



Pima County Local Drought Impact Group
Office of Sustainability and Conservation
2022 Water Year Annual Report

The Pima County Local Drought Impact Group (LDIG) has been an active component of county operations since 2006 when the Board of Supervisors adopted the Drought Response Plan and Water Wasting Ordinance (Chapter 8.70).

LDIG consists of water providers and local, state, and federal agencies interested in the cause and effect of drought conditions in Pima County. LDIG meets bi-monthly to monitor the short-term and long-term drought status, discuss drought impacts, and coordinate drought declarations and responses.

The county's Drought Response Plan and Water Wasting Ordinance established a four-stage trigger category corresponding to the Arizona Drought Monitor Report and their declaration of a watershed drought condition from "Abnormally Dry" to "Exceptional." With each "Stage" declaration the county can consider drought stage response measures established in the ordinance.

LDIG explores drought impacts on various sectors in Pima County, including agricultural water use, ranching, wildfire, hydrology, and flooding. Because many water providers depend on Central Arizona Project (CAP) water, LDIG also monitors the status of the Colorado River, the El Niño Southern Oscillation (ENSO), and other climate weather patterns concerning their effect on drought conditions and climate variability in the Southwest. LDIG also monitors the status of the summer monsoon season and convenes roundtable discussions of drought and water conservation outreach programs. For a list of presentations and agendas, please visit Pima County's [LDIG website](#).

This report is provided for inclusion in the Arizona Drought Preparedness Annual Report and submitted to the Pima County Administrator's Office.

Weather (National Weather Service-Tucson)

In Pima County, the Water Year (WY) 2022 began after a very wet 2021 monsoon, 3rd wettest on record with 12.79" of precipitation, 7.10" above normal. October 2021 was dry with storm systems bringing cooler temperatures, the average temperature was 1.5°F below normal, but little rain, 0.01". November received only 0.01" of rain but was considerably warmer, 5.5°F above normal. Overall, the fall season was warm and dry. The warm pattern continued in December with well above-normal temperatures, but precipitation was above normal. January 2022 began with winter storms and colder air mass, cooling off average temperatures but delivering below-normal precipitation. Cool temperatures and below-normal rain extended into February. Winter was slightly warmer and drier than normal, consistent with La Niña conditions.

March 2022 is interesting in that, according to National Weather Service (NWS) Tucson - 'Even though this March was warmer than last year by one degree, the average monthly temperature was below normal, thanks to the new set of climate normals which went into effect last May. The 1991-2020 normal for March is 1.8°F warmer than the previous normal period (1981-2010).' That leaves March 2022 ranked as the 24th warmest with below normal precipitation.

April and May 2022 were dry with no rain and warm, 3.7°F and 2.7°F above normal, respectively, with high winds and daily temperatures as high as 108°F in May. Spring was warmer and drier as forecast. The water year precipitation deficit reached -2.84”.

June 2022 received normal rainfall amounts and the temperature was 3.0°F above normal with 24 days of highs 100°F or warmer. After 80 consecutive days of no precipitation, 0.05” rain on June 18 was a welcome relief. July was disappointing with over an inch deficit in rain and 1.8°F warmer than normal. Finally, a favorable monsoon pattern developed in August producing 0.84” above-normal precipitation with cooler temperatures. In total, summer was the 3rd warmest on record and 0.29” drier than normal. In September, tropical moisture delivered isolated heavy rainfall but overall the month was below normal. The monsoon was -0.75” drier than normal.

*Precipitation (in inches, recorded at Tucson International Airport)**

WY21-22	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Precipitation	0.01	0.01	1.34	0.28	0.20	0.19	0.00	0.00	0.23	1.08	2.82	0.81
Normal Precipitation	0.67	0.56	0.96	0.84	0.84	0.56	0.24	0.20	0.23	2.21	1.98	1.32
Difference +/-	-0.66	-0.55	+0.38	-0.56	-0.64	-0.37	-0.24	-0.20	0.00	-1.13	+0.84	-0.51
Cumulative	-0.66	-1.21	-0.83	-1.39	-2.03	-2.40	-2.64	-2.84	-2.84	-3.97	-3.13	-3.64
Rank	24 th Dry	25 th Dry	33 rd Wet	38 th Dry	30 th Dry	29 th Dry	Driest	Driest	38 th Wet	28 th Dry	34 th Wet	53 rd Dry

*Monthly Average Temperature (in °F, recorded at Tucson International Airport)**

WY21-22	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average Temperature	71.1	67.0	57.2	54.3	54.3	61.7	71.8	79.5	89.1	90.0	85.8	84.7
Normal Temperature	72.6	61.5	53.0	53.6	56.2	61.9	68.1	76.8	86.1	88.2	86.9	82.8
Difference +/-	-1.5	+5.5	+4.2	+0.7	-1.9	-0.2	+3.7	+2.7	+3.0	+1.2	-1.1	+1.9
Rank	42 nd Hot	2 nd Hot	3 rd Hot	17 th Hot	59 th Hot	24 th Hot	4 th Hot	6 th Hot	5 th Hot	7 th Hot	38 th Hot	4 th Hot

*Season Ranking (NWS-Tucson)**

WY21-22	Fall	Winter	Spring	Summer	Monsoon
Precipitation Rank	13 th Dry	48 th Dry	11 th Dry	52 nd Dry	46 th Dry
Temperature Rank	6 th Hot	13 th Hot	5 th Hot	3 rd Hot	5 th Hot

*Period of record is from 1890 for Tucson

**Pima County Drought Status
(US Drought Monitor & State Monitoring Technical Committee)**

Arizona’s Short-Term drought status is based on the U.S. Drought Monitor and is updated monthly. Long-Term drought status is derived from the 24-, 36- and 48-month Standard Precipitation and Evapotranspiration Index (SPEI) datasets and is updated quarterly by the Arizona State Climate Office. Both are reviewed by ADWR’s Drought Monitoring Technical Committee.

Short-Term

In Pima County WY2022 started with Abnormally Dry conditions in east and west Pima County (59%) and Moderate drought in the central part of the County (41%). Moderate drought remained until improvement in January with the entire county in Abnormally Dry conditions after several storm systems delivered 50-90% of average precipitation in December. Improved conditions held through February.

By March, Abnormally Dry conditions receded to 46% in central Pima County with Moderate drought returning to western and eastern areas. As drier conditions set in and the precipitation deficit for the water year accumulated through April, drought severity increased to 61% in Moderate drought across central and eastern Pima County with 39% in Severe drought in the east. Severe drought increased through May and 95% of the county was in Severe drought by June.

Storm activity began in June, slightly receding Severe drought to 81% in July. July monsoon activity, though below average, contributed to further improvement in western Pima County with 61% of the area reduced to Moderate drought in August. A wet August replaced most of Severe drought with Moderate drought in the east (38%) and Abnormally Dry conditions in the west (50%) in September. Drought improved incrementally through September.

Long-Term

From October to December, western Pima County was in Severe drought worsening to the east with pockets of Extreme drought. From January through March drought improved significantly with Moderate drought and Abnormally Dry conditions in the west and no drought in eastern Pima County. This drought status remained April through June.

Pima County Drought Conditions

WY21-22	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Short-Term	D0(59) D1(41)	D0(58) D1(42)	D0(58) D1(42)	D0(100)	D0(100)	D1(54) D0(46)	D1(61) D2(39)	D1(55) D2(45)	D2(95) D1(4)	D2(81) D1(19)	D1(61) D2(39)	D0(50) D1(38)
Long-Term	D2 D3			None D0/D1			None D0/D1			Not Available		

D0-Abnormally Dry, D1-Moderate, D2-Severe, D3-Extreme, D4-Exceptional. (percentage)

Colorado River Basin & Central Arizona Project (CAP)

Nine water providers deliver CAP municipal water to Pima County water users. Tucson Water has the largest CAP annual municipal allocation in the state. Agricultural and industrial users and the Tohono O’odham Nation have access to and use CAP water. The drought status of the Colorado River Basin and probabilities of shortage declarations and impacts to these sectors are monitored by the Pima County LDIG.

Lake Mead and Lake Powell

The August 2022 the U.S. Bureau of Reclamation (Reclamation) 24-Month Study projected Lake Mead to be below elevation 1,050' above mean sea level on December 31. Concurrent with the 2007 Operating Guidelines and the Drought Contingency Plan, Lake Mead will be operating in a Tier 2a Shortage beginning 2023. This second declared shortage, consecutive and more severe, will impact Arizona's CAP water supplies by reducing 592,000 acre-feet, cutting all Excess water, eliminating Agricultural Pool water and mitigation water for the sector as part of the Drought Contingency Plan. The Non-Indian Agriculture Pool will be mitigated at 75% of normal allocation. Arizona, the Colorado River Basin states, and the federal government continue to work in re-consultation of the 2007 Operating Guidelines and other consultation efforts, such as the 500+ Plan, to reduce the decline of Lake Powell and Lake Mead in light of a hotter and drier climate.

Reclamation's Commissioner testified before the U.S. Senate in June 2022. Despite the 2007 Operating Guidelines, the Drought Contingency Plan, the 500+ Plan and all other conservation efforts, the Commissioner stated significant additional conservation is needed to prevent infrastructure damage and to stabilize the system. Reclamation aims to protect elevations 3,525' at Lake Powell and 1,025' at Lake Mead. This goal will require 2-4 million acre-feet (MAF) of reductions in 2022 and after, distributed across the entire Colorado River Basin and Mexico. The decline in the Colorado River system has accelerated and outpaced collective operational and conservation agreements.

April-July unregulated inflow into Lake Powell was 59% of average. At the end of WY2022 combined storage will be 31% of average. The Operating Guidelines will change operation tiers from a Mid-Elevation Balancing Tier to a Lower Elevation Balancing Tier in 2023. Releases from Lake Powell will be 7.00 MAF in WY2022 and WY2023 (most probable). The August report probability calculations from Reclamation conclude a 57% probability of further Tier 2 shortage in 2024 and a 40-47% probability of a Tier 3 shortage by 2025-26. CAP water supplies would be cut 640,000 and 720,000 acre-feet (AF) in subsequent Tier 2b and 3 shortage declarations.

Tier 2a Shortage

Based on current operational plans, the impact to water customers in Pima County in the near term is minimal. The impact could change depending on any action the U.S. Department of Interior takes to protect the system and system conservation volumes used to meet the goal of conserving 2 to 4 MAF in the next several years. As an example of the impact to Municipal and Industrial (M&I) supplies, Tucson Water's allocation of 144,191 AF will be curtailed by 2 to 4 percent, or 4-6,000 AF. This would increase to 15-20,000 AF in a Tier 2b shortage.

The agriculture sector in Pima County uses CAP M&I water in Groundwater Savings Facilities as well as Irrigation Grandfathered Rights and is unlikely to be affected by the shortage. Pima County also has fewer Non-Indian Agricultural (NIA) water allocations than other Active Management Areas. Shortages can be mitigated by water providers' long-term planning that includes recharge and recovery of unused CAP supplies and other long term storage credits in addition to Arizona Water Banking Authority firming.

With the Tier 2a CAP shortage declaration, water providers receiving CAP water will continue implementing drought responses consistent with their respective drought preparedness plans.

Drought Impacts

Wildfire

Wildfire activity in Pima County was limited to one large wildfire, the Contreras fire around the Kitt Peak National Observatory on the Tohono O’odham Nation. It was categorized as a Type 4 Incident Command fire and did not damage the telescopes, only several support buildings. Other wildfire incidents were minor, small acreage fires requiring no Incident Command.

Ash and debris flow from the 2020 Bighorn fire scar have affected infiltration rates in the Lower Santa Cruz River, increasing flow extent and decreasing infiltration. This summer there was intensified flooding in the Santa Catalina foothills due to the 2020 Bighorn wildfire.

Groundwater

Pima County Regional Flood Control District (RFCD) monitors groundwater levels within various watersheds to help assess the effects of climate and land-use changes on the overall health of floodplains in Pima County. There are a few shallow groundwater areas along Cienega Creek, Davidson Canyon, and Tanque Verde Creek. Groundwater levels have recovered in many of these areas since 2014 though there is an established long-term downward trend in groundwater levels for most areas.

Groundwater levels increased in all monitored shallow groundwater areas in eastern Pima County in 2021 due to record or near record precipitation and moderate to high flow volumes in stream reaches.

Living River Report WY2021

This annual report, released in September 2022, documents benefits of improved water quality released into the Lower Santa Cruz River from Pima County’s water reclamation facilities (WRF). Water quality in the river improved following significant upgrade of the metropolitan treatment facilities in 2013. A [supplemental report](#) compares annual report conditions from 2013 through 2021.

Discharge of high-quality (Class A+) reclaimed water from Pima County’s wastewater reclamation facilities into the Santa Cruz River is a drought-proof water source providing many environmental benefits to the river. Over 7,000 AF was released from the Agua Nueva WRF and 32,000 AF from the Tres Rios WRF in 2021, or approximately 6 and 29 million gallons daily on average. This discharge creates a 16 to 23-mile flow extent (depending on infiltration and seasonality) of established riparian habitat and wetland. This multi-benefit project serves as environmental restoration, aquifer replenishment and public recreation. As the report is titled, the river connects wildlife with the water, home to endangered native and non-native fish and invertebrates and used by birds and small and large mammals, providing ecosystem services and a stored renewable water supply.

Kino Environmental Restoration Project

Kino Environmental Restoration Project (KERP) harvests urban storm water and controls flooding in Tucson. KERP covers 121 acres with 28 acres of open water and riparian habitat. The six-acre, 50-foot “Deep Pond” stores stormwater for irrigation within KERP plus the Kino Sports Park Complex. KERP has suffered from reduced availability of stormwater for internal irrigation needs over the past two years, but inflow runoff from monsoon storms July through September 2022 filled the basin.

Cienega Creek and Davidson Canyon

Located in eastern Pima County, Cienega Creek continues to show the impacts of sustained drought and shifts to seasonal patterns of flow. This year the results demonstrate the impact of climate extremes from the driest year previously to record high base-flows seen in two decades. Pima Association of Governments’ (PAG)

reporting depicts the localized drought impacts on a shallow groundwater-dependent system and designated Outstanding Arizona Water (OAW), representing drought conditions for local wildlife habitat and human activities dependent on shallow groundwater. It is valuable for drought reporting to represent areas that do not currently benefit from artificial recharge and CAP. PAG's Monitoring Year (MY) mentioned below runs from July 1 to June 30.

PAG and its partners have monitored Pima County's Cienega Creek Natural Preserve since the mid-1980s to provide reliable data and trend analysis for the riparian area including water quality, groundwater, and streamflow. Hot and dry June conditions typically represents the minimum extent of perennial flow within a year. The 2021 monsoon season was the third wettest on record, leading to a drastic recovery in baseflows and breaking perennial baseflow records for most flow from the past two decades of drought. In June 2022, PAG recorded 3.395 miles of flow in the monitored stretch of Cienega Creek, about 5.3 times more flow than was recorded in June 2021. This was the highest perennial baseflow recorded since June 2001, at 37% of the 9.3-miles that flowed perennially and throughout the monitoring area in 1985. In addition, at 7.110 miles, September 2021 baseflows in Cienega Creek were the highest observed by PAG for any quarter since PAG resumed wet/dry mapping in 1999. Following a year with the lowest perennial baseflows on record, these observations demonstrate the impacts of climate extremes on shallow groundwater-dependent streams and the riparian areas that they sustain. This highlights the importance of long-term, consistent seasonal monitoring. As PAG completes annual reports for July through June, this does not reflect the monsoon season of 2022.

In June 2022, there were 2.434 miles of baseflow in the monitored stretches of Davidson Canyon, a major tributary to Cienega Creek that is an OAW as well. Davidson Canyon experienced record high baseflows sustained through all four quarters of Monitoring Year (MY) 2021-22, with baseflows ranging from 2.434 miles to 3.679 miles within the Cienega Creek Natural Preserve and a portion of Pima County's Bar V Ranch. Previously, the highest baseflow observed by PAG within this stretch of Davidson Canyon was 1.5 miles in September 2006, the year monitoring in Davidson began. These numbers do not include the additional baseflow observed by PAG outside of PAG's previously established monitoring area. In MY 2021-22, this furthered flow by 0.04 miles to 0.58 miles in Cienega Creek below the Pantano Dam and by 0.51 miles to 1.44 miles in Davidson Canyon upstream of Andrada Rd. to Empire View Rd. These areas were not monitored by PAG in past years but were presumed to be dry previously.

Although water levels rose, drought's previous impact on erosion, sediment movement, wildlife and vegetation is still apparent. The moisture swing did provide notable improvements. As water levels rose last fiscal year, PAG saw native longfin dace and county-protected lowland leopard frogs that have been absent from Davidson Canyon for a long time, as they depend on more regular surface water supplies to survive. Even more remarkable, in September 2022, PAG observed the federally endangered Gila topminnow in the canyon.

Drought Response Actions

Pima County continues to adhere to its water resources and drought management policy framework including implementation of goals and recommendations from planning documents and annual reports cataloging progress and resources. These documents are posted on the County's [Drought Management webpage](#):

- Water & Wastewater Infrastructure, Supply and Planning Study, Action Plan and Annual Report Cards.
- Water Resources Asset Management Plan
- Strategic Plan for Use of Reclaimed Water
- Sustainable Action Plan for County Operations
- Drought Response Plan and Water Wasting Ordinance

Environmental Water

Through intergovernmental agreements, Pima County and the City of Tucson have established a Conservation Effluent Pool (CEP) reserving up to 10,000 acre-feet of effluent a year generated from metropolitan water reclamation facilities for dedicated use in environmental projects. The 2022 CEP Annual Report to the Board of Supervisors confirms two projects authorized in 2021, the City's Heritage Project and the RFCD Agua Nueva Project.

Tucson Mayor and Council and the Board of Supervisors approved the Heritage Project, allocating up to 110 AF per year for evapotranspiration. In total, 39 AF was used in 2021.

As part of an Endangered Species Act stipulation, the RFCD Agua Nueva Project was approved in 2021 by the City of Tucson and Pima County CEP Administrators; not requiring Council or Board approval. This project will provide a weekly average of 5 MGD of flow from Agua Nueva WRF to maintain the endangered Gila Topminnow in the established riparian habitat downstream of the outfall. Maximum use is limited to 5,600 AF per year; no CEP water was used for this project in 2021.

Lower Santa Cruz River Management Plan

The Lower Santa Cruz River Management Plan is being developed by Pima County RFCD to manage the effluent-dependent river while balancing flood risk and infrastructure protection with aquifer recharge, riparian habitat preservation, and recreation.

A stakeholder working group assisted in identifying alternative projects for each specific reach of the river through a Multi-Criteria Decision Assessment framework that determined the sequence and funding of the 20 projects selected from 110 possible. The process involved a comprehensive assessment and evaluation of existing conditions, infrastructure and management in development of the Alternative Selection Report and Implementation Plan. The Plan includes stream restoration, new wetland and land preservation projects.

Lower Santa Cruz River Basin Study

Pima County is participating with Reclamation in a six-year study of the Lower Santa Cruz River Basin. The in-kind study offers Reclamation's technical expertise in applying climate change models, surface water modeling and groundwater modeling to water supply and demand scenarios, charting the potential range of water imbalance in the region and developing adaptive management strategies to address water imbalance and climate change.

The Study has identified areas of concern and developed adaptation strategies for each area and region wide strategies. Technical memoranda have been completed or are pending and the final report is due in 2022.

Pima County Water Working Group

Given the historical period of drought and looming water scarcity challenge facing Pima County and the Basin states, the County Administrator has established an in-house Water Working Group (WWG) to ensure the appropriate knowledge base and expertise is maintained and to develop strategic plans for water storage, conveyance, treatment infrastructure and funding. In addition, the County has a Growing Water Smart Team comprised of water and land use policy experts. The WWG will be cooperating with the County's water providers as needed.

RFCD Urban Stormwater Resource Work Plan

To improve overall regional water resiliency, the Pima County RFCD has developed a work plan to expand the beneficial use of urban stormwater and increase aquifer recharge. The RFCD work plan is a region-wide approach to improve water resiliency by evaluating new large-scale retention projects, expanding existing infrastructure, and decentralizing retention strategies at the neighborhood and lot scale. RFCD is beginning a stakeholder process to modify and improve drainage criteria for new development, maximize retention and reuse stormwater with potential new regional basins. It will also consider opportunities to enhance reclaimed water in channel recharge.

Drought Stage

Currently, Tucson Water is in Drought Stage 1 and is actively preparing for Stage 2. The Town of Marana is in Drought Stage 2. Metro Water is in Stage 1 and recently updated its drought response plan. The Town of Oro Valley is in Water Conservation Level 1. The remaining water providers are in Drought Stage 1 or its equivalent (voluntary reductions). Pima County remains at Drought Stage 1.

Summary

Pima County had a near record summer monsoon in 2021, followed by a hot and dry fall. Winter and spring precipitation was below average and were followed by the Summer 2022 monsoon season. The monsoon activity overall was modest though August did produce a surplus of rainfall. Both short and long-term drought conditions have improved compared to last year. Pima County did not experience Extreme or Exceptional drought conditions, but the WY2022 precipitation deficit is over three inches.

While conditions have improved, for the third consecutive year, the upcoming fall and winter seasons are expected to enter a La Niña phase and are likely to be drier than average.

###