

Upper San Pedro Planning Area

Background

The Upper San Pedro Planning Area is located in the southeast portion of the State. The boundaries for this Planning Area are coincident with the Upper San Pedro Groundwater Basin. The Planning Area is largely within Cochise County. Small portions of the western limits of the Planning Area are with eastern Santa Cruz and southwestern Pima counties and a small portion of the northern most reach of the Planning Area is within Graham County. Communities within the Planning Area, all of which are located in Cochise County, include Hereford, Sierra Vista, Huachuca City, Tombstone, and Benson. The Town of Bisbee is located on the Groundwater Basin divide in the southeast portion of the Planning Area. While most of Bisbee's population resides in the Cochise Planning Area, its water supplies are largely derived from wells located in the Upper San Pedro Basin. Additionally, Fort Huachuca, a US Army installation located in Sierra Vista, houses significant population and economic activity.



Land ownership within the Upper San Pedro Planning Area is diverse, including State, federal, and private lands (*see Figure P.A. 18-1*). Thirty-nine percent of lands in this Planning Area are State Trust Lands with livestock grazing as the principal.

Federal land ownership is comprised of USDA Forest Service (Forest Service), US Bureau of Land Management (BLM), and US Army facilities. Forest Service lands comprise just over 11 percent of land in the Upper San Pedro Planning Area. These discontinuous holdings are largely comprised of the mountain ranges that form the periphery of the Basin, including portions of the Miller Peak and the Rincon Mountain Wilderness Areas. Livestock grazing, recreation and timber production are the primary land uses on the portions of the Coronado National Forest not designated as Wilderness Areas in the Planning Area.

The BLM manages nearly nine percent of land in the Upper San Pedro Planning Area. The majority of the BLM land in this Planning Area is within the San Pedro Riparian National Conservation Area (SPRNCA), the nation's first federal riparian reserve. Portions of the Las Cienegas National Conservation Area and the Redfield Canyon Wilderness are within the Planning Area. Primary land uses on BLM lands are wildlife habitat, recreation and livestock grazing.

Approximately seven percent of land is managed by the US Military at Fort Huachuca. The Fort was established in 1877 and has existed as a military outpost, with varied missions, since that time. Primary land use is military training and preparedness activities.

The National Park Service (NPS) owns and manages less than one percent of land within the Planning Area at the Coronado National Memorial, located along the southern flank of the Huachuca Mountains north of the Mexican border, and a small portion of Saguaro National Park in the northwestern portion of the Planning Area.

One third of the land in the Upper San Pedro Planning Area (33.3 percent) is privately owned. Much of the private land is interspersed with state owned land and, to a lesser extent, BLM lands. Contiguous private lands exist south of Sierra Vista, north of Fort Huachuca, southeast of Benson and in the vicinity of Benson. Primary land uses are private domestic, municipal, commercial, industrial, livestock grazing and farming.

Water Supply Conditions

Groundwater

The Upper San Pedro Planning Area is located in the Basin and Range Physiographic Province. This province is characterized by long broad alluvial valleys separated by mountain ranges, with thick productive regional alluvial aquifers, which may be suitable for artificial underground storage and recovery of renewable water supplies.

The groundwater system in the Upper San Pedro Planning Area is largely housed in the basin-fill sediments and the stream alluvium that has been deposited atop older basin-fill deposits. Depth to groundwater varies significantly across the Upper San Pedro Planning Area (*see Figure P.A. 18-2*). Shallow groundwater, approaching the land surface, is encountered in the floodplain aquifer along the San Pedro River. Water levels in this shallow system respond to water supply conditions along the River and have remained relatively stable. Deep groundwater levels are found in the vicinity of Sierra Vista where a cone of depression has formed in response to groundwater pumping to serve Sierra Vista and Fort Huachuca. Rates of decline in this deep system have been reported in excess of 2.2 feet per year. Similar declines have been experienced in the basin-fill aquifer in the vicinity of Benson's supply wells, which are largely located west of town near the intersection of Interstate-10 and Highway 90.

The principal sources of natural recharge are mountain-front recharge and streambed infiltration, estimated to be 35,750 acre-feet per year in the Planning Area. Groundwater flow is away from these areas of recharge along the periphery toward the center of the Basin and then generally flows parallel and proximate to the axis of the San Pedro River from south to north. Artesian conditions exist in the center of the Basin, primarily in the vicinity of St. David and Benson. Groundwater in storage estimates for the Basin range from 19.8 MAF to 59 MAF to a depth of 1,200 feet below land surface.

Surface Water

The Planning Area is drained by the San Pedro River which flows from south to north in the center of the valley (*see Figure P.A. 18-3*). The headwaters of the San Pedro River are in Mexico near the mining community of Cananea. The River is perennial through much of the reach from the border to a diversion dam, located in the northern portion of the SPRNCA, operated by the St. David Irrigation District. Additional perennial stream reaches include those found in the headwaters in the Huachuca Mountains in Miller, Carr and Ramsey Canyons. Reaches of the Babocomari River are also perennial, immediately above the confluence with the San Pedro River and upstream in the western portion of Planning Area.

Reclaimed Water

There are several wastewater treatment plants (WWTP) in the Upper San Pedro Planning Area serving the communities of Benson, Fort Huachuca, Hauchuca City, Naco, Sierra Vista and Tombstone. Approximately 5,000 acre-feet of reclaimed water is generated from these facilities. Two of these facilities recharge reclaimed water to the regional aquifer. The City of Sierra Vista Storage Facility is a permitted Underground Storage Facility (USF) with a permitted maximum annual storage limit of 4,149 acre-feet. Fort Huachuca also operates an artificial recharge facility using its reclaimed water for aquifer recharge. Direct reuse is practiced on golf courses from reclaimed water generated in Ft. Huachuca and Benson. Additionally, there are two reclaimed water treatment wetlands: 1) a wetland at the Apache Nitrogen Products facility was constructed as part of a Superfund clean-up site and 2) a wetland at the Sierra Vista WWTP Plant is operated in conjunction with the recharge facility. A large portion of the remaining population is dispersed throughout the Planning Area primarily reliant upon septic systems for wastewater treatment and disposal.

Ecological Resources

Ecological resources are an important part of the economy in the Upper San Pedro Planning Area. Significant portions of the Planning Area have been designated as critical habitat under the Endangered Species Act (*see Figure P.A. 18-3*). These areas include lands along the San Pedro River within SPRNCA. Established in November 1988, SPRNCA contains about 40 miles of riparian habitat along the San Pedro River in the Upper San Pedro Basin. It includes over 58,000 acres of land between the international border with Mexico and the community of Saint David south of Benson. The primary purpose for the designation is to protect and enhance the desert riparian ecosystem. Higher elevation critical habitat has also been designated within portions of the Huachuca and Whetstone mountains and the Canelo Hills.

All or portions of four wilderness areas are located in the planning area: Galiuro, Miller Peaks, Redfield Canyon and Saguaro. Wilderness Areas are designated under the 1964 Wilderness Act to preserve and protect the designated area in its natural condition. A small part of the Las Cienegas National Conservation Area conservation area extends into the Upper San Pedro Planning Area. Established in December 2000, the conservation area was designated to protect aquatic, wildlife, vegetative and riparian resources, although livestock grazing and recreation are allowed to continue in "appropriate" areas.

An important State resource is Kartchner Caverns State Park. Located southwest of Benson in the Whetstone Mountains, the "wet cave" is supported by a limestone aquifer that is recharged by infiltration from ephemeral washes.

The Nature Conservancy (TNC) has also acquired property in the Planning Area for habitat protection, including the Ramsey Canyon Preserve in the Huachuca Mountains.

Water Demands

Table P.A. 18-1 below presents the baseline and projected water demands for the Upper San Pedro Planning Area. Agricultural annual water use is estimated at 8,800 acre-feet and is projected to remain stable through 2060. These uses are largely located on the San Pedro River and rely on both near-stream groundwater pumping and surface water diversions.

Municipal use is distributed in the population centers throughout the Planning Area and demands are projected to increase from nearly 20,000 acre-feet in 2010 to over 31,000 acre-feet by 2060. These estimates include water use at Fort Huachuca and the individual domestic wells in the Planning Area. The majority of the growth is projected to occur within the Sierra Vista and Benson areas which are currently largely groundwater served.

While no mining use is active in the Planning Area today, according to estimates provided by industry representatives to the WRDC, mining activity is projected to grow to between 2,000 and 12,000 acre-feet annually.¹

Table P.A. 18-1. Projected Demands (in acre feet) – Upper San Pedro Planning Area

Sector	2010	2035	2060
Agriculture	8,800	8,800	8,800
Dairy	42	42	42
Feedlot	0	0	0
Municipal	19,168	26,226	31,062
Other Industrial	288	288	288
Mining	0		
High		12,000	12,000
Low		2,000	2,000
Power Plants	0		
High		0	0
Low		0	0
Rock Production	75		
High		1,489	1,764
Low		620	735
Turf	1,552		
High		1,675	1,731
Low		1,552	1,734
Total (High)	29,925	50,520	55,687
Total (Low)	29,925	39,528	44,661

Characteristics Affecting Future Demands and Water Supply Availability

General Stream Adjudication

The general stream adjudications are judicial proceedings to determine or establish the extent and priority of water rights in the Gila and Little Colorado River systems. Over 84,000 claimants and water users are joined in the Gila River Adjudication that will result in the Superior Court issuing a comprehensive final decree of water rights. ADWR has, at the request of the

¹ Estimate provided by local mining interests (FMC) during WRDC process.

Adjudication Court, mapped a proposed subflow zone to identify the extent of the surface water system. This proposal has been reviewed and vetted with the parties and is under revision. Until the adjudication process is complete, uncertainty regarding the extent and priority of water rights in this Planning Area will make it difficult to identify strategies for meeting the projected water demands.

Protected Species and Habitat

The presence of a listed species and protected habitat may be a critical consideration in water resource management and supply development in a particular area. A notable example is the City of Tombstone, which has historically used water derived from springs located in the Miller Peak Wilderness Area and transmitted to Tombstone via a pipeline, constructed to support the burgeoning mining community in the 1880s, to supplement its water supplies. In 2011, the Monument Fire burned over 30,000 acres in the Hauchuca Mountains and parts of Sierra Vista. After the fire, monsoon-triggered flooding caused damage to this pipeline. Tombstone and the Forest Service have been at odds over accessing the sites necessary to make the repairs. Tombstone argues that it should have unlimited access to their water system, and needs this access to provide a secure water supply for its citizens. Because the pipeline is located in the Miller Wilderness Area, the Forest Service asserts that Tombstone must submit plans for NEPA and ESA compliance review. According to Tombstone, this review could potentially delay repairs for a significant amount of time which could negatively impact its ability to meet demands.

Water Management - Groundwater/Surface Water

The basin-fill aquifer system, while experiencing water level declines in response to municipal pumping in the Upper San Pedro Planning Area, is believed to be sufficiently robust to sustain current and projected demands beyond the timeframe of this evaluation. The most controversial water management issue facing the Planning Area is ongoing controversy over the long-term impacts of groundwater pumping. Concerns have been raised by some that pumping from the regional aquifer system has the potential to diminish baseflows in the San Pedro River and degrade the riparian habitat along the River.

The Upper San Pedro Planning Area is not located within in State administered water management region, such as an AMA or INA. As such, aside from community water systems, individual water users are not required to meter or report water use to ADWR. Well impact analyses are not required for issuance of new well permits, the use of which is only governed by legal concept of reasonable beneficial use.

Cochise County has adopted mandatory water adequacy requirements under ARS §45-108.01 requiring all new subdivisions to demonstrate to ADWR the existence of a 100-year adequate water supply. While this program ensures that subdivided land has adequate water supplies to meet current and projected water supplies without impacting other municipal water demands in the region, no regulatory framework exists to examine the impact of diversion or pumping to meet these demands on water dependent natural resources. The lack of this framework is largely a consequence of Arizona's bifurcated legal system, regulating surface water and groundwater under separate statutes and rules and the incomplete adjudication process.

Regional initiatives to create a water management framework in the Upper San Pedro Planning Area were rejected by Cochise County voters.

Strategies for Meeting Future Water Demands

Resolution of Indian and Non-Indian Water Rights Claims

Efforts to complete the Gila River General Stream Adjudication are essential to provide long-term certainty for water users in Arizona. A comprehensive focus on what is needed to complete the Adjudication is essential and could help provide guidance to ADWR so adequate funding can be identified and obtained to complete the necessary technical work to support completion of this process.

Expanded Monitoring & Data Collection

Limited monitoring and reporting of water use is required in the Upper San Pedro Planning Area. The lack of data on annual water demands hampers analysis, public education, and development of strategies to address projected water demands in the region.

Reclaimed Water Reuse

Reuse and recharge of reclaimed water is already practiced in the Upper San Pedro Planning Area. The USF in Sierra Vista was sited in a location to temper the growth of the cone of depression that has formed in response to the pumping that serves Sierra Vista and Ft. Huachuca. Revising this facility to reduce the water losses in the treatment process would provide additional renewable supplies for recharge.

Converting other lagoon-based treatment works to mechanical plants will serve to reduce water losses in the treatment process and augment locally available water supplies. Strategic conversion of existing septic systems with treatment plant and effluent reuse and recharge systems may serve to improve the resilience and sustainability of local water supplies in the Planning Area.

Enhanced Conservation

Local conservation efforts have resulted in significant reductions in water use in the Upper San Pedro Planning Area. Continuing and expanding these efforts will serve to limit water demands and the impact of meeting those demands and should be encouraged.

Enhanced Stormwater Recharge

Local efforts are underway to evaluate the feasibility of increasing locally available water supplies through modification of stormwater management systems to increase aquifer replenishment. If successful, these efforts may increase the efficiency of local groundwater recharge, capturing flows that would, without these efforts, leave the Basin as flood flows.

Local efforts are focused on technical feasibility. There are concerns expressed by some surface water right holders that inhibiting flows that otherwise would have entered the surface water system may reduce the water availability of supplies to which they have the rights. To address these issues, in 2012 the Arizona legislature passed House Bill 2363 establishing a Joint

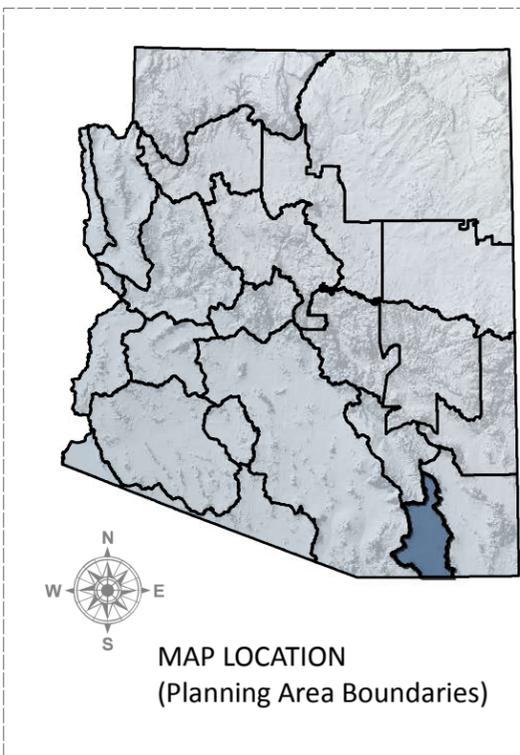
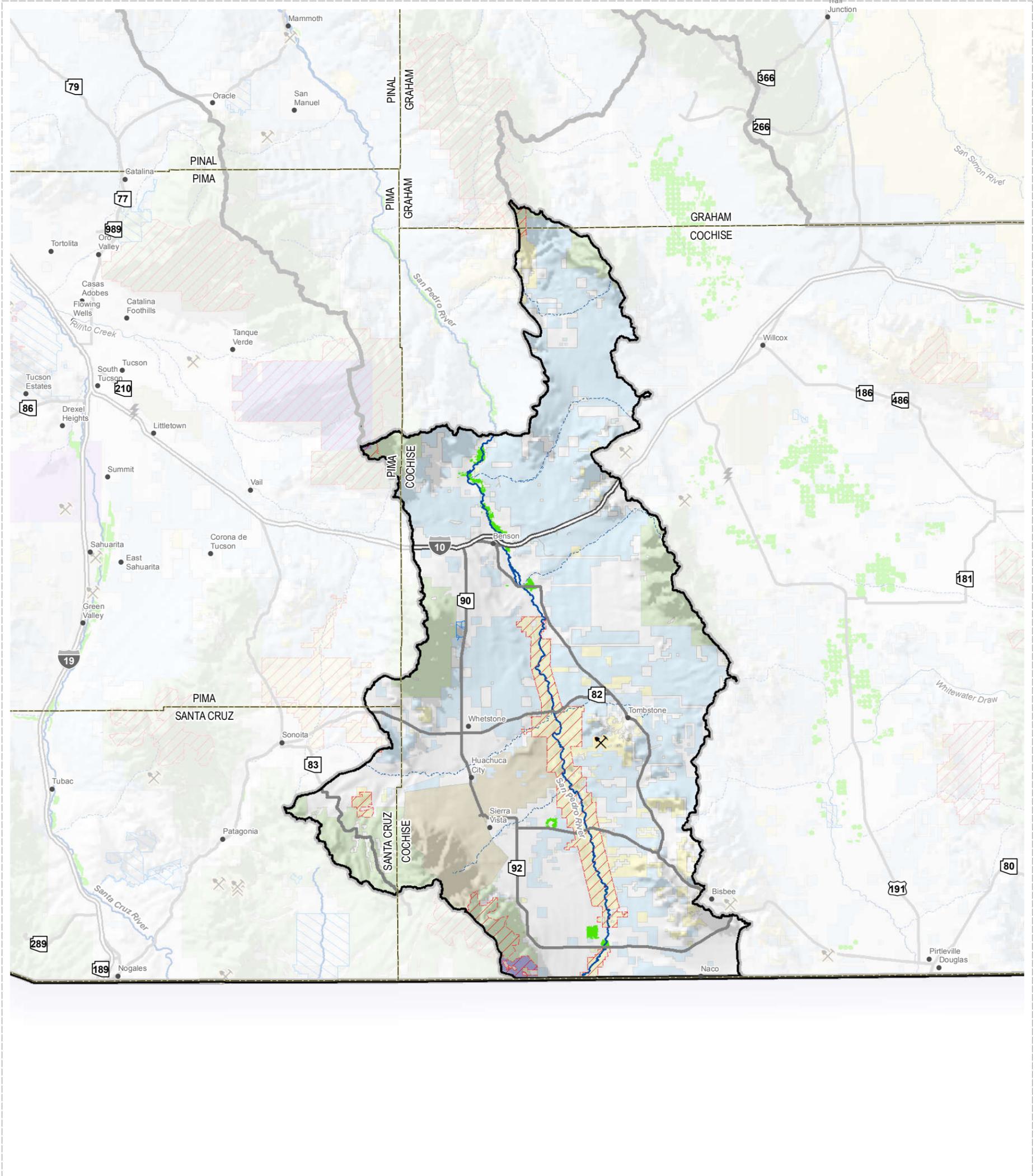
Legislative Study Committee on Macro-Harvested water to evaluate the issues arising from the collection and recovery of large-scale harvested water. The process to evaluate this program will be important in determining whether or not these projects can result in significantly enhancing water supplies beyond what is currently available for future uses.

Importation

Several studies have been conducted to evaluate alternatives for meeting the water demands of current and projected users in the Upper San Pedro Planning Area while protecting the baseflows of the River and the habitat of the riparian corridor. At this time, local efforts are focused on maximizing and augmenting locally available supplies with local efforts. Should these efforts prove insufficient to augment local supplies, importation of supplies from outside the basin may be necessary.

The alternative that has received the most attention to date is extension of the CAP canal delivery system to Sierra Vista. Uncertainty exists with regards to the water supply that would be delivered, the source of capital to construct the infrastructure to affect these deliveries, and the economic feasibility of operating this system. An additional alternative may be participation in a joint seawater desalination project by communities in the Upper San Pedro Planning Area, perhaps through extension of the CAP Canal. There are many hurdles, including those associated with the transportation of water and power across the international border, that such a project would need to overcome before it could reasonably be included in a supply portfolio for the Planning Area.

NOTE: Because GIS data for this project were acquired from multiple sources employing different land base grids and varying accuracy standards, some inconsistencies were encountered. The user is responsible for understanding the accuracy limitations of GIS data layers and is responsible for the results of any application of the data for other than their intended purpose.



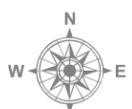
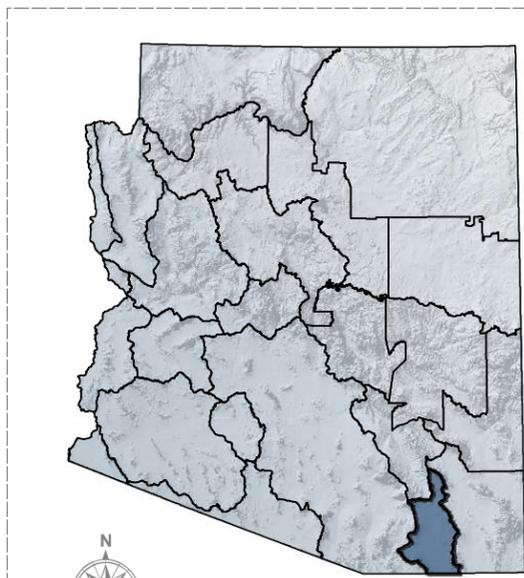
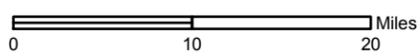
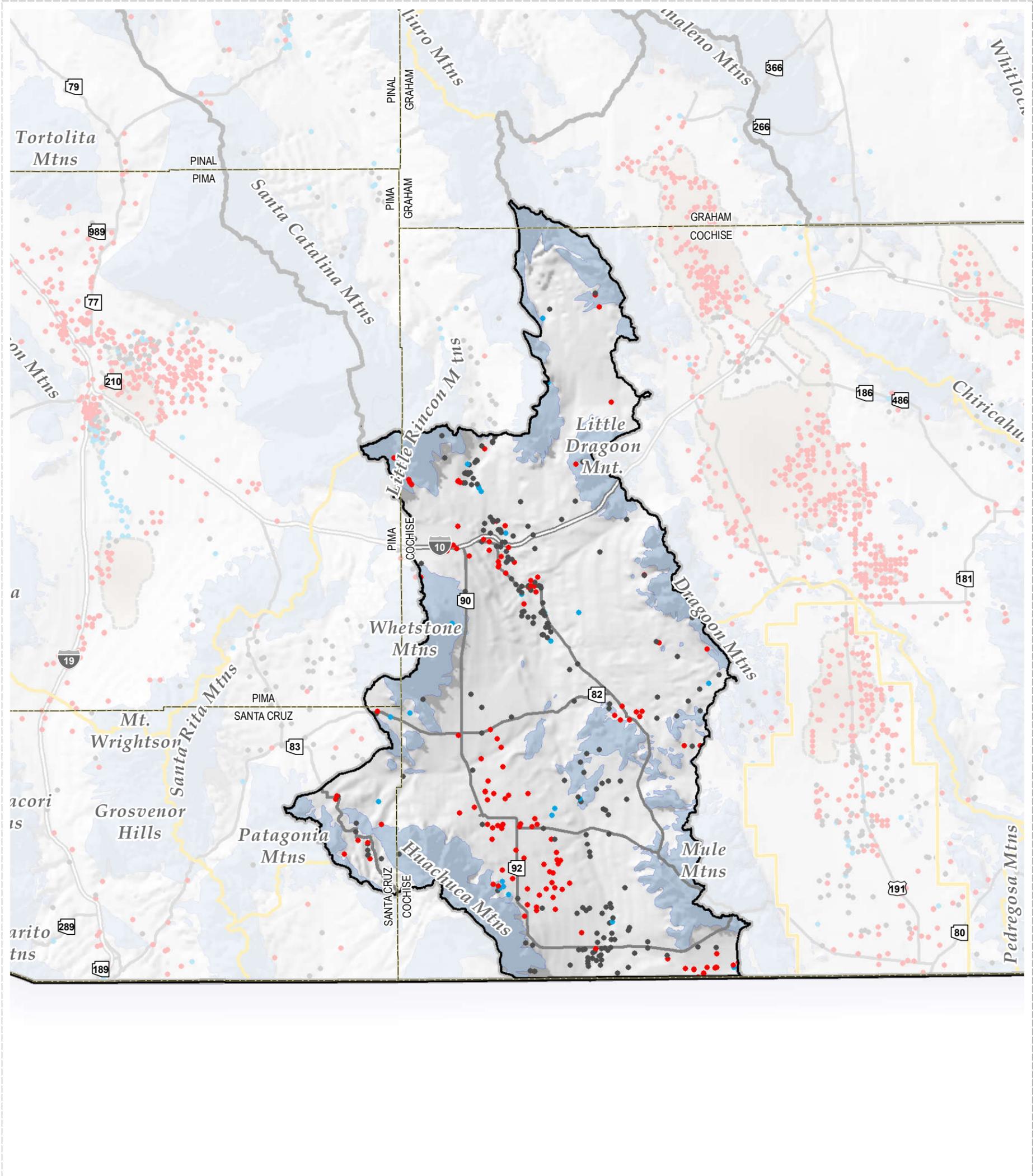
- Planning Area (ADWR)
- State (ALRIS)
- County (ALRIS)
- River or Stream (ASLD)
- Interstate (ADOT)
- Population Center (GNIS)
- Mine (ADMMR, ADWR)
- Hydroelectric Power Plant (ADEQ, ADWR)
- Thermoelectric Power Plant (ADEQ, ADWR)
- Agriculture (SWReGAP, 2004)
- Federal Conservation Land (USFS, BLM, NPS)
- State Managed Conservation Land (AZGFD, AZSP)
- BLM Land
- National Forest
- National Park
- Military Reserve
- Private and Other Land
- State Trust Land
- Tribal Land



Upper San Pedro Land Ownership

Figure P.A.18-1

NOTE: Because GIS data for this project were acquired from multiple sources employing different land base grids and varying accuracy standards, some inconsistencies were encountered. The user is responsible for understanding the accuracy limitations of GIS data layers and is responsible for the results of any application of the data for other than their intended purpose.



MAP LOCATION
(Planning Area Boundaries)

- Planning Area (ADWR)
- State (ALRIS)
- County (ALRIS)
- Groundwater Basin (ADWR)
- Area of Active Land Subsidence (ADWR)
- Hard Rock Geology (AZ Bureau of Mines, UofA)
- Interstate (ADOT)

- Recent Water Level Change * (1990's through 2000's)
- Minor WL Change +5' to -5'
 - Negative
 - Positive

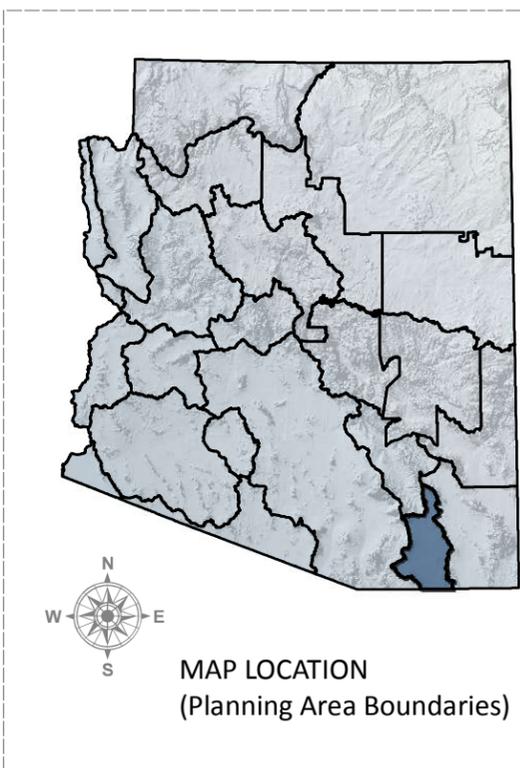
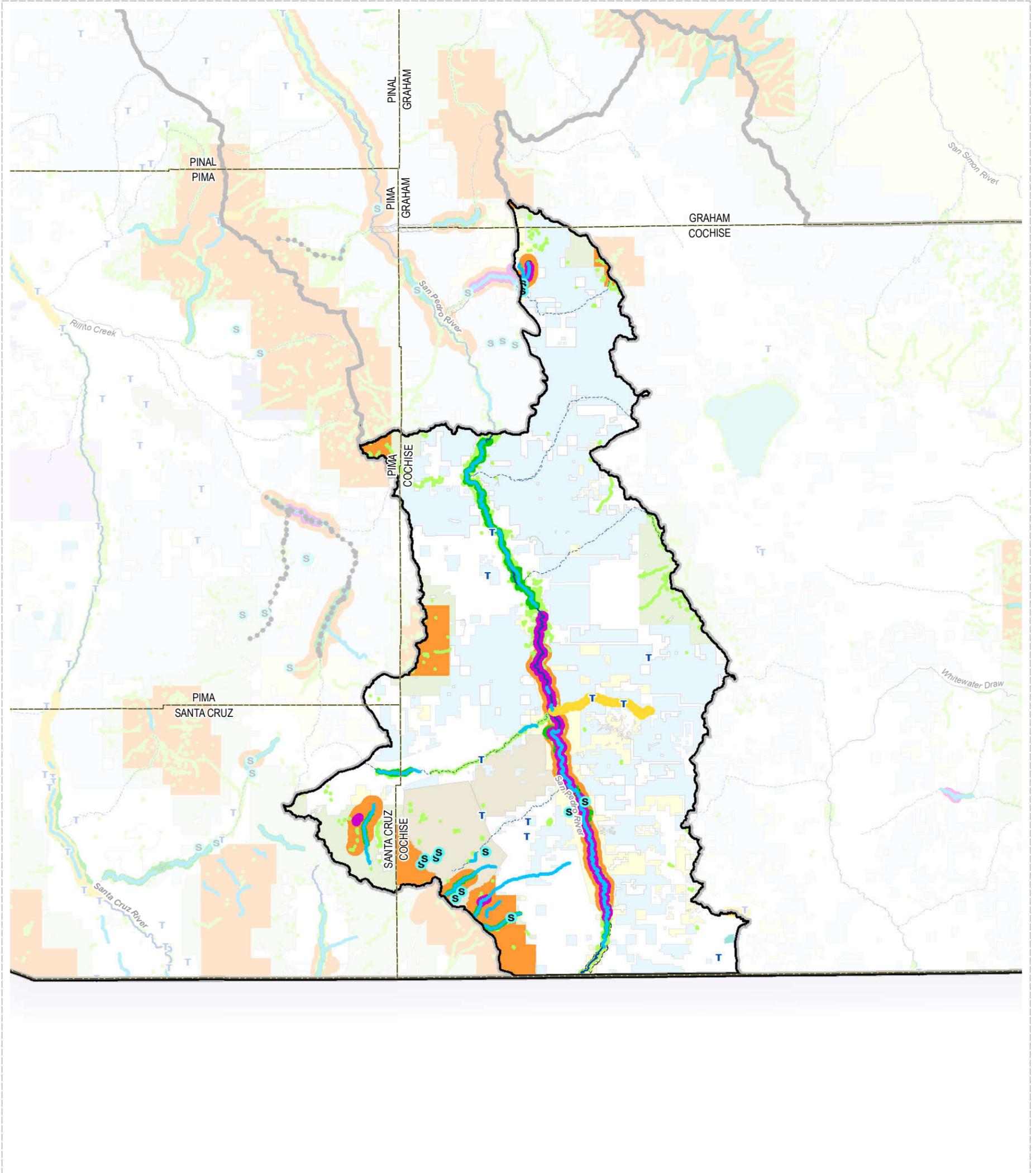
* Data provided by ADWR



Upper San Pedro Groundwater Hydrology

Figure P.A.18-2

NOTE: Because GIS data for this project were acquired from multiple sources employing different land base grids and varying accuracy standards, some inconsistencies were encountered. The user is responsible for understanding the accuracy limitations of GIS data layers and is responsible for the results of any application of the data for other than their intended purpose.

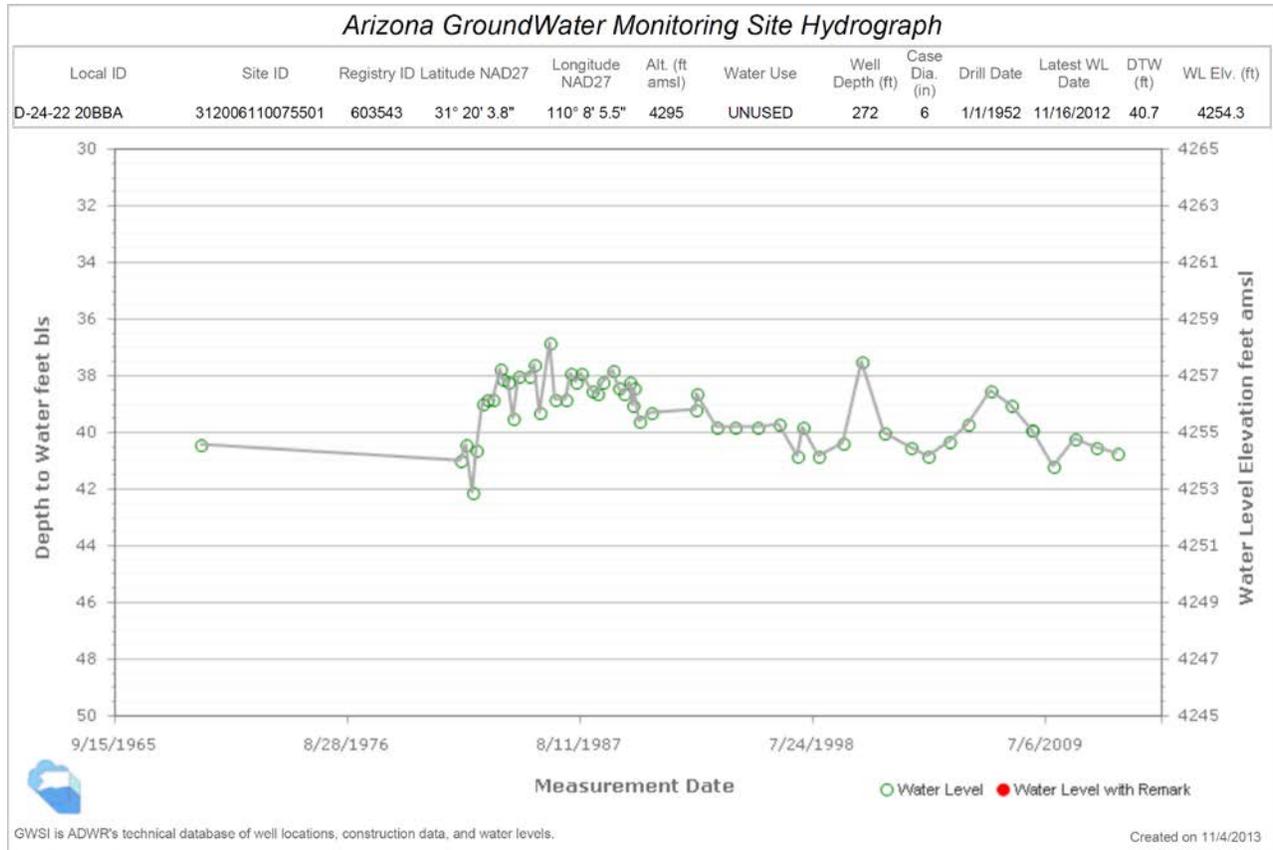


- Planning Area (ADWR)
- State (ALRIS)
- County (ALRIS)
- Reservoir or Lake (NHD)
- Waste Water Treatment Plant (ADEQ)
- Major Spring (ADWR, Pima County)
- Perennial Flow (ADEQ, USGS)
- River or Stream (ASLD)
- Outstanding Arizona Water (ADEQ)
- Effluent Dependent Stream (ADWR, NEMO)
- Instream Flow Certificate (ADWR)
- 1993 Riparian Inventory (AZGFD)
- Modeled Riparian Habitat (AZGFD)
- Designated ESA Critical Habitat (USFWS)
- Proposed ESA Critical Habitat (USFWS)
- Federally Designated Wild and Scenic River (USFS)
- BLM Land
- National Forest
- National Park
- Military Reserve
- Private and Other Land
- State Trust Land
- Tribal Land

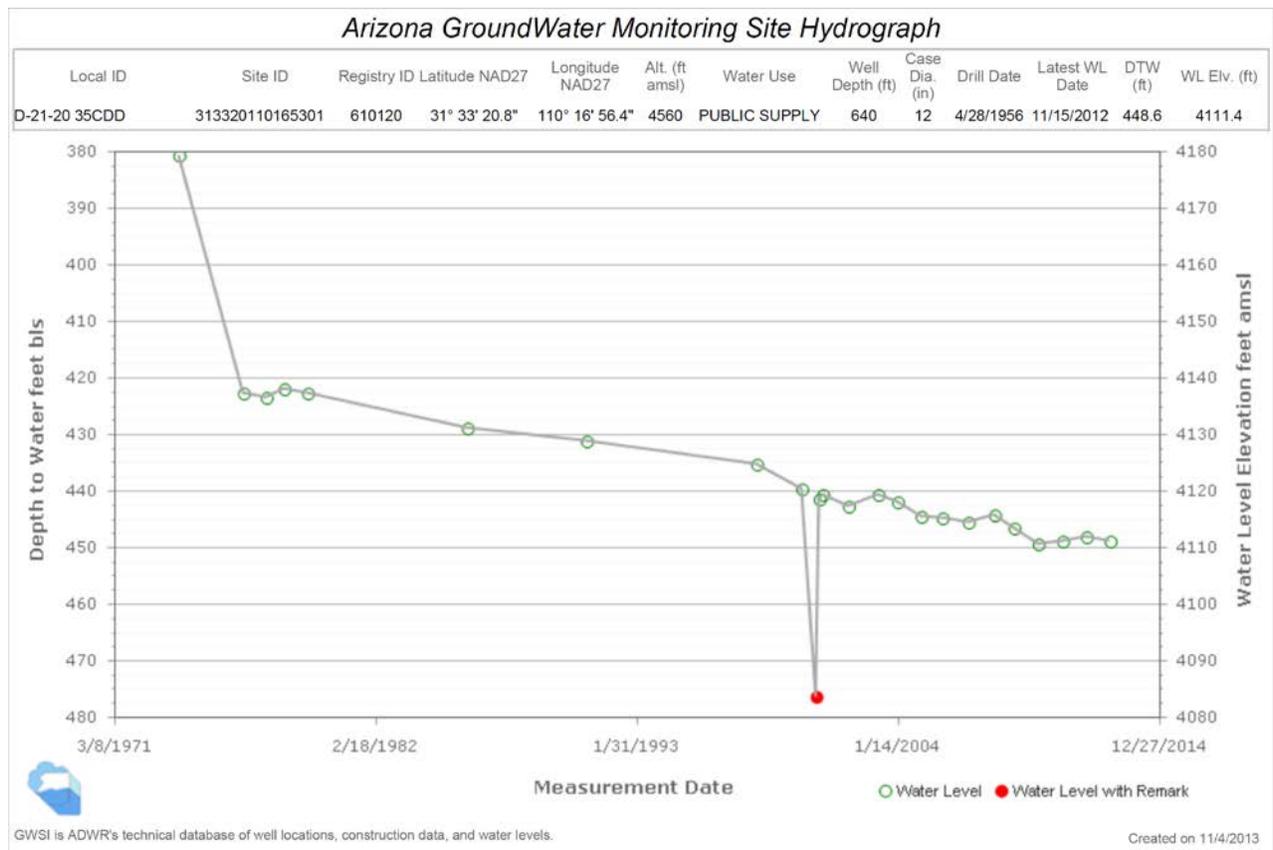


Figure P.A.18-3
Upper San Pedro
Surface Water and Natural Features

Upper San Pedro Basin – Upper San Pedro Planning Area



D-24-22 20BBA -- Upper San Pedro basin – Sierra Vista sub-basin along US/Mexico border 1 mile east of San Pedro River.



D-21-20 35CDD – Upper San Pedro basin – Sierra Vista sub-basin in Sierra Vista.