Arizona Department of Water Resources
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SUPPLY & DEMAND

2024

AGUA FRIA

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2024 SUPPLY AND DEMAND ASSESSMENT
AGUA FRIA BASIN

1 INTRODUCTION

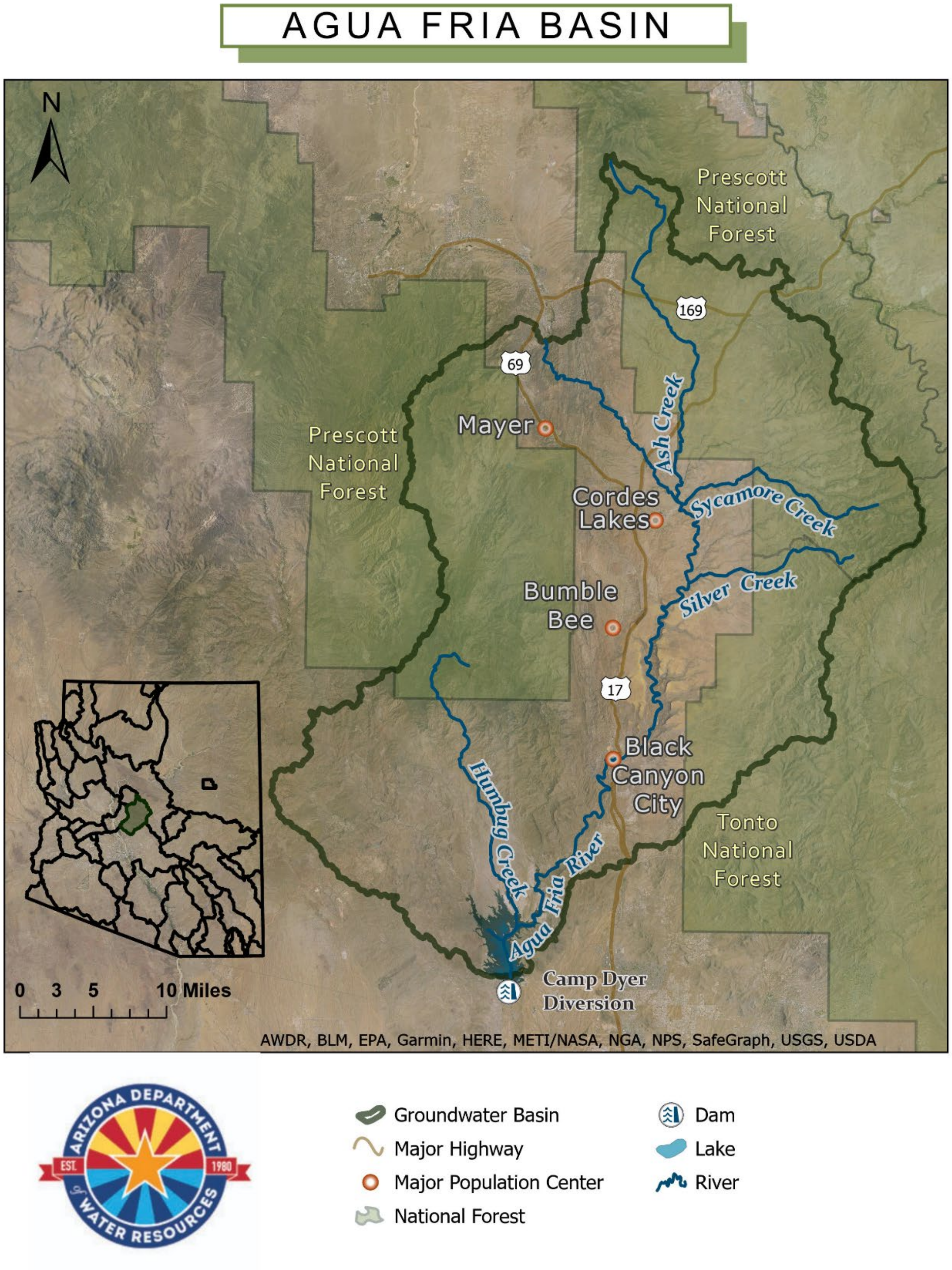

Figure 1. Map of the Agua Fria Basin.

1.1 REPORT BACKGROUND AND PURPOSE

The Supply and Demand Reports (SDRs) are a duty of the director of the Arizona Department of Water Resources (ADWR) required by statute in Arizona Revised Statues (A.R.S.) § 45-105(B)(14).

Although similar assessments have been completed periodically, 2023 was the first time ADWR dedicated annual funding and staff to complete assessments of all of Arizona's groundwater basins on a recurring cycle. By the end of 2027, there will be a comprehensive overview of the estimated supplies and demands for every basin throughout the state, and each basin will be reassessed at least every five years. The SDRs may be used to inform the Water Infrastructure Finance Authority (WIFA) on funding decisions in the future (see A.R.S. § 49-1304(A)(14)). In addition, the SDRs may also be used in future planning work at ADWR and have garnered interest from members of the Governor's Water Policy Council (the "Council") and other stakeholders.

Seven basins were assessed in 2023: Butler Valley, Harquahala Irrigation Non-Expansion Area (INA), McMullen Valley, Tiger Wash, Douglas Active Management Area (AMA), Willcox, and San Bernardino Valley.

The basins and subbasins selected for assessment in 2024 are Agua Fria, Big Sandy (Fort Rock and Wikieup subbasins), Cienega Creek, Donnelly Wash, Gila Bend, Lower San Pedro, Prescott AMA, Ranegras Plain, San Rafael, Santa Cruz AMA, Tonto Creek, Upper Hassayampa, Upper San Pedro, and Verde River (Big Chino, Verde Canyon, and Verde Valley subbasins).

1.2 PROCEDURE AND SCOPE

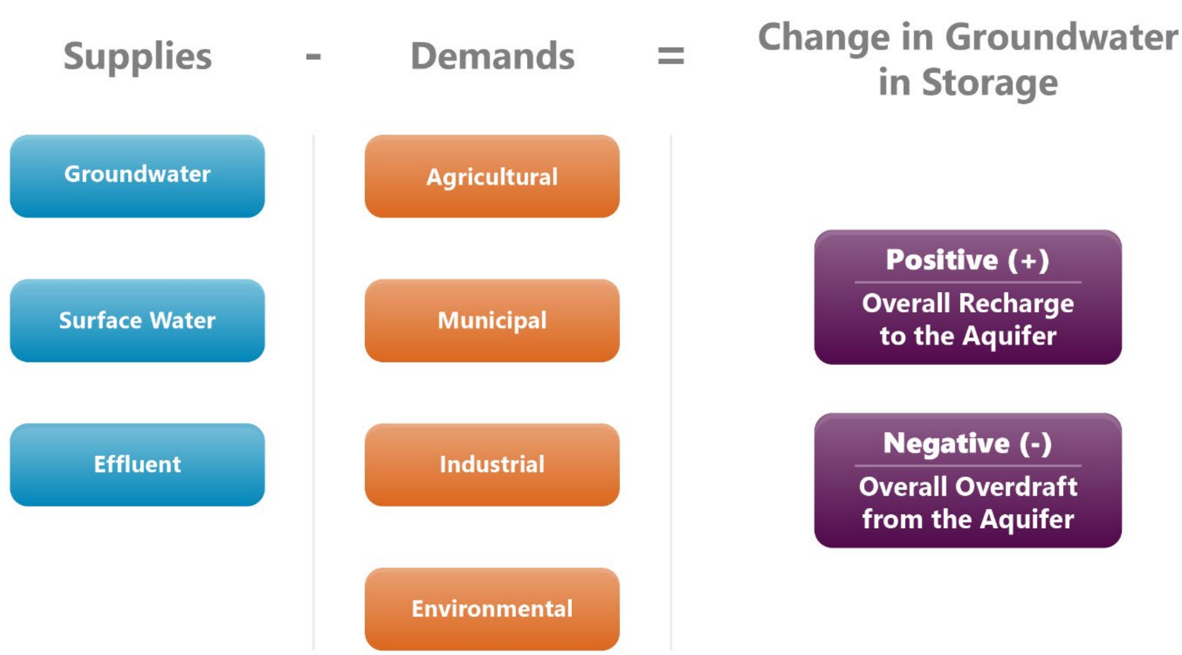

Figure 2. Depiction of the Agua Fria Basin water budget, including all available supplies and demands and how they contribute to changes in groundwater in storage.

The SDRs are structured as water budgets, focusing on total inflows and outflows at the basin scale. The SDRs estimate the volumes of water demands from all uses (categorized into sectors of Agricultural, Industrial, Municipal, and Other) and the volumes of water supplies (Surface Water, Groundwater, Incidental Recharge, and Effluent) available to meet those demands. The reports also include projected demands and supplies under various influences of future scenarios.

The SDRs are not groundwater flow models with finer geographic results. The development of regional groundwater flow models for each basin is an extensive technical process and is not feasible within the time constraints of this project. Outside of the AMAs and INAs, data that has been formally reported is generally not available. In instances where data does exist, it may be outdated or lack reliability. ADWR has endeavored to acquire local or specific data to generate the SDRs. However, when such information was not obtainable, staff utilized literature values, averages, or scientific assumptions to formulate water usage estimates.

The SDRs attempt to answer the following questions:

1. What is the annual volume of water demand?
2. What is the volume of each water supply annually available to meet these demands?
3. Is there enough available supply to balance demand each year?

The water budget was estimated by subtracting the total annual demand from the total annual supply. If demand exceeded supply in a year, the difference was subtracted from the estimated aquifer storage, and if supply exceeded demand, the difference was added to aquifer storage. In this way, the process is like balancing a checkbook, totaling the credits and debits made to the account through the year to understand how much groundwater is available in storage.

This report is designed to be understandable to the public. The Methods Appendix includes specific technical information and additional details regarding data and methods: [Methods Appendix]. Additional resources and interactive dashboards are available for further explanation and detail: [Dashboards].

1.3 METHODOLOGY AND LIMITATIONS

This study reviewed and compiled data to:

1. Estimate supply and demand volumes in the basin.
2. Project changes in supply and demand from likely future scenarios.

ADWR developed and compiled baseline data for the period from 1990 to 2023. Staff then developed scenarios based on the most likely impacts on water demands and supplies over 52 years (from 2024 to 2075), and then projections were made based on the baseline data. The results from these scenarios and the combined baseline data were used to estimate whether supply could meet demand each year from 1990 to 2075. ADWR independently developed both the supply and demand estimates.

ADWR also contacted a comprehensive group of stakeholders from all relevant water use sectors within the basin via a standardized mailed letter to gather information for estimating water demand. The letter informed them of this research and requested water use data. Stakeholders were identified from satellite imagery, county and Arizona Corporation Commission records, internal records, and recommendations by other stakeholders. To better understand the water demand, staff traveled to the basin and met with stakeholders in person.

Due to the limited reported water data available outside Arizona's AMAs and INAs, the supplies and demands outlined in the SDRs are estimates only. When available, ADWR used data collected and maintained by the Department, other government agencies, and local cooperators. Stakeholder outreach and site visits in the study basin resulted in some voluntary data contributions and assisted in the development of estimates. When voluntary data could not be obtained, research into existing literature and the use of representative data were necessary to develop estimates.

Please see the Methods Appendix for an in-depth discussion of the methodologies and assumptions ADWR applied to create each estimate: [Methods Appendix].

2 RESULTS

2.1 BASIN SUMMARY

The Agua Fria Basin encompasses 1,263 square miles and is characterized by mid-elevation mountain ranges and mesas. Land ownership is predominantly federal lands split between the U.S. Forest Service (47 percent) and the Bureau of Land Management (29 percent). The remainder comprises State Trust lands (15 percent), private lands (seven percent), and county lands (two percent). The Agua Fria Basin had a population of 8,210 in 2000.

While a primary aquifer does not supply the basin, regional aquifers, and water-bearing rock units, such as basin-fill, conglomerates, volcanic rock, and fractured bedrock, are present. The conglomerate is found throughout the basin and contains the most significant amount of water. Due to faulting, it is separated into smaller units. Groundwater in the basin's northern portion flows from the margins towards the Agua Fria River and then south. Previous storage estimates range from 620,000 to 3,000,000 acre-feet (AF) to a depth of 1200 feet.

The Agua Fria River runs north to south through the basin's center, eventually flowing through Lake Pleasant. Perennial reaches are situated along the Agua Fria River, Ash Creek, Sycamore Creek, Indian Creek, Silver Creek, Humbug Creek, Yellow Jacket Creek, and Grapevine Creek. Most of the perennial reaches are in the northern portion of the basin.

2.2 SUPPLIES

This subsection describes the types of supplies available in the basin and ADWR's general process of estimating those supplies. For more information on how each of these supplies were derived, please see the Methods Appendix.

2.2.1 Surface Water

ADWR examined all water sources defined as surface water in each basin. Surface water includes water flowing in streams, canyons, ravines, or other natural channels, or in definite underground channels, whether perennial or intermittent, floodwater, wastewater, or surplus water, and of lakes, ponds, and springs discharging to the surface (A.R.S. § 45-141). After examining these sources and deducting any existing surface water diversions (stockponds, reservoirs, and agricultural diversions) from the resulting volumes, ADWR estimated the remaining water available for diversion or use. When possible, streamgage data was used to estimate surface water volumes. Where active streamgages were absent, which often applies to areas with intermittent and ephemeral streamflow, the Drainage-Area Ratio (DAR) method was used to estimate surface water volume.

2.2.2 Groundwater

For this assessment, ADWR refers to the "inflow to" and "outflow from" the aquifer each year as "groundwater," which represents the annual recharge or replenishment of groundwater through processes such as percolation of precipitation or surface water into the subsurface. This volume is distinct from the volume of groundwater considered to be available in storage. Streamflow infiltration, baseflow, groundwater inflow/outflow from other basins, and mountain-front recharge are all components of groundwater that were included in the estimates.

The total volume of groundwater in storage reflects the volume of groundwater reasonably accessible at the average depth of the wells in the basin. This provides a more realistic estimate of the volume of water available for withdrawal using existing infrastructure. This report does not consider subsidence or the permanent loss of aquifer storage if the estimated water volume in storage were to be removed from the basin.

2.2.3 Effluent

ADWR used effluent data provided by the Arizona Department of Environmental Quality (ADEQ) to estimate the amounts of effluent available for reuse from 1990 to 2023. These effluent estimates are based on effluent volumes produced from wastewater treatment plants or industries and do not include septic tanks or other measures of wastewater collection. Recharge from septic tanks is included in the incidental recharge estimation. When ADEQ effluent data was not available, ADWR supplemented using Community Water System (CWS) effluent data.

2.2.4 Incidental Recharge

Incidental recharge is water from human use that replenishes groundwater supplies. It is associated with agricultural, industrial, and municipal water demands. ADWR used data derived from demand analyses to estimate incidental recharge volumes.

2.2.5 Transportation Water

Certain basins have been identified in statute as basins that can receive or source transportation water, but the Agua Fria Basin was not identified as such.

2.3 SUPPLY RESULTS

This subsection contains ADWR's estimates of annual supplies available to the Agua Fria Basin.

2.3.1 Surface Water

In the Agua Fria Basin, ADWR identified the following surface water conveyances (USGS streamgages in parentheses):

- Agua Fria (09512500 and 09512800)
- Ash Creek
- Big Bug Creek
- Little Ash Creek
- Sycamore Creek
- Humbug Creek
- Castle Creek
- Black Canyon Creek
- Boulder Creek

Flows measured with streamgage data are located along Agua Fria (09512500 and 09512800). For streams without streamgage data, the DAR method was applied to estimate streamflow volumes. The streamflow volume estimates in the table below are composites of the streamgage and DAR estimation methods. Surface water contributes 19,000 AF to the supplies in the basin in a typical year. However, there are years with extremely high and low surface water inflows, as shown in the table below. Due to the extremely high flow years associated with floods, the average surface water supply in the basin is much higher than the median of 19,000 AF per year.

Table 1. Surface Water Volumes in the Agua Fria Basin.

Basin	Streamflow Minimum	Streamflow Maximum	Average Streamflow (Streamgage Method)	Average Streamflow (DAR Method)	Total Average Streamflow	Median Streamflow
Agua Fria	1,122 (2011)	533,411 (2022)	55,507	8,469	63,976	19,346

All values are shown in AF. Parentheses indicate the year that streamflow volume was recorded.

Examples of estimated surface water volumes diverted from the Agua Fria Basin for use, either for storage in reservoirs or via agricultural diversions, are provided below:

Table 2. Surface Water Volumes Diverted for Use in the Agua Fria Basin.

Year	Diverted Streamflow*
1990	848
2006	10,544
2023	122,236
Average Annual Diverted Streamflow from 1990-2023	56,823

**All values are shown in AF.*

2.3.2 Groundwater

The following groundwater volumes were estimated in the Agua Fria Basin:

Table 3. Streamflow Infiltration in the Agua Fria Basin.

Basin	Average Annual Streamflow Infiltration (Perennial)	Average Annual Streamflow Infiltration (Intermittent & Ephemeral)	Total Average Annual Streamflow Infiltration
Agua Fria	4,718	2,819	7,537

All values are shown in AF. NA, or Not Applicable, applies to fields without estimates.

- Streamflow Infiltration: Infiltration for perennial streams was estimated using the fixed percentage listed in the Methods Appendix. For intermittent and ephemeral streams, infiltration was estimated using the USDA NRCS methodology. The predominant soil type was clay with a mixture of sand and loam. The standard storm duration utilized was 1.5 hours. Total streamflow infiltration peaked in 1993 at approximately 59,765 AF, with its estimated lowest flow in 2011 at 285 AF.

Table 4. Groundwater Volumes in the Agua Fria Basin.

Basin	Average Annual Baseflow	Average Annual Groundwater Inflow	Average Annual Groundwater Outflow	Average Annual Mountain-Front Recharge	Average Annual Groundwater Storage
Agua Fria	6,699	1,820	2,502	60,853	NA

All values are shown in AF. NA, or Not Applicable, applies to fields without estimates.

- Baseflow: ADWR estimated baseflow using the USGS Hydrologic Toolbox in GIS. Streamgage data was utilized when available. Any gaps in the data were filled using the USGS StreamStats website and the average baseflow index for the streamgage basin areas.
- Groundwater Inflow/Outflow: Interbasin underflow volumes were based on USGS predevelopment maps, literature estimates by Tillman et al. (2011), and ADWR's Hydrology division groundwater flow estimates.
- Mountain-Front Recharge: The mountain-front recharge estimates were calculated using precipitation data, model data, scientific literature values, and a water budget accounting for different groundwater inflows/outflows that affected the mountain-front recharge volume.
- Groundwater Storage: Storage was calculated using either a model data plus water budget method if model data was available for the basin, or a GIS-based geological data non-model method if unavailable (Section 2.5.4., Methods Appendix). Due to the complicated geological nature of the Aqua Fria Basin, ADWR did not estimate the amount of groundwater in storage.

2.3.3 Effluent

Based on information from ADEQ and CWS, effluent produced in the Agua Fria Basin has not been allocated for reuse. As a result, no effluent contributes to the basin's water supply.

2.3.4 Incidental Recharge

Sources of incidental recharge in the Agua Fria Basin are agricultural, municipal, and industrial. These inflows to the aquifer are described below:

Table 5. Incidental Recharge Volumes in the Agua Fria Basin for 1990-2023.

Sector	1990	2006	2023
Municipal	95	134	129
Agricultural	400	540	246
Industrial	9	9	9

All values are shown in AF.

- Municipal Incidental Recharge: Municipal incidental recharge is a byproduct of lost and unaccounted for (L&U) water from water providers and seepage from septic tanks. Due to population growth and increased municipal water usage in the Agua Fria Basin, the volume of municipal incidental recharge has grown from 95 AF in 1990 to 129 AF in 2023.
- Agricultural Incidental Recharge: Agricultural incidental recharge depends on the total irrigation withdrawals and irrigation efficiency within a basin. The volume of agricultural incidental recharge has decreased in the basin as irrigation system improvements were made and total withdrawals were reduced. It was estimated that 400 AF of agricultural incidental recharge was produced in 1990. The volume of agricultural incidental recharge was estimated to be 246 AF in 2023.
- Industrial Incidental Recharge: Industrial incidental recharge occurs from the irrigation of turf facilities. The total withdrawals and efficiency of irrigation systems influence the total volume of incidental recharge. In 2023, industrial incidental recharge was estimated to be 9 AF.

2.3.5 Transportation Water

No water is transported into the Agua Fria Basin.

2.4 DEMAND RESULTS

Table 6. Baseline Demand Data for the Agua Fria Basin by Sector for 1990-2023.

Sector	Subsector/Water Type	Year		
		1990	2006	2023
Agricultural	Agriculture	-1,300	-1,800	-921
Municipal	Non-Residential	-44	-60	-68
	L&U	-78	-111	-107
	Residential Non-Provider	-103	-146	-139
	Residential Provider	-516	-732	-698
Industrial	Feedlots	-1	-1	-1
	Grazing	-30	-30	-30
	Mining	-64	0	0
	Sand and Gravel	-88	-107	-115
	Turf	-80	-85	-87
Environmental	Riparian	-3,863	-3,863	-3,863

Negative numbers indicate demands or water flows leaving the basin—all values in AF.

2.4.1 Municipal Results

Municipal demand is defined as the non-agricultural and non-industrial uses of water supplied by a city, town, private water company, irrigation district, domestic water improvement district, water cooperative, or private domestic well.

The Agua Fria Basin has an estimated population of 9,703, with most residing in Black Canyon City, Bumble Bee, Cordes Lakes, and Mayer. Due to the I-17 HWY, ADWR estimates that a portion of commercial use in the basin is from transitory users. Tourism is limited chiefly to the Agua Fria National Monument and a portion of the Prescott National Forest.

- Residential Provider: Residential provider use is supplied by a municipal provider/community water system (CWS). The Agua Fria Basin has an estimated 8,088 residents that a water provider serves. Residential provider use was 516 AF in 1990 and rose to 698 AF by 2023.
- Residential Non-Provider: Residential non-provider use is any residential water use not supplied by a municipal provider but rather by a non-public water system or domestic well. Agua Fria Basin has an estimated population of 1,615, reliant on self-supplied water resources. In 1990, residential non-provider water use was estimated to be 103 AF, this volume increased to 139 AF by 2023.
- Non-Residential: Non-residential use is defined as municipal water not used for residential purposes but is instead used for commercial, institutional, recreational, or transitory uses. The water demand in the Agua Fria Basin is relatively low, with most of the water usage coming from RV parks and service areas. In 1990, 44 AF of water was used for non-residential demands. Non-residential water use increased over the baseline period to 68 AF in 2023.
- Lost and Unaccounted for Water: Lost and unaccounted for water is defined as the total quantity of water from any source that enters a water distribution system during a calendar year minus the total amount of water deliveries from the water distribution system during the calendar year. ADWR estimates that the total volume of L&U water was 78 AF in 1990. The volume of L&U water increased to 107 AF by 2023.

2.4.2 Agricultural Results

Agricultural demand is water applied to two or more acres of land to produce plants or parts of plants for sale for human consumption or use as feed for livestock, range livestock, or poultry.

An estimated 428 acres are irrigated in the Agua Fria Basin. Most of these acres are dedicated to the cultivation of grass crops and the irrigation of pastures.

- Results: Irrigation withdrawals were estimated to be 1,300 AF in 1990. Average annual water use rose throughout the 1990s and early 2000s until irrigation peaked at 1,900 AF in 2007 and 2009. Withdrawals have decreased since 2009 and were estimated to be 921 AF in 2023.

2.4.3 Industrial Results

Industrial demand is the water used by an industrial facility, such as a dairy, feedlot, mine, or golf course. In the Agua Fria Basin, current and recent industrial demand comes from feedlots, grazing, mining, sand and gravel, and turf.

- Feedlots: An estimated 106 horses are kept in feedlots, with minimal annual consumption at approximately 1 AF of water.
- Grazing: An estimated 1,763 cattle graze in the Agua Fria Basin, consuming 30 AF of water annually.
- Mining: Mining is not a significant industrial water use in the Agua Fria Basin. From 1990 to 1993, one mine was active, consuming an estimated 64 AF of water per year. No water use for mining was estimated for the remainder of the baseline period, 1994 – 2023.
- Sand and Gravel: Withdrawals for sand and gravel facilities have increased over the baseline period from 88 AF in 1990 to 115 AF in 2023. The increase in water use can be attributed to the addition of new facilities in the basin over time.
- Turf: Water use for turf facilities has not changed significantly over the baseline period. In 1990, total turf irrigation was estimated at 80 AF; in 2023, turf irrigation accounted for 87 AF.

2.4.4 Environmental Results

Environmental use is quantified within this report as evapotranspiration along streams, rivers, lakes, and drainage ways.

- Riparian plants near the Agua Fria River have an estimated net water requirement of 3,863 AF per year.

3 COMBINING SUPPLY AND DEMAND

Due to the complex geological nature of the Agua Fria Basin, ADWR has not estimated the amount of groundwater in storage for this area. However, other water supply components have been assessed, such as streamflow, streamflow infiltration, groundwater inflow and outflow to and from other basins, and mountain front recharge. Despite these estimates, the lack of groundwater storage data prevents the complete combination of supply and demand results, limiting the ability to present a comprehensive picture of the basin's overall water budget.

4 RESULTS OF PROJECTION SCENARIOS

The projection scenarios developed are:

1. Status Quo: baseline volumes were carried forward through the projection period.
2. Growth: volumes were assumed to increase within specific parameters throughout the projection period.
3. Conservation: volumes were assumed to be influenced by specific conservation practices through the projection period.
4. Technology: volumes were assumed to be influenced by technological advancements through the projection period.
5. Climate: volumes were adjusted for three different climate scenarios, using a 1-degree Fahrenheit temperature increase in the mean annual temperature for the projection period following a lower emissions pathway for Arizona, a 5-degree Fahrenheit temperature increase following a medium emissions pathway, and a 10-degree Fahrenheit temperature increase following a high emissions pathway.

4.1 SUPPLY PROJECTION RESULTS

4.1.1 Surface Water

Table 7. Surface Water Status Quo Projection Data for the Agua Fria Basin.

Basin	Volume
Agua Fria	60,537

All values are shown in AF.

For the Status Quo scenario, the volume of surface water will remain constant until 2075. Due to ongoing projection scenario improvements, no other projection scenarios were applied to surface water for this report.

4.1.2 Effluent

ADEQ and CWS data show that no effluent produced in the Agua Fria Basin has been allocated for reuse. Therefore, no effluent is used as a water supply in Agua Fria Basin, and no supply projections were applied to the data.

4.1.3 Incidental Recharge

Table 8. Municipal Incidental Recharge Projection Data for the Agua Fria Basin for 2024-2075.

Sector	Scenario	2024	2050	2075
Municipal	Status Quo	130	130	130
	Climate – Low	129	130	130
	Climate – Medium	130	131	133
	Climate - High	130	133	137
	Conservation	129	81	65
	Growth	132	168	200
	Technology	129	116	103

All values are shown in AF.

Municipal incidental recharge is projected to change the most under the Growth scenario. Due to population growth in the basin, total municipal incidental recharge is estimated to grow 52% by 2075.

Table 9. Agricultural Incidental Recharge Projection Data for the Agua Fria Basin for 2024-2075.

Sector	Scenario	2024	2050	2075
Agricultural	Status Quo	239	239	239
	Climate – Low	246	248	250
	Climate – Medium	246	255	264
	Climate - High	247	264	281
	Conservation	237	201	201
	Growth	244	196	159
	Technology	245	209	177

All values are shown in AF.

The volume of agricultural incidental recharge is projected to have the most significant change in the growth scenario. A reduction in total acreage is expected to reduce agricultural incidental recharge by 35%.

Table 10. Industrial Incidental Recharge Projection Data for the Agua Fria Basin for 2024-2075.

Sector	Scenario	2024	2050	2075
Industrial	Status Quo	9	9	9
	Climate – Low	9	9	9
	Climate – Medium	9	9	9
	Climate - High	9	9	9
	Conservation	9	8	8

All values are shown in AF.

In the medium and high emissions Climate scenarios, industrial incidental recharge is expected to decrease. Higher temperatures are assumed to increase evaporative losses, resulting in a net reduction in industrial incidental recharge.

4.2 DEMAND PROJECTION RESULTS

4.2.1 Municipal

Table 11. Projected Demand Volumes for the Municipal Sector for 2024-2075.

	Residential Provider			Residential Non-Provider		
	2024	2050	2075	2024	2050	2075
Status Quo	-699	-699	-699	-140	-140	-140
Climate – Low	-698	-699	-701	-139	-140	-140
Climate – Medium	-698	-707	-715	-139	-141	-143
Climate - High	-699	-720	-740	-139	-143	-146
Conservation	-693	-563	-438	-138	-112	-88
Growth	-710	-904	-1,079	-142	-181	-216
Technology	-695	-619	-546	-139	-124	-109

All values are shown in AF.

	Non-Residential			L&U		
	2024	2050	2075	2024	2050	2075
Status Quo	-67	-67	-67	-107	-107	-107
Climate – Low	-68	-68	-68	-107	-108	-108
Climate – Medium	-68	-68	-68	-107	-109	-110
Climate - High	-68	-68	-68	-107	-110	-113
Conservation	-68	-68	-68	-107	-63	-51
Growth	-70	-88	-106	-109	-139	-166
Technology	-68	-68	-68	-107	-96	-86

All values are shown in AF.

- Climate: Under the Climate scenario, rising temperatures and increased evaporation rates are expected to increase water demand for the Agua Fria Basin. Under the low emissions scenario, residential provider demand is estimated to increase to 701 AF by 2075. Residential non-provider demand is expected to increase to 140 AF by 2075. The total volume of L&U water is projected to increase to 108 AF in 2075. Under a medium emissions scenario, residential provider demand is expected to increase to 715 AF by 2075. Residential non-provider demand is estimated to increase to 143 AF by 2075. The total volume of L&U water is estimated to be 110 AF in 2075. In a high emissions scenario, residential provider demand is projected to reach 740 AF by 2075. Residential non-provider usage is expected to increase to 146 AF by 2075. The total volume of L&U water is anticipated to be 113 AF by 2075.

- Conservation: Under the Conservation scenario, which includes requirements similar to those established in the 5th Management Plan will be implemented alongside additional water-savings measures. Residential provider water demand in 2075 is estimated to be 438 AF, reflecting a 37% annual water savings. Residential non-provider usage is projected to be 88 AF by 2075, reflecting a 37% annual water savings. Additionally, the total volume of L&U water for the basin is estimated to be 51 AF by 2075, with an annual water savings of 53%.
- Growth: In the Growth scenario, population projections produced by the Arizona Commerce Authority Office of Economic Opportunity (ACA OEO) were used to estimate the growth in the Agua Fria Basin. By 2075, municipal demand is expected to rise, with residential provider use estimated at 1,079 AF and non-residential provider at 216 AF. Additionally, the volume of L&U water is projected to be 166 AF by 2075.
- Technology: In the Technology scenario, ADWR assumes the installation of advanced metering infrastructure (AMI) will cut household water usage by an average of 14,000 gallons. For the Agua Fria Basin, it is projected that by 2075, technology may reduce residential provider water use to 546 AF, a water savings of 22%. Residential non-provider demand is calculated to decline to 109 AF by 2075, reflecting a 22% savings. The volume of L&U water for the basin is estimated to be 86 AF, corresponding to a 20% savings.

4.2.2 Agricultural

Table 12. Projected Demand Volumes for the Agricultural Sector for 2024-2075.

Scenarios	Year		
	2024	2050	2075
Status Quo	-891	-891	-891
Climate - Low	-921	-928	-935
Climate – Medium	-922	-968	-993
Climate - High	-924	-996	-1,065
Conservation	-887	-751	-751
Growth	-913	-733	-594
Technology	-920	-885	-852

All values are shown in AF.

- Climate: Under a low emissions scenario, irrigation withdrawals in the Agua Fria Basin are projected to increase by 14 AF by 2075. Withdrawals are expected to further increase under the medium and high emissions scenarios. In the medium emissions scenario, withdrawals are estimated to reach 993 AF by 2075. In the high emissions scenario, withdrawals will be 1,065 AF in 2075.

- Conservation: In the Conservation scenario, it is assumed that conservation requirements similar to those described in the 5th Management Plans will be implemented. Irrigation withdrawals in the Agua Fria Basin could decrease to 751 AF per year, representing an annual water savings of 18%.
- Growth: The Growth scenario considers historic growth trends reported in the USDA Census of Agriculture and estimates the land available for potential agricultural growth. In the Agua Fria Basin, agriculture is not expected to grow under this scenario's parameters. By 2075, irrigation withdrawals are expected to fall to 594 AF annually.
- Technology: In the Technology scenario, irrigation systems are assumed to be upgraded with available technology to reduce overall water use. Implementing new irrigation technologies may reduce annual water use to 852 AF in the Agua Fria Basin.

4.2.3 Industrial

Table 13. Projected Demand Volumes for the Industrial Sector for 2024-2075.

	Grazing	Mining	Sand and Gravel
Status Quo*	-30	0	-113

	Feedlots			Turf		
	2024	2050	2075	2024	2050	2075
Status Quo	-3	-3	-3	-87	-87	-87
Climate – Low	-4	-4	-4	-87	-88	-88
Climate – Medium	-4	-4	-4	-87	-90	-93
Climate - High	-4	-5	-5	-87	-93	-99
Conservation	-4	-4	-4	-86	-84	-84
Growth						
Technology						

**Status quo projection values were applied across all scenarios for the grazing, mining, and sand and gravel subsectors. All values are in AF.*

- Climate
    - Feedlots: In the Climate scenario, it is assumed that higher temperatures and increased evaporation rates will lead to greater water demands for feedlots housing horses. Under the low and medium emissions scenario, the impact on total water requirements is minimal, with no change estimated in annual water use. In the high emissions scenario, water demands are anticipated to reach 5 AF by 2075.

- Turf: In the Climate scenario, higher temperatures and increased evapotranspiration rates are assumed to result in greater water demands for turf facilities. In the low emissions scenario, there is minimal impact on total irrigation requirements, with annual withdrawals expected to increase to 88 AF over the projection period. In the medium emissions scenario, turf water demands are estimated to increase to 93 AF by 2075. In the high emissions scenario, turf water demands are estimated to increase to 99 AF by the end of the projection.

- Conservation
    - Feedlots: The Conservation scenario for feedlots in the Agua Fria Basin is not expected to yield significant results. A constant annual water use of 4 AF is projected.
    - Turf: Implementing a Conservation program for turf is estimated to provide minor water savings in the Agua Fria Basin. Annual water use is projected to be 84 AF once the program is fully implemented; this savings is 3 AF per year over baseline values.

4.2.4 Environmental

Table 14. Projected Environmental Demand for 2024-2075.

	Environmental		
	2024	2050	2075
Status Quo	-3,863	-3,863	-3,863
Climate – Low	-3,863	-3,877	-3,891
Climate – Medium	-3,865	-3,933	-3,992
Climate - High	-3,868	-3,996	-4,095

All values are shown in AF.

- Environmental water use is expected to increase under all Climate scenarios. By 2075, a low emissions scenario will increase riparian water use to 3,891 AF. In that same period, riparian water use will increase to 3,992 AF under a medium emissions scenario and 4,095 AF under a high emissions scenario.

5 CONCLUSION

ADWR has assessed various water supply components in the Agua Fria Basin, including surface water, streamflow infiltration, groundwater inflow and outflow, and mountain front recharge. However, the basin's complex geological nature has prevented the estimation of groundwater storage, which limits the ability to thoroughly combine supply and demand results into a comprehensive water budget.

While agricultural, municipal, and industrial demand have been evaluated, and environmental needs such as riparian water use are quantified, the lack of groundwater storage data creates uncertainty in the long-term assessment of water sustainability. As a result, despite the available supply and demand figures, a complete understanding of the basin's water balance remains incomplete without further geological analysis and groundwater storage estimation.

5.1 ATTACHMENTS

- Acronyms and Definitions
- References (Sources) – general