to more than 5.6 maf at the gage below Gillespie Dam at the northern edge of the Gila Bend Basin. Median flow at the gage is about 43,000 acre-feet per year.

The waters of the Gila are designated as "impaired" due to elevated concentrations of organic compounds that exceed the designated use standard for fish consumption from it's point of entry into the planning area to Painted Rock Dam. Below Painted Rock Dam the Gila is impaired due to dissolved oxygen, organics, selenium and boron concentrations that exceed fish consumption or aquatic and wildlife uses (see Tables 7.2-7 and 7.4-7).

Groundwater

In basins without access to Colorado River or CAP water, groundwater is the primary water supply. Groundwater is a relatively abundant and dependable water supply throughout the planning area with relatively large volumes of groundwater in storage and high well yields in many basins. Well yields typically exceed 1,000 gpm, and often exceed more than 2,000 gpm, in almost all basins in the planning area. In groundwater dependent basins, estimates of water in storage are as high as 61 maf in the Gila Bend Basin, 15 maf in the McMullen Valley Basin and 27 maf in the Ranegras Plain Basin. However, groundwater levels declined in many of these basins between 1990-1991

and 2003-2004. Water levels declined by more than 30 feet in several wells in the northern part of the Gila Bend Basin during this period and wells near Salome-Wenden in the McMullen Valley Basin and in the central part of the Ranegras Plain Basin show similar declines (see Figures 7.2-6, 7.5-6 and 7.7-6). There are widespread instances of fluoride and arsenic levels that equal or exceed drinking water standards and high salinity levels in many agricultural areas. As mentioned previously, importation of Colorado River water in the Lower Gila and Yuma Basins has locally raised groundwater levels and changed groundwater flow directions, requiring drainage wells and exportation of water out of the basins.

In general, the Groundwater Transportation Act of 1991 restricts the transportation of groundwater from non-AMA groundwater basins to AMAs. However, there are three basins in the planning area from which groundwater may be withdrawn and transported outside of the basin: Butler Valley, Harquahala and McMullen Valley. General statutory provisions governing groundwater transportation from these basins are discussed below. Withdrawal and transportation of groundwater may cause groundwater level declines and impact the groundwater supply available for use within the basins.

Pursuant to A.R.S. § 45-553, groundwater may be withdrawn from the Butler Valley Basin and transferred to an initial AMA from State land or land owned by a political subdivision of the State (e.g. counties, cities and special districts). There are no limits on the volume of groundwater that may be transported from the basin. Groundwater may be withdrawn from historically irrigated lands in the McMullen Valley Basin that were owned by a city or person prior to January 1, 1988 and transported to the Phoenix AMA. (A.R.S. § 45-552) Qualified groundwater importers are cities, towns, private water companies and replenishment districts for their use or use by the AWBA. The City of Phoenix owns 14,000 acres of agricultural lands in the basin. The annual volume that may be withdrawn is limited to an average of 3 acre-feet per irrigated acre with a total limit of 6 million acre-feet. If this water is used for an assured water supply demonstration in an AMA, only water withdrawn above 1,000 feet at a rate not to exceed 10 feet per year over the 100 year period will be considered. In the Harquahala Basin, A.R.S. § 45-552 allows the transportation of groundwater pumped from historically irrigated lands owned by a political subdivision of the state and transported for its use in an AMA or use by the AWBA. The volumetric limit is 6 acre-feet per acre per year or 30 acre-feet per acre for any period of ten consecutive years. The director of ADWR may establish an alternative volume as long as it will not unreasonably increase damage to residents and other water users. Groundwater may not be withdrawn below 1,000 feet nor at a rate that cause declines of more than an average of ten feet per year during the one hundred year evaluation period. The City of Scottsdale has applied to the Department to export 3,645.24 acre-feet of groundwater per year from 1,215.08 acres of historically irrigated lands in the Harquahala Basin. As of 12/27/07 the application was still pending.

In order to better understand the water supply situation in areas of the state where data are lacking, the Department has established automated groundwater monitoring sites that record water levels in wells. This information is available through an interactive map on the Department's website to allow access to local information for planning, drought mitigation and other purposes (www.azwater.gov/dwr/). These devices were located based on areas of growth, subsidence, type of land use, proximity to river/stream channels, proximity to water contamination sites or areas affected by drought.

Figure 1-18 of Volume 1 of the Atlas shows the location of automatic water-level recording sites as of 2005. At that time there were a total of ten sites in the Lower Colorado River Planning Area, consisting of ADWR and USGS sites. Of these, there are seven ADWR sites located in the Butler Valley, Gila Bend, Harquahala, Lower Gila, McMullen Valley and Ranegras Plain basins.

Index well hydrographs, which display historic water level behavior, are available through an interactive map at the same website for 174 index wells in the planning area. Index wells are located in all basins except for San Simon Wash, most of which is covered by the Tohono O'odham Indian Reservation.

Information on major aquifers, well yields, estimated natural recharge, estimated water in storage, aquifer flow direction, and water level changes are found in groundwater data tables, groundwater conditions maps, hydrographs and well yield maps for each basin in Sections 7.1-7.11.

Effluent

Effluent, or reclaimed water, is a little used resource in the planning area with less than 700 acre-feet used annually as a partial water supply for six golf courses in the Yuma Basin and one golf course in the Parker Basin. Golf course irrigation demand is higher in the summer, but effluent production is higher in the winter when the area population increases due to winter visitors. The water supply at Foothills Executive, Foothills Par 3 and Las Barrancas Golf Courses is about 90% effluent in the winter and 90% groundwater in the summer (personal communication, T. Holyk, 11/07). Effluent discharged to the Gila River from the Phoenix AMA is an agricultural water supply in the Gila Bend Basin, but the volume used is not quantified.

Approximately 16,300 acre-feet of effluent are treated in the planning area, and 79% of that (12,800 acre-feet) is generated in the Yuma Basin. Approximately 153,000 people or 79% of the total planning area population is served by a sewer system. Most of this potential water supply is discharged to evaporation ponds or to infiltration basins after treatment. A number of basins including, Butler Valley, Harquahala, McMullen Valley, Ranegras Plain, and Tiger Wash, have no record of a wastewater treatment plant. Use of septic tanks appears to be widespread throughout the entire planning area.

Contamination Sites

Sites of environmental contamination may impact the use of some water supplies. An inventory of Department of Defense (DOD), Resource Conservation and Recovery Act (RCRA), Superfund (Environmental Protection Agency designated sites), Water Quality Assurance Revolving Fund (state designated WQARF sites), Voluntary Remediation Program (VRP) and Leaking Underground Storage Tank (LUST) sites was conducted for the planning area. Of these various contamination sites, DOD, Superfund, WQARF and VRP sites are found in the planning area. Table 7.0-8 lists the contaminant and affected media and the basin location of these sites. The location of all contamination sites in the planning area is shown on Figure 7.0-12.

Table 7.0-8 Active contamination sites in the Lower Colorado River Planning Area

SITE NAME	MEDIA AFFECTED AND CONTAMINANT	GROUNDWATER BASIN
Voluntary Remediation Sites		
Adair Memorial Park	Soil/Lead	Yuma
APS Yuma Manufactured Gas Plant (MGP)	Soil/Hydrocarbons, Polycyclic aromatic hydrocarbons (PAHs) and Volatile Organic Compounds(VOCs)	Yuma
Chevron Ajo Bulk Plant	Soil & Groundwater/Total Petroleum Hydrocarbons (TPH) and Benzene, Toluene, Ethyl benzene, and Xylene (BTEX)	Lower Gila
KMEP-Yuma Marine Corps Air Station	Soil & Groundwater/Total Petroleum Hydrocarbons (TPH); Benzene, Toluene, Ethyl benzene, and Xylene (BTEX); and Polycyclic aromatic hydrocarbon (PAH)	Yuma
Union Pacific Railroad Former AZ Agrochemical Facility	Soil/Pesticides	Yuma
Union Pacific Railroad Yuma Yard Dieselville	Soil & Groundwater/Total Petroleum Hydrocarbons (TPH) and Benzene, Toluene, Ethyl benzene, and Xylene (BTEX)	Yuma
Western Farm Service-Yuma Plant	Soil & Groundwater/Toxaphene dieldrin, Dichloro diphenyl trichloroethane (DDT), Dichloro diphenyl dichloroethane (DDD), Dichloro diphenyl dichloroethylene (DDE), Endrin heptachor epoxide disulphate and Nitrate	Yuma
Water Quality Assurance Revolving Fund (WQARF) Sites		
20th Street and Factor Avenue	Soil & Groundwater/Tetrachloroethene (PCE) and Cyanide	Yuma
Tyson Wash	Groundwater/ Tetrachloroethene (PCE) and Tricholoroethene (TCE)	Yuma
National Priority List (NPL) Superfund Sites		
Yuma Marine Corps Air Station	Soil & Groundwater/Trichloroethene (TCE), Dichloroethene (DCE), Tetrachloroethene (PCE) and Petroleum Hydrocarbons	Yuma
Department of Defense (DOD) Sites		
Yuma Army Proving Grounds	Soil & Groundwater/Hydrocarbons, Volatile Organic Compounds (VOCs), Semi-volatile Organic Compounds (SVOCs) and Metals	Lower Gila

Sources: ADEQ 2002, ADEQ 2006a, ADEQ 2006b

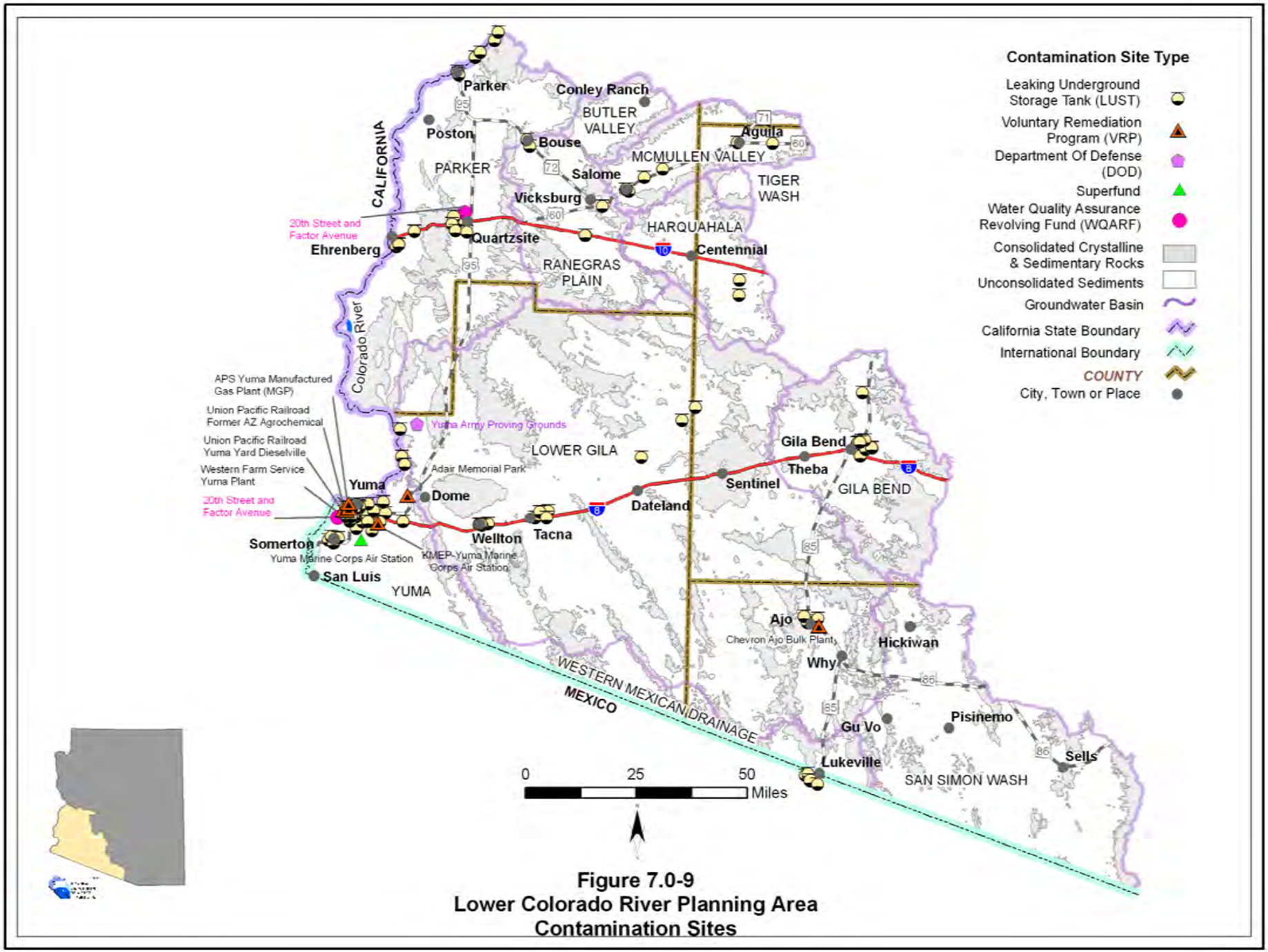


Figure 7.0-9
Lower Colorado River Planning Area
Contamination Sites

There are seven active VRP sites, all but one in the Yuma Basin and all primarily sites of organic compound contamination such as petroleum and pesticide products. The VRP is a state administered and funded voluntary cleanup program. Any site that has soil and/or groundwater contamination, provided that the site is not subject to an enforcement action by another program, is eligible to participate. To encourage participation, ADEQ provides an expedited process and a single point of contact for projects that involve more than one regulatory program (Environmental Law Institute, 2002).

There are two WQARF sites and one Superfund site in the Yuma Basin. All sites involve Trichloroethylene (TCE) or Tetrachloroethene (PCE) contamination. The Tyson Wash WQARF Site is located between Tyson Wash and Highway 95 north of Business Route 10 in Quartzsite. Contamination was detected in 1993 and a groundwater monitoring program began in 1995 to further investigate the extent of contamination. The upper aquifer, located about 42 to 65 feet below the land surface, has been affected. Water is being pumped and treated on site and injected back into the aquifer. (ADEQ, 2005) The 20th Street and Factor WQARF Site is located in Yuma and has cyanide contamination. Formerly the site of a motion picture laboratory and photo equipment manufacturer, wastewater was treated to recover silver and then discharged to a sump and disposal pond, to the ground, and used for landscape irrigation. Remedial actions at this site include soil removal and investigations to define the extent of a groundwater contamination plume. (ADEQ, 2007a) The Yuma Marine Corps Air Station (YMCAS) Superfund site, located at Yuma, involves multiple contaminants in groundwater as a result of disposal of materials related to military activities. Remedial actions include vertical recirculation of groundwater to contain and treat areas of relatively low contaminant concentrations, and air sparging/soil vapor extraction to treat the Area 1 Hot Spot (Source) Plume area (ADEQ, 2007b).

The Yuma Army Proving Ground Department of Defense Site is located northeast of Yuma and was first used as a military training facility during WWII. Later it became a site for testing of equipment under desert conditions. Groundwater contamination has occurred from the possible release of half a million gallons of fuel and from other actions. Environmental investigations and cleanup activities are underway and most of the contaminated areas are fenced. (ADEQ, 2007c)

There are 213 active LUST sites in the planning area. One hundred eight sites are located at Yuma, 22 at Gila Bend, 18 at Quartzsite, 13 each at Parker and Ehrenberg, and ten sites or less at Somerton, Vicksburg, Wellton, Salome, Lukeville, Tacna and Centennial Wash.

7.0.7 Cultural Water Demand

Cultural water demand in the Lower Colorado River Planning Area, organized by water source and water demand sector, is shown in Table 7.0-9. Total cultural water demand averaged approximately 3,038,400 acre-feet per year during the period from 2001-2003. Almost 98% of this demand is by the agricultural sector with approximately 2,974,200 acre-feet of annual demand. Agricultural demand occurs in all of the basins with the exception of Tiger Wash and Western Mexican Drainage basins. About 65% of this agricultural demand is met by surface water diverted from the Colorado River. Municipal demand is about 1.6% of the total planning area demand with an average of 49,380 acre-feet during the period 2001-2003. Municipal demand is primarily met by Colorado

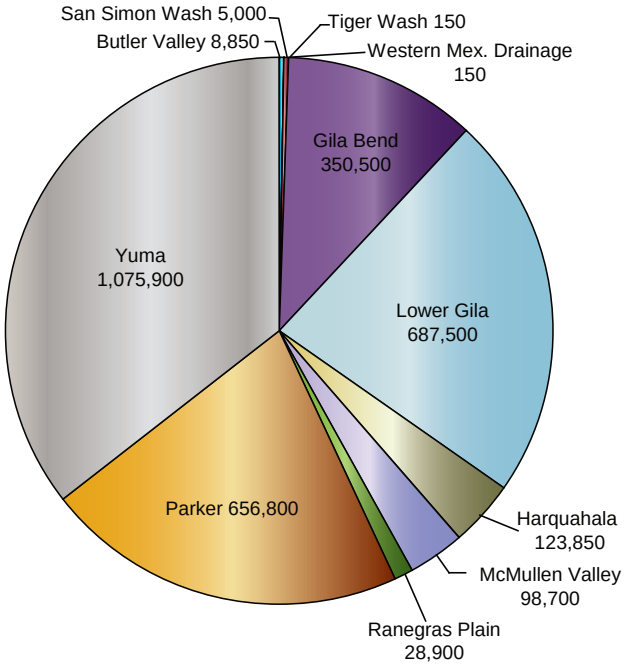
River water and the municipal sector is the only sector that utilizes effluent. Industrial demand, primarily related to dairies and feedlots, accounted for 14,850 acre-feet, 0.5% of the total demand during this period. Tribal water demand is included in these totals.

Cultural demand volumes vary substantially between planning area basins and ranges from less than 300 acre-feet per year in the Tiger Wash and Western Mexican Drainage basins to 1,075,900 acre-feet per year in the Yuma Basin (see Figure 7.0-13).

Table 7.0-9 Lower Colorado River Planning Area average cultural water demand by sector (2001-2003)

Water Source/Demand Sector	Acre-feet	Percent
Groundwater		
Agricultural	999,700	32.93%
Municipal	15,600	0.51%
Industrial	11,398	0.37%
Surface Water		
Agricultural	1,974,500	65.03%
Municipal	33,100	1.09%
Industrial	1,382	0.05%
Effluent		
Municipal	680	0.02%

Figure 7.0-13 Average total basin water demand per year in acre-feet (2001-2003)



Tribal Water Demand

Tribal lands in the planning area include the Cocopah, Colorado River Indian Tribes (CRIT), Gila Bend, Fort Yuma-Quechan and the Tohono O'odham reservations. The Cocopah, Fort Yuma-Quechan and CRIT hold Priority 1 Colorado River entitlements totaling 677,573 acre-feet a year. The CRIT entitlement is 662,402 acre-feet, the largest in the state and about a third of the state's non-CAP entitlement. By comparison, the total non-tribal Priority 1 entitlement in the planning

area is 290,923 acre-feet. Annual tribal demand is approximately 658,000 acre-feet a year, most of which is agricultural irrigation on the CRIT Reservation in the Parker Basin. Almost the entire San Simon Wash Basin is within Tohono O'odham Reservation boundaries.

Cocopah

The Cocopah Reservation is entirely within the Yuma Basin. The reservation has about 1,000 tribal members and consists of three parcels (East, West and North Cocopah) located south of Yuma. The tribe has approximately 2,400 acres of land under irrigation, leased to non-tribal farmers. The tribe operates a casino and a number of community facilities. (ITCA, 2003) There is no tribal water utility but the Cocopah Environmental Protection Office tests the quality of domestic wells and monitors agricultural water use to ensure that the tribe does not exceed its annual Colorado River allocation. This office also conducts weekly monitoring of groundwater levels and Colorado River water quality within the limitrophe region that crosses the boundaries of the West Reservation. (Cocopah Indian Tribe, 2006) The tribe's Colorado River entitlement is 8,821 acre-feet per year of Priority 1 rights and 2,026 acre-feet of Priority 4 entitlement for areas south of Morelos Dam.

Fort Yuma-Quechan

The Fort Yuma-Quechan Reservation is located primarily in California. Only 4% of the reservation land is in Arizona with 45 residents located just east of Yuma in the Yuma Basin. Tribal offices, RV parks and two casinos are also located in Arizona. The tribe owns a 700-acre farm which is leased to a non-Indian farmer. Some of this farm is apparently located in Arizona (ITCA, 2003).

Colorado River Indian Tribes

Most of the CRIT Reservation is located in Arizona in the Parker Basin with a small portion in California. The Colorado River Indian Tribes include the Mohave, Chemehuevi, Hopi and Navajo, and about 3,500 active tribal members. The primary tribal community is Parker, which contains non-tribal lands and Poston with about 400 tribal residents. The CRIT operate the CRIT Regional Water System (CRIT, 2005) and the CRIT Water Department serves the area outside the Parker Town limits. Tribal municipal demand is relatively small.

The primary economic activity on the reservation is agriculture. Pursuant to Arizona v. California, 99,375 acres of irrigated land were decreed with an associated annual Colorado River entitlement of 662,402 acre-feet. According to the 2006 Lower Colorado Accounting System, actual irrigated lands in Arizona totaled 72,610 acres, including land irrigated by lessees. The amount of irrigated acreage in Arizona reportedly averages between 72,000 to 80,000 acres. CRIT Farms manages over 15,000 acres of alfalfa, cotton, durum wheat and other crops (CRIT, 2005).

Other economic activities on the reservation include recreation, gaming, governmental services and light industry. The tribe operates two sand and gravel facilities, one at Parker and one north of Ehrenberg. These facilities supply concrete ready mix, asphalt and sand and gravel products to La Paz County and to neighboring counties in California. (CRIT, 2005)

Tohono O'odham

Water demand on the Tohono O'odham reservation is primarily related to municipal/domestic uses in the tribal communities, particularly at Sells, and farming in the southern part of the San Simon

Wash Basin at Papago Farms. The Tohono O'odham Utility Authority Water Department serves a total of about 3,200 customers and has 1,676 wastewater customers on the entire reservation which stretches into the Pinal and Tucson Active Management Areas. The Water Department is working to connect small systems into a single system that can be maintained in a central location. There are currently seven such systems in operation. (TOUA, 2007a) In the planning area there are plans to connect two community systems south of Gu Vo and connect another community with a regional system by the end of 2007. The water supply for the reservation comes from 73 wells located in and around the reservation. (TOUA, 2007b)

Gila Bend

The Gila Bend Reservation (San Lucy District) is part of the Tohono O'odham Nation but is located outside of the main reservation area north of Gila Bend. Water demand could not be determined, but based on aerial photos, it appears that there is no agricultural demand. In the Town of Gila Bend there is a multi-purpose district building and a health center that serves the district (ADOC, 2005).

Municipal Demand

Municipal demand is summarized by groundwater basin and water supply in Table 7.0-10. Average annual demand during 2001-2003 was about 49,400 acre-feet. Sixty-seven percent of the municipal demand is met by surface water from the Colorado River, primarily in the Yuma Basin. In all other basins, groundwater is the primary municipal water supply. Effluent is used to meet municipal demand in the Yuma and Parker basins.

Table 7.0-10 Average annual municipal water demand in the Lower Colorado River Planning area (2001-2003) in acre-feet

Basin	Groundwater	Surface Water	Effluent	Total
Butler Valley	<300			150
Gila Bend	950			950
Harquahala	950			950
Lower Gila	2,100	600		2,700
McMullen Valley	550			550
Parker	3,300	500	220	4,020
Ranegras Plain	400			400
San Simon Wash	1,000			1,000
Tiger Wash	<300			150
Western Mexican Drainage	<300			150
Yuma	5,900	32,000	460	38,360
Total Municipal	15,600	33,100	680	49,380

Sources: USGS 2005b

Notes: Effluent figures are for golf course irrigation in 2006

Volume <300 acre-feet assumed to be 150 acre-feet for computation purposes

It is estimated that about 84% of the planning area population is served by a water provider. Eight water providers in the planning area served 500 acre-feet of water or more in 2003. These providers and their demand in 1992, 2000 and 2003 are shown in Table 7.0-11. In 2003, municipal

utilities served the communities of Gila Bend, Wellton, Parker, San Luis, Somerton and Yuma. Municipally-owned systems have more flexible water rate-setting ability than private water companies, which are regulated by the Arizona Corporation Commission. In addition, municipal utilities have the authority to enact water conservation ordinances. This authority may enable municipal utilities to better manage water resources within water service areas. Water provider issues are discussed in Section 7.0.8.

Table 7.0-11 Water providers serving a minimum of 500 acre-feet of water per year, excluding effluent, in the Lower Colorado River Planning Area

Basin/Water Provider	1992 (acre-feet)	2000 (acre-feet)	2003 (acre-feet)
Gila Bend			
Town of Gila Bend	537	651	837
Lower Gila			
Ajo Improvement Company	541	660	555
Town of Wellton	NA	158	638
Parker			
Town of Parker	887	1,049	1,027
Yuma			
City of Somerton	827	1,012	2,096
City of San Luis	772	1,904	2,588
Far West Water and Sewer - Fortuna Foothills	2,994	5,222	4,891
Yuma Municipal Water Department	21,680	32,906	30,016

Sources: USBOR 1991, USBOR 2000, USBOR 2003, USGS 2005
NA = Not Available
Notes: The Town of Ajo is served by three water providers. Ajo Improvement Company provides water to all three systems. Yuma Municipal Water Department demand are reported diversions of Colorado River water from the Bureau of Reclamation Article V Decree Accounting Reports.

Golf course demand is estimated to be approximately 12% of the total municipal demand. Estimated demand and water supply for all golf courses in the planning area is shown in Table 7.0-12. There are twelve municipal golf courses in the Yuma Basin receiving a combination of groundwater, surface water and effluent, three in the Lower Gila Basin using groundwater or surface water and one each in McMullen Valley and Parker basins.

Primary municipal demand centers are the Yuma area where the four largest communities in the planning area are located, and Parker/Parker Strip, Ajo, Quartzsite and Gila Bend. The only basins with population centers greater than 1,000 are Gila Bend, Lower Gila, Parker and Yuma basins.

Yuma Area

The total municipal demand in the Yuma Basin is about 38,400 acre-feet per year. The largest providers, City of Yuma, Far West Water and Sewer, Inc., City of Somerton and City of San Luis provided about 29,900 acre-feet of Colorado River water and groundwater to customers in 2003 (although there are accounting discrepancies as noted in Table 7.0-11). A number of wastewater treatment plants treat sewage in the Yuma area. The largest is the Figueroa Avenue Water Pollution Control Facility at Yuma. Somerton, San Luis and Far West Sewer also operate relatively large

treatment plants. In its 2002 General Plan, the City of Yuma estimated that about 24% of existing housing units were not connected to a sewer system and that rapid growth in the Fortuna Foothills area has resulted in construction of on-site septic systems and private package treatment plants. (City of Yuma, 2002)

Table 7.0-12 Golf course demand in the Lower Colorado River Planning Area (c. 2006)

Facility	Basin	# of Holes	Demand (acre-feet)	Water Supply
Ajo Country Club	Lower Gila Basin	9	211	Groundwater
Butterfield Golf Course	Lower Gila Basin	18	441	Surface Water
Coyote Wash Golf Course	Lower Gila Basin	18	441	Groundwater
Sunset Links Golf Club	McMullen Valley	18	441	Groundwater
Emerald Canyon Golf Club	Parker	18	441	Surface Water/Effluent
Arroyo Dunes Golf Club	Yuma	18	175/175	Groundwater/Surface Water
Cocopah Bend RV&GC	Yuma	18	441	Surface Water/Effluent
Desert Hills Golf Course	Yuma	18	441	Surface Water
Dove Valley Golf Course	Yuma	18	441	Groundwater
Foothills Executive Golf Course†	Yuma	9	211	Groundwater/Effluent
Foothills par 3 Golf Course†	Yuma	9	211	Groundwater/Effluent
Fortuna del Rey Golf Course†	Yuma	9	211	Groundwater/Effluent
Ironwood Golf Course	Yuma	9	211	Surface Water
Las Barrancas Golf Course†	Yuma	18	441	Groundwater/Effluent
Mesa Del Sol Golf Course†	Yuma	18	441	Groundwater/Effluent
Sierra Sands Golf Course	Yuma	18	221	Surface Water
Westwind RV & Golf Resort	Yuma	9	211	Surface Water
Total Water Use Municipal Golf Courses			*5,806*	
Yuma Golf & Country Club*	Yuma	18	441	Groundwater/Surface Water
Total Water Use Industrial Golf Courses			*441*	
Total Water Use			**6,247**	

Source: ADWR 2005c
Notes:
* This golf course is served by its own well and is considered to be an industrial user
† These golf courses are served by Far West Water and Sewer. A total of 446 acre-feet of effluent is served for all courses.

The City of Yuma is the largest water provider, with Priority 1 and Priority 3 Colorado River water annual consumptive use entitlements totaling 50,000 acre-feet. The City can supplement its entitlement through the use of return flow credits such as water returned to the river following wastewater treatment and conversion of irrigation rights to municipal use. Colorado River water is transported to Yuma through several facilities (see Figure 7.0-11). About 97% of the City's water is transported through the All American Canal and Yuma County Water Users Association (YCWUA) facilities, including the Yuma Main Canal, to the Yuma Main Street Water Treatment Plant. The remaining three percent is delivered through the Gila Gravity Main Canal to the East Mesa treatment plant. (City of Yuma, 2002) In 2003, City of Yuma water demand was about 20,300 acre-feet. About three quarters of this demand is for residential uses. Commercial demand

includes deliveries to golf courses but the precise number of courses and amount delivered is not known. (City of Yuma, 2007) The Department estimated that there are at least six golf courses served by the City of Yuma with a total annual demand of over 1,800 acre-feet. It does not appear that the City of Yuma provides effluent to meet this turf irrigation demand.

Far West Water and Sewer, Inc. serves the rapidly growing Fortuna Foothills area east of Yuma in unincorporated Yuma County. In 2003, it served about 4,900 acre-feet of water. The primary water supply is surface water from the Colorado River, delivered via the Yuma Mesa Irrigation District and "A" Canal. Groundwater is used as a back-up water supply, for irrigation water at three golf courses, and for construction. Far West operates a drinking water treatment plant, seven wastewater treatment facilities and serves about 15,000 water and 6,500 wastewater connections. (Far West Water & Sewer, Inc., 2006) About 446 acre-feet of treated wastewater, in addition to groundwater, is delivered to Foothills Executive, Foothills Par 3, Fortuna del Rey, Las Barrancas and Mesa del Sol golf courses to meet part of their annual water demand. Total annual demand of these courses is estimated at 1,525 acre-feet.

The City of Somerton, located about ten miles southwest of Yuma, is a fast growing, primarily residential community with almost 10,000 residents in 2005. In 2003, approximately 2,100 acre-feet was served to customers, including the Dove Valley Golf Course. The Somerton Municipal Water System service area is about 2.5 square miles in size and groundwater is pumped from three wells located in T9S, R24W. A fourth well is not used due to water quality problems. Depth to water is consistently about ten feet below land surface. The City is not interconnected to any other systems. It has a 2006 contract for 750 acre-feet of Priority 4 Colorado River water and is purchasing rights that are not currently being used. (City of Somerton, 2006)

Located adjacent to the international boundary, the City of San Luis is the fastest growing community in the entire planning area, growing by 33% between 2000 and 2005. The San Luis Municipal Water System served about 2,600 acre-feet in 2003. In 2006, approximately 3,400 acre-feet was withdrawn from nine wells to serve almost 5,100 customer connections. (City of San Luis, 2007)

Parker/Parker Strip

The Town of Parker and the Parker Strip had a combined population of about 6,400 in 2000. The Parker Strip is the area north of Parker along the Colorado River to the basin boundary. The area is growing rapidly, particularly the Parker Strip, which grew by 101% between 1990 and 2000. The Town of Parker Municipal System is the largest local water provider, serving about 3,200 residents with 1,250 service connections to the one square mile town, deeded inside the CRIT Reservation. The CRIT Water Department serves the area outside the town limits.

Parker Municipal System pumped about 1,000 acre-feet in 2003 from three wells pumping Colorado River water. The town has 630 acre-feet of Priority 1 entitlement and a combined volume of 3,030 acre-feet of 4th, 5th and 6th Priority water. Water levels in system wells vary from 75 to 90 feet and well pumpage reportedly doubles in the summer months. The system is interconnected to the CRIT water system and is used for emergency purposes. (Town of Parker, 2006) Water demand in this area is primarily for residential and commercial use.

Brooke Water LLC is the largest water provider in the Parker Strip and has an entitlement for 360 acre-feet of Priority 1 and 440 acre-feet of Priority 4 water. In 2003 Brooke Water LLC diverted 444 acre-feet of water and had a consumptive use of 297 acre-feet. Cienega Water Company, Inc. and Red Rock are smaller water providers in the Parker Strip that serve groundwater to a combined population of about 500 residents. Emerald Canyon Golf Course, located north of Cienega Springs, uses effluent from the Buckskin/Sandpiper WWTP to meet part of its irrigation demand.

Ajo

The Town of Ajo is the largest community in the planning area not located on or near the Colorado River. Ajo was founded by the New Cornelia Copper Company in about 1915. Phelps Dodge acquired the property in 1931 and continued to operate the mine until 1985. At that time most of the company-owned non-mining properties were sold to the residents and the unincorporated community is now a tourist and retiree destination. However, because of rising copper prices, Phelps Dodge is evaluating reopening the mine. Three water companies serve the town. (ADOC, 2007a) The largest system is the Ajo Improvement Company owned by the Phelps Dodge Corporation. It pumps water from two active wells in the Child's Well Field, seven miles north of Ajo, at a depth of 1,170 to 1,350 feet. It also provides sewer services and wastewater treatment. Effluent is not reused but is discharged to evaporation ponds. Ajo Improvement Company delivers groundwater to two other water systems: Arizona Water Company-Ajo System and Ajo Domestic Water Improvement District (DWID), neither of which operate their own wells to serve customers. (Malcolm Pirnie, 2006)

In 2003, Ajo Improvement Company served about 550 acre-feet of groundwater to 3,000 residents (1,390 service connections) and to the two other water systems. In 2006 its customer demand was about 320 acre-feet, of which 60% was residential and 40% commercial. In that year the Ajo DWID received about 40 acre-feet of water from the Ajo Improvement Company and served about 405 residents. (Phelps Dodge Corporation, 2007) In 2006, Arizona Water Company received about 180 acre-feet of water from the Ajo Improvement Company. Arizona Water Company-Ajo System serves about 686 connections, 73% residential and 27% non-residential. (Arizona Water Company, 2007) There is a nine-hole golf course in Ajo but the source of irrigation water is not known.

Gila Bend

The municipal water demand at Gila Bend is about 840 acre-feet a year for residential and commercial uses. Located at a transportation hub, the town has a number of gas stations, mini-marts, hotels and fast-food restaurants. In 2004, it reported 730 connections were served groundwater from three wells with water levels at 300 feet below land surface (ADWR, 2005b). About 400 acre-feet of effluent is generated at the Gila Bend Wastewater Treatment Plant and all is discharged to a watercourse.

Other municipal water demands in the northern part of the Gila Bend Basin include two large prisons, the Arizona State Prison Lewis Complex and the Eagle Point School Juvenile Corrections Facility, located on either side of Highway 85 in T2S R4W (see Figure 7.2-10). An associated Arizona Department of Corrections wastewater treatment plant generates over 400 acre-feet of effluent so water demand at the site is likely between 600 and 800 acre-feet per year. There is a

small residential community located around a constructed water ski lake in the northern part of T4S R4W and another, Spring Mountain Ski Ranch, under construction in T3S R4W. These types of development are easier to construct outside of the state's active management areas since within an AMA, groundwater may not be used to fill a private lake larger than 12,320 square feet (about 0.28 acres) in area.

Wellton

Wellton is located in the middle of the Wellton-Mohawk Valley along Interstate 8 and serves as a business, service and recreation center for more than 5,000 people in the surrounding area. The Town of Wellton had a population of almost 2,000 in 2005 and grew by 72% between 1990 and 2000. The municipal water system receives Colorado River water from the Wellton-Mohawk Irrigation District and maintains one well for emergency backup. In 2003 the town served 640 acre-feet of surface water to 550 residential and commercial connections. New developments in the area, such as the master planned Coyote Wash, will increase municipal water demand. This planned community would include 2,500 homes, a condominium complex and shopping center, and an 18-hole golf course. The golf course has been completed and more than 500 lots sold. Another 18-hole course (Butterfield) at Wellton uses about 441 acre-feet of surface water annually.

Quartzsite

Although the water system for the Town of Quartzsite is not large, the community is rapidly growing with 3,600 residents in 2005. Located in the middle of the Parker Basin at the junction of Interstate 10 and U.S. 95, it is a tourist and retirement community with a population that swells in the winter with numerous gem and rock shows. There are an estimated 1.5 million annual visitors (ADOC, 2007b).

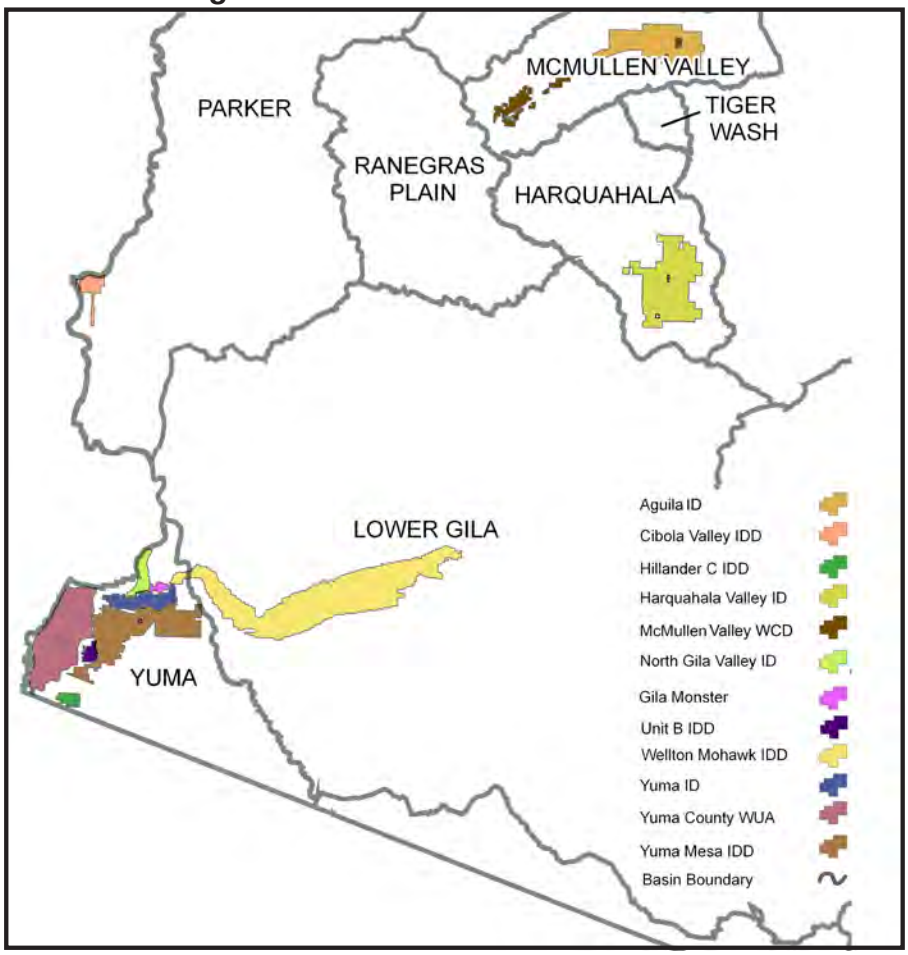
Principal water uses in the town are residential and commercial. Information on water demand is not currently available. It is known that for years, private domestic wells were the only water supply and several hundred exist within the town limits. A public water system was established in 1989 consisting of one main well with a well depth of 1,200 feet and a small, 35 gpm auxiliary well for back up. Plans are underway to drill a second large well. (Town of Quartzsite, 2003) Quartzsite has a 4th Priority Colorado River entitlement of 1,070 acre-feet but no way to convey this water to the town.

In addition to the Town of Quartzsite public water system, two, small private water companies, Desert Gardens RV Park and Q-Mountain MHP serve Quartzsite. The Q-Mountain system has 214 connections served by four wells that delivered about 43 acre-feet of water in 2003.

Agricultural Demand

The planning area contains one of the largest agricultural areas in Arizona and the nation. Yuma County, which contains most of the agricultural lands in the planning area, is considered the nation's winter vegetable capital. Crops grown here include head and leaf lettuce, romaine, broccoli, cauliflower, honeydew, cantaloupe, watermelon, cabbage, spring mix, celery, endive/escarole, and citrus including lemons, oranges, grapefruit, and tangerines. Many seed crops are also grown including broccoli, cauliflower, grasses, and onions. Annual agricultural sales are reported to total over $1.3 billion. In La Paz County, upland cotton is the largest crop, followed by Durum wheat,

Figure 7.0-14 Irrigation districts in the Lower Colorado River Planning Area

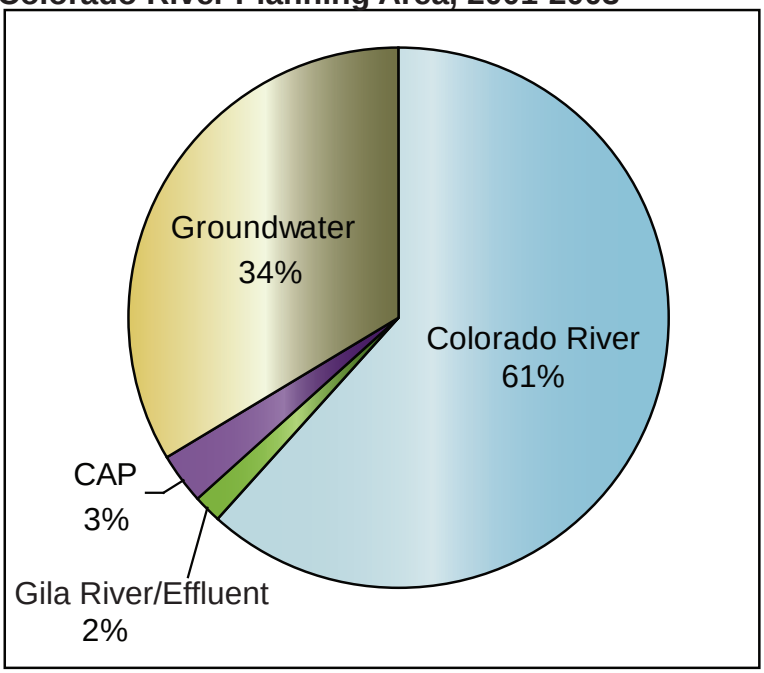


barley, corn for grain, and alfalfa. Other crops include onions, honeydews, cantaloupe and watermelon. Annual agricultural sales are reported to total over $92 million in this county. (AZDA, 2005)

There are 13 irrigation districts in the planning area. Their general location is shown in Figure 7.0-14.

Irrigation water supply is primarily water diverted from the Colorado River. As shown in Table 7.0-13 and Figure 7.0-15, for the period 2001-2003, an average of 1,830,000 acre-feet per year was diverted from the Colorado River for use in the Parker, Lower Gila and Yuma Basins and 90,000 acre-feet was diverted via the Central Arizona Project for use in the Harquahala Basin. Gila River water and effluent averaging 54,500 acre-feet per year was used in the Gila Bend Basin. An average of 999,700 acre-feet of water withdrawn from wells was used to irrigate lands in all basins with agricultural demand.

Figure 7.0-15 Irrigation water supply for the Lower Colorado River Planning Area, 2001-2003



Agricultural demand is greatest in the Yuma, Parker, Lower Gila, Gila Bend, McMullen Valley, and Harquahala basins. As shown in Figure 7.0-16, agricultural demand has steadily increased over time in most of these basins. Agricultural demand in each basin is described below.

Table 7.0-13 Agricultural demand in the Lower Colorado River Planning Area[1]

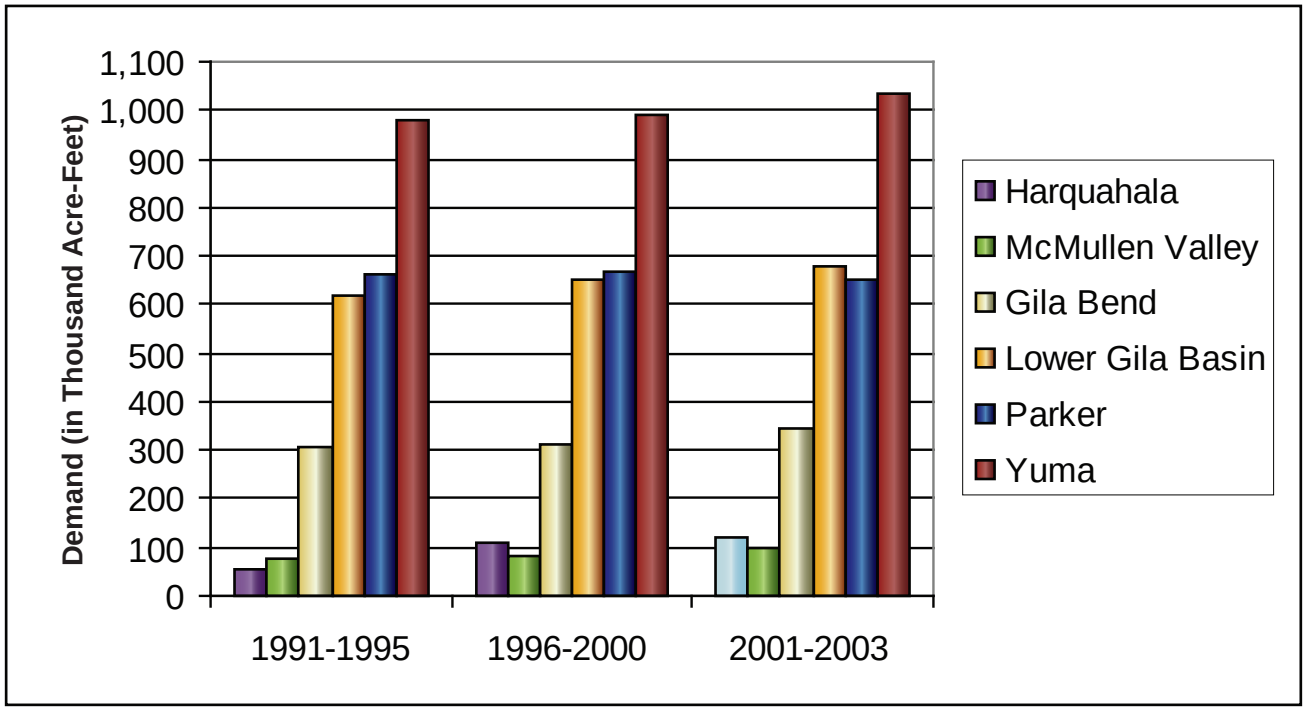
	1991-1995 (acre-feet)	1996-2000 (acre-feet)	2001-2003 (acre-feet)
Butler Valley			
Groundwater	3,400	8,300	8,700
Total	3,400	8,300	8,700
Gila Bend			
Groundwater	237,000	244,000	291,000
Surface Water[2]	71,500	68,500	54,500
Total	308,500	312,500	345,500
Harquahala			
Groundwater	9,500	23,500	31,000
Surface Water[3]	47,500	85,000	90,000
Total	57,000	108,500	121,000
Lower Gila Basin			
Groundwater	254,000	261,000	282,000
Surface Water	365,000	391,000	399,000
Total	619,000	652,000	681,000
McMullen Valley			
Groundwater	77,000	79,500	98,000
Total	77,000	79,500	98,000
Parker			
Groundwater	1,300	<1,000	<1,000
Surface Water	662,000	667,000	653,000
Total	663,300	667,500	653,500
Ranegras Plain			
Groundwater	29,500	32,000	28,500
Total	29,500	32,000	28,500
San Simon Wash			
Groundwater	4,000	3,800	4,000
Total	4,000	3,800	4,000
Yuma			
Groundwater	206,000	218,000	256,000
Surface Water	771,000	771,000	778,000
Total	977,000	989,000	1,034,000
Total All Basins	2,738,700	2,853,100	2,974,200

Source: USGS 2005b
Notes: Volume <1,000 acre-feet assumed to be 500 acre-feet for computational purposes
[1] Unless otherwise noted, all surface water if from the Colorado River
[2] From Gila River and Effluent
[3] From Central Arizona Project water

Butler Valley Basin

Recent agricultural demand in the Butler Valley Basin is about 8,700 acre-feet a year, or 0.3% of the total agricultural demand in the planning area. Demand has more than doubled compared to the 1971-1990 time period (Table 7.1-8). Agricultural lands are located in a contiguous area in the southwest part of the basin and groundwater is the only water supply.

Figure 7.0-16 Agricultural demand in selected basins in the Lower Colorado River Planning Area, 1991-2003



Gila Bend Basin

Irrigation in the Gila Bend Basin is located primarily along the Gila River valley and south of the Gila River in the western part of the basin. Recent agricultural demand has been about 345,500 acre-feet per year of which 291,000 acre-feet is groundwater and 54,500 acre-feet is a mixture of Gila River surface water, agricultural drainage and effluent discharged upstream in the Phoenix AMA. Gila Bend Basin agricultural demand is 12% of the total planning area agricultural demand.

Surface water/effluent supplies are used in the northern part of the basin where they are diverted at Gillespie Dam. Until 1993, when Gillespie Dam was breached during a flood, more surface water was used. Surface water has been a less reliable supply than groundwater due to upstream dams and diversions and the unpredictability of flow even under pre-development conditions. Total agricultural demand has increased steadily from an annual average of 278,000 acre-feet during the 1986-1990 time period. However, recent demand is somewhat lower than some historical demands, for example an annual average of 376,000 acre-feet was used for agriculture during the 1976-1980 time period (see Table 7.2-8). Investigations conducted by the USGS during the summer of 2007 found about 42,900 acres are currently under irrigation and all acreage is flood irrigated. The predominant cropped acreage at that time was alfalfa/hay (81%), followed by sorghum (9%), and small areas of cotton, corn, oats, wheat and jojoba. (USGS, 2007, unpublished data)

Harquahala Basin

The number of irrigation acres allowed in the Harquahala Basin is limited because of the basin's designation as an irrigation non-expansion area, or INA. Groundwater may be pumped and

transported to an AMA from agricultural lands in the basin pursuant to A.R.S. 45 § 554. In an INA farmers must report agricultural water pumpage and use on an annual basis to the Department. Recent demand has been about 121,000 acre-feet a year, the highest average demand reported since 1971 (Table 7.4-8). This demand is 4% of the total recent agricultural demand in the planning area. Non-contract CAP water began to be used in 1984 by the Harquahala Valley Irrigation District, replacing groundwater pumpage as the primary water supply in the basin. Under the Department's Recharge Program, the District is a permitted groundwater savings facility. District lands are the most extensive in the basin, covering a large area in the southeast part of the basin. All irrigation canals and laterals are concrete-lined (ADWR, 1998). Other irrigated areas exist near Centennial and south of the Buckeye-Salome Road in the northwest part of the basin. An investigation conducted by the USGS in the summer of 2007 found 26,165 acres under irrigation in the basin. At that time, about 33% of the cropped acreage was alfalfa/hay, 26% cotton, 15% vegetables, and 14% wheat. Oats, sorghum and corn were also observed. About 85% of the lands were found to be flood irrigated and 15% were drip irrigated. (USGS, 2007, unpublished data)

Lower Gila Basin

The Lower Gila Basin contains 23% of the recent agricultural demand in the planning area. The principal farming area is the Wellton-Mohawk Irrigation and Drainage District, whose location generally follows the Gila River Valley west of Dateland and extends into the Yuma Basin. Other irrigated areas are located north and west of Dateland, north of Hyder, near Agua Caliente (south of Hyder) and in the Dendora Valley near the eastern basin boundary. The USGS conducted a field investigation of non-district lands in the summer of 2007 and found much less land being irrigated north of Hyder than suggested by Figure 7.4-10. The USGS found 20,750 acres being irrigated on non-district lands. Principal cropped acreage observed was alfalfa/hay (34%), vegetables (24%), jojoba (11%), sorghum (10%), citrus (8%), and lesser amounts of cotton, corn, date/palm trees and oats. Irrigation methods vary in this area with 51% of the acreage flood irrigated, 21% sprinkler, 16% drip and 12% center pivot (primarily north of Dateland). (USGS, 2007, unpublished data)

Reclamation's Gila Project delivers Colorado River water to two divisions - the Wellton-Mohawk Division and the Yuma Mesa Division. The WMIDD was created in 1951 to provide a legal entity that could contract with the United States to repay the cost of the project and to operate and maintain project facilities. Lands in the area have been cultivated for many centuries. During the late 19th century, diversion structures and canals were constructed to expand agricultural lands, but periodic floods and construction of upstream reservoirs led to abandonment of the surface water system and conversion to groundwater wells. However, by the early 1930s, increasing salt concentrations in groundwater and falling groundwater levels made successful farming in the area difficult and many farms were abandoned. Area farmers approached Reclamation for delivery of Colorado River water and the project was constructed during the late 1940s and early 1950s. (WMIDD, 2004)

Water for the District is diverted at Imperial Dam into the Gila Canal, a joint-use facility shared by five Yuma Basin irrigation districts (WMIDD, 2004). The WMIDD Colorado River entitlement is diverted into the 18.5 mile long Wellton-Mohawk Canal and to its major branches, the Wellton Canal (19.9 miles long) and the Mohawk Canal (46.8 miles long). The 13-mile long Dome Canal branches off the Wellton-Mohawk Canal west of the major branches and serves the western part

of the District. There are 13 small pumping plants and 227 laterals in the WMIDD. (USBOR, 2007f) Facilities include 378 miles of main canals, laterals and return flow channels, three major pumping plants, drainage wells and groundwater level observation wells. All canals and laterals are concrete-lined except for eight miles of the main canal west of the first pumping plant. There are also hundreds of domestic turnouts along the system (WMIDD, 2004).

The WMIDD has a Colorado River Priority 3 right with a current allowable consumptive use of 278,000 acre-feet per year, but diversions are significantly higher. Diversions to the District averaged 399,000 acre-feet during the 2001-2003 time period. Water pumped from drainage wells and returned to the Colorado River is deemed "return flow" that is subtracted from the District's diversions to derive its consumptive use. Demand within the WMIDD has remained relatively constant, with a slight recent increase (Table 7.4-8). Principal crops grown are alfalfa/hay, sorghum, wheat, bermuda, cotton, citrus, melons, lettuce, vegetables, nuts and safflower. A significant amount of double cropping occurs in the district with irrigation done primarily by flood. (WMIDD, 2004) Portable sprinkler systems are used for seed germination of lettuce and other vegetable crops.

Long-term irrigation with Colorado River water combined with naturally elevated salt concentrations in groundwater and soil require that salts be leached from the soil by irrigating in excess of the crop consumptive use and removal of excess groundwater to prevent waterlogging. In addition, occasional flooding on the Gila River raises groundwater levels. The District operates 90 drainage wells spaced about a mile apart with an average depth of 100 feet to control rising groundwater levels, keeping water below the root zone of crops. Three-hundred observation wells monitor groundwater levels. (WMIDD, 2004)

Because the high salinity of the WMIDD return flows increased the salinity of the Colorado River, a number of actions have been taken to achieve the salinity standards for delivery to Mexico specified in Minute 242. The drainage water is pumped into a concrete-lined channel (Main Outlet Drain and Extension, MOD/MODE), which allows it to be either diverted to the main channel of the Colorado River at the NIB above Morelos Dam, or bypassed around the dam through a canal to the Cienega de Santa Clara. WMIDD has also taken steps within the District to reduce return flows including acreage reduction, improved irrigation scheduling, land-leveling and improvements to ditches and turnouts. (WMIDD, 2004)

McMullen Valley Basin

About 3% of the recent agricultural demand in the planning area is near the communities of Aguila and Wenden-Salome in the McMullen Valley Basin. There are two irrigation districts in this basin. Neither the Aguila Irrigation District nor the McMullen Valley Water Conservation District has a consolidated distribution system and all district wells and ditches are privately owned. Both districts were formed in order to contract water and power from the Colorado River. (ADWR, 1998) Groundwater is currently the only water supply.

Since 1981, agricultural demand in the basin has been increasing with an annual average of 98,000 acre-feet of demand during the 2001-2003 time period. The USGS conducted a field investigation of the basin in the summer of 2007 and found 14,500 acres under irrigation with 80% flood irrigated

and 20% drip irrigated. Cropped acres at the time of the investigation included vegetables (62%), cotton (19%) and sorghum (8%). Other crops observed were oats, guayule, orchards, alfalfa/hay and corn. (USGS, 2007 unpublished data)

McMullen Valley is one of the few groundwater basin in the state designated for out of basin transportation of groundwater. About 14,000 acres of agricultural land have already been purchased by the City of Phoenix for transport of groundwater to the Phoenix AMA (ADWR 1994b).

Parker Basin

Irrigation in the Parker Basin represents 22% of the recent agricultural demand in the planning area. The annual average Colorado River demand for the basin during 2001-2003 was 653,000 acre-feet. A relatively small amount of groundwater, less than 1,000 acre feet, was reportedly pumped for agricultural irrigation.

Irrigation occurs primarily on the CRIT Reservation and also within the Cibola Valley Irrigation and Drainage District (CVIDD). As mentioned above in the Tribal Demand section, about 72,610 acres were irrigated on the CRIT reservation in 2006. Of this total, CRIT Farms manages over 15,000 acres of alfalfa, cotton, durum wheat and other crops (Colorado River Indian Tribes, 2005).

CVIDD was formed in 1962, and in 1964 the southern half of the district was incorporated into the Cibola National Wildlife Refuge. There is an integrated canal system and all main canals are owned by the district and concrete-lined. On average about 3,550 acres of land are irrigated within CVIDD. Primary crops are alfalfa, bermuda and cotton, although a variety of other crops are grown including vegetables, wheat and barley. (ADWR, 1998) Colorado River water is the sole source of water. CVIDD has a Priority 4 Colorado River entitlement of 12,066 acre-feet and 5th and 6th Priority entitlements totaling 3,500 acre-feet.

Ranegras Plain Basin

Agricultural demand in the Ranegras Plain Basin is about 1% of the recent agricultural demand in the planning area. Average annual demand during 2001 to 2003 was about 28,500 acre-feet, all met from groundwater pumping. Since the 1986-1990 time period, average demand has been relatively stable, varying from 32,000 to 28,500 acre-feet per year (Table 7.7-8). Field investigations by the USGS in the summer of 2007 shows that agricultural activity is occurring primarily along Vicksburg road north of Interstate 10, and north of Highway 72 in the northern part of the basin. Cropped acres at that time were corn (25%), barley (21%), cotton (18%), jojoba (16%) and smaller acreages of alfalfa, guayule and sorghum. Their investigations found 99% of the irrigation was by drip systems and 1% by sprinkler. (USGS, 2007, unpublished data).

San Simon Wash Basin

Irrigation in the San Simon Wash Basin appears to be restricted to about 2,200 irrigable acres at the end of Reservation Road 21 near the international boundary. Recent average annual demand is estimated to be 4,000 acre-feet of groundwater. Historic withdrawals were higher, up to 11,300 acre-feet per year during the late 1970s. After 1980, the principal crop was alfalfa, irrigated year round (Hollett, 1985). It is not clear whether these lands are currently being irrigated.

Yuma Basin

The Yuma Basin is the largest agricultural demand center in the planning area with 35% of the recent demand, an annual average of 1,034,000 acre-feet during the 2001-2003 time period. Of this total demand, 778,000 acre-feet is water diverted from the Colorado River and 256,000 acre-feet is water pumped from wells. Annual demand has increased by over 100,000 acre-feet on average since 1991. Agricultural lands surround Yuma and extend through much of the western part of the basin from north of Fortuna Foothills to San Luis.

Bureau of Reclamation Projects

Two Reclamation projects serve irrigation water in the basin – the Gila Project and the Yuma Project. Water for the Gila Project is diverted at Imperial Dam and delivered via the Gila Gravity Main Canal. The project is separated into the Wellton-Mohawk Division (discussed previously) and the Yuma Mesa Division. The Yuma Mesa Division includes three irrigation districts in the basin: Yuma Mesa Irrigation and Drainage District (Yuma Mesa IDD), North Gila Irrigation District (North Gila ID) and Yuma Irrigation District (Yuma ID). (USBOR 2007g)

The Yuma Project includes lands in both Arizona and California. In Arizona, the project is divided into the Valley Division and the Yuma Auxiliary Division. The Valley Division consists of the Yuma County Water Users Association. Water for the Valley Division is diverted at Imperial Dam into the All-American Canal to the Yuma Main Canal, then through the siphon under the Colorado River at Yuma and into the Valley Division canals. Water for the Yuma Auxiliary Division, also referred to as Unit “B”, is diverted at Imperial Dam and conveyed via the Gila Project Canals to the Unit “B” Irrigation District (Unit “B” ID) (see Figure 7.0-11).

Irrigation Districts

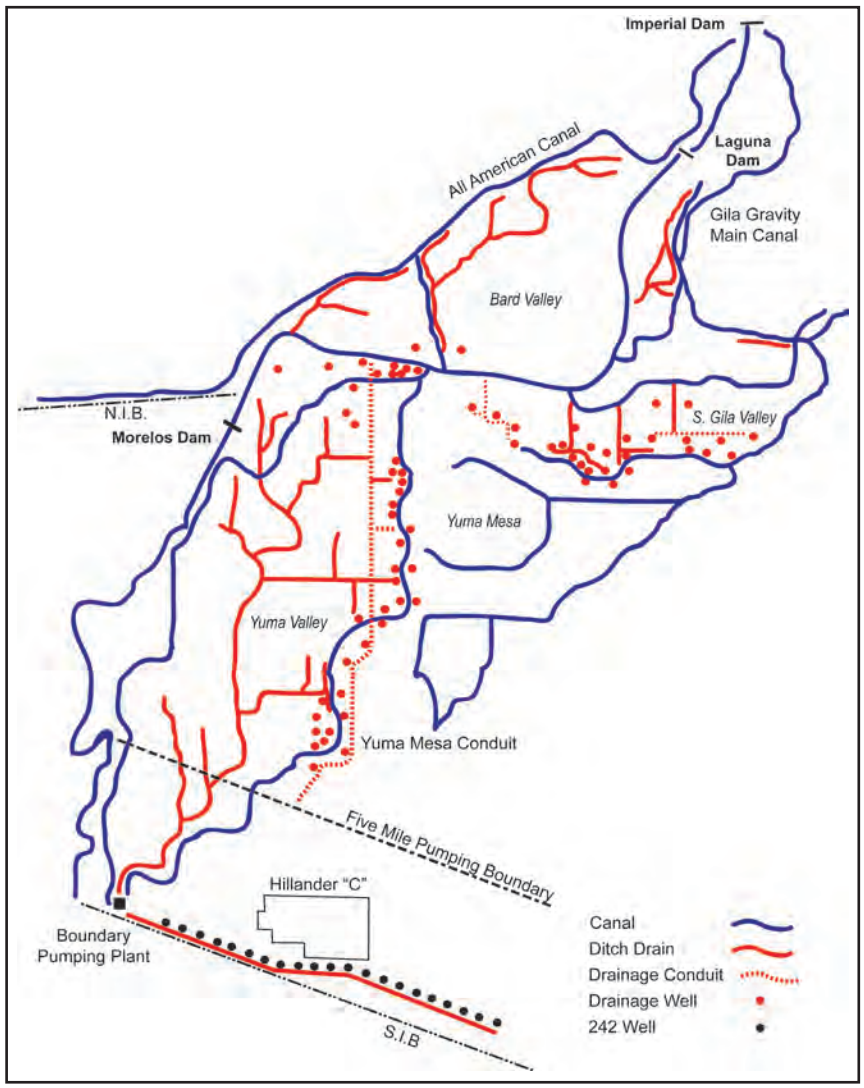
A total of eight irrigation districts operate in the basin (see Figure 7.0-14). The western part of the Wellton-Mohawk Irrigation and Drainage District extends into the basin and is discussed above in the Lower Gila Basin section. The general location of the water delivery and drainage infrastructure in the Yuma area including canals, conduits, drains and drainage wells is shown in Figure 7.0-11 and 7.0-17.

The three Gila Project/Yuma Mesa Division irrigation districts have a shared 3rd priority entitlement of 250,000 acre-feet a year on 37,187 acres. In addition, North Gila Valley ID has 1st and 2nd Priority entitlements, and Yuma Mesa IDD and Yuma ID have 2nd Priority consumptive use entitlements (see Appendix B).

Crops grown on Yuma Mesa IDD lands (the Mesa Unit) include citrus, alfalfa hay and seed, peanuts, cotton and grains. There are about 25,000 irrigated acres in the district. Crops grown on North Gila ID and Yuma ID lands (North and South Gila Units) include alfalfa, cotton, melons, citrus, winter vegetables and Bermuda grass seed (USBOR, 2007f). About 6,300 acres of the North Gila ID and 9,600 acres of the Yuma ID are irrigated (Yuma Area Ag Council, 2004). The South Gila Valley Unit of the Yuma Mesa Division consists of 24 drainage wells (Figure 7.0-17). Water is conveyed to the Gila River Pilot Channel and the Colorado River to become part of the Treaty water delivered to Mexico. (USBOR, 2007g)

Unit "B" ID is a relatively small district that operates and maintains the water distribution facilities of the Yuma Auxiliary Project. It distributes water to about 3,400 acres of land on the Yuma Mesa. Crops are almost entirely citrus including grapefruit, oranges and lemons. (USBOR, 2007h) The district has a 1st Priority diversion entitlement of 6,800 acre-feet and an unquantified 2nd priority diversion entitlement.

Figure 7.0-17 Yuma area drainage fields and conduit systems



Yuma County Water Users Association provides water to the Yuma Valley south of Interstate 8. It encompasses all of the Colorado River flood-plain land, approximately 53,000 acres, between the City of Yuma and the international boundary. YCWUA assumed operation and maintenance of Valley Division works of the Yuma Project in 1951 and the Siphon Drop Power Plant 1962. There are approximately 28,800 irrigable acres in the district (Yuma Area Ag Council, 2004). YCWUA has an annual Colorado River entitlement of 254,200 acre-feet or, the consumptive use for irrigation of 43,562 acres (whichever is less) of 1st and 4th Priority water. Principal crops grown are lettuce and other produce crops in the fall and winter months and wheat, cotton, hay, and melons in the spring and summer months. YCWUA recently received funding to line a number of its earthen canals to reduce seepage and conserve water. (BECC, 2003)

Excess irrigation water from the Valley Division of the Yuma Project is removed via an open drain that runs through the center of the division and terminates at the Boundary Pumping Plant at the international boundary (see Figure 7.0-17). The main drain and its branches total 56 miles in length. This drainage system is supplemented by 16 drainage wells located along the east side of the Yuma Valley that intercept groundwater flows from Yuma Mesa. YCWUA operates 11 of the wells and Reclamation operates the others. Most of this pumped water is discharged into the open

drain. At the Boundary Pumping Plant, the drainage water is discharged into the bypass canal that flows into Mexico (USBOR, 2007i).

Gila Monster Farms is a relatively small operation located north of the Yuma ID and west of the Wellton-Mohawk IDD. It has 1st Priority diversion rights of 780 acre-feet a year and 3rd, 4th, 5th and 6th priority rights for a total entitlement of 9,156 acre-feet (see Appendix B). Water is delivered through the Gila Gravity Main Canal. In 2002, the total irrigated area covered 1,780 acres.

Hillander "C" Irrigation and Drainage District, located north of the international boundary east of San Luis, pumps groundwater to irrigate about 2,300 acres within the 3,440 acre district. Historic use was between 15,000 and 20,000 acre-feet per year for irrigation of citrus and asparagus. Center pivot systems in the area suggest that alfalfa or other crops may be grown. The District is located adjacent to the 242 well field and has a contract to pump up to 4,000 acre-feet of water annually from the 242 Lateral (see Section 7.0.6).

Industrial Demand

Recent industrial demand in the Lower Colorado River planning area has averaged 14,850 acre-feet a year, about 0.5% of the total demand. As shown in Table 7.0-14, most demand is associated with power plants, although dairy and feedlot demand is growing, particularly in the Lower Gila Basin and more recently in the Ranegras Plain Basin. Mining activity in the Yuma Basin is associated with the Yuma Pit, a large sand and gravel operation owned by Rinker Materials in the northern part of the basin east of Highway 95. The New Cornelia Mine, a large open pit copper mining operation at Ajo, was placed on care and maintenance in 1983. There is a possibility that mining and ore processing may resume due to rising copper prices. There are several small gold mines in the planning area including the Yuma King, 30 miles east of Parker. There is also one "industrial" golf course in the Yuma Basin, Yuma Golf and Country Club. Industrial facilities are those with their own well or water supply and not served from a municipal water provider.

Table 7.0-14 shows other industrial uses in the Yuma area that use Colorado River water. Additional industrial demand in the planning area not reflected in the table, comes primarily from sand and gravel operations including at least three in the Parker Basin. Some of these operations are identified on the cultural demand maps. Water is used for aggregate washing, dust control, vehicle washing and equipment cooling. Relatively little water is consumed at these sites. Finally, north of Gila Bend, in the Gila Bend Basin, shrimp are pond grown at the Desert Sweet Shrimp operation. About 300,000 pounds of shrimp are produced annually and the shrimp effluent is applied to nearby agricultural fields. Water demand of this aquaculture operation is not known.

<u>Power Plants</u>
Panda Gila River Power Station is a 2,200 megawatt natural gas fired combined cycle plant located in Gila Bend and completed in 2003. It was approved by the Arizona Corporation Commission (ACC) in 2001 under very strict emissions requirements. The plant has zero water discharge, with concentrated brine effluent disposed to evaporation ponds. The plant used about 4,900 acre-feet of groundwater in 2003.

Table 7.0-14 Industrial demand in selected years in the Lower Colorado River Planning Area

	1991	2000	2003
Type	**Water Use (acre-feet)**		
Power Plant Total	**246**	**578**	**7,004**
Gila Bend			
Groundwater	0	0	4,900
Harquahala			
Groundwater	0	0	1,700
Yuma			
Surface Water	246	578	404
Golf Course Total	**441**	**441**	**441**
Yuma			
Groundwater	220	220	220
Surface Water	221	221	221
Dairy/Feedlot Total	**3,394**	**3,573**	**3,775**
Gila Bend			
Groundwater	0	0	108
Lower Gila			
Groundwater	3,394	3,573	3,667
Mining Total	291	388	399
Parker			
Groundwater	<300	<300	<300
Yuma			
Groundwater	141	238	249
Other Total	1,982	3,454	1,161
Yuma			
Surface Water	1,982	3,454	1,161

Source: ADEQ 2005, ASMMR 2005, ADWR 1994b, ADWR 2007, USGS 2005b

Notes: Volume <300 acre-feet assumed to be 150 acre-feet for computation purposes. Other category includes water use by the Yuma Desalting Plant, Union Pacific Railroad, Desert Lawn Memorial, Huerta Packing and Yuma Mesa Fruit Growers

The Harquahala Generating Project is a 1,000 megawatt gas-fired combined power facility that came on line in 2003. As a condition of approval by the ACC, the owner agreed to use CAP water as the preferable supply. Groundwater use is allowed but must meet the same siting and permitting requirements of facilities in AMAs. The facility is designed to be zero water discharge and treats and recycles water more than 130 times to minimize consumption. (PG&E Corporation, 2000) The facility used about 1,700 acre-feet of groundwater in 2003.

Arizona Public Service (APS) operates the natural gas-fueled Yucca Power Plant near Yuma. There are four combustion turbine units that produce nearly 150 megawatts of power to APS customers. The plant's other combustion turbine unit and one steam unit are owned by the Imperial Irrigation District in California. The plant provides power on an as needed basis, particularly during the summer months. (APS, 2007) The plant, which has a 1,500 acre-feet of 5th priority entitlement, used about 400 acre-feet of Colorado River water in 2003.

Dairy/Feedlot

There are a number of dairy and feedlot operations in the planning area and these facilities are a growing demand sector due to development pressures and land costs in more urban parts of the state. Dairies and feedlots are located adjacent to irrigated land where feed is grown and where disposal of wastes can occur.

In 2003, Citrus Valley Dairy was the only dairy operating in the Gila Bend Basin with a groundwater demand of about 100 acre-feet. Painted Rock Dairy began operation the next year and the combined demand in 2004 was 173 acre-feet for an estimated 1,600 animals.

There are two dairies in the Lower Gila Basin, G.H. Dome Valley and Hine Hettinga, with a recent demand of 152 acre-feet and 94 acre-feet respectively. These dairies house a combined total of 1,900 animals. There are also two feedlots in the basin. The Kammann Cattle Company used about 27 acre-feet of water for about 800 animals while McElhaney Cattle used about 3,394 acre-feet for an estimated 101,000 animals in 2003.

Two dairy facilities are scheduled to begin operations soon in the Ranegras Plain Basin, west of Vicksburg road. One of the facilities will be a dairy/biorefinery. The facility is designed to use cow waste products to produce energy to process corn (not grown locally) into ethanol and biodiesel. Byproducts of the fuel production will be cycled back to the biorefinery and provide feed for the cows. About 2,500 cows will initially be housed at the site with plans to eventually house about 7,500 cows. The second phase of the project involves growing algae on 2,400 acres of adjacent state land using wastewater from the dairy to produce ethanol and biodiesel. (East Valley Tribune, 2007)

7.0.8 Water Resource Issues in the Lower Colorado River Planning Area

Water resource issues in the Lower Colorado River Planning Area have been identified by local water users, in regional studies primary involving Colorado River water supplies, through the distribution of surveys and from other sources. There are no ADWR Rural Watershed Initiative Groups in the planning area. Colorado River and groundwater transportation issues, planning and conservation activities and results from water provider surveys are discussed in this section. Environmental protection and restoration, and local management of water resources to meet the needs of growing communities while maintaining the agricultural economy are important considerations in the planning area.

Colorado River Issues

Issues involving the Colorado River system have implications for resource management and supply availability in the planning area. Issues include consequences related to compliance with the International Treaty with Mexico, agreement on management of the Colorado River system under shortage conditions in a manner equitable for all users, salinity control and water quality, entitlement transfers, and accounting surface rulemaking. Information on the “Law of the River” and more detailed discussion of some of the issues discussed below is found in Appendix C.

Mexican Treaty

Compliance with conditions of the delivery of 1.5 maf of water to Mexico under the 1944 Treaty and Minute 242 have required significant investments and actions within the U.S. and in the planning area. Actions have included rerouting agricultural return flows, construction of the 242 wellfield to return higher quality water to the Colorado River, on farm improvements and other actions.

A consequence of bypassing high salinity water around the river to the Cienega de Santa Clara in Mexico has reestablished a rich, ecologically important wetland and sparked interest in maintaining the area in its present condition. In dry years, bypassing the water to the Cienega results in Lake Mead storage decreasing by approximately 100,000 acre-feet annually since the bypassed water must be "made-up" from storage in Lake Mead. Recently, the decrease in Lake Mead storage after more than a decade of drought has increased the risk of shortage to Arizona Colorado River water users.

Actions upstream that would affect the delivery of the bypass water, including reactivation of the Yuma Desalting Plant to treat this water to a salinity level that would allow it to be discharged to the Colorado, would impact the Cienega. This is an issue with a high degree of international sensitivity. In 2005 a YDP/Cienega de Santa Clara Workgroup formed to discuss solutions that would both preserve the Cienega and offset the impact of the continued bypass of water.

Shortage Sharing

As mentioned in Section 7.0.6, Reclamation issued a Record of Decision in December, 2007 on interim operating criteria (2008-2026), including the coordinated operation of Lake Powell and Lake Mead and criteria for implementing shortage reductions in the Lower Basin. The elements of the ROD, which includes rules for shortages and surpluses, coordinated operation of Lake Powell and Lake Mead, and water conservation, have implications for water supply availability in the planning area.

The shortage recommendation implements water supply reductions when Lake Mead water storage is depleted to key elevation triggers. In Arizona, hydrologic modeling indicates that shortage reductions will impact 4th, 5th and 6th priority water users. The available shortage water supply is sufficient to meet all higher priority water users. However, some reductions to on-river municipal and industrial and agricultural contractors and to the CAP excess pool are expected.

Salinity and Other Water Quality Issues

Increased salinity levels in the Colorado River affect agricultural, municipal and industrial users. Damages in the United States are estimated at $330 million per year, and while economic damage in Mexico is not quantified, it is also a significant concern. The EPA approved salinity standards proposed by the Colorado River Basin Salinity Control Forum for three locations in Arizona, including two in the planning area. The water quality standards establish a flow-weighted average annual salinity standard that must be maintained on the lower Colorado River at the following locations in the planning area:

- Below Parker Dam (to Imperial Dam) - 747 mg/L
- At Imperial Dam - 879 mg/L.

In 2005, the Governor of Arizona appointed The Clean Colorado River Alliance (Alliance) stakeholder group to address water quality issues for the Colorado River. In addition to salinity, the Alliance identified several other water quality concerns including nutrients, metals, endocrine disrupting compounds, perchlorate, bacteria and pathogens, and sediment. In 2006, the Alliance issued a report titled Clean Colorado River Alliance Recommendations to Address Colorado River Water Quality. The report includes a number of recommendations to monitor and mitigate the impacts of these pollutants.

Entitlement Transfers

Arizona communities along the Colorado River that rely on the river for their water supplies have experienced rapid growth over the last decade. These communities are unique because non-Colorado River water supplies are not readily available as a supplementary water supply to meet this growing demand. As a result, some entities have acquired existing irrigation entitlements through contract assignment actions for the purpose of eventually conveying those entitlements for municipal and industrial purposes. Contract assignments involve the transfer of an entitlement for the same type of use in the same location, whereas the conveyance of an entitlement entails a change in the type and/or place of use. Non-federal Arizona contractors of mainstream Colorado River entitlements are required to consult with the Director of the Department regarding any proposed contract actions. The Department reviews proposed actions in accordance with its *Policy and Procedures for Transferring an Entitlement of Colorado River Water* and makes a recommendation to Reclamation.

Since adoption of the *Policy and Procedures* in 2004, the Department has processed three assignment and two conveyance requests. The assignments and conveyances involve partial transfers of Cibola Valley Irrigation and Drainage District's Colorado River irrigation entitlement. CVIDD, located in the southern part of the Parker Basin, assigned a portion of its entitlement to the Mohave County Water Authority (MCWA), the Hopi Tribe and Cibola Resources. Subsequent to these transactions, MCWA conveyed a majority of its entitlement to Mohave County for eventual use in Lake Havasu and Bullhead cities and assigned the remaining amount to the Arizona Game and Fjish Commission for habitat restoration purposes in Cibola Valley. Upon acquisition of its contract, Cibola Resources immediately conveyed its entitlement to B&F Investments, LLC for use by a proposed travel plaza in the Ehrenberg area (see Appendix C).

Federal Rulemaking to Establish the Accounting Surface

In August 2006, Reclamation initiated a rulemaking process to regulate the non-contract use of Colorado River water in the Lower Basin. The rulemaking is intended to ensure that all Colorado River water use is covered by an entitlement and correctly accounted for within the state's apportionment. Reclamation has contracted with the U.S. Geological Survey to document non-contract water uses in the Lower Basin. The rule will establish the methodology that Reclamation will use to determine if a well is pumping Colorado River water and will also establish an appeal process. At this time, approximately 11,500 acre-feet of unallocated fourth-priority Colorado River water is available for allocation. Some of this water will be allocated to existing uses, after currently uncontracted uses have been quantified. The inventory is expected to provide comprehensive information about existing water uses that need an entitlement. The Department will use this information to allocate the remaining supply for domestic purposes.

Groundwater Transportation

In general, groundwater cannot be transported between groundwater basins or from a groundwater basin outside an AMA into an AMA (A.R.S. §§ 45-544 and 45-551 through 45-555). These restrictions were designed to protect hydrologically distinct groundwater supplies and rural economies by ensuring that groundwater is not depleted in one groundwater basin to benefit another. Three basins in the planning area, Butler Valley, Harquahala and McMullen Valley, are designated as basins from which groundwater may be withdrawn and transported under certain conditions. Information about the statutory provisions is found in Section 7.0.6.

As of December 2007, only the City of Phoenix has purchased agricultural land in the McMullen Valley Basin for the purpose of potentially transferring groundwater to the Phoenix AMA. In addition, the Department has received an application for transportation of groundwater from the Harquahala Basin. As competition for water supplies in AMAs increases, it is likely that additional applications will be filed. Although the rate of groundwater decline and pumping depth are regulated in the McMullen Valley and Harquahala basins, there are no specified limits for the Butler Valley Basin. Withdrawal and transportation of groundwater may cause groundwater level declines and impact the groundwater supply available for use within the basins.

Planning and Conservation

On January 1, 2007, all large (>1,850 customers) community water systems in the state were required to submit System Water Plans to the Department. Small systems have until January 1, 2008, to submit their plans. The plans are intended to reduce community water systems' vulnerability to drought, and to promote water resource planning to ensure that water providers are prepared to respond to water shortage conditions. Within the planning area plans have been submitted by the large systems of the City of Yuma, Town of Parker, Ajo Improvement Company/Phelps Dodge Corporation, City of Somerton, and Arizona Water Company-Ajo System (a small system). On June 1, 2007, 48 systems (small and large) in the planning area were required to submit an annual water use report with data on water pumped, diverted, received and delivered to customers. These data will help support water resource planning.

Local Drought Impact Groups (LDIGs) are being formed in all counties across Arizona. LDIGs are voluntary groups that will coordinate drought public awareness, provide impact assessment information to local and state leaders, and implement and initiate local drought mitigation and response actions. These groups are coordinated by local representatives of Arizona Cooperative Extension and County Emergency Management and supported by ADWR's Community Water Planning Program. To date, groups have not been formed in La Paz or Yuma counties but there are plans to organize groups within the next year.

To support the efforts of the LDIGs, professionals and residents are asked to provide monthly feedback on drought conditions throughout their county. Citizens may also participate with the LDIG by assisting with education and outreach efforts and recommending actions for drought mitigation and response. More information on LDIGs may be found at http://www.azwater.gov/dwr/drought/LDIG.html.

Issue Surveys

The Department conducted a rural water resources survey in 2003 to compile information for the public and help identify the needs of growing communities. This survey was also intended to gather information on drought impacts to incorporate into the Arizona Drought Preparedness Plan, adopted in 2004. Questionnaires were sent to almost 600 water providers, jurisdictions, counties and tribes, and a report of the findings from the survey was subsequently completed (ADWR, 2004).

There were 15 water provider and 2 jurisdiction respondents in the Lower Colorado River Planning Area and of these, 17 numerically ranked issues. Respondents were asked to rank 18 issues, which can be grouped into three general categories: infrastructure, water supply and water quality. Issues that ranked consistently high by the most respondents are shown in Table 7.0-15. As shown, most respondents were concerned about aging infrastructure and the ability to fund improvements, and had water quality concerns. Few respondents were concerned about inadequate storage or pumping capacity to meet future demand or the need for additional water supplies.
The Department conducted another, more concise survey of water providers in 2004. This was done to supplement the information gathered in the previous year in support of developing the Arizona Water Atlas, and to reach a wider audience by directly contacting each water provider. Through this effort, 31 water providers in the Lower Colorado River Planning Area, with a total of approximately 40,200 service connections, participated and provided information on water supply, demand, and infrastructure and ranked a list of seven issues. Respondents were from the Gila Bend, Harquahala, Lower Gila, McMullen Valley, Parker and Yuma basins.

Table 7.0-15 Water resource issues ranked by 2003 survey respondents in the Lower Colorado River Planning Area (15 water providers and 2 jurisdictions)

Issue	Ranked as one of the top 5 issues (out of 18)	Percent of respondents
Ability to meet new arsenic standards	6	35%
Concern about proximity of wells to sources of contamination	5	29%
Aging infrastructure in need of replacement	11	65%
Inadequate captial for infrastructure improvement	6	35%

Source: ADWR 2004

With regard to a question of groundwater level trends in their service area, there were 21 respondents and most reported stable water levels as shown by basin with the corresponding number of respondents in Table 7.0-16.

Table 7.0-16 Groundwater level trends reported by 2004 survey respondents by groundwater basin (21 respondents)

Basin	Rising	Stable	Falling	Variable	Don't Know
Gila Bend		1			
Harquahala	1				1
Lower Gila	1	3			
McMullen Valley			1		
Parker		3	1		
Yuma		6		2	1

Source: ADWR 2005c

Water providers were asked in the 2004 survey to rank seven issues from 0 to 3 with 0 = no concern, 1 = minor concern, 2 = moderate concern and 3 = major concern. There were 31 respondents that reported a concern. As shown in Table 7.0-17, infrastructure concerns ranked as important concerns, similar to the 2003 survey. This was especially of concern to providers in the Lower Gila Basin (Table 7.0-18). Unlike results from the 2003 survey, this group of respondents was comprised of more large water providers and expressed concern about storage capacity and supplies to meet future demand.

Table 7.0-17 Water resource issues ranked by 2004 survey respondents in the Lower Colorado River Planning Area (31 respondents)

Issue	Moderate concern	Major concern	Total	Percent of respondents reporting issue was a major or moderate concern
Inadequate storage capacity to meet peak demand	2	6	8	26%
Inadequate well capacity to meet peak demand	1	2	3	10%
Inadequate supplies to meet current demand	2	0	2	6%
Inadequate supplies to meet future demand	3	4	7	23%
Infrastructure in need of replacement	6	8	14	45%
Inadequate capital to pay for infrastructure improvements	4	14	18	58%
Drought related water supply problems	1	1	2	6%

Source: ADWR 2005c

Table 7.0-18 Number of 2004 survey respondents, by groundwater basin, that ranked the survey water resource issues a moderate or major concern (31 respondents)

Issue	Gila Bend (1)	Harquahala (1)	Lower Gila (11)	McMullen Valley (8)	Parker (4)	Yuma (11)
Inadequate storage capacity to meet peak demand	1		3	1	1	2
Inadequate well capacity to meet peak demand			1			2
Inadequate supplies to meet current demand			1			1
Inadequate supplies to meet future demand	1		2	1		3
Infrastructure in need of replacement	1		6	2	3	2
Inadequate capital to pay for infrastructure improvements	1	1	6	2	2	6
Drought related water supply problems			2			

Source: ADWR 2005c

7.0.9 Groundwater Basin Water Resource Characteristics

Sections 7.1 through 7.11 present data and maps on water resource characteristics of the groundwater basins in the Western Plateau Planning Area. A description of the data sources and methods used to derive this information is found in Section 1.3 of Volume 1 of the Atlas. This section briefly describes general information that applies to all of the basins and the purpose of the information. This information is organized in the order in which the characteristics are discussed in Sections 7.1 through 7.11.

Geographic Features

Geographic features maps are included to present a general orientation to principal land features, roads, counties and cities, towns and places in the groundwater basin.

Land Ownership

The distribution and type of land ownership in a basin has implications for land and water use. Large amounts of private land typically translate into opportunities for land development and associated water demand, whereas federal lands are typically maintained for a purpose with little associated water use. State owned land may be sold or traded, and is often leased for grazing and farming. The extent of state owned lands is due to a number of legislative actions. The State Enabling Act of 1910 and the Act that established the Territory of Arizona in 1863 set aside sections 2, 16, 32 and 36 in each township to be held in trust by the state for educational purposes. Other legislation authorized additional state trust lands for specified purposes, which are identified for each basin (ASLD, 2006).

Climate

Climate data including temperature, rainfall, evaporation rates and snow are critical components of water resource planning and management. Averages and variability, seasonality of precipitation and long term climate trends are all important factors in demand and supply planning.

Surface Water Conditions

Depending on physical and legal availability, surface water may be a potential supply in a basin. Stream gage, flood gage, reservoir, stockpond and runoff contour data provide information on physical availability of this supply. Seasonal flow information is relevant to seasonal supply availability. Annual flow volumes provide an indication of potential volumetric availability.

Criteria for including stream gage stations in the basin tables are that there is at least one year of record, and annual streamflow statistics are included only if there are at least three years of record. There are different types of stations and those that only serve repeater functions were not included.

Flood gage information is presented to direct the reader to sources of additional precipitation and flow information that can be used in water resource planning. Large reservoir storage information provides data on the amount of water stored in the basin, its uses, and ownership. Because of the large number of small reservoirs, and less reliable data, individual small reservoir data is not provided. The number of stockponds is a general indicator of small scale surface water capture and livestock demand. Runoff contours reflect the average annual runoff in tributary streams. They provide a generalized indication of the amount of runoff that can be expected at a particular geographic location.

Perennial and Intermittent Streams and Major Springs

A map of perennial and intermittent streams is provided for each basin. For some basins, more than one source of information was used. Stream designations may not accurately reflect current conditions in some cases. Spring data was compiled from a number of sources in an effort to develop as comprehensive a list as possible. Spring data is important to many researchers and to the environmental community due to their importance in maintaining habitat, even from small discharges.

Groundwater Conditions

Several indicators of groundwater conditions are presented for each basin. Aquifer type can be a general indicator of aquifer storage potential, accessibility of the supply, aquifer productivity, water quality and aquifer flux. Well yield information for large diameter wells is provided and is generally measured when the well is drilled and reported on completion reports. It was assumed that large diameter wells were drilled to produce a maximum amount of water and, therefore, their reported pump capacities are indicative of the aquifer's potential to yield water to a well. However, many factors can affect well yields including well design, pump size and condition and the age of the well. Reported well yields are only a general indicator of aquifer productivity and specific information is available from well measurements conducted as part of basin investigations.

Natural recharge is typically the least well known component of a water budget. Many of the estimates in the Atlas are derived from studies of larger geographic areas and all deserve further

study. Similarly, estimates of storage are based on rough estimates and considerably more studies are needed in most basins. Components of storage include aquifer depth and specific yield.

Water level data is from measured wells, usually collected during the period when the wells were not actively being pumped or only minimally pumped. Depth to water measurements are shown on mapped wells if there was a measurement taken during 2003-2004. The basin hydrographs show water-level trends for selected wells over the 30-year period from January 1975 to January 2005. Not all basins have a sufficient number of representative hydrographs.

The flow directions that are shown generally reflect long-term, regional aquifer flow in the basin and are not meant to depict temporary or local-scale conditions. However, flow directions in some basins indicate how localized pumping has altered regional flow patterns.

Water Quality

Water quality conditions impact the availability of water supplies. Water quality data was compiled from a variety of sources as described in Volume 1 Section 1.3. The data indicate areas where water quality exceedences have previously occurred, however additional areas of concern may currently exist where water quality samples have not been collected or sample results were not reviewed by the Department (e.g. samples collected in conjunction with the ADEQ Aquifer Protection Permit programs). It is important to note also that the exceedences presented may or may not reflect current aquifer or surface water conditions.

Cultural Water Demand

Cultural water demand is an important component of a water budget. However, without mandatory metering and reporting of water uses, accurate demand data is difficult to acquire. Municipal demand includes water company and domestic (self-supplied) demand estimates. Basin demand information is from several sources in order to prepare as accurate an estimate as possible. Annual demand estimates have been averaged over a specific time period. This provides general trend information without focusing on potentially inaccurate annual demand estimates due to incomplete data.

Locations of major cultural water uses are primarily from a 2004 USGS land cover study using older satellite imagery that may not represent recent changes. The cultural demand maps provide only general information about the location of water users.

Effluent generation data was compiled from several sources to provide an estimate of how much of this renewable resource might be available for use. However, effluent reuse is often difficult both logistically and economically since a potential user may be far from the wastewater treatment plant.

Water Adequacy Determinations

Information on water adequacy and inadequacy determinations for subdivisions, with the reason for the inadequacy determination provides information on the number and status of subdivision lots. Listing the reason for the inadequacy identifies which subdivisions have a demonstrated physical or legal lack of water or may have elected not to provide the necessary information to

the Department. Briefly, developers of subdivisions outside of AMAs are required to obtain a determination of whether there is sufficient water of adequate quality available for 100 years. If the supply is determined to be inadequate, lots may still be sold, but the condition of the water supply must be disclosed in promotional materials and in sales documents.

In addition to these subdivision determinations for which a water adequacy report is issued, water providers may apply for adequacy designations for their entire service area. If a subdivision is to be served water from one of these water providers, then a separate adequacy determination is not required. (See Appendix A, Volume 1 for more information about the Adequacy Program).

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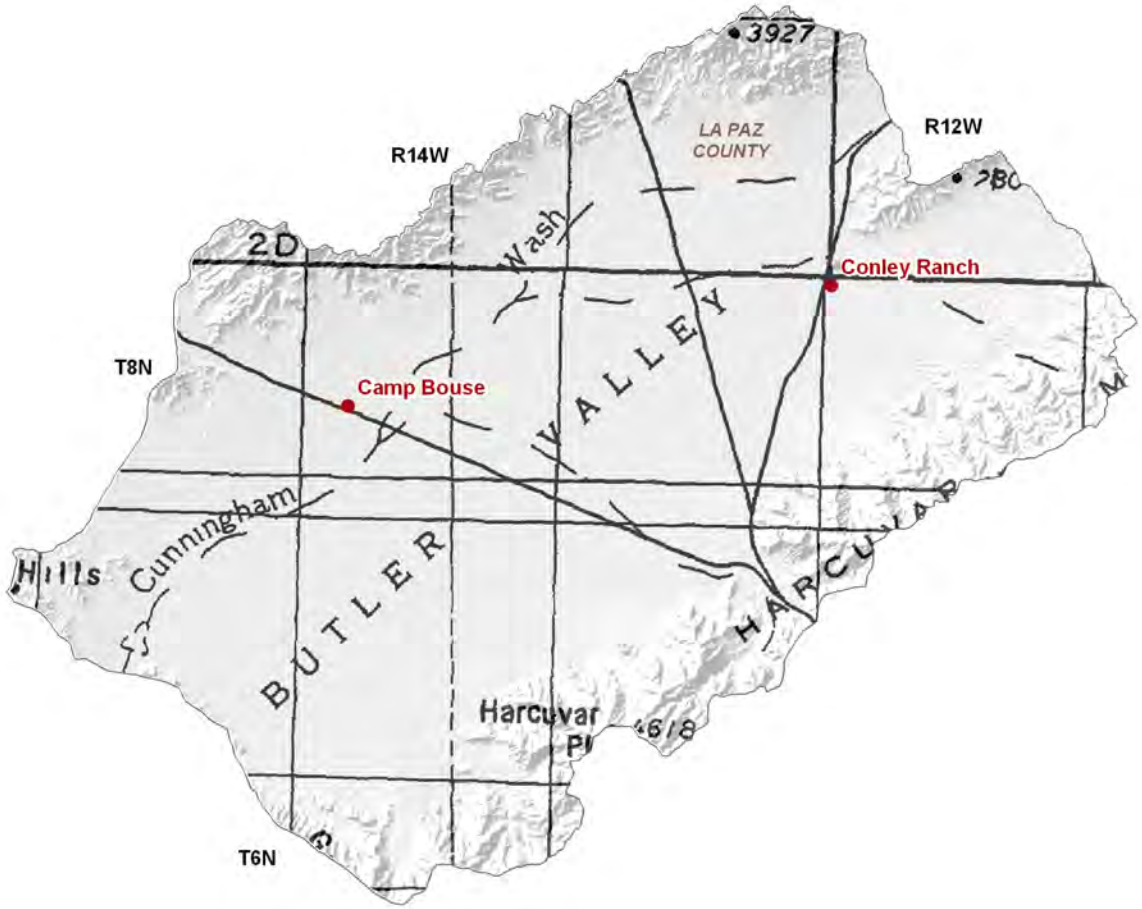
Section 7.1
Butler Valley Basin

7.1.1 Geography of the Butler Valley Basin

The Butler Valley Basin, located in the northern part of the planning area, is 288 square miles in area. Geographic features and principal places are shown on Figure 7.1-1. The basin is characterized by a valley bordered by two mountain ranges. Vegetation types include Lower Colorado River Valley and Arizona Uplands Sonoran desertscrub and a small amount of southwestern interior chaparral on the eastern basin boundary. (See Figure 7.0-7)

- Principal geographic features shown on Figure 7.1-1 are:
    - Basin places of Camp Bouse and Conley Ranch
    - Cunningham Wash running northeast to southwest in the northern portion of the basin
    - Butler Valley bordered by the Harcuvar Mountains on the eastern basin boundary and the Buckskin Mountains on the northwestern basin boundary
    - Harcuvar Peak at 4,618 feet, the highest point in the basin
- Not well shown on the map is the lowest point in the basin 1,345 feet at the “Narrows” where Cunningham Wash exits the basin.



Base Map: USGS 1:500,000, 1981

0 3 6 Miles

City, Town or Place

Figure 7.1-1
Butler Valley Basin
Geographic Features

7.1.2 Land Ownership in the Butler Valley Basin

Land ownership, including the percentage of ownership by category, for the Butler Valley Basin is shown in Figure 7.1-2. Principal features of land ownership in this basin are the large blocks of U.S. Bureau of Land Management and State Trust lands. A description of land ownership data sources and methods is found in Volume 1, Section 1.3.8. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

U.S. Bureau of Land Management (BLM)

- 55.5% of the land is federally owned and managed by the Yuma Field Office of the Bureau of Land Management.
- BLM land in this basin includes 4,900 acres of the 38,000 acre Rawhide Mountains Wilderness and 11,000 acres of the 25,000 acre Harcuvar Mountains Wilderness. (See Figure 7.0-9)
- Land uses include grazing, resource conservation and recreation.

State Trust Land

- 43.9% of the land is held in trust for the public schools, state charitable penal reform and county bonds under the State Trust Land system.
- Primary land use is grazing.

Private

- 0.6% of the land is private.
- Small parcels of private land are found surrounded by BLM land in the northern and southern portions of the basin.
- Land uses include domestic and ranching.

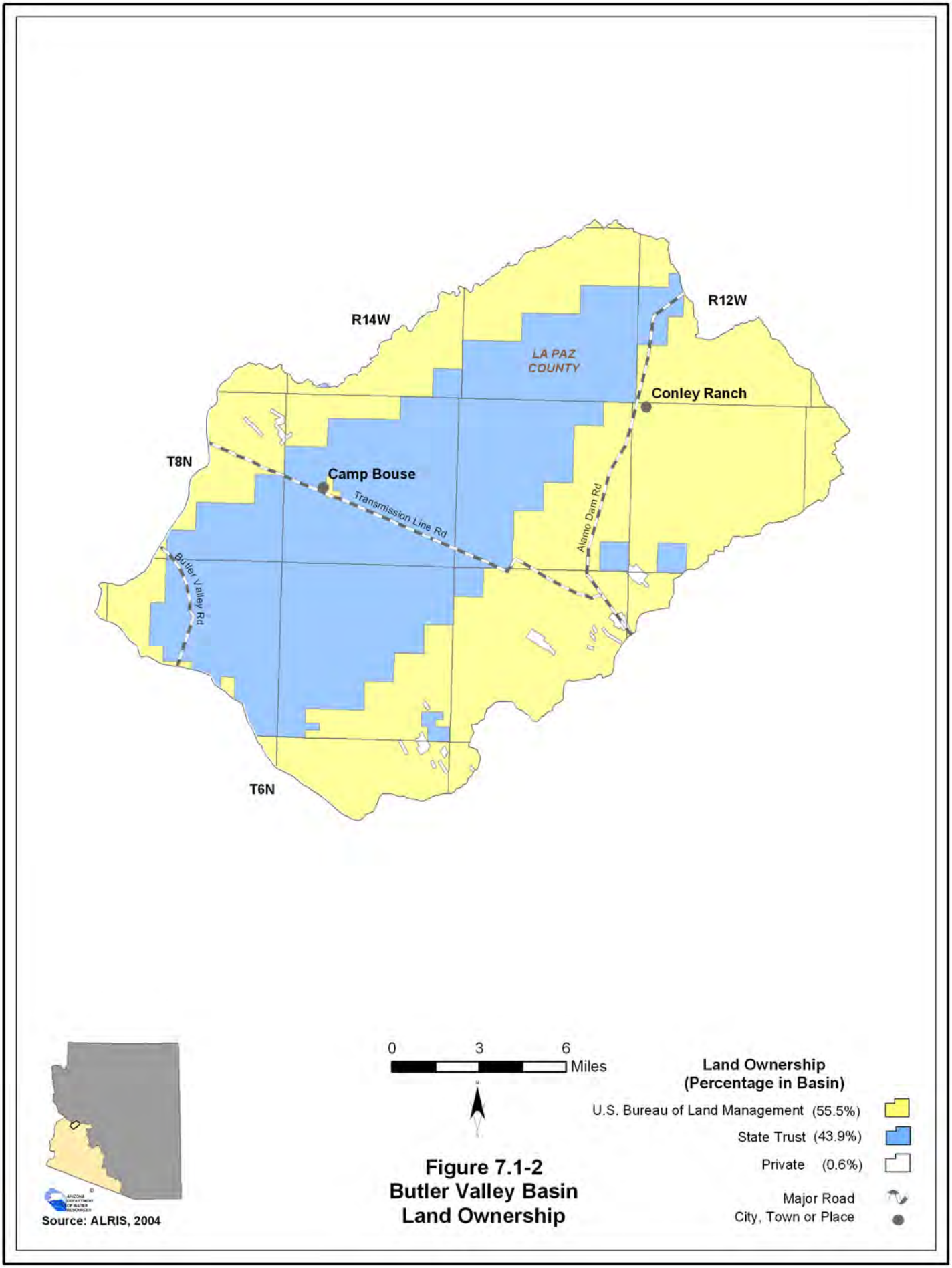


Figure 7.1-2
Butler Valley Basin
Land Ownership

7.1.3 Climate of the Butler Valley Basin

The Butler Valley Basin does not contain NOAA/NWS, Evaporation Pan, AZMET or SNOTEL/ Snowcourse stations. Figure 7.1-3 shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. A description of the climate data sources and methods is found in Volume 1, Section 1.3.3.

SCAS Precipitation Data

- See Figure 7.1-3
- Average annual rainfall is as high as 18 inches along the central eastern basin boundary and as low as six inches in the central western portion of the basin.

Table 7.1-1 Climate Data for the Butler Valley 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
None									

Source: WRCC, 2003

B. Evaporation Pan:

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

Source: WRCC, 2003.

C. AZMET:

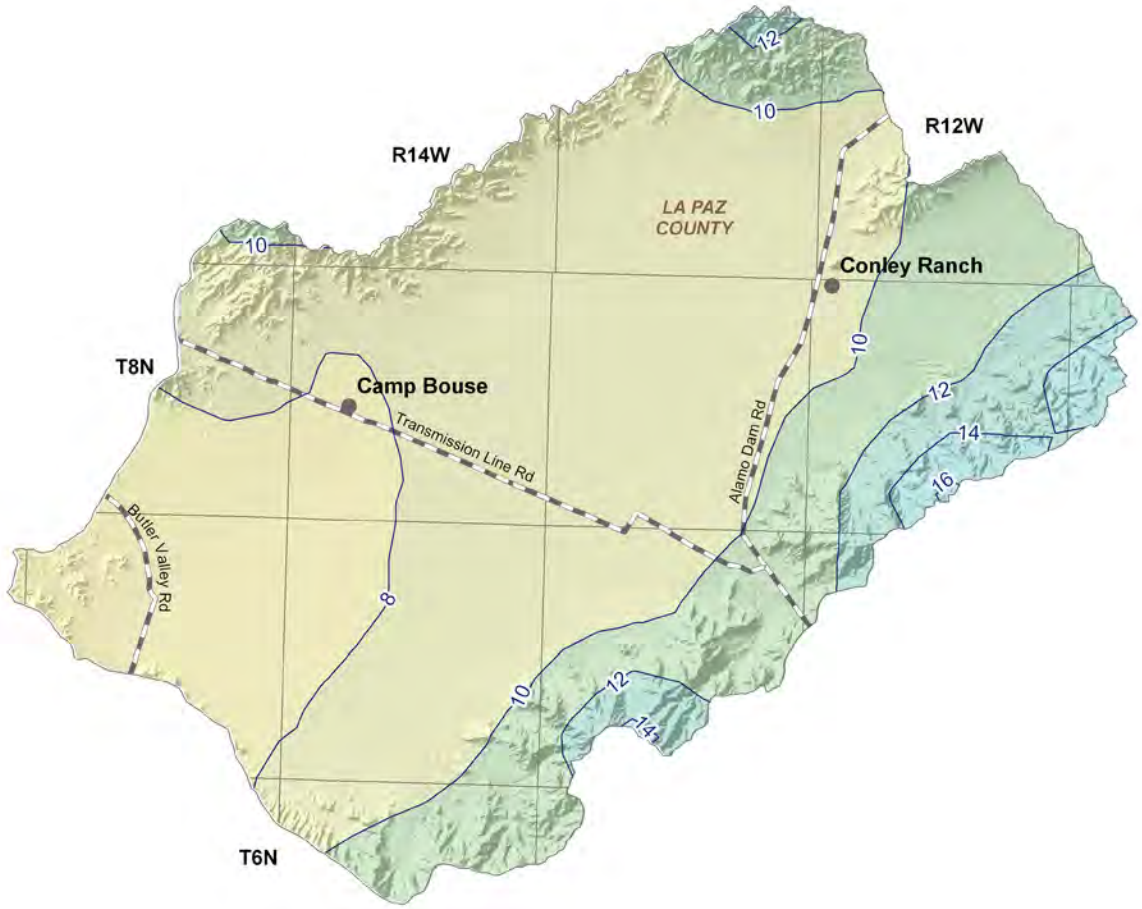
Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Annual Reference Evaportranspiration, in inches (*Number of years to calculate averages*)
None			

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: NRCS, 2005



Average Annual Precipitation (1961-1990)
inches per year

- 6-8
- 8-10
- 10-12
- 12-14
- 14-16
- 16-18

Precipitation Contour
Major Road
City, Town or Place

0 3 6 Miles

Precipitation Data Source: Oregon State University, 1998

Figure 7.1-3
Butler Valley Basin
Meteorological Stations and Annual Precipitation

7.1.4 Surface Water Conditions in the Butler Valley Basin

There are no streamflow data, flood ALERT equipment or USGS runoff contour data available for this basin. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 7.1-4. The location of large reservoirs is shown on Figure 7.1-4. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Reservoirs and Stockponds

- Refer to Table 7.1-4.
- The basin contains one large reservoir, Cunningham Wash, with a maximum surface area of 143 acres. Its use was not available.
- There are no small reservoirs and seven registered stockponds in this basin.

Table 7.1-2 Streamflow Data for the Butler Valley Basin

Station Number	USGS Station Name	Drainage Area (in mi^2)	Mean Basin Elevation (in feet)	Period of Record	Average Seasonal Flow (% of annual flow)				Annual Flow/Year (in acre-feet)				Years of Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
None													

Sources: USGS NWIS, USGS 1998 and USGS 2003.

Table 7.1-3 Flood ALERT Equipment in the Butler Valley Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
None				

Table 7.1-4 Reservoirs and Stockponds in the Butler Valley 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	JURISDICTION
None identified by ADWR at this time					

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

MAP KEY	RESERVOIR/LAKE NAME *(Name of dam, if different)*	OWNER/OPERATOR	MAXIMUM SURFACE AREA (acres)	USE	JURISDICTION
1	Cunningham Wash	NA	143	NA	Private

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

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

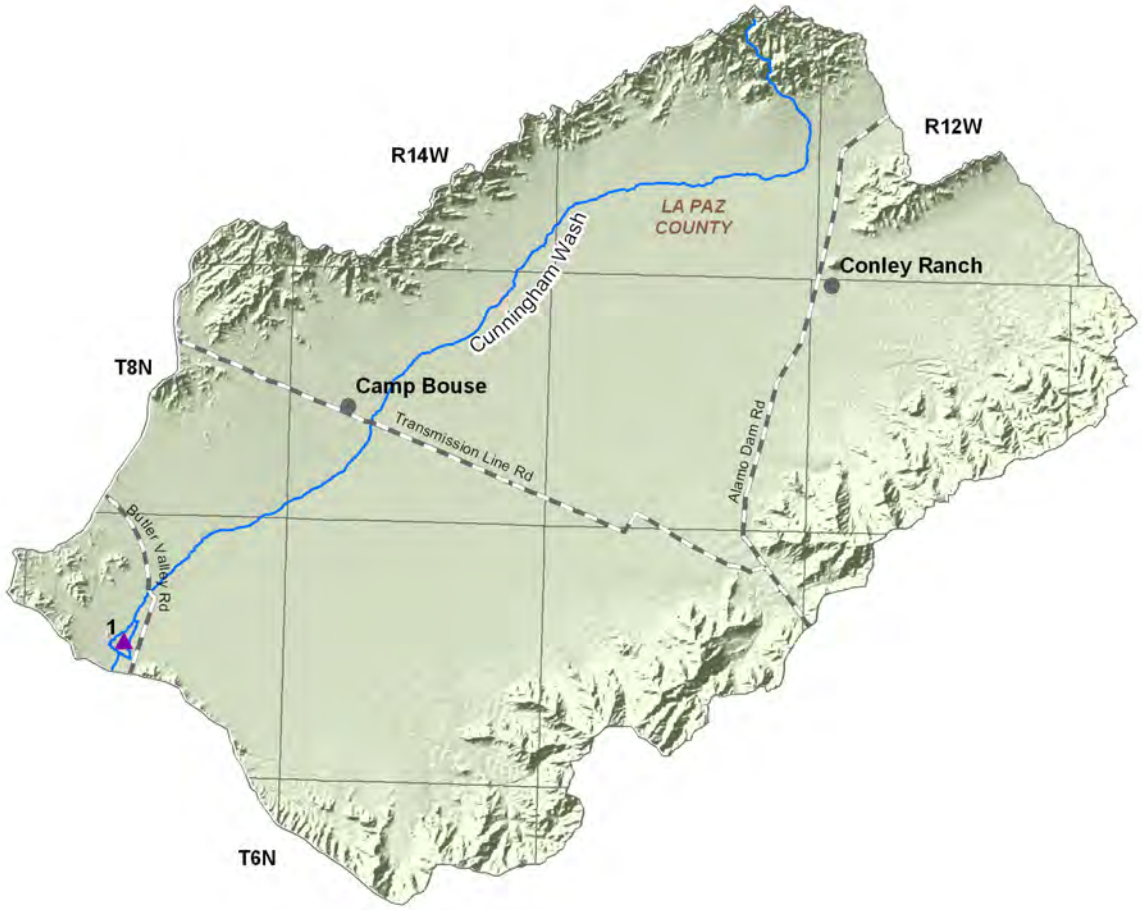
D. Other Small Reservoirs (between 5 and 50 acres surface area)

Total number: 0
Total surface area: 0 acres

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

Total number: 7

Notes:
NA = Information is not available to ADWR at this time



Stream Data Source: ALRIS, 2005

0 3 6 Miles

Figure 7.1-4
Butler Valley Basin
Surface Water Conditions

Large Reservior
Stream Channel (width of line reflects stream order)
Major Road
City, Town or Place

7.1.5 Perennial/Intermittent Streams and Major Springs in the Butler Valley Basin

The total number of springs in the basin are shown in Table 7.1-5. There are no perennial or intermittent streams and no major or minor springs in the Butler Valley Basin. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, Section 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- The total number of springs, regardless of discharge, identified by the USGS is one.

Table 7.1-5 Springs in the Butler Valley 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, 2005 and USGS, 2006): 1

7.1.6 Groundwater Conditions of the Butler Valley Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.1-6. Figure 7.1-5 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 7.1-6 contains hydrographs for selected wells shown on Figure 7.1-5. Figure 7.1-7 shows well yields in four yield categories. A description of aquifer data sources and methods is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields, is found in Volume 1, Section 1.3.19.

Major Aquifers

- Refer to Table 7.1-6 and Figure 7.1-5.
- The major aquifer is basin fill.
- Flow direction is from northeast to southwest generally following Cunningham Wash.

Well Yields

- Refer to Table 7.1-6 and Figure 7.1-7.
- As shown on Figure 7.1-7, well yields generally range from 1,000 gallons per minute (gpm) to greater than 2,000 gpm.
- One source of well yield information, based on 17 reported wells, indicates that the median well yield is 2,200 gpm.

Natural Recharge

- Refer to Table 7.1-6.
- There are two estimates of natural recharge ranging from less than 1,000 acre-feet per year to 1,060 acre-feet per year.

Water in Storage

- Refer to Table 7.1-6.
- There are five estimates of water in storage ranging from two million acre-feet at a depth of 1,200 feet to 20 million acre-feet at a depth of 1,000 feet.

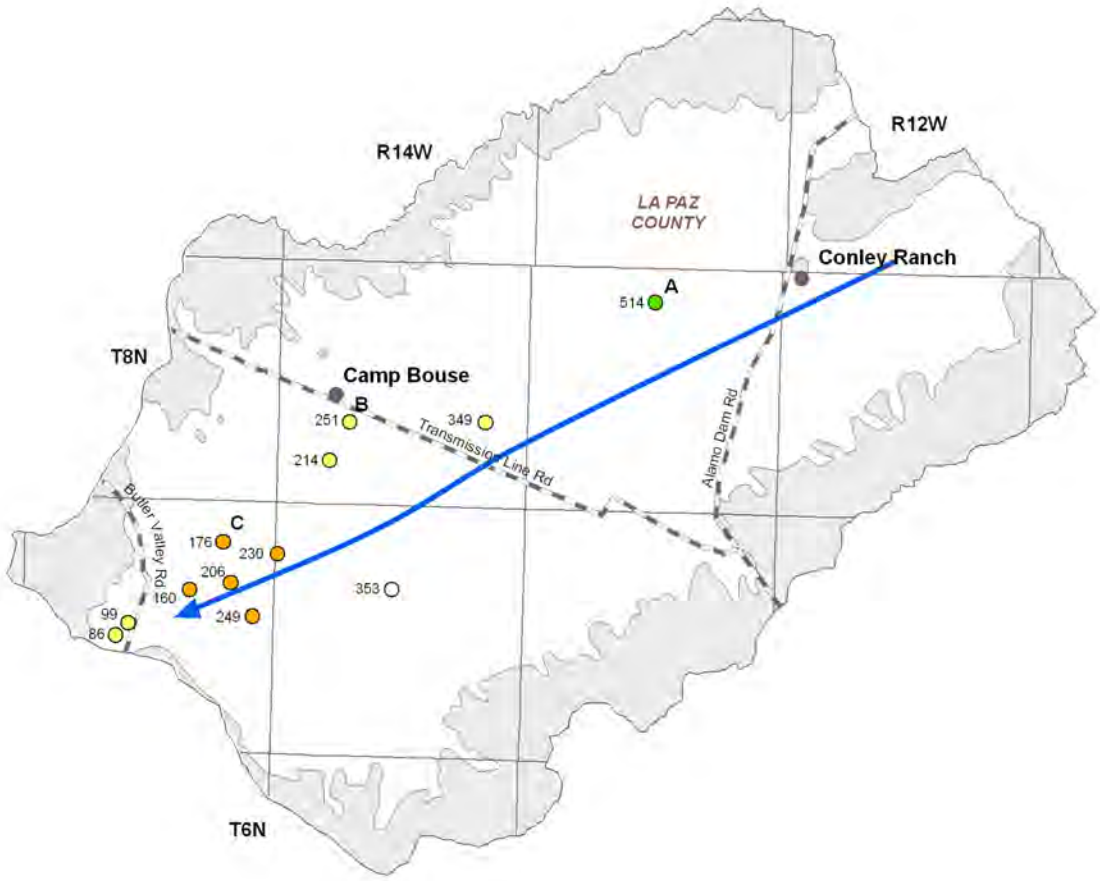
Water Level

- Refer to Figure 7.1-5. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures thirteen index wells in this basin, hydrographs for three index wells are shown on Figure 7.1-6.
- The deepest water level shown on the map is 514 feet west of Conley Ranch and the shallowest water level shown on the map is 86 feet near the southwestern basin boundary.

Table 7.1-6 Groundwater Data for the Butler Valley Basin

Basin Area, in square miles:	288	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
Well Yields, in gal/min:	Range 15.6-2,910 Median 1590 (5 wells measured)	Measured by ADWR and/or USGS
	Range 100-3,200 Median 2,200 (17 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	Range 300-1,000	ADWR (1990)
	Range 0-2,500	USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	<1,000	Freethey and Anderson (1986)
	1,060	Herndon (1985)
Estimated Water Currently in Storage, in acre-feet:	6,400,000 - 6,500,000 (to 1,200 ft)	ADWR (1990 and 1994)
	2,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	5,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
	12,000,000 (to 700 ft)	Herndon (1985)
	20,000,000 (to 1,000 ft)	USBR (1979)
Current Number of Index Wells:	13	
Date of Last Water-level Sweep:	2004 (24 wells measured)	

[1]Predevelopment Estimate



0 3 6 Miles

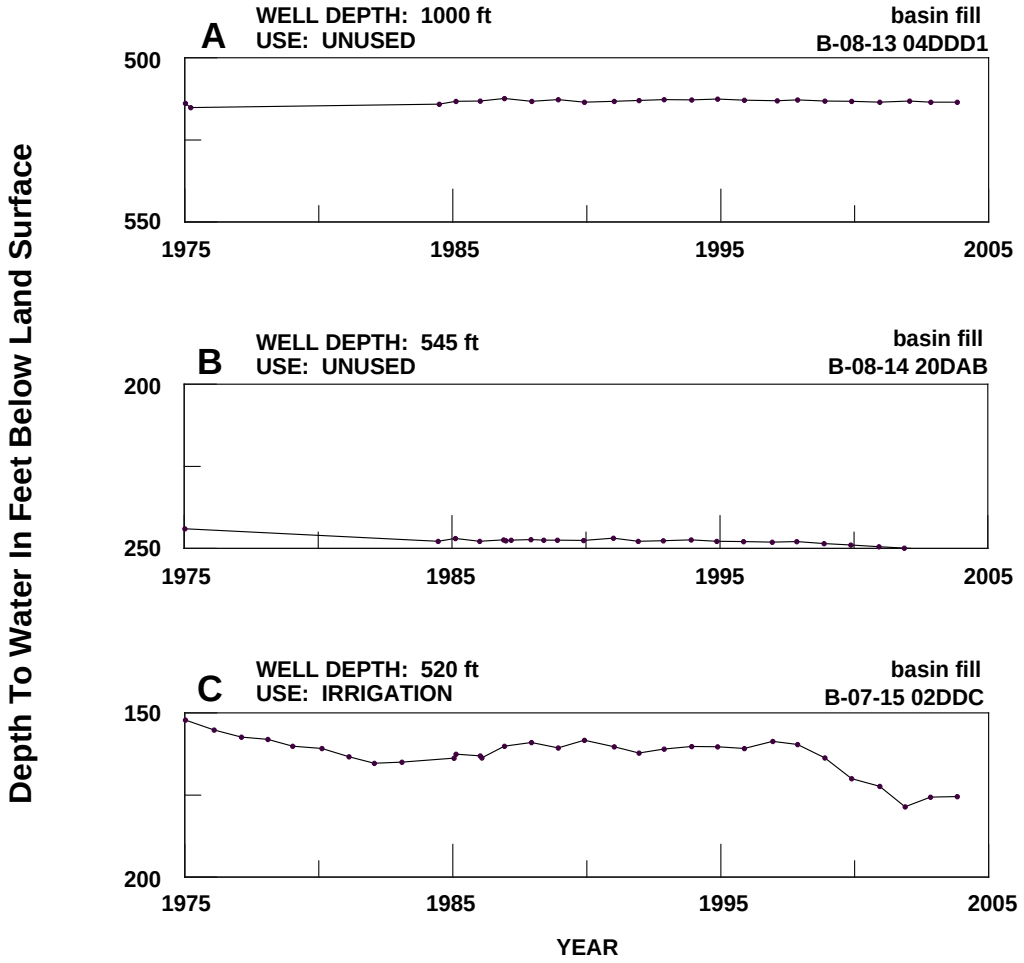
Water-level change in feet between 1990-1991 and 2003-2004

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

Between -30 and -15
Between -15 and -1
Between -1 and +1
Change Data Not Available
Generalized Flow Direction
Consolidated Crystalline & Sedimentary Rocks
Unconsolidated Sediments
Major Road
City, Town or Place

Figure 7.1-5
Butler Valley Basin
Groundwater Conditions

Figure 7.1-6
Butler Valley Basin
Hydrographs Showing Depth to Water in Selected Wells



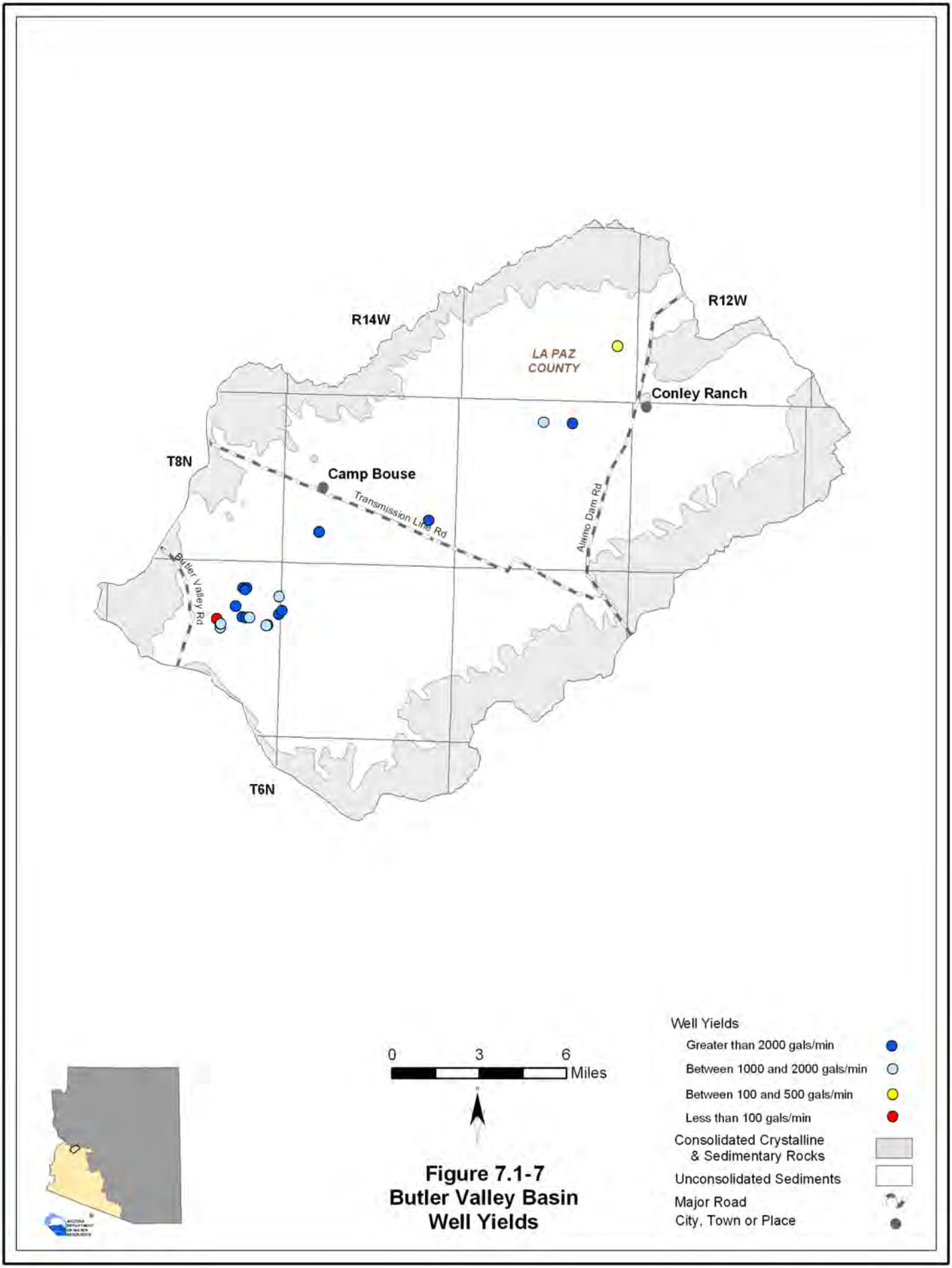


Figure 7.1-7
Butler Valley Basin
Well Yields

7.1.7 Water Quality of the Butler Valley 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 7.1-7A. There are no impaired lakes or streams in this basin. Figure 7.1-8 shows the location of water quality occurrences keyed to Table 7.1-7. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mine Sites

- Refer to Table 7.1-7A.
- Eight wells have parameter concentrations that have equaled or exceeded drinking water standards.
- The parameter most frequently equaled or exceeded was fluoride.
- Other parameters equaled or exceeded include arsenic, lead and nitrates.

Table 7.1-7 Water Quality Exceedences in the Butler Valley Basin[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
1	Well	8 North	14 West	20	As, F
2	Well	8 North	14 West	29	As, F, Pb
3	Well	7 North	15 West	2	F
4	Well	7 North	15 West	10	F
5	Well	7 North	15 West	12	As
6	Well	7 North	15 West	13	As
7	Well	7 North	15 West	15	F
8	Well	7 North	15 West	15	F, NO3

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	Parameter(s) Exceeding Use Standard
None identified by ADWR at this time						

Notes:

[1] Water quality samples collected between 1979 and 1998.
[2] As = Arsenic
NO3 = Nitrate/ Nitrite
F = Fluoride
Pb = Lead

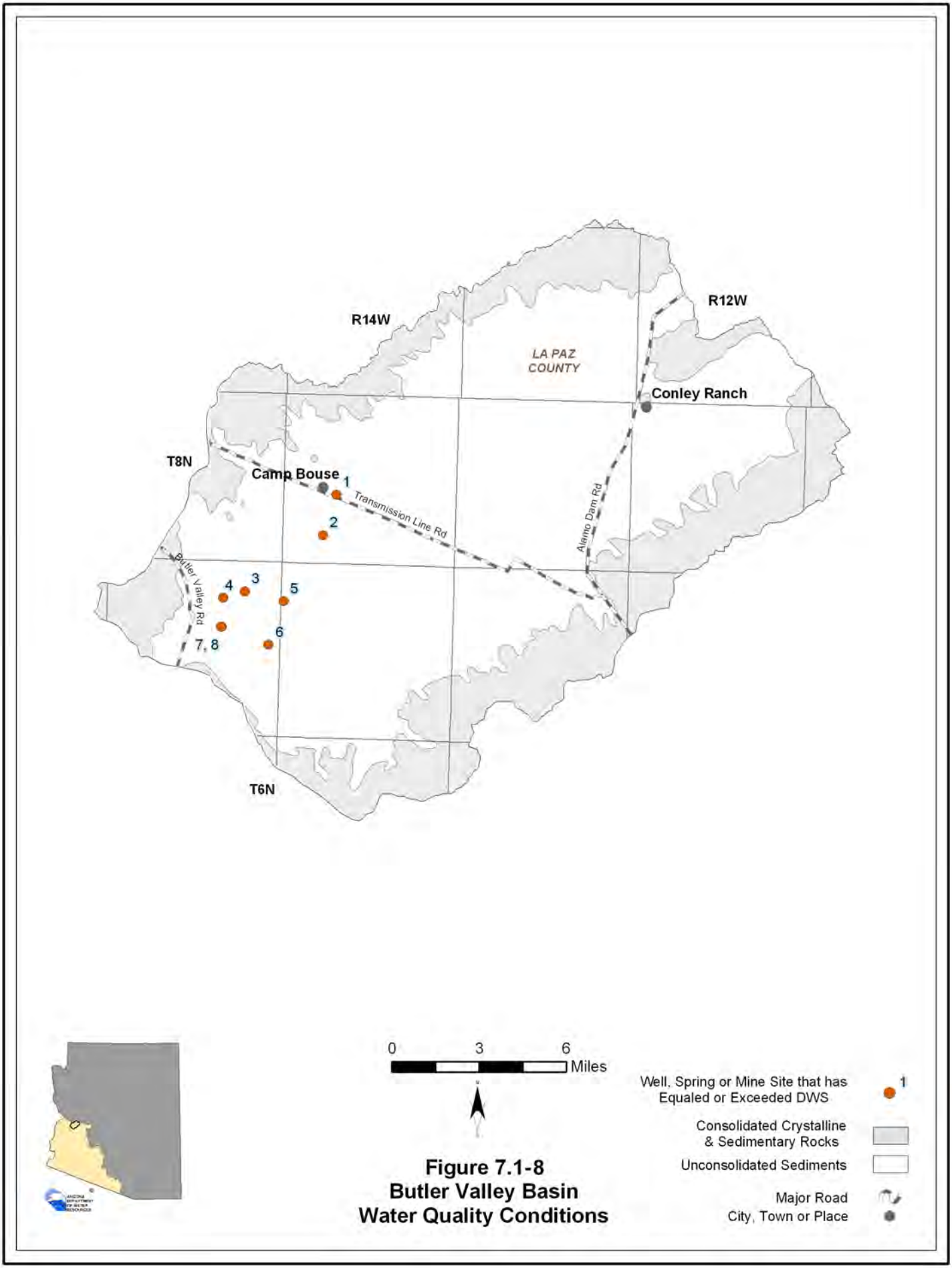


Figure 7.1-8
Butler Valley Basin
Water Quality Conditions

7.1.8 Cultural Water Demands in the Butler Valley 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 7.1-8. Figure 7.1-9 shows the location of demand centers. There is no recorded effluent generation in this basin. A description of cultural water demand data sources and methods is found in Volume 1, Section 1.3.5. More detailed information on cultural water demands is found in Section 7.0.7.

Cultural Water Demands

- Refer to Table 7.1-8 and Figure 7.1-9.
- Population in this basin is very small, with 18 residents in 2000. Projections suggest a small increase in population through 2050.
- There are no surface water diversions in this basin.
- Most cultural water use is for irrigation east of Butler Valley Road in the southwestern portion of the basin. Agricultural water use increased 150% from 1991-2003 with 8,700 acre-feet of demand per year on average from 2000 to 2003.
- Municipal water demand is minimal and did not increase from 1991 to 2003.
- As of 2003 there were 20 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 20 wells with a pumping capacity of more than 35 gallons per minute.

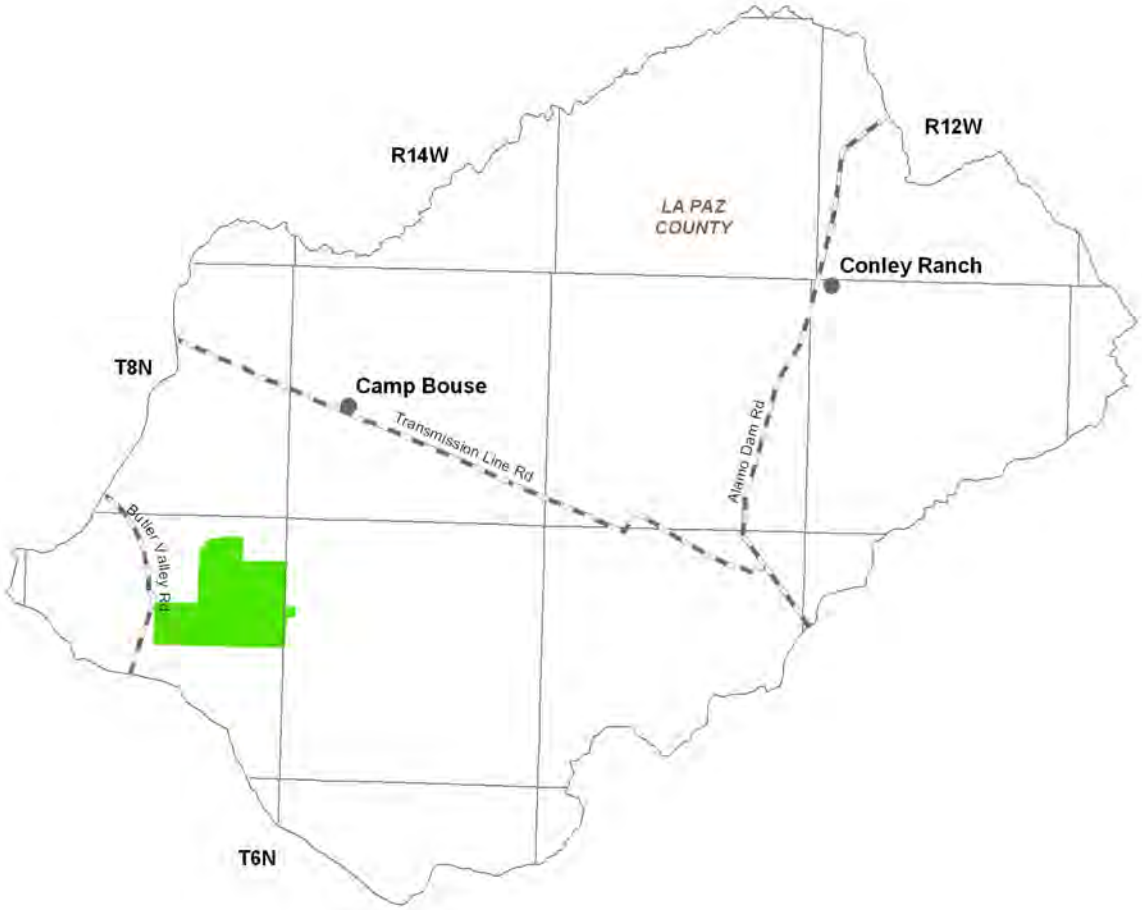
Table 7.1-8 Cultural Water Demands in the Butler Valley Basin[1]

Year	Recent (Census) and Projected (DES) 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	Irrigation	Municipal	Industrial	Irrigation	
1971		20[2]	16[2]	4,000			NR			ADWR (1994)
1972										
1973										
1974										
1975										
1976				4,000			NR			
1977										
1978										
1979										
1980	5									
1981	6	0	1	4,000			NR			
1982	6									
1983	6									
1984	7									
1985	8									
1986	8	0	1	4,000			NR			
1987	8									
1988	9									
1989	10									
1990	10									
1991	11	0	1	<300	NR	3,400[3]	NR			USGS (2005)
1992	12									
1993	12									
1994	13									
1995	14									
1996	15	0	1	<300	NR	8,300	NR			
1997	16									
1998	16									
1999	17									
2000	18									
2001	19	0	0	<300	NR	8,700	NR			
2002	20									
2003	21									
2010	28									
2020	38									
2030	48									
2040	58									
2050	68									
	WELL TOTALS:	**20**	**20**							

[1] Does not include evaporation losses from stockponds and reservoirs.
[2] Includes all wells through 1980.
[3] Data not available for 1991-1993, average shown is 1994-1995
NR - Not reported

Table 7.1-9 Effluent Generation in the Butler Valley Basin

Facility Name	Ownership	City/Location Served	Population Served	Volume Treated/Generated (acre-feet)	Disposal Method							Current Treatment Level	Population Not Served	Year of Record
					Water-course	Evaporation Pond	Irrigation	Golf Course	Wildlife Area	Discharged to Another Facility	Infiltration Basins			
No Waste Water Treatment Facilities Identified by ADWR in this Basin														



Primary Data Source: USGS National Gap Analysis Program, 2004

0 3 6 Miles

Figure 7.1-9
Butler Valley Basin
Cultural Water Demand

Demand Centers

Agriculture

Major Road

City, Town or Place

7.1.9 Water Adequacy Determinations in the Butler Valley Basin

No water adequacy applications for the Butler Valley Basin were filed with the Department as of May 2005. A description of the Water Adequacy Program is found in Volume 1, Appendix A. Adequacy determination data sources and methods are found in Volume 1, Section 1.3.1.

Table 7.1-10 Adequacy Determinations in the Butler Basin

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
None identified by ADWR at this time											

Butler Valley Basin
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A

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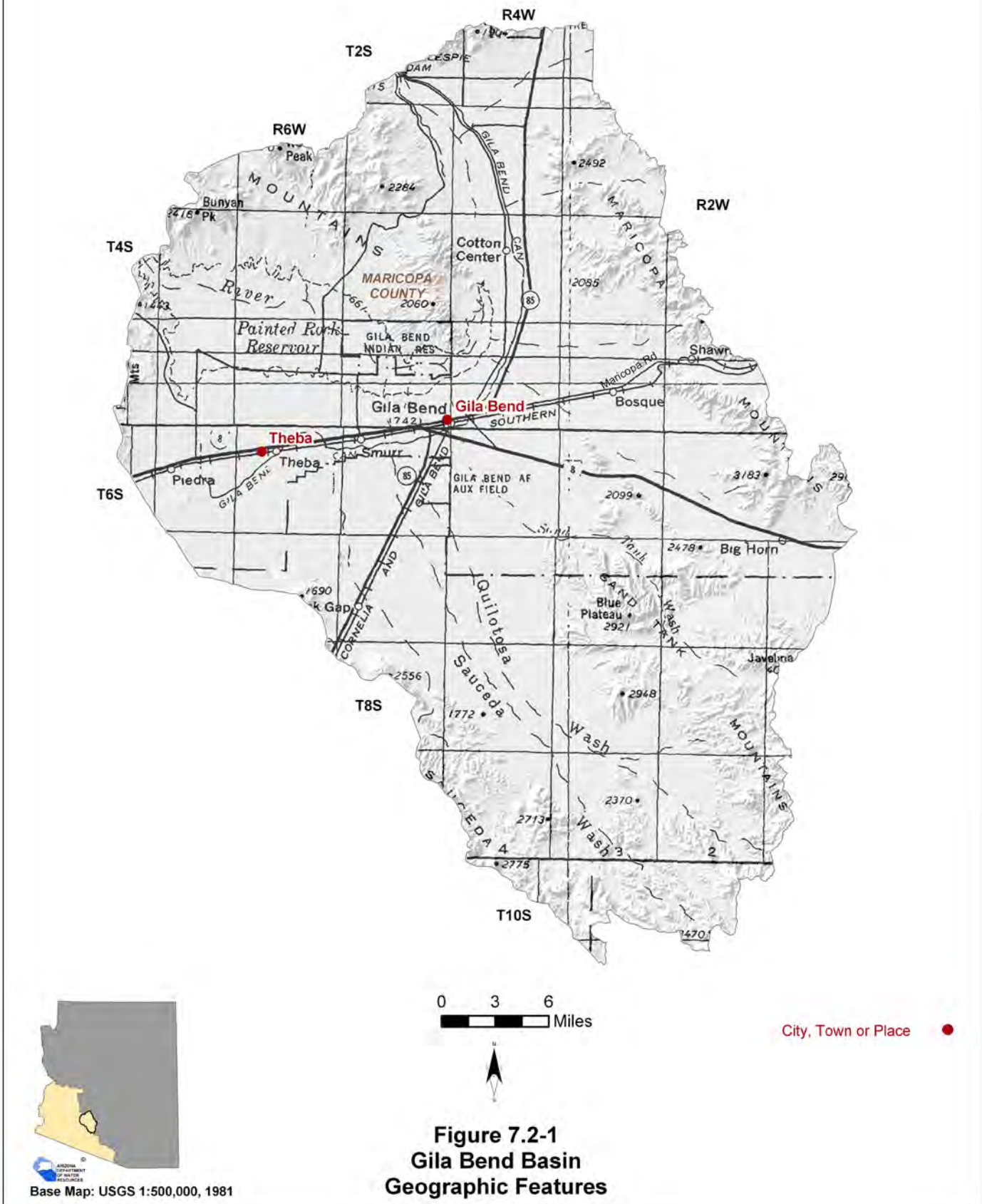
Section 7.2
Gila Bend Basin

7.2.1 Geography of the Gila Bend Basin

The Gila Bend Basin, located in the east central part of the planning area, is 1,284 square miles in area. Geographic features and principal communities are shown on Figure 7.2-1. The basin is characterized by washes and a series of small mountain ranges. Vegetation types include Lower Colorado River Valley and Arizona Uplands Sonoran desertscrub. (See Figure 7.0-7)

- Principal geographic features shown on Figure 7.2-1 are:
    - Basin communities of Gila Bend and Theba
    - The Gila River running east to west in the northern portion of the basin and Painted Rock Reservoir, which during flood events impounds the river
    - Quilotosa and Sauceda Washes south of Gila Bend
    - Maricopa and Sand Tank Mountains in the eastern portion of the basin, the Sauceda Mountains in the south and the Gila Bend Mountains in the north
    - The lowest point in the basin about 660 feet at Painted Rock Dam where the Gila River exits the basin
    - The highest point in the basin at 3,183 feet in the Maricopa Mountains



Base Map: USGS 1:500,000, 1981

Figure 7.2-1
Gila Bend Basin
Geographic Features

7.2.2 Land Ownership in the Gila Bend Basin

Land ownership, including the percentage of ownership by category, for the Gila Bend Basin is shown in Figure 7.2-2. Principal features of land ownership in this basin are the large areas of military and Bureau of Land Management lands. A description of land ownership data sources and methods is found in Volume 1, Section 1.3.8. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

U.S. Bureau of Land Management (BLM)

- 41.7% of the land is federally owned and managed by the Lower Sonoran Office of the Bureau of Land Management.
- BLM Land in this basin includes 238,700 acres of the 487,000 acre Sonoran Desert National Monument and 49,000 acres of the 64,000 acre Woolsey Peak Wilderness. (See Figure 7.0-9)
- Land uses include resource conservation, recreation and grazing.

U.S. Military

- 33.5% of the land is federally owned and managed by the U.S. Military as the Barry Goldwater Air Force Range.
- Primary land use is military activity.

Private

- 15.7% of the land is private.
- The majority of the private land is in the center of the basin in the vicinity of Gila Bend, Highway 89 and Interstate 8.
- Land uses include domestic, commercial and ranching.

State Trust Land

- 6.2% of the land is held in trust for the public schools under the State Trust Land system.
- Primary land use is grazing.

Indian Reservation

- 2.8% of the land is under tribal ownership including all of the Gila Bend Indian Reservation and a small portion of the Tohono O'odham Indian Reservation. Both are part of the Tohono O'odham Nation
- Land uses include agriculture, domestic and grazing.

Other

- 0.1% of the land is owned by Maricopa County.
- County land is located on the northern basin boundary and is managed as the Buckeye Hills County Park.
- Primary land use is recreation.

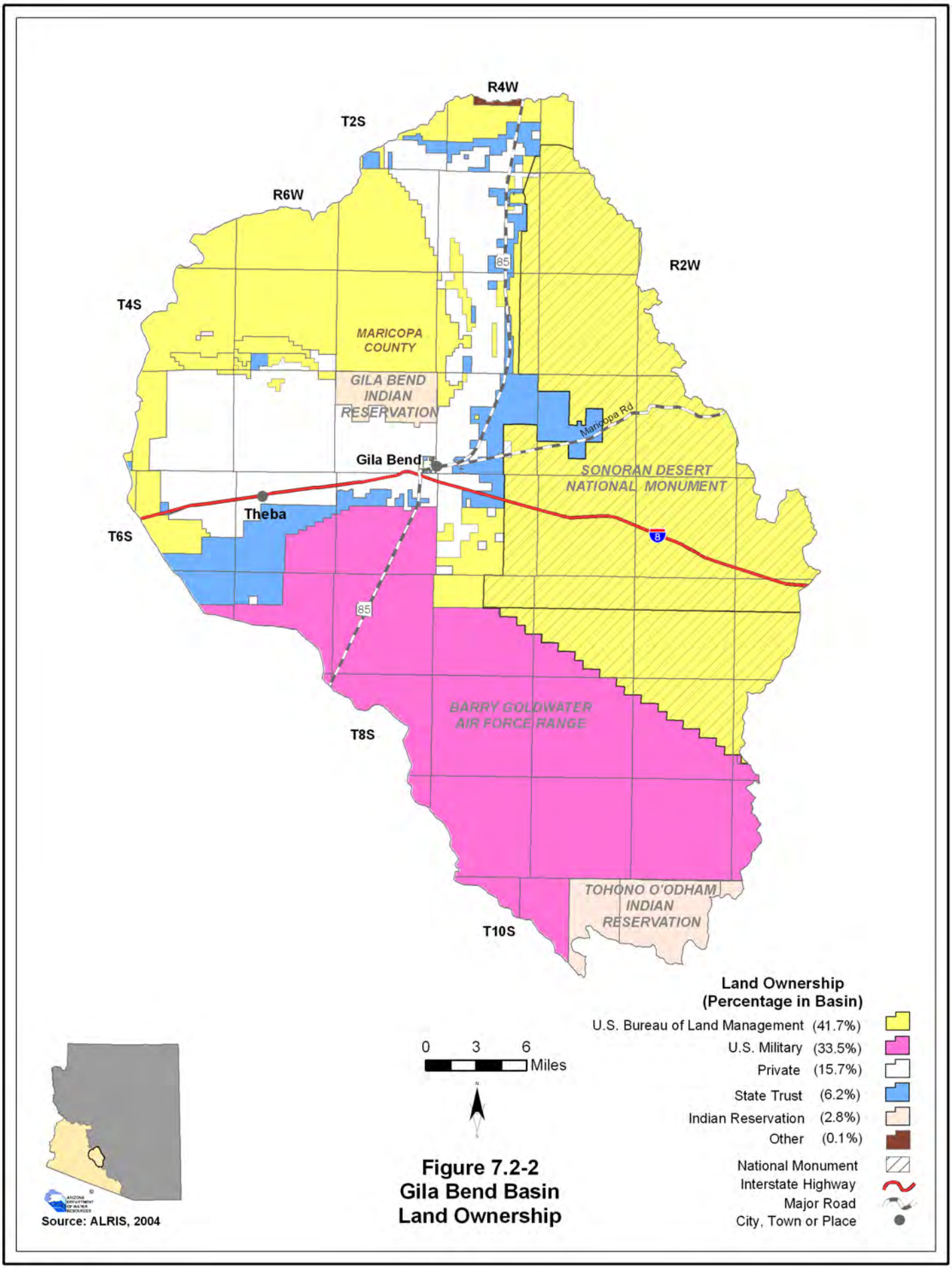


Figure 7.2-2
Gila Bend Basin
Land Ownership

7.2.3 Climate of the Gila Bend Basin

Climate data from NOAA/NWS Co-op Network and AZMET stations are complied in Table 7.2-1 and the locations are shown on Figure 7.2-3. Figure 7.2-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Gila Bend Basin does not contain Evaporation Pan or SNOTEL/ Snowcourse stations. A description of the climate data sources and methods is found in Volume 1, Section 1.3.3.

NOAA/NWS Co-op Network

- Refer to Table 7.2-1A
- There is one NOAA/NWS Co-op Network station in the basin, Gila Bend, with an annual high temperature of 94.1°F and an average annual low of 55.0°F.
- Highest average seasonal rainfall, 2.49 inches, occurs in both the summer (July-September) and fall (October-December) seasons when 66% of the annual average precipitation occurs.

AZMET

- Refer to Table 7.2-1C
- There is one evaporation pan station in the basin, Paloma. This pan is at 719 feet and has an annual evaporation rate of 76.53 inches.

SCAS Precipitation Data

- See Figure 7.2-3
- Additional precipitation data shows average annual rainfall as high as 14 inches at the southeastern tip of the basin and as low as four inches along the western basin boundary.

Table 7.2-1 Climate Data for the Gila Bend 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
Gila Bend	730	1971 - 2000	94.1/Jul	55.0/Dec, Jan	2.21	0.39	2.49	2.49	7.01

Source: WRCC, 2003

B. Evaporation Pan:

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

Source: WRCC, 2003

C. AZMET:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Annual Reference Evaportranspiration, in inches (N*umber of years to calculate averages*)
Paloma	719	1992 - current	76.53 *(6)*

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: NRCS, 2005

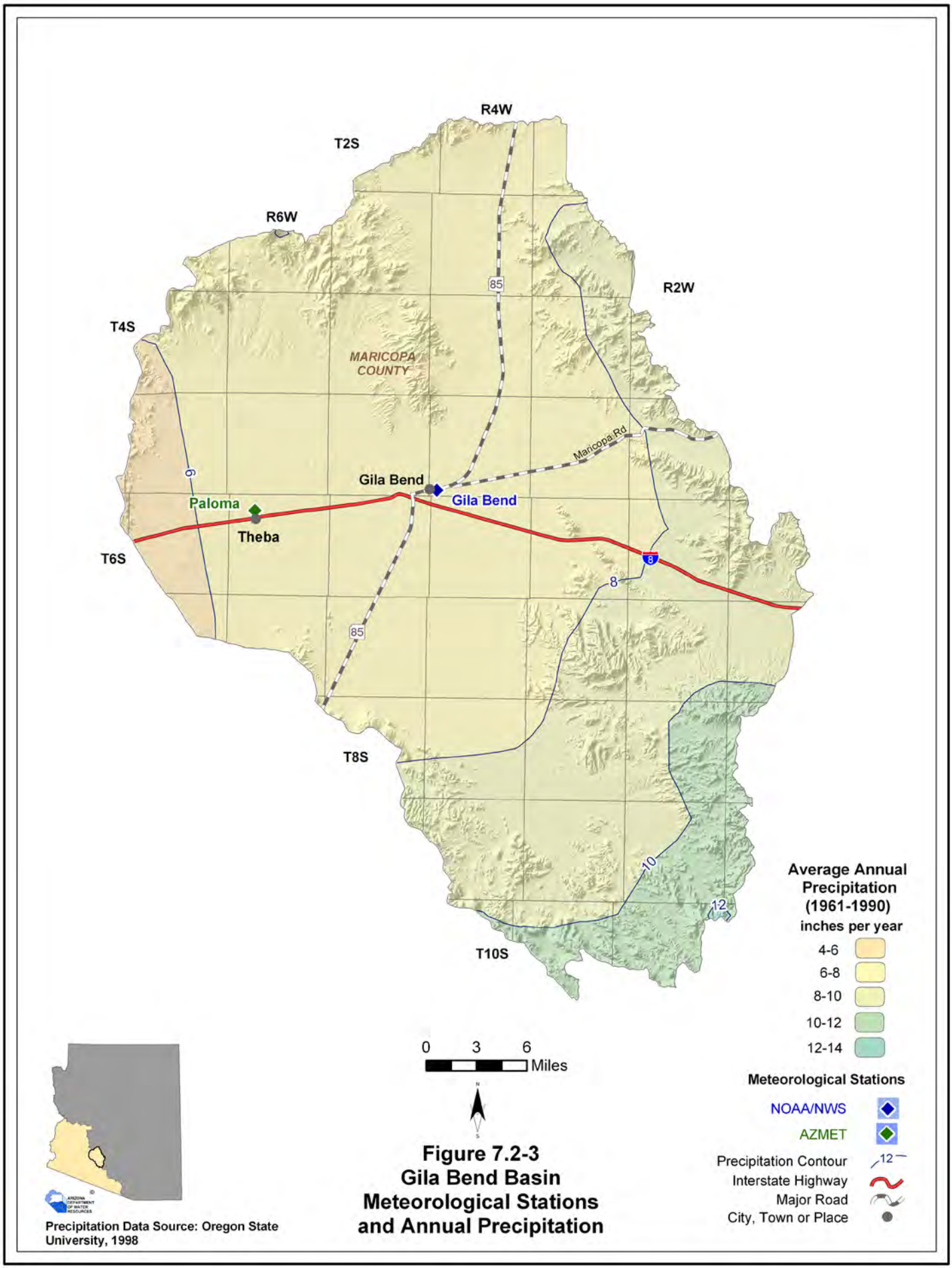


Figure 7.2-3
Gila Bend Basin
Meteorological Stations
and Annual Precipitation

7.2.4 Surface Water Conditions in the Gila Bend Basin

Streamflow data, including average seasonal flow, average annual flow and other information are shown in Table 7.2-2. Flood ALERT equipment in the basin is shown in Table 7.2-3. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 7.2-4. The location of streamflow gages identified by USGS number, flood ALERT equipment, USGS runoff contours and large reservoirs are shown on Figure 7.2-5. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Streamflow Data

- Refer to Table 7.2-2.
- Data from three stations located at two watercourses are shown in the table and on Figure 7.2-5.
- Average seasonal flow varies. At the Gila River stations most of the average seasonal flow occurs during winter (January-March) or spring (April-June). At the Sauceda Wash near Gila Bend station, with a small, local drainage area, 86% of the average seasonal flow occurs in the summer season (July-September) and no flow occurs in the spring season (April-June).
- The largest annual flow recorded in the basin is 5.7 million acre-feet in 1993 at the Gila River below Gillespie Dam station with a contributing drainage area of 49,650 square miles. Gillespie Dam was breached during the 1993 flood. See Figure 7.2-4.

Flood ALERT Equipment

- Refer to Table 7.2-3.
- Most of the nine ALERT gages in the Gila Bend Basin are located along the Gila River and its tributaries.

Reservoirs and Stockponds

- Refer to Table 7.2-4.
- The basin contains one large reservoir, Painted Rock, with a maximum storage of 4,831,500 acre-feet. This reservoir is used for flood control and is only filled during flood events.
- Surface water is stored or could be stored in two small reservoirs in the basin.
- There are 24 registered stockponds in this basin.

Runoff Contour

- Refer to Figure 7.2-4.
- Average annual runoff is highest, 0.2 inches per year or 10.66 acre-feet per square mile, in the southernmost portion of the basin and decreases to 0.1 inches, or five acre-feet per square mile, in the remainder of the basin.

Figure 7.2-4 Hydrograph of annual flows for Gila River below Gillespie Dam Station (#9519500), water years 1960-2003

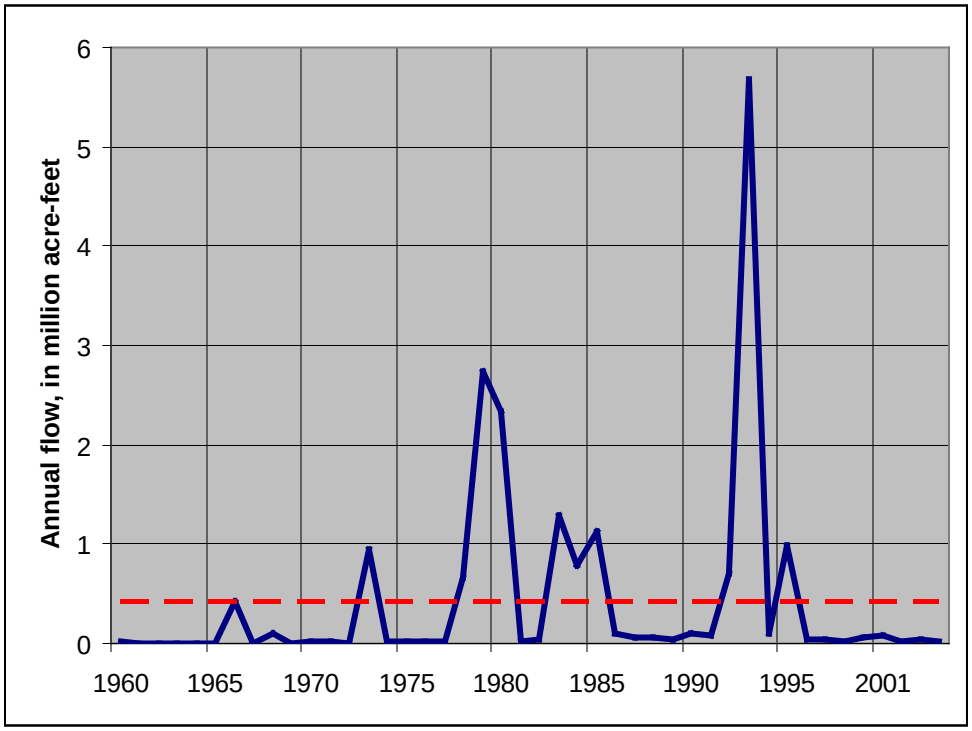


Table 7.2-2 Streamflow Data for the Gila Bend Basin

Station Number	USGS Station Name	Drainage Area (in mi^2)	Mean Basin Elevation (in feet)	Period of Record	Average Seasonal Flow (% of annual flow)				Annual Flow/Year (in acre-feet)				Years of Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
9519500	Gila River below Gillespie Dam	49,650	NA	8/1921-9/2004	66	13	7	13	0 (1956)	43,185	327,935	5,675,984 (1993)	80
9519760	Sauceda Wash near Gila Bend	126	1,980	10/1989-9/1994 (discontinued)	6	0	83	10	4 (1992)	195	385	1,144 (1990)	4
9519800	Gila River below Painted Rock Dam	50,910	NA	10/1959-2003	36	36	16	13	0 (1962, 2002)	5,185	330,347	5,088,672 (1993)	43

Sources: USGS NWIS, USGS 1998 and USGS 2003.

Notes:
NA = Not available
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 years 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

Table 7.2-3 Flood ALERT Equipment in the Gila Bend Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
5060	G&F Woolsey Peak	Weather Station/Stage	6/25/2003	Maricopa County FCD
6905	Gillespie Dam	Precipitation	4/12/1994	Maricopa County FCD
6910	Gila Bend Landfill	Weather Station	4/7/1993	Maricopa County FCD
6920	Sauceda Wash	Precipitation/Stage	2/28/1990	Maricopa County FCD
6930	Sand Tank @ I-8	Precipitation/Stage	6/28/2001	Maricopa County FCD
6940	Sand Tank Wash	Precipitation	7/21/1983	Maricopa County FCD
6950	Rainbow Wash	Precipitation/Stage	11/6/2000	Maricopa County FCD
6955	Maricopa Mountains	Precipitation	4/21/2005	Maricopa County FCD
6960	Bender Wash	Precipitation/Stage	1/12/1982	Maricopa County FCD

Notes:
FCD = Flood Control District

Table 7.2-4 Reservoirs and Stockponds in the Gila Bend 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	Painted Rock	Bureau of Reclamation	4,831,500	C	Federal

Source: U.S. Army Corps of Engineers 2005

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

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

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

Total number: 2
Total maximum storage: 171 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: 24

Notes:
[1]C = Flood control

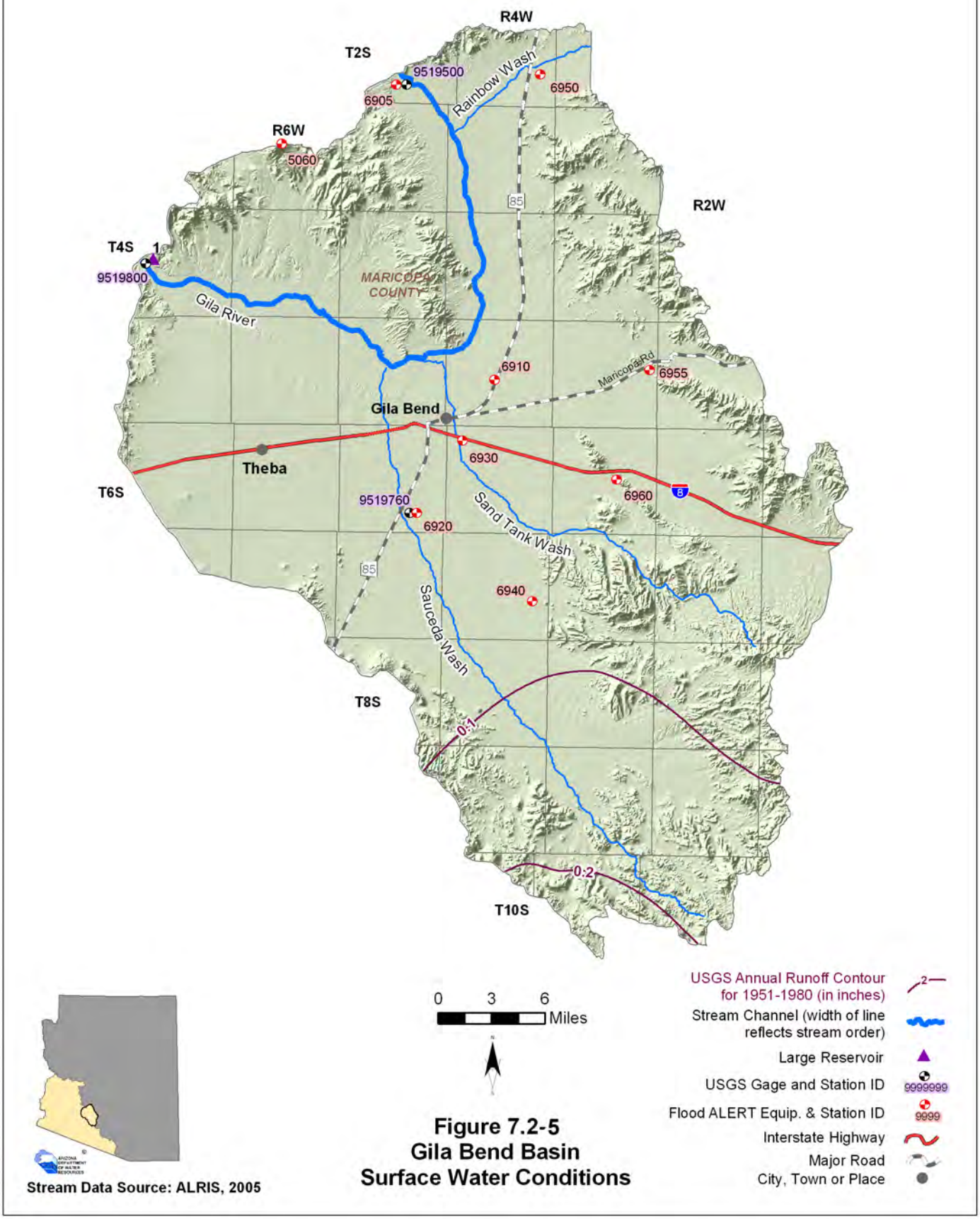


Figure 7.2-5
Gila Bend Basin
Surface Water Conditions

7.2.5 Perennial/Intermittent Streams and Major Springs in the Gila Bend Basin

The total number of springs in the basin are shown in Table 7.2-5. The locations of perennial streams are shown on Figure 7.2-6. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, Section 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- There are no perennial streams and one intermittent stream, the Gila 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 zero to one, depending on the database reference.

Table 7.2-5 Springs in the Gila Bend 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, 2005 and USGS, 2006): 0 - 1

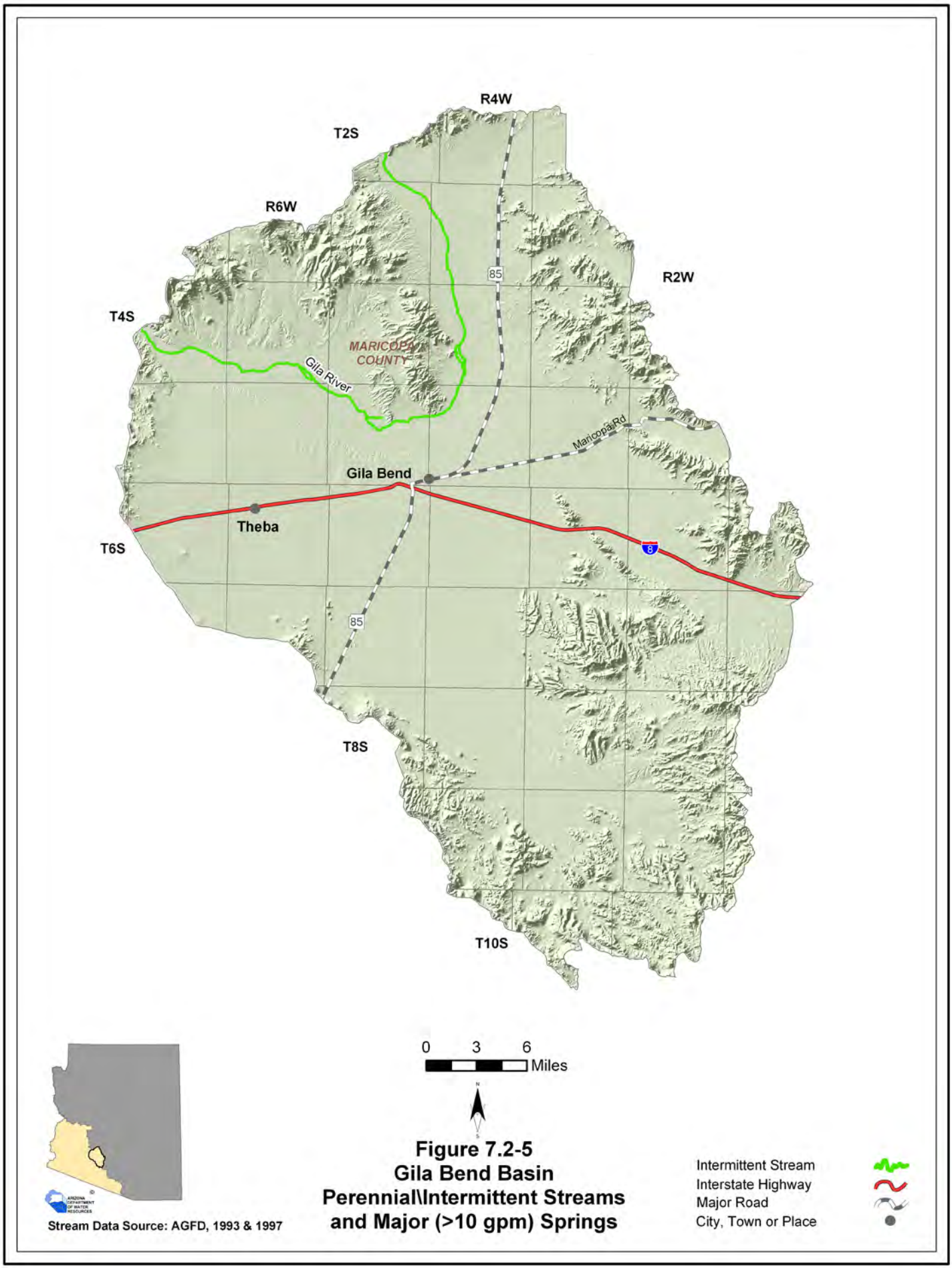


Figure 7.2-5
Gila Bend Basin
Perennial\Intermittent Streams and Major (>10 gpm) Springs

7.2.6 Groundwater Conditions of the Gila Bend Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.2-6. Figure 7.2-7 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 7.2-8 contains hydrographs for selected wells shown on Figure 7.2-7. Figure 7.2-9 shows well yields in five yield categories. A description of aquifer data sources and methods is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields, is found in Volume 1, Section 1.3.19.

Major Aquifers

- Refer to Table 7.2-6 and Figure 7.2-7
- The major aquifer is basin fill.
- Flow direction is from north to southwest in the center of the basin and from the west to east in the northern portion of the basin.

Well Yields

- Refer to Table 7.2-6 and Figure 7.2-9
- As shown on Figure 7.2-9, well yields are generally greater than 2,000 gallons per minute (gpm).
- One source of well yield information, based on 242 reported wells, indicates that the median well yield is 2,700 gpm.

Natural Recharge

- Refer to Table 7.2-6
- There are three estimates of natural recharge for this basin ranging from 10,000 acre-feet per year to 37,000 acre-feet per year.
- The largest source of natural recharge in the basin occurs from Gila River flood events and infiltration of water impounded behind Painted Rock Dam (ADWR 1994).

Water in Storage

- Refer to Table 7.2-6
- There are three estimates of water in storage ranging from 17 million acre-feet to 61 million acre-feet, both to a depth of 1,200 feet.

Water Level

- Refer to Figure 7.2-7. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 31 index wells in this basin, hydrographs for seven index wells are shown on Figure 7.2-8.
- The deepest water level shown on the map is 639 feet south of Maricopa Road and the shallowest is 34 feet near the western basin boundary.

Table 7.2-6 Groundwater Data for the Gila Bend Basin

Basin Area, in square miles:	1,284	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
Well Yields, in gal/min:	Range 300-4,266 Median 2,221 (107 wells measured)	Measured by ADWR and/or USGS
	Range 7-5,800 Median 2,700 (242 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	Range 300-3,000	ADWR (1990)
	Range 0-2,500	USGS (1994)
	Range 1,000-5,000	ADWR HMS 29 (1996)
Estimated Natural Recharge, in acre-feet/year:	26,000	ADWR (1996)
	37,000	Freethey and Anderson (1986)
	10,000	Arizona Water Commission (1975)
Estimated Water Currently in Storage, in acre-feet:	27,600,000 (to 1,200 ft)	ADWR (1994)
	17,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	61,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
Current Number of Index Wells:	31	
Date of Last Water-level Sweep:	1993 (218 wells measured)	

[1]Predevelopment Estimate

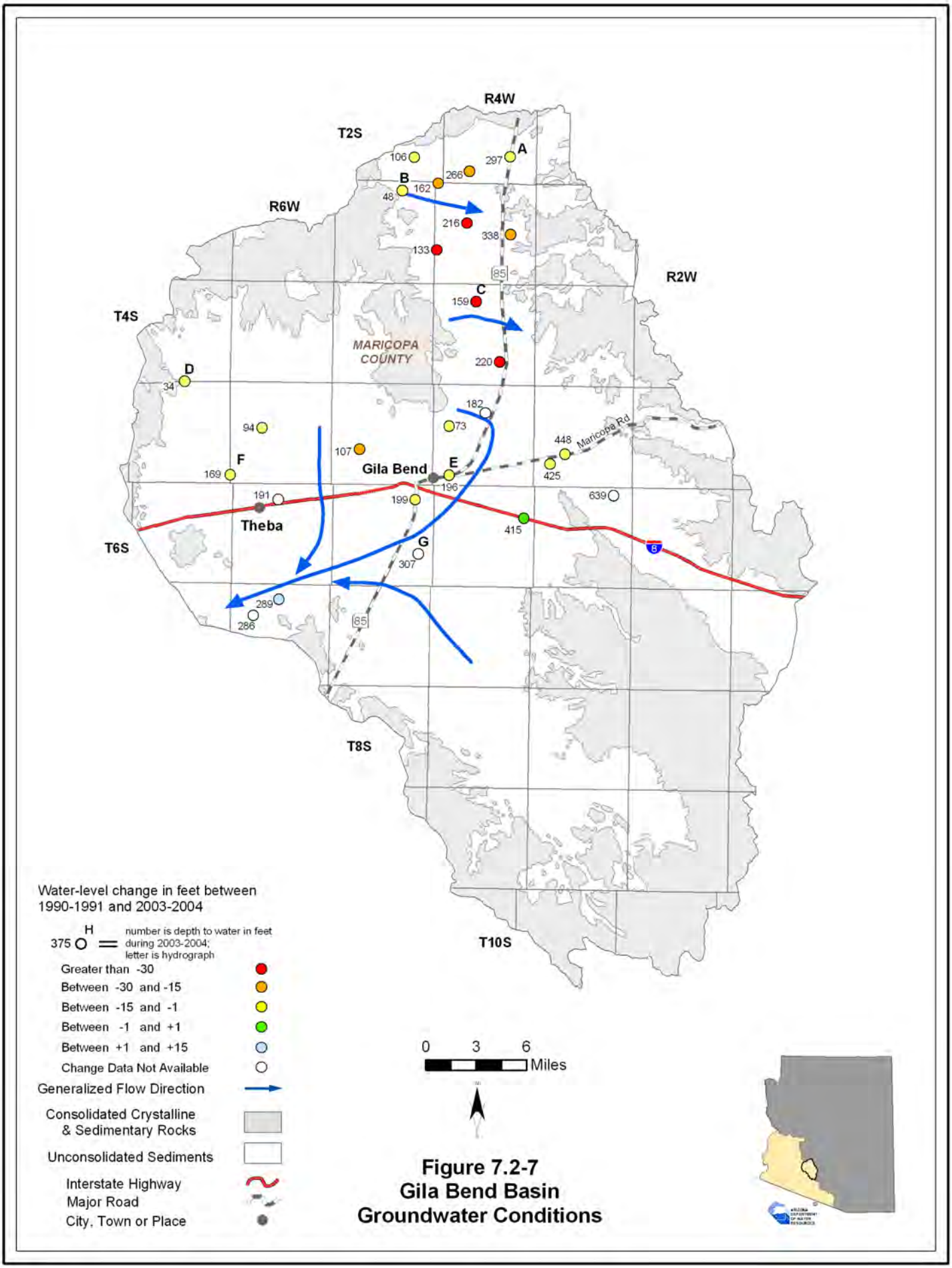


Figure 7.2-7
Gila Bend Basin
Groundwater Conditions

Figure 7.2-8
Gila Bend Basin
Hydrographs Showing Depth to Water in Selected Wells

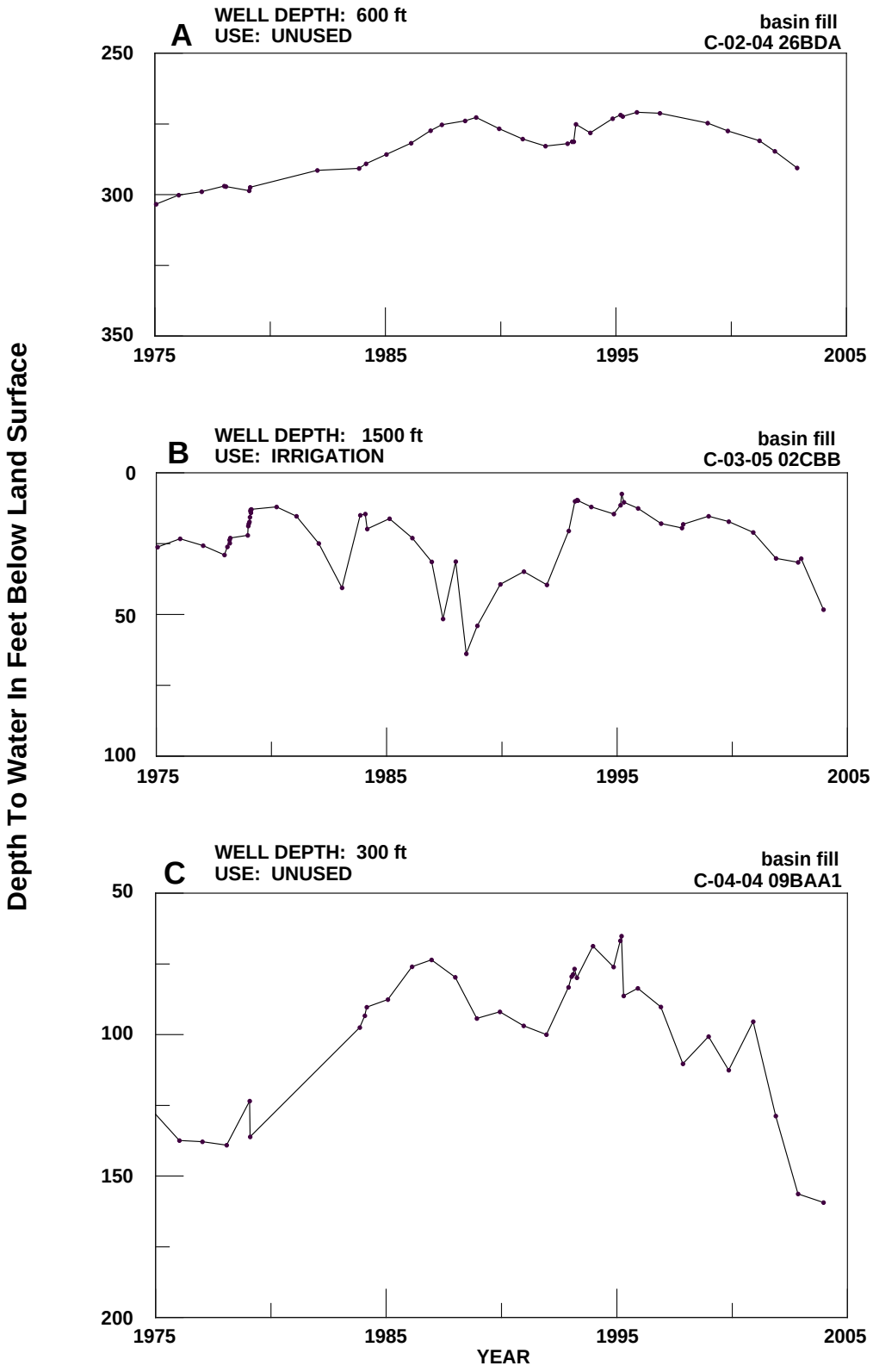
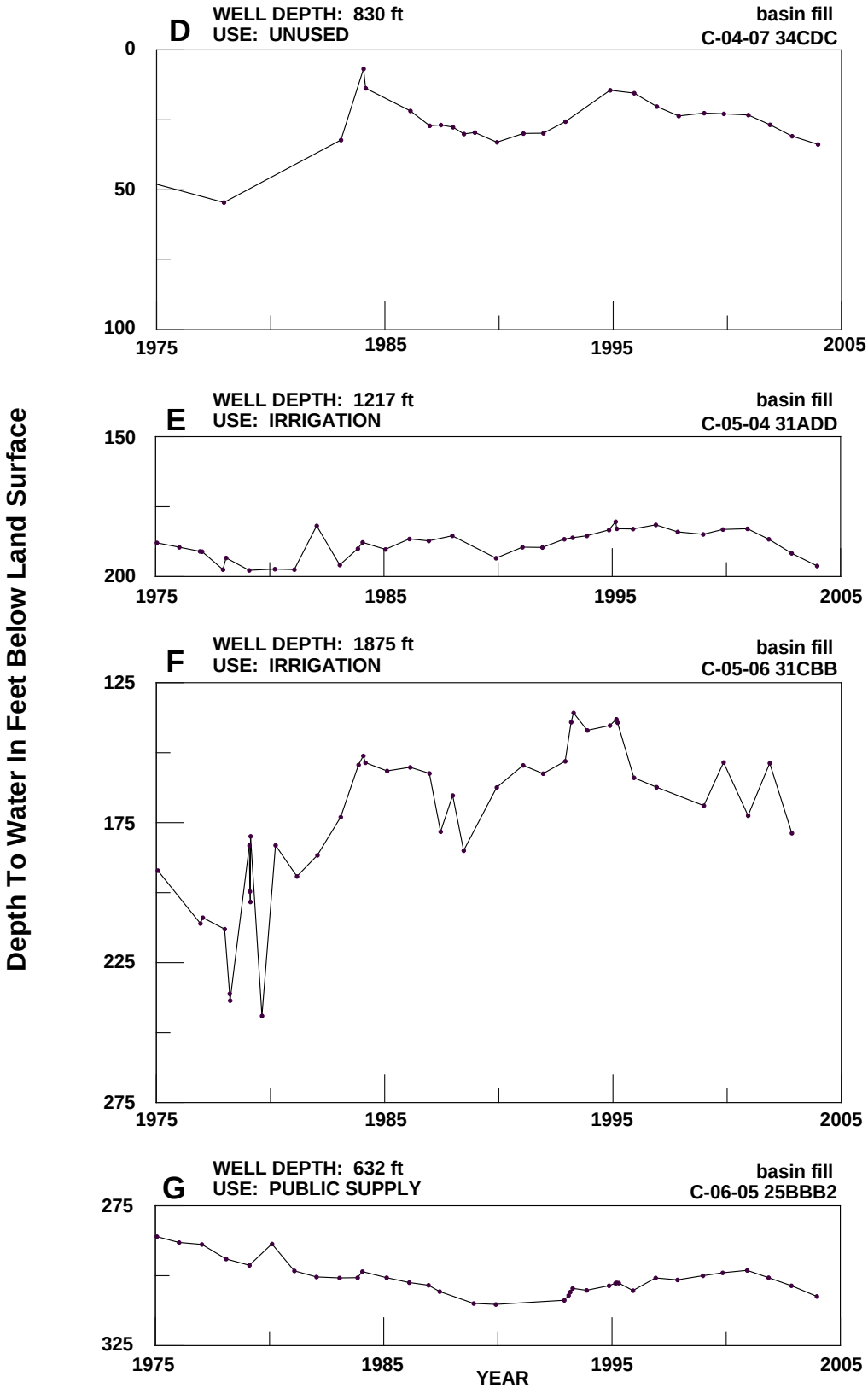


Figure 7.2-8 (cont'd)
Gila Bend Basin
Hydrographs Showing Depth to Water in Selected Wells



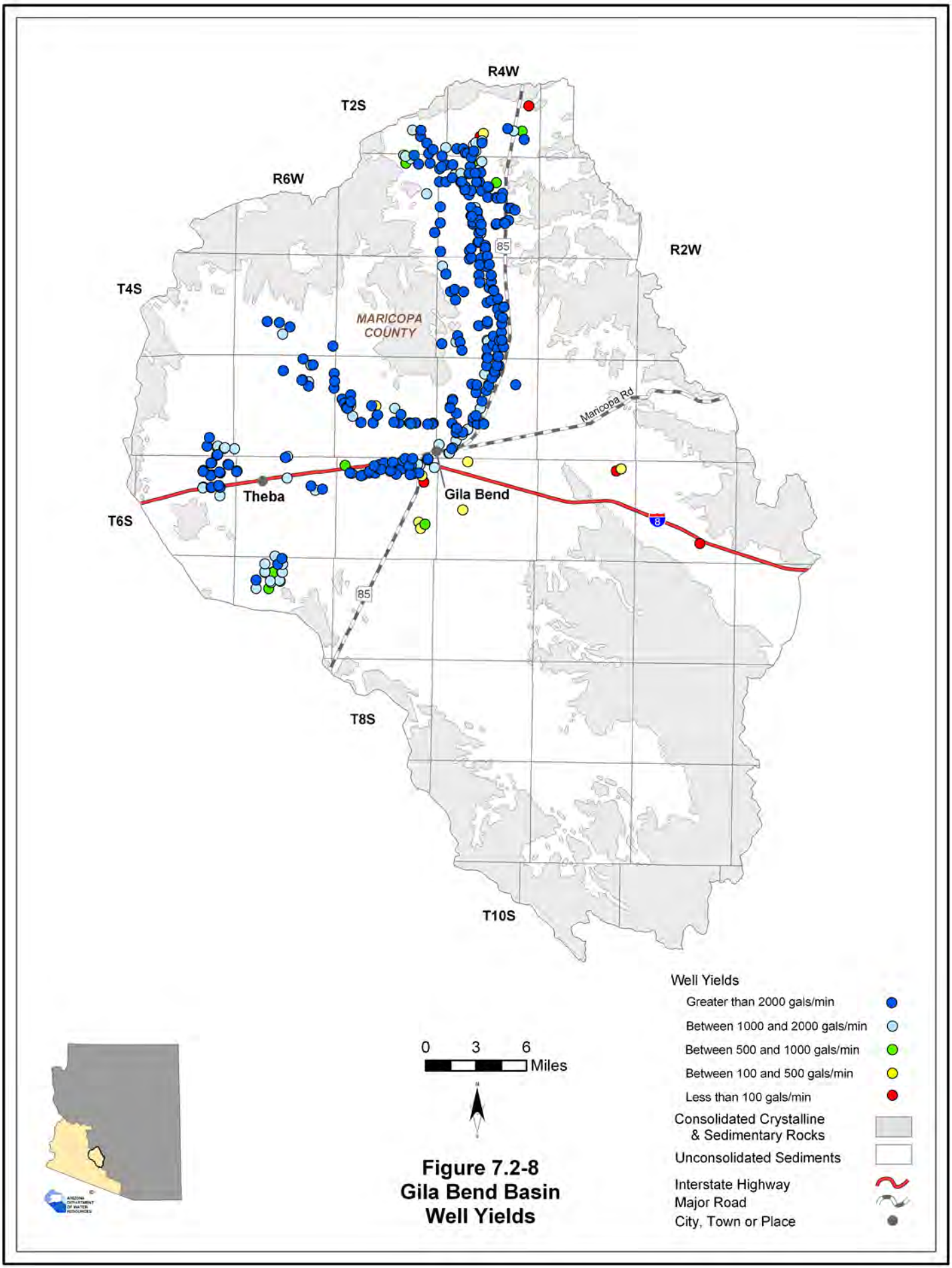


Figure 7.2-8
Gila Bend Basin
Well Yields

7.2.7 Water Quality of the Gila Bend 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 7.2-7A. 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 7.2-7B. Figure 7.2-10 shows the location of water quality occurrences keyed to Table 7.2-7. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mine Sites

- Refer to Table 7.2-7A.
- One hundred and twenty-two wells have parameter concentrations that have equaled or exceeded drinking water standards.
- Ninety-two percent of the wells measured equaled or exceeded the parameter for fluoride.
- Other parameters equaled or exceeded include arsenic, nitrate, mercury, selenium and total dissolved solids.

Lakes and Streams

- Refer to Table 7.2-7B.
- The water quality standard for organics was equaled or exceeded in three reaches of the Gila River totaling 41 miles. The standard for organics was also equaled or exceeded in 100 acres of the Painted Rock Reservoir.
- None of the reaches or the lake are part of the ADEQ water quality improvement effort, the Total Maximum Daily Load (TMDL) Program, at this time.

Effluent Dependent Reaches

- See Figure 7.2-10
- There is one effluent dependent reach north of Gila Bend. This reach receives effluent from the Gila Bend Wastewater Treatment Plant.

Table 7.2-7 Water Quality Exceedences in the Gila Bend Basin[1]

A. Wells, Springs and Mines

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

Table 7.2-7 Water Quality Exceedences in the Gila Bend Basin (cont'd.)[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
46	Well	5 South	4 West	31	As, F, Hg
47	Well	5 South	4 West	31	F
48	Well	5 South	5 West	18	TDS
49	Well	5 South	5 West	18	F
50	Well	5 South	5 West	19	F
51	Well	5 South	5 West	20	F
52	Well	5 South	5 West	21	F
53	Well	5 South	5 West	22	F
54	Well	5 South	5 West	22	F
55	Well	5 South	5 West	23	F
56	Well	5 South	5 West	24	F
57	Well	5 South	5 West	24	F
58	Well	5 South	5 West	36	F
59	Well	5 South	6 West	3	F
60	Well	5 South	6 West	11	F
61	Well	5 South	6 West	11	F
62	Well	5 South	6 West	16	TDS
63	Well	5 South	6 West	31	F, As
64	Well	5 South	6 West	31	F
65	Well	5 South	6 West	34	F, TDS
66	Well	5 South	7 West	26	F
67	Well	5 South	7 West	35	F
68	Well	5 South	7 West	35	F
69	Well	5 South	7 West	36	F
70	Well	5 South	7 West	36	F
71	Well	5 South	7 West	36	F
72	Well	6 South	3 West	18	As, F
73	Well	6 South	3 West	19	F
74	Well	6 South	4 West	20	F
75	Well	6 South	4 West	20	As, F
76	Well	6 South	4 West	20	F
77	Well	6 South	5 West	2	F
78	Well	6 South	5 West	2	F
79	Well	6 South	5 West	2	F
80	Well	6 South	5 West	2	As, F
81	Well	6 South	5 West	2	F
82	Well	6 South	5 West	2	F
83	Well	6 South	5 West	3	F
84	Well	6 South	5 West	3	F
85	Well	6 South	5 West	3	F
86	Well	6 South	5 West	3	F
87	Well	6 South	5 West	4	As, F
88	Well	6 South	5 West	4	As, F
89	Well	6 South	5 West	4	F

Table 7.2-7 Water Quality Exceedences in the Gila Bend Basin (cont'd.)[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
90	Well	6 South	5 West	5	F
91	Well	6 South	5 West	6	F, NO3, TDS
92	Well	6 South	5 West	8	As, F
93	Well	6 South	5 West	25	As, F
94	Well	6 South	6 West	4	F
95	Well	6 South	6 West	4	F
96	Well	6 South	6 West	6	F
97	Well	6 South	6 West	10	F, Se
98	Well	6 South	6 West	11	F
99	Well	6 South	6 West	33	As, F
100	Well	6 South	7 West	2	F
101	Well	6 South	7 West	2	F
102	Well	6 South	7 West	11	F
103	Well	6 South	7 West	11	As, F
104	Well	6 South	7 West	11	F
105	Well	6 South	7 West	11	F
106	Well	6 South	7 West	12	F
107	Well	7 South	6 West	4	As, F
108	Well	7 South	6 West	4	As
109	Well	7 South	6 West	4	As, F
110	Well	7 South	6 West	4	F
111	Well	7 South	6 West	4	F
112	Well	7 South	6 West	5	F
113	Well	7 South	6 West	5	F
114	Well	7 South	6 West	8	As, F
115	Well	7 South	6 West	8	As, F
116	Well	7 South	6 West	9	As, F
117	Well	7 South	6 West	9	As, F
118	Well	7 South	6 West	9	As
119	Well	7 South	6 West	9	F
120	Well	7 South	6 West	9	F
121	Well	7 South	6 West	9	F
122	Well	7 South	6 West	9	As, F

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[3]	Parameter(s) Exceeding Use Standard[2]
a	Stream	Gila River (Gillespie Dam to Rainbow Wash)	5	NA	FC	Organics
b	Stream	Gila River (Rainbow Wash to Sand Tank)	17	NA	FC	Organics
c	Stream	Gila River (Sand Tank to Painted Rock Reservoir)	19	NA	FC	Organics

Table 7.2-7 Water Quality Exceedences in the Gila Bend Basin (cont'd.)[1]

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[3]	Parameter(s) Exceeding Use Standard[2]
d	Lake	Painted Rock Reservoir	NA	100	FC	Organics

Notes:

[1] Water quality samples collected between 1975 and 2001.
[2] As = Arsenic
NO3 = Nitrate/ Nitrite
F = Fluoride
Hg = Mercury
Organics = One or more of several volatile and semi-volatile organic compounds and pesticides
Se = Selenium
TDS = Total Dissolved Solids
[3] FC = Fish Consumption

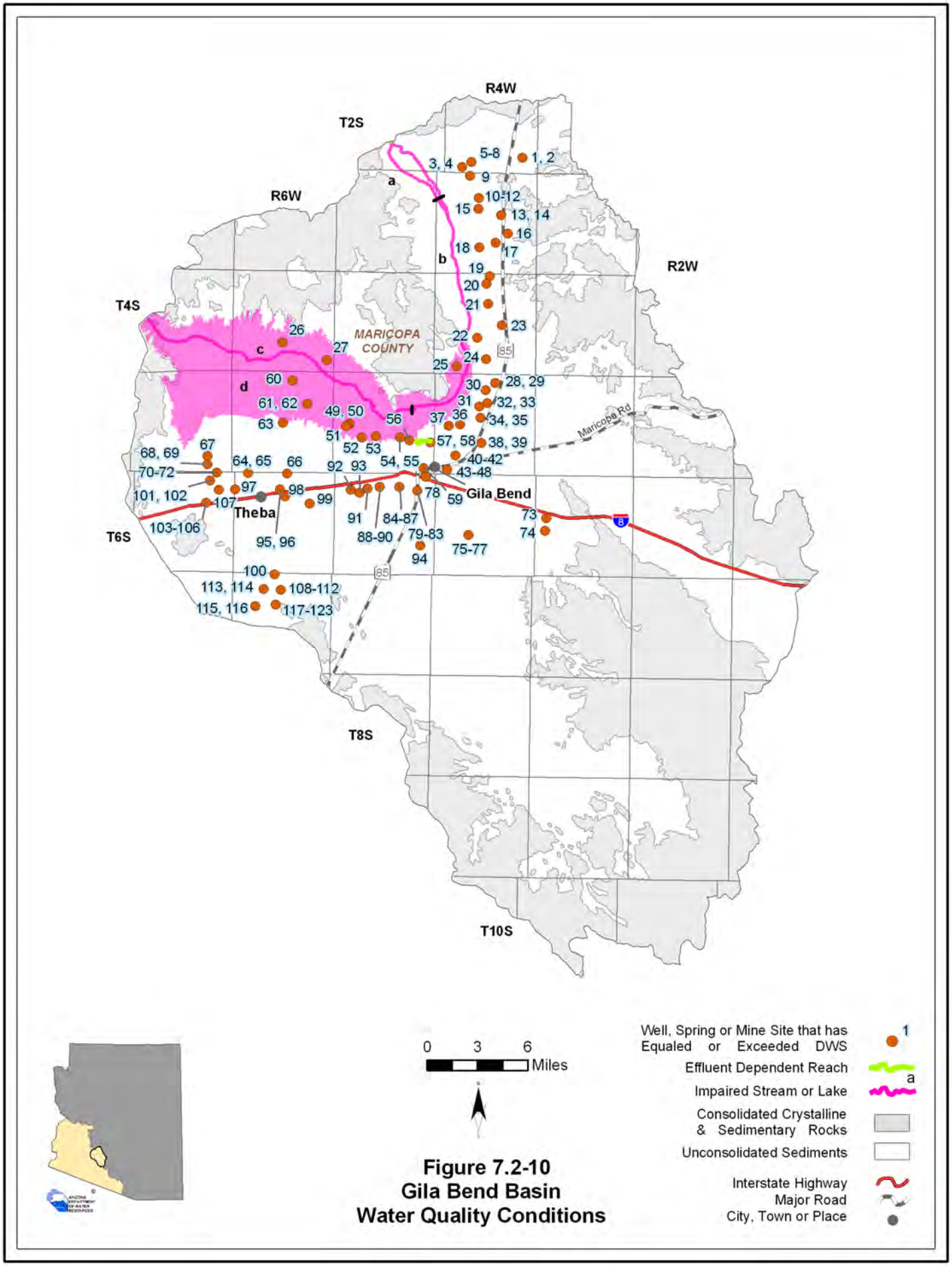


Figure 7.2-10
Gila Bend Basin
Water Quality Conditions

7.2.8 Cultural Water Demands in the Gila Bend 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 7.2-8. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown in Table 7.2-9. Figure 7.2-11 shows the location of demand centers. A description of cultural water demand data sources and methods is found in Volume 1, Section 1.3.5. More detailed information on cultural water demands is found in Section 7.0.7.

Cultural Water Demands

- Refer to Table 7.2-8 and Figure 7.2-11.
- Population in this basin decreased from 3,437 in 1980 to 2,791 in 2000. Projections suggest an increase through 2050.
- Most cultural water use is for irrigation in the northern portion of the basin.
- Agricultural groundwater demand increased 23% and surface water demand decreased 24% from 1991 to 2003.
- There was no reported industrial groundwater demand prior to 2003. In 2003 the Gila River Power Plant and the Citrus Valley Dairy began operation, with a combined demand of 5,000 acre-feet. The Painted Rock Dairy began operation in 2004. Its demand is not shown on Table 7.2-8.
- Municipal groundwater demand is small and increased 18% from 1991 to 2003.
- As of 2003 there were 246 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 277 wells with a pumping capacity of more than 35 gallons per minute.

Effluent Generation

- Refer to Table 7.2-9.
- There are four wastewater treatment facilities in this basin.
- Information on population served was available for three facilities and information on the volume of effluent generated was available for two facilities. These facilities serve almost 4,900 people, 3,400 of which are at the Lewis Prison, and generate almost 800 acre-feet of effluent per year.
- Effluent is discharged to evaporation ponds and a watercourse and is not reused.

Table 7.2-8. Cultural Water Demands in the Gila Bend Basin[1]

Year	Recent (Census) and Projected (DES) 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	Irrigation	Municipal	Industrial	Irrigation	
1971		169[2]	243[2]	237,000			78,000			ADWR (1994)
1972										
1973										
1974										
1975										
1976				274,000			102,000			
1977										
1978										
1979										
1980	3,437									
1981	3,402	29	28	245,000			117,000			
1982	3,367									
1983	3,332									
1984	3,297									
1985	3,262									
1986	3,227	4	3	179,000			99,000			
1987	3,192									
1988	3,157									
1989	3,122									
1990	3,087									
1991	3,058	7	3	800	NR	237,000	NR	NR	71,500	USGS (2005) ADWR (2005)
1992	3,028									
1993	2,998									
1994	2,969									
1995	2,939									
1996	2,910	10	0	800	NR	244,000	NR	NR	68,500	
1997	2,880									
1998	2,850									
1999	2,821									
2000	2,791									
2001	2,812	14	0	950	5,000[3]	291,000	NR	NR	54,500	
2002	2,833									
2003	2,854									
2010	3,000									
2020	3,387									
2030	4,620									
2040	6,593									
2050	10,885									
ADDITIONAL WELLS:[4]		**13**								
WELL TOTALS:		**246**	**277**							

[1] Does not include evaporation losses from stockponds and reservoirs.
[2] Includes all wells through 1980.
[3] Water use shown is for the Gila River Power Plant (4,900 acre-feet) and the Citrus Valley Dairy (100 acre-feet) that opened in 2003
[4] Other water-supply wells are listed in the ADWR Well Registry for this basin, but they do not have completion dates. These wells are summed here.
NR - Not reported

Table 7.2-9 Effluent Generation in the Gila Bend Basin

Facility Name	Ownership	City/Location Served	Population Served	Volume Treated/Generated (acre-feet)	Disposal Method							Current Treatment Level	Population Not Served	Year of Record
					Water-course	Evaporation Pond	Irrigation	Golf Course	Wildlife Area	Discharged to Another Facility	Infiltration Basins			
Auxiliary Field	US Air Force	Airfield	70	NA										
Gila Bend WWTP	Gila Bend	Gila Bend	1,400	392	X							Adv. Trt.I	600	2003
Lewis WWTP	Arizona Department of Corrections	Prison	3,400	403		X						NA	NA	2004
Panda Gila River Project	NA	Power plant	NA			X						NA		

NA: Data not currently available to ADWR
WWTP: Waste Water Treatment Plant
Adv. Trt. I: Advanced Treatment Level I

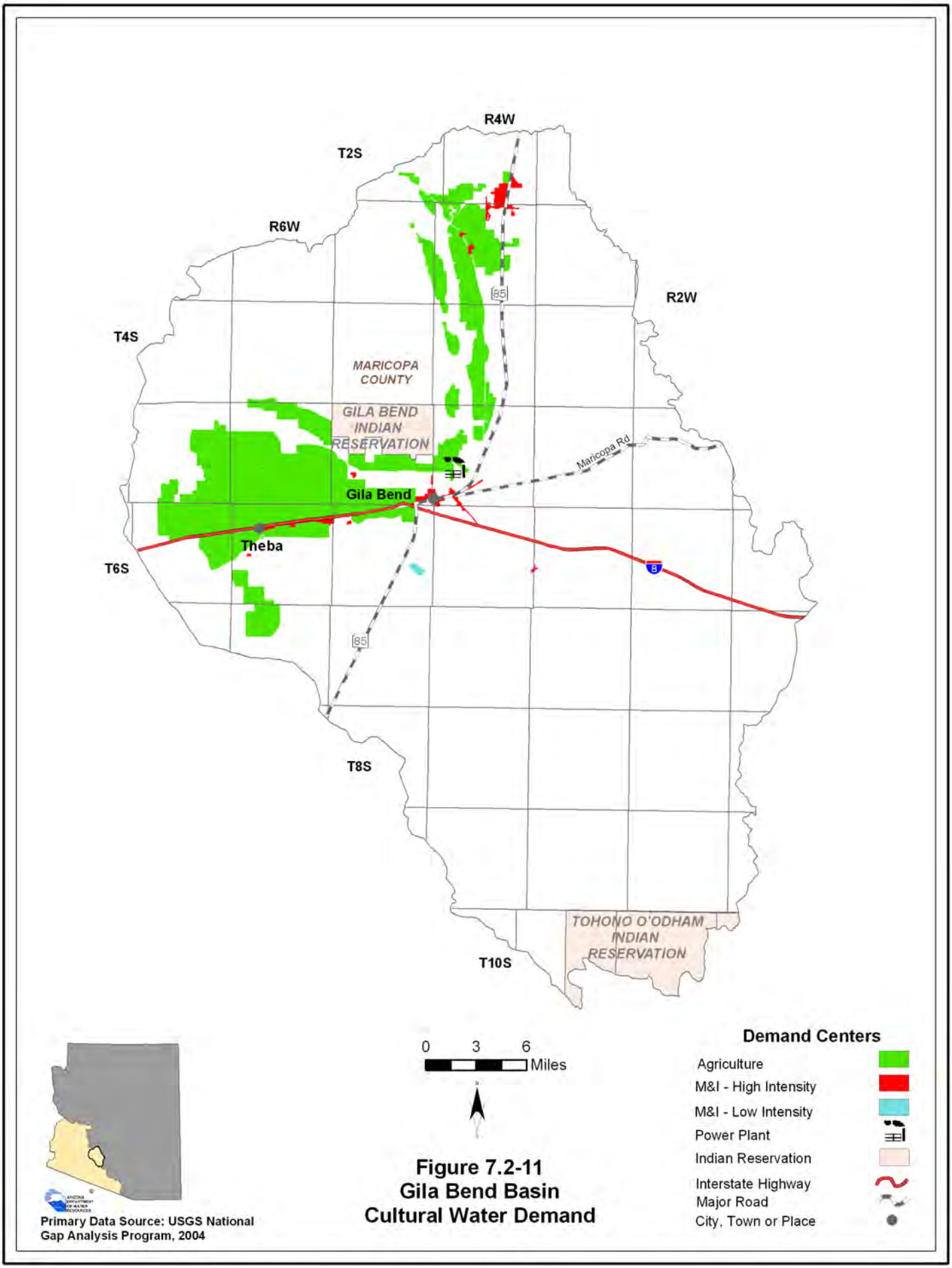


Figure 7.2-11
Gila Bend Basin
Cultural Water Demand

7.2.9 Water Adequacy Determinations in the Gila Bend 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 7.2-10. Figure 7.2-12 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 A. Adequacy determination data sources and methods are found in Volume 1, Sections 1.3.1.

Water Adequacy Reports

- See Table 7.2-10
- As of May 2005, four subdivisions have been reviewed for an adequacy determination. All subdivisions are in Maricopa County.
- Of the 89 lots in three subdivisions for which lot information is available, 24 lots or 27% were determined to be adequate.
- Reasons for a determination of inadequacy included water quality and insufficient data.

Table 7.2-10 Adequacy Determinations in the Gila Bend Basin[1]

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
1	Current Place Unit 1	Maricopa	5 South	4 West	31	30	22-300552	Inadequate	A1	10/23/98	Town of Gila Bend
2	Gila Bend Estates	Maricopa	5 South	5 West	36	35	22-400726	Inadequate	A1, C	07/10/02	Town of Gila Bend
3	Palo Verde Heights Unit I	Maricopa	5 South	4 West	31	24	22-400094	Adequate		06/22/99	Town of Gila Bend
4	Zuni Estates	Maricopa	5 South	5 West	36	NA		Adequate		12/01/75	Town of Gila Bend

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 determination.

[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 unavaible; 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 = Data not currently available to ADWR

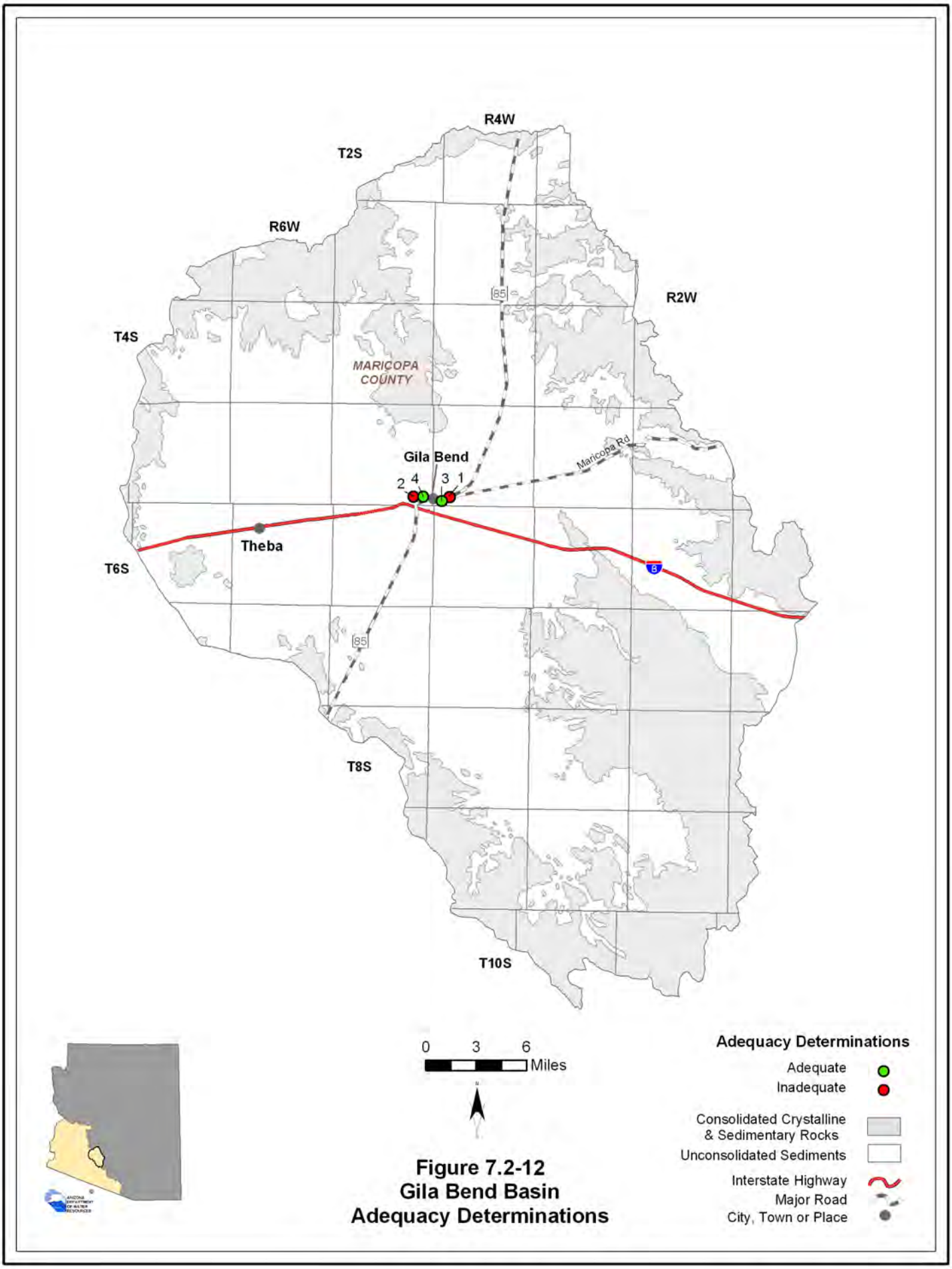


Figure 7.2-12
Gila Bend Basin
Adequacy Determinations

Gila Bend Basin

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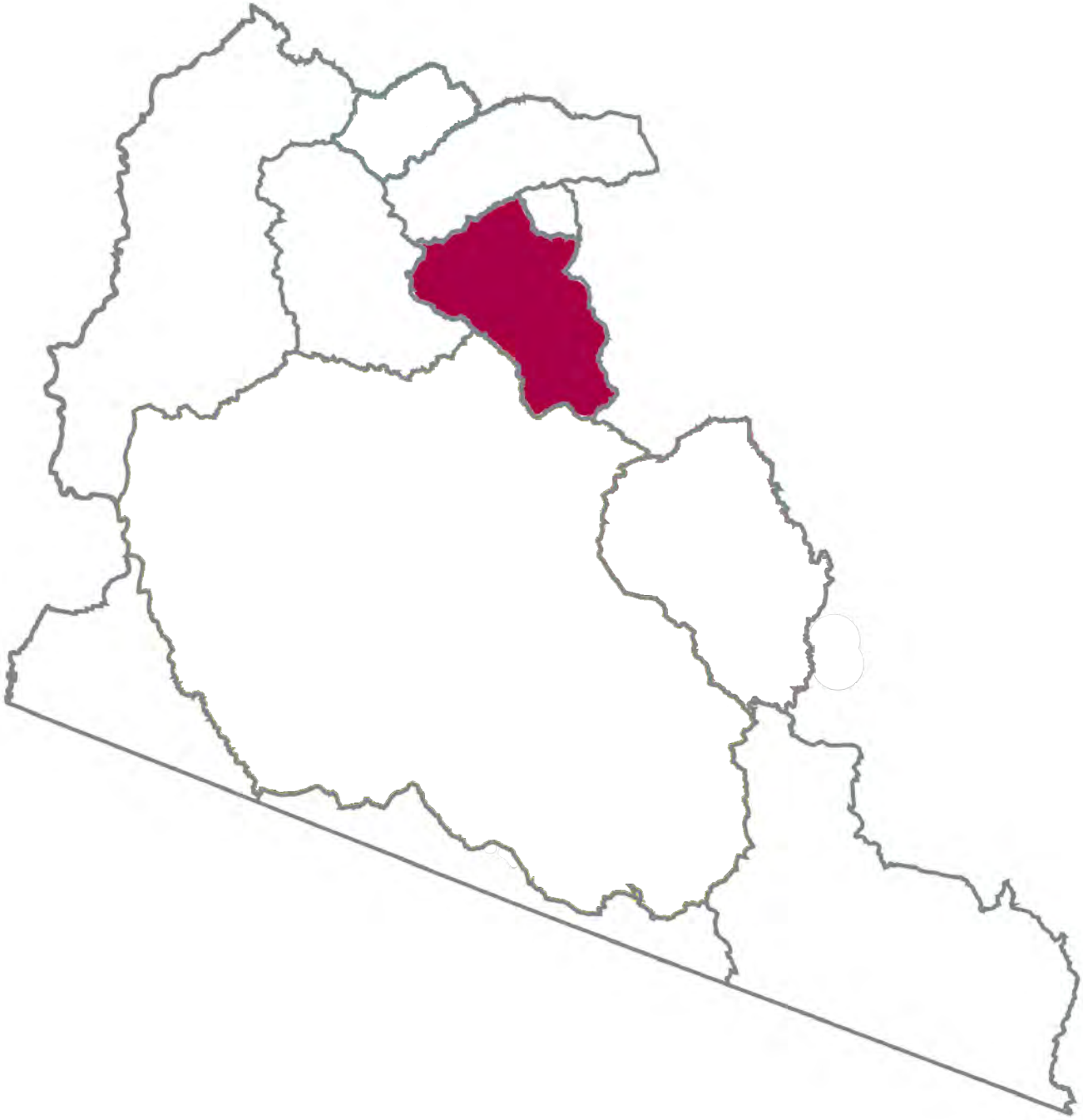
Section 7.3
Harquahala Basin



7.3.1 Geography of the Harquahala Basin

The Harquahala Basin, located in the northeastern part of the planning area, is 766 square miles in area. Geographic features and principal places are shown on Figure 7.3-1. The basin is characterized by a plain bordered by mountain ranges. Vegetation types include Lower Colorado River Valley and Arizona Uplands Sonoran desertscrub and a small amount of southwestern interior chaparral on the northern basin boundary. (See Figure 7.0-7)

- Principal geographic features shown on Figure 7.3-1 are:
    - Basin place of Centennial
    - Centennial Wash running through the center of the basin
    - The Harquahala Plain in the center of the basin bordered by the Big Horn Mountains in the east, the Little Harquahala Mountains in the north and the Eagletail Mountains in the west
    - The highest point in the basin, Big Horn Peak, at 3,480 feet in the Big Horn Mountains
- Not well shown on Figure 7.3-1 is the lowest point in the basin at 1,000 feet where Centennial Wash exits the basin in T4N R12W.

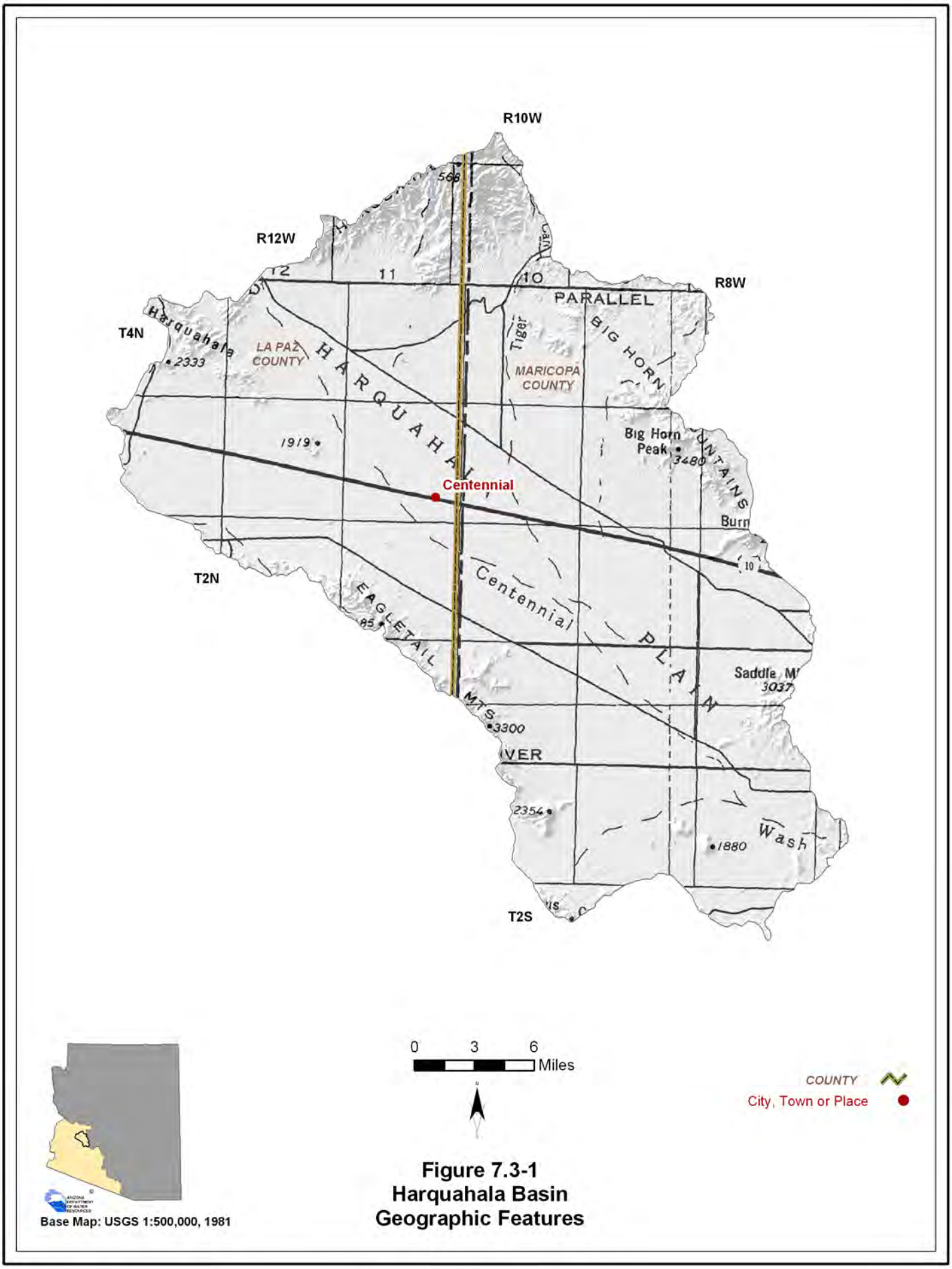


Figure 7.3-1
Harquahala Basin
Geographic Features

7.3.2 Land Ownership in the Harquahala Basin

Land ownership, including the percentage of ownership by category, for the Harquahala Basin is shown in Figure 7.3-2. The principal feature of land ownership in this basin is the large amount of U.S. Bureau of Land Management Land. A description of land ownership data sources and methods is found in Volume 1, Section 1.3.8. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

U.S. Bureau of Land Management (BLM)

- 62.2% of the land is federally owned and managed by the Lower Sonoran Field Office of the Bureau of Land Management.
- This basin contains 52,800 acres of wilderness. This includes 24,000 acres of the 100,000 acre Eagletail Mountains Wilderness, 18,000 acres of the 21,000 acre Big Horn Mountains Wilderness, 5,500 acres of the 31,000 acre Hummingbird Springs Wilderness and 5,300 acres of the 23,000 acre Harquahala Mountains Wilderness. (See Figure 7.0-9)
- Land uses include resource conservation, recreation and grazing.

Private

- 25.1% of the land is private.
- Land uses include domestic, commercial and grazing.

State Trust Land

- 12.6% of the land is held in trust for the public schools, state charitable penal reform and county bonds under the State Trust Land system.
- Primary land use is grazing.

Other

- 0.1% of the land is federally owned by the U.S. Bureau of Reclamation (USBOR)
- USBOR lands are located in the western portion of the basin in the vicinity of Interstate 10 where they surround the Central Arizona Project aqueduct.

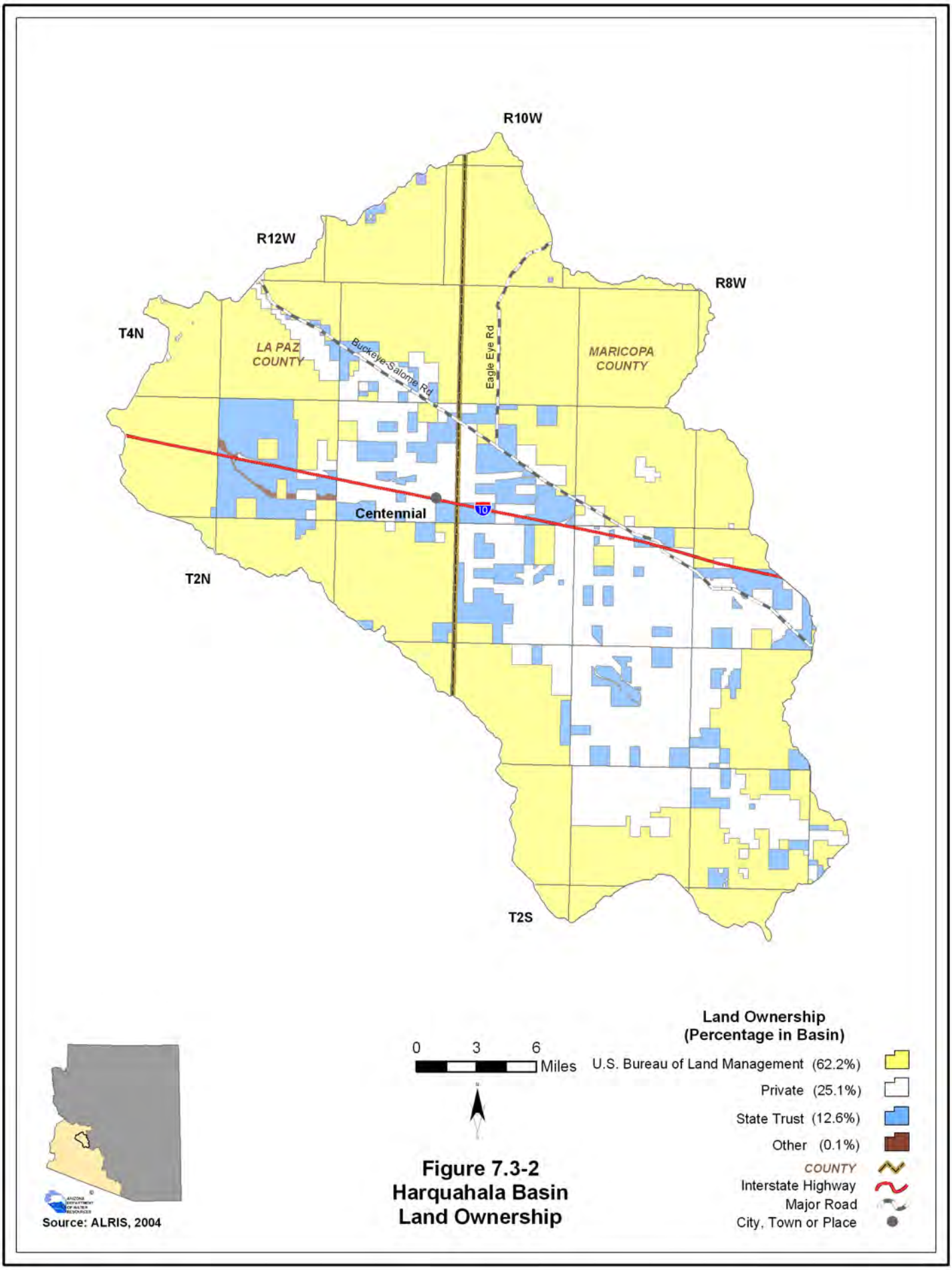


Figure 7.3-2
Harquahala Basin
Land Ownership

7.3.3 Climate of the Harquahala Basin

Climate data from NOAA/NWS Co-op Network and AZMET stations are complied in Table 7.3-1 and the locations are shown on Figure 7.3-3. Figure 7.3-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Harquahala Basin does not contain Evaporation Pan or SNOTEL/ Snowcourse stations. A description of the climate data sources and methods is found in Volume 1, Section 1.3.3.

NOAA/NWS Co-op Network

- Refer to Table 7.3-1A
- Temperatures at the two NOAA/NWS Co-op Network stations in the basin range from an average high of 91.0°F at Salome 17 SE to an average low of 48.0°F at Harquahala Plains.
- Average seasonal rainfall follows a bi-modal pattern with approximately one-third of the average seasonal rainfall occurring in the winter (January-March) season and one-third in the summer (July-September) season. The highest average annual rainfall in the basin is 6.36 inches at the Salome 17 SE station.

AZMET

- Refer to Table 7.3-1C
- There is one AZMET station in the basin, Harquahala. This station is at 1,150 feet and has an annual reference evaportranspiration rate of 82.13 inches.

SCAS Precipitation Data

- See Figure 7.3-3
- Additional precipitation data shows average annual rainfall as high as 18 inches in the Harquahala Mountains at the northern tip of the basin and as low as four inches in the southern and western portions of the basin.

Table 7.3-1 Climate Data for the Harquahala 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
Harquahala Plains	1220	1952 - 1979[1]	89.5/Jul	48.0/Jan	2.03	0.31	2.10	1.71	6.14
Salome 17 SE	1600	1987 - 1998[1]	91.0/Jul	49.1/Dec	2.49	0.43	2.06	1.38	6.36

Source: WRCC, 2003
Notes:
[1]Average temperature data for period of record shown; 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			

Source: WRCC, 2003

C. AZMET:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Annual Reference Evaportranspiration, in inches (N*umber of years to calculate averages*)
Harquahala	1,150	1996 - 2003	82.13 (6)

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: NRCS, 2005

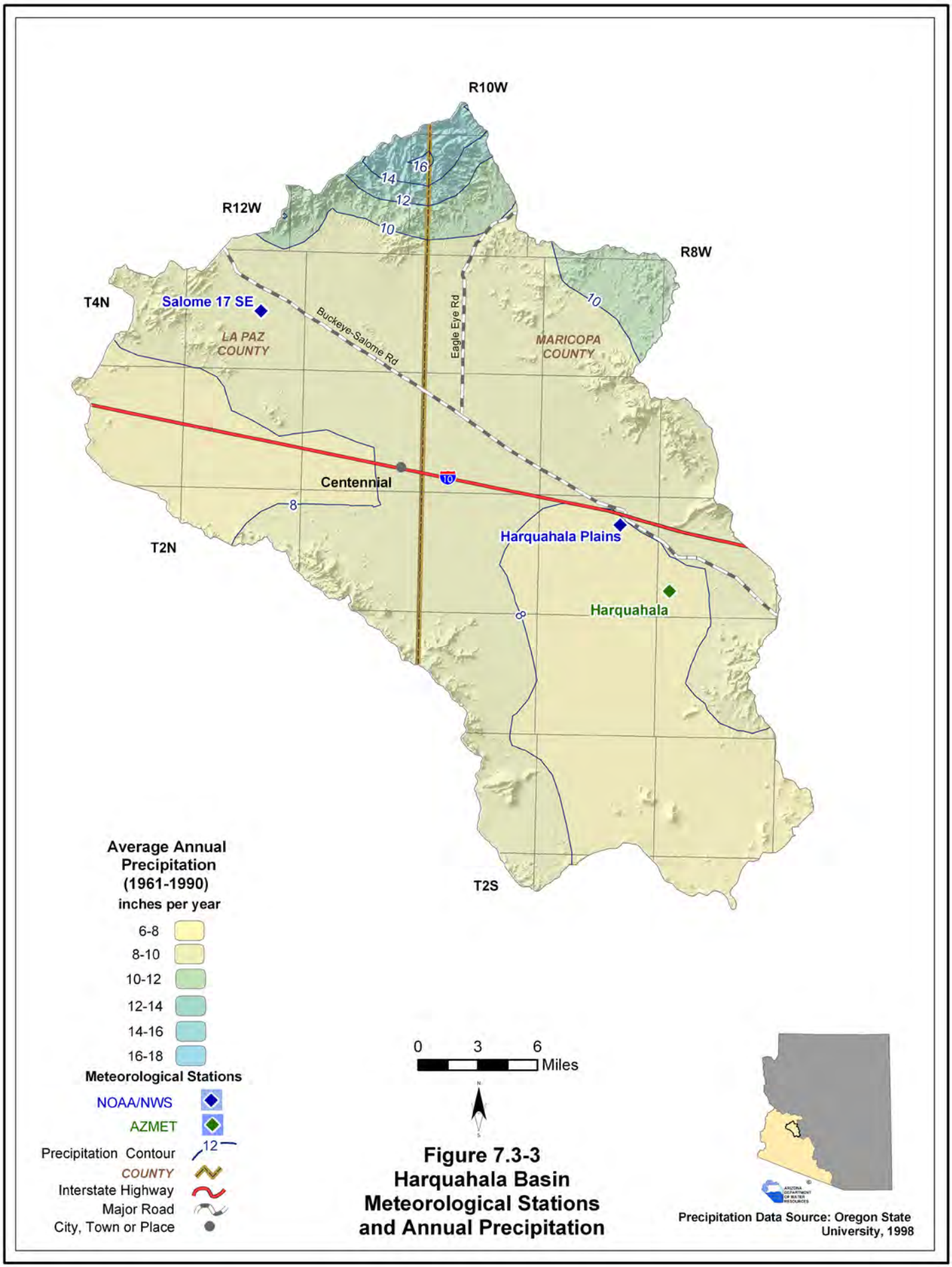


Figure 7.3-3
Harquahala Basin
Meteorological Stations
and Annual Precipitation

7.3.4 Surface Water Conditions in the Harquahala Basin

Flood ALERT equipment in the basin is shown in Table 7.3-3. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 7.3-4. The location of flood ALERT equipment and large reservoirs are shown on Figure 7.3-4. There are no USGS streamflow gages or runoff contour data available for this basin. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Flood ALERT Equipment

- Refer to Table 7.3-3.
- Most of the 10 ALERT gages in Harquahala Basin are located along Centennial Wash and its tributaries.

Reservoirs and Stockponds

- Refer to Table 7.3-4.
- The basin contains one large reservoir, Harquahala FRS, with a maximum storage of 8,000 acre-feet. This reservoir is used for flood control.
- Surface water is stored or could be stored in one small reservoir in the basin.
- There are 42 registered stockponds in this basin.

Table 7.3-2 Streamflow Data for the Harquahala Basin

Station Number	USGS Station Name	Drainage Area (in mi^2)	Mean Basin Elevation (in feet)	Period of Record	Average Seasonal Flow (% of annual flow)				Annual Flow/Year (in acre-feet)				Years of Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
None													

Sources: USGS NWIS, USGS 1998 and USGS 2003.

Table 7.3-3 Flood ALERT Equipment in the Harquahala Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
5065	Eagle Eye Rd. @ CAP	Precipitation	6/17/2003	Maricopa County FCD
5080	Buckeye @ 547th Ave.	Precipitation	6/13/2000	Maricopa County FCD
5085	Baseline @ 547th Ave.	Precipitation	5/24/2000	Maricopa County FCD
5110	Saddleback FRS	Precipitation/Stage	12/16/1988	Maricopa County FCD
5120	Centennial Levee	Precipitation/Stage	3/7/1994	Maricopa County FCD
5125	Harquahala FRS	Precipitation/Stage	9/15/1993	Maricopa County FCD
5140	Tiger Wash Fan	Weather Station	9/21/1994	Maricopa County FCD
5150	Narrows Damsite	Precipitation	9/1/1994	Maricopa County FCD
5160	Tiger Wash	Precipitation/Stage	9/15/1999	Maricopa County FCD
5185	Harquahala Mtn. Repeater	Repeater/Precipitation	2/11/1994	Maricopa County FCD

Notes:
FCD = Flood Control District
FRS = Flood Retention Structure

Table 7.3-4 Reservoirs and Stockponds in the Harquahala 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	Harquahala FRS	Maricopa County FCD	8,000	C	State

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

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

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: 1
Total surface area: 17 acres

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

Total number: 42

Notes:
FCD = Flood Control District
FRS = Flood Retention Structure
[1]C = Flood Control

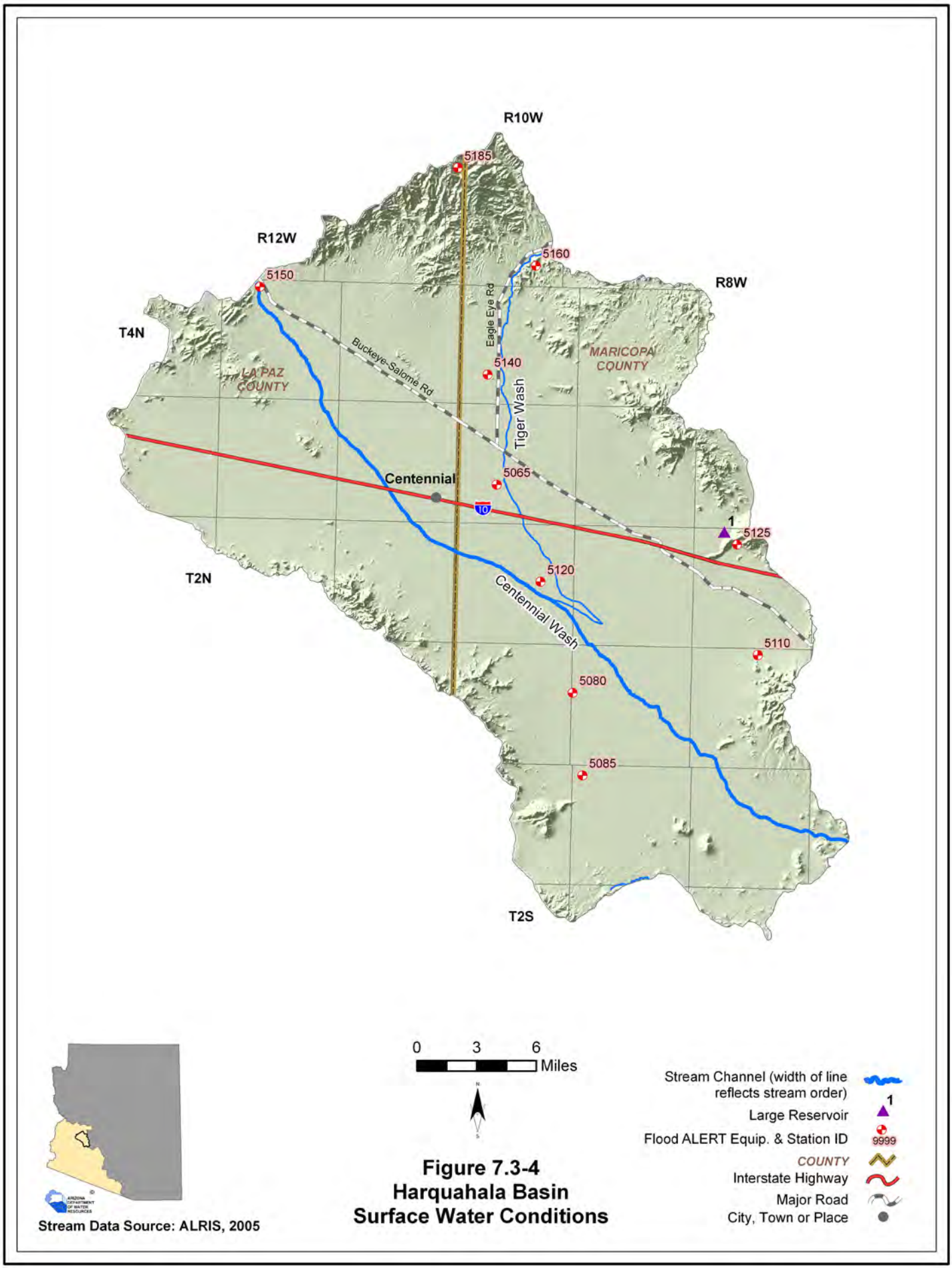


Figure 7.3-4
Harquahala Basin
Surface Water Conditions

7.3.5 Perennial/Intermittent Streams and Major Springs in the Harquahala Basin

The total number of springs in the basin are shown in Table 7.3-5. There are no perennial or intermittent streams and no major or minor springs in the Harquahala Basin. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, Section 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- The total number of springs, regardless of discharge, identified by the USGS varies from zero to one, depending on the database reference.

Table 7.3-5 Springs in the Harquahala 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, 2005 and USGS, 2006): 0 - 1

7.3.6 Groundwater Conditions of the Harquahala Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.3-6. Figure 7.3-5 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 7.3-6 contains hydrographs for selected wells shown on Figure 7.3-5. Figure 7.3-7 shows well yields in six yield categories. A description of aquifer data sources and methods is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields, is found in Volume 1, Section 1.3.19.

Major Aquifers

- Refer to Table 7.3-6 and Figure 7.3-5.
- The major aquifer in this basin is basin fill.
- Flow direction is from the basin edges to a cone of depression in the central portion of the basin.
- As shown on Figure 7.3-6, the water level in the area of the cone of depression has risen by at least one foot and as much as 30 + feet between 1990-1991 and 2003-2004 due to use of Central Arizona Project (CAP) water in place of groundwater and CAP recharge at the Vidler Water Recharge Facility west of Centennial.

Well Yields

- Refer to Table 7.3-6 and Figure 7.3-7
- As shown on Figure 7.3-7, well yields are generally between 1,000 gallons per minute (gpm) to greater than 2,000 gpm.
- One source of well yield information, based on 157 reported wells, indicates that the median well yield is 1,620 gpm.

Natural Recharge

- Refer to Table 7.3-6
- There are three estimates of natural recharge ranging from less than 1,000 acre-feet per year to less than 1,200 acre-feet per year.
- The largest source of natural recharge is runoff infiltration through the Centennial Wash alluvium (ADWR 1994).

Water in Storage

- Refer to Table 7.3-6
- There are three estimates of water in storage ranging from 13 million acre-feet to 27 million acre-feet, both to a depth of 1,200 feet.

Water Level

- Refer to Figure 7.3-5. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 34 index wells in this basin, hydrographs for 11 index wells are shown on Figure 7.3-6.
- The deepest water level shown on the map is 561 feet in the southwestern portion of the basin and the shallowest is 25 feet in T1N R8W.

Table 7.3-6 Groundwater Data for the Harquahala Basin

Basin Area, in square miles:	766	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
Well Yields, in gal/min:	Range 207-3,007 Median 1,613.5 (84 wells measured)	Measured by ADWR and/or USGS
	Range 7-3,500 Median 1,620 (157 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	Range 300-3,000	ADWR (1990 and 1994)
	Range 0-2,500	USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	<1,200[1]	Anderson and Freethey (1995)
	1,000	Freethey and Anderson (1986)
	<1,000[1]	Arizona Water Commission (1975)
Estimated Water Currently in Storage, in acre-feet:	15,500,000 (to 1,200 ft)	ADWR (1994)
	13,000,000[2] (to 1,200 ft)	Freethey and Anderson (1986)
	27,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
Current Number of Index Wells:	34	
Date of Last Water-level Sweep:	2004 (188 wells measured)	

[1]Includes Tiger Wash Basin
[2]Predevelopment Estimate

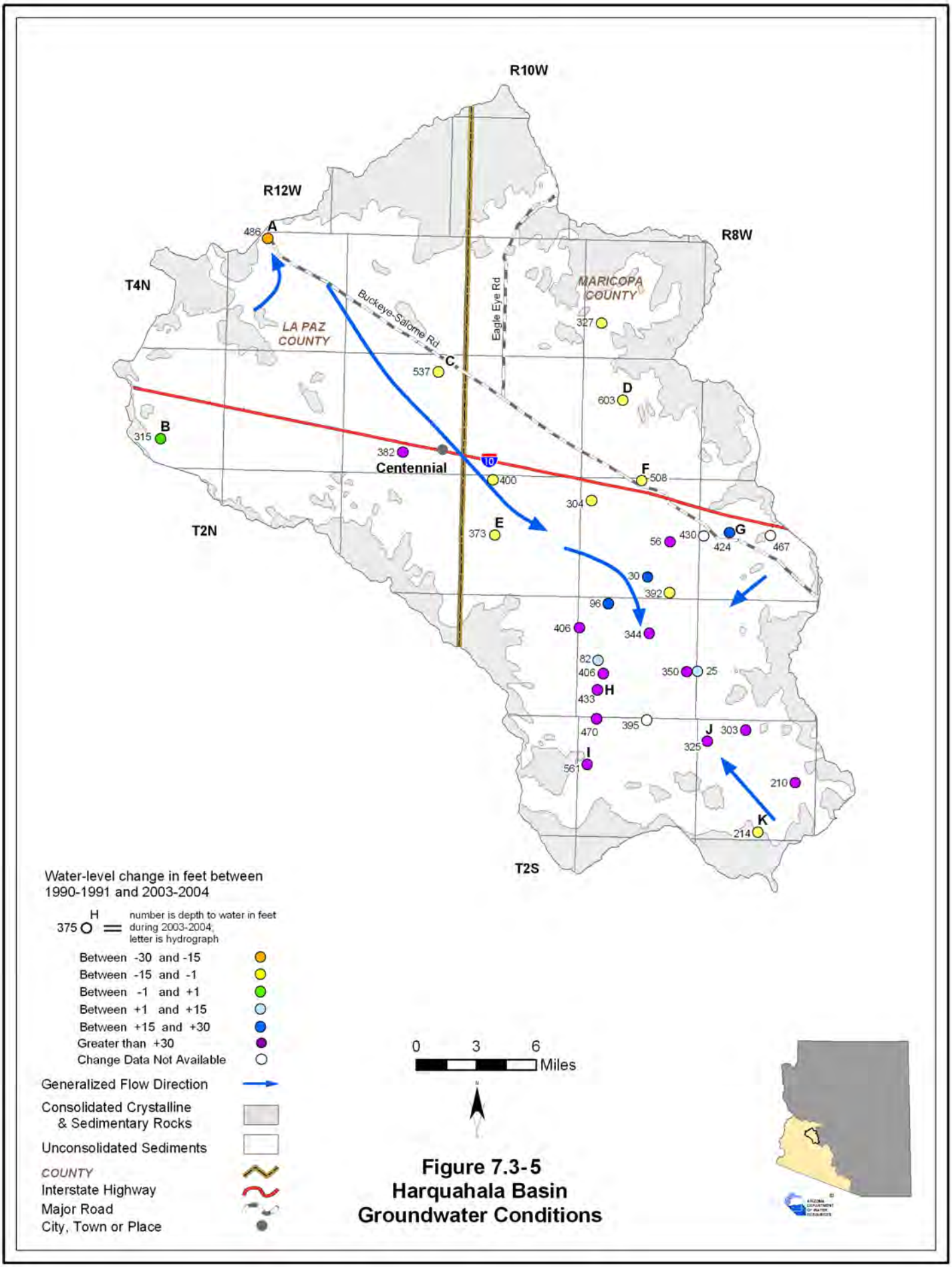


Figure 7.3-5
Harquahala Basin
Groundwater Conditions

Figure 7.3-6
Harquahala Basin
Hydrographs Showing Depth to Water in Selected Wells

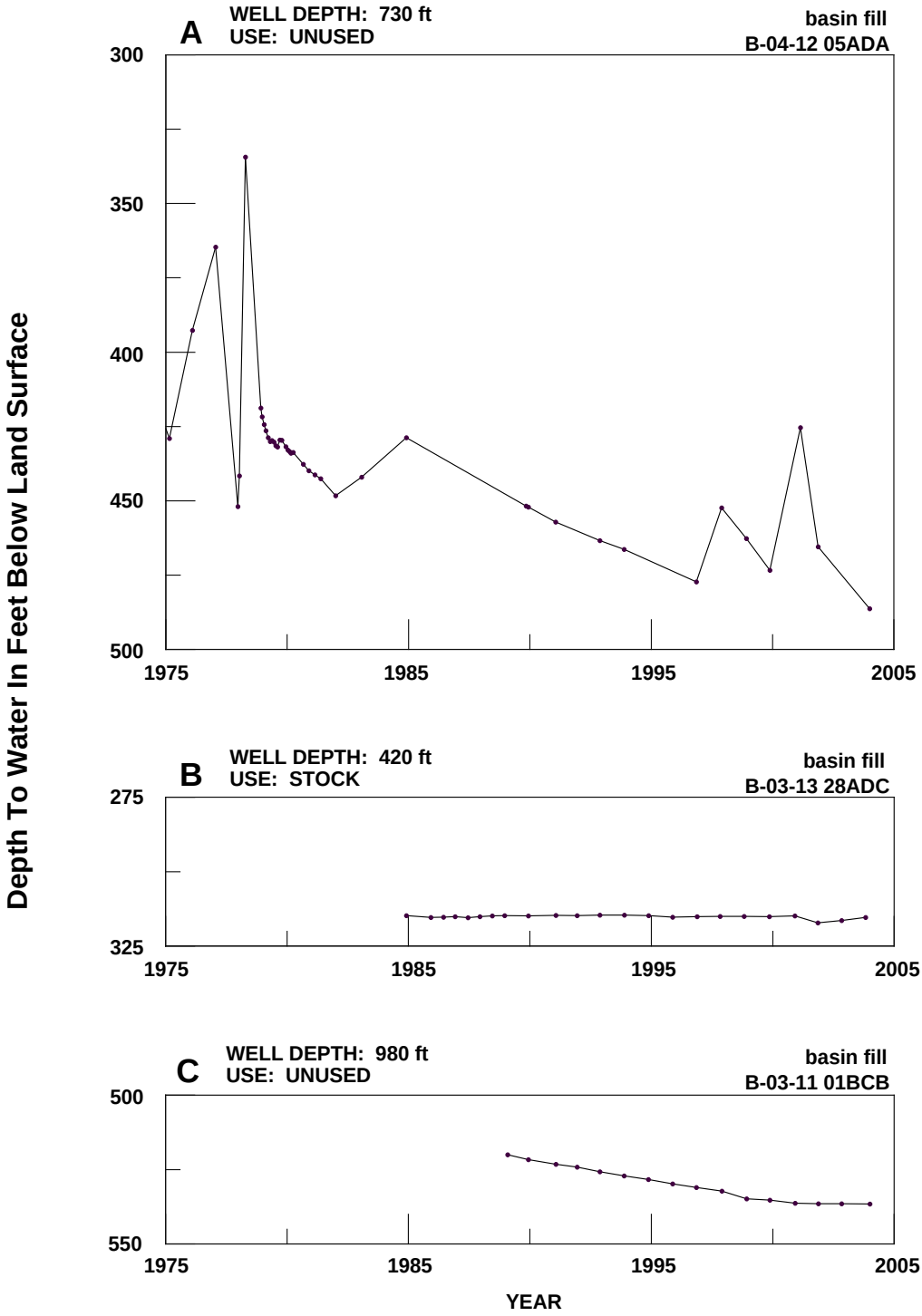


Figure 7.3-6 (cont'd)
Harquahala Basin
Hydrographs Showing Depth to Water in Selected Wells

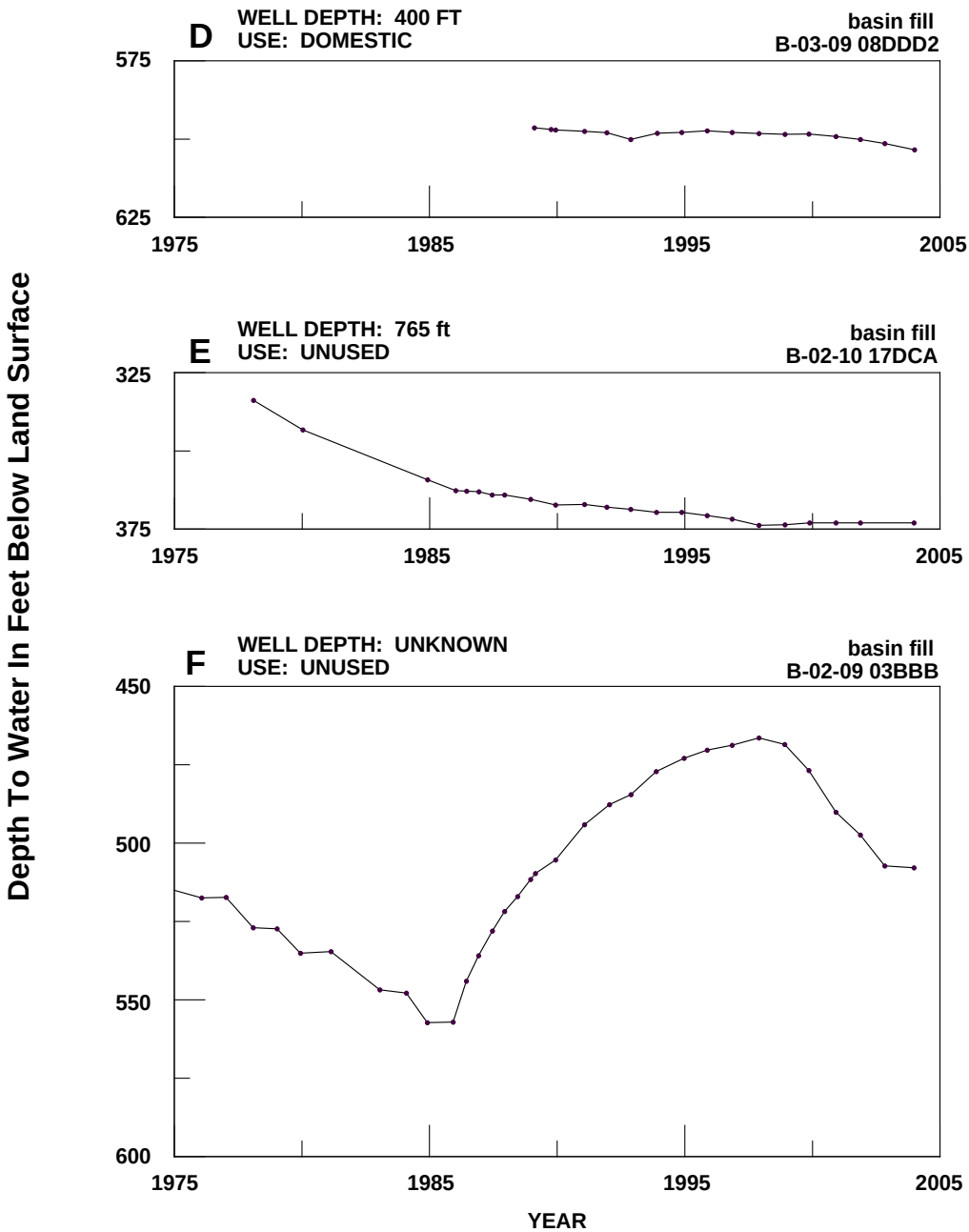


Figure 7.3-6 (cont'd)
Harquahala Basin
Hydrographs Showing Depth to Water in Selected Wells

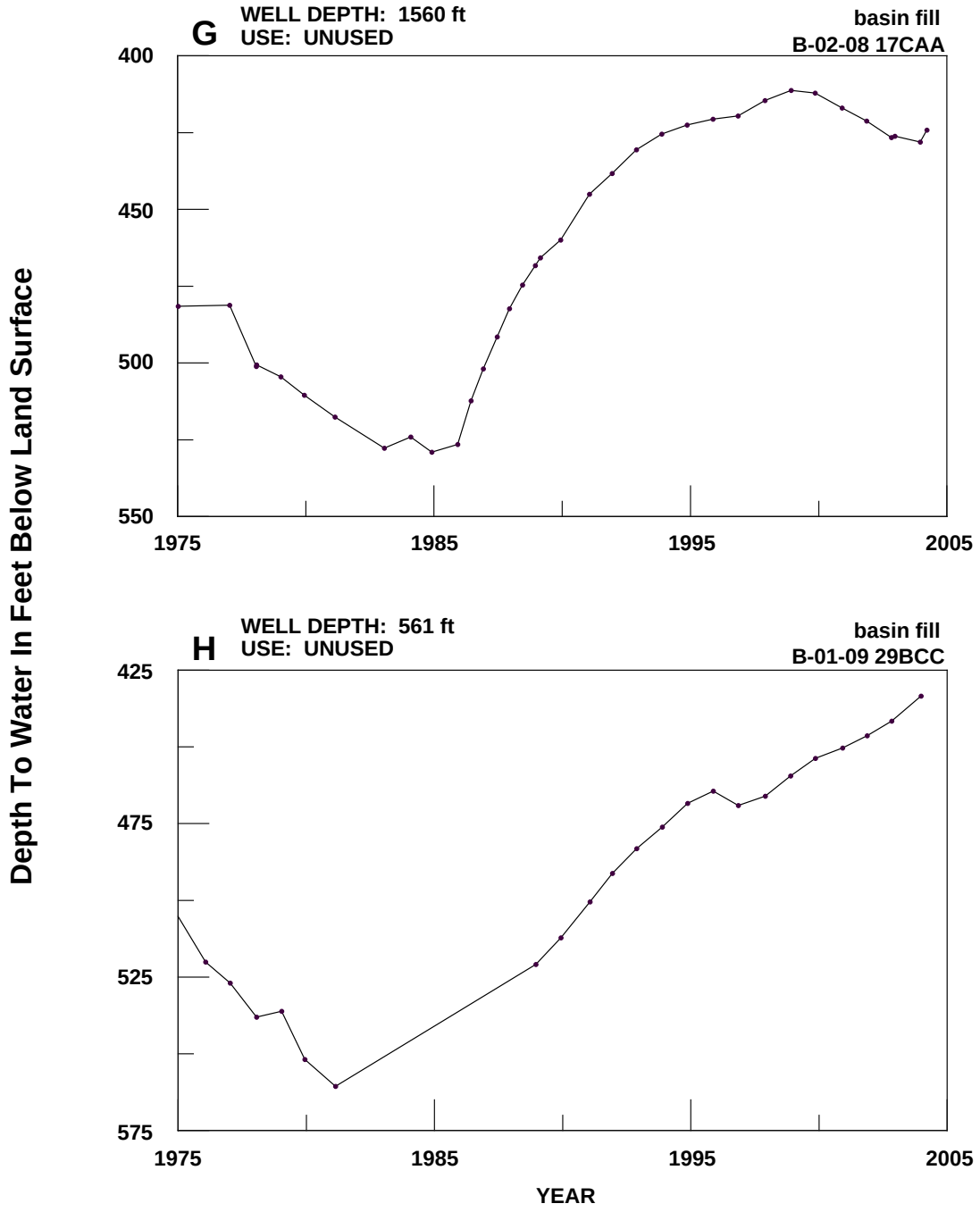


Figure 7.3-6 (cont'd)
Harquahala Basin
Hydrographs Showing Depth to Water in Selected Wells

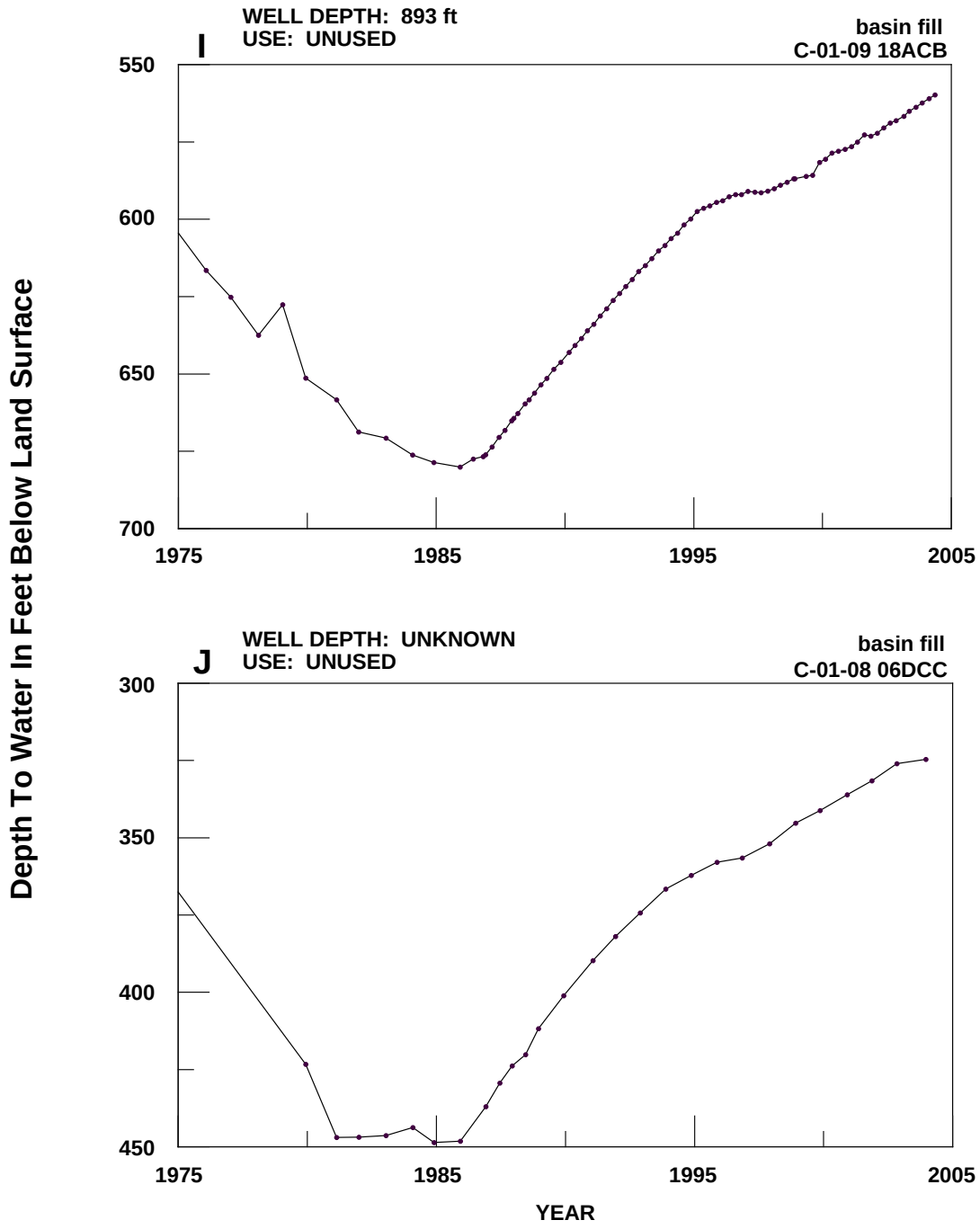
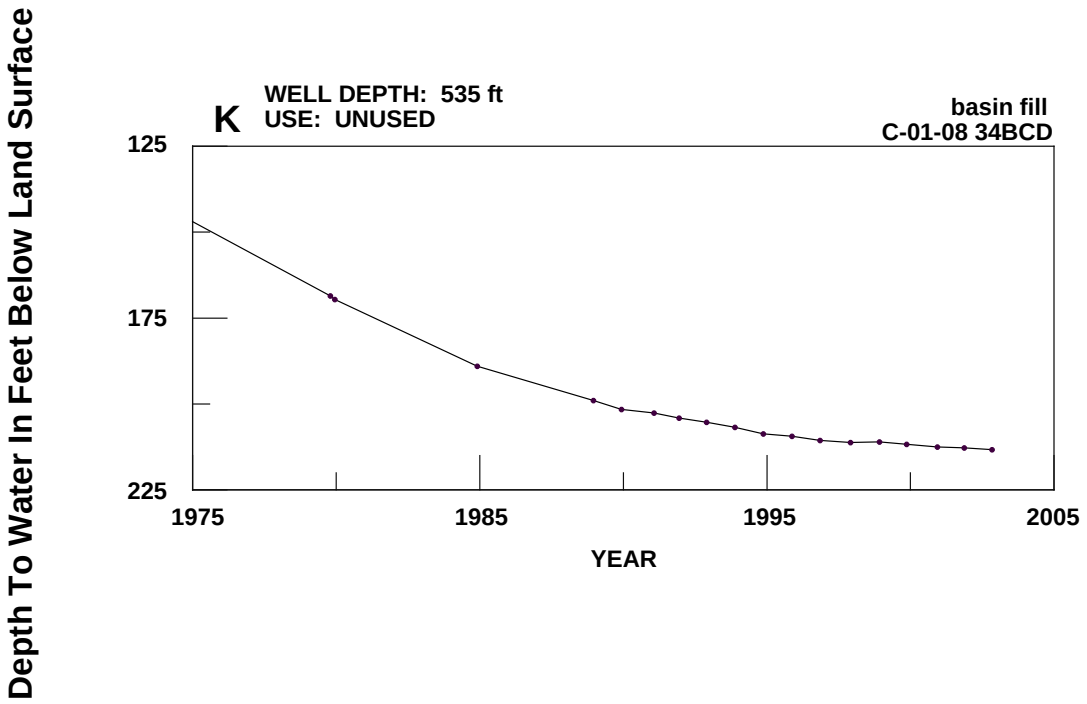


Figure 7.3-6 (cont'd)
Harquahala Basin
Hydrographs Showing Depth to Water in Selected Wells



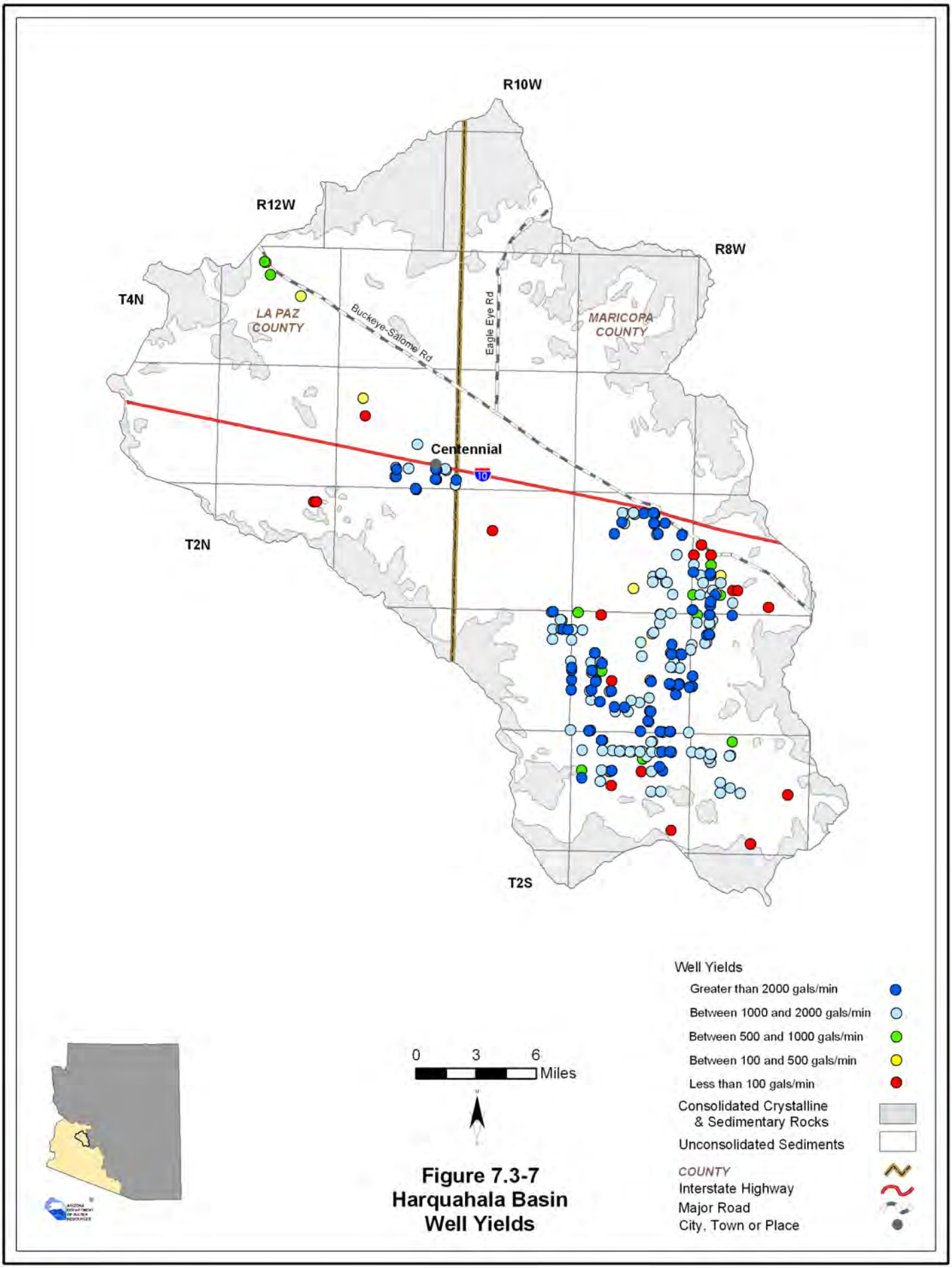


Figure 7.3-7
Harquahala Basin
Well Yields

7.3.7 Water Quality of the Harquahala 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 7.3-7A. There are no impaired lakes or streams in this basin. Figure 7.3-8 shows the location of water quality occurrences keyed to Table 7.3-7. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mine Sites

- Refer to Table 7.3-7A.
- Eighty-two wells have parameter concentrations that have equaled or exceeded drinking water standards.
- Eighty-four percent of the wells measured equaled or exceeded the parameter for fluoride.
- Other parameters equaled or exceeded include arsenic, lead, chromium, total dissolved solids and nitrates.

Table 7.3-7 Water Quality Exceedences in the Harquahala Basin[1]

A. Wells, Springs and Mines

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

Table 7.3-7 Water Quality Exceedences in the Harquahala Basin (cont'd.)[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
52	Well	1 North	9 West	26	F
53	Well	1 North	9 West	31	As, F
54	Well	1 North	9 West	36	F
55	Well	1 North	10 West	1	F
56	Well	1 North	10 West	1	F
57	Well	1 North	10 West	12	F
58	Well	1 South	7 West	19	F
59	Well	1 South	8 West	4	F
60	Well	1 South	8 West	6	As, Pb
61	Well	1 South	8 West	6	As, F
62	Well	1 South	8 West	6	F
63	Well	1 South	8 West	8	Cr, F
64	Well	1 South	8 West	8	F
65	Well	1 South	8 West	9	As, F, Pb
66	Well	1 South	8 West	14	F
67	Well	1 South	8 West	14	As
68	Well	1 South	8 West	20	F
69	Well	1 South	8 West	22	F
70	Well	1 South	8 West	27	F
71	Well	1 South	8 West	27	F
72	Well	1 South	8 West	27	F
73	Well	1 South	9 West	1	F
74	Well	1 South	9 West	2	F
75	Well	1 South	9 West	2	NO3
76	Well	1 South	9 West	3	Pb, NO3
77	Well	1 South	9 West	5	F
78	Well	1 South	9 West	7	F
79	Well	1 South	9 West	10	F
80	Well	1 South	9 West	11	F
81	Well	1 South	9 West	11	F
82	Well	1 South	9 West	11	F

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	Parameter(s) Exceeding Use Standard
None identified by ADWR at this time						

Notes:

[1] Water quality samples collected between 1978 and 1991.
[2] As = Arsenic
Cr = Chromium
NO3 = Nitrate/ Nitrite
F = Fluoride
Pb = Lead
TDS = Total Dissolved Solids

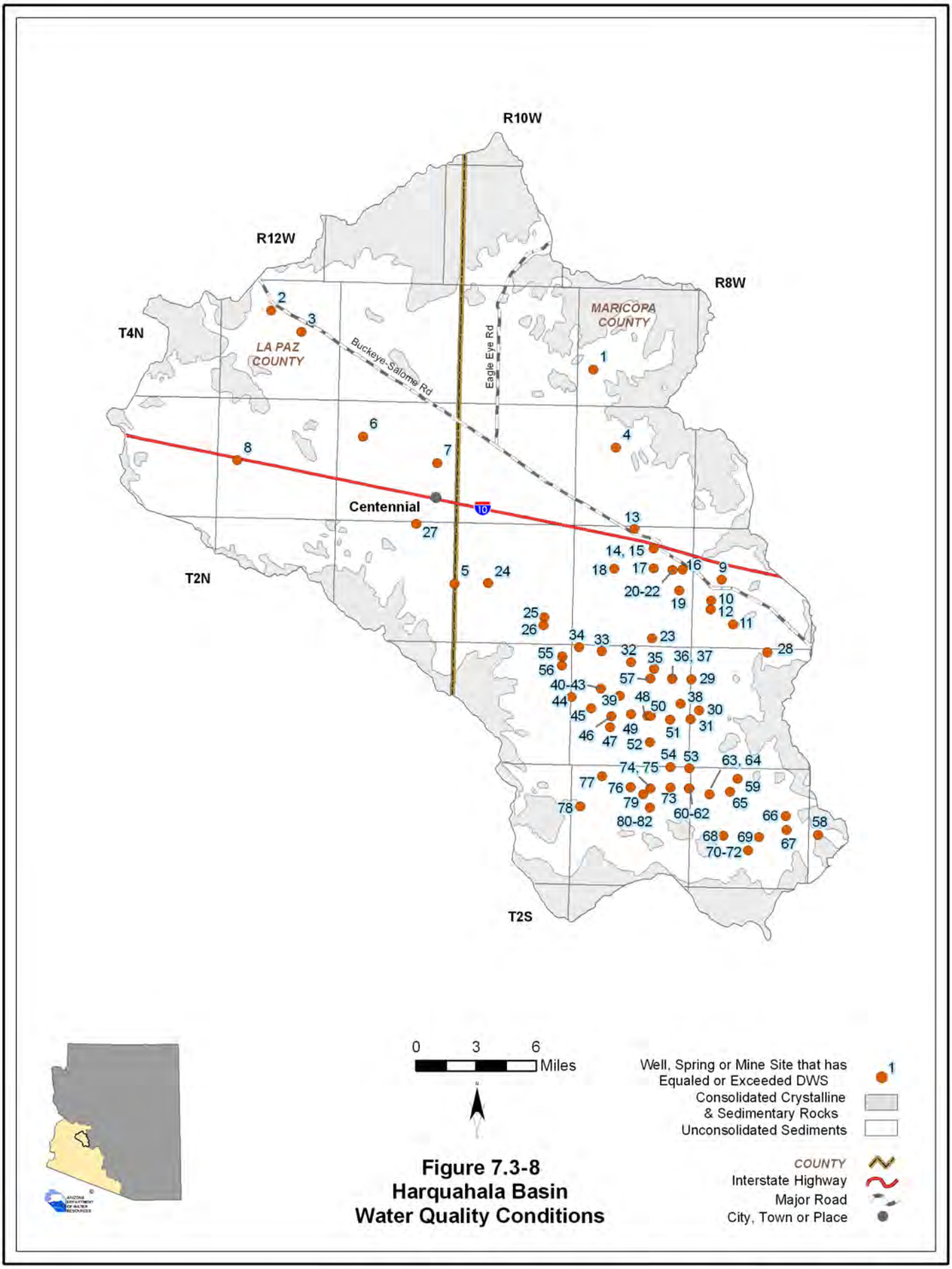


Figure 7.3-8
Harquahala Basin
Water Quality Conditions

7.3.8 Cultural Water Demands in the Harquahala 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 7.3-8. Figure 7.3-9 shows the location of demand centers. There is no recorded effluent generation in this basin. A description of cultural water demand data sources and methods is found in Volume 1, Section 1.3.5. More detailed information on cultural water demands is found in Section 5.0.7.

Cultural Water Demands

- Refer to Table 7.3-8 and Figure 7.3-9.
- Population in this basin increased from 359 in 1980 to 609 in 2000 and projections suggest an increase through 2050.
- Most cultural water use is for irrigation in the southern and northwestern portions of the basin.
- Groundwater use for agriculture increased more than 200% from 1991 to 2003, however, in general agricultural groundwater use declined 73% from 1971 to 2003. The entire Harquahala Basin is within an Irrigation Non-Expansion Area (INA). The Harquahala INA was created in 1981; no new agricultural lands can be irrigated with groundwater in an INA.
- Surface water use for irrigation began in 1986 with deliveries of Central Arizona Project water to the basin. Agricultural surface water demand increased 13% from 1986 to 2003.
- There was no reported industrial groundwater demand prior to 2001-2003. The Harquahala Generating Project began operating in 2001. This plant used an average of 1,900 acre-feet per year from 2001 to 2003.
- Municipal groundwater demand is small and increased 5% from 1991 to 2003.
- As of 2003 there were 187 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 156 wells with a pumping capacity of more than 35 gallons per minute.

Table 7.3-8 Cultural Water Demands in the Harquahala Basin[1]

Year	Recent (Census) and Projected (DES) 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[3]	Irrigation	Municipal	Industrial	Irrigation	
1971		111[2]	152[2]	117,000			NR			ADWR (1994) USGS (2005)
1972										
1973										
1974										
1975										
1976				111,000			NR			
1977										
1978										
1979										
1980	359									
1981	405	13	3	79,000			NR			
1982	451									
1983	498									
1984	544									
1985	590									
1986	636	10	0	6,000			79,000			
1987	682									
1988	729									
1989	775									
1990	821									
1991	800	5	0	900	NR	9,500	NR	NR	47,500	USGS (2005)
1992	779									
1993	757									
1994	736									
1995	715									
1996	694	19	0	950	NR	23,500	NR	NR	85,000	
1997	673									
1998	651									
1999	630									
2000	609									
2001	630	29	1	950	1,900	31,000	NR	NR	90,000	
2002	651									
2003	673									
2010	821									
2020	1,114									
2030	1,511									
2040	2,050									
2050	2,780									
	WELL TOTALS:	**187**	**156**							

[1] Does not include evaporation losses from stockponds and reservoirs.
[2] Includes all wells through 1980.
[3] Industrial demand 1971-1990 includes a small amount of well pumpage in the Tiger Wash Basin.
NR - Not reported

Table 7.3-9 Effluent Generation in the Harquahala Basin

Facility Name	Ownership	City/Location Served	Population Served	Volume Treated/Generated (acre-feet)	Disposal Method							Current Treatment Level	Population Not Served	Year of Record
					Water-course	Evaporation Pond	Irrigation	Golf Course	Wildlife Area	Discharged to Another Facility	Infiltration Basins			
No Waste Water Treatment Facilities Identified by ADWR in this Basin														

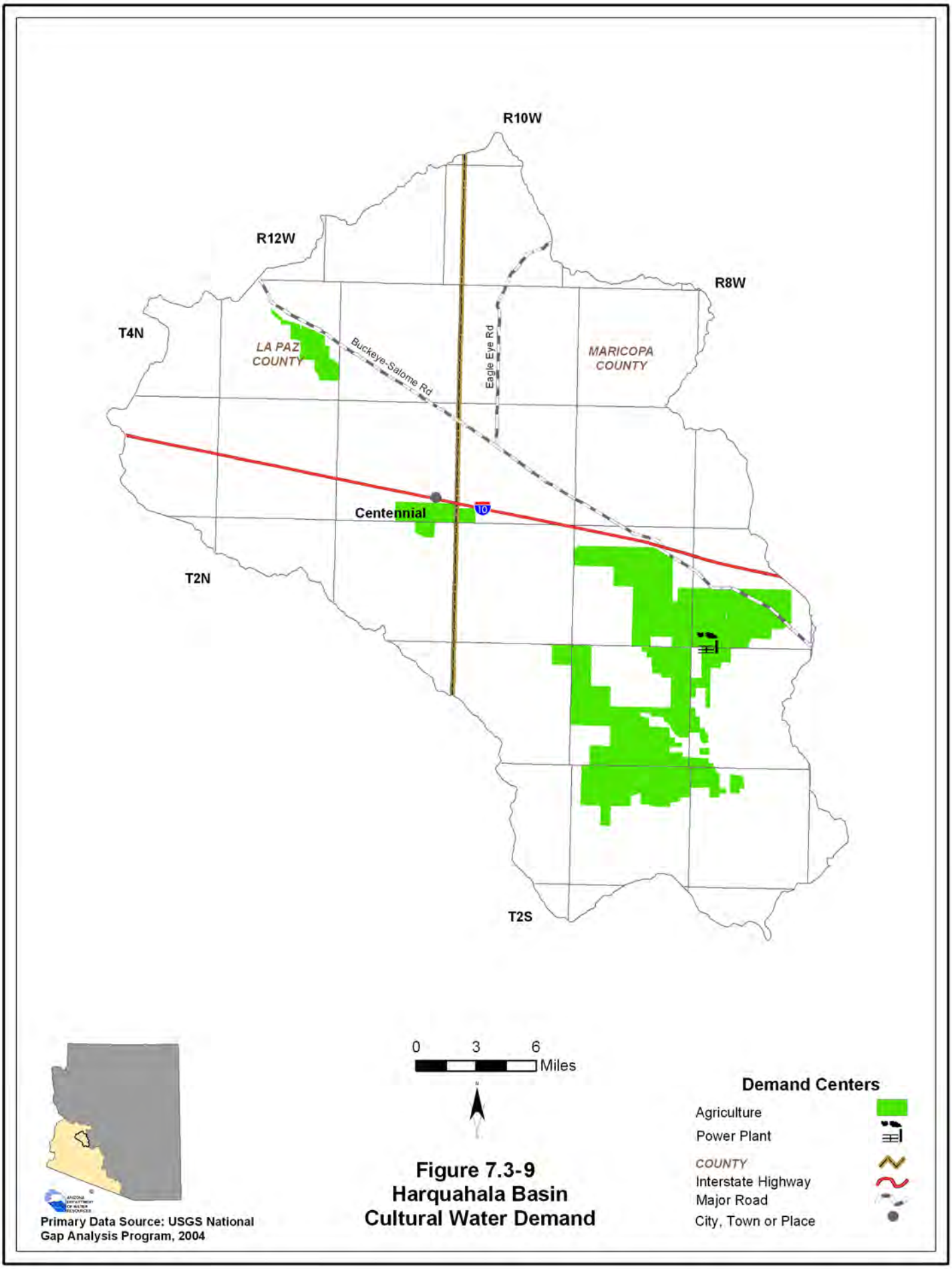


Figure 7.3-9
Harquahala Basin
Cultural Water Demand

7.3.9 Water Adequacy Determinations in the Harquahala 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 7.3-10. Figure 7.3-10 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 A. Adequacy determination data sources and methods are found in Volume 1, Sections 1.3.1.

Water Adequacy Reports

- See Table 7.3-10
- As of May 2005, three subdivisions have been reviewed for an adequacy determination. All subdivisions are in Maricopa County.
- Of the 65 lots in two subdivisions for which lot information is available, 35 lots or 54% were determined to be adequate.
- One subdivision received a determination of inadequacy because of an insufficient supply.

Table 7.3-10 Adequacy Determinations in the Harquahala Basin[1]

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
1	Big Horn Farms	Maricopa	1 North	9 West	31	30	22-300288	Inadequate	A2	05/12/97	NA
2	Harquahala Ranchitos Units 1 & 2	Maricopa	2 North	8 West	36	35	22-300114	Adequate		02/26/96	Dry Lot Subdivision
3	Rose View Estates	Maricopa	1 North	8 West	36	NA		Adequate		04/06/95	Water Utility of Greater Tonopah, Inc.

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 wa
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 anc

[2] Prior to February 1995, ADWR did not assign file numbers to applications for adequacy determination.

[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 unavaible; 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 = Data not currently available to ADWR

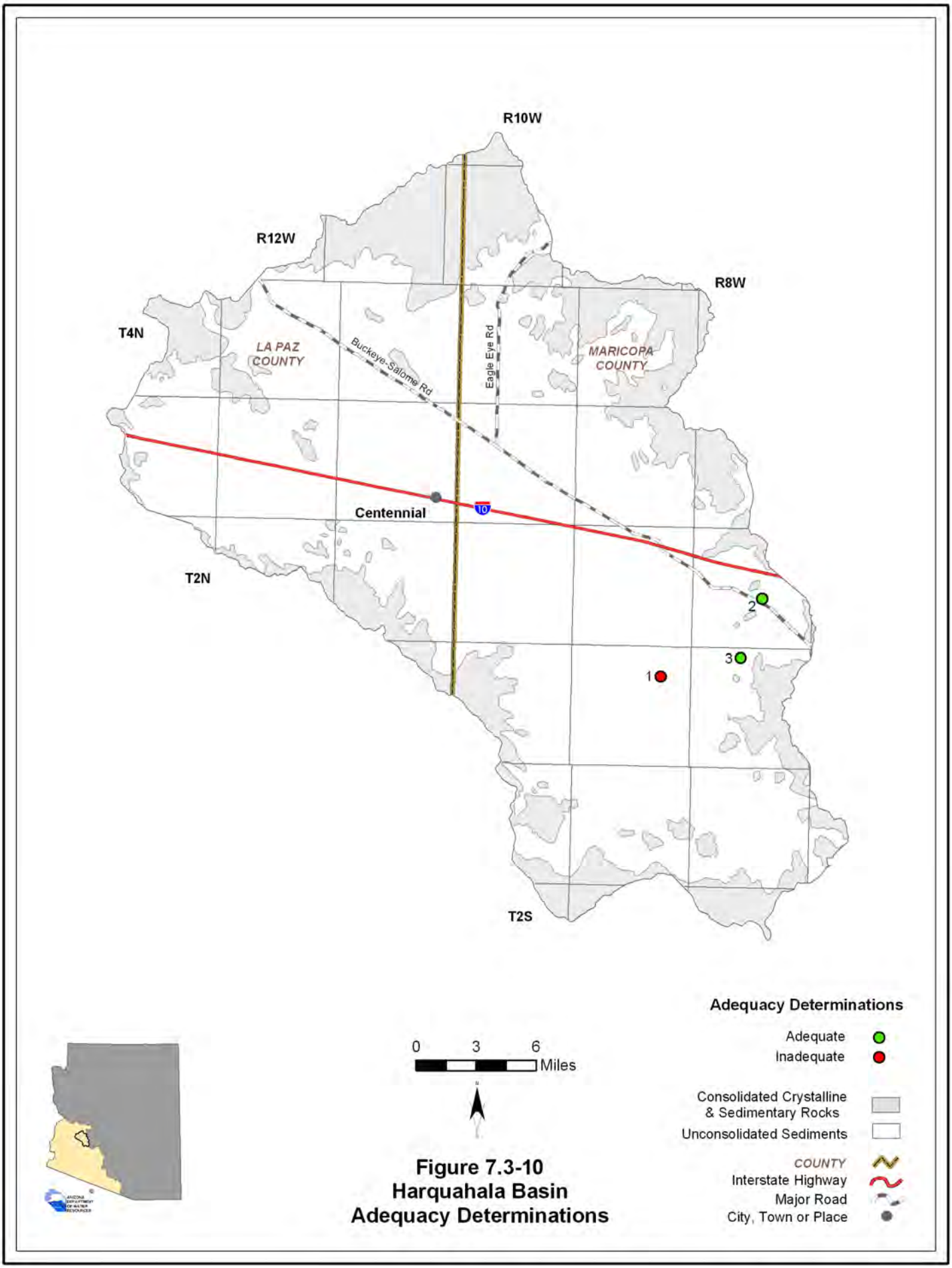


Figure 7.3-10
Harquahala Basin
Adequacy Determinations

Harquahala Basin
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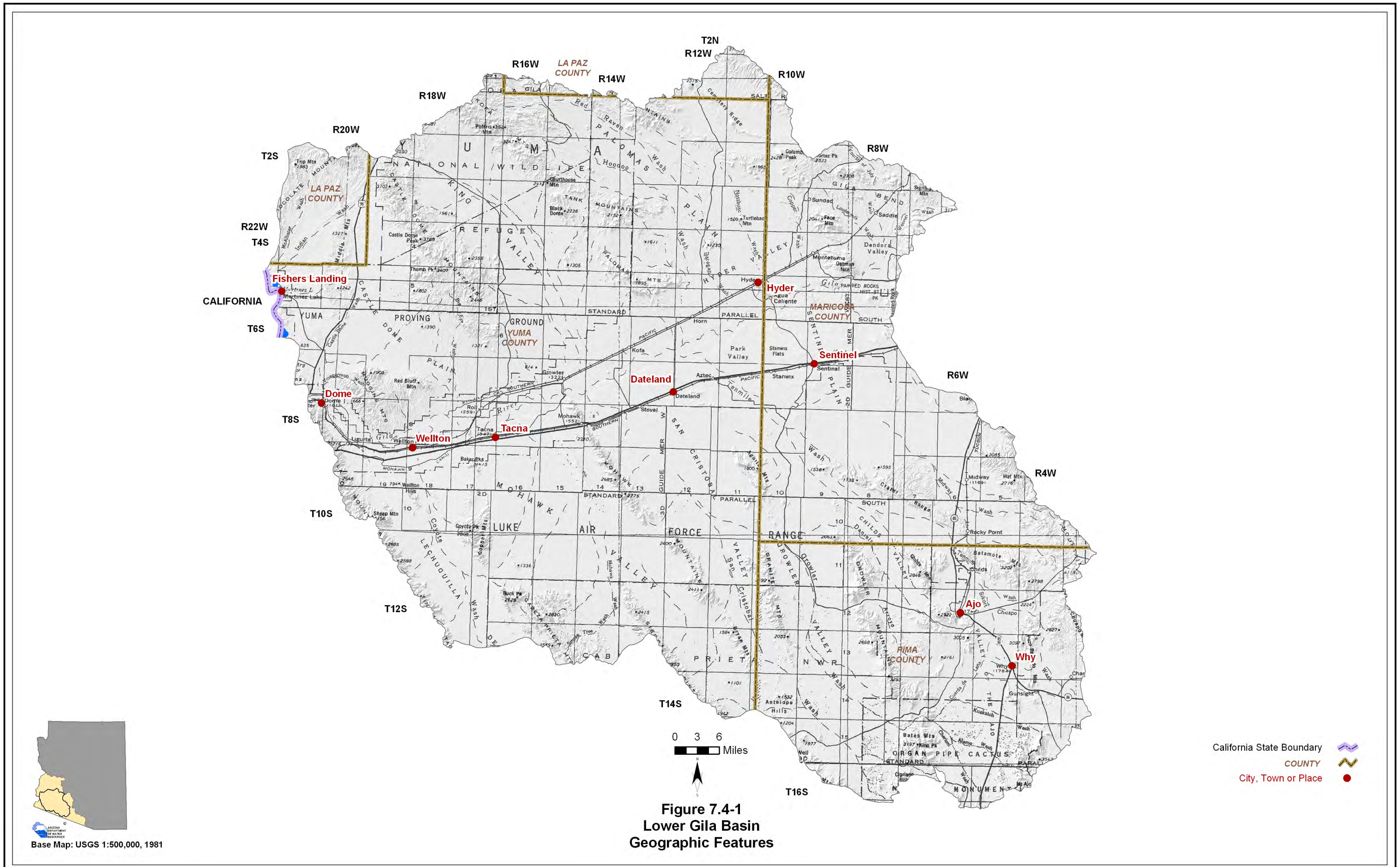
Section 7.4
Lower Gila Basin

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 7.0-7)

- Principal geographic features shown on Figure 7.4-1 are:
    - Principal basin communities of Ajo, Dateland, Tacna and Wellton
    - Other basin communities of Dome, Fishers Landing, Hyder, Sentinel and Why
    - 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 lowest point in the basin at 160 feet west of Dome where the Gila River exits the basin
    - The highest point in the basin, Castle Dome Peak, at 3,788 feet in the Castle Dome Mountains west of Fishers Landing



Base Map: USGS 1:500,000, 1981

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, Section 1.3.8. 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.

National 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. (See Figure 7.0-9)
- 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 7.0-9)
- 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

- 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.

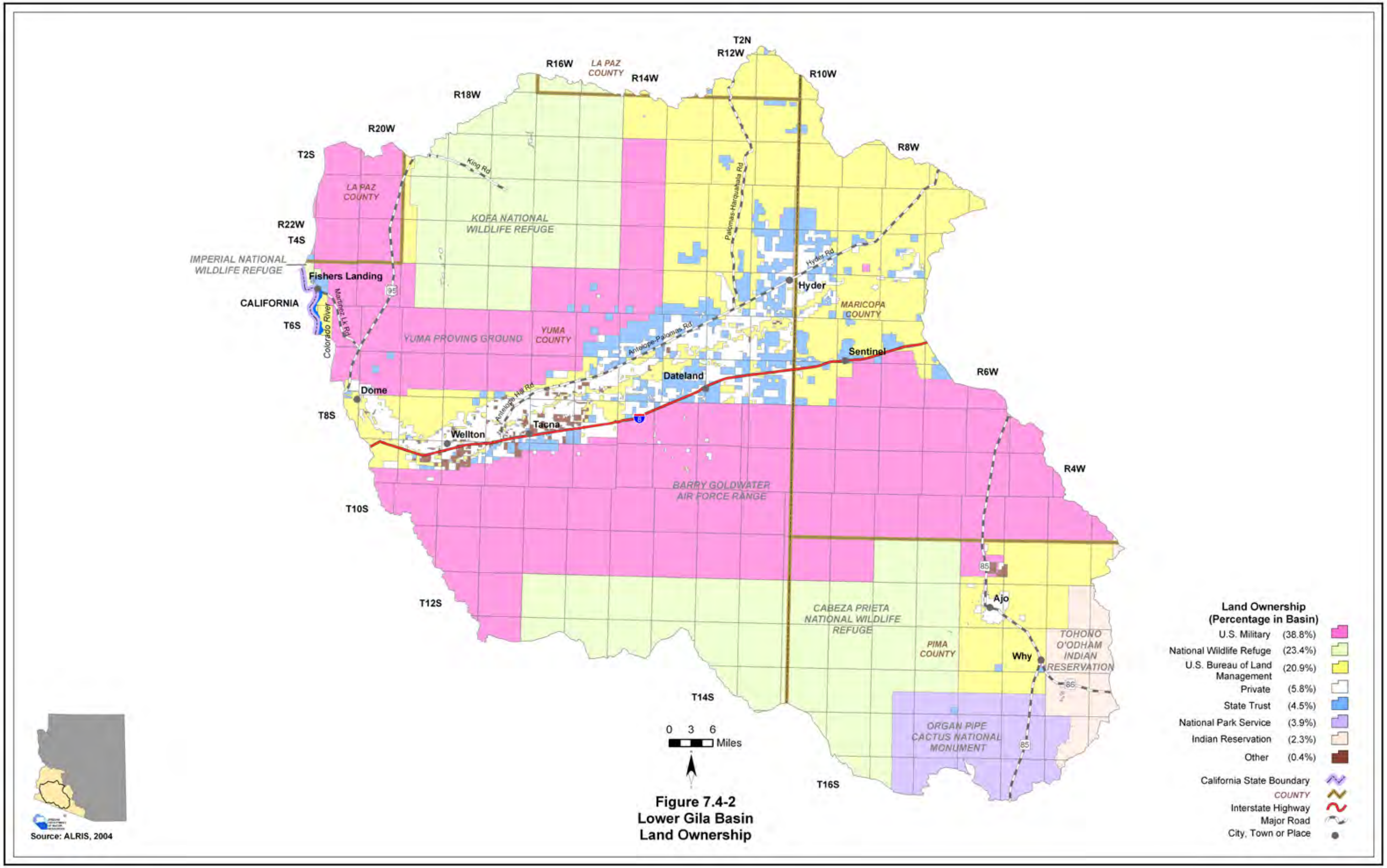


Figure 7.4-2
Lower Gila Basin
Land Ownership

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. A description of the climate data sources and methods is found in Volume 1, Section 1.3.3.

NOAA/NWS Co-op Network

- Refer to Table 7.4-1A
- Temperatures at the eight NOAA/NWS Co-op Network stations in the basin range from an average high of 94.6°F at Mohawk to an average low of 51.1°F at Wellton.
- Highest average seasonal rainfall at all stations occurs in the summer season (July-September) when approximately 37% of the annual average precipitation occurs. Many stations also receive a significant portion of precipitation in the winter (January-March) and fall (October-December) seasons. The highest average annual rainfall in the basin is 7.74 inches at the Ajo station.

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 78.42 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, 2003
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			

Source: WRCC, 2003.

C. AZMET:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Annual Reference Evaportranspiration, in inches *(Number of years to calculate averages)*
Dateland	535	1990 - 1996 (discontinued)	88.06 *(6)*
Roll	299	1997 - current	78.42 *(6)*

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: NRCS, 2005

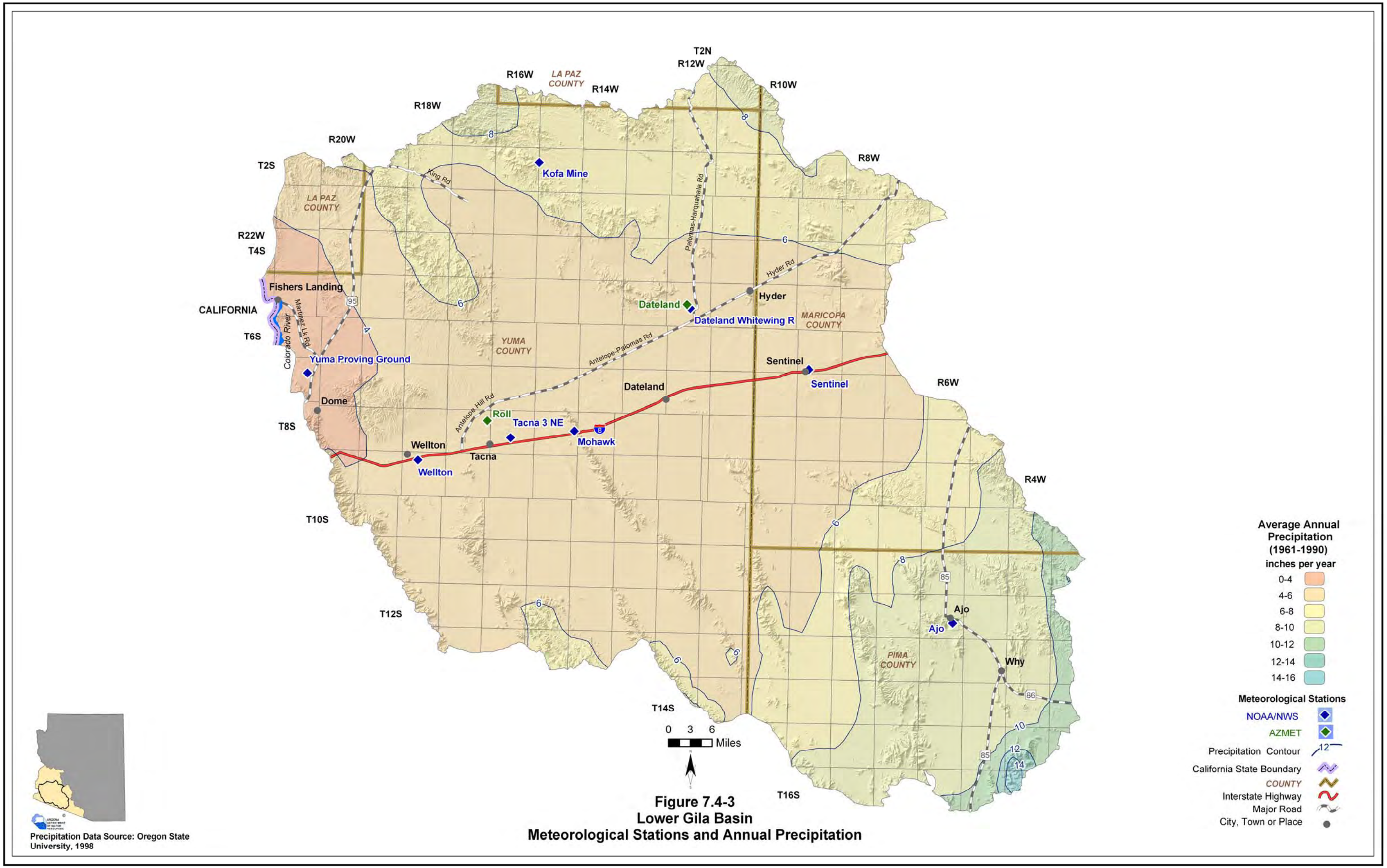


Figure 7.4-3
Lower Gila Basin
Meteorological Stations and Annual Precipitation

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. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

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.
- 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 near Ajo station, 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 the spring (April-June) season.
- The largest annual flow recorded in the basin is 10 million acre-feet 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.
- Most of the nine ALERT gages in Lower Gila Basin are located along tributaries to the Gila River.

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.
- Three reservoirs are used for recreation and/or as fish and wildlife ponds. Two reservoirs are dry lakes.
- 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)	Mean Basin Elevation (in feet)	Period of Record	Average Seasonal Flow (% of annual flow)				Annual Flow/Year (in acre-feet)				Years of 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	1,950	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	NA	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	NA	1966-/1993 (discontinued)	36	38	15	12	0 (1975-1976, 1987-1991)	413	317,233	2,029,309 (1980)	19

Sources: USGS NWIS, USGS 1998 and USGS 2003.

Notes:
NA = Not available
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

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

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

Source: BOR 2007

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

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

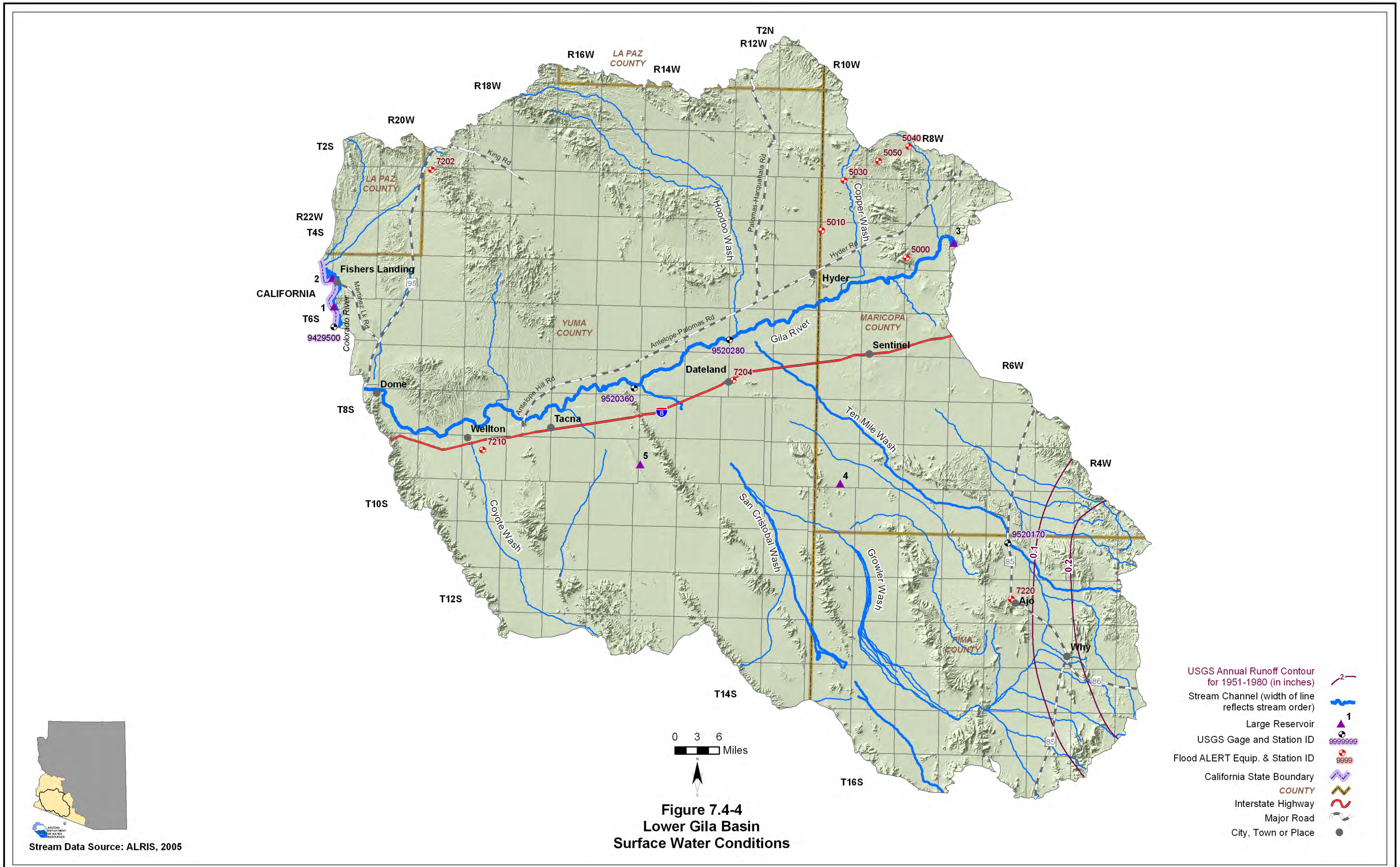


Figure 7.4-4
Lower Gila Basin
Surface Water Conditions

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. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, Section 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- There is one intermittent stream, the Gila River and one perennial stream, 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, 2005 and USGS, 2006): 6 - 8

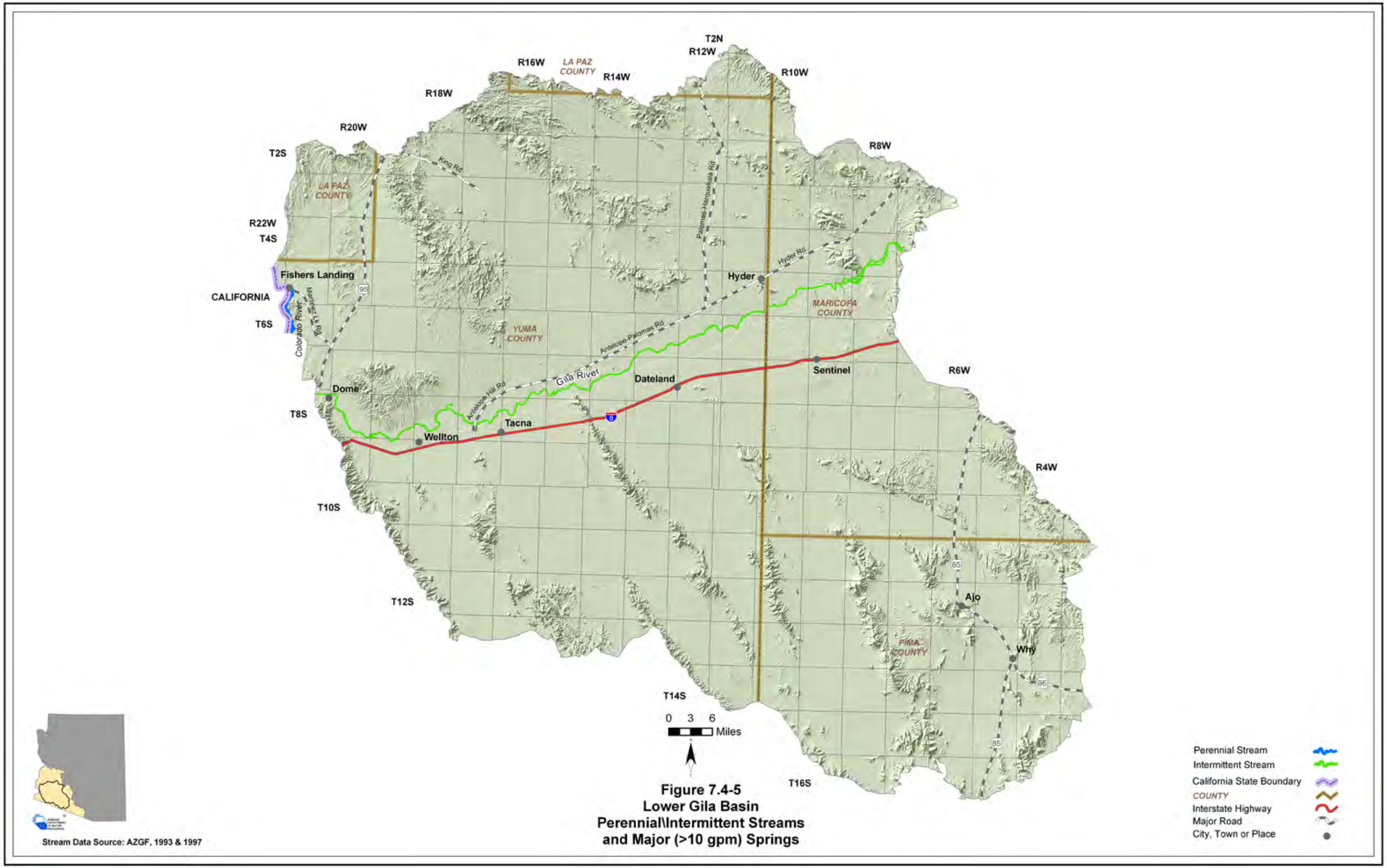


Figure 7.4-5
Lower Gila Basin
Perennial\Intermittent Streams
and Major (>10 gpm) Springs

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 is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields, is found in Volume 1, Section 1.3.19.

Major Aquifers

- Refer to Table 7.4-6 and Figure 7.4-6
- The major aquifers are recent stream alluvium and basin fill.
- 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
- There are two estimates of natural recharge ranging from greater than 9,000 acre-feet per year to 88,000 acre-feet per year.
- The largest source of natural recharge is runoff in washes and the Gila River floodplain. (ADWR 1994)
- 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 1994)

Water in Storage

- Refer to Table 7.4-6
- There are three estimates of water in storage ranging from 100 million acre-feet to a depth of 1,200 feet to 246 million acre-feet 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 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 and/or USGS
	Range 10-6,000 Median 1,600 (597 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	Range 100-2,500	ADWR (1990 and 1994)
	Range 0-2,500	USGS (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

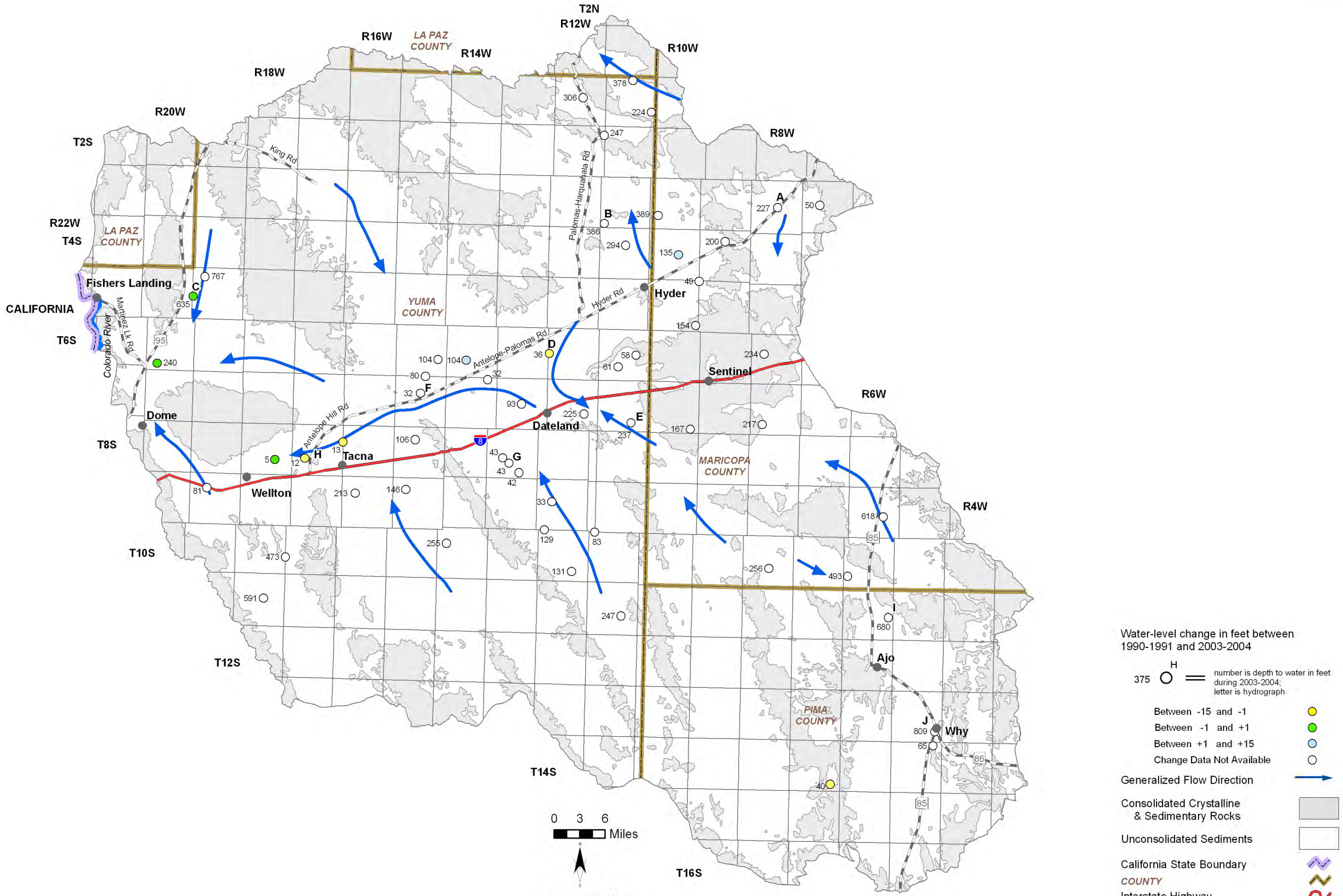


Figure 7.4-6
Lower Gila Basin
Groundwater Conditions

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

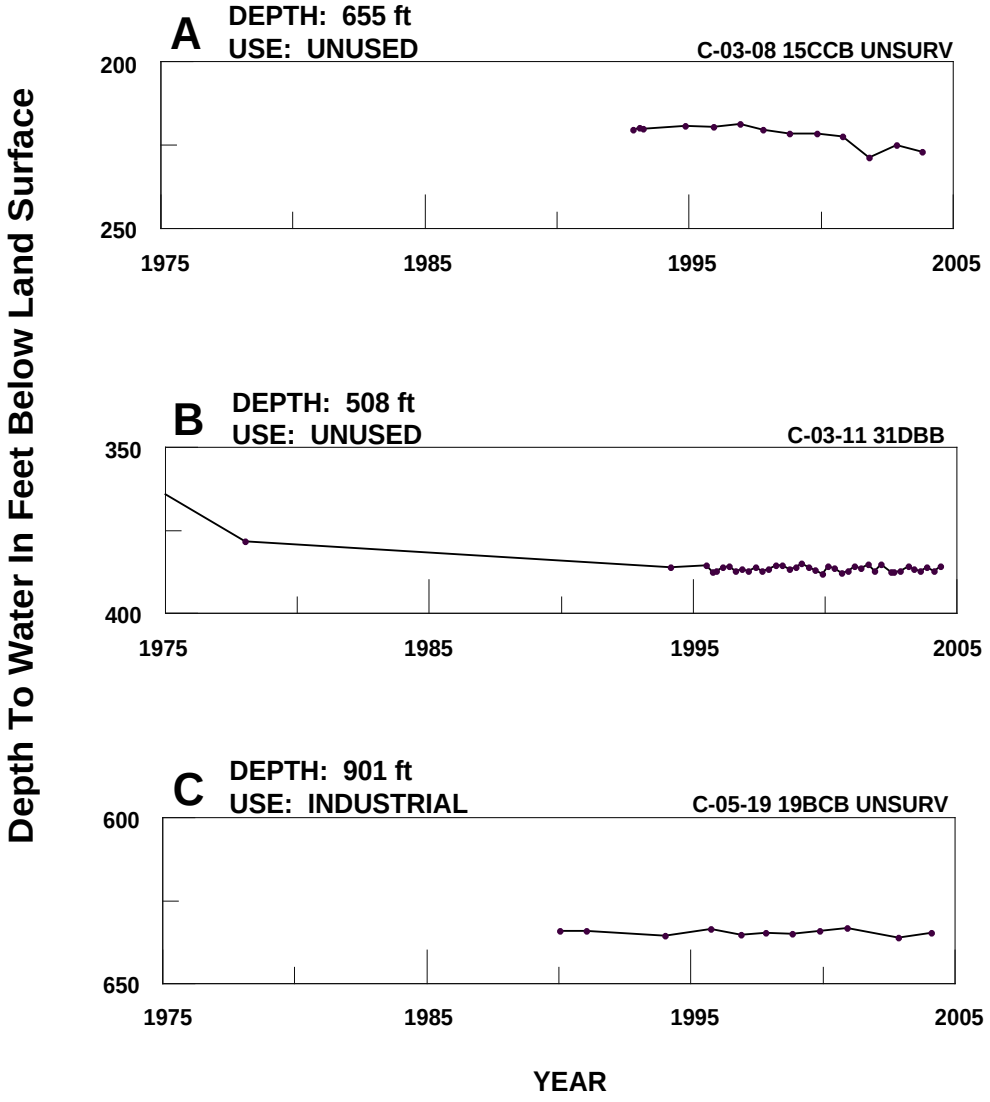


Figure 7.4-7 (cont'd)
Lower Gila Basin
Hydrographs Showing Depth to Water in Selected Wells

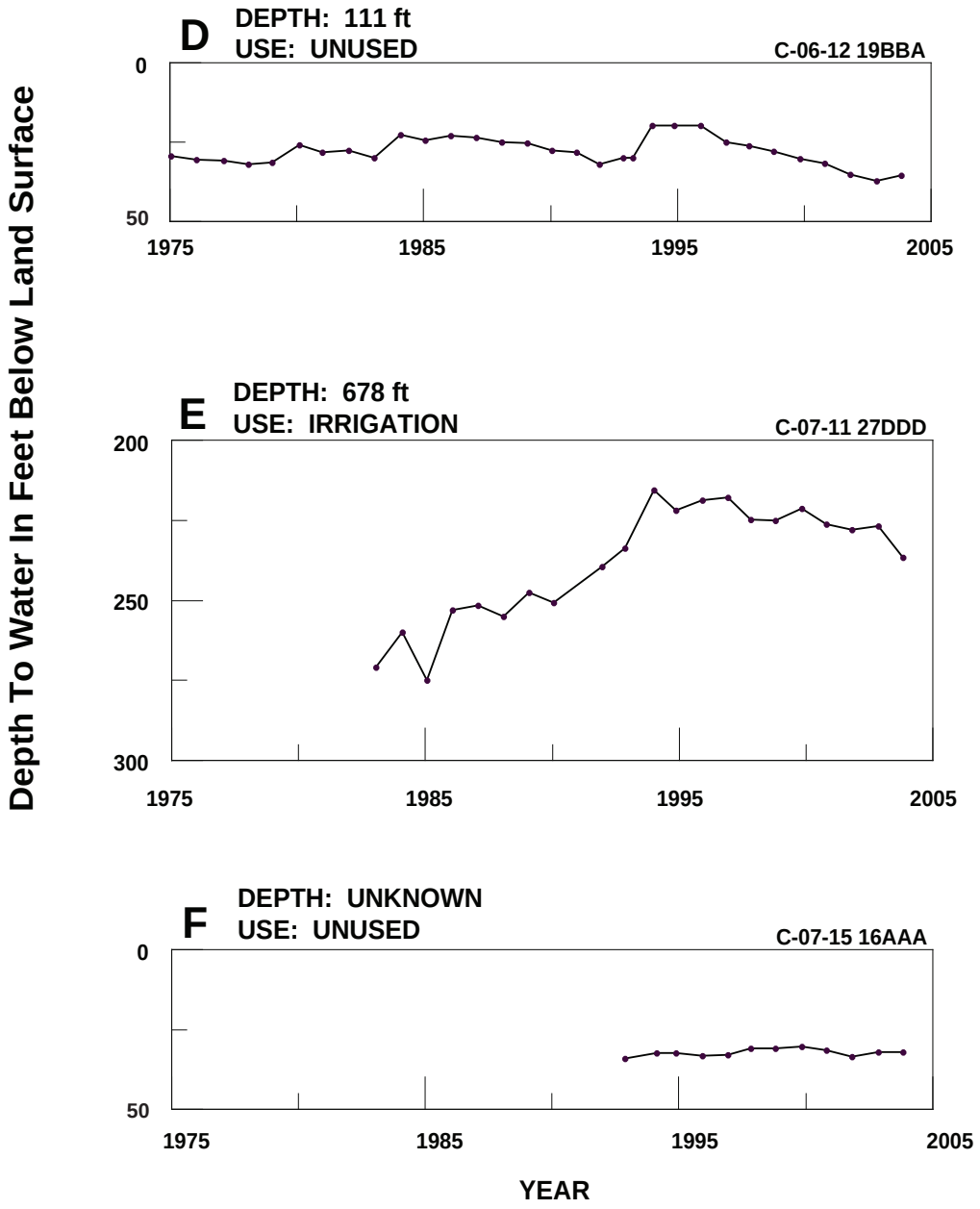
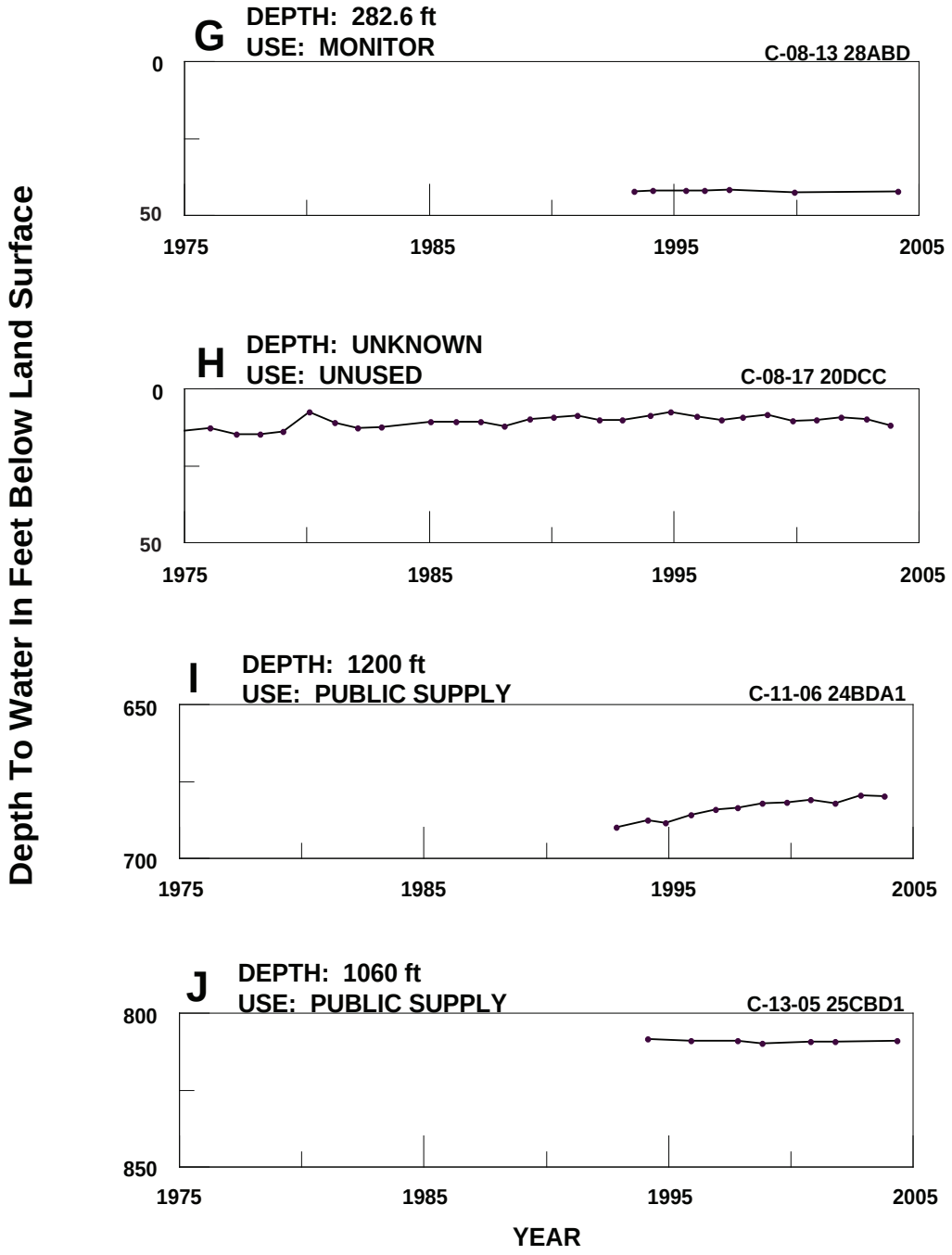


Figure 7.4-7 (cont'd)
Lower Gila Basin
Hydrographs Showing Depth to Water in Selected Wells



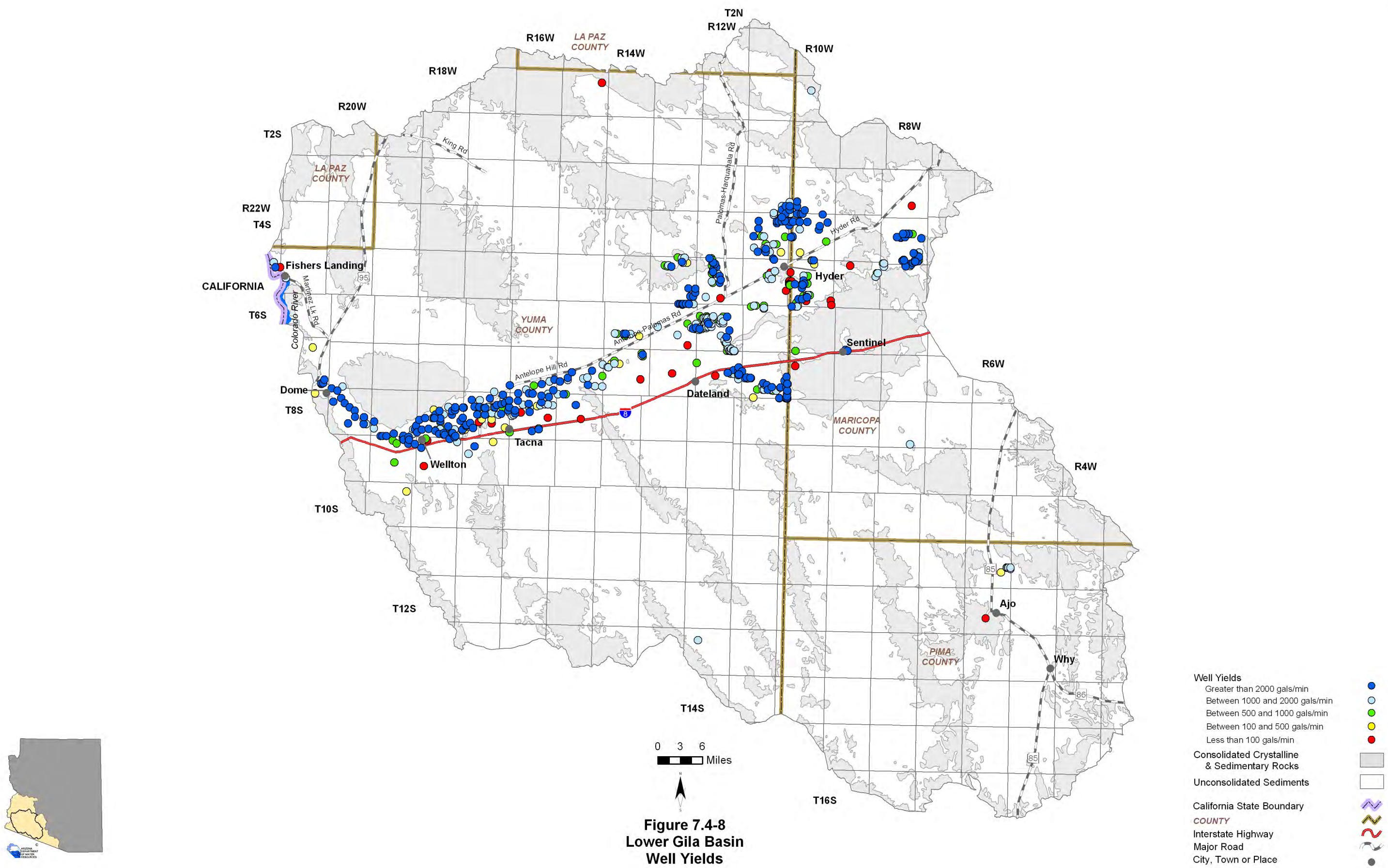


Figure 7.4-8
Lower Gila Basin
Well Yields

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. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mine Sites

- Refer to Table 7.4-7A.
- Two hundred and forty-six wells have parameter concentrations that have equaled or exceeded drinking water standards.
- Sixty-four percent of the wells equaled or exceeded the parameter for fluoride.
- Other parameters equaled or exceeded include arsenic, cadmium, lead, nitrate, selenium and total dissolved solids.

Lakes and Streams

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

Table 7.4-7 Water Quality Exceedences in the Lower Gila Basin (cont'd.)[1]

A. Wells, Springs and Mines

Map Key	Map Location[2]	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[3]
			Township	Range	Section	
53	A	Well	5 South	10 West	36	F
54	A	Well	5 South	11 West	2	F
55	A	Well	5 South	11 West	15	F
56	A	Well	5 South	11 West	15	As, NO3
57	A	Well	5 South	12 West	4	F
58	A	Well	5 South	12 West	4	F
59	A	Well	5 South	12 West	4	F
60	A	Well	5 South	12 West	4	F
61	A	Well	5 South	12 West	5	F
62	A	Well	5 South	12 West	9	F
63	A	Well	5 South	12 West	9	F
64	A	Well	5 South	12 West	16	F
65	A	Well	5 South	12 West	16	As, NO3
66	A	Well	5 South	12 West	22	As
67	A	Well	5 South	13 West	36	F
68	A	Well	5 South	13 West	36	F
69	A	Well	5 South	13 West	36	F
70	M	Well	5 South	19 West	5	F
71	M	Well	5 South	19 West	19	F
72	M	Well	5 South	21 West	19	As, F
73	A	Well	6 South	8 West	17	F
74	A	Well	6 South	9 West	5	F
75	A	Well	6 South	9 West	32	As, F
76	A	Well	6 South	10 West	35	Pb
77	A	Well	6 South	10 West	35	F
78	A	Well	6 South	12 West	8	F
79	A	Well	6 South	12 West	10	F, TDS
80	A	Well	6 South	12 West	17	F
81	A	Well	6 South	12 West	18	F
82	A	Well	6 South	12 West	18	F
83	A	Well	6 South	12 West	19	NO3, TDS
84	A	Well	6 South	12 West	27	F
85	A	Well	6 South	12 West	30	F
86	A	Well	6 South	12 West	35	F
87	A	Well	6 South	12 West	35	F
88	A	Well	6 South	12 West	35	F
89	A	Well	6 South	12 West	35	F
90	A	Well	6 South	12 West	35	F
91	A	Well	6 South	13 West	3	As
92	A	Well	6 South	14 West	22	As
93	M	Well	6 South	15 West	15	F
94	M	Well	6 South	18 West	32	F
95	M	Well	6 South	20 West	21	F
96	M	Well	6 South	20 West	21	F
97	M	Well	6 South	20 West	32	F
98	M	Well	6 South	21 West	10	F
99	M	Well	6 South	21 West	23	F
100	M	Well	6 South	21 West	34	F
101	A	Well	7 South	10 West	7	F
102	M	Well	7 South	10 West	22	F
103	M	Well	7 South	10 West	22	F
104	M	Well	7 South	10 West	36	F

Table 7.4-7 Water Quality Exceedences in the Lower Gila Basin (cont'd.)[1]

A. Wells, Springs and Mines

Map Key	Map Location[2]	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[3]
			Township	Range	Section	
105	M	Well	7 South	11 West	19	F
106	M	Well	7 South	11 West	24	F
107	M	Well	7 South	11 West	25	F
108	M	Well	7 South	11 West	25	F
109	M	Well	7 South	11 West	25	F
110	M	Well	7 South	11 West	25	F
111	M	Well	7 South	11 West	26	F
112	M	Well	7 South	11 West	26	F
113	M	Well	7 South	11 West	28	F
114	M	Well	7 South	11 West	28	F
115	M	Well	7 South	11 West	32	F
116	M	Well	7 South	11 West	36	F
117	M	Well	7 South	11 West	36	F
118	M	Well	7 South	11 West	36	F
119	M	Well	7 South	11 West	36	F
120	M	Well	7 South	11 West	36	As, F
121	A	Well	7 South	12 West	7	As, F
122	A	Well	7 South	12 West	8	As, F
123	A	Well	7 South	12 West	13	F
124	A	Well	7 South	12 West	13	As, F
125	A	Well	7 South	12 West	13	F
126	M	Well	7 South	12 West	14	F
127	M	Well	7 South	12 West	17	F
128	M	Well	7 South	12 West	21	F
129	M	Well	7 South	12 West	23	F
130	M	Well	7 South	12 West	25	F
131	A	Well	7 South	13 West	13	F
132	M	Well	7 South	13 West	21	F
133	M	Well	7 South	13 West	24	TDS
134	M	Well	7 South	13 West	24	As, F
135	M	Well	7 South	13 West	24	As, F
136	M	Well	7 South	13 West	24	F
137	M	Well	7 South	14 West	24	F
138	M	Well	7 South	14 West	24	F
139	B	Well	7 South	15 West	13	TDS
140	B	Well	7 South	15 West	14	TDS
141	B	Well	7 South	15 West	20	TDS
142	B	Well	7 South	15 West	20	TDS
143	B	Well	7 South	15 West	22	TDS
144	B	Well	7 South	15 West	22	TDS
145	B	Well	7 South	15 West	25	TDS
146	B	Well	7 South	15 West	26	As, F, TDS
147	B	Well	7 South	15 West	29	TDS
148	B	Well	7 South	15 West	30	TDS
149	B	Well	7 South	16 West	25	F, TDS
150	B	Well	7 South	16 West	26	TDS
151	B	Well	7 South	16 West	31	F
152	B	Well	7 South	16 West	33	TDS
153	B	Well	7 South	16 West	34	TDS
154	B	Well	7 South	17 West	34	F, NO3, TDS
155	B	Well	7 South	17 West	35	As, NO3, TDS
156	B	Well	7 South	19 West	14	Pb

Table 7.4-7 Water Quality Exceedences in the Lower Gila Basin (cont'd.)[1]

A. Wells, Springs and Mines

Map Key	Map Location[2]	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[3]
			Township	Range	Section	
157	M	Well	7 South	21 West	10	F
158	M	Well	7 South	21 West	10	As
159	M	Well	7 South	21 West	11	F
160	M	Well	8 South	13 West	6	Pb, TDS
161	M	Well	8 South	13 West	20	NO3, TDS
162	M	Well	8 South	13 West	28	NO3, TDS
163	M	Well	8 South	13 West	34	TDS
164	B	Well	8 South	14 West	16	F
165	B	Well	8 South	14 West	16	F
166	B	Well	8 South	16 West	2	As
167	B	Well	8 South	16 West	4	TDS
168	B	Well	8 South	16 West	5	As, TDS
169	B	Well	8 South	16 West	7	NO3
170	B	Well	8 South	16 West	9	TDS
171	B	Well	8 South	16 West	9	TDS
172	B	Well	8 South	16 West	11	F, NO3
173	B	Well	8 South	16 West	11	TDS
174	B	Well	8 South	17 West	1	TDS
175	B	Well	8 South	17 West	3	TDS
176	B	Well	8 South	17 West	3	As, NO3
177	B	Well	8 South	17 West	3	As, F
178	B	Well	8 South	17 West	9	NO3, TDS
179	B	Well	8 South	17 West	9	As, TDS
180	B	Well	8 South	17 West	10	TDS
181	B	Well	8 South	17 West	10	TDS
182	B	Well	8 South	17 West	13	TDS
183	B	Well	8 South	17 West	14	As, F
184	B	Well	8 South	17 West	17	TDS
185	B	Well	8 South	17 West	18	TDS
186	B	Well	8 South	17 West	18	TDS
187	B	Well	8 South	17 West	18	TDS
188	B	Well	8 South	17 West	25	As
189	B	Well	8 South	17 West	25	As
190	B	Well	8 South	18 West	14	F, TDS
191	B	Well	8 South	18 West	14	F, TDS
192	B	Well	8 South	18 West	20	As, TDS
193	B	Well	8 South	18 West	21	F, TDS
194	B	Well	8 South	18 West	21	TDS
195	B	Well	8 South	18 West	22	TDS
196	B	Well	8 South	18 West	25	As
197	B	Well	8 South	18 West	26	TDS
198	B	Well	8 South	18 West	27	TDS
199	B	Well	8 South	18 West	29	F
200	B	Well	8 South	18 West	29	As, TDS
201	B	Well	8 South	18 West	31	TDS
202	B	Well	8 South	18 West	34	As
203	B	Well	8 South	18 West	36	NO3
204	B	Well	8 South	19 West	25	TDS
205	B	Well	8 South	19 West	31	TDS
206	B	Well	8 South	19 West	36	TDS
207	B	Well	8 South	19 West	36	TDS
208	M	Well	8 South	20 West	9	As, TDS

Table 7.4-7 Water Quality Exceedences in the Lower Gila Basin (cont'd.)[1]

A. Wells, Springs and Mines

Map Key	Map Location[2]	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[3]
			Township	Range	Section	
209	M	Well	8 South	20 West	9	NO3, TDS
210	M	Well	8 South	20 West	9	TDS
211	M	Well	8 South	20 West	15	As, TDS
212	M	Well	8 South	20 West	25	As, TDS
213	M	Well	8 South	20.5 West	6	TDS
214	M	Well	8 South	21 West	1	TDS
215	M	Well	8 South	21 West	1	As
216	M	Well	9 South	6 West	23	F
217	M	Well	9 South	7 West	29	As
218	M	Well	9 South	11.5 West	36	F
219	M	Well	9 South	12 West	16	NO3, TDS
220	M	Well	9 South	12 West	31	As, F
221	B	Well	9 South	17 West	4	TDS
222	B	Well	9 South	17 West	9	F
223	B	Well	9 South	18 West	6	F
224	B	Well	9 South	18 West	10	F, NO3, TDS
225	B	Well	9 South	18 West	11	F
226	B	Well	9 South	18 West	19	F, TDS
227	B	Well	9 South	18 West	19	F, TDS
228	B	Well	9 South	18 West	20	F
229	B	Well	9 South	19 West	1	As, TDS
230	B	Well	9 South	19 West	1	F
231	B	Well	9 South	19 West	2	As
232	B	Well	9 South	19 West	3	TDS
233	B	Well	9 South	19 West	3	As, F
234	B	Well	9 South	19 West	4	As, TDS
235	B	Well	9 South	19 West	4	TDS
236	B	Well	9 South	19 West	6	F, TDS
237	B	Well	9 South	19 West	13	As, F
238	B	Well	9 South	19 West	24	TDS
239	M	Well	10 South	6 West	30	F
240	M	Well	10 South	8 West	22	F
241	M	Well	11 South	6 West	24	As, F
242	M	Well	11 South	6 West	24	As, F
243	M	Well	12 South	8 West	1	NO3
244	M	Well	12 South	8 West	17	Nos, TDS
245	M	Well	13 South	3 West	32	As
246	M	Well	13 South	5 West	25	As, Cd
247	M	Well	13 South	5 West	25	As, Cd

Table 7.4-7 Water Quality Exceedences in the Lower Gila Basin (cont'd.)[1]

B. Lakes and Streams

Map Key	Map Location[2]	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	M, B	Stream	Gila River (Coyote Wash to Fortuna Wash)	28	NA	A&W	B, Se
b	A	Lake	Painted Rock Borrow Pit Lake	NA	186	A&W, FC	Dissolved Oxygen, Organics

Notes:

[1] Water quality samples collected between 1975 and 2004.
[2] M = main map, A = inset A, B = inset B
[3] As = Arsenic
Bo = Boron
Cd = Cadmium
F = Fluoride
Pb = Lead
NO3 = Nitrate/ Nitrite
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

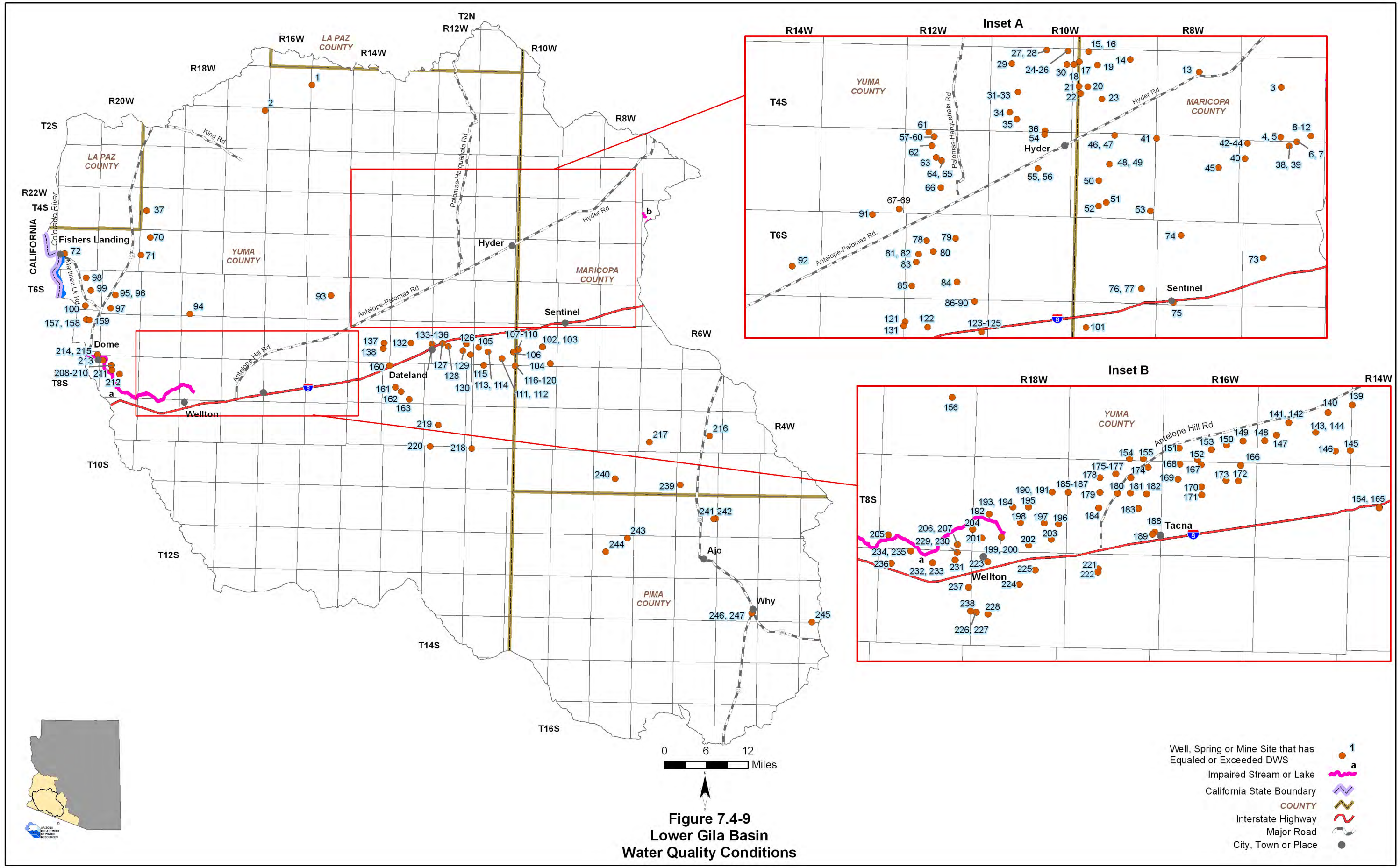


Figure 7.4-9
Lower Gila Basin
Water Quality Conditions

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, Section 1.3.5. 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 11,303 in 2000 and projections suggest an increase of over 9,000 residents by 2050.
- Most cultural water use is for irrigation primarily near the Gila River.
- Agricultural water demand for groundwater and surface water increased approximately 10% between 1991 and 2003.
- Industrial groundwater demand is relatively small but increased 5% from 1991 to 2003. Industrial uses in the basin include multiple dairies and a large feedlot.
- Municipal groundwater demand is relatively small and increased 16% from 1991 to 2003. Municipal surface water use is also minimal but increased 50% from 1991 to 2003.
- As of 2003 there were 1,674 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 593 wells with a pumping capacity of more than 35 gallons per minute.

Effluent Generation

- Refer to Table 7.4-9.
- There are seven wastewater treatment facilities in this basin.
- Information on disposal method was available for five facilities. All five facilities discharge to evaporation ponds and one facility also discharges for irrigation.

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

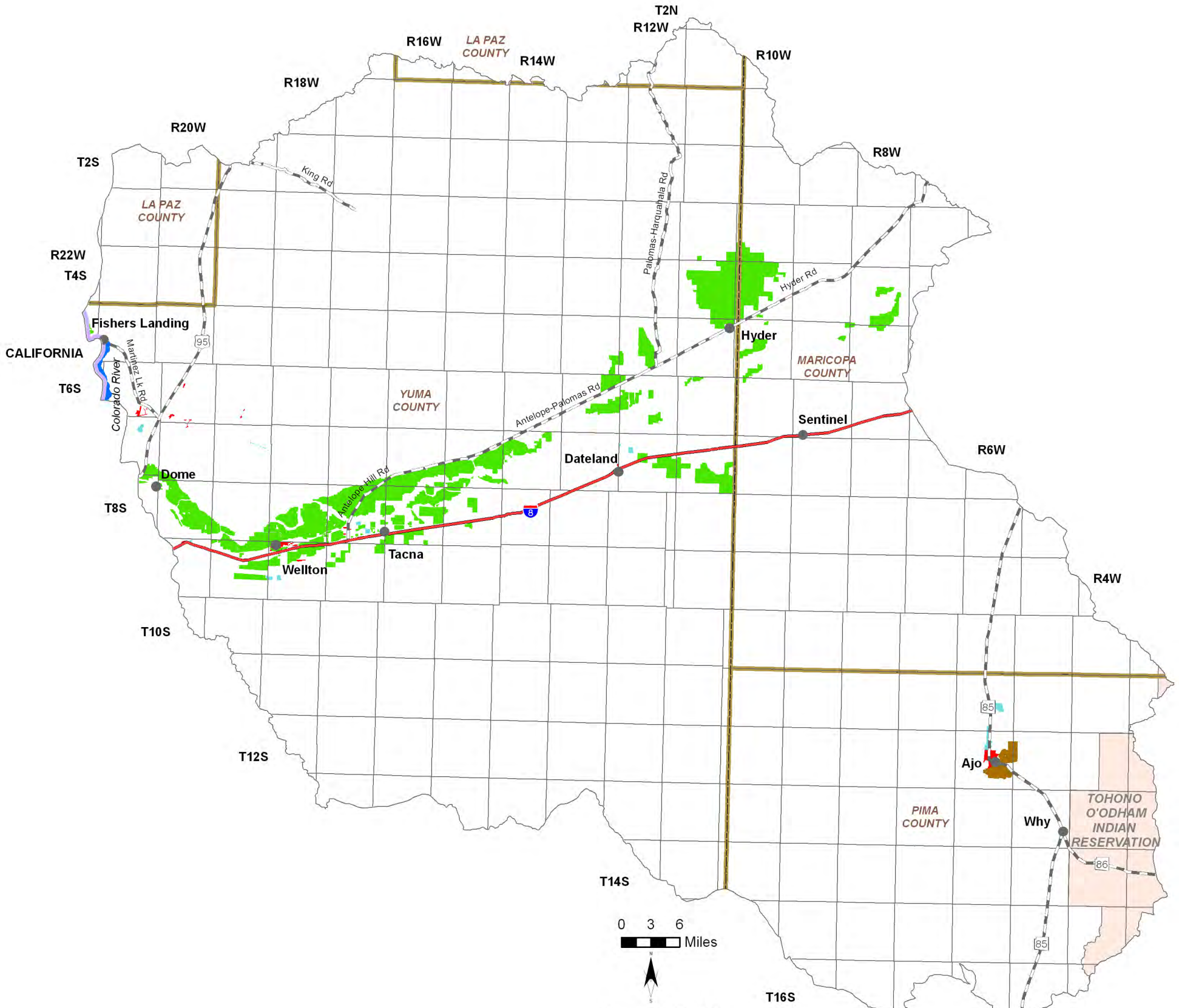
Year	Recent (Census) and Projected (DES) Population	Number of Registered Water Supply Wells Drilled		Average Annual Demand (in acre-feet)[3]						Data Source
				Well Pumpage[4]			Surface-Water Diversions			
		Q ≤ 35 gpm	Q > 35 gpm	Municipal	Industrial	Irrigation	Municipal	Industrial	Irrigation	
1971		539[2]	437[2]	360,000			1,251,000[5]			ADWR (1994)
1972										
1973										
1974										
1975										
1976				404,000			1,102,000[5]			
1977										
1978										
1979										
1980	9,873									
1981	9,813	941	74	348,000			1,130,000[5]			
1982	9,752									
1983	9,692									
1984	9,632									
1985	9,571									
1986	9,511	48	42	402,000			1,229,000[5]			
1987	9,451									
1988	9,390									
1989	9,330									
1990	9,270									
1991	9,473	40	23	1,800	3,600	254,000	400	NR	365,000	USGS (2005) ADWR (2005) ADEQ (2005)
1992	9,676									
1993	9,880									
1994	10,083									
1995	10,286									
1996	10,490	56	10	1,900	3,700	261,000	400	NR	391,000	
1997	10,693									
1998	10,896									
1999	11,100									
2000	11,303									
2001	11,407	34	3	2,100	3,800	282,000	600	NR	399,000	
2002	11,511									
2003	11,615									
2010	12,343									
2020	14,046									
2030	16,055									
2040	18,254									
2050	20,719									
ADDITIONAL WELLS: [6]		**16**	**4**							
WELL TOTALS:		**1,674**	**593**							

[1] Does not include 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.
[6] Other water-supply wells are listed in the ADWR Well Registry for this basin, but they do not have completion dates. These wells are summed here.
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)	Disposal Method							Current Treatment Level	Population Not Served	Year of Record
					Water - course	Evaportion Pond	Irrigation	Golf Course	Wildlife Area	Discharged to Another Facility	Infiltration Basins			
Ajo WWTF	Ajo ID	Ajo	1,089	50		X	X					NA		2003
Links @ Coyote Wash WWTP	NA	Wellton	NA											
Laguna Airfield	US Army	Airfield	NA	NA		X						NA		
Kofa Firing Range	US Army	Army Base		56		X						NA		
US Army Garrison- Main WWTF	US Army	Army Base	NA			X						NA		
US Army Garrison-Main Adminisitration Area WWTF	US Army	Army Base	1,000	NA		X						NA		
US Army Garrison-Material Test Area WWTP	US Army	Army Base	NA											

NA: Data not currently available to ADWR
WWTF: Waste Water Treatment Facility
WWTP: Waste Water Treatment Plant
ID: Improvement District



Primary Data Source: USGS National Gap Analysis Program, 2004

Demand Centers

- Agriculture
- M&I - High Intensity
- M&I - Low Intensity
- Large Mine
- Indian Reservation
- California State Boundary
- COUNTY
- Interstate Highway
- Major Road
- City, Town or Place

Figure 7.4-10
Lower Gila Basin
Cultural Water Demand

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 A. Adequacy determination data sources and methods are found in Volume 1, Sections 1.3.1.

Water Adequacy Reports

- See Table 7.4-10
- A total of 26 water adequacy determinations have been made in this basin through May 2005.
- 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	565	565	100%
Yuma County	2,079	1,748	84%

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 Determination[3]	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
1	Arletta Estates	Yuma	9 South	19 West	14	8		Inadequate	C	02/05/75	Dry Lot Subdivision
2	Butterfield Bluff	Yuma	9 South	18 West	4, 5	201		Adequate		10/29/87	Town of Wellton
3	Butterfield Bluff # 4	Yuma	9 South	18 West	4	21	22-400385	Adequate		09/25/00	Town of Wellton
4	Caballo Farms	Yuma	6 South	15 West	31	60		Inadequate	C	05/19/75	Dry Lot Subdivision
5	Cameron Place Addition	Pima	12 South	6 West	15	97		Adequate		12/20/85	Ajo Improvement Company
6	Camino Viejo	Yuma	9 South	18 West	6	18	22-400480	Inadequate	C	04/25/01	Town of Wellton
7	Citrus Park	Yuma	8 South	16 West	31	656		Adequate		06/01/73	Mohawk Water Company
8	Copper Ridge Unit A	Yuma	9 South	18 West	5	8	22-400197	Adequate		12/13/99	Town of Wellton
9	Coyote Wash Condominiums	Yuma	9 South	18 West	8	80	22-401632	Adequate		03/23/05	Town of Wellton
10	Crystal Sands	Yuma	7 South	13 West	12, 13	15		Inadequate	C	07/01/74	Dry Lot Subdivision
11	Erickson	Yuma	9 South	18 West	4	8	22-400426	Adequate		12/06/00	Town of Wellton
12	Grande Vista	Yuma	8 South	17 West	27, 28, 22, 21	20	22-400243	Adequate		02/02/00	Dry Lot Subdivision
13	Hankins Subdivision	Yuma	9 South	18 West	5	17		Adequate		07/18/86	Town of Wellton
14	Jojoba Farms # 1	Yuma	7 South	12 West	16	20		Adequate		06/23/83	Dry Lot Subdivision
15	Links at Coyote Wash	Yuma	9 South	18 West	7	171	22-401007	Adequate		08/13/03	Town of Wellton
16	Links at Coyote Wash Unit 2	Yuma	10 South	19 West	7	333	22-401286	Adequate		05/18/04	Town of Wellton
17	Morisse	Yuma	3 South	19 West	29	30		Adequate		05/05/78	NA
18	New Cornelia Addition	Pima	12 South	6 West	14, 15, 22, 23	468		Adequate		02/14/86	Ajo Improvement Company
19	New Tacna Townsite	Yuma	8 South	17 West	25	10		Inadequate	C	01/15/87	Tacna Water Company
20	Orange Grove Ranch Estates	Yuma	9 South	18 West	3	122		Inadequate	C	01/15/75	Dry Lot Subdivision
21	Rio Lindo Shores	Yuma	11 South	18 West	31	36		Adequate		02/29/80	Graham Water Service
22	Rio Salado Ranches 1 & 2	Yuma	6 South	11 West	24, 25	116		Inadequate	D	03/14/74	Dry Lot Subdivision

Table 7.4-10 Adequacy Determinations in the Lower Gila Basin (cont'd)[1]

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
23	Sandpiper # 1	Yuma	10 South	19 West	15	73		Adequate		01/14/82	Graham Water Service
24	Sports Valley Condominiums	Yuma	10 South	19 West	22	24		Adequate		09/01/82	Graham Water Company
25	Tacna Manor	Yuma	8 South	17 West	25	14		Adequate		08/12/81	Tacna Water Company
26	VanGelder Subdivision	Yuma	11 South	20 West	6	18		Adequate		01/24/86	Wellton, Town of

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 determination.

[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

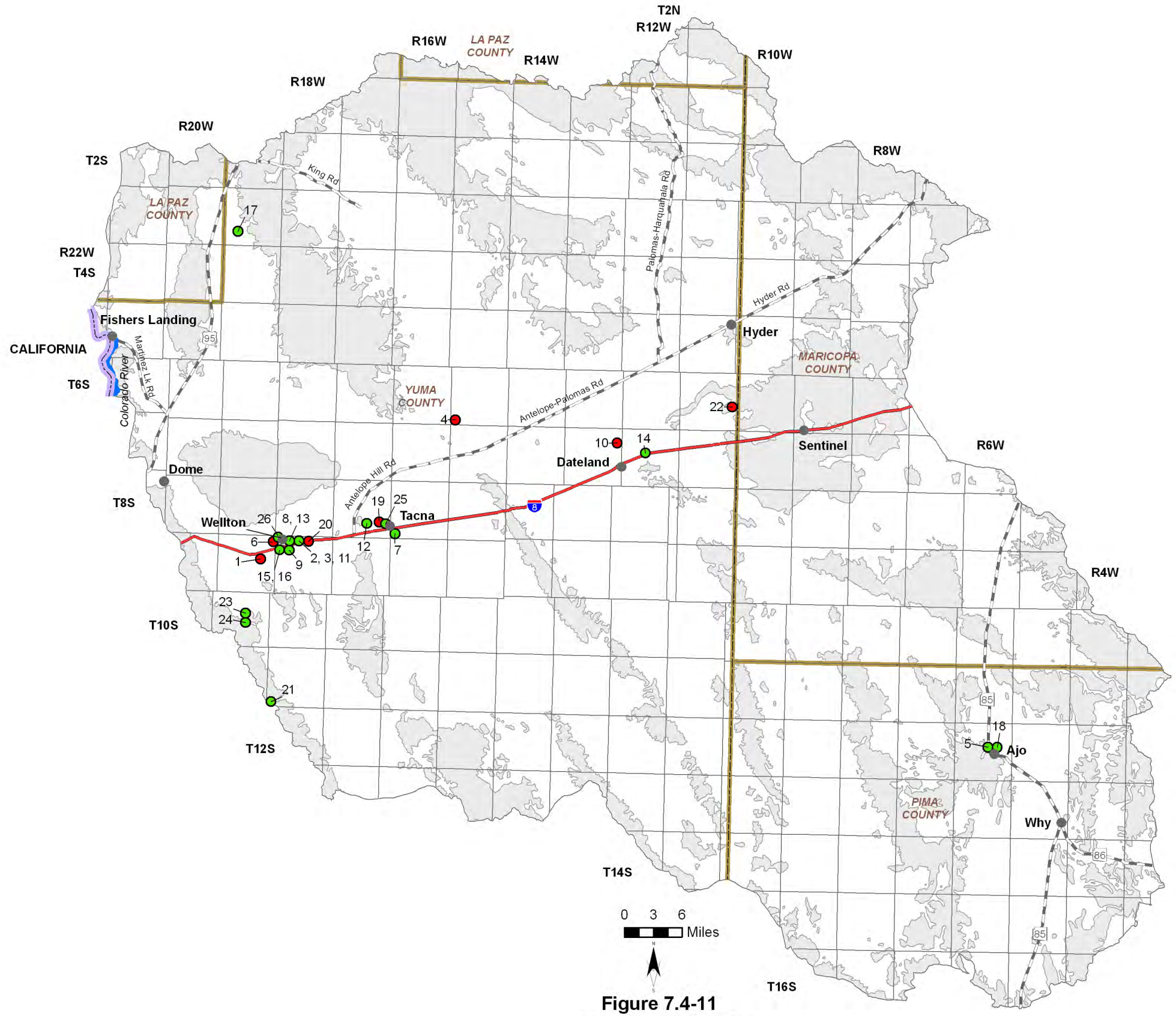


Figure 7.4-11
Lower Gila Basin
Adequacy Determinations

Lower Gila Basin
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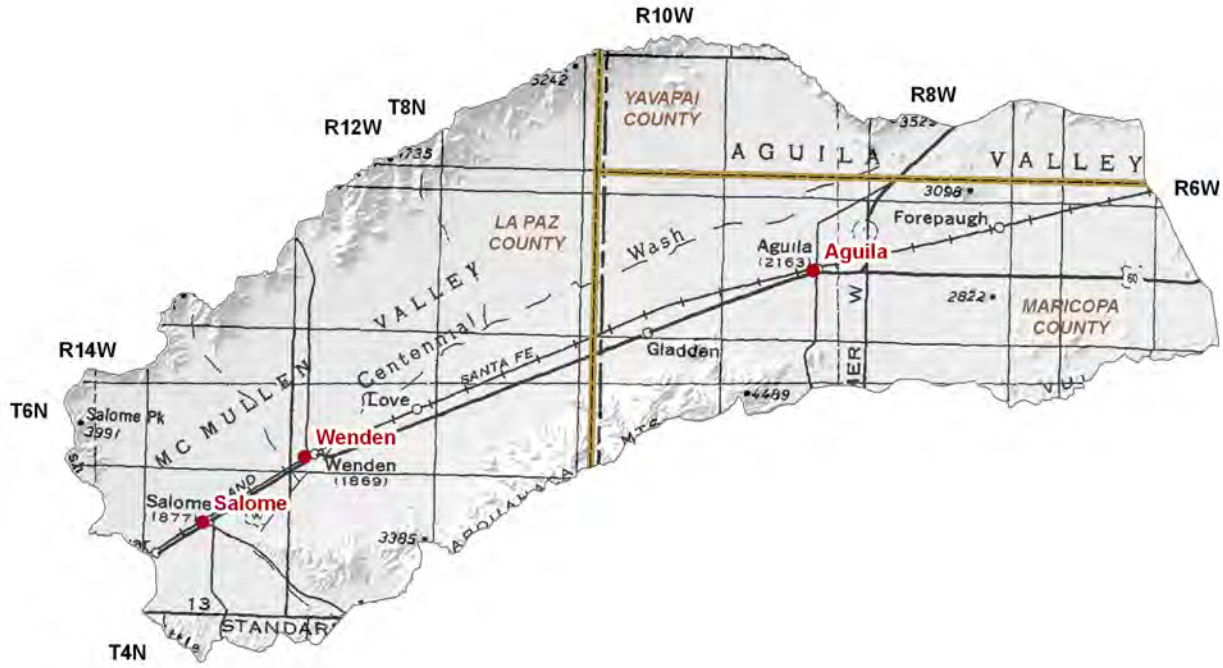
Section 7.5
McMullen Valley Basin

7.5.1 Geography of the McMullen Valley Basin

The McMullen Valley Basin, located in the northeastern part of the planning area, is 649 square miles in area. Geographic features and principal communities are shown on Figure 7.5-1. The basin is characterized by two valleys bordered by mountain ranges. Vegetation types include Lower Colorado River Valley and Arizona Uplands Sonoran desertscrub with small amounts of southwestern interior chaparral and semi-desert grassland. (See Figure 7.0-7)

- Principal geographic features shown on Figure 7.5-1 are:
    - Basin communities of Aguila, Salome and Wenden
    - Centennial Wash running east to west through the center of the basin
    - McMullen Valley in the western portion of the basin and Aguila Valley in the eastern portion of the basin
    - Harquahala Mountains along the southern basin boundary
    - The lowest point in the basin at approximately 1,680 feet where Centennial Wash exits the basin southeast of Salome
- Not well shown on Figure 7.5-1 are the Harcuvar Mountains on the northern basin boundary with the highest point in the basin at 5,242 feet.



Base Map: USGS 1:500,000, 1981

0 3 6 Miles

COUNTY
City, Town or Place

Figure 7.5-1
McMullen Valley Basin
Geographic Features

7.5.2 Land Ownership in the McMullen Valley Basin

Land ownership, including the percentage of ownership by category, for the McMullen Valley Basin is shown in Figure 7.5-2. The principal feature of land ownership in this basin is the limited number of land ownership types. A description of land ownership data sources and methods is found in Volume 1, Section 1.3.8. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

U.S. Bureau of Land Management (BLM)

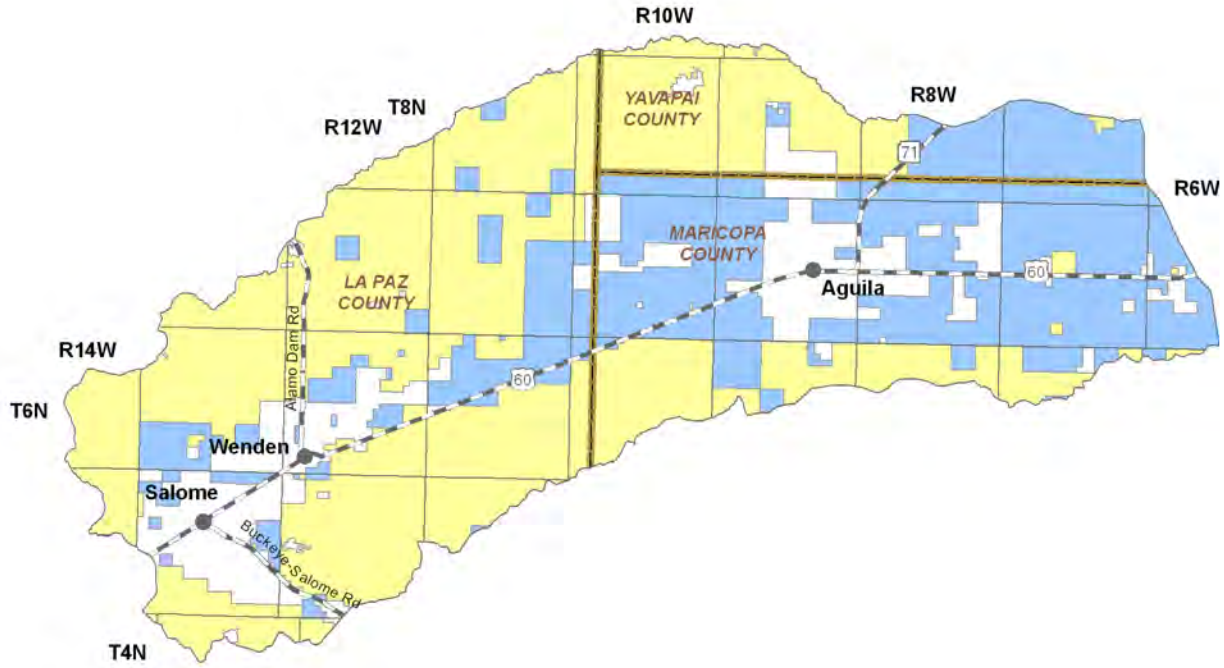
- 51.8% of the land is federally owned and managed by the Yuma Field Office of the Bureau of Land Management.
- This basin contains 9,000 acres of the 23,000 acre Harquahala Mountains Wilderness and 14,000 acres of the 25,000 acre Harcuvar Mountains Wilderness. (See Figure 7.0-9)
- Land uses include grazing, resource conservation and recreation.

State Trust Land

- 33.4% of the land is held in trust for the public schools under the State Trust Land system.
- Land uses include agriculture and grazing.

Private

- 14.8% of the land is private.
- Land uses include agriculture, domestic and commercial.



Source: ALRIS, 2004

0 3 6 Miles

Land Ownership (Percentage in Basin)

U.S. Bureau of Land Management (51.8%)
State Trust (33.4%)
Private (14.8%)

COUNTY
Major Road
City, Town or Place

Figure 7.5-2
McMullen Valley Basin
Land Ownership

7.5.3 Climate of the McMullen Valley Basin

Climate data from NOAA/NWS Co-op Network and AZMET stations are complied in Table 7.5-1 and the locations are shown on Figure 7.5-3. Figure 7.5-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The McMullen Valley Basin does not contain Evaporation Pan or SNOTEL/Snowcourse stations. A description of the climate data sources and methods is found in Volume 1, Section 1.3.3.

NOAA/NWS Co-op Network

- Refer to Table 7.5-1A
- Temperatures at the two NOAA/NWS Co-op Network stations in the basin range from an average high of 88.1°F at Salome 6 SE to an average low of 47.6°F at Aguila.
- Average seasonal rainfall follows a bi-modal pattern with approximately one-third of the average seasonal rainfall occurring in the winter (January-March) season and one-third in the summer (July-September) season. The highest average annual rainfall in the basin is 8.30 inches at the Aguila station.

AZMET

- Refer to Table 7.5-1C
- There is one AZMET station in the basin, Aguila. This station is at 2,149 feet and has an annual evaporation rate of 84.38 inches.

SCAS Precipitation Data

- See Figure 7.5-3
- Additional precipitation data shows average annual rainfall as high as 18 inches in the Harcuvar Mountains along the northern basin boundary and as low as eight inches in the middle of the basin.

Table 7.5-1 Climate Data for the McMullen Valley 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
Aguila	2,170	1971-2000	85.3/Jul	47.6/Dec	3.20	0.42	2.81	1.87	8.30
Salome 6 SE	1,700	1908-1957	88.1/Jul	48.5/Jan	2.53	0.52	3.09	1.75	7.87

Source: WRCC, 2003

B. Evaporation Pan:

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

Source: WRCC, 2003.

C. AZMET:

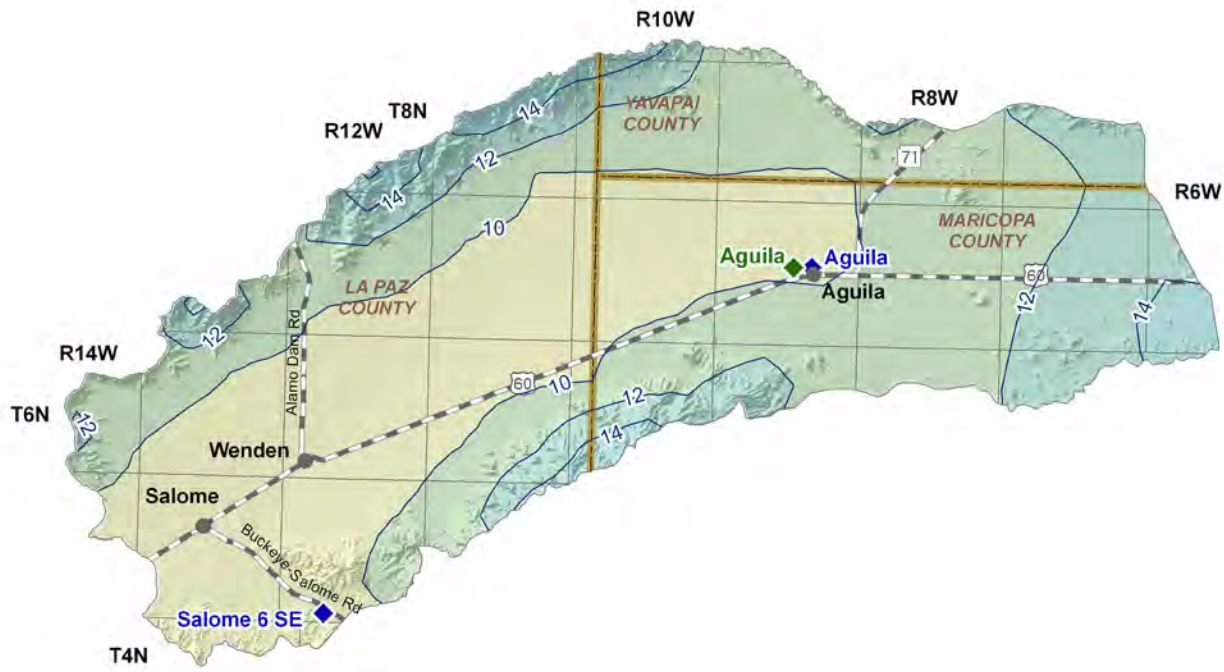
Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Annual Reference Evaportranspiration, in inches (*Number of years to calculate averages*)
Aguila	2,149	1987 - current	84.38 *(6)*

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: NRCS, 2005



Average Annual Precipitation (1961-1990)
inches per year

- 8-10
- 10-12
- 12-14
- 14-16
- 16-18

Meteorological Stations

- NOAA/NWS
- AZMET
- Precipitation Contour (12)
- COUNTY
- Major Road
- City, Town or Place

0 3 6 Miles

Figure 7.5-3
McMullen Valley Basin
Meteorological Stations
and Annual Precipitation

Precipitation Data Source: Oregon State University, 1998

7.5.4 Surface Water Conditions in the McMullen Valley Basin

Flood ALERT equipment in the basin is shown in Table 7.5-3. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 7.5-4. Flood ALERT equipment and USGS runoff contours are shown on Figure 7.5-4. There are no USGS streamflow gages in this basin. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Flood ALERT Equipment

- Refer to Table 7.5-3.
- Most of the eight ALERT gages are located south of Centennial Wash.

Reservoirs and Stockponds

- Refer to Table 7.5-4.
- There are no large reservoirs in this basin.
- Surface water is stored or could be stored in two small reservoirs.
- There are 146 registered stockponds in this basin.

Runoff Contour

- Refer to Figure 7.5-4.
- Average annual runoff is highest, 0.2 inches per year or 10.66 acre-feet per square mile, in the easternmost portion of the basin and decreases to 0.1 inches, or five acre-feet per square mile, in the remainder of the basin.

Table 7.5-2 Streamflow Data for the McMullen Valley Basin

Station Number	USGS Station Name	Drainage Area (in mi^2)	Mean Basin Elevation (in feet)	Period of Record	Average Seasonal Flow (% of annual flow)				Annual Flow/Year (in acre-feet)				Years of Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
None													

Sources: USGS NWIS, USGS 1998 and USGS 2003.

Table 7.5-3 Flood ALERT Equipment in the McMullen Valley Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
5090	Centennial @ Wenden	Precipitation/Stage	9/2/1998	Maricopa Country FCD
5155	Grass Wash @ US 60	Precipitation	9/19/2001	Maricopa County FCD
5165	Outlaw Hill	Precipitation	5/13/2002	Maricopa County FCD
5170	Gladden	Precipitation	8/27/2002	Maricopa County FCD
5175	Centennial near Aguila	Precipitation/Stage	6/5/2001	Maricopa County FCD
5180	Centennial Wash	Precipitation	11/19/1981	Maricopa County FCD
5190	Smith Peak	Precipitation	5/1/1980	Maricopa County FCD
7140	Ritter Dam	Precipitation	11/21/2002	Maricopa County FCD

Notes:
FCD = Flood Control District

Table 7.5-4 Reservoirs and Stockponds in the McMullen Valley 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	JURISDICTION
None identified by ADWR at this time					

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

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

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

Total number: 1
Total maximum storage: 374 acre-feet

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

Total number: 1
Total surface area: 7 acres

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

Total number: 146

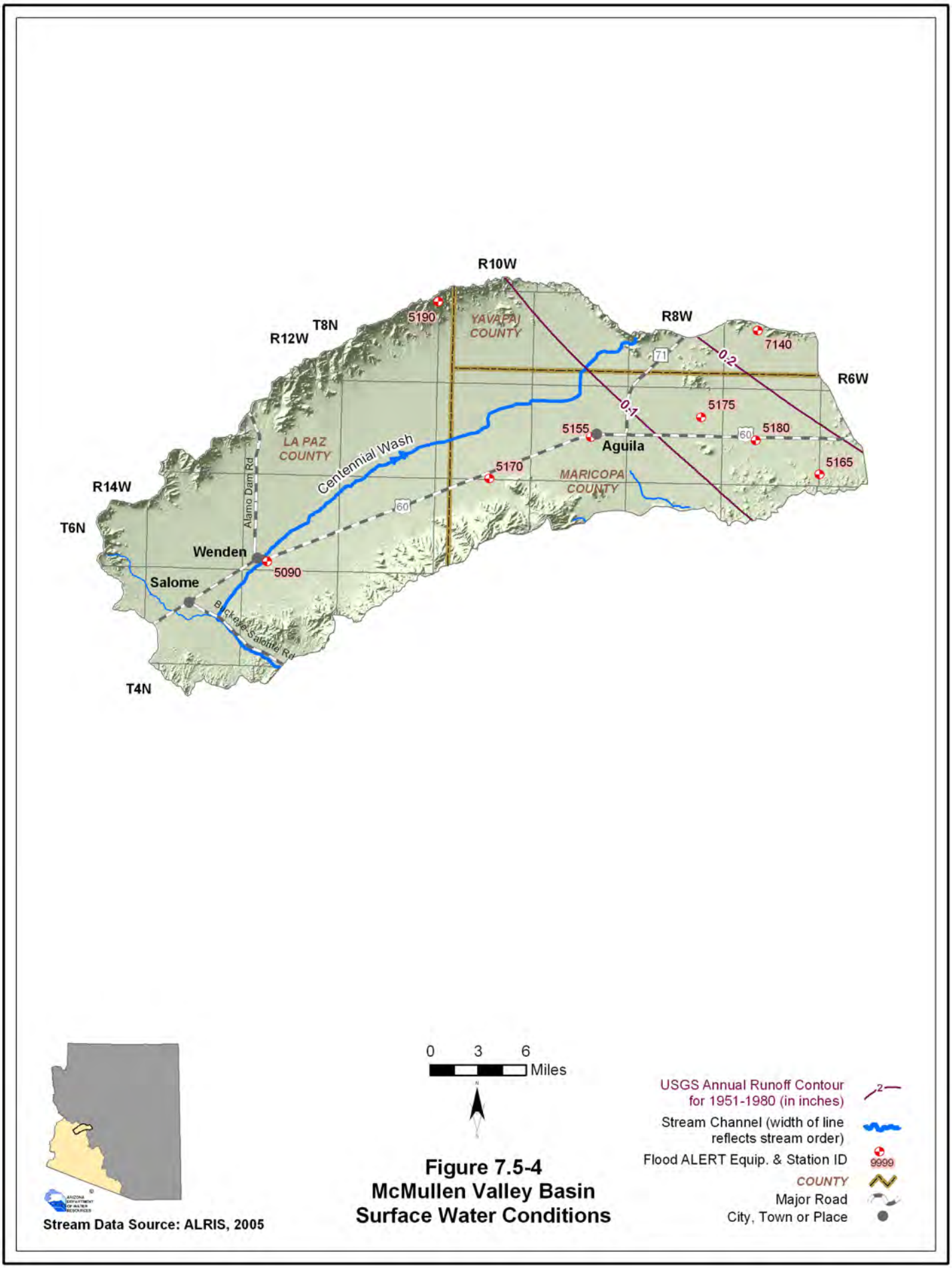


Figure 7.5-4
McMullen Valley Basin
Surface Water Conditions

7.5.5 Perennial/Intermittent Streams and Major Springs in the McMullen Valley Basin

The total number of springs in the basin are shown in Table 7.5-5. There are no perennial or intermittent streams and no major or minor springs in the McMullen Valley Basin. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, Section 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- The total number of springs, regardless of discharge, identified by the USGS is two.

Table 7.5-5 Springs in the McMullen Valley 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, 2005 and USGS, 2006): 2

7.5.6 Groundwater Conditions of the McMullen Valley Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.5-6. Figure 7.5-5 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 7.5-6 contains hydrographs for selected wells shown on Figure 7.5-5. Figure 7.5-7 shows well yields in five yield categories. A description of aquifer data sources and methods is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields, is found in Volume 1, Section 1.3.19.

Major Aquifers

- Refer to Table 7.5-6 and Figure 7.5-5.
- The major aquifer in this basin is basin fill.
- Groundwater flow is toward two cones of depression, one in the Wenden/Salome area and the other in the Aguila area.

Well Yields

- Refer to Table 7.5-6 and Figure 7.5-7.
- As shown on Figure 7.5-6, well yields in this basin are generally between 1,000 and 2,000 gallons per minute (gpm).
- One source of well yield information, based on 167 reported wells, indicates that the median well yield is 1,500 gpm.

Natural Recharge

- Refer to Table 7.5-6.
- There are two estimates of natural recharge; both estimates indicate that natural recharge is 1,000 acre-feet per year.
- The only source of natural recharge is rainfall (ADWR 1994).

Water in Storage

- Refer to Table 7.5-6.
- There are three estimates of water in storage for this basin, two at 14 million acre-feet and the third at 15.1 million acre-feet, all to a depth of 1,200 feet.

Water Level

- Refer to Figure 7.5-5. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 25 index wells in this basin; hydrographs for eight index wells are shown on Figure 7.5-6.
- The deepest water level shown on the map is 636 feet in the vicinity of Aguila and the shallowest is 29 feet west of Wenden.

Table 7.5-6 Groundwater Data for the McMullen Valley Basin

Basin Area, in square miles:	649	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
Well Yields, in gal/min:	Range 150-2,558 Median 1,132 (90 wells measured)	Measured by ADWR and/or USGS
	Range 9-3,500 Median 1,500 (167 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	Range 150-3,500	ADWR (1994)
	Range 0-2,500	USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	1,000	Freethey and Anderson (1986)
	1,000	Arizona Water Commission (1975)
Estimated Water Currently in Storage, in acre-feet:	15,100,000 (to 1,200 ft)	ADWR (1994)
	14,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	14,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
Current Number of Index Wells:	25	
Date of Last Water-level Sweep:	2004 (114 wells measured)	

[1]Prevelopment Estimate

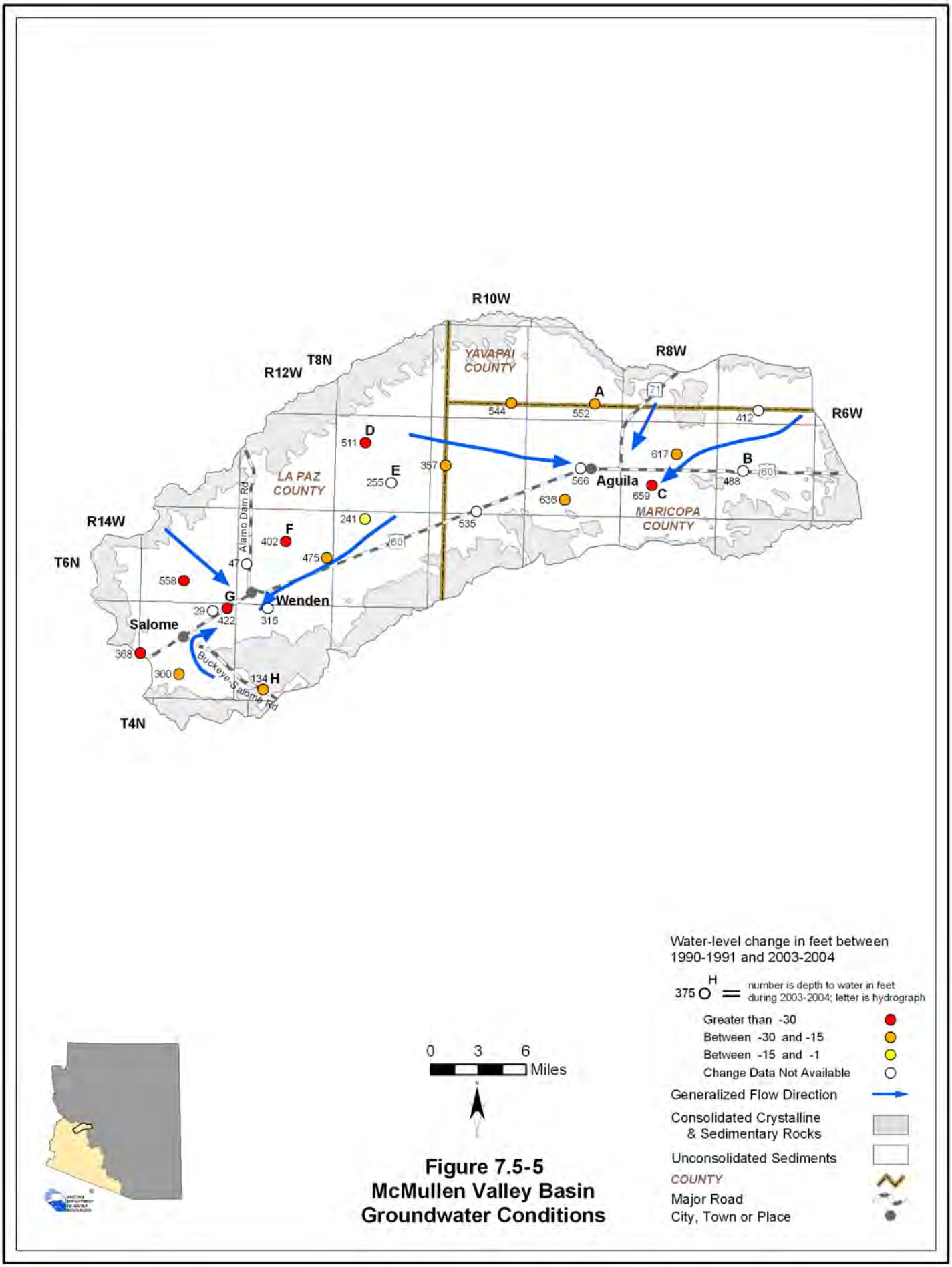


Figure 7.5-5
McMullen Valley Basin
Groundwater Conditions

Figure 7.5-6
McMullen Valley Basin
Hydrographs Showing Depth to Water in Selected Wells

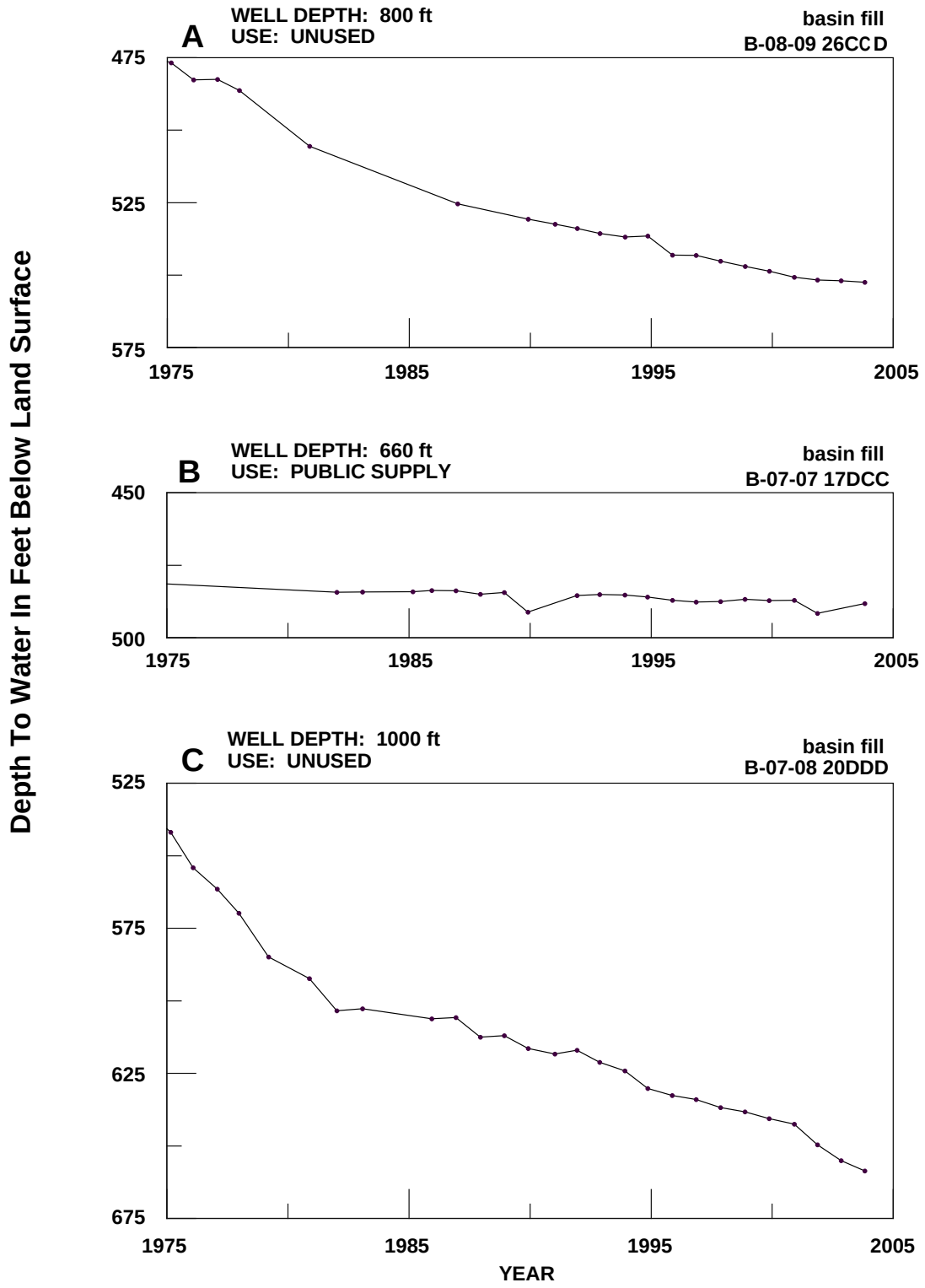


Figure 7.5-6 (cont'd)
McMullen Valley Basin
Hydrographs Showing Depth to Water in Selected Wells

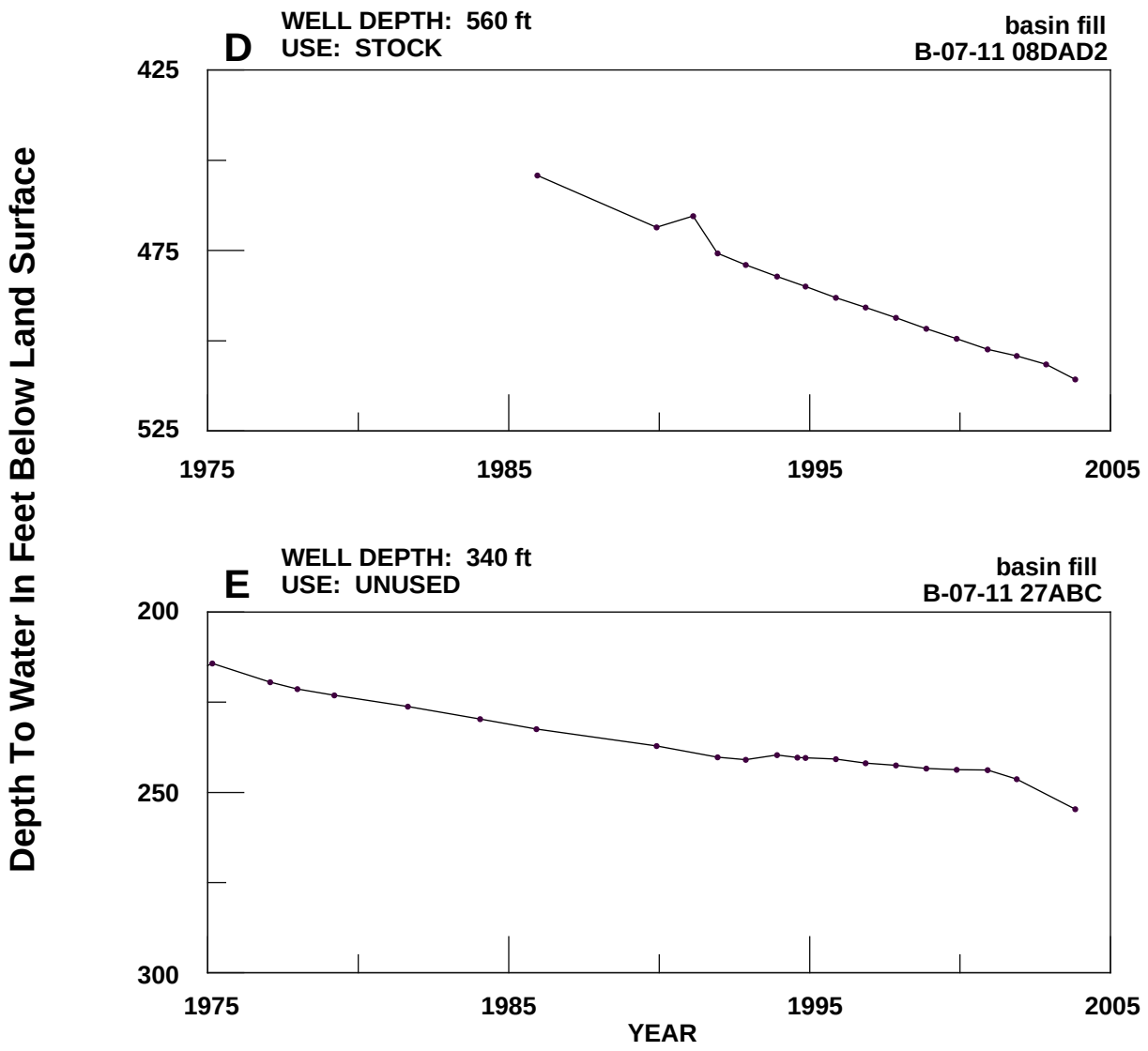


Figure 7.5-6 (cont'd)
McMullen Valley Basin
Hydrographs Showing Depth to Water in Selected Wells

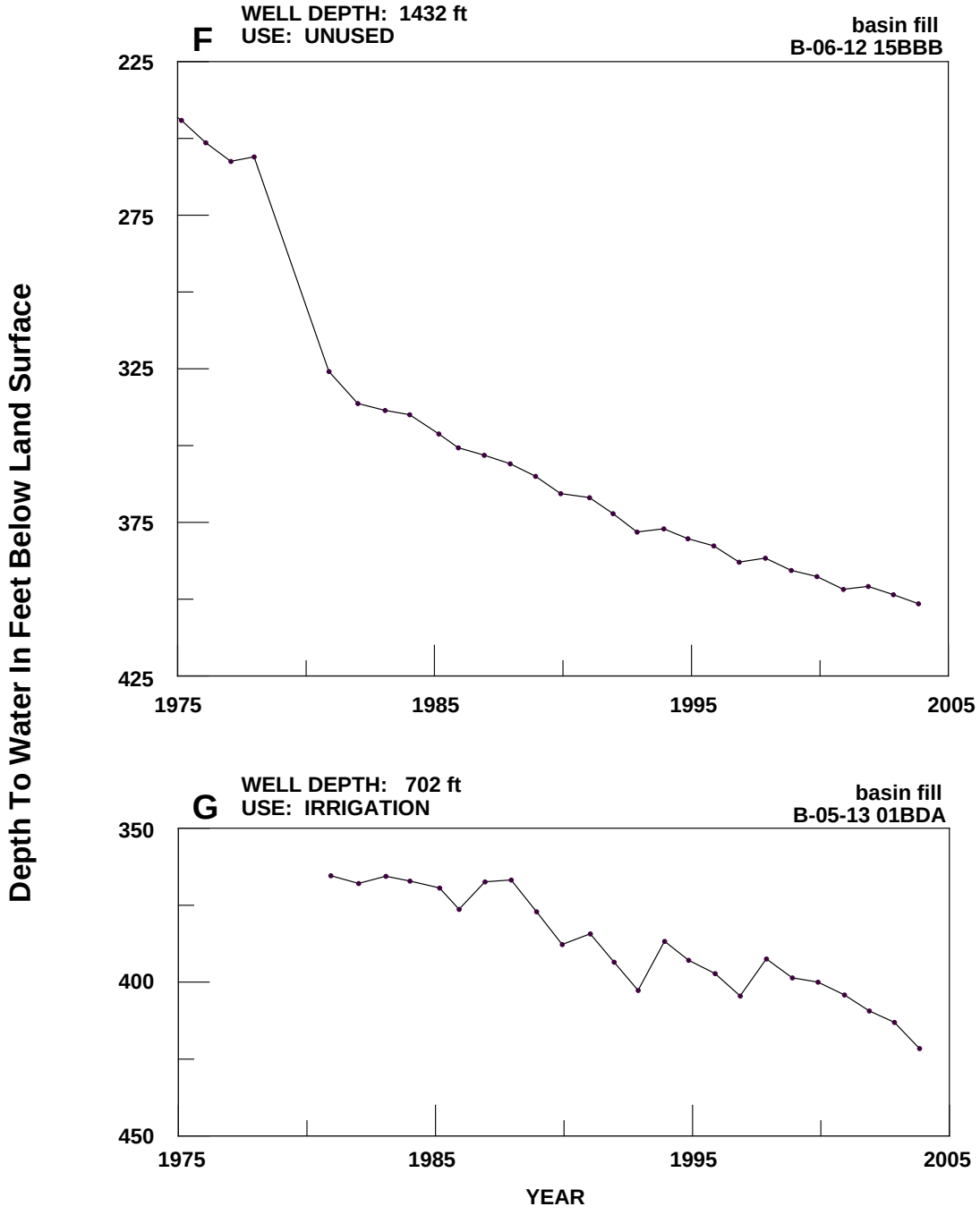
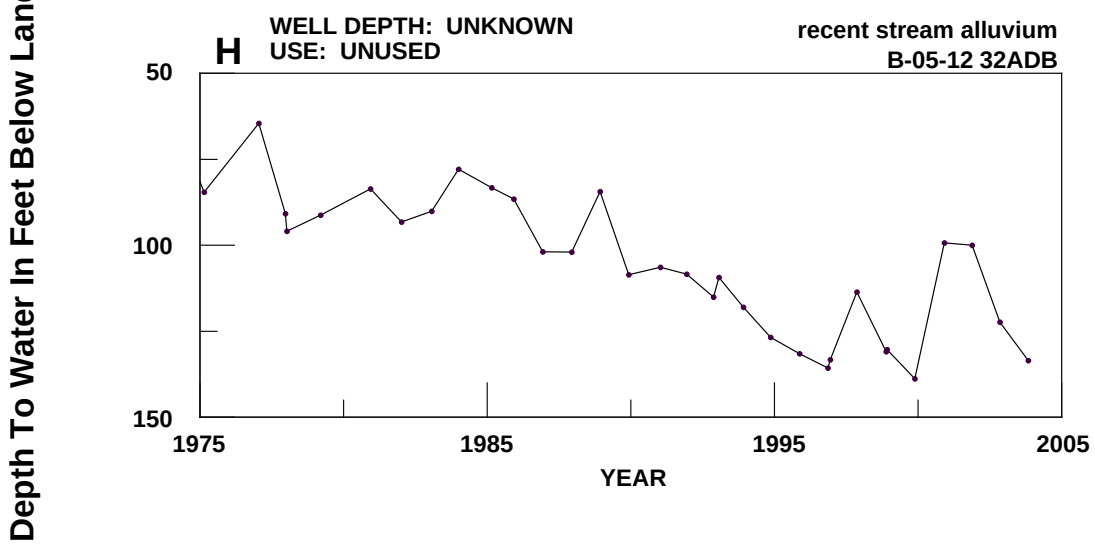
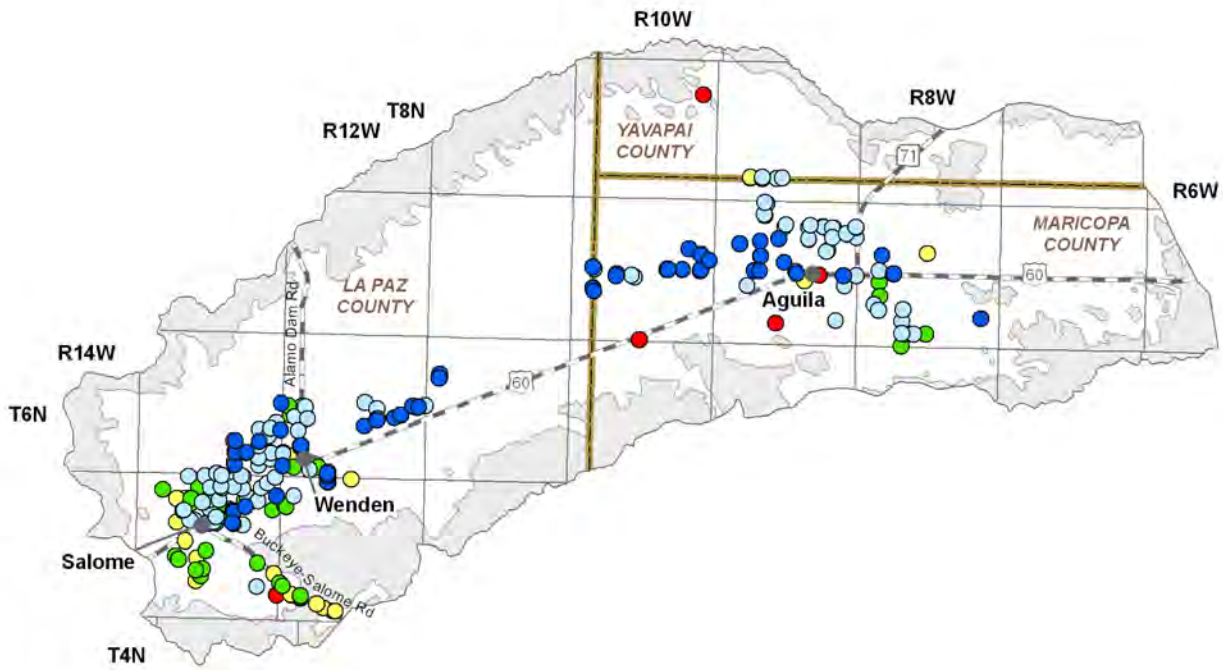


Figure 7.5-6 (cont'd)
McMullen Valley Basin
Hydrographs Showing Depth to Water in Selected Wells





0 3 6 Miles

Well Yields
- Greater than 2000 gals/min
- Between 1000 and 2000 gals/min
- Between 500 and 1000 gals/min
- Between 100 and 500 gals/min
- Less than 100 gals/min

Consolidated Crystalline & Sedimentary Rocks

Unconsolidated Sediments

COUNTY

Major Road

City, Town or Place

Figure 7.5-7
McMullen Valley Basin
Well Yields

7.5.7 Water Quality of the McMullen Valley 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 7.5-7A. There are no impaired lakes or streams in this basin. Figure 7.5-8 shows the location of water quality occurrences keyed to Table 7.5-7. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mine Sites

- Refer to Table 7.5-7A.
- Fifty-eight wells have parameter concentrations that have equaled or exceeded drinking water standards.
- Eighty-two percent of the wells equaled or exceeded the parameter for fluoride.
- Other parameters equaled or exceeded include arsenic, chromium, lead and nitrates.

Table 7.5-7 Water Quality Exceedences in the McMullen Valley Basin[1]

A. Wells, Springs and Mines

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

Table 7.5-7 Water Quality Exceedences in the McMullen Valley Basin cont[1]

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
48	Well	5 South	13 West	10	As, F, NO3
49	Well	5 South	13 West	10	NO3
50	Well	5 South	13 West	10	NO3
51	Well	5 South	13 West	11	NO3
52	Well	5 South	13 West	11	NO3
53	Well	5 South	13 West	11	F, NO3
54	Well	5 South	13 West	12	F
55	Well	5 South	13 West	12	NO3
56	Well	5 South	13 West	12	F, TDS
57	Well	5 South	13 West	14	As, NO3
58	Well	5 South	13 West	14	NO3

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	Parameter(s) Exceeding Use Standard
None identified by ADWR at this time						

Notes:

[1] Water quality samples collected between 1976 and 2001.
[2] As = Arsenic
Cr = Chromium
NO3 = Nitrate/ Nitrite
F = Fluoride
Pb = Lead

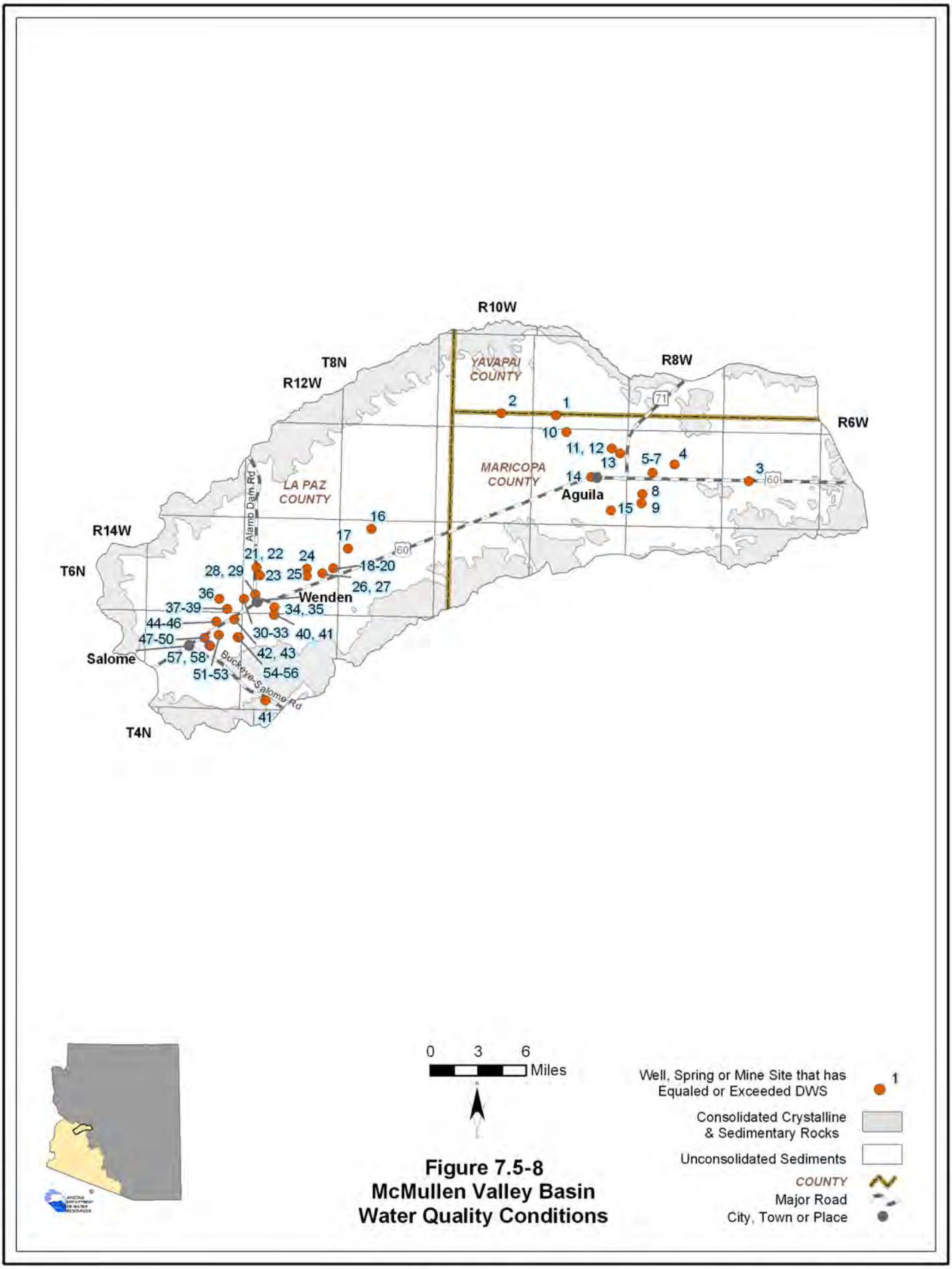


Figure 7.5-8
McMullen Valley Basin
Water Quality Conditions

7.5.8 Cultural Water Demands in the McMullen Valley 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 7.5-8. Figure 7.5-9 shows the location of demand centers. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown in Table 7.5-9. A description of cultural water demand data sources and methods is found in Volume 1, Section 1.3.5. More detailed information on cultural water demands is found in Section 7.0.7.

Cultural Water Demands

- Refer to Table 7.5-8 and Figure 7.5-9.
- Population in this basin increased from 280 in 1980 to 2,291 in 2000 and projections suggest the population will more than double by 2050.
- Most cultural water use is for irrigation located near Wenden/Salome and in the Aguila area.
- Groundwater use for agriculture increased 27% from 1991 to 2003.
- Both municipal and industrial groundwater demand are minimal in this basin. Municipal demand increased 20% from 1991 to 2003 and industrial demand remained the same.
- There is no reported surface water demand in this basin.
- As of 2003 there were 362 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 187 wells with a pumping capacity of more than 35 gallons per minute.

Effluent Generation

- Refer to Table 7.5-9.
- There is one wastewater treatment plant in this basin, Forepaugh WWTP, no other information was available on this facility.

Table 7.5-8 Cultural Water Demands in the McMullen Valley Basin[1]

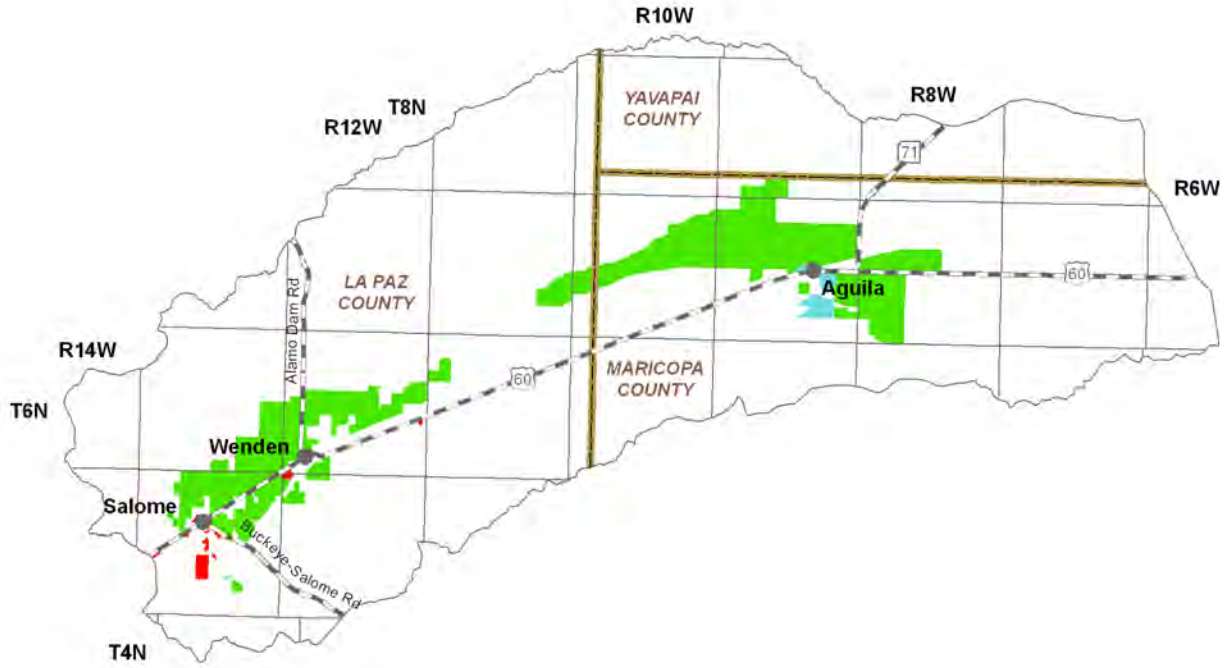
Year	Recent (Census) and Projected (DES) Population	Number of Registered Water Supply Wells Drilled		Average Annual Demand (in acre-feet)						Data Source
				Well Pumpage			Surface-Water Diversions			
		Q ≤ 35 gpm	Q > 35 gpm	Municipal	Industrial	Irrigation	Municipal	Industrial	Irrigation	
1971		127[2]	173[2]	120,000			NR			ADWR (1994)
1972										
1973										
1974										
1975										
1976				123,000			NR			
1977										
1978										
1979										
1980	280									
1981	395	27	9	94,000			NR			
1982	509									
1983	624									
1984	739									
1985	853									
1986	968	24	3	60,000			NR			
1987	1,083									
1988	1,197									
1989	1,312									
1990	1,427									
1991	1,513	38	1	450	<300	77,000	NR			USGS (2005)
1992	1,599									
1993	1,686									
1994	1,772									
1995	1,859									
1996	1,945	79	1	500	<300	79,500	NR			
1997	2,032									
1998	2,118									
1999	2,205									
2000	2,291									
2001	2,430	39	0	550	<300	98,000	NR			
2002	2,569									
2003	2,707									
2010	3,679									
2020	4,143									
2030	4,565									
2040	4,835									
2050	5,028									
ADDITIONAL WELLS: [3]		**28**								
WELL TOTALS:		**362**	**187**							

[1] Does not include evaporation losses from stockponds and reservoirs.
[2] Includes all wells through 1980.
[3] Other water-supply wells are listed in the ADWR Well Registry for this basin, but they do not have completion dates. These wells are summed here.
NR - Not reported

Table 7.5-9 Effluent Generation in the McMullen Valley Basin

Facility Name	Ownership	City/Location Served	Population Served	Volume Treated/Generated (acre-feet)	Disposal Method							Current Treatment Level	Population Not Served	Year of Record
					Water-course	Evaporation Pond	Irrigation	Golf Course	Wildlife Area	Discharged to another facility	Infiltration Basins			
Forepaugh WWTP	NA	Forepaugh	NA											

NA: Data not currently available to ADWR
WWTP: Waste Water Treatment Plant



Primary Data Source: USGS National Gap Analysis Program, 2004

0 3 6 Miles

Figure 7.5-9
McMullen Valley Basin
Cultural Water Demand

Demand Centers

- Agriculture
- M&I - High Intensity
- M&I - Low Intensity
- Small Mine / Quarry
- COUNTY
- Major Road
- City, Town or Place

7.5.9 Water Adequacy Determinations in the McMullen Valley 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 7.5-10. Figure 7.5-10 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 A. Adequacy determination data sources and methods are found in Volume 1, Sections 1.3.1.

Water Adequacy Reports

- See Table 7.5-10
- As of May, 2005 nine subdivisions had been reviewed for an adequacy determination. All subdivisions are in La Paz County.
- Of the 2,030 lots in nine subdivisions, 1,904 lots or 94% were determined to be adequate.
- One determination of inadequacy was made due to water quality.

Table 7.5-10 Adequacy Determinations in the McMullen Valley Basin[1]

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
1	Desert Links	La Paz	5 North	13 West	21	430	22-401492	Adequate		1/12/05	Keaton Development Company
2	Indian Hills Airpark II	La Paz	5 North	13 West	21	126	22-400953	Inadequate	C	4/22/03	Keaton Development Company
3	Indian Hills Estates	La Paz	5 North	13 West	21	516		Adequate		8/17/87	Keaton Development Company
4	Keller Retirement Community	La Paz	5 North	13 West	21	31		Adequate		2/28/74	Keaton Water Company
5	Keller Retirement Community Unit 6	La Paz	5 North	13 West	28	233		Adequate		8/7/75	Keaton Water Company
6	Monroe Heights	La Paz	5 North	13 West	26	236	22-400388	Adequate		10/16/00	Salome Heights Development, LLC
7	Outback Acres	La Paz	5 North	13 West	27	55	22-400391	Adequate		10/17/00	Salome Heights Development, LLC
8	Salome Heights	La Paz	5 North	13 West	27	118	22-400390	Adequate		3/15/01	Dry Lot Subdivision
9	Western Sky Airpark	La Paz	5 North	13 West	17	285	22-401248	Adequate		3/31/04	Western Sky Airpark Water Improvement District

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 determination.

[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

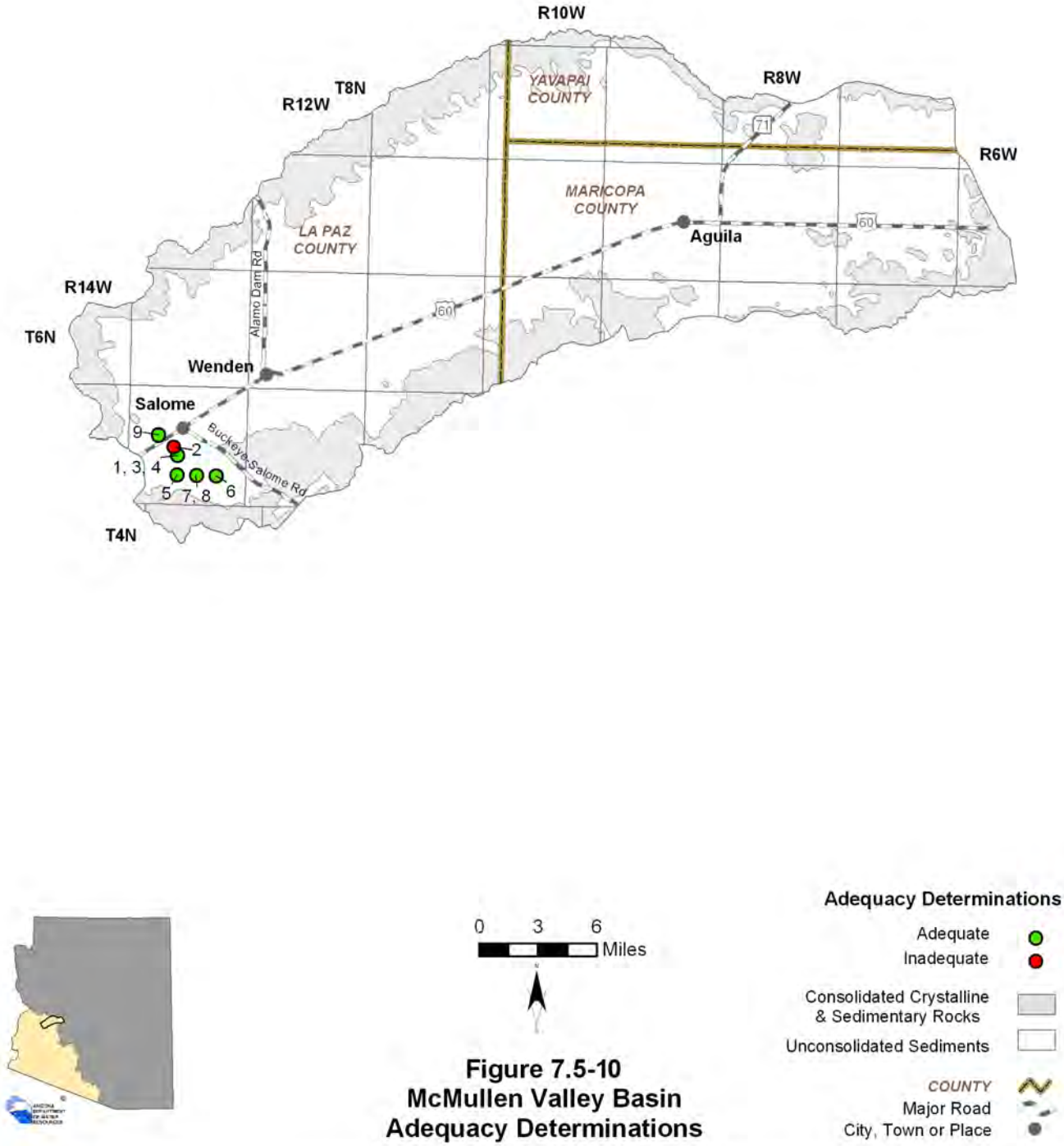


Figure 7.5-10
McMullen Valley Basin
Adequacy Determinations

McMullen Valley Basin
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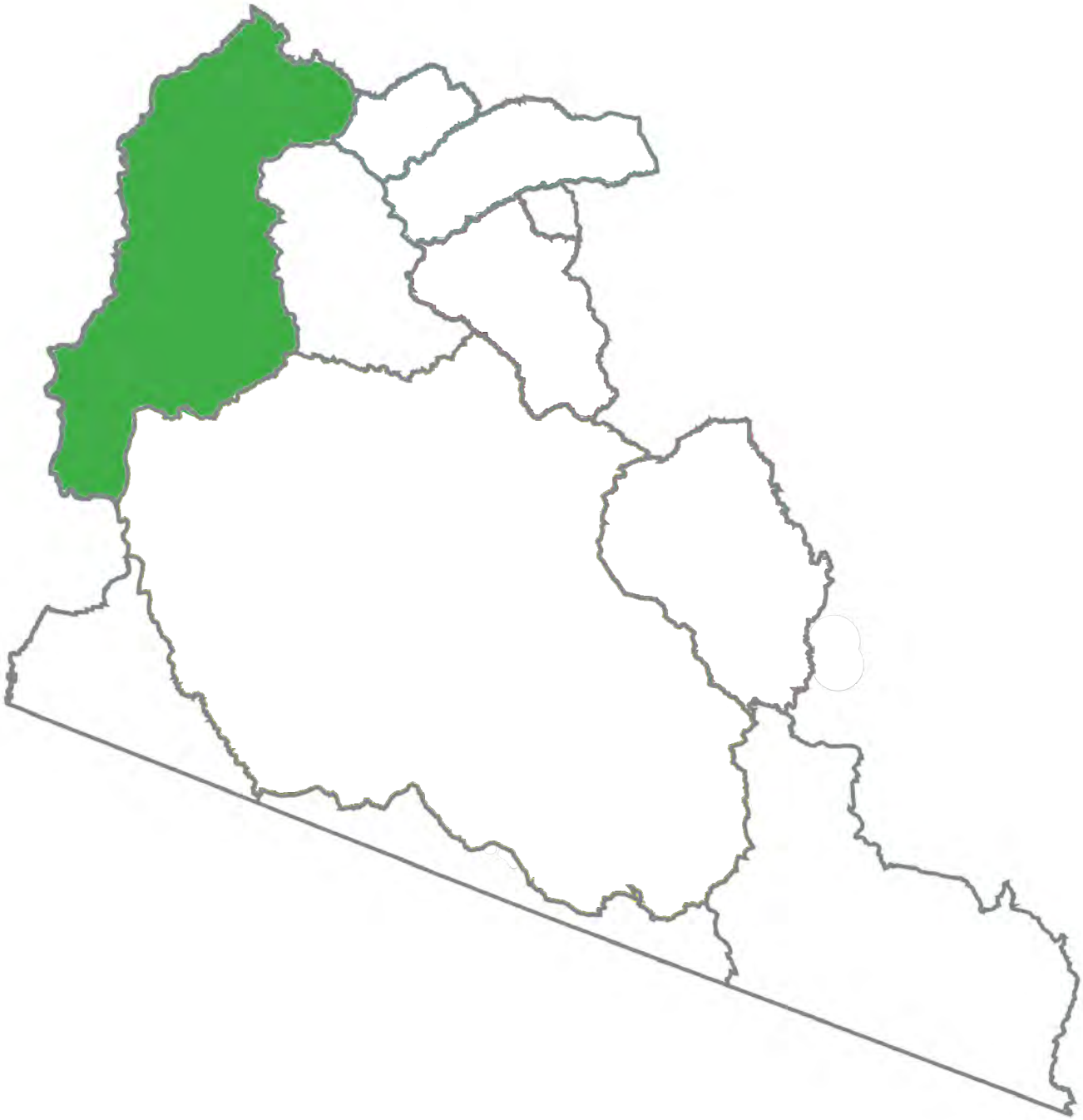
Section 7.6
Parker Basin



7.6.1 Geography of the Parker Basin

The Parker Basin, located in the western part of the planning area is 2,229 square miles in area. Geographic features and principal communities are shown on Figure 7.6-1. The basin is characterized by plains and valleys with low elevation mountain ranges. Vegetation types include Lower Colorado River Valley and Arizona Uplands Sonoran desertscrub. (See Figure 7.0-7)

- Principal geographic features shown on Figure 7.6-1 are:
    - Principal basin communities of Cibola, Ehrenberg, Parker and Quartzite
    - Other communities of Poston and Cienega Springs
    - The Colorado River along the western basin boundary
    - Plains and valleys including La Posa Plain in the center of the basin, Parker Valley on the northwestern basin boundary and Cactus Plain in the northern portion of the basin
    - Mountain ranges including the Trigo and Dome Rock Mountains in the center of the basin
    - The highest point in the basin, Cunningham Mountain, at 3,314 feet in the Dome Rock Mountains east of Ehrenberg
- Not well shown on Figure 7.6-1 are the Kofa Mountains on the eastern basin boundary and the lowest point in the basin at 150 feet where the Colorado River exits the basin.

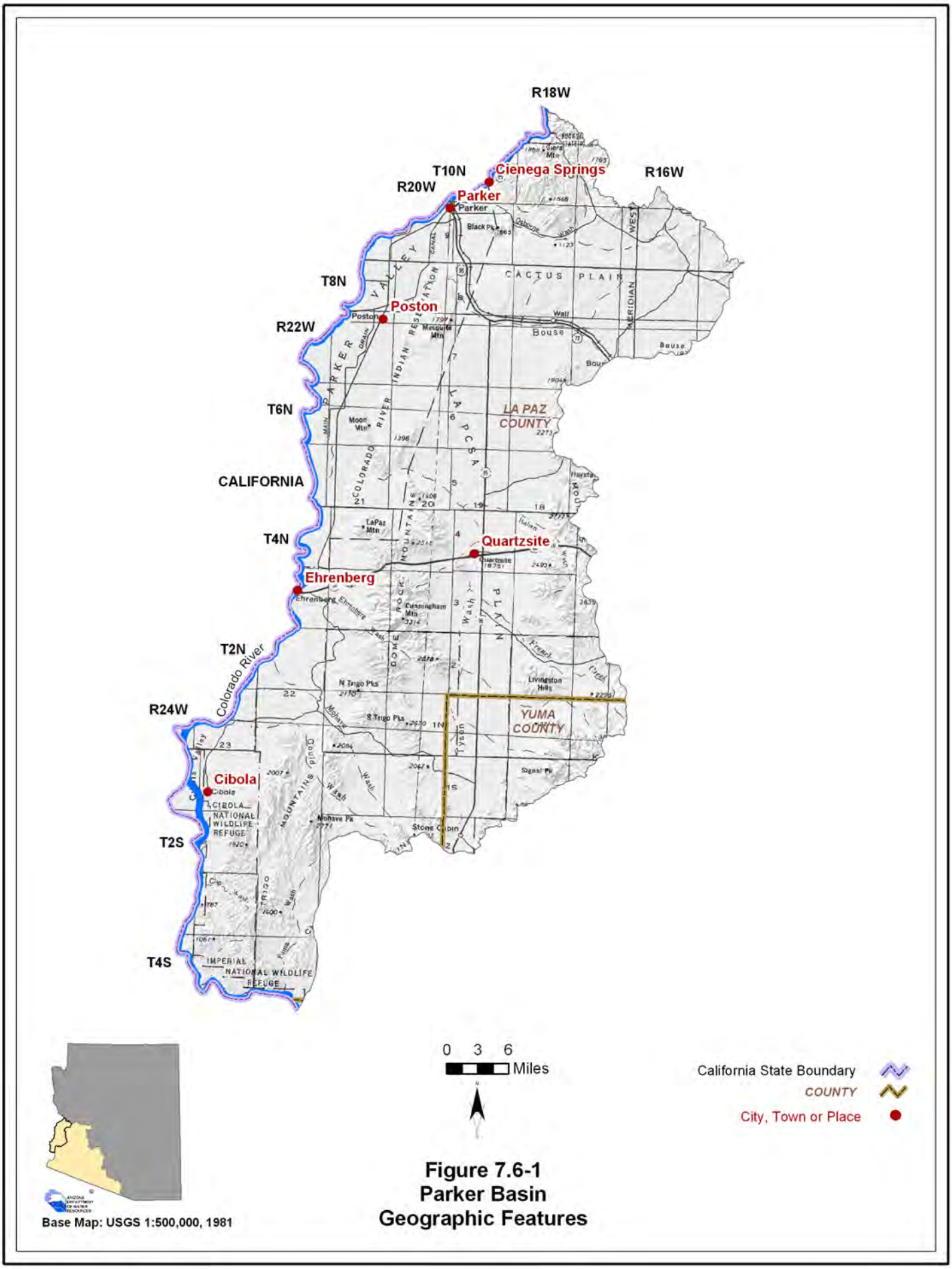


Figure 7.6-1
Parker Basin
Geographic Features

7.6.2 Land Ownership in the Parker Basin

Land ownership, including the percentage of ownership by category, for the Parker Basin is shown in Figure 7.6-2. The principal feature of land ownership in this basin is the very small proportion of private land. A description of land ownership data sources and methods is found in Volume 1, Section 1.3.8. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

U.S. Bureau of Land Management (BLM)

- 49.7% of the land is federally owned and managed by the Yuma Field Office of the Bureau of Land Management.
- This basin includes the 30,000 acre Trigo Mountains Wilderness, the 19,000 acre Gibraltar Mountain Wilderness and the 15,000 acre East Cactus Plain Wilderness. (See Figure 7.0-9)
- Land uses include grazing, resource conservation and recreation.

U.S. Military

- 19.5% of the land is federally owned and managed by the U.S. Military as the Yuma Proving Ground.
- Primary land use is military activity.

Indian Reservation

- 16.4% of the land is under tribal ownership as the Colorado River Indian Tribes Reservation.
- Land uses include domestic, commercial and agriculture.

National Wildlife Refuge

- 9.3% of the land is federally owned and managed by the U.S. Fish and Wildlife Service as the Kofa National Wildlife Refuge (NWR), Cibola NWR and the Imperial NWR
- Land uses include resource conservation, wildlife protection and recreation.

State Trust Land

- 3.7% of the land is held in trust for the public schools under the State Trust Land system.
- Primary land use is agriculture.

Private

- 1.3% of the land is private.
- Small parcels of private land are located in the vicinity of Highway 95, north of Cibola, and at Parker and Cienega Springs
- Land uses include domestic, commercial and agriculture.

Other

- 0.1% of the land is federally owned and managed by the U.S. Bureau of Reclamation (USBOR)
- USBOR lands are located north of Cibola along the Colorado River.
- Primary land use is unknown.

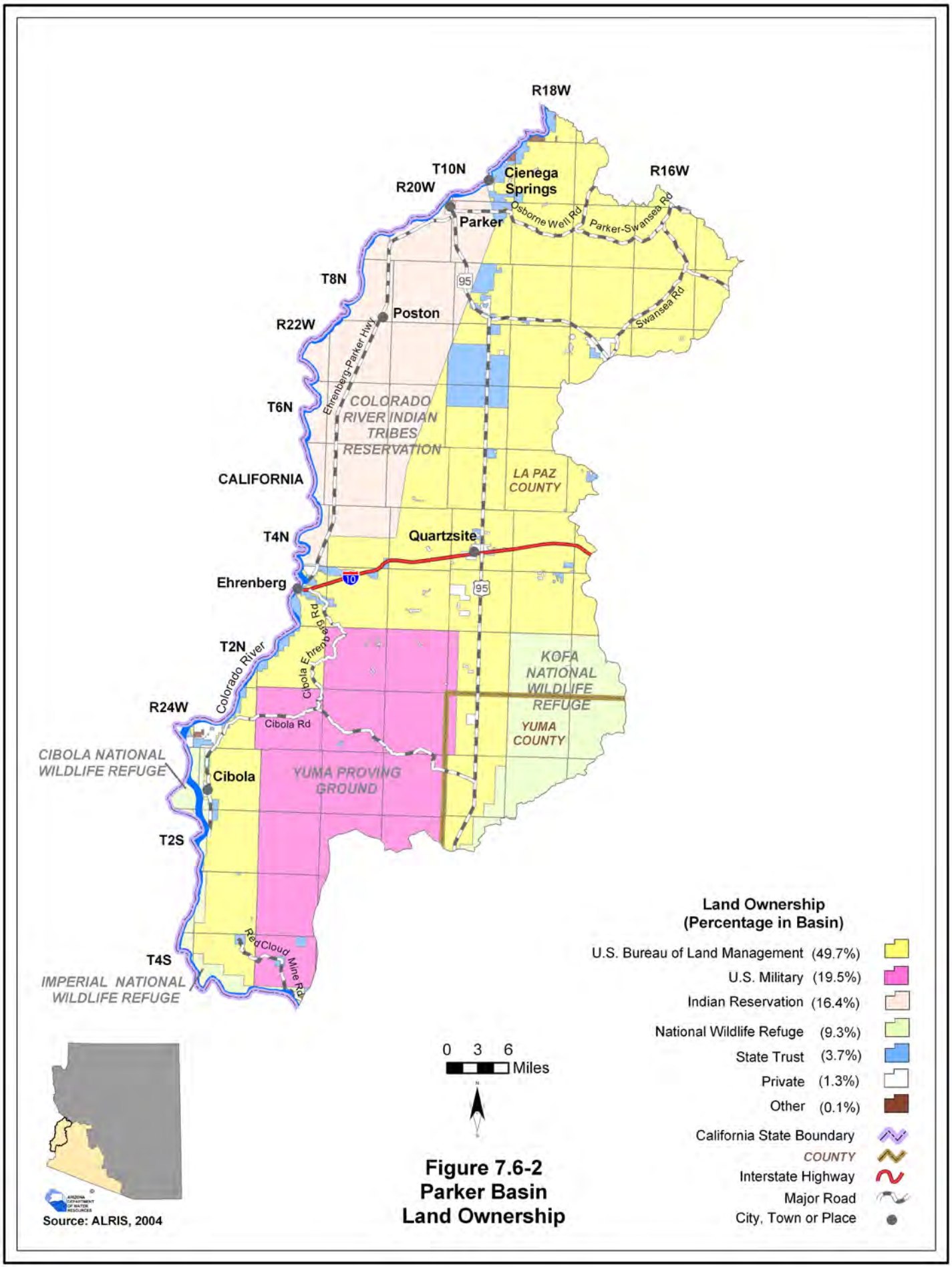


Figure 7.6-2
Parker Basin
Land Ownership

7.6.3 Climate of the Parker Basin

Climate data from NOAA/NWS Co-op Network and AZMET stations are complied in Table 7.6-1 and the locations are shown on Figure 7.6-3. Figure 7.6-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Parker Basin does not contain Evaporation Pan or SNOTEL/ Snowcourse stations. A description of the climate data sources and methods is found in Volume 1, Section 1.3.3.

NOAA/NWS Co-op Network

- Refer to Table 7.6-1A
- Temperatures at the five NOAA/NWS Co-op Network stations in the basin range from an average high temperature of 94.8°F at Quartzite to an average low of 49.8°F at Bouse.
- Average seasonal rainfall follows a bi-modal pattern with approximately one-third of the average seasonal rainfall occurring in the winter (January-March) season and one-third in the summer (July-September) season. The highest average annual rainfall in this basin is 5.89 inches at the Bouse station.

AZMET

- Refer to Table 7.6-1C
- There is one AZMET station in the basin, Parker. This station is at 308 feet and has an annual reference evaportranspiration of 82.93 inches.

SCAS Precipitation Data

- See Figure 7.6-3
- Additional precipitation data shows average annual rainfall as high as 10 inches along the eastern basin boundary and as low as four inches or less along the Colorado River on the western basin boundary.

Table 7.6-1 Climate Data for the Parker Basin

A. NOAA/NWS Co-op Network:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Temperature Range (in F)		Average Total Precipitation (in inches)				
			Max/Month	Min/Month	Winter	Spring	Summer	Fall	Annual
Bouse	930	1971 - 2000	92.2/Jul	49.8/Dec	2.14	0.38	2.12	1.25	5.89
Ehrenberg	320	1948 - 1977[1]	93.1/Jul	52.8/Jan	0.94	0.28	1.41	0.90	3.50
Ehrenberg 2E	460	1971 - 2000	94.4/Jul	54.5/Dec	1.42	0.21	1.69	1.05	4.37
Parker 6 NE	41	1971 - 2000	93.2/Jul	53.9/Dec	2.22	0.28	1.45	1.22	5.17
Quartzsite	870	1971 - 2000	94.8/Jul	51.8/Dec	1.36	0.23	1.18	0.74	3.51

Source: WRCC, 2003
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			

Source: WRCC, 2003

C. AZMet:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Annual Reference Evaportranspiration, in inches *(Number of years to calculate averages)*
Parker	308	1987 - current	82.93 (6)

Source: Arizona Meteorlogical Network, 2005

C. SNOTEL/Snowcourse:

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

Source: NRCS, 2005

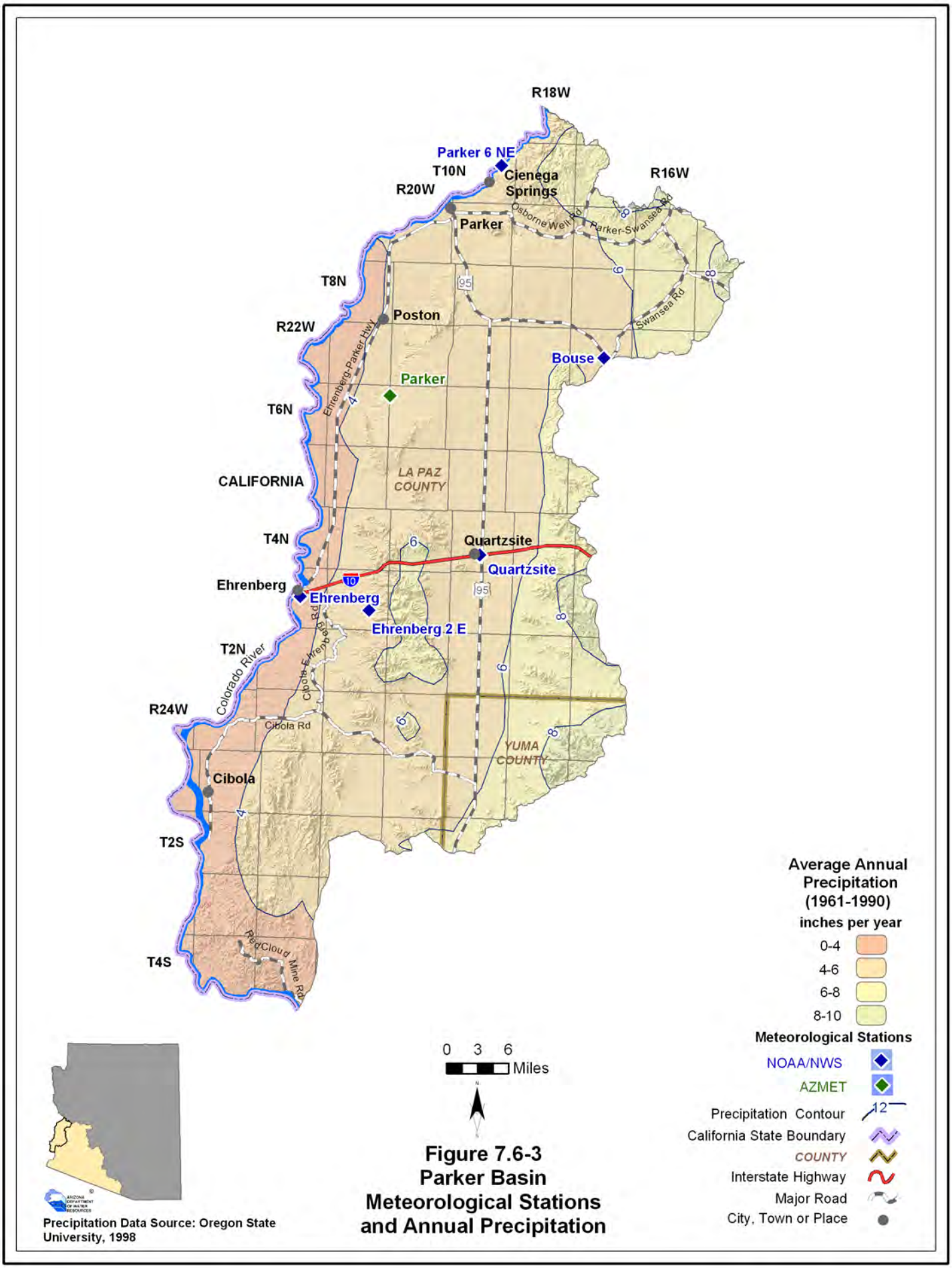


Figure 7.6-3
Parker Basin
Meteorological Stations and Annual Precipitation

7.6.5 Surface Water Conditions in the Parker Basin

Streamflow data, including average seasonal flow, average annual flow and other information are shown in Table 7.6-2. Flood ALERT equipment in the basin is shown in Table 7.6-3. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 7.6-4. The location of streamflow gages identified by USGS number, flood ALERT equipment and large reservoirs are shown on Figure 7.6-4. There are no USGS runoff contour data available for this basin. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Streamflow Data

- Refer to Table 7.6-2.
- Data from three stations located on the Colorado River are shown in the table and on Figure 7.6-4.
- Average seasonal flow is highest in spring and summer at the three stations and is regulated by scheduled releases from dams.
- The largest annual flow recorded in the basin is more than 20 million acre feet in 1984 at the Colorado River below Parker Dam station with a contributing drainage area of 182,700 square miles.

Flood ALERT Equipment

- Refer to Table 7.6-3.
- As of October 2005 there was one precipitation station in the basin located at Tyson Wash.

Reservoirs and Stockponds

- Refer to Table 7.6-4.
- The basin contains five large reservoirs or dams. The largest, Lake Havasu, with a maximum storage of 651,000 acre-feet, is located in the Upper Colorado River Planning Area but Parker Dam is located at the basin boundary.
- Reservoirs in this basin are used for water supply, irrigation, hydroelectric power, recreation and fish and wildlife.
- Surface water is stored or could be stored in five small reservoirs in the basin.
- There are five registered stockponds in this basin.

Table 7.6-2 Streamflow Data for the Parker Basin

Station Number	USGS Station Name	Drainage Area (in mi^2)	Mean Basin Elevation (in feet)	Period of Record	Average Seasonal Flow (% of annual flow)				Annual Flow/Year (in acre-feet)				Years of Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
9427520	Colorado River below Parker Dam[1]	182,700	400	1936 - 2004 (real time)	23	28	28	20	5,534,256 (1993)	7,229,140	8,918,956	20,409,560 (1984)	61
9429100	Colorado River below Palo Verde Dam[1]	182,200	260	1957 - 2004 (real time)	22	31	30	17	4,369,340 (1993)	5,507,468	5,831,096	9,860,880 (1958)	39
9429300	Colorado River below Cibola Valley	183,800	NA	4/1956 - 9/1988	22	28	30	19	5,365,301 (1982)	6,187,223	7,801,072	19,016,442 (1984)	31

Sources: USGS NWIS, USGS 1998 and USGS 2003.

Notes:
[1]Station in California
NA = Not available
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 years 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

Table 7.6-3 Flood ALERT Equipment in the Parker Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
7203	Quartzite	Precipitation	12/5/2001	ADWR

Notes:
ADWR = Arizona Department of Water Resources

Table 7.6-4 Reservoirs and Stockponds in the Parker 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	Lake Havasu *(Parker)* [2]	Bureau of Reclamation	651,000	S, I, H	Federal
2	Moovalya Lake *(Headgate Rock)*	Bureau of Reclamation	20,000	I, H, R	Federal

Source: US Army Corps of Engineers 2005

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
3	Cibola	Bureau of Reclamation/ USFWS	400	R,F	Federal
4	Island	Bureau of Reclamation/ USFWS	220	F	Federal
5	Adobe	Bureau of Reclamation/ USFWS	209	F	Federal

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: 5
Total surface area: 188 acres

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

Total number: 5

Notes:
[1] S = Supply; I = Irrigation; H = Hydroelectric power; F=Fish & wildlife pond; R=Recreation
[2] Dam is located in the Parker Basin and lake storage is in the Lake Havasu Basin in the Upper Colorado River Planning Area.
[3] Capacity data not available to ADWR
USFWS = United States Fish and Wildlife Service

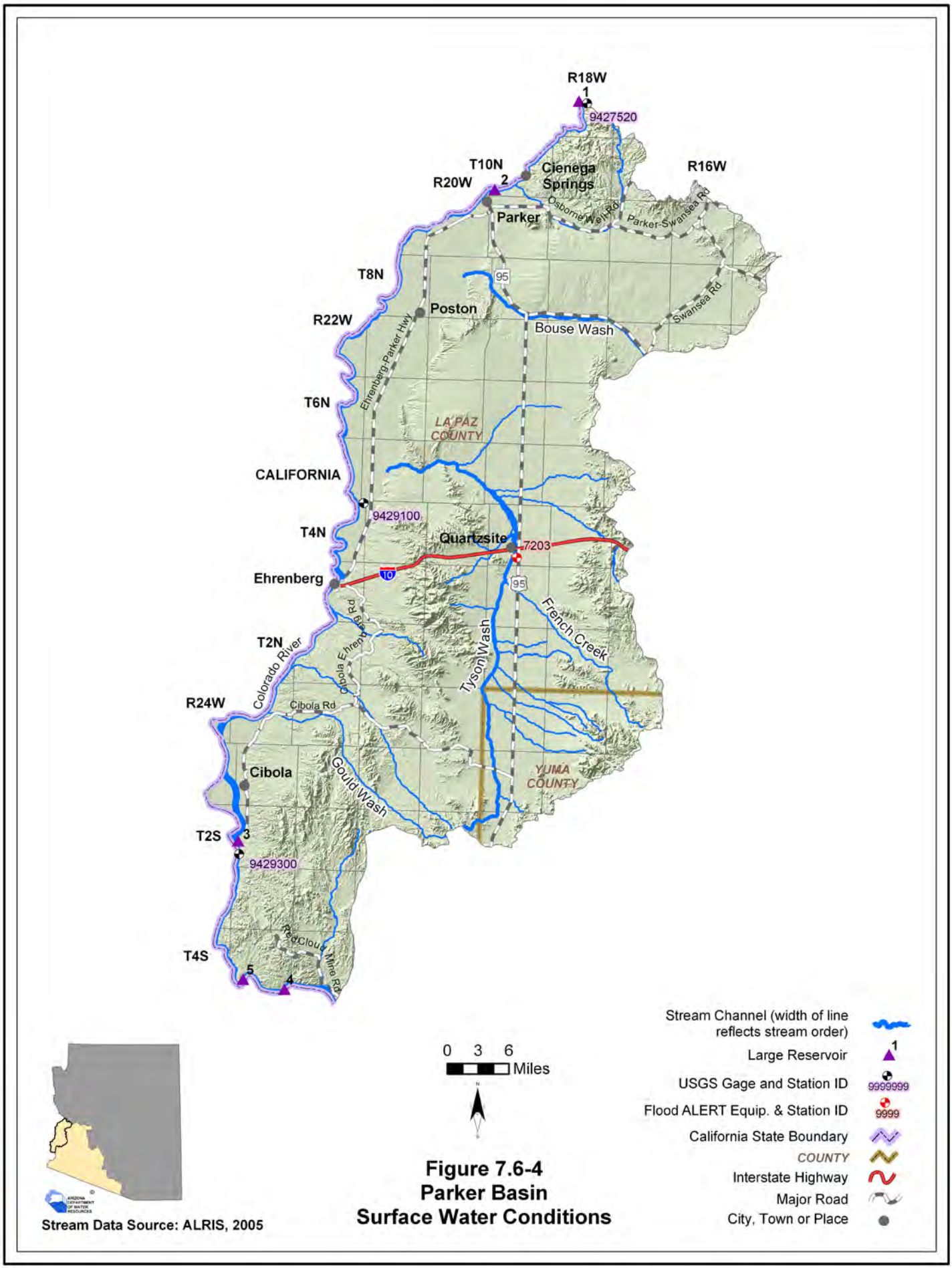


Figure 7.6-4
Parker Basin
Surface Water Conditions

7.6.5 Perennial/Intermittent Streams and Major Springs in the Parker Basin

The total number of springs in the basin are shown in Table 7.6-5. The location of a perennial stream is shown on Figure 7.6-5. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, Section 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- There are no intermittent streams 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 11 to 12, depending on the database reference.

Table 7.6-5 Springs in the Parker 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, 2005 and USGS, 2006): 11 - 12

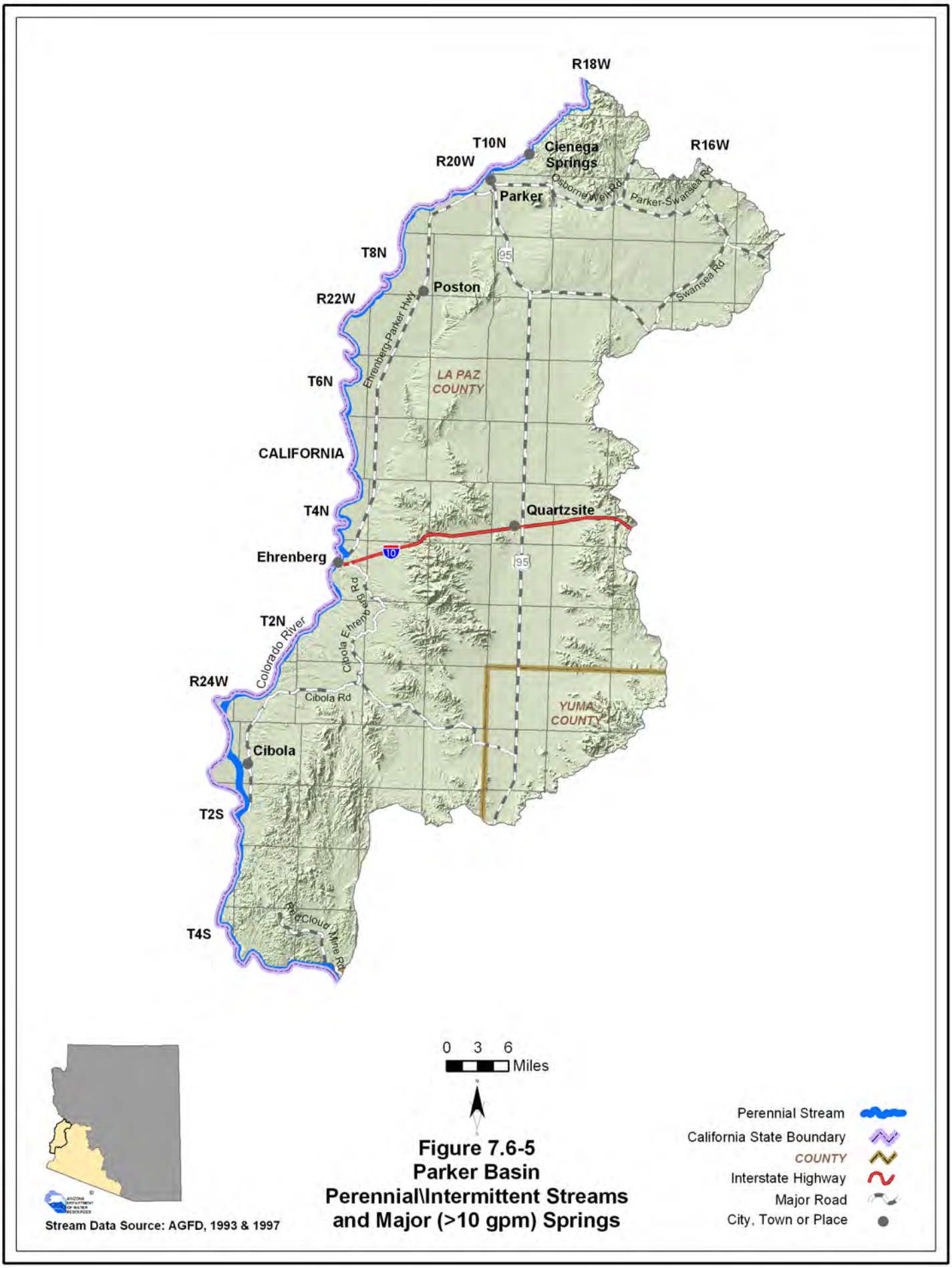


Figure 7.6-5
Parker Basin
Perennial\Intermittent Streams and Major (>10 gpm) Springs

7.6.6 Groundwater Conditions of the Parker Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.6-6. Figure 7.6-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 7.6-7 contains hydrographs for selected wells shown on Figure 7.6-6. Figure 7.6-8 shows well yields in five yield categories. A description of aquifer data sources and methods is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields, is found in Volume 1, Section 1.3.19.

Major Aquifers

- Refer to Table 7.6-6 and Figure 7.6-6.
- The major aquifer is recent stream alluvium and sedimentary rock (Bouse Formation).
- Groundwater flow is from the south and east toward the Colorado River.

Well Yields

- Refer to Table 7.6-6 and Figure 7.6-8.
- As shown on Figure 7.6-8, well yields are generally less than 100 gallons per minute (gpm) although higher well yields are found near the Colorado River.
- One source of well yield information, based on 75 reported wells, indicates that the median well yield is 100 gpm.

Natural Recharge

- Refer to Table 7.6-6.
- The estimate of natural recharge is 241,000 acre-feet per year.
- The largest source of natural recharge is the Colorado River (ADWR 1994).

Water in Storage

- Refer to Table 7.6-6.
- There are three estimates of water in storage ranging from 14 million acre-feet to 24 million acre-feet, both to a depth of 1,200 feet.

Water Level

- Refer to Figure 7.6-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures six index wells in this basin; hydrographs for the six index wells and two additional wells are shown on Figure 7.6-7.
- The deepest water level shown on the map is 553 feet north of Quartzsite and the shallowest is 10 feet west of the Cibola Ehrenberg Road near the Colorado River.

Table 7.6-6 Groundwater Data for the Parker Basin

Basin Area, in square miles:	2,229	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Recent Stream Alluvium	
	Sedimentary Rock (Bouse Formation)	
Well Yields, in gal/min:	N/A	Measured by ADWR and/or USGS
	Range 2-6,000 Median 100 (75 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	Range 30-900	ADWR (1990 and 1994)
	Range 0-2,500	USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	241,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	14,000,000 (to 1,200 ft)	ADWR (1994)
	24,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	21,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
Current Number of Index Wells:	6	
Date of Last Water-level Sweep:	1995-97 (348 wells measured)	

[1]Predevelopment Estimate

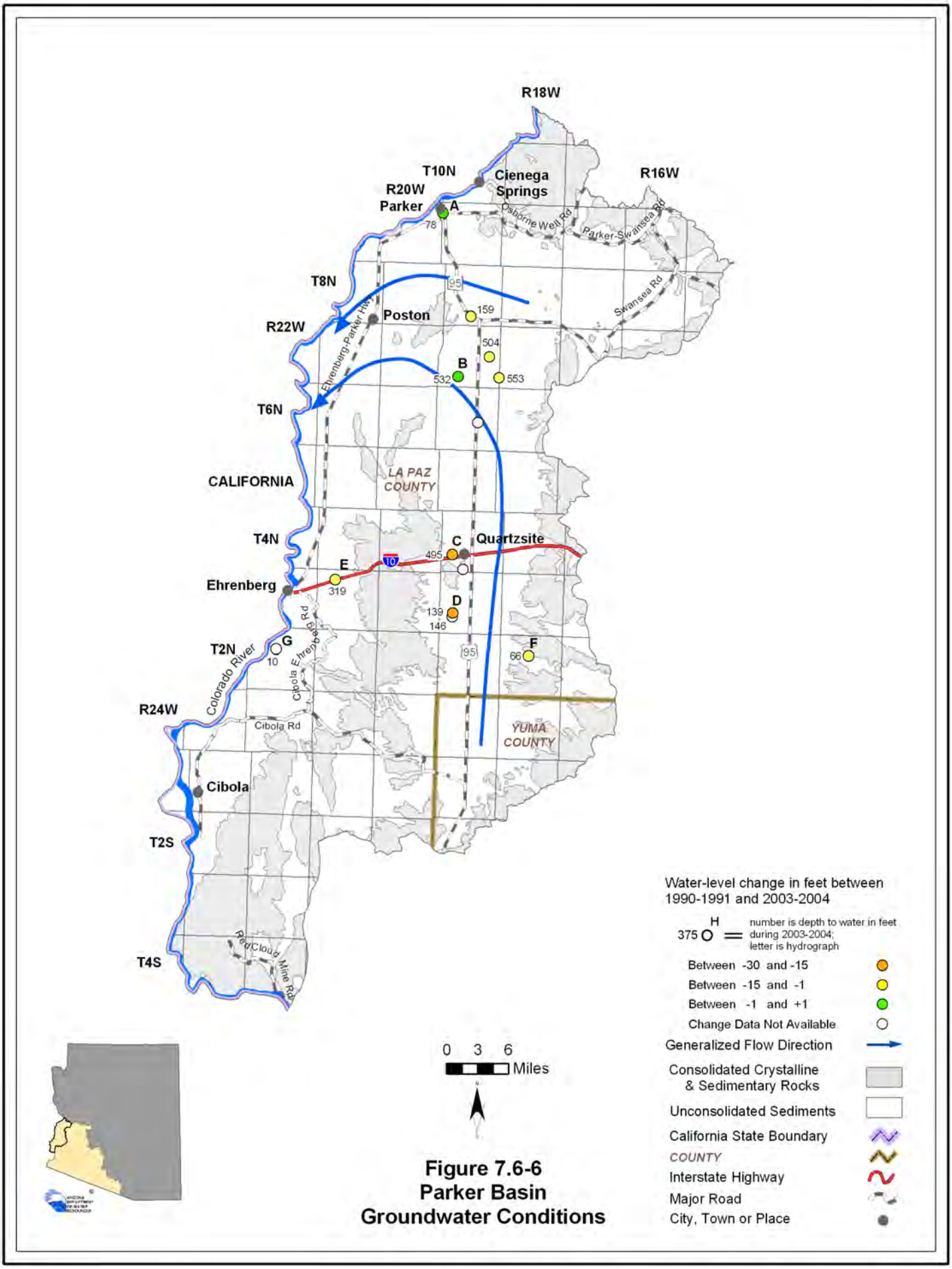


Figure 7.6-6
Parker Basin
Groundwater Conditions

Figure 7.6-7
Parker Basin
Hydrographs Showing Depth to Water in Selected Wells

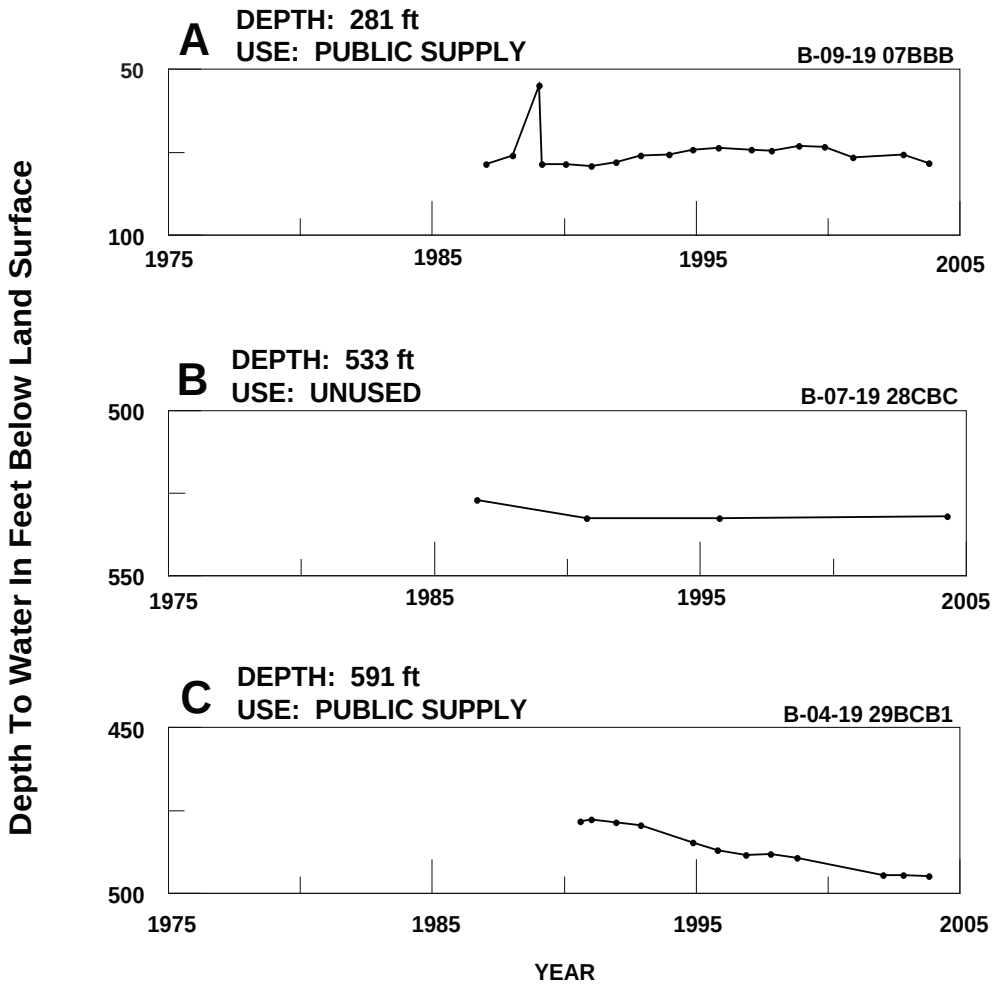
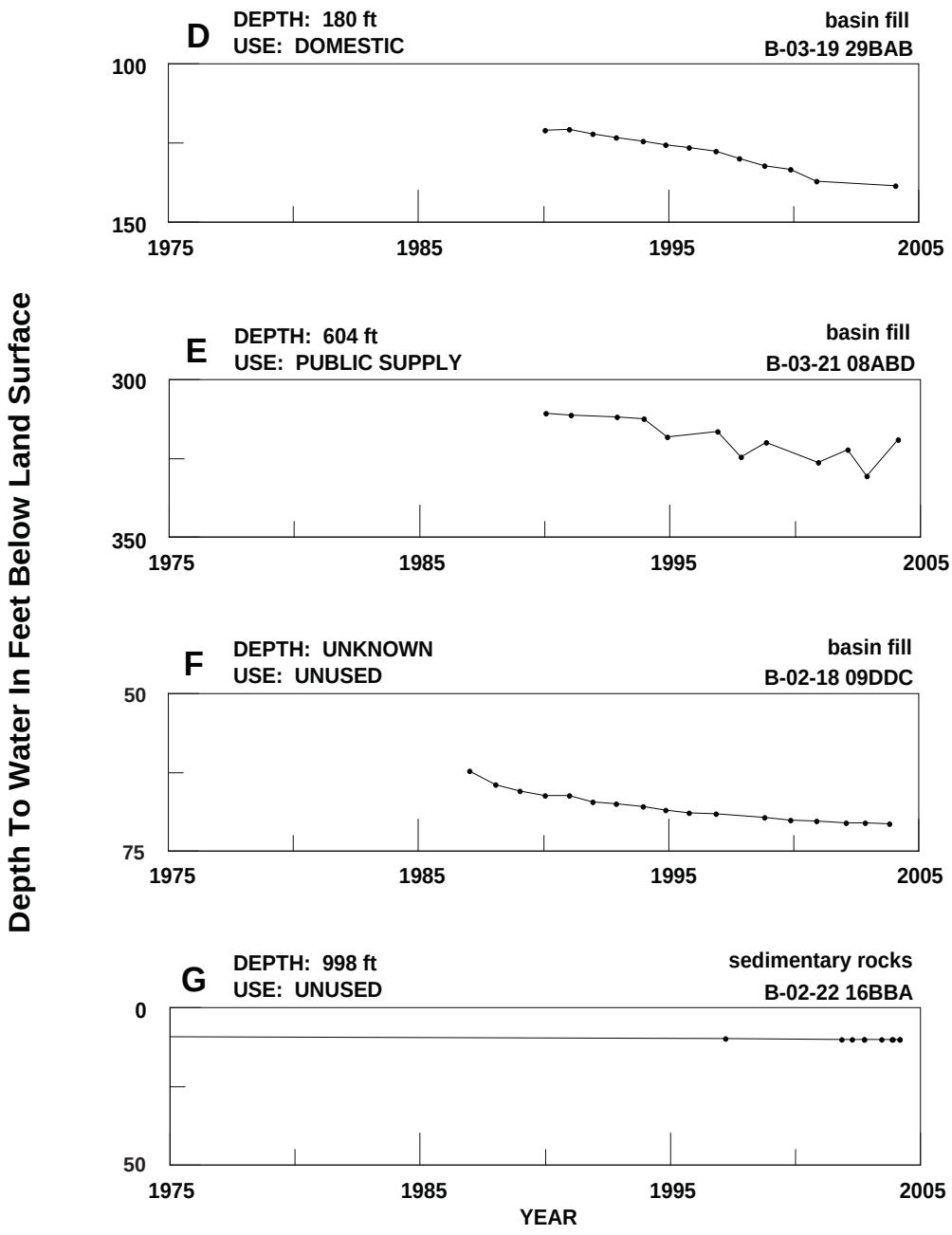


Figure 7.6-7 (cont'd)
Parker Basin
Hydrographs Showing Depth to Water in Selected Wells



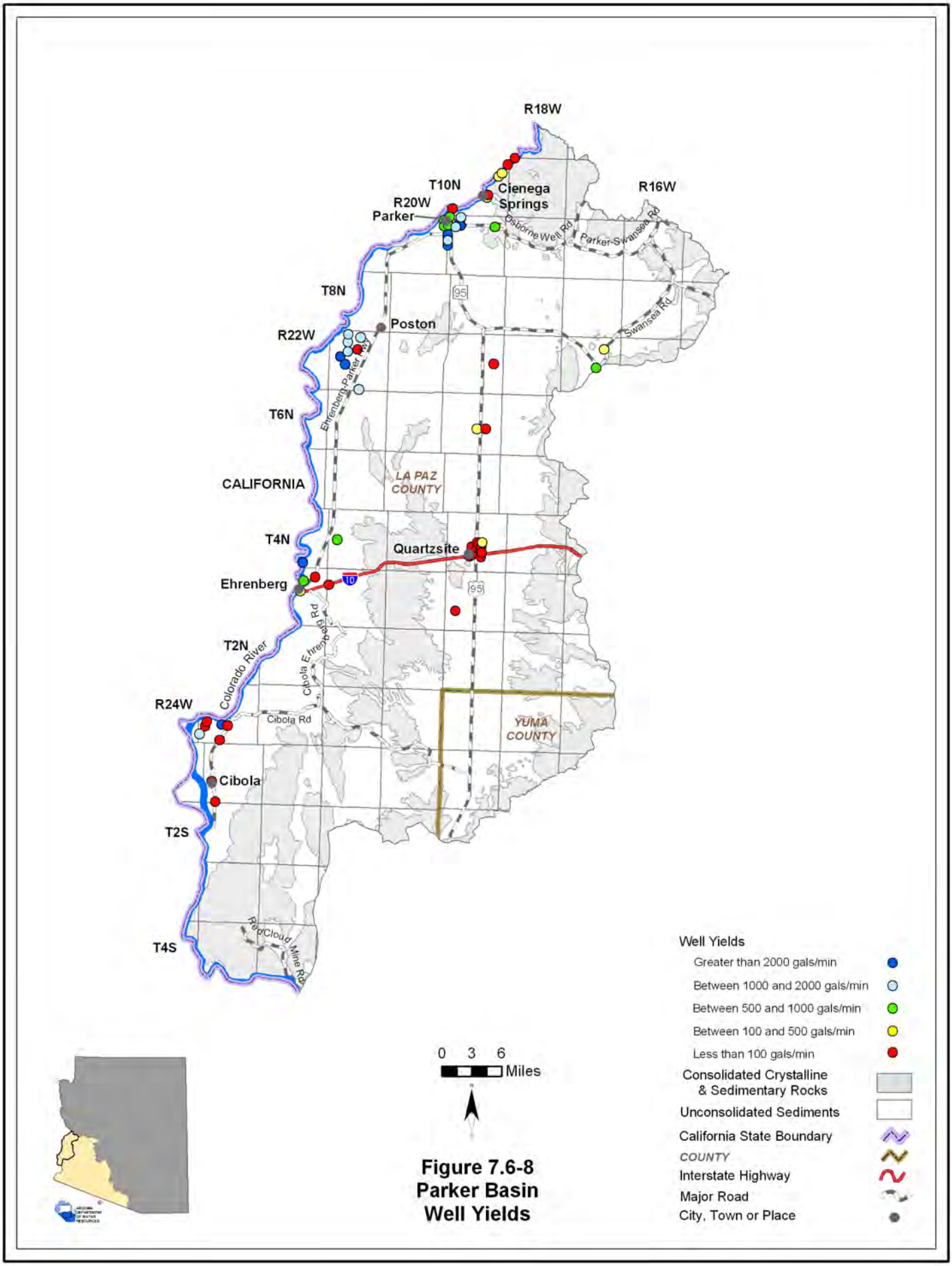


Figure 7.6-8
Parker Basin
Well Yields

7.6.7 Water Quality of the Parker 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 7.6-7A. There are no impaired lakes or streams in this basin. Figure 7.6-9 shows the location of water quality occurrences keyed to Table 7.6-7. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mine Sites

- Refer to Table 7.6-7A.
- Fifty-two wells have parameter concentrations that have equaled or exceeded drinking water standards.
- The parameter most frequently equaled or exceeded was nitrate.
- Other parameters equaled or exceeded include arsenic, chromium, lead, fluoride and organics.

Table 7.6-7 Water Quality Exceedences in the Parker Basin[1]

A. Wells, Springs and Mines

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

Table 7.6-7 Water Quality Exceedences in the Parker Basin (cont'd)[1]

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
45	Well	4 North	19 West	28	NO3
46	Well	4 North	19 West	28	NO3
47	Well	4 North	19 West	28	NO3
48	Well	4 North	19 West	29	NO3
49	Well	4 North	19 West	31	Pb
50	Well	3 North	19 West	7	As
51	Well	1 North	23 West	33	TDS
52	Well	1 South	23 West	32	TDS

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	Parameter(s) Exceeding Use Standard
None identified by ADWR at this time						

Notes:

[1] Water quality samples collected between 1976 and 2001.
[2] As = Arsenic
Cr = Chromium
F = Fluoride
Pb = Lead
Organics = One or more of several volatile and semi-volatile organic compounds and pesticides
NO3 = Nitrate/ Nitrite

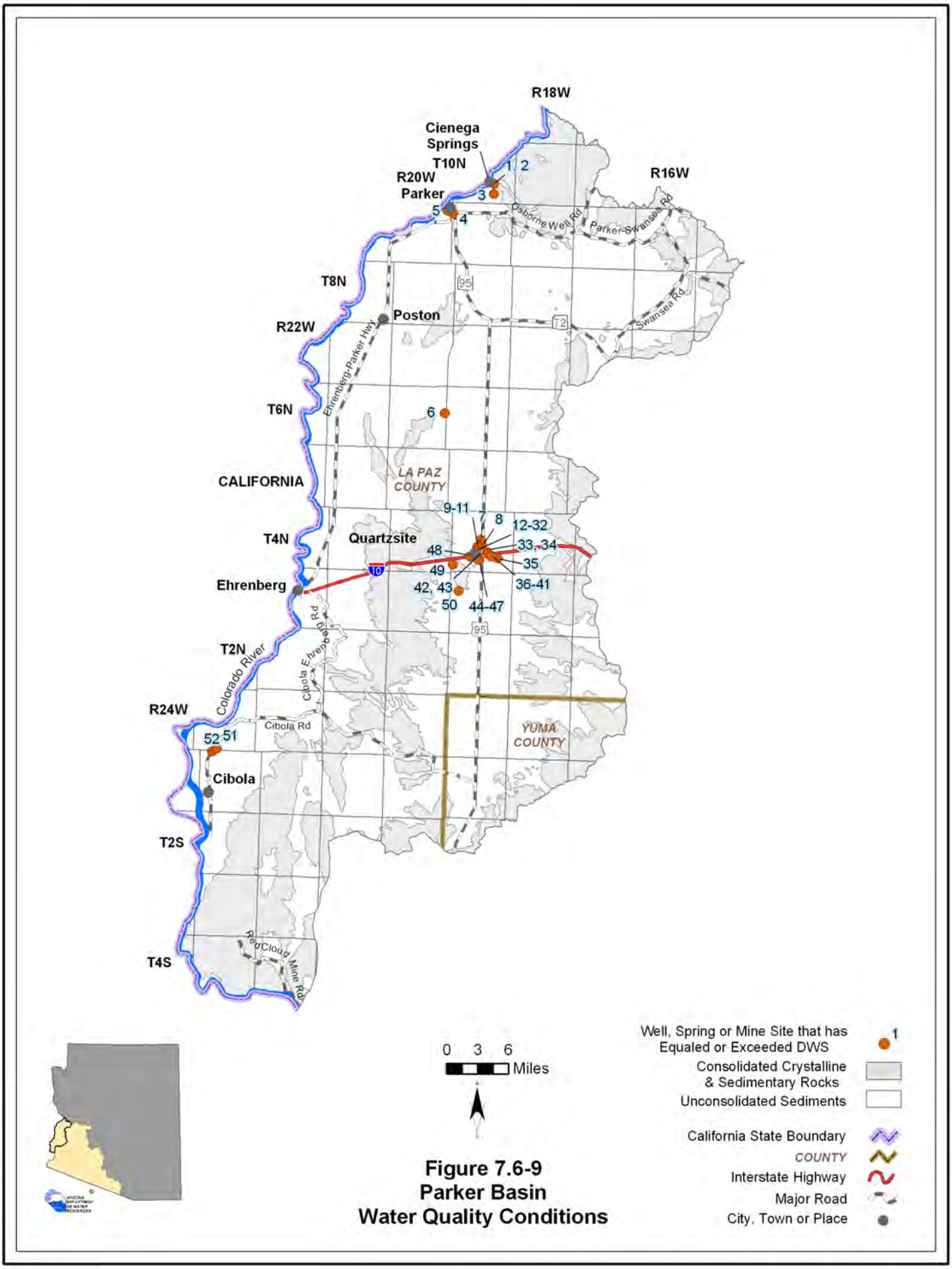


Figure 7.6-9
Parker Basin
Water Quality Conditions

7.6.8 Cultural Water Demands in the Parker 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 7.6-8. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown in Table 7.6-9. Figure 7.6-10 shows the location of demand centers. A description of cultural water demand data sources and methods is found in Volume 1, Section 1.3.5. More detailed information on cultural water demands is found in Section 7.0.7.

Cultural Water Demands

- Refer to Table 7.6-8 and Figure 7.6-10.
- Population in this basin increased from 11,339 in 1980 to 16,166 in 2000 and projections suggest an increase of more than 11,000 people by 2050.
- Most cultural water use is for irrigation on the Colorado River Indian Tribe's land in the northwestern portion of the basin.
- Agricultural surface water demand remained relatively constant from 1991 to 2003 with 653,000 acre-feet diverted per year on average in 2000-2003. Agricultural groundwater demand decreased slightly between 1991 and 2003.
- Municipal demand is relatively small. Groundwater demand increased 13% and surface water demand increased 25% from 1991 to 2003.
- There is a relatively small amount of industrial demand in this basin associated with sand and gravel operations.
- As of 2003 there were 1,551 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 93 wells with a pumping capacity of more than 35 gallons per minute.

Effluent Generation

- Refer to Table 7.6-9.
- There are 12 wastewater treatment facilities in this basin.
- Information on population served was available for 10 facilities and information on the volume of effluent generated was available for all 12 facilities. These facilities serve almost 12,000 people and generate almost 2,200 acre-feet of effluent per year.
- One facility discharges to a watercourse, two facilities discharge for irrigation, one to a golf course and five discharge to unlined impoundments that recharge the aquifer.

Table 7.6-8 Cultural Water Demands in the Parker Basin[1]

Year	Recent (Census) and Projected (DES) Population	Number of Registered Water Supply Wells Drilled		Average Annual Demand (in acre-feet)[3]						Data Source
				Well Pumpage			Surface-Water Diversions			
		Q ≤ 35 gpm	Q > 35 gpm	Municipal	Industrial	Irrigation	Municipal	Industrial	Irrigation	
1971		914[2]	71[2]	9,000			1,251,000[4]			ADWR (1994)
1972										
1973										
1974										
1975										
1976				21,000			1,102,000[4]			
1977										
1978										
1979										
1980	11,339									
1981	11,398	202	9	25,000			1,130,000[4]			
1982	11,457									
1983	11,516									
1984	11,575									
1985	11,634									
1986	11,693	208	8	18,000			1,229,000[4]			
1987	11,752									
1988	11,810									
1989	11,869									
1990	11,928									
1991	12,352	100	3	2,900	NR	1,300	400	NR	662,000	USGS (2005) ADWR (2005)
1992	12,776									
1993	13,200									
1994	13,623									
1995	14,047									
1996	14,471	82	0	3,200	NR	<1,000	450	NR	667,000	
1997	14,895									
1998	15,318									
1999	15,742									
2000	16,166									
2001	16,418	24	0	3,300	<300	<1,000	500	NR	653,000	
2002	16,670									
2003	16,923									
2010	18,688									
2020	23,294									
2030	25,705									
2040	26,759									
2050	27,222									
ADDITIONAL WELLS:[5]		**21**	**2**							
WELL TOTALS:		**1,551**	**93**							

[1] Does not include evaporation losses from stockponds and reservoirs.
[2] Includes all wells through 1980.
[3] Includes pumpage and diversion of Colorado River Contract Water.
[4] Includes surface-water diversions in the Lower Gila and Yuma basins.
[5] Other water-supply wells are listed in the ADWR Well Registry for this basin, but they do not have completion dates. These wells are summed here.
NR - Not reported

Table 7.6-9 Effluent Generation in the Parker Basin

Facility Name	Ownership	City/Location Served	Population Served	Volume Treated/Generated (acre-feet)	Disposal Method							Current Treatment Level	Population Not Served	Year of Record
					Water-course	Evaporation Pond	Irrigation	Golf Course	Wildlife Area	Discharged to Another Facility	Infiltration Basins			
Bouse WWTP	Arizona Department of Transportation	Rest Area	NA	301	NA									1996
Buckskin Mtn. WWTF	State of Arizona	State Park	240	11	X							Secondary	NA	2001
Buckskin/Sandpiper WWTP	Buckskin SD	Parker	50	6			X	Emerald Canyon				Adv. Trt. I	1,450	1996
Colorado River Joint Venture	NA	Parker	5,000	896			X					Secondary	14,000	1999
Headstart Sewer System	Colorado River Tribes	School	90	10							X	Secondary	90	2000
Mochem Sewer System	Colorado River Tribes	Reservation	1,000	112							X	Secondary	125	1999
Parker WWTP	Colorado River Tribes	Parker	3,045	336							X	Secondary	NA	2002
Poston	Colorado River Tribes	Poston	600	67							X	Secondary	NA	2000
Poston BIA WWTF	Bureau of Indian Affairs	Poston	489	11	NA							Secondary	NA	2001
Poston CRHA	Colorado River Housing Authority	Poston	244	11	NA							Secondary	47	2001
Quartzsite WWRF	Quartzsite	Quartzsite	1,000	370							X	Adv.Trt. I	NA	2001
Thompson Enterprises	Private	RV Park	NA	29	NA									

NA: Data not currently available to ADWR
WWTF: Waste Water Treatment Facility
WWTP: Waste Water Treatment Plant
WWRF: Waste Water Reclamation Facility
SD: Sanitation District

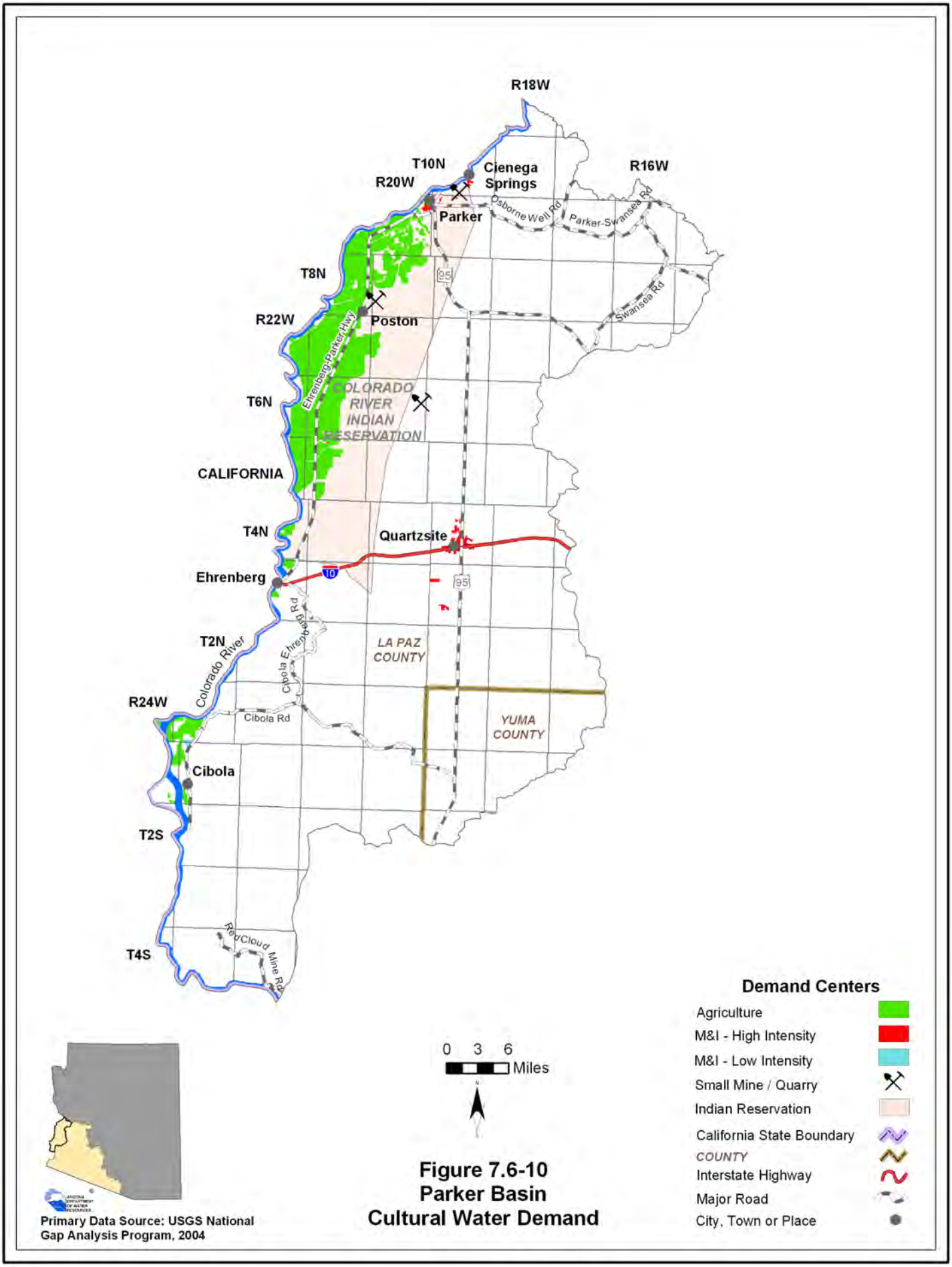


Figure 7.6-10
Parker Basin
Cultural Water Demand

7.6.9 Water Adequacy Determinations in the Parker 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 7.6-10. Figure 7.6-11 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 A. Adequacy determination data sources and methods are found in Volume 1, Sections 1.3.1.

Water Adequacy Reports

- See Table 7.6-10
- As of May 2005, 22 subdivisions had been reviewed for an adequacy determination. All subdivisions are in La Paz County.
- Of the 1,539 lots in 22 subdivisions for which lot information is available, 1,279 lots or 83% were determined to be adequate.
- The most common reason for a determination of inadequacy is insufficient data.

Table 7.6-10 Adequacy Determinations in the Parker Basin[1]

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determinatio	Reason(s) for Inadequacy Determination	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
1	College Acres	La Paz	3 South	22 West	30	16		Adequate		9/18/74	Dry Lot Subdivision
2	Brandy Hills West	La Paz	7 North	17 West	16	92		Inadequate	C	02/21/74	Dry Lot Subdivision
3	Emerald Springs Unit I	La Paz	3 North	22 West	3, 10	53	22-300299	Adequate		5/7/97	Ehrenberg Water Company
4	Highland Estates Amended	La Paz	10 North	19 West	27	17		Inadequate	B	12/5/94	Dry Lot Subdivision
5	La Paz Estates	La Paz	3 South	22 West	2	156		Adequate		5/28/76	La Paz Water Company
6	La Paz Estates # 1	La Paz	3 North	22 West	2	23		Adequate		5/9/88	Ehrenberg Water Company
7	La Paz Valley Acres	La Paz	3 North	19 West	29	20		Adequate		6/10/84	Dry Lot Subdivision
8	Lake Moovalya Keys (amended)	La Paz	10 North	19 West	22			Adequate		1/14/92	Consolidated Water Utilities
9	Miraleste Shores Estates	La Paz	10 North	19 West	15	46		Inadequate	B	4/4/94	Consolidated Water Utilities, Ltd.
10	Moon Mountain Estates	La Paz	4 North	19 West	21	12		Inadequate	A1	4/10/80	Dry Lot Subdivision
11	Moon Mountain Estates # 2	La Paz	4 North	19 West	21	24		Inadequate	A1	6/24/85	Dry Lot Subdivision
12	Mountain View Resort	La Paz	4 North	19 West	21	54	22-300548	Inadequate	A1	10/15/98	Town of Quartzite
13	Mountain View Subdivision	La Paz	4 North	19 West	21	10	22-300549	Inadequate	A1	10/15/98	Town of Quartzite
14	Q Mountain Mobile Home & RV	La Paz	4 North	19 West	28	248		Adequate		1/11/91	Q Mountain Water Company
15	Rainbow Acres Unit 1 Phase II	La Paz	3 North	19 West	7	63	22-300333	Adequate		9/22/97	Q Mountain Water Company
16	Rainbow Acres Unit 2	La Paz	3 North	19 West	7	113	22-300429	Adequate		9/15/98	Q Mountain Water Company
17	Rainbow Acres Unit 3 Phase I	La Paz	3 North	19 West	7	123	22-400086	Adequate		8/2/99	Q Mountain Water Company
18	Rainbow Acres Unit 3 Phase II	La Paz	3 North	19 West	7	137	22-400247	Adequate		5/8/00	Q Mountain Water Company
19	Ranchero Estates 1 & 2	La Paz	11 North	18 West	27	NA		Adequate		06/30/76	Holiday Harbor Utilities Company
20	Riverview	La Paz	10 North	19 West	27			Inadequate	D	10/22/74	Lake-Side Utilities, Inc.
21	Verde West R.V.Park	La Paz	11 North	18 West	27	327		Adequate		4/17/86	Consolidated Utilities
22	Vinnedge	La Paz	4 North	19 West	16	5		Inadequate	D	12/8/75	Dry Lot Subdivision

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 determination.

[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

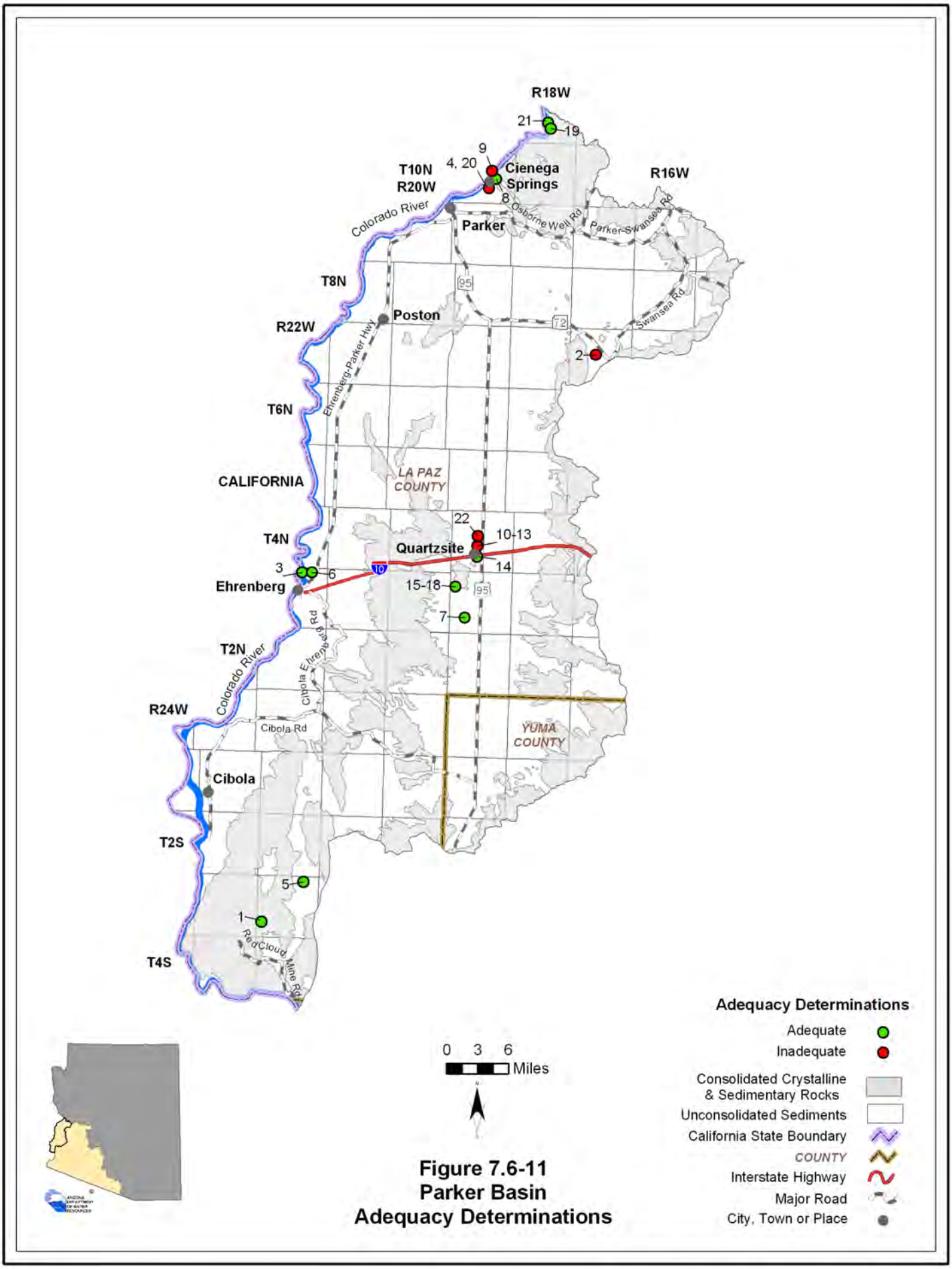


Figure 7.6-11
Parker Basin
Adequacy Determinations

Parker Basin
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A

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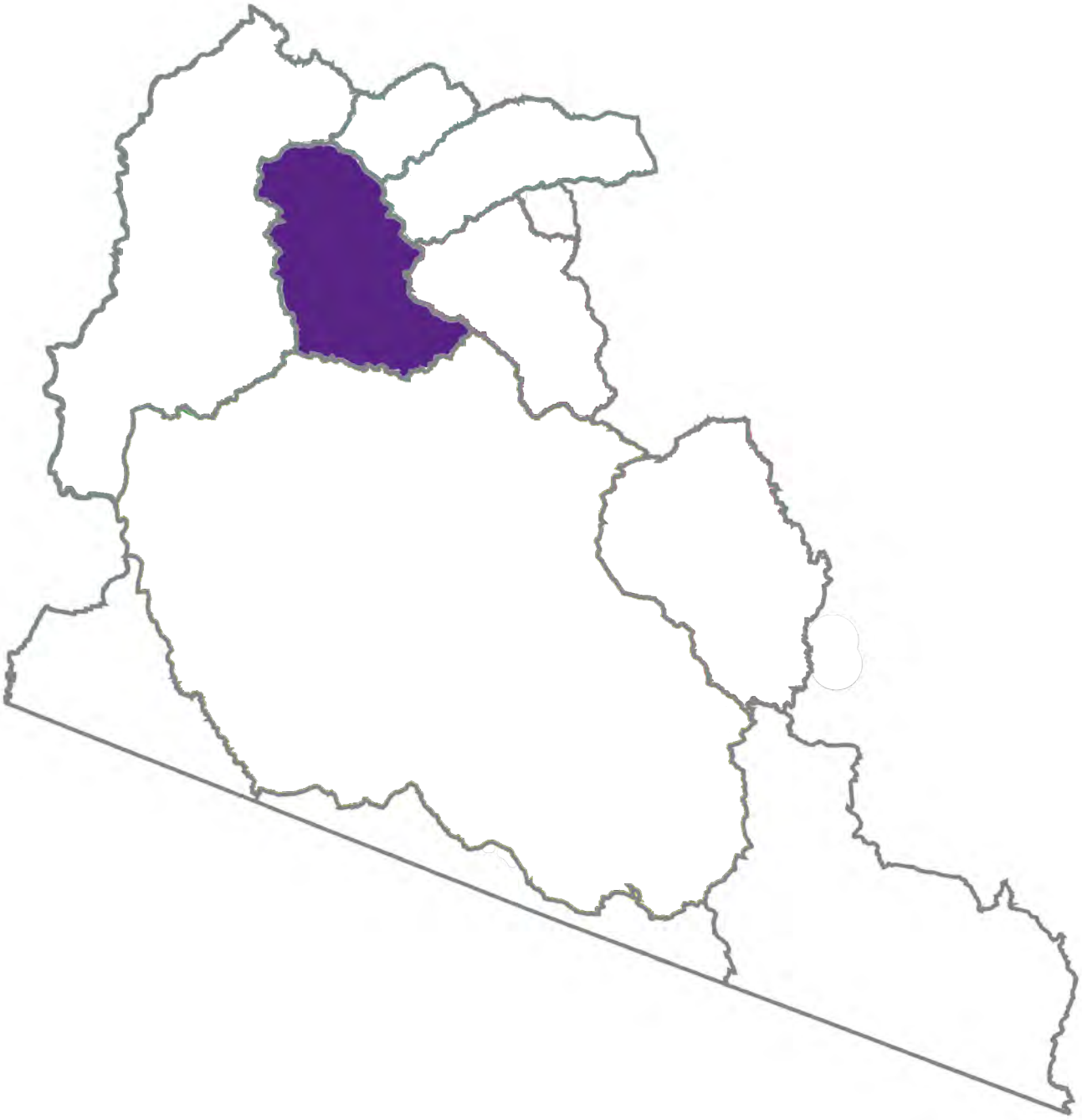
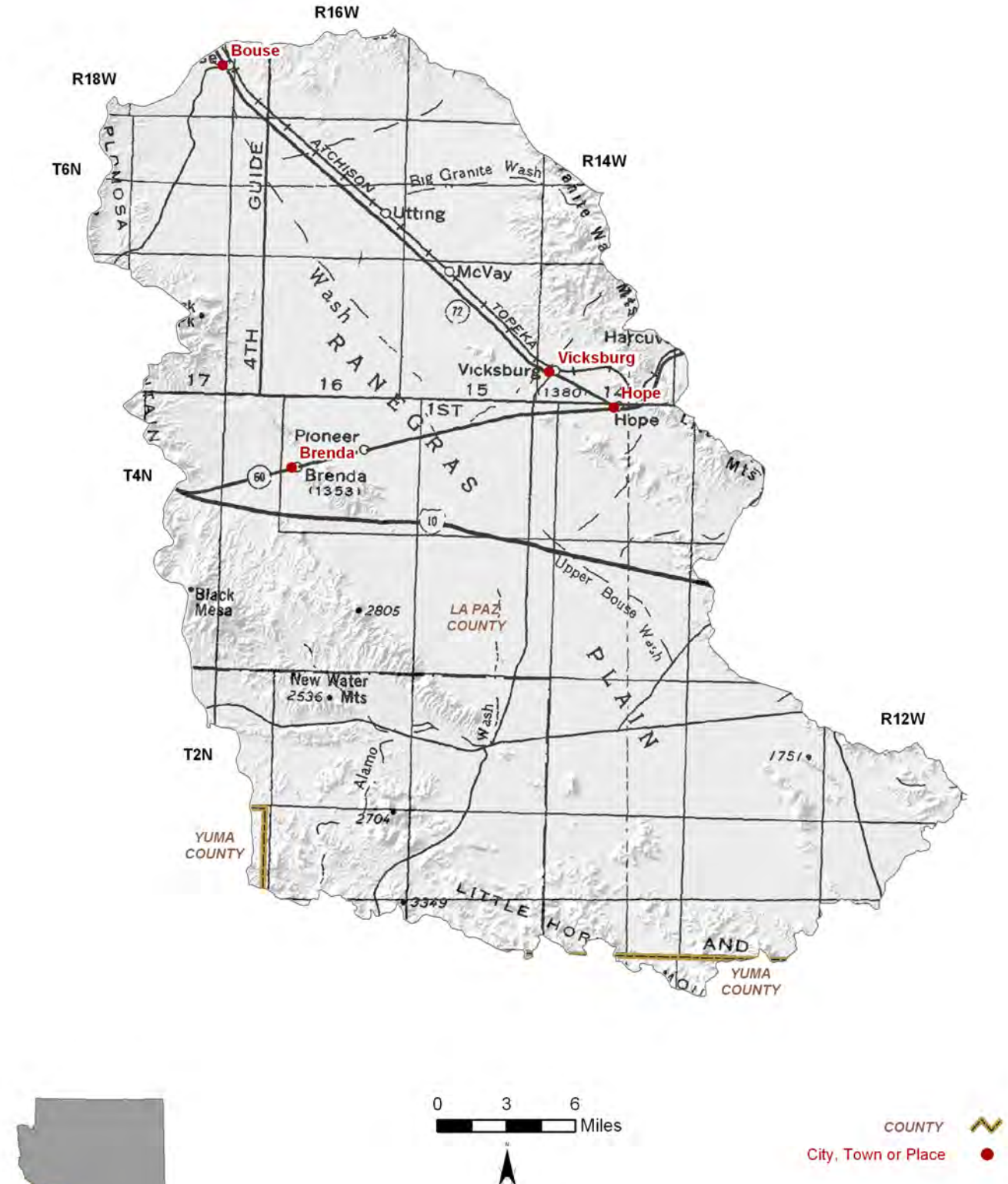
Section 7.7
Ranegras Plain Basin



7.7.1 Geography of the Ranegras Plain Basin

The Ranegras Plain Basin, located in the northern part of the planning area is 912 square miles in area. Geographic features and principal communities are shown on Figure 7.7-1. The basin is characterized by a plain bordered by mountain ranges. Vegetation types include Lower Colorado River Valley and Arizona Uplands Sonoran desertscrub. (See Figure 7.0-7)

- Principal geographic features shown on Figure 7.7-1 are:
    - Basin communities of Bouse, Brenda, Hope and Vicksburg
    - Bouse Wash in the northern portion of the basin
    - Ranegras Plain in the center of the basin bordered by the Plomosa, New Water and Little Horn Mountains in the west and the Granite Wash and Little Harquahala Mountains in the east
    - The highest point in the basin at 2,704 feet in the New Water Mountains
- Not well shown on Figure 7.7-1 is the lowest point in the basin at 930 feet near the Town of Bouse.



Base Map: USGS 1:500,000, 1981

Figure 7.7-1
Ranegras Plain Basin
Geographic Features

7.7.2 Land Ownership in the Ranegras Plain Basin

Land ownership, including the percentage of ownership by category, for the Ranegras Plain Basin is shown in Figure 7.7-2. The principal feature of land ownership in this basin is the large proportion of U.S. Bureau of Land Management land. A description of land ownership data sources and methods is found in Volume 1, Section 1.3.8. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

U.S. Bureau of Land Management (BLM)

- 66.3% of the land is federally owned and managed by the Yuma Field Office of the Bureau of Land Management.
- This basin includes the 25,000 acre New Water Mountains Wilderness and 12,000 acres of the 100,000 acre Eagletail Mountains Wilderness. (See Figure 7.0-9)
- Land uses include grazing, resource conservation and recreation.

National Wildlife Refuge

- 15.5% of the land is federally owned and managed by the U.S. Fish and Wildlife Service as the Kofa National Wildlife Refuge (NWR).
- Land uses include resource conservation, wildlife protection and recreation.

Private

- 11.1% of the land is private.
- Land uses include domestic, commercial and agriculture.

State Trust Land

- 7.1% of the land is held in trust for the public schools under the State Trust Land system.
- Primary land use is grazing and agriculture.

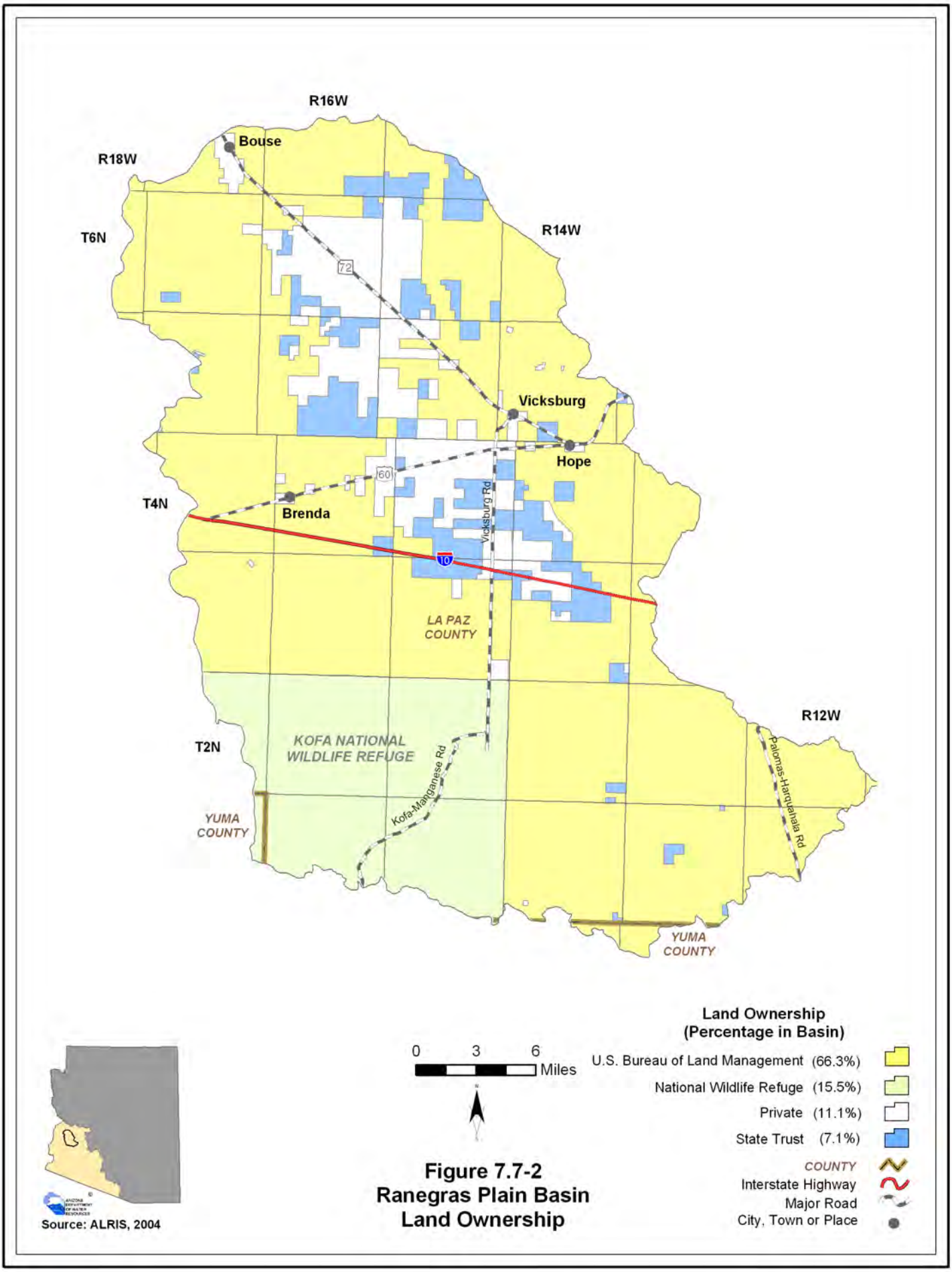


Figure 7.7-2
Ranegras Plain Basin
Land Ownership

7.7.3 Climate of the Ranegras Plain Basin

The Ranegras Plain Basin does not contain NOAA/NWS, Evaporation Pan, AZMET or SNOTEL/ Snowcourse stations. Figure 7.7-3 shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. A description of the climate data sources and methods is found in Volume 1, Section 1.3.3.

SCAS Precipitation Data

- See Figure 7.7-3
- Average annual rainfall is as high as 14 inches along the eastern basin boundary north of Vicksburg and as low as four inches in the north central portion of the basin.

Table 7.7-1 Climate Data for the Ranegras Plain 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
None									

Source: WRCC, 2003

B. Evaporation Pan:

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

Source: WRCC, 2003.

C. AZMET:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Annual Reference Evaportranspiration, in inches (N*umber of years to calculate averages*)
None			

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: NRCS, 2005

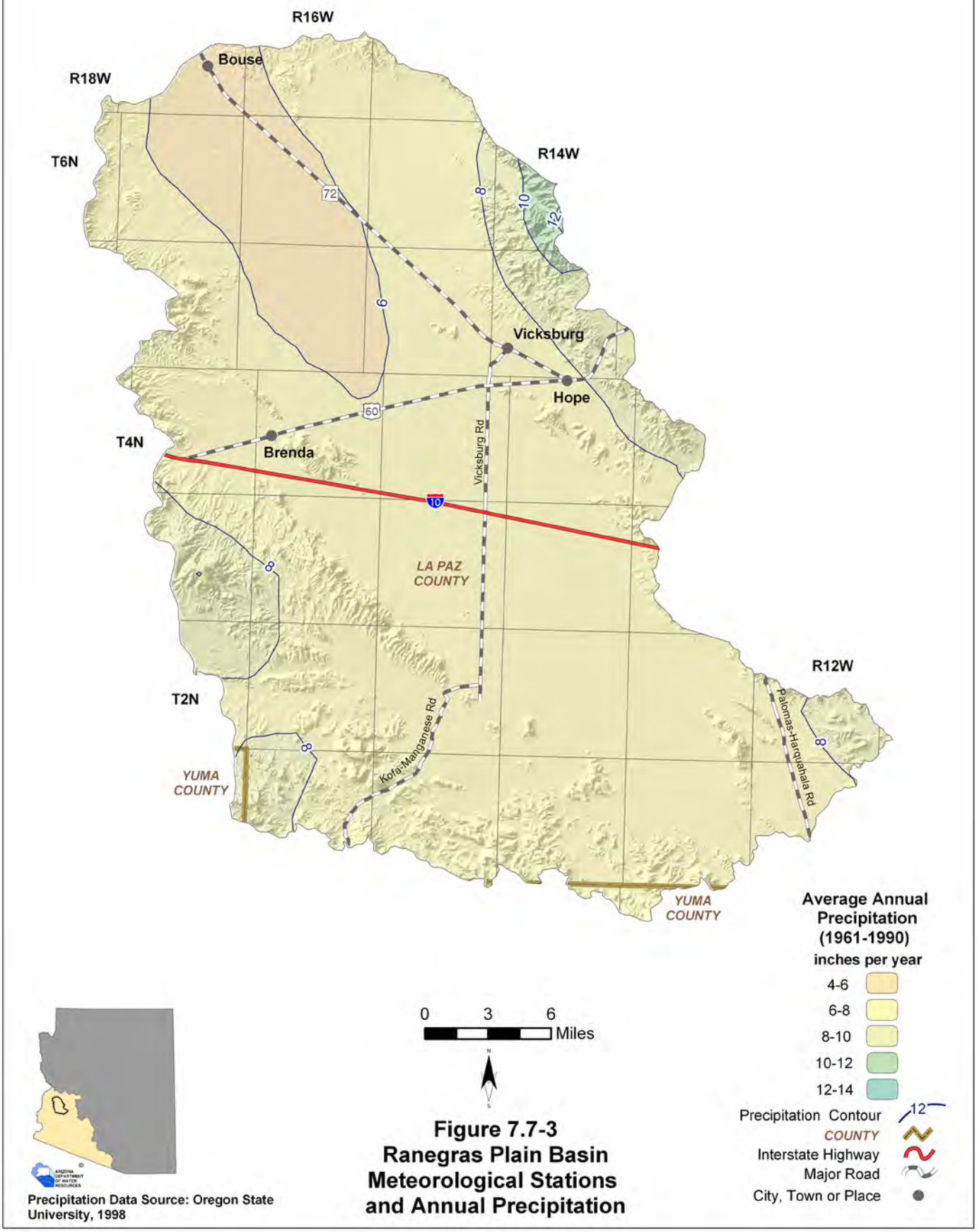


Figure 7.7-3
Ranegras Plain Basin
Meteorological Stations and Annual Precipitation

7.7.4 Surface Water Conditions in the Ranegras Plain Basin

There are no streamflow data, flood ALERT equipment or USGS runoff contour data available for this basin. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 7.7-4. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Reservoirs and Stockponds

- Refer to Table 7.7-4.
- There are no large or small reservoirs and 16 registered stockponds in this basin.

Table 7.7-2 Streamflow Data for the Ranegras Plain Basin

Station Number	USGS Station Name	Drainage Area (in mi^2)	Mean Basin Elevation (in feet)	Period of Record	Average Seasonal Flow (% of annual flow)				Annual Flow/Year (in acre-feet)				Years of Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
None													

Sources: USGS NWIS, USGS 1998 and USGS 2003.

Table 7.7-3 Flood ALERT Equipment in the Ranegras Plain Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
None				

Table 7.7-4 Reservoirs and Stockponds in the Ranegras Plain 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	JURISDICTION
None identified by ADWR at this time					

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

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

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: 16

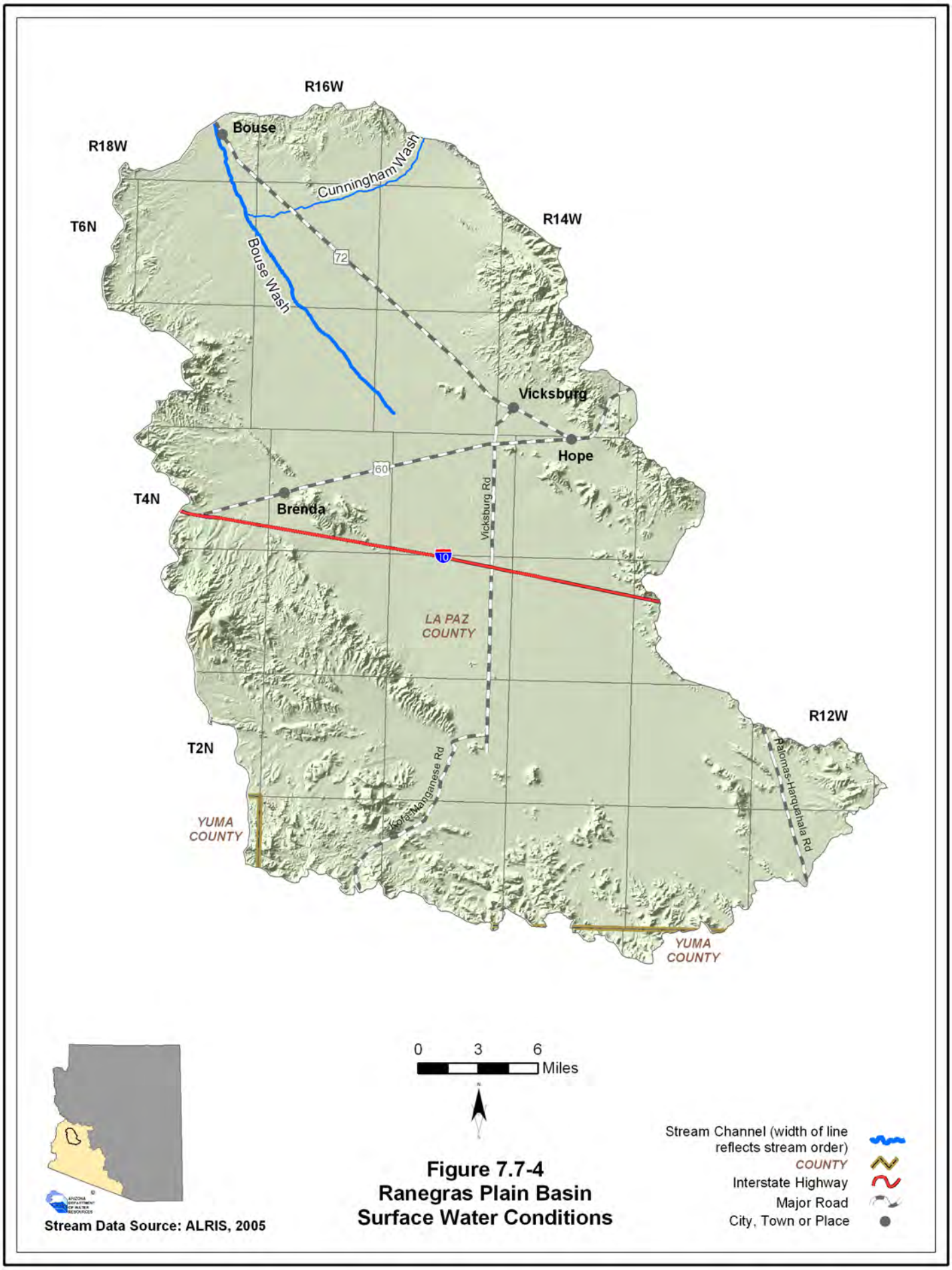


Figure 7.7-4
Ranegras Plain Basin
Surface Water Conditions

7.7.5 Perennial/Intermittent Streams and Major Springs in the Ranegras Plain Basin

The total number of springs in the basin are shown in Table 7.7-5. There are no perennial or intermittent streams and no major or minor springs in the Ranegras Plain Basin. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, Section 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- The total number of springs, regardless of discharge, identified by the USGS is two.

Table 7.7-5 Springs in the Ranegras Plain 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, 2005 and USGS, 2006): 2

7.7.6 Groundwater Conditions of the Ranegras Plain Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.7-6. Figure 7.7-5 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 7.7-6 contains hydrographs for selected wells shown on Figure 7.7-5. Figure 7.7-7 shows well yields in five yield categories. A description of aquifer data sources and methods is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields, is found in Volume 1, Section 1.3.19.

Major Aquifers

- Refer to Table 7.7-6 and Figure 7.7-5.
- The major aquifer is basin fill.
- Groundwater flow is generally from south to north, with a cone of depression caused by irrigation pumping west of Hope.

Well Yields

- Refer to Table 7.7-6 and Figure 7.7-7.
- As shown on Figure 7.7-7, well yields in this basin are generally greater than 1,000 gallons per minute (gpm).
- One source of well yield information, based on 68 reported wells, indicates that the median well yield is 1,150 gpm.

Natural Recharge

- Refer to Table 7.7-6.
- There are five estimates of natural recharges ranging from less than 1,000 acre-feet per year to between 4,550 acre-feet and 6,050 acre-feet per year.
- The largest source of natural recharge is infiltration of runoff from the Bouse Wash and its tributaries (ADWR 1994).

Water in Storage

- Refer to Table 7.7-6.
- There are four estimates of water in storage for this basin ranging from nine million acre-feet to 27 million acre-feet, both to a depth of 1,200 feet.

Water Level

- Refer to Figure 7.7-5. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 19 index wells in this basin, hydrographs for six index wells are shown on Figure 7.7-6.
- The deepest water level shown on the map is 363 feet south of Vicksburg and the shallowest is 75 feet at Bouse.

Table 7.7-6 Groundwater Data for the Ranegras Plain Basin

Basin Area, in square miles:	912	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
Well Yields, in gal/min:	Range 812-3,310 Median 1,993.5 (14 wells measured)	Measured by ADWR and/or USGS
	Range 12-4,000 Median 1,150 (68 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	Range 85-3,310	ADWR (1994)
	Range 0-2,500	USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	5,000	ADWR (1994)
	5,500	ADWR (1990) (HMS 18)
	<1,000	Freethey and Anderson (1986)
	1,000	Arizona Water Commission (1975)
	4,550 - 6,050	Briggs (1969)
Estimated Water Currently in Storage, in acre-feet:	21,700,000 (to 1,200 ft)	ADWR (1994)
	9,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	27,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
	15,400,000 - 22,200,000	Johnson (1990)
Current Number of Index Wells:	19	
Date of Last Water-level Sweep:	2004 (133 wells measured)	

[1]Predevelopment Estimate

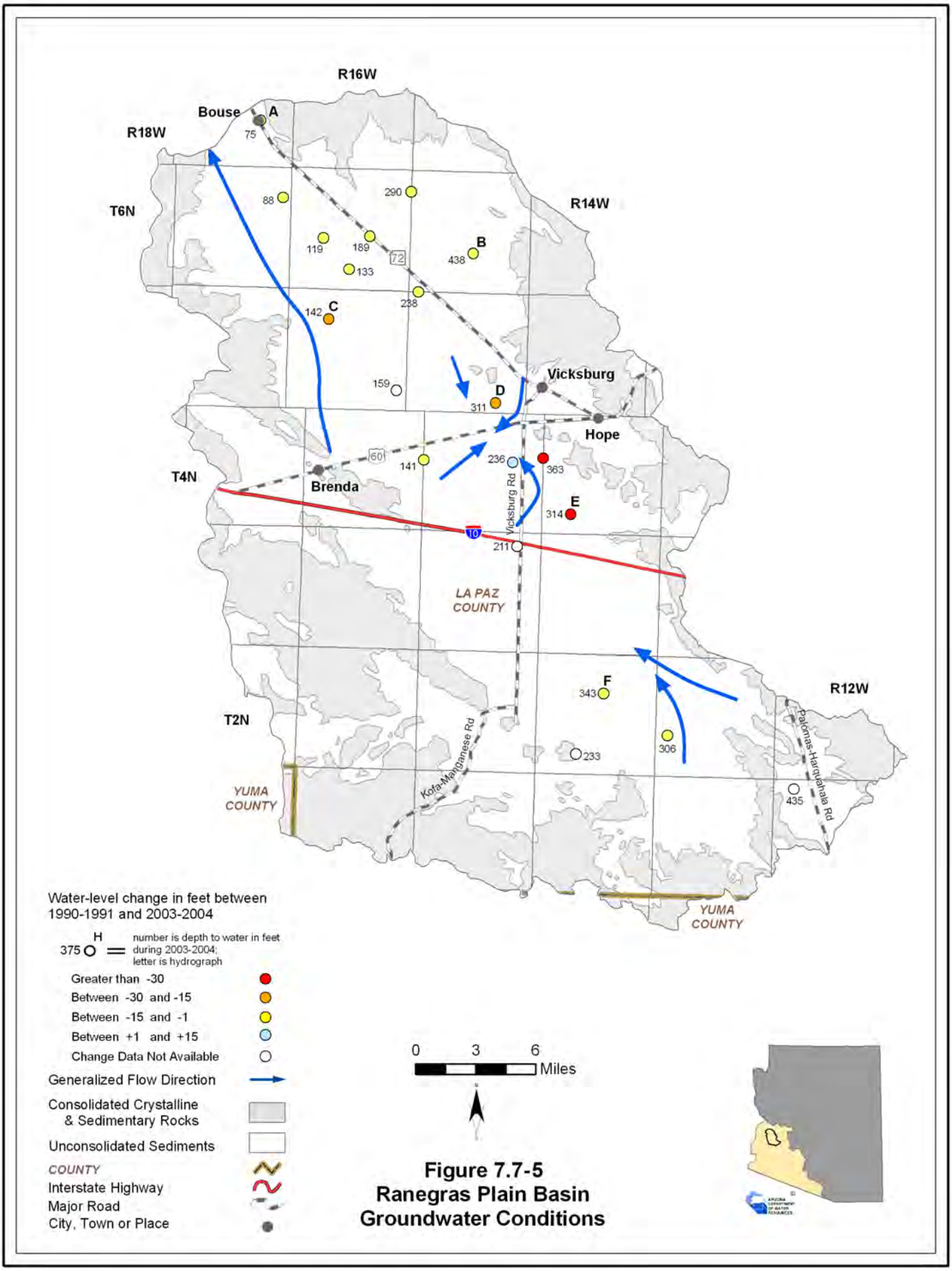


Figure 7.7-5
Ranegras Plain Basin
Groundwater Conditions

Figure 7.7-6
Ranegras Plain Basin
Hydrographs Showing Depth to Water in Selected Wells

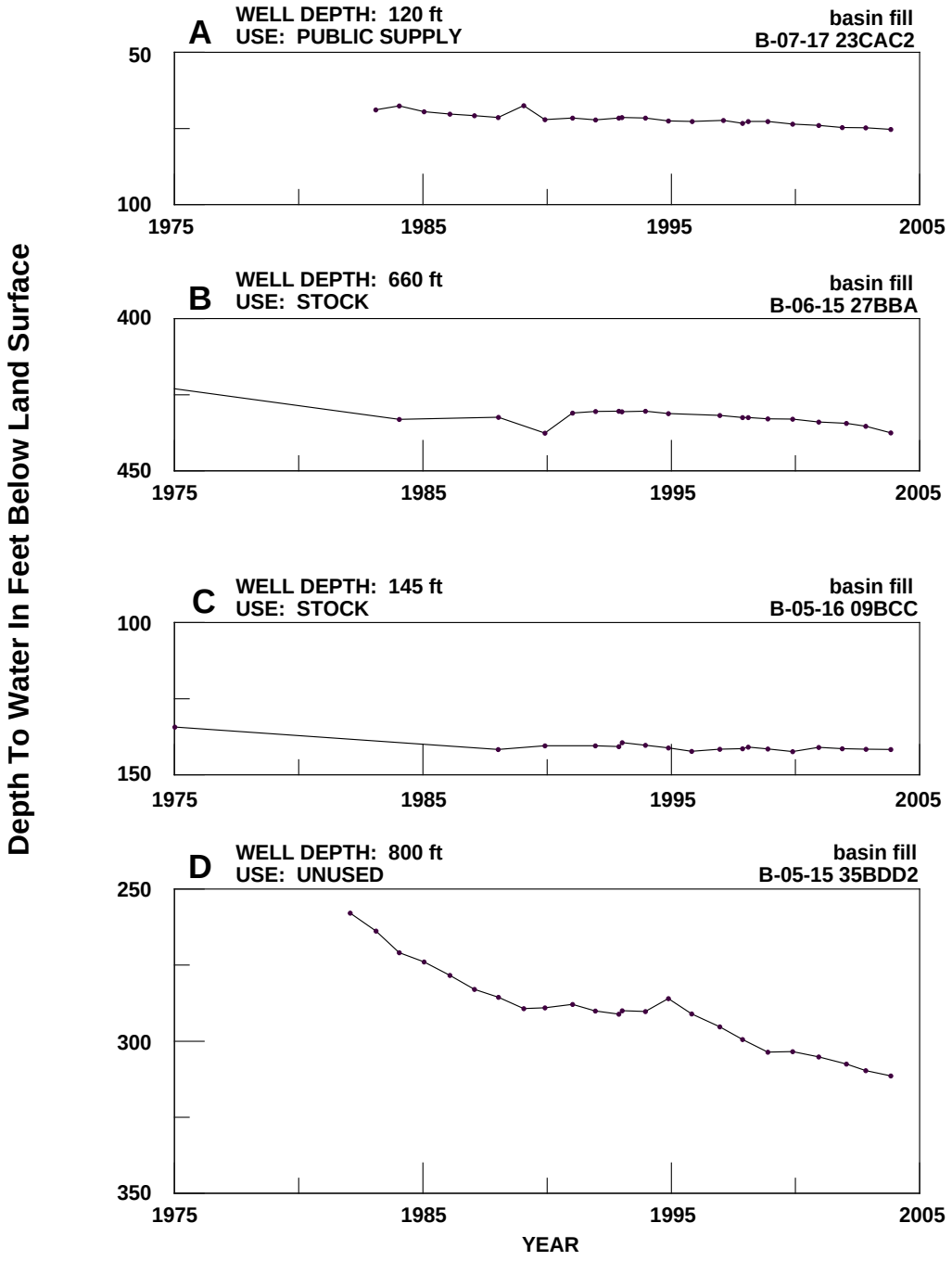
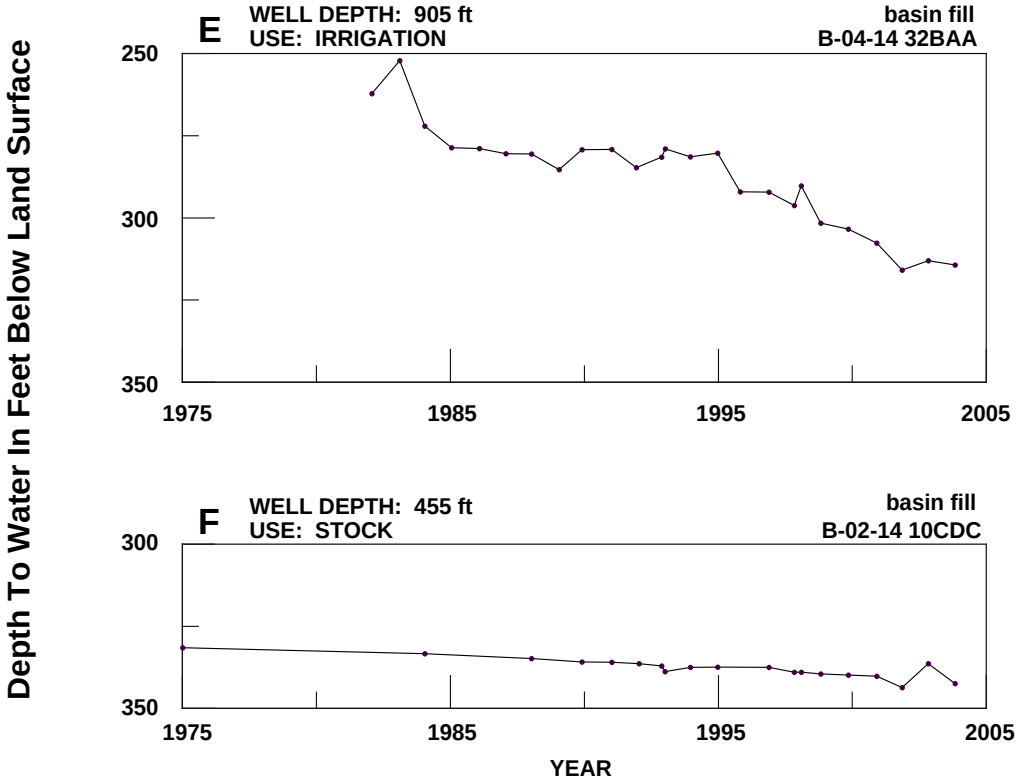


Figure 7.7-6 (cont'd)
Ranegras Plain Basin
Hydrographs Showing Depth to Water in Selected Wells



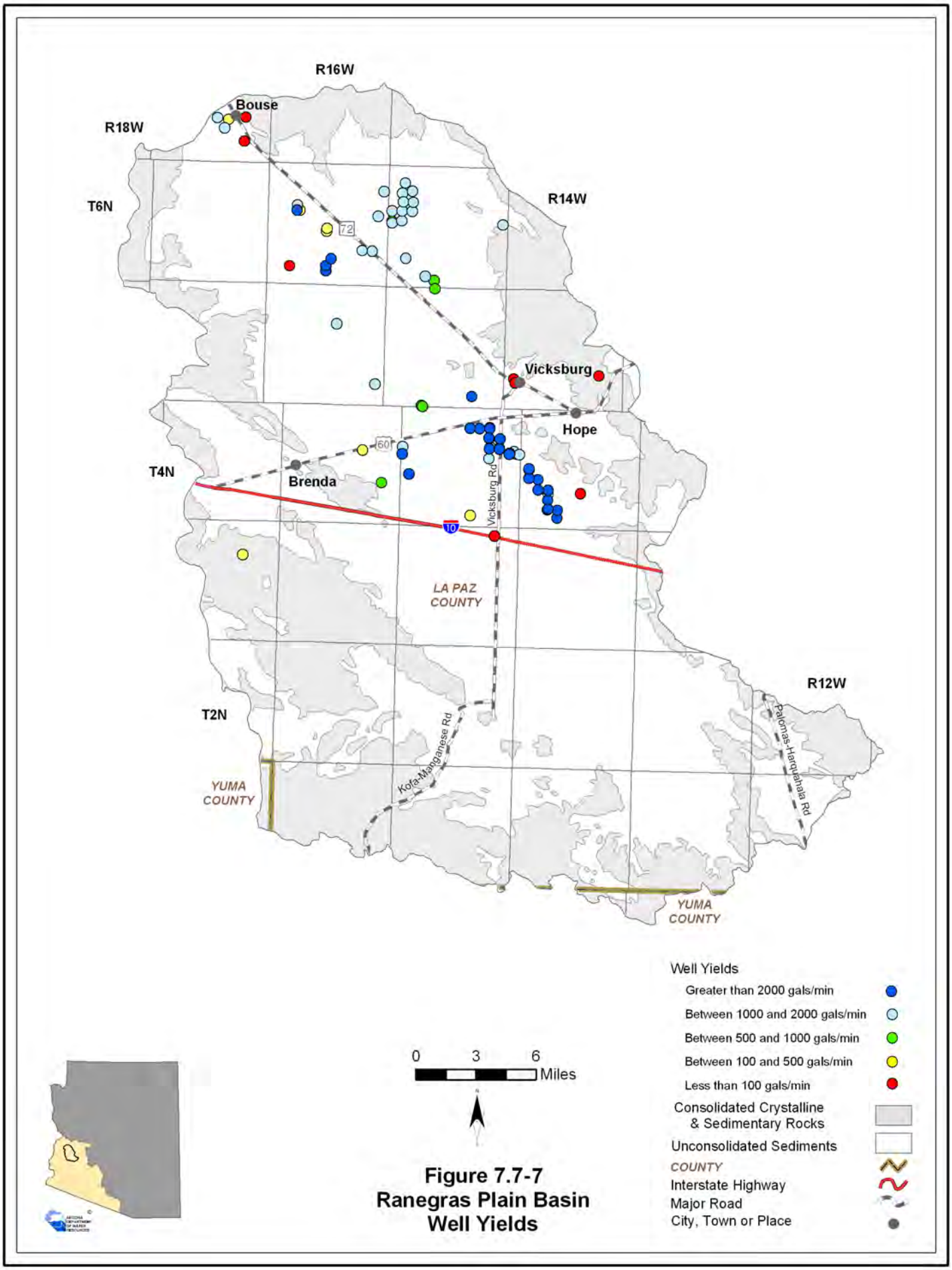


Figure 7.7-7
Ranegras Plain Basin
Well Yields

7.7.7 Water Quality of the Ranegras Plain 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 7.7-7A. There are no impaired lakes or streams in this basin. Figure 7.7-8 shows the location of water quality occurrences keyed to Table 7.7-7. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mine Sites

- Refer to Table 7.7-7A.
- Ninety-one wells have parameter concentrations that have equaled or exceeded drinking water standards.
- Seventy-one percent of the wells equaled or exceeded the parameter for fluoride.
- Other parameters equaled or exceeded include arsenic, barium, chromium, lead, nitrate and total dissolved solids.

Table 7.7-7 Water Quality Exceedences in the Ranegras Plain Basin[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
1	Well	7 North	17 West	22	As, F
2	Well	7 North	17 West	23	As, F
3	Well	7 North	17 West	23	As, F
4	Well	7 North	17 West	23	As, F
5	Well	7 North	17 West	35	As, F
6	Well	6 North	15 West	6	NO3
7	Well	6 North	15 West	6	NO3
8	Well	6 North	15 West	7	NO3, TDS
9	Well	6 North	15 West	8	F
10	Well	6 North	15 West	8	F
11	Well	6 North	15 West	18	F
12	Well	6 North	15 West	18	F
13	Well	6 North	15 West	30	As, F
14	Well	6 North	15 West	30	As, F
15	Well	6 North	15 West	30	As, F
16	Well	6 North	15 West	32	As, F
17	Well	6 North	15 West	33	Pb
18	Well	6 North	15 West	33	As, Pb
19	Well	6 North	16 West	12	F
20	Well	6 North	16 West	15	Cr
21	Well	6 North	16 West	15	Cr, TDS
22	Well	6 North	16 West	16	F
23	Well	6 North	16 West	17	F
24	Well	6 North	16 West	17	As
25	Well	6 North	16 West	17	As, F
26	Well	6 North	16 West	20	F
27	Well	6 North	16 West	22	F
28	Well	6 North	16 West	23	As, NO3, TDS
29	Well	6 North	16 West	23	F
30	Well	6 North	16 West	26	NO3, TDS
31	Well	6 North	16 West	32	As, F
32	Well	6 North	16 West	34	As, F
33	Well	6 North	17 West	12	As, F
34	Well	6 North	17 West	12	Ba
35	Well	6 North	17 West	12	F
36	Well	5 North	15 West	4	As, F
37	Well	5 North	15 West	4	As, F
38	Well	5 North	15 West	6	F, NO3, TDS
39	Well	5 North	15 West	20	As, F
40	Well	5 North	15 West	21	F
41	Well	5 North	15 West	30	As, F, NO3, TDS
42	Well	5 North	16 West	9	As, F, Pb
43	Well	5 North	16 West	10	As, F
44	Well	4 North	14 West	4	As
45	Well	4 North	14 West	19	As, F
46	Well	4 North	14 West	19	As, F, NO3
47	Well	4 North	14 West	19	F
48	Well	4 North	14 West	19	As, F, NO3
49	Well	4 North	14 West	29	As, F
50	Well	4 North	14 West	29	F
51	Well	4 North	14 West	29	F
52	Well	4 North	14 West	30	As, Cr, F
53	Well	4 North	14 West	32	As, Cr, F
54	Well	4 North	14 West	32	As, Cr, F, NO3
55	Well	4 North	14 West	32	F
56	Well	4 North	15 West	8	F, NO3
57	Well	4 North	15 West	8	As
58	Well	4 North	15 West	9	As, NO3

Table 7.7-7 Water Quality Exceedences in the Ranegras Plain Basin (cont'd.)[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
59	Well	4 North	15 West	10	F
60	Well	4 North	15 West	10	F
61	Well	4 North	15 West	11	F
62	Well	4 North	15 West	11	As, Cr, F, NO3
63	Well	4 North	15 West	11	F
64	Well	4 North	15 West	13	As, Cr, F
65	Well	4 North	15 West	13	F
66	Well	4 North	15 West	13	As, F
67	Well	4 North	15 West	13	F
68	Well	4 North	15 West	14	As, F, NO3
69	Well	4 North	15 West	14	As, F, NO3, TDS
70	Well	4 North	15 West	14	As
71	Well	4 North	15 West	18	As
72	Well	4 North	15 West	18	As, F
73	Well	4 North	15 West	23	F
74	Well	4 North	15 West	28	As, NO3
75	Well	4 North	16 West	9	As, F
76	Well	4 North	16 West	13	As
77	Well	4 North	16 West	13	As, F
78	Well	4 North	16 West	13	As
79	Well	4 North	16 West	15	As, F
80	Well	4 North	16 West	18	As
81	Well	4 North	16 West	18	As
82	Well	4 North	16 West	19	As
83	Well	4 North	16 West	19	As
84	Well	3 North	14 West	11	F
85	Well	3 North	15 West	2	As, F, NO3
86	Well	3 North	15 West	2	As, F
87	Well	3 North	15 West	2	As, Cr, F
88	Well	3 North	15 West	23	As, F
89	Well	2 North	13 West	19	As
90	Well	2 North	14 West	10	As
91	Well	2 North	14 West	28	NO3

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[3]	Parameter(s) Exceeding Use Standard[2]
None identified by ADWR at this time						

Notes:

[1] Water quality samples collected between 1979 and 2000.

[2] As = Arsenic
Ba = Barium
Cr = Chromium
F = Fluoride
Pb = Lead
NO3 = Nitrate/ Nitrite
TDS = Total Dissolved Solids

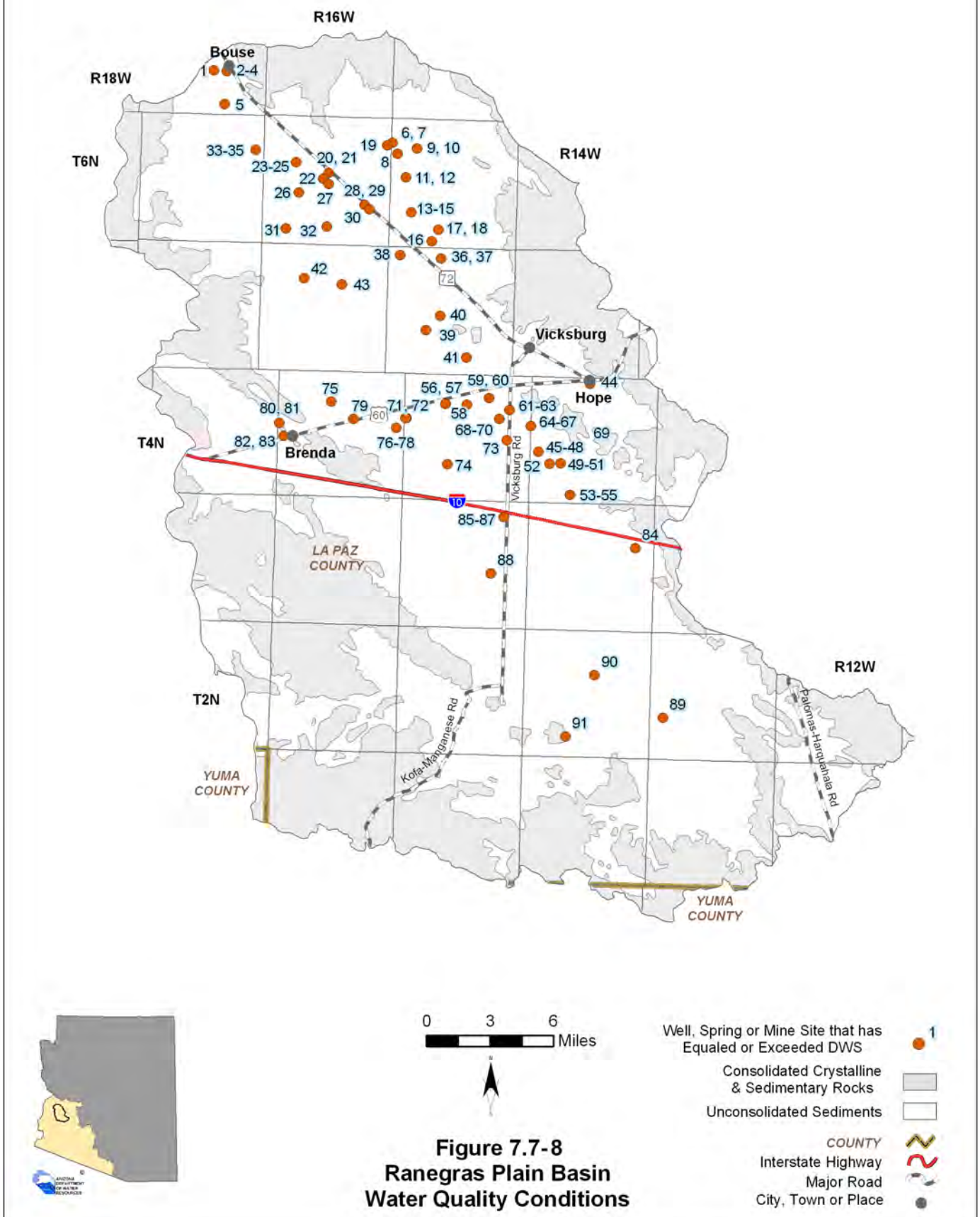


Figure 7.7-8
Ranegras Plain Basin
Water Quality Conditions

7.7.8 Cultural Water Demands in the Ranegras Plain 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 7.7-8. Figure 7.7-9 shows the location of demand centers. There is no recorded effluent generation in this basin. A description of cultural water demand data sources and methods is found in Volume 1, Section 1.3.5. More detailed information on cultural water demands is found in Section 7.0.7.

Cultural Water Demands

- Refer to Table 7.7-8 and Figure 7.7-9.
- Population in this basin declined from 1,024 in 1980 to 581 in 1990 but is slowly increasing. The 2000 basin population was 904. Projections suggest an increase to 7,581 in 2050.
- There are no reported surface water diversions in this basin.
- Most cultural water use is for irrigation in the northern half of the basin.
- Groundwater use for agriculture decreased 3% from 1991 to 2003 with 28,500 acre-feet of demand on average between 2000 and 2003.
- Municipal groundwater demand is relatively small and increased 33% between 1996 and 2003.
- There was no reported industrial groundwater demand from 1991 to 2003. A dairy/bio-refinery is scheduled to begin operation in late 2007 and another dairy began operating in December 2006.
- As of 2003 there were 524 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 74 wells with a pumping capacity of more than 35 gallons per minute.

Table 7.7-8 Cultural Water Demands in the Ranegras Plain Basin[1]

Year	Recent (Census) and Projected (DES) 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	Irrigation	Municipal	Industrial	Irrigation	
1971		194[2]	58[2]	18,000			NR			ADWR (1994)
1972										
1973										
1974										
1975										
1976				11,000			NR			
1977										
1978										
1979										
1980	1,024									
1981	980	70	8	35,000			NR			
1982	935									
1983	891									
1984	847									
1985	802									
1986	758	60	2	31,000			NR			
1987	714									
1988	669									
1989	625									
1990	581									
1991	613	48	2	<300	NR	29,500	NR			USGS (2005)
1992	645									
1993	678									
1994	710									
1995	742									
1996	775	95	3	300	NR	32,000	NR			
1997	807									
1998	839									
1999	872									
2000	904									
2001	954	31	1	400	NR	28,500	NR			
2002	1,005									
2003	1,055									
2010	1,407									
2020	2,139									
2030	3,252									
2040	4,945									
2050	7,518									
ADDITIONAL WELLS:[3]		**26**								
WELL TOTALS:		**524**	**74**							

[1] Does not include evaporation losses from stockponds and reservoirs.
[2] Includes all wells through 1980.
[3] Other water-supply wells are listed in the ADWR Well Registry for this basin, but they do not have completion dates. These wells are summed here.
NR - Not reported

Table 7.7-9 Effluent Generation in the Ranegras Plain Basin

Facility Name	Ownership	City/Location Served	Population Served	Volume Treated/Generated (acre-feet)	Disposal Method							Current Treatment Level	Population Not Served	Year of Record
					Water-course	Evaporation Pond	Irrigation	Golf Course	Wildlife Area	Discharged to Another facility	Infiltration Basins			
No Waste Water Treatment Facilities Identified by ADWR in this Basin														

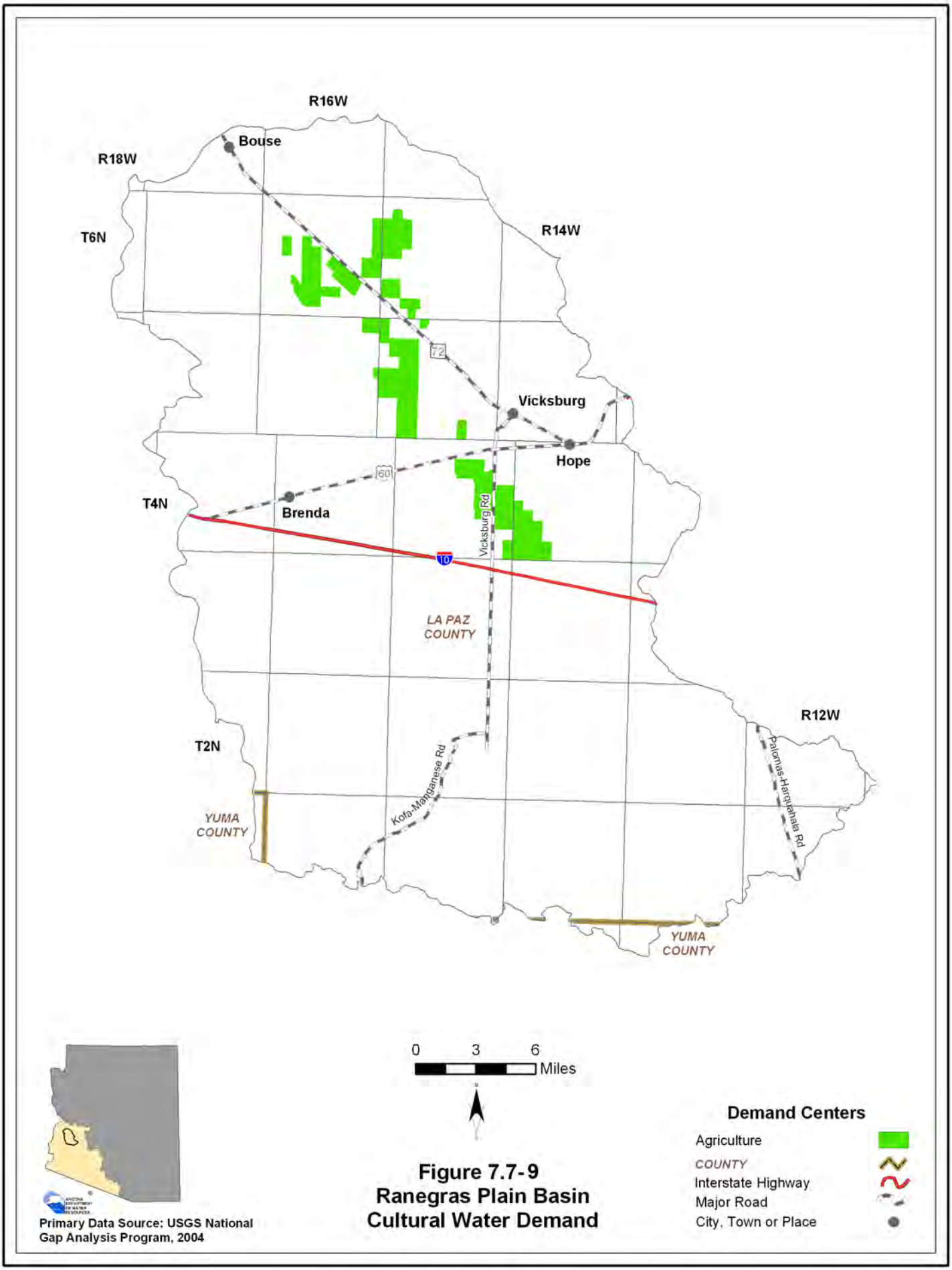


Figure 7.7-9
Ranegras Plain Basin
Cultural Water Demand

7.7.9 Water Adequacy Determinations in the Ranegras Plain 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 7.7-11. Figure 7.7-11 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 A. Adequacy determination data sources and methods are found in Volume 1, Sections 1.3.1.

Water Adequacy Reports

- See Table 7.7-10
- As of May 2005, four subdivisions have been reviewed for an adequacy determination. All subdivisions are in La Paz County.
- Of the 135 lots in four subdivisions, 26 lots or 19% were determined to be adequate.
- The most common reason for a determination of inadequacy is water quality.

Table 7.7-10 Adequacy Determinations in the Ranegras Plain Basin[1]

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
1	Desert Rose Acres Tract 135	La Paz	6 North	16 West	22	64	22-400809	Inadequate	C	10/22/02	Dry Lot Subdivision
2	Desert Shadows	La Paz	4 North	16 West	19	26		Adequate		01/10/94	Desert Shadows Water District
3	Eden Park RV Subdivision	La Paz	4 North	15 West	1	16	22-400701	Inadequate	D	05/28/02	Eden Park Homeowners Association
4	Faybol Subdivision	La Paz	6 North	16 West	34	29	22-300247	Inadequate	A1,C	01/28/97	Dry Lot Subdivision

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 determination.

[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 unavaible; 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 = Data not currently available to ADWR

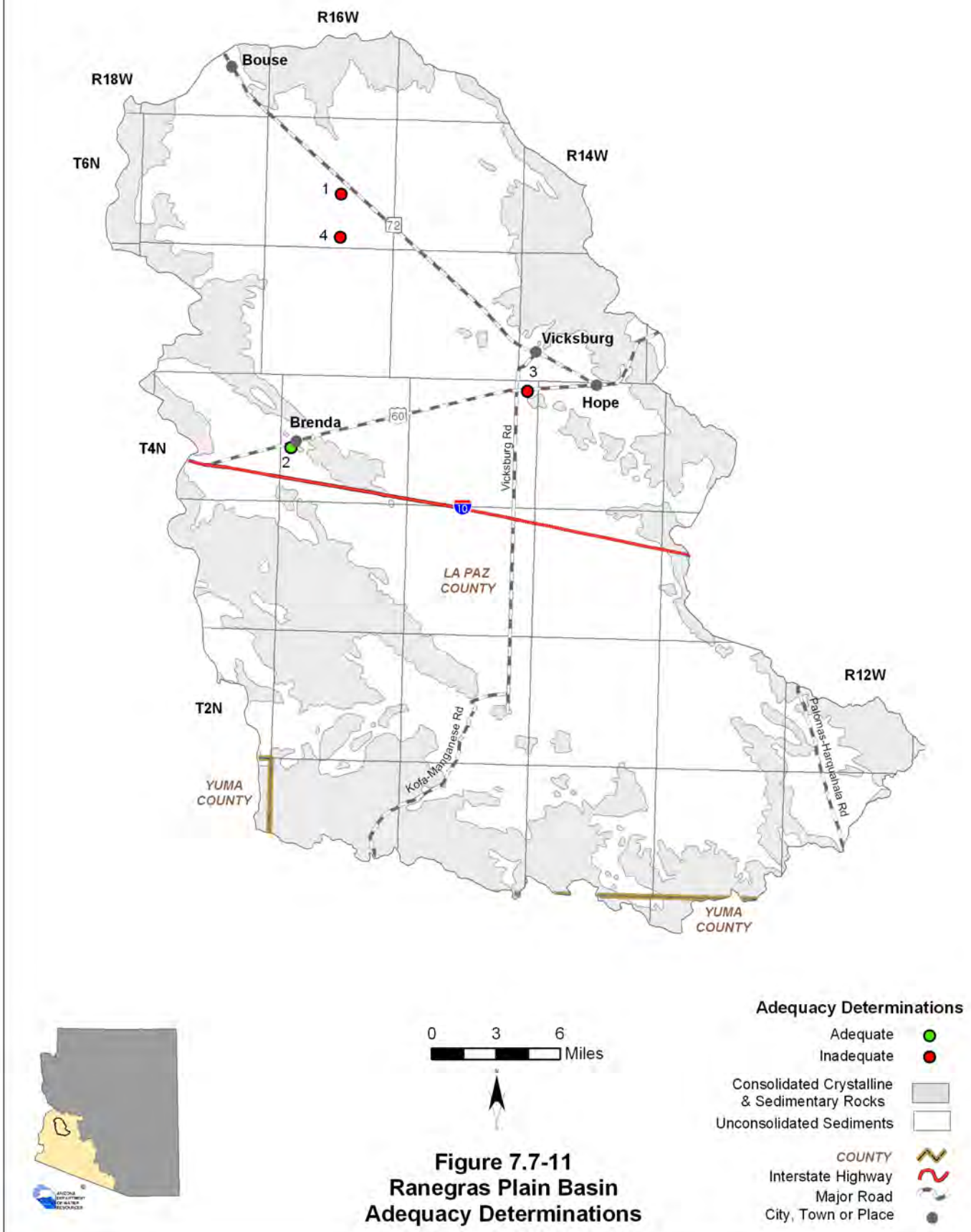


Figure 7.7-11
Ranegras Plain Basin
Adequacy Determinations

Ranegras Plain Basin
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Section 7.8
San Simon Wash Basin

7.8.1 Geography of the San Simon Wash Basin

The San Simon Wash Basin, located in the southeastern part of the planning area is 2,284 square miles in area. Geographic features and principal communities are shown on Figure 7.8-1. The basin is characterized by plains and valleys bordered by mountain ranges including the highest elevation mountain range in the planning area. Vegetation types include Lower Colorado River Valley and Arizona Uplands Sonoran desertscrub, semi desert grassland and madrean evergreen woodland along the eastern basin boundary. (See Figure 7.0-7)

- Principal geographic features shown on Figure 7.8-1 are:
    - Basin communities of Gu Vo, Hickiwan, Pisinemo and Sells
    - San Simon Wash running north-south through the center of the basin
    - Valleys and plains including the Quijotoa Valley in the northern portion of the basin, the Gu Oidak Valley in the center of the basin and the Baboquivari Valley in the southeastern portion of the basin
    - Mountain ranges including the Ajo Range on the southwestern basin boundary and the Baboquivari Mountains on the southeastern basin boundary
    - The highest point in the basin at 7,730 feet in the Baboquivari Mountains
    - The lowest point at about 1,650 feet where San Simon Wash enters Mexico

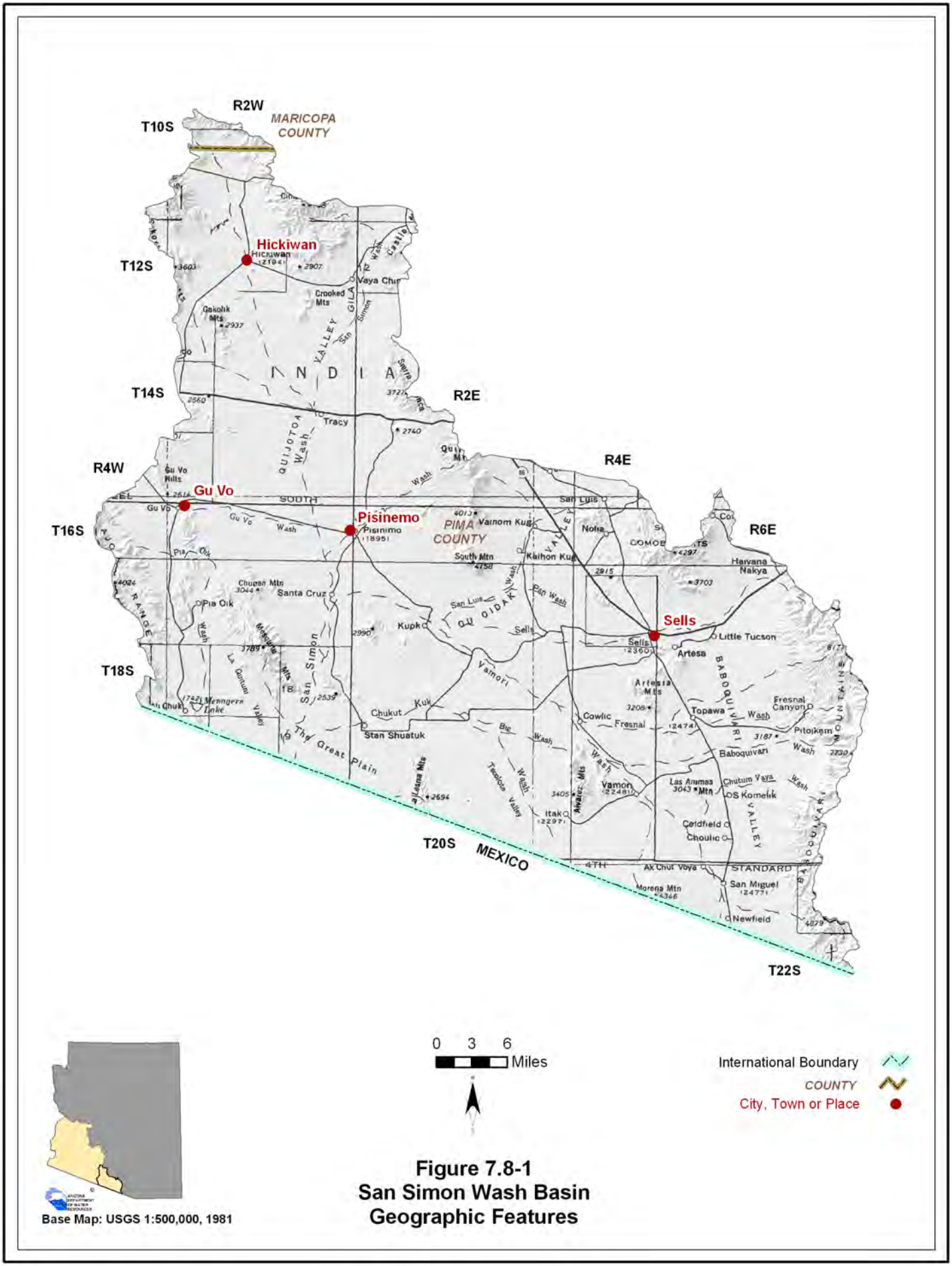

Figure 7.8-1
San Simon Wash Basin
Geographic Features

7.8.2 Land Ownership in the San Simon Wash Basin

Land ownership, including the percentage of ownership by category, for the San Simon Wash Basin is shown in Figure 7.8-2. The principal feature of land ownership in this basin is the large proportion of tribal lands. A description of land ownership data sources and methods is found in Volume 1, Section 1.3.8. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

Indian Reservation

- 99.2% under tribal ownership as the Tohono O'odham Indian Reservation.
- Land uses include domestic, commercial, grazing and farming.

Private

- 0.3% of the land is private.
- Small parcels of private land are found in the southern portion of the basin and in the vicinity of Sells.
- Land uses include domestic, commercial and grazing.

U.S. Bureau of Land Management

- 0.2% of the land is federally owned and managed by the Lower Sonoran Field Office of the U.S. Bureau of Land Management.
- Primary land use is grazing.

State Trust Land

- 0.2% of the land is held in trust for the public schools under the State Trust Land system.
- Primary land use is grazing.

National Park Service

- 0.1% 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.

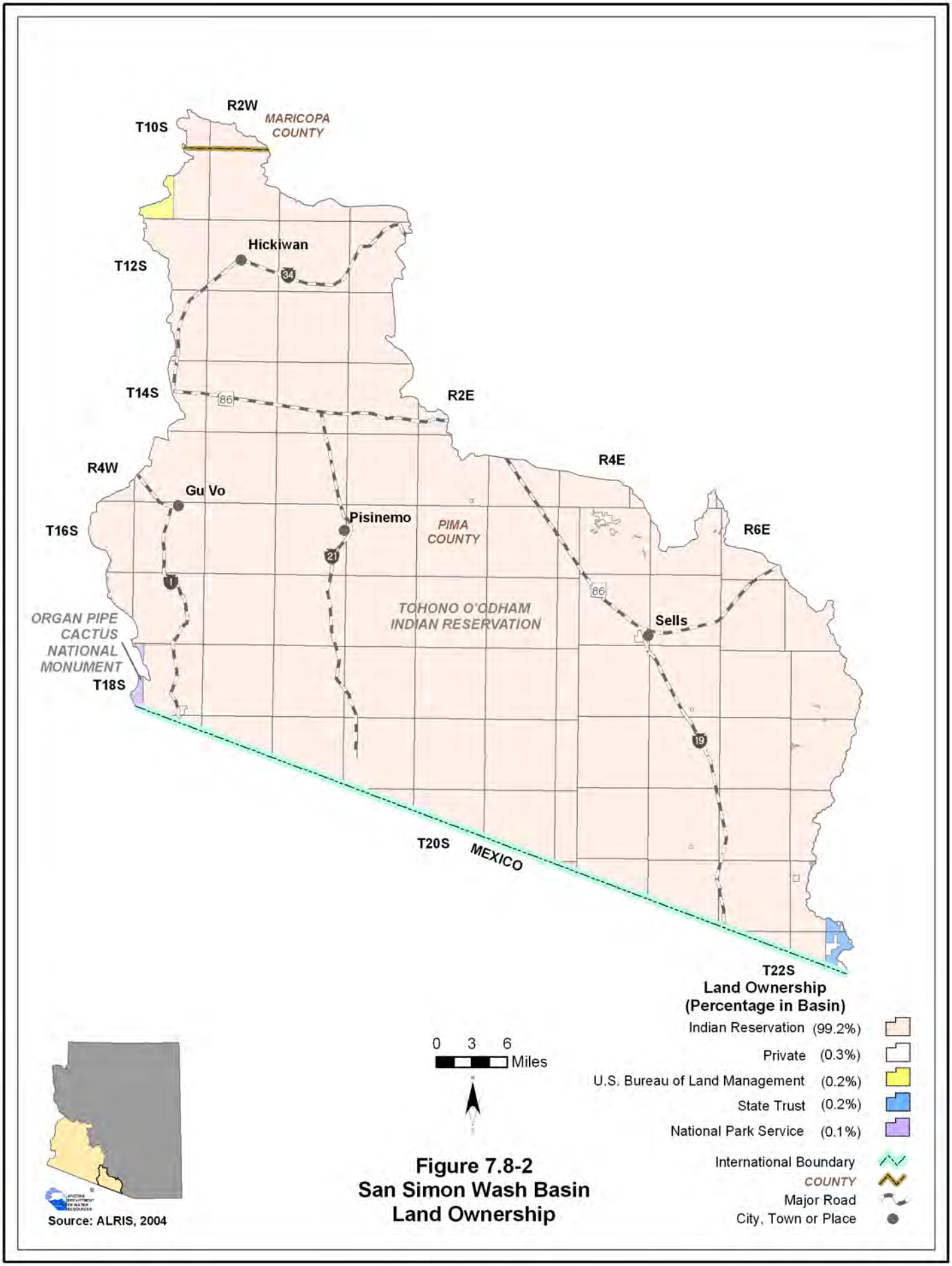

Figure 7.8-2
San Simon Wash Basin
Land Ownership

7.8.3 Climate of the San Simon Wash Basin

Climate data from NOAA/NWS Co-op Network stations are complied in Table 7.8-1 and the locations are shown on Figure 7.8-3. Figure 7.8-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The San Simon Wash Basin does not contain Evaporation Pan, AZMET or SNOTEL/ Snowcourse stations. A description of the climate data sources and methods is found in Volume 1, Section 1.3.3.

NOAA/NWS Co-op Network

- Refer to Table 7.8-1A
- There is one NOAA/NWS Co-op Network station in the basin, Sells, with an average high of 86.4°F and an average low of 51.2°F.
- Highest average seasonal rainfall, 6.66 inches, occurs in the summer season (July-September) when 55% of the annual average precipitation occurs.

SCAS Precipitation Data

- See Figure 7.8-3
- Additional precipitation data shows average annual rainfall as high as 32 inches along the eastern basin boundary in the Baboquivari Mountains and as low as eight inches along the border with Mexico and west and south of Hickiwan.

Table 7.8-1 Climate Data for the San Simon Wash 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
Sells	2380	1948 - 2004[1]	86.4/Jul	51.2/Jan	1.46	0.65	6.66	3.31	12.07

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			

Source: WRCC, 2005

C. AZMET:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Annual Reference Evaportranspiration, in inches (*Number of years to calculate averages*)
None			

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: NRCS, 2005

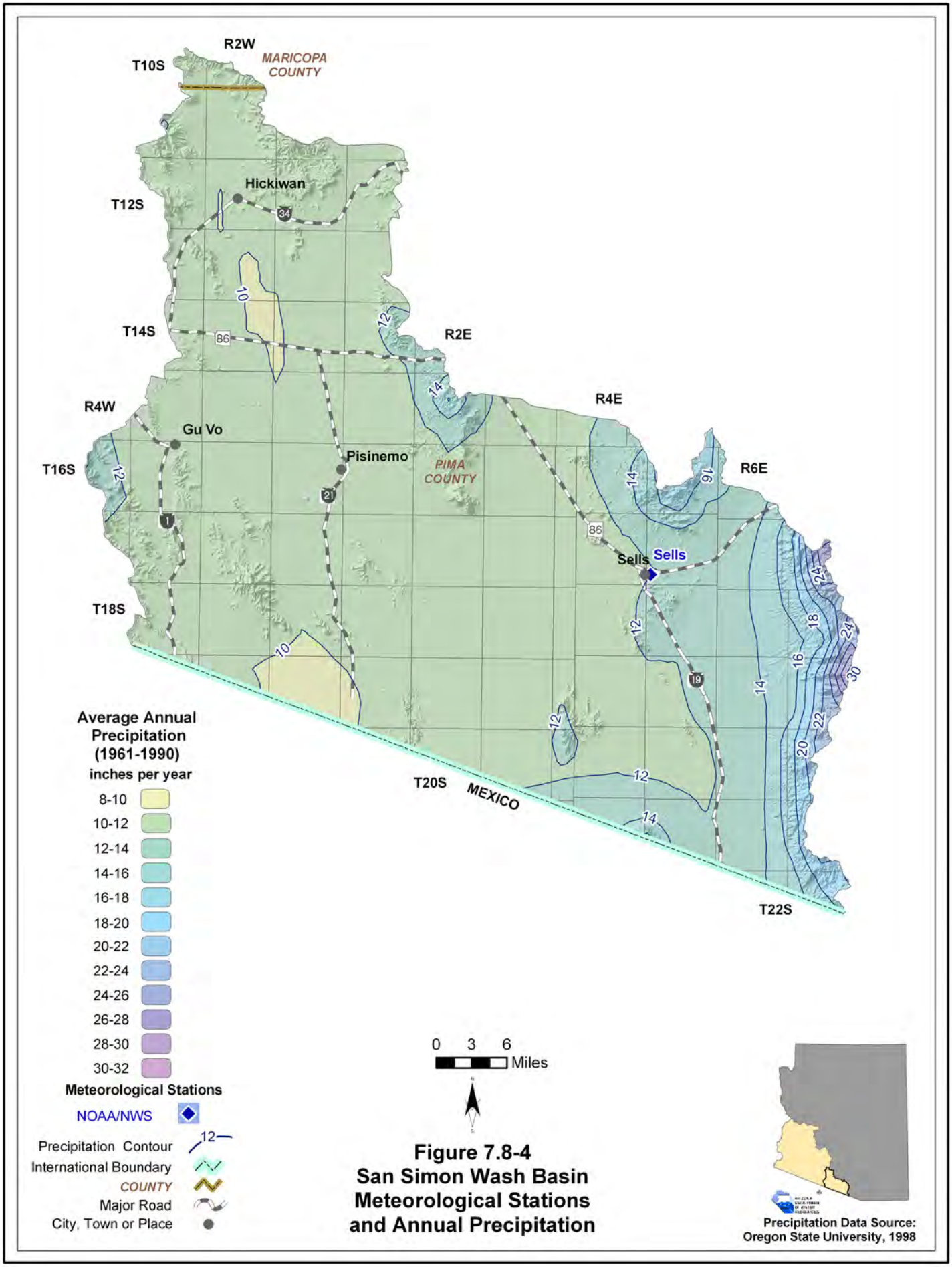

Figure 7.8-4
San Simon Wash Basin Meteorological Stations and Annual Precipitation

7.8.4 Surface Water Conditions in the San Simon Wash Basin

Streamflow data, including average seasonal flow, average annual flow and other information are shown in Table 7.8-2. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 7.8-4. The location of streamflow gages identified by USGS number, USGS runoff contours and large reservoirs are shown on Figure 7.8-4. There are no flood ALERT stations in this basin. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Streamflow Data

- Refer to Table 7.8-2.
- Data from three stations located at two watercourses are shown in the table and on Figure 7.8-4.
- Average seasonal flow at all three stations is highest in the summer season (July-September). All three stations report zero average seasonal flow in the spring season (April-June).
- The largest annual flow recorded in the basin is 39,684 acre-feet in 1983 at the Vamori Wash at Kom Vo station. This station reports a mean annual flow of 6,625 acre-feet.

Reservoirs and Stockponds

- Refer to Table 7.8-4.
- The basin contains one large reservoir, Menegers Lake, with a maximum storage of 15,000 acre-feet. This reservoir is used for irrigation.
- Surface water is stored or could be stored in 12 small reservoirs.
- There are three registered stockponds in this basin.

Runoff Contour

- Refer to Figure 7.8-4.
- Average annual runoff is highest, 0.5 inches per year or 26.67 acre-feet per square mile, in the eastern portion of the basin around Sells and decreases to 0.1 inches, or five acre-feet per square mile, in the southwest corner of the basin.

Table 7.8-2 Streamflow Data for the San Simon Wash Basin

Station Number	USGS Station Name	Drainage Area (in mi^2)	Mean Basin Elevation (in feet)	Period of Record	Average Seasonal Flow (% of annual flow)				Annual Flow/Year (in acre-feet)				Years of Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
9535100	San Simon Wash near Pisinimo	569	2,250	2/1972-2003	12	0	70	17	94 (1980)	1,340	2,372	11,007 (1976)	30
9535295	Vamori Wash at International Boundary near Sells	NA	NA	7/1995-4/2001 (discontinued)	10	0	72	17	4,452 (1996)	8,905	8,274	11,801 (1998)	5
9535300	Vamori Wash at Kom Vo	1,250	2,699	2/1972-2003	11	0	57	32	941 (1973)	4,334	6,625	39,684 (1983)	28

Sources: USGS NWIS, USGS 1998 and USGS 2003.

Notes:
NA = Not available
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 years 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

Table 7.8-3 Flood ALERT Equipment in the San Simon Wash Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
None				

Table 7.8-4 Reservoirs and Stockponds in the San Simon Wash 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	Menegers Lake	Tohono O'odham	15,000	I	Tribal

Source: US Army Corps of Engineers 2005

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

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

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: 12
Total surface area: 144 acres

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

Total number: 3

Notes:
[1]I = Irrigation

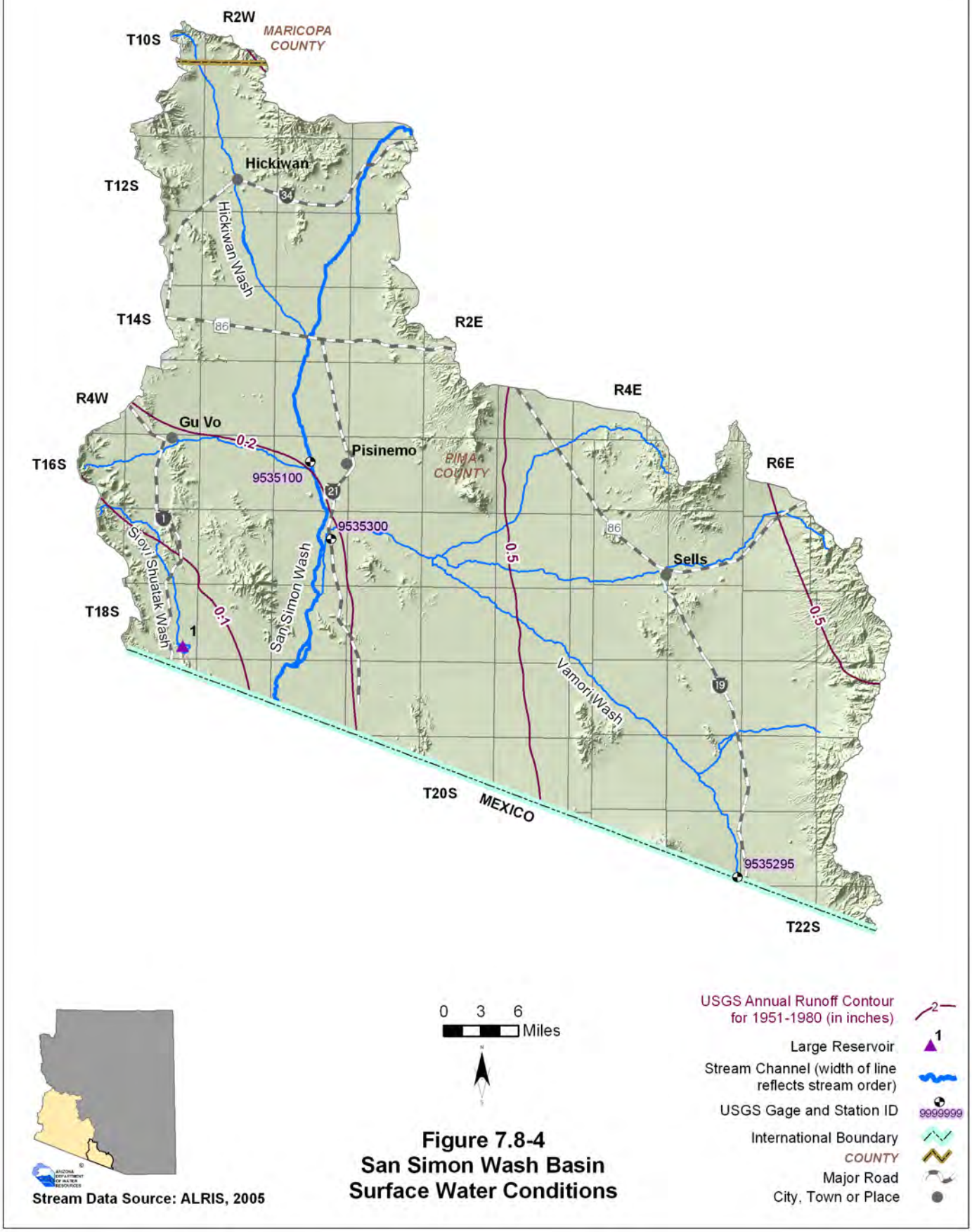

Figure 7.8-4
San Simon Wash Basin
Surface Water Conditions

7.8.5 Perennial/Intermittent Streams and Major Springs in the San Simon Wash Basin

The total number of springs in the basin are shown in Table 7.8-5. There are no perennial or intermittent streams and no major or minor springs in the San Simon Wash Basin. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, Section 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- The total number of springs, regardless of discharge, identified by the USGS varies from 11 to 17, depending on the database reference.

Table 7.8-5 Springs in the San Simon Wash 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, 2005 and USGS, 2006): 11 - 17

7.8.6 Groundwater Conditions of the San Simon Wash Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.8-6. Figure 7.8-5 shows aquifer flow direction, data on water-level change between 1990-1991 and 2003-2004 was not available for this basin. Figure 7.8-6 shows well yields in two yield categories. A description of aquifer data sources and methods is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields, is found in Volume 1, Section 1.3.19.

Major Aquifers

- Refer to Table 7.8-6 and Figure 7.8-5
- The major aquifer in this basin is basin fill.
- Groundwater flow is generally from east and north to south.

Well Yields

- Refer to Table 7.8-6 and Figure 7.8-6
- Well yield data are only available for two wells located in the vicinity of the international boundary.

Natural Recharge

- Refer to Table 7.8-6
- The estimate of natural recharge is 11,000 acre-feet per year.

Water in Storage

- Refer to Table 7.8-6
- There are three estimates of water in storage ranging from 6.7 million acre-feet to 45 million acre-feet, both to a depth of 1,200 feet.

Table 7.8-6 Groundwater Data for the San Simon Wash Basin

Basin Area, in square miles:	2,284	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
Well Yields, in gal/min:	2,000 (1 well measured)	Measured by ADWR and/or USGS
	34 (1 well reported)	Reported on registration forms for large (> 10-inch) diameter wells
	Range 50-3,000	ADWR (1994)
	Range 0-2,500	USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	11,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	6,700,000 (to 1,200 ft)	ADWR (1990)
	21,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	45,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
Current Number of Index Wells:	0	
Date of Last Water-level Sweep:	1979 (148 wells measured)	

[1]Predevelopment Estimate

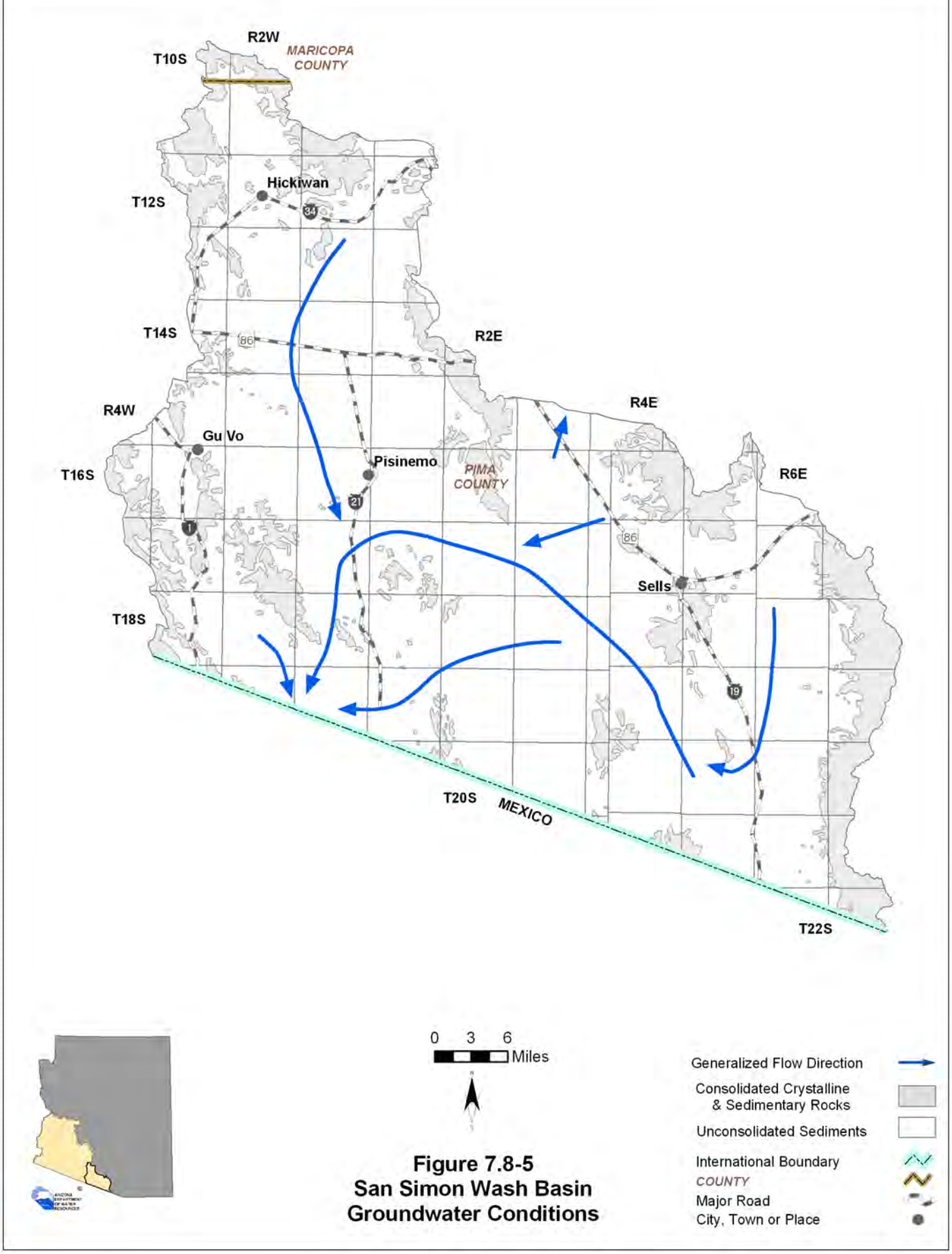

Figure 7.8-5
San Simon Wash Basin
Groundwater Conditions

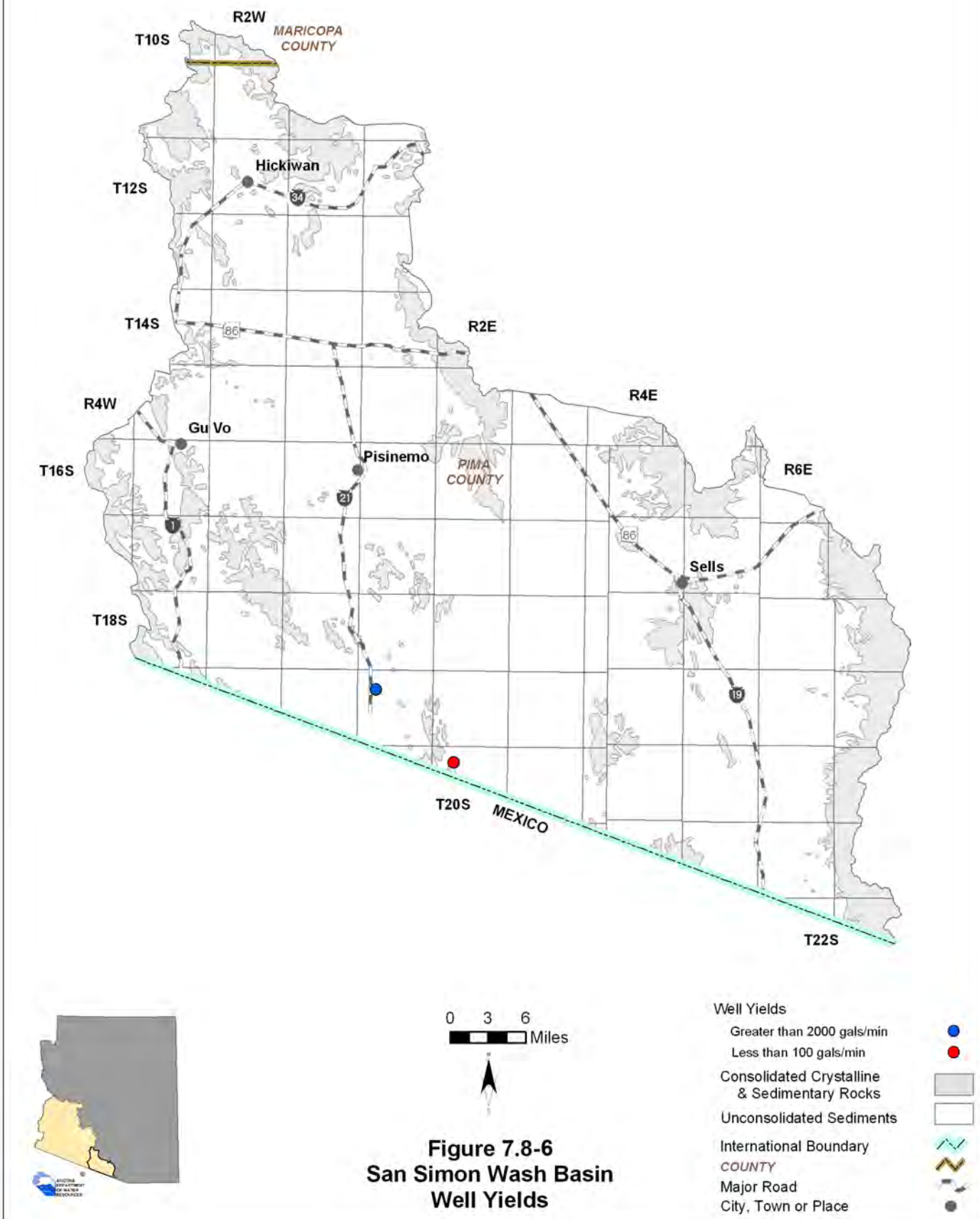

Figure 7.8-6
San Simon Wash Basin
Well Yields

7.8.7 Water Quality of the San Simon Wash 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 7.8-7A. There are no impaired lakes or streams in this basin. Figure 7.8-7 shows the location of water quality occurrences keyed to Table 7.8-7. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mine Sites

- Refer to Table 7.8-7A.
- Fifty-three wells have parameter concentrations that have equaled or exceeded drinking water standards.
- The parameter for arsenic was equaled or exceeded in eighty-one percent of the wells.
- Other parameters equaled or exceeded include chromium, fluoride, mercury, lead, nitrate and total dissolved solids.

Table 7.8-7 Water Quality Exceedences in the San Simon Wash Basin[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
1	Well	12 North	1 West	25	Cd
2	Well	14 North	1 West	20	As, Pb
3	Well	15 South	1 West	15	As, Pb, NO3
4	Well	16 South	1 West	10	As, Pb
5	Well	17 South	1 West	11	As, Hg
6	Well	17 South	1 West	11	As, Pb
7	Well	17 South	3 West	35	F
8	Well	17 South	3 West	36	As, F
9	Well	18 South	1 West	35	As, F
10	Well	18 South	3 West	34	As
11	Well	19 South	1 West	14	As, F
12	Well	19 South	1 West	28	As, F
13	Well	19 South	1 West	36	As, F
14	Well	19 South	2 West	3	TDS
15	Well	15 South	4 East	34	As
16	Well	15 South	4 East	36	As
17	Well	16 South	1 East	18	As
18	Well	16 South	1 East	18	As
19	Well	16 South	1 East	18	As, F
20	Well	16 South	2 East	15	As
21	Well	16 South	3 East	10	As
22	Well	17 South	1 East	3	As
23	Well	17 South	2 East	33	As, Pb
24	Well	17 South	3 East	24	As
25	Well	17 South	4 East	30	As
26	Well	17 South	5 East	20	As
27	Well	17 South	6 East	8	Hg
28	Well	18 South	5 East	5	As
29	Well	18 South	5 East	7	As
30	Well	18 South	7 East	29	As
31	Well	19 South	1 East	5	F
32	Well	19 South	1 East	7	As, F, Pb
33	Well	19 South	1 East	7	F
34	Well	19 South	1 East	8	As, F
35	Well	19 South	1 East	8	As, F
36	Well	19 South	1 East	8	F
37	Well	19 South	1 East	8	F
38	Well	19 South	1 East	8	F
39	Well	19 South	1 East	11	As
40	Well	19 South	1 East	17	As, F
41	Well	19 South	1 East	18	As, F
42	Well	19 South	1 East	18	F
43	Well	19 South	1 East	28	As, F
44	Well	19 South	2 East	22	As
45	Well	19 South	3 East	29	As
46	Well	19 South	3.5 East	1	As
47	Well	19 South	5 East	3	As

Table 7.8-7 Water Quality Exceedences in the San Simon Wash Basin con't[1]

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
48	Well	20 South	2 East	2	As
49	Well	20 South	3 East	2	As, F
50	Well	20 South	4 East	2	As
51	Well	20 South	5 East	24	As
52	Well	20 South	7 East	32	As
53	Well	21 South	7 East	7	As

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	Parameter(s) Exceeding Use Standard
None identified by ADWR at this time						

Notes:

[1] Water quality samples collected between 1977 and 1980.
[2] As = Arsenic
Cr = Chromium
F = Fluoride
Hg = Mercury
Pb = Lead
NO3 = Nitrate/ Nitrite
TDS = Total Dissolved Solids

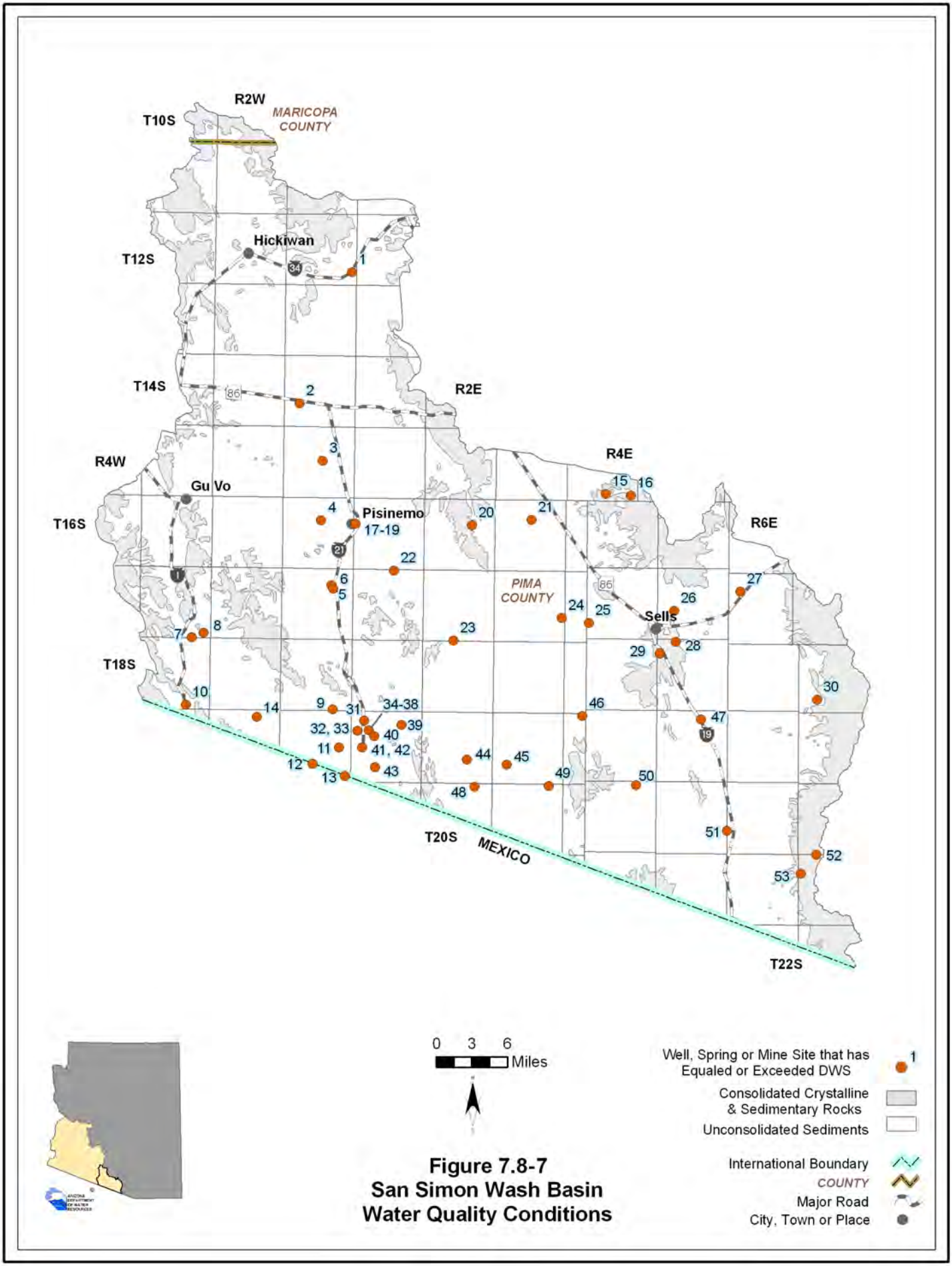

Figure 7.8-7
San Simon Wash Basin
Water Quality Conditions

7.8.8 Cultural Water Demands in the San Simon Wash 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 7.8-8. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown in Table 7.8-9. Figure 7.8-8 shows the location of demand centers. A description of cultural water demand data sources and methods is found in Volume 1, Section 1.3.5. More detailed information on cultural water demands is found in Section 7.0.7.

Cultural Water Demands

- Refer to Table 7.8-8 and Figure 7.8-8.
- Population in this basin increased from 4,852 in 1980 to 5,833 in 2000 and is projected to increase through 2050.
- Most cultural water demand is for irrigation south of Pisinemo.
- Agricultural groundwater demand remained relatively constant from 1991to 2003.
- Municipal groundwater demand is about 1,000 acre-feet per year and increased 5% from 1991 to 2003.
- There are no surface water diversions in this basin.
- As of 2003 there were seven registered wells with a pumping capacity of less than or equal to 35 gallons per minute and no wells with a pumping capacity of more than 35 gallons per minute.
- Tribes are not required to register wells with the Department; therefore, Table 7.8-8 does not reflect all of the wells in the basin.

Effluent Generation

- Refer to Table 7.8-9.
- There are two wastewater treatment facilities in this basin.
- These facilities serve over 4,600 people and generate over 420 acre-feet of effluent per year.
- Both facilities discharge to evaporation ponds.

Table 7.8-8 Cultural Water Demands in the San Simon Wash Basin[1]

Year	Recent (Census) and Projected (DES) 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	Irrigation	Municipal	Industrial	Irrigation	
1971		6[2]	0[2]	3,000			NR			ADWR (1994)
1972										
1973										
1974										
1975										
1976				4,000			NR			
1977										
1978										
1979										
1980	4,852									
1981	4,979	0	0	6,000			NR			
1982	5,106									
1983	5,234									
1984	5,361									
1985	5,488									
1986	5,615	0	0	7,000			NR			
1987	5,742									
1988	5,870									
1989	5,997									
1990	6,124									
1991	6,095	0	0	900	NR	4,000	NR			USGS (2005)
1992	6,066									
1993	6,037									
1994	6,008									
1995	5,978									
1996	5,949	1	0	950	NR	3,800	NR			
1997	5,920									
1998	5,891									
1999	5,862									
2000	5,833									
2001	5,891	0	0	1,000	NR	4,000	NR			
2002	5,950									
2003	6,010									
2010	6,443									
2020	7,117									
2030	7,862									
2040	8,685									
2050	9,593									
	WELL TOTALS	**7**	**0**							

[1] Does not include evaporation losses from stockponds and reservoirs.
[2] Includes all wells through 1980.
NR - Not reported

Table 7.8-9 Effluent Generation in the San Simon Wash Basin

Facility Name	Ownership	City/Location Served	Population Served	Volume Treated/Generated (acre-feet)	Disposal Method							Current Treatment Level	Population Not Served	Year of Record
					Water-course	Evaporation Pond	Irrigation	Golf Course	Wildlife Area	Discharged to Another Facility	Infiltration Basins			
Santa Lucia Sewer System	Tohono O'odham Nation	Santa Lucia	810	90		X						Secondary	NA	2000
Sells WWTF	Tohono O'odham Nation	Sells	3,858	336		X						Secondary	NA	2001

NA: Data not currently available to ADWR
WWTF: Waste Water Treatment Facility

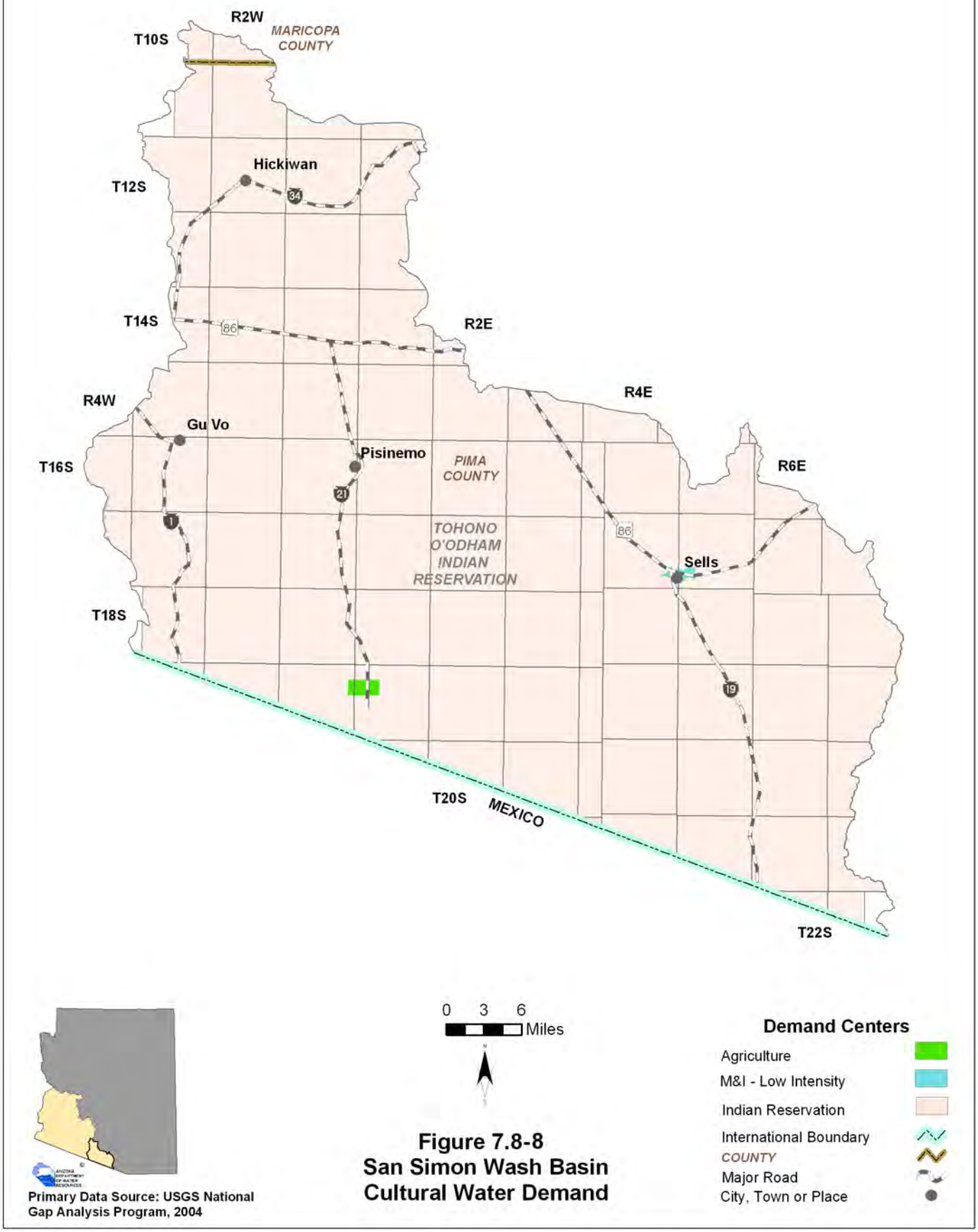

Figure 7.8-8
San Simon Wash Basin
Cultural Water Demand

7.8.9 Water Adequacy Determinations in the San Simon Wash Basin

No water adequacy applications for the San Simon Wash Basin were filed with the Department as of May 2005. A description of the Water Adequacy Program is found in Volume 1, Appendix A. Adequacy determination data sources and methods are found in Volume 1, Section 1.3.1.

Table 7.8-10 Adequacy Determinations in the San Simon Wash Basin

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
None identified by ADWR at this time											

San Simon Wash Basin
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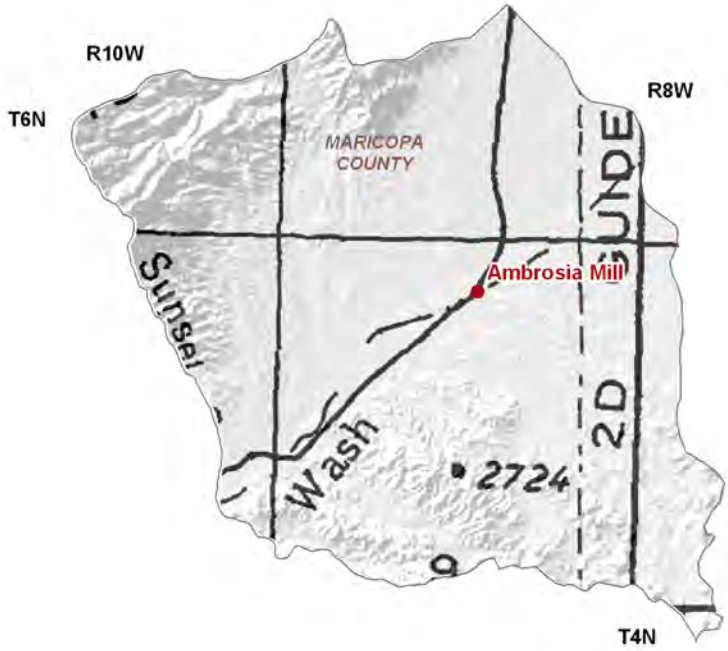
Section 7.9
Tiger Wash Basin

7.9.1 Geography of the Tiger Wash Basin

The Tiger Wash Basin, located in the northeastern part of the planning area is 74 square miles in area, the smallest basin in the planning area and the state. Geographic features and principal places are shown on Figure 7.9-1. The basin is characterized by a valley bordered by mountain ranges. Vegetation types include Lower Colorado River Valley and Arizona Uplands Sonoran desertscrub and a small amount of southwestern interior chaparral near the northwestern basin boundary. (See Figure 7.0-7)

- Principal geographic features shown on Figure 7.9-1 are:
    - Basin place of Ambrosia Mill
    - Tiger Wash in the center of the basin
    - The lowest point is approximately 1,950 feet where Tiger Wash exits the basin southeast of Ambrosia Mill
- Not well shown on Figure 7.9-1 are the Harquahala Mountains in the northern portion of the basin and the Big Horn Mountains in the southern portion of the basin with the highest point at 2,724 feet.



Base Map: USGS 1:500,000, 1981

0 3 6 Miles

City, Town or Place

Figure 7.9-1
Tiger Wash Basin
Geographic Features

7.9.2 Land Ownership in the Tiger Wash Basin

Land ownership, including the percentage of ownership by category, for the Tiger Wash Basin is shown in Figure 7.9-2. The principal feature of land ownership in this basin is the large proportion of U.S Bureau of Land Management lands. A description of land ownership data sources and methods is found in Volume 1, Section 1.3.8. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

U.S. Bureau of Land Management

- 97.4% of the land is federally owned and managed by the Lower Sonoran Field Office of the U.S. Bureau of Land Management.
- This basin contains 8,700 acres of the 23,000 acre Harquahala Mountains Wilderness. (See Figure 7.0-9)
- Land use includes grazing, resource conservation and recreation.

State Trust Land

- 2.3% of the land is held in trust for the public schools under the State Trust Land system.
- Primary land use is grazing.

Private

- 0.3% of the land is private.
- Land uses include domestic and grazing.

Source: ALRIS, 2004

0 3 6 Miles

Land Ownership (Percentage in Basin)

U.S. Bureau of Land Management (97.4%)
State Trust (2.3%)
Private (0.3%)
Major Road
City, Town or Place

Figure 7.9-2
Tiger Wash Basin
Land Ownership

7.9.3 Climate of the Tiger Wash Basin

The Tiger Wash Basin does not contain NOAA/NWS, Evaporation Pan, AZMET or SNOTEL/ Snowcourse stations. Figure 7.9-3 shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. A description of the climate data sources and methods is found in Volume 1, Section 1.3.3.

SCAS Precipitation Data

- See Figure 7.9-3
- Average annual rainfall is as high as 18 inches along the northwestern tip of the basin and as low as eight inches in the southwestern portion of the basin.

Table 7.9-1 Climate Data for the Tiger Wash 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
None									

Source: WRCC, 2003

B. Evaporation Pan:

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

Source: WRCC, 2003.

C. AZMET:

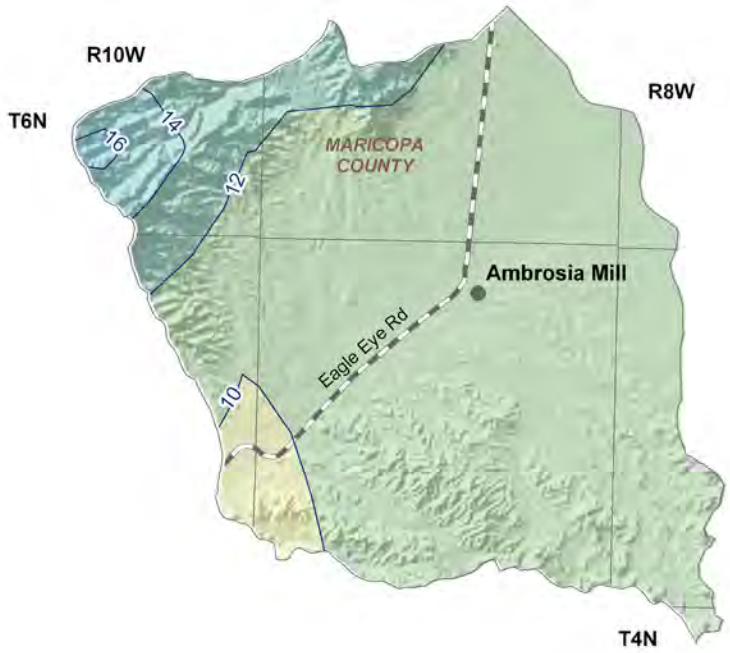
Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Annual Reference Evaportranspiration, in inches (N*umber of years to calculate averages*)
None			

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: NRCS, 2005



Precipitation Data Source: Oregon State University, 1998

0 3 6 Miles

Average Annual Precipitation (1961-1990)
inches per year

- 8-10
- 10-12
- 12-14
- 14-16
- 16-18

Precipitation Contour 12
Major Road
City, Town or Place

Figure 7.9-3
Tiger Wash Basin
Meteorological Stations and Annual Precipitation

7.9.4 Surface Water Conditions in the Tiger Wash Basin

Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 7.9-4. Flood ALERT equipment in the basin is shown in Table 7.9-3 and Figure 7.9-4. There are no streamflow data or USGS runoff contour data available for this basin. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Flood ALERT Equipment

- Refer to Table 7.9-3
- There is one precipitation station in the basin located at Tiger Wash.

Reservoirs and Stockponds

- Refer to Table 7.9-4.
- There are no large or small reservoirs and nine registered stockponds in this basin.

Table 7.9-2 Streamflow Data for the Tiger Wash Basin

Station Number	USGS Station Name	Drainage Area (in mi^2)	Mean Basin Elevation (in feet)	Period of Record	Average Seasonal Flow (% of annual flow)				Annual Flow/Year (in acre-feet)				Years of Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
None													

Sources: USGS NWIS, USGS 1998 and USGS 2003.

Table 7.9-3 Flood ALERT Equipment in the Tiger Wash Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
5130	Upper Tiger Wash	Precipitation	11/1/1981	Maricopa County FCD

Notes:
FCD = Flood Control District

Table 7.9-4 Reservoirs and Stockponds in the Tiger Wash 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	JURISDICTION
None identified by ADWR at this time					

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

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

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: 9

Stream Data Source: ALRIS, 2005

0 3 6 Miles

Figure 7.9-4
Tiger Wash Basin
Surface Water Conditions

Stream Channel (width of line reflects stream order)
Flood ALERT Equip. & Station ID 9999
Major Road
City, Town or Place

7.9.5 Perennial/Intermittent Streams and Major Springs in the Tiger Wash Basin

The total number of springs in the basin are shown in Table 7.9-5. The location of an intermittent stream is shown on Figure 7.9-5. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, Section 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- There are no perennial streams and one intermittent stream, Browns Canyon Wash.
- There are no major or minor springs in the basin.
- The total number of springs, regardless of discharge, identified by the USGS is three.

Table 7.9-5 Springs in the Tiger Wash Basin

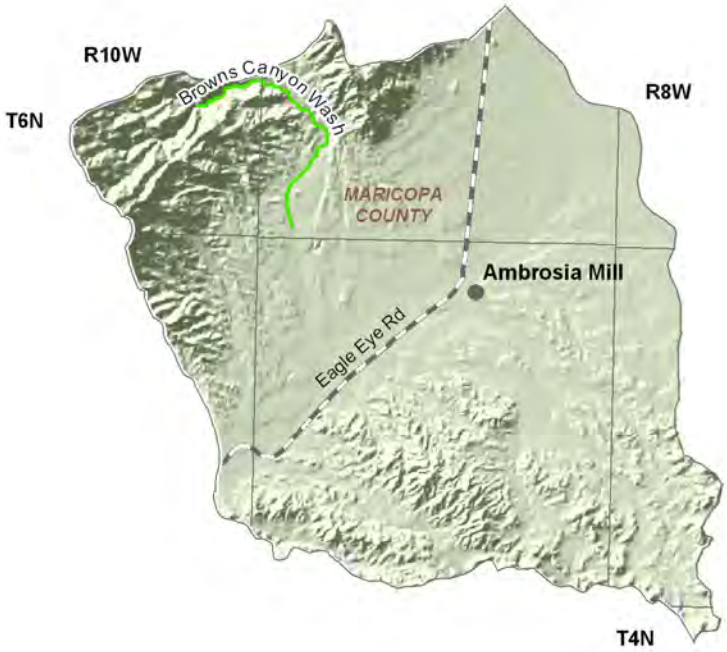
A. Major Springs (10 gpm or greater):

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, 2005 and USGS, 2006): 3



Stream Data Source: AGFD, 1993 & 1997

0 3 6 Miles

Figure 7.9-5
Tiger Wash Basin
Perennial\Intermittent Streams and Major (>10 gpm) Springs

Intermittent Stream
Major Road
City, Town or Place

7.9.6 Groundwater Conditions of the Tiger Wash Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.9-6. Figure 7.9-6 shows aquifer flow direction. Data on water-level change between 1990-1991 and 2003-2004 was not available for this basin. Figure 7.9-7 contains hydrographs for selected wells shown on Figure 7.9-6. A description of aquifer data sources and methods is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields, is found in Volume 1, Section 1.3.19.

Major Aquifers

- Refer to Table 7.9-6 and Figure 7.9-6.
- The major aquifer in this basin is basin fill.
- Groundwater flow is generally to the north and south away from the center of the basin.

Well Yields

- Refer to Table 7.9-6.
- The only well yield data available indicates a well yield ranges from dry to 500 acre-feet.

Natural Recharge

- Refer to Table 7.9-6.
- The estimate of natural recharge is less than 1,000 acre-feet per year.

Water in Storage

- Refer to Table 7.9-6.
- There are three estimates of water in storage ranging from 700,000 acre-feet to two million acre-feet, both to a depth of 1,200 feet.

Water Level

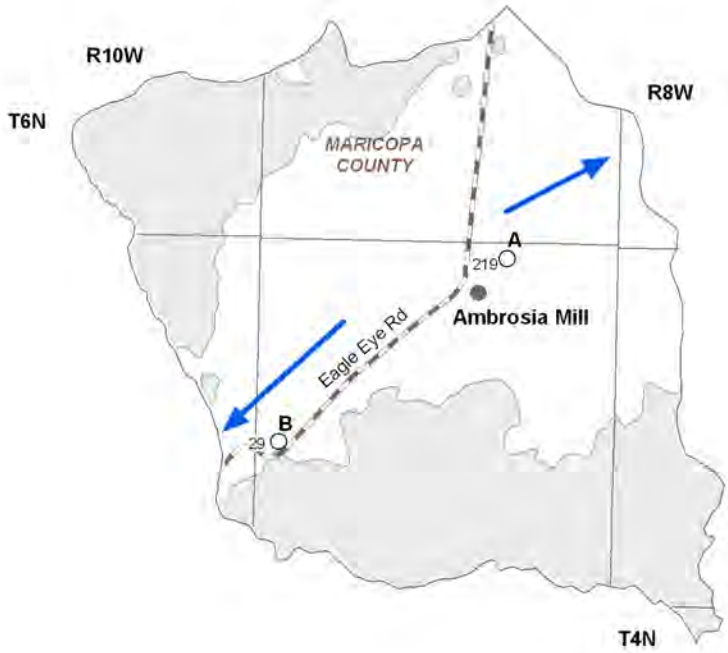
- Refer to Figure 7.9-7.
- The Department annually measures two index wells in this basin, hydrographs for these index wells are shown on Figure 7.9-6.

Table 7.9-6 Groundwater Data for the Tiger Wash Basin

Basin Area, in square miles:	74	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
Well Yields, in gal/min:	769** (1 well measured)	Measured by ADWR and/or USGS
	N/A	Reported on registration forms for large (> 10-inch) diameter wells
	N/A	ADWR (1990 and 1994)
	Range 0-500	USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	<1,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	700,000 (to 1,200 ft)	ADWR (1990)
	1,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	2,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
Current Number of Index Wells:	2	
Date of Last Water-level Sweep:	2004 (5 wells measured)	

** well located just outside basin boundary in Phoenix AMA

[1]Predevelopment Estimate



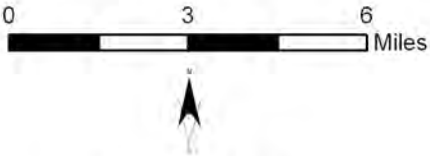


Figure 7.9-6
Tiger Wash Basin
Groundwater Conditions

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

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

Change Data Not Available

Generalized Flow Direction

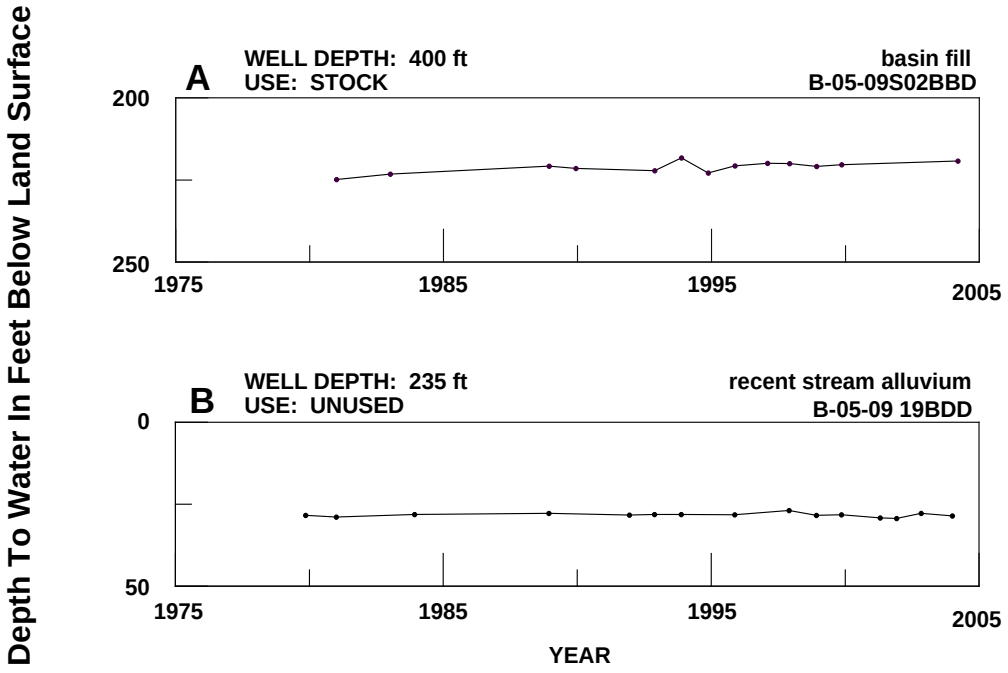
Consolidated Crystalline & Sedimentary Rocks

Unconsolidated Sediments

Major Road

City, Town or Place

Figure 7.9-7
Tiger Wash Basin
Hydrographs Showing Depth to Water in Selected Wells



7.9.7 Water Quality of the Tiger Wash 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 7.9-7A. There are no impaired lakes or streams in this basin. Figure 7.9-8 shows the location of water quality occurrences keyed to Table 7.9-7. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mine Sites

- Refer to Table 7.9-7A.
- Two wells have parameter concentrations that have equaled or exceeded drinking water standards.
- The parameters exceeded were nitrate and arsenic.

Table 7.9-7 Water Quality Exceedences in the Tiger Wash Basin[1]

A. Wells, Springs and Mines

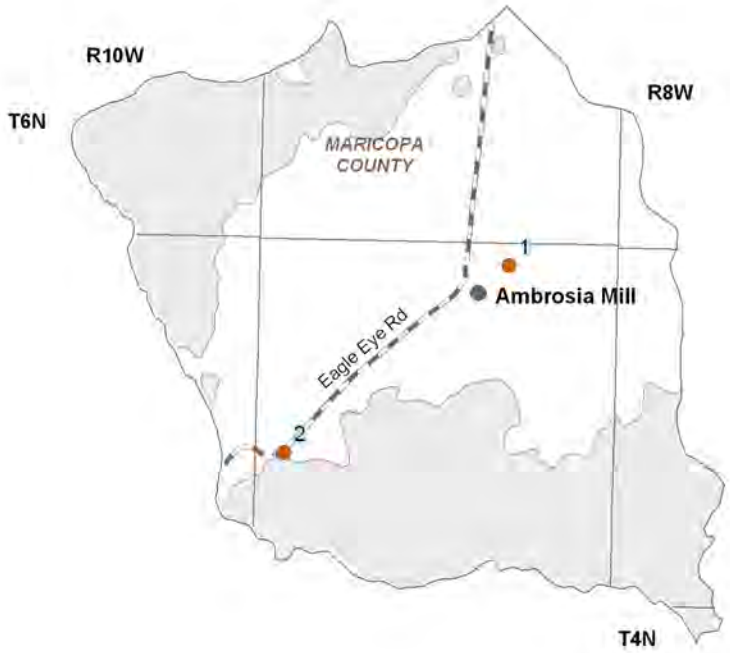
Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
1	Well	5 North	9 West	2	NO3
2	Well	5 North	9 West	19	As

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	Parameter(s) Exceeding Use Standard
None identified by ADWR at this time						

Notes:

[1] Water quality samples collected between 1984 and 2001.
[2] As = Arsenic
NO3 = Nitrate/ Nitrite



0 3 6 Miles

Well, Spring or Mine Site that has Equaled or Exceeded DWS
Consolidated Crystalline & Sedimentary Rocks
Unconsolidated Sediments
Major Road
City, Town or Place

Figure 7.9-8
Tiger Wash Basin
Water Quality Conditions

7.9.8 Cultural Water Demands in the Tiger Wash 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 7.9-8. There is no recorded effluent generation in this basin. The USGS National Gap Analysis Program, the primary source of cultural demand map data, showed no demand centers for this basin. A description of cultural water demand data sources and methods is found in Volume 1, Section 1.3.5. More detailed information on cultural water demands is found in Section 7.0.7.

Cultural Water Demands

- Refer to Table 7.9-8
- Population in this basin is very small, with less than ten residents in 2000.
- There are no recorded surface water uses. All groundwater use is for municipal demand and has remained relatively constant since 1971.
- As of 2003 there were seven registered wells with a pumping capacity of less than or equal to 35 gallons per minute and no wells with a pumping capacity of more than 35 gallons per minute.

Table 7.9-8 Cultural Water Demands in the Tiger Wash Basin[1]

Year	Recent (Census) and Projected (DES) Population	Number of Registered Water Supply Wells Drilled		Average Annual Demand (in acre-feet)						
				Well Pumpage			Surface-Water Diversions			Data Source
		Q ≤ 35 gpm	Q > 35 gpm	Municipal	Industrial	Irrigation	Municipal	Industrial	Irrigation	
1971		7[2]	0[2]	<500			NR			ADWR (1994)
1972										
1973										
1974										
1975										
1976				<500			NR			
1977										
1978										
1979										
1980	<10									
1981	<10	0	0	<500			NR			
1982	<10									
1983	<10									
1984	<10									
1985	<10									
1986	<10	0	0	<500			NR			
1987	<10									
1988	<10									
1989	<10									
1990	<10									
1991	<10	0	0	<300	NR	NR	NR			USGS (2005)
1992	<10									
1993	<10									
1994	<10									
1995	<10									
1996	<10	0	0	<300	NR	NR	NR			
1997	<10									
1998	<10									
1999	<10									
2000	<10									
2001	<10	0	0	<300	NR	NR	NR			
2002	<10									
2003	<10									
2010	<10									
2020	<10									
2030	<10									
2040	<10									
2050	<10									
WELL TOTALS:		**7**	**0**							

[1] Does not include evaporation losses from stockponds and reservoirs.
[2] Includes all wells through 1980.
NR - Not reported

Table 7.9-9 Effluent Generation in the Tiger Wash Basin

Facility Name	Ownership	City/Location Served	Population Served	Volume Treated/Generated (acre-feet)	Disposal Method							Current Treatment Level	Population Not Served	Year of Record
					Water-course	Evaporation Pond	Irrigation	Golf Course	Wildlife Area	Discharged to Another Facility	Infiltration Basins			
No Waste Water Treatment Facilities Identified by ADWR in this Basin														

7.9.9 Water Adequacy Determinations in the Tiger Wash Basin

No water adequacy applications for the Tiger Wash Basin were filed with the Department as of May 2005. A description of the Water Adequacy Program is found in Volume 1, Appendix A. Adequacy determination data sources and methods are found in Volume 1, Section 1.3.1.

Table 7.9-10 Adequacy Determinations in the Tiger Wash Basin[1]

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
None identified by ADWR at this time											

Tiger Wash Basin
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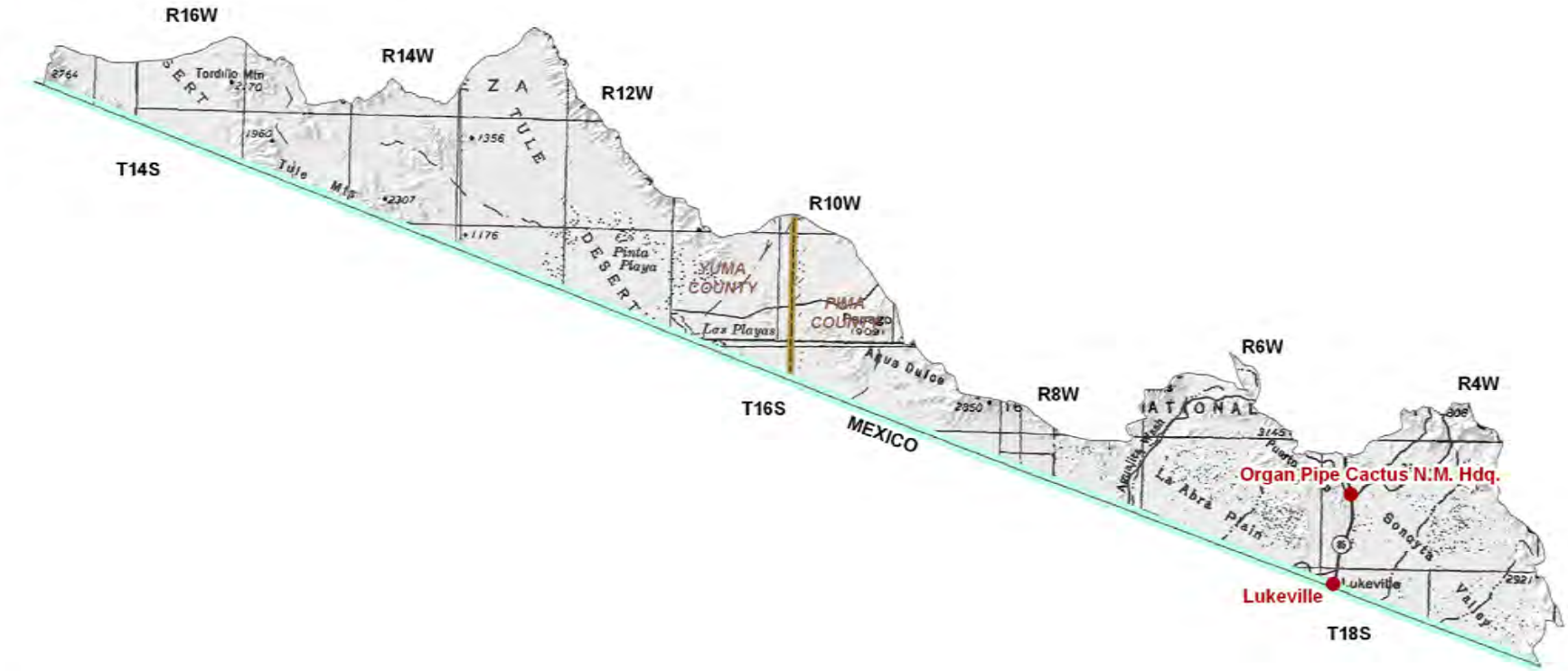
Section 7.10
Western Mexican Drainage Basin

7.10.1 Geography of the Western Mexican Drainage Basin

The Western Mexican Drainage Basin, located in the south central part of the planning area is 610 square miles in area. Geographic features and principal communities are shown on Figure 7.10-1. The basin is characterized by desert valleys and low elevation mountain ranges. Vegetation types include Lower Colorado River Valley and Arizona Uplands Sonoran desertscrub. (See Figure 7.0-7)

- Principal geographic features shown on Figure 7.10-1 are:
    - Basin places of Lukeville and the Organ Pipe National Monument Headquarters
    - Aguajita Wash west of Lukeville
    - Tule Desert in the western portion of the basin
    - The lowest point in the basin at 680 feet at Las Playas at the international boundary
- Not well shown on Figure 7.10-1 is the Sierra de Santa Rosa on the eastern basin boundary and the highest point in the basin at 3,149 feet.



Base Map: USGS 1:500,000, 1981

0 3 6 Miles

International Boundary
COUNTY
City, Town or Place

Figure 7.10-1
Western Mexican Drainage Basin
Geographic Features

7.10.2 Land Ownership in the Western Mexican Drainage Basin

Land ownership, including the percentage of ownership by category, for the Western Mexican Drainage Basin is shown in Figure 7.10-2. The principal feature of land ownership in this basin is the large proportion of National Wildlife Refuge lands. A description of land ownership data sources and methods is found in Volume 1, Section 1.3.8. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

National Wildlife Refuge

- 61.1% of the land is federally owned and managed by the U.S. Fish and Wildlife Service as the Cabeza Prieta National Wildlife Refuge.
- Land uses include resource protection and recreation.

National Park Service (NPS)

- 36.3% 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.

U.S. Military

- 2.2% of the land is federally owned and managed by the U.S. Military as the Barry Goldwater Air Force Range.
- Primary land use is military activity.

Indian Reservation

- 0.2% of the land is under tribal ownership as the Tohono O'odham Indian Reservation.
- Tribal lands are located along the eastern basin boundary
- Primary land use is grazing.

State Trust Land

- 0.1% of the land is held in trust for the public schools under the State Trust Land system.
- State trust land is found in the eastern portion of the basin surrounded by the Organ Pipe Cactus National Monument.
- Primary land use is resource conservation.

Private

- 0.1% of the land is private.
- All private land is in the vicinity of Lukeville, however, it cannot be seen at the map scale shown.
- Land uses include domestic and commercial.

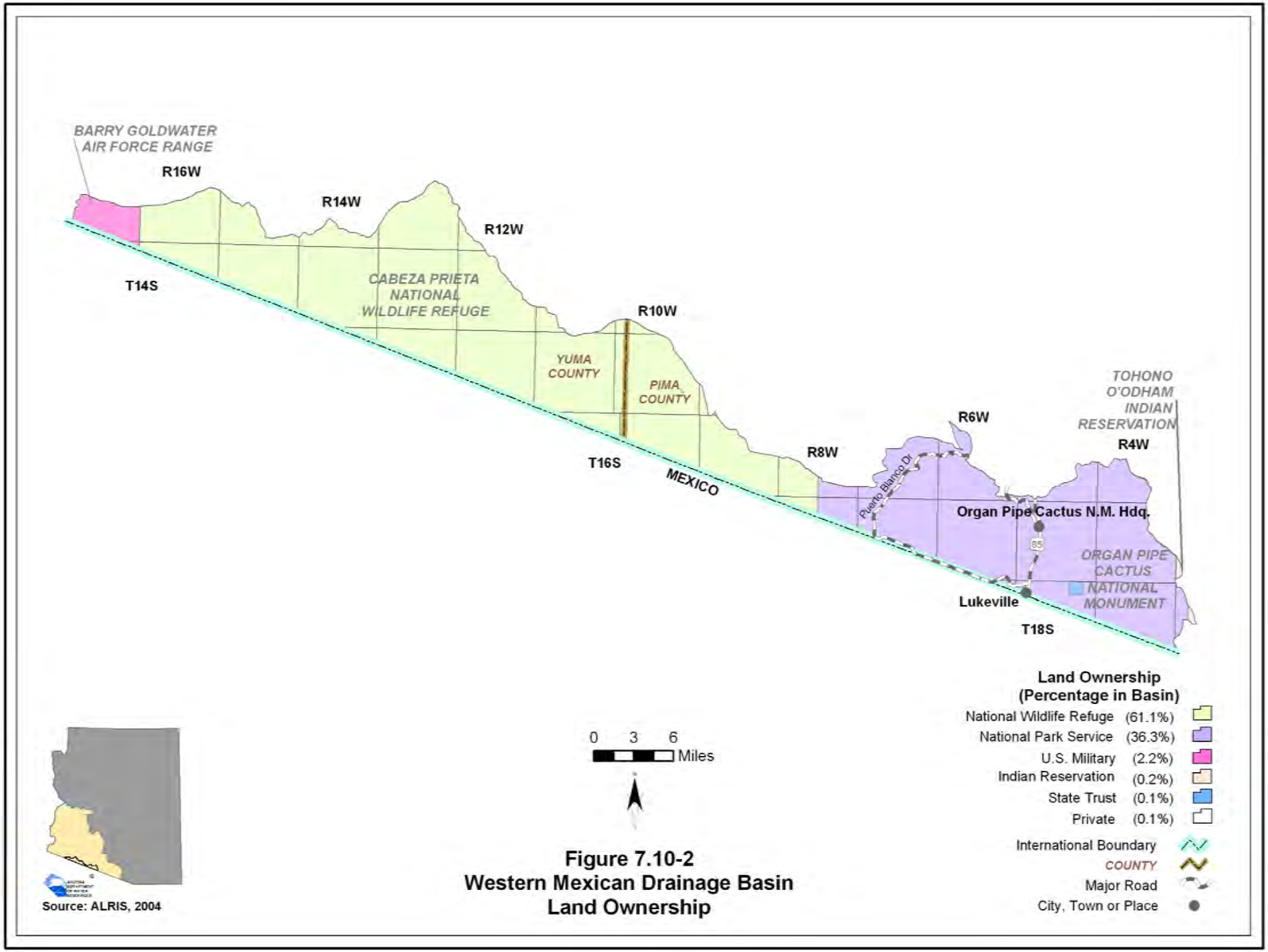


Figure 7.10-2
Western Mexican Drainage Basin
Land Ownership

7.10.3 Climate of the Western Mexican Drainage Basin

Climate data from NOAA/NWS Co-op Network stations are complied in Table 7.10-1 and the locations are shown on Figure 7.10-3. Figure 7.10-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Western Mexican Drainage Basin does not contain Evaporation Pan, AZMET or SNOTEL/Snowcourse stations. A description of the climate data sources and methods is found in Volume 1, Section 1.3.3.

NOAA/NWS Co-op Network

- Refer to Table 7.10-1A
- There is one NOAA/NWS Co-op Network station in the basin, Organ Pipe Cactus N.M., with an average high of 89.2°F and an average low of 54.7°F.
- Highest average seasonal rainfall, 4.38 inches, occurs in the summer season (July-September) when 44% of the annual average precipitation occurs.

SCAS Precipitation Data

- See Figure 7.10-3
- Additional precipitation data shows average annual rainfall as high as 14 inches along the northeastern basin boundary and as low as four inches in the western portion of the basin.

Table 7.10-1 Climate Data for the Western Mexican Drainage 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
Organ Pipe Cactus N.M.	1,680	1971 - 2000	89.2/Jul	54.7/Jan	2.66	0.32	4.38	2.52	9.88

Source: WRCC, 2003

B. Evaporation Pan:

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

Source: WRCC, 2003.

C. AZMET:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Annual Reference Evaportranspiration, in inches (*Number of years to calculate averages*)
None			

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: NRCS, 2005

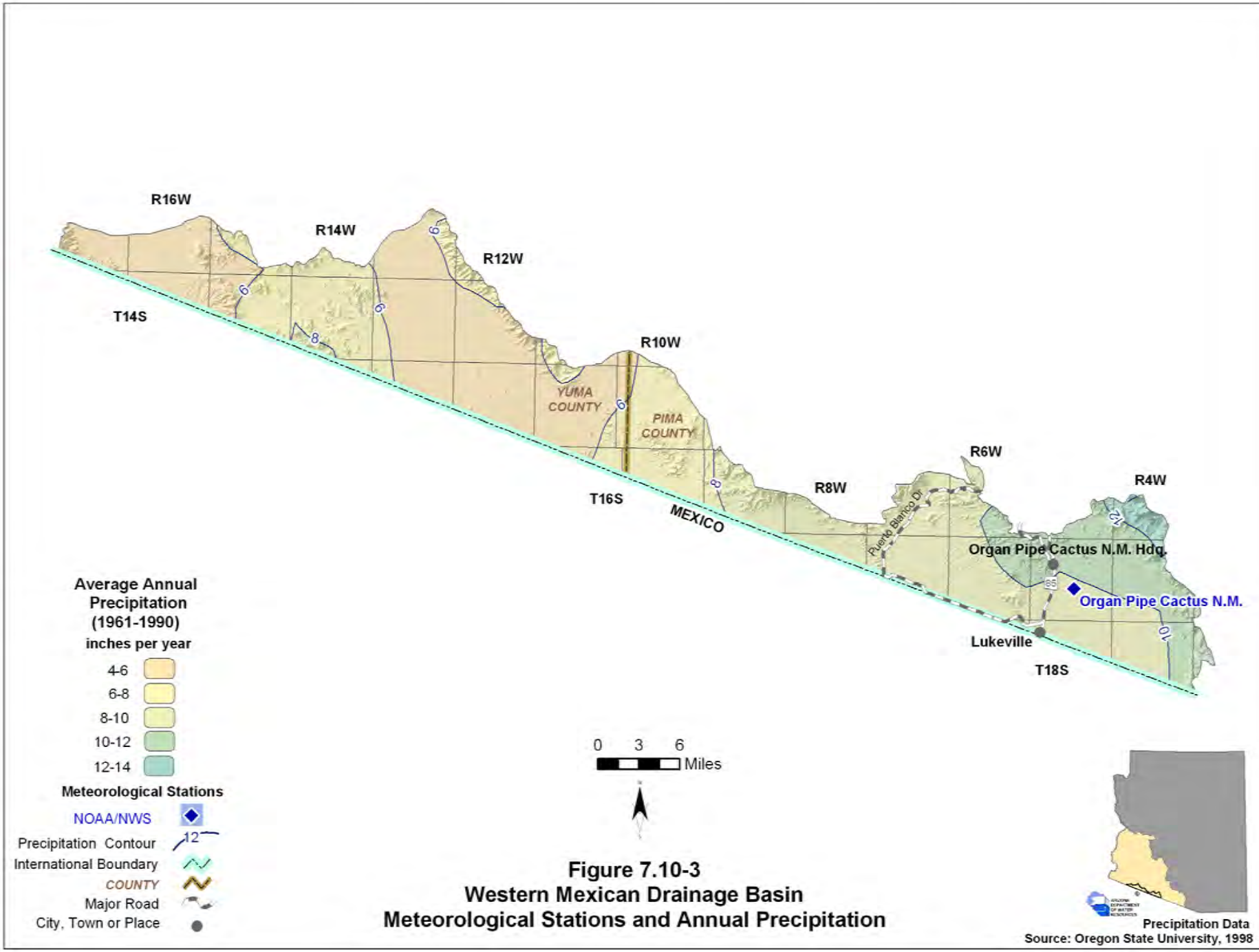


Figure 7.10-3
Western Mexican Drainage Basin
Meteorological Stations and Annual Precipitation

7.10.4 Surface Water Conditions in the Western Mexican Drainage Basin

Flood ALERT equipment in the basin is shown in Table 7.10-3 and Figure 7.10-4. There are no streamflow data, reservoirs, stockponds or USGS runoff contour data available for this basin. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Flood ALERT Equipment

- Refer to Table 7.10-3
- There is one weather station in the basin located at the Organ Pipe Cactus National Monument Headquarters.

Table 7.10-2 Streamflow Data for the Western Mexican Drainage Basin

Station Number	USGS Station Name	Drainage Area (in mi^2)	Mean Basin Elevation (in feet)	Period of Record	Average Seasonal Flow (% of annual flow)				Annual Flow/Year (in acre-feet)				Years of Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
None													

Sources: USGS NWIS, USGS 1998 and USGS 2003.

Table 7.10-3 Flood ALERT Equipment in the Western Mexican Drainage Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
Organ Pipe Weather Station	7230	Weather Station	7/31/2004	ADWR

Notes:
ADWR = Arizona Department of Water Resources

Table 7.10-4 Reservoirs and Stockponds in the Western Mexican Drainage 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	JURISDICTION
None identified by ADWR at this time					

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

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

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: 0

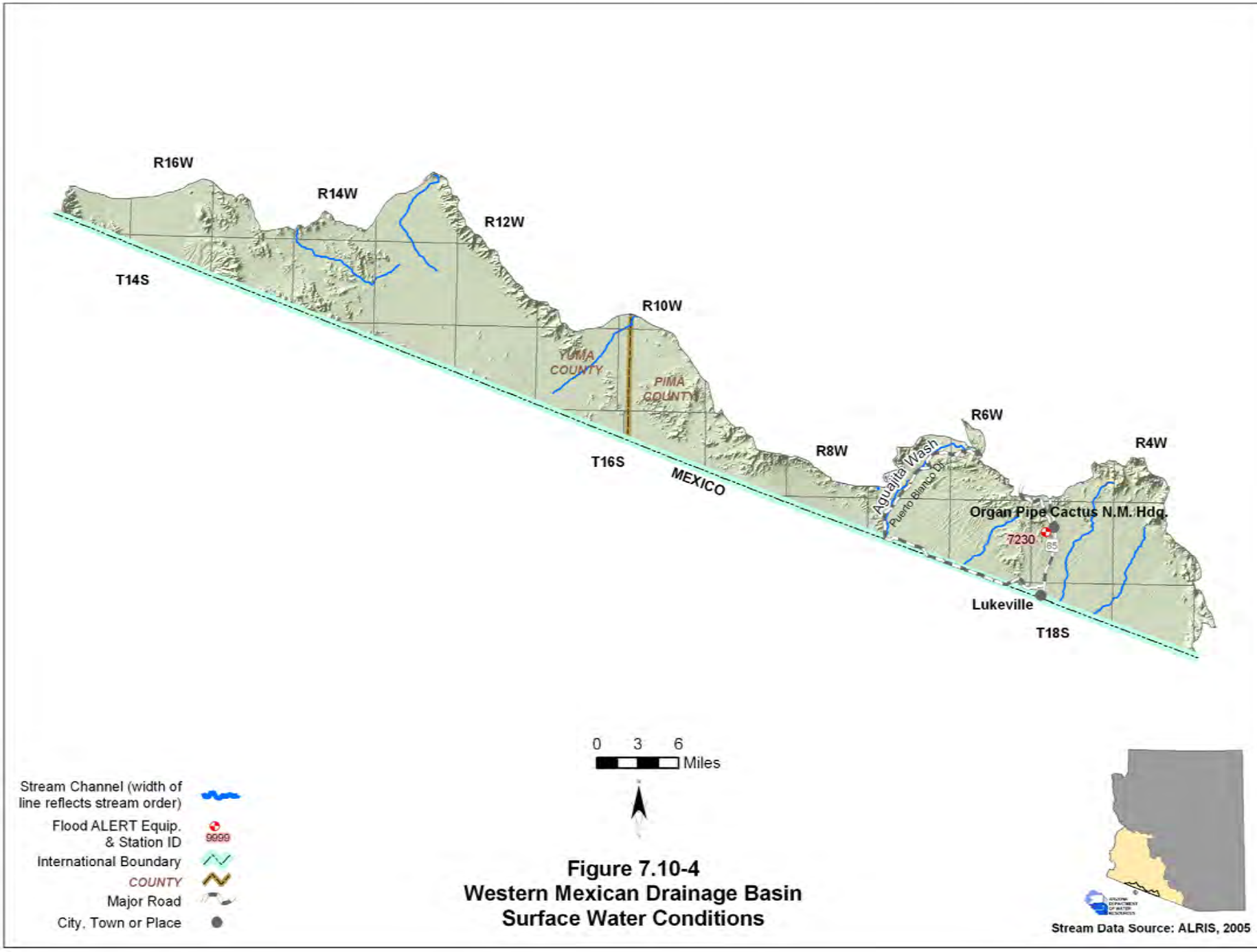


Figure 7.10-4
Western Mexican Drainage Basin
Surface Water Conditions

7.10.5 Perennial/Intermittent Streams and Major Springs in the Western Mexican Drainage Basin

Major and minor springs with discharge rates and date of measurement, and the total number of springs in the basin are shown in Table 7.10-5. The location of a major spring is shown on Figure 7.10-5. There are no perennial or intermittent streams in the Western Mexican Drainage Basin. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, Section 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- There is one major spring with a measured discharge rate of 28 gallons per minute. This discharge rate may not be indicative of current conditions; the spring was last measured during or prior to 1992. This is the only major spring in the planning area.
- Springs with measured discharge of 1 to 10 gpm are not mapped but coordinates are given in Table 7.10-5B. There are two minor springs in this basin.
- The total number of springs, regardless of discharge, identified by the USGS varies from four to six, depending on the database reference.

Table 7.10-5 Springs in the Western Mexican Drainage Basin

A. Major Springs (10 gpm or greater):

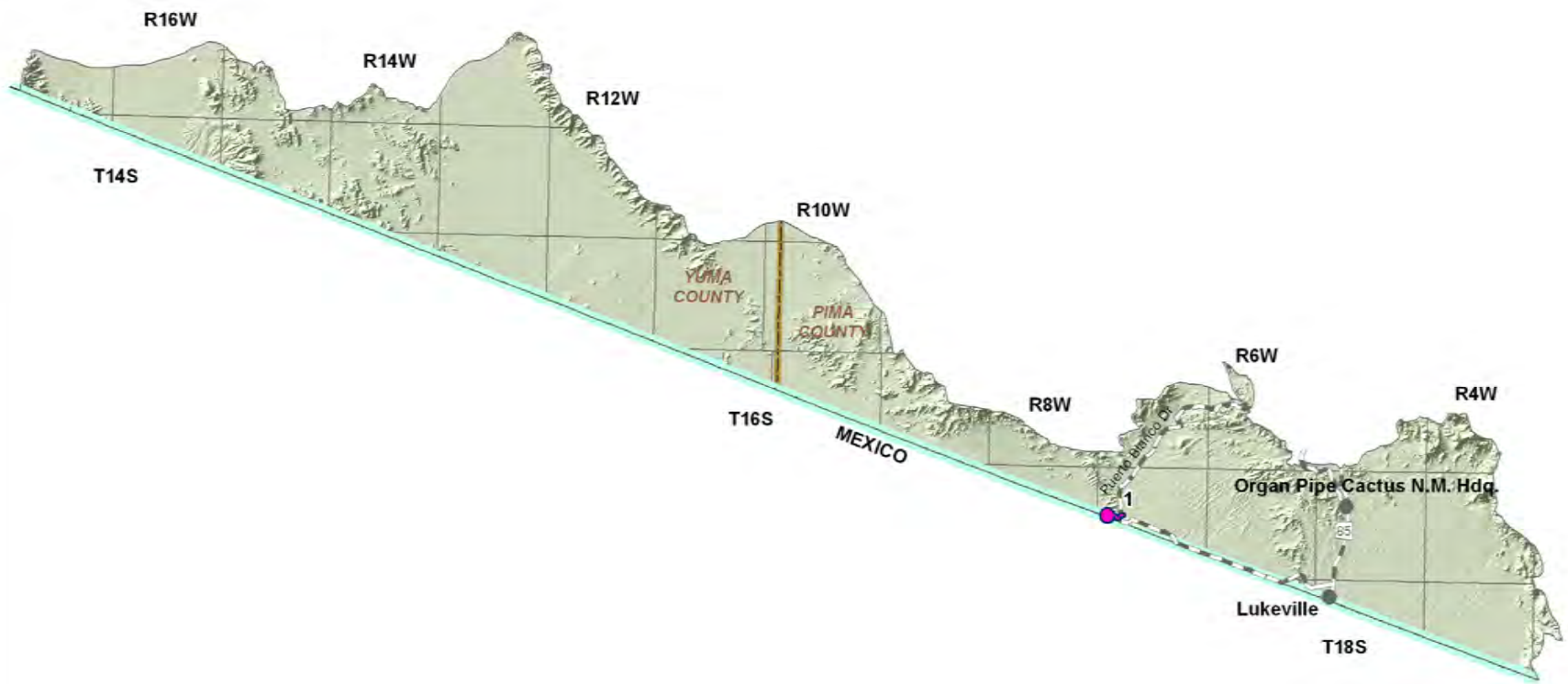
Map Key	Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
		Latitude	Longitude		
1	Quitobaquito (multiple)	315640	1130103	28	During or prior to 1992

B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
Aguajita	315623	1130037	4	12/13/1976
Unnamed	315700	1130116	1	12/14/1976

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005 and NHD, 2006): 4 - 6

Notes:
[1] Most recent measurement identified by ADWR



0 3 6
Miles

Figure 7.10-5
Western Mexican Drainage Basin
Perennial\Intermittent Streams
and Major (>10 gpm) Springs

Springs
International Boundary
COUNTY
Major Road
City, Town or Place

7.10.6 Groundwater Conditions of the Western Mexican Drainage Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.10-6. Figure 7.10-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 7.10-7 contains hydrographs for selected wells shown on Figure 7.10-6. Figure 7.10-8 shows well yields in one category. A description of aquifer data sources and methods is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields, is found in Volume 1, Section 1.3.19.

Major Aquifers

- Refer to Table 7.10-6 and Figure 7.10-6.
- The major aquifer is basin fill.
- Groundwater flow is from north to south.

Well Yields

- Refer to Table 7.10-6 and Figure 7.10-8.
- As shown on Figure 7.10-8, all recorded well yields less than 100 gallons per minute (gpm).
- One source of well yield information, based on three reported wells, indicates that the median well yield is 50 gpm.

Natural Recharge

- Refer to Table 7.10-6.
- The only estimate of natural recharge is 1,000 acre-feet per year.

Water in Storage

- Refer to Table 7.10-6.
- There are two estimates of water in storage, 3 million acre-feet and 4.1 million acre-feet, both to a depth of 1,200 feet.

Water Level

- Refer to Figure 7.10-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures one index well in this basin, hydrographs for this well and four other wells are shown on Figure 7.10-7.
- The deepest water level shown on the map is 337 feet at the Organ Pipe Cactus National Monument Headquarters and the shallowest is 27 feet near Puerto Blanco Drive.

Table 7.10-6 Groundwater Data for the Western Mexican Drainage Basin

Basin Area, in square miles:	610	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
Well Yields, in gal/min:	1.9 (1 well measured)	Measured by ADWR and/or USGS
	Range 30-50 Median 50 (3 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	N/A	ADWR (1990 and 1994)
	Range 0-500	USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	1,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	4,100,000 (to 1,200 ft)	ADWR (1994)
	3,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	N/A	Arizona Water Commission (1975)
Current Number of Index Wells:	1	
Date of Last Water-level Sweep:	2004 (6 wells measured)	

[1]Predevelopment Estimate

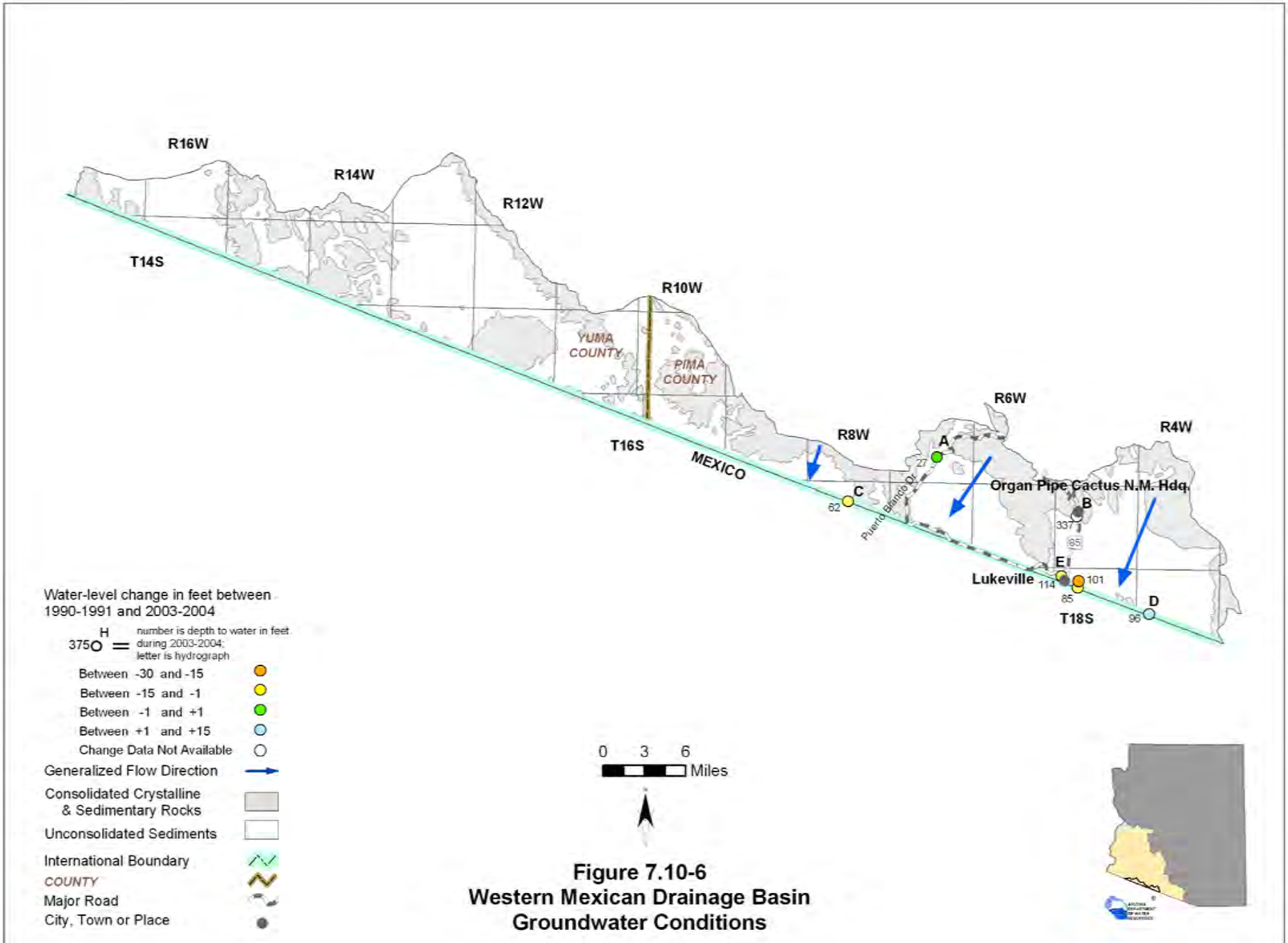
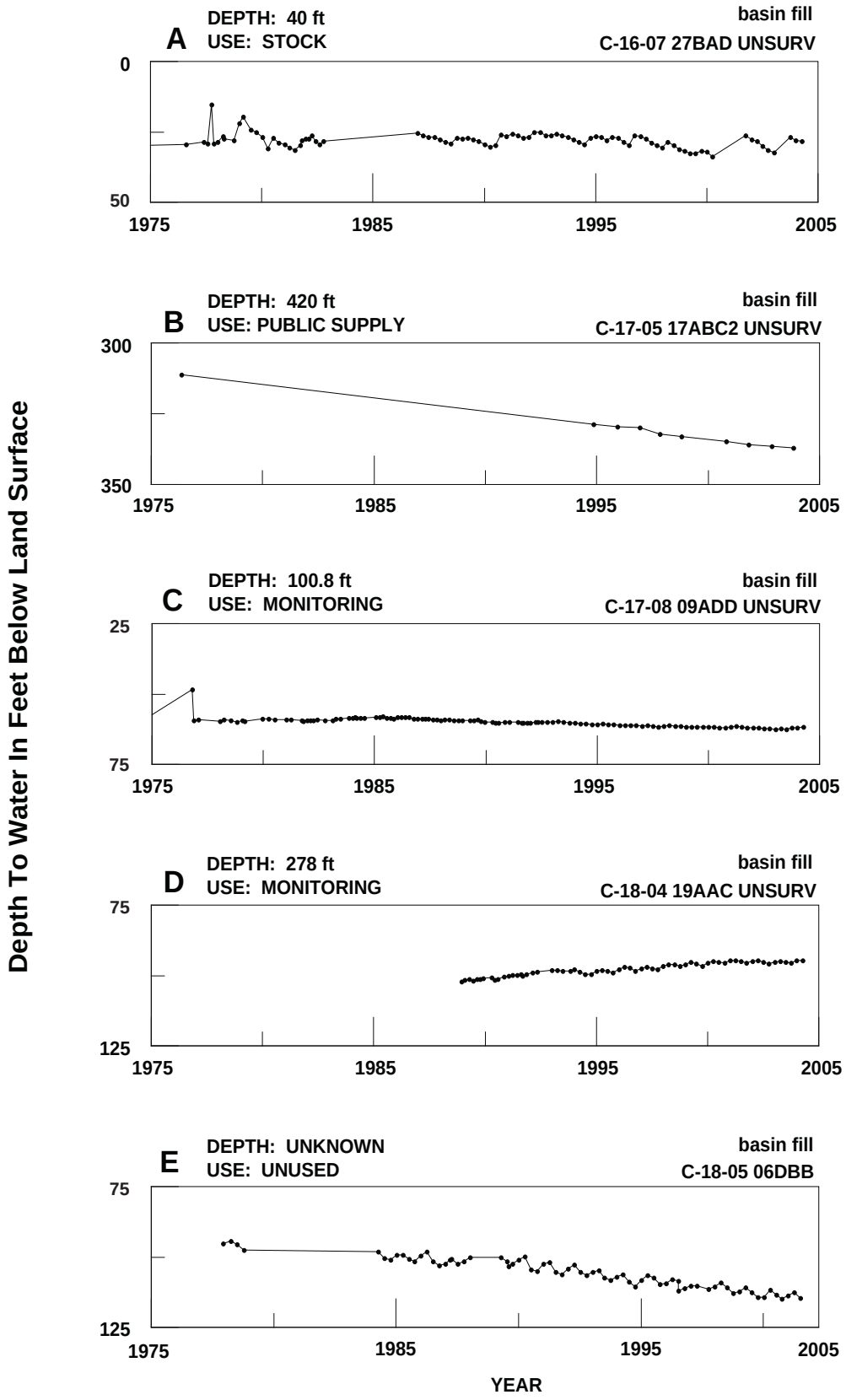


Figure 7.10-6
Western Mexican Drainage Basin
Groundwater Conditions

Figure 7.10-7
Western Mexican Drainage Basin
Hydrographs Showing Depth to Water in Selected Wells



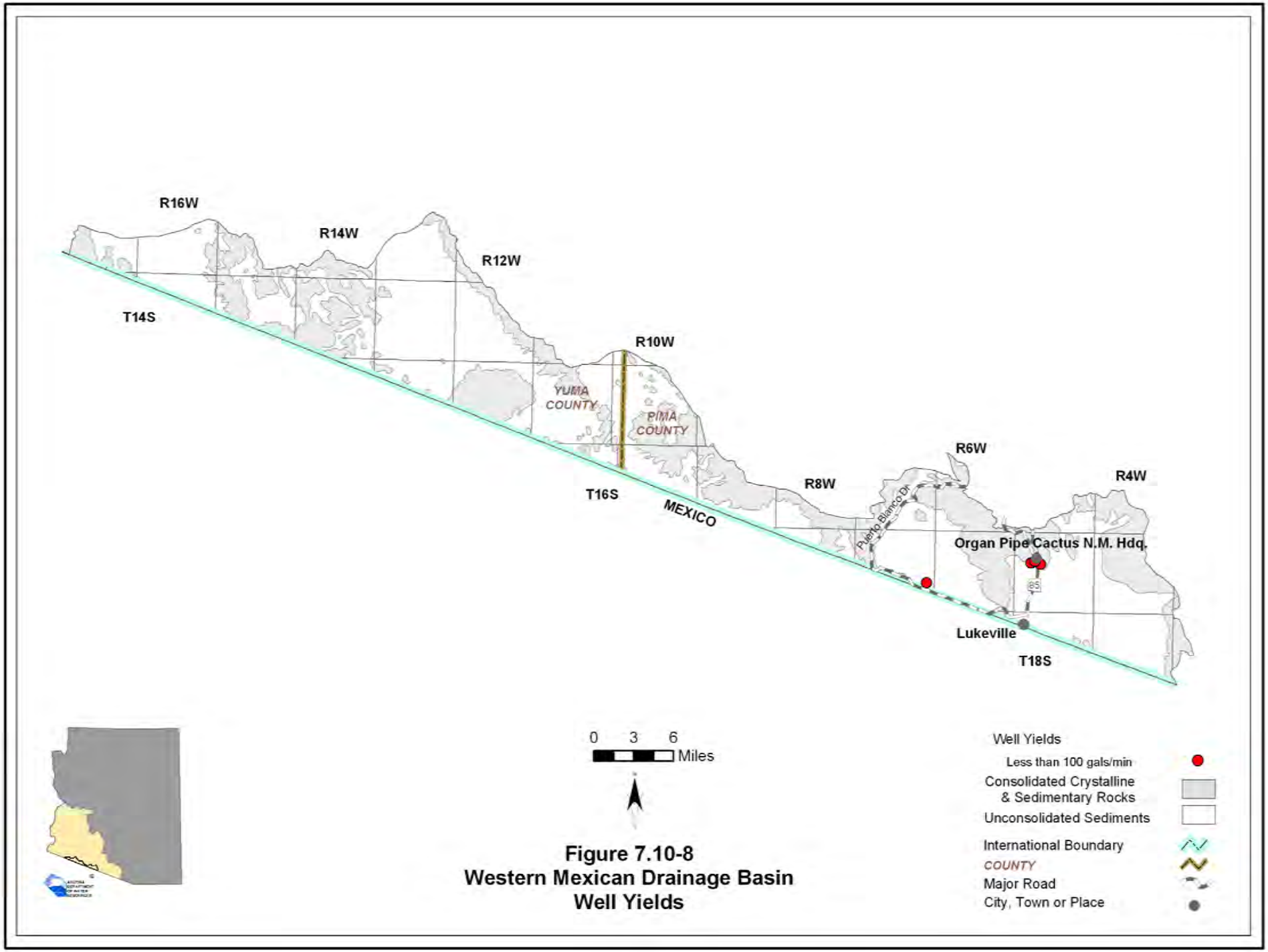


Figure 7.10-8
Western Mexican Drainage Basin
Well Yields

7.10.7 Water Quality of the Western Mexican Drainage 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 7.10-7A. There are no impaired lakes or streams in this basin. Figure 7.10-9 shows the location of water quality occurrences keyed to Table 7.10-7. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mine Sites

- Refer to Table 7.10-7A.
- Six wells have parameter concentrations that have equaled or exceeded drinking water standards.
- The parameter for fluoride was equaled or exceeded in all wells.
- Other parameters equaled or exceeded include arsenic and lead.

Table 7.10-7 Water Quality Exceedences in the Western Mexican Drainage Basin[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
1	Well	17 South	7 West	17	F
2	Well	17 South	7 West	17	As, F
3	Well	17 South	7 West	18	As, F, Pb
4	Well	17 South	7 West	24	F
5	Well	17 South	8 West	9	F
6	Well	17 South	8 West	11	As, F

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	Parameter(s) Exceeding Use Standard
None identified by ADWR at this time						

Notes:

[1] Water quality samples collected between 1976 and 1988.
[2] As = Arsenic
F = Fluoride
Pb = Lead

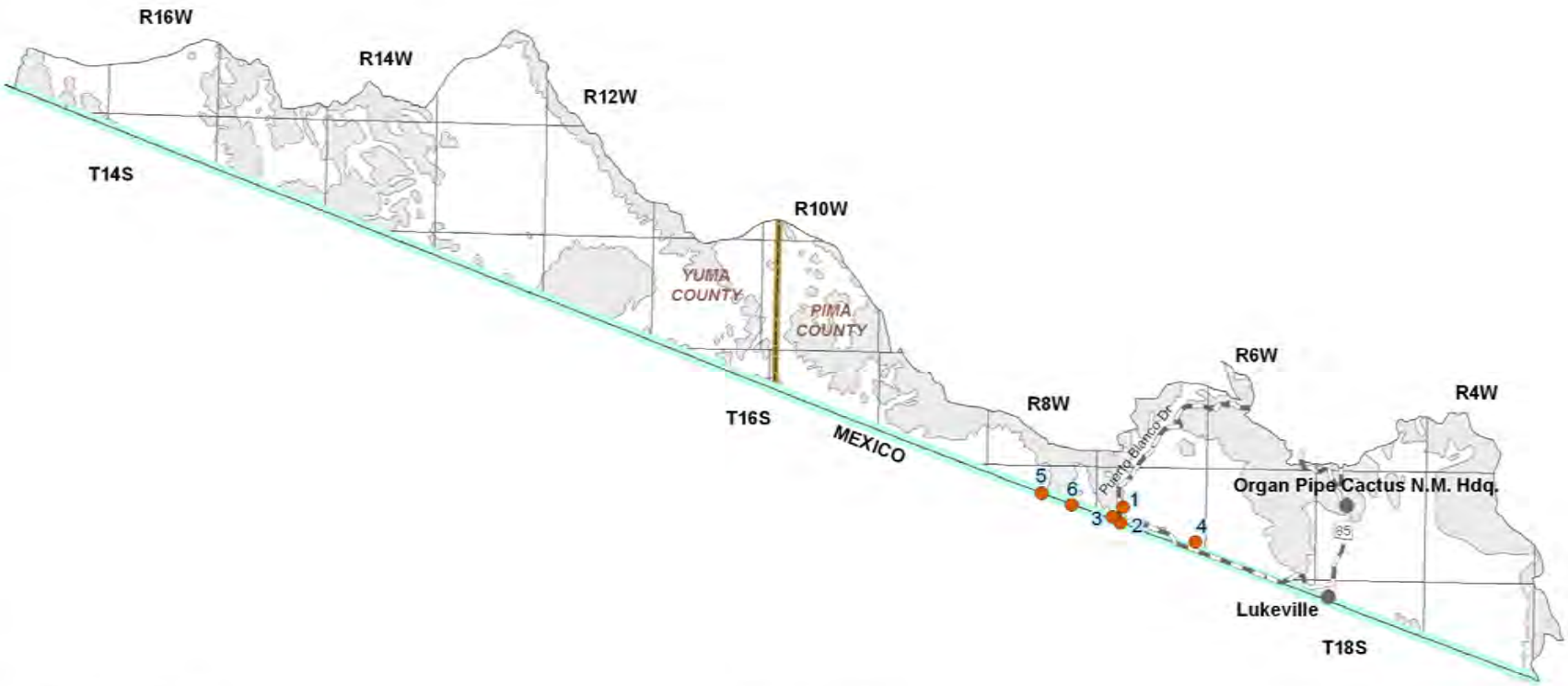


Figure 7.10-9
Western Mexican Drainage Basin
Water Quality Conditions

7.10.8 Cultural Water Demands in the Western Mexican Drainage 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 7.10-8. There is no recorded effluent generation in this basin. The USGS National Gap Analysis Program, the primary source of cultural demand map data, showed no demand centers for this basin. A description of cultural water demand data sources and methods is found in Volume 1, Section 1.3.5. More detailed information on cultural water demands is found in Section 7.0.7.

Cultural Water Demands

- Refer to Table 7.10-8
- Population in this basin is very small, with 34 residents in 2000. Projections suggest a small increase in population through 2050.
- There are no recorded surface water uses. All groundwater use is for municipal demand and has remained relatively constant since 1971.
- As of 2003 there were 16 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and five wells with a pumping capacity of more than 35 gallons per minute.

Table 7.10-8 Cultural Water Demands in the Western Mexican Drainage Basin[1]

Year	Recent (Census) and Projected (DES) 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	Irrigation	Municipal	Industrial	Irrigation	
1971		14[2]	5[2]	<500			NR			ADWR (1994)
1972										
1973										
1974										
1975										
1976				<500			NR			
1977										
1978										
1979										
1980	10									
1981	11	0	0	<500			NR			
1982	12									
1983	13									
1984	14									
1985	15									
1986	16	2	0	<500			NR			
1987	17									
1988	18									
1989	19									
1990	20									
1991	21	0	0	<300	NR	NR	NR			USGS (2005)
1992	23									
1993	24									
1994	26									
1995	27									
1996	28	0	0	<300	NR	NR	NR			
1997	30									
1998	31									
1999	33									
2000	34									
2001	36	0	0	<300	NR	NR	NR			
2002	39									
2003	41									
2010	58									
2020	64									
2030	70									
2040	77									
2050	85									
	WELL TOTALS:	**16**	**5**							

[1] Does not include evaporation losses from stockponds and reservoirs.
[2] Includes all wells through 1980.
NR - Not reported

Table 7.10-9 Effluent Generation in the Western Mexican Drainage Basin

Facility Name	Ownership	City/Location Served	Population Served	Volume Treated/Generated (acre-feet)	Disposal Method							Current Treatment Level	Population Not Served	Year of Record
					Water-course	Evaporation Pond	Irrigation	Golf Course	Wildlife Area	Discharged to Another Facility	Infiltration Basins			
No Waste Water Treatment Facilities Identified by ADWR in this Basin														

7.10.9 Water Adequacy Determinations in the Western Mexican Drainage Basin

No water adequacy applications for the Western Mexican Drainage Basin were filed with the Department as of May 2005. A description of the Water Adequacy Program is found in Volume 1, Appendix A. Adequacy determination data sources and methods are found in Volume 1, Section 1.3.1.

Table 7.10-10 Adequacy Determinations in the Western Mexican Drainage Basin

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
None identified by ADWR at this time											

Western Mexican Drainage Basin
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Section 7.11
Yuma Basin

7.11.1 Geography of the Yuma Basin

The Yuma Basin, located in the northeastern part of the planning area is 792 square miles in area. Geographic features and principal communities are shown on Figure 7.11-1. The basin is characterized by desert valleys and mountain ranges. Vegetation type is Lower Colorado River Valley Sonoran desertscrub. (See Figure 7.0-7)

- Principal geographic features shown on Figure 7.11-1 are:
    - Basin communities of Fortuna Foothills, Gadsden, San Luis, Somerton and Yuma
    - The Colorado River on the western basin boundary
    - Yuma Desert in the southern portion of the basin
    - The lowest point in the basin at 70 feet where the Colorado River enters Mexico at the southern international boundary
- Not well shown on Figure 7.11-1 are the Tinajas Altas Mountains and the Gila Mountains on the eastern basin boundary with the highest point in the basin at 2,694 feet.

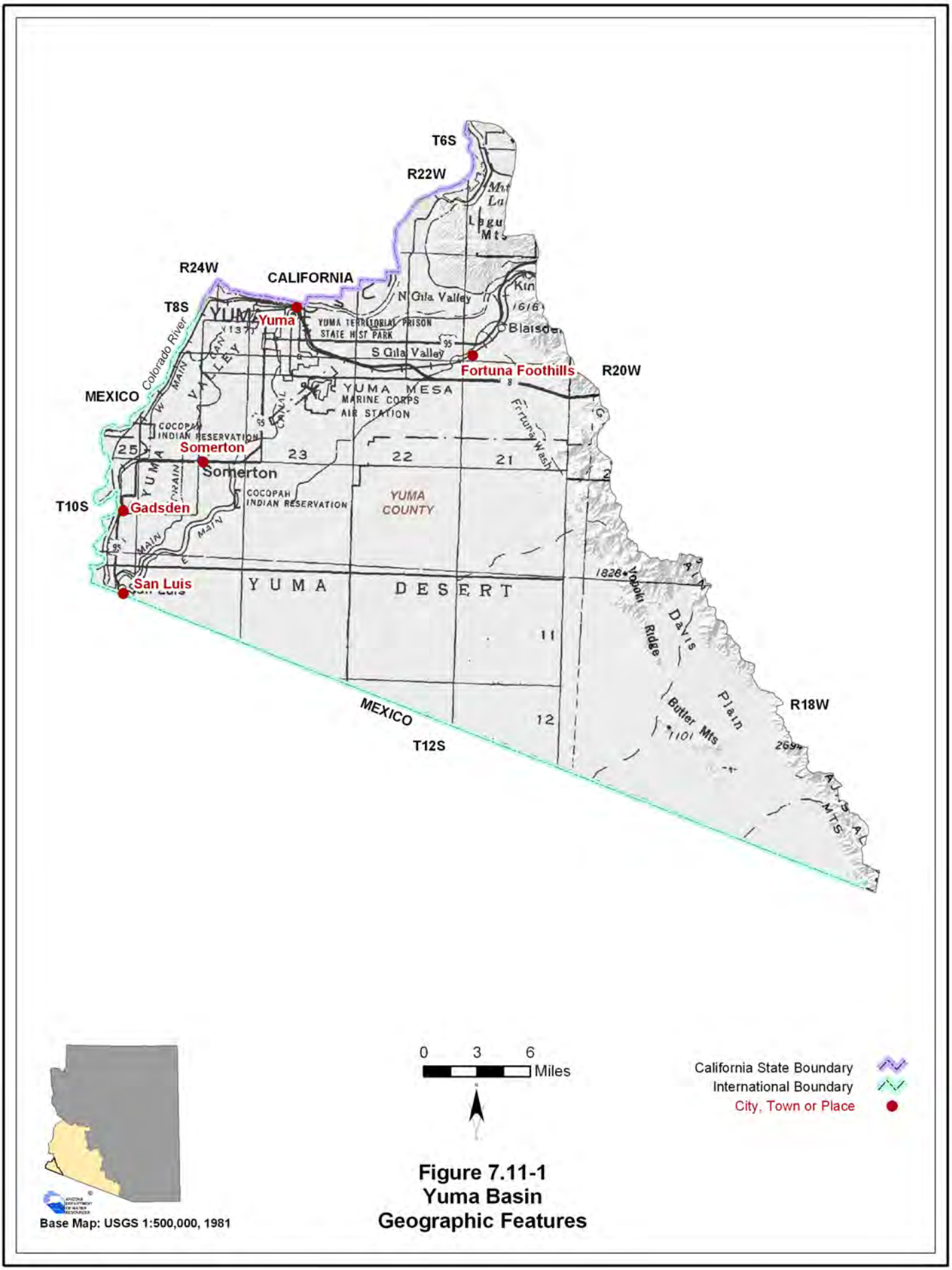


Figure 7.11-1
Yuma Basin
Geographic Features

7.11.2 Land Ownership in the Yuma Basin

Land ownership, including the percentage of ownership by category, for the Yuma Basin is shown in Figure 7.11-2. The principal feature of land ownership in this basin is the relatively large portion of military and private lands. A description of land ownership data sources and methods is found in Volume 1, Section 1.3.8. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

U.S. Military

- 51.7% of the land is federally owned and managed by the U.S. Military
- U.S. Military lands include the Barry Goldwater Air Force Range, the Yuma Marine Corps Air Station (MCAS) and the Yuma Proving Grounds.
- Primary land use is military activity.

Private

- 27.8% of the land is private.
- Land uses include agriculture, domestic and commercial.

U.S. Bureau of Land Management (BLM)

- 8.2% of the land is federally owned and managed by the Yuma Field Office of the Bureau of Land Management.
- Primary land use is unknown.

State Trust Land

- 5.9% of the land is held in trust for the public schools under the State Trust Land system.
- Primary land use is agriculture.

Other

- 4.9% of the land is federally owned and managed by the U.S. Bureau of Reclamation.
- Land use is unknown.

Indian Reservation

- 1.5% of the land is under tribal ownership.
- Tribal lands include the Cocopah Indian Reservation in three separate areas in the western portion of the basin and the Fort Yuma-Quechan Indian Reservation west of Laguna Dam Road.
- Land uses include domestic, commercial and agriculture.

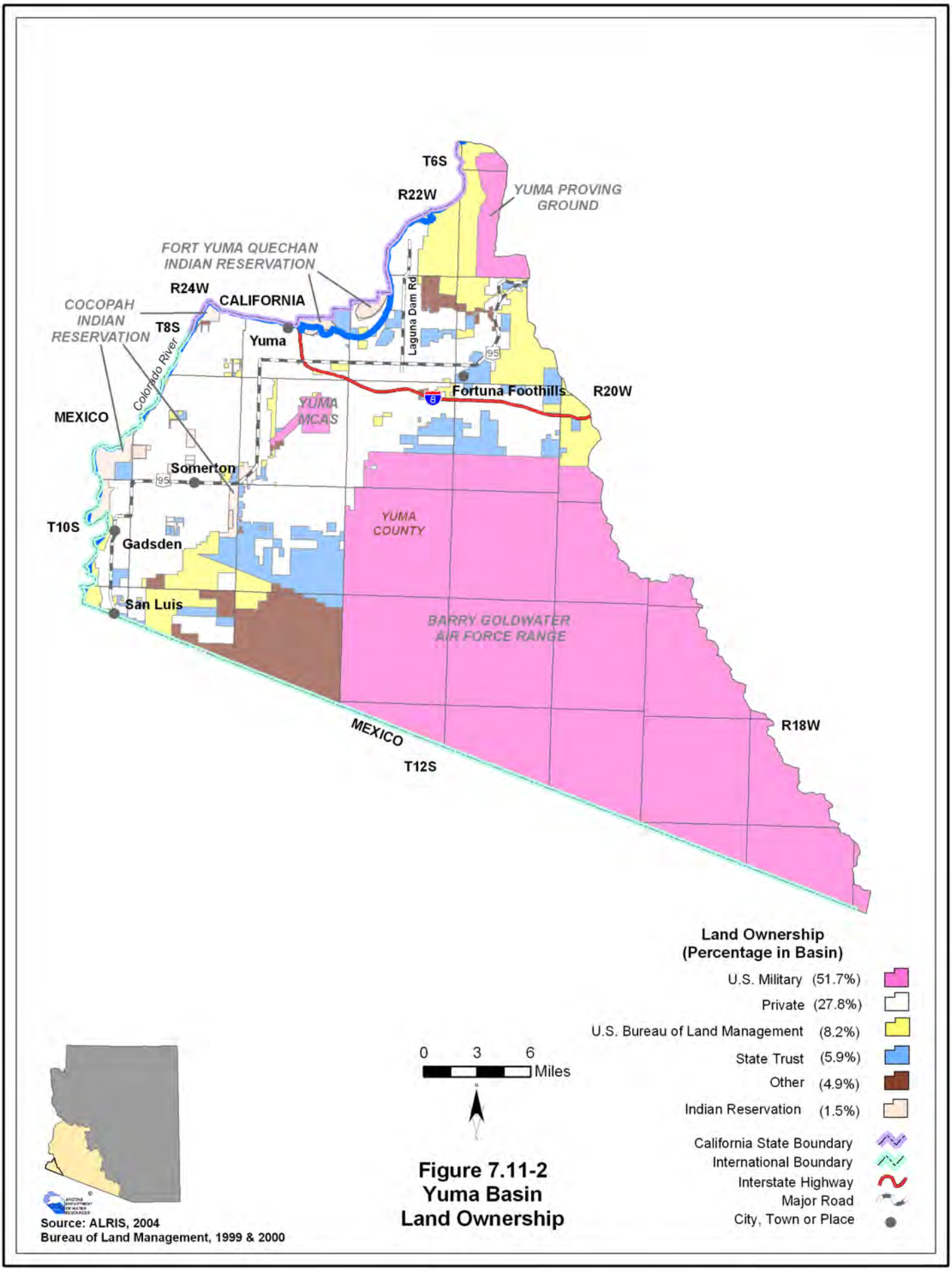


Figure 7.11-2
Yuma Basin
Land Ownership

7.11.3 Climate of the Yuma Basin

Climate data from NOAA/NWS Co-op Network, Evaporation Pan and AZMET stations are complied in Table 7.11-1 and the locations are shown on Figure 7.11-3. Figure 7.11-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Yuma Basin does not contain SNOTEL/ Snowcourse stations. A description of the climate data sources and methods is found in Volume 1, Section 1.3.3.

NOAA/NWS Co-op Network

- Refer to Table 7.11-1A
- Temperatures at the three NOAA/NWS Co-op Network stations in the basin range from an average high temperature of 94.1°F at Yuma WSO AP to an average low of 54.1°F at Yuma Citrus Station.
- Highest average seasonal rainfall at two of the three stations occurs in the summer season (July-September) when approximately 37% of the annual average precipitation occurs. The highest average annual rainfall in the basin is 3.89 inches at the Yuma Citrus Station.
- This is the most arid basin in the state.

Evaporation Pan

- Refer to Table 7.11-1B
- There are two evaporation pan stations in the basin at elevations of 210 feet and 190 feet with an average annual evaporation of 122.5 inches and 99.21 inches respectively.

AZMET

- Refer to Table 7.11-1C
- There are three AZMET stations in the basin at elevations ranging from 105 feet to 190 feet with average annual reference evaportranspiration of between 80.57 inches and 84.05 inches.

SCAS Precipitation Data

- See Figure 7.11-3
- Additional precipitation data shows average annual rainfall of four inches or less in most of the basin and an average annual rainfall as high as six inches along the eastern basin boundary.

Table 7.11-1 Climate Data for the Yuma 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
Yuma Citrus Station	190	1971 - 2000	90.8/Jul	54.1/Dec	1.16	0.23	1.51	0.99	3.89
Yuma Valley	120	1971 - 2000	89.6/Jul	54.9/Dec	0.99	0.13	0.82	0.69	2.63
Yuma WSO AP	210	1971 - 2000	94.1/Jul	57.4/Dec	0.93	0.16	1.10	0.82	3.01

Source: WRCC, 2003

B. Evaporation Pan:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Avg. Annual Evap (in inches)
Yuma AP	210	NA	122.5
Yuma Citrus Station	190	1920 - 2002	99.21

Source: WRCC, 2003.
Notes:
NA = Not available

C. AZMET:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Annual Reference Evaportranspiration, in inches (N*umber of years to calculate averages*)
Yuma Mesa	190	1987 - current	81.26 (6)
Yuma North Gila	144	1988 - current	80.57 (6)
Yuma Valley	105	1987 - current	84.05 (6)

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: NRCS, 2005

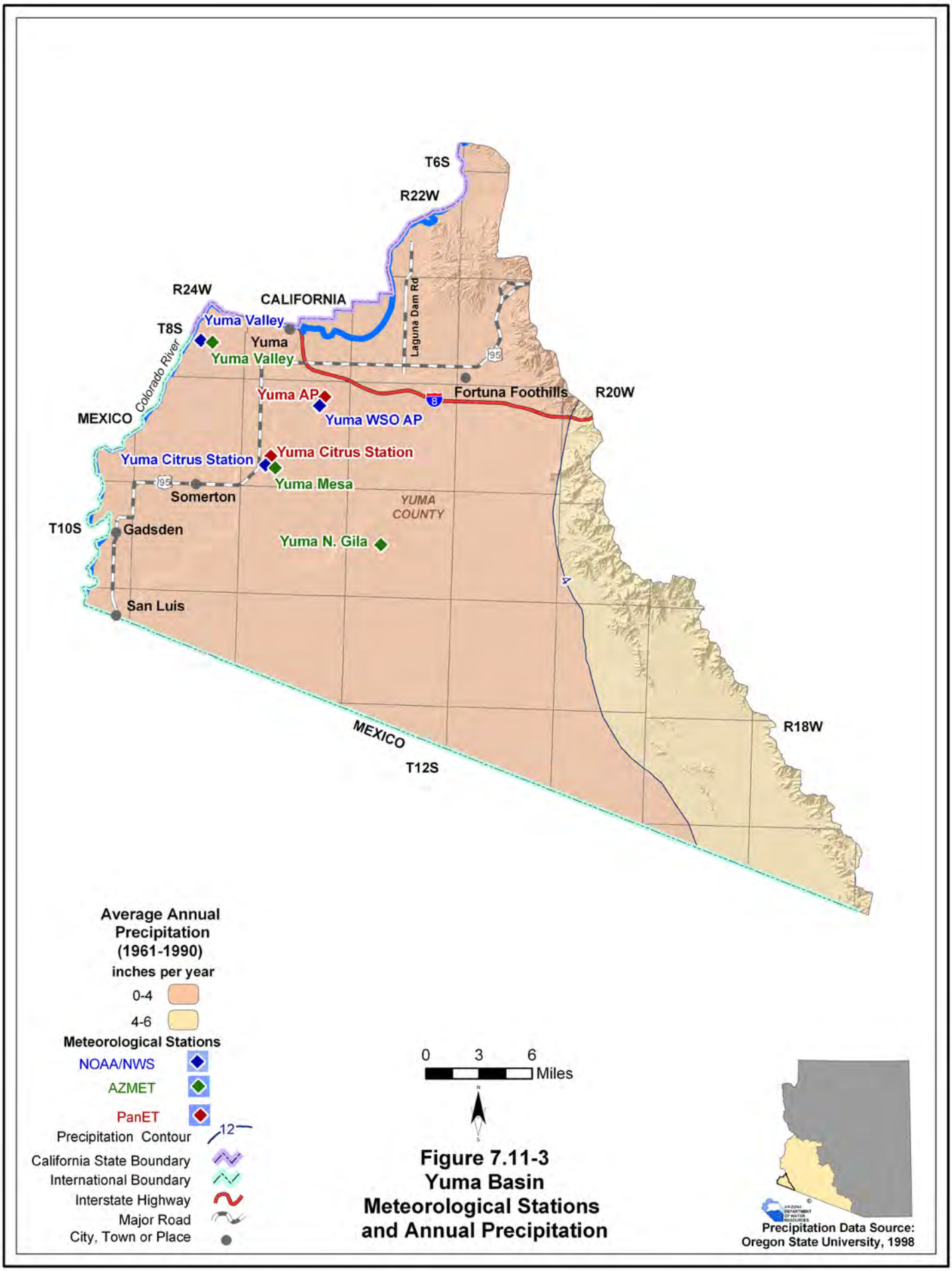


Figure 7.11-3
Yuma Basin
Meteorological Stations
and Annual Precipitation

7.11.4 Surface Water Conditions in the Yuma Basin

Streamflow data, including average seasonal flow, average annual flow and other information are shown in Table 7.11-2. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 7.11-4. The location of streamflow gages identified by USGS number and large reservoirs are shown on Figure 7.11-5. There are no flood ALERT stations or USGS runoff contour data available for this basin. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Streamflow Data

- Refer to Table 7.11-2.
- Data from seven stations located at the Colorado and Gila Rivers are shown in the table and on Figure 7.11-5.
- Highest average seasonal flow varies from station to station. Flows are impacted by regulatory releases, diversions and return flow.
- The largest annual flow recorded in the basin is almost 26 million acre-feet in 1909 at the Colorado River at Yuma Station. Mean annual flow at this station is 10.1 million acre-feet. The hydrograph of annual flows at this station shows the dramatic drop in river flow during the construction of Hoover Dam from 1931-1935. (See Figure 7.11-4)

Reservoirs and Stockponds

- Refer to Table 7.11-4.
- The basin contains two large reservoirs. The largest, Mittry Lake has a maximum storage of 4,850 acre-feet. This reservoir is used as a fish and wildlife pond and for flood control.
- The other large reservoir, Morelos Diversion Dam was constructed by Mexico pursuant to the 1944 Treaty to provide Mexico a mechanism for the utilization of Colorado River water.
- Surface water is stored or could be stored in two small reservoirs in the basin.
- There are no registered stockponds in this basin.

Figure 7.11-4 Hydrograph of annual flows for Colorado River at Yuma Station (# 952100), water years 1904-1965

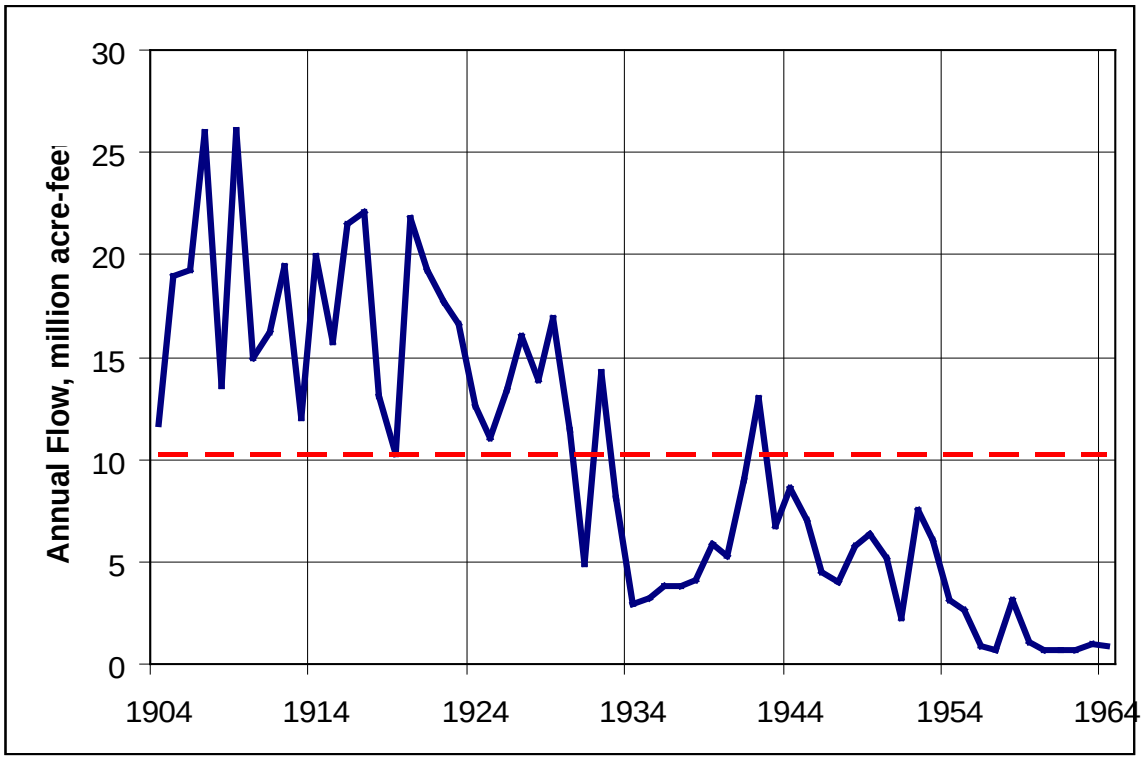


Table 7.11-2 Streamflow Data for the Yuma Basin

Station Number	USGS Station Name	Drainage Area (in mi^2)	Mean Basin Elevation (in feet)	Period of Record	Average Seasonal Flow (% of annual flow)				Annual Flow/Year (in acre-feet)				Years of Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
9429600	Colorado River below Laguna Dam[1]	188,600	121	1973 - 2004 (real time)	24	21	31	24	251,952 (1973)	388,788	1,830,996	10,222,880 (1984)	19
9520500	Gila River near Dome	57,850	NA	1/1903-2003	41	35	10	14	0 (1993, 1936, 1940, 1942-1950)	4,772	237,245	4,733,110 (1993)	76
9520700	Gila River near mouth near Yuma	57,950	NA	5/1968-6/1983 (discontinued)	19	34	24	22	56,398 (1978)	6,700	484,103	1,742,614 (1981)	7
9520701	Gila River at mouth (flow past gage only)	NA	NA	10/1975-6/1983 (discontinued)	17	36	27	20	30,769 (1978)	38,371	458,381	1,720,895 (1980)	7
9521000	Colorado River at Yuma	242,900	NA	1/1904-11/1983 (discontinued)	17	44	25	14	682,711 (1961)	9,628,539	10,090,123	25,969,073 (1909)	60
9522000	Colorado River @ NIB above Morelos Dam	246,700	0	1950 - current	27	24	27	22	1,281,480 (1973)	1,671,716	3,496,196	15,392,240 (1984)	42
9522200	Colorado River @ SIB near San Luis	246,700	NA	1951 - current	23	21	29	26	9,412 (1982)	149,144	1,880,952	12,655,520 (1984)	24

Sources: USGS NWIS, USGS 1998 and USGS 2003.

Notes:
[1]Gage in California
NA = Not available
Statistics based on Calendar Year
Annual Flow statistics based on monthly values
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

Table 7.11-3 Flood ALERT Equipment in the Yuma Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
None				

Table 7.11-4 Reservoirs and Stockponds in the Yuma 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	Mittry Lake *(Laguna Diversion)*	Bureau of Reclamation	4,850	F, C	Federal
2	Morelos Diversion	IBWC	1,160	O	Federal

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

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

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: 2
Total surface area: 25 acres

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

Total number: 0

[1] F = fish & wildlife pond; C = Flood control; O = Other
IBWC = International Boundary Water Commission

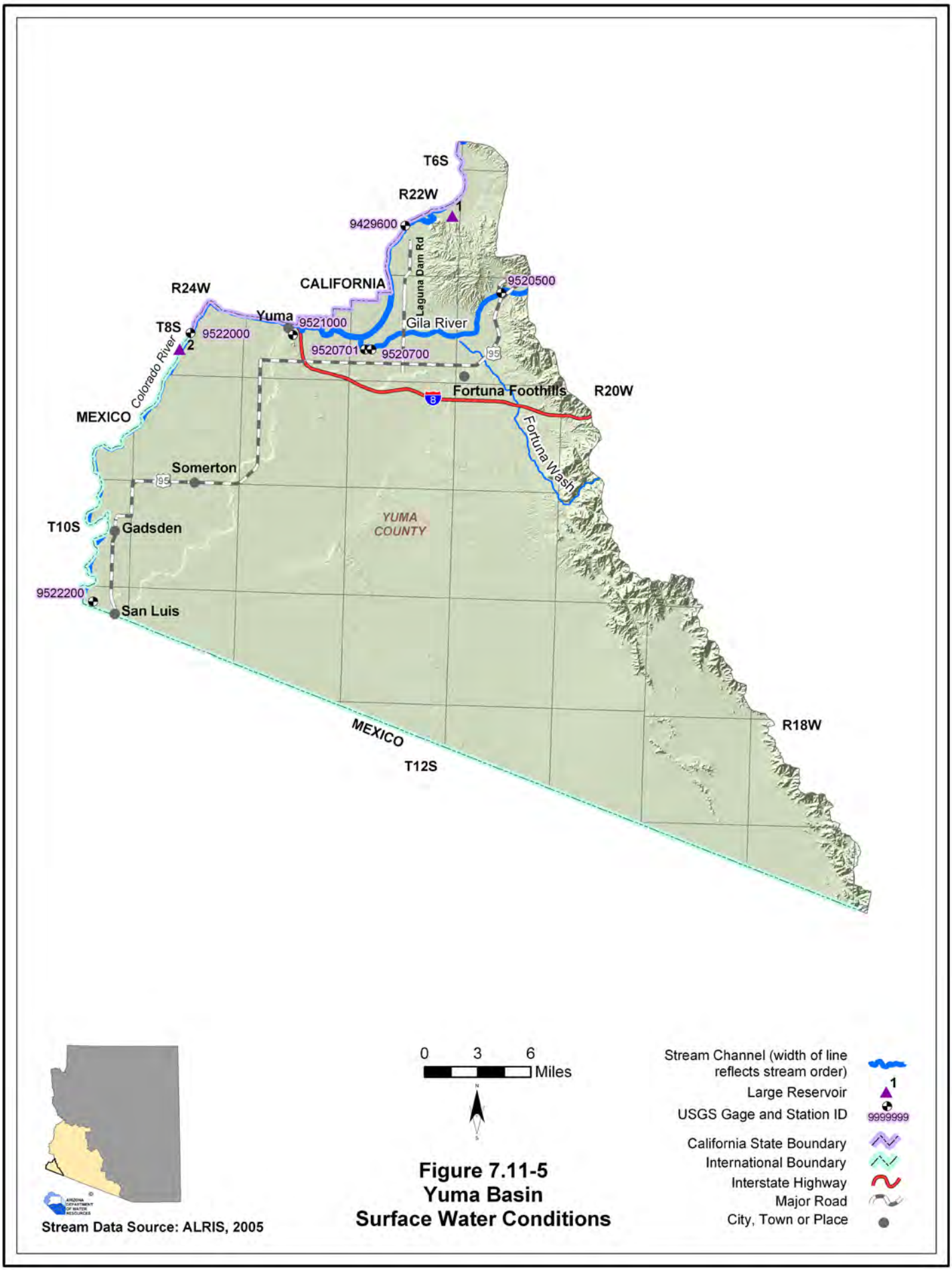


Figure 7.11-5
Yuma Basin
Surface Water Conditions

7.11.5 Perennial/Intermittent Streams and Major Springs in the Yuma Basin

The total number of springs in the basin are shown in Table 7.11-5. The locations of perennial streams are shown on Figure 7.11-6. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, Section 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- There are two perennial streams in this basin, the Colorado River and most of the Gila River. A small reach of the Gila River, located on the eastern basin boundary, is intermittent.
- There are no major or minor springs in the basin.
- The total number of springs, regardless of discharge, identified by the USGS is one.

Table 7.11-5 Springs in the Yuma 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, 2005 and USGS, 2006): 1

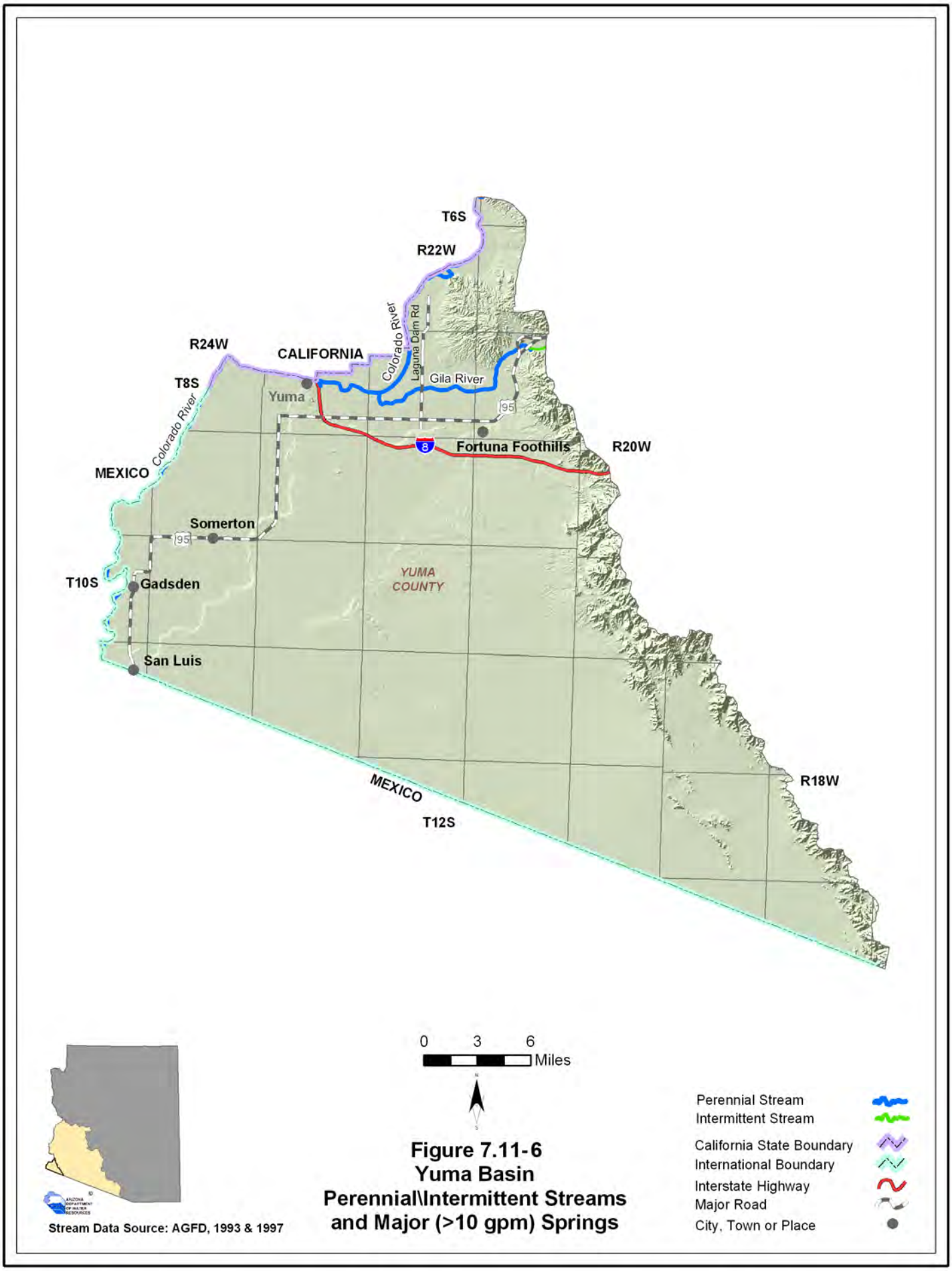


Figure 7.11-6
Yuma Basin
Perennial\Intermittent Streams and Major (>10 gpm) Springs

7.11.6 Groundwater Conditions of the Yuma Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.11-6. Figure 7.11-7 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 7.11-8 contains hydrographs for selected wells shown on Figure 7.11-7. Figure 7.11-9 shows well yields in five yield categories. A description of aquifer data sources and methods is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields, is found in Volume 1, Section 1.3.19.

Major Aquifers

- Refer to Table 7.11-6 and Figure 7.11-7.
- The major aquifer is basin fill.
- Flow direction is generally toward the Colorado River and south toward Mexico.

Well Yields

- Refer to Table 7.11-6 and Figure 7.11-9.
- As shown on Figure 7.11-9, well yields are generally greater than 2,000 gallons per minute (gpm).
- One source of well yield information, based on 327 reported wells, indicates that the median well yield is 2,456 gpm.
- The line of wells along the international boundary is the 242 Well Field. These wells collect groundwater and deliver it via the 242 Lateral to Mexico to meet a portion of the International treaty obligations.

Natural Recharge

- Refer to Table 7.11-6.
- The estimate of natural recharge is 213,000 acre-feet per year.

Water in Storage

- Refer to Table 7.11-6.
- There are three estimates of water in storage ranging from 34 million acre-feet to 49 million acre-feet, both to a depth of 1,200 feet.

Water Level

- Refer to Figure 7.11-7. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 11 index wells in this basin, hydrographs for 10 index wells are shown on Figure 7.11-8.
- The deepest water level shown on the map is 152 feet on the Mexican border and the shallowest is nine feet east of Yuma.

Table 7.11-6 Groundwater Data for the Yuma Basin

Basin Area, in square miles:	792	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
Well Yields, in gal/min:	Range 3,186-5,271 Median 5,098 (3 well reported)	Measured by ADWR and/or USGS
	Range 10-7,000 Median 2,456 (327 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	Range 500-3,000	ADWR (1990)
	Range 0-2,500	USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	213,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	49,000,000 (to 1,200 ft)	ADWR (1994)
	34,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	35,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
Current Number of Index Wells:	11	
Date of Last Water-level Sweep:	1992 (587 wells measured)	

[1]Predevelopment Estimate

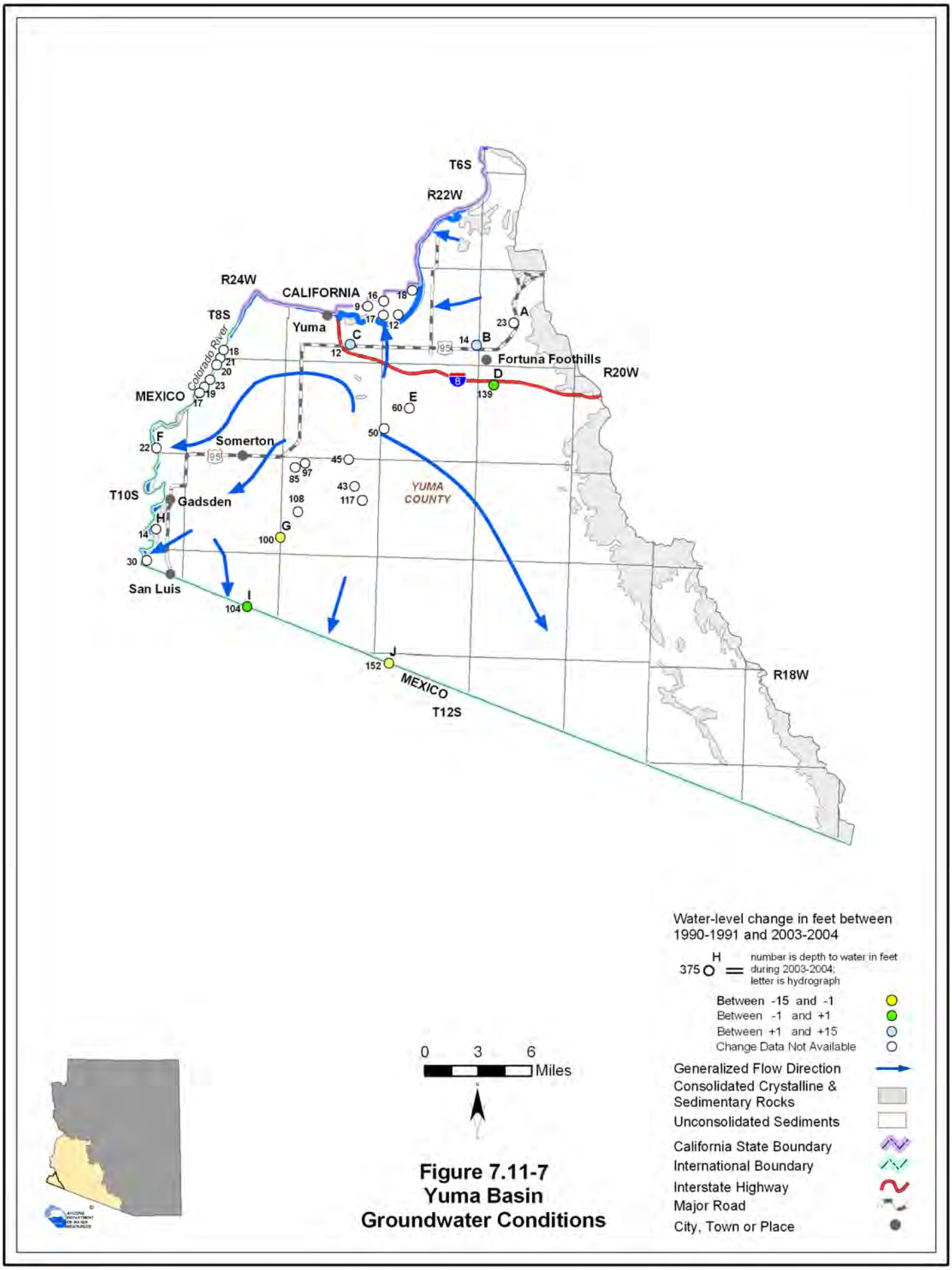


Figure 7.11-7
Yuma Basin
Groundwater Conditions

Figure 7.11-8
Yuma Basin
Hydrographs Showing Depth to Water in Selected Wells

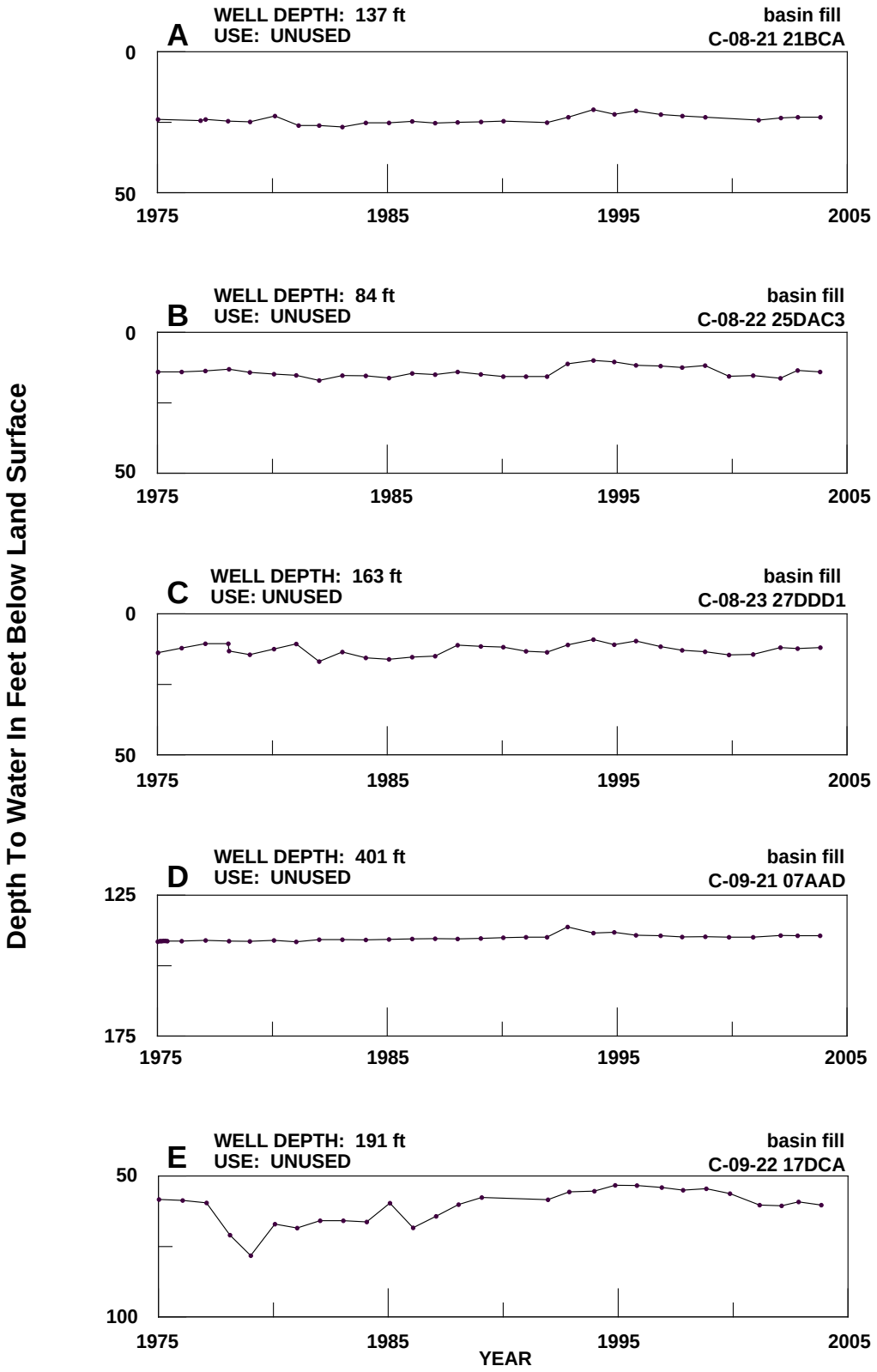
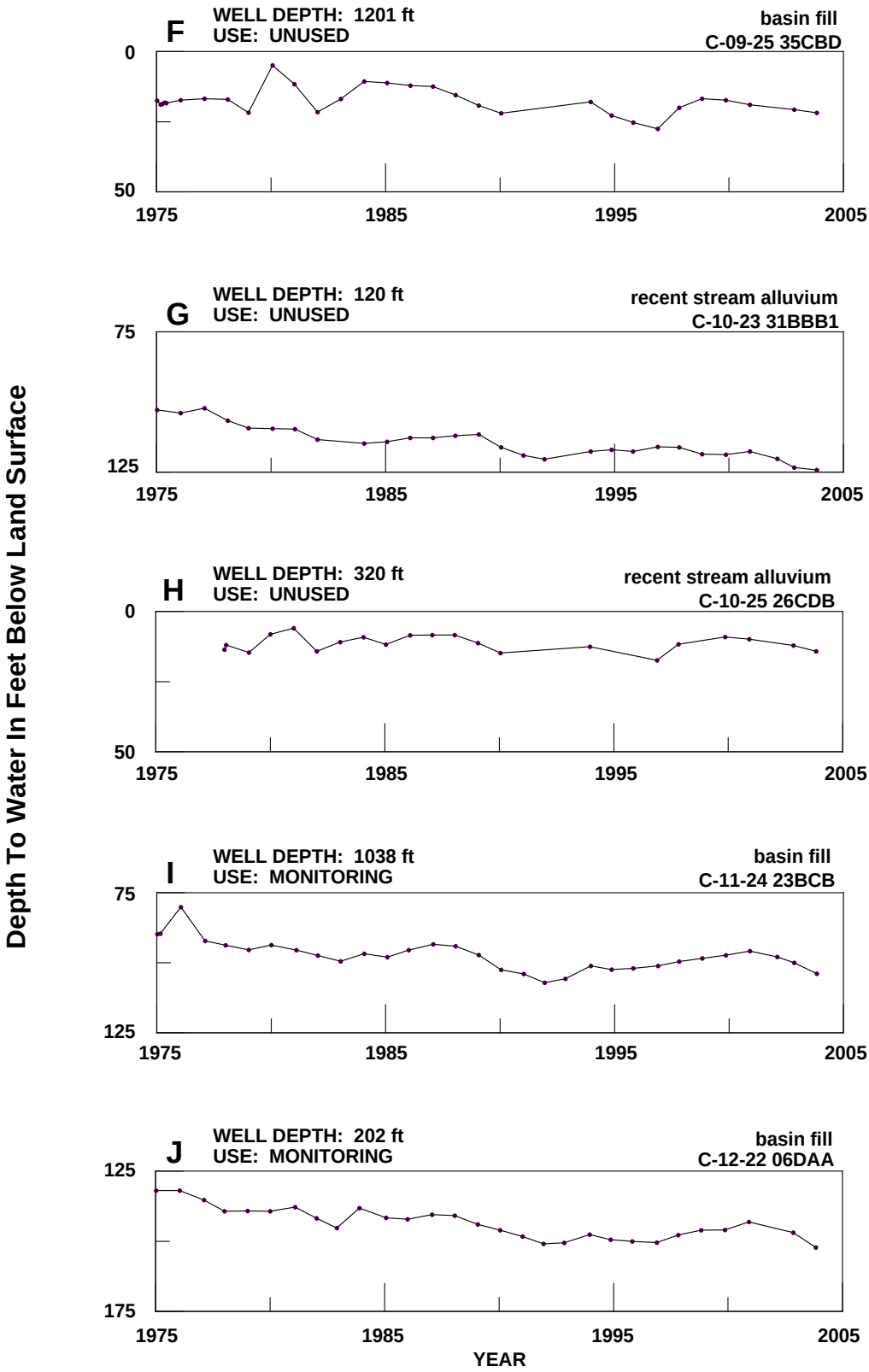


Figure 7.11-8 (cont'd)
Yuma Basin
Hydrographs Showing Depth to Water in Selected Wells



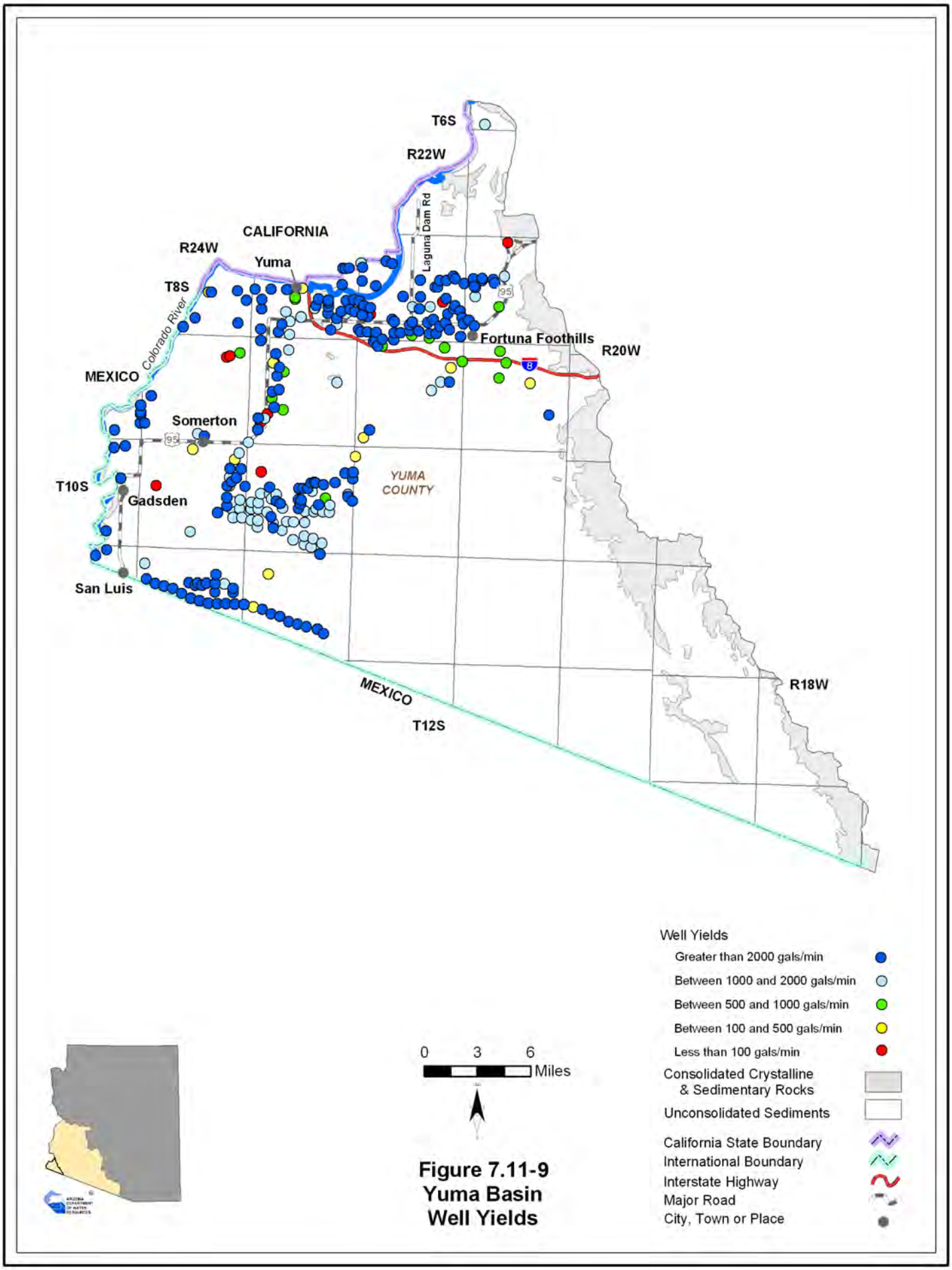


Figure 7.11-9
Yuma Basin
Well Yields

7.11.7 Water Quality of the Yuma 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 7.11-7A. 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 7.11-7B. Figure 7.11-10 shows the location of water quality occurrences keyed to Table 7.11-7. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mines

- Refer to Table 7.11-7A
- One hundred and three wells have parameter concentrations that have equaled or exceeded drinking water standards.
- Parameters frequently equaled or exceeded include arsenic, organics, lead and total dissolved solids.
- Other parameters equaled or exceeded include antimony, beryllium, cadmium thallium, and nitrate.

Lakes and Streams

- Refer to Table 7.11-7B
- 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 Lower Gila Basin.
- This reach of the Gila River is not part of the ADEQ water quality improvement effort, the Total Maximum Daily Load (TMDL) Program, at this time.

Table 7.11-7 Water Quality Exceedences in the Yuma Basin[1]

A. Wells, Springs and Mines

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

Table 7.11-7 Water Quality Exceedences in the Yuma Basin (cont'd.)[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
46	Well	9 South	21 West	4	As
47	Well	9 South	21 West	4	As
48	Well	9 South	21 West	9	As
49	Well	9 South	21 West	9	Pb
50	Well	9 South	21 West	9	Pb
51	Well	9 South	21 West	9	Pb
52	Well	9 South	21 West	9	Pb
53	Well	9 South	21 West	9	Pb
54	Well	9 South	21 West	9	Pb
55	Well	9 South	21 West	9	Pb
56	Well	9 South	21 West	9	Pb
57	Well	9 South	21 West	9	Pb
58	Well	9 South	21 West	9	Pb
59	Well	9 South	21 West	9	As
60	Well	9 South	21 West	9	Pb
61	Well	9 South	21 West	9	Pb
62	Well	9 South	21 West	9	As, Pb
63	Well	9 South	21 West	17	As
64	Well	9 South	21 West	22	Pb
65	Well	9 South	22 West	7	NO3
66	Well	9 South	22 West	7	NO3
67	Well	9 South	22 West	31	Organics
68	Well	9 South	23 West	5	TDS
69	Well	9 South	23 West	24	Cd
70	Well	9 South	23 West	24	Cd
71	Well	9 South	23 West	28	Pb
72	Well	9 South	23 West	29	Organics
73	Well	9 South	23 West	33	NO3
74	Well	9 South	23 West	36	Organics
75	Well	9 South	24 West	1	TDS
76	Well	9 South	24 West	10	As
77	Well	9 South	24 West	11	TDS
78	Well	9 South	24 West	13	NO3, TDS
79	Well	9 South	24 West	15	Organics
80	Well	9 South	24 West	16	Organics
81	Well	9 South	24 West	17	Organics
82	Well	9 South	24 West	19	Pb
83	Well	9 South	24 West	21	NO3, Organics
84	Well	9 South	24 West	24	As, TDS
85	Well	9 South	24 West	36	Organics
86	Well	10 South	21 West	9	As, Pb
87	Well	10 South	23 West	5	F, TDS
88	Well	10 South	23 West	6	Organics
89	Well	10 South	23 West	10	Organics
90	Well	10 South	24 West	1	Organics

Table 7.11-7 Water Quality Exceedences in the Yuma Basin (cont'd.)[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
91	Well	10 South	24 West	1	Sb
92	Well	10 South	24 West	1	Be
93	Well	10 South	24 West	1	Organics
94	Well	10 South	24 West	9	NO3
95	Well	10 South	24 West	9	Organics
96	Well	10 South	24 West	10	NO3, TDS
97	Well	10 South	24 West	10	NO3
98	Well	10 South	24 West	18	Organics
99	Well	10 South	24 West	31	Organics
100	Well	10 South	24 West	31	Organics
101	Well	10 South	25 West	2	Pb
102	Well	10 South	25 West	36	NO3
103	Well	11 South	23 West	20	Organics

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[3]	Parameter(s) Exceeding Use Standard[2]
a	Stream	Gila River (Coyote Wash to Fortuna Wash)	28	NA	A&W	B, Se

Notes:

[1] Water quality samples collected between 1975 and 2004.

[2] As = Arsenic
B = Boron
Be = Beryllium
Cd = Cadmium
F = Fluoride
NO3 = Nitrate/ Nitrite
Organics = One or more of several volatile and semi-volatile organic compounds and pesticides
Sb = Antimony
Se = Selenium
TDS = Total Dissolved Solids
Th = Thallium

[3] A&W = Aquatic and Wildlife

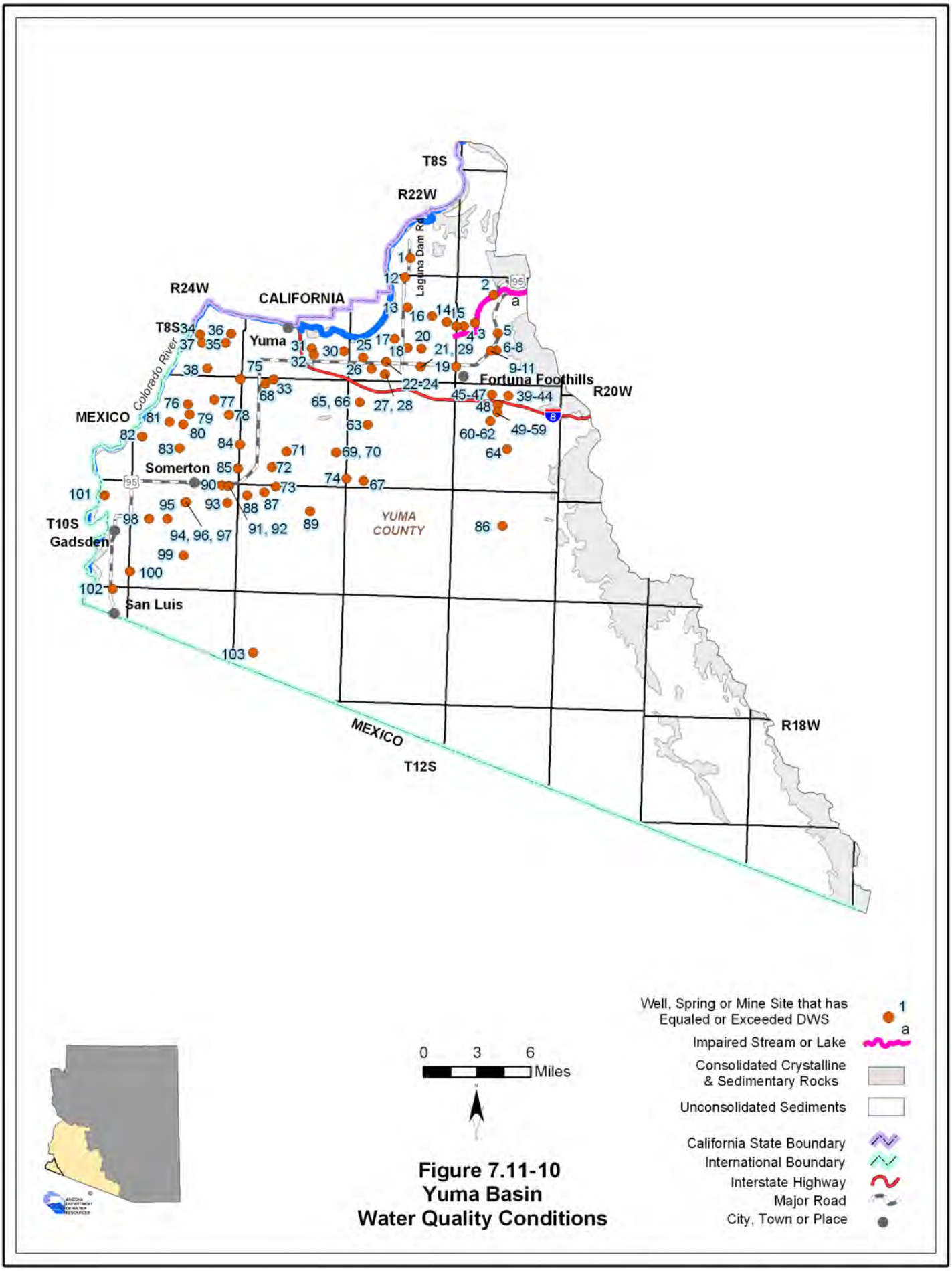


Figure 7.11-10
Yuma Basin
Water Quality Conditions

7.11.8 Cultural Water Demands in the Yuma 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 7.11-8. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown in Table 7.11-9. Figure 7.11-11 shows the location of demand centers. A description of cultural water demand data sources and methods is found in Volume 1, Section 1.3.5. More detailed information on cultural water demands is found in Section 5.0.7.

Cultural Water Demands

- Refer to Table 7.11-8 and Figure 7.11-11.
- Population in this basin increased from 73,319 in 1980 to 152,883 in 2000 and projections suggest an increase to over 502,000 people in 2050.
- Most cultural water use is for irrigation in the western portion of the basin.
- Agricultural groundwater demand increased 24%, and agricultural surface water demand increased 9% between 1991 and 2003. This basin has the largest agricultural water demand in the planning area, with 258,000 acre-feet of groundwater demand and 778,000 acre-feet of surface water demand on average per year in 2001-2003.
- Municipal groundwater demand decreased 27% and municipal surface water demand increased 25% from 1991 to 2003.
- Industrial groundwater demand has remained relatively constant and industrial surface water demand decreased 25% from 1991 to 2003.
- As of 2003 there were 2,778 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 502 wells with a pumping capacity of more than 35 gallons per minute.

Effluent Generation

- Refer to Table 7.11-9.
- There are 26 wastewater treatment facilities in this basin.
- Information on population served was available for 20 facilities and information on the volume of effluent generated was available for 18 facilities. These facilities serve almost 313,000 people and generate over 13,000 acre-feet of effluent per year.
- Four facilities discharge to the Colorado River, four discharge to evaporation ponds, two discharge for irrigation, three discharge to golf courses, three discharge to another facility and four discharge to unlined impoundments that recharge the aquifer.

Table 7.11-8 Cultural Water Demands in the Yuma Basin[1]

Year	Recent (Census) and Projected (DES) Population	Number of Registered Water Supply Wells Drilled		Average Annual Demand (in acre-feet)[3]						Data Source
				Well Pumpage[4]			Surface-Water Diversions			
		Q ≤ 35 gpm	Q > 35 gpm	Municipal	Industrial	Irrigation	Municipal	Industrial	Irrigation	
1971		1,057[2]	331[2]	253,000			1,251,000[5]			ADWR (1994)
1972										
1973										
1974										
1975										
1976				229,000			1,102,000[5]			
1977										
1978										
1979										
1980	73,319									
1981	76,123	211	74	224,000			1,130,000[5]			
1982	78,926									
1983	81,730									
1984	84,533									
1985	87,337									
1986	90,140	472	26	211,000			1,229,000[5]			
1987	92,944									
1988	95,748									
1989	98,551									
1990	101,355									
1991	106,508	352	39	8,100	1,000	206,000	25,500	3,900	711,000	USGS (2005) ADWR (2005)
1992	111,660									
1993	116,813									
1994	121,966									
1995	127,119									
1996	132,272	395	26	10,500	1,100	218,000	31,000	4,700	771,000	
1997	137,425									
1998	142,577									
1999	147,730									
2000	152,883									
2001	160,466	127	1	5,900	1,100	256,000	32,000	2,900	778,000	
2002	168,049									
2003	175,632									
2010	228,713									
2020	276,217									
2030	339,001									
2040	414,022									
2050	502,498									
ADDITIONAL WELLS: [6]		**164**	**5**							
WELL TOTALS:		**2,778**	**502**							

[1] Does not include 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 and the 242 well field.
[5] Includes surface-water diversions in Parker and Yuma basins.
[6] Other water-supply wells are listed in the ADWR Well Registry for this basin, but they do not have completion dates. These wells are summed here.

Table 7.11-9 Effluent Generation in the Yuma Basin

Facility Name	Ownership	City/Location Served	Population Served	Volume Treated/Generated (acre-feet)	Disposal Method							Current Treatment Level	Population Not Served	Year of Record
					Water-course	Evaporation Pond	Irrigation	Golf Course	Wildlife Area	Discharged to Another Facility	Infiltration Basins			
ADOC - Yuma WWTP	State of Arizona	Yuma	2100	336		X	X					NA	NA	2003
Cocopah North Community	Cocopah Tribe	Reservation	140	17							X	Secondary	140	2000
Del Oro WWTF	Far West Water & Sewer	Yuma	1240*	82				Fortuna Del Rey				NA		
Del Pueblo RV & Tennis Resort	Private	RV Park	700	NA										
Desert Dunes/East Mesa	Yuma	Yuma	NA	112							X	NA		
Donavan Estates	Yuma	Yuma	400							Yuma Figueroa				
Fisher's Landing	Private	Fisher's Landing	72	41		X						NA		2004
Gadsen WWTP	Gadsen SD	Gadsen	888	NA						X		NA		2001
Hidden Shores WWTP	Private	RV Park	NA	<56	NA									2004
Jack Rabbit Mesa WPCF	Yuma	Yuma	2,200	224		X						Secondary	NA	2004
Marine Corps Air Station-Main WWTP	US Marines	Yuma	NA							Desert Dunes		NA		2004
Marine Corps Air Station-Recreation Area WWTF	US Marines	Yuma	NA											
Marwood WWTF	Far West Water & Sewer	Yuma	4,000*	220				Foothills Executive/ Foothills Par 3				NA		2004
Mesa Del Ray	Far West Water & Sewer	Yuma	140*	10				Mesa Del Sol				NA		2004
Palm Shadows WWTP	Far West Water & Sewer	Yuma	680*	103							X	NA		2004
Pioneer Center	Private	Yuma	NA											
San Luis SBR	San Luis	San Luis	20,888	1,680	Colorado River							Adv. Trt. I	NA	2003
Seasons RV Village	Far West Water & Sewer	Yuma	740*	34							X	NA		2004
Section 14 WWTP	Far West Water & Sewer	Yuma	880*	26			X					NA		2004
Somerton WWTF	Somerton	Somerton	7,355	612	Colorado River							Adv. Trt. I	NA	2004
Sweetwater Creek Utilities WWTF	Private	Yuma	581	101		X						NA		2003
Villa Royale WWTF[1]	Far West Water & Sewer	Yuma	60*	4						Mesa Del Ray		NA		2004
Windhaven RV Park	Private	RV Park	120	NA										2004
Yuma County Housing WWTP	Yuma County	Yuma	160	NA										2004
YUMA Figueroa WPCF	Yuma	Yuma	87,330	9,520	Colorado River							Adv. Trt. I	15,305	2001
Yuma, Jones & Main WTP	Yuma	Yuma	NA	33.6	Colorado River							NA		2000

NA: Data not currently available to ADWR
* Population fluxuates seasonally, population shown is the annual average.
[1]Plant will combine with Mesa Del Ray in Fall 2005
WWTF: Waste Water Treatment Facility
WWTP: Waste Water Treatment Plant
SBR: Sequencing Batch Reactor
WPCF: Water Pollution Control Facility

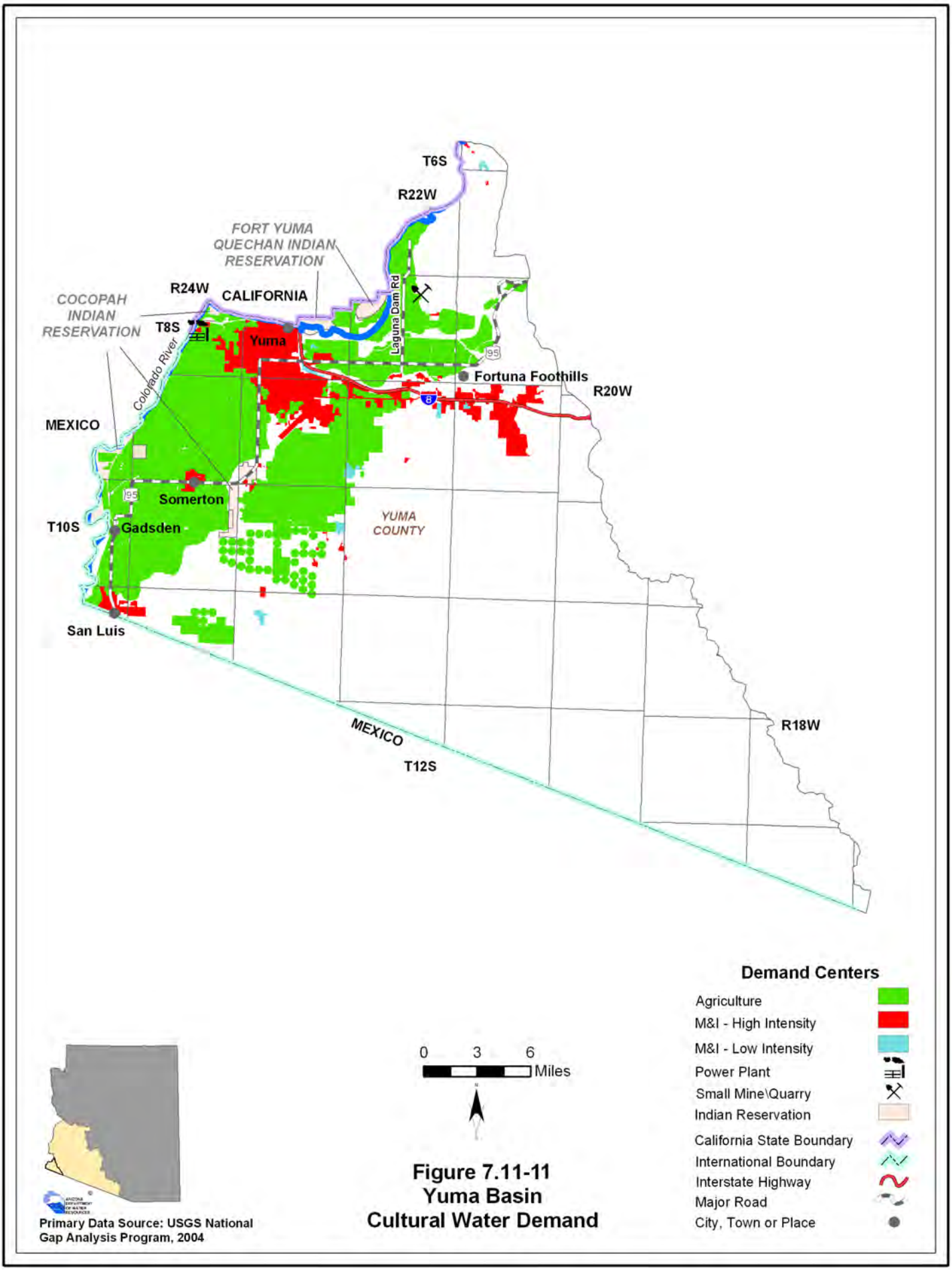


Figure 7.11-11
Yuma Basin
Cultural Water Demand

7.11.9 Water Adequacy Determinations in the Yuma 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 7.11-10. Figure 7.11-12 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 A. Adequacy determination data sources and methods are found in Volume 1, Sections 1.3.1.

Water Adequacy Reports

- See Table 7.11-10
- As of May 2005, 227 subdivisions have been reviewed for an adequacy determination. All subdivisions are in Yuma County.
- Of the 24,579 lots in 225 subdivisions for which lot information is available, 24,358 lots or 99% were determined to be adequate.
- Reasons for a determination of inadequacy included water quality, insufficient water supply and the applicant failed to demonstrate a legal right to use the water.

Table 7.11-10 Adequacy Determinations in the Yuma Basin[1]

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determinatio	Reason(s) for Inadequacy Determination	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
1	Araby Eight Commercial Estates	Yuma	9 South	22 West	4	12		Adequate		07/20/73	Dry Lot Subdivision
2	Bienestar Estates	Yuma	11 South	25 West	12	448		Adequate		09/29/82	Fortuna Water Company
3	Bienestar Estates # 2	Yuma	11 South	24 West	7	450		Adequate		09/26/89	City of San Luis
4	Bienestar Estates # 3	Yuma	11 South	24 West	7	291		Adequate		12/17/91	City of San Luis
5	Bienestar Estates # 4	Yuma	11 South	25 West	1	303		Adequate		12/15/94	City of San Luis
6	Bienestar Estates # 5	Yuma	11 South	24 West	6	281		Adequate		03/09/95	City of San Luis
7	Bienestar Estates # 6	Yuma	11 South	24 West	7	364	22-300489	Adequate		07/07/98	City of San Luis
8	Bienestar Estates # 6A	Yuma	11 South	24 West	7	23	22-400687	Adequate		08/08/02	City of San Luis
9	Bienestar Estates # 7A & 7B	Yuma	11 South	24 West	6	318	22-400677	Adequate		08/08/02	City of San Luis
10	Bienestar Estates # 7C	Yuma	11 South	24 West	6	20	22-401842	Adequate		11/14/05	City of San Luis
11	Bienestar Estates # 8A	Yuma	11 South	24 West	7	403	22-401721	Adequate		07/08/05	City of San Luis
12	Bienestar Estates # 8B	Yuma	11 South	24 West	7	404	22-401843	Adequate		09/28/05	City of San Luis
13	Blaisdell	Yuma	8 South	21 West	21	10		Inadequate	C	02/26/75	Dry Lot Subdivision
14	Bradley Estates	Yuma	9 South	24 West	11	32		Adequate		02/21/74	Dry Lot Subdivision
15	Casa del Sol Townhouses # 1	Yuma	9 South	21 West	4	26		Adequate		12/18/84	Far West Water Company
16	Corcovado Townhouses	Yuma	9 South	21 West	10	37		Adequate		12/22/81	Far West Water Company
17	D J Ranch	Yuma	9 South	23 West	35	18	22-400458	Adequate		01/29/01	Dry Lot Subdivision
18	Daybreak	Yuma	9 South	21 West	4	48	22-400134	Adequate		07/21/99	Far West Water Company
19	Debra Jean Estates	Yuma	9 South	23 West	17	15		Adequate		02/10/78	Dry Lot Subdivision
20	Del Rey Estates	Yuma	9 South	21 West	6	31	22-401215	Adequate		06/16/04	Farwest Water & Sewer Inc.
21	Del Sur	Yuma	9 South	22 West	12	64		Adequate		07/17/73	Subdivision wells
22	Desert Air Mobile Estates # 1 & 2	Yuma	9 South	22 West	11	100		Adequate		01/30/78	Desert Air Water Company
23	Desert Fairways	Yuma	9 South	21 West	4	80		Adequate		12/14/93	Far West Water Company
24	Desert Foothills Estates # 2	Yuma	9 South	21 West	8	49		Adequate		12/03/80	Far West Water Company
25	Desert Foothills Estates # 3	Yuma	9 South	21 West	10	22		Adequate		08/30/82	Far West Water Company
26	Desert Foothills Estates # 4	Yuma	9 South	21 West	10	20		Adequate		09/01/82	Far West Water Company

Table 7.11-10 Adequacy Determinations in the Yuma Basin (cont'd.)[1]

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determinatio	Reason(s) for Inadequacy Determination	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
27	Desert Foothills Estates # 5	Yuma	9 South	21 West	10	39		Adequate		04/27/90	Far West Water Company
28	Desert Foothills Estates # 6	Yuma	9 South	21 West	10	18		Adequate		04/29/92	Far West Water Company
29	Desert Foothills Estates # 7	Yuma	9 South	21 West	10	61		Inadequate	C	09/28/94	Far West Water Company
30	Desert Foothills Estates # 8	Yuma	9 South	21 West	10	28	22-400634	Adequate		02/12/02	Far West Water & Sewer Inc.
31	Desert Ranchos	Yuma	9 South	22 West	23	32		Adequate		01/27/75	Dry Lot Subdivision
32	Desert Star Estates Subdivision	Yuma	9 South	23 West	24	19	22-400592	Adequate		01/17/02	Tierra Mesa Estates Water Co. Inc.
33	Desert Valley Estates	Yuma	10 South	24 West	3	104	22-400906	Adequate		03/31/03	City of Somerton
34	Donley Estates	Yuma	10 South	23 West	8	14	22-400020	Adequate		03/01/99	Dry Lot Subdivision
35	El Camino Casitas	Yuma	9 South	21 West	4	40		Adequate		06/15/81	Far West Water Company
36	El Prado Estates	Yuma	8 South	22 West	28	259		Adequate		06/19/92	El Prado Water Company
37	Escondido Beach	Yuma	11 South	25 West	2	26		Adequate		11/19/73	Fortuna Water Company
38	Escondido Beach # 2	Yuma	11 South	25 West	1, 2	41		Adequate		05/17/74	Fortuna Water Company
39	Estrella at Mesa Del Sol Unit 1	Yuma	9 South	21 West	4, 6	149	22-400978	Adequate		07/07/03	Far West Water Company
40	Estrella at Mesa Del Sol Unit 2	Yuma	9 South	21 West	5	126	22-401421	Adequate		11/05/04	Far West Water Company
41	Foothills # 5B	Yuma	9 South	21 West	9	16		Adequate		08/28/73	Far West Water Company
42	Foothills # 5C	Yuma	9 South	21 West	9	69		Adequate		09/23/76	Far West Water Company
43	Foothills # 5D	Yuma	9 South	21 West	9	18		Adequate		08/17/87	Far West Water Company
44	Foothills Mobile Estates	Yuma	9 South	21 West	3	98		Adequate		02/01/78	Far West Water Company
45	Foothills Mobile Estates # 2	Yuma	9 South	21 West	15	338		Adequate		08/08/78	Far West Water Company
46	Foothills Mobile Estates # 3	Yuma	9 South	21 West	15	343		Adequate		12/28/79	Far West Water Company
47	Foothills Mobile Estates # 4	Yuma	9 South	21 West	15	176		Adequate		03/28/80	Far West Water Company
48	Foothills Mobile Estates # 5	Yuma	9 South	21 West	15	192		Adequate		07/09/81	Far West Water Company
49	Foothills Mobile Estates # 6	Yuma	9 South	21 West	9	142		Adequate		08/30/82	Far West Water Company
50	Foothills Mobile Estates # 7	Yuma	9 South	21 West	14, 15	214		Adequate		10/25/82	Far West Water Company
51	Foothills Mobile Estates # 8	Yuma	9 South	21 West	15	17		Adequate		09/01/82	Far West Water Company
52	Foothills Mobile Estates # 9	Yuma	9 South	21 West	22	284		Adequate		03/08/84	Far West Water Company

Table 7.11-10 Adequacy Determinations in the Yuma Basin (cont'd.)[1]

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determinatio	Reason(s) for Inadequacy Determination	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
53	Foothills Mobile Estates # 10	Yuma	9 South	21 West	9	91		Adequate		12/22/82	Far West Water Company
54	Foothills Mobile Estates # 11	Yuma	9 South	21 West	22	240		Adequate		02/10/84	Far West Water Company
55	Foothills Mobile Estates # 12	Yuma	9 South	21 West	22	278		Adequate		03/06/85	Far West Water Company
56	Foothills Mobile Estates # 13	Yuma	9 South	21 West	22, 23	311		Adequate		05/18/89	Far West Water Company
57	Foothills Mobile Estates # 14	Yuma	9 South	21 West	9	365		Adequate		01/29/86	Far West Water Company
58	Foothills Mobile Estates # 15	Yuma	9 South	21 West	22, 23	276		Adequate		05/12/94	Far West Water Company
59	Foothills Mobile Estates # 16	Yuma	9 South	21 West	15	188		Adequate		10/06/93	Far West Water Company
60	Foothills Mobile Estates # 17	Yuma	9 South	21 West	22, 23	302		Adequate		01/27/95	Far West Water Company
61	Foothills Mobile Estates # 18	Yuma	9 South	21 West	22, 23	267	22-300094	Adequate		02/15/96	Far West Water Company
62	Foothills Mobile Estates # 19	Yuma	9 South	21 West	22, 23	151	22-300132	Adequate		04/17/96	Far West Water Company
63	Foothills Mobile Estates # 19A	Yuma	9 South	21 West	23	13	22-400145	Adequate		10/19/99	Far West Water Company
64	Foothills Mobile Estates # 20	Yuma	9 South	21 West	22	264	22-300212	Adequate		10/18/96	Far West Water Company
65	Foothills Mobile Estates # 21	Yuma	9 South	21 West	22	193	22-300277	Adequate		05/01/97	Far West Water Company
66	Foothills Mobile Estates # 22	Yuma	9 South	21 West	22	172	22-300376	Adequate		12/09/97	Far West Water Company
67	Foothills Mobile Estates # 23	Yuma	9 South	21 West	22	45	22-300325	Adequate		07/28/97	Far West Water Company
68	Foothills Mobile Estates # 24	Yuma	9 South	21 West	22	203	22-300468	Adequate		06/09/98	Far West Water Company
69	Foothills Mobile Estates # 25	Yuma	9 South	21 West	16	294	22-300520	Adequate		09/08/98	Far West Water Company
70	Foothills Mobile Estates # 26	Yuma	9 South	21 West	16	288	22-300589	Adequate		02/17/99	Far West Water Company
71	Foothills Mobile Estates # 27	Yuma	9 South	21 West	23	248	22-400155	Adequate		08/18/99	Far West Water Company
72	Foothills Mobile Estates # 27A	Yuma	9 South	21 West	23	10	22-400486	Adequate		04/06/01	Far West Water Company
73	Foothills Mobile Estates # 27B	Yuma	9 South	21 West	23	10	22-400796	Adequate		11/21/02	Far West Water and Sewer Inc.
74	Foothills Mobile Estates # 28	Yuma	9 South	21 West	23	264	22-400485	Adequate		04/06/01	Far West Water Company
75	Foothills Mobile Estates # 29	Yuma	9 South	21 West	23	361	22-400559	Adequate		08/01/01	Far West Water Company
76	Foothills Mobile Estates # 30	Yuma	9 South	21 West	23	348	22-400754	Adequate		07/02/02	Far West Water and Sewer
77	Foothills Mobile Estates # 31	Yuma	9 South	21 West	14	152	22-400911	Adequate		03/31/03	Far West Water Company
78	Foothills Mountain Estates	Yuma	9 South	21 West	9	66		Adequate		10/10/74	Far West Water Company

Table 7.11-10 Adequacy Determinations in the Yuma Basin (cont'd.)[1]

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determinatio	Reason(s) for Inadequacy Determination	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
79	Foothills North # 3	Yuma	9 South	21 West	2	313		Adequate		11/13/84	Far West Water Company
80	Foothills North # 4	Yuma	9 South	21 West	2	211		Adequate		05/18/94	Far West Water Company
81	Fortuna Golf Units # 2 & 3	Yuma	9 South	21 West	3	32	22-401829	Adequate		11/01/05	Far West Water & Sewer
82	Fortuna Heights	Yuma	9 South	21 West	6	260		Adequate		02/27/74	Far West Water Company
83	Fortuna Hills	Yuma	9 South	21 West	2	63	22-300312	Adequate		05/16/97	Far West Water Company
84	Fortuna Road Commercial	Yuma	9 South	21 West	8	6		Adequate		03/30/94	Far West Water Company
85	Fortuna Road Commercial # 2	Yuma	9 South	21 West	8	15	22-300026	Adequate		06/27/95	Far West Water Company
86	Fortuna Trails	Yuma	9 South	21 West	15	122		Adequate		10/25/84	Far West Water Company
87	Gadsden Estates # 2	Yuma	10 South	25 West	13	56		Adequate		03/30/81	Gadsden Water Company
88	Gila Acres	Yuma	8 South	23 West	26	29		Inadequate	A1	10/17/73	Dry Lot Subdivision
89	Gold Cup Estates	Yuma	10 South	23 West	7	8		Adequate		10/16/74	Dry Lot Subdivision
90	Goldwater Ranch	Yuma	9 South	22 West	29	10	22-400457	Adequate		01/30/01	Dry Lot Subdivision
91	Green Acres # 2	Yuma	9 South	23 West	20	71		Adequate		06/23/80	Green Acres Water Company
92	J & S	Yuma	9 South	21 West	22	7	22-401684	Adequate		04/06/05	Far West Water & Sewer Inc.
93	Jess Gomez' Mountain View Estates	Yuma	9 South	21 West	3	9		Adequate		02/03/94	Far West Water Company
94	Jones Resubdivision	Yuma	9 South	22 West	12	24		Adequate		02/11/77	Dry Lot Subdivision
95	King Ranch	Yuma	9 South	23 West	24	10	22-400219	Adequate		01/18/00	Dry Lot Subdivision
96	La Quinta Estates	Yuma	9 South	24 West	25	23		Adequate		09/19/78	Dry Lot Subdivision
97	Lackner Estates	Yuma	9 South	24 West	34	17		Adequate		03/11/93	City of Somerton
98	Las Barrancas # 1	Yuma	9 South	21 West	14	230	22-401609	Adequate		09/19/05	Far West Water & Sewer Inc.
99	Las Fuentes	Yuma	11 South	24 West	7	NA	22-300576	Adequate		04/19/99	San Luis Municipal Water Company
100	Las Haciendas	Yuma	9 South	24 West	34	76	22-400204	Adequate		11/22/99	City of Somerton
101	Las Quintas De San Luis Phase I & II	Yuma	11 South	24 West	6	207	22-400521	Adequate		06/20/01	City of San Luis
102	Las Terrazzas	Yuma	11 South	24 West	7	37		Adequate		10/04/91	City of San Luis
103	Las Villas de San Luis # 1 & 2	Yuma	11 South	24 West	7	202	22-400005	Adequate		04/19/99	City of San Luis
104	Los Amigos	Yuma	9 South	21 West	6	206		Adequate		01/20/81	Far West Water Company

Table 7.11-10 Adequacy Determinations in the Yuma Basin (cont'd.)[1]

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determinatio	Reason(s) for Inadequacy Determination	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
105	Los Jardines de la Plaza	Yuma	11 South	25 West	11	313		Adequate		07/07/92	City of San Luis
106	Los Portales del Alamo Unit 2	Yuma	11 South	25 West	2	49		Adequate		05/08/80	Fortuna Water Company
107	Los Portales del Alamo Unit 3	Yuma	11 South	25 West	2	46		Adequate		10/15/80	Fortuna Water Company
108	Los Portales del Alamo Unit 4	Yuma	11 South	25 West	2	85		Adequate		03/13/81	Fortuna Water Company
109	Los Portales del Alamo Unit 4 Phase I	Yuma	11 South	25 West	2	42		Adequate		09/01/89	City of San Luis
110	Los Portales del Alamo Unit 4 Phase II	Yuma	11 South	25 West	2	50		Adequate		11/08/89	City of San Luis
111	Los Portales del Alamo Unit 4 Phase III	Yuma	11 South	25 West	2	239		Adequate		01/10/92	City of San Luis
112	Los Portales del Alamo Unit 4 Phases IV & V	Yuma	11 South	25 West	2	183	22-400208	Adequate		12/20/99	City of San Luis
113	Los Portales del Alamo Unit 6	Yuma	11 South	25 West	2	6		Adequate		10/31/82	Fortuna Water Company
114	Lucky Lou Subdivision	Yuma	10 South	23 West	7	14	22-400066	Adequate		05/03/99	Dry Lot Subdivision
115	Mesa View	Yuma	9 South	22 West	17	48	22-400518	Adequate		06/14/01	Dry Lot Subdivision
116	Mesa del Sol # 1	Yuma	9 South	21 West	4	72		Adequate		08/24/79	Far West Water Company
117	Mesa del Sol # 2	Yuma	9 South	21 West	4	121		Adequate		01/23/80	Far West Water Company
118	Mesa del Sol # 3	Yuma	9 South	21 West	5	156		Adequate		02/24/81	Far West Water Company
119	Mesa del Sol # 4	Yuma	9 South	21 West	4	81		Adequate		05/04/84	Far West Water Company
120	Mesa del Sol # 5	Yuma	9 South	21 West	4	35		Adequate		05/02/84	Far West Water Company
121	Mesa del Sol # 6	Yuma	9 South	21 West	5	65		Adequate		01/03/85	Far West Water Company
122	Mesa del Sol # 7	Yuma	9 South	21 West	5	74		Adequate		01/03/85	Far West Water Company
123	Mesa del Sol # 8	Yuma	9 South	21 West	4, 5	40		Adequate		10/23/91	Far West Water Company
124	Mesa del Sol # 9	Yuma	9 South	21 West	5	54		Adequate		01/17/95	Far West Water Company
125	Mesa del Sol Commercial	Yuma	9 South	21 West	5	7		Adequate		03/15/93	Far West Water Company
126	Mesa Del Sol Unit # 10	Yuma	9 South	21 West	5	52	22-400484	Adequate		04/06/01	Far West Water Company
127	Mesa Del Sol Unit # 11	Yuma	9 South	21 West	5	50	22-400483	Adequate		04/06/01	Far West Water Company
128	Mesa Del Sol Unit # 12	Yuma	9 South	21 West	5	135	22-401488	Adequate		09/09/04	Far West Water Company
129	Mesa Dunes Estates	Yuma	9 South	22 West	22	32		Adequate		07/26/76	Dry Lot Subdivision
130	Mountain Shadows # 3	Yuma	9 South	21 West	4	59		Adequate		04/13/94	Far West Water Company

Table 7.11-10 Adequacy Determinations in the Yuma Basin (cont'd.)[1]

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determinatio	Reason(s) for Inadequacy Determination	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
131	Mountain Shadows # 4	Yuma	9 South	21 West	4	34	22-300155	Adequate		10/18/96	Far West Water Company
132	Mountain View Estates # 4	Yuma	9 South	21 West	4			Adequate		08/02/88	Far West Water Company
133	Mountain View Unit # 1	Yuma	9 South	21 West	5	83	22-400636	Adequate		01/08/02	Far West Water Company
134	Mountain View Unit # 2	Yuma	9 South	21 West	5	132	22-400897	Adequate		03/07/03	Far West Water Company
135	Mountain View Unit # 3	Yuma	9 South	21 West	5	180	22-401218	Adequate		05/25/04	Far West Water Company
136	Mountain Vista Estates # 1 & 2	Yuma	9 South	21 West	4	40		Adequate		08/01/83	Far West Water Company
137	Mountain Vista Estates # 3 & 3A	Yuma	9 South	21 West	4	32		Adequate		10/08/85	Far West Water Company
138	Mountain Vista Estates Unit # 5	Yuma	9 South	21 West	4	44	22-401427	Adequate		09/30/04	Far West Water Company
139	Oasis del Este # 2	Yuma	9 South	21 West	8	87		Adequate		12/12/83	Far West Water Company
140	Oasis del Este # 3	Yuma	9 South	21 West	8	90		Adequate		05/13/86	Far West Water Company
141	Oasis del Este # 4	Yuma	9 South	21 West	8	90		Adequate		05/13/86	Far West Water Company
142	Oasis del Oeste	Yuma	9 South	21 West	8	52		Adequate		07/09/81	Far West Water Company
143	Orange Grove Mobile Manor	Yuma	9 South	23 West	31	21		Adequate		11/06/73	Orange Grove Water Company
144	Orange Grove Mobile Manor # 2	Yuma	9 South	23 West	31	29		Adequate		07/08/75	Orange Grove Water Company
145	Orange Grove Mobile Manor # 3	Yuma	9 South	23 West	31	27		Adequate		10/11/77	Orange Grove Water Company
146	Orange Grove Mobile Manor # 4	Yuma	9 South	23 West	31	29		Adequate		02/20/79	Orange Grove Water Company
147	Orange Grove Mobile Manor # 5	Yuma	9 South	23 West	31	63		Adequate		10/15/80	Orange Grove Water Company
148	Purple Mountain Subdivision	Yuma	9 South	22 West	31	10	22-401312	Adequate		12/20/04	Dry Lot Subdivision
149	R Circle J Estates	Yuma	9 South	22 West	12	46		Adequate		06/26/75	Dry Lot Subdivision
150	Rancheros Bonitos	Yuma	9 South	22 West	30	24		Adequate		03/11/78	Rancheros Bonitos Water Company
151	Rancheros Bonitos # 2	Yuma	9 South	22 West	30	24	22-300136	Adequate		11/21/96	Rancheros Bonitos Water Company
152	Rancho Bonitos Co-op Park	Yuma	9 South	22 West	30	121		Inadequate	B	02/15/87	Rancheros Bonitos Water Company
153	Rancho del Oro # 1	Yuma	9 South	21 West	5	110		Adequate		03/24/84	Far West Water Company
154	Rancho Del Oro # 2 Phase I & II	Yuma	9 South	21 West	5	97	22-400382	Adequate		09/12/00	Far West Water Company
155	Rancho Del Sol	Yuma	8 South	23 West	8	15	22-400151	Adequate		08/18/99	Dry Lot Subdivision
156	Rancho Don Carlos	Yuma	11 South	24 West	7	57	22-300131	Adequate		11/13/96	City of San Luis

Table 7.11-10 Adequacy Determinations in the Yuma Basin (cont'd.)[1]

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determinatio	Reason(s) for Inadequacy Determination	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
157	Rancho Los Oros	Yuma	11 South	25 West	2	183	22-400006	Adequate		04/19/99	City of San Luis
158	Rancho Mesa Verde	Yuma	9 South	23 West	6	53		Adequate		04/21/84	Orange Grove Water Company
159	Rancho Mesa Verde # 2	Yuma	10 South	23 West	6	54		Adequate		07/17/86	Orange Grove Water Company
160	Rancho Mesa Verde # 3	Yuma	10 South	23 West	6	56		Adequate		03/23/89	Orange Grove Water Company
161	Rancho San Luis	Yuma	11 South	25 West	2	143		Adequate		09/01/89	City of San Luis
162	Ranchos el Toreo	Yuma	9 South	22 West	12	28		Adequate		08/22/79	Dry Lot Subdivision
163	Ravines # 2	Yuma	9 South	21 West	14	212	22-401610	Adequate		09/19/05	Far West Water & Sewer Inc.
164	Ravines # 3	Yuma	9 South	21 West	14	210	22-401608	Adequate		09/19/05	Far West Water & Sewer Inc.
165	Riebe Ranchettes	Yuma	9 South	22 West	30	8		Adequate		12/04/84	Dry Lot Subdivision
166	Rio Sereno Subdivision	Yuma	11 South	25 West	2	95	22-400341	Adequate		07/21/00	City of San Luis
167	Rivera Estates	Yuma	9 South	24 West	34	24	22-400013	Adequate		06/14/99	City of Somerton
168	Santa Clara Estates Phase I	Yuma	10 South	24 West	3	15	22-400535	Adequate		06/27/01	City of Somerton
169	Santa Clara Estates Phase II	Yuma	10 South	24 West	3	22	22-400534	Adequate		06/27/01	City of Somerton
170	Santa Clara Estates Phase III	Yuma	10 South	24 West	3	76	22-400782	Adequate		10/09/02	City of Somerton
171	Schechert Estates	Yuma	9 South	21 West	23	16	22-400913	Adequate		03/31/03	Far West Water Company
172	Scottsdale East Estates	Yuma	9 South	21 West	8	114	22-401187	Adequate		07/20/04	Far West Water and Sewer
173	Seasons RV Village Unit 1	Yuma	9 South	21 West	6	157	22-400009	Adequate		02/05/99	Far West Water Company
174	Seasons RV Village Unit 2	Yuma	9 South	21 West	6	136	22-400309	Adequate		05/24/00	Far West Water Company
175	Seasons RV Village Unit 3	Yuma	9 South	21 West	6	125	22-400547	Adequate		12/01/05	Far West Water Company
176	Seasons RV Village Unit 4	Yuma	9 South	21 West	6	133	22-400967	Adequate		06/17/03	Far West Water Company
177	Seasons RV Village Unit 5	Yuma	9 South	21 West	6	133	22-400966	Adequate		06/17/03	Far West Water Company
178	Sienna at Mesa Del Sol	Yuma	9 South	21 West	4, 5	60	22-400724	Adequate		07/03/02	Far West Water & Sewer Inc.
179	Sierra Ridge	Yuma	9 South	21 West	9	171	22-401419	Adequate		08/16/04	Far West Water & Sewer
180	Sierra Sands	Yuma	9 South	22 West	31	32	22-300197	Adequate		10/16/96	Dry Lot Subdivision
181	Sinclair Ranch	Yuma	9 South	23 West	13	8		Adequate		06/24/91	Dry Lot Subdivision
182	Somerton Heights	Yuma	10 South	24 West	3	102		Adequate		08/18/76	City of Somerton

Table 7.11-10 Adequacy Determinations in the Yuma Basin (cont'd.)[1]

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determinatio	Reason(s) for Inadequacy Determination	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
183	Somerton Villa	Yuma	9 South	24 West	34	111		Adequate		09/10/87	City of Somerton
184	Southern Sands Mobile Estates	Yuma	9 South	21 West	6	51		Adequate		10/11/85	Far West Water Company
185	Sun Leisure Estates	Yuma	9 South	23 West	28	152		Adequate		07/14/78	Private
186	Sunburst Estates	Yuma	9 South	24 West	10	42		Adequate		07/02/76	Dry Lot Subdivision
187	Taub Subdivision	Yuma	9 South	22 West	20	31	22-400057	Adequate		04/14/99	Dry Lot Subdivision
188	Tierra Bonita Subdivision	Yuma	9 South	23 West	24	15	22-400637	Adequate		02/11/02	Tierra Mesa Estates Water Company
189	Tierra Mesa Estates 1-5	Yuma	9 South	23 West	24	126		Adequate		09/15/78	Improvement District
190	Tierra Mesa Estates 6-9	Yuma	9 South	23 West	24	97		Adequate		05/04/89	Tierra Mesa Water Company
191	Valle Del Sol Phase I & II	Yuma	10 South	24 West	3	201	22-401720	Adequate		09/08/05	City of Somerton
192	Valle Sereno	Yuma	10 South	24 West	3	80	22-400342	Adequate		07/10/00	City of Somerton
193	Valle Sereno Estates Phase III	Yuma	10 South	24 West	3	18	22-400900	Adequate		03/20/03	City of Somerton
194	Valle Sereno Estates Phase IV	Yuma	10 South	24 West	3	55	22-400910	Adequate		03/31/03	City of Somerton
195	Valle Sereno Estates Phase V	Yuma	10 South	24 West	3	39	22-401247	Adequate		06/16/04	City of Somerton
196	Valle Sereno Estates Phase VI	Yuma	10 South	24 West	3	41	22-401287	Adequate		03/18/05	City of Somerton
197	Valley Citrus Estates	Yuma	8 South	24 West	25	33		Adequate		11/05/73	Dry Lot Subdivision
198	Vargas Estates	Yuma	9 South	24 West	34	77	22-400834	Adequate		10/17/02	City of Somerton
199	Villa Chaparal # 1	Yuma	9 South	21 West	7	118	22-400783	Adequate		08/16/02	Far West Water and Sewer Inc.
200	Villa Chaparral # 2	Yuma	9 South	21 West	7	59	22-401238	Adequate		05/25/04	Far West Water Company
201	Villa Chaparral # 3	Yuma	9 South	21 West	7	141	22-401288	Adequate		07/20/04	Far West Water Company
202	Villa Chaparral # 4	Yuma	9 South	21 West	7	157	22-401655	Adequate		04/08/05	Far West Water & Sewer
203	Villa de Coronado	Yuma	9 South	21 West	4	41		Adequate		09/23/83	Far West Water Company
204	Villa del Rey Townhouses	Yuma	9 South	21 West	4	144		Adequate		08/08/80	Far West Water Company
205	Villa Royale Townhouses	Yuma	9 South	21 West	4	35		Adequate		05/20/80	Far West Water Company
206	Villas	Yuma	9 South	21 West	8	62		Adequate		09/27/91	Far West Water Company
207	Vista Del Sol Unit 1	Yuma	9 South	22 West	12	107	22-300510	Adequate		08/17/98	Far West Water Company
208	Vista Montana # 1	Yuma	9 South	21 West	15	44		Adequate		05/08/78	Far West Water Company

Table 7.11-10 Adequacy Determinations in the Yuma Basin (cont'd.)[1]

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determinatio	Reason(s) for Inadequacy Determination	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
209	Vista Montana # 2	Yuma	9 South	21 West	15	44		Adequate		01/17/79	Far West Water Company
210	Westhoff Manor Condominiums	Yuma	9 South	24 West	34	16	22-400236	Adequate		01/12/00	City of Somerton
211	Yuma East # 2	Yuma	9 South	21 West	8	127		Adequate		05/16/79	Far West Water Company
212	Yuma East # 3 & 4	Yuma	9 South	21 West	10	506		Adequate		12/03/80	Far West Water Company
213	Yuma East # 5	Yuma	9 South	21 West	7	87		Adequate		04/23/85	Far West Water Company
214	Yuma East # 6	Yuma	9 South	21 West	8	22		Adequate		03/30/94	Far West Water Company
215	Yuma East Estates # 1	Yuma	9 South	21 West	7	175		Adequate		08/03/94	Far West Water Company
216	Yuma East Estates # 2 Phase II	Yuma	9 South	21 West	7	137	22-300477	Adequate		06/11/98	Far West Water Company
217	Yuma East Estates # 7& 8	Yuma	9 South	21 West	7	130	22-401278	Adequate		07/20/04	Far West Water Company
218	Yuma East Estates # 9 & 10	Yuma	9 South	21 West	7	122	22-401656	Adequate		04/08/05	Far West Water & Sewer Inc.
219	Yuma East Estates Phase III & IV	Yuma	9 South	21 West	7	104	22-400629	Adequate		02/12/02	Far West Water Company
220	Yuma Meadows Unit 3	Yuma	9 South	21 West	7	58	22-400673	Adequate		04/11/02	Far West Water Company
221	Yuma Meadows Units 1 & 2	Yuma	9 South	21 West	7	111	22-400435	Adequate		12/11/00	Far West Water Company
222	Yuma Meadows Unit 4	Yuma	9 South	21 West	7	91	22-400873	Adequate		02/12/03	Far West Water Company
223	Yuma Mesa East	Yuma	9 South	21 West	8	52		Adequate		11/09/78	Far West Water Company
224	Yuma Venture	Yuma	9 South	21 West	9	125		Adequate		12/05/83	Far West Water Company
225	Zocalo Gardens # 1	Yuma	10 South	24 West	3	68		Adequate		03/10/81	City of Somerton
226	Zocalo Gardens # 3	Yuma	10 South	24 West	3	40		Adequate		11/15/83	City of Somerton
227	Zocalo Gardens # 4	Yuma	10 South	24 West	3	100		Adequate		02/03/89	City of Somerton

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 determination.

[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

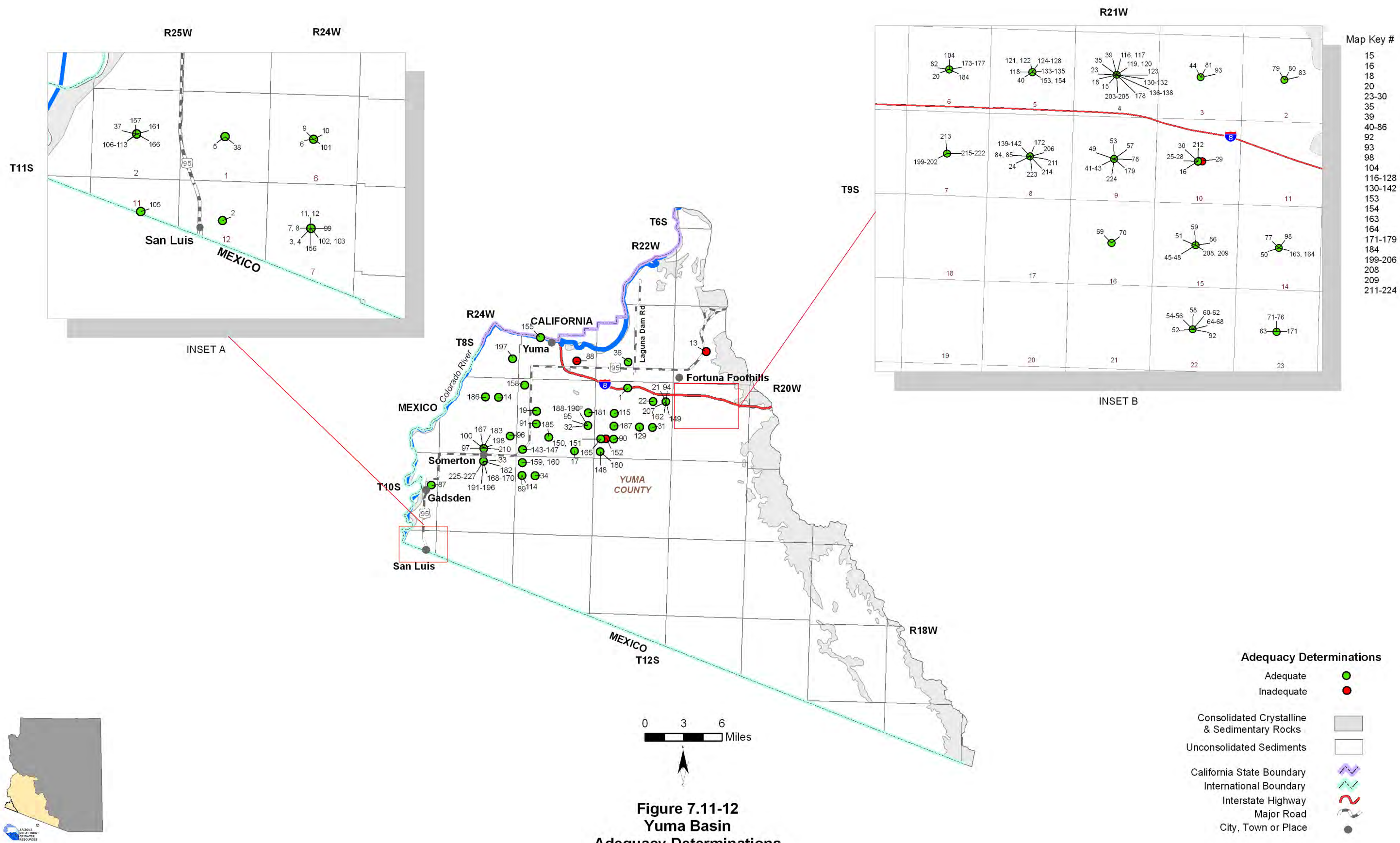


Figure 7.11-12
Yuma Basin
Adequacy Determinations

Yuma Basin
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A

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ACRONYMS AND ABBREVIATIONS

ACC	Arizona Corporation Commission
ADMMR	Arizona Department of Mines and Mineral Resources
ADWR	Arizona Department of Water Resources
ADEQ	Arizona Department of Environmental Quality
ADOC	Arizona Department of Commerce
ALERT	Automated Local Evaluation in Real Time
ALRIS	Arizona Land Resource Information System
AMA	Active Management Area
APS	Arizona Public Service
ARS	Arizona Revised Statute
ASDM	Arizona-Sonora Desert Museum
ASLD	Arizona State Land Department
AWBA	Arizona Water Banking Authority
AWPF	Arizona Water Protection Fund
AZDA	Arizona Department of Agriculture
AZGF	Arizona Game and Fish Department
AZMET	Arizona Meteorological Network
BIA	United States Bureau of Indian Affairs
BCPA	Boulder Canyon Project Act
BECC	Border Environment Cooperation Commission
BLM	United States Bureau of Land Management
CAP	Central Arizona Project
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CLIMAS	Climate Assessment for the Southwest
CNWR	Cibola National Wildlife Refuge
CRIT	Colorado River Indian Tribes
CVCA	Cibola Valley Conservation Area
CVIDD	Cibola Valley Irrigation and Drainage District
DES	Arizona Department of Economic Security
DOD	United States Department of Defense
DWID	Domestic Water Improvement District
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FR	Federal Register
GIS	Geographic Information System
gpcd	Gallons per capita per day
gpm	Gallons per minute
GSF	Groundwater Savings Facility
GWSI	Groundwater Site Inventory System
HIA	Historically Irrigated Acres
HSR	Hydrographic Survey Report
HUC	Hydrologic Unit Code

HVID	Harquahala Valley Irrigation District
ID	Irrigation District
IDD	Irrigation and Drainage District
IGA	Intergovernmental Agreement
INA	Irrigation Non-Expansion Area
INWR	Imperial National Wildlife Refuge
IOPP	Inadvertent Overrun and Payback Policy
ITCA	Intertribal Council of Arizona
LCR MSCP	Lower Colorado River Multi-Species Conservation Program
LDIG	Local Drought Impact Group
LUST	Leaking Underground Storage Tank
MCWA	Mohave County Water Authority
maf	Million acre-feet
mg/L	milligrams per liter
M&I	Municipal and Industrial
MOD	Main Outlet Drain
MODE	Main Outlet Drain Extension
NHD	National Hydrography Dataset
NIB	Northerly International Boundary
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List (Superfund)
NPS	United States National Park Service
NRCD	Natural Resources Conservation District
NRCS	Natural Resources Conservation Service
NWIS	National Water Information System
NWR	National Wildlife Refuge
NWS	National Weather Service
Pan ET	Pan Evaportranspiration
PCE	Tetrachloroethene
PDO	Pacific Decadal Oscillation
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SB	Senate Bill
SIB	Southerly International Boundary
SNOTEL	SNOpack TELemetry
TCE	Trichloroethylene
TDS	Total Dissolved Solids
TOUA	Tohono O’odham Utility Authority
USBOR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USDOI	United States Department of Interior
USF	Underground Storage Facility
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

VRP	Voluntary Remediation Program
WIFA	Water Infrastructure Finance Authority
WC&DD	Water Conservation and Drainage District
WDA	Water Delivery Agreement
WMIDD	Wellton-Mohawk Irrigation and Drainage District
WQARF	Water Quality Assurance Revolving Fund
WRCC	Western Regional Climate Center
WWTF	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant
YCWUA	Yuma County Water Users Association
YDP	Yuma Desalting Plant
YMCAS	Yuma Marine Corps Air Station

APPENDIX A

Appendix A
Arizona Water Protection Fund Projects in the Lower Colorado River Planning Area through 2005[1]

LOWER COLORADO RIVER PLANNING AREA			
Groundwater Basin	**AWPF Grant #**	**Project Title**	**Project Category**
Parker	96-0016	‘Ahakhav Tribal Preserve	Habitat Restoration & Revegetation
Parker	97-032	‘Ahakhav Tribal Preserve – Deer Island Revegetation	Exotic Species Control & Revegetation
Yuma	96-0011	Lower Colorado River – Imperial Division Restoration	Wetland Restoration
Yuma	96-0023	Watershed Restoration at the Yuma Conservation Gardens	Watershed Restoration
Yuma	04-124	Yuma East Wetlands Riparian Revegetation Project	Exotic Species Control & Revegetation
Yuma	05-134	Quechan Indian Nation Yuma East Wetlands Restoration Project – Phase I	Exotic Species Control & Revegetation

Source: ADWR, 2005, Water Protection Fund database: Office of Statewide Planning

[1] A map with all Arizona Water Protection Fund grant locations can be found in Volume 1, Apeendix C

APPENDIX B

Arizona Colorado River Water Use: Present Perfected Right Holders and Priority 1-6 Contractors in the Lower Colorado River Planning Area

Entity	Type of Entitlement	Priority Date	Annual Diversion Entitlement (Acre-Feet)[1]	Annual Consumptive Use Entitlement (Acre-Feet)[1]
PRIORITY 1				
Satisfaction of Present Perfected Rights (PPRs) as defined and provided for in the *Arizona v. California* Decree (2006 Consolidated).				
Federal				
Cocopah Indian Reservation	PPR No. 1	9/27/1917	7,681	
	PPR No. 8	1915	1,140	
		Total	8,821	
Colorado River Indian Tribes Reservation	PPR No. 2	3/3/1865	358,400	
		11/22/1873	252,016	
		11/16/1874	51,986	
		Total	662,402	
Fort Mojave Indian Reservation	PPR No. 3	9/18/1890	27,969	
		2/2/1911	75,566	
		Total	103,535	
Fort Yuma Indian Reservation	PPR No. 3a	1/9/1884	6,350	
		Total	**781,108**	
Water Projects				
Yuma County Water Users' Association *(also has unquantified water right certificates)*	PPR No. 4	1901	254,200	
Unit "B" Irrigation and Drainage District *(also has unquantified water right certificates)*	PPR No. 5	7/8/1905	6,800	
North Gila Valley Irrigation District *(also has 3rd Priority consumptive use entitlement of 41,203 AF)*	PPR No. 6	7/8/1905	24,500	
		Total	**285,500**	
Miscellaneous PPRs				
Powers	PPR No. 7	1915	960	
Brooke Water LLC *(also has 440 AF of 4th priority water - Contract No. 5-XX-30-W044)*	PPR No. 9	1910	360	
Hulet *(located in MVIDD service area)*	PPR No. 10	1902	1,080	
Hoover (formerly Hopal) *(located in MVIDD service area)*	PPR No. 11 Contract No. 4-07-30-W0052	1902	1,050	
Miller *(located in MVIDD area)*	PPR No. 12	1902	240	
McKellips/Granite Reef Farms *(located in MVIDD service area)*	PPR No. 13	1902	810	
Sherill and Lafollette *(located in MVIDD service area)*	PPR No. 14	1902	1,080	
Molina	PPR No. 15	1928	318	
Gila Monster Farms, Inc. *(also has 6,285 AF of 3rd priority, 1,435 AF of 4th priority, 656 AF of 5th priority and an undetermined amount of 6th priority water - Contract No. 6-07-30-W0337)*	PPR No. 16	1925	780	
Zozoya *(located in MVIDD service area)*	PPR No. 17	1912	720	
Swan *(located in MVIDD service area)*	PPR No. 18	1902	960	
Phillips, Milton and Jean	PPR No. 19	1900	42	
Parker, Town of *(also has 1,030 AF of 4th priority and 2,000 AF of 5th and/or 6th priority water)*	PPR No. 20	1905	630	400
Yuma, City of *(also has a 3rd Priority consumptive use entitlement 48,522 AF)*	PPR No. 21	1893	2,333	1,478
		Total	**11,363**	**1,878**

[1] For Priorities 1 through 3 and Priorities 5 and 6, the totals for diversion and consumptive use entitlements **are not** additive.

Entity	Type of Entitlement	Priority Date	Annual Diversion Entitlement (Acre-Feet)[1]	Annual Consumptive Use Entitlement (Acre-Feet)[1]
PRIORITIES 2 and 3				
Second and third priorities are coequal. Priority 2 - Satisfaction of Federal Reservations and Perfected Rights established or effective prior to September 30, 1968 Priority 3 - Satisfaction of Entitlements pursuant to contracts between the United States and water users in Arizona executed on or before September 30, 1968				
Federal				
Ak-Chin Indian Community	AK-CHIN121180A	1/1/1956	50,000	
Cibola National Wildlife Refuge	Secretarial Reservation	8/21/1964	34,500	16,793
Department of the Navy - Marine Corps Air Station - Yuma	Contract No. 14-06-300-937	1/1/1959	3,000	
Department of the Army - Yuma Proving Grounds	Contract No. I76r-696	6/12/1951	1,129	
Havasu National Wildlife Refuge	1964 Supreme Court Decree Exec Order No. 8647/Public Land Order No. 559	1/22/1941 2/11/1949	41,839	37,339
Imperial National Wildlife Refuge	1964 Supreme Court Decree	2/14/1941	28,000	23,000
Lake Mead National Recreation Area - National Park Service	Executive Order No. 5105 Eecutive Order No. 5339	5/3/1929 4/25/1930	Annual quantities reasonably necessary to fulfill the purpose of the Recreation Area	
Salt River Pima Maricopa Indian Community	SRPMIC021288N	3/4/1952	22,000	
Lower Colorado River Dams Project - United States Bureau of Reclamation - Davis Dam	Secretarial Reservation dated November 29, 2000	4/26/1941	100	
		Total	**180,568**	**77,132**
Water Projects				
Unit "B" Irrigation and Drainage District *(also has PPR for 6,800 AF)*	Water right certificates Contract No. 14-06-300-44	12/22/1952	Unquantified water right certificates	
North Gila Valley Irrigation District *(also has a PPR for 24,500 AF)*	Contract Nos.14-06-W-54 14-06-W-102 14-06-300-1270 *(These 3 Districts share a consumptive use entitlement of 250,000 AF, which was allocated to each District by Reclamation on December 27, 2001)*	1/1/1956		41,203
Yuma Irrigation District				67,278
Yuma Mesa Irrigation and Drainage District				141,519
Wellton-Mohawk Irrigation and Drainage District	Contract No. 1-07-30-W0021	3/4/1952		278,000
Yuma County Water Users' Association *(also has a PPR for 254,200 AF)*	Water right certificates Contract No. 14-06-300-621	4/1/1957	Unquantified water right certificates	
		Total		**528,000**
Others				
Arizona, University of	Contract No. 14-06-300-144	1/1/1954	1,088	
C. Allec Company, Inc. (formerly Allec, Camille)	Contract No. 14-06-303-528	12/23/1953	120	
Desert Lawn Memorial Park Association (Cemetery in Yuma) *(also has 360 AF of 4th priority water for undeveloped land near Unit B)*	Contract No. 14-06-303-1079	5/1/1956	200	
Gila Monster Farms, Inc. *(also has 780 AF of 1st priority, 1,435 AF of 4th priority and 656 AF of 5th priority and an undetermined amount of 6th priority water)*	Contract No. 6-07-30-W0337	1/1/1952	6,285	
Kaman, Inc.	Contract No. 14-06-303-1555	12/2/1959	2	
Union Pacific Railroad Company *(formerly Southern Pacific Railroad Company)*	Contract No. 14-06-303-1524	12/21/1959	48	
Yuma, City of *(also has a PPR for 1,478 AF consumptive use)*	Contract No. 14-06-W-106	11/12/1959		48,522
Yuma, City of *(Cemetery)*	Contract No. 14-06-303-1078	5/1/1956	60	
Yuma Mesa Fruit Growers Association	Contract No. 14-06-303-1196	1/1/1956	15	
Yuma Union High School	Contract No. 14-06-303-179	5/3/1960	200	
		Total	**8,018**	**48,522**

Entity	Type of Entitlement	Priority Date	Annual Diversion Entitlement (Acre-Feet)[1]	Annual Consumptive Use Entitlement (Acre-Feet)[1]
PRIORITY 4				
Satisfaction of Entitlements pursuant to: (i) contracts, Secretarial Reservations, and other arrangements between the United States and water users in the State of Arizona entered into or established subsequent to September 30, 1968, for use on Federal, State, or privately owned lands in the State of Arizona (for a total quantity of not to exceed 164,652 acre-feet of diversions annually); and (ii) Contract No. 14-06-W-245 dated December 15, 1972, as amended, between the United States and the Central Arizona Water Conservation District for the delivery of Mainstream Water for the Central Arizona Project, including use of Mainstream Water on Indian lands.				
Municipal and Industrial				
Arizona-American Water Company (Havasu) *(also has a lease with the MCWA for 950 AF of 5th priority water)*	Contract No. 00-XX-30-W0391	1/23/2001	1,420	
Arizona Game and Fish Commission *(entitlement is available for domestic & irrigation use. Also has 750 AF of fifth priority and 1,000 AF of sixth priority water)*	Contract No. 07-XX-30-W0509	9/25/2007	1,419	
Arizona State Land Department	Contract No. 7-07-30-W0358	2/2/2004	1,534	
Arizona State Parks Board / Windsor Beach	Contract No. 7-07-30-W0364	8/17/1998	90	
B & F Investments, LLC	Contract No. 06-XX-30-W0453	10/25/2006	60	
Brooke Water LLC *(also has a PPR for 360 AF)*	Contract No. 5-XX-30-W044	11/9/1983	440	
Bullhead City *(also has a subcontract with MCWA for 6,000 AF of 4th priority water & is in the process of acquiring a second subcontract for 2,139 AF)*	Contract No. 2-07-30-W0273	11/9/1994	15,210	
Bureau of Land Management	Secretarial Reservations and IGA No. 8-07-30-W0373	8/30/1973		800
		9/29/1981		1,280
		4/27/1987		1,930
		6/13/2000		
		Total		4,010
Central Arizona Water Conservation District (CAP) (*Balance of Arizona Colorado River allocation, approximately 1.5 MAF/Year)*	Contract No. 14-06-W-245	12/01/1988		
Crystal Beach Water Conservation District	Contract No. 6-07-30-W0352	11/21/1997	132	
Desert Lawn Memorial Park Association (Cemetery in Yuma) (also has 200 AF of 3rd priority water)	Contract No. 14-06-300-2587	5/30/1975	360	
Ehrenberg Improvement Association	Contract No. 8-07-30-W0006	10/14/1977	500	
Fisher Landing Water and Sewer	Contract No. 06-XX-30-W0450	12/21/2006	53	
Gold Dome Mining Company	Contract No. 0-07-30-W0250	6/6/1990	7	
Gold Standard Mines Corporation	Contract No. 3-07-30-W0038	8/25/1983	75	
Golden Shores Water Conservation District	Contract No. 9-07-30-W0203	6/1/1989	2,000	
Hillcrest Water Company	Contract No. 5-07-30-W0078	3/8/1985	84	
Lake Havasu City *(also has unspecified amount of 5th and/or 6th priority water, and a subcontract with MCWA for 6,000 AF of 4th priority water. It is in the process of acquiring a second subcontract for 2,139 AF)*	Contract No. 3-07-30-W0039	10/4/1995	19,180	
Marble Canyon Company, Inc. *(also has an unspecified amount of 5th and 6th priority water)*	Contract No. 5-07-30-W0322	5/1/1996	70	
McAllister, Maurice L.	Contract No. 7-07-30-W0355	7/31/1998	40	
Mohave County Water Authority *(Has 15,000 AF subcontracted to: Lake Havasu and Bullhead cities - 6,000 AF each; Mohave Water Conservation District - 3,000 AF. MCWA also has an undefined entitlement of 5th and 6th priority water)*	Contract No. 5-07-30-W0320	11/14/1968	18,500	
Mohave County Water Authority *(entitlement is available for domestic and irrigation use in Cibola Valley and for domestic use in Mohave County. The Authority is in the process of subcontracting 2,139 AF of this water to both Bullhead City and Lake Havasu City)*	Contract No. 4-XX-30-W0431	1/31/1983	4,578	
Mohave Valley Irrigation and Drainage District *(part of the District's 41,000 AF entitlement - estimated M&I use based on USBR crop reports) (also has 2 leases with MCWA for a total of 980 AF of 5th priority water)*	Contract No. 14-06-W-204	11/14/1968	8,000	

[1]

Entity	Type of Entitlement	Priority Date	Annual Diversion Entitlement (Acre-Feet)[1]	Annual Consumptive Use Entitlement (Acre-Feet)[1]
PRIORITY 4 (Continued)				
Municipal and Industrial (Continued)				
Mohave Water Conservation District *(also has a subcontract with the MCWA for 3,000 AF of 4th priority water)*	Contract No. 9-07-30-W0012	11/14/1968	1,800	
Parker, Town of *(also has a PPR for 630 acre-feet, and 2,000 acre-feet of Priority 5 and/or Priority 6 water)*	Contract No. 2-07-30-W0025	1/6/1998	1,030	
Quartzsite, Town of	Contract No. 7-07-30-W0353	1/28/1999	1,070	
Roy, Edward P.	Contract No. 9-07-30-W0124	2/24/1986	1	
Smucker Park	Contract No. 14-06-303-2702	11/12/1969	33	
Somerton, City of	Contract No. 3-XX-30-W0419	2/8/2006	750	
Verizon California, Inc. (formerly Continental Telephone of California)	Contract No. 14-06-300-2506	2/5/1974	1	
Water reserved by the Secretary for use in Indian settlements			3,500	
		Total	**81,937**	**4,010**
Municipal and Industrial Recommendations				
Arizona State Parks Board / Contact Point			20	
Martinez Lake cabin sites - *(had 87 AF of which 53 AF was allocated to Fisher Water and Sewer; 8 AF to Shepard Water; and 3 AF to ASLD)*			23	
Shepard Water Company			50	
		Total	**93**	
Agricultural				
Arizona State Land Department *(also has 9,097 AF of 5th and/or 6th priority water)*	Contract No. 4-07-30-W0317	6/28/1999	6,607	
Beattie Farms Southwest	Contract No. 5-XX-30-W0446	2/17/2006	1,110	
Cibola Valley Irrigation and Drainage District (includes *300 AF for M&I use and also has 1,500 AF of 5th priority and 2,000 AF of 6th priority water)*	Contract No. 2-07-30-W0028	1/31/1983	12,066	
Cocopah Indian Reservation *(lands south of Morelos Dam)*	Contract No. 6-07-30-W0346 Supreme Court Decree	6/24/1974	2,026	
Curtis, Armon	Contract No. 3-07-30-W0037	8/29/1983	300	
Gila Monster Farms, Inc. (*also has a PPR for 780 AF, 6,285 AF of 3rd priority, 656 AFof 5th priority and an undetermined amount of 6th priority water)*	Contract No. 6-07-30-W0337 PPR No. 16	7/28/1997	1,435	
Hopi Tribe *(also has 750 AF of 5th priority and 1,000 AF of 6th priority water)*	Contract No. 4-XX-30-W0432	1/31/1983	5,997	
JRJ Partners LLC *(formerly part of Dulin Farms)*	Contract No. 06-XX-30-W0448	9/25/2007	1,080	
Mohave Valley Irrigation and Drainage District (the *41,000 AF entitlement less 8,000 AF for M&I uses and PPR's for 5,940 AF)*	Contract No. 14-06-W-204	11/14/1968	27,060	
North Baja, LLC (formerly Jamar Produce) *(408 AF for agricultural use; 72 AF for M&I use)*	Contract No. 5-07-30-W0066	12/3/1984	480	
George Ogram, Ogram Farms	Contract No. 1-XX-30-W0398	9/4/2003	480	
Ogram Boys Enterprises *(formerly known as GOBO Farms)*	Contract No. 4-XX-30-W0402	7/1/2005	924	
Pasquinelli, Gary J. *(Hall contract assigned and amended from 510 to 486 AF)*	Contract No. 5-07-30-W0065	3/27/2003	486	
Rayner Ranches	Contract No. 5-07-30-W0064	10/29/1984	4,500	
		Total	**64,551**	
Agricultural Recommendations				
CHA CHA, LLC *(Amended contract includes: Auza Farms - 960 AF, Dulin Farms-West portion - 936 AF, and Youmans - 204 AF)*			2,100	
Peach, John *(formerly Bruce Church)*			456	
Phillips, Milton and Jean			18	
		Total	**2,574**	

Entity	Type of Entitlement	Priority Date	Annual Diversion Entitlement (Acre-Feet)[1]	Annual Consumptive Use Entitlement (Acre-Feet)[1]
PRIORITY 5 AND 6				
Priority 5 - Satisfaction of Entitlements to any Unused Arizona Entitlement Priority 6 - Satisfaction of Entitlements to Surplus Apportionment Water				
Priority 5				
Arizona Game and Fish Commission *(also has 1,419 AF of fourth priority and 1,000 AF of sixth priority water)*	Contract No. 07-XX-30-W0509	9/25/2007	750	
Cibola Valley Irrigation and Drainage District *(also has 12,066 acre-feet of 4th priority water and 2,000 AF of 6th Priority water)*	Contract No. 2-07-30-W0028	1/31/1983	1,500	
Hopi Tribe *(also has 5,997 AF of 4th Priority water and 1,000 AF of 6th Priority water)*	Contract No. 04-XX-30-W0432	1/31/1983	750	
Gila Monster Farms, Inc. - 5th priority *(also has a PPR for 780 AF, 6,285 AF of 3rd priority, 1,435 AF of 4th priority water)*	Contract No. 6-07-30-W0337	7/28/1997	656	
Prioirty 5 and/or 6				
Arizona Public Service (Yucca Power Plant)	Contract No. 6-07-30-W0336	10/3/2000	1,500	
Arizona State Land Department (*also has 6,607 acre-feet of 4th priority water)*	Contract No. 4-07-30-W0317	6/28/1999	9,067	
Lake Havasu City *(also has 19,180 AF of 4th Priority water)*	Contract No. 3-07-30-W0039	10/04/1995	unspecified	
Marble Canyon Corporation (*also has 70 AF of 4th prioirty water)*	Contract No. 3-07-30-W0322	5/01/1996	unspecified	
Mohave County Water Authority - Entitlement leased to: MVIDD (Marina Coves) - 600 AF MVIDD (Bella Vista/Los Lagos) - 380 AF AZ-American Water Co.(The Refuge) - 950 AF	Contract No. 5-07-30-W0320	1/31/1983	unspecified	
Parker, Town of (*also has PPR for 630 AF and 1,030 AF of 4th priority)*	Contract No. 2-07-30-W0025	1/6/1998	2,000	
Priority 6				
Arizona Game and Fish Commission *(also has 1,419 AF of fourth priority and 750 AF of fifth priority water)*	Contract No. 07-XX-30-W0509	9/25/2007	1,000	
Cibola Valley Irrigation and Drainage District (*also has 12,066 AF of 4th Priority water and 1,500 AF of 5th priority water)*	Contract No. 2-07-30-W0028	1/31/1983	2,000	
Gila Monster Farms, Inc. - 6th priority *(also has a PPR for 780 AF, 6,285 AFof 3rd priority, 1,435 AFof 4th priority)*	Contract No. 6-07-30-W0337	7/28/1997	unspecified	
Hopi Tribe *(also has 5,997 AF of 4th Priority water and 750 AF of 5th Priority water)*	Contract No. 04-XX-30-W0432	1/31/1983	1,000	
		Total	**20,223**	
		Priority 1 Total	**1,077,971**	**1,878**
		Priority 2 and 3 Total	**188,586**	**653,654**
		Priority 1, 2, and 3 Total	**1,266,557**	**655,532**
		Priority 4 Total	**149,155**	**4,010**
		Priorities 1 through 4 Total	**1,415,712**	**659,542**
		Priorities 5 and 6 Total	**20,223**	**0**

Entity	Type of Entitlement	Priority Date	Annual Diversion Entitlement (Acre-Feet)	Annual Consumptive Use Entitlement (Acre-Feet)
PRIORITY 5 AND 6				
Priority 5, Satisfaction of Entitlements to any Unused Arizona Entitlement Priority 6, Satisfaction of Entitlements to Surplus Apportionment Water				
Priority 5				
Arizona Game and Fish Department *(also has 1,419 AF of fourth prority and 1,000 AF of sixth priority water)*	Contract No. 07-XX-30-W0509	9/25/2007	750	
Cibola Valley Irrigation and Drainage District - 5th priority *(also has 12,066 acre-feet of 4th priority water)*	Contract No. 2-07-30-W0028	1/31/1983	1,500	
Hopi Tribe - 5th priority	Contract No. 04-XX-30-W0432	1/31/1983	750	
Gila Monster Farms, Inc. - 5th priority *(also has 1,435 AF of 4th priority water)*	Contract No. 6-07-30-W0337	7/28/1997	656	
Prioirty 5 and/or 6				
Arizona Public Service (Yucca Power Plant)	Contract No. 6-07-30-W0336	10/3/2000	1,500	
Arizona State Land Department (*also has 6,607 acre-feet of 4th priority water)*	Contract No. 4-07-30-W0317	6/28/1999	9,067	
Lake Havasu, City of	Contract No. 3-07-30-W0039	10/04/1995	unspecified	
Marble Canyon Corporation (*also has 70 AF of 4th prioirty water)*	Contract No. 3-07-30-W0322		unspecified	
Mohave County Water Authority - Entitlement leased to: MVIDD (Marina Coves) - 600 AF MVIDD (Bella Vista/Los Lagos) - 380 AF AZ-American Water Co.(The Refuge) - 950 AF	Contract No. 5-07-30-W0320	1/31/1983	unspecified	
Parker, Town of *(also has 1,030 AF of 4th priority water)*	Contract No. 2-07-30-W0025	1/6/1998	2,000	
Priority 6				
Arizona Game and Fish Department *(also has 1,419 AF of fourth priority and 750 AF of fifth priority)*	Contract No. 07-XX-30-W0509	9/25/2007	1,000	
Cibola Valley Irrigation and Drainage District	Contract No. 2-07-30-W0028	1/31/1983	2,000	
Gila Monster Farms, Inc. - 6th priority *(also has a PPR for 780 AF, 6,285 AFof 3rd priority, 1,435 AFof 4th priority)*	Contract No. 6-07-30-W0337	7/28/1997	unspecified	
Hopi Tribe - 6th priority	Contract No. 04-XX-30-W0432	1/31/1983	1,000	
		Total: Priority 5 and 6	**20,223**	

APPENDIX C

APPENDIX C
Colorado River Management

The "Law of the River" as described briefly below, is a collection of federal and state laws, interstate compacts, Supreme Court decisions and international treaties that govern the operation and use of the Colorado River. In the Lower Colorado River Basin, the United States Secretary of the Interior (Secretary) is the Watermaster. Acting through the Bureau of Reclamation, the Secretary operates Colorado River dams and accounts for water use on an annual basis. Pursuant to Section V of the Boulder Canyon Project Act, the Secretary contracts with water users in the Lower Basin for water up to the total amount of each state's apportionment.

Colorado River Compact – 1922

In 1921, the seven Colorado River Basin states authorized the appointment of commissioners to negotiate a compact for the apportionment of the water supply of the Colorado River. Although the states were unable to negotiate an allocation of water for each state, an agreement was signed in November 1922, the Colorado River Compact (Compact) that divided the Colorado River Basin into the Upper Basin and the Lower Basin.

The Compact apportioned to the Upper Basin (Colorado, New Mexico, Utah, and a portion of Arizona) and to the Lower Basin (Arizona, California, and Nevada) the exclusive beneficial consumptive use of 7.5 million acre-feet of water to each basin annually. Because the Colorado River Basin includes a portion of Mexico, the Compact recognized Mexico's right to use River water. Water for this purpose was to be met from surplus water supplies in excess of the amounts apportioned to the Upper and Lower Basins. Any burden that might arise because of a water treaty with Mexico was to be shared equally by the two basins. The Compact recognized that the ability of the Upper Basin to meet the requirement to deliver 7.5 million acre-feet to the Lower Basin could be impacted by climatic factors, therefore the Compact only required the Upper Basin to restrict its use so that delivery to the Lower Basin would not be depleted below an aggregate of 75,000,000 acre-feet for any period of ten consecutive years.

Boulder Canyon Project Act - 1928

The Boulder Canyon Project Act (Project Act) authorized construction of the Hoover Dam and Power Plant and the All-American Canal. It also authorized Arizona, California and Nevada to enter into an agreement whereby the 7.5 million acre-feet of water apportioned to the Lower Basin by the Colorado River Compact would be apportioned as follows: to California, 4.4 million acre-feet per year; to Arizona, 2.8 million acre-feet per year; and to Nevada, 0.3 million acre-feet per year.

Mexican Treaty – 1945

In 1945, a treaty between the United States and Mexico involving waters of the Colorado, Rio Grande and Tijuana Rivers was enacted to address, among other things, a fixed entitlement for Mexico of 1.5 million acre-feet annually from the Colorado River. The Treaty also provided

an additional 200,000 acre-feet in years of supply surplus. In years of extraordinary drought, Mexico's entitlement is to be reduced in the same proportion as consumptive uses in the U.S. are reduced.

Minute 242 was adopted and executed in 1973 in response to Mexico's concerns regarding the quality of Colorado River water being delivered to the Mexicali Valley. Minute 242 obligates the United States to implement measures that will maintain the salinity of the Colorado River waters delivered to Mexico at nearly the same quality as that diverted at Imperial Dam for use within the United States. The Colorado River Basin Salinity Control Act was signed into law on June 24, 1974, providing for the physical works necessary to implement Minute 242 without permanent loss of water to the Colorado River Basin states.

Upper Colorado River Basin Compact - 1948

This Compact divided the water apportioned to the Upper Basin by the Colorado River Compact between the five states with territory in the Upper Basin. Arizona was allocated 50,000 acre-feet per year with the remainder of the Upper Basin entitlement divided according to the following percentages: Colorado, 51.75; New Mexico, 11.25; Utah, 23.00; and Wyoming, 14.00.

Arizona v. California - 1964

On August 13, 1952, the State of Arizona filed a complaint with the U.S. Supreme Court against California and seven agencies within that state to resolve the contention by California that the Central Arizona Project should not be authorized. At California's insistence, the U.S. Congress would not authorize the Central Arizona Project until Arizona's right to the necessary Colorado River entitlement was clarified.

The Decree, handed down in 1964, confirmed that Congress had already apportioned, through the Boulder Canyon Project Act, the entitlement of water to the three Lower Basin states as follows: Arizona, 2.8 million acre-feet; California, 4.4 million acre-feet; and Nevada, 300,000 acre-feet. Any surplus above 7.5 million acre-feet was apportioned 50 percent to California and 50 percent to Arizona, except that Nevada was given the right to contract for 4 percent of the excess, which would come out of Arizona's share. The Decree also confirmed each of the Lower Basin state's entitlements to the flow of the tributaries within their boundaries, supporting Arizona's utilization of water from its in-state rivers, separate from its entitlement to its full 2.8 million acre-feet of Colorado River water.

The Decree left shortage allocation to the discretion of the Secretary after providing for satisfaction of present perfected rights in the order of their priority dates. These rights were defined as rights existing and used prior to the effective date of the Boulder Canyon Project Act.

Colorado River Basin Project Act - 1968

The Colorado River Basin Project Act on September 30, 1968 authorized construction of the Central Arizona Project and other water development projects in the Upper Basin. A significant

concession was a provision that allowed existing California, Arizona, and Nevada Colorado River contractors to receive a priority over the Central Arizona project in times when the useable supply from the River was inadequate to provide 7.5 million acre-feet to the Lower Basin states, with California's priority limited to its 4.4 million acre-foot entitlement.

The Act directed the Secretary to propose criteria for the "coordinated long-range operation of the reservoirs" in the Upper Basin with the operation of the reservoirs in the Lower Basin. To accomplish this, the Act required the development of an Annual Operating Plan, in consultation with representatives of the seven Basin states.

Current Colorado River Issues

Shortage Criteria

In December 2007, the Secretary of the Interior signed the Record of Decision (ROD) on interim operating criteria (2008-2026) including the coordinated operation of Lakes Powell and Mead and criteria for implementing shortage reductions in the Lower Basin. At this time Lake Powell and Lake Mead are operated independently; annual Lake Powell water releases are determined based on applicable law and relevant factors contained in the Long-Range Operating Criteria. Proposed coordinated operation of the reservoirs would address two goals: avoid Lower Basin shortages and avoid curtailment of Upper Basin water use. If regional drought conditions continue shortage operations could begin as early as 2011.

In May 2005, Arizona water users asked ADWR to convene a stakeholder technical workgroup to develop a recommendation regarding appropriate Lower Basin shortage criteria and a strategy for apportioning shortage reductions between the Central Arizona Project (CAP) and equivalent priority mainstream Colorado River water users. In October, 2006 the Workgroup forwarded their recommendation to the Director, and with minor modifications it has been incorporated into the Reclamation Environmental Impact Study as part of the Basin States Alternative.

The modified shortage recommendation implements shortage reductions when Lake Mead water storage is depleted to key elevation triggers: In years when Lake Mead content is projected on January 1 to be at or below elevation 1075 ft and at or above 1050 ft, Arizona's share of shortage reductions would be 320,000 acre-feet, below 1050 ft and at or above 1025 ft, 400,000 acre-feet and below 1025 feet elevation, 480,000 acre-feet. Reclamation will reconsult with the states if conditions continue to worsen necessitating additional water supply reductions. The available shortage water supply would be apportioned within Arizona between the fourth priority mainstream water users and the CAP by first determining the mainstream available supply, based upon entitlement.

(Total fourth priority mainstream diversion entitlement ÷ total fourth priority water supply before shortage reduction) X (total fourth priority water supply – shortage reduction volume)

The remaining fourth priority water supply after deducting the mainstream supply would be

available for diversion by the CAP.

Entitlement Transfers

Arizona communities along the Colorado River have experienced explosive growth over the last decade. These Arizona communities are unique because groundwater is not readily available as a supplementary water supply to meet this growing demand. Regardless of whether Colorado River water is diverted from the mainstream or pumped from wells that are hydraulically connected to the river, the water is legally Colorado River water, and annual use is limited to a defined, maximum amount.

The Boulder Canyon Project Act requires U.S. Colorado River water users in the Lower Basin to have a contract for such water with the Secretary of the Interior. The Regional Director of Reclamation contracts with Lower Basin water users on behalf of the Secretary. The Supreme Court Decree in *Arizona v. California* requires Reclamation to account annually for all diversions and use of Colorado River water against the total Arizona allocation of 2.8 million acre-feet.

To meet this growing domestic demand, some Colorado River communities have acquired, transferred and changed the type of use of existing agricultural water entitlements. For non-federal Arizona contractors of mainstream Colorado River entitlements, these transfer actions are subject to review by the ADWR and consultation with ADWR and Reclamation. The Department has developed a substantive policy statement titled *Policy and Procedures for Transferring an Entitlement of Colorado River Water* that provides information regarding the Department's review of a proposed transfer action. This policy is available on the Department's website at www.azwater.gov. To date, using its substantive policy statement, the Department has made three assignment and two conveyance recommendations involving agricultural water entitlements. The Department is currently experiencing increasing contact from entities that are interested in the acquisition and conversion of agricultural entitlements to municipal and industrial uses and it expects to process additional contract transfer requests in the future.

A separate substantive policy statement governs the transfer of CAP subcontract entitlements within the three county CAP service area. The *Revised Policy Regarding Transfer of Central Arizona Project Municipal and Industrial Water Subcontract Entitlements* describes the criteria the Department evaluates and the priority of proposed transfer actions. Growth in the CAP service area has resulted in increased use of existing CAP subcontract water, and the Department expects few future transfer action proposals.

Lower Colorado River Planning Area Entitlement Transfer Actions

The following are a list of assignment and conveyances that have been conducted in accordance with the Department's Colorado River transfer policy that affects entities in the Lower Colorado River Planning Area. All involve a series of assignments and conveyances that began with the initial partial assignment of Cibola Valley Irrigation and Drainage District's entitlement in 2004. In 2007, one assignment and one conveyance action occurred, in the planning area. See Appendix B for a complete list of Colorado River entitlements within the planning area.

1. 2004 - Cibola Valley Irrigation and Drainage District (CVIDD), located in the southern

part of the Parker Basin, **assigned** 5,995 acre-feet of 4th priority, 750 acre-feet of fifth priority and 1,000 acre-feet of sixth priority irrigation entitlements to both the Mohave County Water Authority (MCWA) and to The Hopi Tribe.

2. 2007 – CVIDD **assigned** another 60 acre-feet of its 4th priority entitlement to Cibola Resources. Cibola Resources then **conveyed** the 60 acre-feet to B&F Investments for use by a proposed travel plaza to be located in the Ehrenberg area.

3. 2007 - MCWA **conveyed** 4,578 acre-feet of its 4th priority entitlement for eventual M&I use by Lake Havasu and Bullhead City

4. 2007 – MCWA **assigned** 1,419 acre-feet of its 4th priority and all of its 5th and 6th priority entitlements to the Arizona Game and Fish Commission for habitat restoration purposes in the Cibola Valley

Note:
Assignments: Entitlement is assigned to a new entity, the type and place of use remain the same.
Conveyances: Entitlement may or may not be transferred to a new entity, but the place of use and/or the type of use is changed.

Inadvertent Overrun and Payback Policy

In October 2003, the Secretary of the Interior signed the Record of Decision to implement the Colorado River Water Delivery Agreement (WDA). The WDA includes the Inadvertent Overrun and Payback Policy (IOPP) to identify inadvertent overruns and to establish procedures to account for overruns and define subsequent payback requirements for Colorado River water users in the Lower Basin.

Inadvertent overruns occur when Colorado River water is diverted, pumped or received by an entitlement holder in excess of the water user's entitlement for that year. The IOPP creates a process and criteria to structure payback of the amount of water received in excess of the entitlement for that year.

Federal Rulemaking to Establish the Accounting Surface

In August 2006, Reclamation initiated a rulemaking process to regulate the non-contract use of Colorado River water in the Lower Basin. The Boulder Canyon Project Act requires U.S. Colorado River water users in the Lower Basin to have a contract for such water with the Secretary of the Interior. The Regional Director of Reclamation contracts with Lower Basin water users on behalf of the Secretary. The Supreme Court Decree in Arizona v. California requires Reclamation to account annually for all diversions and use of Colorado River water against the total Arizona allocation of 2.8 million acre-feet.

The rulemaking is intended to ensure that all Colorado River water use is covered by an entitlement

and correctly accounted for within the state's apportionment. Reclamation has contracted with the U.S. Geological Survey, to document non-contract water uses in the Lower Basin. The rule will establish the methodology that Reclamation will use to determine if a well is pumping Colorado River water and will also establish an appeal process. At this time, approximately 11,500 acre-feet of unallocated fourth-priority Colorado River water is available for allocation. Some of this water will be allocated to existing uses, after currently uncontracted uses have been quantified. The inventory is expected to provide comprehensive information about existing water uses that need an entitlement. The Department will use this information to allocate the remaining supply for domestic purposes.

Yuma Desalting Plant Operations

One unintended consequence of utilizing Colorado River water for domestic and agricultural purposes has been the steady increase in the salinity of its waters. The salinity problem created international discord in the 1960's when crops in the Mexicali Valley were damaged by the high salinity of the Colorado River water used for irrigation. An amendment to the 1944 treaty with Mexico guaranteed that the treaty water delivery would be no more than 115 ppm (+/- 30 ppm) more saline than the water diverted at Imperial Dam.

To comply with this requirement, the U.S. implemented a number of measures including re-routing drainage water from the Wellton-Mohawk Irrigation and Drainage District (WMIDD), to the Cienega de Santa Clara in Mexico. The U.S. also built a $250 million desalinization plant in Yuma to treat WMIDD drainage water, before returning it to the mainstream. The Yuma Desalinization Plant was completed in 1992, operated briefly in 1993 and then put on standby status until a recent "demonstration run" in 2007.

Wellton-Mohawk drainage water that is bypassed each year to the Cienega, is not counted against the total amount of Colorado River water that must be delivered under the terms of the Treaty. In dry years, this results in Lake Mead storage decreasing by approximately 100,000 acre-feet annually since the bypassed water must be "made-up" from storage in Lake Mead. Recently, the decrease in Lake Mead storage after more than a decade of drought has increased the risk of shortage to Arizona Colorado River water users.

Salinity

Increased salinity levels in the Colorado River affect agricultural, municipal and industrial users. Agricultural water users suffer economic damage due to reduced crop yields, added labor costs for irrigation management and added drainage requirements. Urban users must replace plumbing and water-using appliances more often, or spend money on water softeners or bottled water. Industrial users and water and wastewater treatment facilities incur reductions in the useful life of system infrastructure. Damages in the United States are estimated at $330 million per year, and while economic damage in Mexico is not quantified it is also a significant concern.

In 1972, EPA required development of water quality standards for salinity in the Colorado River in accordance with Clean Water Act Section 303. The seven Colorado River Basin States formed the Colorado River Basin Salinity Control Forum (the Forum) in 1973. The Forum has developed

numeric salinity standards for three locations in the Lower Basin as well as a basin-wide plan of implementation. The EPA has approved the standards and the plan of implementation adopted by the Colorado River Basin States. The water quality standards establish a flow-weighted average annual salinity standard that must be maintained on the lower Colorado River at the following locations:

- Below Hoover Dam (to Parker Dam) - 723 mg/L
- Below Parker Dam (to Imperial Dam) - 747 mg/L
- At Imperial Dam - 879 mg/L

Implementation of the salinity control plan has ensured compliance with the numeric criteria while the Basin States continue to develop the water allocated to them by the Colorado River Compact. Millions of dollars have been spent to prevent 1.9 million tons of salt from entering the river.

Other Water Quality Issues

In 2005, the Governor of Arizona appointed The Clean Colorado River Alliance (Alliance) stakeholder group to address water quality issues for the Colorado River. In addition to salinity, the Alliance identified several other water quality concerns including nutrients, metals, endocrine disrupting compounds, perchlorate, bacteria and pathogens, and sediment. The Alliance issued a report titled Clean Colorado River Alliance Recommendations to Address Colorado River Water Quality, January 2006. The report includes a number of recommendations to monitor and mitigate the impacts of these pollutants.